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Conferences and Courses: 25–29 April 2011

Exhibition: 26–28 April 2011

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Technologies

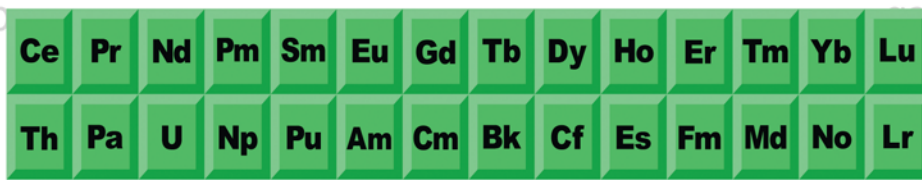
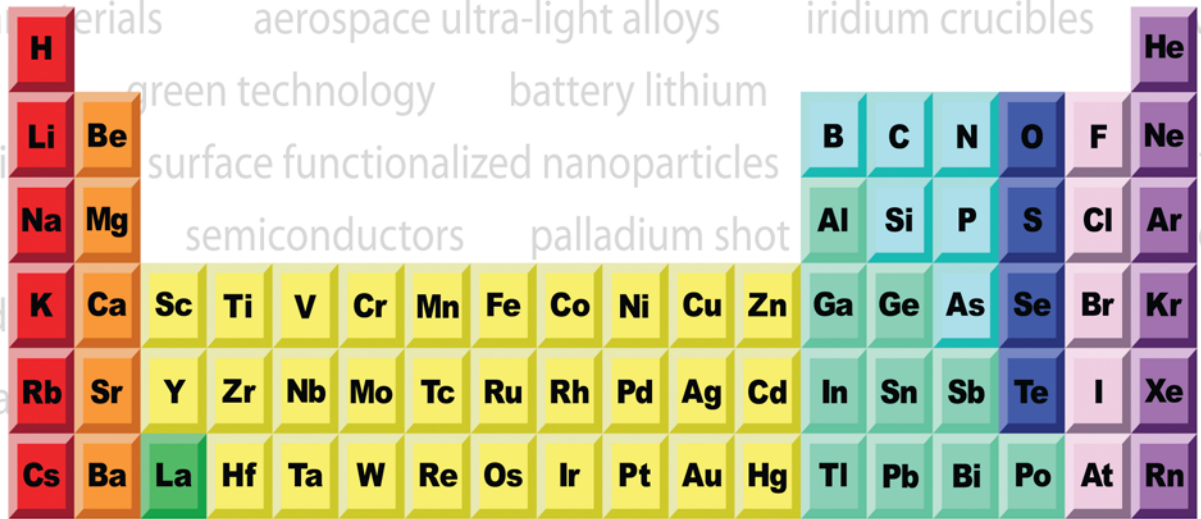
Imaging, Sensors, and Displays

IR Sensors and Systems Engineering | Homeland Security and Law Enforcement | Tactical Sensors and Imagers | Chemical Biological Radiological Nuclear and Explosives (CBRNE) | Military and Avionic Displays | Space Technologies and Operations | Intelligent and Unmanned/Unattended Sensors and Systems | Biometrics

Sensor and Data Analysis

Sensor Data Exploitation and Target Recognition | Information Fusion, Data Mining, and Information Networks | Signal, Image, and Neural Net Processing | Communication and Networking Technologies and Systems

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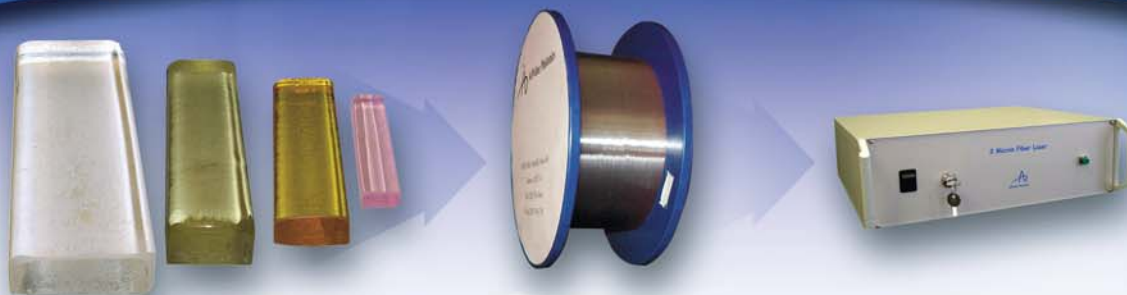


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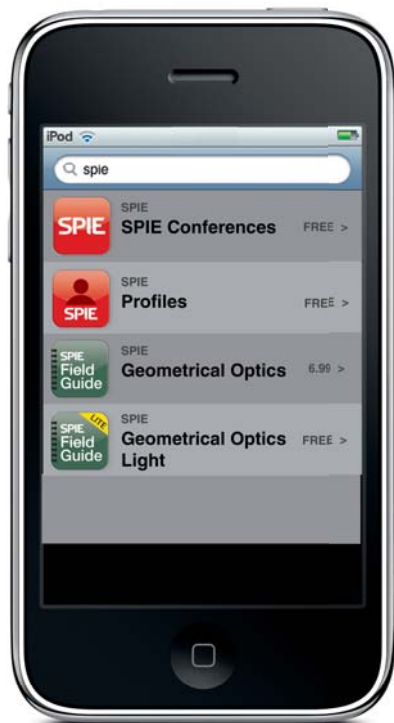
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SPIE would like to express its deepest appreciation to the symposium chairs, conference chairs, program committees, session chairs, and authors who have so generously given of their time and advice to make this symposium possible.

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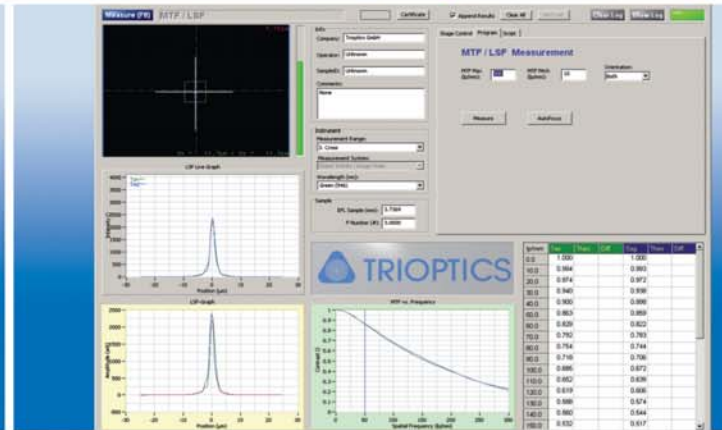


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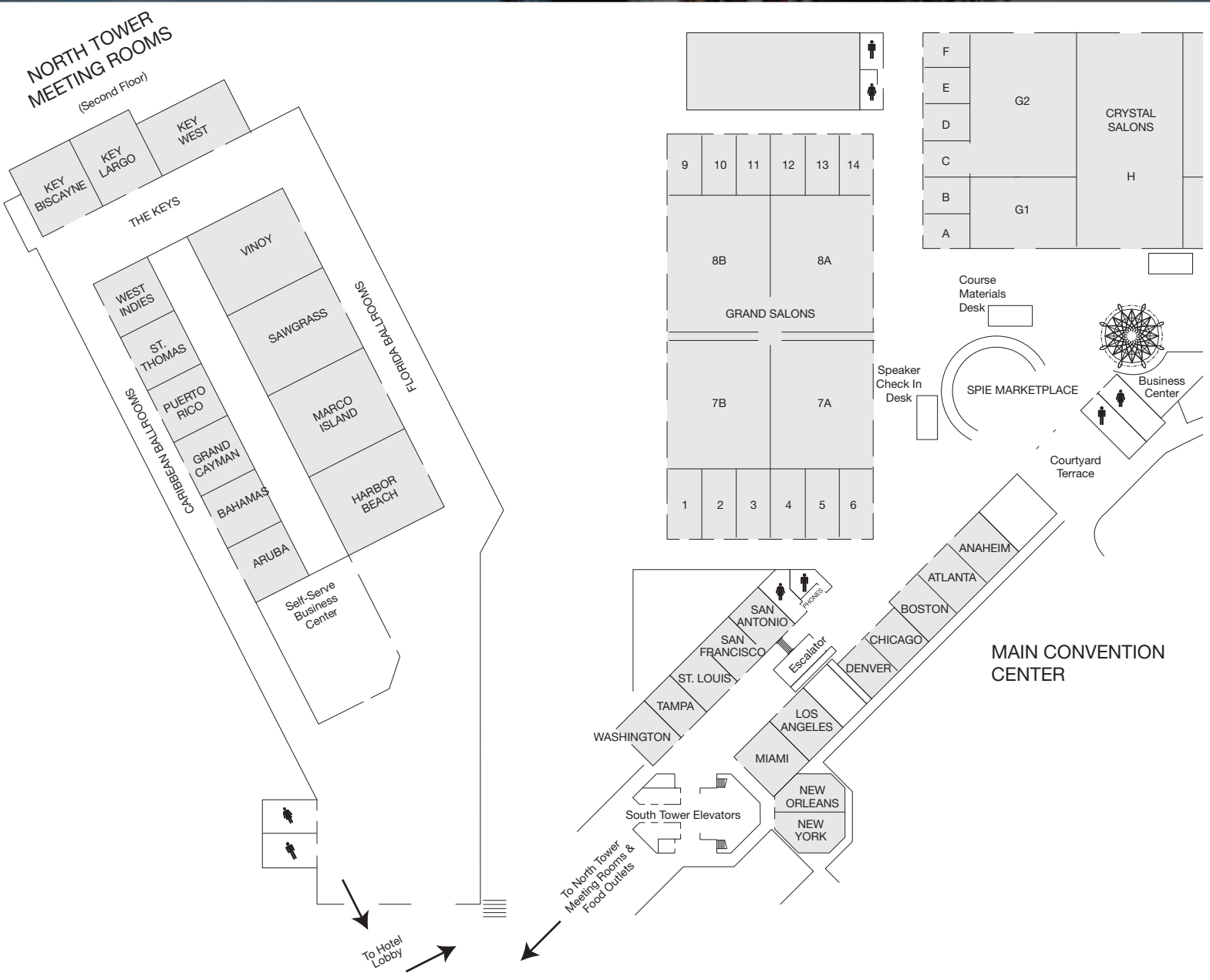
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Tuesday 26 April 9:30 am to 5:00 pm

Wednesday 27 April . . . 10:00 am to 5:00 pm

Thursday 28 April 10:00 am to 2:00 pm

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IR Sensors and Systems

8012	Mon-Fri	Infrared Technology and Applications XXXVII <i>(Andresen, Fulop, Norton)</i>	38
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Defense, Homeland Security, and Law Enforcement

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Imaging and Sensing

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Unmanned, Robotic, and Layered Systems

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Signal, Image, and Neural Net Processing

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

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New and Expanded Courses for 2011: NEW

- SC1031 **Radar Micro-Doppler Signatures - Principles and Applications** (Chen / Tamoush)
- SC1032 **Direct Detection Laser Radar Systems** (Richmond / Cain)
- SC1033 **Optical Phased Array Technologies and Systems** (Probst / McManamon)
- SC1034 **Lab-on-a-Chip Technology—Towards Portable Detection Systems** (Gärtner)
- SC1035 **Military Laser Safety** (Marshall)
- SC1036 **Diode Pumped Alkali Lasers** (Perram)
- SC755 **Infrared Optics and Zoom Lenses** (Mann)
- SC954 **Scanning Microscopy in Forensic Science** (Platek / McVicar / Trimpe / Postek)
- SC947 **Cost-Conscious Tolerancing of Optical and IR Systems** (Youngworth / Contreras)
- WS1037 **Advanced Topics in U.S. International Trade Regulations** (Scarlott)

Registration Required

See SPIE Cashier.

IR Sensors and Systems

- SC713 Mon **Engineering Approach to Imaging System Design** (Holst) 8:30 am to 5:30 pm, \$580 / \$670
- SC278 Mon **Infrared Detectors** (Dereniak) 8:30 am to 12:30 pm, \$435 / \$485
- SC835 Mon-Tues **Infrared Systems - Technology & Design** (Daniels) 8:30 am to 5:30 pm, \$1085 / \$1305
- SC178 Mon **Introduction to Radiometry and Photometry** (Grant) 8:30 am to 12:30 pm, \$440 / \$490
- SC900 Mon **Uncooled Thermal Imaging Detectors and Systems** (Hanson) 8:30 am to 5:30 pm, \$570 / \$660
- SC152 Mon **Infrared Focal Plane Arrays** (Dereniak, Hubbs) 1:30 to 5:30 pm, \$325 / \$375
- SC1000 Mon **Introduction to Infrared and Ultraviolet Imaging Technology** (Richards) 1:30 to 5:30 pm, \$360 / \$410
- SC944 Mon **The Radiometry Case Files** (Grant) 1:30 to 5:30 pm, \$400 / \$450
- SC950 Tues **Infrared Imaging Radiometry** (Richards) 8:30 am to 5:30 pm, \$530 / \$620
- SC892 Tues **Infrared Search and Track Systems** (Schwering) 8:30 am to 5:30 pm, \$530 / \$620
- SC214 Tues **Infrared Window and Dome Materials** (Harris) 8:30 am to 5:30 pm, \$595 / \$685
- SC181 Tues **Predicting Target Acquisition Performance of Electro-Optical Imagers** (Vollmerhausen) 8:30 am to 5:30 pm, \$570 / \$660
- SC838 Tues **Laser Range Gated Imaging Techniques** (Duncan) 1:30 to 5:30 pm, \$325 / \$375
- SC1035 Weds **Military Laser Safety** (Marshall) 8:30 am to 5:30 pm, \$530 / \$620 NEW
- SC947 Weds **Cost-Conscious Tolerancing of Optical and IR Systems** (Youngworth, Contreras) 8:30 to 5:30 pm, \$530 / \$620
- SC755 Thurs **Infrared Optics and Zoom Lenses** (Mann) 8:30 am to 12:30 pm, \$370 / \$420 NEW
- SC067 Thurs **Testing and Evaluation of E-O Imaging Systems** (Holst) 8:30 am to 5:30 pm, \$610 / \$700
- SC659 Thurs **Understanding Reflective Optical Design** (Contreras) 8:30 am to 5:30 pm, \$530 / \$620
- SC154 Fri **Electro-Optical Imaging System Performance** (Holst) 8:30 am to 5:30 pm, \$610 / \$700
- SC789 Fri **Introduction to Optical and Infrared Sensor Systems** (Shaw) 8:30 am to 5:30 pm, \$530 / \$620

Defense, Homeland Security, and Law Enforcement

- SC719 Mon **Chemical & Biological Detection: Overview of Point and Standoff Sensing Technologies** (Gardner) 8:30 am to 12:30 pm, \$325 / \$375
- SC954 Mon **Scanning Microscopy in Forensic Science** (Platek, Trimpe, McVicar, Postek) 8:30 am to 5:30 pm, \$530 / \$620
NEW
- SC1035 Weds **Military Laser Safety** (Marshall) 8:30 am to 5:30 pm, \$530 / \$620
NEW
- SC952 Thurs **Applications of Detection Theory** (Carrano) 8:30 am to 5:30 pm, \$530 / \$620
- SC995 Thurs **Target Detection Algorithms for Hyperspectral Imagery** (Nasrabadi) 8:30 am to 5:30 pm, \$530 / \$620
- SC1034 Fri **Lab-on-a-Chip Technology - Towards Portable Detection Systems** (Gärtner) 8:30 am to 12:30 pm, \$325 / \$375
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- SC178 Mon **Introduction to Radiometry and Photometry** (Grant) 8:30 am to 12:30 pm, \$440 / \$490
- SC1000 Mon **Introduction to Infrared and Ultraviolet Imaging Technology** (Richards) 1:30 to 5:30 pm, \$360 / \$410
- SC1031 Mon **Radar Micro-Doppler Signatures - Principles and Applications** (Chen, Tahmoush) 1:30 to 5:30 pm, \$325 / \$375
NEW
- SC944 Mon **The Radiometry Case Files** (Grant) 1:30 to 5:30 pm, \$400 / \$450
- SC950 Tues **Infrared Imaging Radiometry** (Richards) 8:30 am to 5:30 pm, \$530 / \$620
- SC838 Tues **Laser Range Gated Imaging Techniques** (Duncan) 1:30 to 5:30 pm, \$325 / \$375
- SC946 Tues **Super Resolution in Imaging Systems** (Bagheri, Javidi) 8:30 to 5:30 pm, \$530 / \$620
- SC157 Weds **MTF in Optical and Electro-Optical Systems** (Ducharme) 8:30 am to 5:30 pm, \$570 / \$660
- SC194 Weds **Multispectral and Hyperspectral Image Sensors** (Lomheim) 8:30 am to 12:30 pm, \$325 / \$375
- SC947 Weds **Cost-Conscious Tolerancing of Optical and IR Systems** (Youngworth, Contreras) 8:30 to 5:30 pm, \$530 / \$620
- SC952 Thurs **Applications of Detection Theory** (Carrano) 8:30 am to 5:30 pm, \$530 / \$620
- SC1033 Thurs **Optical Phased Array Technologies and Systems** (Probst, McManamon) 8:30 am to 5:30 pm, \$530 / \$620
NEW
- SC995 Thurs **Target Detection Algorithms for Hyperspectral Imagery** (Nasrabadi) 8:30 am to 5:30 pm, \$530 / \$620
- SC067 Thurs **Testing and Evaluation of E-O Imaging Systems** (Holst) 8:30 am to 5:30 pm, \$610 / \$700
- SC154 Fri **Electro-Optical Imaging System Performance** (Holst) 8:30 am to 5:30 pm, \$610 / \$700
- SC789 Fri **Introduction to Optical and Infrared Sensor Systems** (Shaw) 8:30 am to 5:30 pm, \$530 / \$620

Laser Sensors and Systems

- SC167 Mon **Introduction to Laser Radar** (Kammerman) 8:30 am to 12:30 pm, \$325 / \$375
- SC168 Mon **Advanced Coherent Laser Radars Design and Applications** (Kammerman) 1:30 to 5:30 pm, \$325 / \$375
- SC1031 Mon **Radar Micro-Doppler Signatures - Principles and Applications** (Chen, Tahmoush) 1:30 to 5:30 pm, \$325 / \$375
NEW
- SC1032 Tues **Direct Detection Laser Radar Systems for Imaging Applications** (Richmond, Cain) 8:30 am to 5:30 pm, \$575 / \$665
NEW
- SC160 Tues **Precision Stabilized Pointing and Tracking Systems** (Hilkert) 8:30 am to 5:30 pm, \$530 / \$620
- SC838 Tues **Laser Range Gated Imaging Techniques** (Duncan) 1:30 to 5:30 pm, \$325 / \$375
- SC1035 Weds **Military Laser Safety** (Marshall) 8:30 am to 5:30 pm, \$530 / \$620
NEW
- SC1036 Weds **Diode Pumped Alkali Lasers** (Perram) 1:30 to 5:30 pm, \$325 / \$375
NEW
- SC997 Weds **High Power Laser Beam Quality** (Ross) 1:30 to 5:30 pm, \$325 / \$375
- SC947 Weds **Cost-Conscious Tolerancing of Optical and IR Systems** (Youngworth, Contreras) 8:30 to 5:30 pm, \$530 / \$620
- SC188 Thurs **Laser Beam Propagation for Applications in Laser Communications, Laser Radar, and Active Imaging** (Phillips, Andrews) 8:30 am to 5:30 pm, \$660 / \$750
- SC1033 Thurs **Optical Phased Array Technologies and Systems** (Probst, McManamon) 8:30 am to 5:30 pm, \$530 / \$620
NEW
- SC995 Thurs **Target Detection Algorithms for Hyperspectral Imagery** (Nasrabadi) 8:30 am to 5:30 pm, \$530 / \$620

Sensor Data and Information Exploitation

- SC1031 Mon **Radar Micro-Doppler Signatures - Principles and Applications** (Chen, Tahmoush) 1:30 to 5:30 pm, \$325 / \$375
NEW
- SC994 Tues **Multisensor Data Fusion for Object Detection, Classification and Identification** (Klein) 8:30 am to 5:30 pm, \$600 / \$690
- SC181 Tues **Predicting Target Acquisition Performance of Electro-Optical Imagers** (Vollmerhausen) 8:30 am to 5:30 pm, \$570 / \$660
- SC1035 Weds **Military Laser Safety** (Marshall) 8:30 am to 5:30 pm, \$530 / \$620
NEW
- SC194 Weds **Multispectral and Hyperspectral Image Sensors** (Lomheim) 8:30 am to 12:30 pm, \$325 / \$375
- SC158 Thurs **Fundamentals of Automatic Target Recognition** (Sadjadi) 8:30 am to 5:30 pm, \$530 / \$620
- SC995 Thurs **Target Detection Algorithms for Hyperspectral Imagery** (Nasrabadi) 8:30 am to 5:30 pm, \$530 / \$620

Signal, Image, and Neural Net Processing

- SC066 Mon **Fundamentals of Electronic Image Processing** (Weeks) 8:30 am to 5:30 pm, \$600 / \$690
- SC994 Tues **Multisensor Data Fusion for Object Detection, Classification and Identification** (Klein) 8:30 am to 5:30 pm, \$600 / \$690
- SC946 Tues **Super Resolution in Imaging Systems** (Bagheri, Javidi) 8:30 to 5:30 pm, \$530 / \$620
- SC952 Thurs **Applications of Detection Theory** (Carrano) 8:30 am to 5:30 pm, \$530 / \$620
- SC995 Thurs **Target Detection Algorithms for Hyperspectral Imagery** (Nasrabadi) 8:30 am to 5:30 pm, \$530 / \$620

Course Index

Sensing for Industry, Environment, and Health

- SC719 Mon **Chemical & Biological Detection: Overview of Point and Standoff Sensing Technologies** (*Gardner*) 8:30 am to 12:30 pm, \$325 / \$375
- SC952 Thurs **Applications of Detection Theory** (*Carrano*) 8:30 am to 5:30 pm, \$530 / \$620
- SC995 Thurs **Target Detection Algorithms for Hyperspectral Imagery** (*Nasrabadi*) 8:30 am to 5:30 pm, \$530 / \$620
- SC1034 Fri **Lab-on-a-Chip Technology - Towards Portable Detection Systems** (*Gärtner*) 8:30 am to 12:30 pm, \$325 / \$375
NEW

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

- SC994 Tues **Multisensor Data Fusion for Object Detection, Classification and Identification** (*Klein*) 8:30 am to 5:30 pm, \$600 / \$690
- SC952 Thurs **Applications of Detection Theory** (*Carrano*) 8:30 am to 5:30 pm, \$530 / \$620

Innovative Defense and Security Applications for Displays

- SC159 Weds **Head-Mounted Displays: Design and Applications** (*Melzer, Browne*) 8:30 am to 5:30 pm, \$565 / \$655

Unmanned, Robotic, and Layered Systems

- SC996 Weds **Introduction to GPS Receivers** (*Zhu*) 8:30 am to 12:30 pm, \$325 / \$375
- SC549 Weds **Incorporating GPS Technology into Commercial and Military Applications** (*Zhu*) 1:30 to 5:30 pm, \$325 / \$375
- SC952 Thurs **Applications of Detection Theory** (*Carrano*) 8:30 am to 5:30 pm, \$530 / \$620

Emerging Technologies

- SC1034 Fri **Lab-on-a-Chip Technology - Towards Portable Detection Systems** (*Gärtner*) 8:30 am to 12:30 pm, \$325 / \$375

Scanning Microscopy and Forensics

- SC954 Mon **Scanning Microscopy in Forensic Science** (*Platek, Trimpe, McVicar, Postek*) 8:30 am to 5:30 pm, \$530 / \$620
NEW



Optical and Optomechanical Engineering

- SC156 Mon **Basic Optics for Engineers** (*Ducharme*) 8:30 am to 5:30 pm, \$570 / \$660
- SC010 Mon-Tues **Introduction to Optical Alignment Techniques** (*Ruda*) 8:30 am to 5:30 pm, \$940 / \$1160
- SC178 Mon **Introduction to Radiometry and Photometry** (*Grant*) 8:30 am to 12:30 pm, \$440 / \$490
- SC1000 Mon **Introduction to Infrared and Ultraviolet Imaging Technology** (*Richards*) 1:30 to 5:30 pm, \$360 / \$410
- SC944 Mon **The Radiometry Case Files** (*Grant*) 1:30 to 5:30 pm, \$400 / \$450
- SC950 Tues **Infrared Imaging Radiometry** (*Richards*) 8:30 am to 5:30 pm, \$530 / \$620
- WS609 Tues **Basic Optics for Non-Optics Personnel** (*Harding*) 1:30 to 4:00 pm, \$150 / \$200
- SC014 Weds-Thurs **Introduction to Optomechanical Design** (*Vukobratovich*) 8:30 am to 5:30 pm, \$940 / \$1160
- SC220 Weds **Optical Alignment Mechanisms** (*Guyer*) 8:30 am to 12:30 pm, \$325 / \$375
- SC781 Weds **Optomechanical Analysis** (*Hatheway*) 8:30 am to 5:30 pm, \$530 / \$620
- SC947 Weds **Cost-Conscious Tolerancing of Optical and IR Systems** (*Youngworth, Contreras*) 8:30 to 5:30 pm, \$530 / \$620
- SC755 Thurs **Infrared Optics and Zoom Lenses** (*Mann*) 8:30 am to 12:30 pm, \$370 / \$420
NEW
- SC254 Thurs **Integrated Opto-Mechanical Analysis** (*Genberg, Doyle*) 8:30 am to 5:30 pm, \$580 / \$670
- SC659 Thurs **Understanding Reflective Optical Design** (*Contreras*) 8:30 am to 5:30 pm, \$530 / \$620

INDUSTRY WORKSHOPS

Business & Professional Development

- WS933 Weds **Complying with the ITAR: A Case Study** (*Scarlott*) 8:30 am to 12:30 pm, \$325 / \$375
- WS1037 Thurs **Advanced Topics in U.S. International Trade Regulations** (*Scarlott*) 8:30 am to 12:30 pm, \$325 / \$375
NEW
- WS951 Tues **Leading Successful Product Innovation** (*Carrano*) 8:30 am to 12:30 pm, \$325 / \$375
- WS609 Tues **Basic Optics for Non-Optics Personnel** (*Harding*) 1:30 to 4:00 pm, \$150 / \$200

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Special Events Daily Schedule

Monday	Tuesday	Wednesday	Thursday	Friday
25 April	26 April	27 April	28 April	29 April

Fellows Luncheon, 12:00 to 1:30 pm, p. 24

Vendor Presentations and Reception, 5:00 to 8:30 pm, p. 16



All Symposium Welcome Reception, 6:00 to 7:00 pm, Sponsored by SPIE Contributing Sponsor FLIR, p. 17

INVITED PANEL DISCUSSION: **Real-World Issues and Challenges in Hard and Soft Fusion** (Panel Organizer: Kadar) 7:15 to 9:40 pm, p. 17



FREE SPIE Defense, Security, and Sensing Exhibition 500 Companies

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Exhibition Hours

- Tuesday • 9:30 am to 5:00 pm
- Wednesday • 10:00 am to 5:00 pm
- Thursday • 10:00 am to 2:00 pm

SYMPOSIUM-WIDE PLENARY SESSION: **Dr. Regina E. Dugan**, Director, Defense Advanced Research Projects Agency—8:30 to 9:30 am, p. 18

SPIE Job Fair, 9:30 to 5:00 pm, p. 25

WORKSHOP WS951: **Leading Successful Product Innovation** (Carrano) 8:30 am to 12:30 pm, p. 26

WORKSHOP WS609: **Basic Optics for Non-Optics Personnel** (Harding) 1:30 to 4:00 pm, p. 26

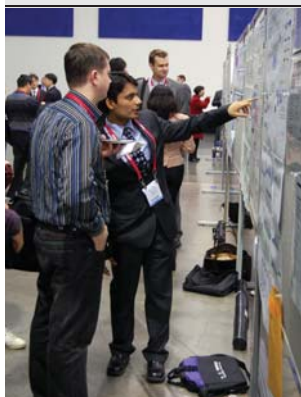
Student Lunch with the Experts, 12:30 to 1:30 pm, p. 24

PANEL DISCUSSION: **Getting Hired in 2011 and Beyond, 1:45 to 3:00 pm, p. 18**

Women in Optics Presentation and Reception, 4:30 to 6:00 pm, p. 24

WORKSHOP: **New NVESD Performance** (Speakers: Teaney, Reynolds) 4:50 to 6:00 pm, p. 18

Interactive Poster Session, 6:00 to 7:30 pm, p. 18



WORKSHOP WS933: **Complying with the ITAR: A Case Study** (Scarlott) 8:30 am to 12:30 pm, p. 27

SPIE Job Fair, 10:00 to 5:00 pm, p. 25

PANEL DISCUSSION: **Cross-Conference Hot Topics: Data to Decisions: "Sensors are No Longer King"** (Moderator: Pellegrino) 10:30 am to 12:30 pm, p. 21

PANEL DISCUSSION: **Verification, Validation, and Accreditation** (Moderator: Kelmelis) 11:30 am to 12:10 pm, p. 21

PANEL DISCUSSION: **Less-Than-Lethal Technologies to Minimize Civilian Casualties** (Moderator: Tafolla) 9:30 to 11:30 am, p. 21

GOVERNMENT FUNDING SPECIAL SESSION (Moderator: McManamon) 3:30 to 5:30 pm, p. 20

Air Force Research Lab. Presentation (Smith)
DARPA Presentation (Neyland)
IARPA Presentation (Baranoski)

PANEL DISCUSSION: **Multisensor, Multisource Information Fusion: Architectures, Algorithms, and Applications 2011** (Moderator: Braun) 4:50 to 5:50 pm, p. 21

TRACK PLENARY PRESENTATION **Evolution of Airborne Chemical and Radiological Remote Sensing for Emergency and Natural Disaster Response**, (Lewis) 5:00 to 6:00 pm, p. 21

Early Career Networking Social, 5:30 to 6:30 pm, p. 24

BANQUET AND DSS LIFETIME ACHIEVEMENT AWARD (**General James E. Cartwright**), 7:00 to 9:30 pm, p. 22

WORKSHOP WS1037: **Advanced Topics in U.S. International Trade Regulations** (Scarlott) 8:30 am to 12:30 pm, p. 27

PANEL DISCUSSION: **Contemporary Concerns in Geographical/Geospatial Information Systems (GIS) Processing** (Moderator: Gangl) 2:00 to 3:00 pm, p. 23

Interactive Poster Session, 6:00 to 7:30 pm, p. 23



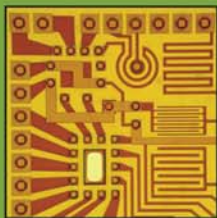
SPIE Job Fair

Top employers are coming together to interview and hire candidates at SPIE Defense, Security, and Sensing

Tuesday 26 April • 9:30 am to 5:00 pm
Wednesday 27 April • 10:00 am to 5:00 pm

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Special Events

MONDAY 25 April

Vendor Presentations and Reception

Monday • 5:00 to 8:30 pm • Location: Crystal C

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

What's New in Hardware and Software at the 2011 SPIE Defense, Security, and Sensing Exhibition?

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

Additional Vendors may join at the end of the session as time allows. If you are interested in participating or have any questions, please contact:

Herb Kaplan, Vendors Session 2011 Moderator, hkaplan@earthlink.net
or

Andres Rozlosnik, aer@termografia.com

STINGRAY OPTICS, LLC (BOOTH 411)

StingRay MWIR & LWIR Thermal Imaging Systems, Achromatically Corrected SWIR Lenses and Accessories

Presenters: **Jennifer Myers**, Sales and Marketing Manager and **Shannon Largig**, Sales Engineer

CI SYSTEMS, INC. (BOOTH 500)

Hyperspectral Imaging, Gas Sensing, New SR 7000 Spectroradiometer and New CVF (Circular Variable Filter) and Other New CI Products

Presenter: **Garrick Matheson**

BOULDER IMAGING, INC. (BOOTH 1130)

Making Multispectral Imagery Useful

Presenter: **Carlos Jorquera**, CEO & CTO

TELOPS INC. (BOOTH 1024)

Hyperspectral Imaging Applications in Defense & Security

Presenter: **Paul Chabot**, Vice-President Sales & Marketing

THERMOTEKNIK SYSTEMS LTD. (BOOTH 1117)

Thermoteknix Greatest Hits

Presenter: **Alistair Brown**, Imaging Products Manager

XENICS INFRARED SOLUTIONS (BOOTH 3119)

Recent Realizations in Sensor Fusion of Multiple Wavelength Products

Presenter: **Jan Vermeiren**, Technology Development Manager

NEW INFRARED TECHNOLOGIES (3305)

The MATRIX 1024 SERIES: Applications of High-Speed Uncooled MWIR Imaging Sensors

Presenter: **Rodrigo Linares**, Director of Marketing/Sales and Marketing Manager

SCD.USA (BOOTH 771)

SCD's New Products

Presenter: **Niels Jacksen**, VP of Technology

IRCAM GMBH (BOOTH 1231)

New IRCAM Products

Presenter: **Monica Lopez Saenz**, Managing Director of IRCAM

FLIR COMMERCIAL SYSTEMS INC. (BOOTH 700)

Quark Camera: A New Standard for SWaP

Presenter: **Dan Walker**, VP Product Development

JEOL USA, INC. (BOOTH 3706)

JEOL's Portable Scanning Electron Microscopes for Product Development to Final Inspection

Presenters: **Donna Guarrera**, Assistant Director, SM Division and **David Edwards**

RAYTHEON CO. (BOOTH 3213)

Raytheon's Revolutionary Long Wave and Short Wave Uncooled Products

Presenter: **Mark Lamb**, Security Solutions Technical Manager

NEW IMAGING TECHNOLOGIES (BOOTH 1137)

High Dynamic Range ROIC with Logarithmic Response

Presenter: **Pierre Potet**, CEO, New Imaging Technologies




All Symposium Welcome Reception

Monday • 6:00 to 7:00 pm • Location: Grand 7

All attendees are invited to the Welcome Reception. Relax, socialize, and enjoy the refreshments. Featuring IR Image Gallery Display presented by SPIE and StingRay Optics. Also watch as attendees have a chance to race FLIR's unmanned vehicles in an intense obstacle race for prizes.

Please remember to wear your registration badges. Dress is casual.

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Booth #700

INVITED PANEL DISCUSSION

Real-World Issues and Challenges in Hard and Soft Fusion (Conf. 8050)

Monday • 7:15 to 9:40 pm • Location: Grand 14

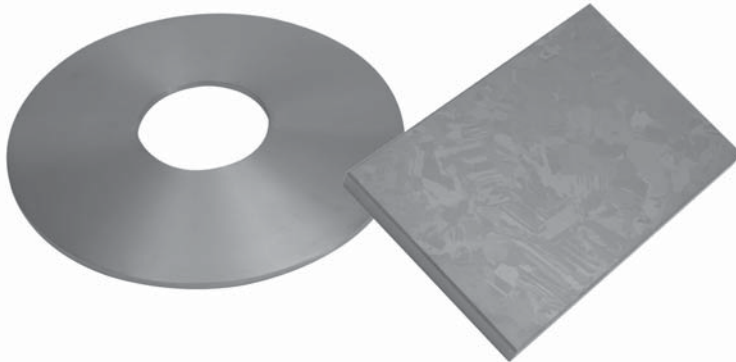
Panel Organizer: **Ivan Kadar**, Interlink Systems Sciences, Inc.

Panel Moderators: **Chee-Yee Chong**, BAE Systems Advanced Information Technologies; **Ivan Kadar**, Interlink Systems Sciences, Inc.

Panelists: **Richard Antony**, SAIC, Inc.; **Chee-Yee Chong**, BAE Systems Advanced Information Technologies; **Erik Blasch**, Defence Research and Development Canada (Canada); ; **David Hall**, The Pennsylvania State Univ.; **Ivan Kadar**, Interlink Systems Sciences, Inc.; **Thiagalingam Kirubarajan**, McMaster Univ. (Canada); **James Llinas**, Univ. at Buffalo; **Ronald P. Mahler**, Lockheed Martin Maritime Systems and Sensors

The panel will address salient real-world issues and challenges in hard and soft data fusion illuminated by invited experts. Accurate situation assessment sometimes cannot be accomplished using just hard or soft data sources alone. Specifically sources of "hard information" are physics-based sources that provide sensor observables such as radar or video data, while "soft information" is usually provided by human-based sources. Fusion of hard and soft data can provide situation pictures that are better than those using hard or soft data alone. For example, patrol reports provide soft data in addition to hard data from physical sensors in urban operational environments. While algorithms for fusing information from physical sensors has a substantial development history as well as maturity, complex technical issues remain in the representation of human-based information to make it suitable for combining with sensor based information. Conceptual real-world related examples associated with the overall complex problem will be addressed by the panel to highlight issues and challenges. Audience participation is welcomed to provide a forum for exchange of ideas.

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TUESDAY 26 April

Symposium-Wide Plenary Session

Tuesday • 8:30 to 9:30 am • Location: Crystal H



Dr. Regina E. Dugan

Director, Defense Advanced Research Projects Agency (DARPA)

Dr. Regina Dugan, Director, DARPA will deliver the Symposium-wide Plenary Presentation at this year's meeting.

In her role as Director, Dr. Dugan leads the DoD agency responsible for the creation and prevention of strategic technology surprise. From its founding more than 50 years ago to current day, this mission implies one imperative for the Agency: radical innovation for national security. Today DARPA is the principal agency within the DoD for research, development and demonstration of high-risk, high-payoff projects for the current and future combat force.

Appointed by Secretary of Defense, Robert M. Gates, and announced by the Director, Defense Research and Engineering, Zachary Lemnios, Dr. Regina E. Dugan was sworn in as the 19th director of the Defense Advanced Research Projects Agency (DARPA) on July 20, 2009.

Founded in 1958 as a response to the Soviet Union's launch of Sputnik, DARPA's mission is to prevent strategic surprise for the United States as well as create strategic surprise for our adversaries. From its founding more than 50 years ago to current day, this mission implies one imperative for the Agency: radical innovation for national security. Today DARPA is the principal agency within the Department of Defense for research, development and demonstration of high-risk, high-payoff projects for the current and future combat force.

Experienced in counterterrorism and defense against explosive threats, Dr. Dugan first served the Nation as a DARPA program manager from 1996 to 2000. During this first tour with the Agency, she directed a diverse \$100 million portfolio of programs including the "Dog's Nose" program, an effort focused on the development of an advanced, field-portable system for detecting the explosive content of land mines. In 1999, Dr. Dugan was named DARPA Program Manager of the Year for her efforts, and in 2000 she was awarded the prestigious Bronze deFleury medal by the Army Engineer Regiment. She is also the recipient of the Office of the Secretary of Defense Award for Exceptional Service and the Award for Outstanding Achievement.

Dr. Dugan's contributions to the United States military are numerous. She led a counterterrorism task force for the Deputy Secretary of Defense in 1999 and, from 2001 to 2003, she served as a special advisor to the Vice Chief of Staff of the Army, completing a Quick Reaction Study on Countermine for Enduring Freedom. The results of this study were subsequently briefed to joint senior military leadership and successfully implemented in the field.

Prior to her appointment as director of DARPA, Dr. Dugan co-founded Dugan Ventures, a niche investment firm, where she served as President and CEO. In 2005, Dugan Ventures founded RedXDefense, LLC, a privately held company devoted to innovating solutions for combating explosive threats, where she also served as President and CEO. From private industry, Dr. Dugan brings a wealth of management, finance, product development, and marketing experience to the Agency.

Widely recognized for her leadership in technology development and as an experienced public speaker, Dr. Dugan has appeared on the Discovery Channel, National Public Radio, and The AAAS Science Report. Her projects have been the subject of articles in The New York Times Science Times, The New York Times Circuits, Forbes, The Wall Street Journal, Chemical and Engineering News and Science News. Additionally, Dr. Dugan previously participated in wide-ranging studies for the Defense Science Board, Army Science Board, National Research Council, and the Science Foundation, and sat on the Naval Research Advisory Committee and the Defense Threat Reduction Agency and Technology Panel.

Dr. Dugan obtained her doctorate degree in mechanical engineering from the California Institute of Technology and her master's and bachelor's degrees from Virginia Tech. She is the sole inventor or co-inventor on multiple patents and patents pending. Dr. Dugan is the co-author of Engineering Thermodynamics, 1996. She is the first female director of DARPA.

Open to All Attendees

exhibition visitors,
exhibitors, and technical
conference attendees

PANEL DISCUSSION

Getting Hired in 2011 and Beyond

Tuesday • 1:45 to 3:00 pm
Location: Grand 7B

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.

WORKSHOP

New NVESD Performance

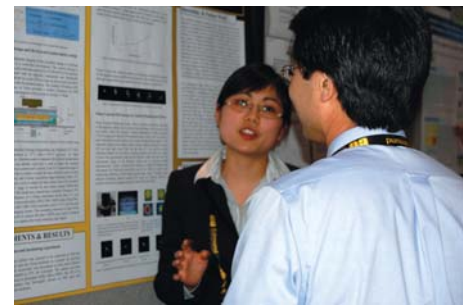
(Conf. 8014)

Tuesday • 4:50 to 6:00 pm
Location: Grand 6

Moderator: **Gerald C. Holst**, JCD Publishing

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

The US Army Night Vision and Electronic Sensors Directorate (NVESD) recently released a beta version of the next generation Integrated Performance Model (NV-IPM). Details concerning the changes to the model interface along with a discussion of model capabilities and a demonstration of existing model functionality will be the focus of this presentation. A discussion of updates to the model theory including revisions to the noise model, aliasing as noise, and the development of a fully 2D model will also be included.



Interactive Poster Session

Tuesday • 6:00 to 7:30 pm
Location: Crystal M

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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Forth Dimension Displays, recently acquired by Kopin Corporation, will be demonstrating the SXGA-R5 display in Kopin Booth # 400. The SXGA-R5 provides unparalleled image fidelity and enables ultra wide viewing angles required for demanding simulation systems.



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Kopin and ForthDD at DSS Booth # 400

WEDNESDAY 27 April

Government Funding Special Session

Wednesday • 3:30 to 5:30 pm • Location: Grand 4

High-level personnel in government funding agencies describe areas of interest to them. This is a chance to guide internal company R&D into areas with a higher probability of funding, based on the insights you will receive during this session. Three major government funding agencies will provide insights into their vision and perceived needs.



Moderator

Paul F. McManamon
Air Force Research Lab. (Ret.),
Univ. of Dayton

Air Force Research Lab. Presentation



Jeffrey J. Smith
Deputy Director, Plans and Programs,
Air Force Research Lab.

Colonel Jeff Smith is the Deputy Director, Plans and Programs, Air Force Research Laboratory. He is responsible for day-to-day operations of the ~145-person organization, which establishes and manages policies, processes and metrics. These in turn enable corporate strategy, business planning, robust systems engineering and program management, and corporate budgeting for the Air Force Research Laboratory, which is responsible for planning and executing all aspects of the Air Force science and technology program, providing leading-edge warfighting capabilities to keep our air, space & cyberspace forces the world's best.

Prior to assuming his current position, Colonel Smith served as an Air Force National Technical Laboratory Fellow at the Argonne National Laboratory, Argonne, Illinois. At Argonne, he gained valuable experience in national laboratory operations while conducting independent research into the analysis and operationalization of weapons of mass influence. He also represented USAF technology interests and coordinated information sharing to potentially leverage cutting edge Department of Energy research against US Air Force requirements.

Colonel Smith was commissioned following graduation from the U.S. Air Force Academy in 1986. He has held a variety of assignments in space lift, acquisition, space and information systems analysis and ICBM operations.

DARPA Presentation



David L. Neyland
Director, Tactical Technology Office, DARPA

Mr. David L. Neyland is Director, Tactical Technology Office, at the Defense Advanced Research Projects Agency. DARPA is the principal Agency within the Department of Defense (DoD) for advanced research and development and TTO specifically addresses technology development and demonstration for Air/Space/Land/Sea platforms, Precision Strike, Unmanned Systems, and Space Operations.

Prior to joining DARPA, Mr. Neyland was a Technical Director at the Charles Stark Draper Laboratory, responsible for studies to evaluate future tactical technology investment. Before Draper, Mr. Neyland was a Vice President and Division Manager at Science Applications International Corporation, and was Senior Program Manager for the development and international deployment of a critical national sensor system for nuclear monitoring.

Prior to SAIC, Mr. Neyland spent the Dot-Com era as Director of Program Management and Vice President of Engineering at three Dot-Coms: Network Solutions, iBrite and inphoMatch. Before boarding the Dot-Com rollercoaster, Mr. Neyland retired as Lieutenant Colonel from a 20 year Air Force career in Research and Development. During his Air Force years, Lieutenant Colonel Neyland (Ret.) was a DARPA Program Manager, a Flight Test Engineer and a Space Shuttle Flight Controller. Mr. Neyland is a PMP Certified Program Manager, a Distinguished Graduate of the Industrial College of the Armed Forces, a Program Manager Graduate of the Defense Systems Management College and a Flight Test Engineer Graduate of the Air Force Test Pilot School.

Mr. Neyland has a Master of Science in Astronautical Engineering from the Air Force Institute of Technology, a Master of Science in Resource Management from the Industrial College of the Armed Forces, and a Bachelor of Science in Applied Physics from the University of Miami.

IARPA Presentation



Edward J. Baranoski
Director, Office of Smart Collection, IARPA

Dr. Edward J. Baranoski is currently the Director of the Office of Smart Collection at Intelligence Advanced Research Projects Activity (IARPA) where the focus is on dramatically improving the value of collected data from all sources. He is a former program manager in the Special Projects Office and Strategic Technology Office at DARPA where his focus was on sensing, communication, and navigation in urban environments. From 1990 through 2004, he worked at MIT Lincoln Laboratory. He received Ph.D. from Carnegie Mellon University, and was an Associate Editor for IEEE Transactions on Antennas and Propagation and has served on the IEEE Underwater Acoustics Signal Processing and Sensor Array and Multichannel (SAM) Technical Committees from 2000-2007, and was co-chair of the first IEEE Sensor Array and Multichannel (SAM 2000) Signal Processing Workshop. He received the Office of the Secretary of Defense Medal for Exceptional Public Service in 2008.

PANEL DISCUSSION

Cross-Conference Hot Topic: Data to Decisions: "Sensors are No Longer King"

Wednesday • 10:30 am to 12:30 pm • Location: Crystal M



Moderator: **John M. Pellegrino**
Director, U. S. Army Research Lab., Computational and Information Sciences Directorate (CISD)

This cross-conference hot topic provides a unique forum for senior leaders from different organizational perspectives to discuss the shifting paradigm of what is needed to achieve the required situational understanding to make the best actionable battlefield decisions. We need to get away from the "autistic" view of sensing and learn to integrate other non-traditional information sources including HUMINT, cultural understanding, social networks, policies and behavior modeling.

Identifying the technology needs from a holistic perspective

Invited Speakers Include:

Mr. Robert Dixon, Jr., Chief, Office of Science & Technology Directorate for MASINT and Technical Collection

Col Charlie Flynn, Director, Mission Command Ctr. of Excellence (MCCoE), U. S. Army Training and Doctrine Command

Mr. Jack Lemon for Prof. Sutton, Director General (Research & Technology), UK MoD

Dr. Randy K. Avent, Chief Scientist, Basic Science, Office of the Secretary of Defense

Col John R. "Buck" Surdu, Ph.D., Military Deputy Director, CERDEC

Dr. Steven Rodgers, Air Force Research Lab.

PANEL DISCUSSION

Verification, Validation, and Accreditation

(Conf. 8060)

Wednesday • 11:30 am to 12:10 pm
Location: San Francisco Room

Panel Moderator: **Eric J. Kelmelis**
EM Photonics, Inc.

PANEL DISCUSSION

Less-Than-Lethal Technologies to Minimize Civilian Casualties (Conf. 8019)

Wednesday • 3:00 to 5:00 pm • Location: Crystal P

Moderator: **Col. Tracy Tafolla**
Director, Joint Non-Lethal Weapons Directorate (JNLWD)

The panel will include members from the following organizations: USMC, JFCOM, CENTCOM, DDRE, and US Army.

PANEL DISCUSSION

Multisensor, Multisource Information Fusion: Architectures, Algorithms, and Applications 2011 (Conf. 8064)

Wednesday • 4:50 to 5:50 pm • Location: San Antonio Room

Panel Moderator: **Jerome J. Braun**
MIT Lincoln Lab.

TRACK PLENARY PRESENTATION

Evolution of Airborne Chemical and Radiological Remote Sensing for Emergency and Natural Disaster Response (Conf. 8048)

Wednesday • 5:00 to 6:00 pm • Location: Crystal M

Presenter: **Paul E. Lewis**
National Geospatial-Intelligence Agency

In 2001 the United States Environmental Protection Agency's (EPA) Airborne Spectral Photometric Environmental Collection Technology (ASPECT) Program became the United States only civil 24/7 operational airborne chemical, radiological, and situational awareness reporting capability. Since 2001 the ASPECT aircraft has completed 107 successful airborne emergency response and homeland security related missions. The ASPECT model of operation combines an airborne operational remote sensing suite with a research and development support team to provide essential situational awareness information to first responders and their local, state and federal lead agencies in accordance with the National Contingency Plan and EPA's responsibility under Emergency Support Function 10 of the National Response Plan. This presentation will showcase the effectiveness and necessity of the ASPECT operational model in meeting the needs of the civil emergency response and homeland security communities. Highlights from a variety of ASPECT airborne missions will be presented including industrial accidents, homeland security situational awareness missions, and natural and anthropogenic disasters such as Hurricane Katrina and the Deepwater Horizon Oil Spill along with issues, and lessons learned.

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Banquet and DSS Lifetime Achievement Award Announcement

Wednesday • 7:00 to 9:30 pm
Location: Crystal H

Ticket Required
Banquet tickets \$95
See SPIE Cashier

Please join your colleagues for the presentation of the DSS Lifetime Achievement Award to General James E. Cartwright!

Dinner will start at 7:00 pm followed by the introduction of the SPIE New Fellows, and DSS Lifetime Achievement Award presentation.

Tickets for the banquet and presentation are \$95 per person and are sold separately from the conference registration fees. Tickets may be purchased onsite at the SPIE Cashier.

Banquet tickets must be purchased by Monday 25 April at 5:00 pm.

Competitive Advantage for the Warfighter

- 21st Century National Security
- DoD Requirement Trends
- The American Warfighter



General James E. Cartwright

Vice-Chairman of the Joint Chiefs of Staff

General Cartwright serves as the eighth Vice Chairman of the Joint Chiefs of Staff. In this capacity, he is a member of the Joint Chiefs of Staff and the Nation's second highest ranking military officer. As Vice Chairman, General Cartwright chairs the Joint Requirements Oversight Council, Co-Chairs the Defense Acquisition Board, and serves as a member of the National Security Council Deputies Committee, the Nuclear Weapons Council and the Missile Defense Executive Board. In addition, he Co-Chairs the Deputies Advisory Working Group, which provides advice to the Deputy Secretary of Defense on resourcing and other high-level departmental business issues.

General Cartwright was commissioned a second lieutenant in the Marine Corps in November 1971. He completed Naval Flight Officer training in April 1973 and graduated from Naval Aviator training in January 1977. He has operational assignments as an NFO in the F-4, and as a pilot in the F-4, OA-4, and F/A-18. He is a distinguished graduate of the Air Command and Staff College at Maxwell AFB, received his Master of Arts in National Security and Strategic Studies from the Naval War College, Newport, Rhode Island and completed a fellowship with Massachusetts Institute of Technology.

General Cartwright's command assignments include: Commander, United States Strategic Command (2004-2007); Commanding General, First Marine Aircraft Wing (2000-2002); Deputy Commanding General, Marine Forces Atlantic (1999-2000).

General Cartwright's joint staff assignments include: Director for Force Structure, Resources and Assessment, J-8 the Joint Staff (2002-2004); Deputy Director for Force Structure, Requirements, J-8 the Joint Staff (1996-1999).

THURSDAY 28 April

PANEL DISCUSSION

Contemporary Concerns in Geographical/ Geospatial Information Systems (GIS) Processing (Conf. 8053)

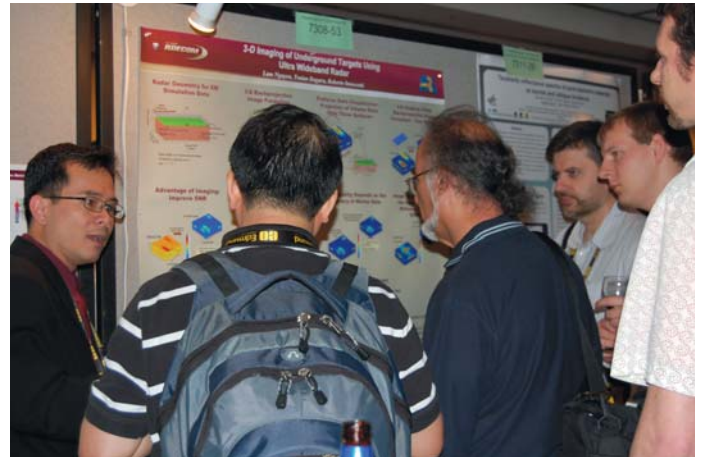
Thursday • 2:00 to 3:00 pm • Location: Grand 14

Moderator: Michael E. Gangl

MacAulay-Brown, Inc.

Panelists: **Erik P. Blasch**, Gunasekaran Seetharaman, Air Force Research Lab.; **Jason S. Brown**, Schafer Corp.; **Matthew Pellechia**, Shiloh L. Dockstader, ITT Corp. Geospatial Systems; **Paul B. Deignan**, L-3 Communications Integrated Systems; **Kannappan Palaniappan**, Univ. of Missouri-Columbia


With the advent of advances in Geospatial Information System (GIS), there is a need to determine the areas of research concern and new tools available for GIS systems. GIS consists of the collection, integration, storage, exploitation, and visualization of geographic and contextual data and information. This paper brings together panelists to assess the current directions of GIS research. The consolidated areas discussed by the panelists give a general direction of GIS needs, techniques, models, and standards. The summary of selected areas include: use of information fusion, support of meta-data, production of challenge problems, adherence to open standards, generation of architectures, and detailed standards and metrics.



Interactive Poster Session

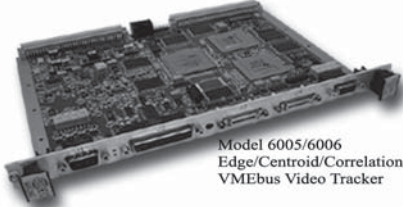
Thursday • 6:00 to 7:30 pm • Location Crystal M

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.

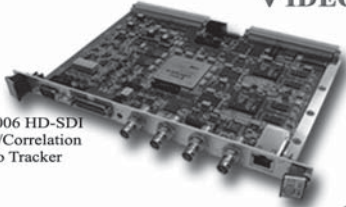


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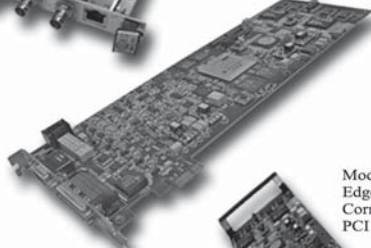
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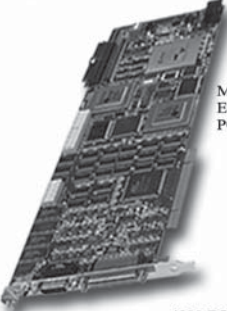
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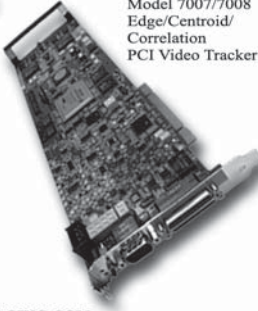
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Join your colleagues and develop new relationships at these relaxed-atmosphere events; enjoy light refreshments as you continue the day's discussions.



Fellows Luncheon

Monday • 12:00 to 1:30 pm • Location: Grand 8B

All Fellows of SPIE are invited to join your colleagues for an SPIE hosted luncheon. The new SPIE Fellows attending SPIE Defense, Security, and Sensing will be introduced and recognized. Please join us for this informal gathering and a chance to interact with other Fellows.



Free Space Optical Communication and Submarine Laser Communication

Dr. Larry B. Stotts

Defense Advanced Research Projects Agency

Two major laser communications applications are finally reaching maturity: Free Space Optical Communication (FSOC) and Submarine Laser Communication (SLC). In this presentation Dr. Stotts will highlight important aspects of their respective propagation channels, turbulence and particulates, that are allowing these systems to be seriously considered.

Dr. Larry Stotts is the Deputy Director for the Strategic Technology Office at the Defense Advanced Research Agency (DARPA). He is a Fellow of the SPIE and IEEE, and has published 95 journal articles, conference papers, and technical reports. Dr. Stotts received a National Partnership in Reinventing Government as part of the Maritime Differential Global Positioning System (GPS) Service Team and the Nationwide GPS Service Team in 1999. He also received the Secretary of Defense Medal for Meritorious Civilian Service in 1991, and again, in 1996. In addition, Dr. Stotts received The Technical Cooperation Program Technical Achievement Award in 1991; The NOSC Technical Director's Award in 1986; and the DARPA Outstanding Technical Achievement Award in 1985. Dr. Stotts holds 7 U.S. Patents.


All Symposium Welcome Reception

Monday • 6:00 to 7:00 pm • Location: Grand 7

All attendees are invited to the Welcome Reception. Relax, socialize, and enjoy the refreshments. Featuring IR Image Gallery Display presented by SPIE and StingRay Optics. Also watch as attendees have a chance to race FLIR's unmanned vehicles in an intense obstacle race for prizes.

Please remember to wear your registration badges. Dress is casual.

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Booth #700

Student Lunch with the Experts

A Student Networking Event

Tuesday • 12:30 to 1:30 pm • Location: Grand 8B

Seating is Limited. Tickets Required

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

Women in Optics Presentation and Reception

Tuesday • 4:30 to 6:00 pm • Location: Grand 7B

Open to all conference attendees

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



The Hand in the Snow

Colleen Fitzpatrick, PhD

Colleen Fitzpatrick is a Forensic Genealogist who has been recognized for her work with the Armed Forces DNA Identification Laboratory on identifying the remains found in the Alaskan crash of Northwest Flight 4422. Retired from the optical industry in 2005, she now assists nonprofits, military organizations, and the FBI with forensic identification, and has been instrumental at exposing two high profile Holocaust literary frauds. As a world traveler and multi-lingual, Colleen specializes in international cases. She has written three books and numerous articles on forensic genealogy. Her article on Flight 4422 will be published in Scientific American early in 2011.

Early Career Networking Social

Wednesday • 5:30 to 6:30 pm • Location: Grand 12

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

Job Fair

Two Days Only

Cypress 1 Foyer

Tuesday 26 April · 9:30 am to 5:00 pm

Wednesday 27 April · 10:00 am to 5:00 pm

Whether you are looking for a better job, re-entering the workforce or just starting your career, the SPIE Career Center and Defense, Security, and Sensing Job Fair are both great places to start!

- Meet with employers and interview on the spot
- Learn more about opportunities in our industry

Recruiters from these companies will be on hand to discuss career opportunities

Companies as of 21 March 2011

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Professional Development

Spend some time focusing on your career development while you're at SPIE Defense, Security, and Sensing. These workshops and presentations will help you be more successful.

PANEL DISCUSSION

Getting Hired in 2011 and Beyond

Tuesday • 1:45 to 3:00 pm

Location: Grand 7B

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.

Leading Successful Product Innovation

WS951 • Course level: Intermediate

CEU .35 Member \$325 / Non-member \$375 USD

Tuesday 8:30 am to 12:30 pm

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

Instructor: **John Carrano** is President of Carrano Consulting. Previously, he was the Vice President, Research & Development, Corporate Executive Officer, and Chairman of the Scientific Advisory Board for Luminex Corporation, where he led the successful development of several major new products from early conception to market release and FDA clearance..

Basic Optics for Non-Optics Personnel

WS609 • Course level: Introductory

CEU .20 \$150 / Non-member \$200 USD

Tuesday 1:30 to 4:00 pm

This course will provide the technical manager, sales engineering, marketing staff, or other non-optics personnel with a basic understanding of the terms, specifications, and measurements used in optical technology to facilitate effective communication with optics professionals on a functional level. Topics to be covered include basic concepts such as interference, diffraction, polarization and aberrations, definitions relating to color and optical quality, and an overview of the basic measures of optical performance such as MTF and wavefront error. The material will be presented with a minimal amount of math, rather emphasizing working concepts, definitions, rules of thumb, and visual interpretation of specifications. Specific applications will include defining basic imaging needs such as magnification and depth-of-field, understanding MTF curves and interferograms, and interpreting radiometric terms.

Instructor: **Kevin Harding** has been active in the optics industry for over 30 years, and has taught machine vision and optical methods for over 25 years in over 70 workshops and tutorials, including engineering workshops on machine vision, metrology, NDT, and interferometry used by vendors and system houses to train their own engineers. He has been recognized for his leadership in optics and machine vision by the Society of Manufacturing Engineers, Automated Imaging Association, and Engineering Society of Detroit.

Registration Required

See SPIE Cashier.

Complying with the ITAR: A Case Study

WS933 • Course level: Introductory
CEU .35 Member \$325 / Non-member \$375 USD
Wednesday 8:30 am to 12:30 pm

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

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

Instructor: **Kerry Scarlott** is a Director at the law firm of Goulston & Storrs. With an office in Boston, MA and Washington, D.C., Kerry focuses his practice on business law and international trade law, with particular expertise in assisting technology-based companies.



Advanced Topics in U.S. International Trade Regulations NEW

WS1037 • Course level: Intermediate
CEU .35 Member \$325 / Non-member \$375 USD
Thursday 8:30 am to 12:30 pm

U.S. businesses are subject to increasing regulatory controls on the export of their products, services and technical data, as well as their sales activities in foreign jurisdictions. Recent increases in penalty amounts and coordination among federal agencies have sharpened the ability of export enforcement authorities to target wrongdoers. These developments coincide with a dramatic up-tick in investigative and enforcement activity involving businesses of every size.

During this fast-paced program, you will be provided with cutting edge information designed to forestall enforcement activities against your company. Real world situations and lessons learned will be provided, as well as practical tips on best practices.

Instructor: **Kerry Scarlott** is a Director at the law firm of Goulston & Storrs. With an office in Boston, MA and Washington, D.C., Kerry focuses his practice on business law and international trade law, with particular expertise in assisting technology-based companies.

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Powerful tools to help you get the most out of your week.

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Walk the floor and see the latest defense, security, sensing homeland security, robotic, and environmental technologies

SPIE Defense, Security, Sensing

Exhibition Halls, Cypress and Palms Ballroom

Tuesday 26 April 9:30 am to 5:00 pm

Wednesday 27 April 10:00 am to 5:00 pm

Thursday 28 April 10:00 am to 2:00 pm

NEW FOR 2011

Imaging Gallery

Hosted by **StingRay**  **SPIE**

Monday 25 April • 6:00 to 7:30 pm
Displayed Outside the Welcome Reception

StingRay Optics and SPIE are proud to announce an exciting new addition to the SPIE Defense, Security, and Sensing Event.

Choice images showcasing technologies upon which SPIE was originally founded, are displayed for the enjoyment of all symposium attendees. The images range from professional applications to artistic renditions and creative scenes.

Visit with reps from the largest prime contractors and the most dynamic startups at the SPIE Defense, Security, and Sensing Exhibition. The free 500-company exhibition showcases the newest products, latest innovations, and cutting-edge technologies.

Don't Miss the New Technology Demos and Displays

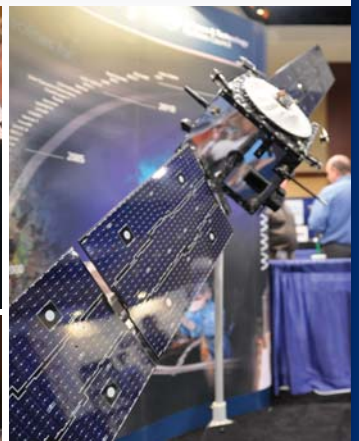
SPIE Defense, Security and Sensing Exhibition will again feature New Technology Demos and Displays. Located in the Palms Exhibition Hall.

Attendees will see: Latest technology developments of imaging and sensing technologies for:

- Defense, Industrial, and Commercial Applications
- Situational Awareness Top-Mount Surveillance System
- High-Power Scanning-Electron Microscopes
- Real-World Applications of Laser Power Beaming Systems for UAVs
- High-Speed, High-Precision Imaging at Work with Audience Participation

Products being featured:

- **PVP Advanced EO Systems, Inc.** – Night Hawk Static Azimuth mount.
- **JEOL** – InTouchScope with multi-touch screen features.
- **LaserMotive, LLC** – Example of an innovative laser power beaming system powering unmanned aerial vehicles.
- **Boulder Imaging, Inc.** – Demonstration on high-speed, high-performance, and high-precision imaging systems. **PRESENTATION SCHEDULE:** Tuesday April 26 – 11:00 am, 1:00 pm, and 3:00 pm; Wednesday April 27 – 11:00 am, 1:00 pm, and 3:00 pm; Thursday April 28 – 11:00 am and 1:00 pm















Don't miss these
FREE Demonstrations

Product Demos • Location: Cypress 2 Foyer

Product Demonstrations are open to all attendees. Exhibiting companies will showcase new and successful products in half-hour demonstrations.

TIME	Tuesday 26 April	Wednesday 27 April	Thursday 28 April
10:30 am	29 Million Pixel Camera for ISR and Persistent Surveillance Kris Balch, Vision Systems Technology, LLC	Mini Linear Coolers with Cooler Diagnostic Software Hans van der Weijden, Thales Cryogenics B.V.	Infrared Material Production by SCHOTT North America Dr. Heather Rayle, SCHOTT North America, Inc.
11:30 am	Nucless or Less Nuc for Opgals' Uncooled Products Shai Fishbain, Opgal Ltd.	SWIR and LWIR Image Fusion with OEM Engines for Night Vision Koen Jacobs, Xenics	Matrox Supersight: High-Performance Computing Platform Michael Chee/Jorge Chang, Matrox Imaging
12:30 pm	ADEPT3000 Ultra Compact Video Tracker Chris Jobling, GE Intelligent Platforms, Applied Image Processing	"I Can See Clearly Now" Arnold Kravitz, SRI International Sarnoff	
1:30 pm	Transitioning from Standard Video to HD Ruben Uribe, Physimetrics, Inc.	SuperBand Optic Jennifer Myers, StingRay Optics	
2:30 pm	Digital HD Rugged Cameras for Enhanced Defense Vision Marcel Dijkema, Adimec	Optikos LensCheck™ Daniel Orband, Optikos Corporation	EXHIBITION CLOSED
3:30 pm	High Performance Coated Components from SCHOTT Dr. Angela Hohl-AbiChedid, SCHOTT North America, Inc.	Controlled Illumination Fiber Optic Filter for Defined Light Signature with Digital Displays Ann Kutsch, SCHOTT North America, Inc. - Defense	
4:30 pm	Night Vision CMOS Tom Vogelsong, SRI International Sarnoff	"Shake, Rattle and Roll" Electronic Video Stabilization Arnold Kravitz, SRI International Sarnoff	

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Daily Conference Schedule

Monday	Tuesday	Wednesday	Thursday	Friday
25 April	26 April	27 April	28 April	29 April

IR Sensors and Systems


Registration Required
See SPIE Cashier to Register.

8012 Infrared Technology and Applications XXXVII (<i>Andresen, Fulop, Norton</i>) p. 38				
	8013 Thermosense: Thermal Infrared Applications XXXIII (<i>Safai, Brown</i>) p. 46			
	8014 Infrared Imaging Systems: Design, Analysis, Modeling, and Testing XXII (<i>Holst, Krapels</i>) p. 49			
		8015 Technologies for Synthetic Environments: Hardware-in-the-Loop XVI (<i>Mobley</i>) p. 52		
		8016 Window and Dome Technologies and Materials XII (<i>Tustison</i>) p. 54		



Defense, Homeland Security, and Law Enforcement

8017 Detection and Sensing of Mines, Explosive Objects, and Obscured Targets XVI (<i>Harmon, Holloway, Broach</i>) p. 56				
8029B Biometric Technology for Human Identification VIII (<i>Vijaya Kumar, Prabhakar, Ross</i>) p. 89	8018 Chemical, Biological, Radiological, Nuclear, and Explosives (CBRNE) Sensing XII (<i>Fountain, Gardner</i>) p. 60			
8019 Sensors, and Command, Control, Communications, and Intelligence (C3I) Technologies for Homeland Security and Homeland Defense X (<i>Carapezza</i>) p. 64				

Imaging and Sensing




8021 Radar Sensor Technology XV (<i>Ranney, Doerry</i>) p. 69		8022 Passive Millimeter-Wave Imaging Technology XIV (<i>Wikner, Luukanen</i>) p. 72		
8023 Terahertz Physics, Devices, and Systems V: Advance Applications in Industry and Defense (<i>Anwar, Dhar, Crowe</i>) p. 74	8020 Airborne Intelligence, Surveillance, Reconnaissance (ISR) Systems and Applications VIII (<i>Henry</i>) p. 67			

Sensing for Industry, Environment, and Health

8024 Advanced Environmental, Chemical, and Biological Sensing Technologies VIII (<i>Vo-Dinh, Lieberman, Gauglitz</i>) p. 76		8025 Smart Biomedical and Physiological Sensor Technology VIII (<i>Cullum, McLamore</i>) p. 78		
8026 Photonic Applications for Aerospace, Transportation, and Harsh Environment II (<i>Kazemi, Kress, Chan</i>) p. 80				
	8027 Sensing for Agriculture and Food Quality and Safety III (<i>Kim, Tu, Chao</i>) p. 82	8028 Fiber Optic Sensors and Applications VIII (<i>Mihailov, Du, Pickrell</i>) p. 84		
8029A Sensing Technologies for Global Health, Military Medicine, Disaster Response, and Environmental Monitoring (<i>Montgomery, Southern, Taylor, Weigl</i>) p. 86				
	8030 Ocean Sensing and Monitoring III (<i>Hou, Arnone</i>) p. 90			

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Emerging Technologies

8031 Micro- and Nanotechnology Sensors, Systems, and Applications III (<i>George, Islam, Dutta</i>) p. 92				
8032 Next-Generation Spectroscopic Technologies IV (<i>Druy, Crocombe</i>) p. 97		8033 Advanced Photon Counting Techniques V (<i>Itzler, Campbell</i>) p. 99		
		8034 Photonic Microdevices/Microstructures for Sensing III (<i>Xiao, Fan, Wang</i>) p. 101		
8035 Energy Harvesting and Storage: Materials, Devices, and Applications II (<i>Dhar, Wijewarnasuriya, Dutta</i>) p. 103				
	8036 Scanning Microscopies 2011: Advanced Microscopy Technologies for Defense, Homeland Security, Forensic, Life, Environmental, and Industrial Sciences (<i>Postek, Newbury, Platek</i>) p. 106			

Laser Sensors and Systems

		8037 Laser Radar Technology and Applications XVI (<i>Turner, Kamerman</i>) p. 109		
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Innovative Defense and Security Applications for Displays

8042A Display Technologies and Applications for Defense, Security, and Avionics V (<i>Thomas, Desjardins</i>) p. 120			8041 Head- and Helmet-Mounted Displays XVI: Design and Applications (<i>Marasco, Havig</i>) p. 119	
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Space Technologies and Operations

8044 Sensors and Systems for Space Applications IV (<i>Pham, Zmuda, Cox, Meyer</i>) p. 126				
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Unmanned, Robotic, and Layered Systems

		8045 Unmanned Systems Technology XIII (<i>Gage, Shoemaker, Karlsen, Gerhart</i>) p. 128		
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Sensor Data and Information Exploitation

8048 Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XVII (<i>Shen, Lewis</i>) p. 135				
8049 Automatic Target Recognition XXI (<i>Sadjadi, Mahalanobis</i>) p. 138			8053 Geospatial InfoFusion Systems and Solutions for Defense and Security Applications (<i>Pellechia, Sorensen</i>) p. 148 NEW	
8050 Signal Processing, Sensor Fusion, and Target Recognition XX (<i>Kadar</i>) p. 140				
8052 Acquisition, Tracking, Pointing, and Laser Systems Technologies XXV (<i>Thompson, McManamon</i>) p. 146		8051 Algorithms for Synthetic Aperture Radar Imagery XVIII (<i>Zelnio, Garber</i>) p. 144		

Signal, Image, and Neural Net Processing

8054 Enabling Photonics Technologies for Defense, Security, and Aerospace Applications VII (<i>Hayduk, Delfyett</i>) p. 150		8058 Independent Component Analyses, Wavelets, Neural Networks, Biosystems, and Nanoengineering IX (<i>Szu</i>) p. 158		
	8056 Visual Information Processing XX (<i>Rahman, Reichenbach, Neifeld</i>) p. 154		8055 Optical Pattern Recognition XXII (<i>Casasent, Chao</i>) p. 152	
			8057 Quantum Information and Computation IX (<i>Donkor, Pirich, Brandt</i>) p. 156	

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

		8059 Evolutionary and Bio-Inspired Computation: Theory and Applications V (<i>Blowers, O'Donnell, Mendoza-Schrock</i>) p. 162	
	8060 Modeling and Simulation for Defense Systems and Applications VI (<i>Kelmelis</i>) p. 164		8061 Wireless Sensing, Localization, and Processing VI (<i>Dianat, Zoltowski</i>) p. 166
		8062 Defense Transformation and Net-Centric Systems 2011 (<i>Suresh</i>) p. 167	
8063 Mobile Multimedia/Image Processing, Security, and Applications 2011 (<i>Agaian, Jassim, Du</i>) p. 169		8064 Multisensor, Multisource Information Fusion: Architectures, Algorithms, and Applications 2011 (<i>Braun</i>) p. 171	

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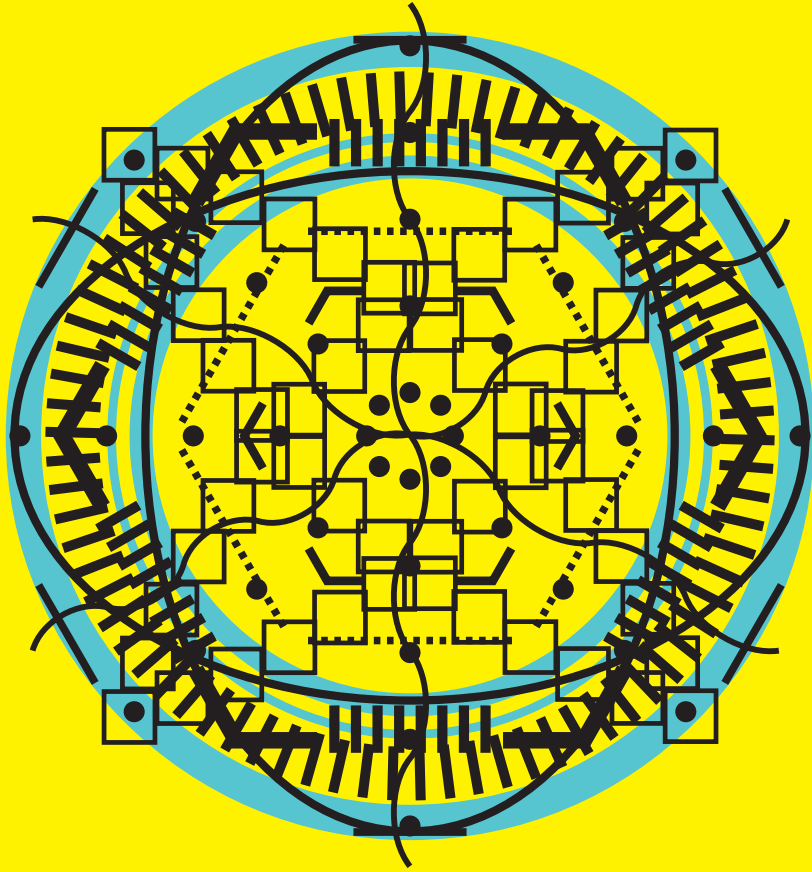


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Infrared Technology and Applications XXXVII

Conference Chairs: **Bjørn F. Andresen**, SCD Semiconductor Devices (Israel); **Gabor F. Fulop**, Maxtech International, Inc. (USA); **Paul R. Norton**, U.S. Army Night Vision & Electronic Sensors Directorate (USA)

Program Committee: **Christopher C. Alexay**, StingRay Optics, LLC (USA); **Timothy Ashley**, QinetiQ Ltd. (United Kingdom); **J. Bajaj**, Teledyne Imaging Sensors (USA); **Stefan T. Baur**, Raytheon Vision Systems (USA); **Philippe F. Bois**, Alcatel-Thales III-V Lab. (France); **Wolfgang A. Cabanski**, AIM INFRAROT-MODULE GmbH (Germany); **John T. Caulfield**, Cyan Systems (USA); **John W. Devitt**, Georgia Tech Research Institute (USA); **Nibir K. Dhar**, Defense Advanced Research Projects Agency (USA); **Michael T. Eismann**, Air Force Research Lab. (USA); **Martin H. Ettenberg**, Sensors Unlimited, Inc., part of Goodrich Corp. (USA); **Sarath D. Gunapala**, Jet Propulsion Lab. (USA); **Charles M. Hanson**, L-3 Electro-Optical Systems (USA); **Masafumi Kimata**, Ritsumeikan Univ. (Japan); **Hee Chul Lee**, Korea Advanced Institute of Science and Technology (Korea, Republic of); **Paul D. LeVan**, Air Force Research Lab. (USA); **Chuan C. Li**, DRS Technologies, Inc. (USA); **Wei Lu**, Shanghai Institute of Technical Physics (China); **Paul L. McCarley**, Air Force Research Lab. (USA); **R. Kennedy McEwen**, SELEX Galileo Ltd. (United Kingdom); **John L. Miller**, FLIR Systems, Inc. (USA); **A. Fenner Milton**, U.S. Army RDECOM CERDEC NVESD (USA); **Peter W. Norton**, BAE Systems (USA); **Joseph G. Pellegrino**, U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Ray Radebaugh**, National Institute of Standards and Technology (USA); **Manijeh Razeghi**, Northwestern Univ. (USA); **Colin E. Reese**, U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Ingmar G. Renhorn**, Swedish Defence Research Agency (Sweden); **Antoni Rogalski**, Military Univ. of Technology (Poland); **Ingo Rühlich**, AIM INFRAROT-MODULE GmbH (Germany); **Gabby Sarusi**, Elbit Systems Electro-Optics EIOp Ltd. (Israel); **Piet B. W. Schwering**, TNO Defence, Security and Safety (Netherlands); **Itay Shtrichman**, SCD Semiconductor Devices (Israel); **Rengarajan Sudharsanan**, Spectrolab, Inc. (USA); **Stefan P. Svensson**, U.S. Army Research Lab. (USA); **Venkataraman S. Swaminathan**, U.S. Army Armament Research, Development and Engineering Ctr. (USA); **Simon Thibault**, Univ. Laval (Canada); **Meimei Z. Tidrow**, U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Jean-Luc M. Tissot**, ULIS (France); **Philippe Tribolet**, SOFRADIR (France); **Jay N. Vizgaitis**, U.S. Army Night Vision & Electronic Sensors Directorate (USA); **James R. Waterman**, U.S. Naval Research Lab. (USA); **Lucy Zheng**, Institute for Defense Analyses (USA)

Monday 25 April

Opening Remarks

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

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

SESSION 1

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

Target Acquisition with Today's Leading Imaging Technologies

Session Chair: **Rainer Breiter**, AIM INFRAROT-MODULE GmbH (Germany)

8:10 am: **Sofradir latest developments for infrared space detectors**, Philippe Chorier, Patricia Pidancier, Yoanna-Reine Nowicki-Bringuier, Anne Delannoy, Bruno Fieque, SOFRADIR (France) [8012-01]

8:30 am: **First flights of a new airborne thermal infrared imaging spectrometer with high area coverage**, Jeffrey L. Hall, Richard H. Boucher, David J. Gutierrez, Steven J. Hansel, Brian P. Kasper, Eric R. Keim, Nery M. Moreno, Mark L. Polak, Mazaher G. Sivjee, David M. Tratt, David W. Warren, The Aerospace Corp. (USA) [8012-02]

8:50 am: **SCD's uncooled detectors and video engines for a wide-range of applications**, Rami Frenkel, Udi Mizrahi, Leonid Bikov, Avihoo Giladi, Niv Shiloah, Shimon Elkind, Tomer Czyzewski, Rotem Gazit, Igal Kogan, Shay Maayani, Asaf Amsterdam, Ilan Vaserman, Offir Duman, Yoav Hirsh, Fabian Schapiro, SCD Semiconductor Devices (Israel); Avi Tuito, Israel Ministry of Defense (Israel) [8012-03]

9:10 am: **The new megapixel thermal imager family**, Jörg Fritze, Mario O. Münzberg, Carl Zeiss Optronics GmbH (Germany) [8012-04]

9:30 am: **A family of handheld thermal imagers**, Ludovic Sogno, Qiopiq S.A.S. (France); Jean-Claude L. Fontanella, Thales Optronique S.A. (France) [8012-06]

9:50 am: **New applications with a SWIR imager employing extended wavelengths**, Gil A. Tidhar, Optigo Directorate IAI-ELTA (Israel) [8012-07]

Coffee Break 10:10 to 10:40 am

SESSION 2

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

Threat Identification I

Session Chair: **Mario O. Münzberg**, Carl Zeiss Optronics GmbH (Germany)

10:40 am: **Blast investigation by fast multispectral radiometric analysis**, Adam D. Devir, Yossi Bushlin, Ilan Mendelewicz, Alex B. Lessin, Michael Y. Engel, IARD Sensing Solutions Ltd. (Israel) [8012-08]

11:00 am: **Open path FTIR detection of threat chemicals in air and on surfaces**, Samuel P. Hernandez-Rivera, John R. Castro-Suarez, Leonardo C. Pacheco-Londoño, Orlando Ruiz-Pesante, Miguel Velez-Reyes, Univ. de Puerto Rico Mayagüez (USA); Max Diem, Northeastern Univ. (USA) [8012-09]

11:20 am: **Scene understanding and task optimisation using multimodal imaging sensors and context: a real-time implementation**, Barry Connor, Iain Carrie, Thales Optronics Ltd. (United Kingdom); Jonathan Letham, Neil M. Robertson, Heriot-Watt Univ. (United Kingdom) [8012-152]

Lunch Break 11:40 am to 1:00 pm

SESSION 3

Room: Grand 8A Mon. 1:00 to 2:00 pm

Threat Identification II

Session Chair: **Ingmar G. Renhorn**, Swedish Defence Research Agency (Sweden)

1:00 pm: **Simultaneous multispectral framing infrared camera using an embedded diffractive optical lenslet array**, Michele Hinrichs, Pacific Advanced Technology, Inc. (USA) [8012-11]

1:20 pm: **Infrared-based early warning system for bird strike prevention at Frankfurt airport**, Mario O. Münzberg, Holger Vogel, Alexa Schilling, Markus Welk, Carl Zeiss Optronics GmbH (Germany); Heiko Cramer, Jan Schlosshauer, FusionSystems GmbH (Germany) [8012-12]

1:40 pm: **Time-varying phase diversity turbulence compensation**, Adam van Eekeren, Klammer Schutte, Judith Dijk, Piet B. W. Schwering, TNO Defence, Security and Safety (Netherlands) [8012-13]

SESSION 4

Room: Grand 8A Mon. 2:00 to 4:10 pm

Smart Image and Signal Processing

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

2:00 pm: **Focal plane generation of multi-resolution and multi-scale image representation for low-power vision applications** (*Invited Paper*), Jorge Fernández-Berni, Ricardo A. Carmona-Galán, Luis Carranza-González, IMSE-CNM (Spain); Akos Zarándy, Computer and Automation Research Institute (Hungary); Ángel B. Rodríguez-Vázquez, IMSE-CNM (Spain). [8012-14]

2:20 pm: **Advanced multi-function infrared detector with on-chip processing** (*Invited Paper*), Lidia Langof, Dan Nussinson, Elad Ilan, Shimon Elkind, Roman Dobromislín, Itzik Nevo, Fanny Khinich, Michael Labilov, Zipora Calahorra, Shay Vaserman, Tuvy Markovitz, SCD Semiconductor Devices (Israel); Ofer Manela, Elbit Systems Electro-Optics El-Op Ltd. (Israel). [8012-15]

2:40 pm: **Analysis and simulation of CTIA-based pixel reset noise** (*Invited Paper*), Daniel A. Van Blerkom, Forza Silicon Corp. (USA). [8012-18]

Coffee Break 3:00 to 3:30 pm

3:30 pm: **Calibration method for division of focal plane polarimeters in the optical and near-infrared regime** (*Invited Paper*), Timothy York, Viktor Gruev, Washington Univ. in St. Louis (USA). [8012-19]

3:50 pm: **Hexagonal sampling in the infrared domain: an introduction to array set addressing** (*Invited Paper*), Nicholas I. Rummelt, Air Force Research Lab. (USA); Geoffrey L. Barrows, Centeye, Inc. (USA); Mark A. Massie, Nova Sensors (USA). [8012-157]

SESSION 5

Room: Grand 8A Mon. 4:10 to 5:30 pm

QWIP and QDIP

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

4:10 pm: **Thermo-electrically cooled shortwave infrared and longwave infrared dual-band quantum-dot photodetector**, Jarrod N. Vaillancourt, Applied NanoFemto Technologies (USA); Xuejun Lu, Univ. of Massachusetts Lowell (USA). [8012-20]

4:30 pm: **Design of broadband QWIPs**, Vincent Guériaux, Alexandru Nedelcu, Agnès Coulibaly, Lydie Dua, Nadia Brière de l'Isle, Virginie Trinité, Xavier Marcadet, Alcatel-Thales III-V Lab. (France). [8012-21]

4:50 pm: **Performance of the QWIP focal plane arrays for NASA's Landsat Data Continuity Mission**, Murzy D. Jhabvala, NASA Goddard Space Flight Ctr. (USA); Kwong-Kit Choi, U.S. Army Research Lab. (USA); Augustyn Waczynski, Anh T. La, NASA Goddard Space Flight Ctr. (USA); Mani Sundaram, QmagiQ, LLC (USA); Eric M. Costard, Thales Research & Technology (France); Christine A. Jhabvala, Emily Kan, Duncan M. Kahle, Roger Folz, NASA Goddard Space Flight Ctr. (USA); Nicholas Boehm, Mike Hickey, Global Science & Technology, Inc. (USA); Jason Sun, U.S. Army Research Lab. (USA); Tomoko Adachi, Catholic Univ. of America (USA); Nicholas P. Costen, Larry A. Hess, Munz Engineering Inc. (USA); Hugues Facoetti, Alcatel-Thales III-V Lab. (France); Matthew Montanaro, Sigma Space Corp. (USA). [8012-22]

5:10 pm: **Electromagnetic modeling of C-QWIP FPA pixels**, Kwong-Kit Choi, U.S. Army Research Lab. (USA); Murzy D. Jhabvala, NASA Goddard Space Flight Ctr. (USA); David P. Forrai, L-3 Communications Cincinnati Electronics (USA); Augustyn Waczynski, NASA Goddard Space Flight Ctr. (USA); Jason Sun, U.S. Army Research Lab. (USA); Robert A. Jones, L-3 Communications Cincinnati Electronics (USA). [8012-23]

Tuesday 26 April

Symposium-Wide Plenary Session

Tuesday • 8:30 to 9:30 am • Location: Crystal H

Dr. Regina E. Dugan

Director, Defense Advanced Research Projects Agency (DARPA)

See page 18 for details • Open to All Attendees

Coffee Break 9:30 to 10:00 am

SESSION 6

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

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)

10:00 am: **Update on III-V superlattice material characterization and FPA performance** (*Invited Paper*), Meimei Z. Tidrow, U.S. Army Night Vision & Electronic Sensors Directorate (USA); Lucy Zheng, Institute for Defense Analyses (USA); Sumith Bandara, Leslie Aitchison, Neil Supola, U.S. Army Night Vision & Electronic Sensors Directorate (USA). [8012-24]

10:30 am: **Recent advances in high-performance antimonide-based superlattice FPAs** (*Invited Paper*), Manijeh Razeghi, Northwestern Univ. (USA). [8012-25]

11:00 am: **Current developments for type-II superlattice imaging systems** (*Invited Paper*), Frank Rutz, Robert H. Rehm, Martin Walther, Michael Masur, Andreas Wörl, Johannes Schmitz, Matthias Wauro, Jasmin Niemasz, Fraunhofer-Institut für Angewandte Festkörperphysik (Germany); Ralf Scheibner, Johann Ziegler, AIM INFRAROT-MODULE GmbH (Germany). [8012-26]

11:20 am: **Performance optimization of long-wave infrared detectors based on InAs/GaSb strained layer superlattices**, Elena A. Plis, Nutan Gautam, Stephen A. Myers, Maya N. Kutty, Brianna Klein, Mikhail Naydenkov, Sanjay Krishna, Ctr. for High Technology Materials (USA). [8012-27]

11:40 am: **Effects of the phonon energy and carrier concentration on the carrier lifetime in LWIR and MWIR type-2 SLS and MCT materials for IR photodetector technology**, Gregory Belenky, Stony Brook Univ. (USA); Stefan P. Svensson, U.S. Army Research Lab. (USA); Dmitry V. Donetsky, Sergey D. Suchalkin, Ding Wang, Stony Brook Univ. (USA); David Westerfeld, Power Photonic Corp. (USA); Amy W. Liu, Joel M. Fastenau, Dmitry Loubychyev, IQE Inc. (USA). [8012-28]

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

SESSION 7

Room: Grand 8A Tues. 1:30 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: **Dual-band response from InAs/GaSb strained layer superlattice detectors with nBn design**, Elena Plis, Sanchita Krishna, Sanjay Krishna, SK Infrared LLC (USA). [8012-29]

1:50 pm: **Minority carrier vertical transport in InAs/GaSb type-II strained layer superlattices for infrared focal plane array applications**, Jarek Antoszewski, Hemendra Kala, Gilberto A. Umana-Membreno, Mariusz P. Martyniuk, John M. Dell, Lorenzo Faraone, The Univ. of Western Australia (Australia); B. Klein, G. Gautam, Maya N. Kutty, Elena Plis, Sanjay Krishna, The Univ. of New Mexico (USA). [8012-30]

2:10 pm: **Noise performance analysis of MWIR InAs/GaSb superlattice pin photodiodes**, Isabelle Ribet-Mohamed, Katarzyna Jaworowicz, ONERA (France); Cyril Cervera, Jean-Baptiste Rodriguez, Philippe Christol, Institut d'Electronique du Sud (France). [8012-31]

Conference 8012 • Current Sessions – Rooms: Grand 8A and Grand 7B

2:30 pm: **Low-temperature noise measurements of an InAs/GaSb-based nBn MWIR detector**, Vincent M. Cowan, Christian P. Morath, Air Force Research Lab. (USA); Stephen A. Myers, Elena A. Plis, Sanjay Krishna, Ctr. for High Technology Materials (USA) [8012-32]

2:50 pm: **Scaling up antimonide wafer production: innovation and challenges for epitaxy ready GaSb and InSb substrates**, Mark J. Furlong, Rebecca Martinez, Sasson Amirhaghi, Andrew Mowbray, Brian Smith, Wafer Technology Ltd. (United Kingdom) [8012-33]

Coffee Break 3:10 to 3:40 pm

3:40 pm: **Fabrication and performance of InAs/GaSb superlattice LWIR detectors**, Sevag Terterian, Hasan Sharifi, Pierre-Yves Delaunay, Brett Z. Noshov, Mark S. Roebuck, Rajesh D. Rajavel, HRL Labs., LLC (USA) [8012-34]

4:00 pm: **Performance analysis of symmetrical and asymmetrical InAs/GaSb superlattice pin photodiode**, Philippe Christol, Rachid Taalat, Cyril Cervera, Jean-Baptiste Rodriguez, Univ. Montpellier 2 (France); Katarzyna Jaworowicz, Isabelle Ribet-Mohamed, ONERA (France); Leszek Konczewicz, Sylvie Contreras, Univ. Montpellier 2 (France) [8012-35]

4:20 pm: **Superlattice barrier infrared detector development at the Jet Propulsion Laboratory (Invited Paper)**, David Z. Ting, Alexander Soibel, Jean Nguyen, Arezou Khoshakhlagh, Linda Höglund, Sir Don B. Rafol, Sam A. Keo, Jason M. Mumolo, John K. Liu, Sarath D. Gunapala, Jet Propulsion Lab. (USA) [8012-36]

SESSION 8

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

Emerging Uncooled Technologies

Session Chairs: **Colin E. Reese**, U.S. Army Night Vision & Electronic Sensors Directorate (USA);
Charles M. Hanson, L-3 Electro-Optical Systems (USA)

4:40 pm: **Toward 17 μ m pitch heterogeneously integrated Si/SiGe quantum well bolometer focal plane arrays**, Per S. Ericsson, Acreo AB (Sweden); Andreas C. Fischer, Fredrik Forsberg, Niclas Roxhed, Royal Institute of Technology (Sweden); Björn Samel, Susan M. Savage, Acreo AB (Sweden); Göran Stemme, Royal Institute of Technology (Sweden); Stanley G. E. Wissmar, Olof Öberg, Acreo AB (Sweden); Frank Niklaus, Royal Institute of Technology (Sweden) [8012-37]

5:00 pm: **Experimental LWIR spectral characterization of wavelength selective microbolometers**, Dean P. Neikirk, Joo-Yun Jung, Jong Yeon Park, The Univ. of Texas at Austin (USA); Aniruddha S. Weling, Foster-Miller, Inc. (USA); Will Hafer, James H. Goldie, Infoscitex Corp. (USA); Paul D. Willson, U.S. Army Armament Research, Development and Engineering Ctr. (USA) [8012-38]

5:20 pm: **Infrared phased-array sensor**, Brian A. Slovick, Jeffrey A. Bean, Glenn D. Boreman, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) [8012-39]

5:40 pm: **High-speed uncooled MWIR hostile fire indication sensor**, Lei Zhang, Francis P. Pantuso, Guanghai Jin, Alex Mazurenko, Matthew Erdtmann, Shankar Radhakrishnan, Jack P. Salerno, Agiltron, Inc. (USA) [8012-40]

Wednesday 27 April

Sessions 9 runs concurrently with session 13.

SESSION 9

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

Uncooled FPAs and Applications I

Session Chairs: **Jean-Luc M. Tissot**, ULIS (France);
Avraham Fraenkel, SCD Semiconductor Devices (Israel)

8:00 am: **Uncooled detector development at Raytheon**, Steve H. Black, Raytheon Co. (USA) [8012-41]

8:20 am: **Development of Terahertz focal plane arrays and handy video camera**, Naoki Oda, Masahiko Sano, Seiji Kurashina, Hajime Yoneyama, Tokuhito Sasaki, Masaru Miyoshi, Ken'ichi Sonoda, NEC Corp. (Japan); Iwao Hosako, Norihiko sekine, National Institute of Information and Communications Technology (Japan) [8012-42]

8:40 am: **VGA 17 μ m development for compact, low-power systems**, Jean-Luc M. Tissot, Alain Durand, Patrick Robert, Sébastien Cortial, Cécile Roman, Michel Vilain, Olivier Legras, ULIS (France) [8012-43]

9:00 am: **Modular, open architecture uncooled video engines based on a DSP processor**, Fabian Schapiro, Rotem Gazit, Alex Neboshchik, Yogeve Ben Simon, Igal Kogan, Igal Lerman, Adi Aharon, Udi Mizrahi, Shay Maayani, Asaf Amsterdam, Ilan Vaserman, Offir Duman, Rami Frenkel, SCD Semiconductor Devices (Israel) [8012-44]

9:20 am: **Development of new SOI diode structure for beyond 17 μ m pixel pitch SOI diode uncooled IRFPAs**, Daisuke Takamuro, Tomohiro Maegawa, Takaki Sugino, Yasuhiro Kosasayama, Takahiro Ohnakado, Hisatoshi Hata, Masashi Ueno, Hiroshi Fukumoto, Kozo Ishida, Mitsubishi Electric Corp. (Japan); Haruyoshi Katayama, Tadashi Imai, Munetaka Ueno, Japan Aerospace Exploration Agency (Japan) [8012-45]

9:40 am: **Improvements of a digital 25 μ m pixel-pitch uncooled amorphous silicon TEC-less VGA IRFPA with massively parallel Sigma-Delta-ADC readout**, Dirk Weiler, Marco Russ, Daniel Würfel, Renee Lerch, Pin Yang, Jochen Bauer, Jennifer Hess, Piotr Kropelnicki, Holger Vogt, Fraunhofer-Institut für Mikroelektronische Schaltungen und Systeme (Germany) [8012-46]

Coffee Break 10:00 to 10:30 am

10:30 am: **Scale down of p-n junction diodes of an uncooled IR-FPA for improvement of the sensitivity and thermal time response by 0.13 μ m CMOS technology**, Ikuo Fujiwara, Keita Sasaki, Kazuhiro Suzuki, Hitoshi Yagi, Honam Kwon, Hiroto Honda, Koichi Ishii, Masako Ogata, Masaki Atsuta, Risako Ueno, Mitsuyoshi Kobayashi, Hideyuki Funaki, Toshiba Corp. (Japan) [8012-47]

10:50 am: **1024 x 768 XGA uncooled camera core achieves new levels of performance in a small package**, Christopher Alicandro, Sofradir EC, Inc. (USA) [8012-150]

11:10 am: **Pixel level packaging for uncooled IRFPA**, Geoffroy Dumont, Wilfried Rabaud, Xavier Baillin, Laurent Carle, Michel Pellat, Emanuelle Lagoutte, Valérie Goudon, Claire Vialle, Agnès Arnaud, CEA Leti-MINATEC (France) [8012-49]

SESSION 13

Room: Grand 7B Wed. 8:00 to 11:30 am

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: **Somewhere under the rainbow: the visible to far infrared imaging lens**, Troy A. Palmer, Nathanael P. Powers, Christopher C. Alexay, Darin A. Murray, Robert W. Ball, StingRay Optics, LLC (USA) [8012-63]

8:20 am: **Refractive lens design for simultaneous SWIR and LWIR imaging**, Scott W. Sparrold, Eric Herman, Edmund Optics, Inc. (USA); Walter C. Czajkowski, Kevin O'Shea, Edmund Optics Inc. (USA) [8012-64]

8:40 am: **Compact dual field of view SWIR/MWIR optical system**, Jay N. Vizgaitis, Kyle Witte, Roy T. Littleton, Philip Perconti, U.S. Army Night Vision & Electronic Sensors Directorate (USA) [8012-65]

9:00 am: **Optical design of compact multichannel and all-reflective system for infrared imaging**, Min Wang, François Châteauneuf, Christian Proulx, INO (Canada) [8012-66]

9:20 am: **Advanced manufacturing technologies for reduced cost and weight in portable, ruggedized, VIS-IR, multi-mode optical systems, for land, sea, and air**, Michael N. Sweeney, Robert Spinazzola, Donald Morrison, Dennis Macklin, General Dynamics Axsys Technologies (USA); Mark R. Fernald, AXSYS Communications (USA) [8012-67]

9:40 am: **Toward infrared DDCA with an imaging function**, Guillaume Druart, Nicolas Guérineau, Florence de la Barrière, Joel R. Deschamps, ONERA (France); Manuel Fendler, Nicolas Lhermet, Jacques Rullière, CEA Leti-MINATEC (France); Serge Magli, Yann Reibel, SOFRADIR (France) [8012-68]

Coffee Break 10:00 to 10:30 am

10:30 am: **Compact designs of hyper- or multispectral imagers compatible with the detector dewar**, Nicolas Guérineau, Guillaume Druart, Frédéric Gillard, Yann Ferrec, Sylvain Rommeluère, Riad Haidar, ONERA (France); Jean Taboury, Lab. Charles Fabry (France); Manuel Fendler, CEA Leti-MINATEC (France) [8012-69]

10:50 am: **Increasing dynamic range of cameras with Dynamic Sunlight Filter (DSF)**, Ariela Donval, Tali Fisher, Dima Cheskis, Yuval Ofir, Moshe Oron, KiloLambda Technologies, Ltd. (Israel) [8012-110]

11:10 am: **Challenges, constraints, and results of lens design for 17 micron-bolometer-FPAs in 8-12 micron waveband**, Norbert Schuster, Umicore Electro-Optic Materials (Belgium); John Franks, Umicore Coating Services (United Kingdom) [8012-71]

SESSION 10

Room: Grand 8A Wed. 11:30 am to 12:00 pm

Joint Keynote Session with Conference 8014

Session Chair: Paul R. Norton,

U.S. Army Night Vision & Electronic Sensors Directorate

Wide-area infrared surveillance: performance requirements and technology

needs (Keynote Presentation), Michael T. Eismann, Air Force Research Lab.

(USA) [8012-50]

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

Sessions 11, 12 run concurrently with sessions 14, 15.

SESSION 11

Room: Grand 8A Wed. 1:30 to 2:50 pm

Uncooled FPAs and Applications II

Session Chairs: Masafumi Kimata, Ritsumeikan Univ. (Japan);

Stefan T. Baur, Raytheon Vision Systems (USA)

1:30 pm: **Comparison of ion beam and magnetron sputtered vanadium oxide thin films for uncooled IR imaging,** Orlando M. Cabarcos, Jing Li, Bryan D. Gauntt, The Pennsylvania State Univ. (USA); Sami Antrazi, 4Wave Inc. (USA); Elizabeth C. Dickey, Dave L. Allara, Hitesh A. Basantani, Mark W. Horn, The Pennsylvania State Univ. (USA) [8012-51]

1:50 pm: **Performance improvement in amorphous silicon-based uncooled microbolometers through pixel design and materials development,** Charles M. Hanson, Sameer Ajmera, John Brady, William McCardel, Tom Schimert, A. J. Syllaios, Michael Taylor, L-3 Electro-Optical Systems (USA) [8012-52]

2:10 pm: **Uncooled infrared detectors toward smaller pixel pitch with newly proposed pixel structure,** Shigeru Tohyama, Tokuhito Sasaki, Tsutomu Endoh, Masahiko Sano, Kouji Katoh, Seiji Kurashina, Masaru Miyoshi, Takao Yamazaki, NEC Corp. (Japan); Munetaka Ueno, Haruyoshi Katayama, Tadashi Imai, Japan Aerospace Exploration Agency (Japan) [8012-53]

2:30 pm: **Uncooled VO_x infrared sensor development and application,** Chuan C. Li, DRS Technologies, Inc. (USA) [8012-54]

Coffee Break 2:50 to 3:20 pm

Standby Oral/Poster Presentation

This poster paper may also be given as an oral presentation in this session.

Impacts and mitigation strategies of sun exposure on uncooled microbolometer image sensors, D. A. Dorn, O. Herrera, C. Tesdahl, E.

Shumard, A. Wang, Pelco Ft. Collins (USA) [8012-149]

SESSION 14

Room: Grand 7B Wed. 1:30 to 2:10 pm

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: **Influence of Spinel head window thickness on the performance characteristics of a submarine, panoramic, infrared imaging system,** Jonathan M. Nichols, James R. Waterman, Shyam S. Bayya, Ishwar D. Aggarwal, Jasbinder S. Sanghera, U.S. Naval Research Lab. (USA) [8012-72]

1:50 pm: **Development of the automatic focus control unit (AFCU) for the Mobile InfraRed Telescope (MIRT),** John S. Allen, U. S. Dept of Defense (USA) [8012-73]

Standby Oral/Poster Presentation

This poster paper may also be given as an oral presentation in this session.

Advanced manufacturing methods for chalcogenide molded optics, G. S. Cogburn, LightPath Technologies, Inc. (USA) [8012-147]

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SESSION 12

Room: Grand 8A Wed. 3:20 to 6:00 pm

NIR/SWIR FPAs and Applications

Session Chair: Martin H. Ettenberg,

Sensors Unlimited, Inc., part of Goodrich Corp. (USA)

3:20 pm: **Dual-band imaging technology on indium gallium arsenide focal plane arrays**, Peter E. Dixon, John A. Trezza, Sensors Unlimited, Inc., part of Goodrich Corp. (USA); Cory D. Hess, Chuan C. Li, DRS Technologies (USA); Martin H. Ettenberg, Sensors Unlimited, Inc., part of Goodrich Corp. (USA) [8012-55]

3:40 pm: **Toward a single-chip TECless/NUCless InGaAs SWIR camera with 120 dB intrinsic operation dynamic range**, Yang Ni, New Imaging Technologies SAS (France) [8012-56]

4:00 pm: **Recent advances in SWIR MEMS-based tuneable Fabry-Pérot microspectrometers**, Jarek Antoszewski, Thuyen H. Nguyen, Mariusz P. Martyniuk, John M. Dell, Lorenzo Faraone, The Univ. of Western Australia (Australia) [8012-57]

4:20 pm: **Analytic modeling and explanation of ultra-low noise in dense SWIR detector arrays**, John A. Trezza, Navneet G. Masaun, Martin H. Ettenberg, Sensors Unlimited, Inc., part of Goodrich Corp. (USA) [8012-58]

4:40 pm: **Modeling of the electrical characteristics of SWIR/MWIR InGaAs/GaAsSb type-II MQW photodiodes**, Baile Chen, Jinrong Yuan, Archie L. Holmes, Jr., Univ. of Virginia (USA) [8012-59]

5:00 pm: **MOVPE grown InGaAs/GaAsSb type II quantum well photodiode for SWIR focal plane array**, Hiroshi Inada, Hiroki Mori, Youichi Nagai, Yasuhiro Iguchi, Tadashi Saitoh, Kei Fujii, Takashi Ishizuka, Katsushi Akita, Sumitomo Electric Industries, Ltd. (Japan) [8012-60]

5:20 pm: **InGaAs focal plane arrays for low-light-level SWIR imaging**, Michael H. MacDougall, Jon Geske, Jim Wang, David Follman, Juan Manzo, Aeries Photonics, LLC (USA); Jonathan Getty, Raytheon Vision Systems (USA) [8012-61]

5:40 pm: **IR CMOS: ultrafast laser-enhanced silicon detection**, Martin U. Pralle, James E. Carey III, SiOnyx Inc. (USA) [8012-62]

Standby Oral/Poster Presentation

This poster paper may also be given as an oral presentation in this session.

Characterization of SiGe-detector arrays for visible-NIR imaging sensor applications, A. K. Sood, E. J. Egerton, Y. R. Puri, Magnolia Optical Technologies, Inc. (USA); N. DiLello, J. L. Hoyt, Massachusetts Institute of Technology (USA); N. Dhar, Defense Advanced Research Projects Agency (USA); R. S. Balcerak, Raymond S. Balcerak, LLC (USA); T. G. Bramhall, U.S. Army Aviation and Missile Command (USA) [8012-151]

SESSION 15

Room: Grand 7B Wed. 2:10 to 5:50 pm

Cryocoolers for IR Focal Plane Arrays

Session Chairs: Alexander Veprik, RICOR-Cryogenic & Vacuum Systems (Israel); *Ingo Rühlich,* AIM INFRAROT-MODULE GmbH (Germany);

Ray Radebaugh, National Institute of Standards and Technology (USA)

2:10 pm: **Development of miniature moving magnet cryocooler**, Ingo Rühlich, Markus Mai, Carsten Rosenhagen, AIM INFRAROT-MODULE GmbH (Germany) [8012-74]

2:30 pm: **Micro cryogenic coolers for IR imaging (Invited Paper)**, Ryan J. Lewis, Martin Lin, Yunda Wang, Jill Cooper, Victor M. Bright, Yung Cheng Lee, Univ. of Colorado at Boulder (USA); Peter Bradley, Ray Radebaugh, Marcia Huber, National Institute of Standards and Technology (USA) [8012-75]

Coffee Break 3:00 to 3:30 pm

3:30 pm: **Adaptation of the low-cost and low-power tactical split Stirling cryogenic cooler for aerospace applications**, Alexander Veprik, Semeon Zechter, Nachman Pundak, RICOR-Cryogenic & Vacuum Systems (Israel); Carl S. Kirkconnell, Jeremy Freeman, Iris Technology Corp. (USA); Sergey V. Riabzev, EADS Astrium Ltd. (United Kingdom) [8012-76]

3:50 pm: **Low-vibration microminiature tactical split Stirling cryogenic cooler for infrared aerospace applications**, Alexander Veprik, Semeon Zechter, Nachman Pundak, RICOR-Cryogenic & Vacuum Systems (Israel); Carl S. Kirkconnell, Jeremy Freeman, Iris Technology Corp. (USA); Sergey V. Riabzev, EADS Astrium Ltd. (United Kingdom) [8012-77]

4:10 pm: **FLIR submicro cooler IDCA**, Uri Binnun, FLIR Systems, Inc. (USA) [8012-78]

4:30 pm: **Release for production if the most compact microcooler in the Thales cryogenic rotary monobloc range**, Jean-Yves Martin, Sebastien Freche, Rene J. Griot, Tonny Benschop, Thales Cryogénie S.A. (France) [8012-79]

4:50 pm: **1/5 W linear cryocooler for infrared applications**, Mark Squires, Cobham Mission Systems (USA) [8012-80]

5:10 pm: **Lifetime testing results and diagnostic performance prediction of linear coolers at Thales Cryogenics**, Hans van der Weijden, Thales Cryogenics B.V. (Netherlands) [8012-81]

5:30 pm: **RICOR's new development of a highly reliable integral rotary cooler: engineering and reliability aspects**, Avishai Filis, Zeev Porat, RICOR-Cryogenic & Vacuum Systems (Israel) [8012-82]

Thursday 28 April

SESSION 16

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

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)

8:00 am: **High-operating temperature MWIR photon detectors based on type II InAs/GaSb superlattice** (*Invited Paper*), Manijeh Razeghi, Binh-Minh Nguyen, Siamak A. Pour, Guanxi Chen, Minh-Anh Hoang, Simeon Bogdanov, Northwestern Univ. (USA) [8012-83]

8:20 am: **MWIR InAsSb XBN detector arrays operating at 150 K** (*Invited Paper*), Philip Klipstein, Olga Klin, Steve Grossman, Noam Snapi, Inna Lukomsky, Maya Brumer, Michael Yassen, Daniel Aronov, Eyal Berkowitz, Alexander Glozman, Tal Fishman, Osnat Magen, Itay Shtrichman, Eliezer Weiss, SCD Semiconductor Devices (Israel) [8012-84]

8:40 am: **InAsSb detectors for visible to MWIR high-operating temperature applications** (*Invited Paper*), Arvind I. D'Souza, Adrian C. Ionescu, Michael M. Salcido, Ernest Robinson, Larry C. Dawson, Daniel Okerlund, DRS Sensors & Targeting Systems, Inc. (USA); Terry J. deLyon, Rajesh D. Rajavel, Hasan Sharifi, Daniel Yap, Michael L. Belicic, HRL Labs., LLC (USA); Nibir K. Dhar, Defense Advanced Research Projects Agency (USA) [8012-85]

9:00 am: **Use of unipolar barriers to block dark currents in infrared detectors** (*Invited Paper*), Gary W. Wicks, Gregory R. Savich, Janet R. Pedrazzani, Shimon Maimon, Univ. of Rochester (USA) [8012-86]

9:20 am: **Development of interband cascade infrared photodetectors**, Zhaobing Tian, Rui Q. Yang, The Univ. of Oklahoma (USA); John F. Klem, Sandia National Labs. (USA); Tetsuya D. Mishima, Michael B. Santos, Matthew B. Johnson, The Univ. of Oklahoma (USA) [8012-87]

9:40 am: **High-operating temperature IR-modules with reduced pitch for SWaP sensitive applications**, Rainer Breiter, Joachim C. Wendler, Holger Lutz, Stefan Rutzinger, Tobias Ihle, Johann Ziegler, AIM INFRAROT-MODULE GmbH (Germany) [8012-88]

Coffee Break 10:00 to 10:30 am

10:30 am: **HOT infrared detectors using MCT technology**, Michel Vuillermet, Michel Zecri, Laurent Rubaldo, Alexandre Kerlain, SOFRADIR (France); Laurent R. Mollard, Johan Rothman, Nicolas Baier, CEA Leti-MINATEC (France) . . . [8012-89]

10:50 am: **High-operating temperature (HOT) broadband quantum-dot infrared photodetector (QDIP)**, Puminun Vasinajindakaw, Guiru Gu, Xifeng Qian, Shivashankar R. Vangala, William D. Goodhue, Xuejun Lu, Univ. of Massachusetts Lowell (USA) [8012-90]

11:10 am: **Digital 640x512/15 μ m InSb detector for high-frame rate, high-sensitivity, and low-power applications**, Tuvy Markovitz, Igor Pivnik, Zipora Calahorra, Elad Ilan, Itay Hirsh, Eran Zeierman, Ezra Kahanov, Igal Kogan, Nir Fishler, SCD Semiconductor Devices (Israel) [8012-91]

Standby Oral/Poster Presentation

This poster paper may also be given as an oral *presentation in this session*.

Controlling the excited energy levels in quantum dots-in-a-well (DWELL) infrared photodetectors with confinement enhancing barriers, A. V. Barve, J. O. Kim, T. J. Rotter, S. Sengupta, J. A. Montoya, S. Krishna, The Univ. of New Mexico (USA) [8012-156]

SESSION 17

Room: Grand 8A Thurs. 11:30 am to 12:10 pm

Active Imaging I

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

11:30 am: **Ion implantation study of Be in InSb for the fabrication of IR detectors**, Josh Duran, Univ. of Dayton (USA) and Air Force Research Lab. (USA); Andrew M. Sarangan, Univ. of Dayton (USA); Thomas R. Nelson, Air Force Research Lab. (USA) [8012-92]

11:50 am: **New developments in HgCdTe APDs and ladar receivers**, Michael D. Jack, Raytheon Co. (USA) [8012-93]

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

SESSION 18

Room: Grand 8A Thurs. 1:30 to 2:10 pm

Active Imaging II

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

1:30 pm: **Design and development of 256x256 linear mode low-noise avalanche photodiode arrays**, Ping Yuan, Rengarajan Sudharsanan, Xiaogang Bai, Joseph C. Boisvert, Paul A. McDonald, James J. Chang, Spectrolab, Inc. (USA) [8012-94]

1:50 pm: **A 320x256 HgCdTe avalanche photodiode focal plane array for passive and active 2D and 3D imaging**, Eric De Borniol, Johan Rothman, Fabrice Guellec, Pierre Castelein, Gérard L. Destéfanis, CEA Leti-MINATEC (France) [8012-95]

SESSION 19

Room: Grand 8A Thurs. 2:10 to 5:10 pm

HgCdTe

Session Chairs: **Philippe Tribolet**, SOFRADIR (France);
Joseph G. Pellegrino, U.S. Army Night Vision & Electronic Sensors
 Directorate (USA); **Michel Vuillermet**, SOFRADIR (France)

2:10 pm: **Remembering Philippe Tribolet (Presentation Only)**, Philippe Bensussan, SOFRADIR (France) [8012-96]

2:20 pm: **Large format high-operability SWIR and MWIR focal plane array performance and capabilities**, James W. Bangs, Raytheon Vision Systems (USA) [8012-97]

2:40 pm: **MCT IR detectors in France**, Gérard L. Destéfanis, CEA Leti-MINATEC (France); Philippe Tribolet, Michel Vuillermet, SOFRADIR (France) [8012-98]

Coffee Break 3:00 to 3:30 pm

3:30 pm: **Latest detector developments with HgCdTe grown by MOVPE on GaAs substrates**, Chris D. Maxey, Paul Abbott, Les G. Hipwood, Chris L. Jones, Peter Knowles, Jim P. Price, SELEX Galileo Infrared Ltd. (United Kingdom) [8012-99]

3:50 pm: **The development of 3rd gen IR detectors at AIM**, Johann Ziegler, Detlef Eich, Karl-Martin Mahlein, Timo Schallenberg, Ralf Scheibner, Joachim C. Wendler, Jan Wenisch, Richard Wollrab, AIM INFRAROT-MODULE GmbH (Germany); Volker Daumer, Robert H. Rehm, Frank Rutz, Martin Walther, Fraunhofer-Institut für Angewandte Festkörperphysik (Germany) [8012-100]

4:10 pm: **Infrared dual-color and dual-band detectors for next generation**, Yann Reibel, Fabien Chabuel, David Billon-Lanfrey, SOFRADIR (France); Jacques Baylet, Philippe Ballet, Gérard L. Destéfanis, CEA Leti-MINATEC (France) [8012-101]

4:30 pm: **Electro-optical characteristics of a p⁺n long-wavelength HgCdTe photodiode limited by auger intrinsic carrier recombination for T>40K**, Roger E. DeWames, Corbin Co. (USA); Patrick G. Maloney, Curtis Billman, Joseph G. Pellegrino, U.S. Army Night Vision & Electronic Sensors Directorate (USA) [8012-102]

4:50 pm: **On the role of dislocations in influencing the electrical properties of HgCdTe photodiodes**, Rajesh K. Sharma, Solid State Physics Lab. (India); Vishnu Gopal, IDST (India); Raghavendra Saxena, R. K. Bhan, Ravindra Pal, Vikram Dhar, Rengarajan Muralidharan, Solid State Physics Lab. (India) [8012-148]

SESSION 20

Room: Grand 8A Thurs. 5:10 to 6:10 pm

IR Optical Materials

Session Chair: Simon Thibault, Univ. Laval (Canada)

5:10 pm: **Dual-band antireflection coatings on 3rd Gen lenses**, Thomas D. Rahmlow, Jr., Jeanne E. Lazo-Wasem, Rugate Technologies, Inc. (USA); Jay N. Vizgaitis, Justin Flanagan-Hyde, U.S. Army Night Vision & Electronic Sensors Directorate (USA) [8012-103]

5:30 pm: **Infrared hybrid glass-polymer optics: combining the thermal stability of glass with low manufacturing cost of polymers**, Valentina V. Doushkina, Qioptiq Polymer, Inc. (USA) [8012-104]

5:50 pm: **Emerging results for producing low-scatter EN clad and bare Al mirrors: enabling technology for new tactical instruments**, Keith G. Carrigan, Jay Daniel, J. B. Barentine, Tony B. Hull, L-3 Communications Tinsley Labs. Inc. (USA) [8012-105]

Standby Oral/Poster Presentation

This poster paper may also be given as an oral presentation in this session.

Erosion resistant anti-reflection coating for ZnSe, CZnS, chalcogenide and glass substrates, K. M. Kajurivala, Janos Technology, Inc. (USA) [8012-158]

POSTERS—Thursday

Room: Crystal M Thurs. 6:00 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. 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 pm 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.

Technical and market trends for microbolometers for thermography and night vision, Eric Mounier, Yole Développement (France) [8012-123]

100mm diameter GaSb substrates with extended IR wavelength for advanced space-based applications, Lisa P. Allen, Patrick Flint, Greg Meshew, Gordon Dallas, Daniel Bakken, Galaxy Compound Semiconductors, Inc. (USA); Gail J. Brown, Air Force Research Lab. (USA); Arezou Khoshakhlagh, Cory J. Hill, Jet Propulsion Lab. (USA) [8012-124]

A high fill-factor high-SNR CMOS image sensor for IR camera applications, Varun Shenoy, Daniel McBride, Sungyong Jung, Hyejin Moon, The Univ. of Texas at Arlington (USA) [8012-125]

A self-protecting uncooled microbolometer structure for uncooled microbolometer, Youngmin Jo, Il-Woong Kwon, Dong Soo Kim, Hyun Bin Shim, Hee Chul Lee, KAIST (Korea, Republic of) [8012-126]

Electric characteristic of nickel oxide film for the microbolometer, Yong Soo Lee, Kyungpook Univ. (Korea, Republic of); Dong Soo Kim, KAIST (Korea, Republic of); Jong Hoon Kim, Kyungpook Univ. (Korea, Republic of); Hee Chul Lee, KAIST (Korea, Republic of) [8012-127]

Non-cryogenically cooled amorphous/polycrystalline InSb and InAs_{0.3}Sb_{0.7} films for long-wavelength infrared detection, Timothy W. C. Zens, Massachusetts Institute of Technology (USA) and Air Force Institute of Technology (USA); Alvin J. Drehman, Air Force Research Lab. (USA); Piotr Becla, Anuradha M. Agarwal, Lionel C. Kimerling, Massachusetts Institute of Technology (USA) [8012-128]

Design of multiple demagnifying filters for small target detection in infrared imageries, Won-Chul Choi, Jai-Hoon Lee, Ayoung Heo, Dong-Jo Park, KAIST (Korea, Republic of) [8012-129]

Image processing module for high-speed thermal camera with cooled detector, Henryk Madura, Grzegorz Bieszcza, Tomasz Sosnowski, Mariusz Kastek, Tomasz Orzanowski, Military Univ. of Technology (Poland) ... [8012-130]

Design of ROIC based on switched capacitor TDI for MCT LWIR focal plane arrays, Huseyin Kayahan, Melik Yazici, Omer Ceylan, Yasar Gurbuz, Sabanci Univ. (Turkey) [8012-131]

Suppression of saturation based on low histogram for uncooled infrared detector, Changan Park, Samsung Thales Co., Ltd. (Korea, Republic of) [8012-132]

Interpolation methods for division of focal plane polarimeters, Shengkui Gao, Viktor Gruev, Washington Univ. in St. Louis (USA) [8012-133]

MWIR continuous zoom with large zoom range, Mark C. Sanson, James Cornell, Brian P. Roy, Stephen Herbert, Kenneth Woodard, Corning Incorporated (USA) [8012-134]

Apache Point Observatory (APO) notch filter design, John S. Allen, U. S. Dept. of Defense (USA) [8012-135]

The advantages of using a digital temperature controller in a miniature Stirling cryogenic refrigerator, Shilo Ninburg, RICOR-Cryogenic & Vacuum Systems (Israel) [8012-136]

Performance of 4.0W/60K pulse tube cryocooler for large-scale long-wave infrared focal plane arrays, Haizheng Dang, Shanghai Institute of Technical Physics (China) [8012-138]

Development of high-capacity pulse tube cryocoolers at 80K for infrared focal plane array applications, Haizheng Dang, Shanghai Institute of Technical Physics (China) [8012-139]

Stirling-cycle cooler reliability growth at L-3 CE, David P. Arndt, Dan Kuo, Quang Phan, L-3 Communications Cincinnati Electronics (USA) [8012-140]

Characterization of quantum cascade laser-based emissivity monitor for CORSAIR, Maung T. Lwin, Princeton Univ. (USA) and Utah State Univ., Energy Dynamic Lab. (USA); Michael D. Wojcik, Utah State Univ., Energy Dynamic Lab. (USA) [8012-141]

Quantum cascade laser as a mid-infrared photovoltaic and photoconductive detector, Xing Chen, David Shyu, Fow-Sen Choa, Univ. of Maryland, Baltimore County (USA); Sudhir B. Trivedi, Brimrose Corp. of America (USA) ... [8012-142]

Different approximation for carrier statistic in non-parabolic MWIR HgCdTe photovoltaic devices, Jun Wang, National Synchrotron Radiation Lab. (China) and Shanghai Institute of Technical Physics (China) and Univ. of Science and Technology of China (China); Xiaoshuang Chen, Weida Hu, Lin Wang, Yongguo Chen, Wei Lu, Shanghai Institute of Technical Physics (China); Faqiang Xu, National Synchrotron Radiation Lab. (China) and Univ. of Science and Technology of China (China) [8012-144]

Study of photosensitive area extension in HgCdTe photodiodes using scanning laser microscopy, Yongguo Chen, Weida Hu, Xiaoshuang Chen, Jun Wang, Wei Lu, Shanghai Institute of Technical Physics (China) [8012-145]

VPD PbSe technology fills the existing gap in uncooled, low-cost and fast IR imagers, Rodrigo Linares-Herrero, Raúl Gutiérrez, María Teresa Montojo, Arturo Baldasano, New Infrared Technologies, Ltd. (Spain) [8012-146]

A detailed analysis for the absorption coefficient of multilevel uncooled infrared detectors, Seniz E. Kucuk, Yusuf Tanrikulu, Tayfun Akin, Middle East Technical Univ. (Turkey) [8012-153]

A 2-stage digital-to-analog converter for bias correction in uncooled microbolometer arrays, Alperen Toprak, Murat Tepegöz, Tayfun Akin, Middle East Technical Univ. (Turkey) [8012-154]

A thermal conductance optimization approach for uncooled microbolometers, Sukru U. Senvelli, Yusuf Tanrikulu, Tayfun Akin, Middle East Technical Univ. (Turkey) [8012-155]

Oral Standby/Posters

Advanced manufacturing methods for chalcogenide molded optics, Gabriel S. Cogburn, LightPath Technologies, Inc. (USA) [8012-147]

Impacts and mitigation strategies of sun exposure on uncooled microbolometer image sensors, David A. Dorn, Oscar Herrera, Curtis Tesdahl, Eric Shumard, Alan Wang, Pelco Ft. Collins (USA) [8012-149]

Characterization of SiGe-detector arrays for visible-NIR imaging sensor applications, Ashok K. Sood, Elwood J. Egerton, Yash R. Puri, Magnolia Optical Technologies, Inc. (USA); Nicole DiLello, Judy L. Hoyt, Massachusetts Institute of Technology (USA); Nibir K. Dhar, Defense Advanced Research Projects Agency (USA); Raymond S. Balcerak, Raymond S. Balcerak, LLC (USA); Thomas G. Bramhall, U.S. Army Aviation and Missile Command (USA) [8012-151]

Controlling the excited energy levels in quantum dots-in-a-well (DWELL) infrared photodetectors with confinement enhancing barriers, Ajit V. Barve, Jun Oh Kim, Thomas J. Rotter, Saumya Sengupta, John A. Montoya, Sanjay Krishna, The Univ. of New Mexico (USA) [8012-156]

Erosion resistant anti-reflection coating for ZnSe, CZnS, chalcogenide and glass substrates, Kumar M. Khajurivala, Janos Technology, LLC (USA) [8012-158]

Friday 29 April

SESSION 21

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

Application of Selected Technologies

Session Chairs: John L. Miller, FLIR Systems, Inc. (USA);
Bjørn F. Andresen, SCD Semiconductor Devices (Israel)

- 8:00 am: **A field spectral reflectometer to characterize surfaces in the infrared from the NIR to the LWIR**, Louis M. Moreau, Hugo A. Bourque, Claude B. Roy, Christian A. Vallieres, ABB Analytical Measurement (Canada). . [8012-107]
- 8:20 am: **Long-wave infrared (8 to 14 μm) hyperspectral imager based on an uncooled thermal camera and the traditional CI block interferometer**, Dario Cabib, Moshe Lavi, Amir Gil, CI Systems (Israel) Ltd. (Israel) [8012-108]
- 8:40 am: **Compact dewar and electronics for large-format infrared detectors**, Alain Manissadjian, Serge Magli, Eric Mallet, François Barillot, SOFRADIR (France) [8012-109]
- 9:00 am: **Integrated approach to optomechanical system development**, Thomas E. Reney, Richard L. Wiggins, Lovell E. Comstock, Jeffrey J. Santman, Kenneth Woodard, Coming NetOptix (USA) [8012-111]
- 9:20 am: **Classification of thermal face images using radial basis function neural network**, Mrinal K. Bhowmik, Debotosh Bhattacharjee, Dipak K. Basu, Jadavpur Univ. (India) [8012-112]
- 9:40 am: **The research on infrared small-target detection technology under complex background**, Lei Liu, Xin Wang, Jilu Chen, Nanjing Univ. of Science & Technology (China) [8012-113]
- Coffee Break 10:00 to 10:30 am

SESSION 22

Room: Grand 8A Fri. 10:30 to 11:50 am

Various Uncooled Detector Technologies I

Session Chairs: John L. Miller, FLIR Systems, Inc. (USA);
Paul R. Norton, U.S. Army Night Vision & Electronic
Sensors Directorate (USA)

- 10:30 am: **Further applications for mosaic pixel FPA technology**, Kevin C. Liddiard, Electro-optic Sensor Design (Australia) [8012-114]
- 10:50 am: **Toward very high-resolution infrared camera core**, Loïc Le Noc, Bruno Tremblay, Luc Mercier, Martin Morissette, Julie Lambert, INO (Canada); Denis Tang, Dept. of National Defence (Canada); Alain Bergeron, INO (Canada) [8012-115]
- 11:10 am: **A look at non-uniformity correction in the spatial frequency domain**, Guy Raz, Yuval Weiss, Elbit Systems Electro-Optics El-Op Ltd. (Israel) [8012-17]
- 11:30 am: **Development of integrated noncryogenic cooled carbon nanotube-based infrared focal plane array**, Ning Xi, Michigan State Univ. (USA) [8012-116]
- Lunch Break 11:50 am to 1:00 pm

SESSION 23

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

Various Uncooled Detector Technologies II

Session Chairs: John L. Miller, FLIR Systems, Inc. (USA);
Bjørn F. Andresen, SCD Semiconductor Devices (Israel)

- 1:00 pm: **New materials for uncooled IR imaging: nickel manganite thin films grown by spin spray**, Song Won Ko, Jing Li, Elizabeth C. Dickey, Susan Trollier-McKinstry, Thomas N. Jackson, Myung-Yoon Lee, The Pennsylvania State Univ. (USA) [8012-117]
- 1:20 pm: **Microstructural aspects of thin film vanadium oxide used for uncooled infrared imaging**, Bryan D. Gauntt, Orlando M. Cabarcos, Jing Li, Hitesh A. Basantani, S. S. N. Bharadwaja, Nikolas J. Podraza, Thomas N. Jackson, Elizabeth C. Dickey, Chandru Venkatasubramanian, The Pennsylvania State Univ. (USA); Sami Antrazi, 4Wave Inc. (USA); Dave L. Allara, Mark W. Horn, The Pennsylvania State Univ. (USA) [8012-118]
- 1:40 pm: **Thin film silicon and germanium for uncooled IR microbolometer applications**, Nikolas J. Podraza, David B. St. John, Hang-Beum Shin, Myung-Yoon Lee, Elizabeth C. Dickey, Thomas N. Jackson, The Pennsylvania State Univ. (USA) [8012-119]
- 2:00 pm: **A 256 pixel pyroelectric linear array with new black coating**, Volkmar Norkus, Marco Schossig, Gerald U. Gerlach, Technische Univ. Dresden (Germany); Reinhard Köhler, DIAS Infrared GmbH (Germany) [8012-120]
- 2:20 pm: **Small-pitch high-performance thermopile focal plane arrays**, David Kryskowski, UD Holdings LLC (USA) [8012-121]
- 2:40 pm: **Application of Graphene for infrared detection**, Ahalapitiya H. Jayatissa, Madhav Gautam, The Univ. of Toledo (USA) [8012-122]

Courses of Related Interest

- SC067 **Testing and Evaluation of E-O Imaging Systems** (Holst) Thursday, 8:30 am to 5:30 pm
- SC152 **Infrared Focal Plane Arrays** (Dereniak, Hubbs) Monday, 1:30 to 5:30 pm
- SC154 **Electro-Optical Imaging System Performance** (Holst) Friday, 8:30 am to 5:30 pm
- SC178 **Introduction to Radiometry and Photometry** (Grant) Monday, 8:30 am to 12:30 pm
- SC181 **Predicting Target Acquisition Performance of Electro-Optical Imagers** (Vollmerhausen) Tuesday, 8:30 am to 5:30 pm
- SC194 **Multispectral and Hyperspectral Image Sensors** (Lomheim) Wednesday, 8:30 am to 12:30 pm
- SC214 **Infrared Window and Dome Materials** (Harris) Tuesday, 8:30 am to 5:30 pm
- SC278 **Infrared Detectors** (Dereniak) Monday, 8:30 am to 12:30 pm
- SC659 **Understanding Reflective Optical Design** (Contreras) Thursday, 8:30 am to 5:30 pm
- SC713 **Engineering Approach to Imaging System Design** (Holst) Monday, 8:30 am to 5:30 pm
- SC755 **Infrared Optics and Zoom Lenses** (Mann) Thursday, 8:30 am to 12:30 pm
- SC789 **Introduction to Optical and Infrared Sensor Systems** (Shaw) Friday, 8:30 am to 5:30 pm
- SC835 **Infrared Systems - Technology & Design** (Daniels) Monday-Tuesday, 8:30 am to 5:30 pm
- SC838 **Laser Range Gated Imaging Techniques** (Duncan) Tuesday, 1:30 to 5:30 pm
- SC892 **Infrared Search and Track Systems** (Schwering) Tuesday, 8:30 am to 5:30 pm
- SC900 **Uncooled Thermal Imaging Detectors and Systems** (Hanson) Monday, 8:30 am to 5:30 pm
- SC944 **The Radiometry Case Files** (Grant) Monday, 1:30 to 5:30 pm
- SC947 **Cost-Conscious Tolerancing of Optical and IR Systems** (Youngworth, Contreras) Wednesday, 8:30 am to 5:30 pm
- SC950 **Infrared Imaging Radiometry** (Richards) Tuesday, 8:30 am to 5:30 pm
- SC1000 **Introduction to Infrared and Ultraviolet Imaging Technology** (Richards) Monday, 1:30 to 5:30 pm
- SC1035 **Military Laser Safety** (Marshall) Wednesday, 8:30 am to 5:30 pm

Visit the registration desk for course descriptions or to register

Conference 8013 • Room: Grand 7A

Tuesday-Thursday 26-28 April 2011 • Proceedings of SPIE Vol. 8013

Thermosense: Thermal Infrared Applications XXXIII

Conference Chairs: **Morteza Safai**, The Boeing Co. (USA); **Jeff R. Brown**, Hope College (USA)

Program Committee: **Andrea Acosta**, Colbert Infrared Services (USA); **Nicolas P. Avdelidis**, National Technical Univ. of Athens (Greece); **Douglas Burleigh**, La Jolla Cove Consulting (USA); **Fred P. Colbert**, Colbert Infrared Services (USA); **K. Elliott Cramer**, NASA Langley Research Ctr. (USA); **Ralph B. Dinwiddie**, Oak Ridge National Lab. (USA); **Ermanno G. Grinzato**, Consiglio Nazionale delle Ricerche (Italy); **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); **Jonathan J. Miles**, James Madison Univ. (USA); **Gary L. Orlove**, FLIR Systems, Inc. (USA); **G. Raymond Peacock**, Temperatures.com, Inc. (USA); **Piotr Pregowski**, Pregowski Infrared Services (Poland); **Ralph A. Rotolante**, Movitherm (USA); **Andrés E. Rozlosnik**, SI Termografia Infrarroja (Argentina); **Takahide Sakagami**, Kobe Univ. (Japan); **Steven M. Shepard**, Thermal Wave Imaging, Inc. (USA); **Gregory R. Stockton**, Stockton Infrared Thermographic Services, Inc. (USA)

THERMOSENSE MISSION STATEMENT

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

THERMOSENSE BACKGROUND

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

Monday 25 April

Vendor Presentations and Reception

Mon. 5:00 to 8:30 pm • Location: Crystal C

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

What's New in Hardware and Software at the 2011 SPIE Defense, Security, and Sensing Exhibition?

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

Additional Vendors may join at the end of the session as time allows. If you are interested in participating or have any questions, please contact:

Herb Kaplan, VendorsSession2011Moderator, hkaplan@earthlink.net
or

Andres Rozlosnik, aer@termografia.com

STINGRAY OPTICS, LLC (BOOTH 411)
StingRay MWIR & LWIR Thermal Imaging Systems, Achromatically Corrected SWIR Lenses and Accessories

Presenters: **Jennifer Myers**, Sales and Marketing Manager and **Shannon Largig**, Sales Engineer

CI SYSTEMS, INC. (BOOTH 500)
Hyperspectral Imaging, Gas Sensing, New SR 7000 Spectroradiometer and New CVF (Circular Variable Filter) and Other New CI Products
Presenter: **Garrick Matheson**

BOULDER IMAGING, INC. (BOOTH 1130)
Making Multispectral Imagery Useful
Presenter: **Carlos Jorquera**, CEO & CTO

TELOPS INC. (BOOTH 1024)
Hyperspectral Imaging Applications in Defense & Security
Presenter: **Paul Chabot**, Vice-President Sales & Marketing

THERMOTEKNIKX SYSTEMS LTD. (BOOTH 1117)
Thermoteknix Greatest Hits
Presenter: **Alistair Brown**, Imaging Products Manager

XENICS INFRARED SOLUTIONS (BOOTH 3119)
Recent Realizations in Sensor Fusion of Multiple Wavelength Products
Presenter: **Jan Vermeiren**, Technology Development Manager

NEW INFRARED TECHNOLOGIES (3305)
The MATRIX 1024 SERIES: Applications of High-Speed Uncooled MWIR Imaging Sensors
Presenter: **Rodrigo Linares**, Director of Marketing/Sales and Marketing Manager

SCD.USA (BOOTH 771)
SCD's New Products
Presenter: **Niels Jacksen**, VP of Technology

IRCAM GMBH (BOOTH 1231)
New IRCAM Products
Presenter: **Monica Lopez Saenz**, Managing Director of IRCAM

FLIR COMMERCIAL SYSTEMS INC. (BOOTH 700)
Quark Camera: A New Standard for SWaP
Presenter: **Dan Walker**, VP Product Development

JEOL USA, INC. (BOOTH 3706)
JEOL's Portable Scanning Electron Microscopes for Product Development to Final Inspection
Presenters: **Donna Guarrera**, Assistant Director, SM Division and **David Edwards**

RAYTHEON CO. (BOOTH 3213)
Raytheon's Revolutionary Long Wave and Short Wave Uncooled Products
Presenter: **Mark Lamb**, Security Solutions Technical Manager

NEW IMAGING TECHNOLOGIES (BOOTH 1137)
High Dynamic Range ROIC with Logarithmic Response
Presenter: **Pierre Potet**, CEO, New Imaging Technologies

Tuesday 26 April

Symposium-Wide Plenary Session

Tuesday • 8:30 to 9:30 am • Location: Crystal H

Dr. Regina E. Dugan

Director, Defense Advanced Research Projects Agency (DARPA)

See page 18 for details • Open to All Attendees

Coffee Break 9:30 to 10:00 am

SESSION 1

Room: Grand 7A Tues. 10:00 to 11:20 am

Pyrometry and Radiometry

Session Chairs: **Morteza Safai**, The Boeing Co. (USA);
Herbert Kaplan, Honeyhill Technical Co. (USA)

10:00 am: **A polynomial regression approach to subpixel temperature extraction from a single-band thermal infrared image**, Sarah Paul, Carl Salvaggio, Rochester Institute of Technology (USA) [8013-01]

10:20 am: **New developments in the NIST spectral radiance and radiance temperature metrology in the thermal and far infrared**, Sergey N. Mekhontsev, Leonard M. Hanssen, Vladimir B. Khromchenko, Boris Wilthan, National Institute of Standards and Technology (USA) [8013-02]

10:40 am: **Status of the NIST program for infrared emittance measurement**, Leonard M. Hanssen, Boris Wilthan, Sergey N. Mekhontsev, National Institute of Standards and Technology (USA) [8013-03]

11:00 am: **Measurement of true temperature fields by bicolor thermorelectrometry**, Gilblas Remi, Thierry Sentenac, Ecole des Mines d'Albi (France); Daniel Hernandez, Procedes, Materiaux et Energie Solaire (France); Yannick Le Maout, Ecole des Mines d'Albi (France) [8013-04]

SESSION 2

Room: Grand 7A Tues. 11:20 am to 12:00 pm

Industrial Applications: Biological

Session Chairs: **Timo T. Kauppinen**, VTT Technical Research Ctr. of Finland (Finland); **Ralph B. Dinwiddie**, Oak Ridge National Lab. (USA);
Andrés E. Rozlosnik, SI Termografía Infrarroja (Argentina)

11:20 am: **Use of infrared imaging for investigation of chicken embryo development**, Ryan A. Frye, Vanderbilt Univ. (USA); Sheng-Jen Hsieh, José B. D. Girón Palomares, Texas A&M Univ. (USA) [8013-05]

11:40 am: **Dynamic infrared imaging for biological and medical applications in Boron neutron capture therapy**, Gustavo A. Santa Cruz, Sara J. González, Alejandra Dagrosa, Amanda Schwint, Marina Carpano, Verónica Trivillin, Esteban F. Boggio, Comision Nacional de Energia Atomica (Argentina); José Bertotti, Univ. Favaloro (Argentina); Julio Marín, Andrea Monti Hughes, Ana Molinari, Comision Nacional de Energia Atomica (Argentina); Miguel Albergo, INVAP S E (Argentina) [8013-06]

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

SESSION 3

Room: Grand 7A Tues. 1:00 to 2:00 pm

Industrial Applications: Buildings

Session Chairs: **Timo T. Kauppinen**, VTT Technical Research Ctr. of Finland (Finland); **Ralph B. Dinwiddie**, Oak Ridge National Lab. (USA);
Andrés E. Rozlosnik, SI Termografía Infrarroja (Argentina)

1:00 pm: **Using a combination of aerial infrared and handheld infrared cameras for measuring, analyzing, and prioritizing the thermal performance of "big box" buildings**, Gregory R. Stockton, Stockton Infrared Thermographic Services, Inc. (USA) [8013-07]

1:20 pm: **Improvement of energy efficiency: the use of thermography and air-tightness test in verification of thermal performance of school buildings**, Timo T. Kauppinen, VTT Technical Research Ctr. of Finland (Finland) . . . [8013-08]

1:40 pm: **A hybrid, infrared thermography: heat diffusion equation, method for the 3D air-temperature measurement**, Frank B. D. Djupkep, Xavier P. V. Maldague, Abdel Hakim Bendada, Univ. Laval (Canada) [8013-09]

SESSION 4

Room: Grand 7A Tues. 2:00 to 4:10 pm

Industrial Applications: Petrochemical and Pipeline Applications

Session Chairs: **Timo T. Kauppinen**, VTT Technical Research Ctr. of Finland (Finland); **Ralph B. Dinwiddie**, Oak Ridge National Lab. (USA);
Andrés E. Rozlosnik, SI Termografía Infrarroja (Argentina)

2:00 pm: **IR gas cloud imaging in oil and gas applications: immunity to false stimuli**, Edward Naranjo, Shakar B. Baliga, John H. Park, General Monitors Inc. (USA); Philippe Bernascolle, Bertin Technologies (France) [8013-10]

2:20 pm: **Development of a gas leak detection method based on infrared spectrum imaging utilizing microbolometer camera**, Takahide Sakagami, Kobe Univ. (Japan); Hiroaki Anzai, Shiro Kubo, Osaka Univ. (Japan) [8013-11]

2:40 pm: **Detectivity of gas leakage based on electromagnetic radiation transfer**, Yunting Long, Jiakun Li, Changxing Zhang, Bei Zhang, Lingxue Wang, Beijing Institute of Technology (China) [8013-12]

Coffee Break 3:00 to 3:30 pm

3:30 pm: **IR evaluation of insulated pipelines to detect trapped water that could cause corrosion under insulation (CUI)**, Douglas Burleigh, La Jolla Cove Consulting (USA) [8013-13]

3:50 pm: **Corrosion detection on pipelines by IR thermography**, Paolo Bison, Sergio Marinetti, Graziano P. Cuogo, Consiglio Nazionale delle Ricerche (Italy); Paolo Zonta, Venezia Tecnologie S.p.A (Italy); Ermanno G. Grinzato, Consiglio Nazionale delle Ricerche (Italy) [8013-14]

SESSION 5

Room: Grand 7A Tues. 4:10 to 5:30 pm

Industrial Applications: Electronics

Session Chairs: **Timo T. Kauppinen**, VTT Technical Research Ctr. of Finland (Finland); **Ralph B. Dinwiddie**, Oak Ridge National Lab. (USA);
Andrés E. Rozlosnik, SI Termografía Infrarroja (Argentina)

4:10 pm: **Enhancing time resolution of infrared cameras using a heterodyne approach: application to the mapping of fast temperature transients upon electronic micro-chips**, Nabil Boutellis, Abdel Hakim Bendada, Univ. Laval (Canada); Jean-Christophe Batsale, Christophe Pradere, Ecole Nationale Supérieure d'Arts et Métiers (France) [8013-15]

4:30 pm: **Comparative analysis of pulse and active thermography for investigating solder joint geometry prediction**, Becky M. Vela, Sheng-Jen Hsieh, José B. D. Girón Palomares, Texas A&M Univ. (USA) [8013-16]

4:50 pm: **Using 3D infrared imaging to calibrate and refine computational fluid dynamic modeling for large computer and data centers**, Gregory R. Stockton, Stockton Infrared Thermographic Services, Inc. (USA) [8013-17]

5:10 pm: **Infrared imaging of LED lighting tubes and fluorescent tubes**, Sami Siikonen, VTT Technical Research Ctr. of Finland (Finland) [8013-18]

Wednesday 27 April

SESSION 6

Room: Grand 7A Wed. 8:00 to 9:00 am

Industrial Applications: Solar Cells

Session Chairs: **Nicolas P. Avdelidis**, National Technical Univ. of Athens (Greece); **Ralph A. Rotolante**, MoviTherm (USA)

8:00 am: **A thermographic survey for evaluating in situ the performance of photovoltaic panels**, Nicolas P. Avdelidis, National Technical Univ. of Athens (Greece); Yiannis Markopoulos, Ioannis Katsis, Green Project S.A. (Greece); Maria Kouli, National Technical Univ. of Athens (Greece) [8013-19]

8:20 am: **Infrared lock-in techniques for solar cell inspection**, Ralph A. Rotolante, MoviTherm (USA) [8013-20]

8:40 am: **The use of infrared imaging with actual input and output power measurements to significantly change the weighted average power conversion efficiencies for photovoltaic solar plant inverters**, Gregory R. Stockton, Stockton Infrared Thermographic Services, Inc. (USA) [8013-21]

SESSION 7

Room: Grand 7A Wed. 9:00 to 10:20 am

Industrial Applications: Miscellaneous

Session Chairs: **Nicolas P. Avdelidis**, National Technical Univ. of Athens (Greece); **Ralph A. Rotolante**, MoviTherm (USA)

9:00 am: **IR imaging for machine vision and process control**, Jason Styron, FLIR Systems, Inc. (USA) [8013-22]

9:20 am: **Experimental study of the detection of buried landmines in soils with increasing water content by infrared imaging**, Danilo J. Dadamia, Univ. de Buenos Aires (Argentina); Eduardo H. Castro, Univ. de Buenos Aires (Argentina) and CITEDEF (Argentina) [8013-23]

9:40 am: **High-speed IR monitoring of a turbojet engine gas flow using an uncooled MWIR imaging sensor**, Rodrigo Linares-Herrero, María Teresa Montojo, Raúl Gutiérrez, Arturo Baldasano, New Infrared Technologies, Ltd. (Spain); Victor Archilla-Prat, Ctr. de Turborreactores (Spain) [8013-24]

10:00 am: **Implementation of thermographers certification in Brazil**, Laerte Santos, Furnas Centrais Elétricas S.A. (Brazil); Luiz M. Alves, ABENDI (Brazil); Edson da Costa Bortoni, Univ. Federal de Itajubá (Brazil) [8013-26]

Coffee Break 10:20 to 10:50 am

SESSION 8

Room: Grand 7A Wed. 10:50 to 11:50 am

IR NDT Theory I

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

10:50 am: **Signal and image processing techniques for digitized frequency modulated thermal-wave imaging for characterization of fiber-reinforced plastics**, Ravibabu Mulaveesala, Subbarao V. Ghali, Lokendra K. Balyan, Subir S. Lamba, Indian Institute of Information Technology (India) [8013-27]

11:10 am: **Automatic thermographic image defect detection in composites**, Bin Luo, Bjorn Liebenberg, Jeffery Raymond, S. P. Santospirito, Kingston Computer Consultancy Ltd. (United Kingdom) [8013-28]

11:30 am: **Fixed eigenvector analysis of thermographic NDE data**, K. Elliott Cramer, William P. Winfree, NASA Langley Research Ctr. (USA) [8013-29]

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

SESSION 9

Room: Grand 7A Wed. 1:20 to 2:20 pm

IR NDT Theory II

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

1:20 pm: **Improved flaw detection and characterization with difference thermography**, William P. Winfree, Joseph N. Zalameda, Patricia A. Howell, NASA Langley Research Ctr. (USA) [8013-30]

1:40 pm: **Defense and illustration of the pulse-stimulated IR thermography for NDE (Invited Paper)**, Daniel L. Balageas, ONERA (France) [8013-31]

SESSION 10

Room: Grand 7A Wed. 2:20 to 5:30 pm

IR NDT Methods and Applications

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

2:20 pm: **Automated transient thermography for the inspection of CFRP structures: experimental results and developed procedures**, Panagiotti Theodorakeas, Nicolas P. Avdelidis, Kostas Chryssagis, National Technical Univ. of Athens (Greece); Clemente Ibarra-Castanedo, Univ. Laval (Canada); Maria Koui, National Technical Univ. of Athens (Greece); Xavier P. V. Maldague, Univ. Laval (Canada) [8013-32]

2:40 pm: **Issues in on-aircraft application of thermographic NDT**, Steven M. Shepard, Thermal Wave Imaging, Inc. (USA) [8013-33]

3:00 pm: **Thinning identification technique using stainless steel film heater and response surface method**, Nagahisa Ogasawara, Hiroyuki Yamada, National Defense Academy (Japan) [8013-34]

Coffee Break 3:20 to 3:50 pm

3:50 pm: **Real-time principle component analysis for thermograms processing and fusion**, Mohammed A. Omar, Yi Zhou, Qin Shen, Clemson Univ. (USA) [8013-35]

4:10 pm: **Detection of subsurface defects in metallic materials with thermo-inductive inspection**, Beate Oswald-Tranta, Mario Sorger, Montan Univ. Leoben (Austria) [8013-36]

4:30 pm: **Thermography based inspection of turbine airfoils**, Steven M. Shepard, Thermal Wave Imaging, Inc. (USA) [8013-37]

4:50 pm: **Pulse and lock-in IR NDT in complex structures**, Markus Tarin, moviMED (USA) [8013-38]

5:10 pm: **Infrared thermography as a nondestructive tool for materials characterisation and assessment**, Tat-Hean Gan, TWI Ltd. (United Kingdom); Nicolas P. Avdelidis, National Technical Univ. of Athens (Greece) [8013-39]

Thursday 28 April

SESSION 11

Room: Grand 7A Thurs. 8:00 to 10:20 am

Materials Evaluation and Detection

Session Chairs: **Takahide Sakagami**, Kobe Univ. (Japan); **Morteza Safai**, The Boeing Co. (USA)

8:00 am: **Fiber optic thermal detection of composite delaminations**, Meng-Chou Wu, William P. Winfree, NASA Langley Research Ctr. (USA) [8013-40]

8:20 am: **Thermoelastic stress analysis of overlap shear splices constructed from wet lay-up FRP composites**, Jeff R. Brown, Benjamin Fineout, Hope College (USA) [8013-41]

8:40 am: **Preliminary investigation of polarization effects during metal cutting**, Eric Whitenon, National Institute of Standards and Technology (USA) [8013-42]

9:00 am: **Infrared imaging during ballistic testing of self-healing materials**, K. Elliott Cramer, Sidney G. Allison, Eric R. Burke, Patricia A. Howell, William T. Yost, NASA Langley Research Ctr. (USA) [8013-43]

9:20 am: **Modeling of laser-analyte-substrate interaction in photo-thermal infrared imaging and laser trace vaporization**, Robert Furstenberg, Jakob Grosser, Christopher A. Kendziora, Michael R. Papantonakis, R. Andrew McGill, U.S. Naval Research Lab. (USA) [8013-44]

9:40 am: **Application of micro-scale thermography to the thermal analysis of polymeric and organic materials**, Junko Morikawa, Tokyo Institute of Technology (Japan); Eita Hayakawa, ai-Phase Co., Ltd. (Japan); Toshimasa Hashimoto, Tokyo Institute of Technology (Japan) [8013-45]

10:00 am: **Infrared imaging for process control of laser glass tube**, Monica Lopez Saenz, Oliver Schreer, IRCAM GmbH (Germany) [8013-46]

POSTERS—Thursday

Room: Crystal M Thurs. 6:00 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. 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 pm 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.

Measurement method based on directional contrast in infrared image for tracking filter, Wanjae Lee, Changhan Park, Samsung Thales Co., Ltd. (Korea, Republic of) [8013-25]

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

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

Program Committee: **Piet Bijl**, TNO Defence, Security and Safety (Netherlands); **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); **Hector Reyes**, Raytheon Co. (USA); **Andre 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); **Ronald B. Sertain**, U.S. Army Research Lab. (USA); **Michael A. Soel**, FLIR Systems, Inc. (USA); **Curtis M. Webb**, Northrop Grumman Corp. (USA)

Tuesday 26 April

Symposium-Wide Plenary Session

Tuesday • 8:30 to 9:30 am • Location: Crystal H

Dr. Regina E. Dugan

Director, Defense Advanced Research Projects Agency (DARPA)

See page 18 for details • Open to All Attendees

Coffee Break 9:30 to 10:00 am

Introduction and Review of 22 Conference Years

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

Session Chair: **Gerald C. Holst**, JCD Publishing (USA)

SESSION 1

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

Modeling Non-Thermal Imaging Systems

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

1:20 pm: **Modeling of pixel edge effects in a novel micro-filter array for the visible spectrum**, Frida E. Strömqvist Vetelino, Ali A. Abtahi, Aerospace Missions Corp. (USA); Peter B. Griffin, Stanford Univ. (USA); Ricky J. Morgan, Usha Raghuram, Aerospace Missions Corp. (USA) [8014-01]

1:40 pm: **Conspicuity of moving soldiers in the field**, Jaap A. Beintema, Alexander Toet, Sjoerd C. de Vries, TNO Defence, Security and Safety (Netherlands) [8014-02]

2:00 pm: **Modeling human performance with low-light sparse color imagers**, David P. Haefner, Jae H. Cha, Joseph P. Reynolds, U.S. Army Night Vision & Electronic Sensors Directorate (USA) [8014-03]

2:20 pm: **Visibility of F-16's with the naked eye, NVG's, and thermal sensor**, Frank L. Kooi, TNO Defence, Security and Safety (Netherlands) [8014-04]

2:40 pm: **Passive SWIR sky-glow illuminated imaging compared with NIR-visible for low-light nighttime observations**, David C. Dayton, Jeffery G. Allen, John D. Gonglewski, Applied Technology Associates (USA) [8014-05]

Coffee Break 3:00 to 3:40 pm

SESSION 2

Room: Grand 6 Tues. 3:40 to 4:40 pm

Modeling Thermal Imaging Systems I

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

3:40 pm: **Modeling MRT for well characterized thermal imagers**, Stephen D. Burks, U.S. Army Night Vision & Electronic Sensors Directorate (USA) . . [8014-06]

4:00 pm: **Performance evaluation of panoramic electro-optic imagers using the TOD method**, Pierre Desaulniers, Simon Thibault, Univ. Laval (Canada) [8014-07]

4:20 pm: **Thermal imager non-uniformity sources modeling**, Emanuele Guadagnoli, Claudio Giunti, SELEX Galileo S.p.A. (Italy); Paolo Mariani, ALTRAN Italy S.p.A. (Italy); Monica Olivieri, Antonio Porta, Barbara Sozzi, Stefano Zatti, SELEX Galileo S.p.A. (Italy) [8014-08]

WORKSHOP

Room: Grand 6 Tues. 4:50 to 6:00 pm

New NVESD Performance Model Interface and Theory Updates

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

The US Army Night Vision and Electronic Sensors Directorate (NVESD) recently released a beta version of the next generation Integrated Performance Model (NV-IPM). Details concerning the changes to the model interface along with a discussion of model capabilities and a demonstration of existing model functionality will be the focus of this presentation. A discussion of updates to the model theory including revisions to the noise model, aliasing as noise, and the development of a fully 2D model will also be included.

Wednesday 27 April

SESSION 3

Room: Grand 6. Wed. 8:40 to 10:00 am

Modeling Thermal Imaging Systems II

Session Chairs: Hector Reyes, Raytheon Co. (USA);

Joseph P. Reynolds, U.S. Army Night Vision & Electronic Sensors Directorate (USA);

Piet Bijl, TNO Defence, Security and Safety (Netherlands)

8:40 am: Matched filtering determines human visual search in natural images, Alexander Toet, TNO Defence, Security and Safety (Netherlands) and Univ. van Amsterdam (Netherlands) [8014-09]

9:00 am: Analytical calculation for probability of detection given time-dependent search parameters, Melvin H. Friedman, Joseph P. Reynolds, David L. Wilson, U.S. Army Night Vision & Electronic Sensors Directorate (USA); Ronald G. Driggers, U.S. Naval Research Lab. (USA) [8014-10]

9:20 am: Drift-insensitive dim-target detection using differential correlation, Alan Y. Hsu, Sandia National Labs. (USA) [8014-11]

9:40 am: Software toolkit for evaluating infrared imaging seeker, Marianne A. Degache, TNO Defence, Security and Safety (Netherlands) [8014-12]

Coffee Break 10:00 to 10:40 am

SESSION 4

Room: Grand 6. Wed. 10:40 to 11:20 am

Modeling Thermal Imaging Systems III

Session Chairs: Hector Reyes, Raytheon Co. (USA);

Joseph P. Reynolds, U.S. Army Night Vision & Electronic Sensors Directorate (USA);

Piet Bijl, TNO Defence, Security and Safety (Netherlands)

10:40 am: Collaborative search with independent sensors, Melvin H. Friedman, Joseph P. Reynolds, Todd W. Du Bosq, U.S. Army Night Vision & Electronic Sensors Directorate (USA) [8014-13]

11:00 am: LWIR thermal imaging through dust obscuration, Forrest A. Smith, Eddie L. Jacobs, Srikant K. Chari, Jason M. Brooks, The Univ. of Memphis (USA) [8014-14]

SESSION 5

Room: Grand 8A Wed. 11:30 am to 12:00 pm

Joint Keynote Session with Conference 8012

Session Chair: Paul R. Norton,

U.S. Army Night Vision & Electronic Sensors Directorate (USA)

11:30 am: Wide-area infrared surveillance: performance requirements and technology needs (Keynote Presentation), Michael T. Eismann, Air Force Research Lab. (USA) [8012-50]

Lunch/Exhibition Break 12:00 to 1:20 pm

SESSION 6

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

Modeling Thermal Imaging Systems IV

Session Chairs: Ronald B. Sertain, U.S. Army Research Lab. (USA);

Michael A. Soel, FLIR Systems, Inc. (USA)

1:20 pm: Performance assessment of treating aliased signal as target-dependent noise, Bradley L. Preece, David P. Haefner, U.S. Army Night Vision & Electronic Sensors Directorate (USA) [8014-15]

1:40 pm: Identification of human activities in a thermal system with noise varied in temporal frequency, Jason M. Brooks, Eddie L. Jacobs, Forrest A. Smith, The Univ. of Memphis (USA) [8014-16]

2:00 pm: System considerations of aerial infrared imaging for wide-area persistent surveillance, Melvin R. Krueger, John N. Lee, Dale C. Linne von Berg, Grant Howard, U.S. Naval Research Lab. (USA); Jason A. Edelberg, V-Systems, Inc. (USA) [8014-17]

2:20 pm: Developing adequate definitions for detection, recognition, and identification of human targets, Patrick D. O'Shea, Jeffrey T. Meier, U.S. Army Redstone Technical Test Ctr. (USA) [8014-18]

2:40 pm: TOD to TTP calibration, Piet Bijl, TNO Defence, Security and Safety (Netherlands); Joseph P. Reynolds, U.S. Army Night Vision & Electronic Sensors Directorate (USA); Wouter K. Vos, Maarten A. Hogervorst, Jonathan D. Fanning, TNO Defence, Security and Safety (Netherlands) [8014-19]

Coffee Break 3:00 to 3:30 pm

SESSION 7

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

Modeling Thermal Imaging Systems V

Session Chairs: Ronald B. Sertain, U.S. Army Research Lab. (USA);

Michael A. Soel, FLIR Systems, Inc. (USA)

3:30 pm: Dependence on target spatial frequency signatures in infrared performance modeling, Todd W. Du Bosq, Jeffrey T. Olson, U.S. Army Night Vision & Electronic Sensors Directorate (USA) [8014-20]

3:50 pm: Estimating the blur kernel for blurry IR imagery from edge profiles, Leslie N. Smith, U. S. Naval Research Lab. (USA); James R. Waterman, U.S. Naval Research Lab. (USA) [8014-21]

4:10 pm: Development of a moving platform model from the ACQUIRE model using first principles, Steve K. Moyer, U.S. Army Night Vision & Electronic Sensors Directorate (USA) [8014-22]

4:30 pm: Comparison of the performance of LWIR and MWIR thermal imagers for varying ambient temperature and humidity conditions, Vikram Dhar, Zafar Khan, Rajesh K. Sharma, Rangarajan Muralidharan, Solid State Physics Lab. (India) [8014-23]

Thursday 28 April

SESSION 8

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

Targets, Backgrounds, and Atmospheric I

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: Improved signature prediction through coupling of ShipIR and CFD, David A. Vaitekunas, W. R. Davis Engineering, Ltd. (Canada) [8014-24]

8:20 am: Simulation of laser beam reflection at the sea surface, Frédéric Schwenger, Endre Repasi, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany) [8014-25]

8:40 am: SMART and SMARTI: visible and IR atmospheric radiative transfer libraries optimized for wide-band applications, Vincent Ross, AEREX avionique inc. (Canada); Denis Dion, Jr., Defence Research and Development Canada (Canada) [8014-26]

9:00 am: Simulation of a laser range-gated SWIR imaging system in weak turbulence conditions, David E. Oxford, Defence Science and Technology Lab. (United Kingdom); Richard L. Espinola, U.S. Army Night Vision & Electronic Sensors Directorate (USA) [8014-27]

9:20 am: Computer simulation of image degradations by atmospheric turbulence for horizontal views, Endre Repasi, Robert Weiss, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany) [8014-28]

9:40 am: Spatial and temporal variability of SWIR air glow measurements, David C. Dayton, Jeffery Allan, Rudolf Nolasco, Applied Technology Associates (USA); John D. Gonglewski, Michael M. Myers, Air Force Research Lab. (USA) [8014-29]

Coffee Break 10:00 to 10:30 am

SESSION 9

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

Targets, Backgrounds, and Atmospheric II

Session Chairs: **Andre 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)

10:30 am: **Statistics of the point spread function for imaging through turbulence**, Mikhail I. Charnotskii, Zel Technologies, LLC (USA). [8014-30]

10:50 am: **CART V: recent advancements in computer-aided camouflage assessment**, Thomas Müller, Markus Müller, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany) [8014-31]

11:10 am: **A simple physical model for simulating turbulent imaging**, Guy Potvin, J. Luc Forand, Denis Dion, Jr., Defence Research and Development Canada (Canada). [8014-32]

11:30 am: **MATISSE-v2.0: new functionalities and comparison with MODIS satellite images**, Luc Labarre, ONERA (France); Karin Stein, Norbert Wendelstein, Caroline Schweitzer, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany); Karine Caillaud, Sandrine Fauqueux, Claire Malherbe, Antoine Roblin, Bernard M. Rosier, Pierre Simoneau, ONERA (France). . [8014-33]

Lunch/Exhibition Break 11:50 am to 1:00 pm

SESSION 10

Room: Grand 6. Thurs. 1:00 to 3:00 pm

Testing I

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

1:00 pm: **3D detector noise revisited**, Astrid Lundmark, Autoliv Electronics AB (Sweden) [8014-34]

1:20 pm: **MRi dual-band MWIR imaging FTS**, Louis M. Moreau, Claude B. Roy, Stéphane Lantagne, Florent Prel, Christian A. Vallieres, ABB Analytical Measurement (Canada). [8014-35]

1:40 pm: **Design and characterization of an integral uniform radiance source for integral veiling glare testing of optical systems**, Joseph Jablonski, Greg A. McKee, Chris Durell, Labsphere, Inc. (USA) [8014-36]

2:00 pm: **Confirming the performance of LWIR optical systems: an affordable high-accuracy lens measurement system**, Stephen D. Fantone, Daniel Orband, Jian Zhang, Roger Kirschner, Optikos Corp. (USA) [8014-37]

2:20 pm: **Blackbody source technology trends**, Jason A. Mazzetta, Stephen D. Scoptaz, John E. Sgheiza, Miguel A. Medina, Electro Optical Industries, Inc. (USA). [8014-38]

2:40 pm: **Calibration and control of a large dynamic range visible source**, Joseph D. LaVeigne, Nathan Radtke, Santa Barbara Infrared, Inc. (USA) [8014-39]

Coffee Break 3:00 to 3:30 pm

SESSION 11

Room: Grand 6. Thurs. 3:30 to 5:10 pm

Testing II

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

3:30 pm: **Removing the statistical bias from three-dimensional noise measurements**, Ze'ev Bomzon, CI Systems (Israel) Ltd. (Israel) [8014-40]

3:50 pm: **A common architecture for TPS development**, Brian Nehring, Alan Irwin, Joseph D. LaVeigne, Santa Barbara Infrared, Inc. (USA) [8014-41]

4:10 pm: **SR-5000N: spectroradiometer's new performance improvements in FOV flatness, scan speed, and other important features**, Dario Cabib, Moshe Lavi, Amir Gil, Shmuel Shapira, CI Systems (Israel) Ltd. (Israel) [8014-42]

4:30 pm: **Increased responsivity pyroelectric radiometer with dome input and temperature control**, George P. Eppeldauer, Jinan Zeng, Leonard M. Hanssen, National Institute of Standards and Technology (USA). [8014-43]

4:50 pm: **Fast MTF and aberrations analysis of MWIR and LWIR imaging systems using quadri wave interferometry**, Sabrina Velghe, Djamel Brahm, William Boucher, Benoit F. Wattellier, PHASICS S.A. (France). [8014-44]

POSTERS—Thursday

Room: Crystal M Thurs. 6:00 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. 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 pm 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.

Dual-wavelength transfer standard for laser peak-power measurement, Rodney Leonhardt, National Institute of Standards and Technology (USA); Daniel King, Naval Surface Warfare Ctr. Corona Div. (USA) [8014-45]

Field performance evaluation for Heliborne FLIR systems by the devised conversion methodology, Kee Tae Han, Agency for Defense Development (Korea, Republic of). [8014-46]

SIFT-based localization and tracking in IR imaging system, Changan Park, Samsung Thales Co., Ltd. (Korea, Republic of) [8014-47]

Laboratory for testing electro-optical surveillance systems, Krzysztof Chrzanowski, Military Univ. of Technology (Poland) [8014-48]

Precision centering error measurement of assembled IR optics in the wavelength range from 3-5 and 8-12µm, Josef Heinisch, Helge Pannhoff, Trioptics GmbH (Germany) [8014-49]

Feasibility analysis and demonstration of high-speed digital imaging using micro-arrays of vertical cavity surface-emitting lasers, Mark A. Mentzer, U.S. Army Aberdeen Test Ctr. (USA). [8014-50]

Courses of Related Interest

- SC152 **Infrared Focal Plane Arrays** (Dereniak, Hubbs) Monday, 1:30 to 5:30 pm
- SC181 **Predicting Target Acquisition Performance of Electro-Optical Imagers** (Vollmerhausen) Tuesday, 8:30 am to 5:30 pm
- SC278 **Infrared Detectors** (Dereniak) Monday, 8:30 am to 12:30 pm
- SC755 **Infrared Optics and Zoom Lenses** (Mann) Thursday, 8:30 am to 12:30 pm
- SC835 **Infrared Systems - Technology & Design** (Daniels) Monday-Tuesday, 8:30 am to 5:30 pm
- SC892 **Infrared Search and Track Systems** (Schwering) Tuesday, 8:30 am to 5:30 pm
- SC900 **Uncooled Thermal Imaging Detectors and Systems** (Hanson) Monday, 8:30 am to 5:30 pm
- SC1000 **Introduction to Infrared and Ultraviolet Imaging Technology** (Richards) Monday, 1:30 to 5:30 pm

Visit the registration desk for course descriptions or to register

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

Conference Chair: **Scott B. Mobley**, U.S. Army AMRDEC (USA)

Conference Co-Chair: **R. Lee Murrer, Jr.**, Millennium Engineering and Integration Co. (USA)

Program Committee: **James A. Annos**, U.S. Navy (USA); **Gary H. Ballard**, U.S. Army AMRDEC (USA); **David B. Beasley**, Optical Sciences Corp. (USA); **James A. Buford, Jr.**, Missile Defense Agency (USA); **Dennis H. Bunfield**, The AEGIS Technologies Group, Inc. (USA); **Raul Fainchtein**, The Johns Hopkins Univ. (USA); **W. Larry Herald**, MacAulay Brown Inc. (USA); **Hajin J. Kim**, U.S. Army AMRDEC (USA); **John M. Lannon, Jr.**, RTI International (USA); **Heard Lowry**, Aerospace Testing Alliance (USA); **William M. Lowry**, U.S. Army Redstone Technical Test Ctr. (USA); **Robert W. Mitchell**, Ideal Aeromsmith, Inc. (USA); **Ronald J. Rapp**, Air Force Research Lab. (USA); **Richard M. Robinson**, The AEGIS Technologies Group, Inc. (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); **Brian K. Woode**, Naval Air Warfare Ctr. (USA)

Wednesday 27 April

Room: Grand 6.Wed. 8:15 to 8:40 am

Welcome and Announcements

Session Chair: **Scott B. Mobley**, U.S. Army AMRDEC (USA)

SESSION 1

Room: Grand 6.Wed. 8:40 to 11:40 am

Scene Simulation: Enabling Technologies

Session Chairs: **David B. Beasley**, Optical Sciences Corp. (USA);
Donald R. Snyder, Air Force Research Lab. (USA);
John M. Lannon, Jr., RTI International (USA)

8:40 am: **IR emitter non-uniformity correction (NUC): making sense of the data**, Jim Oleson, Oleson Convergent Solutions LLC. (USA); Breck A. Sieglinger, Ronald J. Rapp, Air Force Research Lab. (USA); Derek Greer, Naval Air Warfare Ctr. Aircraft Div. (USA). [8015-01]

9:05 am: **IR imaging bundles for HWIL testing**, Brandon Shaw, Daniel J. Gibson, U.S. Naval Research Lab. (USA); Gabrielle Farrar, Univ. Research Foundation (USA); Rafael Gattass, Vinh Q. Nguyen, Jasbinder S. Sanghera, Ishwar D. Aggarwal, U.S. Naval Research Lab. (USA) [8015-02]

9:30 am: **MWIR LED performance enhancement by nano-plasmon layer**, Naresh Das, Wayne Chang, U.S. Army Research Lab. (USA). [8015-03]

Coffee Break 9:55 to 10:25 am

10:25 am: **Contrast analysis for DMD-based IR scene projector**, Julia Rentz Dupuis, David J. Mansur, OPTRA, Inc. (USA). [8015-04]

10:50 am: **Multispectral polarized scene projector (MPSP)**, Le Li, Kent Optronics, Inc. (USA). [8015-05]

11:15 am: **System for driving 2D infrared emitter arrays at cryogenic temperatures**, Corey Lange, Rodney McGee, Fouad E. Kiamilev, Univ. of Delaware (USA) [8015-06]

Lunch/Exhibition Break 11:40 am to 1:20 pm

SESSION 2

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

HWIL in Systems Integration Testing

Session Chairs: **Brian K. Woode**, Naval Air Warfare Ctr. Aircraft Div. (USA); **Richard M. Robinson**, The AEGIS Technologies Group, Inc. (USA);
James A. Buford, Jr., Missile Defense Agency (USA)

1:20 pm: **Integrated optical payload simulator**, Jun-Ho Lee, Seungyeol Ryoo, Kongju National Univ. (Korea, Republic of); Doo-Chun Seo, Ji-Yeon Yang, Korea Aerospace Research Institute (Korea, Republic of). [8015-07]

1:45 pm: **Allegany Ballistics Lab.: Sensor Test Target System**, Deran Eaton, Naval Surface Warfare Ctr. Indian Head Div. (USA) [8015-08]

2:10 pm: **Missile airframe simulation testbed: MANPADS (MAST-M) for test and evaluation of aircraft survivability equipment**, James L. Clements III, U.S. Army Aviation and Missile Command (USA); Richard M. Robinson, Joseph Robinson, The AEGIS Technologies Group, Inc. (USA) [8015-09]

2:35 pm: **Rapid common hardware-in-the-loop development**, Hajin J. Kim, U.S. Army Research, Development and Engineering Command (USA); Stephen Moss, The AEGIS Technologies Group, Inc. (USA) [8015-10]

Coffee Break 3:00 to 3:30 pm

SESSION 3

Room: Grand 6.Wed. 3:30 to 4:45 pm

HWIL Enabling Technologies

Session Chairs: **Heard Lowry**, Aerospace Testing Alliance (USA); **Ronald J. Rapp**, Air Force Research Lab. (USA); **Hajin J. Kim**, U.S. Army Research, Development and Engineering Command (USA)

3:30 pm: **Calibration and deployment of a new NIST transfer radiometer for broadband and spectral calibration of space chambers (MDXR)**, Timothy M. Jung, Jung Research and Development Corp. (USA); Adriaan C. Carter, Booz Allen Hamilton Inc. (USA); Solomon I. Woods, Simon G. Kaplan, National Institute of Standards and Technology (USA). [8015-11]

3:55 pm: **Development of technologies for imaging sensor testing at AEDC**, Heard Lowry, Aerospace Testing Alliance (USA) [8015-12]

4:20 pm: **Fine range-motion simulation for hardware-in-the-loop testing of monostatic-pulsed LFM radars**, Richard F. Olson, Jr., U.S. Army Aviation and Missile Command (USA) [8015-13]

Thursday 28 April

Welcome and Announcements

Room: Grand 6 Thurs. 8:15 to 8:40 am

Session Chair: Scott B. Mobley, U.S. Army AMRDEC (USA)

SESSION 4

Room: Grand 6. Thurs. 8:40 to 11:15 am

Scene Generation Technologies

Session Chairs: James A. Annos, U.S. Navy (USA);

Dennis H. Bunfield, The Aegis Technologies Group, Inc. (USA)

8:40 am: **DRDC’s approach to IR scene generation for IRCM simulation**, Jean-François Lepage, Defence Research and Development Canada (Canada); Marc-André Labrie, Éric Rouleau, Jonathan Richard, LTI Informatique et Génie (Canada); Vincent Ross, AEREX avionique inc. (Canada); Denis Dion, Jr., Nathalie Harrison, Defence Research and Development Canada (Canada) [8015-14]

9:05 am: **Real-time maritime scene simulation for LADAR sensors**, Chad L. Christie, Efthimos T. Gouthas, Leszek Swierkowski, Defence Science and Technology Organisation (Australia) [8015-15]

9:30 am: **High-fidelity real-time maritime scene rendering**, Thomas M. Taczak, Applied Technology Inc. (USA); Haw-Jye S. Shyu, U.S. Naval Research Lab. (USA); Kevin Cox, Space/Ground System Solutions, Inc. (USA); Colin P. Cahill, Envisioneering, Inc. (USA); Carlos G. Maraviglia, Robert E. Gover, U.S. Naval Research Lab. (USA) [8015-16]

Coffee Break 9:55 to 10:25 am

10:25 am: **EO/IR scene generation open source initiative for real-time hardware-in-the-loop and all-digital simulation**, Darian E. Trimble, The Aegis Technologies Group, Inc. (USA); William M. Lowry, U.S. Army Redstone Technical Test Ctr. (USA); Joseph W. Morris, U.S. Army Research, Development and Engineering Command (USA); Brett A. Boren, U.S. Army Redstone Technical Test Ctr. (USA); Dennis H. Bunfield, James B. Towers, The Aegis Technologies Group, Inc. (USA) [8015-17]

10:50 am: **The multispectral advanced volumetric real-time imaging compositor for real-time distributed scene generation**, Dennis H. Bunfield, Thomas E. Peddycoart, Darian E. Trimble, The Aegis Technologies Group, Inc. (USA); Joseph W. Morris, Gary H. Ballard, U.S. Army Aviation and Missile Research Development and Engineering Ctr. (USA) [8015-18]

SESSION 5

Room: Grand 6. Thurs. 11:15 am to 12:30 pm

Flight Motion Simulation Technology

Session Chairs: R. Lee Murrer, Jr., Millennium Engineering and Integration Co. (USA); Robert W. Mitchell, Ideal Aeromsmith, Inc. (USA);

Gary H. Ballard, U.S. Army Aviation and Missile Command (USA)

11:15 am: **Analysis of a flight motion controller**, Thanh L. Vu, Russell M. Thamm, Defence Science and Technology Organisation (Australia) [8015-19]

11:40 am: **Novel distributed real-time control system for a target motion simulator**, Robin Hauser, Martin Kägi, Dominik Gunsch, Walter Rindlisbacher, Peter Wälti, ACUTRONIC Switzerland Ltd. (Switzerland) [8015-20]

12:05 pm: **GPS synchronization of a motion simulator for hardware-in-the-loop applications**, Jay D. Marchetti, Ideal Aeromsmith, Inc. (USA) [8015-21]

Courses of Related Interest

SC152 **Infrared Focal Plane Arrays** (Dereniak, Hubbs) Monday, 1:30 to 5:30 pm

SC278 **Infrared Detectors** (Dereniak) Monday, 8:30 am to 12:30 pm

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

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

Visit the registration desk for course descriptions or to register

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Window and Dome Technologies and Materials XII

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

Program Committee: **Ishwar D. Aggarwal**, U.S. Naval Research Lab. (USA); **Joel Askinazi**, Goodrich Corp. (USA); **Richard Gentilman**, Raytheon Co. (USA); **Daniel C. Harris**, Naval Air Systems Command (USA); **Brian K. Jones**, U.S. Army Research, Development and Engineering Command (USA); **John S. McCloy**, Pacific Northwest National Lab. (USA); **Robert J. Ondercin**, Air Force Research Lab. (USA); **Adrienne E. Selz**, Air Force Research Lab. (USA); **Michael E. Thomas**, The Johns Hopkins Univ. (USA); **Brian J. Zelinski**, Raytheon Missile Systems (USA)

Wednesday 27 April

SESSION 1

Room: Grand 8BWed. 8:00 to 10:00 am

Advances in Mid-Wavelength Infrared Window Technology I

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

8:00 am: **Effects and elimination of nanoporosity in transparent sintered spinel (MgAl₂O₄)**, Andreas Krell, Katja Waetzig, Thomas Hutzler, Jens Klimke, Fraunhofer-Institut für Keramische Technologien und Systeme (Germany) [8016-01]

8:20 am: **Manufacturing solutions for polycrystalline transparent spinel domes**, Evans A. LaRoche, Jeffrey J. Kutsch, Larry Fehrenbacher, Technology Assessment and Transfer (USA) [8016-02]

8:40 am: **High-performance spinel ceramics for IR windows and domes**, Juan L. Sepulveda, Raouf O. Loutfy, Sekyung Chang, Sharly Ibrahim, Materials and Electrochemical Research Corp. (USA) [8016-03]

9:00 am: **Joining of transparent ceramics**, Amir Shechter, Ehud Galun, Elbit Systems Electro-Optics El-Op Ltd. (Israel) [8016-04]

9:20 am: **Large-area electro-optic spinel windows: advances in manufacturing**, Jeffrey J. Kutsch, Evans A. LaRoche, Lynda Renomeron, Larry Fehrenbacher, Technology Assessment and Transfer (USA); Larry Shaffer, ArmorLine Corp. (USA); Joseph A. Randi, The Pennsylvania State Univ. Electro-Optics Ctr. (USA) [8016-05]

9:40 am: **Large optical grade sapphire windows produced from a horizontal growth process**, Jonathan B. Levine, Matthew Montgomery, Andrey Novoselov, Sergej Podlozhenov, Rubicon Technology Inc. (USA) [8016-06]

Coffee Break 10:00 to 10:30 am

SESSION 2

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

Advances in Mid-Wavelength Infrared Window Technology II

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

10:30 am: **ALON optical ceramic transparencies for window, dome, and transparent armor applications**, Lee M. Goldman, Richard Twedt, Sreeram Balasubramanian, Suri Sastri, Surmet Corp. (USA) [8016-07]

10:50 am: **High-impact resistance optical sensor windows**, Joel Askinazi, Goodrich Corp. (USA); Lee M. Goldman, Surmet Corp. (USA) [8016-08]

11:10 am: **Dual IR/RF windows for laser communications**, Lee M. Goldman, Richard Twedt, Jayson Zigman, Surmet Corp. (USA); Robert J. Ondercin, Air Force Research Lab. (USA) [8016-09]

11:30 am: **Transparent ceramics for demanding optical applications**, Mark V. Parish, Marina R. Pascucci, Brenda Boucher-Puputti, Normand Corbin, Guerlyne Chery, Jason Small, CeraNova Corp. (USA) [8016-10]

11:50 am: **Colloidal processing and optical transmittance of submicron polycrystalline alumina**, Tzu-Chien Wen, Dinesh K. Shetty, The Univ. of Utah (USA) [8016-11]

12:10 pm: **Synthesis, characterization, and densification of Al_{2-x}Sc_x(WO₄)³ ceramics for low-expansion infrared-transparent windows**, Niladri Dasgupta, Bruce Butler, Erinn Sorge, Materials and Systems Research, Inc. (USA); Tzu-Chien Wen, Dinesh K. Shetty, The Univ. of Utah (USA) [8016-12]

Lunch/Exhibition Break 12:30 to 2:00 pm

SESSION 3

Room: Grand 8B Wed. 2:00 to 3:20 pm

Optical Properties: Measurement and Prediction

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

2:00 pm: **A mid-infrared prism coupler for bulk and thin film analysis**, Norman C. Anheier, Jr., Amy H. Qiao, Pacific Northwest National Lab. (USA) [8016-14]

2:20 pm: **Measurement of chalcogenide glass optical dispersion using a mid-infrared prism coupler**, Amy H. Qiao, Norman C. Anheier, Jr., Pacific Northwest National Lab. (USA); J. David Musgrave, Kathleen Richardson, Clemson Univ. (USA); Daniel W. Hewak, Univ. of Southampton (United Kingdom) [8016-13]

2:40 pm: **Methods for prediction of refractive index in glasses for the infrared**, John S. McCloy, Pacific Northwest National Lab. (USA) [8016-15]

3:00 pm: **Multiphonon difference band absorption in diamond**, Michael E. Thomas, The Johns Hopkins Univ. (USA) [8016-16]

Coffee Break 3:20 to 3:50 pm

SESSION 4

Room: Grand 8B Wed. 3:50 to 5:30 pm

Advances in Long-Wavelength Infrared Window Technology

Session Chair: **Brian K. Jones**, U.S. Army Research, Development and Engineering Command (USA)

3:50 pm: **Anisotropy in structural and optical properties of chemical vapor deposited ZnS**, John S. McCloy, Pacific Northwest National Lab. (USA) [8016-17]

4:10 pm: **Describing the flexural strength of IR-transmitting materials: case of CVD zinc selenide and CVD zinc sulfide**, Claude A. Klein, C.A.K. Analytics, Int'l. (USA) [8016-18]

4:30 pm: **Microwave mediated synthesis of spherical ZnS nanoparticles**, Duraiswamy Ravichandran, Texas Biochemicals, Inc. (USA); Brian K. Jones, U.S. Army Research, Development and Engineering Command (USA); Daniel C. Harris, Naval Air Warfare Ctr. Weapons Div. (USA); Timothy Wharton, Devan Balachari, Texas Biochemicals, Inc. (USA); Ralph Korenstein, Randal W. Tustison, Raytheon Co. (USA); Sridhar Komarneni, The Pennsylvania State Univ. (USA) [8016-19]

4:50 pm: **Single crystal and polycrystalline CVD diamond for demanding optical applications**, Joseph M. Dodson, John R. Brandon, Ian Friel, Sarah L. Geoghegan, Tim P. Mollart, Element Six (UK) Ltd. (United Kingdom); Peter J. Santini, Element Six (USA); Geoffrey A. Scarsbrook, Andrew J. Whitehead, Jonathan J. Wilman, Element Six (UK) Ltd. (United Kingdom); Henk G. M. de Wit, Element Six N.V. (Netherlands) [8016-20]

5:10 pm: **Depositing high-quality single-crystal-like diamond for optical window applications**, Chao Liu, Wei Qiu, Valdosta Optics Lab., Inc. (USA) [8016-21]

Thursday 28 April

SESSION 5

Room: Grand 8B Thurs. 8:40 to 10:00 am

State-of-the Art in Optical Finishing

Session Chair: Joel Askinazi, Goodrich Corp. (USA)

8:40 am: **History of magnetorheological finishing** (*Invited Paper*), Daniel C. Harris, Naval Air Systems Command (USA); William I. Kordonski, Donald Golini, QED Technologies, Inc. (USA) [8016-22]

9:20 am: **Rapid optical manufacturing of hard ceramic conformal windows and domes**, Jessica D. Nelson, Alan Gould, Daniel Dworzanski, Charles Klinger, Michael Mandina, Optimax Systems, Inc. (USA) [8016-23]

9:40 am: **Ogive and free-form polishing with ultraform finishing**, Scott Bambrick, Michael J. Bechtold, Scott DeFisher, David E. Mohring, OptiPro Systems (USA) [8016-24]

Coffee Break 10:00 to 10:30 am

SESSION 6

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

Optical Surface Treatments and Microstructures

Session Chair: Michael E. Thomas, The Johns Hopkins Univ. Applied Physics Lab. (USA)

10:30 am: **Moldable AR microstructures for improved laser transmission and damage resistance in IRCM fiber optic beam delivery systems**, Douglas S. Hobbs, Bruce D. MacLeod, TelAztec LLC (USA) [8016-25]

10:50 am: **Hyperspectral antireflective coatings for infrared windows**, Donald E. Patterson, Byron G. Zollars, Steve M. Savoy, Nanohmics (USA) [8016-26]

11:10 am: **Development of nanostructured protective "sight glasses" for IR gas sensors**, René Bergmann, Zachary J. Davis, Michael S. Schmidt, Technical Univ. of Denmark (Denmark); Sonnik Clausen, Riso National Lab. (Denmark); Anja Boisen, Technical Univ. of Denmark (Denmark); Jens Moller Jensen, Rainier Havsteen Jakobsen, Danfoss IXA A/S (Denmark); Mogens H. Jakobsen, Technical Univ. of Denmark (Denmark) [8016-27]

11:30 am: **High laser damage threshold optical microstructures in Raytheon ceramic YAG**, Douglas S. Hobbs, Bruce D. MacLeod, TelAztec LLC (USA); Thomas M. Hartnett, Richard Gentilman, Raytheon Co. (USA) [8016-28]

11:50 am: **Numerical comparison of grid pattern diffraction effects through measurement and modeling with OptiScan software**, Ian B. Murray, Matthew W. Pieratt, Douglas L. Hibbard, Exotic Electro-Optics, Inc. (USA); Tom D. Milster, Victor E. Densmore III, College of Optical Sciences, The Univ. of Arizona (USA) [8016-29]

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

SESSION 7

Room: Grand 8B Thurs. 1:40 to 2:40 pm

Metrology of Free-Form and Conformal Optics

Session Chair: John S. McCloy, Pacific Northwest National Lab. (USA)

1:40 pm: **Advances in freeform optical metrology using a multibeam low-coherence optical probe (Quad-Probe)**, Damon W. Diehl, Christopher J. Ditchman, Christopher T. Cotton, Nathan E. Burdick, ASE Optics, Inc. (USA) [8016-30]

2:00 pm: **A non-contact surface measurement system for freeform and conformal optics**, Scott DeFisher, Michael J. Bechtold, David E. Mohring, OptiPro Systems (USA) [8016-31]

2:20 pm: **Interferometric tomography: a new tool for metrology on conformal optics**, Mikhail A. Gutin, Olga N. Gutin, Xu-Ming Wang, Dennis Ehlinger, Applied Science Innovations, Inc. (USA) [8016-32]

Coffee Break 2:40 to 3:20 pm

SESSION 8

Room: Grand 8B Thurs. 3:20 to 5:00 pm

Thin Film Optical Coatings and Analysis

Session Chair: Adrienne E. Selz, Air Force Research Lab. (USA)

3:20 pm: **Low-loss dual-wavelength laser optics coatings at 1060nm and 530nm**, Jue Wang, Horst Schreiber, Corning Tropel Corp. (USA) [8016-33]

3:40 pm: **Optical properties of zinc nitride thin films**, Ahalapitiya H. Jayatissa, The Univ. of Toledo (USA) [8016-34]

4:00 pm: **Highly abrasion resistant ultra-nanocrystalline diamond (UNCD) coatings for ZnS**, Ralph Korenstein, Raytheon Co. (USA) [8016-35]

4:20 pm: **Flexible transparent electrode**, Hulya Demiryont, Kenneth C. Shannon III, Eclipse Energy Systems, Inc. (USA); Matthew S. Bratcher, U.S. Army Research Lab. (USA) [8016-36]

4:40 pm: **Light weight, highly flexible, micro-patternable, electrically conducting polymeric nanocomposites**, Ajit Khosla, Simon Fraser Univ. (Canada) [8016-37]

Courses of Related Interest

SC214 **Infrared Window and Dome Materials** (Harris) Tuesday, 8:30 am to 5:30 pm

SC755 **Infrared Optics and Zoom Lenses** (Mann) Thursday, 8:30 am to 12:30 pm

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

Visit the registration desk for course descriptions or to register

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

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

Program Committee: **Benjamin E. Barrowes**, U.S. Army Engineer Research and Development Ctr. (USA); **Leslie M. Collins**, Duke Univ. (USA); **Gerald J. Dobeck**, Naval Surface Warfare Ctr. Panama City Div. (USA); **Paul Gader**, Univ. of Florida (USA); **John E. McFee**, Defence Research and Development Canada (Canada); **Andrzej W. Miziolek**, U.S. Army Research Lab. (USA); **Henric Oestmark**, Swedish Defence Research Agency (Sweden); **James M. Sabatier**, The Univ. of Mississippi (USA); **Motoyuki Sato IV**, Tohoku Univ. (Japan); **Mehmet Sezgin**, TÜBITAK Marmara Research Ctr. (Turkey); **Waymond R. Scott, Jr.**, Georgia Institute of Technology (USA); **Miranda A. Silvius**, U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Richard C. Weaver**, U.S. Army Night Vision & Electronic Sensors Directorate (USA)

Monday 25 April

SESSION 1

Room: Crystal N. Mon. 9:00 to 11:50 am

Electromagnetic Induction I

Session Chairs: **Jay A. Marble**, U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Gregory Schultz**, Sky Research Inc. (USA)

9:00 am: **Open area concealed weapon detection system**, Prasanta K. Pati, Univ. of Huddersfield (United Kingdom) [8017-01]

9:20 am: **Magnetic sensing techniques for humanitarian ordnance detection and discrimination**, Joe G. Keranen, Sky Research, Inc. (USA); Stephen Billings, Sky Research, Inc. (Australia); Jon Miller, Gregory Schultz, Sky Research, Inc. (USA) [8017-02]

9:40 am: **Incorporating advanced EMI technologies in operational munitions characterization surveys**, Jonathan Miller, Fridon Shubiditze, Leonard R. Pasion, Joe G. Keranen, Gregory Schultz, Sky Research, Inc. (USA) [8017-03]

10:00 am: **Fast inversion of single target dynamic MetalMapper data**, Tomasz M. Grzegorzcyk, Delpsi, LLC (USA); Benjamin E. Barrowes, U.S. Army Engineer Research and Development Ctr. (USA); David George, G&G Sciences Inc. (USA); Fridon Shubiditze, Juan Pablo Fernandez, Dartmouth College (USA); Kevin O'Neill, U.S. Army Engineer Research and Development Ctr. (USA) [8017-04]

Coffee Break 10:20 to 10:50 am

10:50 am: **Comparison of support vector machines and neural networks for UXO classification using EMI data**, Alex Bijamov, Dartmouth College (USA); Fridon Shubiditze, Dartmouth College (USA) and Sky Research, Inc. (USA); Juan Pablo Fernandez, Dartmouth College (USA); Irma Shamatava, Sky Research, Inc. (USA) and Thayer School of Engineering (USA); Benjamin E. Barrowes, U.S. Army Engineer Research and Development Ctr. (USA) and ERDC-CRREL (USA); Kevin O'Neill, Dartmouth College (USA) and ERDC-CRREL (USA) [8017-05]

11:10 am: **MPVII: an enhanced vector man-portable EMI sensor for UXO identification**, Juan Pablo Fernandez, Dartmouth College (USA); Benjamin E. Barrowes, U.S. Army Engineer Research and Development Ctr. (USA); Nicolas Lhomme, Sky Research, Inc. (Canada); Alex Bijamov, Dartmouth College (USA); Tomasz M. Grzegorzcyk, Delpsi, LLC (USA); Kevin O'Neill, U.S. Army Engineer Research and Development Ctr. (USA); Irma Shamatava, Fridon Shubiditze, Dartmouth College (USA) [8017-06]

11:30 am: **Inversion of dynamically repositioned multi-axis electromagnetic data for ordnance characterization**, Joe G. Keranen, Gregory Schultz, Fridon Shubiditze, Jonathan Miller, Lance Besaw, Sky Research, Inc. (USA) . . . [8017-07]

Lunch Break 11:50 am to 1:20 pm

SESSION 2

Room: Crystal N. Mon. 1:20 to 3:00 pm

Electromagnetic Induction II

Session Chairs: **Jay A. Marble**, U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Gregory Schultz**, Sky Research Inc. (USA)

1:20 pm: **Live-site UXO classification studies via advanced EMI models**, Irma Shamatava, Sky Research, Inc. (USA); Fridon Shubiditze, Dartmouth College (USA); Benjamin E. Barrowes, U.S. Army Engineer Research and Development Ctr. (USA); Juan Pablo Fernandez, Alex Bijamov, Dartmouth College (USA) [8017-08]

1:40 pm: **Advanced UXO discrimination: resolving multiple targets and overlapping EMI signals**, Fridon Shubiditze, Dartmouth College (USA); Benjamin E. Barrowes, U.S. Army Engineer Research and Development Ctr. (USA); Irma Shamatava, Juan Pablo Fernandez, Dartmouth College (USA); Tomasz M. Grzegorzcyk, Delpsi, LLC (USA); Kevin O'Neill, U.S. Army Engineer Research and Development Ctr. (USA); Alex Bijamov, Dartmouth College (USA) [8017-09]

2:00 pm: **Frequency domain electromagnetic induction sensor data feature extraction and processing for improved landmine detection**, Stacy L. Tantum, Kenneth D. Morton, Jr., Peter A. Torriano, Leslie M. Collins, Duke Univ. (USA) [8017-10]

2:20 pm: **EMI sensor positioning using a beacon approach**, Nicolas Lhomme, Sky Research, Inc. (Canada); Benjamin E. Barrowes, U.S. Army Engineer Research and Development Ctr. (USA); David George, G&G Sciences Inc. (USA) [8017-11]

2:40 pm: **Multisensor system design dedicated to mine detection**, Mehmet Sezgin, TÜBITAK Marmara Research Ctr. (Turkey) [8017-81]

Coffee Break 3:00 to 3:30 pm

SESSION 3

Room: Crystal N. Mon. 3:30 to 5:30 pm

A Melange of 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)

3:30 pm: **Synthetic aperture acoustic imaging of canonical targets with a 2-15 kHz LFM chirp**, Steven S. Bishop, U.S. Army Night Vision & Electronic Sensors Directorate (USA); Joseph F. Vignola, The Catholic Univ. of America (USA); Mehrdad Soumekh, Soumekh Consultant (USA); John A. Judge, The Catholic Univ. of America (USA); Peter M. Gugino, U.S. Army Night Vision & Electronic Sensors Directorate (USA) [8017-12]

3:50 pm: **Detection of unintended electromagnetic emissions from super-regenerative receivers**, Jake Hertenstein, DRS Sustainment Systems, Inc. (USA); Jagannathan Sarangapani, Missouri Univ. of Science and Technology (USA) [8017-13]

4:10 pm: **Ground target stimulaiton using a moving microwave source**, David C. Heberlein, Bohdan Balko, Ira Kohlberg, John Biddle, John Franklin, Institute for Defense Analyses (USA); Benjamin Grady, Naval Surface Warfare Ctr. Dahlgren Div. (USA) [8017-14]

4:30 pm: **DS Sentry™: an acquisition ASIC for smart, micro-power sensing applications**, John C. Liobe, ADVIS, Inc. (USA) and Univ. of Rochester (USA); Zeljko Ignjatovic, Univ. of Rochester (USA); Eric Moule, Mark Balon, ADVIS, Inc. (USA); Mark Bocko, Univ. of Rochester (USA); Mark Fiscella, ADVIS, Inc. (USA) [8017-15]

4:50 pm: **Threat detection in desert environment with passive millimeter-wave sensor**, John P. Wilson, Univ. of Delaware (USA); Christopher A. Schuetz, Richard D. Martin, Thomas E. Dillon III, Phase Sensitive Innovations, Inc. (USA); Maciej Murakowski, Dennis W. Prather, Univ. of Delaware (USA) [8017-16]

5:10 pm: **Laser neutralization of buried munitions**, James D. Habersat, Bradley Schilling, Joe Alexander III, U.S. Army Night Vision & Electronic Sensors Directorate (USA); Thomas Lehecka, The Pennsylvania State Univ. Electro-Optics Ctr. (USA); Matthew Nixon, Boeing-SVS, Inc. (USA); Russell McElhane, Cobham Analytic Solutions (USA) [8017-17]

Tuesday 26 April

Symposium-Wide Plenary Session

Tuesday • 8:30 to 9:30 am • Location: Crystal H

Dr. Regina E. Dugan

Director, Defense Advanced Research Projects Agency (DARPA)

See page 18 for details • Open to All Attendees

Coffee Break 9:30 to 10:00 am

SESSION 4

Room: Crystal N. Tues. 10:00 am to 12:00 pm

Sensing and Detecting in the Marine Environment I

Session Chairs: **Gerald J. Dobeck**,

Naval Surface Warfare Ctr. Panama City Div. (USA);

James Tory Cobb, Naval Surface Warfare Ctr. Panama City Div. (USA)

10:00 am: **Automation for underwater mine recognition: current trends and future strategy**, Jason R. Stack, Office of Naval Research (USA) [8017-18]

10:20 am: **Adaptive clutter removal from imagery and its impact on ATR with application to high-resolution sonar**, Gerald J. Dobeck, Naval Surface Warfare Ctr. Panama City Div. (USA) [8017-19]

10:40 am: **SAS image segmentation using parameterized autocorrelation function models**, James T. Cobb, Naval Surface Warfare Ctr. Panama City Div. (USA) [8017-20]

11:00 am: **Optimal frames for pattern recognition applications**, Jason C. Isaacs, Naval Surface Warfare Ctr. Panama City Div. (USA) [8017-21]

11:20 am: **Statistical analysis and classification of acoustic color functions**, James D. Tucker, James T. Cobb, Naval Surface Warfare Ctr. Panama City Div. (USA) [8017-22]

11:40 am: **Seabed change detection in challenging environments**, Cameron Matthews, Dan Sternlicht, Naval Surface Warfare Ctr. Panama City Div. (USA) [8017-23]

Lunch/Exhibition Break 12:00 to 1:10 pm

SESSION 5

Room: Crystal N. Tues. 1:10 to 3:10 pm

Sensing and Detecting in the Marine Environment II

Session Chairs: **Gerald J. Dobeck**,

Naval Surface Warfare Ctr. Panama City Div. (USA);

James Tory Cobb, Naval Surface Warfare Ctr. Panama City Div. (USA)

1:10 pm: **Metrics of the eigenfunctions of the graph Laplacian for 3D shape matching**, Jason C. Isaacs, Naval Surface Warfare Ctr. Panama City Div. (USA) [8017-24]

1:30 pm: **Data clustering and fusion using deformable structure Bayesian networks (DSBN)**, Kittipat Kampa, James T. Cobb, Jose C. Principe, Anand Rangarajan, Univ. of Florida (USA) [8017-25]

1:50 pm: **Bayesian surprise metric for outlier detection in on-line learning**, Erion Hasanbelliu, Kittipat Kampa, Jose C. Principe, Univ. of Florida (USA); James T. Cobb, Naval Surface Warfare Ctr. Panama City Div. (USA) [8017-26]

2:10 pm: **Low-noise magnetic sensing for marine munitions characterization**, Gregory Schultz, Sky Research, Inc. (USA); Stephen Billings, Sky Research, Inc. (Australia); Chet Bassani, John Foley, Raul Fonda, Sky Research, Inc. (USA) [8017-27]

2:30 pm: **Active source electromagnetic methods for marine munitions**, Gregory Schultz, Fridon Shubiditze, Jonathan Miller, Sky Research, Inc. (USA) [8017-28]

2:50 pm: **Investigating magnetic-field sensor configurations for underwater geo-location**, Fridon Shubiditze, Dartmouth College (USA); Gregory Schultz, Jon Miller, Irma Shamatava, Sky Research, Inc. (USA) [8017-29]

Coffee Break 3:10 to 3:40 pm

SESSION 6

Room: Crystal N. Tues. 3:40 to 5:20 pm

Soils and Soil Effects

Session Chairs: **Russell S. Harmon**,

U.S. Army Research Office (USA); **Jan M. H. Hendrickx**,

New Mexico Institute of Mining and Technology (USA)

3:40 pm: **Coaxial line measurement and analysis of electromagnetic properties of soils for sensor applications**, William R. Folks, Ryan North, Julie R. Kelley, Amy Cunningham, Jason McKenna, U.S. Army Engineer Research and Development Ctr. (USA) [8017-30]

4:00 pm: **Performance of demining sensors and soil properties**, Kazunori Takahashi, Holger Preetz, Jan Igel, Leibniz Institute for Applied Geosciences (Germany) [8017-31]

4:20 pm: **Effects of different soil types on strip-map SAR images using real-time impulse GPR system data**, Hakki Nazli, Mehmet Sezgin, TÜBITAK Marmara Research Ctr. (Turkey) [8017-32]

4:40 pm: **Simultaneous inversion of electromagnetic induction data for target and soil parameters**, Leonard R. Pasion, Kevin Kingdon, Jon Jacobson, Sky Research, Inc. (Canada); Stephen Billings, Sky Research, Inc. (Australia); Douglas W. Oldenburg, The Univ. of British Columbia (Canada) [8017-33]

5:00 pm: **High-resolution soil moisture mapping in Afghanistan**, Jan M. H. Hendrickx, J. Bruce Harriman, Brian Borchers, New Mexico Institute of Mining and Technology (USA); Julie R. Kelley, Stacy Howington, Jerrell R. Ballard, Jr., U.S. Army Engineer Research and Development Ctr. (USA) [8017-34]

Wednesday 27 April

SESSION 7

Room: Crystal N. Wed. 8:30 to 10:10 am

Detection of Bulk Explosive Threats I

Session Chair: **John E. McFee**,

Defence Research and Development Canada (Canada)

8:30 am: **Principles and status of neutron-based inspection technologies (Invited Paper)**, Tsahi Gozani, Rapiscan Systems Labs. (USA) [8017-35]

9:00 am: **ESCALAD: a scanning landmine detector based on neutron backscattering**, Victor R. Born, Technische Univ. Delft (Netherlands); Ahmed M. Osman, Riad M. Megahid, Egyptian Atomic Energy Authority (Egypt) [8017-36]

9:20 am: **Portable and autonomous x-ray equipment for in-situ threatening materials identification by atomic effective number high-accuracy measurement**, Mihai Ilovea, Marian Neagu, Gabriela Mateiasi, Octavian Dului, Alexandru Caescu, Madalina SIMA, ACCENT PRO 2000 s.r.l. (Romania) [8017-37]

9:40 am: **Defence R&D Canada-Suffield research on nuclear methods for detection of buried bulk explosives (Invited Paper)**, John E. McFee, Anthony A. Faust, Defence Research and Development Canada (Canada) [8017-38]

Coffee Break 10:10 to 10:40 am

SESSION 8

Room: Crystal N. Wed. 10:40 am to 12:00 pm

Detection of Bulk Explosive Threats II

Session Chair: John E. McFee,
Defence Research and Development Canada (Canada)

- 10:40 am: **Nuclear quadrupole resonance detection of explosives: an overview**, Joel B. Miller, U.S. Naval Research Lab. (USA) [8017-39]
- 11:00 am: **Observations on military exploitation of explosives detection technologies**, Anthony A. Faust, Defence Research and Development Canada (Canada); Cornelis J. de Ruiter, TNO Defence, Security and Safety (Netherlands); Anneli Ehlerding, Swedish Defence Research Agency (Sweden); John E. McFee, Defence Research and Development Canada (Canada); Eirik Svinsås, Arthur D. van Rheenen, Norwegian Defence Research Establishment (Norway) . . . [8017-40]
- 11:20 am: **Explosives (and other threats) detection using pulsed neutron interrogation and optimized detectors**, Dan A. Strellis, Tsahi Gozani, Mashal Elsalim, Rapiscan Systems Labs. (USA) [8017-41]
- 11:40 am: **A non-imaging polarized terahertz passive system for detecting and identifying concealed explosives**, Mostafa A. Karam, Douglas Meyer, Northrop Grumman Navigation Systems (USA) [8017-42]
- Lunch/Exhibition Break 12:00 to 1:40 pm

SESSION 9

Room: Crystal N. Wed. 1:40 to 3:00 pm

Standoff Detection of Explosives

Session Chair: John E. McFee,
Defence Research and Development Canada (Canada)

- 1:40 pm: **Detection and identification of explosives hidden under barrier materials: What are the THz-technology challenges?**, Arthur D. van Rheenen, Magnus W. Haakestad, Norwegian Defence Research Establishment (Norway) [8017-43]
- 2:00 pm: **Improved real-time processing of hyperspectral imaging data**, Robert Schweitzer, Matthew P. Nelson, Robert J. D'Agostino, Patrick J. Treado, ChemImage Corp. (USA) [8017-44]
- 2:20 pm: **Stand-off detection of explosive particles by imaging Raman spectroscopy**, Markus Nordberg, Hanna Ellis, Anneli Ehlerding, Henric Oestmark, Torgny Carlsson, Swedish Defence Research Agency (Sweden) [8017-45]
- 2:40 pm: **Picosecond laser pulses improves sensitivity in standoff explosive detection**, Madeleine Akeson, Lars-Erik Nilsson, Pierre Strömbeck, Portendo AB (Sweden) [8017-46]
- Coffee Break 3:00 to 3:30 pm

SESSION 10

Room: Crystal N. Wed. 3:30 to 4:50 pm

Advances in Ground Penetrating Radar Subsurface Object Detection

Session Chairs: Jeremy Bolton, Univ. of Florida (USA); Alina Zare, Univ. of Missouri-Columbia (USA)

- 3:30 pm: **Random GPR antennae height variations and mine detection performance**, G. Martin Milner, AARD, LLC (USA); Michael Younger, BAE Systems (USA) [8017-49]
- 3:50 pm: **Detection of explosive hazards using spectrum features from forward-looking ground-penetrating radar imagery**, Justin W. Farrell, Timothy C. Havens, Dominic K. Ho, James M. Keller, Univ. of Missouri-Columbia (USA); Taun T. Ton, David C. Wong, U.S. Army Night Vision & Electronic Sensors Directorate (USA); Mehrdad Soumekh, Univ. at Buffalo (USA) [8017-50]
- 4:10 pm: **Context-aware detection of explosive hazards using frequency subband processing of forward-looking ground-penetrating radar**, Timothy C. Havens, James M. Keller, Dominic K. Ho, Univ. of Missouri-Columbia (USA); Taun T. Ton, David C. Wong, U.S. Army Night Vision & Electronic Sensors Directorate (USA); Mehrdad Soumekh, Univ. at Buffalo (USA) [8017-51]
- 4:30 pm: **Layer segmentation of GPR images using relaxation labeling for landmine detection**, Matthew A. Laffin, Magdi A. Mohamed, Ali Etebari, NIITEK, Inc. (USA); Mark W. Hibbard, CoVar Applied Technologies, Inc. (USA) . . [8017-52]

Thursday 28 April

SESSION 11

Room: Crystal N. Thurs. 8:30 to 10:10 am

Tracking Rough Ground in Ground-Penetrating Radar Data

Session Chairs: Jeremy Bolton, Univ. of Florida (USA); Peter A. Torrione, Duke Univ. (USA)

- 8:30 am: **The Viterbi algorithm as an approach for incorporating spatial information into air/ground interface inference**, Peter A. Torrione, Leslie M. Collins, Duke Univ. (USA) [8017-53]
- 8:50 am: **DynAlign ground-tracking algorithm**, Brandon Smock, Paul Gader, Joseph N. Wilson, Univ. of Florida (USA) [8017-54]
- 9:10 am: **Support vector data description for detecting the air-ground interface in ground-penetrating radar signals**, Joshua J. Wood, Joseph N. Wilson, Univ. of Florida (USA) [8017-55]
- 9:30 am: **Ground tracking in ground-penetrating radar using Gaussian process and Bayesian inference**, Jeffrey Ho, Jeremy Bolton, Brandon Smock, Univ. of Florida (USA) [8017-56]
- 9:50 am: **Comparison of algorithms for finding the air-ground interface in ground-penetrating radar signals**, Joshua J. Wood, Jeremy Bolton, George Casella, Univ. of Florida (USA); Leslie M. Collins, Duke Univ. (USA); Paul Gader, Taylor C. Glenn, Univ. of Florida (USA); Wen Lee, Richard Mueller, NIITEK, Inc. (USA); Brandon Smock, Univ. of Florida (USA); Peter A. Torrione, Duke Univ. (USA); Joseph N. Wilson, Univ. of Florida (USA) [8017-57]
- Coffee Break 10:10 to 10:40 am

SESSION 12

Room: Crystal N. Thurs. 10:40 am to 12:20 pm

Signal Processing Ground-Penetrating Radar Data I

Session Chairs: Richard C. Weaver, U.S. Army Night Vision & Electronic Sensors Directorate (USA); Paul Gader, Univ. of Florida (USA)

- 10:40 am: **Observations on syntactic landmine detection using impulse ground-penetrating radar**, Ahmed O. Nasif, Kenneth J. Hintz, George Mason Univ. (USA) [8017-58]
- 11:00 am: **Characterization of binary string statistics for syntactic landmine detection**, Ahmed O. Nasif, Brian Mark, Kenneth J. Hintz, George Mason Univ. (USA) [8017-59]
- 11:20 am: **Ground-penetrating radar signal processing for the detection of buried objects**, Mitchell Walters, Ephraim Garcia, Cornell Univ. (USA) . [8017-60]
- 11:40 am: **Adaptive Gaussian mixture models for pre-screening in GPR data**, Peter A. Torrione, Kenneth D. Morton, Jr., New Folder Consulting, LLC (USA); Lance Besaw, Applied Research Associates, Inc. (USA) [8017-61]
- 12:00 pm: **Physics-based features for contextual factors affecting landmine detection with ground-penetrating radar**, Christopher R. Ratto, Kenneth D. Morton, Jr., Leslie M. Collins, Peter A. Torrione, Duke Univ. (USA) [8017-62]
- Lunch/Exhibition Break 12:20 to 1:40 pm

SESSION 13

Room: Crystal N. Thurs. 1:40 to 3:00 pm

Signal Processing Ground-Penetrating Radar Data II

Session Chairs: **Richard L. Weaver**, Univ. of Illinois at Urbana-Champaign (USA); **Paul Gader**, Univ. of Florida (USA)

- 1:40 pm: **Multiple instance learning for landmine detection using ground-penetrating radar data**, Achut Manandhar, Kenneth D. Morton, Jr., Leslie M. Collins, Peter A. Torrione, Duke Univ. (USA) [8017-63]
- 2:00 pm: **Contextual learning in ground-penetrating radar data using Dirichlet process priors**, Christopher R. Ratto, Kenneth D. Morton, Jr., Leslie M. Collins, Peter A. Torrione, Duke Univ. (USA) [8017-64]
- 2:20 pm: **Exploiting spectral content for image segmentation in GPR data**, Patrick Wang, Kenneth D. Morton, Jr., Leslie M. Collins, Peter A. Torrione, Duke Univ. (USA) [8017-65]
- 2:40 pm: **Comparative analysis of clutter suppression techniques for landmine detection using ground-penetrating radar**, Mehmet Sezgin, TÜBITAK Marmara Research Ctr. (Turkey) [8017-64]
- Coffee Break 3:00 to 3:30 pm

SESSION 14

Room: Crystal N. Thurs. 3:30 to 4:50 pm

Infrared

Session Chairs: **Jason J. Lepley**, SELEX Galileo Ltd. (United Kingdom); **James J. Staszewski**, Carnegie Mellon Univ. (USA)

- 3:30 pm: **Detection of buried mines and explosive objects using dual-band thermal imagery**, Jason J. Lepley, Michael T. Averill, SELEX Galileo Ltd. (United Kingdom) [8017-67]
- 3:50 pm: **Investigation of the potential use of hyperspectral imaging for stand-off detection of person-borne IEDs**, Catherine C. Cooksey, David W. Allen, National Institute of Standards and Technology (USA) [8017-69]
- 4:10 pm: **Characterizing optical properties of IED surface signatures**, James J. Staszewski, Carnegie Mellon Univ. (USA); Charles A. Hibbits, Gregory O'Marr, Arnold C. Goldberg, The Johns Hopkins Univ. (USA) [8017-71]
- 4:30 pm: **Automatic detection of targets in medium-wave infrared imagery using adaptive background mixture models**, Christopher J. Spain, James M. Keller, Mihail Popescu, Kevin E. Stone, Univ. of Missouri-Columbia (USA) [8017-72]

Friday 29 April

SESSION 15

Room: Crystal N. Fri. 8:00 to 10:20 am

Signal Processing and Sensor Fusion

Session Chairs: **Pete Howard**, U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Robert H. Luke**, U.S. Army Night Vision & Electronic Sensors Directorate (USA)

- 8:00 am: **Detection of targets in forward-looking infrared imaging using a multiple instance learning framework**, Mihail Popescu, Kevin E. Stone, James M. Keller, Univ. of Missouri-Columbia (USA) [8017-73]
- 8:20 am: **Sensor fusion approaches for EMI and GPR-based subsurface threat identification**, Peter A. Torrione, Kenneth D. Morton, Jr., New Folder Consulting, LLC (USA); Lance Besaw, Applied Research Associates, Inc. (USA) [8017-74]
- 8:40 am: **Vehicle mounted video-based change detection for novel anomaly detection**, Peter A. Torrione, Kenneth D. Morton, Jr., Christopher R. Ratto, Leslie M. Collins, Duke Univ. (USA) [8017-75]
- 9:00 am: **Algorithm fusion in forward-looking longwave infrared imagery for buried explosive hazard detection**, Derek T. Anderson, James M. Keller, Ozy Sjahputera, Univ. of Missouri-Columbia (USA) [8017-76]
- 9:20 am: **Validating spectral-spatial detection based on MMPP formulation**, Anh H. Trang, Sanjeev Agarwal, J. Thomas Broach, Thomas E. Smith, U.S. Army Night Vision & Electronic Sensors Directorate (USA) [8017-77]
- 9:40 am: **Using predictive distributions to estimate uncertainty in classifying landmine targets**, Ryan Close, Ken Watford, Taylor C. Glenn, Paul Gader, Joseph N. Wilson, Univ. of Florida (USA) [8017-78]
- 10:00 am: **Buried explosive hazard detection using forward-looking long-wave infrared imagery**, Kevin E. Stone, James M. Keller, Mihail Popescu, Christopher J. Spain, Univ. of Missouri-Columbia (USA) [8017-79]

Courses of Related Interest

- SC952 **Applications of Detection Theory** (Carrano) Thursday, 8:30 am to 5:30 pm
 - SC1035 **Military Laser Safety** (Marshall) Wednesday, 8:30 am to 5:30 pm
- Visit the registration desk for course descriptions or to register*

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Exhibition Halls, Cypress and Palms Ballroom

Tuesday 26 April 9:30 am to 5:00 pm

Wednesday 27 April 10:00 am to 5:00 pm

Thursday 28 April 10:00 am to 2:00 pm

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

Conference Chairs: **Augustus W. Fountain III**, U.S. Army Edgewood Chemical Biological Ctr. (USA); **Patrick J. Gardner**, The Charles Stark Draper Lab., Inc. (USA)

Program Committee: **Jerome J. Braun**, MIT Lincoln Lab. (USA); **John C. Carrano**, Carrano Consulting (USA); **Christopher C. Carter**, The Johns Hopkins Univ. (USA); **Matthew T. Griffin**, General Dynamics Armament and Technical Products (USA); **Eric J. Houser**, U.S. Dept. of Homeland Security (USA); **Harry Ing**, Bubble Technology Industries, Inc. (Canada); **Harold R. McHugh**, U.S. Dept. of Energy Special Technologies Lab. (USA); **Carter D. Hull**, Y-12 National Security Complex (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 (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) and U.S. Dept. of Homeland Security (USA); **Steven W. Waugh**, Defense Threat Reduction Agency (USA)

Tuesday 26 April

Symposium-Wide Plenary Session

Tuesday • 8:30 to 9:30 am • Location: Crystal H

Dr. Regina E. Dugan

Director, Defense Advanced Research Projects Agency (DARPA)

See page 18 for details • Open to All Attendees

Coffee Break 9:30 to 10:00 am

SESSION 1

Room: Grand 11 Tues. 10:00 am to 12:00 pm

Biological Aerosol Background Characterization

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

10:00 am: **Biological aerosol background characterization**, Janet M. Blatny, Norwegian Defence Research Establishment (Norway); Augustus W. Fountain III, U.S. Army Edgewood Chemical Biological Ctr. (USA) [8018-01]

10:20 am: **Characterization of laser-induced fluorescence from background aerosols in a maritime environment**, Sylvie Buteau, Jean-Robert Simard, Denis Nadeau, Defence Research and Development Canada (Canada) [8018-02]

10:40 am: **Changes in fluorescence spectra of bioaerosols measured in a laboratory reaction chamber to simulate atmospheric transport**, Yongle Pan, Steven C. Hill, Ronald G. Pinnick, U.S. Army Research Lab. (USA); Joshua L. Santarpia, Neal Baker, Shanna Ratnesar-Shumate, Brian Cottrell, Laura McKee, The Johns Hopkins Univ. (USA) [8018-03]

11:00 am: **Ground truth methods for optical cross-section modeling of biological aerosols**, Jeffrey Kalter, Evan P. Thrush, Joshua L. Santarpia, Zahra Chaudhry, Jerome Gilberry, David M. Brown, Andrea M. Brown, Christopher C. Carter, The Johns Hopkins Univ. (USA) [8018-04]

11:20 am: **Optimal classification of standoff bioaerosol measurements using evolutionary algorithms**, Ragnhild Nyhavn, Hans J. F. Moen, Øystein Farsund, Gunnar Rustad, Norwegian Defence Research Establishment (Norway) . [8018-05]

11:40 am: **On the information content of linear and circular depolarization signatures of bioaerosols**, Gilles A. Roy, Defence Research and Development Canada (Canada); Xiaoying Cao, Royal Military College of Canada (Canada); Robert Bernier, Les Instruments Optiques du St-Laurent Inc. (Canada) . [8018-06]

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

SESSION 2

Room: Grand 11 Tues. 1:30 to 3:10 pm

Biological Detection

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

1:30 pm: **Tracking legionella in air generated from a biological treatment plant: a case study of the outbreak of legionellosis in Norway**, Janet M. Blatny, Norwegian Defence Research Establishment (Norway) [8018-07]

1:50 pm: **Characterizing phylogenetic diversity in airborne bacterial populations in China**, Zahra Chaudhry, Joshua L. Santarpia, The Johns Hopkins Univ. Applied Physics Lab. (USA); Jose V. Martins, Univ. of Maryland-Baltimore County (USA) [8018-08]

2:10 pm: **Bacterial identification using kinetics of fluorescence staining**, Vicente Nunez, Srigokul Upadhyayula, Kenny Chau, Adam Y. Lin, Valentine I. Vullev, Univ. of California, Riverside (USA) [8018-09]

2:30 pm: **Selective biomarker detection in saliva and serum using peptide functionalized field-effect transistors**, Joshua A. Hagen, Wanda J. Lyon, Sang Nyon Kim, Yaroslav G. Chushak, Nancy Kelley-Loughnane, Rajesh R. Naik, Morley O. Stone, Air Force Research Lab. (USA) [8018-10]

2:50 pm: **A distributed national network for label-free rapid identification of emerging pathogens**, J. Paul Robinson, Bartek P. Rajwa, Purdue Univ. (USA); M. Murat Dunder, Indiana Univ.-Purdue Univ. Indianapolis (USA); Valery Patsekina, Purdue Univ. (USA); E. Daniel Hirtleman, Univ. of California, Merced (USA); Arun K. Bhunia, Ctr. for Food Safety Engineering (USA); J. Eric Dietz, Purdue Univ. (USA) [8018-11]

Coffee Break 3:10 to 3:40 pm

SESSION 3

Room: Grand 11 Tues. 3:40 to 6:00 pm

Radiological and Nuclear Detection

Session Chair: **Patrick J. Gardner**, Draper Lab. (USA)

3:40 pm: **Gamma/neutron analysis for SNM signatures at high-data rates (greater than 10⁷ cps) for single-pulse active interrogation**, Istvan Dioszegi, Cynthia Salwen, Brookhaven National Lab. (USA); Leon Forman, Ion Focus Technology Inc. (USA) [8018-12]

4:00 pm: **Over-water testing of the neutron imaging camera**, Stanley D. Hunter, NASA Goddard Space Flight Ctr. (USA) [8018-13]

4:20 pm: **Detection of thermal neutrons using gadolinium-oxide-based nanocrystals**, Antonio C. Rivera, Natasha N. Glazener, Nathaniel C. Cook, Brian A. Akins, John B. Plumley, Nathan J. Withers, Eric Sunde, Jose M. Vargas, Gennady A. Smolyakov, Ken Carpenter, Robert D. Busch, Marek Osinski, The Univ. of New Mexico (USA) [8018-14]

4:40 pm: **An air fluorescence imaging system for the detection of radiological contamination**, Vernon Koslowsky, Bubble Technology Industries, Inc. (Canada); Elizabeth L. Inrig, Lorne S. Erhardt, Defence Research and Development Canada (Canada); Bob Andrews, Harry Ing, Michael J. Dick, Patrick Forget, Bubble Technology Industries, Inc. (Canada) [8018-15]

5:00 pm: **Tl-based wide-gap semiconductor materials for x-ray and gamma-ray detection**, Zhifu Liu, John A. Peters, Chunyu Zang, Nam Ki Cho, Bruce W. Wessels, Simon Johnsen, Sebastian Peter, John Androulakis, Mercouri G. Kanatzidis, Jung-Hwan Song, Hosub Jin, Northwestern Univ. (USA) . . . [8018-16]

Wednesday 27 April

SESSION 4

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

Fundamentals Concepts in Chemical Sensing

Session Chair: Paul M. Pellegrino, U.S. Army Research Lab. (USA)

8:00 am: **Visible/near-infrared hyperspectral sensing of solids under controlled environmental conditions**, Bruce E. Bernacki, Norman C. Anheier, Jr., Albert Mendoza, Bradley G. Fritz, Timothy J. Johnson, Pacific Northwest National Lab. (USA) [8018-20]

8:20 am: **Fluorescence lifetime imaging system for the remote sensing of hazardous materials**, Edgar A. Mendoza, Redondo Optics, Inc. (USA) . [8018-21]

8:40 am: **Optical constants of neat liquid-chemical warfare agents and related materials measured by infrared spectroscopic ellipsometry**, Clayton S. Yang, Battelle East Science and Technology Ctr. (USA); Barry R. Williams, Melissa S. Hulet, SAIC (USA); Thomas E. Tivald, J.A. Woollam Co. (USA); Ronald W. Miles, Jr., Alan C. Samuels, U.S. Army Edgewood Chemical Biological Ctr. (USA) [8018-22]

9:00 am: **Active infrared multispectral imaging of chemicals on surfaces**, Anish K. Goyal, Melissa Spencer, Michael W. Kelly, Joseph Costa, Michael DiLiberto, Emily Meyer, Thomas H. Jeys, MIT Lincoln Lab. (USA) [8018-23]

9:20 am: **Polarimetry and infrared spectroscopy in the detection of low-volatility chemical threats**, Michael W. Petryk, Armando J. Marengo, Defence Research and Development Canada (Canada) [8018-24]

9:40 am: **Characterization of next-generation commercial surface-enhanced Raman scattering (SERS) substrates**, Mikella E. Hankus, Paul M. Pellegrino, Dimitra N. Stratis-Cullum, U.S. Army Research Lab. (USA) [8018-25]

Coffee Break 10:00 to 10:30 am

SESSION 5

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

Laser-based Chemical Detection

Session Chair: Cynthia R. Swim, U.S. Army Edgewood Chemical Biological Ctr. (USA)

10:30 am: **A two-pulse, pump probe method for short-range, remote standoff detection of chemical warfare agents**, Scott E. Bisson, Thomas A. Reichardt, Thomas J. Kulp, Sandia National Labs., California (USA) [8018-26]

10:50 am: **Standoff chemical detection using quantum cascade lasers and photoacoustic sensing**, Xing Chen, Univ. of Maryland, Baltimore County (USA); Douglas Janssen, Greater Grace Christian Academy (USA); Fow-Sen Choa, Univ. of Maryland, Baltimore County (USA) [8018-27]

11:10 am: **LIBS spectroscopic classification relative to compressive sensing**, Steven T. Griffin, Eddie Jacobs, Orges Furxhi, The Univ. of Memphis (USA) [8018-28]

11:30 am: **Standoff detection applying laser-induced breakdown spectroscopy at the DLR laser test range**, Jürgen Handke, Frank Duschek, Karin M. Gruenewald, Carsten Pargmann, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany) [8018-29]

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

5:20 pm: **Portable high-speed data acquisition system for x-ray and gamma radiation detection**, Mark Wade, Adam P. Hellmers, Christopher Barber, Heath A. Berry, Radiance Technologies, Inc. (USA) and Louisiana Tech Univ. (USA) [8018-17]

5:40 pm: **Compton imaging with a planar semiconductor system using pulse shape analysis**, Anthony Sweeney, Andrew J. Boston, Helen C. Boston, John P. Cresswell, Jamie Dormand, Univ. of Liverpool (United Kingdom); Mark S. Ellis, Atomic Weapons Establishment (United Kingdom); Laura J. Harkness, Martin Jones, Daniel S. Judson, Paul J. Nolan, David C. Oxley, David P. Scraggs, Mike J. Slee, Univ. of Liverpool (United Kingdom); Amandeep Thandi, Atomic Weapons Establishment (United Kingdom) [8018-18]

POSTERS—Tuesday

Room: Crystal M Tues. 6:00 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. 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 pm 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.

The ChemSight: an open-path, multichemical detector for security applications, Stephen K. Holland, James Madison Univ. (USA); Gabriel Laufer, Univ. of Virginia (USA) [8018-63]

Threat representative droplet generation and surface interaction analysis, Steven M. Simpson, Thomas H. Chyba, Robert M. Jones, Gordon Harper, Diane Haslam, ITT Advanced Engineering & Sciences (USA) [8018-64]

Investigation of standoff explosives detection via photothermal/photoacoustic interferometry, Pak S. Cho, Celight, Inc. (USA); Robert M. Jones, ITT Advanced Engineering & Sciences (USA); Timothy Shuman, Fibertek, Inc. (USA); Daniel J. Scoglietti, ITT Advanced Engineering & Sciences (USA); Geof Harston, Celight, Inc. (USA) [8018-65]

Explosives detection in the marine environment using UUV-modified immunosensor, Paul T. Charles, U.S. Naval Research Lab. (USA); Andre Adams, National Research Council (USA); Jeffrey Deschamps, Anne W. Kusterbeck, U.S. Naval Research Lab. (USA) [8018-66]

Detection of TATP precursor acetone at trace levels using rf sputtered SnO₂ thin film-based sensors, Vinay Gupta, Kondepudy Sreenivas, Anjali Sharma, Arijit Chowdhuri, Univ. of Delhi (India) [8018-67]

Fluorescence/scattering lidar for short-range standoff detection of biological agents, Zygmunt Mierczyk, Krzysztof Kopczyński, Marek Zygmunt, Jarosław Mlynczak, Jacek Wojtanowski, Mirosław Kwasny, Miron Z. Kaliszewski, Andrzej Młodzianko, Maksymilian Włodarski, Andrzej Gietka, Piotr Knysak, Tadeusz Drozd, Michał Muzal, Monika Mularczyk-Oliwa, Aneta Bombalska, Jadwiga Mierczyk, Military Univ. of Technology (Poland) [8018-69]

Gas image enhancement based on morphology and adaptive time-domain filtering, Changxing Zhang, Jiakun Li, Yunting Long, Bei Zhang, Lingxue Wang, Beijing Institute of Technology (China) [8018-70]

Smart radiation monitor for airport baggage screening, Alon Osovizky, Dmitry Ginzburg, Rotem Industries Ltd. (Israel); Eliezer Marcus, Nuclear Research Ctr. Negev (Israel); Baruch Ashkenzi, Rotem Industries Ltd. (Israel); Yaacov Yehuda-Zada, Nuclear Research Ctr. Negev (Israel); Vladislav Bronfenmacher, Rotem Industries Ltd. (Israel); Max Ghelman, Eran Vax, Tzachi Mazor, Yosef Cohen, Nuclear Research Ctr. Negev (Israel) [8018-71]

Rotationally resolved infrared spectra of the explosive bouquet compounds in C-4 explosives, Trocia Clasp, Michael N. Sullivan, Tiffani Johnson, Scott Reeve, Arkansas State Univ. (USA) [8018-73]

SESSION 6

Room: Grand 11..... Wed. 1:20 to 2:40 pm

Novel Devices for Chemical Detection

Session Chair: Steven W. Waugh,
Defense Threat Reduction Agency (USA)

1:20 pm: **Mid-infrared optical fiber Fourier transform infrared spectrometer**, Kenneth J. Ewing, Jasbinder S. Sanghera, Brandon Shaw, Rafael Gattass, Ishwar Aggarwal, U.S. Naval Research Lab. (USA) [8018-30]

1:40 pm: **Hollow-core fiber optics for mid-wave and long-wave infrared spectroscopy**, Jason M. Kriesel, Nahum Gat, Opto Knowledge Systems, Inc. (USA); Bruce E. Bernacki, Rebecca L. Erikson, Bret D. Cannon, Tanya L. Myers, Pacific Northwest National Lab. (USA); Carlos M. Bledt, James A. Harrington, Rutgers, The State Univ. of New Jersey (USA) [8018-31]

2:00 pm: **Design, synthesis, and processing of novel infrared chalcogenide glasses for ultra-sensitive nanocavity photothermal chem-bio detection**, Juejun Hu, Univ. of Delaware (USA); J. David Musgrave, Nathan Carlie, Clemson Univ. (USA); Anuradha M. Agarwal, Massachusetts Institute of Technology (USA); Kathleen Richardson, Clemson Univ. (USA); Lionel C. Kimerling, Massachusetts Institute of Technology (USA) [8018-32]

2:20 pm: **Demonstration of microcantilever-based sensor array with integrated microfluidics**, Gregory P. Nordin, Ryan R. Anderson, Stanley J. Ness, Weisheng Hu, Timothy M. Gustafson, Danny C. Richards, Jong W. Noh, Seunghyun Kim, Brigham Young Univ. (USA) [8018-33]

SESSION 7

Room: Grand 11..... Wed. 2:40 to 4:30 pm

Standoff Chemical Detection Modeling and Algorithms

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

2:40 pm: **Coordinated sensor cueing for chemical plume detection and tracking**, Chad Hawthorne, Adam S. Watkins, Steven J. Marshall, Nathan Abraham, Andrea Jensenius, The Johns Hopkins Univ. Applied Physics Lab. (USA) [8018-34]

3:00 pm: **Enhanced chemical weapon warning via sensor data fusion**, Michael Flaherty, Torch Technologies (USA) [8018-35]

Coffee Break 3:20 to 3:50 pm

3:50 pm: **Sensor fusion for chemical plume detection, classification, and tracking**, Adam S. Watkins, Jeffrey D. Barton, Chad Hawthorne, The Johns Hopkins Univ. Applied Physics Lab. (USA) [8018-36]

4:10 pm: **Modeling of photoacoustic vapor sensors using a multiphysics approach**, Ellen L. Holthoff, Paul M. Pellegrino, U.S. Army Research Lab. (USA) [8018-37]

SESSION 8

Room: Grand 11..... Wed. 4:30 to 6:10 pm

Applications of Standoff Chemical Detection

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

4:30 pm: **Dynamic sensor deployment for the monitoring of chemical releases in urban environments (DYCE)**, Jason J. Lepley, SELEX Galileo Ltd. (United Kingdom) [8018-38]

4:50 pm: **Remote quantification of smokestack total effluent mass flow rates using imaging Fourier-transform spectroscopy**, Jacob L. Harley, Kevin C. Gross, Air Force Institute of Technology (USA) [8018-39]

5:10 pm: **iCATSI: a multi-pixel imaging differential standoff chemical detection sensor**, Louis M. Moreau, Florent Prel, ABB Analytical Measurement (Canada); Hugo Lavoie, Defence Research and Development Canada (Canada); Claude B. Roy, Christian A. Vallieres, ABB Analytical Measurement (Canada); Jean-Marc Theriault, Defence Research and Development Canada (Canada) [8018-40]

5:30 pm: **Chemical agent detection with low-resolution scanning FTIR sensors**, Eric R. Larrieux, Dimitris Manolakis, MIT Lincoln Lab. (USA); Francis M. D'Amico, U.S. Army Edgewood Chemical Biological Ctr. (USA) [8018-41]

5:50 pm: **Characterization of aerosol-containing chemical simulant clouds using a sensitive, thermal infrared imaging spectrometer**, Jeffrey L. Hall, Jun Qian, Mark L. Polak, Clement S. Chang, The Aerospace Corp. (USA); Francis M. D'Amico, U.S. Army Edgewood Chemical Biological Ctr. (USA); Steven J. Kolodzey, U.S. Army Research, Development and Engineering Command (USA) [8018-42]

Thursday 28 April

SESSION 9

Room: Grand 11..... Thurs. 8:00 am to 12:10 pm

Laser and Raman-based Explosives Detection

Session Chair: Aaron LaPointe,
U.S. Army Night Vision & Electronic Sensors Directorate (USA)

8:00 am: **Signal processing for the detection of explosive residues on varying substrates using laser-induced breakdown spectroscopy**, Kenneth D. Morton, Jr., Peter A. Torriano, Leslie M. Collins, Duke Univ. (USA) [8018-43]

8:20 am: **Fabrication and testing of a standoff trace explosives detection system**, Robert D. Waterbury, Jeremy B. Rose, Darius Vunck, Thomas B. Blank, Frank Vilardi, Kenneth R. Pohl, Alan Ford, Troy McVay, Edwin L. Dottery, Alakai Defense Systems, Inc. (USA) [8018-44]

8:40 am: **Multiple-excitation-wavelength resonance-Raman explosives detection**, Balakishore Yellampelle, Mikhail Sluch, West Virginia High Technology Consortium Foundation (USA); Sanford A. Asher, Univ. of Pittsburgh (USA); Brian E. Lemoff, West Virginia High Technology Consortium Foundation (USA) [8018-45]

9:00 am: **Remote detection of explosives using Raman spectroscopy**, Jack E. Fulton, Jr., Naval Surface Warfare Ctr. Crane Div. (USA) [8018-46]

9:20 am: **Deep-UV Raman measurements of energetic materials**, Sanford A. Asher, David Tuschel, Luling Wang, Univ. of Pittsburgh (USA) [8018-47]

9:40 am: **Ultraviolet resonance Raman spectroscopy of nitroaromatic compounds for standoff detection applications**, Erik D. Emmons, Steven D. Christesen, Augustus W. Fountain III, Jason A. Guicheteau, U.S. Army Edgewood Chemical Biological Ctr. (USA) [8018-48]

Coffee Break 10:00 to 10:30 am

- 10:30 am: **Optimal dynamic detection of explosives**, David S. Moore, Los Alamos National Lab. (USA); Herschel A. Rabitz, Princeton Univ. (USA) . [8018-49]
- 10:50 am: **Chemical and explosives point detection through opaque containers using spatially offset Raman spectroscopy (SORS)**, Paul W. Loeffen, Craig Tombling, Matthew Bloomfield, Cobalt Light Systems Ltd. (United Kingdom); Pavel Matousek, Cobalt Light Systems Ltd. (United Kingdom) and Rutherford Appleton Lab. (United Kingdom) [8018-50]
- 11:10 am: **Investigating a drop-on-demand microdispenser for standardized sample preparation**, Ellen L. Holthoff, Mikella E. Hankus, Paul M. Pellegrino, U.S. Army Research Lab. (USA) [8018-51]
- 11:30 am: **A mass spectrometer-based explosives trace detector**, Jack A. Syage, Karl A. Hanold, Andrey Vilkov, Syagen Technology, Inc. (USA) . . [8018-52]
- 11:50 am: **Multi-colorimetric sensor array for detection of explosives in gas and liquid phases**, Natalie Kostesha, Tommy S. Alstrom, Technical Univ. of Denmark (Denmark); Carsten Johnsen, Kent A. Nielsen, Jan O. Jeppesen, Univ. of Southern Denmark (Denmark); Jan Larsen, Anja Boisen, Mogens H. Jakobsen, Technical Univ. of Denmark (Denmark) [8018-53]
- Lunch/Exhibition Break 12:10 to 1:40 pm

SESSION 10

Room: Grand 11 Thurs. 1:40 to 5:10 pm

NIR, IR, and Photothermal Detection of Explosives

Session Chair: Anna Tedeschi, Strategic Analysis, Inc. (USA)

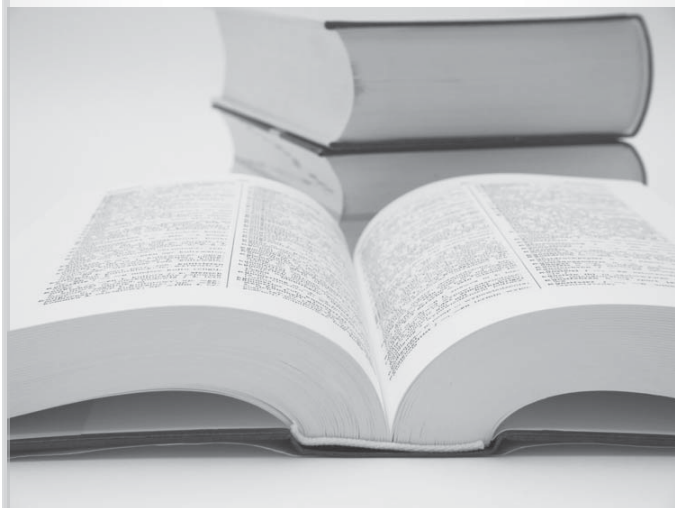
- 1:40 pm: **NIR spectroscopy with multivariate calibration and lock-in amplification to detect chemicals concealed behind fabrics**, Aamer Saleem, Celine Canal, David Hutchins, The Univ. of Warwick (United Kingdom) . . [8018-54]
- 2:00 pm: **Development of standoff detection of trace explosives by infrared photo-thermal imaging**, Christopher A. Kendziora, Robert Furstenberg, Michael R. Papantonakis, Viet Q. Nguyen, U.S. Naval Research Lab. (USA); Jennifer L. Stepnowski, Nova Research, Inc. (USA); R. Andrew McGill, U.S. Naval Research Lab. (USA) [8018-55]
- 2:20 pm: **Enhanced vapor signature of explosive materials using infrared laser excitation**, Michael R. Papantonakis, Robert Furstenberg, Christopher A. Kendziora, R. Andrew McGill, Jakob Grosser, U.S. Naval Research Lab. (USA) [8018-56]
- 2:40 pm: **The limit of detection for explosives in spectroscopic differential reflectometry**, Thierry A. Dubroca, Karthik Vishwanathan, Michael Friedman, Rolf E. Hummel, Univ. of Florida (USA) [8018-57]
- Coffee Break 3:00 to 3:30 pm
- 3:30 pm: **Empirical model for the temporally resolved temperatures of post-detonation fireballs for aluminized high explosives**, Joe M. Gordon, Kevin C. Gross, Glen P. Perram, Air Force Institute of Technology (USA) [8018-58]
- 3:50 pm: **A novel infrared hyperspectral imager for passive standoff detection of explosives and explosive precursors**, Jean-Marc Theriault, Eldon Puckrin, Hugo Lavoie, Francois Bouffard, Defence Research and Development Canada (Canada); Paul Lacasse, AEREX avionique inc. (Canada); Alexandre Vallières, Vincent Farley, Martin Chamberland, Telops (Canada) [8018-59]
- 4:10 pm: **Compact, wide-field DRS explosive detector**, Elizabeth C. Schundler, David L. Carlson, Robert M. Vaillancourt, Julia Rentz Dupuis, Craig R. Schwarze, OPTRA, Inc. (USA) [8018-60]
- 4:30 pm: **Explosive and pharmaceutical mid-and long-wave IR spectra by laser-induced breakdown spectroscopy**, A. Peter Snyder, U.S. Army Edgewood Chemical Biological Ctr. (USA); Clayton S. Yang, Battelle Memorial Institute (USA); Alan C. Samuels, U.S. Army Edgewood Chemical Biological Ctr. (USA); Sudhir B. Trivedi, Brimrose Corp. of America (USA); Ei-Ei Brown, Uwe H. Hommerich, Hampton Univ. (USA) [8018-61]
- 4:50 pm: **Liquid explosive detection in bottle by near infrared**, Hideo Itozaki, Dai Shirofani, Hideo Akaba, Osaka Univ. (Japan); Susumu Morimoto, Kubota Corp. (Japan) [8018-62]

Courses of Related Interest

- SC1034 **Lab-on-a-Chip Technology - Towards Portable Detection Systems** (Gärtner) Friday, 8:30 am to 12:30 pm
- SC719 **Chemical & Biological Detection: Overview of Point and Standoff Sensing Technologies** (Gardner) Monday, 8:30 am to 12:30 pm
- SC952 **Applications of Detection Theory** (Carrano) Thursday, 8:30 am to 5:30 pm
- SC1035 **Military Laser Safety** (Marshall) Wednesday, 8:30 am to 5:30 pm

Visit the registration desk for course descriptions or to register

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

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

Program Committee: **Zoraida P. Aguilar**, Ocean NanoTech (USA); **John G. Blich**, ARACAR: Alliance for Robot Assisted Crisis Assessment and Response (USA); **George Cybenko**, Dartmouth College (USA); **Michael J. DeWeert**, BAE Systems (USA); **Mildred A. Donlon**, Defense Advanced Research Projects Agency (USA); **Susan F. Hallowell**, 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); **Paul F. Morgan**, U.S. Special Operations Command (USA); **Dennis J. Reimer**, National Memorial Institute for the Prevention of Terrorism (USA); **Nino Srour**, U.S. Army Research Lab. (USA)

Monday 25 April

Opening Remarks and Introduction

Room: Crystal P Mon. 11:20 to 11:30 am

Session Chair: **Edward M. Carapezza**, Univ. of Connecticut and DARPA (USA)

SESSION 1

Room: Crystal P Mon. 11:30 am to 12:10 pm

Keynote Session I

Session Chair: **Edward M. Carapezza**, Univ. of Connecticut and DARPA (USA)

11:30 am: **Situational awareness and informed decision-making for law enforcement responders** (Keynote Presentation), G. Chris Tillery, National Institute of Justice (USA) [8019-01]

Lunch Break 12:10 to 1:30 pm

SESSION 2

Room: Crystal P Mon. 1:30 to 2:10 pm

Keynote Session II

Session Chair: **Edward M. Carapezza**, Univ. of Connecticut and DARPA (USA)

1:30 pm: **Cyber security state-of-the-art and challenges and opportunities for the future** (Keynote Presentation), Pradeep K. Khosla, Carnegie Mellon Univ. (USA) [8019-05]

SESSION 3

Room: Crystal P Mon. 2:10 to 6:00 pm

Cyber Security and Visual Analytics

Session Chairs: **Myron E. Hohil**, U.S. Army Armament Research, Development and Engineering Ctr. (USA); **Todd M. Hintz**, Space and Naval Warfare Systems Command (USA)

2:10 pm: **Immune security network model based on multi-agents coevolution**, Jie Su, Harbin Univ. of Science and Technology (China) [8019-06]

2:30 pm: **Visualization techniques for malware behavior analysis**, André R. A. Gregio, Univ. Estadual de Campinas (Brazil); Rafael D. Coelho dos Santos, Instituto Nacional de Pesquisas Espaciais (Brazil) [8019-07]

2:50 pm: **Visual analytics for computer network defense**, Justin M. Beaver, Robert M. Patton, Xiaohui Cui, Chad A. Steed, Oak Ridge National Lab. (USA); Matthew Schultz, Univ. of Maryland, Baltimore County (USA) [8019-08]

3:10 pm: **Comparative evaluation of anomaly detection algorithms for local maritime video surveillance**, Bryan L. Auslander, Kalyan M. Gupta, Knexus Research (USA); David W. Aha, U.S. Naval Research Lab. (USA) [8019-09]

Coffee Break 3:30 to 4:00 pm

4:00 pm: **Image quality assessment using color appearance model**, Mariofanna G. Milanova, Travis A. Bennett, John R. Talburt, Univ. of Arkansas at Little Rock (USA); Brian H. Tsou, Air Force Research Lab. (USA); Sertan Kaya, Hongyan Xu, Univ. of Arkansas at Little Rock (USA) [8019-10]

4:20 pm: **TERRA: efficient video mark-up and analytics**, Scott F. Page, Darren R. Myatt, Waterfall Solutions Ltd. (United Kingdom) [8019-11]

4:40 pm: **Toward intelligent decision support for security staff: evaluation of an interactive resource management system based on a CMDP model**, Jutta Hild, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany); Jonathan Ott, Karlsruhe Institut für Technologie (Germany); Elisabeth Peinsipp-Byma, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany) [8019-12]

5:00 pm: **Entropy based heavy tailed distribution transformation and visual analytics for monitoring massive network traffic**, Keesook J. Han, Air Force Research Lab. (USA); Matthew Hodge, Rochester Institute of Technology (USA); Virginia Ross, Air Force Research Lab. (USA) [8019-13]

5:20 pm: **Increasing the security at vital infrastructures: automated detection of deviant human behavior**, Gertjan Burghouts, Richard den Hollander, Klammer Schutte, Sander Landsmeer, Eric den Breejen, Jan-Willem Marck, TNO Defence, Security and Safety (Netherlands) [8019-14]

5:40 pm: **Joint situation awareness frameworks and informed decision making for federal and civil authorities**, Andrew Lenz, U.S. Army Armament Research, Development and Engineering Ctr. (USA) [8019-15]

Tuesday 26 April

Symposium-Wide Plenary Session

Tuesday • 8:30 to 9:30 am • Location: Crystal H

Dr. Regina E. Dugan

Director, Defense Advanced Research Projects Agency (DARPA)

See page 18 for details • Open to All Attendees

Coffee Break 9:30 to 10:00 am

SESSION 4

Room: Crystal P Tues. 10:00 to 10:40 am

Keynote Session III

Session Chairs: **Daniel Lehrfeld**, Blue Marble Group LLC (USA); **Edward M. Carapezza**, Univ. of Connecticut and DARPA (USA)

10:00 am: **Fast track, fast tech: challenges and opportunities for homeland security** (Keynote Presentation), Susan F. Hallowell, Transportation Security Lab. (USA) [8019-16]

SESSION 5

Room: Crystal P. Tues. 10:40 am to 12:40 pm

Transportation Security Panel

Session Chairs: **Susan F. Hallowell**, Transportation Security Lab. (USA); **Daniel Lehrfeld**, Blue Marble Group LLC (USA)

10:40 am: **Measurement of the reflectivity and absorptivity of liquids, powders, and solids at millimeter wavelengths using dielectric detection by a resonator-post fixture between parallel conducting plates**, James C. Weatherall, SRA International, Inc. (USA); Jeffrey Barber, Battelle (USA); Carolyn S. Brauer, Barry T. Smith, Transportation Security Lab. (USA) [8019-17]

11:00 am: **Development of a contrast phantom for active millimeter-wave imaging systems**, Jeffrey Barber, Battelle Ventures, L.P. (USA); James C. Weatherall, SRA International, Inc. (USA); Carolyn S. Brauer, Barry T. Smith, Transportation Security Lab. (USA) [8019-18]

11:20 am: **Characterization of peroxide-based explosives using Raman spectroscopy**, Carolyn S. Brauer, Transportation Security Lab. (USA); Jeffrey Barber, Battelle (USA); James C. Weatherall, SRA International, Inc. (USA); Barry T. Smith, Transportation Security Lab. (USA) [8019-19]

11:40 am: **Explosive detection technologies for aviation checkpoints**, Ted Grant, Transportation Security Lab. (USA) [8019-20]

12:00 pm: **Optimization of dynamic sampling of trace explosives off of shoes**, Stefan R. Lukow, Transportation Security Lab. (USA); Matthew Staymates, Jessica Grandner, National Institute of Standards and Technology (USA); Inho Cho, Nova Research, Inc. (USA) [8019-21]

12:20 pm: **Opportunities with DHS Science & Technology: Research and Development (R&D) Partnerships Group**, Thomas Cellucci, U.S. Dept. of Homeland Security (USA) [8019-22]

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

SESSION 6

Room: Crystal P. Tues. 1:40 to 3:00 pm

Human/Motion Detection

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

1:40 pm: **Human motion analysis and modeling**, Brian Kocher, J. Michael Cathcart, Alan M. Thomas, Georgia Tech Research Institute (USA) [8019-23]

2:00 pm: **Human motion analysis and characterization**, J. Michael Cathcart, Alan M. Thomas, Brian Kocher, Georgia Tech Research Institute (USA) . [8019-24]

2:20 pm: **Classification of people walking and jogging/running using multimodal sensor signatures**, Thyagaraju Damarla, James M. Sabatier, U.S. Army Research Lab. (USA) [8019-25]

2:40 pm: **Magnetometer-enhanced personal locator for tunnels and GPS-denied outdoor environments**, Surat Kwanmuang, Johann Borenstein, Lauro V. Ojeda, Univ. of Michigan (USA) [8019-26]

Coffee Break 3:00 to 3:30 pm

SESSION 7

Room: Crystal P. Tues. 3:30 to 4:30 pm

Bio-inspired Surveillance and Sensing

Session Chairs: **Myron E. Hohil**, U.S. Army Armament Research, Development and Engineering Ctr. (USA); **Todd M. Hintz**, Space and Naval Warfare Systems Command (USA)

3:30 pm: **Validation of Escherichia coli capture on portable microchips for point-of-care applications**, Utkan Demirci, Harvard Medical School (USA) [8019-27]

3:50 pm: **Monitoring wildlife behavior for the detection of imminent threats**, Charles S. Bendall, Space and Naval Warfare Systems Ctr. Pacific (USA)[8019-28]

4:10 pm: **Bioinspired flow and acoustic sensor**, Junliang Tao, Xiong Yu, Jim Berrilla, Case Western Reserve Univ. (USA) [8019-29]

SESSION 8

Room: Crystal P. Tues. 4:30 to 6:10 pm

Gunshot/Counter Sniper

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

4:30 pm: **Photonics sensor-based rifle mini-fire control system**, Slobodan Rajic, Oak Ridge National Lab. (USA) [8019-30]

4:50 pm: **Classification of acoustic gunshot signatures using a nonparametric Bayesian signal model**, Kenneth D. Morton, Jr., Peter A. Torriane, Leslie M. Collins, New Folder Consulting, LLC (USA) [8019-31]

5:10 pm: **Delay-and-sum beamforming for direction of arrival estimation applied to gunshot acoustics**, Antonio L. L. Ramos, Buskerud Univ. College (Norway) and Univ. of Oslo (Norway); Sverre Holm, Univ. of Oslo (Norway); Sigmund Gudvangen, Buskerud Univ. College (Norway); Ragnvald Otterlei, Posicom AS (Norway) [8019-32]

5:30 pm: **Analysis of multispectral signatures of shot**, Mariusz Kastek, Rafal Dulski, Tadeusz Piatkowski, Henryk Madura, Jaroslaw Barela, Henryk Polakowski, Military Univ. of Technology (Poland) [8019-33]

5:50 pm: **Fast uncooled module 32x32 array of polycrystalline PbSe used for muzzle flash detection**, Mariusz Kastek, Rafal Dulski, Tomasz Sosnowski, Henryk Madura, Grzegorz Bieszcza, Piotr Trzaskawka, Military Univ. of Technology (Poland) [8019-34]

Wednesday 27 April

SESSION 9

Room: Crystal P. Wed. 8:00 to 10:00 am

Surveillance and Border Safety

Session Chairs: **Myron E. Hohil**, U.S. Army Armament Research, Development and Engineering Ctr. (USA); **Todd M. Hintz**, Space and Naval Warfare Systems Command (USA)

8:00 am: **Concept of data processing in multisensor system for perimeter protection**, Rafal Dulski, Mariusz Kastek, Piotr Trzaskawka, Mieczyslaw Szustakowski, Marek Zyczkowski, Military Univ. of Technology (Poland) [8019-35]

8:20 am: **Localisation of threat substances in urban society - LOTUS: a viable tool for finding illegal bomb factories in cities**, Hans G. Önerud, Henric Oestmark, Sara Wallin, Swedish Defence Research Agency (Sweden) . . [8019-36]

8:40 am: **Smart border: ad-hoc wireless sensor networks for border surveillance**, Jun He, Robert A. Norwood, Mahmoud Fallahi, Nasser Peyghambarian, College of Optical Sciences, The Univ. of Arizona (USA)[8019-37]

9:00 am: **Detection of person borne IEDs using multiple cooperative sensors**, Scott MacIntosh, Ling Tang, Reveal Imaging Technologies, Inc. (USA) . . [8019-38]

9:20 am: **Bayesian paradox in homeland security and homeland defense**, Tomasz P. Jansson, Thomas C. Forrester, Wenjian Wang, Physical Optics Corp. (USA) [8019-39]

9:40 am: **Pervasive awareness and guidance for military training**, Hunfuko A. Abeykoon, National Univ. of Singapore (Singapore); Sun Ying, Real Space Pte Ltd. (Singapore); Kasun Karunanayaka, Owen N. Newton Fernando, Adrian D. Cheok, National Univ. of Singapore (Singapore) [8019-40]

Coffee Break 10:00 to 10:30 am

CROSS-CONFERENCE HOT TOPIC PANEL

Room: Crystal M. Wed. 10:30 am to 12:30 pm

Data to Decisions: "Sensors are No Longer King"

Moderator: **John. M. Pellegrino**, Director, U.S. Army Research Lab., (Computational & Information Sciences Directorate (CISD) (USA)

This cross-conference hot topic provides a unique forum for senior leaders from different organizational perspectives to discuss the shifting paradigm of what is needed to achieve the required situational understanding to make the best actionable battlefield decisions. We need to get away from the "autistic" view of sensing and learn to integrate other non-traditional information sources including HUMINT, cultural understanding, social networks, policies and behavior modeling.

Identifying the Technology Needs from a Holistic Perspective
See page 21 for details.

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

Conference 8019

SESSION 10

Room: Crystal P Wed. 1:30 to 2:10 pm

EO, Imaging, and Communications Technologies

Session Chairs: **Myron E. Hohil**, U.S. Army Armament Research, Development and Engineering Ctr. (USA);
Tariq Manzur, Naval Undersea Warfare Ctr. (USA)

1:30 pm: **The all-optical warship: design and integration considerations for a future electro-optical sensor suite**, Krispijn A. Scholte, Koen P. A. Ten Holter, Koninklijke Marine (Netherlands) [8019-02]

1:50 pm: **Nanostructure based EO/IR sensor development for homeland security applications**, Ashok K. Sood, Magnolia Optical Technologies, Inc. (USA); Tariq Manzur, Naval Undersea Warfare Ctr. (USA); A. F. Mehdi Anwar, Univ. of Connecticut (USA); Nibir K. Dhar, Dennis L. Polla, Defense Advanced Research Projects Agency (USA) [8019-03]

PANEL DISCUSSION

Room: Crystal P Wed. 3:00 to 5:00 pm

Less-than-Lethal Technologies to Minimize Civilian Casualties

Panel Moderator: **Col. Tracy J. Tafolla**, Director,
Joint Non-Lethal Weapons Directorate (JNLWD)

Courses of Related Interest

SC952 **Applications of Detection Theory** (Carrano) Thursday, 8:30 am to 5:30 pm

SC1035 **Military Laser Safety** (Marshall) Wednesday, 8:30 am to 5:30 pm

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Conference 8020 • Room: Chicago

Wednesday-Thursday 27-28 April 2011 • Proceedings of SPIE Vol. 8020

Airborne Intelligence, Surveillance, Reconnaissance (ISR) Systems and Applications VIII

Conference Chair: **Daniel J. Henry**, Goodrich ISR Systems (USA)

Conference Co-Chairs: **Beato T. Cheng**, Goodrich ISR (USA); **Dale C. Linne von Berg**, Naval Research Lab. (USA); **Darrell L. Young**, Raytheon Intelligence & Information Systems (USA)

Wednesday 27 April

SESSION 1

Room: ChicagoWed. 8:00 to 10:00 am

ISR Sensors and Systems I

Session Chair: **Daniel J. Henry**, Goodrich ISR Systems (USA)

- 8:00 am: **Miniaturization of a SWIR hyperspectral imager**, Christopher P. Warren, William R. Pfister, Detlev M. Even, Arleen Velasco, Joseph Naungayan, Selwyn M. Yee, David S. Breitwieser, NovaSol (USA) [8020-01]
- 8:20 am: **Small unmanned aerial system high performance payload**, Ricky J. Morgan, Ali A. Abtahi, Usha Raghuram, Frida E. Strömqvist Vetelino, Aerospace Missions Corp. (USA) [8020-02]
- 8:40 am: **Real-world noise in hyperspectral imaging systems**, Richard L. Wiggins, Lovell E. Comstock, Jeffrey J. Santman, Corning NetOptix (USA)[8020-03]
- 9:00 am: **Flight test of an imaging O2(X-b) monocular passive ranging instrument**, Joel R. Anderson, Michael R. Hawks, Kevin C. Gross, Glen P. Perram, Air Force Institute of Technology (USA) [8020-04]
- 9:20 am: **A novel SAL detector giving enhanced spatial and temporal resolution**, Mark S. Robbins, Cliff Weatherup, e2v Technologies plc (United Kingdom) [8020-05]
- 9:40 am: **Orbit efficiency for persistent wide area ground surveillance**, John J. SantaPietro, MITRE Corp. (USA) [8020-06]
- Coffee Break 10:00 to 10:30 am

CROSS-CONFERENCE HOT TOPIC PANEL

Room: Crystal M. Wed. 10:30 am to 12:30 pm

Data to Decisions: "Sensors are No Longer King"

Moderator: **John M. Pellegrino**, Director, U.S. Army Research Lab., (Computational & Information Sciences Directorate (CISD) (USA)

This cross-conference hot topic provides a unique forum for senior leaders from different organizational perspectives to discuss the shifting paradigm of what is needed to achieve the required situational understanding to make the best actionable battlefield decisions. We need to get away from the "autistic" view of sensing and learn to integrate other non-traditional information sources including HUMINT, cultural understanding, social networks, policies and behavior modeling.

Identifying the Technology Needs from a Holistic Perspective

See page 21 for details.

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

SESSION 2

Room: Chicago Wed. 1:30 to 3:10 pm

ISR Sensors and Systems II

Session Chair: **Dale C. Linne von Berg**, U.S. Naval Research Lab. (USA)

- 1:30 pm: **Modular multispectral imaging system for multiple missions and applications**, Jon Schoonmaker, Yuliya Podobna, James Sofianos, Steve Saggese, Cynthia Boucher, Daniel Oakley, Dustin Medeiros, Advanced Coherent Technologies LLC (USA) [8020-07]
- 1:50 pm: **Imaging EO/IR optical system for Long Range Oblique Photography**, Jeong-Yeol Han, Sergey Marchuk, Samsung Thales Co., Ltd. (Korea, Republic of); Hooshik Kim, Vieworks Co., Ltd. (Korea, Republic of); Changwoo Kim, Kwang-Woo Park, Agency for Defense Development (Korea, Republic of) [8020-08]
- 2:10 pm: **Autonomous collection of dynamically cued multisensor imagery**, Scott A. Anderson, Mark D. Jensen, Space Dynamics Lab. (USA); Thomas J. Walls, Dale C. Linne von Berg, Michael L. Wilson, U.S. Naval Research Lab. (USA) [8020-09]
- 2:30 pm: **High-speed laser communications in UAV scenarios**, Wolfgang Griethe, Frank F. Heine, Mark Gregory, Hartmut Kaempfner, Tesat-Spacecom GmbH & Co. KG (Germany) [8020-10]
- 2:50 pm: **On-flight correction algorithm of alignment errors in an optical system**, Satoshi Imaizumi, Mitsubishi Electric Corp. (Japan) [8020-12]
- Coffee Break 3:10 to 3:40 pm

SESSION 3

Room: Chicago Wed. 3:40 to 5:00 pm

ISR Sensors and Systems III

Session Chair: **Dale C. Linne von Berg**, U.S. Naval Research Lab. (USA)

- 3:40 pm: **Optical characterization of artillery blast waves and muzzle flash**, Bryan J. Steward, Kevin C. Gross, Glen P. Perram, Air Force Institute of Technology (USA) [8020-13]
- 4:00 pm: **The building block approach to airborne pod structures**, Jan D. Johansson, Terma A/S (Denmark) [8020-14]
- 4:20 pm: **Search Metric Adaptive Resource Tasking (SMART)**, William J. Rudnisky, Raytheon Space & Airborne Systems (USA) [8020-15]
- 4:40 pm: **Boron carbide and silicon carbide reinforced aluminum composites**, Edgar E. Vidal, Materion Corp. (USA); Andrew D. Tarrant, Aerospace Metal Composites Ltd. (United Kingdom); Ai L. Wood III, Materion Corp. (USA) [8020-16]

Thursday 28 April

SESSION 4

Room: Chicago Thurs. 8:20 to 10:00 am

ISR Detection and Tracking I

Session Chair: **Beato T. Cheng**, Goodrich Corp. (USA)

8:20 am: **Feature-based image registration for multispectral imagery**, Beato T. Cheng, Goodrich Corp. (USA) [8020-17]

8:40 am: **Ocean modeling at multiple resolutions for ISR applications**, J. Michael Cathcart, Brian Kocher, J. Ralph Teague, Sarah E. Lane, Edward Burdette, Georgia Institute of Technology (USA) [8020-18]

9:00 am: **Experimental analysis of adaptive clutter removal techniques in IR target detection systems**, Alessandro Rossi, Nicola Acito, Marco Diani, Giovanni Corsini, Univ. di Pisa (Italy) [8020-19]

9:20 am: **The effect of minimum target size and other factors on the performance envelope of Automated Moving Target Indication Systems for airborne surveillance with EO sensors**, Paul A. Boxer, Tom Loveard, Sentient Vision Systems (Australia) [8020-21]

9:40 am: **Robust vehicle detection in aerial images based on salient region selection and superpixel classification**, Samir Sahli, Pierre-Luc Duval, Yunlong Sheng, Univ. Laval (Canada); Daniel A. Lavigne, Defence Research and Development Canada (Canada) [8020-22]

Coffee Break 10:00 to 10:30 am

SESSION 5

Room: Chicago Thurs. 10:30 am to 12:30 pm

ISR Detection and Tracking II

Session Chair: **Beato T. Cheng**, Goodrich Corp. (USA)

10:30 am: **Robust component-based car detection in aerial images with new segmentation techniques**, Yueh Ouyang, Pierre-Luc Duval, Yunlong Sheng, Univ. Laval (Canada); Daniel A. Lavigne, Defence Research and Development Canada (Canada) [8020-23]

10:50 am: **Layer-based object detection and tracking with graph matching**, Qiang He, Mississippi Valley State Univ. (USA); Aldo Camargo, The Univ. of North Dakota (USA) [8020-25]

11:10 am: **Software-based robust global motion estimation for real-time video target tracking**, Chenhui Yang, Hongwei Mao, Arizona State Univ. (USA); Glen P. Abousleman, General Dynamics C4 Systems, Inc. (USA); Jennie Si, Arizona State Univ. (USA) [8020-26]

11:30 am: **Tracking targets through occlusions in outdoor videos**, Hongwei Mao, Chenhui Yang, Arizona State Univ. (USA); Glen P. Abousleman, General Dynamics C4 Systems, Inc. (USA); Jennie Si, Arizona State Univ. (USA) [8020-27]

11:50 am: **Target location from the estimated instantaneous received frequency**, Douglas J. Nelson, National Security Agency (USA) [8020-28]

12:10 pm: **Vision-based drone flight control and crowd or riot analysis with efficient color histogram-based tracking**, Thomas Müller, Markus Müller, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany) [8020-24]

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

SESSION 6

Room: Chicago Thurs. 1:30 to 3:10 pm

ISR Image Processing and Exploitation I

Session Chair: **Darrell L. Young**, Raytheon Intelligence & Information Systems (USA)

1:30 pm: **Task-based video interpretability as a function of target motion, frame rate, and playback speed**, Darrell L. Young, Raytheon Intelligence & Information Systems (USA) [8020-29]

1:50 pm: **Interactive video compression for remote sensing**, Ray Maleh, Frank A. Boyle, Paul B. Deignan, Jerry W. Yancey, L-3 Communications Integrated Systems (USA) [8020-30]

2:10 pm: **Efficient compression of sequences of multispectral images**, Mariofanna G. Milanova, Univ. of Arkansas at Little Rock (USA); Roumen Kountchev, Technical Univ. of Sofia (Bulgaria); Roumiana Kountcheva, T&K Engineering Co. (Bulgaria) [8020-31]

2:30 pm: **Scene-based blind deconvolution in the presence of anisoplanatism**, David C. Dayton, Applied Technology Associates (USA); John D. Gonglewski, Air Force Research Lab. (USA) [8020-32]

2:50 pm: **Video enhancement effectiveness for target detection**, Michael C. Simon, Amber D. Fischer, Plamen V. Petrov, 21st Century Systems, Inc. (USA) [8020-33]

Coffee Break 3:10 to 3:40 pm

SESSION 7

Room: Chicago Thurs. 3:40 to 4:40 pm

ISR Image Processing and Exploitation II

Session Chair: **Darrell L. Young**, Raytheon Intelligence & Information Systems (USA)

3:40 pm: **Automatic registration and mosaicing algorithm for SAR images**, Manikandan Samykannu, Chhabi Nigam, P. Vardhani, A. Vengadarajan, Defence Research and Development Organisation (India) [8020-34]

4:00 pm: **Automated UAV-based video exploitation using service oriented architecture framework**, Stephen Se, Christian Nadeau, Scott Wood, MacDonald, Dettwiler and Associates Ltd. (Canada) [8020-36]

4:20 pm: **Techniques for inferring terrain parameters related to ground vehicle mobility using UAV born IFSAR and lidar data**, Phillip J. Durst, Gary D. Cantrell, U.S. Army Engineer Research and Development Ctr. (USA) ... [8020-37]

POSTERS—Thursday

Room: Crystal M Thurs. 6:00 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. 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 pm 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.

Mean-shift tracking for surveillance applications using thermal infrared and visible band data fusion, Cigdem Beyan, Middle East Technical Univ. (Turkey) and Baskent Univ. (Turkey); Alptekin Temizel, Middle East Technical Univ. (Turkey) [8020-38]

Multi-field-of-view hyperspectral imager, Lovell E. Comstock, Richard L. Wiggins, Corning NetOptix (USA) [8020-39]

Plenoptic processing methods for distributed camera arrays, Frank A. Boyle, Jerry W. Yancey, Ray Maleh, L-3 Communications Integrated Systems (USA) [8020-40]

Radar Sensor Technology XV

Conference Chairs: **Kenneth I. Ranney**, U.S. Army Research Lab. (USA); **Armin W. Doerry**, Sandia National Labs. (USA)

Program Committee: **Fauzia Ahmad**, Villanova Univ. (USA); **Sean M. Buckley**, Jet Propulsion Lab. (USA); **Joseph C. Deroba**, U.S. Army CERDEC Intelligence and Information Warfare Directorate (USA); **Doreen M. Dyck**, Defence Research and Development Canada (Canada); **Benjamin C. Flores**, The Univ. of Texas at El Paso (USA); **John E. Gray**, Naval Surface Warfare Ctr. Dahlgren Div. (USA); **Majeed M. Hayat**, The Univ. of New Mexico (USA); **Todd A. Kastle**, Air Force Research Lab. (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); **Anthony F. Martone**, U.S. Army Research Lab. (USA); **Atindra K. Mitra**, Air Force Research Lab. (USA); **George J. Moussally**, Mirage Systems (USA); **Lam H. Nguyen**, U.S. Army Research Lab. (USA); **Hector A. Ochoa-Gutierrez**, The Univ. of Texas at Tyler (USA); **Meppalli K. Shandas**, dB Control (USA); **Jerry Silvius**, 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 Tahmouh**, U.S. Army Research Lab. (USA); **Lars M. Wells**, Sandia National Labs. (USA); **Steven J. Weiss**, U.S. Army Research Lab. (USA)

Monday 25 April

Opening Remarks

Room: AtlantaMon. 8:30 to 8:40 am

SESSION 1

Room: AtlantaMon. 8:40 to 10:00 am

Systems and Applications

Session Chair: **James L. Kurtz**, Univ. of Florida (USA)

8:40 am: **Ground penetration radar using free-electron maser**, Alastair D. McAulay, Lehigh Univ. (USA) [8021-01]

9:00 am: **A computer simulation of a long-range CWFM radar showing trade-offs of performance as a function of range**, Robert S. Gordy, Severyn Zoledziowski, Global Technical Systems (USA) [8021-02]

9:20 am: **Augmented reality using ultra-wideband radar imagery**, Lam H. Nguyen, Francois Koenig, Kelly D. Sherbondy, U.S. Army Research Lab. (USA) [8021-03]

9:40 am: **High-coherence track-while-scan low-cost radar for anti-piracy operations**, Volodymyr Gouz, Valeriy Lipatov, Kvant Scientific Research Institute (Ukraine); Vasyl Molebny, National Taras Shevchenko Univ. of Kyiv (Ukraine) [8021-04]

Coffee Break 10:00 to 10:30 am

SESSION 2

Room: Atlanta Mon. 10:30 am to 12:10 pm

Phenomenology I

Session Chairs: **Meppalli K. Shandas**, dB Control (USA); **Gregory J. Mazzaro**, U.S. Army Research Lab. (USA)

10:30 am: **Human polarimetric micro-doppler**, David Tahmouh, U.S. Army Research Lab. (USA) [8021-10]

10:50 am: **A survey of radar applications in medicine**, Atindra K. Mitra, Air Force Research Lab. (USA) [8021-06]

11:10 am: **Polarization dynamics and interference analysis for wideband signals**, Glafkos Stratis, Ghassan C. Maalouli, David G. Manzi, Rafael Ihly, Raytheon Missile Systems (USA) [8021-07]

11:30 am: **Phenomenology of fully polarimetric imaging radars**, Jorge V. Geaga, Consultant (USA) [8021-08]

11:50 am: **Visualizing and displaying radar micro-doppler data**, David Tahmouh, U.S. Army Research Lab. (USA) [8021-11]

Lunch Break 12:10 to 1:10 pm

SESSION 3

Room: Atlanta Mon. 1:10 to 3:10 pm

Phenomenology II

Session Chairs: **Lam H. Nguyen**, U.S. Army Research Lab. (USA); **Joseph C. Deroba**, U.S. Army CERDEC Intelligence and Information Warfare Directorate (USA)

1:10 pm: **A picosecond measuring technique to determine phase instability in a synthetic aperture radar system**, Robert S. Gordy, David Markell, Mark Burns, Andy Anderson, Global Technical Systems (USA) [8021-05]

1:30 pm: **Polarisation transform analysis for detection of shallow buried non-metallic landmines in microwave x-band region**, Kailash C. Tiwari, Military Engineering Services (India) [8021-09]

1:50 pm: **Radar cross section statistics of dismounts at Ku-band**, Ann M. Raynal, Bryan L. Burns, Douglas L. Bickel, Armin W. Doerry, Sandia National Labs. (USA); Tobias J. Verge, Jeremy Stromsoe, Ralf Dunkel, General Atomics Aeronautical Systems, Inc. (USA) [8021-12]

2:10 pm: **Radar cross section statistics of ground vehicles at Ku-band**, Ann M. Raynal, Douglas L. Bickel, Michael M. Denton, Wallace J. Bow, Jr., Armin W. Doerry, Sandia National Labs. (USA); Tobias J. Verge, Jeremy Stromsoe, Ralf Dunkel, General Atomics Aeronautical Systems, Inc. (USA) [8021-13]

2:30 pm: **Human activity classification using Hilbert-Huang transform analysis of radar Doppler data**, Ram M. Narayanan, Dustin P. Fairchild, The Pennsylvania State Univ. (USA) [8021-14]

2:50 pm: **Multifrequency Doppler characteristics of human activities using biomechanical models**, Ram M. Narayanan, Robert M. Sorbello, The Pennsylvania State Univ. (USA) [8021-15]

Coffee Break 3:10 to 3:40 pm

SESSION 4

Room: Atlanta Mon. 3:40 to 5:40 pm

Through the Wall Radar

Session Chair: **Atindra K. Mitra**, Air Force Research Lab. (USA)

3:40 pm: **Comparison of three radars for through-wall sensing**, Junfei Li, Xiaohui Wang, The Univ. of Texas-Pan American (USA); Chiman Kwan, Signal Processing, Inc. (USA) [8021-16]

4:00 pm: **A fast data acquisition and processing scheme for through-the-wall radar imaging**, Francesco Soldovieri, Istituto per il Rilevamento Elettromagnetico dell'Ambiente (Italy); Raffaele Solimene, Seconda Univ. degli Studi di Napoli (Italy); Fauzia Ahmad, Villanova Univ. (USA) [8021-17]

4:20 pm: **Target localization with a single-antenna monostatic radar via multipath exploitation**, Pawan Setlur, Graeme E. Smith, Fauzia Ahmad, Moeness G. Amin, Villanova Univ. (USA) [8021-18]

4:40 pm: **Real-time subsurface imaging algorithm for intra-wall characterization**, Wenji Zhang, Ahmad Hoorfar, Christopher Thajudeen, Villanova Univ. (USA) [8021-19]

5:00 pm: **UWB through complex scattering mechanisms**, Ryan D. White, Blake J. Anderton, Eric Williams, Jonathan Hess, Steve Manson, Glafkos Stratis, Raytheon Missile Systems (USA); Chris Penney, Remcom, Inc. (USA) .. [8021-20]

5:20 pm: **Wave propagation through complex wall structures**, Blake J. Anderton, Ryan D. White, Eric Williams, Jonathan Hess, Steve Manson, Glafkos Stratis, Raytheon Missile Systems (USA) [8021-21]

Tuesday 26 April

Symposium-Wide Plenary Session

Tuesday • 8:30 to 9:30 am • Location: Crystal H

Dr. Regina E. Dugan

Director, Defense Advanced Research Projects Agency (DARPA)

See page 18 for details • Open to All Attendees

Coffee Break 9:30 to 10:00 am

Opening Remarks

Room: Atlanta Tues. 10:00 to 10:10 am

SESSION 5

Room: Atlanta Tues. 10:10 to 11:50 am

Metamaterials for Radar

Session Chair: **Steven J. Weiss**, U.S. Army Research Lab. (USA)

10:10 am: **Novel antennas based upon extraordinary transmission metamaterial lenses**, Mario Sorolla Ayza, Miguel Navarro-Cia, Miguel Beruete, Francisco Falcone, Univ. Pública de Navarra (Spain) [8021-22]

10:30 am: **Transformation optics compressed Rotman lens implemented with complementary metamaterials**, John D. Hunt, Duke Univ. (USA); Nathan Kundtz, Intellectual Ventures (USA); Bruce B. Sun, Duke Univ. (USA); Alper Genc, Anthony F. Starr, SensorMetrix (USA); David R. Smith, Duke Univ. (USA) [8021-23]

10:50 am: **Scalable smart antenna architectures using metamaterials**, Atindra K. Mitra, Colin Hu, Air Force Research Lab. (USA); Connor Johnson, Louisiana Tech Univ. (USA) [8021-24]

11:10 am: **Considerations for dielectric breakdown of metamaterials**, Jeffrey Boksiner, U.S. Army RDECOM CERDEC S&TCD (USA) [8021-25]

11:30 am: **Metamaterial-driven lens optics for new beam forming patterns**, Amir I. Zaghloul, Steven J. Weiss, U.S. Army Research Lab. (USA) [8021-26]

Lunch/Exhibition Break 11:50 am to 1:00 pm

SESSION 6

Room: Atlanta Tues. 1:00 to 3:00 pm

Applications and Techniques I

Session Chairs: **Seong-Hwoon Kim**, Raytheon Space & Airborne Systems (USA); **David Tahmouh**, U.S. Army Research Lab. (USA)

1:00 pm: **Super-resolution technologies for all-weather sense and avoidance (SAA) radar**, Yan Zhang, Hernan A. Montalvo Suarez, Zhengzheng Li, Shang Wang, The Univ. of Oklahoma (USA) [8021-27]

1:20 pm: **Using SAR back-projection for precise interferometric scene height measurement**, Evan C. Zaugg, Matthew C. Edwards, ARTEMIS, Inc. (USA); David G. Long, Brigham Young Univ. (USA) [8021-28]

1:40 pm: **SAR vibrometry using a pseudo-subspace approach based on the discrete fractional Fourier transform**, Qi Wang, Balasubramaniam Santhanam, Matthew P. Pepin, Tom D. Atwood, Majeed M. Hayat, The Univ. of New Mexico (USA) [8021-29]

2:00 pm: **Generation of FM signals with quasi-chirp behavior using three-dimensional chaotic flows**, Chandra S. Pappu, Benjamin C. Flores, Berenice Verdin, The Univ. of Texas at El Paso (USA) [8021-30]

2:20 pm: **PADF RF localization criteria for multimodel scattering environments**, Miguel Gates, Christopher Barber, Louisiana Tech Univ. (USA); Huthaifa Alissa, Univ. of Dayton (USA); Atindra K. Mitra, Air Force Research Lab. (USA); Raul Ordonez, Univ. of Dayton (USA); Rastko R. Selmic, Louisiana Tech Univ. (USA) [8021-31]

2:40 pm: **A method for selecting radar waveforms based upon post-selection criteria**, John E. Gray, Allen D. Parks, Naval Surface Warfare Ctr. Dahlgren Div. (USA) [8021-32]

Coffee Break 3:00 to 3:30 pm

SESSION 7

Room: Atlanta Tues. 3:30 to 5:10 pm

Applications and Techniques II

Session Chairs: **John E. Gray**, Naval Surface Warfare Ctr. Dahlgren Div. (USA); **Fauzia Ahmad**, Villanova Univ. (USA)

3:30 pm: **Clutter locus equation for more general array orientation**, Douglas L. Bickel, Sandia National Labs. (USA) [8021-33]

3:50 pm: **Multisignal radar techniques using smartphone technologies**, Atindra K. Mitra, Air Force Research Lab. (USA); Colin Hu, The Ohio State Univ. (USA); Kasandra Maxwell, Univ. of Dayton (USA) [8021-34]

4:10 pm: **Determination of instantaneous frequency using MCMC bayesian model selection**, Asif Mehmood, U.S. Army Research Lab. (USA); Paul M. Goggans, The Univ. of Mississippi (USA); James M. Sabatier, U.S. Army Research Lab. (USA) [8021-35]

4:30 pm: **Quick signal detection and dynamic resource allocation scheme for ultra-wideband radar**, Xiangming Kong, Mohin Ahmed, HRL Labs., LLC (USA) [8021-36]

4:50 pm: **Adaptive detection of range-spread targets by the generalized detector**, Vyacheslav P. Tuzlukov, Kyungpook National Univ. (Korea, Republic of) [8021-38]

POSTERS—Tuesday

Room: Crystal M Tues. 6:00 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. 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 pm 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.

ECCM performance analysis of chaotic coded orthogonal frequency division multiplexing (COFDM) SAR, Xiangzhi Feng, Xiaojian Xu, BeiHang Univ. (China) [8021-58]

Noise radar with broadband microwave ring correlator, Waldemar Susek, Bronislaw Stec, Military Univ. of Technology (Poland) [8021-59]

Interference suppression in noise radar systems, Slobodan Djukanovic, Univ. of Montenegro (Montenegro); Thayananthan Thayaparan, Defence Research and Development Canada (Canada); Miloš Dakovic, Ljubiša Stankovic, Univ. of Montenegro (Montenegro) [8021-60]

Detection and identification of concealed weapons using matrix pencil, Raviraj S. Adve, Univ. of Toronto (Canada); Thayananthan Thayaparan, Defence Research and Development Canada (Canada) [8021-61]

Through-the-wall detection of human activity, Tommy Johansson, Jonas Rahm, Jan Gustavsson, Stefan L. Nilsson, Ain Sume, Anders Orborn, Swedish Defence Research Agency (Sweden) [8021-62]

Some comments on GMTI false alarm rate, Armin W. Doerry, Sandia National Labs. (USA) [8021-63]

Optimal antenna beamwidth for stripmap SAR, Armin W. Doerry, Sandia National Labs. (USA) [8021-64]

Synthetic aperture radar for disaster monitoring, Ralf Dunkel, Randy Saddler, General Atomics Aeronautical Systems, Inc. (USA); Armin W. Doerry, Sandia National Labs. (USA) [8021-65]

Design and implementation of a digital impulse generator for a 24GHz UWB radar, Sang-Dong Kim, Jonghun Lee, Daegu Gyeongbuk Institute of Science & Technology (Korea, Republic of) [8021-66]

Dc-offset effect cancelation method using mean-padding FFT for automotive UWB radar sensor, Yeonghwan Ju, Sang-Dong Kim, Jonghun Lee, Daegu Gyeongbuk Institute of Science & Technology (Korea, Republic of) [8021-67]

Integrated radar-camera security system: experimental results, Marek Zyczkowski, Norbert Palka, Tomasz Trzcinski, Rafal Dulski, Mariusz Kastek, Piotr Trzaskawka, Military Univ. of Technology (Poland) [8021-68]

Resolution analysis of bistatic SAR image, Zhijun Qiao, Guillermo Garza, Jaime Lopez, The Univ. of Texas-Pan American (USA) [8021-69]

Side-looking image formation with a maneuvering vehicle-mounted antenna array, Kenneth I. Ranney, Lam H. Nguyen, Chi Tran, Roberto Innocenti, U.S. Army Research Lab. (USA) [8021-70]

Wideband fiber optic vector modulator using 8-tap all-optical Hilbert transform, Ryand Tucker, Sergio C. Granieri, Azad Siahmakoun, Rose-Hulman Institute of Technology (USA) [8021-71]

Far-field scattering of random electromagnetic fields from particulate media, Zhisong Tong, Olga Korotkova, Univ. of Miami (USA) [8021-73]

Stereo matching: performance study of two global algorithms, Sarala Arunagiri, Victor J. Jordan, Patricia Teller, The Univ. of Texas at El Paso (USA); Joseph C. Deroba, U.S. Army CERDEC Intelligence and Information Warfare Directorate (USA); Dale R. Shires, Song J. Park, Lam Nguyen, U.S. Army Research Lab. (USA) [8021-74]

On the use of the Shark antenna for radar detection techniques, Laurent Desrumaux, L'IUT du Limousin (France); Valérie Bertrand-Vincent, CISTEME (France); Joël Andrieu, Michèle Lalande, L'IUT du Limousin (France); Bernard Jecko, XLIM Institut de Recherche (France) [8021-75]

Attenuation of front-end reflections in an impulse radar using high-speed switching, Gregory J. Mazzaro, Marc A. Ressler, Gregory D. Smith, U.S. Army Research Lab. (USA) [8021-76]

Scannerless gain-modulated three-dimensional laser imaging radar, Chenfei Jin, Yuan Zhao, Xiudong Sun, Long Wu, Yu Zhang, Harbin Institute of Technology (China) [8021-77]

Exploiting spatial diversity in MIMO radars with collocated antennas, Ghassan C. Maalouli, Daniel Rosser, Glafkos Stratis, Raytheon Missile Systems (USA) [8021-78]

Wednesday 27 April

Opening Remarks

Room: Atlanta Wed. 8:30 to 8:40 am

SESSION 8

Room: Atlanta Wed. 8:40 to 10:20 am

Signal Processing in Noise Radar

Session Chair: Ram M. Narayanan, The Pennsylvania State Univ. (USA)

8:20 am: **Radar signature acquisition using indigenously designed noise radar system**, Al Freundorfer, Queen's Univ. (Canada); Jawad Siddiqui, Yahia Antar, Royal Military College of Canada (Canada); Thayananthan Thayaparan, Defence Research and Development Canada (Canada) [8021-39]

8:40 am: **High-resolution noise radar using slow ADC**, Konstantin A. Lukin, Pavlo L. Vyplavin, Oleg V. Zemlyanyi, Usikov Institute of Radiophysics and Electronics (Ukraine) [8021-40]

9:00 am: **Direct digitization of ultra-wideband (UWB) noise signals using frequency band folding**, Russell Vela, The Pennsylvania State Univ. (USA); Gordon Woodington, Mark R. Deluca, Raytheon Co. (USA); Ram M. Narayanan, The Pennsylvania State Univ. (USA) [8021-41]

9:20 am: **Cross-correlation analysis of noise radar signals propagating through lossy dispersive media**, Ram M. Narayanan, Sonny Smith, The Pennsylvania State Univ. (USA) [8021-42]

9:40 am: **Super-resolution techniques for velocity estimation using UWB random noise radar signals**, Muhammad Dawood, Nafish Quraishi, New Mexico State Univ. (USA) [8021-43]

Coffee Break 10:20 to 10:50 am

SESSION 9

Room: Atlanta Wed. 10:50 to 11:50 pm

Adaptive Generation of Noise and Noise-Like Waveforms

Session Chair: Thayananthan Thayaparan, Defence Research and Development Canada (Canada)

10:50 am: **A technique for the generation of customizable ultra-wideband pseudo-noise waveforms**, Russell Vela, The Pennsylvania State Univ. (USA); David Erisman, X-COM Systems (USA); Ram M. Narayanan, The Pennsylvania State Univ. (USA) [8021-45]

11:10 am: **Brillouin precursor waveforms pertaining to UWB noise radar signals propagating through dispersive media**, Muhammad Dawood, New Mexico State Univ. (USA); Anna V. Alejos, Univ. de Vigo (Spain) and New Mexico State Univ. (USA) [8021-46]

11:30 am: **A technique for the extraction of ultra-wideband (UWB) signals concealed in frequency band folded responses**, Russell Vela, Ram M. Narayanan, The Pennsylvania State Univ. (USA); David Erisman, X-COM Systems (USA) [8021-48]

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

SESSION 10

Room: Atlanta Wed. 1:40 to 3:20 pm

Imaging and Detection Using Noise Radar

Session Chair: Mark Govoni, U.S. Army Research, Development and Engineering Command (USA)

1:40 pm: **SAR imagery using chaotic carrier frequency agility pulses**, Xiaojian Xu, Xiangzhi Feng, BeiHang Univ. (China) [8021-49]

2:00 pm: **The constructive role of noise in tracing of targets behind wall using SAR**, Robert Kozma, The Univ. of Memphis (USA); Robert Linnehan, Air Force Research Lab. (USA) [8021-50]

2:20 pm: **Target discrimination technique utilizing noise waveforms**, Mark R. DeLuca, Raytheon Co. (USA) [8021-51]

2:40 pm: **Design and implementation of random noise radar with spectral-domain correlation for moving target detection**, Jeong-Phill Kim, Chi-Hyeon Jeong, Ahn-Jian Bian, Cheol-Who Kim, Chung-Ang Univ. (Korea, Republic of) [8021-52]

3:00 pm: **Passive radar imaging of moving targets using distributed apertures**, Ling Wang, Nanjing Univ. of Aeronautics and Astronautics (China); Birsen Yazici, Rensselaer Polytechnic Institute (USA) [8021-53]

Coffee Break 3:20 to 3:50 pm

SESSION 11

Room: Atlanta Wed. 3:50 to 5:10 pm

Chaotic and Noise-Like Radar Systems

Session Chair: Russell Vela, The Pennsylvania State Univ. (USA)

3:50 pm: **Microwave chaotic oscillator: a device based on three-wave interactions of spin waves in magnetic thin films**, Mingzhong Wu, Aaron Hagerstrom, Richard Eykholt, Boris Kalinikos, Colorado State Univ. (USA) [8021-54]

4:10 pm: **Concept for low-cost chaos radar using coherent reception**, 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, U.S. Army Research, Development and Engineering Command (USA) [8021-55]

4:30 pm: **Nonlinear dynamics method for target identification**, Thomas L. Carroll, Frederic J. Rachford, U.S. Naval Research Lab. (USA) [8021-56]

4:50 pm: **Quantum radar versus noise radar**, Konstantin A. Lukin, Usikov Institute of Radiophysics and Electronics (Ukraine) [8021-57]

Course of Related Interest

SC1031 **Radar Micro-Doppler Signatures - Principles and Applications** (Chen, Tahmouh) Monday, 1:30 to 5:30 pm

Visit the registration desk for course descriptions or to register

Passive Millimeter-Wave Imaging Technology XIV

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**, Consultant (United Kingdom); **Erich N. Grossman**, National Institute of Standards and Technology (USA); **Christopher A. Martin**, Trex Enterprises Corp. (USA)

Thursday 28 April

SESSION 1

Room: Atlanta Thurs. 8:00 to 11:50 am

Imaging Systems

Session Chair: **David A. Wikner**, U.S. Army Research Lab. (USA)

8:00 am: **Millimeter-wave interferometric radiometry for the detection and geolocation of low-power signals**, David Dowgiallo, Elizabeth Twarog, Wendy Peters, Steve Rauen, Joseph Helmboldt, Peter Gaiser, U.S. Naval Research Lab. (USA) [8022-01]

8:20 am: **Progress toward a video-rate, passive millimeter-wave imager for brownout mitigation**, Christopher A. Schuetz, Richard D. Martin, Thomas E. Dillon III, Daniel Mackrides, Peng Yao, Phase Sensitive Innovations, Inc. (USA); Dennis W. Prather, Univ. of Delaware (USA) [8022-02]

8:40 am: **Towards high-sensitivity and high-resolution submillimeter-wave video imaging**, Erik Heinz, Torsten May, Detlef Born, Gabriel Zieger, Solveig Anders, Viatcheslav Zakosarenko, Institut für Photonische Technologien e.V. (Germany); Marco Schubert, Supracon AG (Germany); Torsten Krause, André Krüger, Hans-Georg Meyer, Institut für Photonische Technologien e.V. (Germany) [8022-03]

9:00 am: **Improved reconstruction and sensing techniques for personnel screening in three-dimensional cylindrical millimeter-wave portal scanning**, Justin L. Fernandes, Pacific Northwest National Lab. (USA); Carey M. Rappaport, Northeastern Univ. (USA); David M. Sheen, Pacific Northwest National Lab. (USA) [8022-04]

9:20 am: **High-resolution passive video-rate imaging at 350 GHz**, Dan T. Becker, James A. Beall, Hsiao-Mei Cho, William D. Duncan, National Institute of Standards and Technology (USA); Cale M. Gentry, The Univ. of Oklahoma (USA); Gene C. Hilton, Kent D. Irwin, Peter Lowell, Michael D. Niemack, Carl D. Reintsema, Frank Schima, Robert E. Schwall, Ki Won Yoon, National Institute of Standards and Technology (USA); Peter A. Ade, Carole E. Tucker, Cardiff Univ. (United Kingdom) [8022-05]

9:40 am: **Design and performance of a passive video-rate THz system demonstrator**, Arttu R. Luukanen, Mika Aikio, Markus Grönholm, Mikko M. Leivo, Aki Mäyrä, Anssi Rautiainen, Hans Toivanen, VTT Technical Research Ctr. of Finland (Finland) [8022-06]

Coffee Break 10:00 to 10:30 am

10:30 am: **A new approach for fast security scanning with millimetre-waves: SARGATE**, Stefan A. Lang, Manfred Högelen, Sebastian Hantscher, Fraunhofer FHR (Germany) [8022-07]

10:50 am: **Multisensor millimeter-wave system for hidden objects detection by non-collaborative screening**, Rhalem Zouaoui, Thierry Lamarque, Czarny Romain, Thales Research & Technology (France); Claude Checkroun, SART (France); Antoine Khy, Telecom ParisTech (France) [8022-08]

11:10 am: **300 GHz imaging with 8 meter stands-off distance and one-dimensional synthetic image reconstruction**, Andreas Keil, Torsten Loeffler, Holger Quast, SynView GmbH (Germany); Viktor Krozer, Johann Wolfgang Goethe-Univ. Frankfurt am Main (Germany); Jørgen Dall, Anders Kusk, Vitaliy Zhurbenko, Technical Univ. of Denmark (Denmark); Peter J. I. de Maagt, European Space Research and Technology Ctr. (Netherlands) [8022-09]

11:30 am: **3D rendering of passive millimeter-wave scenes using modified open source software**, Maciej Murakowski, John P. Wilson, Janusz Murakowski, Garrett Schneider, Univ. of Delaware (USA); Christopher A. Schuetz, Phase Sensitive Innovations, Inc. (USA); Dennis W. Prather, Univ. of Delaware (USA) [8022-10]

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

SESSION 2

Room: Atlanta Thurs. 1:20 to 3:00 pm

Phenomenology

Session Chair: **Arttu R. Luukanen**,

VTT Technical Research Ctr. of Finland (Finland)

1:20 pm: **Phenomenology studies using a scanning fully polarimetric passive W-band millimeter-wave imager**, Bruce E. Bernacki, James F. Kelly, David M. Sheen, Douglas L. McMakin, Jonathan R. Tedeschi, Thomas E. Hall, Brian K. Hatchell, Patrick L. J. Valdez, Pacific Northwest National Lab. (USA) ... [8022-11]

1:40 pm: **Impact of polarization and frequency diversity on a terahertz radar's imaging performance**, Ken B. Cooper, Jet Propulsion Lab. (USA); Nuria Lombart, Univ. Complutense de Madrid (Spain); Robert J. Dengler, Bertrand C. Thomas, Peter H. Siegel, Jet Propulsion Lab. (USA) [8022-12]

2:00 pm: **Validation of a small-sample, bi-directional scattering measurement system from 200-500 GHz**, David R. Novotny, Josh Gordon, Edwin J. Heilweil, Erich N. Grossman, Randy Direen, National Institute of Standards and Technology (USA); Brian Stillwell, Univ. of Colorado at Boulder (USA) [8022-13]

2:20 pm: **Pulsed terahertz bi-directional reflection distribution function (BRDF) measurements of materials and obscurants**, Edwin J. Heilweil, Alena Lo, David R. Novotny, Erich N. Grossman, National Institute of Standards and Technology (USA) [8022-14]

2:40 pm: **Calibration, reconstruction, and rendering of cylindrical millimeter-wave image data**, David M. Sheen, Thomas E. Hall, Pacific Northwest National Lab. (USA) [8022-15]

Coffee Break 3:00 to 3:30 pm

SESSION 3

Room: Atlanta Thurs. 3:30 to 6:10 pm

Devices and Intelligent Sensing

Session Chair: **David A. Wikner**, U.S. Army Research Lab. (USA)

3:30 pm: **Compressive sampling in passive millimeter-wave imaging**, Nachappa Gopalsami, Thomas W. Elmer, Shaolin Liao, Ryan R. Ahern, Alexander Heifetz, Apostolos C. Raptis, Argonne National Lab. (USA); Martin Luessi, Derin Babacan, Aggelos Katsaggelos, Northwestern Univ. (USA) [8022-16]

3:50 pm: **Two-dimensional, real-time, sub-millimeter-wave imaging using a spatially selective mask**, Orges Furxhi, Eddie Jacobs, The Univ. of Memphis (USA) [8022-17]

4:10 pm: **Compressive sensing for a sub-millimeter-wave single pixel imager**, Imama Noor, Orges Furxhi, Eddie Jacobs, The Univ. of Memphis (USA). [8022-18]

4:30 pm: **A multicamera positioning system for steering of a THz stand-off scanner**, Maria Axelsson, Mikael Karlsson, Staffan Rudner, Swedish Defence Research Agency (Sweden) [8022-19]

4:50 pm: **Rapid holographic beamsteering reflectarrays for millimeter-wave and sub-millimeter-wave imaging radars**, Arttu R. Luukanen, VTT Technical Research Ctr. of Finland (Finland); Juha Ala-Laurinaho, Aalto Univ. School of Science and Technology (Finland); David Gomes-Martins, Janne Häkili, Päivi Koivisto, Pekka Pursula, Jussi Säily, VTT Technical Research Ctr. of Finland (Finland); Alekski A. Tamminen, Aalto Univ. School of Science and Technology (Finland); Reijo Tuovinen, Markku Sipilä, VTT Technical Research Ctr. of Finland (Finland) [8022-20]

5:10 pm: **A 220 GHz reflection-type phased array concept study**, Abigail Hedden, Charles R. Dietlein, Tony Ivanov, David A. Wikner, U.S. Army Research Lab. (USA) [8022-21]

5:30 pm: **W-band direct detection radiometers using metamorphic HEMT technology**, Ingmar Kallfass, Axel Huelsmann, Axel Tessmann, Arnulf Leuther, Ernst Weissbrodt, Michael Schlechtweg, Oliver Ambacher, Fraunhofer-Institut für Angewandte Festkörperphysik (Germany) [8022-22]

5:50 pm: **New semiconductor and packaging technologies for small receivers for W-band imaging**, John W. McNicol, Paul Rice, MMIC Solutions Ltd. (United Kingdom) [8022-23]

POSTERS—Thursday

Room: Crystal M Thurs. 6:00 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. 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 pm 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.

The ethics of body scanners: requirements and future challenges from an ethical point of view, Benjamin Rampp, Anja Königseder, Heidi Schäfer, Regina Ammicht-Quinn, Eberhard Karls Univ. Tübingen (Germany). [8022-24]

Investigation of fully-polarimetric signatures from targets with some relevance to security applications, Markus Peichl, Stephan Dill, Daniel Rudolf, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany) [8022-26]

Walk the Exhibition Floor and see the free 500-company exhibition – showcasing the newest products, latest innovations, and cutting-edge technologies in defense, security, sensing, homeland security, robotic, and environmental technologies

Exhibition Halls, Cypress and Palms Ballroom

Tuesday 26 April 9:30 am to 5:00 pm

Wednesday 27 April 10:00 am to 5:00 pm

Thursday 28 April 10:00 am to 2:00 pm

Terahertz Physics, Devices, and Systems V: Advance Applications in Industry and Defense

Conference Chairs: **A. F. Mehdi Anwar**, Univ. of Connecticut (USA); **Nibir K. Dhar**, U.S. Army Research Lab. (USA); **Thomas W. Crowe**, Virginia Diodes, Inc. (USA)

Program Committee: **Alexander Giles Davies**, Univ. of Leeds (United Kingdom); **Gottfried H. Döhler**, Friedrich-Alexander-Univ. Erlangen-Nürnberg (Germany); **Achyut K. Dutta**, Banpil Photonics, Inc. (USA); **M. Saif Islam**, Univ. of California, Davis (USA); **Hiroshi Ito**, NTT Photonics Labs. (Japan); **Peter Uhd Jepsen**, Technical Univ. of Denmark (Denmark); **James Kolodzey**, Univ. of Delaware (USA); **Edmund H. Linfield**, Univ. of Leeds (United Kingdom); **A. Hamed Majedi**, Univ. of Waterloo (Canada); **Tariq Manzur**, Naval Undersea Warfare Ctr. (USA); **Taiichi Otsuji**, Tohoku Univ. (Japan); **B. M. Azizur Rahman**, The City Univ. (United Kingdom); **Victor Ryzhii**, Univ. of Aizu (Japan); **Richard A. Soref**, Air Force Research Lab. (USA); **Simon Verghese**, MIT Lincoln Lab. (USA); **Richard T. Webster**, Air Force Research Lab. (USA); **K. Sigfrid Yngvesson**, Univ. of Massachusetts Amherst (USA); **Weili Zhang**, Oklahoma State Univ. (USA)

Monday 25 April

SESSION 1

Room: Chicago Mon. 10:30 to 11:50 am

Keynote Session

Session Chairs: **Tariq Manzur**, Naval Undersea Warfare Ctr. (USA); **Nibir K. Dhar**, Defense Advanced Research Projects Agency (USA)

10:30 am: **Toward realizing high-power semiconductor terahertz laser sources at room temperature** (*Keynote Presentation*), Manijeh Razeghi, Northwestern Univ. (USA) [8023-01]

11:20 am: **Large area THz emitters** (*Invited Paper*), Gottfried H. Döhler, Max Planck Institute for the Science of Light (Germany) and Friedrich-Alexander-Univ. Erlangen-Nürnberg (Germany); Sascha Preu, Univ. of California, Santa Barbara (USA); Stefan Malzer, Max Planck Institute for the Science of Light (Germany); Luis E. García Muñoz, Belen Andres Garcia, Univ. Carlos III de Madrid (Spain) [8023-02]

Lunch Break 11:50 am to 1:30 pm

SESSION 2

Room: Chicago Mon. 1:30 to 3:10 pm

Advance Concepts in THz Technology

Session Chairs: **Gottfried H. Döhler**, Friedrich-Alexander-Univ. Erlangen-Nürnberg (Germany); **A. F. Mehdi Anwar**, Univ. of Connecticut (USA)

1:30 pm: **Terahertz light amplification by stimulated emission of radiation from optically pumped graphene** (*Invited Paper*), Taiichi Otsuji, Stephane Albon Boubanga Tombet, Akira Satou, Tohoku Univ. (Japan); Victor Ryzhii, Univ. of Aizu (Japan) [8023-03]

1:55 pm: **Modeling electron transport coherence in one- and two-well terahertz step well quantum cascade structures with diagonal optical transitions**, Will Freeman, Naval Air Warfare Ctr. Weapons Div. (USA) . . . [8023-04]

2:10 pm: **Combining backwards wave oscillator and solid state frequency multipliers to extend spectral coverage of electronic sources to 2.2 THz**, Walter C. Hurlbut, Vladimir G. Kozlov, Microtech Instruments, Inc. (USA) [8023-05]

2:25 pm: **Terahertz detection by field effect transistors (FETs) for THz imaging**, Wojciech M. Knap, Univ. Montpellier 2 (France) [8023-06]

2:40 pm: **The effects of individual subband electron temperatures in terahertz quantum cascade laser predictions**, Philip Slingerland, Christopher S. Baird, Robert H. Giles, Univ. of Massachusetts Lowell (USA) [8023-07]

2:55 pm: **Active layer design of GaN-based quantum cascade lasers**, Hung Chi Chou, A. F. Mehdi Anwar, Univ. of Connecticut (USA); Tariq Manzur, Naval Undersea Warfare Ctr. (USA) [8023-08]

Coffee Break 3:10 to 3:40 pm

SESSION 3

Room: Chicago Mon. 3:40 to 6:30 pm

THz Imaging

Session Chairs: **Taiichi Otsuji**, Tohoku Univ. (Japan); **Gottfried H. Döhler**, Friedrich-Alexander-Univ. Erlangen-Nürnberg (Germany)

3:40 pm: **A real-time terahertz imaging system consisting of terahertz quantum cascade laser and uncooled microbolometer array detector** (*Invited Paper*), Iwao Hosako, Norihiko Sekine, National Institute of Information and Communications Technology (Japan); Naoki Oda, Masahiko Sano, Seiji Kurashina, Masaru Miyoshi, Ken'ichi Sonoda, Hajime Yoneyama, Tokuhito Sasaki, NEC Guidance and Electro-Optics Division (Japan) [8023-09]

4:10 pm: **Defect engineering of photovoltaic substrates using THz imaging**, Raimund Leitner, Thomas Arnold, Martin De Biasio, Carinthian Tech Research AG (Austria) [8023-10]

4:30 pm: **Video-rate uncooled microbolometer-based THz imaging camera**, Martin Bolduc, Linda Marchese, Marc Terroux, Bruno Tremblay, Hassane Oulachgar, Michel Doucet, Loïc Le Noc, Christine Alain, Hubert Jerominek, Alain Bergeron, INO (Canada) [8023-11]

4:50 pm: **Concealed object detection with multichannel passive millimeter-wave imaging and multivariate Gaussian mixture modeling**, Dong-Su Lee, Seokwon Yeom, Jung-Young Son, Daegu Univ. (Korea, Republic of) . . . [8023-12]

5:10 pm: **Active THz imaging and explosive detection with uncooled antenna-coupled microbolometer arrays**, François Simoens, Jérôme Meilhan, Stéphane Pocas, Valérie Goudon, Gilles Lasfargues, Jérémy Lalanne-Dera, Fabrice Guellac, Bertrand Dupont, Thierry Maillou, Commissariat à l'Énergie Atomique (France); Olivier Cathabard, Stefano Barbieri, Univ. Paris 7-Denis Diderot (France) [8023-13]

5:30 pm: **Development of an 80 x 64 pixel, broadband, real-time THz imager.**, Don J. Burdette, Traycer Diagnostic Systems, Inc. (USA); Jorgen Alverbro, IRnova AB (Sweden); Patrick J. Fay, Univ. of Notre Dame (USA); Kubilay Sertel, Kagan Topalli, Gerogios Trichopoulos, John Volakis, The Ohio State Univ. (USA); Howard L. Mosbacker, Traycer Diagnostic Systems, Inc. (USA) [8023-14]

5:50 pm: **Broadband sub-millimeter-wave amplifier module with 38dB gain and 8.3dB noise figure**, Stephen Sarkozy, Richard Lai, Northrop Grumman Aerospace Systems (USA); Kevin Leong, Richard Leakey, Wayne Yoshida, Xiaobing Mei, Ling-Shine Lee, Po-Hsin Liu, Ben Gorospe, Northrop Grumman Corp. (USA); William R. Deal, Northrop Grumman Aerospace Systems (USA) [8023-15]

6:10 pm: **Sensitive water concentration mapping in thin fresh tissues using tunable THz-wave parametric oscillator**, Yuye Wang, Ming Tang, Takashi Notake, Kouji Nawata, Hiromasa Ito, Hiroaki Minamide, RIKEN (Japan) . [8023-16]

Tuesday 26 April

Symposium-Wide Plenary Session

Tuesday • 8:30 to 9:30 am • Location: Crystal H

Dr. Regina E. Dugan

Director, Defense Advanced Research Projects Agency (DARPA)

See page 18 for details • Open to All Attendees

Coffee Break 9:30 to 10:30 am

SESSION 4

Room: Chicago Tues. 10:30 am to 12:00 pm

THz Generation

Session Chairs: **A. F. Mehdi Anwar**, Univ. of Connecticut (USA);
Nibir K. Dhar, Defense Advanced Research Projects Agency (USA)

10:30 am: **Frequency-agile terahertz-wave sources and applications to sensitive diagnosis of semiconductor wafers** (*Invited Paper*), Hiroaki Minamide, Hiromasa Ito, RIKEN (Japan) [8023-17]

11:00 am: **Optimized THz emission from intrinsic Josephson junctions**, Nathan A. Moody, Lev N. Boulaevskii, Vitaly Pavlenko, Quanxi Jia, David Devlin, Los Alamos National Lab. (USA) [8023-18]

11:20 am: **Intracavity terahertz generation from gallium arsenide in a fiber laser pumped type 0 doubly resonant optical parametric oscillator**, Walter C. Hurlbut, Vladimir G. Kozlov, Microtech Instruments, Inc. (USA); Konstantin L. Vodopyanov, Stanford Univ. (USA); Patrick F. Tekavec, Microtech Instruments, Inc. (USA) [8023-19]

11:40 am: **InP and InGaAs Schottky type terahertz emitter excited at a wavelength of 1560nm**, Masayoshi Tonouchi, Masato Suzuki, Kazunori Serita, Iwao Kawayama, Hironaru Murakami, Osaka Univ. (Japan) [8023-20]

Lunch/Exhibition Break 12:00 to 1:50 pm

SESSION 5

Room: Chicago Tues. 1:50 to 3:10 pm

THz Detection

Session Chairs: **Tariq Manzur**, Naval Undersea Warfare Ctr. (USA);
Taiichi Otsuji, Tohoku Univ. (Japan)

1:50 pm: **Terahertz spectroscopy of energetic materials**, Ewelina Witko, Timothy M. Korter, Syracuse Univ. (USA); John Wilkinson, Wayne Ouellette, James Lightstone, Naval Surface Warfare Ctr. Indian Head Div. (USA) . . [8023-21]

2:10 pm: **Terahertz remote sensing**, Alexander V. Kellarev, Dan Sheffer, IARD Sensing Solutions Ltd. (Israel) [8023-22]

2:30 pm: **The method of the spectral dynamics analysis of reflected signal for problem of identification of substance**, Vyacheslav A. Trofimov, Svetlana A. Varentsova, Lomonosov Moscow State Univ. (Russian Federation); Norbert Palka, Mieczyslaw Szustakowski, Tomasz Trzcinski, Military Univ. of Technology (Poland) [8023-23]

2:50 pm: **Terahertz imaging with InP high-electron-mobility transistors**, Takayuki Watanabe, Keisuke Akagawa, Yudai Tanimoto, Tohoku Univ. (Japan); Dominique Coquillat, Wojciech M. Knap, Univ. Montpellier 2 (France); Taiichi Otsuji, Tohoku Univ. (Japan) [8023-25]

Coffee Break 3:10 to 3:40 pm

SESSION 6

Room: Chicago Tues. 3:40 to 5:50 pm

THz Spectroscopy

Session Chairs: **A. F. Mehdi Anwar**, Univ. of Connecticut (USA);
Tariq Manzur, Naval Undersea Warfare Ctr. (USA)

3:40 pm: **Laser terahertz emission microscope** (*Invited Paper*), Masayoshi Tonouchi, Sunmi Kim, Shogo Fujiwara, Iwao Kawayama, Hironaru Murakami, Osaka Univ. (Japan) [8023-26]

4:10 pm: **Plasmon resonance response to millimeter-waves of grating-gated InGaAs/InP HEMT**, Nima Nader Esfahani, Gautam Medhi, Univ. of Central Florida (USA); Himanshu Saxena, Zyberwear, Inc. (USA); Christopher J. Fredricksen, Robert E. Peale, Univ. of Central Florida (USA); Walter R. Buchwald, Air Force Research Lab. (USA); Oliver J. Edwards, Zyberwear, Inc. (USA) [8023-27]

4:30 pm: **Absorption spectroscopy of energetic materials using a 0.075 cm-1 resolution Fourier transform spectrometer**, Elizabeth J. Slingerland, Matthew K. Vallon, Edwin G. E. Jahngen, Thomas M. Goyette, Robert H. Giles, Univ. of Massachusetts Lowell (USA); William E. Nixon, National Ground Intelligence Ctr. (USA) [8023-28]

4:50 pm: **Handheld terahertz spectrometry with the micro-Z**, Thomas D. Tongue, Brian J. Schulkin, Zomega Terahertz Corp. (USA); Xi-Cheng Zhang, Rensselaer Polytechnic Institute (USA) [8023-29]

5:10 pm: **Computing methods for THz materials characterization**, Andre U. Sokolnikov, Visual Solutions and Applications (USA) [8023-30]

5:30 pm: **Demonstration of sweep-and-zoom sensing of RNA and DNA in nanofluidic channels using a THz coherent photomixing transceiver**, Elliott R. Brown, Physical Domains, LLC (USA); Edgar A. Mendoza, Redondo Optics, Inc. (USA); Steven R. J. Brueck, The Univ. of New Mexico (USA) [8023-31]

POSTERS—Tuesday

Room: Crystal M Tues. 6:00 to 7:30 pm

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Ground state resonance structure calculated by density functional theory for estimating the dielectric response of the high explosive PETN, Andrew Shabaev, George Mason Univ. (USA) and U.S. Naval Research Lab. (USA); Samuel G. Lambrakos, Noam Bernstein, Verne L. Jacobs, U.S. Naval Research Lab. (USA); Daniel Finkenstadt, U.S. Naval Academy (USA) [8023-32]

Optimization of plasmonic resonances in the two-dimensional electron gas of an InGaAs/InP high electron mobility transistor, Justin W. Cleary, Solid State Scientific Corp. (USA); Robert E. Peale, Univ. of Central Florida (USA); Himanshu Saxena, Zyberwear, Inc. (USA); Walter R. Buchwald, Air Force Research Lab. (USA) [8023-33]

Plasmonic parametric oscillator via coupling between optically and electrically induced plasmons, Jed Khoury, Bahareh Haji-saeed, Charles L. Woods, Air Force Research Lab. (USA); John Kierstead, Solid State Scientific Corp. (USA) [8023-34]

Plasmon modulation using high-frequency current, Jed Khoury, Bahareh Haji-saeed, Charles L. Woods, Air Force Research Lab. (USA); John Kierstead, Solid State Scientific Corp. (USA) [8023-35]

An investigation of parallel plate waveguide terahertz radiation input coupling, James A. Higgins, Forest A. Kernan, Christopher L. Cowen, Branimir Pejcinovic, Portland State Univ. (USA) [8023-36]

Courses of Related Interest

- SC719 **Chemical & Biological Detection: Overview of Point and Standoff Sensing Technologies** (Gardner) Monday, 8:30 am to 12:30 pm
- SC952 **Applications of Detection Theory** (Carrano) Thursday, 8:30 am to 5:30 pm

Visit the registration desk for course descriptions or to register

Advanced Environmental, Chemical, and Biological Sensing Technologies VIII

Conference Chairs: **Tuan Vo-Dinh**, Duke Univ. (USA); **Robert A. Lieberman**, Intelligent Optical Systems, Inc. (USA); **Günter Gauglitz**, Eberhard Karls Univ. Tübingen (Germany)

Program Committee: **Francesco Baldini**, Istituto di Fisica Applicata Nello Carrara (Italy); **Luigi Campanella**, Univ. degli Studi di Roma La Sapienza (Italy); **Franz Ludwig Dickert**, Univ. Wien (Austria); **Fabien J. Josse**, Marquette Univ. (USA); **Vassili Karanassios**, Univ. of Waterloo (Canada); **Dennis K. Killinger**, Univ. of South Florida (USA); **Heinz-Detlef Kronfeldt**, Technische Univ. Berlin (Germany); **Robert Lascola**, Savannah River National Lab. (USA); **Anna Grazia Mignani**, Istituto di Fisica Applicata Nello Carrara (Italy); **Klaus Schäfer**, Forschungszentrum Karlsruhe (Germany)

Monday 25 April

SESSION 1

Room: Crystal F Mon. 8:30 to 9:30 am

Biosensors

Session Chairs: **Robert A. Lieberman**, Intelligent Optical Systems, Inc. (USA); **Tuan Vo-Dinh**, Duke Univ. (USA)

8:30 am: **Enzyme detection by surface plasmon resonance using specially engineered spacers and plasmonic labelling**, Alexandre Francois, Sabrina Heng, Roman Kostecki, Tanya Monro, The Univ. of Adelaide (Australia) [8024-01]

8:50 am: **An optical biosensor using MEMS-based V-grooves**, Ye Tian, Xiaodong Ma, Nan Wu, Xiaotian Zou, Kai Sun, Xingwei Wang, Univ. of Massachusetts Lowell (USA) [8024-10]

9:10 am: **Optofluidic-nanoplasmonic sensors for biochemical detection**, Hatice Altug, Ahmet A. Yanik, Min Huang, Arif E. Cetin, Boston Univ. (USA); Tsung-Yao Chang, Massachusetts Institute of Technology (USA); Alp Artar, Boston Univ. (USA) [8024-04]

SESSION 2

Room: Crystal F Mon. 9:30 to 10:30 am

Chemical Sensors

Session Chairs: **Robert A. Lieberman**, Intelligent Optical Systems, Inc. (USA); **Tuan Vo-Dinh**, Duke Univ. (USA)

9:30 am: **Interaction of stochastic electromagnetic beams with human eye**, Serkan Sahin, Olga Korotkova, Univ. of Miami (USA) [8024-03]

9:50 am: **Distributed fiber optic chemical sensors for security safety, and environmental applications**, Robert A. Lieberman, Manal Beshay, Intelligent Optical Systems, Inc. (USA) [8024-05]

10:10 am: **Plasmonics SERS nanochip sensing platforms for chemical and biological sensing**, Anuj Dhawan, Hsin-Neng Wang, Tuan Vo-Dinh, Duke Univ. (USA) [8024-38]

Coffee Break 10:30 to 11:00 am

SESSION 3

Room: Crystal F Mon. 11:00 am to 12:40 pm

Advanced Sensing Technologies

Session Chair: **Glenn O. Allgood**, Oak Ridge National Lab. (USA)

11:00 am: **Steam distribution and energy delivery optimization using measurement and control over wireless sensors**, Glenn O. Allgood, Mohammed M. Olama, Phani T. Kuruganti, Sreenivas R. Sukumar, Joe E. Lake, Oak Ridge National Lab. (USA) [8024-07]

11:20 am: **Lensfree sensing on a chip using plasmonic nano-apertures**, Bahar Khademhosseini, Gabriel Biener, Ikbal Sencan, Ting-Wei Su, Ahmet F. Coskun, Aydogan Ozcan, Univ. of California, Los Angeles (USA) [8024-08]

11:40 am: **Development of an optically interrogated chemical tag**, Robert R. Boye, Cody M. Washburn, David A. Scrymgeour, Bradley G. Hance, Shawn M. Dirk, David R. Wheeler, W. Graham Yelton, Timothy N. Lambert, Sandia National Labs. (USA) [8024-09]

12:00 pm: **Infrared surface waves on semimetals, semiconductors, and conducting polymers**, Monas Shahzad, Gautam Medhi, Robert E. Peale, Univ. of Central Florida (USA); Walter R. Buchwald, Air Force Research Lab. (USA); Justin W. Cleary, Solid State Scientific Corp. (USA); Oliver J. Edwards, Zyberwear, Inc. (USA) [8024-02]

12:20 pm: **Simultaneous ultra-high harmonic detection wavelength modulation spectroscopy for resolving congested spectra**, Brett M. D. Sawyer, Karan D. Mohan, Amin N. Dharamsi, Old Dominion Univ. (USA) [8024-11]

Lunch Break 12:40 to 2:00 pm

SESSION 4

Room: Crystal F Mon. 2:00 to 3:40 pm

Spectrographic Trace Detection I

Session Chair: **Heinz-Detlef Kronfeldt**, Technische Univ. Berlin (Germany)

2:00 pm: **671 nm microsystem diode laser based portable Raman sensor device for in-situ identification of meat spoilage**, Kay Sowoidnich, Heinar Schmidt, Technische Univ. Berlin (Germany); Fredi Schwägele, Max Rubner-Institut (Germany); Heinz-Detlef Kronfeldt, Technische Univ. Berlin (Germany) [8024-12]

2:20 pm: **High sensitivity calixarene SERS substrates for the continuous in-situ detection of PAHs in seawater**, Yong-Hyok Kwon, Anna Kolomijeca, Kay Sowoidnich, Heinz-Detlef Kronfeldt, Technische Univ. Berlin (Germany) [8024-13]

2:40 pm: **Remote mid-infrared sensing using chirped laser dispersion spectroscopy**, Michal Nikodem, Clinton J. Smith, Princeton Univ. (USA); Damien Weidmann, Rutherford Appleton Lab. (United Kingdom); Gerard Wysocki, Princeton Univ. (USA) [8024-14]

3:00 pm: **Long range trace detection by radar REMPI**, Arthur Dogariu, Celine Stein, Alexander Glaser, Richard B. Miles, Princeton Univ. (USA) [8024-15]

3:20 pm: **Remote air lasing for trace detection**, Arthur Dogariu, James Michael, Richard B. Miles, Princeton Univ. (USA) [8024-16]

Coffee Break 3:40 to 4:00 pm

SESSION 5

Room: Crystal F Mon. 4:00 to 6:00 pm

Environmental Sensing

Session Chair: **Robert A. Lieberman**, Intelligent Optical Systems, Inc. (USA)

4:00 pm: **Nanopillars array for surface enhanced Raman scattering**, Allan Chang, Mihail Bora, Elaine M. Behymer, Hoang T. Nguyen, Cindy C. Larson, Jerald A. Britten, Lawrence Livermore National Lab. (USA); James Chan, Univ. of California, Davis (USA); Tiziana C. Bond, Lawrence Livermore National Lab. (USA) [8024-17]

4:20 pm: **Far-UV LIBS for biological and organic samples**, Khan Lim, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Jason M. Eichenholz, Ocean Optics, Inc. (USA); Matthieu Baudelet, Martin C. Richardson, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) [8024-18]

4:40 pm: **Analyte focusing at self assembling hotspots for SERS by leaning silver coated silicon nanopillars**, Michael S. Schmidt, Anja Boisen, Technical Univ. of Denmark (Denmark) [8024-19]

5:00 pm: **Battery-operated planar-geometry micro-plasmas on postage-stamp size chips: some fundamentals**, Scott Weagant, Vassili Karanassios, Univ. of Waterloo (Canada) [8024-20]

5:20 pm: **Gallium nitride nanowire-nanocluster hybrids for environmental sensing**, Geetha S. Aluri, George Mason Univ. (USA); Abhishek Motayed, Kris A. Bertness, Norman A. Sanford, Albert V. Davydov, National Institute of Standards and Technology (USA); Rao V. Mulpuri, George Mason Univ. (USA); John Melngailis, Univ. of Maryland, College Park (USA) [8024-06]

5:40 pm: **Deforestation modeling for Zagros forests using RS and GIS techniques (case study: forests of Ilam)**, Djafar Oladi, Delavar Bozorgnia, Ali Akbar Jafarzadeh, Univ. of Mazandaran (Iran, Islamic Republic of) [8024-23]

Tuesday 26 April

Symposium-Wide Plenary Session

Tuesday • 8:30 to 9:30 am • Location: Crystal H

Dr. Regina E. Dugan

Director, Defense Advanced Research Projects Agency (DARPA)

See page 18 for details • Open to All Attendees

Coffee Break 9:30 to 10:00 am

SESSION 6

Room: Crystal F Tues. 10:00 am to 12:20 pm

Gas Sensing

Session Chair: Tuan Vo-Dinh, Duke Univ. (USA)

10:00 am: **Spectrally tailored pulsed thulium fiber laser system for broadband lidar CO₂ sensing**, Timothy S. McComb, Northrop Grumman Aerospace Systems (USA); William S. Heaps, Elena M. Georgieva, NASA Goddard Space Flight Ctr. (USA); Eric C. Cheung, Brian K. Baldauf, Peter A. Thielen, James G. Ho, Frank R. Hassell, Northrop Grumman Aerospace Systems (USA) [8024-24]

10:20 am: **Characteristics of polar and nonpolar ZnO nanostructure based gas sensors**, Sheng Chun Hung, Chung Wei Chen, Gou-Chung Chi, National Central Univ. (Taiwan) [8024-25]

10:40 am: **High sensitivity detection of NO₂ employing off-axis integrated cavity output spectroscopy coupled with multiple line integrated spectroscopy**, Gottipaty N. Rao, Andreas Karpf, Adelphi Univ. (USA) [8024-26]

11:00 am: **A low-volume microstructured optical fiber hydrogen peroxide sensor**, Erik P. Schartner, Dominic F. Murphy, Heike Ebendorff-Heidepriem, Tanya M. Monro, The Univ. of Adelaide (Australia) [8024-27]

11:20 am: **Tin oxide nanowire sensors for highly sensitive detection of the toxic gas H₂S**, Anton Koeck, Elise Brunet, Austrian Institute of Technology (Austria); Giorgio Mutinati, Pirelli & C. S.p.A. (Austria); Stephan Steinhauer, Austrian Institute of Technology (Austria) [8024-28]

11:40 am: **Standoff identification and quantification of flare emissions using infrared hyperspectral imaging**, Kevin C. Gross, Air Force Institute of Technology (USA); Simon Savary, Telops (Canada); Pierre Tremblay, Univ. Laval (Canada); Jean-Philippe Gagnon, Vincent Farley, Martin Chamberland, Telops (Canada) [8024-29]

12:00 pm: **Trace gas detection and monitoring with the digital array gas-correlation radiometer (DAGR)**, Martin J. McHugh, Larry L. Gordley, Mark E. Hervig, GATS, Inc. (USA) [8024-30]

POSTERS—Tuesday

Room: Crystal M Tues. 6:00 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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Effects of design parameters of passive FTIR spectroscopy system using Michelson interferometer on the detection probability of stand-off hazardous compounds, Hee Kyung Ahn, Kang Sup Shim, Hong Jin Kong, Min Seok Oh, KAIST (Korea, Republic of) [8024-31]

Strong room-temperature chemiresistive effect of TiO₂-B nanowires to nitro-aromatic compounds, Danling Wang, Antao Chen, Qifeng Zhang, Guozhong Cao, Univ. of Washington (USA) [8024-33]

Gas cloud infrared image enhancement based on anisotropic diffusion, Jiakun Li, Lingxue Wang, Changxing Zhang, Yunting Long, Bei Zhang, Beijing Institute of Technology (China) [8024-34]

Monitoring organic volatiles and flammable gases with a holographic sensor, Juan Leonardo Martinez-Hurtado, Christopher R. Lowe, Univ. of Cambridge (United Kingdom) [8024-35]

Compact mobile ELISA-based pathogen detection: design and implementation challenges, Dmitry S. Starodubov, Anya Asanbaeva, Ihor V. Berezhnyy, Chung-Yen Chao, Richard Koziol, David Miller, Edward Patton, Sushma Trehan, Chris Ulmer, Physical Optics Corp. (USA) [8024-36]

Smart Biomedical and Physiological Sensor Technology VIII

Conference Chairs: **Brian M. Cullum**, Univ. of Maryland, Baltimore County (USA); **Eric S. McLamore**, Univ. of Florida (USA)

Program Committee: **Karl S. Booksh**, Univ. of Delaware (USA); **Marie-Christine F. Daniel**, Univ. of Maryland, Baltimore County (USA); **Andre J. Gesquiere**, Univ. of Central Florida (USA); **Ilko K. Ilev**, U.S. Food and Drug Administration (USA); **T. Joshua Pfefer**, U.S. Food and Drug Administration (USA); **Shiv K. Sharma**, Univ. of Hawai'i (USA); **Brian S. Sorg**, Univ. of Florida (USA); **Chang-Soo Kim**, Missouri Univ. of Science and Technology (USA); **Anhong Zhou**, Utah State Univ. (USA); **William Todd Monroe**, Louisiana State Univ. (USA); **Majed Dweik**, Univ. of Missouri-Columbia (USA); **Liju Yang**, North Carolina Central Univ. (USA); **Mark R. Riley**, The Univ. of Arizona (USA); **Liang Zhu**, Univ. of Maryland, Baltimore County (USA)

Thursday 28 April

SESSION 1

Room: Crystal F Thurs. 8:20 to 10:00 am

Nano/Micro-sensors for Cellular Analyses

Session Chairs: **Liju Yang**, North Carolina Central Univ. (USA); **Shiv K. Sharma**, Univ. of Hawai'i (USA)

8:20 am: **Optimization of SAM-based multilayer SERS substrates for intracellular analyses: the effect of terminating functional groups**, Charles K. Klutse, Brian M. Cullum, Univ. of Maryland, Baltimore County (USA) [8025-01]

8:40 am: **Nitrocellulose-based SERS based immuno-sensor for detection of biological molecules**, Ava C. Dykes, Lori E. Kamemoto, Anupam K. Misra, Shiv K. Sharma, Univ. of Hawai'i (USA) [8025-02]

9:00 am: **Novel optical nanobiosensor encapsulated in erythrocytes**, Majed Dweik, Lincoln Univ. (USA) [8025-03]

9:20 am: **Self-referencing luminescent optrodes for non-invasive, real time measurement of extracellular flux**, Eric S. McLamore, Univ. of Florida (USA); D. Marshall Porterfield, Purdue Univ. (USA) [8025-04]

9:40 am: **Sensor for detection and classification of nano particles and biological agents in situ based on optical resonance in dielectric microspheres**, Vladimir A. Saetchnikov, Elina A. Tcherniavskaia, Belarusian State Univ. (Belarus); Gustav Schweiger, Andreas Ostendorf, Ruhr-Univ. Bochum (Germany) [8025-05]

Coffee Break 10:00 to 10:20 am

SESSION 2

Room: Crystal F Thurs. 10:20 am to 12:00 pm

Spectroscopic Tools for Tissue and Bacterial Analyses

Session Chairs: **Chang-Soo Kim**, Missouri Univ. of Science and Technology (USA); **Liju Yang**, North Carolina Central Univ. (USA)

10:20 am: **Electrical/electrochemical impedance biosensors/biochips for rapid detection of foodborne pathogenic bacteria**, Liju Yang, North Carolina Central Univ. (USA) [8025-06]

10:40 am: **Micro-Raman discrimination of bacterial strains using multilayered microcavity substrates**, Shiv K. Sharma, Ava C. Dykes, Anupam K. Misra, Lori E. Kamemoto, David E. Bates, Univ. of Hawai'i (USA) [8025-07]

11:00 am: **Fluorescence intensity measurements with display screen as excitation source**, Sanghan Park, Satya Achanta, Chang-Soo Kim, Missouri Univ. of Science and Technology (USA) [8025-08]

11:20 am: **Development of a depolarized Raman spectrometer for potential surface-enhanced Raman optical activity (SEROA) measurements**, Honggang Li, Biotools Inc. (USA); Laurence A. Nafie, Syracuse Univ. (USA) [8025-09]

11:40 am: **Colorimetric phosphorescence measurements with a color camera for oxygen determination**, Prajakta Bhagwat, Satya Achanta, Chang-Soo Kim, Missouri Univ. of Science and Technology (USA); David B. Henthorn, Saint Louis Univ. (USA) [8025-10]

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

SESSION 3

Room: Crystal F Thurs. 1:40 to 3:00 pm

In-vitro and In-vivo Imaging and Diagnostics

Session Chairs: **Shiv K. Sharma**, Univ. of Hawai'i (USA); **Marie-Christine F. Daniel**, Univ. of Maryland, Baltimore County (USA)

1:40 pm: **Micro-Raman spectroscopic study of ALVAC virus infected chicken embryo cells**, Anupam K. Misra, Lori E. Kamemoto, Univ. of Hawai'i (USA); Ningjie Hu, Indiana Univ. School of Medicine (USA); Ava C. Dykes, Univ. of Hawai'i (USA); Qigui Yu, Indiana Univ. School of Medicine (USA); Shiv K. Sharma, Univ. of Hawai'i (USA) [8025-11]

2:00 pm: **UV Raman spectroscopy of HIV antigens**, Pavel V. Zinin, Lori E. Kamemoto, Univ. of Hawai'i (USA); Qigui Yu, Ningjie Hu, Indiana Univ. School of Medicine (USA); Anupam K. Misra, Shiv K. Sharma, Univ. of Hawai'i (USA) [8025-12]

2:20 pm: **Two-photon photoacoustic spectroscopy for noninvasive subsurface chemical diagnostics**, Sudhir Dahal, Brian M. Cullum, John B. Kiser, Univ. of Maryland, Baltimore County (USA) [8025-13]

2:40 pm: **Studies of MRI relaxivities of gadolinium-labeled dendronized gold nanoparticles**, Hongmu Pan, Marie-Christine F. Daniel, Univ. of Maryland, Baltimore County (USA) [8025-14]

Coffee Break 3:00 to 3:30 pm

SESSION 4

Room: Crystal F Thurs. 3:30 to 4:50 pm

Toward the Clinic/Field

Session Chairs: **Marie-Christine F. Daniel**, Univ. of Maryland, Baltimore County (USA); **Liang Zhu**, Univ. of Maryland, Baltimore County (USA)

3:30 pm: **Temperature elevations in prostatic tumors during laser photothermal therapy**, Liang Zhu, Anilchandra Attaluri, Hong Cai, Raymond Edziah, Elaine Lalanne, Charles Bieberich, Ronghui Ma, Anthony M. Johnson, Univ. of Maryland, Baltimore County (USA) [8025-15]

3:50 pm: **Synthesis and biological studies of highly concentrated lisinopril-capped gold nanoparticles for CT tracking of angiotensin converting enzyme (ACE)**, William E. Ghann, Univ. of Maryland, Baltimore County (USA); Omer Aras M.D., Thorsten Fleiter M.D., Univ. of Maryland Medical Ctr. (USA); Marie-Christine F. Daniel, Univ. of Maryland, Baltimore County (USA) [8025-16]

4:10 pm: **Securing medical monitoring devices using advanced RFID technology**, Daniel Engels, Massachusetts Institute of Technology (USA) [8025-17]

4:30 pm: **An innovative non-contact ECG sensor**, Ye Sun, Xiong Yu, Jim Berrilla, Case Western Reserve Univ. (USA) [8025-18]

POSTERS—Thursday

Room: Crystal M Thurs. 6:00 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. 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 pm 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.

Anti-sleepiness sensor systems for sober mental condition,
 Won Heum Han, Hyung Sik Jung, Hyo Gun Lee, Hana Academy Seoul (Korea, Republic of) [8025-19]

Two-stage microfluidic device for acoustic particle manipulation, Myeong Chan Jo, Rasim O. Guldiken, Univ. of South Florida (USA) [8025-21]

Courses of Related Interest

SC952 **Applications of Detection Theory** (Carrano) Thursday, 8:30 am to 5:30 pm
 Visit the registration desk for course descriptions or to register

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Photonic Applications for Aerospace, Transportation, and Harsh Environment II

Conference Chairs: **Alex A. Kazemi**, The Boeing Co. (USA); **Bernard Kress**, USI Photonics Inc. (USA); **Eric Y. Chan**, The Boeing Co. (USA)

Conference Co-Chairs: **Nabeel A. Riza**, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); **Lothar U. Kempen**, Intelligent Optical Systems, Inc. (USA)

Program Committee: **Frank Abdi**, AlphaSTAR Corp. (USA); **Jacques Albert**, Carleton Univ. (Canada); **Christopher S. Baldwin**, Aither Engineering, Inc. (USA); **Manal Beshay**, Intelligent Optical Systems, Inc. (USA); **Ayoub Chakari**, Ecole Nationale Supérieure de Physique de Strasbourg (France); **Fu-Kuo Chang**, Stanford Univ. (USA); **Dan Curticapean**, Hochschule Offenburg (Germany); **James E. Fesmire**, NASA Kennedy Space Ctr. (USA); **Leo R. Gauthier, Jr.**, The Johns Hopkins Univ. (USA); **Harold Hager**, The Boeing Co. (USA); **Zuyuan He**, The Univ. of Tokyo (Japan); **Robert G. Johnson**, NASA Kennedy Space Ctr. (USA); **Peter Kiesel**, Palo Alto Research Center, Inc. (USA); **Dennis G. Koshinz**, The Boeing Co. (USA); **Edgar A. Mendoza**, Redondo Optics, Inc. (USA); **Patrick P. Meyrueis**, Ecole Nationale Supérieure de Physique de Strasbourg (France); **Jean-Pierre Moeglin**, Institut Franco-Allemand de Recherches de Saint-Louis (France); **Ayman S. Mosallam**, Univ. of California, Irvine (USA); **Juock S. Namkung**, Naval Air Warfare Ctr. Aircraft Div. (USA); **Allen S. Panahi**, Redondo Optics, Inc. (USA); **Indu F. Saxena**, Intelligent Optical Systems, Inc. (USA); **William St. Cyr**, NASA Stennis Space Ctr. (USA); **Pierre St. Hilaire**, Holox Technologies, Inc. (USA)

Monday 25 April

SESSION 1

Room: Crystal B. Mon. 8:30 to 10:10 am

Sensors in Transportation/Aerospace Applications

Session Chair: **Alex A. Kazemi**, The Boeing Co. (USA)

- 8:30 am: **PFO hydrogen detection sensor systems for space applications** (*Invited Paper*), Alex A. Kazemi, ARK International (USA) [8026-01]
- 9:00 am: **Viability of guided-wave ultrasound-based diagnostics for sharply curved composite structures**, Indu F. Saxena, Intelligent Optical Systems, Inc. (USA); Vinay Dayal, Iowa State Univ. (USA); Lothar U. Kempen, Intelligent Optical Systems, Inc. (USA) [8026-02]
- 9:20 am: **Advances towards the qualification of an aircraft fuel tank inert environment** (*Invited Paper*), Edgar A. Mendoza, Redondo Optics, Inc. (USA) [8026-03]
- 9:50 am: **Intrinsically safe oxygen and hydrogen optical leak detector**, Manal Beshay, Simona Garon, David Ruiz, Lothar U. Kempen, Intelligent Optical Systems, Inc. (USA) [8026-04]
- Coffee Break 10:10 to 10:40 am

SESSION 2

Room: Crystal B. Mon. 10:40 to 11:40 am

Micro, Nano and Laser Photonics in Transportation

Session Chair: **Eric Y. Chan**, The Boeing Co. (USA)

- 10:40 am: **Miniaturized real-time monitor for fuel cell leak applications**, Manal Beshay, Jai Ganesh Chandrasekhar, Jesus Delgado, Christopher Boehr, Robert A. Lieberman, Intelligent Optical Systems, Inc. (USA) [8026-05]
- 11:00 am: **Online automatic measurement of deflection for automobile based on digital CCD sensors**, Chanjun Chen, Yong Liu, Gang Wang, Wuhan Univ. (China); Yaohua He, Wuhan Univ. of Technology (China) [8026-06]
- 11:20 am: **AUV-portable temperature-compensating fiber optic hydrophone**, Indu F. Saxena, Narciso Guzman, Kaleo J. Hui, Steve Pflanze, Intelligent Optical Systems, Inc. (USA) [8026-07]
- Lunch Break 11:40 am to 1:20 pm

SESSION 3

Room: Crystal B. Mon. 1:20 to 3:00 pm

Photonics In Harsh Environment, Signal Processing

Session Chair: **Lothar U. Kempen**, Intelligent Optical Systems, Inc. (USA)

- 1:20 pm: **Incoherent light guide imager for harsh and complex environments**, Leo R. Gauthier, Jr., The Johns Hopkins Univ. (USA) [8026-08]
- 1:40 pm: **Digital micromirror device-based robust object boundary mapping sensor**, Philip J. Marraccini, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Cody Baxley, Univ. of Central Florida (USA); Nabeel A. Riza, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) [8026-09]
- 2:00 pm: **High resolution wide dynamic range distance sensor using spatial signal processing**, Philip J. Marraccini, Nabeel A. Riza, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) [8026-10]
- 2:20 pm: **Multimode laser beam characterization using agile digital-analog photonics**, Philip J. Marraccini, Nabeel A. Riza, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) [8026-11]
- 2:40 pm: **Evanescence wave absorption measurements of corroded materials using ATR and optical fibers**, Juock S. Namkung, Naval Air Warfare Ctr. Aircraft Div. (USA); Michael L. Hoke, Air Force Research Lab. (USA); Andy Schwartz, Naval Air Systems Command (USA) [8026-26]
- Coffee Break 3:00 to 3:20 pm

SESSION 4

Room: Crystal B. Mon. 3:20 to 5:10 pm

Environmental and Gas Monitoring

Session Chair: **Nabeel A. Riza**, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA)

- 3:20 pm: **Wireless/integrated strain monitoring and simulation system**, Frank Abdi, AlphaSTAR Corp. (USA) [8026-12]
- 3:40 pm: **All optical O₂ sensors using innovative phase fluorimetry for monitoring of headspace in ullage for FAA mandated inerting fuel tanks of commercial airlines**, Allen S. Panahi, Accro USA, LLC (USA) [8026-13]
- 4:00 pm: **Compact and fast read-out for wavelength-encoded sensors**, Peter Kiesel, Konrad Bellmann, Noble M. Johnson, Palo Alto Research Center, Inc. (USA) [8026-14]
- 4:20 pm: **Development of an ultrafast response fluorescence hydrogen sensor for leak detection in hazardous explosive environments** (*Invited Paper*), Edgar A. Mendoza, Redondo Optics, Inc. (USA) [8026-15]
- 4:50 pm: **Battery outgassing sensor for electric drive vehicle energy storage systems**, Manal Beshay, Jai Ganesh Chandrasekhar, Lothar U. Kempen, Intelligent Optical Systems, Inc. (USA) [8026-16]

Tuesday 26 April

Symposium-Wide Plenary Session

Tuesday • 8:30 to 9:30 am • Location: Crystal H

Dr. Regina E. Dugan

Director, Defense Advanced Research Projects Agency (DARPA)

See page 18 for details • Open to All Attendees

Coffee Break 9:30 to 10:00 am

SESSION 5

Room: Crystal B. Tues. 10:00 to 11:20 am

Wireless Optical Link, Optical Satellite Communication

Session Chair: **Bernard Kress**, USI Photonics Inc. (USA)

10:00 am: **High speed laser communication network for satellite systems**, Allen S. Panahi, Accro USA, LLC (USA); Alex A. Kazemi, ARK International (USA) [8026-17]

10:20 am: **Wireless optical links for avionic applications** (*Invited Paper*), Eric Y. Chan, Dennis G. Koshinz, William Krug, Harold Hager, The Boeing Co. (USA) [8026-18]

10:40 am: **Towards development of a fiber optic-based transmission monitoring system**, Christopher S. Baldwin, Jason S. Kiddy, Aither Engineering, Inc. (USA) [8026-19]

11:00 am: **A low cost disposable hydrogen sensor using guided optics: review for an optimal sensor**, Cedric Perrotton, Patrick P. Meyrueis, Ecole Nationale Supérieure de Physique de Strasbourg (France) [8026-20]

SESSION 6

Room: Crystal B. Tues. 11:20 am to 12:50 pm

Vision-Based and Imaging Sensors

Session Chair: **Indu F. Saxena**, Intelligent Optical Systems, Inc. (USA)

11:20 am: **Speckle reduction technique for laser based automotive HUD projectors** (*Invited Paper*), Bernard Kress, USI Photonics Inc. (USA) . . . [8026-21]

11:50 am: **Diffractive elements manufactured by grey tone mask and global laser lighting for transportation applications**, Patrick P. Meyrueis, Ecole Nationale Supérieure de Physique de Strasbourg (France) [8026-22]

12:10 pm: **A low cost virtual reality system for automotive surrounding display using only one video beamer**, Thierry Blandet, Ecole Nationale Supérieure de Physique de Strasbourg (France) [8026-23]

12:30 pm: **Novel diffractive HUD combiner fabrication method**, Pierre St. Hilaire, Holox Inc. (USA); Bernard Kress, USI Photonics Inc. (USA) [8026-24]

POSTERS—Tuesday

Room: Crystal M Tues. 6:00 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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ARCADIS: IED detection and logistic infrastructure security, David Monnin, Etienne Bieber, Gwenaël Schmitt, Armin L. Schneider, Jean-Pierre Moeglin, Institut Franco-Allemand de Recherches de Saint-Louis (France) [8026-25]



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Sensing for Agriculture and Food Quality and Safety III

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**, Purdue Univ., Ctr. for Food Safety Engineering (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. (Japan); **Kurt C. Lawrence**, USDA Agricultural Research Service (USA); **Kangjin Lee**, Rural Development Administration (Korea, Republic of); **Alan M. Lefcourt**, USDA Agricultural Research Service (USA); **Renfu Lu**, USDA Agricultural Research Service (USA); **Bosoon Park**, USDA Agricultural Research Service (USA); **Yankun Peng**, China Agricultural Univ. (China); **Yang Tao**, Univ. of Maryland, College Park (USA); **Gang Yao**, Univ. of Missouri-Columbia (USA); **Haibo Yao**, Mississippi State Univ. (USA); **Yibin Ying**, Zhejiang Univ. (China); **Seung-Chul Yoon**, USDA Agricultural Research Service (USA)

Tuesday 26 April

Symposium-Wide Plenary Session

Tuesday • 8:30 to 9:30 am • Location: Crystal H

Dr. Regina E. Dugan

Director, Defense Advanced Research Projects Agency (DARPA)

See page 18 for details • Open to All Attendees

SESSION 1

Room: Crystal F Tues. 1:00 to 2:40 pm

Raman and Terahertz Sensing

Session Chair: **Kuanglin Chao**, Agricultural Research Service (USA)

1:00 pm: **Combination of LIBS and Raman for food quality monitoring**, Yuan Liu, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Lionel Gigant, Univ. Bordeaux 1 (France); Matthieu Baudelet, Martin C. Richardson, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) [8027-01]

1:20 pm: **Evaluating carotenoid changes in tomatoes during postharvest ripening using Raman chemical imaging**, Jianwei Qin, Kuanglin Chao, Moon S. Kim, U.S.D.A. Agricultural Research Service (USA) [8027-02]

1:40 pm: **Polarized Raman investigations of oriented animal muscle fibers affected by storage time applying a 671 nm diode laser**, Halah Al Ebrahim, Kay Sowoidnich, Heinar Schmidt, Heinz-Detlef Kronfeldt, Technische Univ. Berlin (Germany) [8027-03]

2:00 pm: **A quantitative study for determination of sugar concentration using attenuated total reflectance terahertz (ATR-THz) spectroscopy**, Diding Suhandy, Tetsuhito Suzuki, Yuichi Ogawa, Naoshi Kondo, Kyoto Univ. Graduate School of Agriculture (Japan); Takeshi Ishihara, Yuichiro Takemoto, Panasonic Corp. (Japan) [8027-04]

2:20 pm: **THz spectroscopy based high sensitivity measurement of protein using a metal mesh device**, Tetsuhito Suzuki, Yuichi Ogawa, Naoshi Kondo, Kyoto Univ. Graduate School of Agriculture (Japan); Takashi Kondo, Kazuhiro Takigawa, Seiji Kamba, Murata Manufacturing Co., Ltd. (Japan) [8027-05]

SESSION 2

Room: Crystal F Tues. 2:40 to 4:40 pm

Pathogen Detection

Session Chair: **Bryan A. Chin**, Auburn Univ. (USA)

2:40 pm: **AOTF hyperspectral microscopic imaging for foodborne pathogenic bacteria detection**, Bosoon Park, Jaya Sundaram, Gerald W. Heitschmidt, Seung Chul Yoon, Kurt C. Lawrence, William R. Windham, U.S.D.A. Agricultural Research Service (USA) [8027-06]

3:00 pm: **The detection of Salmonella typhimurium on egg shell using a phage-based biosensor**, Yating Chai, Shin Horikawa, Suiqiong Li, Wen Shen, Mi-Kyng Park, Vitaly J. Vodyanoy, Bryan A. Chin, Auburn Univ. (USA) . . [8027-07]

Coffee Break 3:20 to 3:40 pm

3:40 pm: **Detection of Salmonella typhimurium on fresh spinach leaves using phage-coated magnetoelastic biosensors**, Shin Horikawa, Suiqiong Li, Yating Chai, Vitaly J. Vodyanoy, Bryan A. Chin, Auburn Univ. (USA) [8027-08]

4:00 pm: **Multiple phage-based magnetoelastic biosensors for the detection of Salmonella typhimurium on cantaloupe surfaces**, Wen Shen, Suiqiong Li, Shin Horikawa, Bryan A. Chin, Auburn Univ. (USA) [8027-09]

4:20 pm: **Rapid detection of salmonella using surface enhanced raman spectroscopy with silver nanosubstrate**, Jaya Sundaram, Bosoon Park, U.S.D.A. Agricultural Research Service (USA); Yiping Zhao, The Univ. of Georgia (USA); Arthur Hinton, Jr., William R. Windham, Seung Chul Yoon, Kurt C. Lawrence, U.S.D.A. Agricultural Research Service (USA) [8027-10]

SESSION 3

Room: Crystal F Tues. 4:40 to 6:00 pm

Aflatoxin Detection

Session Chair: **Haibo Yao**, Mississippi State Univ. (USA)

4:40 pm: **Characterization of optical properties of bacterial micro-colonies via the comprehensive morphology analyzer**, Nan Bai, Purdue Univ. (USA); Yanji Tang, Arun K. Bhunia, Ctr. for Food Safety Engineering (USA); E. Daniel Hirtelman, Euiwon Bae, Purdue Univ. (USA) [8027-11]

5:00 pm: **Development of narrow-band fluorescence indices for the detection of aflatoxin contaminated corn**, Haibo Yao, Zuzana Hruska, Russell Kincaid, Ambrose E. Ononye, Mississippi State Univ. (USA); Robert L. Brown, Deepak Bhatnagar, Thomas E. Cleveland, U.S.D.A. Agricultural Research Service (USA) [8027-12]

5:20 pm: **Cepstrum based feature extraction method for fungus detection**, Onur Yorulmaz, Enis A. Cetin, Bilkent Univ. (Turkey); Tom C. Pearson, U.S.D.A. Agricultural Research Service (USA) [8027-13]

5:40 pm: **Aflatoxin contaminated chili pepper detection by hyperspectral imaging and machine learning**, Musa Atas, Yasemin Yardimci Cetin, Alptekin Temizel, Middle East Technical Univ. (Turkey) [8027-14]

POSTERS—Tuesday

Room: Crystal M Tues. 6:00 to 7:30 pm

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Hyperspectral imaging for nondestructive quality and maturity evaluation in tomatoes, Sukwon Kang, National Academy of Agriculture Science (Korea, Republic of); Moon S. Kim, U.S.D.A. Agricultural Research Service (USA); Kangjin Lee, National Academy of Agriculture Science (Korea, Republic of) [8027-36]

A control system of mobile navigation robot for precise spraying based ultrasonic detecting and ARM embedded technologies, Xiuying Tang, Cuiling Li, China Agricultural Univ. (China); Xiu Wang, National Engineering Research Ctr. for Information Technology in Agriculture (China); Xinpeng Yue, Yankun Peng, China Agricultural Univ. (China) [8027-37]

A Raman chemical imaging system for detection of contaminants in food, Kaunglin Chao, Jianwei Qin, Moon S. Kim, U.S.D.A. Agricultural Research Service (USA) [8027-38]

Development of whole-surface imaging technique for online inspection of leafy green vegetables, Xiuying Tang, China Agricultural Univ. (China); Moon S. Kim, Jianwei Qin, Chun-Chieh Yang, U.S.D.A. Agricultural Research Service (USA); Yankun Peng, China Agricultural Univ. (China); Diane E. Chan, Kuanglin Chao, U.S.D.A. Agricultural Research Service (USA) [8027-39]

Automatic eggshell crack detection system using acoustic response, Kangjin Lee, National Academy of Agriculture Science (Korea, Republic of); Wankyuu Choi, Nongsim Engineering (Korea, Republic of); Hoyoung Lee, Seoul National Univ. (Korea, Republic of) [8027-40]

Wednesday 27 April

SESSION 4

Room: Crystal F Wed. 8:30 to 10:10 am

Hyperspectral Imaging I

Session Chair: Seung Chul Yoon, Agricultural Research Service (USA)

8:30 am: **Fast and accurate image recognition algorithms for fresh produce food safety sensing**, Chun-Chieh Yang, Moon S. Kim, Kuanglin Chao, U.S.D.A. Agricultural Research Service (USA) [8027-15]

8:50 am: **Hyperspectral imaging technique for determination of pork freshness**, Yankun Peng, Leilei Zhang, China Agricultural Univ. (China) . [8027-16]

9:10 am: **Infrared imaging technology for detection of bruising damages of ‘Singo’ pear**, Byoung-Kwan Cho, Chungnam National Univ. (Korea, Republic of); Moon S. Kim, U.S.D.A. Agricultural Research Service (USA); Hoon-Soo Lee, Chungnam National Univ. (Korea, Republic of); Stephen R. Delwiche, U.S.D.A. Agricultural Research Service (USA) [8027-17]

9:30 am: **Hyperspectral near-infrared imaging for detection of cuticle cracks on tomatoes**, Hoon-Soo Lee, Chungnam National Univ. (Korea, Republic of); Danhee Jeong, Moon S. Kim, Agricultural Research Service, USDA (USA); Byoung-Kwan Cho, Chungnam National Univ. (Korea, Republic of); Stephen R. Delwiche, Kuanglin Chao, Agricultural Research Service, USDA (USA) . . [8027-18]

9:50 am: **Detection of fruit fly infestation in pickling cucumbers using hyperspectral imaging**, Renfu Lu, Agricultural Research Service (USA); Diwan P. Ariana, Michigan State Univ. (USA) [8027-19]

Coffee Break 10:10 to 10:40 am

SESSION 5

Room: Crystal F Wed. 10:40 to 11:40 am

Hyperspectral Imaging II

Session Chair: Renfu Lu, Agricultural Research Service (USA)

10:40 am: **Peach maturity/quality assessment using hyperspectral imaging-based spatially resolved technique**, Haiyan Cen, Renfu Lu, Fernando A. Mendoza, Diwan P. Ariana, Michigan State Univ. (USA) [8027-20]

11:00 am: **Multisensor data fusion for improved prediction of apple fruit firmness and soluble solids**, Fernando A. Mendoza, Michigan State Univ. (USA); Renfu Lu, U.S.D.A. Agricultural Research Service (USA); Haiyan Cen, Michigan State Univ. (USA) [8027-21]

11:20 am: **LED induced fluorescence imaging technology for detection of cuticle cracking on cherry tomatoes**, In-Suck Baek, Byoung-Kwan Cho, Chungnam National Univ. (Korea, Republic of); Moon S. Kim, U.S.D.A. Agricultural Research Service (USA); Young-Sik Kim, SangMyung Univ. (Korea, Republic of) [8027-22]

Lunch/Exhibition Break 11:40 am to 1:30 pm

SESSION 6

Room: Crystal F Wed. 1:30 to 3:10 pm

Fluorescence Applications

Session Chair: Byoung-Kwan Cho, Chungnam National Univ. (Korea, Republic of)

1:30 pm: **Dynamic fluorescence-based method for measuring oxygen transmission rate of food packaging**, Bruce Welt, Univ. of Florida (USA) [8027-24]

1:50 pm: **Fluorescence lifetime monitor for the remote inspection of hermetic packaged food**, Edgar A. Mendoza, Redondo Optics, Inc. (USA) [8027-25]

2:10 pm: **Fluorescence excitation and emission wavebands for evaluation of freshness of pork meats**, Jae-Gon Kim, Byoung-Kwan Cho, Chungnam National Univ. (Korea, Republic of); Moon S. Kim, U.S.D.A. Agricultural Research Service (USA) [8027-26]

2:30 pm: **Study on excitation and fluorescence spectrums of Japanese citrus to construct machine vision system for acquiring fluorescent images**, Md. Abdul Momin, Naoshi Kondo, Kyoto Univ. Graduate School of Agriculture (Japan); Makoto Kuramoto, Ehime Univ. (Japan); Yuichi Ogawa, Tomoo Shigi, Kyoto Univ. Graduate School of Agriculture (Japan) [8027-27]

2:50 pm: **Homogenization of a pulsed laser beam using a lightpipe**, Alan M. Lefcourt, Payam Motabar, Moon S. Kim, U.S.D.A. Agricultural Research Service (USA); Uri Tasch, Univ. of Maryland, Baltimore County (USA); Mary Camp, U.S.D.A. Agricultural Research Service (USA) [8027-28]

Coffee Break 3:10 to 3:40 pm

SESSION 7

Room: Crystal F Wed. 3:40 to 5:00 pm

Vis/NIR and Optical Sensing

Session Chair: Sukwon Kang,

National Academy of Agriculture Science (Korea, Republic of)

3:40 pm: **Development of the pungency measuring system for red-pepper powder**, Changyeun Mo, Kangjin Lee, Jongguk Lim, Sukwon Kang, Hyundong Lee, Rural Development Administration (Korea, Republic of) [8027-29]

4:00 pm: **Improved egg crack detection algorithm for modified pressure imaging system**, Seung-Chul Yoon, Kurt C. Lawrence, Deana R. Jones, Gerald W. Heitschmidt, Bosoon Park, U.S.D.A. Agricultural Research Service (USA) [8027-30]

4:20 pm: **Quality measurement of Korean traditional rice beer ‘Makgeolri’ using VIS/NIR spectroscopy**, Dae-Yong Kim, Byoung-Kwan Cho, Chungnam National Univ. (Korea, Republic of) [8027-32]

4:40 pm: **Potential of using satellite remote sensing data for estimation of Aus rice yield in Bangladesh**, Mohammad Nizamuddin, Leonid Roytman, The City College of New York (USA); Felix Kogan, Mitchell D. Goldberg, National Environmental Satellite, Data, and Information Service (USA) [8027-33]

Fiber Optic Sensors and Applications VIII

Conference Chairs: **Stephen J. Mihailov**, Communications Research Ctr. Canada (Canada); **Henry H. Du**, Stevens Institute of Technology (USA); **Gary Pickrell**, Virginia Polytechnic Institute and State Univ. (USA)

Conference Co-Chairs: **Anbo Wang**, Virginia Polytechnic Institute and State Univ. (USA); **Alexis Mendez**, MCH Engineering LLC (USA); **Eric Udd**, Columbia Gorge Research (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 P. Chen**, Univ. of Pittsburgh (USA); **Steven D. Christesen**, U.S. Army Edgewood Chemical Biological Ctr. (USA); **Brian Culshaw**, Univ. of Strathclyde (United Kingdom); **Abdessaama Elyamani**, Northrop Grumman Navigation Systems (USA); **Yoel Fink**, Massachusetts Institute of Technology (USA); **Eric 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); **Svetlana A. Sukhishvili**, Stevens Institute of Technology (USA); **Dennis J. Trevor**, OFS Labs. (USA); **Xingwei Wang**, Univ. of Massachusetts Lowell (USA); **Reinhardt Willsch**, IPHT Jena (Germany); **Younan Xia**, Washington Univ. in St. Louis (USA); **Hai Xiao**, Missouri Univ. of Science and Technology (USA)

Thursday 28 April

SESSION 1

Room: Crystal E. Thurs. 8:00 to 10:00 am

Evanescent Field Sensing, Long Period Gratings, Structured Fibers

Session Chair: **Stephen J. Mihailov**, Communications Research Ctr. Canada (Canada)

8:00 am: **Polarization properties of tilted fiber Bragg gratings for novel sensing modalities** (*Invited Paper*), Jacques Albert, Li-Yang Shao, Aexander Beliaev, Carleton Univ. (Canada); Christophe Caucheteur, Faculté Polytechnique de Mons (Belgium). [8028-01]

8:30 am: **Chiral fiber sensors for harsh environments** (*Invited Paper*), Victor I. Kopp, Jonathan Singer, Daniel Neugroschl, Azriel Z. Genack, Chiral Photonics, Inc. (USA). [8028-02]

9:00 am: **Long period grating in photonic crystal fiber as opto-microfluidic label-free biosensor**, Zonghu He, Fei Tian, Stevens Institute of Technology (USA); Jiri Kanka, Institute of Photonics and Electronics of the ASCR, v.v.i. (Czech Republic); Nina Lavinskaia, High Tech High School (USA); Dennis J. Trevor, OFS Labs. (USA); Henry H. Du, Stevens Institute of Technology (USA). [8028-03]

9:20 am: **Sensitive fluorescence detection with microstructured optical fibers**, Erik P. Scharfner, Heike Ebdorff-Heidepriem, Tanya M. Monro, The Univ. of Adelaide (Australia). [8028-04]

9:40 am: **Photonic crystal fiber long-period gratings as refractive index transduction platform for gas sensing**, Fei Tian, Zonghu He, Stevens Institute of Technology (USA); Jiri Kanka, Institute of Photonics and Electronics of the ASCR, v.v.i. (Czech Republic); Dennis J. Trevor, OFS Labs. (USA); Henry H. Du, Stevens Institute of Technology (USA). [8028-05]

Coffee Break 10:00 to 10:30 am

SESSION 2

Room: Crystal E. Thurs. 10:30 to 11:50 am

Fiber Optic Sensing in Harsh Environments

Session Chair: **Henry H. Du**, Stevens Institute of Technology (USA)

10:30 am: **Thermally regenerated fiber Bragg gratings in air-hole microstructured fibers for high-temperature pressure sensing** (*Invited Paper*), Kevin P. Chen, Tong Chen, Jordan B. Negley, Univ. of Pittsburgh (USA); Dan Grobnc, Stephen J. Mihailov, Communications Research Ctr. Canada (Canada); John Canning, The Univ. of Sydney (Australia). [8028-06]

11:00 am: **High speed measurements using fiber-optic Bragg gratings** (*Invited Paper*), Jerry J. Benterou, Chadd M. May, Lawrence Livermore National Lab. (USA); Eric Udd, Columbia Gorge Research (USA). [8028-07]

11:30 am: **Study of blast event propagation in different materials using a novel ultrafast miniature optical pressure sensor**, Xiaotian Zou, Nan Wu, Ye Tian, Jiacheng Li, Kai Sun, Xingwei Wang, Univ. of Massachusetts Lowell (USA). [8028-08]

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

SESSION 3

Room: Crystal E. Thurs. 1:20 to 5:00 pm

Fiber Bragg Gratings for Sensing

Session Chair: **Gary Pickrell**, Virginia Polytechnic Institute and State Univ. (USA)

1:20 pm: **Advanced spectral fiber optic sensor systems and their application in energy facility monitoring** (*Invited Paper*), Reinhardt Willsch, Wolfgang Ecke, Institut für Photonische Technologien e.V. (Germany); Thomas Bosselmann, Michael Willsch, Siemens AG (Germany); Eric Lindner, Hartmut Bartelt, Institut für Photonische Technologien e.V. (Germany). [8028-09]

1:50 pm: **All-optical vibration and temperature monitoring systems for large scale power generators** (*Invited Paper*), Luis A. Ferreira, Francisco M. Araújo, FiberSensing (Portugal); Evangelos V. Diatzikis, Siemens Power Generation, Inc. (USA). [8028-10]

2:20 pm: **Advanced draw-tower fiber Bragg gratings and their application in sensing**, Eric Lindner, Institut für Photonische Technologien e.V. (Germany); Christoph Chojetzki, Julia Moerbitz, FBGS Technologies GmbH (Germany); Martin Becker, Sven Brückner, Reinhardt Willsch, Manfred Rothhardt, Hartmut Bartelt, Institut für Photonische Technologien e.V. (Germany). [8028-11]

2:40 pm: **Automatic fiber Bragg grating fabrication system for mass production**, Yunmiao Wang, Jianmin Gong, Dorothy Y. Wang, Bo Dong, Anbo Wang, Virginia Polytechnic Institute and State Univ. (USA). [8028-12]

Coffee Break 3:00 to 3:30 pm

3:30 pm: **Innovative use of embedded FBG sensors in civil engineering and other applications** (*Invited Paper*), Giorgio Nosenzo, Monitor Optics Solutions (Australia). [8028-13]

4:00 pm: **Next generation distributed fiber optic acoustic emission sensor (FAESense™) system for condition-based maintenance**, Edgar A. Mendoza, Redondo Optics, Inc. (USA). [8028-14]

4:20 pm: **A 40 ksamples/sec spectrometer based FBG interrogator, capable of simultaneously measuring more than 16 FBG sensors**, Jan P. Vermeiren, Jonas L. Bentell, Danny De Gaspari, Dirk Uwaerts, Peet Verbeke, Xenics NV (Belgium); Johan Vlekken, OpticalFiberSensors.org BVBA (Belgium). . . . [8028-15]

4:40 pm: **A discrete liquid level sensor based on fiber Bragg grating**, Dongcao Song, Jilin Zou, Jing Xie, Hong-liang cui, L.C. Pegasus Corp. (USA). . . . [8028-16]

SESSION 4

Room: Crystal E. Thurs. 5:00 to 5:50 pm

Novel Sensing Fiber Optic Sensing Techniques

Session Chair: Gary Pickrell,

Virginia Polytechnic Institute and State Univ. (USA)

5:00 pm: **Fiber laser sensors: enabling the next generation of miniaturized, wideband marine sensors** (*Invited Paper*), Geoffrey A. Cranch, Gary A. Miller, Clay K. Kirkendall, U.S. Naval Research Lab. (USA) [8028-17]

5:30 pm: **Surface scattering plasmon resonance fibre sensors: demonstration of rapid influenza A virus detection**, Alexandre Francois, Jonathan Boehm, The Univ. of Adelaide (Australia); Sawyin Oh, Tuckweng Kok, Institute of Medical and Veterinary Science (Australia); Tanya Monro, The Univ. of Adelaide (Australia) [8028-18]

POSTERS—Thursday

Room: Crystal M Thurs. 6:00 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. 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 pm 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.

Computational analysis and considerations of an optical fiber sensor with multiple cladding, Jose A. Betancur Ramirez, Univ. EAFIT (Colombia) . [8028-25]

A research on polarization effects in an distributed optical fiber sensor disturbance location system, Haiyan Xu, Xiao Qian, Fudan Univ. (China) [8028-26]

A novel frequency domain location method in distributed optic-fiber sensor based on PGC, Haiyan Xu, Hongyan Wu, Xiao Qian, Fudan Univ. (China); Zhong-De Qiao, Zhengben Water Purification Co., Ltd. (China) [8028-27]

All-fiber multimode interference micro-displacement sensor, Jose E. Antonio-López, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) and CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Jaime A. Arredondo-Lucio, Univ. Autónoma de Tamaulipas (Mexico); Patrick L. Likamwa, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Daniel A. May-Arrijoa, Univ. Autónoma de Tamaulipas (Mexico) . . [8028-28]

Phase-shifted Bragg gratings generated by CO₂ laser post-fabrication processing, Fawen Guo, Ming Han, Univ. of Nebraska-Lincoln (USA) . . [8028-29]

Automated testing for the fast and accurate determination of detergent efficiency by optical fibre sensors, Maria Patitsa, Helge Pfeiffer, Martine Wevers, Katholieke Univ. Leuven (Belgium) [8028-31]

Friday 29 April

SESSION 5

Room: Crystal E. Fri. 8:30 to 10:30 am

Novel Micro-optic Devices and Sensing Applications

Session Chair: Henry H. Du, Stevens Institute of Technology (USA)

8:30 am: **Optical efficiency in metal-lined capillary waveguide Raman sensors**, Stephen Biedrzycki, Michael P. Buric, National Energy Technology Lab. (USA) and Univ. of Pittsburgh (USA); Joel Falk, Steven D. Woodruff, National Energy Technology Lab. (USA) [8028-19]

8:50 am: **Position Determination and Monitoring of Disturbance along Distributed Fiber Optic Sensors**, Hongyan Wu, Haiyan Xu, Tingting Bu, Dong Zhao, Fudan Univ. (China) [8028-20]

9:10 am: **Lithographic inscription of micro-optical devices on a multi-material optical fiber tip**, Joshua Kaufman, Guangming Tao, Ayman F. Abouraddy, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) [8028-21]

9:30 am: **Test of a novel miniature blood pressure sensor in the coronary arteries of a swine model**, Nan Wu, Kai Sun, Xiaotian Zou, Univ. of Massachusetts Lowell (USA); Kurt Barringhaus, Univ. of Massachusetts Medical School (USA); Xingwei Wang, Univ. of Massachusetts Lowell (USA) . . . [8028-22]

9:50 am: **Optoacoustic fiber optic interferometric sensors for biomedical applications**, Daniel C. Gallego, Horacio Lamela, Univ. Carlos III de Madrid (Spain) [8028-23]

10:10 am: **Continuous monitoring of plant fiber-optic interferometric sensing**, Julius Chatterjee, Barry G. Grossman, Florida Institute of Technology (USA) [8028-24]

Courses of Related Interest

SC719 **Chemical & Biological Detection: Overview of Point and Standoff Sensing Technologies** (Gardner) Monday, 8:30 am to 12:30 pm

SC952 **Applications of Detection Theory** (Carrano) Thursday, 8:30 am to 5:30 pm

SC1034 **Lab-on-a-Chip Technology - Towards Portable Detection Systems** (Gärtner) Friday, 8:30 am to 12:30 pm

Visit the registration desk for course descriptions or to register

Sensing Technologies for Global Health, Military Medicine, Disaster Response, and Environmental Monitoring

NEW

Conference Chairs: **Sárka O. Southern**, Gaia Medical Institute (USA); **Kevin N. Montgomery**, U.S. Army Telemedicine and Advanced Technology Research Ctr. (USA); **Carl W. Taylor**, Univ. of South Alabama (USA); **Bernhard H. Weigl**, PATH (USA)

Program Committee: **Mark J. Buller**, U.S. Army Research Institute of Environmental Medicine (USA); **John C. Carrano**, Carrano Consulting (USA); **Samuel N. Cheuvront**, U.S. Army Research Institute of Environmental Medicine (USA); **James B. Delehanty III**, U.S. Naval Research Lab. (USA); **Theresa G. Evans-Nguyen**, The Charles Stark Draper Lab., Inc. (USA); **Konrad Faulstich**, Embedded System Engineering GmbH (Germany); **Marjorie J. Greene**, CNA Corp. (USA); **Peter Kiesel**, Palo Alto Research Center, Inc. (USA); **Baochuan Lin**, U.S. Naval Research Lab. (USA); **Igor L. Medintz**, U.S. Naval Research Lab. (USA); **Christopher Myers**, Naval Health Research Ctr. (USA); **Worth Nowlin, Jr.**, Texas A&M Univ. (USA); **Richard M. Ozanich**, Pacific Northwest National Lab. (USA); **Lada Rasochova**, Univ. of California, San Diego (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); **Aurel Ymeti**, Ostendum R&D BV (Netherlands); **Kevin Wang**, Banyan Biomarkers, Inc. (USA); **David E. Wolf**, Radiation Monitoring Devices, Inc. (USA)

Monday 25 April

SESSION 1

Room: Crystal E. Mon. 8:00 am to 12:00 pm

Global Health and Disease Surveillance I

Session Chairs: **Paul LaBarre**, PATH (USA); **Sárka O. Southern**, Gaia Medical Institute (USA)

8:00 am: **Instrument free nucleic acid amplification assays for global health settings** (*Invited Paper*), Paul LaBarre, Bernhard H. Weigl, PATH (USA) [8029A-01]

8:30 am: **Novel approaches in diagnosing tuberculosis**, Arend H. J. Kolk, Ngoc A. Dang, Sjoukje Kuijper, Univ. van Amsterdam (Netherlands); Tim Gibson, Scensive Technologies, Ltd. (United Kingdom); Richard Anthony, Royal Tropical Institute (Netherlands); Mareli Claassens, Stellenbosch Univ. (South Africa); Erwin Kaal, DSM Food Specialties (Netherlands); Hans-Gerd Janssen, Unilever N.V. (Netherlands) [8029A-02]

8:50 am: **Massively multiplexed microbial identification using resequencing DNA microarrays for outbreak investigation**, Tomasz A. Leski, U.S. Naval Research Lab. (USA) [8029A-03]

9:10 am: **Label-free methods for detection of viruses by magnetic relaxometry**, Louis H. Strong, Daniel B. Hall, Gregory Derderian, Radiation Monitoring Devices, Inc. (USA); Michael A. Whitt, The Univ. of Tennessee Health Science Ctr. (USA); Gyula Varadi, Radiation Monitoring Devices, Inc. (USA) [8029A-04]

9:30 am: **Tunable wavelength interrogated sensor platform (TWIST) for point-of-care diagnostics of infectious diseases**, Sonia Grego, Kristin H. Gilchrist, Brian R. Stoner, RTI International (USA) [8029A-05]

9:50 am: **Constructing paths through social networks for disease surveillance**, Marjorie J. Greene, CNA Corp. (USA) [8029A-06]

10:10 am: **Solving stochastic epidemiological models using computer algebra**, Juan F. Ospina, Univ. EAFIT (Colombia) [8029A-07]

Coffee Break 10:30 to 11:00 am

11:00 am: **Molecular and cellular sensing on health diagnostic compact disc in portable computer for global health and telemedicine**, Logan Liu, Univ. of Illinois at Urbana-Champaign (USA) [8029A-08]

11:20 am: **Lab-on-a-cellphone as an emerging telemedicine platform**, Onur Mudanyali, Derek Tseng, Cetin Oztoprak, Serhan O. Isikman, Ikbal Sencan, Oguzhan Yaglidere, Aydogan Ozcan, Univ. of California, Los Angeles (USA) [8029A-09]

11:40 am: **On-chip blood analysis using lensless microscopy**, Serhan O. Isikman, Univ. of California, Los Angeles (USA); Sungkyu Seo, Korea Univ. (Korea, Republic of); Ikbal Sencan, Onur Mudanyali, Ting-Wei Su, Waheb Bishara, Anthony Erlinger, Aydogan Ozcan, Univ. of California, Los Angeles (USA) [8029A-10]

Lunch Break 12:00 to 1:30 pm

SESSION 2

Room: Crystal E. Mon. 1:30 to 3:10 pm

Global Health and Disease Surveillance II

Session Chairs: **Paul LaBarre**, PATH (USA); **Sárka O. Southern**, Gaia Medical Institute (USA)

1:30 pm: **Digital microbiology: detection and classification of unknown bacterial pathogens using a label-free laser light scatter-sensing system**, Bartek P. Rajwa, Purdue Univ. (USA); M. Murat Dundar, Ferit Akova, Indiana Univ.-Purdue Univ. Indianapolis (USA); Valery Patsek, J. Eric Dietz, Purdue Univ. (USA); Arun K. Bhunia, Ctr. for Food Safety Engineering (USA); E. Daniel Hirleman, J. Paul Robinson, Purdue Univ. (USA) [8029A-11]

1:50 pm: **Digital pathology: development and validation of feature analysis on consecutive tissue sections**, Trevor D. Johnson, Frank Voelker, G. David Young, Steven Potts, Flagship Biosciences, LLC (USA) [8029A-12]

2:10 pm: **Concurrent magnetic resonance and diffuse optical imaging for neo-adjuvant therapy assessment**, Madhavi Seetamraju, Xuefeng Zhang, Radiation Monitoring Devices, Inc. (USA); Scott Davis, Dartmouth College (USA); Rajan Gurjar, Richard Myers, Radiation Monitoring Devices, Inc. (USA); Brian W. Pogue, Dartmouth College (USA); Gerald Entine, Radiation Monitoring Devices, Inc. (USA) [8029A-13]

2:30 pm: **Light without substrate amendment: the bacterial luciferase gene cassette as a mammalian bioreporter**, Dan Close, Tingting Xu, Pat Jegier, Abby Smartt, Steven A. Ripp, Gary Saylor, The Univ. of Tennessee (USA) . . . [8029A-14]

2:50 pm: **Characterization of a chromosomally integrated luxCDABE marker for investigation of STEC shedding in cattle**, Yingying Hong, The Univ. of Tennessee (USA) [8029A-15]

Coffee Break 3:10 to 3:40 pm

SESSION 3

Room: Crystal E. Mon. 3:40 to 5:40 pm

Global Health: Ensuring Safe Water Supply

Session Chairs: **Peter Kiesel**, Palo Alto Research Center, Inc. (USA); **Sárka O. Southern**, Gaia Medical Institute (USA)

3:40 pm: **Measuring from source to tap: ensuring water supply safety and security** (*Invited Paper*), Dan J. Kroll, Hach Co., Inc. (USA) [8029A-16]

4:10 pm: **On-the-flow pathogen detection in water**, Peter Kiesel, Joerg Martini, Malte F. Huck, Noble M. Johnson, Marshall Bern, Palo Alto Research Center, Inc. (USA) [8029A-18]

4:30 pm: **Large area radiation source for water and wastewater treatment**, Michael T. Mueller, Seungwoo Lee, Anthony Kloba, Ronald Hellmer, Nalin Kumar, Mark Eaton, Stellarray (USA); Charlotte Rambo, Suresh Pillai, Texas A&M Univ. (USA) [8029A-19]

4:50 pm: **Early warning system for detection of microbial contamination of source waters** (*Invited Paper*), Claus T. Mogensen, Anders Bentzen, Mogens Lau, Bo Højris, Kåre Iversen, Grundfos AS (Denmark) [8029A-20]

5:20 pm: **A new demulsifier device for oil-water separation in oil tanks**, Mahmoud Meribout, The Petroleum Institute (United Arab Emirates) . . [8029A-74]

Tuesday 26 April

Symposium-Wide Plenary Session

Tuesday • 8:30 to 9:30 am • Location: Crystal H

Dr. Regina E. Dugan

Director, Defense Advanced Research Projects Agency (DARPA)

See page 18 for details • Open to All Attendees

Coffee Break 9:30 to 10:00 am

SESSION 4

Room: Crystal E. Tues. 10:00 am to 12:30 pm

Military Health and Traumatic Brain Injury I

*Session Chairs: C. Edward Dixon, Univ. of Pittsburgh (USA);
Kevin N. Montgomery, Stanford Univ. (USA)*

10:00 am: **Traumatic brain injury produced by exposure to blasts—a critical problem in current wars: biomarkers, clinical studies, and animal models** (*Invited Paper*), C. Edward Dixon, Univ. of Pittsburgh (USA) [8029A-21]

10:30 am: **Biomarkers for severe, moderate and mild traumatic brain injury**, Kevin Wang, Banyan Biomarkers, Inc. (USA) [8029A-22]

10:50 am: **Saliva-based biomarkers for noninvasive diagnostics: applications for mTBI, PTSD and HIV/AIDS**, Sárka O. Southern, Gaia Medical Institute (USA) [8029A-23]

11:10 am: **Field-based multiplexed and quantitative assay platforms for diagnostics of TBI and wound infections**, Srivatsa Venkatasubbarao, Intelligent Optical Systems, Inc. (USA) [8029A-24]

11:30 am: **Virtual reality exposure therapy for combat related PTSD**, Albert S. Rizzo III, The Univ. of Southern California (USA) [8029A-25]

11:50 am: **Accelerating the commercialization of university technologies for military healthcare applications: the role of the proof of concept process**, Rosibel Ochoa, Lada Rasochova, Univ. of California, San Diego (USA). [8029A-27]

12:10 pm: **A non-contact ECG sensing platform**, Xiong Yu, Case Western Reserve Univ. (USA) [8029A-48]

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

SESSION 5

Room: Crystal E. Tues. 1:30 to 2:50 pm

Military Health and Traumatic Brain Injury II

*Session Chairs: C. Edward Dixon, Univ. of Pittsburgh (USA);
Kevin N. Montgomery, Stanford Univ. (USA)*

1:30 pm: **Detecting gait alterations due to concussion impairment with radar using information-theoretic techniques**, Jennifer Palmer, Kristin Bing, Amy Sharma, Eugene Greneker, Georgia Tech Research Institute (USA) ... [8029A-28]

1:50 pm: **A miniature pressure sensor for blast event evaluation**, Nan Wu, Wenhui Wang, Ye Tian, Christopher Niezrecki, Xingwei Wang, Univ. of Massachusetts Lowell (USA) [8029A-29]

2:10 pm: **Point-of-care instrument for monitoring tissue health during skin graft repair**, Rajan Gurjar, Madhavi Seetamraju, David E. Wolf, Radiation Monitoring Devices, Inc. (USA) [8029A-30]

2:30 pm: **Towards trustworthy medical device systems**, Nathanael Paul, Oak Ridge National Lab. (USA); David C. Klonoff M.D., Mills-Peninsula Diabetes Research Institute (USA) [8029A-31]

SESSION 6

Room: Crystal E. Tues. 2:50 to 6:00 pm

Disaster Response and Situational Awareness

*Session Chairs: Ricardo Arias, U.S. Dept. of Defense (USA);
Carl W. Taylor, Univ. of South Alabama (USA)*

2:50 pm: **Classification of airborne particles from two-dimension, angle-resolved optical scattering (TAOS) patterns by a new feature extraction method**, Giovanni F. Crosta, Univ. degli Studi di Milano-Bicocca (Italy); Yongle Pan, U.S. Army Research Lab. (USA); Richard K. Chang, Yale Univ. (USA) [8029A-49]

3:10 pm: **Beyond command and control**, Ricardo Arias, U.S. Dept. of Defense (USA) [8029A-32]

Coffee Break 3:30 to 4:00 pm

4:00 pm: **Paradigms for integration and data synthesis of military, civilian and infrastructure health through adaptive software defined radio and antennas (SDR-A)**, Gerald Lillenthal, Argon ST (USA) [8029A-34]

4:20 pm: **Communication architectures for remote environmental monitoring**, Tarun Soni, Argon ST, Inc. (USA) [8029A-35]

4:40 pm: **Using social media to communicate during crises: an analytic methodology**, Marjorie J. Greene, CNA (USA) [8029A-36]

5:00 pm: **Mobile sensors for environmental chemical awareness**, Erica Forzani, Cheng Chen, Amlendu Prabhakar, Rui Wang, Francis Tsow, Nongjian Tao, Arizona State Univ. (USA) [8029A-38]

5:20 pm: **The development of a multiband system for early detection of wildfire fires and indoor search and rescue operations**, Benedict Gouverneur, Guy Gielis, Jonathan Cloots, Stefan Nemeth, Jan P. Vermeiren, Xenics NV (Belgium) [8029A-39]

5:40 pm: **Evaluating the capability of SPOT5 data in monitoring pollarding forest areas of Northern Zagros: case study—Kurdistan, pollarded forests of Baneh, Djafar Oladi, Ayob Moradi, Univ. of Mazandaran (Iran, Islamic Republic of) [8029A-53]**

POSTERS—Tuesday

Room: Crystal M Tues. 6:00 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. 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 pm 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.

Global Health

Field-portable semen analysis using lensless microscopy on a chip, Ting-Wei Su, Anthony Erlinger, Derek Tseng, Aydogan Ozcan, Univ. of California, Los Angeles (USA) [8029A-46]

Amplification-free point of care immunosensor for high sensitivity monitoring of lung transplant rejection, Pei-Yu Chung, Evelyn R. Bracho-Sanchez, Peng Jiang, Gregory Schultz, Christopher D. Batich, Univ. of Florida (USA) [8029A-47]

Environmental Monitoring

Research of soil moisture retrieval in arid region on the moistured scale, Qing Zhang, National Astronomical Observatories (China); Kefa Zhou, Xinjiang Institute of Ecology and Geography (China) [8029A-40]

Aerosol sensing technologies in the mining industry, Sam Janisko, National Institute for Occupational Safety and Health (USA) [8029A-51]

A statistical method to correct radiometric data measured by AVHRR onboard the National Oceanic and Atmospheric Administration (NOAA) Polar Orbiting Environmental Satellites (POES), Md. Z. Rahman, LaGuardia Community College (USA); Leonid Roytman, The City College of New York (USA); Abdel Hamid Kadik, LaGuardia Community College (USA) [8029A-52]

Low-power wireless trace gas sensing network, Clinton J. Smith, Stephen So, Amir Khan, Mark A. Zondlo, Gerard Wysocki, Princeton Univ. (USA) ... [8029A-54]

Simultaneous detection of atmospheric nitrous oxide and carbon monoxide using a quantum cascade laser, Amir Khan, Kang Sun, Mark A. Zondlo, Princeton Univ. (USA) [8029A-55]

Novel handheld x-ray fluorescence spectrometer for routine testing for the presence of lead, Noa M. Rensing, Timothy C. Tiernan, Michael R. Squillante, Radiation Monitoring Devices, Inc. (USA) [8029A-56]

Environmental monitoring of brominated flame retardants, Mary C. Vagula, Nathan Kubeldis, Gannon Univ. (USA); Charles F. Nelatury, Univ. of Pennsylvania (USA) [8029A-57]

Conference 8029A

Wednesday 27 April

SESSION 7

Room: Crystal E. Wed. 10:00 am to 12:00 pm

Oil Spill (DHW) and Ocean Monitoring I

Session Chairs: **Sárka O. Southern**, Gaia Medical Institute (USA);
Weilin Will Hou, U.S. Naval Research Lab. (USA)

Joint Session with Conference 8030

Ocean Sensing and Monitoring III

- 10:00 am: **Measurement techniques for the Deepwater Horizon (MC-252) oil spill response** (*Invited Paper*), Richard Crout, National Oceanic and Atmospheric Administration (USA) [8030-18]
- 10:30 am: **Operational mapping of the DWH deep subsurface dispersed oil**, Harvey Seim, The Univ. of North Carolina at Chapel Hill (USA); Richard Crout, Glen Rice, National Oceanic and Atmospheric Administration (USA) . . . [8029A-41]
- 10:50 am: **Combining numerical ocean circulation models with satellite observations in a trajectory forecast system: a rapid response to the Deepwater Horizon oil spill** (*Invited Paper*), Yonggang Liu, Robert H. Weisberg, Chuanmin Hu, Univ. of South Florida (USA) [8030-19]
- 11:20 am: **Automated oil spill detection with multispectral imagery**, Brian Bradford, Pedro J. Sanchez-Reyes, ITT Corp. Geospatial Systems (USA)[8030-20]
- 11:40 am: **In situ characterization of distributions of dissolved contaminants using underwater mass spectrometry**, R. Timothy Short, Ryan J. Bell, Ashish Chaudhary, Strawn K. Toler, Friso H. W. van Amerom, SRI St. Petersburg (USA) [8029A-42]
- Lunch/Exhibition Break 12:00 to 1:30 pm

SESSION 8

Room: Crystal E. Wed. 1:30 to 3:30 pm

Oil Spill (DHW) and Ocean Monitoring II

Session Chairs: **Sárka O. Southern**, Gaia Medical Institute (USA);
Robert Arnone, U.S. Naval Research Lab. (USA)

Joint Session with Conference 8030

Ocean Sensing and Monitoring III

- 1:30 pm: **An empirical approach to derive MODIS ocean color patterns under severe sun glint**, Chuanmin Hu, Univ. of South Florida (USA) [8030-21]
- 1:50 pm: **Making sense of ocean sensing: the Gulf of Mexico Coastal Ocean Observing System links observations to applications**, Chris Simoniello, Gulf of Mexico Coastal Ocean Observing System Regional Association (USA) and Univ. of South Florida (USA); Ann E. Jochens, Matthew K. Howard, Texas A&M Univ. (USA); Joseph Swaykos, The Univ. of Southern Mississippi (USA); Douglas R. Levin, National Oceanic and Atmospheric Administration (USA); Debbi Stone, The Florida Aquarium, Inc. (USA); Barb Kirkpatrick, Mote Marine Lab. and Aquarium (USA) [8029A-43]
- 2:10 pm: **Building interoperable data systems in the Gulf of Mexico: a case study**, Matthew K. Howard, Texas A&M Univ. (USA) [8029A-44]
- 2:30 pm: **Developing technologies for regional ocean observing systems**, Jan R. van Smirren, Robert I. Smith, Gulf of Mexico Coastal Ocean Observing System Regional Association (USA); Xiaorui Guan, Fugro GEOS, Inc. (USA) . . . [8029A-45]
- 2:50 pm: **Texas coastal ocean observation network: data access and archive software**, Gary A. Jeffress, Scott Duff, Texas A&M Univ. Corpus Christi (USA) [8030-22]
- 3:10 pm: **Applications of high frequency radar for emergency response in the coastal ocean: utilization of the Central Gulf of Mexico Ocean Observing System during the Deepwater Horizon oil spill and vessel tracking**, Stephan Howden, The Univ. of Southern Mississippi (USA); Donald Barrick, Hector Aguilar, CODAR Ocean Sensors (USA) [8030-23]



Biometric Technology for Human Identification VIII

Conference Chairs: **B. V. K. Vijaya Kumar**, Carnegie Mellon Univ. (USA); **Salil Prabhakar**, DigitalPersona, Inc. (USA); **Arun A. Ross**, West Virginia Univ. (USA)

Program Committee: **George Bebis**, Univ. of Nevada, Reno (USA); **Thirimachos Bourlai**, West Virginia Univ. (USA); **Julien Bringer**, Morpho (France); **Mark Burge**, MITRE Corp. (USA); **Bernadette Dorizzi**, TELECOM & Management SudParis (France); **Eliza Yingzi Du**, Indiana Univ.-Purdue Univ. Indianapolis (USA); **Jianjiang Feng**, Tsinghua Univ. (China); **Julian Fierrez**, Univ. Autónoma de Madrid (Spain); **Patrick J. Flynn**, Univ. of Notre Dame (USA); **Venu Govindaraju**, Univ. at Buffalo (USA); **John M. Irvine**, The Charles Stark Draper Lab., Inc. (USA); **Anil K. Jain**, Michigan State Univ. (USA); **Sabah A. Jassim**, Univ. of Buckingham (United Kingdom); **Ioannis A. Kakadiaris**, Univ. of Houston (USA); **Josef Kittler**, Univ. of Surrey (United Kingdom); **Ajay Kumar**, The Hong Kong Polytechnic Univ. (Hong Kong, China); **David Maltoni**, Univ. degli Studi di Bologna (Italy); **Brian Martin**, L-1 Identity Solutions, Inc. (USA); **Karthik Nandakumar**, Institute for Infocomm Research (Singapore); **Karl Ricanek, Jr.**, Univ. of North Carolina at Wilmington (USA); **Marios Savvides**, Carnegie Mellon Univ. (USA); **Michael E. Schuckers**, St. Lawrence Univ. (USA); **Alex Stoianov**, Information and Privacy Commissioner/Ontario (Canada); **Zhenan Sun**, Institute of Automation (China); **Kar-Ann Toh**, Yonsei Univ. (Korea, Republic of); **Damon L. Woodard**, Clemson Univ. (USA); **Pong C. Yuen**, Hong Kong Baptist Univ. (Hong Kong, China)

Monday 25 April

SESSION 8

Room: Crystal Q Mon. 9:00 to 10:00 am

Face Biometrics

Session Chair: **B. V. K. Vijaya Kumar**, Carnegie Mellon Univ. (USA)

9:00 am: **Superresolution benefit for face recognition**, Shuowen Hu, Robert A. Maschal, Jr., Susan S. Young, Stephen M. Won, U.S. Army Research Lab. (USA); Tsai Hong, Jonathon Phillips, National Institute of Standards and Technology (USA) [8029B-58]

9:20 am: **A quantitative comparison of 3D face databases for 3D face recognition**, Dirk Smeets, Jeroen Hermans, Dirk Vandermeulen, Paul Suetens, Katholieke Univ. Leuven (Belgium) [8029B-59]

9:40 am: **QUEST hierarchy for hyperspectral face recognition**, David Ryer, U.S. Air Force (USA); Trevor J. Bihl, Kenneth W. Bauer, Air Force Institute of Technology (USA); Steven K. Rogers, Air Force Research Lab. (USA) . . [8029B-60]

Coffee Break 10:00 to 10:30 am

SESSION 9

Room: Crystal Q Mon. 10:30 to 11:15 am

Invited Session I

Session Chair: **Salil Prabhakar**, DigitalPersona, Inc. (USA)

10:30 am: **Video analytics and activity recognition (Invited Paper)**, Mubarak A. Shah, Univ. of Central Florida (USA) [8029B-61]

SESSION 10

Room: Crystal Q Mon. 11:15 am to 12:15 pm

Fingerprint and Voice Biometrics

Session Chair: **Salil Prabhakar**, DigitalPersona, Inc. (USA)

11:15 am: **Adding localization information in a fingerprint binary feature vector representation**, Julien Bringer, Vincent Despiegel, Mélanie Favre, Morpho (France) [8029B-62]

11:35 am: **Speech biometric mapping for key binding cryptosystem**, Keerati Inthavisas, Daniel P. Lopresti, Lehigh Univ. (USA) [8029B-63]

11:55 am: **C-BET evaluation of voice biometrics**, Dmitry O. Gorodnichy, Canada Border Services Agency (Canada); Michael Thiemi, International Biometric Group (Canada); Elan Dubrofsky, Canada Border Services Agency (Canada) [8029B-64]

Lunch Break 12:15 to 2:00 pm

SESSION 11

Room: Crystal Q Mon. 2:00 to 2:45 pm

Invited Session II

Session Chair: **B. V. K. Vijaya Kumar**, Carnegie Mellon Univ. (USA)

2:00 pm: **Recent advances in face and iris biometrics (Invited Paper)**, Arun A. Ross, West Virginia Univ. (USA) [8029B-65]

SESSION 12

Room: Crystal Q Mon. 2:45 to 3:45 pm

Iris Biometrics

Session Chair: **B. V. K. Vijaya Kumar**, Carnegie Mellon Univ. (USA)

2:45 pm: **Impact of out-of-focus blur on iris recognition**, Nadezhda A. Sazonova, The Univ. of Alabama at Tuscaloosa (USA); Stephanie C. Schuckers, Peter Johnson, Clarkson Univ. (USA); Paulo Lopez-Meyer, Edward S. Sazonov, The Univ. of Alabama at Tuscaloosa (USA); Lawrence Hornak, West Virginia Univ. (USA) [8029B-66]

3:05 pm: **A simple shape prior model for iris image segmentation**, Daniel Bishop, Anthony J. Yezzi, Jr., Georgia Institute of Technology (USA) . . [8029B-67]

3:25 pm: **Security enhanced BioEncoding for protecting iris codes**, Osama M. Ouda, Chiba Univ. (Japan) and Mansoura Univ. (Egypt); Norimichi Tsumura, Toshiya Nakaguchi, Chiba Univ. (Japan) [8029B-68]

Coffee Break 3:45 to 4:15 pm

SESSION 13

Room: Crystal Q Mon. 4:15 to 5:15 pm

Ocular Biometrics

Session Chair: **Salil Prabhakar**, DigitalPersona, Inc. (USA)

4:15 pm: **Challenging ocular image recognition**, Victor P. Pauca, Michael Forkin, Xiao Xu, Robert J. Plemmons, Wake Forest Univ. (USA); Arun A. Ross, West Virginia Univ. (USA) [8029B-69]

4:35 pm: **Segmentation-free ocular detection and recognition**, Andres F. Rodriguez, B. V. K. Vijaya Kumar, Carnegie Mellon Univ. (USA) [8029B-70]

4:55 pm: **Eye safety considerations in the design of an iris capture system**, Gil Abramovich, Frederick W. Wheeler, GE Global Research (USA) . . . [8029B-71]

Course of Related Interest

SC952 **Applications of Detection Theory** (Carrano) Thursday, 8:30 am to 5:30 pm

Visit the registration desk for course descriptions or to register

Ocean Sensing and Monitoring III

Conference Chairs: **Weilin W. Hou**, U.S. Naval Research Lab. (USA); **Robert Arnone**, U.S. Naval Research Lab. (USA)

Program Committee: **Kendall L. Carder**, SRI International (USA); **Georges R. Fournier**, Defence Research and Development Canada (Canada); **Michael P. Strand**, Naval Surface Warfare Ctr. Panama City Div. (USA); **Chuck Trees**, NATO Undersea Research Ctr. (Italy); **Alan Weidemann**, U.S. Naval Research Lab. (USA); **Sarah Woods**, U.S. Naval Research Lab. (USA)

Tuesday 26 April

Symposium-Wide Plenary Session

Tuesday • 8:30 to 9:30 am • Location: Crystal H

Dr. Regina E. Dugan

Director, Defense Advanced Research Projects Agency (DARPA)

See page 18 for details • Open to All Attendees

Coffee Break 9:30 to 10:00 am

SESSION 1

Room: Crystal C. Tues. 10:00 am to 12:10 pm

Remote Sensing

Session Chair: **Joan S. Cleveland**, Office of Naval Research (USA)

10:00 am: **Hyperspectral and multispectral above-water radiometric measurements to monitor satellite data quality over coastal area** (*Invited Paper*), Samir Ahmed, The City College of New York (USA); Robert Arnone, U.S. Naval Research Lab. (USA); Curtiss O. Davis, Oregon State Univ. (USA); Alex Gilerson, Tristan Harmel, Soe Min Hlaing, Alberto Tonizzo, The City College of New York (USA); Alan Weidemann, U.S. Naval Research Lab. (USA) ... [8030-01]

10:30 am: **Estimation of the attenuation coefficient of the water body using polarimetric observations**, Alberto Tonizzo, Tristan Harmel, Amir Ibrahim, Alex Gilerson, Samir Ahmed, The City College of New York (USA) [8030-02]

10:50 am: **Automated detection and removal of cloud shadows on HICO images**, Ruhul Amin, U.S. Naval Research Lab. (USA) and Mississippi State Univ. (USA); Richard Gould, Weilin W. Hou, U.S. Naval Research Lab. (USA); Zhongping Lee, Mississippi State Univ. (USA); Robert Arnone, U.S. Naval Research Lab. (USA) [8030-03]

11:10 am: **Influence of aerosol estimation on coastal water products retrieved from HICO images**, Karen W. Patterson, Gia M. Lamela, U.S. Naval Research Lab. (USA) [8030-04]

11:30 am: **A plan for the polarimetric remote sensing of the oceans**, Deric J. Gray, U.S. Naval Research Lab. (USA) [8030-05]

11:50 am: **Infrared imaging of surface waves interaction with a submerged object**, Ivan Savelyev, Geoffrey B. Smith, U.S. Naval Research Lab. (USA) [8030-06]

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

SESSION 2

Room: Crystal C. Tues. 1:40 to 3:00 pm

UW Imaging

Session Chair: **Weilin Will Hou**, U.S. Naval Research Lab. (USA)

1:40 pm: **Optical modulation techniques for underwater detection, ranging and imaging**, Linda J. Mullen, Brandon Cochenour, Alan Laux, Derek Alley, Naval Air Systems Command (USA) [8030-07]

2:00 pm: **Impacts of optical turbulence on underwater imaging**, Weilin W. Hou, U.S. Naval Research Lab. (USA) [8030-08]

2:20 pm: **Turbulence measurements for underwater imaging**, Sarah Woods, Weilin W. Hou, Wesley Goode, Ewa Jarosz, Alan Weidemann, U.S. Naval Research Lab. (USA) [8030-09]

2:40 pm: **Experimental imaging performance evaluation for alternate configurations of undersea pulsed laser serial imagers**, Fraser R. Dalgleish, A. K. Vuorenkoski, Bing Ouyang, Frank M. Caimi, Gero Nootz, Florida Atlantic Univ. (USA) [8030-10]

Coffee Break 3:00 to 3:30 pm

SESSION 3

Room: Crystal C. Tues. 3:30 to 5:50 pm

Ocean and Riverine Sensing

Session Chair: **Robert Arnone**, U.S. Naval Research Lab. (USA)

3:30 pm: **Creation of bathymetric maps using satellite imagery**, Bradley L. McCarthy, The Boeing Co. (USA); Richard C. Olsen, Angela M. Kim, Naval Postgraduate School (USA) [8030-11]

3:50 pm: **Using WorldView-2 to determine ocean bottom-type and bathymetry**, Krista R. Lee, Richard C. Olsen, Fred A. Kruse, Angela M. Kim, Naval Postgraduate School (USA) [8030-12]

4:10 pm: **Automated, in-water determination of colored dissolved organic material and phytoplankton community structure using the optical phytoplankton discriminator**, Gary J. Kirkpatrick, Mote Marine Lab. and Aquarium (USA); Steven E. Lohrenz, The Univ. of Southern Mississippi (USA); Mark A. Moline, California Polytechnic State Univ., San Luis Obispo (USA); Oscar Schofield, Rutgers Univ. (USA) [8030-13]

4:30 pm: **Design and implementation of cooperative autonomous underwater vehicles for Antarctic exploration**, Arturo E. Cadena, Jr., Escuela Superior Politécnica del Litoral (Ecuador) [8030-14]

4:50 pm: **Automated identification of rivers and shorelines in aerial imagery using image texture**, Paul McKay, Cheryl Ann Blain, U.S. Naval Research Lab. (USA); Robert S. Linzell, QinetiQ North America (USA) [8030-15]

5:10 pm: **Merging imagery and models for river current prediction**, Cheryl Ann Blain, U.S. Naval Research Lab. (USA); Robert S. Linzell, QinetiQ North America (USA); Paul McKay, U.S. Naval Research Lab. (USA) [8030-16]

5:30 pm: **Using thermal remote sensing as a tool for calibrating a hydrodynamic model in inland waters**, Nima Pahlevan, Aaron D. Gerace, John R. Schott, Rochester Institute of Technology (USA) [8030-17]

Wednesday 27 April

SESSION 4

Room: Crystal E Wed. 10:00 am to 12:00 pm

Oil Spill (DHW) and Ocean Monitoring I

Session Chairs: **Weilin Will Hou**, U.S. Naval Research Lab. (USA);
Sárka O. Southern, Gaia Medical Institute (USA)

Joint Session with Conference 8029A

Sensing Technologies for Global Health, Military Medicine, Disaster Response, and Environmental Monitoring

- 10:00 am: **Measurement techniques for the Deepwater Horizon (MC-252) oil spill response** (*Invited Paper*), Richard Crout, National Oceanic and Atmospheric Administration (USA) [8030-18]
- 10:30 am: **Operational mapping of the DWH deep subsurface dispersed oil**, Harvey Seim, The Univ. of North Carolina at Chapel Hill (USA); Richard Crout, Glen Rice, National Oceanic and Atmospheric Administration (USA) . . [8029A-41]
- 10:50 am: **Combining numerical ocean circulation models with satellite observations in a trajectory forecast system: a rapid response to the Deepwater Horizon oil spill** (*Invited Paper*), Yonggang Liu, Robert H. Weisberg, Chuanmin Hu, Univ. of South Florida (USA) [8030-19]
- 11:20 am: **Automated oil spill detection with multispectral imagery**, Brian Bradford, Pedro J. Sanchez-Reyes, ITT Corp. Geospatial Systems (USA)[8030-20]
- 11:40 am: **In situ characterization of distributions of dissolved contaminants using underwater mass spectrometry**, R. Timothy Short, Ryan J. Bell, Ashish Chaudhary, Strawn K. Toler, Friso H. W. van Amerom, SRI St. Petersburg (USA) [8029A-42]
- Lunch/Exhibition Break 12:00 to 1:30 pm

SESSION 5

Room: Crystal E Wed. 1:30 to 3:30 pm

Oil Spill (DHW) and Ocean Monitoring II

Session Chairs: **Sárka O. Southern**, Gaia Medical Institute (USA);
Robert Arnone, U.S. Naval Research Lab. (USA)

Joint Session with Conference 8029A

Sensing Technologies for Global Health, Military Medicine, Disaster Response, and Environmental Monitoring

- 1:30 pm: **An empirical approach to derive MODIS ocean color patterns under severe sun glint**, Chuanmin Hu, Univ. of South Florida (USA) [8030-21]
- 1:50 pm: **Making sense of ocean sensing: the Gulf of Mexico Coastal Ocean Observing System links observations to applications**, Chris Simoniello, Gulf of Mexico Coastal Ocean Observing System Regional Association (USA) and Univ. of South Florida (USA); Ann E. Jochens, Matthew K. Howard, Texas A&M Univ. (USA); Joseph Swaykos, The Univ. of Southern Mississippi (USA); Douglas R. Levin, National Oceanic and Atmospheric Administration (USA); Debbi Stone, The Florida Aquarium, Inc. (USA); Barb Kirkpatrick, Mote Marine Lab. and Aquarium (USA) [8029A-43]
- 2:10 pm: **Building interoperable data systems in the Gulf of Mexico: a case study**, Matthew K. Howard, Texas A&M Univ. (USA) [8029A-44]
- 2:30 pm: **Developing technologies for regional ocean observing systems**, Jan R. van Smirren, Robert I. Smith, Gulf of Mexico Coastal Ocean Observing System Regional Association (USA); Xiaorui Guan, Fugro GEOS, Inc. (USA) [8029A-45]
- 2:50 pm: **Texas coastal ocean observation network: data access and archive software**, Gary A. Jeffress, Scott Duff, Texas A&M Univ. Corpus Christi (USA) [8030-22]
- 3:10 pm: **Applications of high frequency radar for emergency response in the coastal ocean: utilization of the Central Gulf of Mexico Ocean Observing System during the Deepwater Horizon oil spill and vessel tracking**, Stephan Howden, The Univ. of Southern Mississippi (USA); Donald Barrick, Hector Aguilar, CODAR Ocean Sensors (USA) [8030-23]



Pick up your free souvenir!

Booth 1543

Tuesday-Thursday • Cypress Exhibition Hall

Ticket from Registration Packet required.
While supplies last.

Micro- and Nanotechnology Sensors, Systems, and Applications III

Conference Chairs: **Thomas George**, Zyomed Corp. (USA); **M. Saif Islam**, Univ. of California, Davis (USA); **Achyut K. Dutta**, Banpil Photonics, Inc. (USA)

Program Committee: **Debjyoti Banerjee**, Texas A&M Univ. (USA); **Steve Blair**, The Univ. of Utah (USA); **Anja Boisen**, Technical Univ. of Denmark (Denmark); **Robert Candler**, Univ. of California, Los Angeles (USA); **Scott D. Collins**, Univ. of Maine (USA); **Nibir K. Dhar**, Defense Advanced Research Projects Agency (USA); **Ernest J. Garcia**, Sandia National Labs. (USA); **Savas Kaya**, Ohio Univ. (USA); **Shanalyn A. Kemme**, Sandia National Labs. (USA); **Nobuhiko P. Kobayashi**, Univ. of California, Santa Cruz (USA); **Ryan P. Lu**, Space and Naval Warfare Systems Command (USA); **Joseph N. Mait**, U.S. Army Research Lab. (USA); **Robert Osiander**, The Johns Hopkins Univ. (USA); **Nezih Pala**, Florida International Univ. (USA); **Jeremy J. Pietron**, U.S. Naval Research Lab. (USA); **Michael K. Rafailov**, RICHER International LLC (USA); **Noriko Satake**, UC Davis Medical Ctr. (USA); **Andre U. Sokolnikov**, Visual Solutions and Applications (USA); **Kyung-Ah Son**, Jet Propulsion Lab. (USA); **Thomas G. Thundat**, Oak Ridge National Lab. (USA); **David V. Wick**, Sandia National Labs. (USA); **Eui-Hyeok Yang**, Stevens Institute of Technology (USA); **Karl Y. Yee**, Jet Propulsion Lab. (USA)

Monday 25 April

SESSION 1

Room: Crystal G1 Mon. 8:00 to 9:50 am

Dip Pen Nanolithography

Session Chairs: **Ryan P. Lu**, Space and Naval Warfare Systems Command (USA); **Debjyoti Banerjee**, Texas A&M Univ. (USA)

8:00 am: **Tip-based manufacturing (TBN): an approach to true nanotechnology** (Keynote Presentation), Kristen Bloschok, Adam R. Schofield, System Planning Corp. (USA); Thomas Kenny, Stanford Univ. (USA) ... [8031-01]

8:30 am: **Direct-write scanning probe lithography: toward a desktop fab** (Invited Paper), Louise R. Giam, Chad A. Mirkin, Northwestern Univ. (USA) [8031-02]

8:50 am: **Tip-based patterning of graphite and CVD graphene** (Invited Paper), Bryan Hicks, Norimasa Yoshimizu, Cornell Univ. (USA); Christopher O'Connell, Univ. of Rhode Island (USA); Amit K. Lal, Clifford R. Pollock, Cornell Univ. (USA) [8031-03]

9:10 am: **Nanofabrication using heated probe tips** (Invited Paper), Jonathan R. Felts, Patrick C. Fletcher, Suhas Somnath, James Pikul, Zhenting Dai, Univ. of Illinois at Urbana-Champaign (USA); Woo Kyung Lee, Paul E. Sheehan, U.S. Naval Research Lab. (USA); William P. King, Univ. of Illinois at Urbana-Champaign (USA) [8031-04]

9:30 am: **Laser-assisted nanoprocessing and growth of semiconductor nanostructures** (Invited Paper), Costas P. Grigoropoulos, David J. Hwang, Sang-Gil Ryu, Eunpa Kim, Jae-Hyuck Yoo, Bin Xiang, Oscar D. Dubon, Andrew M. Minor, Univ. of California, Berkeley (USA) [8031-05]

Coffee Break 9:50 to 10:20 am

SESSION 2

Room: Crystal G1 Mon. 10:20 to 11:30 am

Advanced Nanoscale Materials Systems

Session Chair: **Nobuhiko P. Kobayashi**, Univ. of California, Santa Cruz (USA)

10:20 am: **Semiconductor nanomembranes: a platform for new science and technology** (Keynote Presentation), Max G. Lagally, Univ. of Wisconsin-Madison (USA) [8031-06]

10:50 am: **Development of carbon nanotube-based sensors** (Invited Paper), M. Meyyappan, NASA Ames Research Ctr. (USA) [8031-07]

11:10 am: **Pillar-structured thermal neutron detectors: performance expectations and fabrication challenges** (Invited Paper), Rebecca J. Nikolic, Adam M. Conway, Radoslav Radev, Qinghui Shao, Lars F. Voss, Tzu-Fang Wang, Lawrence Livermore National Lab. (USA); Barry C. L. Cheung, Univ. of Nebraska-Lincoln (USA); Lorenzo Fabris, Charles L. Britton, Jr., Milton N. Ericson, Oak Ridge National Lab. (USA) [8031-08]

Lunch Break 11:30 am to 12:45 pm

SESSION 3

Room: Crystal G1 Mon. 12:45 to 2:35 pm

Micro/Nanotechnology for MM-Wave/THz Security Applications

Session Chair: **Robert Osiander**, The Johns Hopkins Univ. Applied Physics Lab. (USA)

12:45 pm: **The role of THz and submillimeter wave technology in DHS** (Keynote Presentation), Thomas P. Coty, U.S. Dept. of Homeland Security (USA); Anna Tedeschi, Strategic Analysis, Inc. (USA) [8031-09]

1:15 pm: **High-performance heterostructure backward diode detectors** (Invited Paper), Patrick J. Fay, Ze Zhang, Univ. of Notre Dame (USA) ... [8031-10]

1:35 pm: **A micro-fabricated sheet-beam Orotron THz source** (Invited Paper), Stergios J. Papadakis, Joan A. Hoffmann, Andrew H. Monica, David M. Deglau, Robert Osiander, The Johns Hopkins Univ. Applied Physics Lab. (USA); J. Yu, Thomas M. Antonsen, Jr., Gregory S. Nusinovich, The Univ. of Maryland (USA) [8031-11]

1:55 pm: **MEMS-based uncooled THz detectors for staring imagers** (Invited Paper), J. Allen Cox, Honeywell ACS Labs. (USA); Robert E. Higashi, Fouad Nusseibeh, C. Zins, Honeywell Solid State Electronics Ctr. (USA) [8031-12]

2:15 pm: **Integrated chip-scale THz technology** (Invited Paper), Michael C. Wanke, Sandia National Labs. (USA); Mark Lee, The Univ. of Texas at Dallas (USA); Chris D. Nordquist, Michael J. Cich, Adam M. Rowen, James R. Gillen, Sandia National Labs. (USA); Christian L. Arrington, Albert D. Grine, LMATA Govt. Services (USA); Charles T. Fuller, John L. Reno, Sandia National Labs. (USA) [8031-13]

SESSION 4

Room: Crystal G1 Mon. 2:35 to 5:15 pm

THz Characterization of Semiconductor Materials

Session Chair: **Andre U. Sokolnikov**, Visual Solutions and Applications (USA)

2:35 pm: **Programmatic perspectives with technical examples for THz materials characterization** (Keynote Presentation), Walter R. Buchwald, Air Force Research Lab. (USA) [8031-14]

3:05 pm: **THz characterization of hydrated and anhydrous materials** (Invited Paper), Andre U. Sokolnikov, Visual Solutions and Applications (USA) [8031-15]

Coffee Break 3:25 to 3:55 pm

- 3:55 pm: **THz heterodyne sensing with AlInN/GaN hot-electron microbolometers using quantum cascade lasers** (*Invited Paper*), Vladimir V. Mitin, Rahul Ramaswamy, Kai Wang, Univ. at Buffalo (USA); Andrey V. Muraviev, Univ. at Buffalo (USA) and Rensselaer Polytechnic Institute (USA); Gottfried Strasser, Andrea G. Markelz, Univ. at Buffalo (USA); Michael S. Shur, Rensselaer Polytechnic Institute (USA); Remis Gaska, Sensor Electronic Technology, Inc. (USA); Andrei V. Sergeev, Univ. at Buffalo (USA) [8031-16]
- 4:15 pm: **Ultra-fast metal-insulator transition in vanadium oxide thin films** (*Invited Paper*), Shriram Ramanathan, Harvard School of Engineering and Applied Sciences (USA) [8031-17]
- 4:35 pm: **Silicon and nitride FETs for THz sensing** (*Invited Paper*), Michael S. Shur, Rensselaer Polytechnic Institute (USA) [8031-18]
- 4:55 pm: **Terahertz active metamaterials and lasers** (*Invited Paper*), Benjamin S. Williams, Amir Ali Tavallae, Philip Hon, Tatsuo Itoh, Univ. of California, Los Angeles (USA); Qisheng Chen, Northrop Grumman Aerospace Systems (USA) [8031-19]

Tuesday 26 April

Symposium-Wide Plenary Session

Tuesday • 8:30 to 9:30 am • Location: Crystal H

Dr. Regina E. Dugan

Director, Defense Advanced Research Projects Agency (DARPA)

See page 18 for details • Open to All Attendees

Coffee Break 9:30 to 10:00 am

SESSION 5

Room: Crystal G1 Tues. 10:00 to 11:50 am

MEMS Optical Systems

Session Chairs: **David V. Wick**, Sandia National Labs. (USA);
Shanalyn A. Kemme, Sandia National Labs. (USA)

- 10:00 am: **Technology for Navy and Marine Corps EO/IR sensors and sensor systems** (*Keynote Presentation*), Michael Duncan, Office of Naval Research (USA) [8031-20]
- 10:30 am: **MEMs adaptive optics at the Naval Research Laboratory** (*Invited Paper*), Sergio R. Restaino, Jonathan R. Andrews, Ty Martinez, Christopher C. Wilcox, Freddie Santiago, Don M. Payne, U.S. Naval Research Lab. (USA) [8031-21]
- 10:50 am: **Actuation for deformable thin-shelled composite mirrors** (*Invited Paper*), Christopher C. Wilcox, U.S. Naval Research Lab. (USA); David V. Wick, Brett E. Bagwell, Sandia National Labs. (USA); Robert C. Romeo, Robert N. Martin, Composite Mirror Applications, Inc. (USA); Michael S. Baker, Nicole L. Breivik, Brad L. Boyce, Sandia National Labs. (USA); Ty Martinez, Sergio R. Restaino, U.S. Naval Research Lab. (USA) [8031-22]
- 11:10 am: **Micro ion frequency standard** (*Invited Paper*), Peter D. Schwindt, Yuan Jau, Heather Partner, Roy H. Olsson III, Kenneth Wojciechowski, Darwin K. Serkland, Lu Fang, Adrian Casias, Ronald P. Manginell, Matthew Moorman, Sandia National Labs. (USA) [8031-23]
- 11:30 am: **Imaging a linearly or circularly polarized scene: micro-components and shrimp** (*Invited Paper*), Shanalyn A. Kemme, David A. Scrymgeour, Alvaro A. Cruz-Cabrera, A. Robert Ellis, Robert R. Boye, Joel R. Wendt, Tony R. Carter, Sally Samora, Sandia National Labs. (USA) [8031-24]
- Lunch/Exhibition Break 11:50 am to 12:50 pm

SESSION 6

Room: Crystal G1 Tues. 12:50 to 2:00 pm

Nanophotonics

Session Chair: **Steve Blair**, The Univ. of Utah (USA)

- 12:50 pm: **Trends in nanophotonics** (*Keynote Presentation*), Gernot S. Pomrenke, Air Force Office of Scientific Research (USA) [8031-25]
- 1:20 pm: **Nanomembranes for optofluidic and autonomous systems** (*Invited Paper*), Oliver G. Schmidt, Leibniz-Institut für Festkörper- und Werkstoffforschung Dresden (Germany) [8031-26]
- 1:40 pm: **Integrated microsystems for molecular pathology** (*Invited Paper*), Axel Scherer, California Institute of Technology (USA) [8031-27]

SESSION 7

Room: Crystal G1 Tues. 2:00 to 2:40 pm

Photon Trapping with 1D Structures and Novel Device Applications

Session Chair: **M. Saif Islam**, Univ. of California, Davis (USA)

- 2:00 pm: **Efficient light-trapping nanostructures in thin silicon solar cells** (*Invited Paper*), Sang Eon Han, Anastassios Mavrokefalos, Matthew Branham, Carl G. Chen, Massachusetts Institute of Technology (USA) [8031-28]
- 2:20 pm: **Magnetically responsive photonic nanostructures: making color with magnets** (*Invited Paper*), Yadong Yin, Univ. of California, Riverside (USA) [8031-29]

SESSION 8

Room: Crystal G1 Tues. 2:40 to 4:40 pm

Advanced Nanomaterials, Nanolithography and Nanomanufacturing

Session Chair: **Eui-Hyeok Yang**, Stevens Institute of Technology (USA)

- 2:40 pm: **Functionalized DNA materials for sensing and medical applications** (*Keynote Presentation*), Dwight L. Woolard, U.S. Army Research Office (USA); James O. Jensen, U.S. Army Edgewood Chemical Biological Ctr. (USA) [8031-30]
- Coffee Break 3:10 to 3:40 pm
- 3:40 pm: **Photonic meta materials, nanoscale plasmonics, and super lens** (*Invited Paper*), Xiang Zhang, Univ. of California, Berkeley (USA) [8031-31]
- 4:00 pm: **Manufacturing coatings of micro- and nanoparticles by controlled evaporation of drops and thin films** (*Invited Paper*), Daniel Attinger, Columbia Univ. (USA) [8031-32]
- 4:20 pm: **Graphene optoelectronics based on antidot superlattices** (*Invited Paper*), Eui-Hyeok Yang, Stefan Strauf, Stevens Institute of Technology (USA) [8031-33]

Wednesday 27 April

SESSION 9

Room: Crystal G1 Wed. 8:00 to 9:40 am

Joint Session with conference 8045

MAST-Navigation

Session Chairs: **Larry H. Matthies**, Jet Propulsion Lab. (USA);
Joseph N. Mait, U.S. Army Research Lab. (USA)

- 8:00 am: **Results from MAST joint experiment 3.1** (*Invited Paper*), John G. Rogers III, Georgia Institute of Technology (USA) and Univ. of Pennsylvania (USA); Alex Cunningham, Manohar Paluri, Henrik I. Christensen, Georgia Institute of Technology (USA); Nathan Michael, Vijay Kumar, Univ. of Pennsylvania (USA); Larry H. Matthies, Jeremy Ma, Jet Propulsion Lab. (USA); Frank Dellaert, Georgia Institute of Technology (USA) [8031-34]
- 8:20 am: **Autonomous navigation with teams of aerial robots** (*Invited Paper*), Nathan Michael, Univ. of Pennsylvania (USA) [8031-35]
- 8:40 am: **Vision-aided landing and ingress of a micro-air-vehicle using a monocular camera** (*Invited Paper*), Roland Brockers, Jet Propulsion Lab. (USA); Patrick Bouffard, Univ. of California, Berkeley (USA); Jeremy Ma, Larry H. Matthies, Jet Propulsion Lab. (USA); Claire Tomlin, Univ. of California, Berkeley (USA) [8031-36]
- 9:00 am: **Estimation of vehicle velocity and proximity via wide-field integration of optic flow** (*Invited Paper*), James S. Humbert, Steven Gerardi, Andrew Hyslop, Univ. of Maryland, College Park (USA) [8031-37]
- 9:20 am: **Compact beam scanning 240GHz radar for navigation and collision avoidance** (*Invited Paper*), Kamal Sarabandi, Mehrnoosh Vahidpour, Maysam Moallem, Jack R. East, Univ. of Michigan (USA) [8031-38]

SESSION 10

Room: Crystal G1 Wed. 9:40 to 11:30 am

Joint Session with conference 8045

MAST-Communication

Session Chairs: **William Nothwang**, U.S. Army Research Lab. (USA);
Joseph N. Mait, U.S. Army Research Lab. (USA)

- 9:40 am: **New techniques for efficient flexible wireless transceivers in nanometer CMOS** (*Invited Paper*), Michael Flynn, Univ. of Michigan (USA) [8031-39]
Coffee Break 10:00 to 10:30 am
10:30 am: **Reconfigurable firmware-defined radios synthesized from standard digital logic cells** (*Invited Paper*), David D. Wentzloff, Muhammad Faisal, Youngmin Park, Univ. of Michigan (USA) [8031-40]
10:50 am: **Radio signal strength tracking and control for robotic networks** (*Invited Paper*), Brian M. Sadler, Paul Yu, Jeffrey Twigg, U.S. Army Research Lab. (USA) [8031-41]
11:10 am: **Enhanced ad hoc wireless connectivity in complex environment using small radio repeater systems** (*Invited Paper*), Kamal Sarabandi, Youngjun Song, Jungsuek Oh, Univ. of Michigan (USA) [8031-42]
Lunch/Exhibition Break 11:30 am to 12:45 pm

SESSION 11

Room: Crystal G1 Wed. 12:45 to 2:55 pm

Quality Factors for Nano/Micromechanical Resonators

Session Chairs: **Robert Candler**, Univ. of California, Los Angeles (USA);
Thomas George, Zyomed Corp. (USA)

- 12:45 pm: **Precision navigation and timing enabled by microtechnology: are we there yet?** (*Keynote Presentation*), Andrei M. Shkel, Defense Advanced Research Projects Agency (USA) [8031-43]
1:15 pm: **Energy dissipation in micro-mechanical resonators** (*Invited Paper*), Farrokh Ayazi, Georgia Institute of Technology (USA) [8031-44]
1:35 pm: **The effect of surface chemistry on the quality factors of micromechanical resonators** (*Invited Paper*), Melissa A. Hines, Cornell Univ. (USA) [8031-45]
1:55 pm: **Finite element modeling and simulation of thermo-elastical damping of MEMS vibrations** (*Invited Paper*), Saulius Kausinis, Kaunas Univ. of Technology (Lithuania); Karl Y. Yee, Jet Propulsion Lab. (USA); Rimantas Barauskas, Kaunas Univ. of Technology (Lithuania) [8031-46]
2:15 pm: **Thermal energy loss mechanisms in micro- to nano-scale devices** (*Invited Paper*), Amy E. Duwel, Jeff Lozow, Chris Fisher, Terese Phillips, Draper Lab. (USA); Roy H. Olsson III, Sandia National Labs. (USA); Marc S. Weinberg, Draper Lab. (USA) [8031-47]
2:35 pm: **Computational modeling of anchor loss in MEMS devices and correlations with experiments** (*Invited Paper*), K. C. Park, Univ. of Colorado at Boulder (USA) [8031-48]
Coffee Break 2:55 to 3:25 pm

SESSION 12

Room: Crystal G1 Wed. 3:25 to 5:15 pm

MEMS Performance Challenges

Session Chair: **Ernest J. Garcia**, Sandia National Labs. (USA)

- 3:25 pm: **An analysis of microsystems development at Sandia National Laboratories** (*Keynote Presentation*), Gilbert V. Herrera, Sandia National Labs. (USA) [8031-49]
3:55 pm: **MEMS performance challenges: packaging and shock tests** (*Invited Paper*), Liwei Lin, Univ. of California, Berkeley (USA) [8031-50]
4:15 pm: **Sensors for hydraulic-induced fracturing characterization** (*Invited Paper*), Jose Mireles, Jr., Univ. Autónoma de Ciudad Juárez (Mexico); Horacio Estrada, Ctr. Nacional de Metrología (Mexico); Roberto Ambrosio, Univ. Autónoma de Ciudad Juárez (Mexico) [8031-51]
4:35 pm: **Tribology in MEMS** (*Invited Paper*), Michael T. Dugger, Sandia National Labs. (USA) [8031-52]
4:55 pm: **MEMS and nanostructures: challenges and opportunities** (*Invited Paper*), Victor M. Castano, Univ. Nacional Autónoma de México (Mexico) [8031-53]

Thursday 28 April

SESSION 13

Room: Crystal G1 Thurs. 8:00 to 11:30 am

Joint Session with conference 8035

Nanotechnologies for Energy Generation and Storage

Session Chairs: **Jeremy J. Pietron**, U.S. Naval Research Lab. (USA);
Nezih Pala, Florida International Univ. (USA)

- 8:00 am: **Thermoelectric energy conversion using nanostructured materials** (*Invited Paper*), Carl G. Chen, Andrew Muto, D. Kramer, Ken McEnaney, H.-P. Feng, Massachusetts Institute of Technology (USA); W. S. Liu, Q. Zhang, B. Yu, Zhifeng Ren, Boston College (USA) [8031-54]
8:20 am: **Engineering carbon nanomaterials for future applications: energy and sensor** (*Invited Paper*), Wonbong Choi, Florida International Univ. (USA) [8031-55]
8:40 am: **Developments in MEMS scale printable alkaline and Li-ion technology** (*Invited Paper*), Karl Littau, Corie L. Cobb, Palo Alto Research Center, Inc. (USA) [8031-56]
9:00 am: **Further studies in the electrochemical/mechanical strength of printed microbatteries** (*Invited Paper*), Daniel A. Steingart, The City College of New York (USA) [8031-57]
9:20 am: **Energy and size-scalable 3D battery architectures** (*Invited Paper*), Jeffrey W. Long, U.S. Naval Research Lab. (USA) [8031-58]
9:40 am: **Ultrathin, microscale epitaxial compound semiconductor solar cells** (*Invited Paper*), John A. Rogers, Univ. of Illinois at Urbana-Champaign (USA) [8031-59]
Coffee Break 10:00 to 10:30 am
10:30 am: **Little Robeep: miniature power sources for autonomous systems** (*Invited Paper*), Shriram Ramanathan, Harvard School of Engineering and Applied Sciences (USA) [8031-60]
10:50 am: **Self-powered nanosystems: nanogenerators, piezotronics, and piezo-phototronics** (*Invited Paper*), Zhong Lin Wang, Georgia Institute of Technology (USA) [8031-61]
11:10 am: **Nanotechnology enabled flexible energy harvesting** (*Invited Paper*), Michael C. McAlpine, Princeton Univ. (USA) [8031-62]
Lunch/Exhibition Break 11:30 am to 12:45 pm

SESSION 14

Room: Crystal G1 Thurs. 12:45 to 2:35 pm

Micro- and Nanotechnology for Health Care Applications

Session Chairs: **Scott D. Collins**, Univ. of Maine (USA);
Noriko Satake, UC Davis Medical Ctr. (USA)

- 12:45 pm: **Cancer nanotechnology: new pipeline for diagnostics, imaging agents, and therapies** (*Keynote Presentation*), Krzysztof Ptak, NCI Ctr. for Strategic Scientific Initiatives (USA) [8031-63]
1:15 pm: **Nanomaterial strategies for immunodetection** (*Invited Paper*), Marc D. Porter, The Univ. of Utah (USA) [8031-64]
1:35 pm: **Nanoparticle-targeted therapy against childhood acute lymphoblastic leukemia** (*Invited Paper*), Noriko Satake, UC Davis Medical Ctr. (USA); Joyce S. Lee, Kai Xiao, Juntao Luo, Susmita Sarangi, UC Davis Cancer Ctr. (USA); Astra Chang, Bridget McLaughlin, Ping Zhou, Elaina Kenny, Liliya Kraynov, Sarah Arnott, Jeannine McGee, Jan Nolte, UC Davis Medical Ctr. (USA); Kit S. Lam, UC Davis Cancer Ctr. (USA) [8031-65]
1:55 pm: **Microfluidic and nanofluidic systems for the detection and quantification of biomolecules** (*Invited Paper*), Pamela N. Nge, Ming Yu, Weichun Yang, Jie Xuan, Mark N. Hamblin, Aaron R. Hawkins, Milton L. Lee, Adam T. Woolley, Brigham Young Univ. (USA) [8031-66]
2:15 pm: **Quantum dots and microfluidic single molecule detection for screening genetic and epigenetic cancer markers in clinical samples** (*Invited Paper*), Tza-Huei Wang, The Johns Hopkins Univ. (USA) [8031-67]

SESSION 15

Room: Crystal G1 Thurs. 2:35 to 5:15 pm

Micro- and Nanotechnology for Future Harsh Environment ApplicationsSession Chair: **Kyung-Ah Son**, Jet Propulsion Lab. (USA)2:35 pm: **Growth of carbon-based nanostructures** (*Keynote Presentation*), William C. Mitchel, John J. Boeckl, Air Force Research Lab. (USA) [8031-68]3:05 pm: **Micro- and nano-electronic technologies and their qualification methodology for harsh environment applications** (*Invited Paper*), Yuan Chen, NASA Langley Research Ctr. (USA); Mohammad Mojarradi, Elizabeth Kolawa, Jet Propulsion Lab. (USA) [8031-69]

Coffee Break 3:25 to 3:55 pm

3:55 pm: **Electronics for harsh environments in space exploration: now and beyond** (*Invited Paper*), Jagdish U. Patel, Jet Propulsion Lab. (USA) ... [8031-70]4:15 pm: **Chemical vapor sensing with carbon** (*Invited Paper*), Frank K. Perkins, U.S. Naval Research Lab. (USA) [8031-71]4:35 pm: **Graphene field-effect transistors for label-free chemical and biological sensors** (*Invited Paper*), Yasuhide Ohno, Kenzo Maehashi, Kazuhiko Matsumoto, The Institute of Scientific and Industrial Research (Japan) . . [8031-72]4:55 pm: **Graphene transistors: from rad-hard electronics to radiation detection** (*Invited Paper*), Yong P. Chen, Purdue Univ. (USA) [8031-73]

POSTERS—Thursday

Room: Crystal M Thurs. 6:00 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. 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 pm 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.

On chip MWCNT-PDMS micro-temperature sensors for MEMS/MST, Ajit Khosla, Simon Fraser Univ. (Canada) [8031-85]**Integration of CMM software standards for nanopositioning and nanomeasuring machines**, Erik Sparrer, Torsten Machleidt, Eberhard Manske, Karl-Heinz Franke, Technische Univ. Ilmenau (Germany) [8031-86]**A novel atomic layer deposition method to fabricate economical and robust large-area microchannel plate detectors**, Anil Mane, Qing Peng, Matthew Wetstein, Argonne National Lab. (USA); Henry J. Frisch, The Univ. of Chicago (USA) and Argonne National Lab. (USA); Oswald H. Siegmund, Univ. of California, Berkeley (USA); Jeffrey W. Elam, Argonne National Lab. (USA) [8031-87]**Fabrication of plasmonic nanopore array for biomolecule sensor**, Seong Soo Choi, Sun Moon Univ. (Korea, Republic of); Mounq Jin Park, Korea Military Academy (Korea, Republic of); DaiSik Kim, Nam Kyu Park, Seoul National Univ. (Korea, Republic of) [8031-88]**Compacteds nanoscale sensors by merging ZnO nanorods with interdigitated electrodes**, Qin Wang, Boban Gavric, Susanne Almqvist, Andreas Bergström, Wlodek Kaplan, Jan Y. Andersson, Acreo AB (Sweden) [8031-89]**Optimization of plasmonic grating THz source using finite element analysis**, Justin W. Cleary, Solid State Scientific Corp. (USA); Bahareh Haji-saeed, Jed Khoury, Walter R. Buchwald, Charles L. Woods, Air Force Research Lab. (USA); John Kierstead, Solid State Scientific Corp. (USA) [8031-90]**Highly tunable corrugated metal nano-grating laser using current injection**, Jed Khoury, Bahareh Haji-saeed, Charles L. Woods, Air Force Research Lab. (USA); John Kierstead, Solid State Scientific Corp. (USA) [8031-91]**Design of an ultrasensitive active pixel sensor that is based on silicon nanostructures**, Wayne Richardson, Qusemde (USA) [8031-92]**Zero-bandgap graphene for infrared sensing applications**, Ning Xi, Michigan State Univ. (USA) [8031-93]**Scalable fabrication of micro- and nanoparticles utilizing the Rayleigh instability in multi-material fibers**, Soroush Shabahang, Joshua Kaufman, Ayman F. Abouraddy, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) [8031-94]**Differential thermal analysis microsystem for explosive detection**, Jesper K. Olsen, Technical Univ. of Denmark (Denmark); Larry R. Senesac, Oak Ridge National Lab. (USA); Thomas G. Thundat, Univ. of Alberta (Canada); Anja Boisen, Technical Univ. of Denmark (Denmark) [8031-95]**Spatially resolved leakage radiation spectroscopy of integrated plasmonic microresonators**, Pieter G. Kik, Amitabh Ghoshal, Chatdanai Lumdee, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) ... [8031-96]**Rapid laser direct writing for extremely sensitive surface-enhanced Raman scattering substrates based on the photoreduction mechanism of silver nanoparticles**, Chen-Han Huang, Hsing-Ying Lin, National Chung Cheng Univ. (Taiwan) and National Cheng Kung Univ. (Taiwan) [8031-97]**Nanofabrication of large-scale periodic metal nanostructure arrays by nano-imprint lithography and laser annealing**, Chen-Han Huang, Hsing-Ying Lin, National Chung Cheng Univ. (Taiwan) and National Cheng Kung Univ. (Taiwan) [8031-98]**An implementation for the detection and analysis of negative peaks in an applied current signal across a silicon nanopore**, Joseph Billo, Waseem Asghar, Samir Iqbal, Univ. of Texas at Arlington (USA) [8031-99]**Nanostencil lithography for high-throughput fabrication of infrared plasmonic sensors**, Serap Aksu, Ahmet A. Yanik, Ronen Adato, Alp Artar, Min Huang, Hatice Altug, Boston Univ. (USA) [8031-100]**Cathodoluminescence of metal gratings and electron-beam induced current in metal-oxide-metal junctions for plasmonic applications**, Janardan Nath, Robert E. Peale, Casey Schwarz, Yuqing Lin, Leonid Chernyak, Univ. of Central Florida (USA); Jeffrey A. Bean, Guy Zummo, Glenn D. Boreman, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Walter R. Buchwald, Air Force Research Lab. (USA) [8031-101]**Nanochemical sensors: polyaniline nanofibers and graphene**, Bruce H. Weiller, The Aerospace Corp. (USA) [8031-102]**Nanosensors: from near-field to far-field applications**, Samuel P. Hernandez-Rivera, Julio G. Briano, Oliva M. Primera-Pedrozo, Leonardo C. Pacheco-Londoño, Pedro M. Fierro-Mercado, Natacha Souto-Melgar, Gloria M. Herrera, Marcia del R. Balaguera, Hilsamar Felix-Rivera, Univ. de Puerto Rico Mayagüez (USA) [8031-103]**Plasmonic photonic crystal MEMS platform for IFF and sensing applications**, Irina Puscasu, ICx Photonics (USA) [8031-104]**Hydrogenation effect on graphene field effect devices relevant to photonic device application**, Ahalapitiya H. Jayatissa, Madhav Gautam, The Univ. of Toledo (USA) [8031-105]**Design of low-cost photonic crystal-based three-dimensional invisibility cloak**, Geng Zheng, Hualiang Zhang, Yuankun Lin, Univ. of North Texas (USA) [8031-106]**Microoptoelectromechanical (MOEM) accelerometers: possibility versus performance**, Jagannath Nayak, Research Ctr. Imarat (India); Talabattula Srinivas, Indian Institute of Science (India) [8031-107]**Nanowire-based photodetectors: growth and development of chalcogenide nanostructured detectors**, Matthew King, Sean McLaughlin, David A. Kahler, Andre Berghmans, Brian P. Wagner, David J. Knuteson, Maaz Aziz, Narsingh B. Singh, Northrop Grumman Electronic Systems (USA) [8031-108]**Effect of dielectric layer on the response times of electrostatic MEMS switches**, Sudarshan R. Nelatury, Penn State Erie, The Behrend College (USA) [8031-109]**Tuneable optical waveguide using dielectrophoretically manipulated nanoparticles in microfluidics**, Aminuddin Kayani, Adam F. Chrimes, RMIT Univ. (Australia); Khashayar Khoshmanesh, Deakin Univ. (Australia); Aman Mitchell, Kourosh Kalantar-Zadeh, RMIT Univ. (Australia) [8031-110]**Dielectrophoresis-Raman spectroscopy system for analysing suspended WO₃ nanoparticles**, Adam F. Chrimes, Kourosh Kalantar-Zadeh, RMIT Univ. (Australia) [8031-111]

Conference 8031

Friday 29 April

SESSION 16

Room: Crystal G1 Fri. 8:00 to 9:00 am

Miniaturized Sensors and Systems

Session Chair: **Anja Boisen**, Technical Univ. of Denmark (Denmark)

8:00 am: **Xsense: a miniaturised multisensor platform for explosives detection** (*Invited Paper*), Michael S. Schmidt, Jesper K. Olsen, Filippo G. Bosco, Natalie Kostesha, Mogens H. Jakobsen, Tommy S. Alström, Jan Larsen, Technical Univ. of Denmark (Denmark); Carsten Johnsen, Kent A. Nielsen, Jan O. Jeppesen, Univ. of Southern Denmark (Denmark); Thomas G. Thundat, Univ. of Alberta (Canada); Anja Boisen, Technical Univ. of Denmark (Denmark) . . . [8031-74]

8:20 am: **Explosives detection using nanoporous solids** (*Invited Paper*), Pilar Pina, Univ. de Zaragoza (Spain); Ismael Pellejero, Miguel Urbiztondo, Javier Sesé, Jesus Santamaria, Instituto de Nanociencia de Aragon (Spain) [8031-75]

8:40 am: **The photonic nose: a simple and versatile tool for sensing** (*Invited Paper*), Leonardo D. Bonifacio, Andre Arsenault, Opalux, Inc. (Canada); Geoffrey A. Ozin, Univ. of Toronto (Canada) [8031-76]

SESSION 17

Room: Crystal G1 Fri. 9:00 am to 12:20 pm

Micro-Nanotechnologies for Standoff Detection and Counter Insurgency

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

9:00 am: **Quantum cascade lasers: a game changer for defense and homeland security IR photonics** (*Keynote Presentation*), Chandra Kumar N. Patel, Pranalytica, Inc. (USA) [8031-77]

9:30 am: **QCL-assisted infrared chemical imaging** (*Invited Paper*), Miles J. Weida, Peter Buerki, Eric B. Takeuchi, Timothy Day, Daylight Solutions Inc. (USA) [8031-78]

9:50 am: **Ultrafast bandgap photonics** (*Invited Paper*), Michael K. Rafailov, The Reger Group (USA) [8031-79]

Coffee Break 10:10 to 10:40 am

10:40 am: **Vibrational spectroscopy standoff detection of threat chemicals** (*Invited Paper*), Samuel P. Hernandez-Rivera, John R. Castro-Suarez, Leonardo C. Pacheco-Londoño, William Ortiz, Hilsamar Felix-Rivera, Jose L. Ruiz-Caballero, Univ. de Puerto Rico Mayagüez (USA) [8031-80]

11:00 am: **Nano-antenna-based detectors for focal plane arrays across the electromagnetic spectrum (from mmW to IR)** (*Invited Paper*), Michael A. Gritz, Borys P. Kolasa, Robert Burkholder, Raytheon Co. (USA) [8031-81]

11:20 am: **Standoff detection of explosives: a challenging approach for optical technologies** (*Invited Paper*), Sylvain Désilets, Defence Research & Development Canada, Valcartier (Canada); Nicolas Ho, INO (Canada); Pierre Mathieux, Jean-Robert Simard, Eldon Puckrin, Jean-Marc Theriault, Hugo Lavoie, Francis Théberge, Defence Research & Development Canada, Valcartier (Canada); François Babin, David Guay, Simon Deblois, INO (Canada); Jean Maheux, Gilles A. Roy, Marc Châteauneuf, Defence Research & Development Canada, Valcartier (Canada) [8031-82]

11:40 am: **Standoff detection of chemicals using IR spectroscopy** (*Invited Paper*), Panos G. C. Datskos, Larry R. Senesac, Charles Van Neste, Marissa E. Morales, Oak Ridge National Lab. (USA) [8031-83]

12:00 pm: **Mid-wave/long-wave infrared lasers and their sensing applications** (*Invited Paper*), K. K. Law, Naval Air Warfare Ctr. Weapons Div. (USA) . . . [8031-84]

Walk the Exhibition Floor and see the free 500-company exhibition – showcasing the newest products, latest innovations, and cutting-edge technologies in defense, security, sensing, homeland security, robotic, and environmental technologies
Exhibition Halls, Cypress and Palms Ballroom
Tuesday 26 April 9:30 am to 5:00 pm
Wednesday 27 April . . . 10:00 am to 5:00 pm
Thursday 28 April 10:00 am to 2:00 pm

Course of Related Interest

SC1034 **Lab-on-a-Chip Technology - Towards Portable Detection Systems** (Gärtner) Friday, 8:30 am to 12:30 pm

Visit the registration desk for course descriptions or to register

Next-Generation Spectroscopic Technologies IV

Conference Chairs: **Mark A. Druy**, Physical Sciences Inc. (USA); **Richard A. Crocombe**, Thermo Fisher Scientific Inc. (USA)

Program Committee: **John M. Dell**, The Univ. of Western Australia (Australia); **Erik Deutsch**, Block Engineering, LLC (USA); **Richard D. Driver**, Headwall Photonics Inc. (USA); **Jason M. Eichenholz**, Ocean Optics, Inc. (USA); **Michael B. Frish**, Physical Sciences Inc. (USA); **David M. Haaland**, Spectral Resolutions (USA); **Fred Haibach**, Thermo Fisher Scientific, Inc. (USA); **Martin Kraft**, Carinthian Tech Research AG (Austria); **Jouko O. Malinen**, VTT Optical Instruments (Finland); **Christopher J. Manning**, Manning Applied Technologies, Inc. (USA); **Curtis A. Marcott**, Light Light Solutions, LLC (USA); **Robert G. Messerschmidt**, Rare Light Inc. (USA); **Ellen V. Miseo**, Agilent Technologies, Inc. (USA); **David W. Schiering**, Smiths Detection (USA); **Eric B. Takeuchi**, Daylight Solutions, Inc. (USA)

Monday 25 April

SESSION 1

Room: Crystal J1 Mon. 8:30 to 9:50 am

Enabling Technologies

Session Chair: **Richard A. Crocombe**,
Thermo Fisher Scientific Inc. (USA)

8:30 am: **Analysis on polarization interference imaging spectroscopy in remote sensing**, Hongwen Gao, Chunmin Zhang, Xi'an Jiaotong Univ. (China) [8032-01]

8:50 am: **Light focusing by chirped waveguide grating coupler**, Pradeep Kumar, Wayne State Univ. (USA); Brent C. Bergner, David Cook, Spectum Scientific, Inc. (USA); Ivan A. Avrutsky, Wayne State Univ. (USA) [8032-02]

9:10 am: **New generation of compact femtosecond system for laser-based detection and identification of biological materials**, Khan Lim, Yuan Liu, Matthieu Baudalet, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Evgueni Slobodtchikov, Peter Moulton, Q-Peak, Inc. (USA); Andrzej W. Miziolek, U.S. Army Research Lab. (USA); Martin C. Richardson, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) [8032-03]

9:30 am: **A MEMS-based tunable Fabry-Perot filter**, Neelam Gupta, U.S. Army Research Lab. (USA); Songsheng Tan, Dennis R. Zander, Infotonics Technology Ctr. (USA) [8032-04]

Coffee Break 9:50 to 10:30 am

SESSION 2

Room: Crystal J1 Mon. 10:30 to 11:50 am

Laser-based and Cavity Ringdown Spectrometry I

Session Chair: **Mark A. Druy**, Physical Sciences Inc. (USA)

10:30 am: **Microsensors based on quantum cascade lasers**, Sheng Wu, Andrei Deev, California Institute of Technology (USA) [8032-05]

10:50 am: **Development of a field-deployable isotopic N₂O analyzer based on mid-infrared cavity ring-down spectroscopy**, Alejandro D. Farinas, Eric R. Crosson, Picarro Inc. (USA); David Balslev-Clausen, Thomas Blunier, Univ. of Copenhagen (Denmark) [8032-06]

11:10 am: **Mid-infrared absorption spectroscopy using quantum cascade lasers**, Erik Deutsch, John F. Heanue, Block Engineering, LLC (USA) . . . [8032-07]

11:30 am: **Accuracy of miniature tunable diode laser absorption spectrometers**, Michael B. Frish, Mark A. Druy, Physical Sciences Inc. (USA) [8032-08]

Lunch Break 11:50 am to 1:20 pm

SESSION 3

Room: Crystal J1 Mon. 1:20 to 3:00 pm

Laser-based and Cavity Ringdown Spectrometry II

Session Chair: **Mark A. Druy**, Physical Sciences Inc. (USA)

1:20 pm: **Advances in QCL for security and crime fighting**, Simon A. Nicholson, Cascade Technologies Ltd. (United Kingdom) [8032-09]

1:40 pm: **Quantum cascade laser-based substance detection**, Charles C. Harb, UNSW@ADFA (Australia); Thomas G. Spence, Loyola Univ. (USA) [8032-10]

2:00 pm: **Small, low-power consumption CO-sensor for post-fire cleanup aboard spacecraft**, John L. Bradshaw, John D. Bruno, Kevin M. Lascola, Richard P. Leavitt, John T. Pham, Frederick J. Towner, Maxion Technologies, Inc. (USA); David M. Sonnenfroh, Krishnan R. Parameswaran, Physical Sciences Inc. (USA) [8032-11]

2:20 pm: **Intracavity laser absorption spectroscopy using mid-IR quantum cascade laser**, Gautam Medhi, Univ. of Central Florida (USA); Andrey V. Muraviev, Himanshu Saxena, Zyberwear, Inc. (USA); Christopher J. Fredricksen, Tatiana N. Brusentsova, Robert E. Peale, Univ. of Central Florida (USA); Oliver J. Edwards, Zyberwear, Inc. (USA) [8032-12]

2:40 pm: **On the accuracy of decay constant measurement by heterodyne cavity ringdown spectroscopy**, Dilusha K. K. M. B. Silva, Aislinn van der Walt, John M. Dell, Lorenzo Faraone, The Univ. of Western Australia (Australia) [8032-13]

Coffee Break 3:00 to 3:30 pm

SESSION 4

Room: Crystal J1 Mon. 3:30 to 5:30 pm

Raman, SERS, and Security Applications

Session Chair: **Richard A. Crocombe**,
Thermo Fisher Scientific Inc. (USA)

3:30 pm: **Rapid and field-deployable biological and chemical Raman-based identification**, Edita Botonjic-Sehic, Marie Lesaicherre, Hacene Boudries, Morpho Detection (USA) [8032-14]

3:50 pm: **Detection of fire protection and mineral glasses in industrial recycling using Raman mapping spectroscopy**, Martin De Biasio, Thomas Arnold, Martin Kraft, Raimund Leitner, Carinthian Tech Research AG (Austria); Dirk Balthasar, Volker Rehrmann, TITECH GmbH (Germany) [8032-15]

4:10 pm: **Toward non-invasive detection of concealed energetic materials in-field under ambient-light conditions**, Emad L. Kiriakous, Queensland Univ. of Technology (Australia) [8032-16]

4:30 pm: **Integration of optical devices and nanotechnology for conducting genome research**, Pei-Yu Chung, Hanying Luo, Gregory Schultz, Peng Jiang, Christopher D. Batch, Univ. of Florida (USA) [8032-17]

4:50 pm: **Application of an ion mobility spectrometer with pulsed ionization source in the detection of dimethyl methylphosphonate and toluene diisocyanate**, Frank Gunzer, The German Univ. in Cairo (Egypt); Wolfgang Baether, Draegerwerk AG & Co. (Germany); Stefan Zimmerman, Leibniz Univ. Hannover (Germany) [8032-18]

5:10 pm: **Detection of trace concentrations of TATP in complex surroundings using SERS**, Kevin M. Spencer, Susan L. Clauson, James M. Sylvia, EIC Labs., Inc. (USA) [8032-19]

Tuesday 26 April

Symposium-Wide Plenary Session

Tuesday • 8:30 to 9:30 am • Location: Crystal H

Dr. Regina E. Dugan

Director, Defense Advanced Research Projects Agency (DARPA)

See page 18 for details • Open to All Attendees

Coffee Break 9:30 to 10:00 am

SESSION 5

Room: Crystal J1 Tues. 10:00 am to 12:00 pm

Novel Spectrometers I

Session Chair: **Richard A. Crocombe**,
Thermo Fisher Scientific Inc. (USA)

10:00 am: **Two novel static polarization imaging spectrometers**, Tingkui Mu, Chunmin Zhang, Xi'an Jiaotong Univ. (China) [8032-20]

10:20 am: **Photonic crystal slot waveguide optical absorption spectrometer for high-sensitivity near-infrared detection of xylene in water**, Swapnajt Chakravarty, Omega Optics, Inc. (USA); Wei-Cheng Lai, The Univ. of Texas at Austin (USA); Xiaolong A. Wang, Omega Optics, Inc. (USA); Cheyun Lin, Ray T. Chen, The Univ. of Texas at Austin (USA) [8032-21]

10:40 am: **A compact and portable IR analyzer: progress of a MOEMS FT-IR system for MIR sensing**, Andreas Kenda, Martin Lenzhofer, Martin Kraft, Carinthian Tech Research AG (Austria); Stephan Luettjohann, Bruker Optik GmbH (Germany); Thilo Sandner, Fraunhofer-Institut für Photonische Mikrosysteme (Germany) [8032-22]

11:00 am: **Portable coherent frequency domain terahertz spectrometer**, Joseph R. Demers, Ronald T. Logan, Jr., Bryon L. Kasper, EMCORE Corp. (USA) [8032-23]

11:20 am: **Compact remote Raman and LIBS system for detection of minerals, water, ices, and atmospheric gases for planetary exploration**, Anupam K. Misra, Shiv K. Sharma, Tayro E. Acosta, David E. Bates, Univ. of Hawai'i (USA) [8032-24]

11:40 am: **Combination optical and mass spectrometric technologies for detection of chemical and biological threats to the food supply**, Robert A. Lodder, Univ. of Kentucky (USA) [8032-25]

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

SESSION 6

Room: Crystal J1 Tues. 1:30 to 3:10 pm

Novel Spectrometers II

Session Chair: **Mark A. Druy**, Physical Sciences Inc. (USA)

1:30 pm: **Real-time smart fluorescence sensor platform**, Mike Ponstingl, Custom Sensors & Technology (USA) [8032-26]

1:50 pm: **TerraSpec Explorer real-time mineral analysis for economic mineral deposit exploration**, Brian Curtiss, ASD, Inc. (USA) [8032-27]

2:10 pm: **Sensing of FWHM and peak wavelength for LEDs via a low-cost filter-based spectrum sensor and PSO optimization**, Cheng-Chun Chang, Chien-Chou Chen, Nan-Ting Lin, National Taipei Univ. of Technology (Taiwan); Umpei Kurokawa, Byung Il Choi, nanoLambda (USA) [8032-28]

2:30 pm: **A compact, fast, wide-field imaging spectrometer system**, Pantazis Mouroulis, Byron van Gorp, Victor White, Jason M. Mumolo, Ronald G. Holm, Jet Propulsion Lab. (USA); Daniel Hebert, Martin Feldman, Louisiana State Univ. (USA) [8032-29]

2:50 pm: **High-speed resonant FTIR spectrometer**, Julia Rentz Dupuis, David L. Carlson, David J. Mansur, Thomas Evans, Robert M. Vaillancourt, James R. Engel, OPTRA, Inc. (USA); Bradley B. Engel, Nelson Air Corp. (USA) ... [8032-30]

Coffee Break 3:10 to 3:40 pm

SESSION 7

Room: Crystal J1 Tues. 3:40 to 5:20 pm

Imaging and Chemometrics

Session Chair: **Richard A. Crocombe**,
Thermo Fisher Scientific Inc. (USA)

3:40 pm: **Compact high-resolution VIS/NIR hyperspectral sensor**, Timo Hyvärinen, Esko Herrala, Specim Spectral Imaging Ltd. (Finland) . . [8032-31]

4:00 pm: **Advances in hyperspectral LWIR pushbroom imagers**, Hannu Holma, Antti-Jussi Mattila, Timo Hyvärinen, Specim Spectral Imaging Ltd. (Finland) [8032-32]

4:20 pm: **Near-infrared imaging spectroscopy for counterfeit drug detection**, Thomas Arnold, Martin De Biasio, Raimund Leitner, CTR Carinthian Tech Research AG (Austria) [8032-33]

4:40 pm: **Advanced algorithms for the identification of mixtures using condensed-phase FT-IR spectroscopy**, Josep Arnó, Greger Andersson, Dustin Levy, Carol A. Tomczyk, Peng Zou, Eric Zuidema, Smiths Detection (USA) [8032-34]

5:00 pm: **Development of simple algorithm for direct and rapid determination of cotton maturity from FT-IR spectroscopy**, Yongliang Liu, Gary R. Gamble, Devron P. Thibodeaux, Agricultural Research Service (USA) [8032-35]

Advanced Photon Counting Techniques V

Conference Chairs: **Mark A. Itzler**, Princeton Lightwave, Inc. (USA); **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 M. Hayat**, The Univ. of New Mexico (USA); **Michael A. Krainak**, NASA Goddard Space Flight Ctr. (USA); **Robert A. Lamb**, SELEX Galileo Ltd. (United Kingdom); **Alan L. Migdall**, National Institute of Standards and Technology (USA); **Simon Verghese**, MIT Lincoln Lab. (USA); **Michael Wahl**, PicoQuant GmbH (Germany); **Hugo Zbinden**, Univ. of Geneva (Switzerland)

Wednesday 27 April

SESSION 1

Room: Crystal J1 Wed. 8:00 to 10:10 am

SPADs I: Si-based SPADs

Session Chair: **Mark A. Itzler**, Princeton Lightwave, Inc. (USA)

8:00 am: **Improving the performance of silicon single-photon avalanche diodes** (*Invited Paper*), Angelo Gulinati, Ivan Rech, Politecnico di Milano (Italy); Piera Maccagnani, Consiglio Nazionale delle Ricerche (Italy); Massimo Ghioni, Sergio Cova, Politecnico di Milano (Italy) and Micro Photon Devices S.r.l. (Italy) [8033-01]

8:30 am: **Tau-SPAD: a new red sensitive single-photon counting module**, Gerald Kell, Fachhochschule Brandenburg (Germany); Andreas Buelter, Michael Wahl, Rainer Erdmann, PicoQuant GmbH (Germany) [8033-02]

8:50 am: **Characterization of commercial single-photon counting modules in operational mode**, Thiago Ferreira da Silva, Inmetro (Brazil) and Pontificia Univ. Católica do Rio de Janeiro (Brazil); Guilherme B. Xavier, Jean Pierre von der Weid, Pontificia Univ. Católica do Rio de Janeiro (Brazil) [8033-03]

9:10 am: **Characterization of photon-counting detector responsivity for nonlinear two-photon absorption process**, Suzana E. Sburlan, William H. Farr, Jet Propulsion Lab. (USA) [8033-04]

9:30 am: **Frequency up-conversion single-photon detectors for quantum communication systems**, Lijun Ma, Oliver T. Slattery, Xiao Tang, National Institute of Standards and Technology (USA) [8033-05]

9:50 am: **Geiger-mode operation of Ge on Si avalanche photodiodes**, Zhiwen Lu, Univ. of Virginia (USA); Yimin Kang, Intel Corp. (USA); Joe C. Campbell, Univ. of Virginia (USA) [8033-06]

Coffee Break 10:10 to 10:40 am

SESSION 2

Room: Crystal J1 Wed. 10:40 am to 12:20 pm

SPADs II: Arrays

Session Chair: **Gerald S. Buller**, Heriot-Watt Univ. (United Kingdom)

10:40 am: **CMOS SPAD: from fundamentals to single-photon imaging and applications** (*Invited Paper*), Edoardo Charbon, Matthew W. Fishburn, Yuki Maruyama, Technische Univ. Delft (Netherlands) [8033-07]

11:10 am: **MEGAFRAME: a fully integrated, time-resolved 160x128 SPAD pixel array with microconcentrators**, Jochen Art, Univ. of Edinburgh (United Kingdom); Fausto Borghetti, Smart Optical Sensors and Interfaces (Italy); Claudio E. Bruschini, Ecole Polytechnique Fédérale de Lausanne (Switzerland); Edoardo Charbon, Technische Univ. Delft (Netherlands); David T. F. Dryden, Univ. of Edinburgh (United Kingdom); Steve East, STMicroelectronics (R&D) Ltd. (United Kingdom); Matthew W. Fishburn, Technische Univ. Delft (Netherlands); Marek Gersbach, Ecole Polytechnique Fédérale de Lausanne (Switzerland); Gerard Giraud, Univ. of Edinburgh (United Kingdom); Lindsay A. Grant, STMicroelectronics (R&D) Ltd. (United Kingdom); Robert K. Henderson, David U. Li, Univ. of Edinburgh (United Kingdom); Yuki Maruyama, Technische Univ. Delft (Netherlands); Justin A. Richardson, Univ. of Edinburgh (United Kingdom); David Stoppa, Fondazione Bruno Kessler (Italy); David Tyndall, Univ. of Edinburgh (United Kingdom); Chockalingam Veerappan, Technische Univ. Delft (Netherlands); Richard Walker, Univ. of Edinburgh (United Kingdom) ... [8033-08]

11:30 am: **Smart-pixel for 3D ranging imagers based on single-photon avalanche diode and time-to-digital converter**, Bojan Markovic, Politecnico di Milano (Italy); Simone Tisa, Micro Photon Devices S.r.l. (Italy); Alberto Tosi, Franco Zappa, Politecnico di Milano (Italy) [8033-09]

11:50 am: **Scaling trends of single-photon avalanche diode arrays in nanometer CMOS technology** (*Invited Paper*), Justin A. Richardson, Eric A. G. Webster, The Univ. of Edinburgh (United Kingdom); Lindsay A. Grant, STMicroelectronics (R&D) Ltd. (United Kingdom); Robert K. Henderson, The Univ. of Edinburgh (United Kingdom) [8033-10]

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

SESSION 3

Room: Crystal J1 Wed. 1:30 to 3:30 pm

SPADs III: Arrays

Session Chair: **Robert A. Lamb**, SELEX Galileo Ltd. (United Kingdom)

1:30 pm: **Resonant cavity silicon GPD arrays** (*Invited Paper*), Stefan A. Vasile, aPeak, Inc. (USA); M. Selim Unlu, Boston Univ. (USA) [8033-11]

2:00 pm: **MBE back-illuminated silicon Geiger-mode avalanche photodiodes for enhanced ultra-violet response**, Daniel R. Schuette, Brian F. Aull, Richard C. Westhoff, Joseph S. Ciampi, Gayatri E. Perlin, Douglas J. Young, David C. Shaver, MIT Lincoln Lab. (USA) [8033-12]

2:20 pm: **Techniques for improved performances of direct-detection three-dimensional imaging laser radar system using Geiger-mode avalanche photodiode** (*Invited Paper*), Min Seok Oh, KAIST (Korea, Republic of) and Samsung Electronics (Korea, Republic of); Hong Jin Kong, Tae Hoon Kim, Sung Eun Jo, KAIST (Korea, Republic of) [8033-13]

2:50 pm: **Design considerations for high-altitude altimetry and lidar systems incorporating single-photon avalanche diode detectors**, Philip A. Hiskett, Brian Howie, Peter Sinclair, Mark D. Hartree, James Henderson, Robert A. Lamb, SELEX Galileo Ltd. (United Kingdom) [8033-14]

3:10 pm: **Geiger-mode avalanche photodiode focal plane arrays for 3D imaging ladar**, Mark A. Itzler, Mark Entwistle, Mark Owens, Xudong Jiang, Ketan M. Patel, Krystyna Slomkowski, Sabbir S. Rangwala, Princeton Lightwave, Inc. (USA); Peter Zalud, Tom Senko, John R. Tower, Joseph Ferraro, Sarnoff Corp. (USA) [8033-15]

Coffee Break 3:30 to 4:00 pm

SESSION 4

Room: Crystal J1 Wed. 4:00 to 5:40 pm

SPADs IV: Circuits and Integration

Session Chair: **Joe C. Campbell**, Univ. of Virginia (USA)

4:00 pm: **Compact eight-channel SPAD module for photon timing applications**, Corrado Cammi, Angelo Gulinati, Ivan Rech, Francesco Panzeri, Massimo Ghioni, Politecnico di Milano (Italy) [8033-16]

4:20 pm: **A technique to measure afterpulse probabilities in InGaAs SPADs at nanosecond time scales with sub-pico Coulomb avalanche charge**, Alessandro Restelli, Joshua C. Bienfang, Alan L. Migdall, Charles W. Clark, National Institute of Standards and Technology (USA) and Joint Quantum Institute (USA) [8033-17]

4:40 pm: **High-speed characterization of quantum systems in the near infrared**, Christopher J. Healey, Xiaofan Mo, Chris Dascollas, Michael R. E. Lamont, Joshua A. Slater, Itzel Lucio Martinez, Philip Chan, Univ. of Calgary (Canada); Steve Hosier, Southern Alberta Institute of Technology (Canada); Wolfgang Tittel, Univ. of Calgary (Canada) [8033-19]

5:00 pm: **InGaAs/InP negative feedback avalanche diodes (NFADs)**, Xudong Jiang, Mark A. Itzler, Kevin O'Donnell, Mark Entwistle, Krystyna Slomkowski, Princeton Lightwave, Inc. (USA) [8033-20]

5:20 pm: **Active hold-off characterization of negative avalanche feedback single-photon detectors**, William H. Farr, Jet Propulsion Lab. (USA) ... [8033-21]

Thursday 28 April

SESSION 5

Room: Crystal J1 Thurs. 8:00 to 10:20 am

Analog Semiconductor SPDs

Session Chair: **Joe C. Campbell**, Univ. of Virginia (USA)

8:00 am: **HgCdTe APD-based linear-mode photon counting components and ladar receivers** (*Invited Paper*), Michael D. Jack, Raytheon Co. (USA) . . [8033-22]

8:30 am: **Linear-mode photon counting with the noiseless gain HgCdTe e-APD** (*Invited Paper*), Jeffrey D. Beck, Richard Scritchfield, DRS RSTA, Inc. (USA); William Sullivan III, Texas Tech Univ. (USA); Pradip Mitra, DRS RSTA, Inc. (USA); Robert J. Martin, Analog/Digital Integrated Circuits, Inc. (USA); Robert Strittmatter, Currant Innovations (USA); Anthony D. Gleckler, GEOST, Inc. (USA) [8033-23]

9:00 am: **Application of an end-to-end linear mode photon-counting (LMPC) model to noiseless-gain HgCdTe APDs**, Anthony D. Gleckler, Robert Strittmatter, GEOST, Inc. (USA); Jeffrey D. Beck, DRS Sensors & Targeting Systems, Inc. (USA) [8033-24]

9:20 am: **New developments in nano-injection-based imagers** (*Invited Paper*), Hooman Mohseni, Northwestern Univ. (USA) [8033-25]

9:50 am: **Opportunities for single-photon detection using visible light photon counters** (*Invited Paper*), Jungsang Kim, Duke Univ. (USA) [8033-26]

Coffee Break 10:20 to 10:50 am

SESSION 6

Room: Crystal J1 Thurs. 10:50 to 11:20 am

Solid State PMT

Session Chair: **William H. Farr**, Jet Propulsion Lab. (USA)

10:50 am: **CMOS solid state photomultipliers for ultra-low light levels** (*Invited Paper*), Erik B. Johnson, Christopher J. Stapels, Xaio-Jie Chen, Chad Whitney, Eric C. Chapman, Guy Alberghini, Radiation Monitoring Devices, Inc. (USA); Frank Augustine, Augustine Engineering (USA); James F. Christian, Radiation Monitoring Devices, Inc. (USA) [8033-27]

SESSION 7

Room: Crystal J1 Thurs. 11:20 am to 12:20 pm

Photocathode-based SPDs I

Session Chair: **William H. Farr**, Jet Propulsion Lab. (USA)

11:20 am: **High-performance HPD for photon counting** (*Invited Paper*), Atsuhito Fukasawa, Akifumi Kamiya, Shinichi Muramatsu, Yasuharu Negi, Motohiro Suyama, Hamamatsu Photonics K.K. (Japan) [8033-28]

11:50 am: **Multichannel intensified photodiode at near infrared** (*Invited Paper*), Verle W. Aebi, Derek F. Sykora, Michael J. Jurkovic, Kenneth A. Costello, Intevac Photonics, Inc. (USA) [8033-29]

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

SESSION 8

Room: Crystal J1 Thurs. 1:30 to 2:20 pm

Photocathode-based SPDs II

Session Chair: **William H. Farr**, Jet Propulsion Lab. (USA)

1:30 pm: **Development of large area fast microchannel plate photo-detectors from Argonne National Laboratory** (*Invited Paper*), Karen Byrum, Argonne National Lab. (USA) [8033-30]

2:00 pm: **Microchannel plate imaging photon counters for ultraviolet through NIR detection with high time resolution**, Oswald H. Siegmund, John V. Vallerga, Anton S. Tremsin, Jason B. McPhate, Univ. of California, Berkeley (USA) [8033-31]

SESSION 9

Room: Crystal J1 Thurs. 2:20 to 4:50 pm

Superconducting SPDs

Session Chair: **Robert H. Hadfield**, Heriot-Watt Univ. (United Kingdom)

2:20 pm: **Fast superconducting IR single-photon detectors with a microwave reflectometry readout** (*Invited Paper*), Daniel F. Santavicca, Yale Univ. (USA); Boris S. Karasik, Jet Propulsion Lab. (USA); Bertrand M. Reulet, Univ. de Sherbrooke (Canada); Faustin W. Carter, Luigi Frunzio, Daniel E. Prober, Yale Univ. (USA) [8033-32]

2:50 pm: **Photon-number resolving transition edge sensors and superconducting nanowire single-photon detectors for optical Schrödinger cat state generation** (*Invited Paper*), Thomas Gerrits, National Institute of Standards and Technology (USA) [8033-33]

Coffee Break 3:20 to 3:50 pm

3:50 pm: **Developments in efficiency, timing, and implementations of superconducting nanowire single-photon detectors** (*Invited Paper*), Michael G. Tanner, John A. O'Connor, Chandra M. Natarajan, Robert H. Hadfield, Heriot-Watt Univ. (United Kingdom) [8033-36]

4:20 pm: **Putting superconducting nanowire detectors to use** (*Invited Paper*), Valery Zwiller, Sander N. Dorenbos, Esteban Bermudez-Urena, Reinier Heeres, Maaik Witteveen, Hatim Azzouz, P. Forndiaz, Tomoko Fuse, Tony Zijlstra, Teun Klapwijk, Technische Univ. Delft (Netherlands) [8033-37]

Friday 29 April

SESSION 10

Room: Crystal J1 Fri. 8:10 to 9:00 am

Single-Photon Sources

Session Chair: **Michael Wahl**, PicoQuant GmbH (Germany)

8:10 am: **Single-photon emission from artificial atoms in diamond** (*Invited Paper*), Helmut Fedder, Fedor Jelezko, Jörg Wrachtrup, Univ. Stuttgart (Germany) [8033-38]

8:40 am: **Efficient narrow-band PDC source for quantum interfaces**, Sergey V. Polyakov, Andreas Muller, Alex Ling, Natalia Borjemscaia, Edward B. Flagg, Alan L. Migdall, Glenn S. Solomon, National Institute of Standards and Technology (USA) [8033-39]

SESSION 11

Room: Crystal J1 Fri. 9:00 to 10:10 am

Photon Counting Applications I

Session Chair: **Michael Wahl**, PicoQuant GmbH (Germany)

9:00 am: **Quantum information with photon-number-resolved measurements of continuous-wave quantum sources** (*Invited Paper*), Olivier Pfister, Univ. of Virginia (USA) [8033-40]

9:30 am: **Improved correlation determination for intensity correlation interferometers**, Phan D. Dao, Patrick J. McNicholl, Air Force Research Lab. (USA) [8033-41]

9:50 am: **Photon correlation spectroscopy in ophthalmology**, Luigi L. Rovati, Univ. degli Studi di Modena e Reggio Emilia (Italy) [8033-42]

Coffee Break 10:10 to 10:40 am

SESSION 12

Room: Crystal J1 Fri. 10:40 am to 12:00 pm

Photon Counting Applications II

Session Chair: **Mark A. Itzler**, Princeton Lightwave, Inc. (USA)

10:40 am: **A SPAD-based hybrid system for time-gated fluorescence measurements** (*Invited Paper*), Alberto Gola, Lucio Pancheri, Claudio Piemonte, David Stoppa, Fondazione Bruno Kessler (Italy) [8033-43]

11:10 am: **New photon-counting detectors for single-molecule fluorescence spectroscopy and imaging** (*Invited Paper*), Xavier Michalet, Ryan A. Colyer, Giuseppe Scalia, Shimon Weiss, Univ. of California, Los Angeles (USA); Oswald H. Siegmund, Anton S. Tremsin, John V. Vallerga, Univ. of California, Berkeley (USA); Federica A. Villa, Fabrizio Guerrieri, Ivan Rech, Simone Tisa, Angelo Gulinatti, Franco Zappa, Massimo Ghioni, Sergio Cova, Politecnico di Milano (Italy) [8033-44]

11:40 am: **Single-photon detectors for ultra-low-voltage time-resolved emission measurements of VLSI circuits**, Franco Stellari, Peilin Song, Alan J. Weger, IBM Thomas J. Watson Research Ctr. (USA) [8033-45]

Photonic Microdevices/Microstructures for Sensing III

Conference Chairs: **Hai Xiao**, Missouri Univ. of Science and Technology (USA); **Xudong Fan**, Univ. of Michigan (USA); **Anbo Wang**, Virginia Polytechnic Institute and State Univ. (USA)

Program Committee: **Hatice Altug**, Boston Univ. (USA); **Junhang Dong**, Univ. of Cincinnati (USA); **Henry H. Du**, Stevens Institute of Technology (USA); **Erica Forzani**, Arizona State Univ. (USA); **Bai-Ou Guan**, Jinan Univ. (China); **Susan M. Maley**, U.S. Dept. of Energy (USA); **Radislav A. Potyrailo**, GE Global Research (USA); **Venkataraman S. Swaminathan**, U.S. Army Armament Research, Development and Engineering Ctr. (USA); **Wei Jin**, The Hong Kong Polytechnic Univ. (Hong Kong, China); **Ian M. White**, Univ. of Maryland, College Park (USA); **Yibing Zhang**, ExxonMobil Research and Engineering Co. (USA); **Mohammed M. Zourob**, Biophage Pharma Inc. (Canada)

Wednesday 27 April

SESSION 1

Room: Crystal K. Wed. 1:00 to 3:20 pm

Microphotonic Biosensors

Session Chairs: **Xudong Fan**, Univ. of Michigan (USA); **Hai Xiao**, Missouri Univ. of Science and Technology (USA)

1:00 pm: **Photonic crystal microarray nanopatform for high-throughput detection of biomolecules for diagnostic assays**, Swapnajit Chakravarty, Omega Optics, Inc. (USA); Wei-Cheng Lai, The Univ. of Texas at Austin (USA); Xiaolong A. Wang, Omega Optics, Inc. (USA); Cheyun Lin, Ray T. Chen, The Univ. of Texas at Austin (USA) [8034-01]

1:20 pm: **Identification of biological agents using surface-enhanced Raman scattering** (*Invited Paper*), Tracy L. Paxon, Frank J. Mondello, R. Scott Duthie, Casey Renko, Andrew A. Burns, GE Global Research (USA); Marie Lesaichere, Morpho Detection (USA) [8034-02]

2:00 pm: **A new generation of mid-infrared sensors based on quantum cascade laser** (*Invited Paper*), Hooman Mohseni, Northwestern Univ. (USA) [8034-03]

2:40 pm: **Immobilization of aptamers onto unmodified glass surfaces for affordable biosensors**, Rui Chen, Cheryl Surman, Radislav A. Potyrailo, Andrew Pris, GE Global Research (USA); Eric A. Holwit, Veronica K. Sorola, Johnathan L. Kiel, Air Force Research Lab. (USA) [8034-04]

3:00 pm: **Integrated photonic structures for parallel fluorescence and refractive index biosensing**, Meredith M. Lee, Thomas D. O'Sullivan, Antonio Cerruto, Victor Liu, Stanford Univ. (USA); Jingyu Zhang, The Univ. of New Mexico (USA); Ofer Levi, Univ. of Toronto (Canada); Heon Lee, Korea Univ. (Korea, Republic of); Steven R. J. Brueck, The Univ. of New Mexico (USA); Shanhui Fan, James S. Harris, Stanford Univ. (USA) [8034-05]

Coffee Break 3:20 to 3:50 pm

SESSION 2

Room: Crystal K. Wed. 3:50 to 5:10 pm

New and Enabling Microphotonic Devices and Sensors I

Session Chair: **Bai-Ou Guan**, Jinan Univ. (China)

3:50 pm: **Fiber-optic intrinsic Fabry-Perot interferometric sensors fabricated by femtosecond lasers** (*Invited Paper*), Tingyun Wang, Shanghai Univ. (China) [8034-06]

4:30 pm: **Micro-structured sapphire fiber sensor for measurement of high-temperature in harsh environments**, Xia Fang, Tao Wei, Yukun Han, Baokai Cheng, Xinwei Lan, Hai Xiao, Missouri Univ. of Science and Technology (USA) [8034-07]

4:50 pm: **Thinned fiber Bragg grating magnetic field sensor with nano-magnetic fluid**, Ciming Zhou, Li Ding, Dongli Wang, Desheng Jiang, Wuhan Univ. of Technology (China) [8034-08]

Thursday 28 April

SESSION 3

Room: Crystal K. Thurs. 8:00 to 10:00 am

Microphotonic Chemical Sensors

Session Chairs: **Hai Xiao**, Missouri Univ. of Science and Technology (USA); **Xudong Fan**, Univ. of Michigan (USA)

8:00 am: **Passive infrared sensing using plasmonic resonant dust particles**, Mark S. Mirotnik, Univ. of Delaware (USA); William A. Beck, Kimberly Olver, John W. Little, U.S. Army Research Lab. (USA) [8034-10]

8:20 am: **Lithography free fabrication of high-aspect-ratio silver-coated silicon nanopillars as Raman-enhancing substrates for explosives detection**, Michael S. Schmidt, Jörg Hübner, Anja Boisen, Technical Univ. of Denmark (Denmark) [8034-11]

8:40 am: **On-chip plasmonic systems for ultrasensitive nanospectroscopy** (*Invited Paper*), Hatice Altug, Ahmet A. Yanik, Ronen Adato, Serap Aksu, Arif E. Cetin, Alp Artar, Mustafa Turkmen, Boston Univ. (USA) [8034-12]

9:20 am: **Ultra-fast and ultra-sensitive 2,4-dinitrotoluene vapor sensing using gold nanoparticle assembled SERS probes**, Maung Kyaw Khaing Oo, Chia-Fang Chang, Xudong Fan, Univ. of Michigan (USA) [8034-13]

9:40 am: **Toward development of nanostructured-integrated optical waveguide sensors with tunable dual-output capacity**, Mustafa M. Aslan, TÜBITAK Marmara Research Ctr. (Turkey) and Univ. of Louisville (USA); Sergio B. Mendes, Univ. of Louisville (USA); Kerim Allahverdiev, TÜBITAK Marmara Research Ctr. (Turkey) and Institute of Physics ANAS (Azerbaijan); Tarik Baykara, TÜBITAK Marmara Research Ctr. (Turkey) [8034-14]

Coffee Break 10:00 to 10:30 am

SESSION 4

Room: Crystal K. Thurs. 10:30 am to 12:10 pm

New and Enabling Microphotonic Devices and Sensors II

Session Chairs: **Anbo Wang**, Virginia Polytechnic Institute and State Univ. (USA); **Hai Xiao**, Missouri Univ. of Science and Technology (USA)

10:30 am: **Fully distributed fiber-optic sensing based on acoustically induced long-period grating** (*Invited Paper*), Dorothy Y. Wang, Virginia Polytechnic Institute and State Univ. (USA) [8034-15]

11:10 am: **Polarimetric heterodyning fiber grating laser sensors** (*Invited Paper*), Bai-Ou Guan, Jinan Univ. (China) [8034-16]

11:50 am: **U-shaped nano-apertures for enhanced optical transmission and resolution**, Mustafa Turkmen, Boston Univ. (USA) and Erciyes Univ. (Turkey); Serap Aksu, Arif E. Cetin, Alp Artar, Ahmet A. Yanik, Hatice Altug, Boston Univ. (USA) [8034-17]

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

SESSION 5

Room: Crystal K Thurs. 1:30 to 3:30 pm

New and Enabling Microphotonic Devices and Sensors III

Session Chairs: **Bai-Ou Guan**, Jinan Univ. (China); **Yibing Zhang**, ExxonMobil Research and Engineering Co. (USA)

1:30 pm: **Nanoscale optics with negative metamaterials** (*Invited Paper*), Srinivas Sridhar, Northeastern Univ. (USA) [8034-18]

2:10 pm: **High-sensitivity temperature sensing by employing an on-chip high-Q PDMS-coated toroidal microcavity**, Bei-Bei Li, Xue-Feng Jiang, Qihuang Gong, Yunfeng Xiao, Peking Univ. (China) [8034-19]

2:30 pm: **Resonant cavity enhancement of polycrystalline PbTe films for IR detectors on Si-ROICs**, Timothy W. C. Zens, Massachusetts Institute of Technology (USA) and U.S. Air Force (USA); Jianfei Wang, Piotr Becla, Anuradha M. Agarwal, Lionel C. Kimerling, Massachusetts Institute of Technology (USA) [8034-20]

2:50 pm: **Frequency tunable nonlinear-optical negative-index metamirror for sensing applications**, Alexander K. Popov, Univ. of Wisconsin-Stevens Point (USA) [8034-21]

3:10 pm: **Sapphire tube waveguide as a potential basis for high-temperature Raman spectroscopy**, Michael J. Fraser, Evan M. Lally, Anbo Wang, Virginia Polytechnic Institute and State Univ. (USA) [8034-23]

POSTERS—Thursday

Room: Crystal M Thurs. 6:00 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. 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 pm 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.

Fiber Bragg grating high-current sensor based on magnetic coupling, Ciming Zhou, Dongli Wang, Wenju Zhang, Lin Wu, Yuan Yao, Wuhan Univ. of Technology (China) [8034-22]

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Energy Harvesting and Storage: Materials, Devices, and Applications II

Conference Chairs: Nibir K. Dhar, Defense Advanced Research Projects Agency/Microelectronics Technology Office (USA); Priyalal S. Wijewarnasuriya, U.S. Army Research Lab. (USA); Achyut K. Dutta, Banpil Photonics, Inc. (USA)

Program Committee: Pulickel M. Ajayan, Rice Univ. (USA); Palani Balaya, National Univ. of Singapore (Singapore); Fow-Sen Choa, Univ. of Maryland, Baltimore County (USA); Deryn Chu, U.S. Army Research Lab. (USA); Angelo S. Gilmore, EPIR Technologies, Inc. (USA); M. Saif Islam, Univ. of California, Davis (USA); Ahalapitiya H. Jayatissa, The Univ. of Toledo (USA); Nobuhiko P. Kobayashi, Univ. of California, Santa Cruz (USA); Pat McGrath, Booz Allen Hamilton Inc. (USA); Robert Olah, Banpil Photonics, Inc. (USA); Unil A. Perera, Georgia State Univ. (USA); A. Fred Semendy, U.S. Army Research Lab. (USA); Ashok K. Sood, Magnolia Optical Technologies, Inc. (USA); Rao Surampudi, Jet Propulsion Lab. (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)

Monday 25 April

Opening Remarks

Room: Crystal K. Mon. 8:15 to 8:20 am

Session Chair: Nibir K. Dhar,
Defense Advanced Research Projects Agency (USA)

SESSION 1

Room: Crystal K. Mon. 8:20 to 10:05 am

Advanced Lithium Batteries: Electrodes I

Session Chairs: Nibir K. Dhar, Defense Advanced Research Projects Agency (USA); Achyut Dutta, Banpil Photonics, Inc. (USA)

8:20 am: **Emergence of power and energy as a driver in the modern army** (*Keynote Presentation*), John M. Pellegrino, John M. Pellegrino, U. S. Army Research Lab., Computational & Information Sciences Directorate (CISD) (USA) [8035-01]

9:00 am: **Mesoporous electrode materials for lithium battery applications** (*Invited Paper*), Palani Balaya, National Univ. of Singapore (Singapore) . . [8035-02]

9:25 am: **Search for greener Li-ion batteries: an alternative offered by organic electroactive materials** (*Invited Paper*), Franck Dolhem, Philippe Poizat, Univ. de Picardie Jules Verne (France) [8035-03]

9:45 am: **Sustainable nanostructured materials for energy storage** (*Invited Paper*), Jaephil Cho, Ulsan National Institute of Science and Technology (Korea, Democratic Peoples Republic of) [8035-04]

Coffee Break 10:05 to 10:35 am

SESSION 2

Room: Crystal K. Mon. 10:35 to 11:55 am

Advanced Lithium Batteries: Electrodes II

Session Chairs: Palani Balaya, National Univ. of Singapore (Singapore); Chunlei Wang, Florida International Univ. (USA)

10:35 am: **Recent advances in nanocrystalline intermetallic tin compounds for the negative electrode of lithium ion batteries** (*Invited Paper*), Jose L. Tirado, Ricardo Alcantara, Uche Nwokeke, Francisco Nacimiento, Pedro Lavela, Univ. de Córdoba (Spain) [8035-05]

10:55 am: **Green energy storage materials: advanced nanostructured materials for lithium-ion batteries** (*Invited Paper*), Sagar Mitra, Indian Institute of Technology Bombay (India) [8035-06]

11:15 am: **Micro- and nanostructural design approaches for improved Li-ion batteries** (*Invited Paper*), Shen J. Dillon, Univ. of Illinois at Urbana-Champaign (USA) [8035-07]

11:35 am: **Computational design of high-performance lithium ion battery cathodes** (*Invited Paper*), Stefan N. Adams, R. Prasada Rao, National Univ. of Singapore (Singapore) [8035-08]

Lunch Break 11:55 am to 1:15 pm

SESSION 3

Room: Crystal K. Mon. 1:15 to 2:50 pm

Advanced Lithium Batteries: Electrolytes

Session Chairs: Chunlei Wang, Florida International Univ. (USA); Palani Balaya, National Univ. of Singapore (Singapore)

1:15 pm: **Enabling organosilicon-based electrolytes for lithium ion batteries** (*Invited Paper*), Zhengcheng Zhang, Argonne National Lab. (USA) [8035-10]

1:35 pm: **Soft matter electrolytes for Li-ion batteries** (*Invited Paper*), Aninda J. Bhattacharyya, Indian Institute of Science, Bangalore (India) [8035-11]

1:55 pm: **All solid state rechargeable lithium batteries with three-dimensionally ordered macroporous ceramic electrolyte** (*Invited Paper*), Kiyoshi Kanamura, Ryo Osone, Hirokazu Munakata, Tokyo Metropolitan Univ. (Japan) [8035-12]

2:15 pm: **An external sensor for instantaneous measurement of the internal temperature in lithium-ion rechargeable cells**, Rengaswamy Srinivasan, Bliss G. Carkhuff, Michael E. Butler, A. Carson Baisden, The Johns Hopkins Univ. Applied Physics Lab. (USA) [8035-13]

2:30 pm: **All-solid-state thin film microbatteries fabricated by rf sputtering** (*Invited Paper*), Li Lu, National Univ. of Singapore (Singapore) [8035-14]

Coffee Break 2:50 to 3:30 pm

SESSION 4

Room: Crystal K. Mon. 3:30 to 5:05 pm

Advanced Capacitors Technology

Session Chairs: Palani Balaya, National Univ. of Singapore (Singapore); Minato Egashira, Yamaguchi Univ. (Japan)

3:30 pm: **Pseudo-capacitive reactions based on imidazolium ion** (*Invited Paper*), Minato Egashira, Tomoyo Tanaka, Yuki Matsuno, Nobuko Yoshimoto, Masayuki Morita, Yamaguchi Univ. (Japan) [8035-15]

3:50 pm: **Advances in solid polymer electrochemical capacitors and hybrid energy systems** (*Invited Paper*), Keryn K. Lian, Univ. of Toronto (Canada) [8035-16]

4:10 pm: **Carbon nanotube and 1-Ethyl-3-methylimidazolium tetrafluoroborate-based electrochemical double layer capacitors** (*Invited Paper*), W. Jud Ready, Georgia Tech Research Institute (USA) [8035-17]

4:30 pm: **In-situ preparation of PEDOT/V₂O₅ nanocomposite and its synergism for enhanced capacitive behavior**, P. Ragupathy, H. N. Vasan, N. Munichandraiah, N. Vasanthacharya, Indian Institute of Science (India) . . [8035-18]

4:45 pm: **Design, fabrication, and evaluation of on-chip microsupercapacitors** (*Invited Paper*), Majid Beidaghi, Chunlei Wang, Florida International Univ. (USA) [8035-19]

Tuesday 26 April

Symposium-Wide Plenary Session

Tuesday • 8:30 to 9:30 am • Location: Crystal H

Dr. Regina E. Dugan

Director, Defense Advanced Research Projects Agency (DARPA)

See page 18 for details • Open to All Attendees

Coffee Break 9:30 to 10:00 am

SESSION 5

Room: Crystal K. Tues. 10:00 to 11:40 am

Photovoltaic Cells and Related Technologies

Session Chairs: **Nibir K. Dhar**, Defense Advanced Research Projects Agency (USA); **Achyut Dutta**, Banpil Photonics, Inc. (USA)

10:00 am: **Photovoltaic commercialization potential in the U.S.** (*Keynote Presentation*), Martha Symko-Davies, National Renewable Energy Lab. (USA) [8035-20]

10:40 am: **Simulation of novel energy harvesting devices**, Vijay Parameshwaran, Robert Olah, Achyut Dutta, Banpil Photonics, Inc. (USA); Nibir K. Dhar, Defense Advanced Research Projects Agency (USA) [8035-21]

10:55 am: **Nanoscale engineering: optimized electron-hole kinetics of quantum dot solar cells**, Kimberly A. Sablon, U.S. Army Research Lab. (USA) [8035-22]

11:10 am: **Metal-black scattering centers to enhance light harvesting by thin film solar cells**, Christopher J. Fredricksen, LRC Engineering Inc. (USA) and Univ. of Central Florida (USA); Robert E. Peale, Deep Panjwani, Univ. of Central Florida (USA); Isaiah Oladeji, SISOM Thin Films, LLC (USA); Kenneth M. Beck, Pacific Northwest National Lab. (USA); F. Khalilzadeh Rezaie, Univ. of Central Florida (USA) [8035-25]

11:25 am: **Fabrication of dye sensitized solar cells using sol-gel coated nanostructured metal oxide thin films**, Ahalapitiya H. Jayatissa, The Univ. of Toledo (USA) [8035-26]

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

SESSION 6

Room: Crystal K. Tues. 1:50 to 3:05 pm

Advanced Fuel Cells

Session Chair: **Palani Balaya**, National Univ. of Singapore (Singapore)

1:50 pm: **Embeddable miniature solid oxide fuel cells** (*Invited Paper*), Shirram Ramanathan, Harvard School of Engineering and Applied Sciences (USA) [8035-27]

2:10 pm: **Interfacial effects on the ionic conductivity of thin film electrolytes for micro-solid oxide fuel cells (μ -SOFCs)** (*Invited Paper*), Enrico Traversa, National Institute for Materials Science (Japan) [8035-28]

2:30 pm: **Development of reversible solid oxide fuel cell for power generation and hydrogen production** (*Invited Paper*), G. B. Jung, J. Y. Chen, S. H. Chan, Yuan Ze Univ. (Taiwan) [8035-29]

2:50 pm: **Recent development of miniaturized enzymatic biofuel cell**, Yin Song, Florida International Univ. (USA) [8035-31]

Coffee Break 3:05 to 3:35 pm

SESSION 7

Room: Crystal K. Tues. 3:35 to 5:15 pm

Advanced Harvesting Devices

Session Chairs: **Priyalal S. Wijewarnasuriya**, U.S. Army Research Lab. (USA); **Achyut Dutta**, Banpil Photonics, Inc. (USA)

3:35 pm: **Multimodal vibration energy harvesting** (*Invited Paper*), Shashank Priya, Virginia Polytechnic Institute and State Univ. (USA) [8035-32]

3:55 pm: **Perpetual harvesting device electronics**, Robert Olah, Genki Mizuno, Achyut Dutta, Banpil Photonics, Inc. (USA); Nibir K. Dhar, Defense Advanced Research Projects Agency (USA) [8035-33]

4:10 pm: **Development of MEMS-based pyroelectric thermal energy harvesters**, Scott R. Hunter, Thirumalesh Bannuru, Oak Ridge National Lab. (USA); Salwa Mostafa, The Univ. of Tennessee (USA); Nickolay V. Lavrik, Slobodan Rajic, Panos G. C. Datskos, Oak Ridge National Lab. (USA) .. [8035-34]

4:25 pm: **Innovative microbial fuel cell design for energy harvesting and corrosion protection**, Chih-Chien Kung, Xiong Yu, Case Western Reserve Univ. (USA) [8035-35]

4:40 pm: **Ultra-high transmittance through nanostructure-coated glass for solar cell applications**, Roger E. Welsler, Adam W. Sood, Magnolia Solar, Inc. (USA); Ashok K. Sood, Magnolia Optical Technologies, Inc. (USA); David J. Poxson, Sameer Chhajed, Jaehee Cho, E. Fred Schubert, Rensselaer Polytechnic Institute (USA); Dennis L. Polla, Defense Advanced Research Projects Agency (USA); Nibir K. Dhar, Defense Advanced Research Projects Agency (USA) [8035-36]

4:55 pm: **Challenges and opportunities in polycrystalline CdTe thin-film solar cells** (*Invited Paper*), Ramesh G. Dhere, David S. Albin, Joel Duenow, Timothy A. Gessert, National Renewable Energy Lab. (USA) [8035-37]

POSTERS—Tuesday

Room: Crystal M Tues. 6:00 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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Energy harvesting from mortar tube firing impulse to supplement fire-control electronics battery, Jahangir S. Rastegar, Richard T. Murray, Omnitek Partners, LLC (USA); Ralph Tillinghast, Carlos M. Pereira, Hai-Long Nguyen, U.S. Army Armament Research, Development and Engineering Ctr. (USA) [8035-45]

Piezoelectric energy harvesting power sources for gun-fired munitions, Jahangir S. Rastegar, Richard T. Murray, Omnitek Partners, LLC (USA); Carlos M. Pereira, Hai-Long Nguyen, U.S. Army Armament Research, Development and Engineering Ctr. (USA) [8035-46]

Design and optimization of a fiber-based luminescent solar concentrator, Esmaeil Banaei, Ayman F. Abouraddy, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) [8035-48]

Energy harvesting roads via pyroelectric effect: a possible approach, Ashok K. Batra, Sudip Bhattacharjee, Ashwith K. Chilvery, Alabama A&M Univ. (USA) [8035-49]

Investigation on solution processed films for organic photovoltaic cells, Ashok K. Batra, Ashwith K. Chilvery, Padmaja Guggilla, M. D. Aggarwal, M. E. Edwards, Alabama A&M Univ. (USA) [8035-50]

Ligand-engineered optical performance of nanocrystal photovoltaics and photodetectors, George M. Williams, Jr., Voxel, Inc. (USA) [8035-51]

Quantum well and quantum dot energy harvesting devices, Roger E. Welsler, Magnolia Solar, Inc. (USA); Ashok K. Sood, Magnolia Optical Technologies, Inc. (USA); Oleg A. Laboutin, Kopin Corp. (USA); Louis J. Guido, Virginia Polytechnic Institute and State Univ. (USA); Nibir K. Dhar, Defense Advanced Research Projects Agency (USA); Priyalal S. Wijewarnasuriya, U.S. Army Research Lab. (USA) [8035-52]

A high-temperature acoustic-electric system for power delivery and data communication through thick metallic barriers, Tristan J. Lawry, Kyle R. Wilt, Sebastian Roa-Prada, Jon D. Ashdown, Gary J. Saulnier, Henry A. Scarton, Rensselaer Polytechnic Institute (USA); Pankaj K. Das, Univ. of California, San Diego (USA); Andrew J. Gavens, Knolls Atomic Power Lab. (USA) [8035-53]

Conference 8035 • Room: Crystal K;
Thurs. Crystal G1 (Joint Sessions)

Wednesday 27 April

SESSION 8

Room: Crystal K. Wed. 9:05 to 11:40 am

Advanced Thermo-Electric Devices

Session Chairs: **Gary E. Bulman**, RTI International (USA);
Patrick J. Taylor, U.S. Army Research Lab. (USA)

9:05 am: **Wearable thermoelectric generators** (*Invited Paper*), Krishna Settalur,
Katey Lo, Rajeev J. Ram, Massachusetts Institute of Technology (USA). [8035-38]

9:25 am: **Progress in Bi₂Te₃-based superlattice thermoelectric materials**
(*Invited Paper*), Gary E. Bulman, David Stokes, Rama Venkatasubramanian, RTI
International (USA). [8035-39]

9:45 am: **Isothermal method for rapid, steady-state measurement of
thermoelectric materials and devices**, Patrick J. Taylor, Jay R. Maddux, U.S.
Army Research Lab. (USA); Sudhir B. Trivedi, Brimrose Corp. of America
(USA) [8035-40]

Coffee Break 10:00 to 10:30 am

10:30 am: **Thin film thermoelectric energy harvesting for security and sensing
applications** (*Invited Paper*), David A. Koester, Nextreme Thermal Solutions, Inc.
(USA) [8035-41]

10:50 am: **Demonstration of 15-mW electrical power using 2-cc
thermoelectric generators with radioisotope heat**, Nicholas G. Baldasaro,
Rama Venkatasubramanian, David Stokes, John Posthill, Peter Thomas, Ryan
Wiitala, RTI International (USA) [8035-42]

11:05 am: **Nanoparticle-based thin-film thermoelectric materials**,
George M. Williams, Jr., Voxel, Inc. (USA) [8035-43]

11:20 am: **High figure of merit bulk thermoelectric nanomaterials from
directed synthesis and assembly of sculpted chalcogenide and oxide
nanocrystals** (*Invited Paper*), Theo Borca-Tasciuc, Ganpati Ramanath,
Rensselaer Polytechnic Institute (USA) [8035-44]

Thursday 28 April

SESSION 9

Room: Crystal G1 Thurs. 8:00 to 10:00 am

Joint Session with conference 8031

Nanotechnologies for Energy Generation and Storage

Session Chairs: **Jeremy J. Pietron**, U.S. Naval Research Lab. (USA);
Nezih Pala, Florida International Univ. (USA)

8:00 am: **Thermoelectric energy conversion using nanostructured materials**
(*Invited Paper*), Carl G. Chen, Andrew Muto, D. Kramer, Ken McEnaney,
H.-P. Feng, Massachusetts Institute of Technology (USA); W. S. Liu, Q. Zhang,
B. Yu, Zhifeng Ren, Boston College (USA) [8031-54]

8:20 am: **Engineering carbon nanomaterials for future applications:
energy and sensor** (*Invited Paper*), Wonbong Choi, Florida International Univ.
(USA) [8031-55]

8:40 am: **Developments in MEMS scale printable alkaline and Li-ion
technology** (*Invited Paper*), Karl Littau, Corie L. Cobb, Palo Alto Research Center,
Inc. (USA). [8031-56]

9:00 am: **Further studies in the electrochemical/mechanical strength of
printed microbatteries** (*Invited Paper*), Daniel A. Steingart, The City College of
New York (USA). [8031-57]

9:20 am: **Energy and size-scalable 3D battery architectures** (*Invited Paper*),
Jeffrey W. Long, U.S. Naval Research Lab. (USA) [8031-58]

9:40 am: **Ulthra-thin, microscale epitaxial compound semiconductor
solar cells** (*Invited Paper*), John A. Rogers, Univ. of Illinois at Urbana-Champaign
(USA) [8031-59]

Coffee Break 10:00 to 10:30 am

SESSION 10

Room: Crystal G1 Thurs. 10:30 to 11:30 am

Joint Session with conference 8031

Nanotechnologies for Energy Generation and Storage

Session Chairs: **Jeremy J. Pietron**, U.S. Naval Research Lab. (USA);
Nezih Pala, Florida International Univ. (USA)

10:30 am: **Little Robeeep: miniature power sources for autonomous systems**
(*Invited Paper*), Shriram Ramanathan, Harvard School of Engineering and Applied
Sciences (USA) [8031-60]

10:50 am: **Self-powered nanosystems: nanogenerators, piezotronics, and
piezo-phototronics** (*Invited Paper*), Zhong Lin Wang, Georgia Institute of
Technology (USA) [8031-61]

11:10 am: **Nanotechnology enabled flexible energy harvesting** (*Invited Paper*),
Michael C. McAlpine, Princeton Univ. (USA). [8031-62]

NEW

Scanning Microscopies 2011: 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)

Conference Co-Chairs: **David C. Joy**, The Univ. of Tennessee (USA); **Tim K. Maugel**, Univ. of Maryland, College Park (USA)

Program Committee: **Eva M. Campo**, Ctr. Nacional de Microelectrónica (Spain); **Ronald G. Dixon**, National Institute of Standards and Technology (USA); **Lucille A. Giannuzzi**, L.A. Giannuzzi & Associates LLC (USA); **Brendan J. Griffin**, The Univ. of Western Australia (Australia); **Michael A. Trimpe**, Hamilton County Coroner's Lab. (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); **Oliver C. Wells**, IBM Corp. (USA)

Tuesday 26 April

Symposium-Wide Plenary Session

Tuesday • 8:30 to 9:30 am • Location: Crystal H

Dr. Regina E. Dugan

Director, Defense Advanced Research Projects Agency (DARPA)

See page 18 for details • Open to All Attendees

Coffee Break 9:30 to 10:00 am

SESSION 1

Room: Crystal L Tues. 10:00 to 11:00 am

Keynote Session

Session 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)

10:00 am: **Is scanning electron microscopy/energy dispersive x-ray microanalysis (SEM/EDS) quantitative?** (Keynote Presentation, Invited Paper), Dale E. Newbury, Nicholas W. M. Ritchie, National Institute of Standards and Technology (USA) [8036-01]

10:30 am: **Scanning microscopies in forensic science: classic and new applications** (Keynote Presentation, Invited Paper), S. Frank Platek, Mark R. Witkowski, Nicola Ranieri, John B. Crowe, Adam C. Lanzarotta, Douglas C. Albright, U.S. Food and Drug Administration (USA) [8036-02]

SESSION 2

Room: Crystal L Tues. 11:00 am to 12:40 pm

Forensics

Session Chairs: **S. Frank Platek**, U.S. Food and Drug Administration (USA); **Michael A. Trimpe**, Hamilton County Coroner's Lab. (USA)

11:00 am: **Analysis of particles produced during airbag deployment by SEM/EDS and their deposition on surrounding surfaces**, J. Matney Wyatt, U.S. Army Criminal Investigation Lab. (USA) [8036-18]

11:20 am: **Probative value of gunshot residue on victims of shootings and comparison of gunshot residue results with modern technology versus older testing of samples**, Robert S. White, West Virginia State Police, Retired (USA); William J. Mershon, Tescan USA Inc. (USA) [8036-04]

11:40 am: **Scientific working group on gunshot residue (SWGSR): progress report**, Michael A. Trimpe, Hamilton County Coroner's Lab. (USA) [8036-05]

12:00 pm: **Characterization and source identification of fugitive dusts by light and electron microscopy**, Richard S. Brown, MVA Scientific Consultants (USA) [8036-06]

12:20 pm: **Application possibilities of several modern methods of microscopy and microanalysis in forensic science field**, Marek Kotrly, Ivana Turkova, Institute of Criminalistics Prague (Czech Republic) [8036-07]

Lunch/Exhibition Break 12:40 to 2:00 pm

SESSION 3

Room: Crystal L Tues. 2:00 to 3:20 pm

Advancements in Scanning Electron Microscopy I

Session Chairs: **Eva M. Campo**, Univ. of Pennsylvania (USA);

Lucille A. Giannuzzi, L.A. Giannuzzi & Associates LLC (USA)

2:00 pm: **Quantitative scanning electron microscopy**, András E. Vladár, Petr Cizmar, Bradley Damazo, Purushotham P. Kavuri, Michael T. Postek, National Institute of Standards and Technology (USA) [8036-08]

2:20 pm: **Comparison of channeling contrast from ion and electron images**, Lucille A. Giannuzzi, L.A. Giannuzzi & Associates LLC (USA); Joseph R. Michael, Sandia National Labs. (USA) [8036-09]

2:40 pm: **FIB/SEM-EDX operations for intracellular granules characterization**, Marziale Milani, Univ. degli Studi di Milano-Bicocca (Italy); Claudio Savoia, STMicroelectronics (Italy); Lyubov Didenko, Natalia Shevlyagina, Gamaleya Research Institute (Russian Federation); Francesco Tatti, FEI Co. (Netherlands) [8036-10]

3:00 pm: **Pursuit of clean SEM and HIM**, Purushotham P. Kavuri, András E. Vladár, Michael T. Postek, National Institute of Standards and Technology (USA) [8036-11]

Coffee Break 3:20 to 3:40 pm

SESSION 4

Room: Crystal L Tues. 3:40 to 5:40 pm

Advancements in Scanning Electron Microscopy II

Session Chairs: **Lucille A. Giannuzzi**, L.A. Giannuzzi & Associates LLC (USA); **Eva M. Campo**, Univ. of Pennsylvania (USA)

3:40 pm: **Advanced SCPM image composition with intra-frame drift correction**, Petr Cizmar, András E. Vladár, Michael T. Postek, National Institute of Standards and Technology (USA) [8036-12]

4:00 pm: **The characterization of nanoparticles using analytical electron microscopy**, Whitney B. Hill, MVA Scientific Consultants (USA) [8036-13]

4:20 pm: **Transmission electron microscopy of electrospun GaN nanofibers**, Joshua L. Robles-Garcia, Anamaris Melendez, Univ. de Puerto Rico en Humacao (USA); Jorge J. Santiago-Aviles, Univ. of Pennsylvania (USA); Idalia Ramos, Univ. de Puerto Rico en Humacao (USA); Eva M. Campo, Univ. of Pennsylvania (USA) [8036-14]

4:40 pm: **Study of LCE nanocomposites through electron microscopy**, Núria Torras, Kirill E. Zinoviev, Ctr. Nacional de Microelectrónica (Spain); Douglas Yates, Lolita Rotkina, Univ. of Pennsylvania (USA); Jaume Esteve, Ctr. Nacional de Microelectrónica (Spain); E. M. Terentjev, Univ. of Cambridge (United Kingdom); Eva M. Campo, Univ. of Pennsylvania (USA) [8036-15]

5:00 pm: **Morphological classification and microanalysis of fractured and degraded tire rubber**, Giovanni F. Crosta, Univ. degli Studi di Milano-Bicocca (Italy) [8036-16]

5:20 pm: **Morphological analysis and classification of dispersion in a polymer nano-composite**, Giovanni F. Crosta, Univ. degli Studi di Milano-Bicocca (Italy) [8036-17]

Wednesday 27 April

SESSION 5

Room: Crystal L. Wed. 8:30 to 10:30 am

Advancements in Helium Ion Microscopy

Session Chairs: **András E. Vladár**, National Institute of Standards and Technology (USA); **Michael T. Postek**, National Institute of Standards and Technology (USA)

8:30 am: **Nanometer-scale imaging and metrology; nano-fabrication with the Orion helium ion microscope**, Bin Ming, András E. Vladár, Michael T. Postek, National Institute of Standards and Technology (USA). [8036-19]

8:50 am: **Investigation of cellular interactions of nanoparticles by helium ion microscopy**, Bruce W. Arey, Vaithiyalingam Shutthanandan, Galya Orr, Pacific Northwest National Lab. (USA) [8036-20]

9:10 am: **Formation of embedded gold nanoclusters and nanocluster-cavity pairs in SrTiO₃ single crystals**, Vaithiyalingam Shutthanandan, Bruce W. Arey, Chongmin Wang, Grace Newhouse, Pacific Northwest National Lab. (USA); Suntharmpillai Thevuthasan, Pacific Northwest National Lab.. (USA) . . . [8036-21]

9:30 am: **Creating nanohole arrays with the helium ion microscope**, Mohan Ananth, Colin Sanford, Lewis Stern, David Ferranti, Chuong Huynh, Larry Scipioni, Carl Zeiss NTS, LLC (USA) [8036-22]

9:50 am: **Plasma FIB system for large volume cross-sectional metrology and analysis**, Paul P. Tesch, Noel S. Smith, Noel P. Martin, Oregon Physics, LLC (USA) [8036-23]

10:10 am: **Secondary electrons energy distribution and energy selective imaging in helium ion microscope**, Oleg F. Vyvenko, Yuri V. Petrov, St. Petersburg State Univ. (Russian Federation) [8036-24]

Coffee Break 10:30 to 11:00 am

SESSION 6

Room: Crystal L. Wed. 11:00 am to 12:20 pm

Advances in Scanned Probe Microscopies I

Session Chairs: **Ronald G. Dixon**,

National Institute of Standards and Technology (USA);

Ndubuisi G. Orji, National Institute of Standards and Technology (USA)

11:00 am: **Progress on a metrological scanning probe microscope for traceable dimensional metrology at the nanoscale**, Jan Herrmann, Bakir Babic, Christopher H. Freund, Malcolm A. Lawn, John R. Miles, Magnus T. Hsu, Malcolm B. Gray, National Measurement Institute of Australia (Australia); Daniel A. Shaddock, The Australian National Univ. (Australia) [8036-25]

11:20 am: **Measurement strategies and uncertainty estimations for pitch and step height calibrations by metrological AFM**, Virpi Korpelainen, Jeremias Seppä, Antti Lassila, MIKES Mittatekniikan keskus (Finland) [8036-26]

11:40 am: **Study of a large range metrological atomic force microscope applied for calibration of a vertical PZT stage**, Shihua Wang, Siew-Leng Tan, Gan Xu, A*STAR National Metrology Ctr. (Singapore) [8036-27]

12:00 pm: **Traceable calibration of a critical dimension atomic force microscope (CD-AFM)**, Ronald G. Dixon, Ndubuisi Orji, National Institute of Standards and Technology (USA) [8036-28]

Lunch/Exhibition Break 12:20 to 2:00 pm

SESSION 7

Room: Crystal L. Wed. 2:00 to 4:30 pm

Advances in Scanned Probe Microscopies II

Session Chairs: **Ronald G. Dixon**,

National Institute of Standards and Technology (USA);

Ndubuisi G. Orji, National Institute of Standards and Technology (USA)

2:00 pm: **Effects of tip characteristics on nanoparticle metrology with atomic force microscopy**, Malcolm A. Lawn, Asa K. Jämting, Jan Herrmann, National Measurement Institute of Australia (Australia) [8036-29]

2:20 pm: **Development of photomask linewidth measurement and calibration using AFM and SEM in NMIJ**, Kentaro Sugawara, Osamu Sato, Ichiko Misumi, Satoshi Gonda, Mingzi Lu, National Institute of Advanced Industrial Science and Technology (Japan) [8036-30]

2:40 pm: **New developments at PTB in 3D-AFM with tapping and torsion AFM mode and vector approach probing strategy**, Gaoliang Dai, Wolfgang Hässler-Grohne, Dorothee Hüser-Espig, Helmut Wolff, Jens Fluegge, Harald Bosse, Physikalisch-Technische Bundesanstalt (Germany) [8036-31]

3:00 pm: **Pitch metrology for data storage: a plan for useful pitch standards down to 5 nm**, Donald A. Chernoff, David L. Burkhead, Advanced Surface Microscopy, Inc. (USA) [8036-32]

Coffee Break 3:20 to 3:50 pm

3:50 pm: **Meniscus effects: a new model for ink transport in dip-pen nanolithography**, Brandon L. Weeks, Mark W. Vaughn, Texas Tech Univ. (USA); Omkar A. Nafday, Nanolink, Inc. (USA) [8036-33]

4:10 pm: **Development of the interference microscope for traceable step height standard measurements and AFM calibration**, Igor Malinovsky, Ricardo d. S. França, Luiz V. G. Tarelho, Iakyrá B. Couceiro, Clara M. S. Almeida, National Metrology Institute of Brazil (Brazil) [8036-34]

Thursday 28 April

SESSION 8

Room: Crystal L. Thurs. 8:30 to 10:10 am

Advances in Optical Microscopy

Session Chairs: **Ravikiran Attota**, National Institute of Standards and Technology (USA); **Tim K. Maugel**, Univ. of Maryland, College Park (USA)

8:30 am: **Compressive decoding enabled lensless fluorescent imaging on a chip**, Ahmet F. Coskun, Ikbal Sencan, Ting-Wei Su, Aydogan Ozcan, Univ. of California, Los Angeles (USA) [8036-35]

8:50 am: **Through-focus scanning optical microscopy**, Ravikiran Attota, National Institute of Standards and Technology (USA) [8036-36]

9:10 am: **High-speed 3D nonlinear optical imaging using FPGA, deformable and scanning mirrors**, Masood Samim, Univ. of Toronto (Canada); Virginijus Barzda, Univ. of Toronto Mississauga (Canada) [8036-37]

9:30 am: **Dispersion free all reflective confocal microscope objective**, Wojtek J. Walecki, Sunrise Optical LLC (USA); Mike Scaggs, Neoteric Concepts, LLC (USA); Fanny Szondy, Sunrise Optical LLC (USA) [8036-38]

9:50 am: **Use of fluorescence and scanning electron microscopy as tools in teaching biology**, Nabarun Ghosh, West Texas A&M Univ. (USA); Jessica Silva, Eastfield College (USA); Don W. Smith, Univ. of North Texas (USA) [8036-40]

Coffee Break 10:10 to 10:40 am

SESSION 9

Room: Crystal L. Thurs. 10:40 to 11:40 am

Particle Beam Interaction Workshop

Session Chairs: **John S. Villarrubia**,

National Institute of Standards and Technology (USA);

András E. Vladár, National Institute of Standards and Technology (USA)

10:40 am: **Universal yield curves: understanding electron and ion interactions**, David C. Joy, The Univ. of Tennessee (USA); Brendan J. Griffin, The Univ. of Western Australia (Australia) [8036-41]

11:00 am: **3D-measurement using a scanning electron microscope with 4 Everhart-Thornley detectors**, Taras Vynnyk, Renke Scheuer, Eduard Reithmeier, Leibniz Univ. Hannover (Germany) [8036-42]

11:20 am: **Simulation of SEM images of core-shell nanospheres using CHARIOT Monte Carlo software**, Shah Kwok Wei, A*STAR Institute of Materials Research and Engineering (Singapore); Sergey Babin, Sergey S. Borisov, Abeam Technologies (USA); Ming Yong Han, A*STAR Institute of Materials Research and Engineering (Singapore) [8036-43]

Course of Related Interest

SC954 **Scanning Microscopy in Forensic Science** (Platek, Trimpe, McVicar, Postek) Monday, 8:30 am to 5:30 pm

Visit the registration desk for course descriptions or to register

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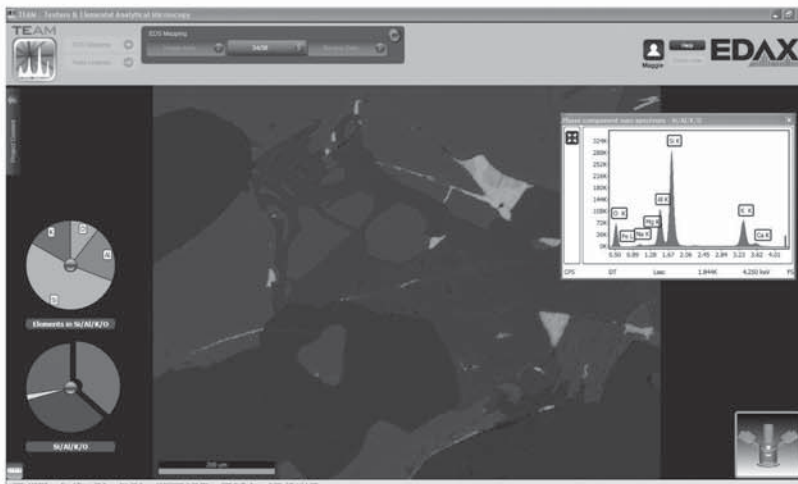
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Laser Radar Technology and Applications XVI

Conference Chairs: **Monte D. Turner**, Defense Advanced Research Projects Agency (USA); **Gary W. Kamerman**, FastMetrix, Inc. (USA)

Program Committee: **Philip Gatt**, Lockheed Martin Coherent Technologies (USA); **Vasyl V. Molebny**, National Taras Shevchenko Univ. of Kyiv (Ukraine); **C. Russell Philbrick**, North Carolina State Univ. (USA); **Upendra N. Singh**, NASA Langley Research Ctr. (USA); **Ove Steinvall**, Swedish Defence Research Agency (Sweden)

Wednesday 27 April

SESSION 1

Room: Crystal C. Wed. 9:00 am to 12:20 pm

Advanced Systems and Measurements

Session Chair: **Monte D. Turner**,
Defense Advanced Research Projects Agency (USA)

9:00 am: **Long-range target discrimination using UV fluorescence**, Mark E. Bray, Jason J. Lepley, SELEX Galileo Ltd. (United Kingdom) [8037-01]

9:20 am: **Slant path 1.5 µm range gated imaging close to ground**, Ove Steinvall, Magnus Elmqvist, Kjell Karlsson, Ove K. Gustafsson, Tomas R. Chevalier, Swedish Defence Research Agency (Sweden) [8037-02]

9:40 am: **Near infrared lidar system for perimeter security and surveillance in low-visibility weather conditions**, Richard I. Billmers, RL Associates Inc. (USA) [8037-03]

10:00 am: **Characterisation of small targets in a maritime environment by means of laser range profiling**, Robin M. Schoemaker, Gijs Franssen, Koen Benoist, Arjan L. Mieremet, TNO Defence, Security and Safety (Netherlands) [8037-04]

10:20 am: **High-resolution hydrographic airborne laser scanner for surveying inland waters and shallow coastal zones**, Martin Pfennigbauer, Andreas Ullrich, RIEGL Laser Measurement Systems GmbH (Austria); Frank Steinbacher, Markus Aufleger, Leopold-Franzens-Univ. Innsbruck (Austria) [8037-05]

Coffee Break 10:40 to 11:00 am

11:00 am: **Underwater laser serial imaging using compressive sensing and digital mirror device**, Bing Ouyang, Fraser R. Dalgleish, Walter Britton, Brian Ramos, Florida Atlantic Univ. (USA) [8037-06]

11:20 am: **High-precision, accuracy, and resolution 3D laser scanner employing pulsed-time-of-flight measurement**, Martin Pfennigbauer, Andreas Ullrich, RIEGL Laser Measurement Systems GmbH (Austria); Joao Pereira do Carmo, European Space Research and Technology Ctr. (Netherlands) [8037-07]

11:40 am: **In cooperation with laser radar**, Vasyl V. Molebny, National Taras Shevchenko Univ. of Kyiv (Ukraine); Gary W. Kamerman, FastMetrix, Inc. (USA); Ove Steinvall, Swedish Defence Research Agency (Sweden) [8037-08]

12:00 pm: **Highly sensitive lidar with sensor-head of thumb size by using optical fiber preamplifier**, Daisuke Inoue, Tadashi Ichikawa, Hiroyuki Matsubara, Xuesong Mao, Mitsutoshi Maeda, Chie Nagashima, Manabu Kagami, Toyota Central R&D Labs., Inc. (Japan) [8037-09]

Lunch/Exhibition Break 12:20 to 2:00 pm

SESSION 2

Room: Crystal C. Wed. 2:00 to 5:30 pm

Visualization and Data Analysis

Session Chair: **Ove Steinvall**,
Swedish Defence Research Agency (Sweden)

2:00 pm: **Line of sight analysis using voxelized discrete lidar**, Shea Hagstrom, David W. Messinger, Rochester Institute of Technology (USA) [8037-10]

2:20 pm: **Extracting intelligence from ladar sensing modalities**, Allan M. Burwinkel, Stuart J. Shelley, Etegent Technologies, Ltd. (USA) [8037-11]

2:40 pm: **Automatic merging of lidar point-clouds using data from low-cost GPS/IMU systems**, Scott E. Budge, Utah State Univ. (USA); Kurt von Niederhausen, Ball Aerospace & Technologies Corp. (USA) [8037-12]

3:00 pm: **Terrain classification of ladar data point clouds**, Amy L. Neuenschwander, Lori A. Magruder, Marcus Tyler, The Univ. of Texas at Austin (USA); Melba M. Crawford, Purdue Univ. (USA) [8037-13]

Coffee Break 3:20 to 3:50 pm

3:50 pm: **Automated method for detection and quantification of building damage and debris using light detection and ranging (lidar) data**, Richard Labiak, Rochester Institute of Technology (USA) and Air Force Institute of Technology Civilian Institution Program (USA); Jan W. van Aardt, Darryl Eychner, Erin Wirch, Hans-Peter Bischof, Rochester Institute of Technology (USA) [8037-14]

4:10 pm: **Lidar depth image compression using clustering, re-indexing, and JPEG2000**, Dmitriy Karpman, David Ashbrook, Xiaoling Li, Ye Duan, Wenjun Zeng, Univ. of Missouri-Columbia (USA) [8037-15]

4:30 pm: **Rapid high-fidelity visualisation of multispectral 3D mapping**, Philip M. Tudor, Mark A. Christy, General Dynamics UK Ltd. (United Kingdom) [8037-16]

4:50 pm: **A calibration and error correction method for improved texel (fused lidar/digital camera) images**, Scott E. Budge, Ziang Wang, Utah State Univ. (USA) [8037-17]

5:10 pm: **Quality metrics for 3D laser radar systems**, Norman A. Lopez, Jeffrey R. Stevens, Robin R. Burton, FastMetrix, Inc. (USA) [8037-18]

Thursday 28 April

SESSION 3

Room: Crystal C. Thurs. 9:00 to 10:20 am

Laser Remote Sensing

Session Chair: **Philip Gatt**, Lockheed Martin Coherent Technologies (USA)

9:00 am: **Sensitivity of the polarization ratio method to aerosol concentration**, Michelle G. Snyder, North Carolina State Univ. (USA); Andrea M. Brown, The Johns Hopkins Univ. (USA); C. Russell Philbrick, North Carolina State Univ. (USA) [8037-19]

9:20 am: **Pseudorandom noise code-based technique for cloud and aerosol discrimination applications**, Joel Campbell, Narasimha S. Prasad, Michael Flood, Wallace Harrison, NASA Langley Research Ctr. (USA) [8037-20]

9:40 am: **Laser remote sensing of atmospheric properties**, C. Russell Philbrick, Timothy P. Wright, Hans D. Hallen, North Carolina State Univ. (USA) [8037-21]

10:00 am: **Detection of microwave emission from solid targets ablated with an ultra-short pulsed laser**, Joseph A. Miragliotta, Benjamin Brawley, Caroline Sailor, James B. Spicer, Jane W. Spicer, The Johns Hopkins Univ. (USA) [8037-22]

Coffee Break 10:20 to 10:40 am

SESSION 4

Room: Crystal C. Thurs. 10:40 am to 12:00 pm

Coherent Systems I

Session Chair: **C. Russell Philbrick**, North Carolina State Univ. (USA)

10:40 am: **All-fiber coherent doppler lidar for wind sensing**, Sameh Abdelazim, The City College of New York (USA) [8037-23]

11:00 am: **Minimization of differential Doppler induced fringe averaging in holographic aperture lidar**, Ross L. Bobb, Bradley D. Duncan, Univ. of Dayton (USA); Matthew P. Dierking, Air Force Research Lab. (USA) [8037-24]

11:20 am: **Pulsed coherent fiber lidar transceiver for aircraft in-flight turbulence and wake-vortex hazard detection**, Shantanu Gupta, Mehmetcan Akbulut, Youming Chen, Jacob Hwang, Horacio Verdun, Frank Kimpel, Fibertek, Inc. (USA) [8037-25]

11:40 am: **Vertical and horizontal wind profiling from a high-energy, pulsed, 2-micron, coherent-detection doppler lidar and intercomparison with other sensors**, Upendra N. Singh, NASA Langley Research Ctr. (USA) [8037-26]

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

SESSION 5

Room: Crystal C. Thurs. 1:40 to 3:00 am

Coherent Systems II

Session Chair: C. Russell Philbrick, North Carolina State Univ. (USA)

2:00 am: **Piston phase determination and its effect on multi-aperture image resolution recovery**, Jeffrey R. Kraczek, Paul McManamon, Joseph W. Haus, Univ. of Dayton (USA); Joseph C. Marron, Lockheed Martin Coherent Technologies (USA) [8037-28]

2:20 am: **Short pulse synthetic aperture lidar**, Jennifer L. Cams, Air Force Research Lab. (USA); Bradley D. Duncan, Univ. of Dayton (USA); Matthew P. Dierking, Air Force Research Lab. (USA) [8037-29]

2:40 am: **Impact of Gaussian beam jitter on Gaussian beam coherent laser radar performance**, Philip Gatt, Scott M. Shald, Lockheed Martin Coherent Technologies (USA) [8037-30]

Coffee Break 3:00 to 3:20 pm

SESSION 6

Room: Crystal C. Thurs. 3:20 to 4:20 pm

Laser Doppler Vibrometry

Session Chair: Vasyl Molebny, National Taras Shevchenko Univ. of Kyiv (Ukraine)

3:20 pm: **Green laser vibrometry based on single frequency monolithic microchip laser**, Arkadiusz J. Antonczak, Pawel Koziol, Jaroslaw Z. Sotor, Krzysztof M. Abramski, Wroclaw Univ. of Technology (Poland) [8037-31]

3:40 pm: **Multichannel flexible fiber vibrometer**, Adam Waz, Pawel R. Kaczmarek, Arkadiusz J. Antonczak, Grzegorz Dudzik, Jaroslaw Z. Sotor, Grzegorz Sobon, Karol Krzempek, Krzysztof M. Abramski, Wroclaw Univ. of Technology (Poland) [8037-32]

4:00 pm: **Airborne laser vibrometer for seismic subsurface inspection**, Alastair D. McAulay, Lehigh Univ. (USA) [8037-33]

SESSION 7

Room: Crystal C. Thurs. 4:20 to 5:20 pm

Staring Array Lidar

Session Chair: Vasyl Molebny, National Taras Shevchenko Univ. of Kyiv (Ukraine)

4:20 pm: **Flash lidar waveform measurements using an intensified photodiode focal plane array**, Christopher Bracikowski, Chung M. Wong, Toni Uchima, Brian K. Baldauf, Northrop Grumman Aerospace Systems (USA) [8037-34]

4:40 pm: **Topographic mapping flash lidar for multiple scattering, terrain, and forest mapping**, Tanya Ramond, Carl S. Weimer, Eileen Saiki, Jeffrey T. Applegate, Ball Aerospace & Technologies Corp. (USA); Yongxiang Hu, NASA Langley Research Ctr. (USA); Thomas Delker, Lyle Ruppert, Brian Donley, Ball Aerospace & Technologies Corp. (USA) [8037-35]

5:00 pm: **Drogue tracking using 3D flash lidar for autonomous aerial refueling**, Chao-I Chen, Roger Stettner, Advanced Scientific Concepts, Inc. (USA) [8037-36]

POSTERS—Thursday

Room: Crystal M Thurs. 6:00 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. 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 pm 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.

Simulation results on false-alarm reduction method by intensity dividing in three-dimensional imaging direct-detection laser radar using Geiger-mode avalanche photodiodes, Tae Hoon Kim, Hong Jin Kong, Min Seok Oh, Sung Eun Jo, KAIST (Korea, Republic of) [8037-55]

Fluorescence/depolarization lidar for mid-range stand-off detection of biological agents, Jacek Wojtanowski, Zygmunt Mierczyk, Krzysztof Kopczyński, Marek Zygmunt, Wiesław Piotrowski, Andrzej Gietka, Piotr Krnysak, Tadeusz Drozd, Michał Muzal, Andrzej Młodzianko, Andrzej Gawlikowski, Mirosława H. Kaszczyk, Roman Ostrowski, Marcin Jakubaszek, Jarosław Mlynczak, Military Univ. of Technology (Poland) [8037-56]

Simulated lidar waveforms for understanding factors affecting waveform shape, Angela M. Kim, Richard C. Olsen, Naval Postgraduate School (USA) [8037-49]

Friday 29 April

SESSION 8

Room: Crystal C. Fri. 9:00 to 11:40 am

Detectors and Receiver Technology

Session Chair: Gary W. Kamerman, FastMetrix, Inc. (USA)

9:00 am: **Flash lidar focal plane array technologies**, George M. Williams, Jr., Voxel, Inc. (USA) [8037-37]

9:20 am: **Geiger-mode lidar cameras**, Ping Yuan, Rengarajan Sudharsanan, Xiaogang Bai, Joseph C. Boisvert, Paul A. McDonald, Eduardo L. Labios, Spectrolab, Inc. (USA); Bryan A. Morris, John P. Nicholson, Gary M. Stuart, Harrison Danny, Boeing-SVS, Inc. (USA); Stephen T. Van Duyne, Greg Pauls, Stephen D. Gaalema, Black Forest Engineering (USA) [8037-38]

9:40 am: **Coincidence processing algorithms for GmAPD laser radar systems**, Norman A. Lopez, FastMetrix, Inc. (USA) [8037-39]

10:00 am: **Advanced coincidence processing of 3D laser radar data**, Alexandru N. Vasile, Richard M. Marino, Luke Skelly, Michael O'Brien, MIT Lincoln Lab. (USA) [8037-40]

Coffee Break 10:20 to 10:40 am

10:40 am: **Target detection capabilities of flash lidar detectors**, George M. Williams, Jr., Voxel, Inc. (USA) [8037-41]

11:00 am: **Linear-mode avalanche photo-diode detectors with a quasi-deterministic gain component: statistical model studies**, Douglas G. Youmans, Cobham Analytic Solutions (USA) [8037-42]

11:20 am: **GHz low-noise SWIR photo receivers**, Xiaogang Bai, Ping Yuan, Paul A. McDonald, Joseph C. Boisvert, James J. Chang, Robyn L. Woo, Eduardo L. Labios, Rengarajan Sudharsanan, Spectrolab, Inc. (USA); Michael A. Krainak, Guangning Yang, Xiaoli Sun, Wei Lu, NASA Goddard Space Flight Ctr. (USA) [8037-43]

SESSION 9

Room: Crystal C. Fri. 11:40 am to 12:20 pm

Novel Applications

Session Chair: Gary W. Kamerman, FastMetrix, Inc. (USA)

- 11:40 am: **Lidar characteristics for detecting and tracking high-speed bullets**, Joseph S. J. Peri, The Johns Hopkins Univ. (USA) [8037-44]
- 12:00 pm: **Small UAV surveillance and detection system**, Ryan Franz, Brian S. Goldberg, Adsys Controls, Inc. (USA) [8037-45]
- Lunch Break 12:20 to 1:40 pm

SESSION 10

Room: Crystal C. Fri. 1:40 to 3:00 pm

Lasers and Transmitter Technology

Session Chair: Upendra N. Singh, NASA Langley Research Ctr. (USA)

- 1:40 pm: **A 243mJ, eye-safe, injection-seeded, KTA ring-cavity optical parametric oscillator**, Robert Foltynowicz, Michael D. Wojcik, Utah State Univ. (USA); Arlee V. Smith, AS-Photonics, LLC (USA) [8037-46]
- 2:00 pm: **High-power diode-pumped Q-switched Er³⁺:YAG single-crystal fiber laser for active imaging system**, Igor Martial, Lab. Charles Fabry (France); Julien Didierjean, Nicolas Aubry, Fibercryst SAS (France); François Balembos, Patrick Georges, Lab. Charles Fabry (France) [8037-47]
- 2:20 pm: **Field tests of optical ranging using PRBS modulation techniques**, Joseph M. Kovalik, Keith E. Wilson, Malcolm W. Wright, Walton Williamson, Jet Propulsion Lab. (USA) [8037-48]
- 2:40 pm: **System gain optimization in direction detection ladar system**, Long Wu, Yuan Zhao, Yong Zhang, Yu Zhang, Jie Wu, Harbin Institute of Technology (China) [8037-50]
- Coffee Break 3:00 to 3:20 pm

SESSION 11

Room: Crystal C. Fri. 3:20 to 4:40 pm

Autonomous Vehicle Sensors

Session Chair: Gary W. Kamerman, FastMetrix, Inc. (USA)

- 3:20 pm: **Virtual navigation of interior structures by lidar**, Yongjian Xi, Xiaoling Li, Ye Duan, Univ. of Missouri-Columbia (USA); Norbert H. Maerz, Missouri Univ. of Science and Technology (USA) [8037-51]
- 3:40 pm: **Spectral ladar as a UGV navigation sensor**, Michael A. Powers, General Dynamics Robotic Systems (USA); Christopher C. Davis, Univ. of Maryland, College Park (USA) [8037-52]
- 4:00 pm: **Brassboard development of a MEMS-scanned ladar sensor for small ground robots**, Barry L. Stann, John F. Dammann, U.S. Army Research Lab. (USA); Pey-Schuan Jian, Aerotek, Inc. (USA); Mark M. Giza, William B. Lawler, U.S. Army Research Lab. (USA) [8037-53]
- 4:20 pm: **Compact 3D lidar based on optically coupled horizontal and vertical scanning mechanism for the autonomous navigation of robots**, Min-Gu Lee, Seung-Ho Baeg, Moon-Hong Baeg, Korea Institute of Industrial Technology (Korea, Republic of); Ki Min Lee, Hae Seok Lee, LG Innotek (Korea, Republic of); Jong Ok Park, Hyundai Rotem Co. (Korea, Republic of); Hong Ki Kim, Samsung Electro-Mechanics (Korea, Republic of) [8037-54]

Courses of Related Interest

- SC1032 **Direct Detection Laser Radar Systems for Imaging Applications** (Richmond, Cain) Tuesday, 8:30 am to 5:30 pm
- SC167 **Introduction to Laser Radar** (Kamerman) Monday, 8:30 am to 12:30 pm
- SC168 **Advanced Coherent Laser Radars Design and Applications** (Kamerman) Monday, 1:30 to 5:30 pm
- SC1031 **Radar Micro-Doppler Signatures - Principles and Applications** (Chen, Tahmoush) Monday, 1:30 to 5:30 pm
- SC1035 **Military Laser Safety** (Marshall) Wednesday, 8:30 am to 5:30 pm
- SC997 **High Power Laser Beam Quality** (Ross) Wednesday, 1:30 to 5:30 pm
- SC1033 **Optical Phased Array Technologies and Systems** (Probst, McManamon) Thursday, 8:30 am to 5:30 pm
- SC838 **Laser Range Gated Imaging Techniques** (Duncan) Tuesday, 1:30 to 5:30 pm
- SC995 **Target Detection Algorithms for Hyperspectral Imagery** (Nasrabadi) Thursday, 8:30 am to 5:30 pm

Visit the registration desk for course descriptions or to register



Atmospheric Propagation VIII

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 (USA); **Larry C. Andrews**, Univ. of Central Florida (USA); **Gary J. Baker**, Lockheed Martin Space Systems Co. (USA); **Harris Rayvon Burris, Jr.**, U.S. Naval Research Lab. (USA); **James M. Cicchiello**, Northrop Grumman Electronic Systems (USA); **G. Charmaine C. Gilbreath**, U.S. Naval Research Lab. (USA); **Gary G. Gimmestad**, Georgia Tech Research Institute (USA); **Kenneth J. Grant**, Defence Science and Technology Organisation (Australia); **Christopher I. Moore**, 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 26 April

Symposium-Wide Plenary Session

Tuesday • 8:30 to 9:30 am • Location: Crystal H

Dr. Regina E. Dugan

Director, Defense Advanced Research Projects Agency (DARPA)

See page 18 for details • Open to All Attendees

Coffee Break 9:30 to 10:00 am

SESSION 1

Room: Crystal B. Tues. 1:50 to 3:20 pm

Performance, Modeling, and Simulation

Session Chair: **Larry C. Andrews**, Univ. of Central Florida (USA)

1:50 pm: **Monte Carlo-based multiple-scattering channel modeling for non-line-of-sight ultraviolet communications** (*Invited Paper*), Robert J. Drost, Brian M. Sadler, U.S. Army Research Lab. (USA) [8038-01]

2:20 pm: **Performance modeling of the effects of aperture phase error, turbulence, and thermal blooming on tiled subaperture systems**, Charles L. Leakeas, Richard J. Bartell, Salvatore J. Cusumano, Air Force Institute of Technology (USA); Matthew Whitely, MZA Associates Corp. (USA). [8038-02]

2:40 pm: **Practical calculation of the beam scintillation index based on the rigorous asymptotic propagation theory**, Mikhail I. Charnotskii, Zel Technologies, LLC (USA); Gary J. Baker, Lockheed Martin Space Systems Co. (USA) [8038-03]

3:00 pm: **Fading probability density function of free-space optical communication channels with pointing error**, Zhijun Zhao, Rui Liao, Michigan Technological Univ. (USA). [8038-05]

Coffee Break 3:20 to 3:50 pm

SESSION 2

Room: Crystal B. Tues. 3:50 to 5:10 pm

Atmospheric Measurements

Session Chair: **Earl J. Spillar**, Air Force Research Lab. (USA)

3:50 pm: **Characterizing aerosol extinction in the UV-NIR spectral range**, Gary G. Gimmestad, David W. Roberts, Georgia Tech Research Institute (USA) [8038-06]

4:10 pm: **Validation of technique to hyperspectrally characterize the lower atmosphere with limited surface observations**, Robb M. Randall, Steven T. Fiorino, Michelle F. Gerling, Adam D. Downs, Air Force Institute of Technology (USA) [8038-07]

4:30 pm: **Simulation of plane wave propagation through non-Kolmogorov turbulent atmosphere: a comparison between simulations and theory**, Venkata S. R. Gudimetla, Air Force Research Lab. (USA); Richard B. Holmes, Boeing LTS Inc. (USA). [8038-08]

4:50 pm: **Measurements of atmospheric parameters using the SOR atmospheric monitor**, Earl J. Spillar, Air Force Research Lab. (USA). . . [8038-09]

Wednesday 27 April

SESSION 3

Room: Crystal B. Wed. 8:30 to 10:20 am

Laser Communication I

Session Chair: **Linda M. Wasiczko Thomas**, U.S. Naval Research Lab. (USA)

8:30 am: **Analysis of the propagation channel and its impact on the ORCA laser communication system** (*Invited Paper*), David T. Wayne, Troy Leclerc, Paul Sauer, Ronald L. Phillips, Larry C. Andrews, Florida Space Institute (USA) [8038-10]

9:00 am: **Free-space optical channel propagation tests over a 147 km link**, Juan C. Juarez, The Johns Hopkins Univ. Applied Physics Lab. (USA) . . [8038-11]

9:20 am: **Characterization of impact ionization engineered InGaAs avalanche photodiodes for free-space lasercomm applications**, Harris R. Burris, Jr., Michael S. Ferraro, William S. Rabinovich, Linda M. Wasiczko Thomas, Christopher I. Moore, Ben B. Xu, U.S. Naval Research Lab. (USA); William D. Waters, William R. Clark, OptoGration Inc. (USA). [8038-12]

9:40 am: **Analysis of fading in the propagation channel for the ORCA laser communication system**, Paul Sauer, David T. Wayne, Troy Leclerc, Ronald L. Phillips, Larry C. Andrews, Florida Space Institute (USA) [8038-13]

10:00 am: **Evaluation of a control algorithm for mobile FSO node alignment**, Dayong Zhou, Peter G. LoPresti, Hazem Refai, The Univ. of Oklahoma - Tulsa (USA) [8038-14]

Coffee Break 10:20 to 10:50 am

SESSION 4

Room: Crystal B. Wed. 10:50 am to 12:20 pm

Laser Communication II

Session Chair: Gary J. Baker,
Lockheed Martin Space Systems Co. (USA)

10:50 am: **Observations of atmospheric effects for FALCON laser communication system flight test** (*Invited Paper*), Thomas M. Fletcher, James A. Cunningham, Daniel Baber, Timothy Goode, Brian Gaughan, ITT Advanced Engineering & Sciences (USA) [8038-15]

11:20 am: **PDF computations for power-in-the-bucket measurements of an IR laser beam propagating in the maritime environment**, Charles Nelson, The Johns Hopkins Univ. (USA); Svetlana Avramov-Zamurovic, Reza Malek-Madani, U.S. Naval Academy (USA); Olga Korotkova, Univ. of Miami (USA); Raymond Sova, The Johns Hopkins Univ. Applied Physics Lab. (USA); Frederic Davidson, The Johns Hopkins Univ. (USA) [8038-16]

11:40 am: **Near-the-ground laser communication system: anisoplastic studies based on the PSF measurements**, Aleksandr V. Sergeev, Michael C. Roggemann, Casey D. Demars, Michigan Technological Univ. (USA) . . . [8038-17]

12:00 pm: **Evaluation of the performance of a fiber-bundle-based optical wireless link**, Peter G. LoPresti, Dayong Zhou, Hazem Refai, The Univ. of Oklahoma - Tulsa (USA) [8038-18]

Lunch/Exhibition Break 12:20 to 1:50 pm

SESSION 5

Room: Crystal B. Wed. 1:50 to 4:20 pm

Components and Techniques

Session Chair: Harris Rayvon Burris, Jr.,
U.S. Naval Research Lab. (USA)

1:50 pm: **Turbulence modeling for non-line-of-sight ultraviolet scattering channels** (*Invited Paper*), Haipeng Ding, Zhengyuan Xu, Univ. of California, Riverside (USA); Brian M. Sadler, U.S. Army Research Lab. (USA) [8038-19]

2:20 pm: **Laser communication of FM audio/video signals using InGaAs modulating retro-reflectors**, Kenneth J. Grant, Bradley A. Clare, Wayne Martinsen, Kerry A. Mudge, Defence Science and Technology Organisation (Australia); Harris R. Burris, Jr., Christopher I. Moore, Jake Overfield, Charmaine Gilbreath, William S. Rabinovich, Joseph A. Duperré III, U.S. Naval Research Lab. (USA) [8038-20]

2:40 pm: **Orbital angular momentum receiver bandwidth for laser communications systems operating in atmospheric turbulence**, Frida S. Vetelino, Ricky J. Morgan, Aerospace Missions Corp. (USA) [8038-21]

3:00 pm: **Buffered block acknowledgement (BuBa) protocol for highly errored data links**, Christopher I. Moore, Harris R. Burris, Jr., Linda M. Wasiczko Thomas, Michele R. Suite, Walter R. Smith, Jr., Rita Mahon, William S. Rabinovich, U.S. Naval Research Lab. (USA) [8038-22]

3:20 pm: **Blackbody remote optical thermometry through turbulent atmosphere**, Gil A. Tidhar, Norman S. Kopeika, Ben-Gurion Univ. of the Negev (Israel) [8038-23]

3:40 pm: **A flexible testbed for adaptive optics in strong turbulence**, Jason D. Schmidt, Michael J. Steinbock, Air Force Institute of Technology (USA) . [8038-24]

4:00 pm: **USAF High Energy Laser (HEL) systems: HEL-generated extinction effects and degradation of multibandpass algorithm efficiencies during missile staging (case PRC DF-21; GHADR 110)**, Clifford A. Paiva, BSM Research Associates (USA) [8038-25]



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Booth 1543

Tuesday-Thursday • Cypress Exhibition Hall

Ticket from Registration Packet required.
While supplies last.

Laser Technology for Defense and Security VII

Conference Chairs: **Mark Dubinskii**, U.S. Army Research Lab. (USA); **Stephen G. Post**, Missile Defense Agency (USA)

Program Committee: **Steven R. Bowman**, U.S. Naval Research Lab. (USA); **Scott Christensen**, Nufern (USA); **Nils C. Fernelius**, Air Force Research Lab. (USA); **Walter Fink**, High Energy Laser Joint Technology Office (USA); **Anthony M. Johnson**, Univ. of Maryland, Baltimore County (USA); **Mark W. Neice**, High Energy Laser Joint Technology Office (USA)

Monday 25 April

SESSION 1

Room: Crystal D. Mon. 9:00 to 10:30 am

Bulk Solid State Lasers I

Session Chair: **Mark Dubinskii**, U.S. Army Research Lab. (USA)

9:00 am: **Pulsed 2-micron lasers based on Tm³⁺-doped monoclinic double tungstate crystals** (*Invited Paper*), Xavier Mateos, Martha Segura, Maria Cinta Pujol Baiges, Joan Josep Carvajal, Magdalena Aguiló, Francesc Diaz, Univ. Rovira i Virgili (Spain); Won Bae Cho, Ajou Univ. (Korea, Republic of); Valentin P. Petrov, Uwe Griebner, Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie (Germany) [8039-01]

9:30 am: **74% laser efficiency using 10% Yb³⁺ doped Lu₂O₃ ceramic**, Jasbinder S. Sanghera, WooHong Kim, Guillermo R. Villalobos, Jesse A. Frantz, Brandon Shaw, U.S. Naval Research Lab. (USA); Frederic H. Kung, Univ. Research Foundation (USA); Ishwar Aggarwal, U.S. Naval Research Lab. (USA) [8039-02]

9:50 am: **Tm-doped disordered molybdate crystals for ultrashort mode-locked solid state lasers**, Maria D. Serrano, Xiumei Han, Mauricio Rico, Maria Concepción Cascales, Carlos Zaldo, Instituto de Ciencia de Materiales de Madrid (Spain) [8039-03]

10:10 am: **Resonantly diode pumped Ho³⁺:YVO₄ 2.1-micron laser**, George A. Newburgh, Mark Dubinskii, U.S. Army Research Lab. (USA) [8039-04]

Coffee Break 10:30 to 11:00 am

SESSION 2

Room: Crystal D. Mon. 11:00 am to 12:40 pm

Bulk Solid State Lasers II and Beam Combining

Session Chair: **Stephen G. Post**, Missile Defense Agency (USA)

11:00 am: **Spectroscopy and laser performance of resonantly pumped Er³⁺-doped double tungstate single crystals**, Mark Dubinskii, Viktor Fromzel, Nikolay Ter-Gabrielyan, U.S. Army Research Lab. (USA); Maria D. Serrano, Maria Concepción Cascales, Carlos Zaldo, Instituto de Ciencia de Materiales de Madrid (Spain) [8039-05]

11:20 am: **Composite Yb:YAG/Yb:GSAG cryogenic amplifier for picosecond pulses**, Darren A. Rand, Scot E. J. Shaw, Juan R. Ochoa, Daniel J. Ripin, Tso Yee Fan, MIT Lincoln Lab. (USA); Hector Martin, Laurence S. Hawes, Jiamin Zhang, Samvel Sarkisyan, Eric Wilson, Paul Lundquist, Applied Energetics, Inc. (USA) [8039-06]

11:40 am: **Edge-pumped Yb:YAG disk amplifier with multipassed extraction**, John Vetrovec, Drew A. Copeland, Aqwest, LLC (USA); Detao Du, General Atomics Aeronautical Systems, Inc. (USA) [8039-07]

12:00 pm: **Coherent combining of high-power Yb fiber amplifiers**, Charles X. Yu, Steven J. Augst, Shawn Redmond, Daniel V. Murphy, Antonio Sanchez-Rubio, Tso Yee Fan, MIT Lincoln Lab. (USA) [8039-08]

12:20 pm: **High-efficiency Yb:YAG thin disk laser at room and cryogenic temperatures**, T. Carson, Tim C. Newell, William P. Latham, Air Force Research Lab. (USA); Natasa Vretenar, The Univ. of New Mexico (USA); Tim L. Lucas, Boeing-SVS, Inc. (USA); P. Peterson, Boeing LTS Inc. (USA) [8039-48]

Lunch Break 12:40 to 1:50 pm

SESSION 3

Room: Crystal D. Mon. 1:50 to 3:30 pm

Laser Diodes I

Session Chair: **Walter Fink**,

High Energy Laser Joint Technology Office (USA)

1:50 pm: **Ultra-high-intensity 1550nm single junction pulsed laser diodes**, Jean-Francois Boucher, Laser Components Canada, Inc. (Canada); John J. Callahan, SemiNex Corp. (USA) [8039-09]

2:10 pm: **Elevated-temperature operation of lasers and laser diode arrays**, Ryan Feeler, Jay Doster, Wade F. Collins, Mark E. Kushina, Northrop Grumman Cutting Edge Optronics (USA) [8039-10]

2:30 pm: **High-performance blue and green laser diodes based on nonpolar/semipolar InGaN**, Mathew C. Schmidt, Christine Poblenz, Yu-Chia Chang, Ben Li, Mark J. Mondry, Thomas C. Hasenberg, Justin Iveland, Michael R. Krames, Richard Craig, James W. Raring, James S. Speck, Steven P. DenBaars, Shuji Nakamura, Soraa, Inc. (USA) [8039-11]

2:50 pm: **High-brightness QCW pump stacks based on 200W laser diode bars and mini bars at 808nm and 940nm**, Yuri Berk, Yoram Karni, Yaki Openhaim, Ronen Diamant, Genadi Klumel, Shalom Cohen, Ophir Peleg, SCD Semiconductor Devices (Israel) [8039-12]

3:10 pm: **Extending the locking range of VHG-stabilised diode laser bars using wavefront compensator phaseplates**, Roy McBride, Jozef J. Wendland, PowerPhotonic, Ltd. (United Kingdom); Natalia Trela, Howard J. Baker, Heriot-Watt Univ. (United Kingdom) [8039-13]

Coffee Break 3:30 to 4:00 pm

SESSION 4

Room: Crystal D. Mon. 4:00 to 6:30 pm

Fiber Lasers: CW and Pulsed

Session Chair: **Scott Christensen**, Nufern (USA)

4:00 pm: **Recent progress in power scaling of resonantly-pumped Yb-free Er-doped fiber lasers** (*Invited Paper*), Mark Dubinskii, Jun Zhang, Viktor Fromzel, Tigran Sanamyan, U.S. Army Research Lab. (USA) [8039-14]

4:30 pm: **Monolithic, narrow linewidth, polarization maintaining, thulium fiber laser using femtosecond laser written fiber bragg gratings**, Christina C. C. Willis, Joshua D. Bradford, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) [8039-15]

4:50 pm: **Co-pumped 130 W monolithic single frequency fiber amplifier with an optically induced thermal gradient**, Clint Zeringue, Christopher Vergien, Iyad A. Dajani, Air Force Research Lab. (USA) [8039-16]

5:10 pm: **Amplification of gain switched thulium doped laser with 1.5ns pulsewidth**, Bryce N. Samson, Jim Ding, Chiachi Wang, Kanishka Tankala, Adrian L. G. Carter, Nufern (USA) [8039-17]

5:30 pm: **Generation and amplification of femtosecond laser pulses in Tm:fiber**, Robert A. Sims, Pankaj Kadwani, Lawrence Shah, Martin C. Richardson, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) [8039-18]

5:50 pm: **Atmospheric gas detection using broadband mid-IR thulium fiber-based sources**, Pankaj Kadwani, Robert A. Sims, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Jeffrey Chia, College of Optical Sciences, The Univ. of Arizona (USA); Faleh Altal, Masdar Institute of Science and Technology (United Arab Emirates); Lawrence Shah, Martin C. Richardson, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) [8039-19]

6:10 pm: **Compactly packaged, photonic crystal fiber-based MOPA delivering mJ-energy, MW-peak-power, near diffraction-limited, high spectral brightness ns pulses**, Fabio Di Teodoro, Northrop Grumman Aerospace Systems (USA) [8039-20]

Tuesday 26 April

Symposium-Wide Plenary Session

Tuesday • 8:30 to 9:30 am • Location: Crystal H

Dr. Regina E. Dugan

Director, Defense Advanced Research Projects Agency (DARPA)

See page 18 for details • Open to All Attendees

Coffee Break 9:30 to 10:20 am

SESSION 5

Room: Crystal D. Tues. 10:20 to 11:50 am

Laser Diodes II and Beam Combining

Session Chair: Steven R. Bowman, U.S. Naval Research Lab. (USA)

10:20 am: **Extremely high-brightness, kW-class fiber coupled diode lasers with wavelength stabilization** (*Invited Paper*), Robin K. Huang, Bien Chann, John D. Glenn, TeraDiode, Inc. (USA) [8039-21]

10:50 am: **Progress in commercial wavelength-stabilized high-brightness diode sources suitable for pumping Yb-doped fiber lasers**, Aaron Brown, Paul O. Leisher, Ling Bao, Mike Grimshaw, Mark A. DeVito, Kirk Price, Keith W. Kennedy, Shelly Lin, Mitchell Reynolds, Scott R. Karlsen, Jay A. Small, Robert J. Martinsen, Jim Haden, nLIGHT Corp. (USA) [8039-22]

11:10 am: **Diode laser beam combining for directed energy applications**, Yakov G. Soskind, Richard Gifford, Joseph Aletta, Mark DeLorenzo, David Pollock, DHPC Technologies, Inc. (USA); Allan Chan, Richard C. Cooke, U.S. Army CERDEC Intelligence and Information Warfare Directorate (USA) . . [8039-23]

11:30 am: **Passive coherent beam combining of fiber lasers using volume Bragg gratings**, Apurva Jain, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Christine P. Spiegelberg, Vadim Smirnov, OptiGrate Corp. (USA); Leonid B. Glebov, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) [8039-24]

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

SESSION 6

Room: Crystal D. Tues. 1:20 to 3:10 pm

Mid-IR Lasers and Mid-IR Fiber Material Development

Session Chair: Anthony M. Johnson, Univ. of Maryland, Baltimore County (USA)

1:20 pm: **Oxide glasses for mid-infrared lasers** (*Invited Paper*), Billy D. Richards, Animesh Jha, Gin Jose, Univ. of Leeds (United Kingdom); Xin Jiang, Max-Planck-Institut für die Physik des Lichts (Germany); Mark Dubinskii, U.S. Army Research Lab. (USA) [8039-25]

1:50 pm: **Integrated multispectral high-power laser platform for defense and security applications**, Boris Tadjikov, Alexei G. Tsekoun, Arkadiy Lyakh, Richard Maulini, Pranalytica, Inc. (USA); Chandra Kumar N. Patel, Pranalytica, Inc. (USA) and Univ. of California, Los Angeles (USA) [8039-26]

2:10 pm: **Recent advances in high-power quantum cascade laser systems**, Eric B. Takeuchi, Timothy Day, Bill Chapman, Michael B. Pushkarsky, Daylight Solutions Inc. (USA) [8039-27]

2:30 pm: **Power scaling of diode-pumped 2.7- μm Er³⁺-doped Y₂O₃ ceramic laser**, Tigran Sanamyan, Mark Dubinskii, U.S. Army Research Lab. (USA) [8039-28]

2:50 pm: **Development of tellurite fibers for multiband mid-IR (2-5 μm) fiber laser source**, Shantanu Gupta, Jiangfan Xia, Richard A. Utano, Fibertek, Inc. (USA); Aoxiang Lin, Jean Toulouse, Lehigh Univ. (USA); Michael J. Myers, Kigre, Inc. (USA); Kevin Vora, Eric D. Mazur, Harvard Univ. (USA) [8039-29]

Coffee Break 3:10 to 3:40 pm

SESSION 7

Room: Crystal D. Tues. 3:40 to 6:00 pm

Laser Material Development: Single Crystalline, Ceramics, Fibers

Session Chair: Mark Dubinskii, U.S. Army Research Lab. (USA)

3:40 pm: **Submicrometer-grained highly transparent sesquioxide ceramics: synthesis, processing, and properties**, John Ballato, Clemson Univ. (USA); Karn Serivalsatit, Clemson Univ. (USA) and Chulalongkorn Univ. (Thailand) . . [8039-30]

4:00 pm: **Development of ceramic fibers for high-energy lasers**, Geoff E. Fair, Air Force Research Lab. (USA); Hyun Jun Kim, Heedong Lee, Kristin A. Keller, Triplicane A. Parthasarathy, UES, Inc. (USA) [8039-31]

4:20 pm: **Spectroscopy and laser potential of transition metal doped Cd_{(1-x)Mn_xTe}** for MWIR applications, Tigran Sanamyan, Mark Dubinskii, U.S. Army Research Lab. (USA); Witold Palosz, Joo-Soo Kim, Sudhir B. Trivedi, Brimrose Corp. of America (USA) [8039-32]

4:40 pm: **Characterization of dysprosium for visible solid state lasers**, Shawn P. O'Connor, Steven R. Bowman, Nicholas J. Condon, U.S. Naval Research Lab. (USA) [8039-33]

5:00 pm: **Performance comparison of SCHOTT laser glasses**, Mark J. Davis, Joseph Hayden, SCHOTT North America, Inc. (USA) [8039-34]

5:20 pm: **Low-noise single frequency all phosphate fiber laser**, Peter Hofmann, College of Optical Sciences, The Univ. of Arizona (USA); Arturo Chavez-Pirson, NP Photonics, Inc. (USA); Axel Schülzgen, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Lingyun Xiong, Albane Laronche, Jacques Albert, Carleton Univ. (Canada); Nasser Peyghambarian, College of Optical Sciences, The Univ. of Arizona (USA) [8039-35]

5:40 pm: **Development of Er-doped photonic crystal fiber for high energy laser applications**, E. Joseph Friebele, Charles G. Askins, U.S. Naval Research Lab. (USA); Chad G. Carlson, U.S. Air Force Academy (USA); Mark Dubinskii, Jun Zhang, U.S. Army Research Lab. (USA); Benjamin G. Ward, U.S. Air Force Academy (USA) [8039-36]

POSTERS—Tuesday

Room: Crystal M Tues. 6:00 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. 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 pm 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.

Ultrafast bandgap photonics applications: IRCM and laser VLO, Michael K. Rafailov, RICHER International LLC (USA) [8039-41]

Spectral beam combining using superimposed reflective volume Bragg grating, Benjian Shen, Jichun Tan, Guangwei Zheng, Yanlan He, Xiujian Li, Yisheng Yang, National Univ. of Defense Technology (China) [8039-42]

Generalized active mode locking due to amplitude modulation in a ultra-short pulse laser using maple, Daniel E. Sierra, Univ. EAFIT (Colombia)[8039-43]

High-energy microlaser and compact MOPA transmitter, Brian K. Brickeen, Joseph Mosovsky, The Pennsylvania State Univ. Electro-Optics Ctr. (USA) [8039-46]

Modeling of first-order distributed feedback semiconductor lasers, Meng-Mu Shih, Peter S. Zory, Univ. of Florida (USA) [8039-47]

Conference 8039

Wednesday 27 April

SESSION 8

Room: Crystal D.Wed. 8:30 to 9:50 am

Lasers for Specific Applications and Latest Technology for Laser Functionality

Session Chair: **Mark Dubinskii**, U.S. Army Research Lab. (USA)

8:30 am: **Multifunction laser source for ground and airborne applications**, Bruno Crépy, CILAS (France) [8039-37]

8:50 am: **Laser sources for Raman spectroscopy**, Joyce P. Kilmer, Andrew Iadevaia, Yusong Yin, Photonics Industries International, Inc. (USA) [8039-38]

9:10 am: **Liquid metal-cooled heat sink for advanced high-power laser diodes**, John Vetrovec, Aqwest, LLC (USA); Jeremy Junghans, Northrop Grumman Cutting Edge Optronics (USA) [8039-39]

9:30 am: **Laser damage testing for ion beam sputtered optical coatings at 2 μ m and 2.94 μ m**, Christopher S. Wood, Ove Lyngnes, Precision Photonics Corp. (USA) [8039-40]

Conference Wrap-Up

Room: Crystal D.Wed. 9:50 to 10:10 am

Session Chair: **Mark Dubinskii**, U.S. Army Research Lab. (USA)

Courses of Related Interest

SC1036 **Diode Pumped Alkali Lasers** (Perram) Wednesday, 1:30 to 5:30 pm

SC1035 **Military Laser Safety** (Marshall) Wednesday, 8:30 am to 5:30 pm

SC1033 **Optical Phased Array Technologies and Systems** (Probst, McManamon) Thursday, 8:30 am to 5:30 pm

SC997 **High Power Laser Beam Quality** (Ross) Wednesday, 1:30 to 5:30 pm

Visit the registration desk for course descriptions or to register

Active and Passive Signatures II

Conference Chairs: **G. Charmaine C. Gilbreath**, U.S. Naval Research Lab. (USA); **Chadwick Todd Hawley**, National Signature Program (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)

Wednesday 27 April

SESSION 1

Room: Crystal D. Wed. 1:30 to 3:10 pm

Active and Passive Signatures

Session Chair: **Charmaine Gilbreath**, U.S. Naval Research Lab. (USA)

1:30 pm: **Status of active and passive signatures for detection and characterization of materials and activities of special interest** (*Invited Paper*), Chadwick T. Hawley, National Signature Program (USA) [8040-01]

2:00 pm: **Composite signatures from airborne sensors** (*Invited Paper*), Sean M. Anklam, SpectIR, LLC (USA) [8040-02]

2:30 pm: **Acoustic signature analysis for underground anomalies**, Latasha Solomon, Leng Sim, U.S. Army Research Lab. (USA) [8040-03]

2:50 pm: **2D signature for detection and identification of drugs**, Vyacheslav A. Trofimov, Svetlana A. Varentsova, Lomonosov Moscow State Univ. (Russian Federation); Cunlin Zhang, Jingling Shen, Qingli Zhou, Yulei Shi, Capital Normal Univ. (China) [8040-04]

Coffee Break 3:10 to 3:40 pm

SESSION 2

Room: Crystal D. Wed. 3:40 to 4:50 pm

Signature Mining in Large Data Sets

Session Chair: **Carlos Omar Font**, U.S. Naval Research Lab. (USA)

3:40 pm: **ALADDIN: signatures from uncued video** (*Invited Paper*), John S. Garofolo, National Institute of Standards and Technology (USA) [8040-05]

4:10 pm: **Uncertainties of measures in speaker recognition evaluation**, Jin Chu Wu, Alvin F. Martin, Craig S. Greenberg, Raghu N. Kacker, National Institute of Standards and Technology (USA) [8040-06]

4:30 pm: **Advances in the design, development, and deployment of the U.S. Army Research Laboratory's Multimodal Signatures Database**, Kelly W. Bennett, U.S. Army Research Lab. (USA); James Robertson, Clearhaven Technologies LLC (USA) [8040-07]

Thursday 28 April

SESSION 3

Room: Crystal D. Thurs. 8:30 to 9:50 am

Atmospheric Signatures

Session Chair: **Chadwick Todd Hawley**, National Signature Program (USA)

8:30 am: **Coherent uplink arraying techniques for next generation space communications and planetary radar systems** (*Keynote Presentation*), Barry Geldzahler, NASA Headquarters (USA) [8040-26]

9:00 am: **Experimental signature studies in random and chaotic distributions in the atmosphere**, Carlos O. Font, Joseph A. Duperre III, Charmaine Gilbreath, David Bonanno, Eshani Tarpara, U.S. Naval Research Lab. (USA) [8040-10]

9:20 am: **Next generation signature-based hyperspectral detection: a challenge to atmospheric modelers** (*Invited Paper*), Alan P. Schaum, Brian J. Daniel, U.S. Naval Research Lab. (USA) [8040-11]

SESSION 4

Room: Crystal D. Thurs. 9:50 to 11:00 am

Unique Applications

Session Chair: **Chadwick Todd Hawley**, National Signature Program (USA)

9:50 am: **An optical fiber-based intruder detection sensor**, Xiong Yu, Case Western Reserve Univ. (USA) [8040-12]

Coffee Break 10:10 to 10:40 am

10:40 am: **The performance of all-optical switching based on fiber Bragg grating**, Zhigang Zang, Kyushu Univ. (Japan); Wenxuan Yang, Harbin Institute of Technology (China) [8040-13]

SESSION 5

Room: Crystal D. Thurs. 11:00 am to 12:10 pm

Spectral-Based Signatures

Session Chair: **Kelly W. Bennett**, U.S. Army Research Lab. (USA)

11:00 am: **Two-dimensional, active, resonance-Raman signatures of fresh and aged explosives, bacteria, and chemicals** (*Invited Paper*), Jacob Grun, Robert Lunsford, U.S. Naval Research Lab. (USA); Pratima Kunapareddy, Sergei Nikitin, Research Support Instruments, Inc. (USA); David B. Gillis, Jeffrey H. Bowles, U.S. Naval Research Lab. (USA); Jared C. Gump, Naval Surface Warfare Ctr. Indian Head Div. (USA); Leonid I. Perlovsky, Air Force Research Lab. (USA) [8040-14]

11:30 am: **Spectral variations in HSI signatures of thin fabrics for detecting and tracking of dismounts**, Jared Herweg, Rochester Institute of Technology (USA) and Air Force Institute of Technology (USA); John P. Kerekes, Emmett Ientilucci, Rochester Institute of Technology (USA); Michael T. Eismann, Air Force Research Lab. (USA) [8040-15]

11:50 am: **Spectral analysis algorithm for material detection from multispectral imagery**, Joseph K. Racine, Defense Intelligence Agency (USA) and Booz Allen Hamilton Inc. (USA) [8040-16]

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

SESSION 6

Room: Crystal D. Thurs. 1:40 to 3:20 pm

Signatures for Terrain Characterization and Mapping

Session Chair: **Frank Pipitone**, U.S. Naval Research Lab. (USA)

1:40 pm: **Quantification of constituents in areal and intimate binary mixtures of particulate materials**, Michael West, Keith Manville, Ronald G. Resmini, MITRE Corp. (USA) [8040-17]

2:00 pm: **Changes in apparent emissivity as a function of viewing geometry**, Michael West, John M. Grossmann, Christopher Deloye, MITRE Corp. (USA) [8040-18]

2:20 pm: **Complex soil electrical impedivity signatures**, Simon J. Ghionea, David M. Hull, U.S. Army Research Lab. (USA) [8040-19]

2:40 pm: **Crude oil and refined petroleum product detection on terrestrial substrates with airborne imaging spectroscopy**, C. Scott Allen, George Mason Univ. (USA); Mark P. S. Krekeler, Miami Univ. (USA) [8040-20]

3:00 pm: **Analyses of reflectance characteristics of selected plants**, Mirosława H. Kaszczuk, Zygmunt Mierczyk, Marek Zygmunt, Wiesław Piotrowski, Jadwiga Mierczyk, Military Univ. of Technology (Poland) [8040-21]

Coffee Break 3:20 to 3:50 pm

Conference 8040

SESSION 7

Room: Crystal D. Thurs. 3:50 to 5:20 pm

Depth Recovery for 3D Signatures

Session Chair: Michael West, MITRE Corp. (USA)

3:50 pm: **Efficient RPG detection in noisy 3D image data** (*Invited Paper*), Frank Pipitone, U.S. Naval Research Lab. (USA) [8040-22]

4:20 pm: **Developing 3D signatures using lidar technology**, Ralston Mitchell, The Aerospace Corp. (USA) [8040-23]

4:40 pm: **On the discrimination of solid targets by their depolarization signatures for ladar applications to terrain mapping**, Xiaoying Cao, Royal Military College of Canada (Canada); Gilles A. Roy, Defence Research and Development Canada (Canada); Robert Bernier, Les Instruments Optiques du St-Laurent Inc. (Canada); Gregoire Tremblay, Simon Roy, Christian Laflamme, Defence Research and Development Canada (Canada) [8040-24]

5:00 pm: **Stereoscopic signatures derived from spectroscopic dielectrometry**, Charmaine Gilbreath, U.S. Naval Research Lab. (USA); William F. Brooks, Northrop Grumman Information Technology-TASC (USA); Blerta Bajramaj, U.S. Naval Research Lab. (USA); Daniel Aiken, EMCORE Corp. (USA) [8040-25]

Courses of Related Interest

SC1031 **Radar Micro-Doppler Signatures - Principles and Applications** (Chen, Tahmoush) Monday, 1:30 to 5:30 pm

SC995 **Target Detection Algorithms for Hyperspectral Imagery** (Nasrabadi) Thursday, 8:30 am to 5:30 pm

Visit the registration desk for course descriptions or to register

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Head- and Helmet-Mounted Displays XVI: Design and Applications

Conference Chairs: **Peter L. Marasco**, Air Force Research Lab. (USA); **Paul R. Havig**, Air Force Research Lab. (USA)

Program Committee: **Randall E. Bailey**, NASA Langley Research Ctr. (USA); **Sion A. Jennings**, National Research Council Canada (Canada)

Thursday 28 April

SESSION 1

Room: Crystal B. Thurs. 8:00 to 10:00 am

Human Factors Issues in HMDs

Session Chair: **Paul R. Havig**, Air Force Research Lab. (USA)

8:00 am: **Rise of the HMD: the need to review our human factors guidelines**, Eric E. Geiselman, Paul R. Havig, Air Force Research Lab. (USA) [8041-01]

8:20 am: **Human-machine interface issues in the use of helmet-mounted displays in short conjugate simulators**, James E. Melzer, Rockwell Collins Optronics (USA). [8041-02]

8:40 am: **How much camera separation should be used for the capture and presentation of 3D stereoscopic imagery on binocular HMDs?**, John P. McIntire, Paul R. Havig, Eric E. Geiselman, Eric L. Heft, Air Force Research Lab. (USA) [8041-03]

9:00 am: **Preliminary experimental results from a dichoptic vision system**, Michael P. Browne, SA Photonics (USA); Kirk Moffitt, Human Factors Consultant (USA); Darrel G. Hopper, Bridget I. Fath, Air Force Research Lab. (USA) [8041-04]

9:20 am: **Evaluation of anti-glare applications for a tactical helmet-mounted display**, Jason Roll, Noel Trew, Matt Geis, Paul R. Havig, Air Force Research Lab. (USA) [8041-05]

9:40 am: **Virtual reality in a cave: limitations and the need for HMDs**, Paul R. Havig, John P. McIntire, Eric E. Geiselman, Air Force Research Lab. (USA) [8041-06]

Coffee Break 10:00 to 10:30 am

SESSION 2

Room: Crystal B. Thurs. 10:30 to 11:50 am

HMD Components

Session Chair: **Peter L. Marasco**, Air Force Research Lab. (USA)

10:30 am: **Sensor image augmentation to avoid saturation**, Kohei Funabiki, Japan Aerospace Exploration Agency (Japan); Takashi Yoshida, NEC Corp. (Japan); Kazuho Tawada, Shimadzu Corp. (Japan); Hiroka Tsuda, Japan Aerospace Exploration Agency (Japan) [8041-07]

10:50 am: **Transfer alignment from a personal dead reckoning system to a handheld IMU**, Lauro V. Ojeda, Johann Borenstein, Univ. of Michigan (USA) [8041-08]

11:10 am: **Active matrix organic light emitting diode (AMOLED)-XL performance and life test results**, David A. Fellowes, U.S. Army Night Vision & Electronic Sensors Directorate (USA) [8041-09]

11:30 am: **Spatial noise in microdisplays for near to eye applications**, David A. Fellowes, U.S. Army Night Vision & Electronic Sensors Directorate (USA) [8041-10]

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

SESSION 3

Room: Crystal B. Thurs. 1:20 to 3:00 pm

Current HMD Developments

Session Chair: **Randall E. Bailey**, NASA Langley Research Ctr. (USA)

1:20 pm: **Binocular Scorpion helmet-mounted display**, Robert Atac, Mark Edel, Gentex Corp. (USA). [8041-11]

1:40 pm: **Wide field of view digital night vision head-mounted display**, Michael P. Browne, SA Photonics (USA) [8041-12]

2:00 pm: **Full-color, see-through, daylight-readable, goggle-mounted display**, Christian D. DeJong, Microvision, Inc. (USA) [8041-13]

2:20 pm: **Development of a dichoptic foveal/peripheral head-mounted display with partial binocular overlap**, Dale R. Tyczka, Martha J. Chatten, John B. Chatten, Chatten Associates, Inc. (USA); John O. Merritt, The Merrit Goup (USA); H. Lee Task, Task Consulting (USA); Darrel G. Hopper, Bridget I. Fath, Air Force Research Lab. (USA) [8041-14]

2:40 pm: **Head-worn displays for NextGen**, Randall E. Bailey, Jarvis J. Arthur III, NASA Langley Research Ctr. (USA) [8041-15]

Coffee Break 3:00 to 3:30 pm

SESSION 4

Room: Crystal B. Thurs. 3:30 to 4:50 pm

Flight Tests and Theater Operations

Session Chair: **Sion A. Jennings**, National Research Council Canada (Canada)

3:30 pm: **Flight tests with enhanced/synthetic vision system for rescue helicopter**, Hiroka Tsuda, Kohei Funabiki, Tomoko Iijima, Japan Aerospace Exploration Agency (Japan); Kazuho Tawada, Shimadzu Corp. (Japan); Takashi Yoshida, NEC Corp. (Japan) [8041-16]

3:50 pm: **In-flight evaluation of an optical head motion tracker III**, Kazuho Tawada, Masakazu Okamoto, Shimadzu Corp. (Japan). [8041-17]

4:10 pm: **Qualification testing of the Scorpion HMCS for A-10 and F-16**, Robert Atac, Tony Bugno, Gentex Corp. (USA) [8041-18]

4:30 pm: **The reported incidence of man-machine interface issues in Army aviators using the Aviator's Night Vision System (ANVIS) in a combat theatre**, Keith L. Hiatt, U.S. Army Research Institute of Environmental Medicine (USA); Clarence E. Rash, U.S. Army Aeromedical Research Lab. (USA) [8041-19]

SESSION 5

Room: Crystal B. Thurs. 4:50 to 5:30 pm

HMDs in Non-Piloted Systems

Session Chair: **Peter L. Marasco**, Air Force Research Lab. (USA)

4:50 pm: **Mask-mounted display (MMD) design considerations for diver operating environment**, Richard Manley, Dennis G. Gallagher, William W. Hughes, Charles G. Holmes, Naval Surface Warfare Ctr. Panama City Div. (USA) [8041-20]

5:10 pm: **Has the HMD taken off yet? A look toward the future of HMDs**, Paul R. Havig, Air Force Research Lab. (USA) [8041-21]

Course of Related Interest

SC159 **Head-Mounted Displays: Design and Applications** (Melzer, Browne) Wednesday, 8:30 am to 5:30 pm

Visit the registration desk for course descriptions or to register

Display Technologies and Applications for Defense, Security, and Avionics V

Conference Chairs: **John Tudor Thomas**, General Dynamics Canada Ltd. (Canada); **Daniel D. Desjardins**, Air Force Research Lab. (USA)

Program Committee: **Reginald Daniels**, Air Force Research Lab. (USA); **Eric W. Forsythe**, U.S. Army Research Lab. (USA); **Michael J. Hackert**, NAVAIR (USA); **David C. Huffman**, L-3 Display Systems (USA); **Rick J. Johnson**, Rockwell Collins, Inc. (USA); **Mark A. Livingston**, U.S. Naval Research Lab. (USA); **Gail Nicholson**, Naval Surface Warfare Ctr. Crane Div. (USA); **Kalluri R. Sarma**, Honeywell Technology (USA); **Terrance M. Tierney**, U.S. Army Tank Automotive Research, Development and Engineering Ctr. (USA)

Monday 25 April

SESSION 1

Room: Crystal A. Mon. 1:30 to 3:00 pm

Army, Navy, Air Force Displays Roadmaps

Session Chair: **Daniel D. Desjardins**, Air Force Research Lab. (USA)

1:30 pm: **A look at current and future display needs for Air Force applications** (Invited Paper), Paul R. Havig, Air Force Research Lab. (USA) [8042A-01]

2:00 pm: **Army roadmap for future displays** (Invited Paper), Eric W. Forsythe, U.S. Army Research Lab. (USA) [8042A-02]

2:30 pm: **Navy roadmap for future displays** (Invited Paper), Randall O'Connor, Naval Air Systems Command (USA) [8042A-03]

Coffee Break 3:00 to 3:30 pm

SESSION 2

Room: Crystal A. Mon. 3:30 to 4:50 pm

Future Display Issues and Research

Session Chair: **Kalluri R. Sarma**, Honeywell Technology (USA)

3:30 pm: **Flight instrument modifications for helmet-mounted SWIR imaging systems**, Tim R. Robinson, John Green, Greg J. Grabski, Mickey A. Jacobson, Esterline Technologies Corp. (USA) [8042A-04]

3:50 pm: **Light surface display**, Hakki H. Refai, 3DIcon Corp. (USA) . . [8042A-05]

4:10 pm: **Augmented reality maintenance system (ARMS) for complex military assets**, Kevin Osborn, Noa M. Rensing, Timothy C. Tiernan, Radiation Monitoring Devices, Inc. (USA) [8042A-06]

4:30 pm: **Performance and development considerations for a new generation of land vehicle displays**, John T. Thomas, General Dynamics Canada Ltd. (Canada) [8042A-07]

Tuesday 26 April

Symposium-Wide Plenary Session

Tuesday • 8:30 to 9:30 am • Location: Crystal H

Dr. Regina E. Dugan

Director, Defense Advanced Research Projects Agency (DARPA)

See page 18 for details • Open to All Attendees

Coffee Break 9:30 to 10:00 am

SESSION 3

Room: Crystal A. Tues. 10:00 to 10:40 am

Considerations for Use of 3D Displays

Session Chair: **Gail Nicholson**,

Naval Surface Warfare Ctr. Crane Div. (USA)

10:00 am: **Hybrid magneto-photonic crystal (MPC) nanotechnology display technology for 3D auto stereo projection and flexible fiber composite display systems**, Sutherland C. Ellwood, Jr., C. Frank Stirling, Photonica, Inc. (USA) [8042A-08]

10:20 am: **Precise positioning surveillance in 3D using night-vision stereoscopic photogrammetry**, Jason M. Schwartz, Follow-Me Systems, LLC (USA) [8042A-09]

SESSION 4

Room: Crystal A. Tues. 10:40 am to 12:00 pm

HUDs, HMDs, and Microdisplays

Session Chair: **David C. Huffman**, L-3 Display Systems (USA)

10:40 am: **Ultra-high-resolution AMOLED**, Ihor Wacyk, Olivier F. Prache, Amalkumar Ghosh, eMagin Corp. (USA) [8042A-10]

11:00 am: **Alternatives to flat panel displays in vehicle turrets**, Gail Nicholson, Naval Surface Warfare Ctr. Crane Div. (USA) [8042A-11]

11:20 am: **Microdisplay contributions to system level performance**, Tony Bacarella, Timothy Hogan, Kopin Corp. (USA) [8042A-12]

11:40 am: **General implications of HUD systems applied to automobile industries**, Jose A. Betancur Ramirez, Gilberto Osorio Gómez, Univ. EAFIT (Colombia) [8042A-13]

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

SESSION 5

Room: Crystal A Tues. 1:00 to 2:20 pm

Human Factors Considerations for Display Systems Engineering

Session Chair: Reginald Daniels, Air Force Research Lab. (USA)

1:00 pm: **Accounting for human neurocognitive function in the design and evaluation of 360 degree situational awareness display systems**, Jason S. Metcalfe, DCS Corp. (USA); Thomas Mikulski, U.S. Army Tank Automotive Research, Development and Engineering Ctr. (USA); Scott Dittman, Vorteil Technologies, Inc. (USA) [8042A-14]

1:20 pm: **A methodology for the assessment of 360° local area awareness displays**, Christopher Manteuffel, Matthew Jaswa, Tony Johnson, Jason S. Metcalfe, DCS Corp. (USA); Bradley J. Brumm, U.S. Army Tank Automotive Research, Development and Engineering Ctr. (USA) [8042A-15]

1:40 pm: **Visual tools for human guidance in manual operations**, Gil Abramovich, Kevin G. Harding, GE Global Research (USA) [8042A-16]

2:00 pm: **Head-mounted display (HMD) assessment for tracked vehicles**, Gail Nicholson, William Hurley, Naval Surface Warfare Ctr. Crane Div. (USA)[8042A-17]

SESSION 6

Room: Crystal A Tues. 2:20 to 5:10 pm

Display Subsystems and Supporting Technologies

Session Chair: Joe Tchon, Rockwell Collins, Inc. (USA)

2:20 pm: **Non-RF wireless helmet-mounted display and two-way audio connectivity using covert free-space optical communications**, Michael Strauss, Leo Volfson, Torrey Pines Logic, Inc. (USA) [8042A-18]

2:40 pm: **Evolution of LED backlighting in avionics displays**, Josh Davis, Joe Tchon, Rockwell Collins, Inc. (USA) [8042A-19]

3:00 pm: **ARINC 818 for video and display control**, Tim Keller, Jon A. Alexander, Great River Technology, Inc. (USA). [8042A-20]

Coffee Break 3:20 to 3:50 pm

3:50 pm: **Evolution of low-profile and lightweight electrical connectors for soldier-worn applications**, Eric Gans, Kang S. Lee, Tomasz Jansson, Kevin Walter, Physical Optics Corp. (USA) [8042A-21]

4:10 pm: **Affordable multisensor digital video architecture for 360 degree situational awareness displays**, Steven P. Scheiner, DCS Corp. (USA); Dina A. Khan, Alexander L. Marecki, U.S. Army Tank Automotive Research, Development and Engineering Ctr. (USA); David A. Berman, U.S. Army Night Vision & Electronic Sensors Directorate (USA); Dana Carberry, General Dynamics Robotic Systems (USA) [8042A-22]

4:30 pm: **Display technology gaps used with electro-optic sensors**, Jack E. Fulton, Jr., Gail Nicholson, Naval Surface Warfare Ctr. Crane Div. (USA) [8042A-23]

4:50 pm: **Ultra-mobile rugged computing platforms design considerations**, Ray Garcia, Mark Wright-Johnson, General Dynamics Itronix Corp. (USA); Reginald Daniels, Air Force Research Lab. (USA). [8042A-24]

Closing Comments

Room: Crystal A Tues. 5:10 to 5:20 pm

Session Chairs: John Tudor Thomas, General Dynamics Canada Ltd. (Canada); Daniel D. Desjardins, Air Force Research Lab. (USA)

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Exhibition Halls, Cypress and Palms Ballroom

Tuesday 26 April 9:30 am to 5:00 pm

Wednesday 27 April . . . 10:00 am to 5:00 pm

Thursday 28 April 10:00 am to 2:00 pm

Enhanced and Synthetic Vision 2011

Conference Chairs: **Jeff J. Güell**, The Boeing Co. (USA); **Kenneth L. Bernier**, The Boeing Co. (USA)

Program Committee: **Jarvis J. Arthur III**, NASA Langley Research Ctr. (USA); **Bernd R. Korn**, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); **Christian Pschierer**, Jeppesen GmbH (Germany); **Maarten Uijt de Haag**, Ohio Univ. (USA); **Jacques G. Verly**, Univ. de Liège (Belgium)

Tuesday 26 April

Symposium-Wide Plenary Session

Tuesday • 8:30 to 9:30 am • Location: Crystal H

Dr. Regina E. Dugan

Director, Defense Advanced Research Projects Agency (DARPA)

See page 18 for details • Open to All Attendees

Coffee Break 9:30 to 10:00 am

SESSION 7

Room: Grand 5 Tues. 1:30 to 3:10 pm

Mission Operations

Session Chairs: **Jarvis J. Arthur III**, NASA Langley Research Ctr. (USA); **Bernd R. Korn**, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); **Maarten Uijt de Haag**, Ohio Univ. (USA)

1:30 pm: **Enhanced/synthetic vision and head-worn display technologies for terminal maneuvering area NextGen operations**, Jarvis J. Arthur III, Steven P. Williams, Lawrence J. Prinzel III, Randall E. Bailey, Kevin J. Shelton, NASA Langley Research Ctr. (USA) [8042B-25]

1:50 pm: **Helicopter Autonomous Landing System (HALS): an enhanced flight vision system that enables multiship landing, takeoff, and en-route flight in degraded visual environments**, Jack Cross, David Howard, Craig Chapman, Sierra Nevada Corp. (USA) [8042B-26]

2:10 pm: **A compact wide-area surveillance system for defence and security applications**, James R. E. Sadler, John Davis, Duncan L. Hickman, Waterfall Solutions Ltd. (United Kingdom) [8042B-27]

2:30 pm: **Enhanced and synthetic vision for terminal maneuvering area NextGen operations**, Randall E. Bailey, Lynda J. Kramer, Lawrence J. Prinzel III, Kyle Ellis, Kevin J. Shelton, Jarvis J. Arthur III, NASA Langley Research Ctr. (USA) [8042B-28]

2:50 pm: **Next generation EFB applications**, Christian Pschierer, Jeppesen GmbH (Germany) [8042B-29]

Coffee Break 3:10 to 3:40 pm

SESSION 8

Room: Grand 5 Tues. 3:40 to 5:40 pm

Sensors and Displays

Session Chairs: **Jacques G. Verly**, Univ. de Liège (Belgium); **Christian Pschierer**, Jeppesen GmbH (Germany)

3:40 pm: **A comparison of synthetic and human observer approaches to multispectral sensor resolution assessment**, Alan R. Pinkus, David W. Dommert, Air Force Research Lab. (USA); H. Lee Task, Task Consulting (USA) [8042B-30]

4:00 pm: **Millimeter-wave data acquisition for terrain mapping, obstacle detection, and dust penetrating capability testing**, Sven Schmerwitz, Hans-Ullrich Doehler, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); Sion A. Jennings, Kristopher Ellis, National Research Council Canada (Canada) [8042B-31]

4:20 pm: **Small-scale anomaly detection in panoramic imaging using neural models of low-level vision**, M. C. Casey, Univ. of Surrey (United Kingdom); Duncan L. Hickman, Waterfall Solutions Ltd. (United Kingdom) [8042B-32]

4:40 pm: **Real-time image registration and fusion in a FPGA architecture (FIRE)**, Rick Rickman, Toby Waters, Lindsay Swan, Waterfall Solutions Ltd. (United Kingdom) [8042B-33]

5:00 pm: **Investigating attentional tunneling through a flexible experimentation environment and eye tracking**, Matthias Wies, Niklas Peinecke, Anne Papenfuss, Christoph Möhlenbrink, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany) [8042B-34]

5:20 pm: **Efficient reduction of complex noise in passive millimeter-wavelength video utilizing Bayesian surprise**, Terrell N. Mundhenk, Josh Baron, Roy M. Matic, HRL Labs., LLC (USA) [8042B-36]

Course of Related Interest

SC159 **Head-Mounted Displays: Design and Applications** (Melzer, Browne)
Wednesday, 8:30 am to 5:30 pm

Visit the registration desk for course descriptions or to register

Three-Dimensional Imaging, Visualization, and Display 2011

Conference Chairs: **Bahram Javidi**, Univ. of Connecticut (USA); **Jung-Young Son**, Daegu Univ. (Korea, Republic of)

Conference Co-Chairs: **Manuel Martinez-Corral**, Univ. de València (Spain); **Wolfgang Osten**, Univ. Stuttgart (Germany); **Fumio Okano**, Ultra-Realistic Communications Forum (Japan)

Program Committee: **Amit Ashok**, The Univ. of Arizona (USA); **Saeed Bagheri**, IBM Thomas J. Watson Research Ctr. (USA); **Frank Dubois**, Univ. Libre de Bruxelles (Belgium); **Michael T. Eismann**, Air Force Research Lab. (USA); **Pietro Ferraro**, Istituto Nazionale di Ottica Applicata (Italy); **Thierry Fournel**, Lab. Hubert Curien (France); **William E. Higgins**, The Pennsylvania State Univ. (USA); **Yi-Pai Huang**, National Chiao Tung Univ. (Taiwan); **Naomi Inoue**, Advanced Telecommunications Research Institute International (Japan); **Osamu Matoba**, Kobe Univ. (Japan); **Thomas J. Naughton**, National Univ. of Ireland, Maynooth (Ireland); **Takanori Nomura**, Wakayama Univ. (Japan); **Min-Chul Park**, Korea Institute of Science and Technology (Korea, Republic of); **Adrian Stern**, Ben-Gurion Univ. of the Negev (Israel); **Wa James Tam**, Communications Research Ctr. Canada (Canada); **Chao-Hsu Tsai**, Industrial Technology Research Institute (Taiwan); **Edward A. Watson**, Air Force Research Lab. (USA); **Kenji Yamamoto**, National Institute of Information and Communications Technology (Japan); **Sumio Yano**, NHK Science and Technical Research Labs. (Japan); **Zeev Zalevsky**, Bar-Ilan Univ. (Israel)

Wednesday 27 April

SESSION 1

Room: Crystal A. Wed. 8:30 to 10:00 am

3D Image Processing

Session Chairs: **Jinwoong Kim**, Electronics and Telecommunications Research Institute (Korea, Republic of); **Touradj Ebrahimi**, Ecole Polytechnique Fédérale de Lausanne (Switzerland)

8:30 am: **Towards reliable and reproducible 3D video quality assessment** (*Invited Paper*), Touradj Ebrahimi, Lutz Goldmann, Ecole Polytechnique Fédérale de Lausanne (Switzerland) [8043-01]

9:00 am: **Hybrid video encoding schemes for backward-compatible 3DTV services** (*Invited Paper*), Jinwoong Kim, Se-Yoon Jeong, Jin Soo Choi, Electronics and Telecommunications Research Institute (Korea, Republic of) [8043-02]

9:30 am: **Fast and accurate algorithms for quadratic phase integrals in optics and signal processing** (*Invited Paper*), Aykut Koc, Stanford Univ. (USA); Haldun M. Ozaktas, Bilkent Univ. (Turkey); Lambertus Hesselink, Stanford Univ. (USA) [8043-04]

Coffee Break 10:00 to 10:30 am

SESSION 2

Room: Crystal A. Wed. 10:30 am to 12:00 pm

Digital Holography

Session Chairs: **Kenji Yamamoto**, National Institute of Information and Communications Technology (Japan); **Hiroshi Yoshikawa**, Nihon Univ. (Japan)

10:30 am: **Research activities on digital holographic 3D displays in Japan** (*Invited Paper*), Hiroshi Yoshikawa, Nihon Univ. (Japan) [8043-05]

11:00 am: **Ray-based and wavefront-based holographic displays for high-density light-field reproduction** (*Invited Paper*), Masahiro Yamaguchi, Tokyo Institute of Technology (Japan) [8043-07]

11:30 am: **Digitized holography: spatial 3D imaging of virtual and real objects** (*Invited Paper*), Kyoji Matsushima, Yasuaki Arima, Sumio Nakahara, Kansai Univ. (Japan) [8043-08]

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

Luncheon Dialogue

Room: Canary Wed. 12:00 to 1:40 pm

The Conference Chairs invite all authors and attendees to meet for discussions during lunch on Wednesday. Two tables will be reserved in the Concessions area for a no-host buffet lunch. Seats at the tables will be available on a first-come, first-served basis.

SESSION 3

Room: Crystal A. Wed. 1:40 to 4:00 pm

Integral Imaging

Session Chair: **Manuel Martinez-Corral**, Univ. de València (Spain)

1:40 pm: **Fully programmable display parameters in integral imaging by smart pseudoscopic-to-orthoscopic conversion** (*Invited Paper*), Manuel Martinez-Corral, Hector Navarro, Genaro Saavedra, Univ. de València (Spain); Raul Martinez-Cuenca, Univ. Jaume I (Spain); Bahram Javidi, Univ. of Connecticut (USA) [8043-10]

2:10 pm: **3D integral imaging with unknown sensor positions**, Xiao Xiao, Mehdi Daneshpanah, Myungjin Cho, Bahram Javidi, Univ. of Connecticut (USA)[8043-11]

2:30 pm: **Method of enlarging horizontal viewing zone in integral imaging** (*Invited Paper*), Masato Miura, Jun Arai, Makoto Okui, Japan Broadcasting Corp. (Japan); Fumio Okano, Japan Broadcasting Corp. (Japan) and NHK Engineering Services (Japan) [8043-12]

Coffee Break 3:00 to 3:30 pm

3:30 pm: **Realization of precise depth perception with coarse integral volumetric imaging** (*Invited Paper*), Hideki Kakeya, Shimpei Sawada, Univ. of Tsukuba (Japan) [8043-13]

SESSION 4

Room: Crystal A. Wed. 4:00 to 5:40 pm

3D Displays and Related Technologies I

Session Chair: **Jung-Young Son**, Daegu Univ. (Korea, Republic of)

4:00 pm: **Development of three types of multifocus 3D display** (*Invited Paper*), Sung-Kyu Kim, Dong-Wook Kim, Korea Institute of Science and Technology (Korea, Republic of) [8043-14]

4:30 pm: **The effect of stereoscopic display luminance and ambient illuminance on physiological measurement and image quality** (*Invited Paper*), Pei-Chia Wang, Kuan-Yu Chen, Sheue-Ling Hwang, National Tsing Hua Univ. (Taiwan); Chin-Sen Chen, Industrial Technology Research Institute (Taiwan) [8043-15]

5:00 pm: **Bright 3D display, native and integrated on-chip or system-level**, Sutherland C. Ellwood, Jr., C. Frank Stirling, Photonica, Inc. (USA) [8043-17]

5:20 pm: **Field of view extension in integral imaging using frequency division multiple access technique: numerical analysis**, Zahra Kavehvash, Khashayar Mehrany, Sharif Univ. of Technology (Iran, Islamic Republic of); Saeed Bagheri, IBM Thomas J. Watson Research Ctr. (USA) [8043-16]

Thursday 28 April

SESSION 5

Room: Crystal A. Thurs. 8:00 to 10:00 am

3D Visualization

Session Chair: **Adrian Stern**, Ben-Gurion Univ. of the Negev (Israel)

8:00 am: **Application issues in the use of depth from (de)focus analysis methods** (*Invited Paper*), Mehdi Daneshpanah, Kevin G. Harding, Gil Abramovich, GE Global Research (USA); Arun Vemury, U.S. Dept. of Homeland Security (USA) [8043-18]

8:30 am: **Automated modified composite pattern single image depth acquisition**, Charles Casey, Laurence Hassebrook, Univ. of Kentucky (USA) [8043-19]

8:50 am: **Efficient reconstruction of 3D images from photon starved integral imaging using preconditioned PMLEM** (*Invited Paper*), Doron Aloni, Ben-Gurion Univ. of the Negev (Israel) [8043-20]

9:20 am: **3D sensing and visualization of micro-objects using axially distributed image capture**, Donghak Shin, Myungjin Cho, Bahram Javidi, Univ. of Connecticut (USA) [8043-21]

9:40 am: **Three-dimensional imaging of objects in scattering medium by using statistical image processing**, Myungjin Cho, Bahram Javidi, Univ. of Connecticut (USA) [8043-22]

Coffee Break 10:00 to 10:30 am

SESSION 6

Room: Crystal A. Thurs. 10:30 to 11:40 am

3D Displays and Related Technologies II

Session Chairs: **Ramesh Raskar**, Massachusetts Institute of Technology (USA); **Fumio Okano**, NHK Science & Technical Research Labs. (Japan)

10:30 am: **HR3D: high-rank 3D display using content-adaptive parallax barriers** (*Invited Paper*), Douglas R. Lanman, Ramesh Raskar, Massachusetts Institute of Technology (USA) [8043-23]

11:00 am: **Comparisons of perceived images from three different stereo camera arrangements**, Jung-Young Son, Seokwon Yeom, Dong-Su Lee, Daegu Univ. (Korea, Republic of); Min-Chul Park, Korea Institute of Science and Technology (Korea, Republic of) [8043-24]

11:20 am: **Compensation of stereoscopic crosstalk in 3D display by equalizing gamma characteristics**, Dae-Sik Kim, Sergey A. Chestak, Samsung Electronics Co., Ltd. (Korea, Republic of) [8043-25]

Lunch/Exhibition Break 11:40 am to 12:50 pm

2010 Best Paper Awards

Room: Crystal A Thurs. 12:50 to 1:00 pm

Announcement: Three papers will be selected for the 2011 Best Paper Awards among the papers accepted for Three-Dimensional Imaging, Visualization, and Display conference 8043. A panel of experts will evaluate all the papers. The criteria for evaluation will include: 1) innovation; 2) clarity and quality of the manuscript submitted; 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.

SESSION 7

Room: Crystal A. Thurs. 1:00 to 2:40 pm

3D Displays and Related Technologies III

Session Chair: **Thierry Fournel**, Lab. Hubert Curien (France)

1:00 pm: **Virtual touch on 3D images based on embedded optical sensor array system** (*Invited Paper*), Yi-Pai Huang, Guo-Zhen Wang, Shan-Yu Tung, Ming-Ching Ma, National Chiao Tung Univ. (Taiwan); Hung-Wei Tseng, Jui-Chi Lo, Chung-Hong Kuo, AU Optronics Corp. (Taiwan) [8043-26]

1:30 pm: **Applications of liquid crystal lens for autostereoscopic 2D/3D display based on tablet personal computer**, Sheng-Chi Liu, Chunghwa Picture Tubes, Ltd. (Taiwan) [8043-27]

1:50 pm: **A method for taking a right scaled depth sense in multiview autostereoscopy: using a recomposed hybrid object space based on the actual images by both multi Z-depth and common cameras**, Kwang-Hoon Lee, Sung-Kyu Kim, Korea Institute of Science and Technology (Korea, Republic of) [8043-28]

2:10 pm: **3D imaging and wavefront sensing with a plenoptic objective** (*Invited Paper*), José Manuel Rodríguez-Ramos, Univ. de La Laguna (Spain); Roberto López López, Instituto de Astrofísica de Canarias (Spain); Jonas Philipp Lüke, Jose Gil Marichal-Hernández, Fernando Rosa González, Univ. de La Laguna (Spain) [8043-29]

SESSION 8

Room: Crystal A. Thurs. 2:40 to 5:50 pm

Digital Holography and Related Technologies

Session Chair: **Mehdi Daneshpanah**, Univ. of Connecticut (USA)

2:40 pm: **Inverse problem approach for digital hologram reconstruction** (*Invited Paper*), Corinne Fournier, Univ. Jean Monnet Saint-Etienne (France); Loic Denis, Eric M. Thiebaut, Ctr. de Recherche Astronomique de Lyon (France); Thierry Fournel, Mozhdeh Seifi, Univ. Jean Monnet Saint-Etienne (France) [8043-30]

Coffee Break 3:10 to 3:40 pm

3:40 pm: **Three-dimensional imaging of dynamic phenomena in micro-objects using phase contrast digital holographic interference microscopy** (*Invited Paper*), Arun Anand, Vani Chhaniwal, Maharaja Sayajirao Univ. of Baroda (India); Bahram Javidi, Univ. of Connecticut (USA) [8043-31]

4:10 pm: **Quantitative analysis of three-dimensional biological cells using interferometric microscopy** (*Invited Paper*), Natan T. Shaked, Adam P. Wax, Duke Univ. (USA) [8043-32]

4:40 pm: **Integration of microscopic holograms based on view compensation**, Ho-Dong Lee, Min-Chul Park, Korea Institute of Science and Technology (Korea, Republic of); Jung-Young Son, Daegu Univ. (Korea, Republic of) [8043-33]

5:00 pm: **Phase contrast imaging using digital holography** (*Invited Paper*), Joby Joseph, Samsheerali Poyithil Thottiparambil, Indian Institute of Technology Delhi (India); Bhargab Das, Univ. of Massachusetts Boston (USA) [8043-34]

5:30 pm: **Dual wavelength digital holography phase unwrapping by linear regression**, Alexander T. Khmaladze, Rebecca Matz, Chi Zhang, Joshua Jasensky, Mark Banaszak Holl, Zhan Chen, Univ. of Michigan (USA) [8043-35]

POSTERS—Thursday

Room: Crystal M Thurs. 6:00 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. 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 pm 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.

3D abnormal behavior recognition in power generation, Jie Su, Harbin Univ. of Science and Technology (China); Zhenhua Wei, North China Electric Power Univ. (China) [8043-36]

Reconfiguration methods of viewing zone in mobile auto-stereoscopic display, Seon-Kyu Yoon, Sung-Kyu Kim, Korea Institute of Science and Technology (Korea, Republic of) [8043-38]

Digital holographic microscopy of optically trapped three-dimensional microstructures, Ali-Reza Moradi, Institute for Advanced Studies in Basic Sciences (Iran, Islamic Republic of) and Zanjan Univ. (Iran, Islamic Republic of); Mohammad Kutub Ali, Institute for Advanced Studies in Basic Sciences (Iran, Islamic Republic of); Mehdi Daneshpanah, Univ. of Connecticut (USA); Arun Anand, Maharaja Sayajirao Univ. of Baroda (India); Bahram Javidi, Univ. of Connecticut (USA) [8043-39]

Three-dimensional speckle-noise reduction by using computational integral imaging and statistical point estimator, Inkyu Moon, Chosun Univ. (Korea, Republic of); Bahram Javidi, Univ. of Connecticut (USA) [8043-40]

Courses of Related Interest

- SC159 **Head-Mounted Displays: Design and Applications** (Melzer, Browne)
Wednesday, 8:30 am to 5:30 pm
- SC838 **Laser Range Gated Imaging Techniques** (Duncan) Tuesday, 1:30 to 5:30 pm

Visit the registration desk for course descriptions or to register

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Conference 8044 • Room: Los Angeles

Monday-Tuesday 25-26 April 2011 • Proceedings of SPIE Vol. 8044

Sensors and Systems for Space Applications IV

Conference Chairs: **Khanh D. Pham**, Air Force Research Lab. (USA); **Henry Zmuda**, Univ. of Florida (USA); **Joseph Lee Cox**, Missile Defense Agency (USA); **Greg J. Meyer**, U.S. Air Force (USA)

Program Committee: **Thomas George**, Zyomed Corp. (USA); **Steven C. Gordon**, Georgia Tech Research Institute (USA); **Richard T. Howard**, NASA Marshall Space Flight Ctr. (USA); **Jeffrey L. Janicik**, Innoflight Inc. (USA); **Ou Ma**, New Mexico State Univ. (USA); **Pejmun Motaghedhi**, The Boeing Co. (USA)

Monday 25 April

SESSION 1

Room: Los Angeles Mon. 8:40 to 10:00 am

Data Exploitation

Session Chairs: **Greg J. Meyer**, U.S. Air Force (USA);
Khanh Pham, Air Force Research Lab. (USA)

8:40 am: **Ground jammer localization with two satellites based on the fusion of multiple parameters**, Zhonghai Wang, Michigan Technological Univ. (USA); Khanh D. Pham, Erik P. Blasch, Air Force Research Lab. (USA); Genshe Chen, DCM Research Resources, LLC (USA) [8044-01]

9:00 am: **Track splitting for improved tracking performance in a cluttered environment using PDAF**, Xin Tian, Yaakov Bar-Shalom, Univ. of Connecticut (USA); Erik P. Blasch, Khanh D. Pham, Air Force Research Lab. (USA); Genshe Chen, DCM Research Resources, LLC (USA) [8044-02]

9:20 am: **Scheduling of a constellation of imaging satellites with usage constraints**, Peter J. Shea, Nathan Nasgovitz, Black River Systems Co. (USA) [8044-03]

9:40 am: **Fusion of radar and satellite target measurements**, Morton S. Farber, Donald Blaty, Gabriel Moy, Carlton D. Nealy, The Aerospace Corp. (USA) [8044-04]

Coffee Break 10:00 to 10:30 am

SESSION 2

Room: Los Angeles Mon. 10:30 am to 12:10 pm

Space Situational Awareness

Session Chairs: **Khanh Pham**, Air Force Research Lab. (USA);
Greg J. Meyer, U.S. Air Force (USA)

10:30 am: **Optical payload for the STARE Mission**, Lance M. Simms, Vincent J. Riot, Willem H. De Vries, Brian J. Bauman, Donald W. Phillion, Scot S. Olivier, Alexander J. Pertica, Sergei Nikolaev, Lawrence Livermore National Lab. (USA) [8044-05]

10:50 am: **Upstream data fusion of multiple optical sensors for improved tracking and discrimination of geosynchronous satellites**, Andrew J. Newman, Christopher H. Michaelis, Eric M. Klatt, Nishant L. Mehta, Thomas S. Spisz, Eliezer G. Kahn, The Johns Hopkins Univ. (USA) [8044-06]

11:10 am: **Compressive sensing for space imaging applications**, Sang P. Chin, The Johns Hopkins Univ. Applied Physics Lab. (USA); Lauren Kennell, U.S. Naval Academy (USA); Alison Carr, Dave Blodgett, The Johns Hopkins Univ. Applied Physics Lab. (USA); Trac D. Tran, Dzung T. Nguyen, The Johns Hopkins Univ. (USA) [8044-08]

11:30 am: **Homography based change detection for space-based satellite inspection**, Ryan Buffington, John E. McInroy, Univ. of Wyoming (USA) [8044-09]

11:50 am: **Change detection for visual satellite inspection using pose estimation and image synthesis**, Ryan Buffington, John E. McInroy, Univ. of Wyoming (USA) [8044-10]

Lunch Break 12:10 to 2:00 pm

SESSION 3

Room: Los Angeles Mon. 2:00 to 3:20 pm

RSO and Collision Avoidance

Session Chairs: **Richard T. Howard**, NASA Marshall Space Flight Ctr. (USA); **Greg J. Meyer**, U.S. Air Force (USA)

2:00 pm: **Pursuit-evasion orbital game for satellite interception and collision avoidance**, Dan Shen, DCM Research Resources, LLC (USA); Khanh D. Pham, Air Force Research Lab. (USA); Genshe Chen, DCM Research Resources, LLC (USA); Erik P. Blasch, Air Force Research Lab. (USA) [8044-11]

2:20 pm: **A trust-based sensor allocation algorithm in cooperative space tracking problems**, Dan Shen, Genshe Chen, DCM Research Resources, LLC (USA); Khanh Pham, Erik P. Blasch, Air Force Research Lab. (USA) [8044-12]

2:40 pm: **Detection and tracking of LEO collision events using space-based sensors**, Adel I. El-Fallah, Aleksandar Zatezalo, Scientific Systems Co., Inc. (USA); Ronald Mahler, Lockheed Martin Maritime Systems & Sensors (USA); Khanh Pham, Air Force Research Lab. (USA) [8044-13]

3:00 pm: **Sensor management for collision alert in orbital object tracking**, Peiran Xu, Huimin Chen, Univ. of New Orleans (USA); Dan Shen, Genshe Chen, DCM Research Resources LLC (USA); Khanh D. Pham, Erik P. Blasch, Air Force Research Lab. (USA) [8044-14]

Coffee Break 3:20 to 3:50 pm

SESSION 4

Room: Los Angeles Mon. 3:50 to 4:30 pm

Rendezvous and Docking

Session Chairs: **Ou Ma**, New Mexico State Univ. (USA);
Steven C. Gordon, Georgia Tech Research Institute (USA)

3:50 pm: **Fast relative guidance approach for autonomous rendezvous and docking control**, Mike DeVelle, Yunjun Xu, Univ. of Central Florida (USA); Khanh Pham, Air Force Research Lab. (USA); Genshe Chen, DCM Research Resources LLC (USA) [8044-15]

4:10 pm: **Control of an industrial robot for hardware-in-the-loop simulation of satellite docking**, Ou Ma, Steven Fillmore, New Mexico State Univ. (USA); Melak Zebenay, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany) . . [8044-16]

SESSION 5

Room: Los Angeles Mon. 4:30 to 5:40 pm

Spacecraft Structures

Session Chairs: **Ou Ma**, New Mexico State Univ. (USA);
Steven C. Gordon, Georgia Tech Research Institute (USA)

4:30 pm: **A suborbital flight experiment for validating a satellite inertia identification method** (*Invited Paper*), Gerardo Martinez, Ivann Ferrel, Pu Xie, Ou Ma, New Mexico State Univ. (USA) [8044-17]

5:00 pm: **Spaceborne telescopes on a budget: paradigms for producing high-reliability telescopes, scanners, and EO assemblies using heritage building blocks**, Mark Schwalm, L-3 Communications SSG-Tinsley (USA); Tony B. Hull, L-3 Communications Tinsley Labs. Inc. (USA) [8044-18]

5:20 pm: **The isotropic behavior of an anisotropic material: single crystal silicon (SCSi)**, Roger A. Paquin, Douglas R. McCarter, McCarter Machine, Inc. dba McCarter Technology, Inc. (USA) [8044-19]

Tuesday 26 April

Symposium-Wide Plenary Session

Tuesday • 8:30 to 9:30 am • Location: Crystal H

Dr. Regina E. Dugan

Director, Defense Advanced Research Projects Agency (DARPA)

See page 18 for details • Open to All Attendees

Coffee Break 9:30 to 10:00 am

SESSION 6

Room: Los Angeles Tues. 10:00 to 11:00 am

Keynote Session

10:00 am: **Is space the ultimate high ground?** (*Keynote Presentation*), Greg J. Meyer, U.S. Air Force (USA) [8044-20]

SESSION 7

Room: Los Angeles Tues. 11:00 am to 12:00 pm

Photonics in Space

Session Chairs: **Henry Zmuda**, Univ. of Florida (USA); **Joseph Lee Cox**, Missile Defense Agency (USA)

11:00 am: **Narrow ion-beam figuring: a figuring tool that enables new optical systems solutions**, Ulrich Mueller, Jeff Stone, Bridget Peters, L-3 Communications Tinsley Labs. Inc. (USA); Thomas P. Greene, NASA Ames Research Ctr. (USA) [8044-21]

11:20 am: **Fiber Bragg-grating true-time delay-based multi-RF-beam steering**, Richard J. Black, Behzad Moslehi, Intelligent Fiber Optic Systems Corp. (USA); Azad Siahmakoun, Sergio C. Granieri, Rose-Hulman Institute of Technology (USA) [8044-22]

11:40 am: **Radiation-resistant fiber optic gyroscope for space applications**, Behzad Moslehi, Intelligent Fiber Optic Systems Corp. (USA); Ram Yahalom, InFiber Technology (USA); Richard J. Black, Ferey Faridian, Intelligent Fiber Optic Systems Corp. (USA); Teng Ooi, Aaron Corder, U.S. Army Space and Missile Defense Command (USA) [8044-23]

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

SESSION 8

Room: Los Angeles Tues. 1:30 to 4:20 pm

Space-Based Sensors

Session Chairs: **Joseph Lee Cox**, Missile Defense Agency (USA); **Henry Zmuda**, Univ. of Florida (USA)

1:30 pm: **A thermal infrared hyperspectral imager for small satellites** (*Invited Paper*), Sarah T. Crites, Paul G. Lucey, Robert Wright, Univ. of Hawai'i (USA) [8044-24]

2:00 pm: **A 30 frames-per-second 18-million pixel image sensor for space applications**, Paul P. K. Lee, J. Daniel Newman, Andrew P. Sacco, John A. Nieznanski, ITT Corp. Geospatial Systems (USA) [8044-25]

2:20 pm: **A study of image quality for imagery generated by standard and hybrid intensity interferometers**, Jeremy Murray-Krezan, Peter N. Crabtree, Air Force Research Lab. (USA) [8044-26]

2:40 pm: **Holographic weapons sight as a crew optical alignment sight**, Nujoud Merancy, Booz Allen Hamilton Inc. (USA); Brian Dehmlow, L-3 Communications EOTech (USA); Jack P. Brazzel, NASA Johnson Space Ctr. (USA) [8044-27]

Coffee Break 3:00 to 3:30 pm

3:30 pm: **Navigation Doppler lidar sensor for precision altitude and vector velocity measurements: flight test results**, Diego F. Pierrottet, Coherent Applications, Inc. (USA); Farzin Amzajerdian, Larry Petway, Bruce Barnes, NASA Langley Research Ctr. (USA); George Lockard, Coherent Applications, Inc. (USA); Glenn Hines, NASA Langley Research Ctr. (USA) [8044-28]

3:50 pm: **POSE algorithms for automated docking** (*Invited Paper*), Richard T. Howard, Andrew Heaton, NASA Marshall Space Flight Ctr. (USA) [8044-29]

SESSION 9

Room: Los Angeles Tues. 4:20 to 5:20 pm

Extraterrestrial Robotics

Session Chairs: **Steven C. Gordon**, Georgia Tech Research Institute (USA); **Richard T. Howard**, NASA Marshall Space Flight Ctr. (USA)

4:20 pm: **Manipulability analysis of a two-link space robot using differential geometry method**, Yanheng Zhang, Hanxu Sun, Qingxuan Jia, Jingzhou Song, Beijing Univ. of Posts and Telecommunications (China) [8044-30]

4:40 pm: **Dynamic analysis of a spherical mobile robot in rough terrains**, Tao Yu, Hanxu Sun, Yanheng Zhang, Beijing Univ. of Posts and Telecommunications (China) [8044-31]

5:00 pm: **Mechanical analysis about the spherical mobile robot on the moon environment**, Zhao Wei, Hanxu Sun, Yanheng Zhang, Beijing Univ. of Posts and Telecommunications (China) [8044-32]

POSTERS—Tuesday

Room: Crystal M Tues. 6:00 to 7:30 pm

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An active co-phasing imaging testbed with segmented mirrors, Weirui Zhao, Beijing Institute of Technology (China) [8044-33]

Carbon/carbon for satellite applications, Mustapha M. Meftah, Ctr. National de la Recherche Scientifique (France) [8044-35]

Conference 8045 • Room: Grand 3

Wed. Crystal G1 (Joint Session)

Wednesday-Friday 27-29 April 2011 • Proceedings of SPIE Vol. 8045

Unmanned Systems Technology XIII

Conference Chairs: **Douglas W. Gage**, XPM Technologies (USA); **Charles M. Shoemaker**, General Dynamics Robotic Systems (USA); **Robert E. Karlsen**, U.S. Army Tank Automotive Research, Development and Engineering Ctr. (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 (Canada); **David Gorsich**, U.S. Army Tank Automotive Research, Development and Engineering Ctr. (USA); **Susan G. Hill**, U.S. Army Aberdeen Test Ctr. (USA); **Karl D. Iagnemma**, Massachusetts Institute of Technology (USA); **Gene A. Klager**, U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Andreas F. Koschan**, The Univ. of Tennessee (USA); **James H. Lever**, U.S. Army Corps of Engineers (USA); **Larry H. Matthies**, Jet Propulsion Lab. (USA); **Kevin L. Moore**, Colorado School of Mines (USA); **Hoa G. Nguyen**, Space and Naval Warfare Systems Command (USA); **James L. Overholt**, U.S. Army Tank Automotive Research, Development and Engineering Ctr. (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); **Magnús S. H. Snorrason**, Charles River Analytics, Inc. (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 27 April

SESSION 1

Room: Crystal G1Wed. 8:00 to 9:40 am

Joint Session with Conference 8031

MAST-Navigation

Session Chairs: **Larry H. Matthies**, Jet Propulsion Lab. (USA); **Joseph N. Mait**, U.S. Army Research Lab. (USA)

8:00 am: **Results from MAST joint experiment 3.1** (*Invited Paper*), John G. Rogers III, Georgia Institute of Technology (USA) and Univ. of Pennsylvania (USA); Alex Cunningham, Manohar Paluri, Henrik I. Christensen, Georgia Institute of Technology (USA); Nathan Michael, Vijay Kumar, Univ. of Pennsylvania (USA); Larry H. Matthies, Jeremy Ma, Jet Propulsion Lab. (USA); Frank Dellaert, Georgia Institute of Technology (USA) [8031-34]

8:20 am: **Autonomous navigation with teams of aerial robots** (*Invited Paper*), Nathan Michael, Univ. of Pennsylvania (USA) [8031-35]

8:40 am: **Vision-aided landing and ingress of a micro-air-vehicle using a monocular camera** (*Invited Paper*), Roland Broekers, Jet Propulsion Lab. (USA); Patrick Bouffard, Univ. of California, Berkeley (USA); Jeremy Ma, Larry H. Matthies, Jet Propulsion Lab. (USA); Claire Tomlin, Univ. of California, Berkeley (USA) [8031-36]

9:00 am: **Estimation of vehicle velocity and proximity via wide-field integration of optic flow** (*Invited Paper*), James S. Humbert, Steven Gerardi, Andrew Hyslop, Univ. of Maryland, College Park (USA) [8031-37]

9:20 am: **Compact beam scanning 240GHz radar for navigation and collision avoidance** (*Invited Paper*), Kamal Sarabandi, Mehrnoosh Vahidpour, Maysam Moallem, Jack R. East, Univ. of Michigan (USA) [8031-38]

SESSION 2

Room: Crystal G1Wed. 9:40 to 10:00 am

Joint session with conference 8031

MAST-Communication

Session Chairs: **William Nothwang**, U.S. Army Research Lab. (USA); **Joseph N. Mait**, U.S. Army Research Lab. (USA)

9:40 am: **New techniques for efficient flexible wireless transceivers in nanometer CMOS** (*Invited Paper*), Michael Flynn, Univ. of Michigan (USA) [8031-39]

Coffee Break 10:00 to 10:30 am

SESSION 2A

Room: Crystal G1Wed. 10:30 to 11:30 am

Joint session with conference 8031

MAST-Communication

Session Chairs: **William Nothwang**, U.S. Army Research Lab. (USA); **Joseph N. Mait**, U.S. Army Research Lab. (USA)

10:30 am: **Reconfigurable firmware-defined radios synthesized from standard digital logic cells** (*Invited Paper*), David D. Wentzloff, Muhammad Faisal, Youngmin Park, Univ. of Michigan (USA) [8031-40]

10:50 am: **Radio signal strength tracking and control for robotic networks** (*Invited Paper*), Brian M. Sadler, Paul Yu, Jeffrey Twigg, U.S. Army Research Lab. (USA) [8031-41]

11:10 am: **Enhanced ad hoc wireless connectivity in complex environment using small radio repeater systems** (*Invited Paper*), Kamal Sarabandi, Youngjun Song, Jungsoek Oh, Univ. of Michigan (USA) [8031-42]

Lunch/Exhibition Break 11:30 am to 1:00 pm

SESSION 3

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

Perception

Session Chairs: **Larry H. Matthies**, Jet Propulsion Lab. (USA); **Magnús S. H. Snorrason**, Charles River Analytics, Inc. (USA)

1:00 pm: **Safe operations of unmanned systems for reconnaissance in complex environments**, Joseph Kott III, U.S. Army Tank Automotive Research, Development and Engineering Ctr. (USA); Edward Mottern, General Dynamics Robotic Systems (USA) [8045-01]

1:20 pm: **Stereo vision-based terrain perception using thermal infrared sensors**, Arturo L. Rankin, Larry H. Matthies, Andres Huertas, Max Bajracharya, Jet Propulsion Lab. (USA); Gary Sherwin, General Dynamics Robotic Systems (USA) [8045-02]

1:40 pm: **Robot training through incremental learning**, Robert E. Karlsen, U.S. Army Tank Automotive Research, Development and Engineering Ctr. (USA); Gary Witus, Wayne State Univ. (USA); Shawn T. Hunt, U.S. Army Tank Automotive Research, Development and Engineering Ctr. (USA) [8045-03]

2:00 pm: **Safeguarding tele-operation using an automotive radar sensor**, Jared Giesbrecht, Defence Research and Development Canada (Canada) [8045-04]

2:20 pm: **High-frequency imaging radar for robotic navigation and situational awareness**, David J. Thomas, U.S. Army Tank-Automotive and Armaments Command (USA) [8045-05]

2:40 pm: **Pedestrian and car detection, classification, and tracking for unmanned ground vehicle using 3D lidar and monocular camera**, Kuk Cho, Univ. of Science & Technology (Korea, Republic of); Seung-Ho Baeg, Korea Institute of Industrial Technology (Korea, Republic of); Ki Min Lee, Hae Seok Lee, LG Innotek (Korea, Republic of); SangDeok Park, Korea Institute of Industrial Technology (Korea, Republic of) [8045-06]

Coffee Break 3:00 to 3:30 pm

SESSION 4

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

Articulation and Manipulation

Session Chairs: **Paul Muench**, U.S. Army Tank Automotive Research, Development and Engineering Ctr. (USA); **Mike Perschbacher**, RovnoTech (USA)

- 3:30 pm: **Some recent advances and remaining challenges in bipedal walking robots and exoskeletons** (*Invited Paper*), Jerry E. Pratt, Institute for Human and Machine Cognition (USA) [8045-07]
- 3:50 pm: **Aladdin: a semi-autonomous door opening system for EOD-class robots**, Jack Craft, Jack Wilson, Honeybee Robotics (USA); Wesley H. Huang, Mark R. Claffee, Emilie Phillips, iRobot Corp. (USA) [8045-08]
- 4:10 pm: **Human-like characteristics for high-degree of freedom robotic door opening end effector**, Jeremy Gray, U.S. Army Tank Automotive Research, Development and Engineering Ctr. (USA); Frank Campagna, RE2, Inc. (USA) [8045-10]
- 4:30 pm: **Dexterous manipulation for non-line-of-sight articulated manipulators**, John Hu, Yi-Je Lim, Hstar Technologies (USA) [8045-12]
- 4:50 pm: **Modular intelligent manipulation for high-DOF robotic arms**, Jeremy Gray, U.S. Army Tank Automotive Research, Development and Engineering Ctr. (USA); David Rusbarsky, Douglas J. Peters, RE2, Inc. (USA) [8045-14]
- 5:10 pm: **Sensor-based redundancy resolution for a mobile robotic manipulator**, Ning Xi, Michigan State Univ. (USA) [8045-15]

Thursday 28 April

SESSION 5

Room: Grand 3. Thurs. 8:00 to 10:00 am

Joint Session with Conference 8062

Self-Organizing, Collaborative, and Unmanned ISR Robots

Session Chairs: **Melanie Dumas**, Defense Advanced Research Projects Agency (USA); **Grant R. Gerhart**, U.S. Army Tank Automotive Research, Development and Engineering Ctr.-Retired (USA)

- 8:00 am: **Biologically inspired approaches for self-organization, adaptation, and collaboration of heterogeneous autonomous systems**, Marc L. Steinberg, Office of Naval Research (USA) [8062-16]
- 8:20 am: **Migration strategies for service-enabling ground control stations for unmanned systems**, Joseph B. Kroclic, Winifred Associates (USA) [8062-17]
- 8:40 am: **JEFX 10 demonstration of cooperative hunter killer UAS and upstream data fusion**, Brian K. Funk, Andrew J. Newman, Jonathan C. Castelli, Adam S. Watkins, Christopher B. McCubbin, Jeffrey D. Barton, Cameron K. Peterson, Jonathan T. DeSena, Daniel A. Dutrow, Pedro A. Rodriguez, Steven J. Marshall, The Johns Hopkins Univ. (USA) [8045-09]
- 9:00 am: **Dynamic replanning on demand of UAS constellations performing ISR missions**, Daniel W. Stouch, Ernest Zeidman, William Callahan, Charles River Analytics, Inc. (USA); Kirk McGraw, U.S. Army Engineer Research and Development Ctr. (USA); Joshua Serrin, Charles River Analytics, Inc. (USA) [8045-11]
- 9:20 am: **All weather sense and avoid system (AWSAS) for all UAS and manned platforms**, Vincent M. Contarino, R-Cubed Engineering, LLC (USA) [8045-13]
- 9:40 am: **Autonomous sustain and resupply: what is the future?**, Gregory S. Broten, Defence Research and Development Canada (Canada) [8045-29]
- Coffee Break 10:00 to 10:30 am

SESSION 6

Room: Grand 3. Thurs. 10:30 to 11:50 am

Navigation and Mobility I

Session Chairs: **Robert E. Karlsen**, U.S. Army Tank Automotive Research, Development and Engineering Ctr. (USA); **Brian M. Yamauchi**, iRobot Corp. (USA)

- 10:30 am: **Little dog learning tractive and compressive terrain characteristics**, Bruce L. Digney, Defence Research and Development Canada (Canada) [8045-17]
- 10:50 am: **Driver-assist behaviors for high-speed small UGVs**, Brian M. Yamauchi, iRobot Corp. (USA) [8045-18]
- 11:10 am: **Fusion of visual odometry and inertial data for enhanced, real-time egomotion estimation**, Victor E. Perlin, David B. Johnson, Mitchell M. Rohde, Quantum Signal LLC (USA); Robert E. Karlsen, U.S. Army Tank Automotive Research, Development and Engineering Ctr. (USA) [8045-19]
- 11:30 am: **Design, modelling, implementation, and intelligent fuzzy control of a hovercraft**, Wessam M. Hussein, Mahmoud M. Elkhatib, Egyptian Armed Forces (Egypt) [8045-20]
- Lunch/Exhibition Break 11:50 am to 1:00 pm

SESSION 7

Room: Grand 3. Thurs. 1:00 to 2:40 pm

Navigation and Mobility II

Session Chairs: **Robert E. Karlsen**, U.S. Army Tank Automotive Research, Development and Engineering Ctr. (USA); **Brian M. Yamauchi**, iRobot Corp. (USA)

- 1:00 pm: **Human leader and robot follower team without GPS and without line of sight**, Surat Kwanmuang, Johann Borenstein, Lauro V. Ojeda, Univ. of Michigan (USA) [8045-21]
- 1:20 pm: **Methods for UGV teloperation with high latency communications**, Gary Witus, Turing Associates, Inc. (USA); Shawn T. Hunt, Ryan Wolcott, U.S. Army Tank Automotive Research, Development and Engineering Ctr. (USA); Phillip Janicki, Signature Research, Inc. (USA) [8045-22]
- 1:40 pm: **SUGV waypoint following**, David Baran, U.S. Army Research Lab. (USA) [8045-24]
- 2:00 pm: **Energy efficient path planning for skid-steered autonomous ground vehicles**, Aneesh Sharma, Nikhil Gupta, Emmanuel G. Collins, Jr., The Florida State Univ. (USA) [8045-25]
- 2:20 pm: **Lessons to improve testing for countermine robotic systems**, Isaac Chappell, Franklin L. Moses, Institute for Defense Analyses (USA); Matt Aeillo, U.S. Army Night Vision & Electronic Sensors Directorate (USA) [8045-26]
- Coffee Break 2:40 to 3:30 pm

SESSION 8

Room: Grand 3. Thurs. 3:30 to 5:30 pm

Intelligent Behaviors

Session Chairs: **Gregory R. Hudas**, U.S. Army Tank Automotive Research, Development and Engineering Ctr. (USA); **Frank L. Lewis**, The Univ. of Texas at Arlington (USA)

- 3:30 pm: **A cell decomposition approach to pursuit and evasion with adversarial agents**, Greg Foderaro, Brian Bernard, Silvia Ferrari, Duke Univ. (USA) [8045-27]
- 3:50 pm: **Trust dynamics in multi-agent coalition formation**, Dariusz G. Mikulski, U.S. Army Tank Automotive Research, Development and Engineering Ctr. (USA) and Oakland Univ. (USA); Frank L. Lewis, The Univ. of Texas at Arlington (USA); Edward Y. Gu, Oakland Univ. (USA); Gregory R. Hudas, U.S. Army Tank Automotive Research, Development and Engineering Ctr. (USA) [8045-28]
- 4:10 pm: **An improved particle filter approach for multiple target detection and tracking**, Wenjie Lu, Guoxian Zhang, Silvia Ferrari, Duke Univ. (USA); Rafael O. Fierro, Ivana Palunko, The Univ. of New Mexico (USA) [8045-16]
- 4:30 pm: **X-band radar for UAV-borne MAV target recognition**, Allistair Moses, Matthew J. Rutherford, Kimon P. Valavanis, Univ. of Denver (USA) [8045-30]

4:50 pm: **Building entity models through observation and learning**, Richard D. Garcia, Motile Robotics Inc. (USA); Robert Kania, U.S. Army Tank Automotive Research, Development and Engineering Ctr. (USA); MaryAnne Fields, U.S. Army Research Lab. (USA); Laura E. Barnes, Univ. of South Florida (USA). . . . [8045-31]

5:10 pm: **Neuro-optimal control of helicopter UAVs**, David J. Nodland, Missouri Univ. of Science and Technology (USA); Arpita Ghosh, National Metallurgical Lab. (India); Jagannathan Sarangapani, Missouri Univ. of Science and Technology (USA) [8045-32]

POSTERS—Thursday

Room: Crystal M Thurs. 6:00 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. 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 pm 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.

Development of an autonomous positioning and navigation spherical robot, Kang Hou, Hanxu Sun, Qingxuan Jia, Yanheng Zhang, Beijing Univ. of Posts and Telecommunications (China) [8045-44]

Friday 29 April

SESSION 9

Room: Grand 3 Fri. 8:00 am to 11:50 am

Special Topics

Session Chairs: **Douglas W. Gage**, XPM Technologies (USA); **Charles M. Shoemaker**, General Dynamics Robotic Systems (USA)

8:00 am: **High-fidelity physics-based simulation of a UGV reconnaissance mission in a complex urban environment**, Christopher Goodin, Jody D. Priddy, Christopher L. Cummins, Burhman Q. Gates, Jr., Phillip J. Durst, Taylor R. George, U.S. Army Engineer Research and Development Ctr. (USA). . . . [8045-33]

8:20 am: **Light weight, portable operator control unit using an Android-enabled mobile phone**, Nicholas Fung, U.S. Army Research Lab. (USA) [8045-34]

8:40 am: **Practical robotic self awareness and self knowledge**, Douglas W. Gage, XPM Technologies (USA) [8045-35]

9:00 am: **Microbotic surveillance: discrete and continuous starbots**, Mohammad Mayyas, Woo Ho Lee, Harry E. Stephanou, The Univ. of Texas at Arlington (USA) [8045-36]

9:20 am: **Novel locomotion via biological inspiration**, Roger D. Quinn, Alexander Boxerbaum, Alexander Hunt, Case Western Reserve Univ. (USA); Luther Palmer, Univ. of South Florida (USA); Hillel Chiel, Case Western Reserve Univ. (USA); Richard Bachmann, BioRobots, LLC (USA); Eric Diller, Case Western Reserve Univ. (USA) [8045-37]

9:40 am: **Zipper mast for enhanced communications and surveillance**, George Woodruff, Geo Systems, Inc. (USA); Gary Witus, Turing Associates, Inc. (USA); Paul Muench, U.S. Army Tank Automotive Research, Development and Engineering Ctr. (USA). [8045-38]

Coffee Break 10:00 to 10:30 am

10:30 am: **Small unmanned aerial platform for geospatial data collection and analysis**, Eugene Levin, Aleksandr V. Sergeyev, Michigan Technological Univ. (USA) [8045-39]

10:50 am: **Laser power beaming for defense and security applications**, Thomas Nugent, Jr., Jordin Kare, LaserMotive (USA) [8045-40]

11:10 am: **Quantitative investigation of the perception of the technology needs, trends, and future vision for unmanned systems**, Ronald F. Storm, Jim Paul, Ricardo Inc. (USA); Corey Clothier, U.S. Army Tank Automotive Research, Development and Engineering Ctr. (USA); Joshua A. Kovac, AeroMech Engineering, Inc. (USA) [8045-42]

11:30 am: **Taking on the tall poles of autonomous robot navigation**, Mark H. Rosenblum, Lockheed Martin Corp. (USA) [8045-45]

Courses of Related Interest

SC996 **Introduction to GPS Receivers** (Zhu) Wednesday, 8:30 am to 12:30 pm

SC549 **Incorporating GPS Technology into Commercial and Military Applications** (Zhu) Wednesday, 1:30 to 5:30 pm

SC894 **Introduction to INS and INS-Based Integrated Navigation** (Soloviev) Wednesday, 8:30 am to 5:30 pm

Visit the registration desk for course descriptions or to register

Unattended Ground, Sea, and Air Sensor Technologies and Applications XIII

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

Program Committee: **Jacques Bédard**, Defence Research and Development Canada (Canada); **John G. Blich**, ARACAR: Alliance for Robot Assisted Crisis Assessment and Response (USA); **John C. Carrano**, Carrano Consulting (USA); **Christina J. Deckard**, Space and Naval Warfare Systems Ctr. Pacific (USA); **Sachi V. Desai**, U.S. Army Armament Research, Development and Engineering Ctr. (USA); **Daniel D. Desjardins**, Air Force Research Lab. (USA); **John S. Eicke**, U.S. Army Research Lab. (USA); **Alan J. Gray**, Defence Science and Technology Lab. (United Kingdom); **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); **Tariq Manzur**, Naval Undersea Warfare Ctr. (USA); **George McNamara**, Naval Undersea Warfare Ctr. (USA); **Huub A.J.M. van Hoof**, TNO Defence, Security and Safety (Netherlands); **Graeme P. van Voorthuijsen**, TNO Defence, Security and Safety (Netherlands)

Thursday 28 April

SESSION 1

Room: Grand 7B Thurs. 8:00 to 10:00 am

Gunfire Detection/Counter Sniper/Beam Forming

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)

8:00 am: **Networked localization of sniper shots using acoustics**, Sébastien Hengy, Pascal Hamery, Sebastien De Mezzo, Pascal Duffner, Institut Franco-Allemand de Recherches de Saint-Louis (France) [8046-01]

8:20 am: **Microphones' directivity for the localization of sound sources**, Mahdi Tajari, Piervincenzo Rizzo, Univ. of Pittsburgh (USA) [8046-02]

8:40 am: **Supersonic projectile models for asynchronous shooter localization**, Richard J. Kozick, Bucknell Univ. (USA); Gene T. Whipps, U.S. Army Research Lab. (USA); Joshua N. Ash, The Ohio State Univ. (USA) [8046-03]

9:00 am: **Suppressor evaluation**, David Grasing, U.S. Army Research, Development and Engineering Command (USA) [8046-04]

9:20 am: **Helicopter gunfire detection system: shockwave only solutions**, Sachi V. Desai, U.S. Army Armament Research, Development and Engineering Ctr. (USA) [8046-05]

9:40 am: **Helicopter gunfire detection system: livefire data collection results**, Benjamin Ellwood, U.S. Army Research, Development and Engineering Command (USA) [8046-06]

Coffee Break 10:00 to 10:30 am

SESSION 2

Room: Grand 7B Thurs. 10:30 to 11:30 am

Unmanned Surveillance Platforms (UUV/UAV)

Session Chairs: **Myron E. Hohil**, U.S. Army Armament Research, Development and Engineering Ctr. (USA); **George McNamara**, Naval Undersea Warfare Ctr. (USA)

10:30 am: **A compact, fast-response synchronous measurement of temperature for UAV applications**, Amir Khan, Mark A. Zondlo, Princeton Univ. (USA) [8046-08]

10:50 am: **Unmanned air systems (UAS) autonomous collision avoidance system (ACAS)**, Robert T. Hintz, Naval Air Warfare Ctr. Weapons Div. (USA) [8046-09]

11:10 am: **Miniature UUV concept for coastal surveillance**, Edward M. Carapezza, Defense Advanced Research Projects Agency (USA) [8046-10]

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

SESSION 3

Room: Grand 7B Thurs. 1:20 to 2:40 pm

Perimeter Surveillance/Asset Protection

Session Chairs: **Myron E. Hohil**, U.S. Army Armament Research, Development and Engineering Ctr. (USA); **George McNamara**, Naval Undersea Warfare Ctr. (USA)

1:20 pm: **Biomimetic fusion that enhances sensor performance in bimodal surveillance system**, Leah Ziph-Schatzberg, The Boston Univ. Photonics Ctr. (USA); Sarah Kelsall, General Dynamics Electric Boat (USA); Allyn E. Hubbard, Boston Univ. (USA) [8046-12]

1:40 pm: **MUGI: the covert surveillance system**, Israel Kasher, Uri Adar, Seraphim Optronics Ltd. (Israel) [8046-13]

2:00 pm: **SCORPION II persistent surveillance system features update**, Michael A. Coster, Jonathan L. Chambers, Gregory A. Prisco, Northrop Grumman-Xetron (USA) [8046-14]

2:20 pm: **Critical asset protection modeling, simulation, analysis, and visualization**, William Malinowski, Robinson Cruz, U.S. Army Armament Research, Development and Engineering Ctr. (USA) [8046-15]

Coffee Break 2:40 to 3:30 pm

SESSION 4

Room: Grand 7B Thurs. 3:30 to 4:30 pm

Personnel Detection/Classification

Session Chairs: **Sachi V. Desai**, U.S. Army Armament Research, Development and Engineering Ctr. (USA); **Todd M. Hintz**, Space and Naval Warfare Systems Command (USA)

3:30 pm: **Robust discrimination of human footsteps using seismic signals**, Aram Faghfour, Michael B. Frish, Physical Sciences Inc. (USA) [8046-17]

3:50 pm: **Multimodal sensor fusion for personnel detection**, Sachi V. Desai, U.S. Army Armament Research, Development and Engineering Ctr. (USA) [8046-18]

4:10 pm: **Active ultrasonic micro-Doppler for human classification**, Shafik A. Quoraishie, U.S. Army Armament Research, Development and Engineering Ctr. (USA) [8046-19]

Conference 8046

SESSION 5

Room: Grand 7B Thurs. 4:30 to 5:50 pm

Distributed Sensor Fields and Networks

Session Chairs: **Sachi V. Desai**, U.S. Army Armament Research, Development and Engineering Ctr. (USA);
Todd M. Hintz, Space and Naval Warfare Systems Command (USA)

4:30 pm: **Fish schools and bird flocks as mobile sensor arrays**, Charles S. Bendall, Space and Naval Warfare Systems Ctr. Pacific (USA) [8046-20]

4:50 pm: **Escape and evade control policies for ensuring the physical security of nonholonomic, ground-based, unattended mobile sensor nodes**, David Mascarenas, Christopher Stull, Charles R. Farrar, Los Alamos National Lab. (USA) [8046-21]

5:10 pm: **A method for robust adaptation of the configuration of distributed sensor fields**, Thomas A. Wettergren, Naval Undersea Warfare Ctr. (USA) [8046-22]

5:30 pm: **FIRESTORM: a collaborative network suite application for rapid sensor data processing and precise decisive**, Shaji Kaniyantethu, U.S. Army Armament Research, Development and Engineering Ctr. (USA) [8046-23]

Friday 29 April

SESSION 6

Room: Grand 7B Fri. 8:30 to 11:40 am

EO, Imaging, and Communications Technologies

Session Chairs: **Myron E. Hohil**, U.S. Army Armament Research, Development and Engineering Ctr. (USA);
Tariq Manzur, Naval Undersea Warfare Ctr. (USA)

8:30 am: **Detection of electromagnetic waves using MEMS antennas**, Panos G. C. Datskos, Oak Ridge National Lab. (USA) [8046-24]

8:50 am: **An empirical method for dynamic camouflage assessment**, John G. Blitch, Colorado State Univ., DoD SMART Program (USA) [8046-25]

9:10 am: **Relative intensity noise for uncooled silicon carbide mid-wave infrared detectors**, 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) [8046-26]

9:30 am: **Ultraviolet photodetectors directly integrated on CMOS using low-temperature ZnO nanowire techniques**, Robert Olah, Achyut Dutta, Banpil Photonics, Inc. (USA); Deli Wang, Consultant; Tariq Manzur, [8046-27]

Coffee Break 9:50 to 10:20 am

10:20 am: **Nanostructure-based EO/IR focal plane arrays for unattended ground sensor applications**, Ashok K. Sood, Magnolia Optical Technologies, Inc. (USA); Tariq Manzur, Naval Undersea Warfare Ctr. (USA); A. F. Mehdi Anwar, Univ. of Connecticut (USA); Nibir K. Dhar, Dennis L. Polla, DARPA (USA); Priyalal S. Wijewarnasuriya, Army Research Lab. (USA) [8046-28]

10:40 am: **Free-space optical communication links at 1.55 μm for remote operation**, John W. Zeller, Naval Undersea Warfare Ctr. (USA) [8046-29]

11:00 am: **Nighttime camera options for unattended ground sensor (UGS) applications**, David C. Hartup, L-3 Communications Nova Engineering (USA); Charles M. Hanson, L-3 Electro-Optical Systems (USA); Robert A. Owen, L-3 Communications Nova Engineering (USA) [8046-30]

11:20 am: **Heading errors in an alignment-based magnetometer**, Chris Hovde, Southwest Sciences, Inc. (USA); Brian Patton, Univ. of California, Berkeley (USA); Oscar Versolato, Univ. of Groningen (Netherlands); Eric Corsini, Simon Rochester, Dmitry Budker, Univ. of California, Berkeley (USA) [8046-31]

Courses of Related Interest

SC996 **Introduction to GPS Receivers** (Zhu) Wednesday, 8:30 am to 12:30 pm

SC549 **Incorporating GPS Technology into Commercial and Military Applications** (Zhu) Wednesday, 1:30 to 5:30 pm

SC894 **Introduction to INS and INS-Based Integrated Navigation** (Soloviev) Wednesday, 8:30 am to 5:30 pm

SC952 **Applications of Detection Theory** (Carrano) Thursday, 8:30 am to 5:30 pm

Visit the registration desk for course descriptions or to register

Ground/Air Multisensor Interoperability, Integration, and Networking for Persistent ISR II

Conference Chair: **Michael A. Kolodny**, U.S. Army Research Lab. (USA)

Conference Co-Chairs: **Tien Pham**, U.S. Army Research Lab. (USA); **Kevin L. Priddy**, Air Force Research Lab. (USA)

Program Committee: **Jacques Bédard**, Defence Research and Development Canada (Canada); **Robert Heathcock**, U.S. Defense Intelligence Agency (USA); **Jeff Houser**, U.S. Army Research Lab. (USA); **Gavin Pearson**, Defence Science and Technology Lab. (United Kingdom); **Stephen G. Perry**, MTC Services Corp. (USA); **Ronald B. Sartain**, U.S. Army Research Lab. (USA); **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); **Rob Williams**, Air Force Research Lab. (USA)

Tuesday 26 April

Symposium-Wide Plenary Session

Tuesday • 8:30 to 9:30 am • Location: Crystal H

Dr. Regina E. Dugan

Director, Defense Advanced Research Projects Agency (DARPA)

See page 18 for details • Open to All Attendees

Coffee Break 9:30 to 10:00 am

SESSION 1

Room: Grand 1 Tues. 10:00 am to 12:00 pm

Interoperability I: Terra Harvest

Session Chairs: **Michael A. Kolodny**, U.S. Army Research Lab. (USA); **Tien Pham**, U.S. Army Research Lab. (USA)

10:00 am: **Ground/air multisensor interoperability, integration, and networking for persistent ISR: what, why, who**, Michael A. Kolodny, U.S. Army Research Lab. (USA) [8047-01]

10:20 am: **Promoting interoperability within the UGS community and effective acquisition of UGS solutions for the warfighter**, Robert Heathcock, U.S. Defense Intelligence Agency (USA) [8047-02]

10:40 am: **Terra Harvest: an open, integrated battlefield unattended ground sensors (UGS) architecture**, Robert Heathcock, U.S. Defense Intelligence Agency (USA); Colson Brasch, Kent Linnebur, MITRE Corp. (USA) [8047-03]

11:00 am: **Architectural developments for Terra Harvest and the UGS Standards Working Group**, Jeff Houser, U.S. Army Research Lab. (USA) [8047-04]

11:20 am: **After three phases of the Terra Harvest program, what are the lessons learned, and future impacts?**, Duke Buster, Derick Gerlock, Honeywell, Inc. (USA) [8047-05]

11:40 am: **Terra Harvest open source environment (THOSE): a universal unattended ground-sensor controller**, Kevin Klawon, Joshua Gold, Univ. of Dayton Research Institute (USA); Darren Landoll, Phil M. Hirz, L-3 Communications Nova Engineering (USA) [8047-06]

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

SESSION 2

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

Interoperability II

Session Chairs: **Jacques Bédard**, Defence Research and Development Canada (Canada); **Jeff Houser**, U.S. Army Research Lab. (USA)

1:30 pm: **Interoperability: a big picture perspective**, Michael A. Kolodny, U.S. Army Research Lab. (USA) [8047-07]

1:50 pm: **Integration of current force unattended ground sensors for the Empire Challenge**, Gary H. Stolovy, U.S. Army Research Lab. (USA) [8047-08]

2:10 pm: **A packaged native data format for interoperability of unattended ground sensors with a sensorML-enabled controller**, Jonathan L. Chambers, Albert J. Brunck, Jr., Northrop Grumman-Xetron (USA) [8047-09]

2:30 pm: **Model-driven SOA for sensor networks**, Christopher Gibson, John Ibbotson, David Braines, Tom Klapiscak, IBM United Kingdom Ltd. (United Kingdom); Boleslaw K. Szymanski, Sahin Geyik, Rensselaer Polytechnic Institute (USA) [8047-10]

2:50 pm: **Decentralized operating procedures for orchestrating data and behavior across distributed military systems and assets**, Nicholas Peach, PB Partnership Ltd. (United Kingdom) [8047-11]

Coffee Break 3:10 to 3:40 pm

SESSION 3

Room: Grand 1 Tues. 3:40 to 5:20 pm

New Technology I

Session Chairs: **King K. Siu**, U.S. Army Armament Research, Development and Engineering Ctr. (USA); **Ronald B. Sartain**, U.S. Army Research Lab. (USA)

3:40 pm: **PILAR gunfire detection system enhancements (GDS)**, Alain Donzier, 01dB-Metravib (France); Sandra Gomez, U.S. Army Armament Research, Development and Engineering Ctr. (USA) [8047-12]

4:00 pm: **The acoustic vector sensor: a versatile battlefield acoustics sensor**, Jelmer Wind, Hans-Elias de Bree, Microflown Technologies (Netherlands) [8047-13]

4:20 pm: **Attenuation of individual seismic-wave types using various architectural enclosures for geophones**, Sean Schumer, U.S. Army RDECOM-ARDEC (USA) [8047-14]

4:40 pm: **Embedded real-time classifier for profiling sensors and custom detector configuration**, R. Kenny Reynolds, Jr., Srikant K. Chari, The Univ. of Memphis (USA); David J. Russomanno, Indiana Univ.-Purdue Univ. Indianapolis (USA) [8047-15]

5:00 pm: **An assessment of a 360-degree profiling sensor for object classification**, Jeremy B. Brown, Srikant K. Chari, Eddie Jacobs, The Univ. of Memphis (USA) [8047-16]

Conference 8047

Wednesday 27 April

SESSION 4

Room: Grand 1. Wed. 8:20 to 10:00 am

New Technology II

Session Chairs: **Rob Williams**, Air Force Research Lab. (USA);
Kevin L. Priddy, Air Force Research Lab. (USA)

8:20 am: **SmartPhone innovations for persistent surveillance**, Rob Williams, Air Force Research Lab. (USA) [8047-17]

8:40 am: **TwittINT**, Rob Williams, Air Force Research Lab. (USA) [8047-18]

9:00 am: **Web-based open layered sensing testbed**, Rob Williams, Air Force Research Lab. (USA) [8047-19]

9:20 am: **Virtual world technology for persistent surveillance command and control**, Rob Williams, Air Force Research Lab. (USA) [8047-20]

9:40 am: **Adapting persistent surveillance storage innovations for homeland security**, Rob Williams, Air Force Research Lab. (USA) [8047-21]

Coffee Break 10:00 to 10:30 am

CROSS-CONFERENCE HOT TOPIC PANEL

Room: Crystal M. Wed. 10:30 am to 12:30 pm

Data to Decisions: "Sensors are No Longer King"

Moderator: **John M. Pellegrino**, Director, U.S. Army Research Lab.,
(Computational & Information Sciences Directorate (CISD) (USA)

This cross-conference hot topic provides a unique forum for senior leaders from different organizational perspectives to discuss the shifting paradigm of what is needed to achieve the required situational understanding to make the best actionable battlefield decisions. We need to get away from the "autistic" view of sensing and learn to integrate other non-traditional information sources including HUMINT, cultural understanding, social networks, policies and behavior modeling.

Identifying the Technology Needs from a Holistic Perspective

See page 21 for details.

Lunch/Exhibition Break 12:30 to 1:40 pm

SESSION 5

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

Signal Processing and Fusion I

Session Chairs: **Jacques Bédard**, Defence Research and Development Canada (Canada); **Graeme P. van Voorthuijsen**, TNO Defence, Security and Safety (Netherlands)

1:40 pm: **Semantically enriched data for effective sensor data fusion**, Geeth R. de Mel, Univ. of Aberdeen (United Kingdom); Thyagaraju Damarla, Tien Pham, U.S. Army Research Lab. (USA) [8047-22]

2:00 pm: **A flexible data fusion architecture for persistent surveillance using ultra-low-power wireless sensor networks**, Jeffrey A. Hanson, Keith L. McLaughlin, Thomas J. Sereno, Jr., SAIC (USA) [8047-23]

2:20 pm: **Knowledge-aided multisensor data fusion for maritime surveillance**, Giulia Battistello, Martin Ulmke, Wolfgang Koch, Fraunhofer FKIE (Germany) [8047-24]

2:40 pm: **Sensor trustworthiness in uncertain time varying stochastic environment**, Ajay Verma, Ronald Fernandes, Kalyan Vadakkeveedu, Knowledge Based Systems, Inc. (USA) [8047-25]

Coffee Break 3:00 to 3:30 pm

SESSION 6

Room: Grand 1. Wed. 3:30 to 5:10 pm

Signal Processing and Fusion II

Session Chairs: **Kevin L. Priddy**, Air Force Research Lab. (USA);
King K. Siu, U.S. Army Armament Research, Development and Engineering Ctr. (USA)

3:30 pm: **NIR threat detection applications**, Ronald B. Sertain, Ronald Frankel, Joseph R. Montoya, U.S. Army Research Lab. (USA); Timothy C. Edwards, U.S. Army Redstone Technical Test Ctr. (USA); Jeffrey Liese, Optics 1 (USA); Stephen W. Kennerly, The Johns Hopkins Univ. Applied Physics Lab. (USA) . . . [8047-40]

3:50 pm: **Implementation of a sensor-guided flight algorithm for target tracking by small UAVs**, Gaemus E. Collins, Toyon Research Corp. (USA); Jeffrey Liese, California Polytechnic State Univ., San Luis Obispo (USA) [8047-27]

4:10 pm: **Localization using ground- and air-based acoustic arrays**, Geoffrey H. Goldman, Christian G. Reiff, U.S. Army Research Lab. (USA) [8047-28]

4:30 pm: **On the detection, classification, and tracking of unmanned air vehicles using low-cost acoustic arrays**, Benjamin Ellwood, Sean Schumer, David Grasing, U.S. Army Research, Development and Engineering Command (USA) [8047-29]

4:50 pm: **Integration of a vehicle tracker into the SPADE architecture**, Andrew Kondrath, Richard Van Hook, Air Force Research Lab. (USA) [8047-30]

Thursday 28 April

SESSION 7

Room: Grand 1. Thurs. 8:20 to 10:00 am

Sensor Networking and Communications

Session Chairs: **Graeme P. van Voorthuijsen**, TNO Defence, Security and Safety (Netherlands); **Tien Pham**, U.S. Army Research Lab. (USA)

8:20 am: **Open-source layered sensing model**, Todd V. Rovito, Matthew Lenzo, Matthew McClure, Ritchie D'Alto, Jeff Endicott, Air Force Research Lab. (USA); Curtis Cohenour, Ohio Univ. (USA) [8047-31]

8:40 am: **Operational information content capacity**, Thomas F. La Porta, Aylin Yener, The Pennsylvania State Univ. (USA); Ramesh Govindan, The Univ. of Southern California (USA); Matthew P. Johnson, The Pennsylvania State Univ. (USA); Ram Ramanathan, BBN Technologies (USA) [8047-32]

9:00 am: **Forecasting routes and self-adaptation in multi-hop wireless sensor networks (WSN)**, Themistoklis Bourdenas, IBM Thomas J. Watson Research Ctr. (USA) and Imperial College London (United Kingdom); Flavio Bergamaschi, IBM United Kingdom Ltd. (United Kingdom); David Wood, Petros Zerfos, IBM Thomas J. Watson Research Ctr. (USA); Ananthram Swami, U.S. Army Research Lab. (USA); Morris Sloman, Imperial College London (United Kingdom) [8047-33]

9:20 am: **Broadcast scheduling with data bundles**, Fangfei Chen, Matthew P. Johnson, The Pennsylvania State Univ. (USA); Diego Pizzocaro, Alun Preece, Cardiff Univ. (United Kingdom); Amotz Bar-Noy, The Graduate Ctr. (USA); Thomas F. La Porta, The Pennsylvania State Univ. (USA) [8047-34]

9:40 am: **Service-oriented reasoning architecture for resource-task assignment in sensor networks**, Geeth R. de Mel, Univ. of Aberdeen (United Kingdom); Flavio Bergamaschi, IBM United Kingdom Ltd. (United Kingdom); Tien Pham, U.S. Army Research Lab. (USA); Wamberto Vasconcelos, Univ. of Aberdeen (United Kingdom) [8047-35]

Coffee Break 10:00 to 10:30 am

SESSION 8

Room: Grand 1. Thurs. 10:30 am to 12:10 pm

Joint Session with conference 8062

Sensor Networks and Wide-Area Persistent Surveillance

Session Chairs: **Leo J. Rose**, U.S. Air Force (USA);
Michael A. Kolodny, U.S. Army Research Lab. (USA)

10:30 am: **Bio-inspired UAV routing, source localization, and acoustic signature classification for persistent surveillance**, Jerry A. Burman, Teledyne Scientific Co. (USA); Joao P. Hespanha, Upamanyu Madhow, Daniel J. Klein, Univ. of California, Santa Barbara (USA); Tien Pham, U.S. Army Research Lab. (USA) [8047-36]

10:50 am: **Trident Spectre 2010: agile integration and demonstration of a multisensor airborne pod**, Greg Twaites, Brent Rickenbach, General Dynamics Advanced Information Systems (USA) [8062-18]

11:10 am: **Sensor and information fusion for enhanced detection, classification, and localization**, Michael V. Scanlon, William D. Ludwig, U.S. Army Research Lab. (USA) [8047-39]

11:30 am: **Discovering geospatial networks from ambiguous track data**, James E. Bevington, General Dynamics Advanced Information Systems (USA); Michael Evans, Shashi Shekhar, Univ. of Minnesota, Twin Cities (USA) . [8062-19]

11:50 am: **A Bayesian formulation for auction-based task allocation in heterogeneous, multi-agent teams**, Charles E. Pippin, Georgia Tech Research Institute (USA); Henrik I. Christensen, Georgia Institute of Technology (USA) [8047-38]

12:10 pm: **Network exploitation using WAMI tracks**, Raymond D. Rimey, Dan Keefe, Jim N. Record, Lockheed Martin Corp. (USA); Levi Kennedy, Christopher E. Cramer, Signal Innovations Group, Inc. (USA) [8062-20]

Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XVII

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); **Hsiao-hua K. Burke**, MIT Lincoln 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); **James R. Irons**, NASA Goddard Space Flight Ctr. (USA); **Fred A. Kruse**, Naval Postgraduate School (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 H. Tuell**, Optech International, Inc. (USA); **Miguel Velez-Reyes**, Univ. de Puerto Rico Mayagüez (USA)

Monday 25 April

SESSION 1

Room: Grand 10. Mon. 8:30 to 10:00 am

Detection, Identification, and Quantification I

Session Chair: **Sylvia S. Shen**, The Aerospace Corp. (USA)

- 8:30 am: **Generalized fusion: a new framework for hyperspectral detection** (*Invited Paper*), Peter Bajorski, Rochester Institute of Technology (USA). [8048-01]
- 9:00 am: **Issues in algorithm fusion**, Alan P. Schaum, U.S. Naval Research Lab. (USA) [8048-02]
- 9:20 am: **Log-linear Laplacian ratio (LLLR) algorithm for spectral detection using laboratory signatures**, Brian J. Daniel, Alan P. Schaum, U.S. Naval Research Lab. (USA) [8048-03]
- 9:40 am: **Algorithm for detecting anomaly in hyperspectral imagery using factor analysis**, Edisanter Lo, Susquehanna Univ. (USA) [8048-04]
- Coffee Break 10:00 to 10:30 am

SESSION 2

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

Change Detection

Session Chair: **Paul E. Lewis**, National Geospatial-Intelligence Agency (USA)

- 10:30 am: **Extension and implementation of model-based hyperspectral change detection**, Joseph Meola, Air Force Research Lab. (USA) [8048-05]
- 10:50 am: **Hierarchical image segmentation for context-dependent anomalous change detection**, James Theiler, Lakshman Prasad, Los Alamos National Lab. (USA) [8048-06]
- 11:10 am: **Change detection using mean-shift and outlier-distance metrics**, Joshua D. Zollweg, Rochester Institute of Technology (USA); David B. Gillis, U.S. Naval Research Lab. (USA); Ariel Schlamm, David W. Messinger, Rochester Institute of Technology (USA) [8048-07]
- 11:30 am: **Graph theoretic metrics for spectral imagery with application to change detection**, James A. Albano, David W. Messinger, Ariel Schlamm, William F. Basener, Rochester Institute of Technology (USA) [8048-08]
- Lunch Break 11:50 am to 1:20 pm

SESSION 3

Room: Grand 10. Mon. 1:20 to 3:20 pm

Spectral Data Analysis Methodologies I

Session Chair: **Miguel Velez-Reyes**, Univ. de Puerto Rico Mayagüez (USA)

- 1:20 pm: **Characterization of turbulence in smokestack plumes via imaging Fourier-transform spectroscopy**, Jennifer L. Massman, Kevin C. Gross, Air Force Institute of Technology (USA) [8048-10]
- 1:40 pm: **Anomaly detection of man-made objects using spectro-polarimetric imagery**, Brent D. Bartlett, Ariel Schlamm, Carl Salvaggio, David W. Messinger, Rochester Institute of Technology (USA) [8048-11]
- 2:00 pm: **Selecting training and test images for optimized anomaly detection and material identification algorithms in hyperspectral imagery through robust parameter design**, Frank M. Mindrup, Trevor J. Bihl, Kenneth W. Bauer, Air Force Institute of Technology (USA) [8048-12]
- 2:20 pm: **Target detection using multiple hyperspectral imagers and physics-based models**, Emmett Lentilucci, John P. Kerekes, Rochester Institute of Technology (USA); Arnab Shaw, Gitam Technologies (USA) [8048-13]
- 2:40 pm: **An automated method for identification and ranking of hyperspectral target detections**, William F. Basener, Rochester Institute of Technology (USA) [8048-14]
- 3:00 pm: **Enhancement of flow-like structures in hyperspectral imagery using anisotropic diffusion**, Maider Marin-McGee, Miguel Velez-Reyes, Univ. de Puerto Rico Mayagüez (USA) [8048-15]
- Coffee Break 3:20 to 3:50 pm

SESSION 4

Room: Grand 10. Mon. 3:50 to 5:30 pm

Spectral Methodologies and Applications I

Session Chair: **David Messinger**, Rochester Institute of Technology (USA)

- 3:50 pm: **Supporting relief efforts of the 2010 Haitian earthquake using an airborne multimodal remote sensing platform**, Jason W. Faulring, Donald M. McKeown, Jan W. van Aardt, Rochester Institute of Technology (USA) . [8048-16]
- 4:10 pm: **Demonstration of delivery of ortho imagery in near-real-time for local emergency response**, Donald M. McKeown, Jason W. Faulring, Stephen A. Cavilia, Robert S. Krzaczek, Jan W. van Aardt, Rochester Institute of Technology (USA) [8048-17]
- 4:30 pm: **Deepwater horizon oil spill monitoring using airborne multispectral infrared imagery**, Sylvia S. Shen, The Aerospace Corp. (USA); Paul E. Lewis, National Geospatial-Intelligence Agency (USA) [8048-18]
- 4:50 pm: **Spectral performance related to in-road victim operated improvised explosive devices campaign**, Andre D. Cropper, ITT Corp. Geospatial Systems (USA) [8048-19]
- 5:10 pm: **Evaluation of potential emission spectra for the reliable classification of fluorescently coded materials**, Siegfried Brunner, Christian M. Kargel, Univ. der Bundeswehr München (Germany) [8048-20]

Tuesday 26 April

Symposium-Wide Plenary Session

Tuesday • 8:30 to 9:30 am • Location: Crystal H

Dr. Regina E. Dugan

Director, Defense Advanced Research Projects Agency (DARPA)

See page 18 for details • Open to All Attendees

Coffee Break 9:30 to 10:00 am

SESSION 5

Room: Grand 10. Tues. 10:00 to 11:50 am

Advancements in Spectral Sensor Technologies

Session Chair: **Eustace L. Dereniak**,

College of Optical Sciences, The Univ. of Arizona (USA)

10:00 am: **Image mapping spectrometry: a novel hyperspectral platform for rapid snapshot imaging** (*Invited Paper*), Tomasz S. Tkaczyk, Rice Univ. (USA) [8048-21]

10:30 am: **A Fabry-Perot interferometer with a spatially variable resonance gap employed as a Fourier transform spectrometer**, Paul G. Lucey, Univ. of Hawai'i (USA); Jason Akagi, Spectrum Photonics, Inc. (USA) [8048-22]

10:50 am: **The enhanced MODIS airborne simulator hyperspectral imager**, Daniel Guerin, Ted Graham, John Fisher, Brandywine Optics, Inc. (USA) [8048-23]

11:10 am: **An interference microfilter array with tunable spectral response for each pixel**, Frida E. Strömqvist Vetelino, Ali A. Abtahi, Aerospace Missions Corp. (USA); Peter B. Griffin, Stanford Univ. (USA); Ricky J. Morgan, Usha Raghuram, Aerospace Missions Corp. (USA); Francisco Tejada, Sensing Machines (USA) [8048-24]

11:30 am: **Broadband source for multispectral imager characterization**, Miguel A. Medina, Jason A. Mazzetta, Stephen D. Scoptaz, Electro Optical Industries, Inc. (USA) [8048-26]

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

SESSION 6

Room: Grand 10. Tues. 1:20 to 3:00 pm

Spectral Data Analysis Methodologies II

Session Chair: **Michael T. Eismann**, Air Force Research Lab. (USA)

1:20 pm: **Hyperspectral processing in graphical processing units**, Michael E. Winter, Edwin Winter, Technical Research Associates, Inc. (USA) [8048-27]

1:40 pm: **GPGPU-based real-time conditional dilation for robust target detection in multispectral and hyperspectral imagery**, James P. Morgenstern, Vision4ce LLC (USA) [8048-71]

2:00 pm: **Evaluation of the GPU architecture for the implementation of target detection algorithms for hyperspectral imagery**, Blas Trigueros-Espinosa, Miguel Velez-Reyes, Nayda G. Santiago-Santiago, Univ. de Puerto Rico Mayagüez (USA) [8048-28]

2:20 pm: **Parallel implementation of nonlinear dimensionality reduction methods using CUDA in GPU architecture**, Romel Campana, Vidya B. Manian, Univ. de Puerto Rico Mayagüez (USA) [8048-29]

2:40 pm: **Real-time georeferencing for an airborne hyperspectral imaging system**, Thomas O. Opsahl, Trym V. Haavardsholm, Atle Skaugen, Ingebrigt Winjum, Norwegian Defence Research Establishment (Norway) [8048-31]

Coffee Break 3:00 to 3:30 pm

SESSION 7

Room: Grand 10. Tues. 3:30 to 4:50 pm

Spectral Methodologies and Applications II

Session Chair: **Fred A. Kruse**, Naval Postgraduate School (USA)

3:30 pm: **Identification and mapping of night lights signatures using hyperspectral data**, Fred A. Kruse, Naval Postgraduate School (USA); Christopher D. Elvidge, National Oceanic and Atmospheric Administration (USA) [8048-32]

3:50 pm: **Ship detection in MODIS imagery**, Leidy P. Dorado-Muñoz, Miguel Velez-Reyes, Univ. de Puerto Rico Mayagüez (USA) [8048-33]

4:10 pm: **Multiresolution and directional filtering techniques for detecting dust storm direction in satellite imagery**, Mohammed Q. Alkhatib, Sergio D. Cabrera, The Univ. of Texas at El Paso (USA) [8048-35]

4:30 pm: **High-spatial resolution bidirectional reflectance retrieval using satellite data**, Richard C. Olsen, Cecelia L. McConnon, Angela M. Kim, Naval Postgraduate School (USA) [8048-34]

POSTERS—Tuesday

Room: Crystal M Tues. 6:00 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. 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 pm 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.

Hyperspectral band selection using statistical models, Jochen M. Maerker, Alfons Ebert, Wolfgang Middelmann, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany) [8048-67]

Noise reduction of hyperspectral images by using joint bilateral filter, Ayong Heo, Jai-Hoon Lee, Eun-Jin Choi, Won-Chul Choi, Seo Hyun Kim, Dong-Jo Park, KAIST (Korea, Republic of) [8048-68]

High-fidelity spectrum reconstruction for filter-based spectrum sensor using sparse representation, Cheng-Chun Chang, Nan-Ting Lin, National Taipei Univ. of Technology (Taiwan); Umpei Kurokawa, Byung Il Choi, nanoLambda (USA) [8048-69]

Subpixel target detection and enhancement in hyperspectral images, Kailash C. Tiwari, Military Engineering Services (India) [8048-70]

Wednesday 27 April

SESSION 8

Room: Grand 10. Wed. 8:30 to 10:10 am

Clustering and Classification

Session Chair: **Fred A. Kruse**, Naval Postgraduate School (USA)

8:30 am: **Object classification using discriminating features derived from higher-order spectra of multi- and hyperspectral imagery**, Karen N. Zachery, Jiangying Zhou, Yuwei Liao, Teledyne Scientific & Imaging, LLC (USA) . [8048-37]

8:50 am: **Trilateral filter on multispectral imagery for classification and segmentation**, Weihua Sun, David W. Messinger, Rochester Institute of Technology (USA) [8048-38]

9:10 am: **Automatic clustering of multispectral imagery by maximization of the graph modularity**, Ryan A. Mercovich, Anthony A. Harkin, David W. Messinger, Rochester Institute of Technology (USA) [8048-39]

9:30 am: **A scalable hierarchical image classification approach**, Francis P. Padula, Harry N. Gross, David R. Pogorzala, Integrity Applications, Inc. (USA) [8048-40]

9:50 am: **Multiclass sub-pixel target detection using functions of multiple instances**, Alina Zare, Univ. of Missouri-Columbia (USA); Paul Gader, Univ. of Florida (USA) [8048-41]

Coffee Break 10:10 to 10:40 am

SESSION 9

Room: Grand 10. Wed. 10:40 am to 12:20 pm

Landsat Data Continuity Mission

Session Chair: Scott Brown, Rochester Institute of Technology (USA)

10:40 am: **The operational land imager (OLI) and the thermal infrared sensor (TIRS) on the Landsat Data Continuity Mission (LDCM)**, Dennis C. Reuter, James R. Irons, NASA Goddard Space Flight Ctr. (USA); Allen Lunsford, The Catholic Univ. of America (USA); Matthew Montanaro, Sigma Space Corp. (USA); Fernando A. Pellerano, Cathleen Richardson, Ramsey Smith, NASA Goddard Space Flight Ctr. (USA); Zelalem Tesfaye, Millenium Engineering and Integration Co. (USA); Kurtis J. Thome, NASA Goddard Space Flight Ctr. (USA) . . . [8048-42]

11:00 am: **Calibration plan for the thermal infrared sensor on the Landsat Data Continuity Mission**, Kurtis J. Thome, NASA Goddard Space Flight Ctr. (USA); Allen Lunsford, Catholic Univ. (USA); Matthew Montanaro, Sigma Space Corp. (USA); Dennis C. Reuter, Ramsey Smith, NASA Goddard Space Flight Ctr. (USA); Zelalem Tesfaye, Johns Hopkins Bayview Medical Ctr. (USA); Brian Wenny, Sigma Space Corp. (USA) [8048-43]

11:20 am: **Modeling space-based multispectral imaging systems with DIRSIG**, Scott Brown, Niek J. Sanders, Adam A. Goodenough, Michael Gartley, Rochester Institute of Technology (USA) [8048-44]

11:40 am: **Data-driven simulations of the Landsat Data Continuity Mission (LDCM) platform**, Aaron D. Gerace, Michael Gartley, Nina Raqueno, Rolando Raqueno, John R. Schott, Rochester Institute of Technology (USA) [8048-45]

12:00 pm: **Spectral requirements analysis of the primary flight focal plane arrays for the thermal infrared sensor**, Matthew Montanaro, Sigma Space Corp. (USA); Dennis C. Reuter, Brian L. Markham, Kurtis J. Thome, Allen Lunsford, Murzy D. Jhabvala, Scott Rohrbach, NASA Goddard Space Flight Ctr. (USA); Aaron D. Gerace, Rochester Institute of Technology (USA) [8048-46]

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

SESSION 10

Room: Grand 10. Wed. 1:20 to 3:00 pm

Spectral Data Analysis Methodologies III

Session Chair: Miguel Velez-Reyes, Univ. de Puerto Rico Mayagüez (USA)

1:20 pm: **Joint segmentation and reconstruction of hyperspectral images from a single snapshot**, Peter Qiang Zhang, Robert J. Plemmons, Wake Forest Univ. (USA); David J. Brady, David Kittle, Duke Univ. (USA) [8048-47]

1:40 pm: **Estimation of low-resolution visible spectra from RGB imagery II: simulation results**, Harvey C. Schau, Meridian Systems LLC (USA) . . . [8048-48]

2:00 pm: **A multiband statistical restoration of the Aqua MODIS 1.6 micron band**, Irina Gladkova, Michael D. Grossberg, Fazlul Shahriar, George Bonev, The City College of New York (USA) [8048-49]

2:20 pm: **Estimating true color imagery for GOES-R**, Michael D. Grossberg, Fazlul Shahriar, Irina Gladkova, Paul K. Alabi, The City College of New York (USA); Donald W. Hillger, National Oceanic and Atmospheric Administration (USA) [8048-50]

2:40 pm: **A new deblurring morphological filter for hyperspectral images**, Ezz E. Ali, Military Technical College (Egypt) [8048-51]

Coffee Break 3:00 to 3:30 pm

SESSION 11

Room: Grand 10. Wed. 3:30 to 4:50 pm

Detection, Identification, and Quantification II

Session Chair: Sylvia S. Shen, The Aerospace Corp. (USA)

3:30 pm: **Hyperspectral anomaly detection using sparse kernel-based ensemble learning**, Prudhvi Gurram, Heesung Kwon, U.S. Army Research Lab. (USA) [8048-52]

3:50 pm: **Effect of random measurements on the performance of classical hyperspectral target detection algorithms**, Yi Chen, The Johns Hopkins Univ. (USA); Nasser M. Nasrabadi, U.S. Army Research Lab. (USA); Trac D. Tran, The Johns Hopkins Univ. (USA) [8048-53]

4:10 pm: **Implications of model mismatch and covariance contamination on chemical detection algorithms**, Dimitris Manolakis, Steven E. Golowich, MIT Lincoln Lab. (USA); Sidi Niu, Vinay K. Ingle, Northeastern Univ. (USA) . . [8048-54]

4:30 pm: **Performance limits of LWIR gaseous plume quantification**, Steven E. Golowich, Dimitris Manolakis, MIT Lincoln Lab. (USA) [8048-55]

Track Plenary Presentation

Room: Crystal M. Wed. 5:00 to 6:00 pm

Evolution of Airborne Chemical and Radiological Remote Sensing for Emergency and Natural Disaster Response

Presenter: Paul E. Lewis, National Geospatial-Intelligence Agency

In 2001 the United States Environmental Protection Agency's (EPA) Airborne Spectral Photometric Environmental Collection Technology (ASPECT) Program became the United States only civil 24/7 operational airborne chemical, radiological, and situational awareness reporting capability. Since 2001 the ASPECT aircraft has completed 107 successful airborne emergency response and homeland security related missions. The ASPECT model of operation combines an airborne operational remote sensing suite with a research and development support team to provide essential situational awareness information to first responders and their local, state and federal lead agencies in accordance with the National Contingency Plan and EPA's responsibility under Emergency Support Function 10 of the National Response Plan. This presentation will showcase the effectiveness and necessity of the ASPECT operational model in meeting the needs of the civil emergency response and homeland security communities. Highlights from a variety of ASPECT airborne missions will be presented including industrial accidents, homeland security situational awareness missions, and natural and anthropogenic disasters such as Hurricane Katrina and the Deepwater Horizon Oil Spill along with issues, and lessons learned.

Thursday 28 April

SESSION 12

Room: Grand 10. Thurs. 8:20 to 10:20 am

Spectral Data Analysis Methodologies IV

Session Chair: David Messinger, Rochester Institute of Technology (USA)

8:20 am: **Multi- and hyperspectral scene modeling**, Christoph C. Borel, Ronald F. Tuttle, Air Force Institute of Technology (USA) [8048-56]

8:40 am: **The target implant method for predicting target difficulty and detector performance in hyperspectral imagery**, William F. Basener, John P. Kerekes, Rochester Institute of Technology (USA); C. Eric Nance, Raytheon Intelligence & Information Systems (USA) [8048-57]

9:00 am: **Dynamic dimensionality reduction for hyperspectral imagery**, Haleh Safavi, Keng-Hao Liu, Chein-I Chang, Univ. of Maryland, Baltimore County (USA) [8048-58]

9:20 am: **An empirical estimate of the multivariate normality of spectral image data**, Ariel Schlamm, David W. Messinger, Rochester Institute of Technology (USA) [8048-59]

9:40 am: **Interactive visualization of hyperspectral images on a hyperbolic disk**, Adam A. Goodenough, Ariel Schlamm, Rochester Institute of Technology (USA) [8048-60]

10:00 am: **Realism, utility, and the evolution of simulated remotely sensed imagery**, Erin Ontiveros, Michael G. Gartely, Rochester Institute of Technology (USA) [8048-61]

Coffee Break 10:20 to 10:50 am

SESSION 13

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

Endmember Extraction and Spectral Unmixing

Session Chair: Paul E. Lewis, National Geospatial-Intelligence Agency (USA)

10:50 am: **Simultaneous sparse recovery for unsupervised hyperspectral unmixing**, Dzung T. Nguyen, Yi Chen, Timothy S. Han, Trac D. Tran, The Johns Hopkins Univ. (USA) [8048-62]

11:10 am: **Joint sparsity for target detection**, Yi Chen, The Johns Hopkins Univ. (USA); Nasser M. Nasrabadi, U.S. Army Research Lab. (USA); Trac D. Tran, The Johns Hopkins Univ. (USA) [8048-63]

11:30 am: **High-spatial resolution hyperspectral spatially adaptive endmember selection and spectral unmixing**, Kelly Canham, Ariel Schlamm, William F. Basener, David W. Messinger, Rochester Institute of Technology (USA) [8048-64]

11:50 am: **Kernel-based weighted abundance constrained linear spectral mixture analysis**, Keng-Hao Liu, Englin Wong, Univ. of Maryland, Baltimore County (USA); Chein-I Chang, Univ. of Maryland, Baltimore County (USA) and National Chung Hsing Univ. (Taiwan) [8048-65]

Automatic Target Recognition XXI

Conference Chairs: **Firooz A. Sadjadi**, Lockheed Martin Maritime Systems & Sensors (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 P. Casasent**, Carnegie Mellon Univ. (USA); **Leon Cohen**, Hunter College (USA); **Frederick D. Garber**, Wright State Univ. (USA); **Guillermo C. Gaunard**, Consultant (USA); **Izidor Gertner**, The City College of New York (USA); **Patti S. Gillespie**, U.S. Army Research Lab. (USA); **Riad I. Hammoud**, Delphi Corp. (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); **Bradley C. Wallet**, Automated Decisions LLC (USA); **Edmund Zelnio**, Air Force Research Lab. (USA)

Monday 25 April

SESSION 1

Room: Grand 12. Mon. 8:30 to 11:40 am

Advanced Sensing and Techniques I

Session Chair: **Carl Holden, Jr.**, Lockheed Martin Missiles and Fire Control (USA)

8:30 am: **Object classification using local subspace projection**, Jennifer L. Nealy, Univ. of Central Florida (USA); Robert R. Muise, Lockheed Martin Missiles and Fire Control (USA). [8049-01]

8:50 am: **Method of recognition and pose estimation of multiple occurrences of multiple objects in visual images**, Deepak Khosla, David Huber, HRL Labs., LLC (USA) [8049-02]

9:10 am: **Bio-inspired 'surprise' for real-time change detection in visual imagery**, David Huber, Deepak Khosla, HRL Labs., LLC (USA). [8049-03]

9:30 am: **Hybrid photometric and correspondence-based georegistration**, Scott A. Merritt, Naval Air Warfare Ctr. Weapons Div. (USA) [8049-04]

9:50 am: **Perspective transformation and image warping for wide-baseline scene matching**, Hai-Wen Chen, Michael C. Tarnowski, Craig Stutts, Applied Research Associates, Inc. (USA). [8049-05]

Coffee Break 10:10 to 10:40 am

10:40 am: **Non-invasive eye control technology based on single CCD camera**, Jie Su, Harbin Univ. of Science and Technology (China); Kai Han, Harbin Engineering Univ. (China) [8049-06]

11:00 am: **Metal object detection using a forward-looking polarimetric ground penetrating radar**, Cornell S. L. Chun, Ethan H. Chun, Physics Innovations Inc. (USA). [8049-07]

11:20 am: **Evaluation of methods for computation of CID in a distributed composite tracking system**, Clay J. Stanek, Northrop Grumman Corp. (USA) [8049-40]

Lunch Break 11:40 am to 1:00 pm

Courses of Related Interest

- SC158 **Fundamentals of Automatic Target Recognition** (Sadjadi) Thursday, 8:30 am to 5:30 pm
- SC181 **Predicting Target Acquisition Performance of Electro-Optical Imagers** (Vollmerhausen) Tuesday, 8:30 am to 5:30 pm
- SC892 **Infrared Search and Track Systems** (Schwering) Tuesday, 8:30 am to 5:30 pm
- SC995 **Target Detection Algorithms for Hyperspectral Imagery** (Nasrabadi) Thursday, 8:30 am to 5:30 pm
- SC994 **Multisensor Data Fusion for Object Detection, Classification and Identification** (Klein) Tuesday, 8:30 am to 5:30 pm

Visit the registration desk for course descriptions or to register

SESSION 2

Room: Grand 12. Mon. 1:00 to 3:30 pm

Advanced Sensing and Techniques II

Session Chair: **Leo H. Cohen**, TNO Defence, Security and Safety (Netherlands)

1:00 pm: **Informative representation learning for automatic target recognition** (*Invited Paper*), Charles F. Hester, U.S. Army Research, Development and Engineering Command (USA); Kelly K. Dobson, U.S. Army Aviation and Missile Command (USA) [8049-09]

1:30 pm: **Time-dependent moments for a nonstationary noise model**, Leon Cohen, Affa Ahmad, Hunter College (USA). [8049-10]

1:50 pm: **MaxMin signal design for optimal detection in signal-dependent noise**, Brandon Hamschin, Patrick J. Loughlin, Univ. of Pittsburgh (USA) [8049-11]

2:10 pm: **Reverberation probability distribution for intensity**, Leon Cohen, Affa Ahmad, Hunter College (USA). [8049-12]

2:30 pm: **Impact of range-dependent propagation on classification of underwater objects by their sonar backscatter**, Patrick J. Loughlin, Vikram T. Gomatam, Univ. of Pittsburgh (USA) [8049-13]

2:50 pm: **An adaptive algorithm for subpixel target detection using the spectral information divergence measure**, Wesam A. Sakla, U.S. Dept. of Defense (USA); Adel A. Sakla, Univ. of South Alabama (USA) [8049-14]

3:10 pm: **Curvilinear target detection using spatial spectroscopy**, James M. Coggins, BAE Systems (USA) [8049-15]

Coffee Break 3:30 to 4:00 pm

SESSION 3

Room: Grand 12. Mon. 4:00 to 5:50 pm

Automatic Human Activity and Behavior Recognition

Session Chair: **Abhijit Mahalanobis**, Lockheed Martin Missiles and Fire Control (USA)

4:00 pm: **Activity recognition** (*Invited Paper*), Anthony J. Hoogs, Kitware, Inc. (USA) [8049-16]

4:30 pm: **3D object model-based neural network approach for activity recognition**, Bing Li, Lockheed Martin Systems Integration-Owego (USA) [8049-17]

4:50 pm: **Superresolution for dismounted human detection at long ranges**, Amy Bell, Institute for Defense Analyses (USA) [8049-18]

5:10 pm: **Human body tracking using LMS-VSMM from monocular video sequences**, Hong Han, Zhichao Chen, Licheng Jiao, Youjian Fan, Xidian Univ. (China) [8049-19]

5:30 pm: **Human detection based on curvelet transform and integrating heterogeneous features**, Hong Han, Youjian Fan, Xidian Univ. (China) . [8049-20]

Tuesday 26 April

Symposium-Wide Plenary Session

Tuesday • 8:30 to 9:30 am • Location: Crystal H

Dr. Regina E. Dugan

Director, Defense Advanced Research Projects Agency (DARPA)

See page 18 for details • Open to All Attendees

Coffee Break 9:30 to 10:00 am

SESSION 4

Room: Grand 12. Tues. 10:00 to 11:40 am

Automatic Human Activity and Behavior Recognition II

Session Chair: Robert R. Muise,
Lockheed Martin Missiles and Fire Control (USA)

10:00 am: **Purposeful interpretation of video** (*Keynote Presentation*), Mita D. Desai, Defense Advanced Research Projects Agency (USA) [8049-21]

10:40 am: **Detection and tracking of people and their body parts in infrared**, Juengling Kai, Michael Arens, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany) [8049-22]

11:00 am: **An implicit shape-model based approach to identify armed persons**, Stefan Becker, Juengling Kai, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany) [8049-23]

11:20 am: **Multiframe correlation filtering for activity recognition using quadratic correlation filters**, Shih-Chi K. Chen, Steven R. Stanfill, Abhijit Mahalanobis, Lockheed Martin Missiles and Fire Control (USA) [8049-25]

Lunch/Exhibition Break 11:40 am to 1:00 pm

SESSION 5

Room: Grand 12. Tues. 1:00 to 4:20 pm

Multisensor and Multidimensional Target Recognition

Session Chair: Abhijit Mahalanobis,
Lockheed Martin Missiles and Fire Control (USA)

1:00 pm: **The importance of performance modeling for ATR** (*Invited Paper*), Edmund Zelnio, Air Force Research Lab. (USA) [8049-26]

1:30 pm: **Practical optimal processing in hyperdimensional spaces via domain-reducing mappings**, Manuel F. Fernández, Tom Ardigides, Firooz A. Sadjadi, Lockheed Martin Maritime Systems & Sensors (USA) [8049-27]

1:50 pm: **Baseline processing pipeline for fast automatic target detection and recognition in airborne 3D ladar imagery**, Simon Roy, Jean Maheux, Defence Research and Development Canada (Canada) [8049-28]

2:10 pm: **Integrating LPR with CCTV systems: problems and solutions**, Dmitry O. Gorodnichy, Canada Border Services Agency (Canada) [8049-29]

2:30 pm: **Applying visual saliency to the automatic target recognition domain**, Suresh Subramanian, Jason Gauci, Lockheed Martin Missiles and Fire Control (USA) [8049-41]

2:50 pm: **Anomaly detection in hyperspectral imagery using stable distribution**, Suat Mercan, Univ. of Nevada, Reno (USA); Mohammad S. Alam, Univ. of South Alabama (USA) [8049-31]

Coffee Break 3:10 to 3:40 pm

3:40 pm: **Multisensor ISR in geo-registered contextual visual dataspace (CVD)**, Kyungnam (Ken) Kim, HRL Labs., LLC (USA) [8049-32]

4:00 pm: **Integration of low-level and ontology derived features for automatic weapon recognition and identification**, Nikolay M. Sirakov, Sang Won Suh, Salvatore Attardo, Texas A&M Univ.-Commerce (USA) [8049-33]

Wednesday 27 April

SESSION 6

Room: Grand 12. Wed. 8:00 to 10:00 am

ATR Performance Evaluations

Session Chair: Izidor Gertner, The City College of New York (USA)

8:00 am: **Predicting new views of an object from an existing image by parametrized predictions on the manifold**, Abhijit Mahalanobis, Lockheed Martin Missiles and Fire Control (USA) [8049-34]

8:20 am: **Redefining automatic target recognition (ATR) performance standards**, Donald Waagen, Charles F. Hester, Ben Schmid, Margaret Phillips, M. Shane Thompson, U.S. Army Aviation and Missile Command (USA); Steven Vanstone, U.S. Army Armament Research, Development and Engineering Ctr. (USA); Kelly K. Dobson, U.S. Army Aviation and Missile Command (USA) [8049-35]

8:40 am: **Analytic performance model for grayscale quantization in the presence of additive noise**, Adam R. Nolan, George S. Goley, Etegent Technologies, Ltd. (USA) [8049-36]

9:00 am: **Variability and robustness of scatterers in HRR/ISAR ground target data and its influence on the ATR performance**, Rolf Schumacher, Hartmut M. Schimpf, Joachim Schiller, Fraunhofer FHR (Germany) [8049-37]

9:20 am: **The influence of multipath on ship ATR performance**, Hartmut M. Schimpf, Fraunhofer FHR (Germany) [8049-38]

9:40 am: **A comparison of machine learning methods for target recognition using ISAR imagery**, Karen D. Uttecht, Cindy X. Chen, Jason C. Dickinson, Thomas M. Goyette, Robert H. Giles, Univ. of Massachusetts Lowell (USA); William E. Nixon, National Ground Intelligence Ctr. (USA) [8049-39]

2011 Best Paper Award Presentation

Room: Grand 12 Wed. 10:00 to 10:20 am

Sponsored by



TRACK PLENARY PRESENTATION

Evolution of Airborne Chemical and Radiological Remote Sensing for Emergency and Natural Disaster Response (Conf. 8048)

Wednesday • 5:00 to 6:00 pm • Location: Crystal M

Presenter: Paul E. Lewis

National Geospatial-Intelligence Agency
In 2001 the United States Environmental Protection Agency's (EPA) Airborne Spectral Photometric Environmental Collection Technology (ASPECT) Program became the United States only civil 24/7 operational airborne chemical, radiological, and situational awareness reporting capability. Since 2001 the ASPECT aircraft has completed 107 successful airborne emergency response and homeland security related missions. The ASPECT model of operation combines an airborne operational remote sensing suite with a research and development support team to provide essential situational awareness information to first responders and their local, state and federal lead agencies in accordance with the National Contingency Plan and EPA's responsibility under Emergency Support Function 10 of the National Response Plan. This presentation will showcase the effectiveness and necessity of the ASPECT operational model in meeting the needs of the civil emergency response and homeland security communities. Highlights from a variety of ASPECT airborne missions will be presented including industrial accidents, homeland security situational awareness missions, and natural and anthropogenic disasters such as Hurricane Katrina and the Deepwater Horizon Oil Spill along with issues, and lessons learned..

See p. 21 for details.

Signal Processing, Sensor Fusion, and Target Recognition XX

Conference Chair: **Ivan Kadar**, Interlink Systems Sciences, Inc. (USA)

Program Committee: **Mark G. Alford**, Air Force Research Lab. (USA); **William D. Blair**, Georgia Tech Research Institute (USA); **Erik P. Blasch**, Defence Research and Development Canada (Canada); **Mark J. Carlotto**, General Dynamics Advanced Information Systems (USA); **Kuo-Chu Chang**, George Mason Univ. (USA); **Chee-Yee Chong**, BAE Systems Advanced Information Technologies (USA); **Marvin N. Cohen**, Georgia Tech Research Institute (USA); **Mohammad Farooq**, Royal Military College of Canada (Canada); **Charles W. Glover**, Oak Ridge National Lab. (USA); **I. R. Goodman**, Consultant (USA); **Lynne L. Grewe**, California State Univ., East Bay (USA); **Michael L. Hinman**, Air Force Research Lab. (USA); **Kenneth J. Hintz**, George Mason Univ. (USA); **Jon S. Jones**, Air Force Research Lab. (USA); **Thiagalingam Kirubarajan**, McMaster Univ. (Canada); **Martin E. Liggins II**, MITRE Corp. (USA); **James Linas**, Univ. at Buffalo (USA); **Ronald P. Mahler**, Lockheed Martin Maritime Systems & Sensors (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 (Canada)

Monday 25 April

SESSION 1

Room: Grand 14. Mon. 8:10 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 J. Hintz**, George Mason Univ. (USA)

8:10 am: **Road network estimation through GMTI track fusion**, Mark G. Alford, Maria Scalzo, Adnan Bubalo, Gregory E. Wood, Eric C. Jones, Air Force Research Lab. (USA) [8050-01]

8:30 am: **Measures of nonlinearity for single target tracking problems**, Eric C. Jones, Maria Scalzo, Adnan Bubalo, Mark G. Alford, Benjamin Arthur, Air Force Research Lab. (USA) [8050-02]

8:50 am: **Toward a computationally efficient approach for improving target tracking using grid-based methods**, Mark E. Silbert, The George Washington Univ. (USA) and Naval Air Systems Command (USA); Shahram Sarkani, Thomas Mazzuchi, The George Washington Univ. (USA) [8050-03]

9:10 am: **The effect of disparate sensors on tracking performance**, Charles A. Rea, Mark E. Silbert, Naval Air Systems Command (USA) [8050-04]

9:30 am: **A multiple IMM approach with unbiased mixing for thrusting projectiles**, Ting Yuan, Yaakov Bar-Shalom, Peter K. Willett, Univ. of Connecticut (USA); David F. Hardiman, U.S. Army Research, Development and Engineering Command (USA) [8050-05]

9:50 am: **Tracking system to maximize engagement envelope of a data-linked weapon**, James M. Davies, Jason F. Ralph, Univ. of Liverpool (United Kingdom) [8050-06]

Coffee Break 10:10 to 10:40 am

SESSION 2

Room: Grand 14. Mon. 10:40 am to 12:20 pm

Multisensor Fusion, Multitarget Tracking, and Resource Management II

Session Chairs: **Thiagalingam Kirubarajan**, McMaster Univ. (Canada); **Kenneth J. Hintz**, George Mason Univ. (USA); **Erik P. Blasch**, Defence Research and Development Canada (Canada)

10:40 am: **Efficiency of the composite position measurements from satellite-based LOS**, Richard W. Osborne III, Yaakov Bar-Shalom, Univ. of Connecticut (USA) [8050-07]

11:00 am: **Multitarget smooth variable structure filter: theory, design, and implementation**, Stephen A. Gadsden, Darcy Dunne, Saeid Habibi, Thiagalingam Kirubarajan, McMaster Univ. (Canada) [8050-08]

11:20 am: **Maximum likelihood probabilistic multihypothesis tracker applied to multistatic sonar data sets**, Steven C. Schoenecker, Naval Undersea Warfare Ctr. (USA); Peter K. Willett, Yaakov Bar-Shalom, Univ. of Connecticut (USA) [8050-09]

11:40 am: **Wide-area video exploitation (WAVE) joint data management for layered sensing**, Erik P. Blasch, Defence Research and Development Canada (Canada); Gunasekaran S. Seetharaman, Air Force Research Lab. (USA) [8050-10]

12:00 pm: **Information-theoretic sensor management analysis**, Erik P. Blasch, Defence Research and Development Canada (Canada); Ivan Kadar, Interlink Systems Sciences, Inc. (USA); Chun Yang, Sigtem Technology, Inc. (USA) [8050-11]

Lunch Break 12:20 to 1:30 pm

SESSION 3

Room: Grand 14. Mon. 1:30 to 2:50 pm

Multisensor Fusion, Multitarget Tracking, and Resource Management III

Session Chairs: **Kenneth J. Hintz**, George Mason Univ. (USA); **Ivan Kadar**, Interlink Systems Sciences, Inc. (USA); **Thiagalingam Kirubarajan**, McMaster Univ. (Canada)

1:30 pm: **Optimal threshold policies for radar resource management in GMTI systems**, Vikram Krishnamurthy, Erik J. Miehling, The Univ. of British Columbia (Canada); Bhashyam Balaji, Defence Research and Development Canada (Canada) [8050-12]

1:50 pm: **Efficient exchange of information in a distributed tracking environment**, Peter J. Shea, Eric Blake, Black River Systems Co. (USA) [8050-13]

2:10 pm: **Optimal update with multiple out-of-sequence measurements**, Shuo Zhang, Yaakov Bar-Shalom, Univ. of Connecticut (USA) [8050-14]

2:30 pm: **Stability of out-of-sequence measurement processing: an open problem**, Lingji Chen, BAE Systems Advanced Information Technologies (USA); Nima Moshtagh, Scientific Systems Co., Inc. (USA) [8050-15]

SESSION 4

Room: Grand 14. Mon. 2:50 to 6:20 pm

Multisensor Fusion Methodologies and Applications I

Session Chair: **Ronald P. Mahler**, Lockheed Martin Maritime Systems & Sensors (USA)

2:50 pm: **Bayesian unified registration and tracking**, Ronald Mahler, Lockheed Martin Maritime Systems & Sensors (USA); Adel I. El-Fallah, Scientific Systems Co., Inc. (USA) [8050-16]

3:10 pm: **Distributed PHD filter-based bias removal in PCL system**, Maheswaran Subramaniam, McMaster Univ. (Canada); Kumaradevan Punithakumar, GE Healthcare (Canada); Ratnasingham Thamarasa, McMaster Univ. (Canada); Michael McDonald, Defence Research and Development Canada (Canada); Thiagalingam Kirubarajan, McMaster Univ. (Canada) [8050-17]

Coffee Break 3:30 to 4:00 pm

Tuesday 26 April

Symposium-Wide Plenary Session

Tuesday • 8:30 to 9:30 am • Location: Crystal H

Dr. Regina E. Dugan

Director, Defense Advanced Research Projects Agency (DARPA)

See page 18 for details • Open to All Attendees

Coffee Break 9:30 to 10:00 am

SESSION 5

Room: Grand 14. Tues. 10:00 am to 12:00 pm

Multisensor Fusion Methodologies and Applications II

Session Chairs: **Michael L. Hinman**, Air Force Research Lab. (USA); **Chee-Yee Chong**, BAE Systems Advanced Information Technologies (USA); **Ivan Kadar**, Interlink Systems Sciences, Inc. (USA)

10:00 am: **Acoustic and imagery semantic labeling and fusion of human-vehicle interactions**, Amir H. Shirkhodaie, Vinayak Elangovan, Aaron Rababaah, Tennessee State Univ. (USA) [8050-25]

10:20 am: **Adaptive characterization, tracking, and semantic labeling of human-vehicle interactions via multimodality data fusion techniques**, Amir H. Shirkhodaie, Vinayak Elangovan, Aaron Rababaah, Tennessee State Univ. (USA) [8050-26]

10:40 am: **Structure learning of Bayesian network using a cloud-based adaptive immune genetic algorithm**, Song Qin, Zhejiang Univ. (China); Feng Lin, Zhejiang Univ. (China) and George Mason Univ. (USA); Kuo-Chu Chang, George Mason Univ. (USA) [8050-27]

11:00 am: **Study of most probable explanations in hybrid Bayesian networks**, Wei Sun, Kuo-Chu Chang, George Mason Univ. (USA) [8050-28]

11:20 am: **Fusion and Gaussian mixture based-classifiers for SONAR data**, Vikas Kotari, Kuo-Chu Chang, George Mason Univ. (USA) [8050-29]

11:40 am: **Sequential fusion**, Christine M. Schubert Kabban, Air Force Institute of Technology (USA); Kathleen E. Daly, Lewis and Clark College (USA); David A. Zitelli, Steven N. Thorsen, U.S. Air Force Academy (USA); Mark E. Oxley, Air Force Institute of Technology (USA) [8050-30]

Lunch/Exhibition Break 12:00 to 1:10 pm

SESSION 6

Room: Grand 14. Tues. 1:10 to 2:50 pm

Multisensor Fusion Methodologies and Applications III

Session Chairs: **Chee-Yee Chong**, BAE Systems Advanced Information Technologies (USA); **Michael L. Hinman**, Air Force Research Lab. (USA); **Kenneth Hintz**, George Mason Univ. (USA); **Ivan Kadar**, Interlink Systems Sciences, Inc. (USA)

1:10 pm: **Twelve dubious methods to solve a first-order linear (highly) underdetermined PDE for exact particle flow nonlinear filters**, Frederick E. Daum, Raytheon Co. (USA) [8050-32]

1:30 pm: **Numerical results for exact particle flow filters**, Frederick E. Daum, Jim Huang, Raytheon Co. (USA) [8050-33]

1:50 pm: **The exact fundamental solution for the Benes filter: a Feynman path integral derivation**, Bhashyam Balaji, Defence Research and Development Canada (Canada) [8050-34]

2:10 pm: **Impact of radar system parameters on trajectory inference using stochastic context-free grammars**, Bhashyam Balaji, Alex Wang, Defence Research and Development Canada (Canada) [8050-35]

2:30 pm: **The multitarget set JPDA filter with target identity**, Daniel Svensson, Lennart Svensson, Chalmers Univ. of Technology (Sweden); Marco Guerriero, Elettronica S.p.A. (Italy) [8050-36]

Coffee Break 2:50 to 3:20 pm

4:00 pm: **Multivehicle decentralized fusion and tracking**, Adel I. El-Fallah, Aleksandar Zatezalo, Raman K. Mehra, Scientific Systems Co., Inc. (USA); Ronald P. Mahler, Lockheed Martin Maritime Systems & Sensors (USA) [8050-18]

4:20 pm: **Multimodel filtering of partially observable space object trajectories**, Aleksandar Zatezalo, Adel I. El-Fallah, Raman K. Mehra, Scientific Systems Co., Inc. (USA); Ronald P. Mahler, Lockheed Martin Maritime Systems & Sensors (USA); Khanh D. Pham, Air Force Research Lab. (USA) [8050-19]

4:40 pm: **On the differences between the probability hypothesis density (PHD) filter and the multitarget multi-Bernoulli (MeMBeR) filter**, Daniel E. Clark, Heriot-Watt Univ. (United Kingdom); Trevor Wood, Oxford Univ. (United Kingdom); Ba-Ngu B. Vo, The Univ. of Western Australia (Australia); Branko Ristic, Defence Science and Technology Organisation (Australia); Ba Tuong Vo, The Univ. of Western Australia (Australia) [8050-20]

5:00 pm: **On the ordering of the sensors in the iterated-corrector probability hypothesis density (PHD) filter**, Sharad Nagappa, Daniel E. Clark, Heriot-Watt Univ. (United Kingdom) [8050-21]

5:20 pm: **A tracker based on a CPHD filter approach for infrared applications**, Yohan Petetin, TELECOM & Management SudParis (France); Daniel E. Clark, Heriot-Watt Univ. (United Kingdom); Branko Ristic, Defence Science and Technology Organisation (Australia); Dominique Maltese, Sagem Defense Securite (France) [8050-22]

5:40 pm: **The set IMMJPDA filter for multitarget tracking**, Daniel Svensson, Lennart Svensson, Chalmers Univ. of Technology (Sweden); David Crouse, Univ. of Connecticut (USA); Marco Guerriero, Elettronica S.p.A. (Italy); Peter K. Willett, Univ. of Connecticut (USA) [8050-23]

6:00 pm: **Dempster's combination is a special case of Bayes' rule**, Ronald P. Mahler, Lockheed Martin Maritime Systems & Sensors (USA) [8050-24]

Invited Panel Discussion

Room: Grand 14 Mon. 7:15 to 9:40 pm

Real-World Issues and Challenges in Hard and Soft Fusion

Panel Moderators: **Ivan Kadar**, Interlink Systems Sciences, Inc. (USA); **Chee-Yee Chong**, BAE Systems Advanced Information Technologies (USA)

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

Panelists: **Richard Antony**, SAIC, Inc.;

Chee-Yee Chong, BAE Systems Advanced Information Technologies;

Erik Blasch, Defence Research and Development Canada (Canada);

Ivan Kadar, Interlink Systems Sciences, Inc.;

Thiagalingam Kirubarajan, McMaster Univ. (Canada);

James Llinas, Univ. at Buffalo;

Ronald P. Mahler, Lockheed Martin Maritime Systems and Sensors;

David Hall, The Pennsylvania State Univ.

The panel will address salient real-world issues and challenges in hard and soft data fusion illuminated by invited experts. Accurate situation assessment sometimes cannot be accomplished using just hard or soft data sources alone. Specifically sources of "hard information" are physics-based sources that provide sensor observables such as radar or video data, while "soft information" is usually provided by human-based sources. Fusion of hard and soft data can provide situation pictures that are better than those using hard or soft data alone. For example, patrol reports provide soft data in addition to hard data from physical sensors in urban operational environments. While algorithms for fusing information from physical sensors has a substantial development history as well as maturity, complex technical issues remain in the representation of human-based information to make it suitable for combining with sensor based information. Conceptual real-world related examples associated with the overall complex problem will be addressed by the panel to highlight issues and challenges. Audience participation is welcomed to provide a forum for exchange of ideas.

SESSION 7

Room: Grand 14. Tues. 3:20 to 4:40 pm

Multisensor Fusion Methodologies and Applications IV

Session Chairs: **Erik P. Blasch**, Defence Research and Development Canada (Canada); **Chee-Yee Chong**, BAE Systems Advanced Information Technologies (USA); **Michael L. Hinman**, Air Force Research Lab. (USA); **Kenneth Hintz**, George Mason Univ. (USA)

3:20 pm: **Information fusion measures of effectiveness for decision support**, Erik P. Blasch, Pierre Valin, Eloi Bossé, Defence Research and Development Canada (Canada). [8050-37]

3:40 pm: **Toward more robust exploitation of the asymmetric threat: binary fusion class extensions**, Richard T. Antony, SAIC (USA); Joseph A. Karakowski, U.S. Army CERDEC Intelligence and Information Warfare Directorate (USA). [8050-38]

4:00 pm: **Probabilistic programming for assessing capability and capacity**, Avi Pfeffer, Scott A. Harrison, Charles River Analytics, Inc. (USA) [8050-39]

4:20 pm: **Effects of operation parameters on multitarget tracking in proximity sensor networks**, Qiang Le, Hampton Univ. (USA); Lance M. Kaplan, U.S. Army Research Lab. (USA) [8050-40]

SESSION 8

Room: Grand 14. Tues. 4:40 to 6:20 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 Advanced Information Technologies (USA); **Erik P. Blasch**, Defence Research and Development Canada (Canada)

4:40 pm: **An information matrix fusion (IMF)-based heterogeneous track-to-track fusion algorithm**, Xin Tian, Yaakov Bar-Shalom, Univ. of Connecticut (USA); Erik P. Blasch, Defence Research and Development Canada (Canada); Khanh D. Pham, Air Force Research Lab. (USA); Genshe Chen, I-Fusion, Inc. (USA); Yuan Ting, Univ. of Connecticut (USA) [8050-41]

5:00 pm: **Object discovery, identification, and association**, Vijay Kumar, Univ. of Missouri-Kansas City (USA); James Metzler, Mark H. Linderman, Jon S. Jones, Mark G. Alford, Adnan Bubalo, Maria Scalzo, Air Force Research Lab. (USA) [8050-42]

5:20 pm: **Target signature agnostic tracking with ad-hoc network of omni-directional sensors**, Kalin Atanassov, Qualcomm Inc. (USA); William S. Hodgkiss, Univ. of California, San Diego (USA); Sergio R. Goma, Qualcomm Inc. (USA) [8050-43]

5:40 pm: **A sensor reduction technique using Bellman optimal estimates of target agent dynamics**, Brian J. Goode, Philip A. Chin, Michael J. Roan, Virginia Polytechnic Institute and State Univ. (USA) [8050-44]

6:00 pm: **Real-time sensor fusion technique for acoustic and seismic sensors**, Mussab Zubair, Klaus Hartmann, Otmar Loffeld, Univ. Siegen (Germany) [8050-45]

POSTERS—Tuesday

Room: Crystal M Tues. 6:00 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. 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 pm 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.

Detecting large frequency weak signal in heavy noise background using nonlinear bi-stable system, Yu Zhang, Yuan Zhao, Yong Zhang, Long Wu, Haifeng Lv, Harbin Institute of Technology (China). [8050-67]

Micro-Doppler analysis of human motion using 77 GHz radar, Amer Nezirovic, Svante Björklund, Henrik Petersson, Swedish Defence Research Agency (Sweden) [8050-68]

Visualization of hyperspectral images using bilateral filtering with spectral angles, Jai-Hoon Lee, Ayoung Heo, Won-Chul Choi, Seo Hyun Kim, Dong-Jo Park, KAIST (Korea, Republic of) [8050-70]

Feynman path integrals, effective action, and metropolis-based Monte-Carlo methods for nonlinear filtering, Bhashyam Balaji, Defence Research and Development Canada (Canada) [8050-71]

Target tracking based on video sequences, Yahui Liu, Beijing Univ. of Posts and Telecommunications (China) [8050-72]

Multiple model assignment for multipath-assisted multitarget tracking, Maheswaran Subramaniam, McMaster Univ. (Canada); Kumaradevan Punithakumar, GE Healthcare (Canada); Ratnasingham Tharmarasa, McMaster Univ. (Canada); Michael McDonald, Defence Research and Development Canada (Canada); Thiagalingam Kirubarajan, McMaster Univ. (Canada). [8050-73]

Discussion and application of the homotopy filter, Sora Choi, Peter K. Willett, Univ. of Connecticut (USA); Frederick E. Daum, Jim Huang, Raytheon Co. (USA) [8050-74]

Wednesday 27 April

SESSION 9

Room: Grand 14. Wed. 8:00 to 10:00 am

Signal and Image Processing, and Information Fusion Applications I

Session Chairs: **Lynne L. Grewe**, California State Univ., East Bay (USA); **Alastair D. McAulay**, Lehigh Univ. (USA); **Mark G. Alford**, Air Force Research Lab. (USA)

8:00 am: **Sub-pixel registration of moving objects in visible and thermal imagery with adaptively thresholded segmentation**, Stephen M. Won, Susan S. Young, U.S. Army Research Lab. (USA); Gunasekaran S. Seetharaman, Air Force Research Lab. (USA); Kannappan Palaniappan, Univ. of Missouri-Columbia (USA) [8050-46]

8:20 am: **Interactive target recognition in images using machine-learning techniques**, Ariel Michaeli, Irit Camon, Rafael Advanced Defense Systems Ltd. (Israel) [8050-47]

8:40 am: **Optimal detection of objects in images and videos using electroencephalography (EEG)**, Deepak Khosla, Rajan Bhattacharyya, Penn Tasinga, David Huber, HRL Labs., LLC (USA) [8050-48]

9:00 am: **Improved classification using image data fused via nonlinear dimensionality reduction**, Colin C. Olson, Jonathan M. Nichols, K. Peter Judd, Frank Bucholtz, U.S. Naval Research Lab. (USA) [8050-49]

9:20 am: **Shape and texture fused recognition of flying targets**, Levente Kovács, Ákos Utasi, Andrea Kovács, Tamás Szirányi, Computer and Automation Research Institute (Hungary) [8050-50]

9:40 am: **Millimeter-wavelength radar improves target identification**, Alastair D. McAulay, Lehigh Univ. (USA) [8050-51]

Coffee Break 10:00 to 10:30 am

SESSION 10

Room: Grand 14. Wed. 10:30 to 11:50 am

Signal and Image Processing, and Information Fusion Applications II

Session Chairs: **Lynne L. Grewe**, California State Univ., East Bay (USA);
Alastair D. McAulay, Lehigh Univ. (USA);
Mark G. Alford, Air Force Research Lab. (USA)

10:30 am: **An optical tracker for the maritime environment**, Asheer K. Bachoo, Francois P. J. Le Roux, Council for Scientific and Industrial Research (South Africa); Fred Nicolls, Univ. of Cape Town (South Africa) [8050-52]

10:50 am: **Lane detection using road planar information**, Qiang He, Mississippi Valley State Univ. (USA); Chee-Hung Chu, Univ. of Louisiana at Lafayette (USA) [8050-53]

11:10 am: **Detection and classification of poorly known aircraft with a low-resolution infrared sensor**, Sidonie Lefebvre, ONERA (France); Stéphanie Allassonnière, Ecole Polytechnique (France); Gérard Durand, ONERA (France); Jérémie Jakubowicz, Eric Moulines, Telecom ParisTech (France); Antoine Roblin, ONERA (France) [8050-54]

11:30 am: **Detection and classification of moving objects from UAVs with optical and IR sensors**, Michael Teutsch, Wolfgang Krüger, Norbert F. Heinze, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany) [8050-55]

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

SESSION 11

Room: Grand 14. Wed. 1:20 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)

1:20 pm: **Adaptive statistical inferential methods for detection and classification in sensing systems**, Xinjia Chen, Ernest L. Walker, Southern Univ. and A&M College (USA) [8050-56]

1:40 pm: **Channel-aware distributed classification using binary local decisions**, Mohammad Fanaei, Matthew C. Valenti, Natalia A. Schmid, Vinod K. Kulathumani, West Virginia Univ. (USA) [8050-57]

2:00 pm: **Benchmark for detection algorithms of target signal observables with significant temporal characteristic**, Nathan Levy, Israel Ministry of Defense (Israel); Gil A. Tidhar, Optigo Systems, Ltd. (Israel); Avy Louski, Raanan Schlisselberg, Israel Ministry of Defense (Israel) [8050-58]

2:20 pm: **Interacting multiple model estimators for tracking thousands of interacting, small targets in a complex plasma**, Neil Oxtoby, Jason F. Ralph, Céline Durniak, Dmitry Samsonov, Univ. of Liverpool (United Kingdom) [8050-59]

2:40 pm: **Diversity detection in non-Gaussian noise employing the generalized approach to signal processing in noise with fading diversity channels**, Vyacheslav P. Tuzlukov, Kyungpook National Univ. (Korea, Republic of) [8050-60]

Coffee Break 3:00 to 3:30 pm

SESSION 12

Room: Grand 14. Wed. 3:30 to 5:30 pm

Signal and Image Processing, and Information Fusion Applications IV

Session Chairs: **Mark G. Alford**, Air Force Research Lab. (USA);
Alastair D. McAulay, Lehigh Univ. (USA);
Lynne L. Grewe, California State Univ., East Bay (USA)

3:30 pm: **A survey of imagery techniques for semantic labeling of human-vehicle interactions in persistent surveillance systems**, Vinayak Elangovan, Amir H. Shirkhodaie, Tennessee State Univ. (USA) [8050-61]

3:50 pm: **A new research tool for hybrid Bayesian networks using script language**, Wei Sun, Cheol-Young Park, Rommel Carvalho, George Mason Univ. (USA) [8050-62]

4:10 pm: **Indoor localization of medication packages using RFID**, Stelios A. Mitilneos, George E. Vastianos, Olga E. Segou, Dimitris M. Kyriazanos, Stelios C. A. Thomopoulos, National Ctr. for Scientific Research Demokritos (Greece) [8050-63]

4:30 pm: **GPS signal modeling for location estimation in indoor environments using GPS repeaters**, Dionysia K. Petraki, Stelios A. Mitilneos, Stelios C. A. Thomopoulos, National Ctr. for Scientific Research Demokritos (Greece) [8050-64]

4:50 pm: **Low power, real time digital video stabilization using the HyperX parallel processor**, Martin A. Hunt, Lin Tong, Keith Bindloss, Shang Zhong, Stephen Lim, Coherent Logix, Inc. (USA); Paul D. Willson, U.S. Army Armament Research, Development and Engineering Ctr. (USA) [8050-65]

5:10 pm: **Adaptive event detection for nonintrusive load monitoring**, Yuanwei Jin, Eniye Tebekeami, Univ. of Maryland Eastern Shore (USA); Mario Berges, Carnegie Mellon Univ. (USA) [8050-66]



Algorithms for Synthetic Aperture Radar Imagery XVIII

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**, BAE Systems Advanced Information Technologies (USA); **Charles V. Jakowatz, Jr.**, Sandia National Labs. (USA); **Eric R. Keydel**, SAIC (USA); **Jian Li**, Univ. of Florida (USA); **Michael Minardi**, Air Force Research Lab. (); **Randolph L. Moses**, The Ohio State Univ. (USA); **Les Novak**, Scientific Systems Co., Inc. (USA); **Lee Potter**, The Ohio State Univ. (USA); **Brian D. Rigling**, Wright State Univ. (USA); **Timothy D. Ross**, Air Force Research Lab. (USA); **Michael A. Saville**, Air Force Institute of Technology (USA); **Gerard W. Titi**, BAE Systems Advanced Information Technologies (USA)

Innovative Format

Once again, this conference will follow a "Briefing, Poster Workshop, Panel Discussion" format. During the first sessions of each day, authors will highlight the results for their work in 10 minute oral briefings. After the presentations, these same authors will be available for in-depth discussions in an extended poster session setting, which will be held in or near the conference room. After the Poster Workshop, there will be a Panel Discussion where experts and audience will address pressing issues from the sessions that day.

Wednesday 27 April

SESSION 1

Room: Grand 13. Wed. 8:10 to 10:00 am

Advanced SAR Imaging I

Session Chair: **Charles V. Jakowatz, Jr.**, Sandia National Labs. (USA)

- 8:10 am: **Fast synthetic aperture radar imaging with a streamlined 2D fractional Fourier transform**, Matthew P. Pepin, Majeed M. Hayat, The Univ. of New Mexico (USA) [8051-01]
- 8:20 am: **A comparison of SAR imaging algorithms for high-squint angle trajectories**, Matt Horvath, Brian D. Rigling, Wright State Univ. (USA) . . [8051-02]
- 8:30 am: **Extensions to polar formatting with spatially variant post filtering**, Wendy L. Garber, Robert W. Hawley, Matrix Research Inc. (USA) [8051-03]
- 8:40 am: **A butterfly algorithm for synthetic aperture radar imaging**, Laurent Demanet, Massachusetts Institute of Technology (USA); Matthew Ferrara, Nicholas Maxwell, Jack Poulson, Matrix Research Inc. (USA); Lexing Ying, The Univ. of Texas at Austin (USA) [8051-04]
- 8:50 am: **Ultrasonic tomographic imaging using a propagation and backpropagation method**, Yuanwei Jin, Chengdong Dong, Univ. of Maryland Eastern Shore (USA); Matthew Ferrara, Kevin L. Priddy, Air Force Research Lab. (USA) [8051-05]
- 9:00 am: **Aperture weighting technique for video synthetic aperture radar imaging**, Robert W. Hawley, Wendy L. Garber, Matrix Research Inc. (USA) [8051-06]
- 9:10 am: **Video-like image exploitation for MISAR image sequences taken from small UAVs**, Günter M. Saur, Norbert F. Heinze, Wolfgang Krüger, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany) [8051-07]
- 9:20 am: **3D ISAR imaging of objects through 2D rotations**, Zhijun Qiao, Guillermo Garza, Jaime Lopez, The Univ. of Texas-Pan American (USA) [8051-08]
- 9:30 am: **An algorithm for wide aperture 3D SAR imaging with measured data**, Forest A. Lee-Elkin, Lee Potter, The Ohio State Univ. (USA) [8051-09]
- 9:40 am: **Sparse near-field radar imagery for quick RCS analysis**, François Giraud, Pierre Minvielle, Commissariat à l'Énergie Atomique (France); Jean-Francois Giovanelli, Univ. Bordeaux 1 (France); Pierre Del Moral, INRIA Bordeaux Suf-Ouest (France) [8051-41]
- 9:50 am: **Computationally efficient FBP-type direct segmentation of synthetic aperture radar images**, Huseyin C. Yanik, Zhengmin Li, Birsen Yazici, Rensselaer Polytechnic Institute (USA) [8051-10]
- Coffee Break 10:00 to 10:30 am

SESSION 2

Room: Grand 13. Wed. 10:30 am to 12:30 pm

Advanced SAR Imaging II

Session Chair: **Lee Potter**, The Ohio State Univ. (USA)

- 10:30 am: **Performance analysis of sparse 3D SAR imaging**, Christian Austin, Randolph L. Moses, The Ohio State Univ. (USA) [8051-12]
- 10:40 am: **Toeplitz embedding for fast iterative regularized imaging**, Rizwan Ahmad, Lee Potter, The Ohio State Univ. (USA) [8051-13]
- 10:50 am: **Doppler synthetic aperture radar imaging**, Ling Wang, Nanjing Univ. of Aeronautics and Astronautics (China); Birsen Yazici, Rensselaer Polytechnic Institute (USA) [8051-14]
- 11:00 am: **Combining synthetic aperture radar and space-time adaptive processing using a single-receive channel**, Christie Bryant, Matrix Research Inc. (USA); Emre Ertin, Lee Potter, The Ohio State Univ. (USA) [8051-15]
- 11:10 am: **Observations of clutter suppression in bistatic VHF/UHF-band synthetic-aperture radar**, Lars Ulander, Björn Flood, Per-Olov Frörlind, Anders Gustavsson, Tommy Jonsson, Björn Larsson, Daniel Murdin, Rolf Ragnarsson, Gunnar Stenström, Swedish Defence Research Agency (Sweden); Remi Baqué, Hubert Cantalloube, Philippe Dreuillet, Olivier Ruault du Plessis, ONERA (France) [8051-16]
- 11:20 am: **Spatially variant interference suppression method based on superresolution algorithm for synthetic aperture radar**, Kei Suwa, Toshio Wakayama, Mitsubishi Electric Corp. (Japan) [8051-17]
- 11:30 am: **High-resolution interrupted SAR imaging via iterative adaptive techniques**, Duc Vu, Luzhou Xu, Jian Li, Univ. of Florida (USA) [8051-18]
- 11:40 am: **CBP-based multichannel autofocus for near-field SAR imaging**, Hyun Jeong Cho, David C. Munson, Jr., Univ. of Michigan (USA) [8051-19]
- 11:50 am: **Windowing functions for focused range-Doppler imaging**, Patrick R. Williams, Raytheon Co. (USA) [8051-20]
- 12:00 pm: **A transformation between on-center and off-center point scatters for circular synthetic aperture radar**, Linda J. Moore, Air Force Research Lab. (USA) [8051-21]
- 12:10 pm: **Two-stage backprojection on synthetic aperture radar data using multiple GPUs**, William Chapman, Sanjay Ranka, Sartaj Sahni, Mark S. Schmalz, Univ. of Florida (USA); Bracy Elton, Uttam Majumder, Linda J. Moore, Air Force Research Lab. (USA) [8051-22]
- 12:20 pm: **InSAR processing using a GPGPU**, Aaron Rogan, Richard Carande, Neva Ridge Technologies, Inc. (USA) [8051-40]
- Lunch/Exhibition Break 12:40 to 1:40 pm

POSTER SESSION Wed. 1:40 to 3:30 pm

Coffee Break 3:30 to 4:00 pm

DISCUSSION/WORKSHOP Wed. 4:00 to 5:00 pm

SESSION 4

Room: Grand 13. Thurs. 10:40 am to 12:20 pm

Automatic Target Detection/Processing/Recognition

Session Chair: David Blacknell,

Defence Science and Technology Lab. (United Kingdom)

10:40 am: **Low-complexity, rate-efficient SAR raw data compression**, Shantanu Rane, Petros T. Boufounos, Anthony Vetro, Mitsubishi Electric Research Labs. (USA); Yu Okada, Mitsubishi Electric Corp. (Japan) [8051-30]

10:50 am: **Feature phenomenology and feature extraction of civilian vehicles from SAR images**, Christopher Paulson, Univ. of Florida (USA); Edmund Zelnio, LeRoy Gorham, Air Force Research Lab. (USA); Dapeng Wu, Univ. of Florida (USA) [8051-31]

11:00 am: **Comparison of the HRRP phase gradient statistics between ships and sea surfaces using alpha-stable distribution**, Dan Jiang, Xiaojian Xu, BeiHang Univ. (China) [8051-32]

11:10 am: **Prediction of coherent change detection performance in synthetic aperture imagery**, David Blacknell, Daniel B. Andre, Defence Science and Technology Lab. (United Kingdom) [8051-33]

11:20 am: **Predicting the effectiveness of SAR imagery for target detection**, Daniel Gutches, Charles River Analytics, Inc. (USA); John M. Irvine, Mon Young, Draper Lab. (USA); Magnús S. H. Snorrason, Charles River Analytics, Inc. (USA) [8051-34]

11:30 am: **Derived operating conditions for classifier performance understanding**, Joshua P. Blackburn, Jacobs Technology, Inc. (USA); Timothy D. Ross, Air Force Research Lab. (USA); Adam R. Nolan, Etegent Technologies, Ltd. (USA); John C. Mossing, John U. Sherwood, David J. Pikas, Jacobs Technology, Inc. (USA); Edmund G. Zelnio, Air Force Research Lab. (USA) [8051-35]

11:40 am: **Joint sparse representation-based automatic target recognition in SAR images**, Haichao Zhang, Univ. of Illinois at Urbana-Champaign (USA); Nasser M. Nasrabadi, U.S. Army Research Lab. (USA); Thomas Huang, Univ. of Illinois at Urbana-Champaign (USA); Yanning Zhang, Northwestern Polytechnical Univ. (China) [8051-36]

11:50 am: **Target classification in synthetic aperture radar using map-seeking circuit technology**, Cameron K. Peterson, Patricia Murphy, Pedro A. Rodriguez, The Johns Hopkins Univ. (USA) [8051-37]

12:00 pm: **Radar target classification using morphological image processing**, Julie A. Jackson, Air Force Institute of Technology (USA); Patrick Brady, Cedarville Univ. (USA) [8051-38]

12:10 pm: **Automatic target recognition from highly incomplete SAR data**, Chaoran Du, Gabriel Rilling, Michael E. Davies, Bernard Mulgrew, The Univ. of Edinburgh (United Kingdom) [8051-39]

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

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

Coffee Break 3:30 to 4:00 pm

DISCUSSION/WORKSHOP Thurs. 4:00 to 5:00 pm

Courses of Related Interest

SC181 **Predicting Target Acquisition Performance of Electro-Optical Imagers** (Vollmerhausen) Tuesday, 8:30 am to 5:30 pm

SC1031 **Radar Micro-Doppler Signatures - Principles and Applications** (Chen, Tahmouh) Monday, 1:30 to 5:30 pm

Visit the registration desk for course descriptions or to register

TRACK PLENARY PRESENTATION

Evolution of Airborne Chemical and Radiological Remote Sensing for Emergency and Natural Disaster Response (Conf. 8048)

Wednesday • 5:00 to 6:00 pm • Location: Crystal M

Presenter: Paul E. Lewis

National Geospatial-Intelligence Agency

In 2001 the United States Environmental Protection Agency's (EPA) Airborne Spectral Photometric Environmental Collection Technology (ASPECT) Program became the United States only civil 24/7 operational airborne chemical, radiological, and situational awareness reporting capability. Since 2001 the ASPECT aircraft has completed 107 successful airborne emergency response and homeland security related missions. The ASPECT model of operation combines an airborne operational remote sensing suite with a research and development support team to provide essential situational awareness information to first responders and their local, state and federal lead agencies in accordance with the National Contingency Plan and EPA's responsibility under Emergency Support Function 10 of the National Response Plan. This presentation will showcase the effectiveness and necessity of the ASPECT operational model in meeting the needs of the civil emergency response and homeland security communities. Highlights from a variety of ASPECT airborne missions will be presented including industrial accidents, homeland security situational awareness missions, and natural and anthropogenic disasters such as Hurricane Katrina and the Deepwater Horizon Oil Spill along with issues, and lessons learned..

See p. 21 for details.

Thursday 28 April

SESSION 3

Room: Grand 13. Thurs. 9:00 to 10:10 am

Advance Motion Processing

Session Chair: Michael A. Saville, Air Force Institute of Technology (USA)

9:00 am: **Along-track interferometry for simultaneous SAR and GMTI: application to gotcha challenge data**, Ross W. Deming, Air Force Research Lab. (USA) [8051-23]

9:10 am: **Ground moving target indication via multichannel airborne SAR**, Duc Vu, Bin Guo, Luzhou Xu, Jian Li, Univ. of Florida (USA) [8051-24]

9:20 am: **Persistent SAR change detection with posterior models**, Gregory E. Newstadt, Univ. of Michigan (USA); Edmund Zelnio, Air Force Research Lab. (USA); Alfred O. Hero III, Univ. of Michigan (USA) [8051-25]

9:30 am: **Analysis of SAR moving grid processing for focusing and detection of ground moving targets**, Daniel E. Hack, Michael A. Saville, Air Force Institute of Technology (USA) [8051-26]

9:40 am: **Waveform-diverse moving-target spotlight SAR**, Margaret Cheney, Rensselaer Polytechnic Institute (USA); Brett Borden, Naval Postgraduate School (USA) [8051-27]

9:50 am: **Passive imaging of moving targets using distributed apertures in multiple-scattering environments**, Ling Wang, Nanjing Univ. of Aeronautics and Astronautics (China); Birsan Yazici, Rensselaer Polytechnic Institute (USA) [8051-28]

10:00 am: **The physics of vibrating scatterers in SAR imagery**, Daniel B. Andre, David Blacknell, Darren B. Muff, Matthew Nottingham, Defence Science and Technology Lab. (United Kingdom) [8051-29]

Coffee Break 10:10 to 10:40 am

Acquisition, Tracking, Pointing, and Laser Systems Technologies XXV

Conference Chairs: **William E. Thompson**, New Mexico Institute of Mining and Technology (USA); **Paul F. McManamon**, Exciting Technology, LLC (USA)

Conference Co-Chair: **Ali T. Alouani**, Tennessee Technological Univ. (USA)

Program Committee: **William D. Blair**, Georgia Tech Research Institute (USA); **David Blacknell**, Defence Science and Technology Lab. (United Kingdom); **Gillian K. Groves**, Raytheon Space & Airborne Systems (USA); **Dan C. Herrick**, Air Force Research Lab. (USA); **James M. Hilkert**, Alpha-Theta Technologies (USA); **Paul S. Idell**, The Boeing Co. (USA); **Eric Kaltenbacher**, SRI St. Petersburg (USA); **Christopher J. Musial**, Boeing-SVS, Inc. (USA); **Kevin Probst**, Core Group, Inc. (USA); **Jim F. Riker**, Air Force Research Lab. (USA); **Michael C. Roggemann**, Michigan Technological Univ. (USA); **Juan R. Vasquez**, Numerica Corp. (USA); **Matthew R. Whiteley**, MZA Associates Corp. (USA)

Monday 25 April

SESSION 1

Room: Grand 13. Mon. 8:30 am to 12:00 pm

Requirements and System-Level Applications

Session Chairs: **Paul F. McManamon**, Exciting Technology, LLC (USA); **Dan C. Herrick**, Air Force Research Lab. (USA)

8:30 am: **Requirements on active (laser) tracking and imaging from a technology perspective** (*Invited Paper*), Jim F. Riker, Air Force Research Lab. (USA) [8052-01]

9:00 am: **HEL-JTO beam control technology research and development programs** (*Invited Paper*), Dan C. Herrick, Air Force Research Lab. (USA) [8052-02]

9:30 am: **Improved mission effectiveness of HEL systems with phased array beam control** (*Invited Paper*), Kevin Probst, Core Group, Inc. (USA) . . . [8052-03]

Coffee Break 10:00 to 10:30 am

10:30 am: **Conformal apertures: concepts and requirements** (*Invited Paper*), Edward A. Watson, Air Force Research Lab. (USA) [8052-04]

11:00 am: **Influence of aero-optical disturbances on acquisition, tracking, and pointing performance characteristics in laser systems** (*Invited Paper*), Matthew R. Whiteley, MZA Associates Corp. (USA) [8052-05]

11:30 am: **Multi-aperture coherent imaging** (*Invited Paper*), Nicholas Miller, Ladar and Optical Communications Institute (USA) [8052-06]

Lunch Break 12:00 to 1:30 pm

SESSION 2

Room: Grand 13. Mon. 1:30 to 5:00 pm

Image and Signal Processing for Target Tracking Applications

Session Chair: **Ali T. Alouani**, Tennessee Technological Univ. (USA)

1:30 pm: **Preliminary performance comparison of a synchronous and an asynchronous multisensor tracker** (*Invited Paper*), Ali T. Alouani, Tennessee Technological Univ. (USA) [8052-07]

2:00 pm: **Track initialization for multistatic active sonar systems**, Christian G. Hempel, Tod Luginbuhl, Steven C. Schoenecker, Naval Undersea Warfare Ctr. (USA) [8052-08]

2:20 pm: **Simulations of a hybrid active-segmentation and Fitts correlator tracker** (*Invited Paper*), Joseph Riley, MZA Associates Corp. (USA) . . . [8052-10]

2:50 pm: **HEL-generated extinction effects and degradation of USAF BILL/TILL-ATR multispectral infrared algorithms (case study GHADR 110)**, Clifford A. Paiva, BSM Research Associates (USA) [8052-11]

3:10 pm: **Performance analysis of embedded real-time video tracking systems**, Douglas A. Scott, Olegs Mise, GE Intelligent Platforms (United Kingdom) [8052-12]

Coffee Break 3:30 to 4:00 pm

4:00 pm: **Passive ranging of dynamic rocket plumes using infrared and visible oxygen attenuation**, Robert A. Vincent, Michael R. Hawks, Air Force Institute of Technology (USA) [8052-13]

4:20 pm: **Quantitative analysis of the improvement in high-zoom maritime tracking due to real-time image enhancement**, Asheer K. Bachoo, Jason P. de Villiers, Council for Scientific and Industrial Research (South Africa); Fred C. Nicolls, Univ. of Cape Town (South Africa); Francois P. J. Le Roux, Council for Scientific and Industrial Research (South Africa) [8052-14]

4:40 pm: **Quantitative analysis of the improvement in omnidirectional maritime surveillance and tracking due to real-time image enhancement**, Jason P. de Villiers, Asheer K. Bachoo, Council for Scientific and Industrial Research (South Africa); Fred C. Nicolls, Univ. of Cape Town (South Africa); Francois P. J. Le Roux, Council for Scientific and Industrial Research (South Africa) [8052-15]

Tuesday 26 April

Symposium-Wide Plenary Session

Tuesday • 8:30 to 9:30 am • Location: Crystal H

Dr. Regina E. Dugan

Director, Defense Advanced Research Projects Agency (DARPA)

See page 18 for details • Open to All Attendees

Coffee Break 9:30 to 10:00 am

SESSION 3

Room: Grand 13. Tues. 10:00 am to 12:00 pm

Control Systems and Components

Session Chair: **William E. Thompson**, New Mexico Institute of Mining and Technology (USA)

10:00 am: **New generation inductive position encoding techniques for EO, radar, and missile systems**, Mark A. Howard, Zettlex UK Ltd. (United Kingdom) [8052-16]

10:20 am: **A reduced-order disturbance observer applied to inertially stabilized line-of-sight control**, James M. Hilkert, Alpha-Theta Technologies (USA); Brian Pautler, Raytheon Network Centric Systems (USA) [8052-17]

10:40 am: **Calibration of VISSTA pointing control system**, Justin Teuscher, Rees Fullmer, Robert T. Pack, Utah State Univ. (USA) [8052-18]

11:00 am: **Dynamic performance of a two-axis gimbaled pedestal in keyhole gimbal-lock conditions**, James DeBruin, IJK Controls, LLC (USA) [8052-19]

11:20 am: **Predicting and preventing reaction torque coupling in gimbal system mounts**, Gunnar Ristroph, James DeBruin, IJK Controls, LLC (USA) [8052-20]

11:40 am: **Optomechanically linking the imager's optical axis to the laser and the gyroscope in finite element models**, Alson E. Hatheway, Alson E. Hatheway Inc. (USA) [8052-21]

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

SESSION 4

Room: Grand 13 Tues. 1:00 to 5:30 pm

Rapid Beam Steering

Session Chairs: **Paul F. McManamon**, Exciting Technology, LLC (USA);
Edward A. Watson, Air Force Research Lab. (USA)

1:00 pm: **Non-mechanical conformal beam steering system with an 80 degree x 80 degree field of regard** (*Invited Paper*), Steven A. Serati, Boulder Nonlinear Systems, Inc. (USA); Jihwan Kim, Michael J. Escuti, North Carolina State Univ. (USA); Lance Hosting, Boulder Nonlinear Systems, Inc. (USA) [8052-22]

1:30 pm: **MWIR wide-area step and stare imager** (*Invited Paper*), Joseph R. Buck, Steven A. Serati, Roylenn Serati, Hugh Masterson, Boulder Nonlinear Systems, Inc. (USA) [8052-23]

2:00 pm: **Optical characterization of MEMS micromirror arrays using digital holographic Shack-Hartmann wavefront sensor: a new technique.** Igor Anisimov, Sarah B. Dooley, Air Force Research Lab. (USA) [8052-24]

2:20 pm: **Beam shape of coherently combined optical array** (*Invited Paper*), Irl W. Smith, Raytheon Co. (USA) [8052-25]

2:50 pm: **Embedded FPGA platform for fast steering mirror and optical inertial reference unit applications.** Steven R. Wasson, Felix E. Morgan, Dan Eckelkamp-Baker, Applied Technology Associates (USA) [8052-26]

Coffee Break 3:10 to 3:40 pm

3:40 pm: **A liquid crystal shutter for unpolarized broadband light** (*Invited Paper*), Ravi Komanduri, Kris Lawler, Michael J. Escuti, North Carolina State Univ. (USA) [8052-27]

4:10 pm: **LC polarization gratings: performance review and prospects for visible through longwave infrared applications** (*Invited Paper*), Michael J. Escuti, Jihwan Kim, Matthew N. Miskiewicz, Kris Lawler, Ravi Komanduri, North Carolina State Univ. (USA) [8052-28]

4:30 pm: **Demonstration of large-angle nonmechanical laser beam steering based on LC polymer polarization gratings.** Jihwan Kim, Matthew N. Miskiewicz, North Carolina State Univ. (USA); Steven A. Serati, Boulder Nonlinear Systems, Inc. (USA); Michael J. Escuti, North Carolina State Univ. (USA) [8052-29]

4:50 pm: **An update on electro-evanescent beamsteers: higher speeds (greater-than 50 kHz), wider 2D fields-of-view (40° x 10°), and larger apertures (1 cm)** (*Invited Paper*), Scott R. Davis, George Farca, Seth Johnson, Scott D. Rommel, Michael H. Anderson, Vescent Photonics Inc. (USA) . [8052-30]

5:10 pm: **High-precision scanner control system using online learning.** Kazuhiko Aoki, Yoshiho Yanagita, NEC Corp. (Japan); Toshihiro Kurii, NEC TOSHIBA Space Systems, Ltd. (Japan) [8052-31]

Courses of Related Interest

- SC160 **Precision Stabilized Pointing and Tracking Systems** (Hilkert) Tuesday, 8:30 am to 5:30 pm
- SC158 **Fundamentals of Automatic Target Recognition** (Sadjadi) Thursday, 8:30 am to 5:30 pm
- SC181 **Predicting Target Acquisition Performance of Electro-Optical Imagers** (Vollmerhausen) Tuesday, 8:30 am to 5:30 pm
- SC892 **Infrared Search and Track Systems** (Schwering) Tuesday, 8:30 am to 5:30 pm
- SC1035 **Military Laser Safety** (Marshall) Wednesday, 8:30 am to 5:30 pm
- SC997 **High Power Laser Beam Quality** (Ross) Wednesday, 1:30 to 5:30 pm

Visit the registration desk for course descriptions or to register

Walk the Exhibition Floor and see the free 500-company exhibition – showcasing the newest products, latest innovations, and cutting-edge technologies in defense, security, sensing, homeland security, robotic, and environmental technologies

Exhibition Halls, Cypress and Palms Ballroom

Tuesday 26 April 9:30 am to 5:00 pm

Wednesday 27 April . . . 10:00 am to 5:00 pm

Thursday 28 April 10:00 am to 2:00 pm

Geospatial InfoFusion Systems and Solutions for Defense and Security Applications

NEW

Conference Chairs: **Matthew F. Pellechia**, ITT Corp. Geospatial Systems (USA); **Richard Sorensen**, U.S. Air Force (USA)

Conference Co-Chairs: **Shiloh L. Dockstader**, ITT Corp. Geospatial Systems (USA); **Rudy G. Benz II**, ITT Corp. Geospatial Systems (USA); **Bernard V. Brower**, ITT Corp. Geospatial Systems (USA)

Program Committee: **Erik P. Blasch**, Air Force Research Lab. (USA); **Jason S. Brown**, Schafer Corp. (USA); **Hui Cheng**, Sarnoff Corp. (USA); **Paul B. Deignan**, L-3 Communications Integrated Systems (USA); **Dan Edwards**, National Geospatial-Intelligence Agency (USA); **Michael E. Gangl**, MacAulay-Brown, Inc. (USA); **Robert Gillen**, Univ. of Dayton Research Institute (USA); **Arun Hampapur**, IBM Thomas J. Watson Research Ctr. (USA); **James H. Kasner**, WISC Enterprises LLC (USA); **Eric R. Keydel**, SAIC Corp. (USA); **James Llinas**, Univ. at Buffalo (USA); **Charles Mondello**, Pictometry International Corp. (USA); **Kannappan Palaniappan**, Univ. of Missouri-Columbia (USA); **Carlo Regazzoni**, Univ. degli Studi di Genova (Italy); **Gunasekaran S. Seetharaman**, Air Force Research Lab. (USA); **Mubarak Ali Shah**, Univ. of Central Florida (USA); **Christopher P. Stauffer**, BAE Systems (USA); **Bradford C. Tousley**, Logos Technologies, Inc. (USA); **Pramod Kumar Varshney**, Syracuse Univ. (USA); **Karmon M. Vongsy**, Air Force Institute of Technology (USA); **Robb Wilcox**, Office of Naval Research Global (USA)

Thursday 28 April

SESSION 1

Room: Grand 14. Thurs. 8:00 to 11:10 am

Architectures for Geospatial Collection Sensors

Session Chair: **Kannappan Palaniappan**, Univ. of Missouri-Columbia (USA)

8:00 am: **A MEMS-based spectral-polarimetric imaging and target tracking architecture for airborne broad-area search**, J. Daniel Newman, Bernard V. Brower, Paul P. K. Lee, Andre D. Cropper, Matthew F. Pellechia, Mark C. Gibney, ITT Corp. Geospatial Systems (USA) [8053-01]

8:20 am: **Techniques for high-performance processing of large image collections into tiled image sets**, John T. Sample, Elias Z. Ioup, U.S. Naval Research Lab. (USA) [8053-02]

8:40 am: **Indoor localization for GIS using acoustic wireless sensor network**, Pratikumar U. Desai, Nicholas A. Baine, Kuldip S. Rattan, Wright State Univ. (USA) [8053-03]

9:00 am: **Reconfigurable real-time distributed processing network**, Scott F. Page, Richard Seely, Duncan L. Hickman, Waterfall Solutions Ltd. (United Kingdom) [8053-04]

9:20 am: **MapSnap system to perform vector-to-raster fusion**, Boris Kovalerchuk, Central Washington Univ. (USA); Peter J. Doucette, Integrity Applications, Inc. (USA); Gamal Seedahmed, NG4 (USA); Jerry Tagestad, Pacific Northwest National Lab. (USA); Sergei Kovalerchuk, BKF Systems (USA); Brian Graff, Army Geospatial Ctr. (USA) [8053-05]

9:40 am: **Spatio-temporal analysis framework**, Arun Hampapur, Xuan Liu, Shilpa Mahatma, Tarun Kumar, IBM Thomas J. Watson Research Ctr. (USA) [8053-06]

Coffee Break 10:00 to 10:30 am

10:30 am: **Scale-space representation of remote sensing images using an object-oriented approach**, Abdul H. Syed, Eli Saber, David Messinger, Rochester Institute of Technology (USA) [8053-07]

10:50 am: **KOLAM: an open, extensible framework for interactive visualization of high-resolution, high-throughput imagery**, Anoop Haridas, Joshua Fraser, Kannappan Palaniappan, Univ. of Missouri-Columbia (USA); Gunasekaran S. Seetharaman, Air Force Research Lab. (USA) [8053-08]

Lunch/Exhibition Break 11:10 am to 1:40 pm

SESSION 2

Room: Grand 14. Thurs. 1:40 to 2:00 pm

Geospatial Information Application Needs and Challenges

Session Chair: **Michael E. Gangl**, MacAulay-Brown, Inc. (USA)

1:40 pm: **Urban event detection for wide field-of-view (WFOV) operations**, Edward E. Huling, U.S. Air Force (USA) [8053-09]

PANEL DISCUSSION

Room: Grand 14 Thurs. 2:00 to 3:00 pm

Panel on Contemporary Concerns in Geographical/ Geospatial Information Systems (GIS) Processing

Moderator: **Michael E. Gangl**, MacAulay-Brown, Inc.

Panelists: **Erik P. Blasch**, Gunasekaran Seetharaman, Air Force Research Lab.;

Jason S. Brown, Schafer Corp.;

Matthew Pellechia, Shiloh L. Dockstader,

ITT Corp. Geospatial Systems;

Paul B. Deignan, L-3 Communications Integrated Systems;

Kannappan Palaniappan, Univ. of Missouri-Columbia

With the advent of advances in Geospatial Information System (GIS), there is a need to determine the areas of research concern and new tools available for GIS systems. GIS consists of the collection, integration, storage, exploitation, and visualization of geographic and contextual data and information. This paper brings together panelists to assess the current directions of GIS research. The consolidated areas discussed by the panelists give a general direction of GIS needs, techniques, models, and standards. The summary of selected areas include: use of information fusion, support of meta-data, production of challenge problems, adherence to open standards, generation of architectures, and detailed standards and metrics.

Coffee Break 3:00 to 3:30 pm

SESSION 3

Room: Grand 14. Thurs. 3:30 to 4:50 pm

Data Standards, Formats, and Interoperability

Session Chair: Robert Gillen, Univ. of Dayton Research Institute (USA)

3:30 pm: **Formatting research and development sensors for data interoperability and fusion with GIS**, Karmon M. Vongsy, Air Force Institute of Technology (USA); Eric Cincotta, ITT Corp. Geospatial Systems (USA); Tom Jones, ITT Visual Information Solutions (USA) [8053-10]

3:50 pm: **Standards to improve tracking**, Scott Randall, H. Jim Antonisse, Booz Allen Hamilton Inc. (USA) [8053-11]

4:10 pm: **Delivery methods for LVSD systems**, James H. Kasner, WiSC Enterprises, LLC. (USA); Bernard V. Brower, ITT Corp. Geospatial Systems (USA) [8053-12]

4:30 pm: **The standard exchange of features in feature-based tracking**, H. Jim Antonisse, Booz Allen Hamilton Inc. (USA) and Harris Corp. (USA); Scott Randall, Booz Allen Hamilton Inc. (USA) [8053-13]

Friday 29 April

SESSION 4

Room: Grand 14. Fri. 8:00 to 11:30 am

Geospatial Data Processing Algorithms and Techniques

Session Chair: Paul B. Deignan, L-3 Communications Integrated Systems (USA)

8:00 am: **Target tracking with GIS data using a fusion-based approach**, William D. Reynolds, Jr., Eric M. Dixon, Joshua Sisskind, Brian Bradford, ITT Corp. Geospatial Systems (USA) [8053-14]

8:20 am: **Spatial analysis of data registration methodologies for fusion applications**, Peter J. Doucette, Henry Theiss, Edward M. Mikhail, National Geospatial-Intelligence Agency (USA) [8053-15]

8:40 am: **Characterizing the semantic information loss between geospatial sensors and geospatial information systems**, Eric Dorion, Defence Research and Development Canada (Canada); Erik P. Blasch, Defence Research and Development Canada (Canada) and Air Force Research Lab. (USA); Pierre Valin, Defence Research and Development Canada (Canada) [8053-16]

9:00 am: **Tracking in wide-area persistent motion imagery**, Ilker Ersoy, Kannappan Palaniappan, Univ. of Missouri-Columbia (USA); Gunasekaran S. Seetharaman, Air Force Research Lab. (USA) [8053-17]

9:20 am: **Hypercube processing of mixed sensed data entropic associations**, Paul B. Deignan, Jr., Antone Kusmanoff, L-3 Communications Integrated Systems (USA) [8053-18]

9:40 am: **Multisensor-based image fusion for improvement of small-target detection and tracking (Invited Paper)**, Changhan Park, Samsung Thales Co., Ltd. (Korea, Republic of) [8053-19]

Coffee Break 10:00 to 10:30 am

10:30 am: **The standard exchange of motion indicators by image-based trackers**, Scott Randall, Booz Allen Hamilton Inc. (USA); H. Jim Antonisse, Booz Allen Hamilton Inc. (USA) and Harris Corp. (USA) [8053-20]

10:50 am: **Cognitive Modeling to Predict Video Interpretability**, Darrell L. Young, Raytheon Intelligence & Information Systems (USA) [8053-21]

11:10 am: **Geospatial InfoFusion systems and solutions for defense and security applications**, Randal Wiginton, Intergraph Corp. (USA) [8053-22]



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Booth 1543

Tuesday-Thursday • Cypress Exhibition Hall

Ticket from Registration Packet required.

While supplies last.

Enabling Photonics Technologies for Defense, Security, and Aerospace Applications VII

Conference Chairs: **Michael J. Hayduk**, Air Force Research Lab. (USA); **Peter J. Delfyett**, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA)

Conference Co-Chairs: **Andrew R. Pirich**, ACP Consulting (USA); **Eric Donkor**, Univ. of Connecticut (USA)

Program Committee: **H. John Caulfield**, Diversified Research Corp. (USA); **Reinhard K. Erdmann**, Air Force Research Lab. (USA); **Michael L. Fanto**, Air Force Research Lab. (USA); **Sangyoung Gee**, Gwangju Institute of Science and Technology (Korea, Republic of); **Bahram Javidi**, Univ. of Connecticut (USA); **Robert L. Kaminski**, Air Force Research Lab. (USA); **Guifang Li**, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); **Joseph M. Osman**, Air Force Research Lab. (USA); **Edward W. Taylor**, International Photonics Consultants, Inc. (USA); **Henry Zmuda**, Univ. of Florida (USA)

Monday 25 April

SESSION 1

Room: Grand 3. Mon. 10:30 am to 12:20 pm

Photonic Devices and Components

Session Chair: **Michael J. Hayduk**, Air Force Research Lab. (USA)

10:30 am: **Multimaterial optical fibers: fabrication and applications** (*Invited Paper*), Ayman F. Abouraddy, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA). [8054-01]

11:00 am: **Theoretical study of spur-free dynamic range of a semiconductor resonant cavity linear interferometric intensity modulator** (*Invited Paper*), Nazanin Hoghooghi, Sharad P. Bhoopapur, Peter J. Delfyett, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) [8054-02]

11:30 am: **Plasmonic crystals: a new platform to enhance photodetector performance** (*Invited Paper*), Hooman Mohseni, Northwestern Univ. (USA) [8054-03]

12:00 pm: **Large scale micro-Fabry-Perot optical filter arrays**, Ali A. Abtahi, Aerospace Missions Corp. (USA); Peter B. Griffin, Stanford Univ. (USA); Ricky J. Morgan, Usha Raghuram, Aerospace Missions Corp. (USA); Francisco Tejada, Sensing Machines (USA); Frida S. Vetelino, Aerospace Missions Corp. (USA) [8054-04]

Lunch Break 12:20 to 1:30 pm

SESSION 2

Room: Grand 3. Mon. 1:30 to 3:10 pm

VCSELs and Quantum Dots

Session Chair: **Peter J. Delfyett**, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA)

1:30 pm: **Multimode 40Gbps CWDM transceivers for optical backplanes** (*Invited Paper*), Tyler J. Eustis, Mitch Harris, Vincent Cheung, Sven Mahnkopf, Duane Louderback, OptiComp Corp. (USA) [8054-05]

2:00 pm: **Record performance levels in quantum dot lasers with applications to 1.3 and 1.55 μm wavelengths** (*Invited Paper*), Dennis Deppe, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Sabine Freisem, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) and sdPhotonics LLC (USA); Guowei Zhao, Long Wang, Abdullah Demir, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) [8054-06]

2:30 pm: **Rapidly reconfigurable pulse-shaping using injection-locked VCSELs**, Sharad P. Bhoopapur, Nazanin Hoghooghi, Peter J. Delfyett, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) . . . [8054-07]

2:50 pm: **New VCSEL technology with scalability for single mode operation and densely integrated arrays**, Guowei Zhao, Abdullah Demir, Sabine Freisem, Yu Zhang, Xiaohang Liu, Dennis Deppe, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) [8054-08]

Coffee Break 3:10 to 3:40 pm

SESSION 3

Room: Grand 3. Mon. 3:40 to 5:20 pm

Ultrashort Pulsed Lasers and Optical Switching

Session Chair: **Michael L. Fanto**, Air Force Research Lab. (USA)

3:40 pm: **Coupled optoelectronic oscillator with 1000 finesse intracavity etalon**, Ibrahim T. Ozdur, Josue Davila-Rodriguez, Dimitrios Mandridis, Peter J. Delfyett, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) [8054-09]

4:00 pm: **Injection locked coupled opto-electronic oscillator for optical frequency comb generation**, Charles G. Williams, Dimitrios Mandridis, Josue Davila-Rodriguez, Peter J. Delfyett, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) [8054-10]

4:20 pm: **A passively mode-locked SOA laser with tunable pulse-repetition frequency based on normal mode splitting of the SOA amplified spontaneous emission spectrum**, Eric Donkor, Univ. of Connecticut (USA); Suvhasis Mukhopadhyay, TranSwitch Corp. (USA) [8054-11]

4:40 pm: **Design of cascaded plasmon resonances for ultrafast nonlinear optical switching**, Seyfollah Toroghi, Pieter G. Kik, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) [8054-12]

5:00 pm: **Next generation liquid crystal devices for advance photonic applications**, Robert A. Ramsey, Meadowlark Optics, Inc. (USA) [8054-13]

Tuesday 26 April

Symposium-Wide Plenary Session

Tuesday • 8:30 to 9:30 am • Location: Crystal H

Dr. Regina E. Dugan

Director, Defense Advanced Research Projects Agency (DARPA)

See page 18 for details • Open to All Attendees

Coffee Break 9:30 to 10:00 am

SESSION 4

Room: Grand 3. Tues. 10:00 am to 12:00 pm

Emitter and Detector Technology

Session Chair: **Guifang Li**, CREOL,

The College of Optics and Photonics, Univ. of Central Florida (USA)

10:00 am: **An etalon stabilized 10 GHz comb source using a slab coupled waveguide amplifier**, Josue Davila-Rodriguez, Ibrahim Ozdur, Charles G. Williams, Dimitrios Mandridis, Peter J. Delfyett, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) [8054-14]

10:20 am: **Temporal shaping of ultrafast chirped pulses with 27 dB extinction ratio using an arbitrary waveform generator**, Dat Nguyen, Mohamad Umar Piracha, Dimitrios Mandridis, Peter J. Delfyett, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) [8054-15]

10:40 am: **Semiconductor-based low-noise 100 MHz chirped pulse laser source based on a theta cavity design with an intra-cavity etalon and long-term stabilization** (*Invited Paper*), Dimitrios Mandridis, Charles G. Williams, Ibrahim Ozdur, Anthony Klee, Peter J. Delfyett, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) [8054-16]

11:10 am: **Long-range high-resolution lidar for velocity and distance measurements**, Mohamad Umar Piracha, Dat Nguyen, Ibrahim T. Ozdur, Peter J. Delfyett, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) [8054-17]

11:30 am: **25Gbps 850nm photodiode for emerging 100Gb ethernet applications** (*Invited Paper*), Donald A. Becker, Abhay Joshi, Shubhashish Datta, Jim Rue, Discovery Semiconductors, Inc. (USA) [8054-18]

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

SESSION 5

Room: Grand 3 Tues. 1:30 to 2:10 pm

Keynote Session

Session Chair: Eric Donkor, Univ. of Connecticut (USA)

1:30 pm: **Coherent optical communications and imaging** (*Keynote Presentation*), Guifang Li, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) [8054-19]

SESSION 6

Room: Grand 3 Tues. 2:10 to 3:10 pm

Optical Communication Systems and Technology I

Session Chair: Peter J. Delfyett, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA)

2:10 pm: **Free-space optical communication link using spatial optical encryption**, Syed H. Murshid, William Howard, Florida Institute of Technology (USA) [8054-20]

2:30 pm: **Optical encryption as a function of polarization in optical fiber communications**, Syed H. Murshid, Haripriya Muralikrishnan, Jayachandran Tamilarasan, Florida Institute of Technology (USA); H. John Caulfield, Diversified Research Corp. (USA) [8054-21]

2:50 pm: **A method of hardware support for high-speed data capture at 40 Gbps and beyond**, Joshua S. White, Adam W. Pilbeam, Everis, Inc. (USA) [8054-22]

Coffee Break 3:10 to 3:40 pm

SESSION 7

Room: Grand 3 Tues. 3:40 to 4:40 pm

Optical Communication Systems and Technology II

Session Chair: Michael J. Hayduk, Air Force Research Lab. (USA)

3:40 pm: **An analysis of coupling attacks in high-speed fiber optic networks**, Joshua S. White, Adam W. Pilbeam, Everis, Inc. (USA) [8054-23]

4:00 pm: **Attenuation and bit error rate for four copropagating spatially multiplexed optical communication channels of exactly same wavelength in step index multimode fibers**, Syed H. Murshid, Abhijit Chakravarty, Florida Institute of Technology (USA) [8054-24]

4:20 pm: **Nonlinearity compensation for dispersion managed fiber-optic transmission systems**, Likai Zhu, Guifang Li, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) [8054-25]

POSTERS—Tuesday

Room: Crystal M Tues. 6:00 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. 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 pm 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.

Mode-locked fiber laser using SU-8 resist incorporating carbon nanotubes, Ivan Hernandez-Romano, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); Dimitrios Mandridis, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Daniel A. May-Arrijo, Univ. Autónoma de Tamaulipas (Mexico); Jose J. Sanchez-Mondragon, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); Peter J. Delfyett, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) [8054-26]

Impairment compensation for unrepeated fiber transmission with distributed Raman amplification, Likai Zhu, Eduardo F. Mateo, Guifang Li, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) [8054-27]

Description of various test scenarios for temporary blinding of pilots by means of bright optical radiation during darkness, Hans-Dieter Reidenbach, Fachhochschule Köln (Germany) [8054-28]

Optical Pattern Recognition XXII

Conference Chairs: **David P. 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. Stibril**, Jet Propulsion Lab. (USA); **Ashit Talukder**, Jet Propulsion Lab. (USA); **Shizhuo Yin**, The Pennsylvania State Univ. (USA); **Rupert C. D. Young**, Univ. of Sussex (United Kingdom)

Thursday 28 April

SESSION 1

Room: Crystal P. Thurs. 8:30 to 10:30 am

Invited Session

Session Chair: **David P. Casasent**, Carnegie Mellon Univ. (USA)

8:30 am: **Autonomous learning approach for automatic target recognition processor** (*Invited Paper*), Tien-Hsin Chao, Thomas Lu, Jet Propulsion Lab. (USA) [8055-01]

9:00 am: **Tracking illegally parked vehicles using correlation of multiscale difference of Gaussian filtered patches** (*Invited Paper*), Bhargav K. Mitra, Waqas Hassan, Nagachetan Bangalore, Philip M. Birch, Rupert C. D. Young, Chris Chatwin, Univ. of Sussex (United Kingdom) [8055-02]

9:30 am: **Remote sensing of cardiopulmonary activity using Doppler radar** (*Invited Paper*), Jesmin F. Khan, Gregory V. Murphy, Sharif M. A. Bhuiyan, Tuskegee Univ. (USA); Mohammad S. Alam, Univ. of South Alabama (USA) [8055-03]

10:00 am: **ATR using passive 3D photon counting images** (*Invited Paper, Presentation Only*), Abhijit Mahalanobis, Lockheed Martin Missiles and Fire Control (USA); Bahram Javidi, Univ. of Connecticut (USA) [8055-04]

Coffee Break 10:30 to 11:00 am

SESSION 2

Room: Crystal P. Thurs. 11:00 to 11:40 am

Optical Spectral Processing and Hardware

Session Chair: **Tien-Hsin Chao**, Jet Propulsion Lab. (USA)

11:00 am: **Monolithic liquid crystal waveguide Fourier transform spectrometer for gas species sensing**, Tien-Hsin Chao, Thomas Lu, Michael Boesen, Didier Keymeulen, Jet Propulsion Lab. (USA); Scott R. Davis, George Farca, Vescent Photonics Inc. (USA) [8055-05]

11:20 am: **Feasibility breadboard demonstration of an imaging Fourier transform spectrometer using solid state time delay**, Tien-Hsin Chao, Thomas Lu, Jet Propulsion Lab. (USA) [8055-06]

Lunch/Exhibition Break 11:40 am to 1:20 pm

SESSION 3

Room: Crystal P. Thurs. 1:20 to 3:20 pm

Novel Correlation and Distortion Invariant Pattern Recognition Filters

Session Chair: **Rupert C. D. Young**, Univ. of Sussex (United Kingdom)

1:20 pm: **Parameter optimization of the Optimal Trade-off Maximum Average Correlation Height filter (OT-MACH) for FLIR imaging in high clutter environments**, Ahmad T. Alkandri, Univ. of Sussex (United Kingdom) and Kuwait Naval Force (Kuwait); Akber A. Gardezi, Rupert C. D. Young, Philip M. Birch, Chris Chatwin, Univ. of Sussex (United Kingdom) [8055-07]

1:40 pm: **Enhancement of the speed of space-variant correlation filter implementations by using low-pass pre-filtering for kernel placement and applications to real-time security monitoring**, Akber A. Gardezi, Ahmad T. Alkandri, Philip M. Birch, Rupert C. D. Young, Chris Chatwin, Univ. of Sussex (United Kingdom) [8055-08]

2:00 pm: **Multifeature constellation correlation filters**, Charles Casey, Laurence Hassebrook, Aaron Davidson, Eli Crane, Univ. of Kentucky (USA) [8055-09]

2:20 pm: **Distortion-invariant color pattern recognition using multiple phase-shifted-reference-based joint transform correlation incorporating synthetic discriminant function**, Mohammed Nazrul Islam, Farmingdale State College (USA); Mohammad A. Karim, Old Dominion Univ. (USA) [8055-10]

2:40 pm: **Automatic angle measurement of a 2D object using optical correlator-neural networks hybrid system**, Nadarajah Manivannan, Brunel Univ. (United Kingdom); Mark A. Neil, Imperial College London (United Kingdom) [8055-11]

3:00 pm: **Wide-area surveillance with multiple cameras using distributed compressive imaging**, Christopher Huff, Univ. of Central Florida (USA); Robert R. Muise, Lockheed Martin Missiles and Fire Control (USA) [8055-30]

Coffee Break 3:20 to 3:50 pm

SESSION 4

Room: Crystal P. Thurs. 3:50 to 4:50 pm

Feature Extraction and Tracking for Pattern Recognition

Session Chairs: **Mohammad S. Alam**, Univ. of South Alabama (USA); **Tien-Hsin Chao**, Jet Propulsion Lab. (USA)

3:50 pm: **Optimization of nonlinear kernel PCA feature extraction algorithms for automatic target recognition**, Seth Winger, Stanford Univ. (USA); Tien-Hsin Chao, Thomas Lu, Jet Propulsion Lab. (USA) [8055-13]

4:10 pm: **Moving object tracking by using a novel real-time 2D image processing method**, Chialun J. Hu, Southern Illinois Univ. Carbondale (USA) [8055-14]

4:30 pm: **A compressed sensing method with analytical results for lidar feature classification based on height gradient density features**, Josef D. Allen, Harris Corp. (USA); Xiuwen Liu, The Florida State Univ. (USA); Mark D. Rahmes, Harris Corp. (USA) [8055-15]

SESSION 5

Room: Crystal P. Thurs. 4:50 to 5:30 pm

Photorefractive Optical Pattern Recognition

Session Chairs: **Mohammad S. Alam**, Univ. of South Alabama (USA); **Tien-Hsin Chao**, Jet Propulsion Lab. (USA)

4:50 pm: **Optical correlation via dynamic range compression using organic photorefractive materials**, Bahareh Haji-saeed, Jed Khoury, Charles L. Woods, Air Force Research Lab. (USA); John Kierstead, Solid State Scientific Corp. (USA) [8055-16]

5:10 pm: **Optical dynamic range compression deconvolution and correlation using organic photorefractive materials**, Jed Khoury, Bahareh Haji-saeed, Charles L. Woods, Air Force Research Lab. (USA) [8055-17]

POSTERS—Thursday

Room: Crystal M Thurs. 6:00 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. 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 pm 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.

Kernel and stochastic expectation maximization fusion for target detection in hyperspectral imagery, Mohamed I. Elbakary, Mohammad S. Alam, Univ. of South Alabama (USA) [8055-25]

Spectral pattern recognition of controlled substances in street samples using artificial neural network system, Larisa Porovkina, Valeri Aleksejev, Sergey M. Babichenko, Laser Diagnostic Instruments AS (Estonia). [8055-26]

Study on the relationship between image features and detection probability based on psychology experiments, Wei Lin, Canbao Engineering Design & Research Institute of Beijing (China) and Beijing Institute of Technology (China); Yu-Hua Chen, Ji-yuan Wang, Hongsheng Gao, Wei Mao, Jijun Wang, Ronghua Su, Canbao Engineering Design & Research Institute of Beijing (China) . [8055-27]

The concept models and implementations of multiport neural net associative memory for 2D patterns, Vladimir G. Krasilenko, Vinnitsa Social Economy Institute (Ukraine); Aleksandr I. Nikolskyy, Vinnitsa National Technical Univ. (Ukraine); Rimma A. Yatskovskaya, Victor I. Yatskovsky, Vinnitsa State Agrarian Univ. (Ukraine). [8055-28]

Text encryption via double-random phase encoding, Jun Sang, Shenggui Ling, Chongqing Univ. (China); Mohammad S. Alam, Univ. of South Alabama (USA) [8055-29]

Error correction in image registration using POCS, Prakash Duraisamy, Univ. of North Texas (USA); Mohammad S. Alam, Univ. of South Alabama (USA) [8055-22]

Friday 29 April

SESSION 6

Room: Crystal P Fri. 9:00 to 10:00 am

Pattern Recognition Applications I

Session Chair: Rupert C. D. Young, Univ. of Sussex (United Kingdom)

9:00 am: **Robust human intrusion detection techniques using and hue-saturation histogram**, Waqas Hassan, Bhargav K. Mitra, Nagachetan Bangalore, Philip M. Birch, Rupert C. D. Young, Chris Chatwin, Univ. of Sussex (United Kingdom) [8055-18]

9:20 am: **Accurate, fast, and secure biometric recognition system utilizing sensor fusion of same pattern**, Salim Alsharif, Aed M. El-Saba, Univ. of South Alabama (USA) [8055-19]

9:40 am: **Arabic handwritten optical character recognition using hidden Markov models**, Mohammed M. Olama, Oak Ridge National Lab. (USA); Muhannad Aulama, Asem Natsheh, Gheith Abandah, The Univ. of Jordan (Jordan) [8055-20]

Coffee Break 10:00 to 10:30 am

SESSION 7

Room: Crystal P Fri. 10:30 to 11:30 am

Pattern Recognition Applications II

Session Chair: Rupert C. D. Young, Univ. of Sussex (United Kingdom)

10:30 am: **Non-intrusive human fatigue monitoring in command centers**, Abdul R. Alsamman, T. Ratecki, The Univ. of New Orleans (USA) [8055-31]

10:50 am: **Sampling balanced system for point target detection**, Yochay Danziger, Rafael Advanced Defense Systems Ltd. (Israel) [8055-23]

11:10 am: **A novel bag of visual words approach for geospatial object recognition**, Caglar Aytakin, Aydin A. Alatan, Middle East Technical Univ. (Turkey) [8055-24]



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Booth 1543

Tuesday-Thursday • Cypress Exhibition Hall

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Visual Information Processing XX

Conference Chairs: **Zia-ur Rahman**, NASA Langley Research Ctr. (USA); **Stephen E. Reichenbach**, Univ. of Nebraska-Lincoln (USA); **Mark A. Neifeld**, The Univ. of Arizona (USA)

Program Committee: **Gary W. Euliss**, MITRE Corp. (USA); **Amit Ashok**, The Univ. of Arizona (USA); **Richard D. Juday**, NASA Johnson Space Ctr. (USA); **Ram M. Narayanan**, The Pennsylvania State Univ. (USA); **John M. Pellegrino**, U. S. Army Research Lab., Computational & Information Sciences Directorate (CISD) (USA); **Robert A. Schowengerdt**, The Univ. of Arizona (USA); **Joseph van der Gracht**, HoloSpex, Inc. (USA)

Tuesday 26 April

Symposium-Wide Plenary Session

Tuesday • 8:30 to 9:30 am • Location: Crystal H

Dr. Regina E. Dugan

Director, Defense Advanced Research Projects Agency (DARPA)

See page 18 for details • Open to All Attendees

Coffee Break 9:30 to 10:30 am

SESSION 1

Room: Grand 2 Tues. 10:30 to 11:50 am

Image Enhancement, Noise, Etc.

Session Chair: **Stephen E. Reichenbach**, Univ. of Nebraska-Lincoln (USA)

10:30 am: **Impulse noise detection and removal using multiple weighted median filters**, Dimitrios Charalampidis, Naga R. Vayuvegula, The Univ. of New Orleans (USA) [8056-01]

10:50 am: **Mean squared error performance of speckle-imaging using the bispectrum in horizontal imaging applications**, Jeremy Bos, Michael C. Roggemann, Michigan Technological Univ. (USA) [8056-02]

11:10 am: **Modified bilateral-filter for illumination equalization**, Samuel Brisebois, Rochester Institute of Technology (USA) [8056-03]

11:30 am: **Optimization approach in local image enhancement**, Numan Unaldi, Suleyman Demirci, Turkish Air Force Academy (Turkey) [8056-04]

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

SESSION 2

Room: Grand 2 Tues. 1:20 to 3:00 pm

Applications I

Session Chair: **Ram M. Narayanan**, The Pennsylvania State Univ. (USA)

1:20 pm: **A novel orientation code for face recognition**, Yufeng Zheng, Alcorn State Univ. (USA) [8056-05]

1:40 pm: **Eye tracking and its application in human computer interfaces, active contour orientation**, Thomas Carroll, Univ. of Central Florida (USA); Aaron J. Rogers, Louisiana Tech Univ. (USA); Dimitrios Charalampidis, Huimin Chen, The Univ. of New Orleans (USA) [8056-06]

2:00 pm: **Door surveillance using edge map-based Harris corner detector and active contour orientation**, Nagachetan Bangalore, Waqas Hassan, Bhargav K. Mitra, Philip M. Birch, Rupert C. D. Young, Chris Chatwin, Univ. of Sussex (United Kingdom) [8056-07]

2:20 pm: **Submap joining smoothing and mapping for camera-based indoor localization and mapping**, Joakim Rydell, Jon Bjärkefur, Anders Karlsson, Christina A. Grönwall, Swedish Defence Research Agency (Sweden) ... [8056-08]

2:40 pm: **Designing the optimal convolution kernel for modeling the motion blur**, Jan Jelínek, Honeywell Technology (USA) [8056-09]

Coffee Break 3:00 to 3:30 pm

SESSION 3

Room: Grand 2 Tues. 3:30 to 5:30 pm

Superresolution Algorithms/System Design

Session Chair: **Mark A. Neifeld**, The Univ. of Arizona (USA)

3:30 pm: **Digital zoom algorithm with context derived basis functions**, Harvey C. Schau, Meridian Systems LLC (USA) [8056-10]

3:50 pm: **Super-resolution of time-lapse seismic images**, Sergio E. Zarantonello, Algorithmica LLC (USA) and Santa Clara Univ. (USA); Bonnie J. Smithson, Santa Clara Univ. (USA); Dimitri Bevc, 3DGeo Development, Inc. (USA); Youli Quan, Jerry M. Harris, Stanford Univ. (USA); Sally L. Wood, Santa Clara Univ. (USA) [8056-11]

4:10 pm: **On the restoration of the microscanned images captured from unmanned airborne vehicles**, Amr H. Yousef, Old Dominion Univ. (USA); Zia-ur Rahman, NASA Langley Research Ctr. (USA) [8056-12]

4:30 pm: **Continuous quantification of uniqueness and stereoscopic vision**, Val Petran, Artificial Perception Technologies Inc. (USA) and Case Western Reserve Univ. (USA); Frank L. Merat, Case Western Reserve Univ. (USA) [8056-13]

4:50 pm: **Big-data feature screening using Bregman divergence**, Jie Cheng, Univ. of Hawai'i (USA); Mehdi R. Zargham, Qiang Cheng, Southern Illinois Univ. Carbondale (USA) [8056-15]

5:10 pm: **Creating bespoke COTS solutions for image processing applications**, Duncan L. Hickman, Moira Smith, Scott F. Page, James R. E. Sadler, Waterfall Solutions Ltd. (United Kingdom) [8056-16]

POSTERS—Tuesday

Room: Crystal M Tues. 6:00 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. 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 pm 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.

Generalized accelerated hyperspectral, and multiframe algorithm for nondestructive micro-electromechanical systems (MEMS) microscope metrology, Wojtek J. Walecki, Fanny Szondy, Sunrise Optical LLC (USA) [8056-35]

The new image segmentation algorithm using adaptive evolutionary programming and fuzzy c-means clustering, Fang Liu, Beijing Univ. of Technology (China) and Tsinghua Univ. (China); Qionghai Dai, Tsinghua Univ. (China) [8056-37]

Review of metropolis Monte Carlo image enhancement, Abolfazl M. Amini, Southern Univ. and A&M College (USA) [8056-38]

A system for airport surveillance: detection of people running, abandoned objects and pointing gestures, Samuel Foucher, Marc Lalonde, Langis Gagnon, CRIM (Canada) [8056-39]

Wednesday 27 April

IN MEMORIAM

Room: Grand 2 Wed. 8:20 to 8:40 am



Zia-ur Rahman,
Research Engineer at NASA Langley
Research Center

Dr. Zia-ur Rahman, age 48, passed away on December 16th, 2010 in a tragic car accident near Lexington, Virginia.

A Williamsburg resident, Rahman was originally from Pakistan. He was awarded a Bachelor's Degree from Ripon College, Wisconsin, and an M.S. and Ph.D. from the University of Virginia.

Rahman was a research scientist with NASA Langley Research Center. He was previously an Associate Professor at Old Dominion University and at the College of William & Mary.

An SPIE member, Rahman was very active with the Society, serving as chair or co-chair of the Visual Information Processing Conference held annually at the SPIE Defense, Security, and Sensing meeting. He also presented papers at other SPIE meetings, including SPIE/IS&T Electronic Imaging, and SPIE Photonics West, and authored several SPIE journal papers.

Dr. Rahman is survived by his wife Katherine, and his three sons: Haroun, Camran, and Noor.

SESSION 4

Room: Grand 2 Wed. 8:40 to 10:00 am

Image Analysis

Session Chair: Stephen E. Reichenbach,
Univ. of Nebraska-Lincoln (USA)

8:40 am: **Automatic detection for aircraft emergency landing sites,** Yu-Fei Shen, Old Dominion Univ. (USA); Zia-ur Rahman, NASA Langley Research Ctr. (USA) [8056-18]

9:00 am: **Context-based semantic labeling of human-vehicle interactions in persistent surveillance systems,** Amir H. Shirkhodaie, Vinayak Elangovan, Tennessee State Univ. (USA) [8056-19]

9:20 am: **Image understanding algorithm for segmentation evaluation and region-of-interest identification using Bayesian networks,** Mustafa Jaber, Eli Saber, Rochester Institute of Technology (USA) [8056-20]

9:40 am: **Fast motion prediction algorithm for multiview video coding,** Abdelrahman Abdelazim, Yao Guang Zhang, Stephen J. Mein, Martin R. Varley, Univ. of Central Lancashire (United Kingdom); Djamel Ait-Boudaoud, Univ. of Portsmouth (United Kingdom) [8056-21]

Coffee Break 10:00 to 10:30 am

SESSION 5

Room: Grand 2 Wed. 10:30 to 11:50 am

Modeling

Session Chair: Amit Ashok, The Univ. of Arizona (USA)

10:30 am: **Improved neural network modeling of inverse lens distortion,** Jason P. de Villiers, Council for Scientific and Industrial Research (South Africa); Fred Nicolls, Univ. of Cape Town (South Africa) [8056-22]

10:50 am: **Novel adaptive kernels for image sharpening in the presence of noise,** David C. Bamber, Waterfall Solutions Ltd. (United Kingdom); Paul K. Kimber, SELEX Galileo Ltd. (United Kingdom) [8056-23]

11:10 am: **Information theoretic analysis of canny edge detection in visual communication,** Bo Jiang, Old Dominion Univ. (USA); Zia-ur Rahman, NASA Langley Research Ctr. (USA) [8056-24]

11:30 am: **Local color transfer based on dark-channel dehazing for visible/infrared image fusion,** Bei Zhang, Lingxue Wang, Beijing Institute of Technology (China) [8056-25]

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

SESSION 6

Room: Grand 2 Wed. 1:10 to 4:00 pm

Computational Imaging

Session Chair: Amit Ashok, The Univ. of Arizona (USA)

1:10 pm: **Space-time compressive imaging,** Vicha Treeaporn, Amit Ashok, Mark A. Neifeld, The Univ. of Arizona (USA) [8056-26]

1:30 pm: **Adaptive multiscale resolution enhancement for compressive imaging (Invited Paper),** Abhijit Mahalanobis, Lockheed Martin Missiles and Fire Control (USA) [8056-27]

2:00 pm: **Novel helical point spread functions for 3D imaging (Invited Paper),** Sean Quirin, Rafael Piestun, Univ. of Colorado at Boulder (USA) [8056-29]

2:30 pm: **Unconventional optical system design (Invited Paper),** Joseph Ford, Eric J. Tremblay, Univ. of California, San Diego (USA) [8056-30]

Coffee Break 3:00 to 3:30 pm

3:30 pm: **Image formation challenges in the MOSAIC platform (Invited Paper),** Michael E. Gehm, The Univ. of Arizona (USA); David J. Brady, Duke Univ. (USA) [8056-31]

SESSION 7

Room: Grand 2 Wed. 4:00 to 5:00 pm

Applications II

Session Chair: Stephen E. Reichenbach,
Univ. of Nebraska-Lincoln (USA)

4:00 pm: **On grey levels in random CAPTCHA generation,** Michael A. Kouritzin, Fraser Newton, Samira Sadeghi, Univ. of Alberta (Canada) [8056-32]

4:20 pm: **A simplified rate control algorithm for H.264/SVC,** Yao Guang Zhang, Abdelrahman Abdelazim, Stephen J. Mein, Martin R. Varley, Univ. of Central Lancashire (United Kingdom); Djamel Ait-Boudaoud, Univ. of Portsmouth (United Kingdom) [8056-33]

4:40 pm: **A joint perceptual encryption and watermarking scheme (JPEW) for DCT-based codecs,** Muhammad Imran Khan, Varun Jeoti, Aamir S. Malik, Univ. Teknologi Petronas (Malaysia) [8056-34]

Course of Related Interest

SC838 **Laser Range Gated Imaging Techniques (Duncan)** Tuesday, 1:30 to 5:30 pm

Visit the registration desk for course descriptions or to register

Quantum Information and Computation IX

Conference Chairs: **Eric Donkor**, Univ. of Connecticut (USA); **Andrew R. Pirich**, ACP Consulting (USA); **Howard E. Brandt**, U.S. Army Research Lab. (USA)

Program Committee: **Paul M. Alsing**, Air Force Research Lab. (USA); **Reinhard K. Erdmann**, 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 28 April

SESSION 1

Room: Grand 2. Thurs. 8:00 to 8:30 am

Invited Session

Session Chair: **Howard E. Brandt**, U.S. Army Research Lab. (USA)

8:00 am: **Quantum braids and their applications** (*Invited Paper*), Samuel J. Lomonaco, Jr., Univ. of Maryland, Baltimore County (USA); Louis H. Kauffman, Univ. of Illinois at Chicago (USA). [8057-01]

SESSION 2

Room: Grand 2. Thurs. 8:30 to 10:10 am

Quantum States and Quantum Logic

Session Chairs: **John M. Myers**, Harvard Univ. (USA); **Louis H. Kauffman**, Univ. of Illinois at Chicago (USA)

8:30 am: **Bright photon pair source with high spectral and spatial purity**, Warren P. Grice, Ryan S. Bennink, Philip G. Evans, Travis S. Humble, Oak Ridge National Lab. (USA); Jason Schaaake, The Univ. of Tennessee (USA). . . . [8057-02]

8:50 am: **Entangled photons produced by interactions with quantum wells and quantum dots**, Michael N. Leuenberger, Mikhail V. Erementchouk, Univ. of Central Florida (USA). [8057-03]

9:10 am: **Multiple-entangled photon spontaneous parametric down-conversion source**, Michael L. Fanto, Reinhard K. Erdmann, Paul M. Alsing, Air Force Research Lab. (USA); Enrique J. Galvez, Colgate Univ. (USA); Corey Peters, Air Force Research Lab. (USA). [8057-04]

9:30 am: **Proposals to produce entangled states of spatial modes of light**, Enrique J. Galvez, Colgate Univ. (USA). [8057-05]

9:50 am: **Experimental consideration of local realism with entangled photon pairs**, Reinhard K. Erdmann, Michael L. Fanto, Paul M. Alsing, Corey Peters, Air Force Research Lab. (USA); Enrique J. Galvez, Colgate Univ. (USA); Warner A. Miller, Florida Atlantic Univ. (USA). [8057-06]

Coffee Break 10:10 to 10:40 am

SESSION 3

Room: Grand 2. Thurs. 10:40 am to 12:00 pm

Quantum Imaging and Quantum Memory

Session Chair: **Reinhard K. Erdmann**, Air Force Research Lab. (USA)

10:40 am: **Generation and detection of quantum entangled states and quantum imaging**, James F. Smith III, U.S. Naval Research Lab. (USA) [8057-07]

11:00 am: **Resolution enhancement of imaging systems by quantum phase amplification**, Yanchun Yin, Doug French, Igor Jovanovic, The Pennsylvania State Univ. (USA). [8057-08]

11:20 am: **All-optical flip-flop memory for quantum computing**, Eric Donkor, Univ. of Connecticut (USA). [8057-09]

11:40 am: **Entangled photon holes and nonclassical interferometry**, Junlin Liang, James D. Franson, Todd B. Pittman, Univ. of Maryland, Baltimore County (USA). [8057-10]

Lunch/Exhibition Break 12:00 to 1:50 pm

SESSION 4

Room: Grand 2. Thurs. 1:50 to 3:10 pm

Quantum Algorithms

Session Chairs: **Samuel J. Lomonaco, Jr.**, Univ. of Maryland, Baltimore County (USA); **Michael J. Hayduk**, Air Force Research Lab. (USA)

1:50 pm: **Quantum computing in a piece of glass**, Warner A. Miller, Florida Atlantic Univ. (USA); Paul M. Alsing, Jonathan R. McDonald, Air Force Research Lab. (USA); Christopher C. Tison, Florida Atlantic Univ. (USA). [8057-27]

2:10 pm: **Analytical calculation of the dynamics of Shor state verification in the presence of non-equiprobable errors**, Gerald N. Gilbert, Yaakov S. Weinstein, MITRE Corp. (USA). [8057-12]

2:30 pm: **Unitary quantum lattice gas representation of 2D quantum turbulence**, Bo Zhang, George Vahala, The College of William & Mary (USA); Linda L. Vahala, Old Dominion Univ. (USA); Jeffrey Yezpez, Air Force Research Lab. (USA). [8057-13]

2:50 pm: **Using the Mathematica package Qucalc to simulate quantum algorithms and games**, David A. Bolivar, Univ. EAFIT (Colombia). [8057-15]

Coffee Break 3:10 to 3:40 pm

SESSION 5

Room: Grand 2. Thurs. 3:40 to 5:20 pm

Quantum Game Theory, Cryptography, and Measurements

Session Chairs: **Eric Donkor**, Univ. of Connecticut (USA); **Michael L. Fanto**, Air Force Research Lab. (USA)

3:40 pm: **Causal connectivity**, Howard E. Brandt, U.S. Army Research Lab. (USA). [8057-16]

4:00 pm: **Wonderful world of weak values**, John C. Howell, Curtis J. Broadbent, Andrew N. Jordan, David J. Starling, Benjamin Dixon, Univ. of Rochester (USA). [8057-17]

4:20 pm: **A statistical and comparative study of quantum walks under weak measurements and weak values regimes**, Debabrata Ghoshal, George Mason Univ. (USA); Marco O. Lanzagorta, ITT Advanced Engineering & Sciences (USA); Salvador E. Venegas-Andraca, Tecnologico de Monterrey (Mexico). . . . [8057-18]

4:40 pm: **Quantum spread spectrum communication**, Travis S. Humble, Oak Ridge National Lab. (USA). [8057-19]

5:00 pm: **Nash equilibrium in quantum superpositions**, Faisal S. Khan, Simon Phoenix, Khalifa Univ. of Science, Technology and Research (United Arab Emirates). [8057-20]

Friday 29 April

SESSION 6

Room: Grand 2. Fri. 8:00 to 10:20 am

Quantum Computing

Session Chairs: **Samuel J. Lomonaco, Jr.**, Univ. of Maryland, Baltimore County (USA); **Louis H. Kauffman**, Univ. of Illinois at Chicago (USA)

8:00 am: **Implementing an optical CNOT using spatial parity qubits**, Kumel H. Kagalwala, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Giovanni Di Giuseppe, Univ. degli Studi di Camerino (Italy); Ayman F. Abouraddy, Bahaa E. A. Saleh, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) [8057-21]

8:20 am: **Quantum cellular automata without quiescent states**, Howard A. Blair, Robert J. Irwin, Syracuse Univ. (USA) [8057-22]

8:40 am: **Rhythms essential to logical communication**, John M. Myers, Harvard Univ. (USA); Frederick H. Madjid, Consultant (USA) [8057-23]

9:00 am: **Quantum computing with induced dipole-dipole forbidden transitions**, Eric Donkor, Univ. of Connecticut (USA) [8057-24]

9:20 am: **A theoretical model of multi-agent quantum computing**, Fabian M. Mihelic, Light Consulting (USA) [8057-25]

9:40 am: **Encoding qubits into the spatial distribution of single photons and entangled photon pairs**, Ayman F. Abouraddy, Bahaa E. A. Saleh, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) [8057-26]

10:00 am: **Grover's search algorithm with an entangled database state**, Paul M. Alsing, Nathan McDonald, Air Force Research Lab. (USA) [8057-11]

Coffee Break 10:20 to 10:50 am

SESSION 7

Room: Grand 2. Fri. 10:50 am to 1:00 pm

Quantum Information Theory

Session Chairs: **Howard E. Brandt**, U.S. Army Research Lab. (USA); **John M. Myers**, Harvard Univ. (USA)

10:50 am: **Random gauge theory**, John E. Gray, Naval Surface Warfare Ctr. Dahlgren Div. (USA) [8057-28]

11:10 am: **Quantizing knots, groups and graphs**, Louis H. Kauffman, Univ. of Illinois at Chicago (USA); Samuel J. Lomonaco, Jr., Univ. of Maryland, Baltimore County (USA) [8057-29]

11:30 am: **Possible quantum algorithms for generalized turaev-viro invariants of 3-manifolds**, Juan F. Ospina, Univ. EAFIT (Colombia) [8057-30]

11:50 am: **A combinatorial approach to the optical random walk**, Scott E. Spence, Naval Surface Warfare Ctr. Dahlgren Div. (USA) [8057-31]

12:10 pm: **Two-spectral Yang-Baxter operators in topological quantum computation**, William F. Sánchez, Univ. EAFIT (Colombia) [8057-32]

12:30 pm: **New gauge field from extension of space time parallel transport of vector spaces to underlying scalar fields** (*Invited Paper*), Paul Benioff, Argonne National Lab. (USA) [8057-33]



Independent Component Analyses, Wavelets, Neural Networks, Biosystems, and Nanoengineering IX

Conference Chair: **Harold 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); **Hamid Bolouri**, California Institute of Technology (USA); **Kenneth A. Byrd**, U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Chee-Hung Chu**, Univ. of Louisiana at Lafayette (USA); **Kai-Dee Chu**, U.S. Dept. of Homeland Security (USA); **Wen-Yan Danny Chung**, Chung Yuan Christian Univ. (Taiwan); **Andrzej S. Cichocki**, Telcordia Technologies, Inc. (USA); **Ronald R. Coifman**, Yale Univ. (USA); **John Daugman**, Univ. of Cambridge (United Kingdom); **Qian Du**, Mississippi State Univ. (USA); **Glenn R. Easley**, System Planning Corp. (USA); **John E. Gray**, Naval Surface Warfare Ctr. Dahlgren Div. (USA); **Fredric M. Ham**, Florida Institute of Technology (USA); **Yutaka Hata**, Univ. of Hyogo (Japan); **Charles C. Hsu**, Trident Systems Inc. (USA); **Diana L. Huffaker**, Univ. of California, Los Angeles (USA); **Tzyy-Ping Jung**, Univ. of California, San Diego (USA); **Joseph Landa**, BriarTek, Inc. (USA); **Te-Won Lee**, Univ. of California, San Diego (USA); **Kevin W. Lyons**, National Institute of Standards and Technology (USA); **Uwe Meyer Baese**, The Florida State Univ. (USA); **Francesco Carlo Morabito**, Univ. Mediterranea di Reggio Calabria (Italy); **Hairong Qi**, The Univ. of Tennessee (USA); **Horacio Lamela**, Univ. Carlos III de Madrid (Spain); **Jan-Olov Stromberg**, Royal Institute of Technology (Sweden); **Mladen Victor Wickerhauser**, Washington Univ. in St. Louis (USA); **Olaf Wolkenhauer**, Univ. Rostock (Germany); **Donald C. Wunsch II**, Missouri Univ. of Science and Technology (USA); **Ning Xi**, Michigan State Univ. (USA)

Wednesday 27 April

Wavelet Pioneer Award

Room: Crystal Q Wed. 8:00 to 8:40 am

Wavelet Pioneer Award for Elucidation of Wavelet Frames for Sensing Applications

Presented to: **Prof. John J. Benedetto**, Univ. of Maryland, College Park

8:00 am: **Intrinsic wavelet and frame applications** (*Invited Paper*), John J. Benedetto, Univ. of Maryland, College Park (USA) [8058-01]

PANEL DISCUSSION

Room: Crystal Q Wed. 8:40 to 9:00 am

The R/D/A Future of Wavelets

Panel Moderators: **Harold Szu**, U.S. Army Night Vision & Electronic Sensors Directorate; **John J. Benedetto**, Univ. Maryland, College Park (USA); **Mark J. T. Smith**, Purdue Univ. (USA); **Ronald R. Coifman**, Yale Univ. (USA); **Jan-Olov Stromberg**, Royal Institute of Technology (Sweden)

SESSION 2

Room: Crystal Q Wed. 9:00 to 10:20 am

Wavelets Applications I

Session Chairs: **John J. Benedetto**, Univ. of Maryland, College Park (USA); **Ronald R. Coifman**, Yale Univ. (USA)

9:00 am: **Adaptive supermother wavelet for compressive sensing**, Harold Szu, U.S. Army Night Vision & Electronic Sensors Directorate (USA); Ming-Kai Hsu, Ting Lee, The George Washington Univ. (USA) [8058-02]

9:20 am: **Classification of transient signals using sparse representations over adaptive dictionaries**, Daniela I. Moody, Los Alamos National Lab. (USA) and Univ. of Maryland, College Park (USA); Steven P. Brumby, Kary L. Myers, Norma H. Pawley, Los Alamos National Lab. (USA) [8058-03]

9:40 am: **Fractional wavelet transform using an unbalanced lifting structure**, Kivanc Kose, Enis A. Cetin, Bilkent Univ. (Turkey) [8058-04]

10:00 am: **Anomaly recovery from compressive sensed spectral image sequences via low-rank matrix minimization**, Ana Ramirez, Henry Arguello, Gonzalo Arce, Univ. of Delaware (USA) [8058-05]

Coffee Break 10:20 to 10:40 am

SESSION 3

Room: Crystal Q Wed. 10:40 am to 12:00 pm

Wavelets Applications and 3D Shearlets

Session Chairs: **Harold Szu**, U.S. Army Night Vision & Electronic Sensors Directorate (USA); **John J. Benedetto**, Univ. of Maryland, College Park (USA)

10:40 am: **Optimally sparse shearlet approximations of 3D data**, Demetrio Labate, Univ. of Houston (USA); Kanghui Guo, Missouri State Univ. (USA) [8058-06]

11:00 am: **Three-dimensional shearlet edge analysis**, David A. Schug, Univ. of Maryland, College Park (USA); Glenn R. Easley, System Planning Corp. (USA); Dianne P. O'Leary, Univ. of Maryland, College Park (USA) [8058-07]

11:20 am: **Denoising medical imagery using a novel framework**, Samuel P. Kozaitis, Jharana Mehta, Shreya Ponkia, Florida Institute of Technology (USA) [8058-09]

11:40 am: **Application of wavelet transforms in de-noising optical emission transient signals generated from microsamples introduced into microplasmas and comparison with Fourier-transform and Hartley-transform signal processing noise-filtering methods**, Vassili Karanassios, David Hunter, Univ. of Waterloo (Canada) [8058-10]

Lunch/Exhibition Break 12:00 to 1:20 pm

ICA Unsupervised Learning Award

Room: Crystal Q Wed. 1:20 to 2:00 pm

ICA Unsupervised Learning Award

Session Chairs: **Soo-Young Lee**, KAIST (Korea, Republic of); **Tzyy-Ping Jung**, Univ. of California, San Diego (USA)

ICA Unsupervised Learning Pioneer Award for Blind Demixing of Acoustic Signals

Presented to: **Prof. Hyung-Min Park**, Sogang Univ. (Korea, Republic of)

1:20 pm: **Filterbank-based independent component analysis for acoustic mixtures** (*Invited Paper*), Hyung-Min Park, Sogang Univ. (Korea, Republic of) [8058-11]

PANEL DISCUSSION

Room: Crystal Q Wed. 2:00 to 2:20 pm

Advances of ICA

Panel Moderators: **Soo-Young Lee**, KAIST (Korea, Republic of); **Takeshi Yamakawa**, Kyushu Institute of Technology (Japan); **Harold Szu**, U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Tzyy-Ping Jung**, Univ. of California, San Diego (USA)

SESSION 5

Room: Crystal Q Wed. 2:20 to 3:40 pm

Unsupervised Learning and ICA

*Session Chairs: Soo-Young Lee, KAIST (Korea, Republic of);
Hyung-Min Park, Sogang Univ. (Korea, Republic of)*

2:20 pm: **Imposing constraints on extracting filters to extract specific sources from convolutive mixtures**, Jae-Kwon Yoo, Choong Hwan Choi, Soo-Young Lee, KAIST (Korea, Republic of) [8058-12]

2:40 pm: **Robust speech recognition using missing feature theory and target speech enhancement based on degenerate unmixing and estimation technique**, Minook Kim, Ji-Seon Kim, Hyung-Min Park, Sogang Univ. (Korea, Republic of) [8058-13]

3:00 pm: **Bioimaging and biospectra analysis by means of ICA: experimental results**, Qun Zhao, Jason Langley, Joonsang Lee, Justin Abell, Yiping Zhao, The Univ. of Georgia (USA) [8058-14]

3:20 pm: **Stability analysis of minimum free energy equilibrium prediction**, Balvinder Kaur, U.S. Army Night Vision & Electronic Sensors Directorate (USA) [8058-15]

Coffee Break 3:40 to 4:00 pm

SESSION 6

Room: Crystal Q Wed. 4:00 to 6:00 pm

Applications and Neural Network Learning

Session Chairs: Takeshi Yamakawa, Kyushu Institute of Technology (Japan); Soo-Young Lee, KAIST (Korea, Republic of)

4:00 pm: **Understanding human implicit intention from physiological and behavioral data**, Soo-Young Lee, Suhyeon Dong, Dae-shik Kim, KAIST (Korea, Republic of) [8058-16]

4:20 pm: **Estimation of the magnetic flux induced by human motion**, Harold Szu, U.S. Army Night Vision & Electronic Sensors Directorate (USA); Jeff Willey, U.S. Naval Research Lab. (USA) [8058-18]

4:40 pm: **Generative and discriminant feature extraction with supervised learning**, Chandra S. Dhir, Soo-Young Lee, KAIST (Korea, Republic of) [8058-19]

5:00 pm: **Development of artificial neural networks for spectral interference correction in optical emission spectrometry**, Zhimin Li, Vassili Karanassios, Univ. of Waterloo (Canada) [8058-20]

5:20 pm: **A new approach for neural network training and evaluation**, Xinjia Chen, Ernest L. Walker, Southern Univ. and A&M College (USA) [8058-21]

5:40 pm: **Generalized statistics framework for lagrange constraint neural networks**, Ravi C. Venkatesan, Systems Research Corp. (India); Arun Sharma, SecureALL Corp. (USA) [8058-22]

Thursday 28 April

Nano-engineering Award

Room: Crystal Q Thurs. 8:00 to 8:40 am

Nano-engineering Award for his contribution of stability of micro and nano manipulator

Presented to: Prof. Metin Sitti, Carnegie Mellon Univ. (USA)

8:00 am: **Tip-based nanorobotic manipulation systems (Invited Paper)**, Metin Sitti, Carnegie Mellon Univ. (USA) [8058-23]

PANEL DISCUSSION

Room: Crystal Q Thurs. 8:40 to 9:00 am

Micron-Nano-Engineering

Panel Moderators: F. Jack Agee, Rice Univ. (USA); Ning Xi, Michigan State Univ. (USA); Metin Sitti, Carnegie Mellon Univ. (USA); Harold Szu, U.S. Army Night Vision & Electronic Sensors Directorate (USA); Kitt C. Reinhardt, Air Force Office of Scientific Research (USA)

SESSION 8

Room: Crystal Q Thurs. 9:00 to 10:20 am

Nano-engineering

*Session Chairs: F. Jack Agee, Rice Univ. (USA);
Ning Xi, Michigan State Univ. (USA)*

9:00 am: **Infrared imaging using carbon nanotube-based detector (Invited Paper)**, Ning Xi, Michigan State Univ. (USA) [8058-24]

9:40 am: **Catalytic nanomotors: challenges and opportunities**, Yiping Zhao, The Univ. of Georgia (USA) [8058-25]

10:00 am: **Adaptive hyperspectral sensing with carbon nanotubes**, Harold Szu, U.S. Army Night Vision & Electronic Sensors Directorate (USA); Yin-Lin Shen, Kenneth H. Ou, The George Washington Univ. (USA); Reinhardt Kit, Air Force Office of Scientific Research (USA) [8058-26]

Coffee Break 10:20 to 10:40 am

SESSION 9

Room: Crystal Q Thurs. 10:40 am to 12:35 pm

Persistent Surveillance I

*Session Chairs: Kai-Dee Chu, U.S. Dept. of Homeland Security (USA);
Charles Hsu, Trident Systems Inc. (USA)*

10:40 am: **How to build a smart sensing surveillance net**, Kai-Dee Chu, U.S. Dept. of Homeland Security (USA); Charles Hsu, Trident Systems Inc. (USA) [8058-27]

11:00 am: **What is a missing link among a persistent surveillance?**, Harold Szu, U.S. Army Night Vision & Electronic Sensors Directorate (USA); Charles Hsu, Trident Systems Inc. (USA); Jerry Wu, WJ Associates (USA) [8058-28]

11:20 am: **How to sequentially update eigen face**, Charles C. Hsu, Trident Systems Inc. (USA); Harold Szu, U.S. Army Night Vision & Electronic Sensors Directorate (USA) [8058-29]

11:40 am: **What is a good biometrics at distance?**, Harold Szu, U.S. Army Night Vision & Electronic Sensors Directorate (USA); Charles Hsu, Trident Systems Inc. (USA); Ira Kohlberg, Institute for Defense Analyses (USA) [8058-30]

12:00 pm: **A review of the current state-of-the-art in crowd behavior analysis and simulation**, Kenneth A. Byrd, U.S. Army Night Vision & Electronic Sensors Directorate (USA) [8058-31]

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

SESSION 9A

Room: Crystal Q Thurs. 10:40 am to 12:35 pm

Persistent Surveillance II

*Session Chairs: Kai-Dee Chu, U.S. Dept. of Homeland Security (USA);
Charles Hsu, Trident Systems Inc. (USA)*

1:20 pm: **Distributed signal decorrelation in wireless sensor networks using the sparse matrix transform**, Leonardo R. Bachege, Purdue Univ. (USA); Srikanth Hariharan, The Ohio State Univ. (USA); Charles A. Bouman, Purdue Univ. (USA); Ness Shroff, The Ohio State Univ. (USA) [8058-32]

1:40 pm: **Real-world Nyquist sampling rate (of facial ordering)**, Harold Szu, U.S. Army Night Vision & Electronic Sensors Directorate (USA); Ming-Kai Hsu, The George Washington Univ. (USA) [8058-33]

Biomedical Wellness Award

Room: Crystal Q Thurs. 2:00 to 2:40 pm

Applying Computational Intelligence to Image Diagnosis

*Session Chairs: Takeshi Yamakawa, Kyushu Institute of Technology (Japan);
Soo-Young Lee, KAIST (Korea, Republic of)*

Biomedical Wellness Award

Presented to: Dr. Hiroshi Nakajima, OMRON Corp. (Japan) for Contribution to Effective Monitoring and Smart Processing Devices

2:00 pm: **Smart health management technology and its applications (Invited Paper)**, Hiroshi Nakajima, OMRON Corp. (Japan) [8058-34]

PANEL DISCUSSION

Room: Crystal Q Thurs. 2:40 to 3:00 pm

Biomedical Wellness for Aging Global Village

Panel Moderators: **Dr. Hiroshi Nakajima**, OMRON Corp. (Japan);
Soo-Young Lee, KAIST(Korea, Republic of);
Takeshi Yamakawa, Kyushu Institute of Technology (Japan);
Yutaka Hata, Univ. of Hyogo (Japan);
Harold Szu, U.S. Army Night Vision & Electronic Sensors Directorate

Coffee Break 3:00 to 3:20 pm

SESSION 11

Room: Crystal Q Thurs. 3:20 to 6:00 pm

Biomedical Wellness Applications

Session Chairs: **Takeshi Yamakawa**, Kyushu Institute of Technology (Japan); **Soo-Young Lee**, KAIST (Korea, Republic of)

3:20 pm: **YURAGI: analysis for detecting heart-rate by mat-type sensor in bed**, Yutaka Hata, Kiyotaka Ho, Kei Kuramoto, Syoji Kobashi, Univ. of Hyogo (Japan); Naoki Tsuchiya, Hiroshi Nakajima, OMRON Corp. (Japan) [8058-35]

3:40 pm: **Visceral fat estimation method by bio-impedance and causal analysis**, Hiroshi Nakajima, Hiroshi Tasaki, Naoki Tsuchiya, OMRON Corp. (Japan); Takehiro Hamaguchi, Toshikazu Shiga, OMRON Healthcare Co., Ltd. (Japan) [8058-36]

4:00 pm: **Multiscale edge detection for small blood vessel segmentation in magnetic resonance angiography**, Rakesh Chandramohan, Samuel P. Kozaitis, Florida Institute of Technology (USA) [8058-37]

4:20 pm: **Heart-rate monitoring by air pressure and causal analysis**, Naoki Tsuchiya, Hiroshi Nakajima, OMRON Corp. (Japan); Yutaka Hata, Univ. of Hyogo (Japan) [8058-38]

4:40 pm: **Biomedical wellness by tai chi and sports**, Daniel C. Chin, The Johns Hopkins Univ. Applied Physics Lab. (USA); Amita G. Chin, Virginia Commonwealth Univ. (USA) [8058-39]

5:00 pm: **YURAGI: analysis for trans-skull brain visualizing by ultrasonic array probe**, Naomi Yagi, Yoshitetsu Oshiro, Osamu Ishikawa, Ishikawa Hospital (Japan); Yutaka Hata, Univ. of Hyogo (Japan); Yuri T. Kitamura, Toshio Yanagida, Osaka Univ. (Japan) [8058-52]

5:20 pm: **Biometrics security by dynamics of left and right sole pressure while walking**, Takahiro Takeda, Kei Kuramoto, Syoji Kobashi, Yutaka Hata, Univ. of Hyogo (Japan) [8058-57]

5:40 pm: **A fuzzy automated object classification by infrared laser camera**, Seigo Kanazawa, Univ. of Hyogo (Japan); Kazuhiko Tanigushi, Kinden Corp. (Japan); Asari Kazunari, Kansai Electric Power Co., Inc. (Japan); Kei Kuramoto, Shoji Kobashi, Yutaka Hata, Univ. of Hyogo (Japan) [8058-58]

Friday 29 April

SESSION 12

Room: Crystal Q Fri. 8:00 to 10:00 am

System Biology Imaging Processing

Session Chairs: **Chee-Hung Chu**, Univ. of Louisiana at Lafayette (USA);
Jide Familoni, U.S. Army Night Vision & Electronic Sensors Directorate (USA)

8:00 am: **Defense-related insights and solutions from neuroscience and neuroengineering**, Gerwin Schalk, New York State Dept. of Health (USA) and Albany Medical College (USA) and Univ. of New York at Albany (USA); Aysegul Gunduz, Peter Brunner, New York State Dept. of Health (USA) and Albany Medical College (USA) [8058-40]

8:20 am: **Wavelets for full reconfigurable ECG signal acquisition system**, Diego P. Morales, Antonio Garcia, Encarnación Castillo, Univ. de Granada (Spain); Uwe Meyer Baese, The Florida State Univ. (USA); Alberto J. Palma, Univ. de Granada (Spain) [8058-41]

8:40 am: **Wavelet domain analysis of EEG data for emotion recognition: evaluation of recounging energy efficiency**, Theus Aspiras, Vijayan K. Asari, Univ. of Dayton (USA) [8058-42]

9:00 am: **Gaussian graphical models reveal specific lipid correlations in glioblastoma cells**, Nikola S. Mueller, Max-Planck-Institut für Biochemie (Germany); Jan Krumsiek, Fabian Theis, Helmholtz Zentrum München GmbH (Germany); Christian Böhm, Ludwig-Maximilians-Univ. München (Germany); Anke D. Meyer-Bäse, The Florida State Univ. (USA) [8058-43]

9:20 am: **Gut feeling is electric**, Jide Familoni, U.S. Army Night Vision & Electronic Sensors Directorate (USA) [8058-44]

9:40 am: **Reconstruction algorithms for optoacoustic imaging based on fiber optic detectors**, Daniel C. Gallego, Horacio Lamela, Rebeca Gutiérrez, Univ. Carlos III de Madrid (Spain); Alexander A. Oraevsky, TomoWave Labs., Inc. (USA) [8058-45]

Coffee Break 10:00 to 10:20 am

SESSION 13

Room: Crystal Q Fri. 10:20 am to 12:20 pm

Engineering System of Systems and Application

10:20 am: **NIOS II processor-based acceleration of motion compensation techniques**, Diego González Rodríguez, Univ. Complutense de Madrid (Spain); Guillermo Botella Juan, Uwe Meyer Baese, Anke D. Meyer-Bäse, The Florida State Univ. (USA) [8058-46]

10:40 am: **PCA method for automated detection of mispronounced words**, Zhenhao Ge, Sudhendu R. Sharma, Mark J. T. Smith, Purdue Univ. (USA) [8058-47]

11:00 am: **Applying genetic algorithm to optimization parameters of robust optical flow system**, Olmo Zavala, Guillermo Botella Juan, Anke D. Meyer-Bäse, Uwe Meyer Baese, The Florida State Univ. (USA) [8058-48]

11:20 am: **Intellectual property protection (IPP) using lossless obfuscation in C, VHDL, and Verilog coding**, Uwe Meyer Baese, Guillermo Botella Juan, The Florida State Univ. (USA); Encarnación Castillo, Antonio Garcia, Univ. de Granada (Spain) [8058-49]

11:40 am: **Polarimetric detection for slowly moving/stationary targets in inhomogeneous environments**, Charles Hsu, Howard B. Mendelson, Albert Burgstahler, Dan Hibbard, James Faist, Trident Systems Inc. (USA) [8058-50]

12:00 pm: **Independent component analysis (ICA) of fused wavelet coefficients of thermal and visual images for human face recognition**, Mrinal K. Bhowmik, Debotosh Bhattacharjee, Dipak K. Basu, Jadavpur Univ. (India) [8058-17]

Lunch Break 12:20 to 1:20 pm

SESSION 14

Systems Biology Pioneer Award

Room: Crystal Q Fri. 1:20 to 2:00 pm

System Biology Pioneer Award for the Excellence in the Field of System Biology Science for receptor-mediated regulation in systems biology

Presented to: Prof. Douglas A. Lauffenburger, Massachusetts Institute of Technology (USA)

1:20 pm: **Receptor-mediated regulation in biology** (*Invited Paper*), Douglas A. Lauffenburger, Massachusetts Institute of Technology (USA) [8058-51]

PANEL DISCUSSION

Room: Crystal Q: Fri. 2:00 to 2:20 pm

System of Systems Computational Intelligence

Panel Moderators: Nadarajen A. Vydelingum, National Institute of Health (USA);

Jide Familoni, U.S. Army Night Vision & Electronic Sensors Directorate (USA);

Takeshi Yamakawa, Kyushu Institute of Technology (Japan);

Soo-Young Lee, KAIST(Korea, Republic of);

Harold Szu, U.S. Army Night Vision & Electronic Sensors Directorate (USA)

SESSION 15

Room: Crystal Q Fri. 2:20 to 4:20 pm

Wellness Smart Sensors

Session Chairs: Yutaka Hata, Univ. of Hyogo (Japan);

Takeshi Yamakawa, Kyushu Institute of Technology (Japan)

2:20 pm: **Biomedical wellness (BMW) concerns**, Harold Szu, U.S. Army Night Vision & Electronic Sensors Directorate (USA) [8058-53]

2:40 pm: **Solving channel assignment problems using local search methods and simulated annealing**, Lipo Wang, Nanyang Technological Univ. (Singapore) [8058-54]

Coffee Break 3:00 to 3:20 pm

3:20 pm: **Reverse engineering cellular decisions for hybrid reconfigurable network modeling**, Howard A. Blair, Syracuse Univ. (USA) [8058-55]

3:40 pm: **Approximate nearest neighbors in high-dimensional vector spaces via dictionary learning**, Anoop Cherian, Vassilios Morellas, Nikos Papanikolopoulos, Univ. of Minnesota, Twin Cities (USA) [8058-56]

4:00 pm: **The golden ratio in peripheral monochromatic and central chromatic vision**, Jeffrey C. Jenkins, Harold Szu, U.S. Army Night Vision & Electronic Sensors Directorate (USA) [8058-59]

Closing Remarks

Room: Crystal Q Fri. 4:20 to 4:40 pm

Session Chair: Harold Szu,

U.S. Army Night Vision & Electronic Sensors Directorate (USA)

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Evolutionary and Bio-Inspired Computation: Theory and Applications V

Conference Chairs: **Misty Blowers**, Air Force Research Lab. (USA); **Teresa H. O'Donnell**, Air Force Research Lab. (USA); **Olga Mendoza-Schrock**, Air Force Research Lab. (USA)

Program Committee: **Peter M. LaMonica**, Air Force Research Lab. (USA); **Leonid I. Perlovsky**, Air Force Research Lab. (USA); **Michael R. Peterson**, Univ. of Hawai'i (USA); **Alex F. Sisti**, Air Force Research Lab. (USA); **Hugh L. Southall**, Air Force Research Lab. (USA); **John Spina**, Air Force Research Lab. (USA)

Wednesday 27 April

SESSION 1

Room: San Francisco Wed. 1:30 to 2:10 pm

Keynote Session I

Session Chair: **Misty Blowers**, Air Force Research Lab. (USA)

1:30 pm: **Using concepts from biology to improve problem-solving methods** (Keynote Presentation), Erik Goodman, Michigan State Univ. (USA) [8059-01]

SESSION 2

Room: San Francisco Wed. 2:10 to 5:00 pm

Layered-Sensing Intelligence

Session Chair: **Olga Mendoza-Schrock**, Air Force Research Lab. (USA)

2:10 pm: **PADF RF localization experiments with multi-agent caged-MAV platforms**, Christopher Barber, Miguel Gates, Louisiana Tech Univ. (USA); Huthaifa Alissa, Univ. of Dayton (USA); Atindra K. Mitra, Air Force Research Lab. (USA); Rastko R. Selmic, Louisiana Tech Univ. (USA); Raul Ordonez, Univ. of Dayton (USA) [8059-02]

2:30 pm: **Discriminative feature sets for object detection in layered sensing environments**, Michael P. Dessauer, Louisiana Tech Univ. (USA) [8059-03]

2:50 pm: **Multisensor registration using correlation-based, mutual information-based and scale invariant feature transform (SIFT) algorithms**, Yang Xu, Wright State Univ. (USA) [8059-04]

Coffee Break 3:10 to 3:40 pm

3:40 pm: **Boresight calibration of the aerial multi-head camera system**, Alper Yilmaz, Young-Jin Lee, The Ohio State Univ. (USA) [8059-05]

4:00 pm: **Initial data sampling in high dimensional design optimization**, Hugh L. Southall, Teresa H. O'Donnell, Air Force Research Lab. (USA) [8059-06]

4:20 pm: **A robust regularization algorithm for polynomial networks for machine learning**, Holger M. Jaenisch, Licht Strahl Engineering, Inc. (USA) and The Johns Hopkins Univ. (USA); James W. Handley, Licht Strahl Engineering, Inc. (USA) [8059-07]

4:40 pm: **A scaled, performance driven evaluation of the layered-sensing framework utilizing polarimetric infrared imagery**, Hamilton S. Clouse, Hamid Krim, North Carolina State Univ. (USA); Olga Mendoza-Schrock, Air Force Research Lab. (USA) [8059-08]

Thursday 28 April

SESSION 3

Room: San Francisco Thurs. 8:40 to 9:20 am

Keynote Session II

Session Chair: **Misty Blowers**, Air Force Research Lab. (USA)

8:20 am: **The knowledge instinct and the mathematical implementation of the mechanisms of the mind** (Keynote Presentation), Leonid I. Perlovsky, Air Force Research Lab. (USA) [8059-09]

SESSION 4

Room: San Francisco Thurs. 9:20 to 11:30 am

Knowledge Extraction

Session Chairs: **John Spina**, Air Force Research Lab. (USA); **Peter M. LaMonica**, Air Force Research Lab. (USA)

9:20 am: **Categorification of the layered sensing construct**, Jared L. Culbertson, Air Force Research Lab. (USA); Mark E. Oxley, Air Force Institute of Technology (USA); Steven K. Rogers, Air Force Research Lab. (USA); Kirk Sturtz, Universal Mathematics (USA) [8059-10]

9:40 am: **Cross layers decision fusion model in layered sensing systems**, Saleh Zein-Sabatto, Abduliqadir Khoshnaw, Sachin Shetty, Mohan Malkani, Tennessee State Univ. (USA); Atindra K. Mitra, Air Force Research Lab. (USA) [8059-11]

10:00 am: **Wide-threat detection: recognition of adversarial missions and activity patterns in Empire Challenge 2009**, Georgiy M. Levchuk, Charlotte Shabarekh, Caitlin Furjanic, Aptima Inc. (USA) [8059-12]

Coffee Break 10:20 to 10:50 am

10:50 am: **Semi-supervised learning approach for event detection**, Misty Blowers, Air Force Research Lab. (USA) [8059-13]

11:10 am: **Intelligent information dissemination to hand-held devices**, John Spina, Air Force Research Lab. (USA) [8059-14]

SESSION 5

Room: San Francisco Thurs. 11:30 am to 12:10 pm

Medical Imaging

Session Chair: **Frank W. Moore**, Univ. of Alaska Anchorage (USA)

11:30 am: **Graph-visualization techniques for representing glycomic response in GSC11 glioblastoma cells**, Anke D. Meyer-Bäse, The Florida State Univ. (USA) [8059-16]

11:50 am: **Improved computer-aided diagnosis for breast lesions in DCE-MRI based on motion artifact removal and integration of morphologic and dynamic information**, Anke D. Meyer-Bäse, The Florida State Univ. (USA) [8059-17]

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

SESSION 6

Room: San Francisco Thurs. 1:40 to 3:00 pm

Image Intelligence

Session Chair: Frank W. Moore, Univ. of Alaska Anchorage (USA)

- 1:40 pm: **Evolving wavelet and scaling numbers for optimized image compression: forward, inverse, or both? A comparative study**, Frank W. Moore, Brendan J. Babb, Shawn Aldridge, Univ. of Alaska Anchorage (USA); Michael R. Peterson, Univ. of Hawai'i (USA) [8059-18]
- 2:00 pm: **Evolving matched filter transform pairs for satellite image processing**, Michael R. Peterson, Toby Horner, Univ. of Hawai'i (USA); Frank W. Moore, Univ. of Alaska Anchorage (USA) [8059-19]
- 2:20 pm: **Image sets for satellite image processing systems**, Michael R. Peterson, Toby Horner, Asael Temple, Univ. of Hawai'i (USA) [8059-20]
- 2:40 pm: **Evolving point-cloud features for gender discrimination**, Brittany Keen, Aaron Fouts, Mateen M. Rizki, Louis A. Tamburino, Wright State Univ. (USA); Olga Mendoza-Schrock, Air Force Research Lab. (USA) [8059-21]
- Coffee Break 3:00 to 3:30 pm

SESSION 7

Room: San Francisco Thurs. 3:30 to 4:30 pm

Computer/Network Security

Session Chair: Misty Blowers, Air Force Research Lab. (USA)

- 3:30 pm: **Behavioral analysis of malicious code through network traffic and system call monitoring**, André R. A. Gregio, Dario S. Fernandes Filho, Vitor M. Afonso, Ctr. de Tecnologia da Informação Renato Archer (Brazil) and Univ. Estadual de Campinas (Brazil); Rafael D. Coelho dos Santos, Instituto Nacional de Pesquisas Espaciais (Brazil); Mario Jino, Paulo L. de Geus, Univ. Estadual de Campinas (Brazil) [8059-22]
- 3:50 pm: **An adaptive neural swarm approach for intrusion defense in ad hoc networks**, James D. Cannady, Nova Southeastern Univ. (USA) [8059-23]
- 4:10 pm: **Combined bio-inspired/evolutionary computational methods in cross-layer protocol optimization for wireless ad hoc sensor networks**, William S. Hortos, Jr., Associates in Communications Engineering Research and Technology (USA) [8059-24]

Modeling and Simulation for Defense Systems and Applications VI

Conference Chair: **Eric J. Kelmelis**, EM Photonics, Inc. (USA)

Program Committee: **James N. Elele**, Naval Air Systems Command (USA); **Susan Harkrider**, U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Alex F. Sisti**, Air Force Research Lab. (USA); **David J. Thornley**, Imperial College London (United Kingdom); **Dawn A. Trevisani**, Air Force Research Lab. (USA)

Tuesday 26 April

Symposium-Wide Plenary Session

Tuesday • 8:30 to 9:30 am • Location: Crystal H

Dr. Regina E. Dugan

Director, Defense Advanced Research Projects Agency (DARPA)

See page 18 for details • Open to All Attendees

Coffee Break 9:30 to 10:30 am

SESSION 1

Room: San Francisco Tues. 10:30 to 11:50 am

Tools and Techniques

Session Chair: **Ahmed S. Sharkawy**, Lumilant, Inc. (USA)

10:30 am: **A high-performance computing framework for physics-based modeling and simulation of the mobility of military ground vehicles**, Dan Negrut, Univ. of Wisconsin-Madison (USA); David Lamb, David Gorsich, U.S. Army Tank Automotive Research, Development and Engineering Ctr. (USA) [8060-01]

10:50 am: **Rolling partial prefix-sums to speedup evaluation of uniform and affine recurrence equations**, Narayan Ganesan, Univ. of Delaware (USA) and Washington Univ. in St. Louis (USA); Roger D. Chamberlin, Jeremy Buhler, Washington Univ. in St. Louis (USA); Michela Taufer, Univ. of Delaware (USA) [8060-02]

11:10 am: **Accelerating sparse linear algebra using graphics processing units**, Kyle Spagnoli, John R. Humphrey, Jr., Daniel Price, Eric J. Kelmelis, EM Photonics, Inc. (USA) [8060-03]

11:30 am: **High-level GPU computing with jacket: for MATLAB and C/C++**, Gallagher Pryor, Brett Lucey, Pavan Yalamanchili, Chris McClanahan, James Malcolm, AccelerEyes LLC (USA) [8060-04]

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

SESSION 2

Room: San Francisco Tues. 1:30 to 3:10 pm

Sensors and Imaging

Session Chair: **Narayan Ganesan**, Univ. of Delaware (USA)

1:30 pm: **Roles and assessment methods for models of sensor data exploitation algorithms**, Adam R. Nolan, Etegent Technologies, Ltd. (USA); Timothy D. Ross, Lloyd G. Clark, Air Force Research Lab. (USA) [8060-05]

1:50 pm: **Multiframe atmospheric compensation under moving camera conditions**, Aaron L. Paolini, Daniel Price, Fernando Ortiz, EM Photonics, Inc. (USA) [8060-06]

2:10 pm: **Power versus performance tradeoffs of GPU-accelerated backprojection-based synthetic aperture radar image processing**, Ricardo Portillo, Sarala Arunagiri, Patricia Teller, The Univ. of Texas at El Paso (USA); Joseph C. Deroba, U.S. Army CERDEC Intelligence and Information Warfare Directorate (USA); Lam H. Nguyen, Song J. Park, Dale R. Shires, U.S. Army Research Lab. (USA) [8060-07]

2:30 pm: **A hardware-in-the-loop simulation program for ground-based radar**, Eric P. Lam, Thales-Raytheon Systems Co. LLC (USA) [8060-08]

2:50 pm: **An agile acquisition decision-support workbench for evaluating ISR effectiveness**, Daniel W. Stouch, Charles River Analytics, Inc. (USA); Valerie Champagne, PatchPlus Consulting (USA); Christopher P. Mow, Brad Rosenberg, Charles River Analytics, Inc. (USA) [8060-09]

Coffee Break 3:10 to 3:40 pm

SESSION 3

Room: San Francisco Tues. 3:40 to 5:00 pm

Physics-Based Simulations

Session Chair: **Aaron L. Paolini**, EM Photonics, Inc. (USA)

3:40 pm: **Electrically tuned slow light-based coupled photonic crystal waveguides using a laterally doped p-i-n junction**, Ahmed S. Sharkawy, Lumilant, Inc. (USA); Mathew J. Zablocki, David Grund, Dennis W. Prather, Univ. of Delaware (USA) [8060-10]

4:00 pm: **Modeling of hybrid organic/inorganic dual RF-photonic slot waveguide modulator**, Shouyuan Shi, Univ. of Delaware (USA); Ahmed S. Sharkawy, Lumilant, Inc. (USA); Mathew J. Zablocki, Lumilant, Inc. (USA); Dennis W. Prather, Univ. of Delaware (USA) [8060-11]

4:20 pm: **Reconfigurable chip-scale optical router**, Ahmed S. Sharkawy, Lumilant, Inc. (USA); Mathew J. Zablocki, Dennis W. Prather, Univ. of Delaware (USA) [8060-12]

4:40 pm: **Advances in computational fluid dynamics solvers for the GPU**, John R. Humphrey, Jr., Dan Hertenstein, Eric J. Kelmelis, EM Photonics, Inc. (USA) [8060-13]

POSTERS—Tuesday

Room: Crystal M Tues. 6:00 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. 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 pm 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.

Naval Electronic Warfare Simulation for effectiveness assessment and softkill programmability facility, Fabienne Lancon, SAGEM SA (France) [8060-22]

Implementation and research of the linkage IDS based on Windows XP, Peili Qiao, Harbin Univ. of Science and Technology (China) [8060-23]

An efficient geometric computation for ladar simulation, Seran Hwang, Seongjoon Kim, Impyeong Lee, The Univ. of Seoul (Korea, Republic of) . [8060-24]

Wednesday 27 April

SESSION 4

Room: San Francisco Wed. 8:20 to 10:00 am

Battlefield Simulation and Cyber Warfare

Session Chair: Daniel Mackrides,
Phase Sensitive Innovations, Inc. (USA)

8:20 am: **Automation of air defence commander using Bayesian decision trees**, Ali Hilal Ali, Garik Markarian, Lancaster Univ. (United Kingdom); Alex Tarter, Ultra Electronics (United Kingdom); Rainer Koelle, European Organisation for the Safety of Air Navigation (Belgium). [8060-14]

8:40 am: **Improving representation of situational awareness in constructive combat simulation**, Kangjin D. Lee, Micheal Colony, Decisive Analytics Corp. (USA) [8060-15]

9:00 am: **Simulating cyber warfare and cyber defenses: information value considerations**, Martin R. Stytz, Sheila B. Banks, Calculated Insight (USA) [8060-16]

9:20 am: **Advancing bot army simulation techniques for simulation environments**, Sheila B. Banks, Martin R. Stytz, Calculated Insight (USA) [8060-17]

9:40 am: **The National Operational Environment Model (NOEM)**, John J. Salerno, Jr., Brian C. Romano, Warren Geiler, Air Force Research Lab. (USA) [8060-18]

Coffee Break 10:00 to 10:30 am

SESSION 5

Room: San Francisco Wed. 10:30 to 11:30 am

Verification, Validation and Accreditation

Session Chair: John J. Salerno, Jr., Air Force Research Lab. (USA)

10:30 am: **Applying risk-based M&S VV&A techniques to test and laboratory facilities**, David Hall, SURVICE Engineering Co. (USA); James N. Elele, Jeremy S. Smith, Naval Air Systems Command (USA) [8060-19]

10:50 am: **Lessons learned in the process of conducting the verification and validation of live virtual and constructive distributed environment (LVC-DE)**, James N. Elele, Naval Air Systems Command (USA); David Turner, SURVICE Engineering Co. (USA). [8060-20]

11:10 am: **Utility of information**, David J. Thornley, Imperial College London (United Kingdom). [8060-21]

PANEL DISCUSSION

Room: San Francisco. Wed. 11:30 am to 12:10 pm

Verification, Validation and Accreditation

Panel Moderators: James N. Elele, Naval Air Systems Command (USA);
David J. Thornley, Imperial College London (United Kingdom)



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Conference 8061 • Room: Grand 4

Thursday-Friday 28-29 April 2011 • Proceedings of SPIE Vol. 8061

Wireless Sensing, Localization, and Processing VI

Conference Chairs: **Sohail A. Dianat**, Rochester Institute of Technology (USA); **Michael D. Zoltowski**, Purdue Univ. (USA)

Program Committee: **Moeness G. Amin**, Villanova Univ. (USA); **John W. Nieto**, Harris Corp. (USA); **Raghuveer M. Rao**, Rochester Institute of Technology (USA); **Yimin D. Zhang**, Villanova Univ. (USA)

Thursday 28 April

SESSION 1

Room: Grand 4. Thurs. 8:30 to 10:10 am

Sensor Networks

Session Chair: **John W. Nieto**, Harris Corp. (USA)

8:30 am: **Wireless sensor network for sniper detection: experiment and simulation**, Armin L. Schneider, Martin Laurenzis, Sébastien Hengy, Institut Franco-Allemand de Recherches de Saint-Louis (France) [8061-01]

8:50 am: **Ant-based power efficient, adaptive, reliable, and load balanced (A-PEARL) routing for smart metering networks**, Rajani Muraleedharan-Sreekumaridevi, Syracuse Univ. (USA) [8061-02]

9:10 am: **Optimization of the relay position and resource allocation in cooperative broadcast wireless networks**, Ying Jin, Yimin D. Zhang, Villanova Univ. (USA) [8061-03]

9:30 am: **Adaptive beamforming and rate control in real-time wireless sensor networks for QoS optimization**, William S. Hortos, Jr., Associates in Communications Engineering Research and Technology (USA) [8061-04]

9:50 am: **Sensor deployment optimization based on optimal recovery interpolation**, Sergio D. Cabrera, Veenarai Moram, Jose G. Rosiles, The Univ. of Texas at El Paso (USA) [8061-05]

Coffee Break 10:10 to 10:40 am

SESSION 2

Room: Grand 4. Thurs. 10:40 am to 12:00 pm

Modulation and Channel Estimation

Session Chair: **Yimin D. Zhang**, Villanova Univ. (USA)

10:40 am: **Performance evaluation of CCI on the reverse CDMA channel**, Salim Alsharif, Mohammad S. Alam, Univ. of South Alabama (USA) [8061-06]

11:00 am: **Equalisation for continuous phase modulation using basis functions**, Colin Brown, Phil Vigneron, Communications Research Ctr. Canada (Canada) [8061-07]

11:20 am: **Iterative detection of continuous phase modulation on multipath channels**, John W. Nieto, Harris Corp. (USA) [8061-08]

11:40 am: **Application and analysis of rake receiver to hybrid CPM modulation**, James A. Norris, Harris Corp. (USA) [8061-09]

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

SESSION 3

Room: Grand 4. Thurs. 1:30 to 3:10 pm

Detection and Localization I

Session Chair: **Sohail A. Dianat**, Rochester Institute of Technology (USA)

1:30 pm: **Location-dependent RF geotags for positioning and security**, Di Qiu, Sigtem Technology, Inc. (USA); Robert S. Lynch, Jr., Naval Undersea Warfare Ctr. (USA); Chun Yang, Sigtem Technology, Inc. (USA) [8061-10]

1:50 pm: **Single-node MMSE for MMSE cooperative positioning**, Songnan Xi, Michael D. Zoltowski, Purdue Univ. (USA); Yao Zhao, Liang Dong, Western Michigan Univ. (USA) [8061-11]

2:10 pm: **A novel grid density-based geolocation algorithm for noncooperative radio emitters using power difference of arrival**, Shanzeng Guo, Brad R. Jackson, Sichun Wang, Defence Research and Development Canada (Canada); William Arnold, Univ. of Waterloo (Canada); Robert Inkol, Defence Research and Development Canada (Canada) [8061-12]

2:30 pm: **Low-complexity narrowband adaptive beamforming based on symmetrically distributed arrays**, Lei Zhang, Wei Liu, Richard J. Langley, The Univ. of Sheffield (United Kingdom) [8061-13]

2:50 pm: **A spatial filtering approach to electronic wideband beam steering**, Wei Liu, The Univ. of Sheffield (USA); Dennis R. Morgan, Alcatel-Lucent Bell Labs. (USA) [8061-14]

Coffee Break 3:10 to 3:40 pm

SESSION 4

Room: Grand 4. Thurs. 3:40 to 4:20 pm

Detection and Localization II

Session Chair: **Raghuveer M. Rao**, Rochester Institute of Technology (USA)

3:40 pm: **Source location detection using unique characterizations of multipath propagation in an urban environment**, Brian R. Phelan, Ram M. Narayanan, Erik H. Lenzing, The Pennsylvania State Univ. (USA) [8061-15]

4:00 pm: **Accurate position service based on interacting multiple model with enhanced Kalman filter**, Jun Li, Yuan Cao, Nan Wu, Nanjing Univ. (China); Xiangdong Li, New York City College of Technology (USA) [8061-16]

Friday 29 April

SESSION 5

Room: Grand 4. Fri. 8:30 to 10:10 am

Implementation and Application

Session Chair: **Fred C. Kellerman**, Harris Corp. (USA)

8:30 am: **Navigation of robotic systems using cricket motes**, Yogendra Patil, Kuldip S. Rattan, Nicholas A. Baine, Wright State Univ. (USA) [8061-17]

8:50 am: **An improved antenna circuit model utilizing a transmission line**, Allen Hollister, Physical Optics Corp. (USA); John T. Armstrong, Probe Science, Inc. (USA) [8061-18]

9:10 am: **Robust visible light communications system using filter-based sensor array**, Cheng-Chun Chang, Yuan-Jun Su, National Taipei Univ. of Technology (Taiwan); Umpei Kurokawa, Byung Il Choi, nanoLambda (USA) [8061-19]

9:30 am: **INS aided by an acoustic wireless sensor network and magnetometer**, Nicholas A. Baine, Pratikumar U. Desai, Kuldip S. Rattan, Wright State Univ. (USA) [8061-20]

9:50 am: **Performance of concatenated convolutional codes with differential modulations: coherent versus non-coherent**, Fred C. Kellerman, Harris Corp. (USA) [8061-21]

Coffee Break 10:10 to 10:40 am

SESSION 6

Room: Grand 4. Fri. 10:40 to 11:20 am

Diversity and Multicarrier Techniques

Session Chair: **Michael D. Zoltowski**, Purdue Univ. (USA)

10:40 am: **Sensing using eigenchannels in RF MIMO communication systems**, Nicolas Bikhazi, Sandia National Labs. (USA); William F. Young, National Institute of Standards and Technology (USA); Hung D. Nguyen, Sandia National Labs. (USA) [8061-22]

11:00 am: **Computation-efficient blind estimation of OFDM signal parameters for interception and data recovery**, Qian Chen, Xianbin Wang, Dian Fan, The Univ. of Western Ontario (Canada); Shanzeng Guo, Defence Research and Development Canada (Canada) [8061-23]

Conference 8062 • Room: Los Angeles

Thurs: Grand 3 (Joint Session)

Wednesday-Thursday 27-28 April 2011 • Proceedings of SPIE Vol. 8062

Defense Transformation and Net-Centric Systems 2011

Conference Chair: **Raja Suresh**, General Dynamics Advanced Information Systems (USA)

Program Committee: **Keith Arthur**, U.S. Army Aviation Applied Technology Directorate (USA); **Vasu D. Chakravarthy**, Air Force Research Lab. (USA); **Melanie Dumas**, Defense Advanced Research Projects Agency (USA); **John S. Eicke**, U.S. Army Research Lab. (USA); **Paul Gaertner**, Embassy of Australia (USA); **Gayle D. Grant**, U.S. Army Communications-Electronics Command (USA); **Michael A. Kolodny**, U.S. Army Research Lab. (USA); **James R. Milligan**, Air Force Research Lab. (USA); **Leo J. Rose**, U.S. Air Force (USA); **Larry B. Stotts**, Defense Advanced Research Projects Agency (USA); **Venkataraman Sundareswaran**, Teledyne Scientific Co. (USA); **Guy Vézina**, Defence Research and Development Canada (Canada)

Wednesday 27 April

SESSION 1

Room: Los Angeles Wed. 8:20 to 10:00 am

Net-Centric Architectures and Information Management Services

Session Chairs: **James R. Milligan**, Air Force Research Lab. (USA); **Paul Gaertner**, Embassy of Australia (USA)

8:20 am: **VFILM: a value function driven approach to information lifecycle management**, Jeffrey Cleveland, Joseph P. Loyall, Jonathan Webb, BBN Technologies (USA); James Hanna, Air Force Research Lab. (USA) [8062-01]

8:40 am: **Evaluating QoS-enabled information management services in a Navy operational context**, Aaron Paulos, Joseph P. Loyall, Matthew Gillen, BBN Technologies (USA); Asher Sinclair, Air Force Research Lab. (USA) [8062-02]

9:00 am: **An enterprise service set for adaptive role-relevant operational displays**, John D. Zaiantz, Soar Technology, Inc. (USA); Michael Hultner, Lockheed Martin Orincon (USA); David Ray, Laura Hamel, Soar Technology, Inc. (USA) [8062-03]

9:20 am: **Net-centric interoperability**, Mark T. Sevening, The Boeing Co. (USA) [8062-04]

9:40 am: **SMASHUP: secure mashup for defense transformation and net-centric systems**, Mark D. Heileman, Modus Operandi, Inc. (USA); Gregory L. Heileman, The Univ. of New Mexico (USA); Matthew P. Shaver, Air Force Research Lab. (USA); Mike D. Gilger, Modus Operandi, Inc. (USA); John Benner, Jr., Booz Allen Hamilton Inc. (USA) [8062-05]

Coffee Break 10:00 to 10:30 am

CROSS-CONFERENCE HOT TOPIC PANEL

Room: Crystal M. Wed. 10:30 am to 12:30 pm

Data to Decisions: "Sensors are No Longer King"

Moderator: **John M. Pellegrino**, Director, U.S. Army Research Lab., (Computational & Information Sciences Directorate (CISD) (USA)

This cross-conference hot topic provides a unique forum for senior leaders from different organizational perspectives to discuss the shifting paradigm of what is needed to achieve the required situational understanding to make the best actionable battlefield decisions. We need to get away from the "autistic" view of sensing and learn to integrate other non-traditional information sources including HUMINT, cultural understanding, social networks, policies and behavior modeling.

Identifying the Technology Needs from a Holistic Perspective

See page 21 for details.

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

SESSION 2

Room: Los Angeles Wed. 1:30 to 5:40 pm

ISR Systems and Fusion

Session Chairs: **Raja Suresh**, General Dynamics Advanced Information Systems (USA); **Larry B. Stotts**, Defense Advanced Research Projects Agency (USA)

1:30 pm: **Issues in defense innovation (Invited Paper)**, Arun Seraphin, Office of Science and Technology Policy (USA) [8062-06]

1:55 pm: **Gotcha radar update (Invited Paper)**, Michael L. Bryant, Air Force Research Lab. (USA) [8062-07]

2:20 pm: **Adaptive radar (Invited Paper)**, Muralidhar Rangaswamy, Air Force Research Lab. (USA) [8062-08]

2:45 pm: **Developing an open architecture (OA) roadmap and defining OA levels (Invited Paper)**, Megan Cramer, U.S. Navy (USA); Brett Cordes, Naval Surface Warfare Ctr. Panama City Div. (USA); Jason R. Stack, Office of Naval Research (USA) [8062-09]

Coffee Break 3:10 to 3:40 pm

3:40 pm: **Improving network utilization over heterogeneous airborne networks**, Brent Rickenbach, General Dynamics Advanced Information Systems (USA) [8062-10]

4:00 pm: **Vision and critical challenges in exploiting distributed data for distributed decision making**, Gavin Pearson, Defence Science and Technology Lab. (United Kingdom) [8062-11]

4:20 pm: **A multi-agent infrastructure for hard and soft information fusion**, Jeffrey C. Rimland, David L. Hall, The Pennsylvania State Univ. (USA) . . [8062-12]

4:40 pm: **3DSF: three-dimensional spatiotemporal fusion**, Richard L. Tutwiler, Donald J. Natale, Matthew S. Baran, David L. Hall, The Pennsylvania State Univ. (USA) [8062-13]

5:00 pm: **A new synthetic dataset for evaluating soft and hard fusion algorithms**, Jake Graham, David L. Hall, Jeffrey C. Rimland, The Pennsylvania State Univ. (USA) [8062-14]

5:20 pm: **JDL level 0 and 1 algorithms for processing and fusion of hard sensor data**, Jeffrey C. Rimland, Ganesh M. Iyer, Rachana R. Agumamidi, Soumya V. Pisupati, Jake Graham, The Pennsylvania State Univ. (USA) . [8062-15]

Conference 8062 • Thurs: Grand 3 (Joint Session)

Thursday 28 April

SESSION 3

Room: Grand 3. Thurs. 8:00 to 10:00 am

Joint Session with Conference 8045

Self-Organizing, Collaborative, and Unmanned ISR Robots

Session Chairs: **Melanie Dumas**, Defense Advanced Research Projects Agency (USA); **Grant R. Gerhart**, U.S. Army Tank Automotive Research, Development and Engineering Ctr.-Retired (USA)

8:00 am: **Biologically-inspired approaches for self-organization, adaptation, and collaboration of heterogeneous autonomous systems**, Marc L. Steinberg, Office of Naval Research (USA). [8062-16]

8:20 am: **Migration strategies for service-enabling ground control stations for unmanned systems**, Joseph B. Kroclic, Winifred Associates (USA). . . [8062-17]

8:40 am: **JEFX 10 demonstration of cooperative hunter killer UAS and upstream data fusion**, Brian K. Funk, Andrew J. Newman, Jonathan C. Castelli, Adam S. Watkins, Christopher B. McCubbin, Jeffrey D. Barton, Cameron K. Peterson, Jonathan T. DeSena, Daniel A. Dutrow, Pedro A. Rodriguez, Steven J. Marshall, The Johns Hopkins Univ. (USA). [8045-09]

9:00 am: **Dynamic replanning on demand of UAS constellations performing ISR missions**, Daniel W. Stouch, Ernest Zeidman, William Callahan, Charles River Analytics, Inc. (USA); Kirk McGraw, U.S. Army Engineer Research and Development Ctr. (USA); Joshua Serrin, Charles River Analytics, Inc. (USA). [8045-11]

9:20 am: **All weather sense and avoid system (AWSAS) for all UAS and manned platforms**, Vincent M. Contarino, R-Cubed Engineering, LLC (USA). [8045-13]

9:40 am: **Autonomous sustain and resupply: what is the future?**, Gregory S. Broten, Defence Research and Development Canada (Canada) [8045-29]

Coffee Break 10:00 to 10:30 am

SESSION 4

Room: Grand 1. Thurs. 10:30 am to 12:30 pm

Joint Session with Conference 8047

Sensor Networks and Wide Area Persistent Surveillance

Session Chairs: **Leo J. Rose**, U.S. Air Force (USA); **Michael A. Kolodny**, U.S. Army Research Lab. (USA)

10:30 am: **Bio-inspired UAV routing, source localization, and acoustic signature classification for persistent surveillance**, Jerry A. Burman, Teledyne Scientific Co. (USA); Joao P. Hespanha, Upamanyu Madhow, Daniel J. Klein, Univ. of California, Santa Barbara (USA); Tien Pham, U.S. Army Research Lab. (USA). [8047-36]

10:50 am: **Trident Spectre 2010: agile integration and demonstration of a multisensor airborne pod**, Greg Twaites, Brent Rickenbach, General Dynamics Advanced Information Systems (USA) [8062-18]

11:10 am: **Sensor and information fusion for enhanced detection, classification, and localization**, Michael V. Scanlon, William D. Ludwig, U.S. Army Research Lab. (USA) [8047-39]

11:30 am: **Discovering geospatial networks from ambiguous track data**, James E. Bevington, General Dynamics Advanced Information Systems (USA); Michael Evans, Shashi Shekhar, Univ. of Minnesota, Twin Cities (USA) . [8062-19]

11:50 am: **A Bayesian formulation for auction-based task allocation in heterogeneous, multi-agent teams**, Charles E. Pippin, Georgia Tech Research Institute (USA); Henrik I. Christensen, Georgia Institute of Technology (USA). [8047-38]

12:10 pm: **Network exploitation using WAMI tracks**, Raymond D. Rimey, Dan Keefe, Jim N. Record, Lockheed Martin Corp. (USA); Levi Kennedy, Christopher E. Cramer, Signal Innovations Group, Inc. (USA) [8062-20]

Lunch/Exhibition Break 12:30 to 1:40 pm

SESSION 5

Room: Los Angeles Thurs. 1:40 to 4:50 pm

Communications and Networks

Session Chairs: **Vasu D. Chakravarthy**, Air Force Research Lab. (USA); **Gayle D. Grant**, Consultant (USA)

1:40 pm: **The effects of synthetically augmented training data on parameter tuning for anomaly detection algorithms**, Joseph Natarian, Leonard Lightfoot, Ellen Laubie, Air Force Research Lab. (USA) [8062-21]

2:00 pm: **Strategy for wireless integration into U.S. Army tactical networks**, Frederick R. Carlson, U.S. Army Battle Command Battle Lab.-Gordon (USA) [8062-22]

2:20 pm: **Potential game models for efficient resource allocation in wireless networks**, Yenumula B. Reddy, Grambling State Univ. (USA) [8062-23]

2:40 pm: **Fast detection of network intrusion**, Xinjia Chen, Ernest L. Walker, Southern Univ. and A&M College (USA) [8062-24]

Coffee Break 3:00 to 3:30 pm

3:30 pm: **Analyzing the requirements for a robust security criteria and management of multilevel security in the clouds**, Bassam S. Farroha, U.S. Dept. of Defense (USA) and The Johns Hopkins Univ. (USA); Deborah L. Farroha, U.S. Dept. of Defense (USA) [8062-25]

3:50 pm: **A novel approach to implementing a comprehensive digital policy management as an enabler for dynamic secure information sharing**, Bassam S. Farroha, Northrop Grumman Electronic Systems (USA); Deborah L. Farroha, U.S. Dept. of Defense (USA) [8062-26]

4:10 pm: **Agile enterprise development framework: utilizing services principles for building pervasive security in the enterprise**, Deborah L. Farroha, U.S. Dept. of Defense (USA); Bassam S. Farroha, Northrop Grumman Electronic Systems (USA) [8062-27]

4:30 pm: **Single-ended IP roaming solution for dynamic network reconstruction**, Joshua S. White, Adam W. Pilbeam, Joe McCoy, Everis, Inc. (USA) [8062-28]

Mobile Multimedia/Image Processing, Security, and Applications 2011

Conference Chairs: **Sos S. Agaian**, The Univ. of Texas at San Antonio (USA); **Sabah A. Jassim**, Univ. of Buckingham (United Kingdom); **Eliza Yingzi Du**, Indiana Univ.-Purdue Univ. Indianapolis (USA)

Program Committee: **Farid Ahmed**, The Johns Hopkins Univ. (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 Dietze**, Consultant (Germany); **Frederic Dufaux**, Ecole Polytechnique Fédérale de Lausanne (Switzerland); **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 Maknivicus**, TELECOM & Management SudParis (France); **Alessandro Neri**, Univ. degli Studi di Roma Tre (Italy); **Salil Prabhakar**, DigitalPersona, Inc. (USA); **Cheryl L. Resch**, The Johns Hopkins Univ. (USA); **Sonia Garcia-Salicetti**, Telecom ParisTech (France); **Harin Sellahewa**, Univ. of Buckingham (United Kingdom); **Xiyu Shi**, Univ. of Surrey (United Kingdom); **Yuri Shukuryan**, National Academy of Sciences of Armenia (Armenia)

Monday 25 April

SESSION 1

Room: San Antonio Mon. 8:00 to 10:00 am

Information/Image Security I

Session Chairs: **Sabah A. Jassim**, Univ. of Buckingham (United Kingdom); **Reiner Creutzburg**, Fachhochschule Brandenburg (Germany)

8:00 am: **Video scrambling for privacy protection in video surveillance: recent results and validation framework** (*Invited Paper*), Frederic Dufaux, Telecom ParisTech (France) [8063-01]

8:30 am: **Ensuring security of H.264 videos by using watermarking** (*Invited Paper*), Marc Chaumont, Lab. d'Informatique de Robotique et de Microelectronique de Montpellier (France) [8063-02]

9:00 am: **Novel technology for enhanced security and trust in communication networks**, Alexander Milovanov, Leonid Bukshpun, Ranjit Pradhan, Tomasz Jansson, Physical Optics Corp. (USA) [8063-03]

9:20 am: **System for nondisruptive high-capacity indexed data embedding and recovery using multimedia signal covers**, James C. Collins, The Univ. of Texas at San Antonio (USA) [8063-04]

9:40 am: **Establishing trust in decentralized smart sensor networks**, Hauke Vagts, Taner Cosar, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany) [8063-05]

Coffee Break 10:00 to 10:30 am

SESSION 2

Room: San Antonio Mon. 10:30 am to 12:20 pm

Multimedia Signal Processing Algorithms and Systems

Session Chairs: **Sos S. Agaian**, The Univ. of Texas at San Antonio (USA); **Salim Alsharif**, Univ. of South Alabama (USA)

10:30 am: **Maximizing gain to time-cost of human-machine interactive decision-making under asymmetrical time constraints** (*Invited Paper*), Hideyasu Sasaki, Ritsumeikan Univ. (Japan) and Keio Univ. (Japan) [8063-47]

11:00 am: **An adaptive LMS technique for wavelet polynomial threshold denoising**, David Akopian, Sushanth G. Sathyanarayana, Sos S. Agaian, The Univ. of Texas at San Antonio (USA) [8063-06]

11:20 am: **Accuracy, security, and processing time comparisons of biometric fingerprint recognition system using digital and optical enhancements**, Salim Alsharif, Aed M. El-Saba, Univ. of South Alabama (USA) [8063-07]

11:40 am: **Arabic handwritten baseline estimation, slope correction, and document segmentation into sub-words**, Makki Maliki, Sabah A. Jassim, Harin Sellahewa, Naseer Al-Jawad, Univ. of Buckingham (United Kingdom) [8063-08]

12:00 pm: **Remote object authentication against counterfeiting using elliptic curves**, Jean Lancrenon, Roland D. Gillard, Univ. Joseph Fourier (France); Thierry Fournel, Univ. Jean Monnet Saint-Etienne (France) [8063-09]

Lunch Break 12:20 to 1:50 pm

SESSION 3

Room: San Antonio Mon. 1:50 to 3:20 pm

Mobile Applications

Session Chairs: **Sos S. Agaian**, The Univ. of Texas at San Antonio (USA); **Dalton S. Rosario**, U.S. Army Research Lab. (USA)

1:50 pm: **Smart compression using high-dimensional imagery** (*Invited Paper*), Dalton S. Rosario, U.S. Army Research Lab. (USA) [8063-10]

2:20 pm: **Multitemplate image matching using alpha-rooted biquaternion phase correlation with application to logo recognition**, Stephen P. DelMarco, BAE Systems (USA) [8063-11]

2:40 pm: **Parallel design patterns for a low-power, software defined compressed video encoder**, Michael W. Bruns, Martin A. Hunt, Coherent Logix, Inc. (USA); Nageswara R. Gunupudi, Sekar Sonachalam, Parallel Prisms (USA) [8063-12]

3:00 pm: **A fast, efficiency-preserving system for simultaneous compression and encryption**, Richard Metzler, Sos S. Agaian, The Univ. of Texas at San Antonio (USA) [8063-13]

Coffee Break 3:20 to 3:50 pm

SESSION 4

Room: San Antonio Mon. 3:50 to 5:50 pm

Biometrics I

Session Chairs: **Eliza Yingzi Du**, Indiana Univ.-Purdue Univ. Indianapolis (USA); **Jacob Scharcanski**, Univ. Federal do Rio Grande do Sul (Brazil)

3:50 pm: **Real-time and location-secured multifactor biometrics for mCommerce authentication**, Torben Kuseler, Hisham Al-Assam, Ihsan A. Lami, Sabah A. Jassim, Univ. of Buckingham (United Kingdom) [8063-14]

4:10 pm: **Block error correction codes for face recognition**, Wafaa R. Hussein, Harin Sellahewa, Sabah A. Jassim, Univ. of Buckingham (United Kingdom) [8063-15]

4:30 pm: **Estimation of the head pose based on monocular images**, Yessenia Yari, Jacob Scharcanski, Univ. Federal do Rio Grande do Sul (Brazil) [8063-16]

4:50 pm: **A design of smart robot for human identification**, Zhi Zhou, Eliza Y. Du, Indiana Univ.-Purdue Univ. Indianapolis (USA); Edward J. Delp III, Purdue Univ. (USA) [8063-17]

5:10 pm: **A new approach for willingness test in biometric systems**, Kai Yang, Eliza Y. Du, Indiana Univ.-Purdue Univ. Indianapolis (USA) [8063-18]

5:30 pm: **Unsupervised tattoo segmentation combining bottom-up and top-down cues**, Josef D. Allen, Harris Corp. (USA) [8063-19]

Tuesday 26 April

Symposium-Wide Plenary Session

Tuesday • 8:30 to 9:30 am • Location: Crystal H

Dr. Regina E. Dugan

Director, Defense Advanced Research Projects Agency (DARPA)

See page 18 for details • Open to All Attendees

Coffee Break 9:30 to 10:00 am

SESSION 5

Room: San Antonio Tues. 10:00 am to 12:30 pm

Image/Information Security II

Session Chairs: **Sos S. Aгаian**, The Univ. of Texas at San Antonio (USA);
Erlan H. Feria, College of Staten Island (USA)

10:00 am: **iPhone forensics: an overview** (*Invited Paper*), Thomas Höne, Reiner Creutzburg, Fachhochschule Brandenburg (Germany). [8063-20]

10:30 am: **Automated detection of semagram-laden images using adaptive neural networks**, Paul Cerkez, DCS Corp. (USA) [8063-21]

10:50 am: **Rapid prototyping of an automated video surveillance system: a hardware-software co-design approach**, Hau T. Ngo, Ryan N. Rakvic, Randy P. Broussard, Robert W. Ives, U.S. Naval Academy (USA) [8063-22]

11:10 am: **System approach to steganalysis**, Josef D. Allen, Harris Corp. (USA) [8063-23]

11:30 am: **Forensic investigation of mobile phones**, Silas Luttenberger, Reiner Creutzburg, Fachhochschule Brandenburg (Germany). [8063-24]

11:50 am: **Video object trajectory perturbation-based data hiding**, Abdullah Cay, Old Dominion Univ. (USA) [8063-25]

12:10 pm: **On the novel space-time duality language of the latency information theory revolution, part I: the time-dislocation of the information-space uncertainty outputs of sources**, Erlan H. Feria, College of Staten Island (USA) [8063-26]

Lunch/Exhibition Break 12:30 to 1:50 pm

SESSION 6

Room: San Antonio Tues. 1:50 to 3:10 pm

Biometrics II

Session Chairs: **Sabah A. Jassim**, Univ. of Buckingham (United Kingdom); **Stephen P. DelMarco**, BAE Systems (USA)

1:50 pm: **Palmprint identification using FRIT**, Dakshina R. Kisku, Asansol Engineering College (India); Phalguni Gupta, Indian Institute of Technology Kanpur (India); Jamuna K. Sing, Jadavpur Univ. (India); Ajita Rattani, Univ. degli Studi di Cagliari (Italy); C. Jinshong Hwang, Texas State Univ. San Marcos (USA) [8063-27]

2:10 pm: **A secure wavelet-based isometric projection for face recognition**, Hisham Al-Assam, Harin Sellahewa, Sabah Jassim, Univ. of Buckingham (United Kingdom). [8063-28]

2:30 pm: **A three-factor challenge/response approach for remote biometric authentication**, Hisham Al-Assam, Sabah Jassim, Univ. of Buckingham (United Kingdom). [8063-29]

2:50 pm: **Palmprint verification using Lagrangian decomposition and invariant interest points**, Dakshina R. Kisku, Asansol Engineering College (India); Phalguni Gupta, Indian Institute of Technology Kanpur (India); Jamuna K. Sing, Jadavpur Univ. (India); Ajita Rattani, Univ. degli Studi di Cagliari (Italy); C. Jinshong Hwang, Texas State Univ. San Marcos (USA) [8063-30]

POSTERS—Tuesday

Room: Crystal M Tues. 6:00 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. 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 pm 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.

SIFT-based feature level fusion of face, palmprint and fingerprint biometrics using log polar transform, Dakshina R. Kisku, Asansol Engineering College (India); Phalguni Gupta, Indian Institute of Technology Kanpur (India); Jamuna K. Sing, Jadavpur Univ. (India); Ajita Rattani, Univ. degli Studi di Cagliari (Italy); C. Jinshong Hwang, Texas State Univ. San Marcos (USA) [8063-31]

PreNotiS: a case study of a mobile disaster informatics framework, David Akopian, Michael Chan, Abhinav Kumar, The Univ. of Texas at San Antonio (USA) [8063-32]

An interpolation filter based on wavelet polynomial threshold operators, David Akopian, Michael Chan, Sos S. Aгаian, The Univ. of Texas at San Antonio (USA) [8063-33]

An image similarity measure using enhanced human visual system characteristics, Shahan C. Nercessian, Karen A. Panetta, Tufts Univ. (USA); Sos S. Aгаian, The Univ. of Texas at San Antonio (USA) [8063-34]

Remote laboratory architecture for radio-communications, Arsen Melkonyan, Murillo Pontual, Grant Huang, Andreas Gampe, David Akopian, The Univ. of Texas at San Antonio (USA) [8063-35]

Image sequence enhancement based on alpha trimmed mean and histogram equalization, Josue R. Figueroa, Sos S. Aгаian, The Univ. of Texas at San Antonio (USA) [8063-36]

Empirical mode decomposition-based contrast enhancement for color images, Somayeh Bakhtiari, Sos S. Aгаian, Mo Jamshidi, The Univ. of Texas at San Antonio (USA) [8063-37]

Novel local enhancement algorithm with 3D weighted median filters for image sequences, Sos S. Aгаian, Emanuel Silva, Josue R. Figueroa, The Univ. of Texas at San Antonio (USA) [8063-38]

A polynomial threshold wavelet denoising approach for 3D biomedical applications, David Akopian, Michael Chan, Sushanth G. Sathyannarayana, Sos S. Aгаian, The Univ. of Texas at San Antonio (USA) [8063-39]

Comparative study of color image enhancement techniques, Junjun Xia, Karen A. Panetta, Tufts Univ. (USA); Sos S. Aгаian, The Univ. of Texas at San Antonio (USA) [8063-40]

Using fuzzy data mining to diagnose patients' degrees of melancholia, Yo-Ping Huang, Wen-Lin Kuo, National Taipei Univ. of Technology (Taiwan) [8063-41]

Detection of modified matrix encoding using compressed sensing, Josef D. Allen, Harris Corp. (USA) [8063-42]

On the novel space-time duality language of the latency information theory revolution, part II: the space-dislocation of the latency-time certainty inputs of movers, Erlan H. Feria, College of Staten Island (USA) [8063-43]

On the novel space-time duality language of the latency information theory revolution, part III: the time-dislocation of the information-space uncertainty outputs of retainers, Erlan H. Feria, College of Staten Island (USA) [8063-44]

On the novel space-time duality language of the latency information theory revolution, part IV: the space-dislocation of the latency-time certainty inputs of processors, Erlan H. Feria, College of Staten Island (USA) [8063-45]

A new approach for automatic human deceit detection, Jacob Norby, Eliza Y. Du, Indiana Univ.-Purdue Univ. Indianapolis (USA) [8063-46]

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Multisensor, Multisource Information Fusion: Architectures, Algorithms, and Applications 2011

Conference Chair: **Jerome J. Braun**, MIT Lincoln Lab. (USA)

Program Committee: **Sheela V. Belur**, The Van Dyke Technology Group, Inc. (USA); **D. Paul 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**, General Dynamics Armament and Technical Products (USA); **Firooz A. Sadjadi**, Lockheed Martin Maritime Systems & Sensors (USA); **Pierre Valin**, Defence Research and Development Canada (Canada); **Pramod Kumar Varshney**, Syracuse Univ. (USA); **Shanchieh Jay Yang**, Rochester Institute of Technology (USA)

Wednesday 27 April

SESSION 1

Room: San Antonio Wed. 8:40 to 10:00 am

Information Fusion Approaches and Algorithms I

Session Chairs: **Jerome J. Braun**, MIT Lincoln Lab. (USA); **Damian M. Lyons**, Fordham Univ. (USA)

8:40 am: **Image fusion for remote sensing using fast, large-scale neuroscience models**, Steven P. Brumby, Los Alamos National Lab. (USA) [8064-01]

9:00 am: **The continuum fusion theory of signal detection, with an application to multimodal fusion**, Alan P. Schaum, U.S. Naval Research Lab. (USA) [8064-02]

9:20 am: **Probabilistic inference for battle damage assessment using physics-based models**, Youngwon Shin, Applied Research Associates, Inc. (USA) [8064-03]

9:40 am: **Wavelet-based fusion of overhead imagery and digital surface models**, Alan M. Thomas, J. Michael Burkhart, Georgia Tech Research Institute (USA) [8064-04]

Coffee Break 10:00 to 10:30 am

SESSION 2

Room: San Antonio Wed. 2:00 to 3:00 pm

Information Fusion Approaches and Algorithms II

Session Chairs: **Pierre Valin**, Defence Research and Development Canada (Canada); **Charles F. Hester**, U.S. Army Research, Development and Engineering Command (USA)

2:00 pm: **Feature-aided Monte Carlo probabilistic data association filter for ballistic missile tracking**, Onur Ozdemir, ANDRO Computational Solutions, LLC (USA); Ruixin Niu, L.C. Smith College of Engineering & Computer Science of Syracuse Univ. (USA); Pramod K. Varshney, Syracuse Univ. (USA); Andrew L. Drozd, Richard Loe, ANDRO Computational Solutions, LLC (USA) [8064-05]

2:20 pm: **Architectures, algorithms, and applications using Bayesian networks**, Todd Kingsbury, General Dynamics Advanced Information Systems (USA) [8064-06]

2:40 pm: **Fusion of hyperspectral and ladar data for autonomous target detection**, Andrey V. Kanaev, Thomas J. Walls, U.S. Naval Research Lab. (USA) [8064-07]

Coffee Break 3:00 to 3:30 pm

SESSION 3

Room: San Antonio Wed. 3:30 to 4:50 pm

Information Fusion in Cognitive Robotics

Session Chairs: **Damian M. Lyons**, Fordham Univ. (USA); **D. Paul Benjamin**, Pace Univ. (USA)

3:30 pm: **A relaxed fusion of information from real and synthetic images to predict complex behavior**, Damian M. Lyons, Fordham Univ. (USA); D. Paul Benjamin, Pace Univ. (USA) [8064-08]

3:50 pm: **Inner rehearsal modeling for cognitive robotics**, Jerome J. Braun, Karianne Bergen, Timothy J. Dasey, MIT Lincoln Lab. (USA) [8064-09]

4:10 pm: **The perception problem in robotics**, Troy D. Kelley, U.S. Army Research Lab. (USA) [8064-10]

4:30 pm: **A motion writing based on perceptograms and its use in motor skill transfer**, Adrian Stoica, Jet Propulsion Lab. (USA) [8064-11]

PANEL DISCUSSION

Room: San Antonio Wed. 4:50 to 5:50 pm

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

CROSS-CONFERENCE HOT TOPIC PANEL

Room: Crystal M. Wed. 10:30 am to 12:30 pm

Data to Decisions: "Sensors are No Longer King"

Moderator: **John. M. Pellegrino**, Director, U.S. Army Research Lab., (Computational & Information Sciences Directorate (CISD) (USA)

This cross-conference hot topic provides a unique forum for senior leaders from different organizational perspectives to discuss the shifting paradigm of what is needed to achieve the required situational understanding to make the best actionable battlefield decisions. We need to get away from the "autistic" view of sensing and learn to integrate other non-traditional information sources including HUMINT, cultural understanding, social networks, policies and behavior modeling.

Identifying the Technology Needs from a Holistic Perspective

See page 21 for details.

Lunch/Exhibition Break 12:30 to 2:00 pm

Thursday 28 April

SESSION 4

Room: San Antonio Thurs. 9:00 to 10:20 am

Information Fusion Approaches and Algorithms III

Session Chairs: D. Paul Benjamin, Pace Univ. (USA); Jerome J. Braun, MIT Lincoln Lab. (USA)

9:00 am: A hidden Markov model for multimodal biometrics score fusion, Yufeng Zheng, Alcorn State Univ. (USA) [8064-12]

9:20 am: INFORM Lab: a testbed for high-level information fusion and resource management, Pierre Valin, Adel Guitouni, Eloi Bossé, Defence Research and Development Canada (Canada); Hans W. Wehn, Jens Happe, MacDonald, Dettwiler and Associates Ltd. (Canada) [8064-13]

9:40 am: Multisensor remote sensing information fusion for urban area classification and change detection, Gintautas Palubinskas, Aliaksei Makarau, Peter Reinartz, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany) [8064-14]

10:00 am: Metrics for the selection of frequency bands from hyperspectral data for image fusion and sensor development, Jack E. Fulton, Jr., Naval Surface Warfare Ctr. Crane Div. (USA) [8064-15]

Coffee Break 10:20 to 10:50 am

SESSION 5

Room: San Antonio Thurs. 10:50 to 11:50 am

Information Fusion Approaches and Algorithms IV

Session Chairs: Michael Heizmann, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany); Mirela Popa, General Dynamics Armament and Technical Products (USA)

10:50 am: Fusion of chemical, biological, and meteorological observations for agent source term estimation and hazard refinement, Paul E. Bieringer, National Ctr. for Atmospheric Research (USA) [8064-16]

11:10 am: Implementation and testing of a sensor-netting algorithm for early warning and high confidence C/B threat detection, Thomas C. Gruber, Jr., Larry B. Grim, Ryan A. Fauth, Brian M. Tercha, MESH, Inc. (USA) [8064-17]

11:30 am: Fusion of disparate spectra for chemical identification, Christian P. Minor, Nova Research, Inc. (USA); Kevin Johnson, Heather Brooke, U.S. Naval Research Lab. (USA) [8064-18]

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

SESSION 6

Room: San Antonio Thurs. 1:20 to 3:00 pm

Image Fusion

Session Chairs: Mirela Popa, General Dynamics Armament and Technical Products (USA); Pierre Valin, Defence Research and Development Canada (Canada)

1:20 pm: Learned fusion operators based on matrix completion, Charles F. Hester, Kelly K. Dobson, U.S. Army Aviation and Missile Command (USA) [8064-19]

1:40 pm: Mask pyramid methodology for enhanced localization in image fusion and enhancement, David C. Zhang, Gooitzen S. van der Wal, Sek Chai, David Berends, Azhar A. Sufi, Greg Buchanan, Michael Piacentino, Peter J. Burt, Sarnoff Corp. (USA) [8064-20]

2:00 pm: GStreamer as a framework for image processing applications in image fusion, Stephen D. Burks, Joshua M. Doe, U.S. Army Night Vision & Electronic Sensors Directorate (USA) [8064-21]

2:20 pm: Ultrasonic flaw imaging exploiting multipath information, Xizhong Shen, Shanghai Institute of Technology (China) and Villanova Univ. (USA); Yimin D. Zhang, Ramazan Demirli, Moeness G. Amin, Villanova Univ. (USA) [8064-22]

2:40 pm: A classification-based image fusion scheme using wavelet transform, Xiaoyan Luo, Jun Zhang, BeiHang Univ. (China); Qionghai Dai, Tsinghua Univ. (China) [8064-23]

Coffee Break 3:00 to 3:30 pm

SESSION 7

Room: San Antonio Thurs. 3:30 to 4:30 pm

Information Fusion Applications and Systems

Session Chairs: Charles F. Hester, U.S. Army Research, Development and Engineering Command (USA); Michael Heizmann, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany)

3:30 pm: Songs of cyberspace: an update on sonifications of network traffic to support situational awareness, Mark Ballora, Nicklaus A. Giacobe, David L. Hall, The Pennsylvania State Univ. (USA) [8064-24]

3:50 pm: Secure data aggregation in WSN-based border surveillance systems, Suat Ozdemir, Gazi Univ. (Turkey) [8064-25]

4:10 pm: Multisource information fusion for logistics, Robert Woodley, Plamen V. Petrov, Warren Noll, 21st Century Systems, Inc. (USA) [8064-26]

Course of Related Interest

SC994 Multisensor Data Fusion for Object Detection, Classification and Identification (Klein) Tuesday, 8:30 am to 5:30 pm

Visit the registration desk for course descriptions or to register

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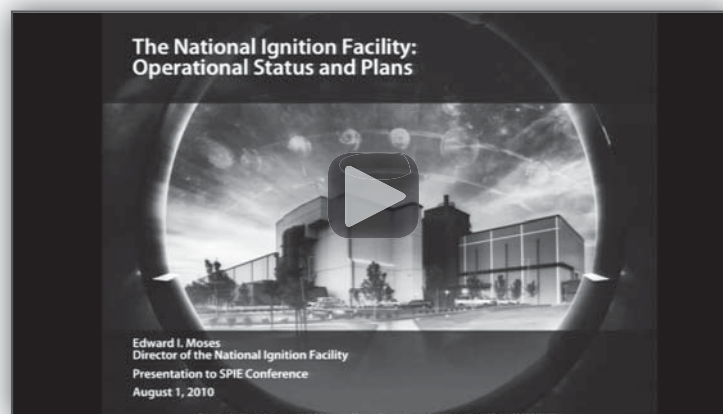
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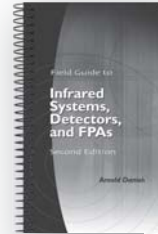
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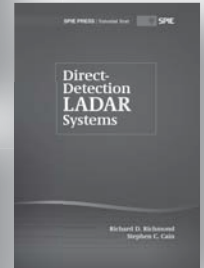


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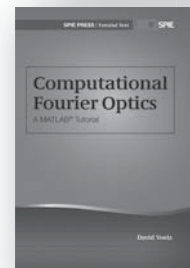
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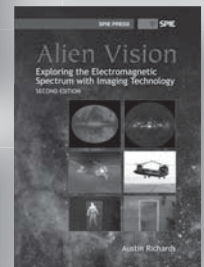
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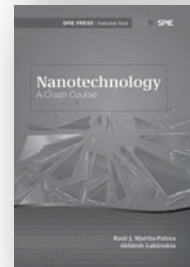
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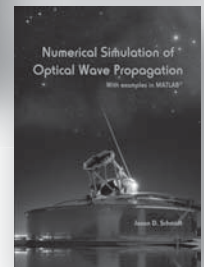
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Registration _____



Headquarters Hotel

Orlando World Center Marriott

8701 World Center Drive, Orlando, FL 32821
Phone: +1 407 239 4200 · Fax: +1 407 238 8777

Registration Hours

Orlando World Center Marriott Resort & Convention Center
Arrival Concourse next to Canary Ballroom

Sunday 24 April	5:00 to 8:00 pm
Monday 25 April	7:00 am to 5:00 pm
Tuesday 26 April	7:30 am to 5:00 pm
Wednesday 27 April	7:30 am to 5:00 pm
Thursday 28 April	7:30 am to 4:00 pm
Friday 29 April	7:45 to 11:00 am

Exhibition Hours

Orlando World Center Marriott Resort &
Convention Center · Cypress and Palms Ballrooms

Tuesday 26 April	9:30 am to 5:00 pm
Wednesday 27 April	10:00 am to 5:00 pm
Thursday 28 April	10:00 am to 2:00 pm

Course Materials Desk

Crystal Registration Desk
Open during registration hours

If you have registered to attend a course, stop by the Course Materials Desk **after** you pick up your badge to obtain your course notes and course location. Pick up a copy of the latest Education Services catalog to see SPIE Courses at symposia, on video and CD-ROM, and to discover the opportunities of customized In-Company courses.

SPIE Membership

SPIE Members receive discounts on conference and course registration fees. Sign up for SPIE Membership when you register and take immediate advantage of Member pricing.

SPIE Receipts, Badge Corrections, Cashier

Receipts - Preregistered attendees who did not receive a receipt prior to the meeting may obtain a new copy of their registration receipt onsite at the Badge Corrections and Receipts counter in the registration area.

Badge Corrections - Attendees who need a correction to their badge information onsite may do so at the Badge Corrections and Receipts counter in the registration area.

Cashier Station - If you are paying by cash or check as part of your onsite registration, wish to add a course, workshop, or special event requiring payment, or have questions regarding your registration, please see the onsite cashier at the Cashier station in the registration area.

Author/Presenter Information _____

Speaker Check-in Desk/Preview Station

Across from Grand Ballrooms

Monday through Friday 7:30 am to 5:00 pm

All conference rooms will have a computer workstation, LCD projector, screen, lapel microphone, and laser pointer. All presenters are requested to come to the speaker check-in desk to confirm display settings of their presentations from their memory devices or laptops with the audiovisual equipment being used at this symposium.

Poster Setup Instructions

Tuesday 24 April · Crystal M 6:00 to 7:30 pm

Thursday 26 April · Crystal M. 6:00 to 7:30 pm

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

Food and Beverage Services _____

Breakfast Breads

Grand Atrium

Breakfast breads and coffee will be served from 7:30 to 8:30 am Monday through Thursday for registered conference attendees.

Coffee Breaks

Coffee will be served at the following times and locations. Please review your program to see when your conference is scheduled to break for coffee.

Monday 10:00 to 11:00 am; 3:00 to 4:00 pm Grand Foyer

Tuesday 9:30 to 10:30 am; 3:00 to 4:00 pm Exhibition Halls

Wednesday . . 10:00 to 11:00 am; 3:00 to 4:00 pm Exhibition Halls

Thursday 10:00 to 11:00 am Exhibition Halls
3:00 to 4:00 pm Grand Foyer

Friday 10:00 to 11:00 am; 3:00 to 4:00 pm Grand Foyer

Lunch Locations

Canary Ballroom

The Marriott will provide concessions with a variety of hot and cold items. There are also various choices in the Marriott Food Court. High Velocity and the Poolside Grill will also be open.

Desserts

Palms and Cypress Exhibition Halls Tuesday and Wednesday

Dessert snacks will be served from 3:00 to 3:30 pm. Complimentary tickets for the dessert snacks will be included in attendee registration packets.

Free Popcorn

Palms and Cypress Exhibition Halls

Popcorn carts will be open Tuesday and Wednesday from 11:00 am to 3:00 pm; Thursday from 11:00 am to 2:00 pm.

SPIE Onsite Services _____

SPIE Marketplace

Grand Atrium

Open during registration hours, Monday–Friday

The SPIE Marketplace is your source for the latest SPIE Press books, Proceedings, and Educational and Professional Development materials. Become a member of SPIE or explore the Digital Library.

SPIE Job Fair – Special 2-Day Event!

Cypress 1 Foyer · Admission is free; Registration is required.

Tuesday 26 April 9:30 am to 5:00 pm
Wednesday 27 April 10:00 am to 5:00 pm

Top employers are coming together to interview and hire. Whether you’re looking for a better job, re-entering the workforce or just starting your career, plan to visit the Job Fair at SPIE Defense, Security, and Sensing – come prepared to discuss your skills and talents with our industries leaders.

- Discuss career options with employers
- Build your network
- Gain visibility with hiring companies
- Post your resume today! Visit the Career Center on spie.org/careercenter

NOTE: Many of the positions posted to this career event require an active security clearance or the ability to acquire one.
For more information see p. 25.

Press & Media Center

Cypress Foyer

The Press & Media Center provides press conference facilities, refreshments, and press releases from exhibitors. Credentialed media are invited to communicate news via the provided telephone and high-speed internet connections. Registration and exhibition fees are waived for working journalists and editors. Preregister by e-mailing name, organization, title, address, e-mail, and phone number to media@spie.org.

Guest Hospitality Suite

Suite 22774

Guests of attendees are invited to meet, relax, and enjoy a cup of coffee and breakfast breads in the SPIE Guest Hospitality Suite. The Suite will be open Monday 10:00 to 11:30 am and Tuesday through Thursday from 8:30 to 10:00 am. This event is for guests of SPIE Defense, Security, and Sensing attendees only.

Internet Pavilion

Crystal Foyer

SPIE will have a complimentary Internet Pavilion open during registration hours. Attendees can use provided workstations or hook up their laptop to an Ethernet connection to access the Internet.

Complimentary Internet Wireless Access

Canary Ballroom & Atrium and Cypress Foyer

SPIE is pleased to provide complimentary wireless access to the Internet for all conference attendees bringing 802.11b wireless-enabled laptops or mobile devices.

Business Services _____

Attraction Tickets or Activities

The Marriott Group Concierge will have a fully staffed VIP Concierge Desk near SPIE registration to assist SPIE Defense, Security, and Sensing attendees with discounted attraction tickets, dining reservations, golf tee times, and local information on shopping, local parks, and activities.

All attendees who ordered tickets on-line can pick-up their tickets at the Concierge Desk at the Orlando World Center Marriott upon arrival at no cost.

SPIE Copy Center

Across from Crystal Salon K

San Diego Copy will provide a copy service during the week for symposium attendees. The rates are 5 cents per copy and \$1 per transparency (\$2.50 for color).

SPIE Message Center

SPIE has an urgent message line available during registration hours Sunday through Friday (407-309-7873).

Child Care

All About Kids Professional Child Care, toll free 1-800-728-6506, Phone (407) 812-9300, www.All-About-Kids.com, or email AAboutKids@aol.com

Note: SPIE does not imply an endorsement nor recommendation of these services. They are provided on an “information only” basis for your further analysis and decision. Other services may be available.



Pick up your free souvenir!

Booth 1543

Tuesday-Thursday • Cypress Exhibition Hall

Ticket from Registration Packet required.
While supplies last.

General Information

Policies

Refund Policy for Preregistration

There is a \$40 service charge for processing refunds. A letter requesting the refund should state the preregistrant's name and to whom the check should be made payable. Requests for preregistration refunds must be received no later than 14 April 2011. Membership dues are not refundable. SPIE Digital Library subscriptions are not refundable.

Underage Persons on Exhibition Floor

For safety and insurance reasons, no persons under the age of 16 will be allowed in the exhibition area during move-in and move-out. During open exhibition hours, only children over the age of 12 accompanied by an adult will be allowed in the exhibition area.

Unauthorized Solicitation

Any manufacturer or supplier who is not an exhibitor and is observed to be soliciting business in the aisles, or in another company's booth, will be asked to leave immediately. Unauthorized solicitation in the Exhibition Hall is prohibited.

Unsecured Items

Personal belongings such as briefcases, backpacks, coats, book bags, etc. should not be left unattended in meeting rooms or public areas. These items will be subject to removal by security upon discovery.

Parking

On-site Parking

There is ample hotel parking for Marriott guests. Event attendees who are not hotel guests are strongly encouraged to utilize the overflow parking lot.

COMPLIMENTARY SHUTTLE SERVICE: Due to the popularity of this conference, the Orlando World Center Marriott does not have parking space for all of the event's attendees. SPIE will provide shuttle service to attendees and exhibitors. Defense, Security, and Sensing attendees, exhibitors, and visitors not staying at the Orlando World Center Marriott should plan to use the complimentary shuttle service.

The complimentary shuttle service is available Monday through Thursday, 5-8 April, and will start at 7:00 am. The shuttle schedule will be available onsite.

See map for Overflow parking on page 205.

Audio, Video, Digital Recording Policy

In the Meeting Rooms and Poster Sessions: For copyright reasons, recordings of any kind are strictly prohibited without prior written consent of the presenter in any conference session, course or of posters presented. Each presenter being taped must file a signed written consent form. Individuals not complying with this policy will be asked to leave a given session and asked to surrender their film or recording media. Consent forms are available at the SPIE Audiovisual Desk.

In the Exhibition Hall: For security and courtesy reasons, photographing or videotaping individual booths and displays in the exhibit hall is allowed ONLY with explicit permission from on-site company representatives. Individuals not complying with this policy will be asked to surrender their film and to leave the exhibit hall.

Laser Pointer Safety Information

SPIE supplies tested and safety approved laser pointers for all conference meeting rooms, and for short course rooms if instructors request one. For safety reasons, SPIE requests that presenters use our provided laser pointers available in each meeting room.

If using your own laser pointer, have it tested at your facility to make sure it has <5 mW power output. Laser pointers in Class II and IIIa (<5 mW) are eye safe if power output is correct - but don't automatically trust the labeling. Commercially available laser pointers, red or green (or any color), could be incorrectly labeled as to their wavelength and power output.

Presenters intending to use their own laser pointer for presentations are required to come to the Speaker Check In Desk onsite and test their pointer on our power meter. If the pointer fails the safe power level you may not use the pointer at the conference. You will be required to sign a waiver releasing SPIE of any liability for use of potentially non-safe laser pointers.

Use of a personal laser pointer at an SPIE event represents user's acceptance of liability for use of a non-SPIE supplied laser pointer device. Misuse of any laser pointer could lead to eye damage.



Hertz Car Rental has been selected as the official car rental agency for this Symposium. To reserve a car, identify yourself as a SPIE Defense, Security & Sensing Symposium attendee using the Hertz Meeting Code CV# 029B0016. 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 entered with the letters CV before the number, i.e. CV029B0016.

- In the United States call 1-800-654-2240.
Book Online at www.hertz.com.

Directions to Overflow Parking next to Charley's Restaurant:

From Orlando World Center Marriott:

When leaving Marriott, take the 1st right onto Highway 536 West/World Center Drive.

Merge onto I-4 W via the ramp to Tampa (take I-4 West)

Take Exit 64 to merge onto Highway 530 East (US192 East) toward Kissimmee.

At first available left, turn left on Parkway Blvd.

(Charley's Steakhouse will be on your right once you make the left turn.)

Once on Parkway Blvd, take first left and follow SPIE signs to the large Overflow parking area.

At the overflow parking lot, parking is complimentary so park anywhere.

Busses will pick up at the white tent.

**Physical address for GPS purposes is:
2901 Parkway Blvd, Kissimmee, FL 34747**

From Orlando International Airport:

Take North exit out of Orlando International Airport.

Take Highway 528 West

Take Highway 4 West

Take exit 64 to merge onto Highway 530 East (US192 East) toward Kissimmee.

Merge onto I-4 W via the ramp to Tampa (take I-4 West)

Take exit 64 to merge onto FL-530 E/US-192 E toward Kissimmee.

At first available left, turn left on Parkway Blvd.

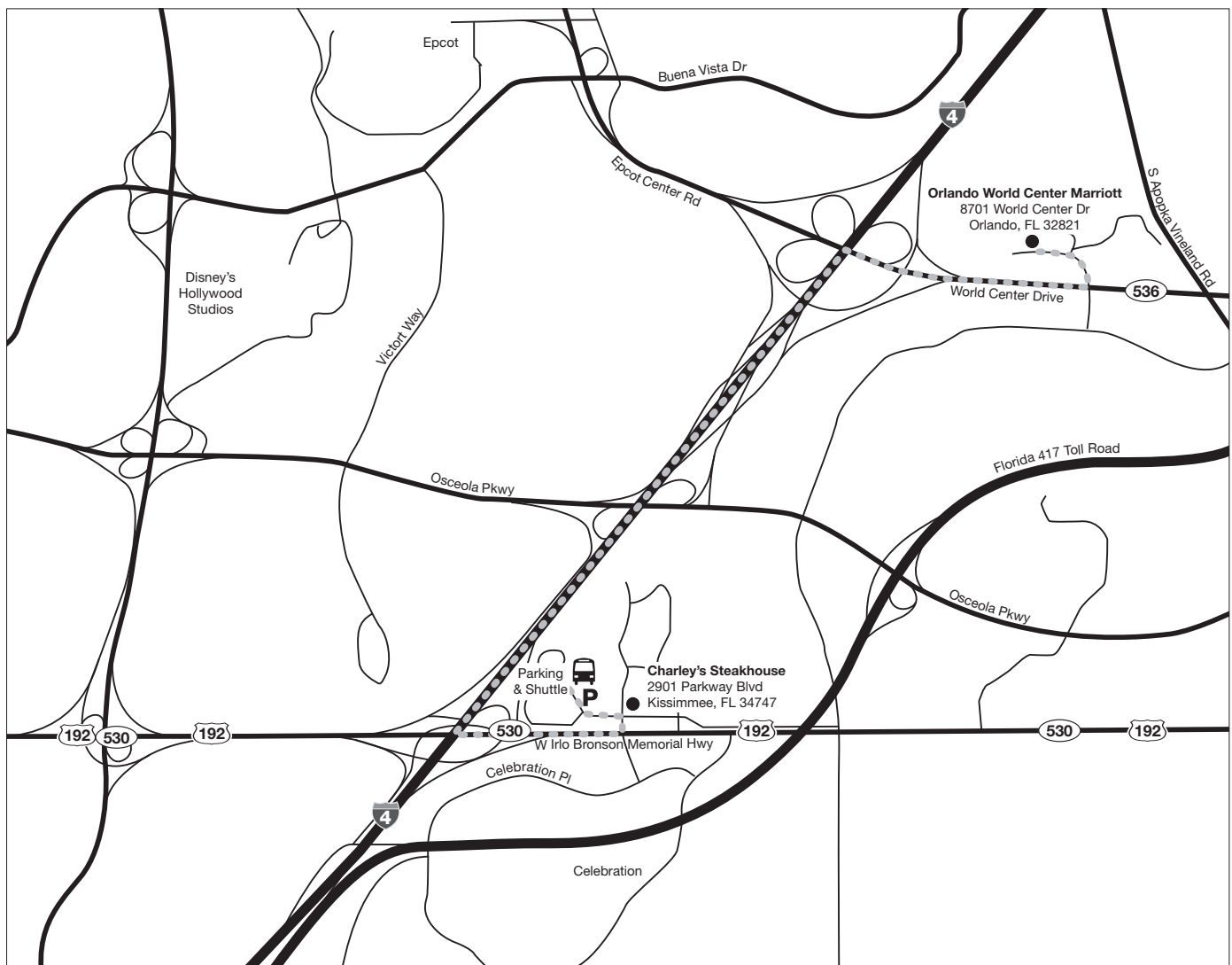
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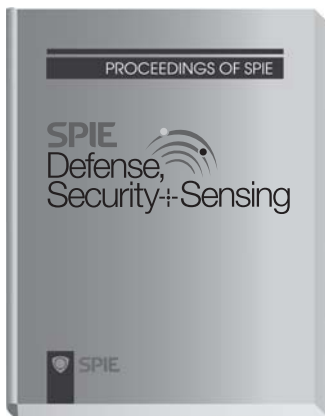
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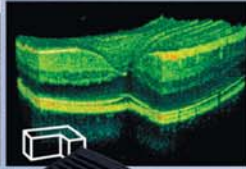
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