SPIE. DEFENSE+ COMMERCIAL SENSING

DEFENSE + COMMERCIAL SENSING

CALL FOR PAPERS

Submit abstracts by 7 October 2020

11–15 April 2021
Gaylord Palms Resort & Convention Center
Orlando, Florida, USA

spie.org/dcs21call
#SPIEDCS

DEFENSE + COMMERCIAL SENSING CALL FOR PAPERS

SPIE. DEFENSE+ COMMERCIAL SENSING

Gaylord Palms Resort & Convention Center
Orlando, Florida, USA

Conferences and Courses
11–15 APRIL 2021

EXPO
13–15 APRIL 2021

Your research supports the defense and security community

Accelerate the development process

SPIE Defense + Commercial Sensing is the leading meeting for scientists, researchers, and engineers to share their latest breakthroughs, deepen their understanding of important defense technologies and applications, and cultivate meaningful contacts with colleagues and other leading experts.

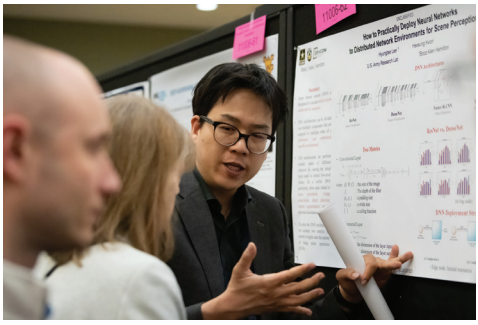
One program, 4 tracks, and 40+ conferences highlight emerging and relevant sensing and imaging technologies, while addressing a wide range of applications.

O R L A N D O

Submit abstracts by **7 October 2020**

spie.org/dcs21call






Plan to Participate

We invite you to participate in SPIE Defense + Commercial Sensing 2021, the leading meeting for scientists, researchers, and engineers from industry, military, government agencies, and academia throughout the world. Defense + Commercial Sensing continues with more than 45 years as the leading conference on imaging, sensing, and photonic technologies used for defense and security applications, as well as fast-emerging innovations for health care, industry, and environmental applications.

In 2021, Defense + Commercial Sensing travels to beautiful Orlando, Florida. The Southeast is a hub of defense technology and is a fast-growing area with a high number of large contractors nearby. Florida is a premier aerospace and space location, and Central Florida has an evolving focus in the world of smart sensors. Nearly 500 nearby companies excel in areas from aircraft parts and assembly, to intelligence, surveillance, reconnaissance, and missiles.

The top eight Aerospace and Defense companies on the Fortune 500 list all have operations—including major manufacturing operations—in or near Orlando. Florida's economy is strong in diverse components for homeland security applications—including infotech, photonics, simulation and training, and biotech—making it a supportive location for companies working with the latest technologies to secure our ports, detect threats, and enhance cybersecurity. The warm, sunny weather makes this another popular destination for attendees to bring their families. *(Enterprise Florida)*

Along with sharing your latest research, you will have a chance to see the latest products from leading companies on the exhibition floor and network with leaders in the sensing and imaging industry. We urge your participation by submitting your abstract and encouraging your colleagues to do the same. We look forward to a closer and stronger partnership with you during Defense + Commercial Sensing 2021. Plan to join us in Orlando!

SYMPOSIUM CHAIRS

Jay Kumler
President, JENOPTIK
Optical Systems, LLC (USA)

John Pellegrino
Director, Electro-Optical
Systems Laboratory, Georgia
Institute of Technology (USA)

SYMPOSIUM CO-CHAIRS

Augustus W. Fountain III
Professor, Department of
Chemistry, and Biochemistry,
The University of South Carolina
(USA)

Teresa Pace
Fellow – IMS,
Aeromet Engineering
L3 Technologies, Inc. (USA)

Contents

Materials and Devices

TRACK CHAIR:
Mark A. Itzler, Argo AI, LLC (USA)

Imaging and Analytics

TRACK CHAIR:
David W. Messinger, Rochester Institute of Technology (USA)

Submit your abstract today: **spie.org/dcs21call**

SPIE International Headquarters
PO Box 10
Bellingham, WA 98227-0010 USA
Tel: +1 360 676 3290 / Fax: +1 360 647 1445
help@spie.org / SPIE.org

SPIE Europe Office
2 Alexandra Gate
Ffordd Pengam, Cardiff, CF24 2SA UK
Tel: +44 29 2089 4747 / Fax: +44 29 2089 4750
info@spieeurope.org / SPIE.org

Advanced Sensing and Imaging

TRACK CHAIR:
Peter Marasco, Air Force Research Lab. (USA)

Next Generation Sensor Systems and Applications

TRACK CHAIR:
Tien Pham, U.S. Army Research Lab. (USA)

EXECUTIVE ORGANIZING COMMITTEE

Sos S. Agaian, College of Staten Island (USA)
Fauzia Ahmad, Temple Univ. (USA)
Mohammad S. Alam, Texas A&M Univ.-Kingsville (USA)
Bjørn F. Andresen, Consultant (Israel)
Robert A. Arnone, The Univ. of Southern Mississippi (USA)
Jarvis (Trey) J. Arthur, NASA Langley Research Ctr. (USA)
Vijayan K. Asari, Univ. of Dayton (USA)
Amit Ashok, College of Optical Sciences, The Univ. of Arizona (USA)
Theresa Axenson, National Reconniassance Office (USA)
Abul K. Azad, Los Alamos National Lab. (USA)
Sachidananda R. Babu, NASA Earth Science Technology Office (USA)
Bhashyam Balaji, Defence Research and Development Canada (Canada)
Palani Balaya, National Univ. of Singapore (Singapore)
Steven M. Barnett, Barnett Technical Services, LLC (USA)
Tonny Benschop, Thales Cryogenics B.V. (Netherlands)
Joshua C. Bienfang, National Institute of Standards and Technology (USA)
Steven S. Bishop, U.S. Army Night Vision & Electronic Sensors Directorate (USA)
Erik P. Blasch, Air Force Research Lab. (USA)
Misty Blowers, Datalytica, LLC (USA)
Matthias F. Carlsohn, Computer Vision and Image Communication at Bremen (Germany)
Genshe Chen, Intelligent Fusion Technology, Inc. (USA)
Bryan Chin, Auburn Univ. (USA)
Byoung-Kwan Cho, Chungnam National Univ. (Korea, Republic of)
Brian Cullum, Univ. of Maryland, Baltimore County (USA)
Venkateswara R. Dasari, U.S. Army Research Lab. (USA)
Stephen P. DelMarco, BAE Systems (USA)
Mark S. Dennison, USC Institute for Creative Technologies (USA)
Nibir K. Dhar, U.S. Army Night Vision & Electronic Sensors Directorate (USA)
Eric Donkor, Univ. of Connecticut (USA)
Peter J. Doucette, U.S. Geological Survey (USA)
Mark Dubinskii, U.S. Army Combat Capabilities Development Command (USA)
Michael C. Dudzik, IQM Research Institute (USA)
Achyut K. Dutta, Banpil Photonics, Inc. (USA)
Michael R. Frey, Bucknell Univ. (USA)
Gabe F. Fulop, Maxtech International, Inc. (USA)
Frederick D. Garber, Wright State Univ. (USA)
Michael E. Gehm, Duke Univ. (USA)
Joel A. Greenberg, Duke Univ. (USA)
Lynne L. Grewe, California State Univ., East Bay (USA)
Jason A. Guicheteau, U.S. Army Edgewood Chemical Biological Ctr. (USA)
David Haefner, U.S. Army Combat Capablilities Development Command C5ISR (USA)
Russell Hall, Northrop Grumman Corp. (USA)
Riad I. Hammoud, TuSimple Inc. (USA)
Kevin G. Harding, Optical Metrology Solutions (USA)
Joshua D. Harguess, Shield AI, Inc. (USA)
Michael J. Hayduk, Air Force Research Lab. (USA)
Myron Hohil, CCDC Armament Ctr. (USA)
Gerald C. Holst, JCD Publishing (USA)
Will Hou, U.S. Naval Research Lab. (USA)
Chris R. Howle, Defence Science and Technology Lab. (United Kingdom)
Jason C. Isaacs, Naval Surface Warfare Ctr. Panama City Div. (USA)
M. Saif Islam, Univ. of California, Davis (USA)
Mark A. Itzler, Argo AI, LLC (USA)
Stephen Jameson, BAE Systems, FAST Labs (USA)
Sabah A. Jassim, The Univ. of Buckingham (United Kingdom)
Bahram Javidi, Univ. of Connecticut (USA)
Ivan Kadar, Interlink Systems Sciences, Inc. (USA)
Gary W. Kamerman, Argo AI, LLC (USA)
Nasser Kehtarnavaz, The Univ. of Texas at Dallas (USA)
Douglas Kiehl, Eli Lilly and Co. (USA)
Moon S. Kim, USDA Agricultural Research Service (USA)
Masafumi Kimata, Ritsumeikan Univ. (Japan)
Carl Kirkconnell, West Coast Solutions (USA)
Thia Kirubarajan, McMaster Univ. (Canada)
David Krum, The Univ. of Southern California (USA)
Laura Lechuga Gomez, Institut Català de Nanociència i Nanotecnologia (ICN2) (Spain)
Beiwen Li, Iowa State Univ. of Science and Technology (USA)
Robert A. Lieberman, Lumoptix, LLC (USA)
Samuel J. Lomonaco, Univ. of Maryland, Baltimore County (USA)
Abhijit Mahalanobis, Univ. of Central Florida (USA)
Peter Marasco, Air Force Research Lab. (USA)
Panos Markopoulos, Rochester Institute of Technology (USA)
K. Alex McIntosh, MIT Lincoln Lab. (USA)
Eric McLamore, Univ. of Florida (USA)
Arantza Mendioroz, Univ. del Pais Vasco (Spain)
David W. Messinger, Rochester Institute of Technology (USA)
John Lester Miller, Cascade Electro-Optics, LLC (USA)
Paul L. Muench, U.S. Army Ground Vehicle Systems Ctr. (USA)
Linda Mullen, Naval Air Systems Command (USA)
John Myers, Harvard Univ. (USA)
Hoa G. Nguyen, Space and Naval Warfare Systems Ctr. Pacific (USA)
Bing Ouyang, Florida Atlantic Univ. (USA)
Timothy L. Overman, Lockheed Martin Space Systems Co. (USA)
Kannappan Palaniappan, Univ. of Missouri-Columbia (USA)

Dmitri Papkovsky, Univ. College Cork (Ireland)
Jonathan C. Petruccelli, Univ. at Albany (USA)
Khanh D. Pham, Air Force Research Lab. (USA)
Tien Pham, U.S. Army Research Lab. (USA)
Gary Pickrell, Virginia Polytechnic Institute and State Univ. (USA)
Chrysanthe Preza, The Univ. of Memphis (USA)
Luisa T. M. Profeta, Field Forensics, Inc. (USA)
Kenneth I. Ranney, U.S. Army Research Lab. (USA)
Ann M. Raynal, Sandia National Labs. (USA)
Duncan Robertson, Univ. of St. Andrews (United Kingdom)
Glen A. Sanders, Honeywell Technology (USA)
Jack N. Sanders-Reed, The Boeing Co. (USA)
Jasbinder S. Sanghera, U.S. Naval Research Lab. (USA)
Ingrid U. Scheel, Columbia Gorge Research LLC (USA)
Gunasekaran Seetharaman, U.S. Naval Research Lab. (USA)
Brian Skibba, U.S. Air Force Civil Engineer Ctr. (USA)
Latasha Solomon, CCDC Army Research Lab. (USA)
Adrian Stern, Ben-Gurion Univ. of the Negev (Israel)
Raja Suresh, General Dynamics Mission Systems (USA)
Eiichi Tamiya, Osaka Univ. (Japan)
Lei Tian, Boston Univ. (USA)
J. Alex Thomasson, Texas A&M Univ. (USA)
Alfonso F. Torres-Rua, Utah State Univ. (USA)
Monte D. Turner, U.S. Air Force (USA)
Eric Udd, Columbia Gorge Research (USA)
Miguel Velez-Reyes, The Univ. of Texas at El Paso (USA)
Jay Vizgaitis, optX imaging systems (USA)
Tuan Vo-Dinh, Fitzpatrick Institute for Photonics, Duke Univ. (USA)
Michael Wardlaw, Office of Naval Research (USA)
David A. Wikner, U.S. Army Research Lab. (USA)
Joseph Zalameda, NASA Langley Research Ctr. (USA)
Edmund G. Zelnio, Air Force Research Lab. (USA)
Song Zhang, Purdue Univ. (USA)
Lucy Zheng, Institute for Defense Analyses (USA)

We are here to ensure that your work is shared with your colleagues.

How that looks may change as world events impact our personal and professional lives. Rest assured, if the timing of an in-person meeting will not allow us to gather, we will leverage our Digital Forum platform and virtual meetups to give you alternative ways to connect with your community.

We look forward to connecting with you soon.

Stay Up to Date via Email

Sign up to receive emails about SPIE Defence + Commercial Sensing
spie.org/signup

Advanced Photon Counting Techniques XV (SI100)

Conference Chairs: **Mark A. Itzler,** Argo AI, LLC (United States); **Joshua C. Bienfang,** National Institute of Standards and Technology (United States); **K. Alex McIntosh,** MIT Lincoln Lab. (United States)

Program Committee: **Giulia Acconcia,** Politecnico di Milano (Italy); **Gerald S. Buller,** Heriot-Watt Univ. (United Kingdom); **Joe C. Campbell,** Univ. of Virginia (United States); **Robert H. Hadfield,** Univ. of Glasgow (United Kingdom); **Michael A. Krainak,** Relative Dynamics, Inc. (United States); **Robert A. Lamb,** Leonardo MW Ltd. (United Kingdom); **Alan L. Migdall,** National Institute of Standards and Technology (United States); **Ivan Rech,** Politecnico di Milano (Italy); **Michael Wahl,** PicoQuant GmbH (Germany); **Emma Wollman,** Jet Propulsion Lab. (United States)

Single-photon counting is the ultimate level of sensitivity in optical measurement techniques. The growing interest in the creation, manipulation, and detection of single photons has been spurred by emerging applications for which photon counting is an enabling technology. In many cases, these applications involve physical processes in which a very small number of photons, often just one, are available for detection, such as single-molecule spectroscopy and ultra-low-light-level imaging. In other instances, it is the quantum properties of a single- or correlated-photon state that are exploited, and the broad field of quantum optics, particularly quantum information processing, is critically dependent on the means for controlling and sensing various properties of photons.

This conference provides a forum for the presentation of advances in all aspects of the science and technology of single-photon counting. The program will emphasize the latest developments in detector technologies capable of sensing single photons, as well as sources capable of generating single photons. A multitude of material systems is used to achieve single-photon generation and detection at operating wavelengths that span ultraviolet, visible, infrared, and terahertz regimes, and developments throughout these spectral regions are of interest. Associated electronic circuitry and signal processing is often crucial to photon-counting instrumentation, and submissions concerning advances in these areas are of great value. Applications and techniques that employ these detectors and sources are the drivers for improved device performance, and the presentation of applications that exploit single photons is essential to the program. Submissions covering photon counting theory, metrology, and all other elements of photon counting technology are encouraged.

Original papers are solicited in the following areas:

- photon counting theory
- single-photon sources
- detectors for photon counting
- photomultiplier technologies
- single-photon avalanche diodes (SPADs)
- superconducting single-photon detectors (SSPDs)
- novel structures/devices for single-photon detection
- electronic circuitry for photon-counting detectors
- signal processing for photon counting
- technical principles of photon counting
- photon correlation techniques
- multidimensional TCSPC
- photon-counting imaging techniques
- single-photon metrology
- instrumentation for photon counting
- applications of photon counting
- fluorescence techniques (FLIM, FRET, FCS)
- optical tomography
- quantum optics and photonic quantum-information processing
- quantum cryptography
- free-space optical communications
- laser radar for ranging and 3D imaging
- low-light-level imaging
- adaptive optics systems
- single-photon detectors for consumer products.

Save the date

ABSTRACTS DUE: 7 OCTOBER 2020

AUTHOR NOTIFICATION: 4 DECEMBER 2020

The contact author will be notified of acceptance by email.

MANUSCRIPTS DUE: 17 MARCH 2021

PLEASE NOTE: Submission implies the intent of at least one author to register, attend the conference, present the paper as scheduled, and submit a full-length manuscript for publication in the conference proceedings.

Submit your abstract today: **spie.org/dcs21call**

Energy Harvesting and Storage: Materials, Devices, and Applications XI (SI101)

Conference Chair: **Palani Balaya,** National Univ. of Singapore (Singapore)

Conference Co-Chair: **Achyut K. Dutta,** Banpil Photonics, Inc. (United States)

Program Committee: **Pulickel M. Ajayan,** Rice Univ. (United States); **Paul Boieriu,** EPISOLAR, Inc. (United States); **Deryn Chu,** U.S. Army Research Lab. (United States); **Nibir K. Dhar,** U.S. Army Night Vision & Electronic Sensors Directorate (United States); **M. Saif Islam,** Univ. of California, Davis (United States); **Nobuhiko P. Kobayashi,** Univ. of California, Santa Cruz (United States); **Andrew P. Lange,** Lawrence Livermore National Lab. (United States); **Matthew McDowell,** Georgia Institute of Technology (United States); **Hidenori Mimura,** Shizuoka Univ. (Japan); **Jagjit Nanda,** Oak Ridge National Lab. (United States); **Vijay Parameshwaran,** U.S. Army Research Lab. (United States); **Sivalingam Sivananthan,** EPIR Technologies (United States); **Ashok K. Sood,** Magnolia Optical Technologies, Inc. (United States); **Patrick J. Taylor,** U.S. Army Research Lab. (United States); **Sudhir B. Trivedi,** Brimrose Corp. of America (United States); **Chunlei Wang,** Florida International Univ. (United States); **Priyalal Wijewarnasuriya,** U.S. Army Research Lab. (United States)

The scope of the conference ranges from topics in basic research in energy harvesting and storage techniques to component and subsystem level development for defense, security, space, and commercial applications. This conference intends to bring together scientists and engineers involved in the development and transition of novel Energy Harvesting and Energy Storage concepts. Novel energy harvesting concepts from heat, light, ultraviolet, infrared, and motion sources, and high-capacity energy storages such as batteries, fuel cells, ultra-capacitors, supercapacitors batteries, and other options cover this conference. Concepts relating to portable, flexible, and integrated energy source/storage relevant to defense applications are of interest. Given the enormous diversity of energy harvesting and storage techniques, we have selected several cutting-edge topics relevant to the technology development and transition process. Novel applications range from small scale system (e.g. small unmanned air vehicle, wireless sensor networks etc., to large scale system (e.g. electric vehicle) such as wireless sensor networks, electric vehicle etc.), requiring nanoscale, microscale to macroscale energy is also covered in this conference area.

The topics of interest in this conference also includes low to ultra-low power electronics requiring little to no external power or electronics harvesting power from its environment. Current trends in Cyber Physical Systems and Internet of Things require innovative approaches in both, very efficiently delivering power as well as harvesting power. Significant progress in sub-threshold transistors, circuits and various other strategies that can function under power starving constraints present a new paradigm in nanoscale, microscale and embedded systems design.

The sessions are organized to facilitate the exchange of ideas and promote the discussion of recent progress in energy harvesting, storage and integration research and trends toward system-level development. It is anticipated that this conference will foster cross-fertilization across many disciplines with participants being exposed to the entire range of scientific and engineering problems associated with the concepts-to-systems development pipeline, as well as the development roadmaps at commercial companies and government agencies.

This conference will consider existing and new harvesting and storage techniques as well as recent advances in novel harvesting and storage materials and devices. It will also consider novel approaches to components and systems consuming very low power. Its objective is to bring together experimentalists, theorists, computational specialists, and development engineers to provide an interdisciplinary forum to discuss physical understanding and the state-of-the-art of active and passive electronic and optoelectronic harvesting and storage materials, devices, and their applications. Areas of research that are particularly active include but not limited to standard (bio, electrolytes, semiconductor, polymer, etc.) and non-standard materials (including biological materials along with its standard and nanostructures such as nanopillars, nanotubes, quantum dots, quantum wires, and bio-inspired materials) for energy scavenging including energy storage techniques, energy scavenging electronics and their applications are attracting increasing interest in the scientific community.

This special meeting will be of interest to researchers in next generation harvesting or scavenging energy and their storage technology; as well as new electronic design approach for very low power technology. We hope to bring together researchers from the wide fields of materials science, devices, optics, physics, chemistry, biology, electrical engineering, etc.

NOVEL MICRO/NANO MATERIALS GROWTH AND DEVICE ARCHITECTURES FOR ENERGY HARVESTING AND STORAGE:

- advanced patterning: nano-imprinting e-beam lithography etc. for nano energy devices
- new materials; synthesis and fabrication: inorganic and organic electrodes for batteries and supercapacitors, aqueous and non-aqueous electrolytes for batteries, semiconductors, dielectrics, polymers, superconductors, organics, magnetics, pyroelectrics, hybrid composites, nano-particles and nano-composites
- techniques for improvement of the energy generation and storage properties, surface treatment and surface functionalization
- hydrogen production by water splitting and hydrogen storage
- MEMS, NEMS, and NOEMS devices for energy generation and storage

continued next page

Energy Harvesting and Storage: Materials, Devices, and Applications XI (SI101 continued)

- theoretical investigation of the phenomena for understanding the energy generation and storage mechanism in micro-/nanomaterials and device architectures
- nano-structure/nano-composite materials and devices for biological inspired energy devices
- biologically assisted nano-energy devices
- next-generation nano-bio-opto energy devices for improved storage and energy generation
- development of new hybrid energy generation and storage devices and systems with traditional electrolyte, polymeric, semiconductors and/or biological materials
- multifunctional nano-particles based devices
- novel optical rectenna technology
- modeling and simulations of energy devices in micro-/nanodevices
- novel, energy device structures employing PV, vibration, or piezoelectric, RF effects
- novel micro-nano scaled thermoelectric devices for power harvesting (generation)
- MEMS based, reformed methanol micro fuel cell for portable power
- self-sustaining miniature solid oxide fuel cell
- high-power density storage devices based on nanostructures
- energy harvest from water using graphene or other micro-nano materials
- wide bandgap semiconductor materials and devices for betavoltaic cells
- novel manufacturing technologies for energy harvest and storage devices.
- innovations in materials growth of III-V and II-VI semiconductors for photovoltaics and solar fuels
- modeling of heat and light transfer processes in thermophotovoltaic (TPV) modules
- innovations in materials growth for thermophotovolatic (TPV) applications.

THIN FILMS AND NOVEL MICRO/NANO MATERIALS GROWTH AND DEVICE STRUCTURES FOR ENERGY GENERATION AND STORAGE:

- novel 3D confined structures, nano-wire and nano-tube-based energy devices and energy storage devices for mechanical, chemical, biological, medical, and military applications
- novel nano-wire, nano-dots, and nano-tube growth and synthesis
- interactions between photons (radiation) and nano-wires, nano-tubes, and nano-dots
- functionalization of nanostructures for energy generation
- nano-photonics devices for PV cells
- thin-film materials for solar energy harvesting such as II-VI, III-V, polymer, Si etc.
- organic photovoltaics and dye-sensitized solar cells toward solar energy harvesting
- photoconduction in graphene- energy harvest
- graphene based high density battery technologies
- all-solid-state battery technologies
- beyond Li-ion battery for energy storage: Li-air, Li-S, Na-ion battery.
- development of integrated thin film isotope sources (tritium, nickel-63) for betavoltaic power Hybrid Generation and Storage Device and Systems:
- interfaces of electrode/electrolyte within energy harvesting, storage, and semiconductor devices
- energy generation/storage from bio-mass, bio-fuels, electrolyte (battery)
- electrical characterization of hybrid devices (generation, storage)
- mesoscale microdroplet-based combustion power generation using ultrasonic droplets
- MEMS and nanowires for Li-, Na-, or Ni-based micro batteries and novel fuel cells electrodes.

ULTRA-LOW POWER COMPONENTS AND ELECTRONICS

- electronic components
- novel circuits and topology
- power management
- energy harvesting circuits
- technology for Internet of Things
- autonomous power generation for wireless sensors.

APPLICATIONS:

- flexible, rigid, semi-rigid, energy harvesting/storage systems
- power tent, circuit interfaces of energy devices
- power skin, power electronics
- integrated portable/deployable systems incorporating energy generation and energy storage devices
- thin film energy storage (battery) including thin-film Li , Ni, or novel material based battery
- energy scavenging systems for on-chip power harvesting and storage
- energy harvesting and storage for wireless sensor networks and electrical vehicle
- energy device for Internet of Things (IoTs)
- solar powered wireless sensing systems for border security.
- power beaming light for wireless energy transfer.

Image Sensing Technologies: Materials, Devices, Systems, and Applications VIII (SI102)

Conference Chairs: **Nibir K. Dhar,** U.S. Army Night Vision & Electronic Sensors Directorate (United States); **Achyut K. Dutta,** Banpil Photonics, Inc. (United States); **Sachidananda R. Babu,** NASA Earth Science Technology Office (United States)

Program Committee: **Homayoon Ansari,** Jet Propulsion Lab. (United States); **Houtong Chen,** Los Alamos National Lab. (United States); **Arvind I. D'Souza,** DRS Sensors & Targeting Systems, Inc. (United States); **Michael D. Gerhold,** U.S. Army Research Office (United States); **Randy Jacobs,** U.S. Army RDECOM CERDEC NVESD (United States); **Marvin Jaime-Vasquez,** U.S. Army Night Vision & Electronic Sensors Directorate (United States); **Margaret Kim,** The Univ. of Alabama (United States); **Nobuhiko P. Kobayashi,** Univ. of California, Santa Cruz (United States); **Sanjay Krishna,** The Ohio State Univ. (United States); **Rihito Kuroda,** Tohoku Univ. (Japan); **Hidenori Mimura,** Shizuoka Univ. (Japan); **Willie Padilla,** Duke Univ. (United States); **Vijay Parameshwaran,** U.S. Army Research Lab. (United States); **Mukti M. Rana,** Delaware State Univ. (United States); **Amrita Sahu,** Altria Group, Inc. (United States); **Siva Sivananthan,** Sivananthan Labs. (United States); **Ashok K. Sood,** Magnolia Optical Technologies, Inc. (United States); **Priyalal S. Wijewarnasuriya,** Teledyne Imaging Sensors (United States)

Image sensing technologies extending across broad bands of the spectrum from ultraviolet (UV) to long-wave infrared (LWIR) regions are advancing from novel sensing devices to camera system level implementations for commercial applications in a diverse market mix including automotive, biomedical, security and surveillance, agriculture and industrial machine vision. In the near future, embedded vision technologies will become an integral part of the emerging Internet of Things and Smart Cities. The goal of the conference is to convene the community of researchers active in image-sensing-related research covering materials, devices (image sensor), optics, hybridized or monolithic integration of optics and electronics, camera systems, and their novel applications. The conference provides a robust platform for the mutual exchange of ideas. The conference will address topics directed towards the understanding and advancement of the state-of-the-art for image sensing technologies ranging from UV to LWIR spectrum. The primary emphasis is on emerging commercial and industrial applications.

Silicon-based imaging sensors (CMOS/CCD) in large format especially for the visible (VIS) spectrum are today widely used in all types of consumer and commercial camera systems from security and surveillance, to smart phones and digital cameras, and recently making in-roads into more value-added applications such as emerging automotive, medical imaging, IoT and Smart Cities. With this progression, technology innovation in Si-based camera systems not only requires large formats extending from tens of mega pixels to several giga-pixel formats, but also extending its spectrum range into the near-infrared (NIR) region.

Initially, image sensing technologies, especially in NIR, shortwave IR (SWIR), mid-wave IR (MWIR), and long-wave IR (LWIR) spectrum regions were used exclusively by the geo-satellite and defense industries. This was in part due to restrictions on dual-use, but overwhelmingly due to the high cost of such imaging devices, systems, and applications. However, this extremely expansive and spectrally unique portion of the wavelength spectrum was of high interest for such applications as space-based imaging and communications, upper atmospheric sensing, remote sensing, security and surveillance, and high-end machine vision. More recently, the UV to LWIR spectral bands have been identified as ideal for a wide range of imaging applications beyond scientific and defense sectors, to include the commercial industry from medical systems to bulk-cargo transit security, from automotive systems to agricultural crop monitoring systems, and from food safety to semiconductor quality control systems.

The need for low-cost small form-factor, light-weight, and low-power (SWaP-C) camera systems is pushing the technology innovation of image sensor technology to wafer level optics and/or electronics integration, either hybridized or monolithically integrated kinds. Researchers are seeking ways to embed more intelligence not only at the system software and algorithm levels that will power these image sensing applications, but also at the component and device level to include advanced and adaptive readout electronics, and image fusion processors. Moreover, the realization of various material systems especially on a wide range of substrate usage (e.g., Si, GaAs, dielectric, etc.), nanostructures, metamaterials, 2D materials and composite materials along with advances in optics and device performance may revolutionize overall image sensing technologies in all spectrum regions.

In addition to Si-CMOS/CCD sensors, low-cost and larger format infrared imagers are making in-roads. Recent developments in various detector materials systems, II-VI, III-V, and developments in room temperature IR detectors have resulted in significant material advances, signaling the possibility of higher-performance IR image sensing technologies at optimal cost to continue the trend towards broader commercial and defense industry applications.

The scope of the conference spans topics in new image sensor device-physics, new optical and sensing materials, components and subsystem level development for novel commercial and industrial applications. The scope also includes research in embedded intelligence in imaging sensors such as Artificial Intelligence and machine learning capabilities. This conference intends to bring together scientists and engineers involved in the development and transition into commercial and industrial application spaces of novel image sensing concepts from UV to LWIR, broadband or multispectral imaging including various multiband combinations VIS-SWIR, VIS-LWIR, NIR-MWIR, SWIR-LWIR, and other options. Concepts relating to new broadband antireflection (AR) coating and lens technologies are also of interest. Cutting edge topics including image processing techniques on or off the focal plane array, smart reconfigurable readout electronics that bring more intelligence, including but not limited to, artificial intelligence, machine / deep learnings, and neuromorphic processing, technologies to the imaging devices or systems, innovative packaging techniques, small scale compact systems, lens and optics integration at wafer scale, innovative camera encapsulation techniques with SWaP-C optimization in emerging applications are all of interest.

continued next page

Image Sensing Technologies: Materials, Devices, Systems, and Applications VIII (SI102 continued)

The sessions are organized to facilitate the exchange of ideas and promote the discussion of recent progress in image sensing device, materials, optics integration research, and trends toward application and system-level development. It is anticipated that this conference will foster cross-fertilization amidst many disciplines with participants being exposed to the entire range of scientific and engineering problems associated with the concepts-to-systems development pipeline, as well as the development roadmaps at commercial companies, research institutions, academia, and government agencies.

We are looking for papers that demonstrate state-of-the-art in novel image sensing technologies that will serve as tools for researchers in various disciplines. Papers are solicited for, but not limited to, the following topics:

MATERIAL TECHNOLOGIES FOR IMAGE SENSING

- composites material systems for image sensor and bolometer
- detector / bolometer materials (i.e., Si, Ge, InSb, HgCdTe, GaAs, ZnS, ZnSe, etc.)
- nanotechnologies (nanowires, nanopillars, plasmonic, metamaterials, etc.) -based image sensor
- colloidal technologies for low-cost image sensor
- smart sensing materials
- broadband operation with sensitive detection and conversion of below-bandgap photons
- nano-patterned structures for advanced light trapping schemes via holographic lithography
- nano-enhanced absorbers in the IR range
- advanced windows based on novel transparent conductors
- bandstructure nano-engineering for high conversion performance
- nano-engineered electron processes for suppression of thermalization and recombination losses
- advanced passivation schemes for reducing surface recombination
- epitaxial growth processes of materials on compliant and non-compliant substrates (e.g. HgCdTe, GaAs, InGaAs, etc.) for detectors, and other optoelectronic applications.

DEVICE TECHNOLOGIES FOR IMAGE SENSING

- innovative devices (e.g. PIN, MQW, APD etc.)
- innovative process and post process (e.g. 3-D integration)
- recent development of detectors and bolometers for image sensing: X-ray, UV, VIS, SWIR, MWIR, and LWIR
- advances in alternative technologies (organic, a-Si etc.)
- nano/micro bolometers
- single-photon imaging: theoretical basis, sensor design, and production
- large-format FPA, bolometer, and CMOS sensor
- advanced quantum structures for large FPAs
- on-chip (image sensor) image fusion processors
- novel uncooled FPA and bolometer technologies
- Bio-inspired techniques for detectors
- development of Novel III/V II/IV/VI materials and devices
- transition efforts that raise the operating temperature and reduce the cost of “cooled” high performance infrared detectors
- transition efforts that increase performance of “uncooled” infrared detectors.
- plasmonics /photonics structure to enhance detector QE
- FPA and lens/filter-integration
- single photon detector and its array for quantum sensing

READ-OUT TECHNOLOGIES FOR IMAGE SENSING, RANGE DETECTION, AND QUANTUM SENSING

- development of advanced readout circuits including neuromorphic and bio-inspired circuit designs
- on-chip image processing for 3-D imaging
- innovative high-performance (e.g., high dynamic range and high frame rate, ultralow power, ultra low noise, large format, high speed , etc.) readout integrated circuits (ROIC)
- noise analysis and noise reduction techniques
- on-chip signal or image processing
- high throughput image sensor
- readout cirucits for quantum sensing

OPTICS AND INTEGRATION TECHNOLOGIES

- theoretical studies and modeling of materials and photonic crystal applications to lenses and windows
- hybrid and monolithic integration of optics and image sensors
- wafer-level optics and electronics integration
- on-chip and off-chip micro-lens array
- broadband AR coating and lens and their integration to image sensors.
- broadband metasurface based optics and their integration to image sensors

IMAGE SENSING SYSTEMS, ALGORITHMS, AND APPLICATIONS

- sensor system integration and performance
- multi-sensor system
- high throughput system for image sensing computer vision
- multiband image fusion systems
- FPAs for simultaneous active and passive imaging
- adaptive multimode sensing
- multimodal-sensor-in-a-pixel FPA
- time-of-flight and 3D imaging applications
- developments in broadcast image sensor technology
- multi-aperture imaging
- computer simulation and modeling of single and multicolor detectors and systems
- on-chip/off-chip vs component/algorithm trade-off strategies for system speed, efficiency, and SWaP-C maximization
- imaging systems and camera image quality benchmarking: pinpointing defects that degrade image quality and their source (optics, sensor, processing).
- machine learning and algorithm for smart imaging and sensing
- compression sensing and imaging
- ladar/lidar for 3D imaging
- computational imaging
- embedded vision for intelligent imaging
- imaging and its applications based on THz technique
- hyperspectral/multispectral imaging, system integration, and applications
- machine Learning (ML) or Deep Learning / AI Algorithms for smart vision or imaging and their applications
- multispectral system for Medical imaging
- remote sensing
- optical sensing for agriculture
- fluorescence imaging
- quantum sensing/imaging.

Laser Technology for Defense and Security XVI

(SI103)

Conference Chairs: **Mark Dubinskii,** CCDC Army Research Laboratory (ARL) (United States); **Lawrence Grimes,** Joint Directed Energy Transition Office (United States)

Program Committee: **Colin C. Baker,** U.S. Naval Research Lab. (United States); **Patrick A. Berry,** Air Force Research Lab. (United States); **Scott Christensen,** IPG Photonics Corp. (United States); **Chris Ebert,** Coherent, Inc. (United States); **Thomas Ehrenreich,** Missile Defense Agency (United States); **Timothy C. Newell,** Gryphon Technologies L.C. (United States); **Craig A. Robin,** Army Rapid Capabilities and Critical Technologies Office (RCCTO) (United States)

The development of moderate to high average power solid-state (bulk and fiber) lasers or ultra-high pulse power lasers is a demanding engineering feat, involving critical component technologies based on the latest scientific advances. These laser systems have important emerging DOD applications as well as uses in commercial markets. This conference will focus on moderate to high-power solid-state (bulk and fiber) laser component and device technology to address laser source technology applicable to LIDAR, LADAR, remote chemical detection, IRCM, high-power illuminators, trackers, and laser weapons. These laser systems have many similar challenges yet can be quite different depending on the type of laser, the laser architecture, and the requirements and constraints of the application. Development of the laser engine itself, e.g., solid state laser, or a solid-state/gas hybrid, and the components that go into making a high energy laser are critical for any high energy laser system. All high-energy lasers must have an efficient thermal management and very good beam quality, which assumes the use of thermally advanced gain media as well as proper designs. In addition, depending on the particular application, there are many other engineering issues such as efficiency, size and weight, power management, beam propagation, pulse width, repetition rate, wavelength, and spectral brightness to consider. This conference will also address the current issues facing moderate to high average power and ultra-high pulse power solid-state lasers and introduce future projections for component and system technologies. Also addressed will be advances in the area of laser eye and sensor protection.

The topic areas include, but are not limited to:

- laser performance: modeling and simulation
- beam propagation and phase aberrations involving issues such as resonator design, adaptive optics for wavefront correction, and mode locking
- thermal management: novel means to control heat and minimize its impact on the laser power and beam quality while maximizing overall laser efficiency, including cryogenic cooling of gain medium
- laser scaling to higher energy and power levels and how the laser can be designed to effectively mitigate or take advantage of nonlinear effects, probability of damage to optical elements, and complexity
- compact and robust ultra-short pulsed lasers for high average power operation
- lasers beyond 2000 nm for pulsed illuminators, infrared countermeasures and high energy (including rare-earth solid state lasers, quantum cascade lasers, long wavelength diode lasers and frequency conversion techniques)
- power scaling through incoherent beam combining (e.g. spectral multiplexing) as well as passive or active coherent phasing of multiple laser sources
- solid state laser designs such as rod, slab, disk, and fiber lasers as well as gain media advances such as ceramics, gradient-doped ceramics, composite gain elements based on bonding of dissimilar materials, new laser materials with advanced thermal and/or spectroscopic properties
- fiber laser advances in single aperture power or pulsed energy scaling, including fiber lasers operating at eye-safer wavelengths and fiber-based nonlinear generation of UV, visible, and mid-IR wavelengths
- diode laser advances in output power and efficiency, brightness, spectral brightness, and spectral stability; advances in underdeveloped spectral ranges; efficient diode laser fiber coupling
- advanced laser designs and devices such as waveguide-based lasers, hybrid gas/diode lasers (DPALs), scalable optically pumped semiconductor lasers, novel laser materials, including critical optical components for advanced laser development.

Window and Dome Technologies and Materials XVII (SI104)

Conference Chair: **W. Howard Poisl,** Raytheon Missiles & Defense (United States)

Program Committee: **Brian T. Anderson,** Air Force Research Lab. (United States); **Bernadett Bodnar,** Naval Air Warfare Ctr. Weapons Div. (United States); **Rick Gentilman,** Raytheon Missiles & Defense (United States); **Daniel C. Harris,** Naval Air Warfare Ctr. Weapons Div. (United States); **John S. McCloy,** Washington State Univ. (United States); **Melissa Seitz,** II-VI Aerospace & Defense, Inc. (United States); **Roger M. Sullivan,** Office of Naval Research (United States); **Michael E. Thomas,** Johns Hopkins Univ. (United States)

This conference is intended as an international forum for the presentation of advances in design, processing, characterization, and use of optical windows, domes, and related materials technology. It is particularly focused on optical materials intended for operation from the ultraviolet to the infrared. These materials technologies will impact electro-optic (EO) systems and the platforms on which they operate including ground, air, or sea-based systems. Radio-Frequency (RF) materials, processing, and characterization are of interest as well and papers are encouraged.

This conference will report on the state-of-the-art of the various optical materials and associated technologies. Papers on the following and related topics are solicited:

- theoretical studies and modeling of materials and opto-photonic crystal applications to windows and domes
- modeling of transmittance, surface and bulk scattering, and absorption in window and dome materials
- physically induced phenomenon in optical materials (eg., dn/dT, fracture, impact resistance, rain and sand erosion, thermal shock, emission, ballistic impact)
- mechanical toughening and strengthening of optical materials
- optical materials for supersonic and/or hypersonic applications
- optical materials for window applications including multimode operation
- abrasion and rain erosion protective and related hard coatings
- conductive coatings and structures for EMI protection
- optical filters, frequency selective coatings, and microstructures
- composite, bonded, tiled, or faceted windows and domes
- actively cooled windows and domes
- conformal optics: design, manufacturing, and testing
- deterministic optical finishing methods
- rapid, low-cost optical finishing methods
- fabrication of optical materials for windows and domes
- optical ceramics and glasses of oxides, nitrides, sulfides, and phosphides
- semiconductor optical materials (i.e.; Ge, Si, GaAs, GaP, ZnS, ZnSe)
- diamond and diamond-like material and coatings
- sapphire and polycrystalline alumina
- UV-VS-NIR transmitting materials
- 3-5 μm transmitting materials
- 8-12 μm transmitting materials
- materials characterization and testing, especially at elevated temperatures
- nanophase and nanocomposite optical materials and processing
- photonic bandgap materials and processing
- optical metamaterials for window and dome applications
- optical materials for high-energy laser applications
- multifunctional optical materials and structures
- alkali halide optical elements.

Next-Generation Spectroscopic Technologies XIV (SI105)

Conference Chairs: **Luisa T.M. Profeta,** Field Forensics, Inc. (United States); **Abul K. Azad,** Los Alamos National Lab. (United States); **Steven M. Barnett,** Barnett Technical Services, LLC (United States)

Program Committee: **Leigh J. Bromley,** DRS Daylight Solutions (United States); **Elbert Chia,** Nanyang Technological Univ. (Singapore); **Richard A. Crocombe,** Crocombe Spectroscopic Consulting, LLC (United States); **John M. Dell,** The Univ. of Western Australia (Australia); **Mark A. Druy,** Galvanic Applied Sciences USA Inc. (United States); **Fredrick G. Haibach,** Spectro Scientific (United States); **Willem Hoving,** Anteryon BV (Netherlands); **Vassili Karanassios,** Univ. of Waterloo (Canada); **Martin Kraft,** Carinthian Tech Research AG (Austria); **Jouko O. Malinen,** Malinen Consulting (Finland); **Ellen V. Miseo,** TeakOrigin, Inc. (United States); **John F. O'Hara,** Oklahoma State Univ. (United States); **Diyar Talbayev,** Tulane Univ. (United States); **Ulrike Willer,** Technische Univ. Clausthal (Germany)

The overall emphasis in this conference is on advanced technologies for spectroscopic instrumentation, particularly for miniature and portable instruments, but also including novel spectroscopic sources used in the laboratory and process applications (e.g., QCL, ICL, supercontinuum).

The scope focuses on the optical region: UV-visible, infrared, near-infrared, Terahertz, and Raman molecular techniques. However, it also includes advances enabling miniature and portable spectrometers across the electromagnetic spectrum, including x-ray fluorescence, laser induced fluorescence, laser induced breakdown spectroscopy (LIBS), nuclear magnetic resonance and mass spectrometry.

The conference includes papers describing breakthrough, novel, recently-introduced, and commercial instrumentation; also the rapidly emerging fields of portable and handheld hyperspectral imaging, 'smartphone spectroscopy', 'citizen spectroscopy', with cloud-based collection and processing of data from those instruments.

FOCUS AREAS FOR 2021

- Portable hyperspectral imaging (technologies, instruments, applications)
- Smartphone spectroscopy, including developments for point-of-care applications
- Portable spectrometers for consumer and consumer applications (technologies, instruments, applications)
- Very low-cost, very compact, spectrometers (e.g., Si-based sensors using LVFs, mosaic filters, Fabry-Perots, etc.)
- Portable spectrometer algorithms and databases to generate actionable answers in the field
- Terahertz technologies, instrumentations, and applications
- Terahertz plasmonics, metamaterials, and 2D terahertz spectroscopy
- Optical food spectroscopy (sorting, freshness, contamination, adulteration, fraud)
- UV-, gated- and stand-off Raman
- QCL- and ICL-based spectroscopy
- Spectroscopy using supercontinuum sources
- Dual- or Hyphenated-Technology instruments
- New and novel instruments for chemical sensing
- Stand-off detection, and drone-mounted spectrometers and imagers.

Save the date

ABSTRACTS DUE: 7 OCTOBER 2020

AUTHOR NOTIFICATION: 4 DECEMBER 2020

The contact author will be notified of acceptance by email.

MANUSCRIPTS DUE: 17 MARCH 2021

PLEASE NOTE: Submission implies the intent of at least one author to register, attend the conference, present the paper as scheduled, and submit a full-length manuscript for publication in the conference proceedings.

Submit your abstract today: **spie.org/dcs21call**

Quantum Information Science, Sensing, and Computation XIII (SI106)

Conference Chairs: **Eric Donkor,** Univ. of Connecticut (United States); **Michael Hayduk,** Air Force Research Lab. (United States)

Conference Co-Chairs: **Michael R. Frey,** Bucknell Univ. (United States); **Samuel J. Lomonaco Jr.,** Univ. of Maryland, Baltimore County (United States); **John M. Myers,** Harvard Univ. (United States)

Program Committee: **Paul M. Alsing,** Air Force Research Lab. (United States); **Radhakrishnan Balu,** U.S. Army Research Lab. (United States); **Mishkatul Bhattacharya,** Rochester Institute of Technology (United States); **Wes Campbell,** Univ. of California, Los Angeles (United States); **Jerry Chow,** IBM Thomas J. Watson Research Ctr. (United States); **Michael L. Fanto,** Air Force Research Lab. (United States); **Durdu O. Guney,** Michigan Technological Univ. (United States); **Louis H. Kauffman,** Univ. of Illinois at Chicago (United States); **Prem Kumar,** Northwestern Univ. (United States); **Alexander V. Sergienko,** Boston Univ. (United States); **Kathy-Anne Soderberg,** Air Force Research Lab. (United States); **Neal E. Solmeyer,** The MITRE Corp. (United States); **Yaakov S. Weinstein,** The MITRE Corp. (United States)

Quantum systems that compute, store, and distribute information based on quantum mechanical entanglement, superposition, and interference phenomena are being developed and realized in many physical systems, with possible commercial/industrial applications in quantum cryptography, quantum sensing, quantum communications, and quantum computation. Quantum cryptography exploits the non-cloning property of quantum states to implement secure cryptosystems, quantum sensors exploit quantum correlations to achieve a sensitivity or resolution surpassing classical systems, quantum communication exploits entanglement of quantum states for teleportation, and quantum computing utilizes the parallelism of quantum interference states for computational complexity and speed that may ultimately exceed the capability of today's digital technology. Non-locality principles can provide a basis for robust quantum networks that can detect and defend against malicious cyber attacks.

Progress in quantum information science, sensing and computation requires multidisciplinary efforts amongst physicists, computer scientists, mathematicians, and engineers. This conference will provide a forum for discussion including theoreticians and experimentalists from these disciplines and others with interest in quantum technologies. Papers that report on new developments and breakthroughs in quantum information science, quantum sensing, quantum communication, quantum cryptography, quantum computing, and mathematical aspects of quantum computing are invited.

Of particular interest are papers dealing with the following topics:

QUANTUM INFORMATION SCIENCE
- quantum information theory
- quantum measurement
- decoherence effects
- quantum complexity theory
- quantum algorithms

QUANTUM SENSORS, CLOCKS AND SYSTEMS
- quantum magnetometers
- quantum gravimeters and gravity gradiometers
- atom-based accelerometers
- atom clocks
- quantum imaging systems
- quantum memories

QUANTUM COMMUNICATION, NETWORKS AND CRYPTOGRAPHY
- quantum networks
- quantum repeaters and memories
- entangled states and their creation
- information processing with entangled states
- teleportation
- quantum cryptography and cryptosystems
- system architecture and engineering

QUANTUM COMPUTING
- solid state computing
- ion-trap quantum computing
- neutral-atom quantum computing
- Josephson junction quantum computing
- Photonic-based quantum computing
- cavity-QED quantum computing
- molecular quantum computing
- NMR quantum computing
- fault-tolerant quantum computing
- integrated photonics for quantum information processing
- single-photon sources and detectors
- classical quantum computing

MATHEMATICAL QUANTUM COMPUTATION
- Braid groups and topological quantum computing
- Holonomic quantum computing
- quantum walks and games
- quantum cellular automata
- quantum error correction

CYBERSECURITY
- secure communications
- quantum key distribution
- quantum number generation
- information sharing and secrecy
- cyber attack countermeasures

Cryogenic Cooling of Sensing Devices (SI107)

Conference Chairs: **Tonny Benschop,** Thales Cryogenics B.V. (Netherlands); **Carl S. Kirkconnell,** West Coast Solutions (United States)

Conference Co-Chairs: **Bjørn F. Andresen,** Consultant IR Technology (Israel); **Ingo N. Rühlich,** AIM INFRAROT-MODULE GmbH (Germany)

Program Committee: **Alexander Veprik,** Cryo Tech Ltd. (Israel)

This conference will be the opportunity to present and discuss progress in the areas of research, development, and the integration of cryogenic coolers with sensing devices for sensor manufacturers, system integrators and end users.

The conference section will be open to presentations of the various cooling technologies available to achieve the required low temperatures – focusing on temperatures below 180K – required for optimal detector and system operation. New cooling technologies which could lead to new applications are of particular interest to this conference. Customers who are willing to share their specific needs for the cooling of their device to cryogenic temperatures are encouraged to present their specific requirements and challenges during this session, as well.

Although the considered sensing devices are first and foremost those related to military and para-military sensor system technologies (like infrared detectors, optics, etc. for surveillance and targeting), we also welcome contribution to cover civilian commercial sensing applications, i.e., gamma-ray spectrometers, low-noise amplifiers required for signal conditioning, sensing devices requiring cooled sensors for pollution and process monitoring, etc.

Critical cooler parameters will vary with the type of device, its application and with the ingenuity of the developers. Among these parameters are size, weight, power consumption, vibration export, robustness, and cost. The purpose of the conference is to help developers of sensing systems understand the pros and cons of the different refrigeration technologies. This understanding will enable them to select the one technology that best answers their system performance requirements, and its technical and commercial limitations.

Beyond the different cooling techniques (i.e., mechanical coolers, optical refrigeration, thermo-electric refrigeration, etc.) we would like to encourage presentations addressing cryocooler requirements, system definition and integration challenges, not only at the cooler level, but also at the detector and system levels.

Please address questions or comments to the conference chairs via an email to:

Tonny.Benschop@nl.thalesgroup.com

Save the date

ABSTRACTS DUE: 7 OCTOBER 2020

AUTHOR NOTIFICATION: 4 DECEMBER 2020

The contact author will be notified of acceptance by email.

MANUSCRIPTS DUE: 17 MARCH 2021

PLEASE NOTE: Submission implies the intent of at least one author to register, attend the conference, present the paper as scheduled, and submit a full-length manuscript for publication in the conference proceedings.

Submit your abstract today: **spie.org/dcs21call**

Algorithms, Technologies, and Applications for Multispectral and Hyperspectral Imaging XXVII

(SI108)

Conference Chairs: **Miguel Velez-Reyes,** The Univ. of Texas at El Paso (United States); **David W. Messinger,** Rochester Institute of Technology (United States)

Program Committee: **Wojciech Czaja,** Univ. of Maryland, College Park (United States); **Michael T. Eismann,** Air Force Research Lab. (United States); **Jacqueline J. Le Moigne,** NASA Goddard Space Flight Ctr. (United States); **Joseph Meola,** Air Force Research Lab. (United States); **Daniela I. Moody,** Ursa Space Systems Inc. (United States); **Alan P. Schaum,** U.S. Naval Research Lab. (United States); **Torbjørn Skauli,** Norwegian Defence Research Establishment (Norway); **James Theiler,** Los Alamos National Lab. (United States); **Alina Zare,** Univ. of Florida (United States); **Amanda K. Ziemann,** Los Alamos National Lab. (United States)

Multispectral (MSI) sensors and hyperspectral (HSI) imaging spectrometers have become essential tools for a wide range of commercial, civil, environmental, defense and homeland security applications. Advances in optical fabrication and focal plane sensor technology for the ultraviolet through longwave infrared (0.3 - 14 µm) spectral regions, in combination with high-speed data capture, storage, and retrieval make it feasible and cost effective to conduct remote spectrometry from field, airborne, and spaceborne platforms. Models and algorithms for exploitation of spectral data must keep pace with remote spectral sensor system development and application.

The objectives of this conference are to demonstrate the utility and advance the capabilities of algorithms and sensors for spectral imaging, to address current and emerging applications, and to provide comprehensive insight into the field of spectral remote sensing. This conference facilitates the exchange of information and new ideas amongst the community of spectral sensor systems developers, exploitation systems and algorithm designers, modeling and phenomenology investigators, spectral data analysts, geospatial researchers, and application domain experts.

Papers are solicited on all topics relevant to spectral imaging and its applications. Thematic session proposals are also welcome.

Subjects of particular interest include, but are not limited to the following areas:

- Design, implementation, calibration, and characterization of active and passive spectral imaging systems
- Spectral remote sensing using airborne and terrestrial autonomous vehicles
- Physical modeling and spectral phenomenology
- Spectral data collection campaigns and development of spectral libraries
- Atmospheric compensation and radiometric calibration of spectral imagery
- Spectral characterization
- Spectral imaging standards
- Mathematical, statistical and data-driven modeling of spectral data
- Algorithms for spectral image exploitation
- Machine learning and big data analytics for spectral imaging
- Fusion of spectral data with other imaging or sensing modalities
- Development of data sets for testing and validation of spectral image processing algorithms
- Commercial, civil, environmental, space, defense and homeland security applications
- New and emerging concepts in active and passive spectral imaging and its applications.

Save the date

ABSTRACTS DUE: 7 OCTOBER 2020

AUTHOR NOTIFICATION: 4 DECEMBER 2020

The contact author will be notified of acceptance by email.

MANUSCRIPTS DUE: 17 MARCH 2021

PLEASE NOTE: Submission implies the intent of at least one author to register, attend the conference, present the paper as scheduled, and submit a full-length manuscript for publication in the conference proceedings.

Submit your abstract today: **spie.org/dcs21call**

Algorithms for Synthetic Aperture Radar Imagery XXVIII (SI109)

Conference Chairs: **Edmund Zelnio,** Air Force Research Lab. (United States); **Frederick D. Garber,** Wright State Univ. (United States)

Program Committee: **Joshua N. Ash,** Wright State Univ. (United States); **David Blacknell,** Defence Science and Technology Lab. (United Kingdom); **Mujdat Cetin,** Sabanci Univ. (Turkey); **Gil J. Ettinger,** Systems & Technology Research (United States); **David A. Garren,** Naval Postgraduate School (United States); **Eric R. Keydel,** Leidos, Inc. (United States); **Juan Li,** Univ. of Central Florida (United States); **Uttam Kumar Majumder,** Air Force Research Lab. (United States); **Michael J. Minardi,** Air Force Research Lab. (United States); **Randolph L. Moses,** The Ohio State Univ. (United States); **Les Novak,** Scientific Systems Co., Inc. (United States); **Christopher Paulson,** Air Force Research Lab. (United States); **Lee C. Potter,** The Ohio State Univ. (United States); **Brian Rigling,** Wright State Univ. (United States); **Timothy D. Ross,** Jacobs Technology (United States)

Z-FORMAT This conference follows a "Briefing, Poster Workshop, Panel Discussion" sequence known as the Z-format. During the first sessions of each day, authors highlight the results for their work in 10-minute oral briefings. After the presentations, these same authors are available for in-depth discussions in an extended poster session setting held in or near the conference room. Following the Poster Workshop, experts and audience address pressing issues and extensions from the sessions that day in a Panel Discussion.

SYNTHETIC APERTURE RADAR RESEARCH IS ADVANCING IN SEVERAL KEY APPLICATION AREAS:

- SAR target discrimination and classification algorithms and characterization of performance tradeoffs
- moving target (vehicles, dismounts) detection, tracking, imaging, and classification exploiting the long integration times provided by SAR based MTI
- video SAR for continuous surveillance
- image compression for large area coverage and video SAR streams
- ground, foliage, and building penetration
- advanced detection algorithms including coherent and non-coherent change detection for finding difficult targets (e.g., targets deployed under tree cover, camouflage, etc.) and for discriminating decoys
- 3D reconstruction and geolocation.

These enhancements are enabled by significant advancements in 2D and 3D imaging which are, in turn, driven by the incorporation of diversity into the imaging process. These diversities include: wide angle, polarization, waveform, frequency (e.g., Ka, Ku, X, L, UHF, VHF), and aperture (interferometric, MIMO, multi-static, passive sensing, and multi-pass sensing).

Of particular interest and importance is the application of machine learning (e.g., deep learning) approaches to these important problems. These very promising approaches are still in development and have the following challenges:

- using machine learning with relatively small amounts of measured data for training including the generation and use of synthetic data
- developing deep learning approaches that are robust, particularly when the conditions of the training and testing are mismatched
- developing deep learning approaches that are self-aware of their performance (e.g., providing full posteriors conditioned on target, sensor, and environment states)
- understanding the technical basis of a deep learning algorithm decision or estimate.

We strongly encourage papers to address these key challenges in applying machine learning to SAR applications and problems.

CONTEXT AND REPRODUCIBILITY

In order to provide context for technical contributions and enhance the reproducibility of results, authors are urged to explicitly characterize and state assumed models and model parameters/operating conditions affecting performance evaluations or simulations.

CHALLENGE PROBLEMS

Previous conferences have revealed emerging needs for the following types of problems: compressive sensing, sparse aperture processing systems, change detection systems, foliage and building penetration systems, and adaptive ATR systems that adapt to changing conditions and requirements.

To facilitate the development of such systems, AFRL has published a number of challenge problems on the site: https://www.sdms.afrl.af.mil/

2021 BEST STUDENT PAPER AWARD

In order to be considered for this award, the student must be the presenter and the primary author. A panel of experts will evaluate the papers, both for quality and content with regard to: 1) innovation, clarity, and style, and 2) the importance of the work to the field.

Automatic Target Recognition XXXI (SI110)

Conference Chairs: **Riad I. Hammoud,** TuSimple, Inc. (United States); **Timothy L. Overman,** Lockheed Martin Space Systems Co. (United States); **Abhijit Mahalanobis,** Univ. of Central Florida (United States)

Program Committee: **Leon Cohen,** Hunter College (United States); **Frederick D. Garber,** Wright State Univ. (United States); **Izidor Gertner,** The City College of New York (United States); **Megan King,** U.S. Army Combat Capabilities Development Command (United States); **Bing Li,** Lockheed Martin Rotary and Mission Systems (United States); **Jason P. Luck,** Lockheed Martin Missiles and Fire Control (United States); **Olga Mendoza-Schrock,** U.S. Air Force (United States); **Robert R. Muise,** Univ. of Central Florida (United States); **Nasser M. Nasrabadi,** West Virginia Univ. (United States); **Lakshmanan Nataraj,** Mayachitra, Inc. (United States); **Saurabh Prasad,** Univ. of Houston (United States); **Vahid R. Riasati,** California State Univ., Northridge (United States); **Firooz A. Sadjadi,** Lockheed Martin Corp. (United States); **Angel D. Sappa,** ESPOL Polytechnic Univ. (Ecuador), Computer Vision Ctr. (Spain); **Jason R. Stack,** Office of Naval Research (United States); **Michael Teutsch,** HENSOLDT Optronics GmbH (Germany); **Alan J. Van Nevel,** Naval Air Warfare Ctr. Aircraft Div. (United States); **Vincent J. Velten,** Air Force Research Lab. (United States); **Donald Waagen,** Air Force Research Lab. (United States); **Edmund Zelnio,** Air Force Research Lab. (United States)

Conference Cosponsor: LOCKHEED MARTIN

This conference will emphasize all aspects relating to the modern automatic and machine assisted target and object recognition technology: concepts such as model-based object/target recognition and tracking, neural networks, wavelets, information fusion, knowledge-based methods, adaptive and learning approaches, and advanced signal and image processing concepts for detection, tracking, and recognition for sonar/acoustic, EO, IR, radar, laser radar, multispectral and hyperspectral sensors. Papers dealing with the entire spectrum of algorithms, systems, and architecture in ATR/AOR will be considered.

In particular, papers on the model-based solutions will be considered. This includes hypotheses of the initial sets of the sensor data, predictive models of the target features and their relationships, techniques of evaluations/comparisons of the predicted models with the features extracted from the data. Suggested topics also include methods of imputation of missing or sparse data and subsequent evaluation of the results.

Another extremely important challenge for ATR is the evaluation and prediction of ATR performance given the practical limitation that data sets cannot represent the extreme variability of the real world. Methods are sought that allow a rapid insertion of new targets and adaptive algorithms capable of supporting flexible and sustained employment of ATR. A key technical challenge is the development of affordable ATR solutions that employ an open architecture to provide timely hardware and software insertion.

Papers presented at this conference will be automatically considered for inclusion in an ATR Special Issue in a refereed journal. Papers are solicited in the following and related topics:

MACHINE LEARNING FOR ATR
- Deep learning
- Adversarial learning
- Multi-view learning
- Training methodologies.

GEOSPATIAL REMOTE SENSING SYSTEMS
- Object recognition from multi-view 3D
- Object level change detection, recognizing the object from the change
- Wide area search – finding the object of interest in a scene
- Scene understanding/Sensemaking – inference of activity from a single image
- Performance evaluation issues.

IR-BASED SYSTEMS
- Detection, tracking, and recognition
- Phenomenological modeling of targets and background
- Polarization diversity
- Target/object and scene segmentation
- Passive Autonomous Navigation
- Performance evaluation issues.

HYPERSPECTRAL-BASED SYSTEMS REGISTRATION ISSUES
- Detection, tracking, and recognition
- Phenomenological modeling of targets and background
- Polarization and waveform adaptation
- Target/object and scene segmentation
- Performance evaluation issues.

RADAR/LASER RADAR-BASED SYSTEMS
- High-range resolution radar techniques
- Joint radar target tracking and classification approaches
- Ultra-wide band radar techniques
- Doppler, polarization, and waveform diversity for target classification
- Detection, tracking, recognition, segmentation, target, and clutter modeling
- Multisensory processing and fusion
- Performance evaluation issues.

SONAR/ACOUSTIC AND SEISMIC-BASED SYSTEMS

- Inverse scattering issues
- Direct scattering of acoustic waves
- Tomographic image formation
- Material identification
- Ultra-wide band methods for target detection and classification
- Multisensory fusion
- Biosensor systems
- Performance evaluation issues.

NEW METHODOLOGIES

- Information theoretical approaches in ATR
- Distributed and centralized sensor decision making
- Model-based object recognition
- Neural networks for ATR applications
- Wavelet decomposition methods for ATR
- Machine learning approaches such as deep learning, transfer learning, dictionary learning and manifold learning applications to ATR
- Mission adaptive systems
- Data characterization
- Performance estimation and modeling
- ATR/AOR development tools
- ATR/AOR architecture
- Algorithms for human detection, tracking, and activity recognition.

PANEL DISCUSSION:
Machine Learning for Automatic Target Recognition (ML4ATR)

Following the great success of the 2018 ML4ATR session, we intend to organize another session in 2021. The Machine Learning for Automatic Target Recognition (ML4ATR) session at SPIE Defense + Security (ATR conference) highlights the accomplishments to date and challenges ahead in designing and deploying deep learning and big data analytics algorithms, systems, and hardware for ATR. It provides a forum for researchers, practitioners, solution architects and program managers across all the widely varying disciplines of ATR involved in connecting, engaging, designing solutions, setting up requirements, testing and evaluating to shape the future of this exciting field. ML4ATR topics of interest include training deep learning based ATR with limited measured/real data, multi-modal satellite/hyperspectral/Sonar/FMV Imagery analytics, graph analytic multi-sensory fusion, change detection, pattern-of-life analysis, adversarial learning, trust and ethics.

We invite experts in the field to join this panel discussion in 2021. Each panelist gives a short keynote talk about their projects on machine learning for ATR.

Generous cash awards for best paper and student best paper presentations are sponsored by:

LOCKHEED MARTIN

Save the date

ABSTRACTS DUE: 7 OCTOBER 2020

AUTHOR NOTIFICATION: 4 DECEMBER 2020

The contact author will be notified of acceptance by email.

MANUSCRIPTS DUE: 17 MARCH 2021

PLEASE NOTE: Submission implies the intent of at least one author to register, attend the conference, present the paper as scheduled, and submit a full-length manuscript for publication in the conference proceedings.

Submit your abstract today:

Big Data III: Learning, Analytics, and Applications (SI111)

Conference Chairs: **Fauzia Ahmad,** Temple Univ. (United States); **Panos P. Markopoulos,** Rochester Institute of Technology (United States); **Bing Ouyang,** Florida Atlantic Univ. (United States)

Program Committee: **Moeness G. Amin,** Villanova Univ. (United States); **Gonzalo R. Arce,** Univ. of Delaware (United States); **Abdesselam Salim Bouzerdoum,** Univ. of Wollongong (Australia); **Ali Cafer Gurbuz,** Mississippi State Univ. (United States); **Dimitris A. Pados,** Florida Atlantic Univ. (United States); **Piya Pal,** Univ. of Maryland, College Park (United States); **Ashley Prater-Bennette,** Air Force Research Lab. (United States); **Zhijun G. Qiao,** The Univ. of Texas-Pan American (United States); **Ervin Sejdic,** Univ. of Pittsburgh (United States); **Adrian Stern,** Ben-Gurion Univ. of the Negev (Israel); **Yimin D. Zhang,** Temple Univ. (United States)

With the information deluge resulting from ubiquitous communication, imaging, and surveillance devices, medical and e-commerce platforms, and social networking sites, big data analytics and learning are becoming increasingly important. The objective of this conference is to provide a consolidated forum to explore and promote advances in big data from learning, analytics, and application perspectives. Furthermore, it seeks to foster cross-fertilization of ideas across the various application areas of big data.

Original papers are solicited in, but not limited to, the following topical areas:

- theoretical and physics-based modeling of big data systems
- computational modeling and integration of big data
- signal processing for big data
- distributed sensing and processing for big data
- big data science and analytics
- visualization analytics for big data
- machine learning for big data
- hardware implementation of big data systems
- compressive sensing techniques for big data analytics
- energy-efficient big data systems
- massive MIMO as big data systems
- multi-function, multi-mission big data systems
- big data for autonomous networked sensing
- big data for imaging
- big data for communications
- big data in defense and security
- big data in internet-of-things (IoT) and social networks
- big data in medicine and biology.

SPECIAL SESSION ON
Tensor Methods for Signal Processing and Machine Learning

A special session on tensor methods for signal processing and machine learning is being planned. This session will focus on most recent advances in the theory and practice of tensor processing and analysis for a variety of applications.

Save the date

ABSTRACTS DUE: 7 OCTOBER 2020

AUTHOR NOTIFICATION: 4 DECEMBER 2020

The contact author will be notified of acceptance by email.

MANUSCRIPTS DUE: 17 MARCH 2021

PLEASE NOTE: Submission implies the intent of at least one author to register, attend the conference, present the paper as scheduled, and submit a full-length manuscript for publication in the conference proceedings.

Submit your abstract today: **spie.org/dcs21call**

Computational Imaging VI (SI112)

Conference Chairs: **Lei Tian,** Boston Univ. (United States); **Jonathan C. Petruccelli,** Univ. at Albany (United States); **Chrysanthe Preza,** The Univ. of Memphis (United States)

Program Committee: **Amit Ashok,** College of Optical Sciences, The Univ. of Arizona (United States); **Oliver Cossairt,** Northwestern Univ. (United States); **Michael E. Gehm,** Duke Univ. (United States); **Ryoichi Horisaki,** Osaka Univ. (Japan); **Ulugbek Kamilov,** Washington Univ. in St. Louis (United States); **Jun Ke,** Beijing Institute of Technology (China); **Jinyang Liang,** Institut National de la Recherche Scientifique (Canada); **George Nehmetallah,** The Catholic Univ. of America (United States); **Yaron Rachlin,** MIT Lincoln Lab. (United States); **Adrian Stern,** Ben-Gurion Univ. of the Negev (Israel); **Andreas Velten,** Univ. of Wisconsin-Madison (United States); **Laura Waller,** Univ. of California, Berkeley (United States); **Ge Wang,** Rensselaer Polytechnic Institute (United States); **Abbie Watnik,** U.S. Naval Research Lab. (United States); **Zeev Zalevsky,** Bar-Ilan Univ. (Israel); **Yunhui Zhu,** Virginia Polytechnic Institute and State Univ. (United States); **Chao Zuo,** Nanjing Univ. of Science and Technology (China)

Conventional imaging methods typically strive to obtain an 'isomorphic' mapping of the spatial/spectral/temporal/polarimetric distribution of an object/scene's parameters (e.g. irradiance, morphology, temperature distribution, scattering strength, etc.). In order to achieve this objective, a prime goal of optical engineering has been to build 'perfect' lenses, mirrors, etc. to get an ideal isomorphic replicate, i.e. an image, of the object/scene of interest. This design philosophy results in many well-known limitations in conventional imaging systems. For example, one has to give up resolution for wide field-of-view in both photography and microscopy; images acquired from the optical instruments tend to be constrained by Nyquist sampling, resulting in huge data size in many applications.

Computational imaging and more generally sensing, is a new optical imaging system design frontier, which emphasizes the tight integration of physical optical design and computational post-measurement processing. This alternate approach to system design originates from the idea that imaging capabilities far beyond conventional imaging can be achieved by jointly designing 'indirect' measurement through encoding in the optical domain and decoding (e.g. 'reconstruction') via post-processing. Notable examples include demonstrations of extended depth of field imaging, compressive imagers that recover salient object features with orders of magnitude reduction in data requirement, single-shot hyper-spectral imaging, single-shot 3D imagers, and gigapixel high throughput imagers that achieve high resolution and wide field of view simultaneously.

Computational imaging spans a broad class of applications ranging from fundamental science, biomedical to industrial, defense and security applications. The aim of this conference is to bring together researchers from industry, academia and government that specialize in optical instrumentation, coded imaging designs, inverse problems, and signal processing in a single multidisciplinary forum. With the presentations of the latest developments, this conference is intended to serve as a platform to promote idea exchanges, interdisciplinary collaborations, and technological advancements in this new and exciting field with a focus on its future trends and development, and its implications to industrial, defense and security.

This conference intends to cover, but not limited to, the following topics:

INSTRUMENTATION DESIGN FOR COMPUTATIONAL IMAGING AND SENSING

- Compressive and feature specific design
- Coded aperture imaging
- Point spread function and pupil engineering
- Light field and tomographic imaging
- Digital and optical super resolution
- Adaptive optics and phase conjugation
- Phase diversity
- Computational/structured illumination
- Multi-modal and multiplexed imaging
- Multi-dimensional data capture, e.g. 3D, hyperspectral, spatiotemporal
- Multiple aperture systems

COMPUTATIONAL METHODS IN COMPUTATIONAL IMAGING AND SENSING

- Sparsity and low rank minimization methods
- Bayesian techniques in image reconstruction
- Machine learning and neural networks
- Phase retrieval
- Pattern matching, feature specific and principle component analysis
- Blind deconvolution
- Super resolution methods
- Multi-dimensional reconstruction, e.g. 3D, hyperspectral, spatiotemporal
- Information exploitation algorithms, such as detection, tracking, etc.

APPLICATIONS OF COMPUTATIONAL IMAGING AND SENSING

- Multi-spectral and Hyper-spectral imaging
- High-throughput and high-content disease screening
- Security X-ray, Terahertz, and Millimeter wave imaging
- Surveillance and situation awareness sensing and imaging
- Imaging through highly scattering media.

Dimensional Optical Metrology and Inspection for Practical Applications X (SI113)

Conference Chairs: **Kevin G. Harding,** Optical Metrology Solutions (United States); **Song Zhang,** Purdue Univ. (United States)

Conference Co-Chair: **Beiwen Li,** Iowa State Univ. of Science and Technology (United States)

Program Committee: **Nikola Dudukovic,** Lawrence Livermore National Lab. (United States); **Greg A. Finney,** IERUS Technologies, Inc. (United States); **Jason C. Fox,** National Institute of Standards and Technology (United States); **Motoharu Fujigaki,** Univ. of Fukui (Japan); **Steven E. Grantham,** National Institute of Standards and Technology (United States); **Stefan Heist,** Friedrich-Schiller-Univ. Jena (Germany); **Aravinda Kar,** CREOL, The College of Optics and Photonics, Univ. of Central Florida (United States); **Damien P. Kelly,** Technische Univ. Ilmenau (Germany); **Chris Koontz,** Raytheon Co. (United States); **Peter Kühmstedt,** Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany); **Martin Landmann,** Friedrich-Schiller-Univ. Jena (Germany); **Rongguang Liang,** College of Optical Sciences, The Univ. of Arizona (United States); **Andrés Guillermo Marrugo Hernandez,** Univ. Tecnológica de Bolívar (Colombia); **Georges T. Nehmetallah,** The Catholic Univ. of America (United States); **Gunther Notni,** Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany); **Kemao Qian,** Nanyang Technological Univ. (Singapore); **Prem Rachakonda,** National Institute of Standards and Technology (United States); **Edward W. Reutzel,** Pennsylvania State Univ. (United States); **Brian Simonds,** National Institute of Standards and Technology (United States); **Lei Tian,** Boston Univ. (United States); **Yajun Wang,** Wuhan Univ. (China); **Zhaoyang Wang,** The Catholic Univ. of America (United States); **Jiangtao Xi,** Univ. of Wollongong (Australia); **Jing Xu,** Tsinghua Univ. (China); **Dongmin Yang,** Apple Inc. (United States); **Xiangchao Zhang,** Fudan Univ. (China); **Zonghua Zhang,** Hebei Univ. of Technology (China); **Aurora A. Zinck,** Lockheed Martin (United States); **Chao Zuo,** Nanjing Univ. of Science and Technology (China)

This conference will focus on methods, analysis, and applications of optical metrology and inspection as applied to various industries, with particular emphasis on practical applications for non-optical parts. The field of optical metrology and inspection has grown to wide acceptance for many applications in industry. The advances in machine vision have provided compact, smart camera systems, new cameras and lighting systems, and better ways of communicating with the outside world. Two- and three-dimensional methods have seen wide use in the electronics industry but have also made advances in traditional areas such as automotive and aerospace metrology and manufacturing. The growth of additive manufacturing methods is demanding new, fast measurement tools for both monitoring the build process as well as checking the final parts. Additive metrology tools are being used for defect inspection, precision measurements, and the monitoring of automated processes. Modern computing power has made analysis methods such as phase shifting a viable tool for fast on-line monitoring and metrology applications.

This conference is intended to address the latest advances and future developments in the areas of optical inspection and metrology as they are applied to practical applications. Imaging and calibration techniques used in industrial automation are also welcome to this conference.

- machine/robot vision methods, architectures, and applications
- lighting methods and systems for inspection
- surface inspection methods and applications
- special optical systems for inspection and measurements
- 2D and 3D machine vision methods and applications
- structured light methods and applications
- image-based range measurement methods
- micro- and nano-scale measurement methods
- interferometric techniques applied to non-optical parts
- phase shifting methods applied to industrial inspection of non-optical parts
- optical methods for surface metrology
- mechano-optics and photonics for metrology and inspection
- system calibration and error analysis
- dimensional standards and artifacts
- 3D data manipulation
- on-line and process control measurements
- reverse engineering applications
- on-machine measurements of shape and finish
- metrology of additively manufactured parts
- optical methods for monitoring additive manufacturing
- high-resolution and high-speed inspection and monitoring applications.

Geospatial Informatics XI (SI114)

Conference Chairs: **Peter J. Doucette,** U.S. Geological Survey (United States); **Kannappan Palaniappan,** Univ. of Missouri-Columbia (United States); **Gunasekaran Seetharaman,** U.S. Naval Research Lab. (United States)

Conference Co-Chair: **Joshua D. Harguess,** The MITRE Corp. (United States)

Program Committee: **Hadi AliAkbarpour,** Univ. of Missouri-Columbia (United States); **Alex Aved,** Air Force Research Lab. (United States); **John A. Berger,** Toyon Research Corp. (United States); **Arnav Bhavsar,** Indian Institute of Technology Mandi (India); **Erik Blasch,** Air Force Office of Scientific Research (United States); **Prasad Calyam,** Univ. of Missouri-Columbia (United States); **May V. Casterline,** NVIDIA (United States); **John T. Dolloff,** Integrity Applications, Inc. (United States); **Flavio Esposito,** Saint Louis Univ. (United States); **Isabel Figueiredo,** Univ. de Coimbra (Portugal); **Hirsh Goldberg,** Johns Hopkins Univ. Applied Physics Lab., LLC (United States); **Jutta E. Hild,** Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany); **John M. Irvine,** The MITRE Corp. (United States); **Raju Namburu,** U.S. Army Research Lab. (United States); **Ram M. Narayanan,** The Pennsylvania State Univ. (United States); **Shibin Parameswaran,** Naval Information Warfare Ctr. Pacific (United States); **Raghuveer M. Rao,** U.S. Army Research Lab. (United States); **Andreas Savakis,** Rochester Institute of Technology (United States); **Jason S. Schwendenmann,** National Geospatial-Intelligence Agency (United States); **Clark N. Taylor,** Air Force Institute of Technology (United States); **William R. Thissell,** Deftec Corp. (United States); **Chris M. Ward,** Naval Information Warfare Ctr. Pacific (United States)

Geospatial Informatics is the science and technology that develops and uses information science and technology to address applications in the geospatial and geosciences. Recent trends in big data, visual analytics and cloud computing, small satellite technologies, wide availability of low-cost drones, innovations in sensors and the exponentially increasing volumes of geo-aware multi-sensor data streams for layered sensing are driving the development of novel methodologies and tools for integrating and exploiting multi-dimensional (temporal, spatial, and spectral) geospatial information. Geospatial information systems (GIS) combined with spatiotemporal data streams from sensor networks, social networks and ancillary information are enabling new insights and pattern discovery in large environmental, defense, and civil datasets that was not previously possible.

GIS is an essential analysis tool to support decision making from time-varying spatial information. Today, defense and civil applications, such as space-based satellite imaging, airborne/unmanned airborne systems (UAS), navigation for autonomous vehicles, terrestrial and maritime-based security systems, are rapidly transforming their focus from volume to value. From a traditional collect-and-view paradigm, that simply "takes pictures" to commercial high value, fully-capable GIS, that incorporate multi-sensor collections, perform advanced processing and analytics in real-time, initiate sensor cross-cueing, and allow multiple user communities to collaborate, rapidly retrieve and disseminate information with improved accuracies.

Exploitation of remote sensing data, and temporal data cubes for change analysis, are essential components of the evolving Geospatial Informatics field. Geospatial Informatics and remote sensing data analytics are critical technologies that enable defense and civil data providers to satisfy emerging demands in monitoring and security, for rapid access to information for situational awareness, for forensic retrospective analysis to track past change, and to develop decision models for anticipating future change.

Visual or geospatial cloud computing is becoming an enabling technology for large area mapping and in disaster response using small aerial and ground mapping systems with computing at the edge that have limited endurance and communication links. Algorithms, processing chains, work flows, data access, network routing and distributed processing need to be adapted and optimized for visual cloud and fog computing applied to streaming data with high data volume and variety but limited bandwidth, computational resources and node availability.

This conference provides a central collaboration point for industry, government, and academic leaders of geospatial informatics, GIS and remote sensing data analytics technologies to share their advancements, learning, and new solutions in algorithms, data integration architectures and standards, and big data science and cloud computing instrumental for achieving predictive analytics.

Topic areas include, but are not limited to:

GEOSPATIAL BIG DATA SCIENCE, ALGORITHMS AND DATA VISUALIZATION

- geospatial epidemiology
- detection and categorization of image features
- multisensor data fusion (VIS, IR, LIDAR, RADAR, SAR, etc.)
- multi- and hyperspectral data analysis
- 3D urban reconstruction and point cloud processing
- geospatial sourcing, human geography and behavior
- activity based/anticipatory intelligence
- predictive analytics for modeling and decision making
- autonomous mobile mapping systems
- geospatial contextual data and social networks
- geopositioning, pose estimation, error propagation, and uncertainty characterization
- augmented reality (AR)/virtual reality (VR) systems for geospatial data visualization.

ENVIRONMENTAL SENSING, ECOSYSTEM SCIENCE AND MONITORING

- drone-based mapping and aerial networking
- naval and marine applications of machine learning
- sensor and data management technologies to support sustainable land imaging strategies
- machine learning methods for land monitoring and change analysis
- implementation of temporal data cubes for community sharing

continued next page

Geospatial Informatics XI (SI114 continued)

- assessment of user needs to inform future sensor system designs
- geometric and radiometric calibration and validation methods
- applications including water quality, agriculture, wildlife, mining, forestry, oil and gas
- GPU-based real time processing
- mobile apps, cognitive interfaces and human factors.

FULL MOTION VIDEO ANALYTICS

- deep learning for vision
- cloud-based video analytics, processing and dissemination
- image, video and target track intelligence
- motion imagery standards and quality metrics
- motion imagery tagging, geopositioning
- large volume streaming data, wide area motion imagery
- next-generation video, stereo, multiview 3D
- precision navigation, geolocalization, visual odometry, SLAM
- automatic target recognition
- target tracking in dense, urban environments.

GEOSPATIAL INFORMATICS APPLICATIONS

- autonomous vehicle mapping and navigation
- visual geospatial cloud computing
- geospatially aware cyber-physical systems and cybersecurity
- urban planning, disaster response, search and rescue
- smart cities and smart health
- social networks, geospatial databases for data mining
- infrastructure inspection such as bridges and construction sites
- food, energy, water sustainable practices and policies
- crop phenotyping, methane detection, marine ecosystem resilience
- model-based image and video compression
- artificial intelligence and deep learning
- ground-truthing, crowd sourcing tools and challenge datasets
- automatic building detection and segmentation
- real estate development, zoning, state and local government mapping
- cultural heritage studies, archaeology.

Save the date

ABSTRACTS DUE: 7 OCTOBER 2020

AUTHOR NOTIFICATION: 4 DECEMBER 2020

The contact author will be notified of acceptance by email.

MANUSCRIPTS DUE: 17 MARCH 2021

PLEASE NOTE: Submission implies the intent of at least one author to register, attend the conference, present the paper as scheduled, and submit a full-length manuscript for publication in the conference proceedings.

Submit your abstract today: **spie.org/dcs21call**

Multimodal Image Exploitation and Learning 2021 (SI115)

Conference Chairs: **Sos S. Agaian,** College of Staten Island (United States); **Vijayan K. Asari,** Univ. of Dayton (United States); **Stephen P. DelMarco,** BAE Systems (United States)

Conference Co-Chair: **Sabah A. Jassim,** The Univ. of Buckingham (United Kingdom)

Program Committee: **David Akopian,** The Univ. of Texas at San Antonio (United States); **Reiner Creutzburg,** Fachhochschule Brandenburg (Germany); **Johan Debayle,** MINES Saint-Étienne (France); **Yunbin Deng,** BAE Systems (United States); **Eliza Yingzi Du,** Qualcomm Inc. (United States); **Frederic Dufaux,** Lab. des Signaux et Systèmes, CNRS (France); **Erlan H. Feria,** College of Staten Island (United States); **Artyom M. Grigoryan,** The Univ. of Texas at San Antonio (United States); **Balvinder Kaur,** U.S. Army Research, Development and Engineering Command (United States); **Mehrube Mehrubeoglu,** Texas A&M Univ. Corpus Christi (United States); **Karen Panetta,** Tufts Univ. (United States); **Haleh Safavi,** NASA Goddard Space Flight Ctr. (United States); **Harin Sellahewa,** The Univ. of Buckingham (United Kingdom); **Jinshan Tang,** Michigan Technological Univ. (United States); **Viacheslav Voronin,** Don State Technical Univ. (Russian Federation); **Shiqian Wu,** Wuhan Univ. of Science and Technology (China); **Yufeng Zheng,** Alcorn State Univ. (United States)

This conference is designed to attract expert researchers and end users in multimedia field, secure communication, and their counterparts in the mobile and wireless field, with the aim of creating a framework to foster research in various aspects of processing, analysis, transmission, and classification of media objects. Current generations of programmable mobile devices are endowed with low-cost high-resolution digital cameras and can provide new opportunity for mass deployment in applications that involve the use of imaging in various scientific and engineering endeavors. The range of such applications is widening fast to include commercial, biomedical image analysis for diagnoses, crime and terrorism fighting, military, and industrial use. Video streaming over mobile devices, the use of PDA's in m-health, transmission of image-based biometrics over mobile networks for crime fighting, and deployment of mobile secure communications in disaster areas are all but a few examples of such applications. The emphasis in many such applications is on security based efficient tools from cryptography and steganography. On the theoretical front, recent advances in compressive sampling provides new efficient tools to process extremely complex biomedical images of very high resolutions as well as deal with objects detection/recognition from low-resolution degraded images in surveillance scenarios. The constrained capabilities of mobile devices, the nature of wireless channels, and the severe degradation in image quality and resolution are a source of tough challenges in image processing and security of multimedia objects. The combination of commercial and security-related topics to be covered in this conference is designed to facilitate multidisciplinary discussions and collaboration on the algorithmic and technological issues. In addition, the conference welcomes contributions relating to other real-world applications and theoretical developments in the area of mobile multimedia/imaging techniques in secure and pervasive computing environments.

Key topics discussed include, but are not limited to:

- multimodal image analytics
- multimodal deep learning algorithms and systems
- multimedia processing for mobile devices
- innovative multimodal image processing techniques (e.g., enhancement, detection, recognition, restoration, verification, and authentication)
- secure mobile communication
- homeland defense and crime-fighting applications
- biometrics-based authentication for mobile and wireless devices/networks
- security and privacy of image-based identity data
- steganography, steganalysis, and watermarking
- fusion techniques for multimedia analysis
- computing architectures for multimodal imaging
- mobile image/video databases
- mobile imaging
- mobile deep learning applications
- content-based video indexing and retrieval
- virtual reality and multimodal imaging for navigation
- digital media and mobile forensics
- security, trust, and privacy issues in wireless ad hoc networks
- multimedia authentication, encryption, identification, fingerprinting, and copyright protection
- secure multimedia system design and evaluation benchmarks
- biometric key generation and data hiding in multimodal biometrics
- practical systems exhibiting data hiding
- mobile TV technologies
- compressive sensing
- superresolution
- multimodal imaging on encrypted domain.

Pattern Recognition and Tracking XXXII (SI116)

Conference Chair: **Mohammad S. Alam,** Texas A&M Univ.-Kingsville (United States)

Program Committee: **Ayman Alfalou,** ISEN Brest (France); **Vijayan K. Asari,** Univ. of Dayton (United States); **Khan M. Iftekharuddin,** Old Dominion Univ. (United States); **Jed Khoury,** Lartec, Inc. (United States); **Thomas T. Lu,** Jet Propulsion Lab. (United States); **Asif Mehmood,** Air Force Research Lab. (United States); **Vahid R. Riasati,** Northrop Grumman Corp. (United States); **Rupert C. D. Young,** Univ. of Sussex (United Kingdom)

This conference is an annual forum for new research on pattern recognition and tracking (PRT). It includes algorithm, architecture, and system approaches. Theoretical, simulation, and optical/digital/hybrid hardware realizations are strongly encouraged. Special emphasis will be given to new advances in pattern recognition and tracking. Papers on optical/digital filters and systems that perform with real-world non-ideal optical/digital devices are encouraged. Besides correlators, other pattern recognition architectures and approaches are also encouraged, which may include feature extractors for product inspection, and object identification and tracking. Papers on devices, components, systems, and products developed under the Small Business Innovative Research (SBIR) program are encouraged. We further encourage papers on new techniques to process newer sensor data, such as laser radar and synthetic aperture radar (SAR) inputs.

The tentative list of topics for which papers are requested include:

- novel pattern recognition and tracking (PRT) systems
- distortion-invariant and controlled invariance correlation filters
- correlation filters for clutter and structural noise rejection, and for segmentation/detection
- new techniques to process infrared, SAR, laser radar, MMW, etc., sensor data
- hyperspectral and fuzzy logic based PRT systems
- feature extractors for product inspection and target identification
- optical/digital neural networks
- Deep learning based PRT techniques
- optical/digital hardware and use of non-ideal real-world devices
- photorefractive elements in OPR for PRT systems
- SBIR devices, components, systems, and products
- computer vision and perception
- speech recognition
- medical image recognition
- pattern recognition in big data analytics
- optical/digital techniques as related to homeland security, sensing, and defense
- new recognition and tracking algorithms
- optical/digital biometric recognition
- wide-area surveillance.

Real-Time Image Processing and Deep Learning 2021 (SI117)

Conference Chairs: **Nasser Kehtarnavaz,** The Univ. of Texas at Dallas (United States); **Matthias F. Carlsohn,** Computer Vision and Image Communication at Bremen (Germany)

Program Committee: **Mohamed Akil,** LIGM, Univ. Paris-Est Marne-la-Vallée (France); **Guillermo Botella,** Univ. Complutense de Madrid (Spain); **M. Emre Celebi,** Univ. of Central Arkansas (United States); **Touradj Ebrahimi,** Ecole Polytechnique Fédérale de Lausanne (Switzerland); **Christos Grecos,** National College of Ireland (Ireland); **Ruby Mehrubeoglu,** Texas A&M Univ. Corpus Christi (United States); **Volodymyr Ponomaryov,** Instituto Politécnico Nacional (Mexico); **Fatih Porikli,** Qualcomm Inc. (United States); **Luis Salgado,** Univ. Politécnica de Madrid (Spain); **Sergio Saponara,** Univ. di Pisa (Italy); **Mukul V. Shirvaikar,** The Univ. of Texas at Tyler (United States); **Bogdan Smolka,** Silesian Univ. of Technology (Poland)

This conference addresses the real-time aspects of image processing and real-time aspects of deep learning solutions in various imaging and vision applications. These aspects include algorithmic computational complexity, hardware implementation, and software optimization for the purpose of making an image processing or recognition system to operate in real-time for an application of interest. The SPIE Conference on Real-Time Image Processing and Deep learning is the continuation of the SPIE Conference on Real-Time Image and Video Processing that has been held for many years but is now expanded to include real-time deep learning for solving image recognition problems. This conference, similar to the previous real-time image processing conferences, is intended to serve as a field catalyst bringing together scientists and researchers from industry and academia working in real-time image processing and deep learning to present recent research results pertaining to real-time solutions to image processing and recognition applications.

Papers of interest include, but not limited to, the following general topics addressing real-time aspects of image processing and deep learning:

- real-time image and video processing algorithms
- computational efficiency aspects of image or video processing systems
- real-time hardware implementation of image or video processing on embedded processors
- computational efficiency aspects of training image recognition deep learning networks
- real-time operation of image recognition deep learning networks
- real-time hardware implementation of image recognition deep learning networks on embedded processors
- applying machine learning techniques to improve image processing speeds
- real-time image processing and machine learning addressing COVID-19 pandemic.

Save the date

ABSTRACTS DUE: 7 OCTOBER 2020

AUTHOR NOTIFICATION: 4 DECEMBER 2020

The contact author will be notified of acceptance by email.

MANUSCRIPTS DUE: 17 MARCH 2021

PLEASE NOTE: Submission implies the intent of at least one author to register, attend the conference, present the paper as scheduled, and submit a full-length manuscript for publication in the conference proceedings.

Submit your abstract today: **spie.org/dcs21call**

Advanced Optics for Imaging Applications: UV through LWIR VI (SI200)

Conference Chairs: **Jay N. Vizgaitis,** optX imaging systems (United States); **Peter L. Marasco,** Air Force Research Lab. (United States); **Jasbinder S. Sanghera,** U.S. Naval Research Lab. (United States)

Program Committee: **Bjørn F. Andresen,** Consultant, Infrared Technologies & Applications (Israel); **Guy Beadie,** Peak Nano Optics (United States); **Kyle R. Bryant,** U.S. Army AMRDEC (United States); **John P. Deegan,** Rochester Precision Optics, LLC (United States); **Mark Durham,** DRS Technologies, Inc. (United States); **Stephen P. McGeoch,** Thales Optronics Ltd. (United Kingdom); **Craig Olson,** L-3 Communications (United States); **Clara Rivero-Baleine,** Lockheed Martin Missiles and Fire Control (United States); **Harry H. Schlemmer,** HENSOLDT Optronics GmbH (Germany); **Miguel P. Snyder,** U.S. Army RDECOM CERDEC NVESD (United States); **Doron Sturlesi,** Rafael Advanced Defense Systems Ltd. (Israel); **Alan Symmons,** LightPath Technologies, Inc. (United States); **Stan Szapiel,** Raytheon ELCAN Optical Technologies (Canada); **Nicholas A. Thompson,** Qioptiq Ltd. (United Kingdom); **Jue Wang,** Corning Specialty Materials, Inc. (United States)

The demands for lower system weight, volume, and cost while expecting enhanced imaging performance, coupled with many advancements in focal plane technology, has created a paradigm shift in optical systems, requiring renewed emphasis on optics development as a critical enabler in meeting the demands of scientific, industrial, security, and defense systems. The recent emergence of new design capabilities, materials, and fabrication techniques has created a near-revolution in designing high performance single- and multi-band optical systems. These developments have gone a long way towards answering the recurring demands for sensor systems having better imaging performance, longer target acquisition ranges, greater reliability, greater flexibility, reduced weight, volume, power consumption, and lower cost.

A strong trend towards the use of optical multi-band sensor systems requires the conference to consider the full optical region from ultra-violet to long-wave infrared. This conference will bring together researchers and students, as well as developers and users of optical technologies and optical systems, to discuss improvements in sensor systems brought about by the incorporation of advanced optics technologies and/or new techniques in their design, development, and manufacture. Our goal is, in the communities noted earlier, to inspire, advance, and support revolutionary advancement in optics and optical technologies. Papers that examine and advance novel concepts in optical engineering and demonstrate their utility in relevant, real-world context are desired.

BEST STUDENT PAPER AWARD

Special emphasis will be placed on university research in general, and student conceived and executed research in particular. A cash award will be given for the best paper authored by a student, sponsored by optX imaging system, LLC. Presentations/Manuscripts will be judged based on scientific merit, impact, and clarity. Qualifying papers must be authored (first author) by a full-time student, and meet all submission deadlines. Papers will be judged by the chairs on innovation, scientific merit, impact, and clarity. Please notify the conference chairs if you would like your qualifying paper to be considered for this competition.

Optical technologies will include but not be limited to:

DESIGN, MATERIALS, FABRICATION, AND METROLOGY FOR:

- reflective and refractive optics for the UV, NIR, SWIR, MWIR and LWIR
- multispectral/multiple waveband imaging optics
- multi-field of view optics
- low-cost optics
- advanced lenses (GRIN, diffractive, aspheres, etc)
- new materials (GRIN, chalcogenides, polymers, nanoparticle-based materials, etc.)
- metamaterial and metasurfaces for imaging optics
- molded optics
- freeform optics
- optics and imaging systems unique to computational imaging
- conventional/unconventional coatings for filters, lenses, and mechanics
- stray light control
- opto-mechanics, assembly, and alignment
- optical systems testing
- integrated optics/camera technologies
- optics created through additive manufacturing techniques
- newly developing optics technologies
- design tools for new developing optics technologies.

FOR USE IN IMAGING APPLICATIONS INCLUDING BUT NOT LIMITED TO:

- infrared imaging systems
- handheld/body-mounted imaging systems (objective lenses, relay systems, and eyepieces)<
- weapon sights
- low light level imaging
- small and large uninhabited vehicles (UAV) (air, ground, water, underwater)
- ground-based systems (for observation, surveillance, navigation, pilotage, and targeting)
- airborne systems (for observation, surveillance, navigation, pilotage, and targeting)
- marine systems (for maritime observation, surveillance, navigation, pilotage, and targeting)
- spaceborne systems
- threat/hazard warning systems
- vehicle guidance system
- hyperspectral systems
- imaging around corners
- next-generation systems.

Save the date

ABSTRACTS DUE: 7 OCTOBER 2020

AUTHOR NOTIFICATION: 4 DECEMBER 2020

The contact author will be notified of acceptance by email.

MANUSCRIPTS DUE: 17 MARCH 2021

PLEASE NOTE: Submission implies the intent of at least one author to register, attend the conference, present the paper as scheduled, and submit a full-length manuscript for publication in the conference proceedings.

Submit your abstract today:

Anomaly Detection and Imaging with X-Rays (ADIX) VI (SI201)

Conference Chairs: **Amit Ashok,** The Univ. of Arizona (United States); **Joel A. Greenberg,** Duke Univ. (United States); **Michael E. Gehm,** Duke Univ. (United States)

Program Committee: **Mark A. Anastasio,** Washington Univ. in St. Louis (United States); **Gonzalo R. Arce,** Univ. of Delaware (United States); **Ali Bilgin,** The Univ. of Arizona (United States); **Eric W. Clarkson,** The Univ. of Arizona (United States); **Mini Das,** Univ. of Houston (United States); **Edward D. Franco,** Rapiscan Systems Labs. (United States); **Christopher W. Gregory,** Smiths Detection Inc. (United States); **Tim E. Harvey,** EMF Corp. (United States); **Harry E. Martz,** Lawrence Livermore National Lab. (United States); **Joseph A. O'Sullivan,** Washington Univ. in St. Louis (United States); **Sean Pang,** CREOL, The College of Optics and Photonics, Univ. of Central Florida (United States); **Lei Tian,** Univ. of California, Berkeley (United States); **Laura Waller,** Univ. of California, Berkeley (United States); **Sharene Young,** U.S. Dept. of Homeland Security (United States); **Yunhui Zhu,** Virginia Polytechnic Institute and State Univ. (United States)

X-ray imaging has its beginning in medical imaging. However, advances in x-ray component technology coupled with the exponential growth in computational capability has fueled the expansion of x-ray imaging to numerous defense and security applications. For example, x-ray based imaging system are now widely deployed at security checkpoints and air-cargo screening at airports, seaports, commercial and military building/installations. Another modern application of x-ray imaging is non-destructive part inspection for industrial and aviation safety. Recently, there has been a growing interest in Opioid detection with X-rays. While the application base for x-ray based anomaly detection and imaging continues to grow the x-ray imaging system architecture, inspired by computed tomography (CT) for medical imaging, has remained largely unchanged. However, recently non-traditional x-ray imaging architectures and sophisticated post-processing algorithms have begun to emerge which leverage recent advances in mathematical theory of sampling (e.g. compressive sensing) together with increasing exploitation of available signal and task prior information. This conference provides an open forum for researchers from academia, industry and government to address current/future challenges by sharing latest advances in all aspects of x-ray based anomaly detection and imaging, ranging from component technology, reconstruction and data exploitation algorithms, imaging/sensing system architectures to system performance metrics and novel defense and security applications.

Save the date

ABSTRACTS DUE: 7 OCTOBER 2020

AUTHOR NOTIFICATION: 4 DECEMBER 2020

The contact author will be notified of acceptance by email.

MANUSCRIPTS DUE: 17 MARCH 2021

PLEASE NOTE: Submission implies the intent of at least one author to register, attend the conference, present the paper as scheduled, and submit a full-length manuscript for publication in the conference proceedings.

Submit your abstract today: **spie.org/dcs21call**

Fiber Optic Sensors and Applications XVII (SI202)

Conference Chairs: **Robert A. Lieberman,** Lumoptix, LLC (United States); **Glen A. Sanders,** Honeywell Technology (United States); **Ingrid U. Scheel,** Columbia Gorge Research LLC (United States)

Conference Co-Chairs: **Gary Pickrell,** Virginia Polytechnic Institute and State Univ. (United States); **Eric Udd,** Columbia Gorge Research (United States)

Program Committee: **Christopher S. Baldwin,** Weatherford International Ltd. (United States); **Eric A. Bergles,** BaySpec Inc. (United States); **Michael P. Buric,** National Energy Technology Lab. (United States); **Brian Culshaw,** Univ. of Strathclyde (United Kingdom); **Abdessama Elyamani,** Northrup Grumman Navigation Systems (United States); **Yoel Fink,** Massachusetts Institute of Technology (United States); **Eric Lee Goldner,** U.S. Sensor Systems, Inc. (United States); **Hajime Haneda,** National Institute for Materials Science (Japan); **Daniel Homa,** Virginia Polytechnic Institute and State Univ. (United States); **Kazuo Hotate,** The Univ. of Tokyo (Japan); **Jiri Kanka,** Institute of Photonics and Electronics of the ASCR, v.v.i. (Czech Republic); **Gurbinder Kaur,** Thapar Univ. (India); **Victor I. Kopp,** Chiral Photonics, Inc. (United States); **Katerina Krebber,** Bundesanstalt für Materialforschung und -prüfung (Germany); **John L. Maida Jr.,** Halliburton (United States); **Alexis Mendez,** MCH Engineering LLC (United States); **Thomas D. Monte,** KVH Industries, Inc. (United States); **Reinhardt Willsch,** Institut für Photonische Technologien e.V. (Germany)

This conference covers all aspects of optical and laser sensing and measurement based on waveguides and other light-guiding structures.

SENSOR TYPES INCLUDE:
- fiber optic sensors
- sensors based on photonic integrated circuits ("PIC chips")
- sensors based on optofluidics
- contained-laser sensors (e.g. ring-laser gyroscopes, cavity-ringdown sensors)
- optrodes/optodes
- nuclear sensors (e.g. radiation monitoring)

SENSOR MEASURANDS INCLUDE:
- mechanical properties (strain, pressure, vibration, flow, displacement, rotation...)
- electromagnetic properties (voltage, charge, current, magnetic field...)
- chemical properties (composition, concentration, density, reaction kinetics ...)
- bio/medical properties (physiological parameters, pathogens, biomarkers, malignancies...)
- radiation monitoring

SENSING MECHANISMS INCLUDE:
- interferometry and polarimetry (e.g., Sagnac, Michelson, Mach-Zehnder...)
- scattering (e.g. Rayleigh, Brillouin, Mie, Raman/SERS...)
- spectroscopy (UV-VIS-IR absorbance/reflectance/luminescence, evanescent field...)
- acousto-optics
- laser ultrasonics
- plasmonic interactions
- quantum phenomena
- topological photonics and optics for sensing

SENSOR TECHNOLOGIES INCLUDE:
- photonic crystal fibers
- coated-waveguide sensors
- metamaterial structures
- ring resonators
- integrated optic chips for interrogating fiber sensors
- distributed and multipoint sensors, sensing systems

PAPERS OF THE FOLLOWING TYPE ARE SOUGHT:
- theory and simulations
- studies of sensing architectures and techniques
- experimental demonstrations of sensor function
- reports of "real world" sensor operation
- comparative analysis of sensor system performance.

FOCUS AREA: FIBER OPTIC SENSORS AND APPLICATIONS

This focus area seeks papers on the development and application of fiber optic sensors technology and the components that are being used to support them which includes but is not limited to the following:
- fiber etalon and fiber Bragg grating (FBG)-based sensors
- specialty fibers and passive/active fiber devices for sensing applications
- multiplexing and sensor networking
- field applications and system trials in civil structures, aerospace, oil and gas, medical, utilities, environmental monitoring, and security
- military and defense fiber sensor development, uses, and applications

FOCUS AREA: INTEGRATED OPTICS FOR SENSING

This focus area seeks papers on the development and application of photonic integrated circuits for sensing – both as application-specific optical chips for sensor systems, and as sensor elements themselves. Some illustrative examples of appropriate subjects are:
- structures for sensors based on quantum phenomena
- lithium niobite structures for optical gyroscopes
- coated and/or porous optical waveguide structures for chemical detection
- silicon photonics for light-handling in multiplexed sensor systems
- "spectrometer-on-a-chip" structures
- PIC chips for Bragg grating sensor interrogation
- PIC chips for luminescence-based sensors

continued next page

Fiber Optic Sensors and Applications XVII (SI202 continued)

FOCUS AREA: EXOTIC GUIDED-WAVE STRUCTURES FOR SENSING

The rapid proliferation, and in some cases deep market penetration, of non-traditional optical structures has created a revolution in the thinking of optical sensor designers and users. Because progress in optical/photonic science is so broad and so rapid, we give only a few examples of topics on which papers sought:

- waveguide structures embodying topological photonics
- metamaterials and other non-classical optical structures
- photonic crystal and photonic bandgap structures
- antiresonant reflecting optical waveguide (ARROW) structures
- hollow-core and metallic fibers
- ring laser structures
- resonant cavity sensors
- CRS and evanescent fiber-laser spectroscopic structures
- free-form optical elements designed for sensor systems

FOCUS AREA: HARSH ENVIRONMENT SENSORS FOR ENERGY APPLICATIONS

Alternative energy systems are being developed to meet growing consumer demands and will drive innovative of alternative and advanced sensing techniques to monitor, verify, and adapt systems to evolving needs. This focus area will include papers on new techniques and applications for sensing in harsh environments specific to energy applications.

- power system monitoring
- downhole monitoring for harsh environment applications
- generation, transportation, and distribution of electric power and other energy resources
- applications in novel energy systems
- harsh environment applications and sensor packaging for operation in extreme environments
- field applications and system trials in environmental and energy monitoring, modeling, manufacturing.

Infrared Imaging Systems: Design, Analysis, Modeling, and Testing XXXII (SI203)

Conference Chairs: **Gerald C. Holst,** JCD Publishing (United States); **David P. Haefner,** U.S. Army Combat Capabilities Development Command C5ISR (United States)

Program Committee: **Gisele Bennett,** Cintron-Brock Engineering Corp. (United States); **Piet Bijl,** TNO Defence, Security and Safety (Netherlands); **Katrin Braesicke,** Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany); **James A. Dawson,** Dynetics, Inc. (United States); **John W. Devitt,** Raytheon Co. (United States); **Russell M. Drake,** Raytheon Network Centric Systems (United States); **Ronald G. Driggers,** Univ. of Central Florida (United States); **Richard L. Espinola,** U.S. Naval Research Lab. (United States); **Orges Furxhi,** imec USA - Florida (United States); **Jonathan G. Hixson,** U.S. Army Night Vision & Electronic Sensors Directorate (United States); **Eddie L. Jacobs,** Univ. of Memphis (United States); **Terrence S. Lomheim,** The Aerospace Corp. (United States); **Joseph P. Reynolds,** U.S. Army RDECOM CERDEC NVESD (United States); **Nicolas Rivière,** ONERA (France); **Michael A. Soel,** FLIR Systems, Inc. (United States); **Sean Strickland,** Santa Barbara Infrared, Inc. (United States); **Curtis M. Webb,** L3Harris Technologies, Inc. (United States)

Sensor technologies are undergoing revolutionary advances. Increases in spatial, spectral, and temporal resolution, and in breadth of spectral coverage, render feasible sensors that function with unprecedented performance. Advances in computational power allow unparalleled exploitation of information collected by multicolor sensors, hyperspectral imagers, and multisensors. Existing applications are significantly enhanced and completely new application areas are arising. This has generated a renewed demand for measuring, modeling, and simulating target and background signatures and synthesizing multisensor contrast attributes to a depth of detail not seen before.

Sensor suites (multi-sensor platforms) are becoming prevalent. The methods used for design, modeling, analysis, and testing are generic to all imaging systems and apply to all sensors within a suite. Papers (listed in the following areas) are solicited for both non-thermal (UV, visible, low light level TV, NIR, and SWIR) as well as thermal imaging systems (MWIR and LWIR).

The potential for smart sensing, robotic platforms, and communication networks has inspired both commercial and military users to look at families of affordable, interactive sensors to enhance situational awareness including surveillance, targeting, seekers, and damage assessment. Platforms for consideration are unmanned ground and air vehicles, munitions, and unattended ground sensors.

Topics include:
- smart sensor design
- sensor suites (including sensor interactions)
- sensor suite analysis metrics
- testing metrics

Varieties of models (e.g., NVIPM) exist for analyzing advanced imaging systems. New models or upgrades to existing models are necessary as new concepts are developed or existing systems are improved. Emerging technologies include uncooled detectors, quantum well detectors, novel scanning focal plane arrays, as well as image processing algorithms. The advantages of image processing on target detection has not been fully quantified.

Topics include:
- modeling of scanning, staring, TDI systems
- imaging trackers and seekers
- image quality metrics of sampled data systems
- image processing models (applicable to target detection and recognition)
- human factors
- display characteristics
- effects of sampling and phasing
- system improvements gained by microscan
- super-resolution

Model validation can only be ascertained through accurate and comprehensive testing.

Topics include:
- calibration
- measurement techniques
- uncertainty analysis
- test requirements for second generation and uncooled systems
- laboratory-field test correlation

The sensor suite may contain laser range finders and laser designators. Future applications on unmanned ground and air vehicles will place more importance on integration, alignment, testing and field support of multi-sensor platforms.

Topics include:
- multi-sensor boresight
- laser range finder and designator testing
- low light level TV testing
- development of test metrics for integrated systems
- sensor fusion metrics

Imaging system optimization requires knowledge of the target signatures, and atmospheric propagation effects.

Topics include:
- target and background measurements and characterization
- characterization of backgrounds in other than moderate climates, including the urban environment
- improvements in and validation of target & background models including clutter

continued next page

Infrared Imaging Systems: Design, Analysis, Modeling, and Testing XXXII (SI203 continued)

- advances in scene simulation/representation models and related technologies
- camouflage, concealment & deception (CC&D)
- target acquisition in benign and cluttered scenes
- broad band atmospheric phenomena (absorption, scattering, and path radiance)
- atmospheric turbulence effects on target acquisition
- comparison of measure and predicted atmospheric transmission

Scene simulation and hardware-in-the-loop (HWIL) focusses on smart weapon testing.

Topics include:

- Facilities, Testbed Examples/Techniques
- development/feasibility of low-cost PC scene generators
- real-time modeling and rendering of synthetic targets/backgrounds/countermeasures
- image projection, signal injection, sensor bypass modelling
- LADAR hyperspectral, semi-active laser, image generation and presentation for real-time HWIL.
- multiple bands/views, high spatial/frame rates, dynamic objects such as clouds, plumes, and explosions.

Save the date

ABSTRACTS DUE: 7 OCTOBER 2020

AUTHOR NOTIFICATION: 4 DECEMBER 2020

The contact author will be notified of acceptance by email.

MANUSCRIPTS DUE: 17 MARCH 2021

PLEASE NOTE: Submission implies the intent of at least one author to register, attend the conference, present the paper as scheduled, and submit a full-length manuscript for publication in the conference proceedings.

Submit your abstract today: **spie.org/dcs21call**

Infrared Technology and Applications XLVII (SI204)

Conference Chairs: **Bjørn F. Andresen,** Consultant, Infrared Technologies & Applications (Israel); **Gabor F. Fulop,** Maxtech International, Inc. (United States), Infrared Imaging News (United States); **Lucy Zheng,** Institute for Defense Analyses (United States)

Conference Co-Chairs: **Masafumi Kimata,** Ritsumeikan Univ. (Japan); **John Lester Miller,** Cascade Electro-Optics, LLC (United States)

Program Committee: **Tayfun Akin,** Mikro-Tasarim Ltd. (Turkey), Middle East Technical Univ. (Turkey); **Oguz Altun,** ASELSAN A.S. (Turkey); **Sooho Bae,** i3system, Inc. (Korea, Republic of); **Eric Belhaire,** Thales LAS France SAS (France); **Wolfgang A. Cabanski,** AIM INFRAROT-MODULE GmbH (Germany); **John T. Caulfield,** Cyan Systems (United States); **Leonard P. Chen,** Raytheon Vision Systems (United States); **Eric Costard,** IRnova AB (Sweden); **Ronald G. Driggers,** Univ. of Central Florida (United States); **Michael T. Eismann,** Air Force Research Lab. (United States); **Martin H. Ettenberg,** Princeton Infrared Technologies, Inc. (United States); **Michael Groenert,** U.S. Army Night Vision & Electronic Sensors Directorate (United States); **Sarath D. Gunapala,** Jet Propulsion Lab. (United States); **Charles M. Hanson,** SenseIR Solutions, LLC (United States); **Weida Hu,** Shanghai Institute of Technical Physics of the Chinese Academy of Sciences (China); **Daniel Jardine,** L3Harris Technologies Inc (United States); **Arjun KarRoy,** Jazz Semiconductor, Inc. (United States); **Hee Chul Lee,** KAIST (Korea, Republic of); **Paul D. LeVan,** Air Force Research Lab. (United States); **Kevin C. Liddiard,** Electro-optic Sensor Design (Australia); **Wei Lu,** Shanghai Institute of Technical Physics of the Chinese Academy of Sciences (China); **Michael H. MacDougal,** Attollo Engineering, LLC (United States); **Tara J. Martin,** Collins Aerospace (United States); **Whitney Mason,** Defense Advanced Research Projects Agency (United States); **Paul L. McCarley,** Air Force Research Lab. (United States); **R. Kennedy McEwen,** Leonardo MW Ltd. (United Kingdom); **Mario O. Münzberg,** HENSOLDT Optronics GmbH (Germany); **Minh Nguyen,** HRL Labs., LLC (United States); **Peter W. Norton,** BAE Systems (United States); **Joe G. Pellegrino,** U.S. Army Night Vision & Electronic Sensors Directorate (United States); **Manijeh Razeghi,** Northwestern Univ. (United States); **Donald A. Reago Jr.,** U.S. Army RDECOM CERDEC NVESD (United States); **Austin Richards,** FLIR Systems, Inc. (United States); **Patrick Robert,** Lynred (France); **Antoni Rogalski,** Military Univ. of Technology (Poland); **Laurent Rubaldo,** Lynred (France); **Thomas R. Schimert,** Leonardo DRS (United States); **Itay Shtrichman,** SCD Semiconductor Devices (Israel); **Stefan P. Svensson,** U.S. Army Research Lab. (United States); **J. Ralph Teague,** Georgia Tech Research Institute (United States); **Simon Thibault,** Univ. Laval (Canada); **Meimei Tidrow,** U.S. Army Night Vision & Electronic Sensors Directorate (United States); **Mike D. Walters,** FLIR Systems, Inc. (United States); **James R. Waterman,** U.S. Naval Research Lab. (United States); **Ami Yaacobi,** Rafael Advanced Defense Systems Ltd. (Israel)

Rapid advances are taking place today in infrared technologies. These are enabling the development of more capable super-systems, sensor systems, cameras and subsystems that are expected to have improved performance with greater reliability, reduced Size, Weight and Power/Cost (SWaP-C). These improvements also enable new and novel applications of the technology such as self-driving vehicles, robotics and the internet of things, as well as in scanning for elevated skin temperature (EST) to monitor for potential infectious diseases like COVID-19.

The emphasis in this conference is on the infrared components, systems and applications. To demonstrate the degree of system performance improvement due to a better technology, the author may compare the performance of the system designed with and without the improved technology.

In addition, general-purpose existing sub-systems and systems will be included. Selected applications will be covered, especially in military, security systems and self-driving vehicles so as to provide continuity between developers of components and systems.

This conference will bring together researchers, engineers and students, as well as developers and users of infrared technologies, to discuss improvements in military, security, and commercial sensors brought about by the incorporation of advanced technologies and/or new techniques.

PAPERS SOLICITED FOR THIS CONFERENCE MAY ADDRESS INFRARED TECHNOLOGIES SUCH AS:

- Infrared detector materials
- Cooled and uncooled Focal Plane Arrays (FPAs)
- Cooled and uncooled single element and linear array detectors
- Monolithic and hybrid detectors
- Two- and three-color detectors
- Quantum Dot FPAs
- Multiband and hyperspectral FPAs
- Very large arrays for astronomy and situational awareness
- FPAs for 3D imaging and ranging
- Integrated and fused sensors
- FPAs for simultaneous active and passive imaging
- Artificial Intelligence (AI) in thermal sensing
- Augmented Reality infrared systems
- Deep learning, neural networks in IR system design
- Scanning and staring imagers
- Low-cost IR sensors for defense applications
- Novel concepts for improved IR detection
- In- and behind-the focal plane signal processing electronics
- ROICs, including in-pixel digital ROICs (DROICs)
- Graphene and other new IR imaging techniques

continued next page

Infrared Technology and Applications XLVII (SI204 continued)

AND THEIR USE IN SENSORS/SYSTEMS SUCH AS:

- Elevated Skin Temperature (EST)/Fever Detection Sensors
- Advanced driver assistance systems (ADAS) and Self Driving Vehicles
- Thermal imagers and infrared search and track (IRST)
- Distributed Aperture Systems
- Commercial IR sensors
- Gas and environmental sensors
- Microsensors
- Multispectral and hyperspectral imagers
- Image fusion such as combined thermal imaging/low-light-level imaging systems
- Sensors for micro air vehicles and UAVs (including commercial UAVs)
- Threat warning systems
- Airborne navigation, piloting, and precision targeting systems
- Enhanced Flight Vision Systems (EFVS)
- Degraded Visual Environment (DVE) systems
- Thermal weapons sights (TWS)
- Local Situational Awareness (LSA) for Ground Vehicles
- Smart munitions
- Space-based sensors
- Missile seekers
- Trackers with and without radiation hardening.
- Human activity detection, face detection and recognition

AMONG SESSIONS BEING PLANNED FOR THE FOUR DAY CONFERENCE ARE:<

- Cooled FPAs and applications
  - HgCdTe detectors and FPAs
  - Superlattice, barrier detectors and FPAs
  - High-operating temperature (HOT) detectors
  - QWIP and QDIP FPAs (including Colloidal Quantum Dots, CQDs) and applications
- Reduced pixel pitch FPAs
- Uncooled IRFPAs and applications
  - Elevated Skin Temperature (EST)/Fever Detection Sensors
- Emerging uncooled detector technologies
- On/near FPA smart image and signal processing, including deep learning
- Advanced sensors, technologies, and techniques
- Army, Navy, Air Force and paramilitary infrared R&D
- Combined uncooled IR and low-light level integrated sensors
- Integrated and fused sensors
- Thermal imagers
- Development of 3rd generation thermal imagers
- NIR and SWIR imagers and applications
- Facial recognition
- Range-gated imaging and 3D imaging
- Role of passive and active IR in driverless vehicles
- IR seaborne, airborne, and ground-based sensor systems
- IR technologies in security
- Gas emission monitoring and detection.

A SPECIAL SESSION IS BEING PLANNED ON: The impact of AI / Deep Learning on IR system performance – basics and examples

Note 1: Only one paper on a given topic will be accepted from each company/institution.

Note 2: Papers should emphasize the technical nature of the topic. Product names and any type of product promotion must be avoided.

Note 3: Please address questions and comments concerning the conference to any one or all of the conference chairs / co-chairs: andresen@netvision.net.il; gfulop@maxtech-intl.com; lzheng@ida.org; kimata@se.ritsumei.ac.jp; oainfrared@gmail.com

Note 4: To provide the research community with enhanced access to information presented at SPIE conferences, SPIE will record the audio plus screen content of oral presentations and, with author permission only, will publish the recordings on the SPIE Digital Library. Authors may change their permission by signing into their SPIE.org account at any time prior to the meeting.

Radar Sensor Technology XXV (SI205)

Conference Chairs: **Kenneth I. Ranney,** U.S. Army Research Lab. (United States); **Ann M. Raynal,** Sandia National Labs. (United States)

Program Committee: **Joseph C. Deroba,** U.S. Army Combat Capabilities Development Command (United States); **Armin Doerry,** Sandia National Labs. (United States); **Kahlil R. Gedin,** Naval Surface Warfare Ctr. Dahlgren Div. (United States); **Mark Govoni,** U.S. Army Research Lab. (United States); **Sevgi Zubeyde Gurbuz,** The Univ. of Alabama (United States); **Majeed Hayat,** Marquette Univ. (United States); **Abigail S. Hedden,** U.S. Army Combat Capabilities Development Command (United States); **Chandra Kambhamettu,** Univ. of Delaware (United States); **Seong-Hwoon Kim,** WhiteFox Defense (United States); **Marco O. Lanzagorta,** U.S. Naval Research Lab. (United States); **Bing Li,** Lockheed Martin Systems Integration-Owego (United States); **Changzhi Li,** Texas Tech Univ. (United States); **Robert Linnehan,** General Atomics Aeronautical Systems, Inc. (United States); **Neeraj Magotra,** Western New England Univ. (United States); **Anthony F. Martone,** U.S. Army Research Lab. (United States); **Gregory J. Mazzaro,** The Citadel (United States); **Ram M. Narayanan,** The Pennsylvania State Univ. (United States); **Marius Necsoiu,** Southwest Research Institute (United States); **Lam H. Nguyen,** U.S. Army Research Lab. (United States); **Hector A. Ochoa,** The Univ. of Texas at Tyler (United States); **Thomas J. Pizzillo,** U.S. Naval Research Lab. (United States); **Zhijun G. Qiao,** The Univ. of Texas-Pan American (United States); **David Tahmoush,** The Univ. of Kansas (United States); **Russell Vela,** U.S. Army Space and Missile Defense Command (United States); **Frank Yakos,** Consultant (United States); **Yan Zhang,** The Univ. of Oklahoma (United States); **Ruolin Zhou,** Univ. of Massachusetts Dartmouth (United States); **Duncan A. Robertson,** Univ. of St. Andrews (United Kingdom); **David A. Wikner,** U.S. Army Research Lab. (United States)

The continued advance of basic technologies in areas including components, processing, and enabling tools is facilitating remarkable leaps forward in radar system performance. This includes enabling new modes, more sophisticated processing algorithms, and new applications in defense, homeland security, and commercial arenas. This broad-based conference seeks to foster dialog between researchers and developers in the various aspects of radar technology development, including commercial, academic, military, and government sectors. It furthermore seeks to provide a forum to present new developments, including experimental and theoretical results that might be of interest to the larger community.

Papers are solicited in topical areas, including the following:

PROGRAMS AND SYSTEMS

- Air-, vehicle-, maritime-, ground-, missile-, and space-based radar systems including new small satellite systems, hypersonics, and degraded visual environments
- operational, experimental, developmental, and demonstration systems
- science missions, radar astronomy, and space situational awareness
- multi-mission systems, collaborative and distributed sensors, system of systems
- electronic warfare (EW), radio-frequency-enabled cyber, and cognitive EW

APPLICATIONS AND EXPLOITATION TECHNIQUES

- intelligence, surveillance, and reconnaissance (ISR)
- foliage penetration (FOPEN) radar, ground penetration (GPEN) radar
- homeland security, law enforcement, border monitoring, tunnel detection, disaster monitoring
- maritime, littoral and coastal, and Arctic applications
- collision avoidance, sense-and-avoid, due-regard, air traffic control, guidance and control
- moving target detection, traffic monitoring, vibrometry, dismount detection, change detection
- meteorological, environmental, and climate monitoring
- Low-SWAP (size weight and power) applications, SDR-based (software-defined radio) applications
- high-fidelity mapping, precision navigation, tags and transponders
- polarimetric techniques
- medical applications of radar
- indoor/urban target detection, localization, and tracking
- consumer and commercial radar applications such as automotive, smart wearables and phones, and economic intelligence

ALGORITHMS AND PROCESSING TECHNIQUES

- inverse problems
- imaging radar including real-beam, synthetic aperture radar (SAR), inverse SAR (ISAR), and motion imagery
- interferometric processing, 3D and tomographic techniques, passive radar, bistatic, multistatic, and multiple-input multiple-output (MIMO)
- target detection and tracking, space-time adaptive processing (STAP), and system optimization
- interference mitigation, GPS-denied operation, and compressive sensing applied to radar
- multisensor integration and aiding, sensor fusion, and automatic target recognition (ATR)
- cognition, spectrum sensing strategies, spectrum engineering, and machine learning
- underground chemical monitoring: radar detection techniques

COMPONENTS AND TECHNOLOGIES

- navigation systems, instruments, and components for radar
- microwave components, including digital radio-frequency memory (DRFM) technology
- software defined radios, software defined radar, radio-frequency systems on a chip (RFSOC), and distributed systems
- automotive radar technologies
- waveform design and generation, radar processors

continued next page

Radar Sensor Technology XXV (SI205 continued)

- antennas, including AESA antennas, multi-aperture and multi-beam antennas
- metamaterials, double-negative and single-negative materials
- tools and techniques for system and circuit design, modeling, fabrication, and performance validation

PHENOMENOLOGY

- radar scattering from terrain, rain/snow, ice, atmospheric particulates, and sea clutter
- propagation through walls, foliage, ground, and other media, including atmospheric effects
- target scattering modeling and measurements from cultural targets, vehicles, and vessels
- calculation of theoretical response or high-fidelity EM modeling of scattering from discrete and distributed clutter

SPECIAL SESSION ON Radar Micro-Doppler

- techniques, targets, phenomenology, models, and simulations
- micro-Doppler radar and waveform design
- micro-range with micro-Doppler, non-coherent micro-Doppler
- classification, fusion with micro-Doppler
- windmills and wind farms

SPECIAL SESSION ON Noise, (Low-Probability of Intercept) LPI, and NON-LINEAR RADAR

- noise, noise-like, steganographic, and chaotic waveform generation
- hardware and system architecture design and implementation, including processing techniques
- LPI, passive, and covert radar sensing technology
- applications of noise radar (e.g. MTI, SAR, ATR)
- theory and practice of non-linear radar, including signal processing (operational bands, hardware implementation issues, high-resolution processing, etc.)
- non-linear radar detection, tracking, and image formation (e.g., non-linear SAR and non-linear MTI)

SPECIAL SESSION ON RF PHOTONICS, INTEGRATED PHOTONIC CIRCUITS AND THEIR APPLICATIONS TO RADAR SYSTEMS

- simultaneous transmit and receive concepts to include hybrid analog/digital techniques
- true-time-delay beamforming using integrated photonic circuits
- analog photonic signal processing concepts
- high-speed/wide-band photonic filtering concepts applied to radar
- electromagnetic component hardening concepts leveraging photonics
- low-phase noise RF photonic signal generation
- hybrid photonic/electronic circuit integration concepts for radar applications

SPECIAL SESSION ON Next-Generation RF and Power Device Technology

- microwave power amplifiers
- high-power RF applications including future radar, EW, and communications
- new materials and device-level physics for RF Applications
- ultra-wide bandgap (UWBG) semiconductors for RF Applications
- wireless power transfer, including microwave power beaming technologies, techniques, and applications

SPECIAL SESSION ON Quantum Radar

- theory and experiments relating to orbital angular momentum (OAM) and quantum radar

SPECIAL SESSION ON Passive, and Active Millimeter Wave Imaging

- Refer to joint conference site for more information.

This conference encourages submissions to a dedicated session of undergraduate students on relevant research/projects.

Thermosense: Thermal Infrared Applications XLIII (SI206)

Conference Chair: **Joseph N. Zalameda,** NASA Langley Research Ctr. (United States)

Conference Co-Chair: **Arantza Mendioroz,** Univ. del País Vasco (Spain)

Program Committee: **Nicolas P. Avdelidis,** National Technical Univ. of Athens (Greece); **Paolo Bison,** Consiglio Nazionale delle Ricerche (Italy); **Douglas Burleigh,** La Jolla Cove Consulting (United States); **Terry Clausing,** Drysdale and Associates, Inc. (United States); **Fred P. Colbert,** Colbert Infrared Services (United States); **Jaap de Vries,** FM Global (United States); **Giovanni Ferrarini,** Istituto per le Tecnologie della Costruzione (Italy); **Sheng-Jen (Tony) Hsieh,** Texas A&M Univ. (United States); **Timo T. Kauppinen,** VTT Technical Research Ctr. of Finland (Finland); **Dennis H. LeMieux,** Siemens Power Generation, Inc. (United States); **Monica Lopez Saenz,** IRCAM GmbH (Germany); **Xavier P. V. Maldague,** Univ. Laval (Canada); **Junko Morikawa,** Tokyo Institute of Technology (Japan); **Gary L. Orlove,** Thermal Imaging Consultant (United States); **Beate Oswald-Tranta,** Montan Univ. Leoben (Austria); **G. Raymond Peacock,** Temperatures.com, Inc. (United States); **Ralph A. Rotolante,** Vicon Enterprises Inc. (United States); **Andres E. Rozlosnik,** SI Termografía Infrarroja (Argentina); **Morteza Safai,** The Boeing Co. (United States); **Takahide Sakagami,** Kobe Univ. (Japan); **Steven M. Shepard,** Thermal Wave Imaging, Inc. (United States); **Sami Siikanen,** VTT Technical Research Ctr. of Finland (Finland); **Gregory R. Stockton,** Stockton Infrared Thermographic Services, Inc. (United States); **Gary E. Strahan,** Infrared Cameras, Inc. (United States); **Vladimir P. Vavilov,** National Research Tomsk Polytechnic Univ. (Russian Federation); **Catherine R. Ward,** General Atomics Aeronautical Systems, Inc. (United States)

Thermosense is the oldest and largest international technical conference focused on scientific, industrial, and medical uses of infrared imaging, infrared temperature measurements, and image analysis. Its regular printed proceedings are found in most scientific and engineering libraries, providing an unequaled depth and breadth of technical information and reference data.

The Thermosense conference promotes worldwide exchange of information about research, uses and applications of infrared (IR) imaging technology. This includes infrared thermography and thermal infrared sensing primarily in the NIR, SWIR, MWIR and LWIR bands. Thermosense encompasses technical papers, workshops and short-courses. Over the past 42 years, these activities have included topics from the fundamentals of infrared imaging and calibration to virtually all infrared research and applications. Special emphasis has been on problem solving and turning new developments into standard practices. This year, we would like to have special sessions on (1) Covid-19 and pandemic containment, (2) Drone and airborne thermography, and (3) Additive manufacturing.

Academic, research and professional practical papers are solicited related to infrared applications (NIR/SWIR /MWIR/LWIR) in the areas listed below, and are also welcome in other areas.

ADDITIVE MANUFACTURING
- in-situ monitoring
- post build inspection
- molten metals measurement

AEROSPACE APPLICATIONS
- aircraft NDT
- process monitoring
- corrosion/FOD/fatigue
- aging aircraft
- spacecraft and satellites

ARTIFICIAL INTELLIGENCE IN INFRARED APPLICATIONS
- machine learning
- deep learning
- cognitive computing
- Internet of Things
- big data

AUTOMOTIVE INDUSTRY
- IR imaging for autonomous vehicles
- predictive maintenance – electrical
- predictive maintenance - mechanical
- automotive NDT
- process monitoring - automation
- driver vision enhancement

BUILDING APPLICATIONS
- energy conservation and energy efficiency
- construction quality control
- roof moisture surveying
- weatherization

CALIBRATION
- standards
- sources
- instruments traceability
- atmospheric transmission

DETECTION OF GAS AND OTHER LEAKS
- pipelines, oil fields, offshore platforms, refineries
- gas pumping stations, gasoline stations
- UXO: unexploded ordinance

DRONE AND AIRBORNE THERMOGRAPHY
- environmental monitoring
- building assessment
- solar cell and power plant inspection

ENVIRONMENTAL AND AGRICULTURAL MONITORING
- agriculture and water conservation
- fish and wildlife migration
- geology - volcanoes activity
- pollution and storm water monitoring
- seawater sensing

FIBER OPTICS FOR INFRARED
- detection of hazardous chemicals
- remote sensing in high temperature and corrosive environments
- medical applications

continued next page

Thermosense: Thermal Infrared Applications XLIII (SI206 continued)

FIRE ANALYSIS AND DETECTION
- wildfire
- home and building fire
- pool fires
- fire research
- flame emission

FOOD PROCESSING AND HANDLING
- quality control monitoring
- temperatures of animals at slaughter
- foreign object detection and characterization

HYPERSPECTRAL (HS) AND MULTISPECTRAL (MS) IMAGERY
- identify materials
- detecting processes and objects

INFRASTRUCTURE
- transportation – roads, bridges, airports, harbors, reservoirs, and dams
- energy – nuclear, wind, solar, fossil fuels power plants

INFRARED IMAGE FUSION APPLICATIONS
- biological and medical
- field security
- process monitoring

LOSS PREVENTION
- roof inspections
- electrical equipment
- switchboards

MANUFACTURING AND PROCESSING INDUSTRIES
- composite fabrication and uses
- glass and ceramics
- metals processing
- petrochemical
- plastics
- pulp and paper
- semiconductors and microelectronics
- quality control and predictive maintenance applications

INFRARED NONDESTRUCTIVE TESTING (IR NDT) AND MATERIALS EVALUATION
- composite structures (aerospace, marine, wind turbine blades, etc.)
- metallic structures (aerospace, turbine blades, and other)
- inspection data fusion
- fatigue analysis/ thermal stress analysis (TSA)
- sonic IR
- IR NDT combined with other techniques (ultrasound, x-ray, terahertz, etc.).
- thermal properties of materials
- underground anomalies
- electronic components

MEDICAL
- fever detection for pandemic containment
- health screening and diagnostics
- veterinary applications

POWER GENERATION AND DISTRIBUTION
- nuclear, wind, and solar power plants
- field measurement issues
- power plant heat-rate efficiency
- electrical and mechanical P/PM

RESEARCH AND DEVELOPMENT
- multi-spectral/hyperspectral imaging
- enhanced spatial resolution
- enhanced time resolution
- microscopy
- thermal modeling, CFD and FEA

REMOTE SENSING AND SECURITY
- Search and rescue (fire, snow, etc.)
- law enforcement
- maritime guidance

ROBOTIC APPLICATIONS
- Automated Fiber Layup
- Welding
- Large Area Contour Following

STANDARDS, CERTIFICATIONS AND GUIDELINES
- NDT
- buildings
- condition monitoring

During the Symposium, authors are expected to attend their respective sessions to enable interaction with the audience.

Selected papers will be recommended for publication in related SPIE journals such as *Optical Engineering* and *Journal of Electronic Imaging*.

VENDOR PRESENTATION AND RECEPTION XVII: CALL FOR PRESENTATIONS

Calling all SPIE - DCS 2021 Exhibiting Companies – Gaylord Palms Hotel Orlando, Florida

Share the Latest – What's new in hardware & software for thermography, thermal imaging, and non-contact temperature measurement?

The Vendors Session started seventeen years ago and has become a very popular and well-attended success. This Special Session provides an early opportunity for exhibitors to highlight their latest technology and newest products to the Thermosense, Infrared industry, and Defense + Commercial Sensing (DCS) technical audience prior to the opening of the DCS21 Expo. In a relaxed atmosphere, enjoy a casual meeting setting with ample time for questions and answers. This session enables the conference attendees and visitors to better prioritize their activities when visiting the Expo (highlights your company)

SESSION INCLUDES:

- Exhibitors sharing state-of-the-art in future generation of infrared detectors, IR imagers radiometric and non-radiometric and IR image processing systems
- Explores other related infrared optics, semitransparent materials ,characterization and calibration sources, infrared fiber optics, coolers, multispectral and hyperspectral cameras
- It also covers topics related hardware and software involved in infrared applications:NIR - SWIR - MWIR - LWIR

For more information please check the following link: Guidelines - General and specific topics

AUDIENCE BACKGROUND:
Innovative infrared systems & applications researches, Applications engineers & professionals, Advanced optics engineers, Photonics and imaging researchers, Photonics Engineering, Infrared systems engineers, Calibration & Test engineers, Academics, Physicists, Exhibition-Only Visitors, and other Exhibitor Representatives (DCS-2021).

TO PARTICIPATE:
Open to all DCS21 exhibitors offering products or services related to infrared sensing or imaging, or photonics. There are no restrictions to the content or topics of submissions: Technical, Academics or Commercial within Infrared Imaging Hardware, Optics, Accessories, and Software. Session format features 12-15-minute oral presentations from hardware to software whose product lines impact thermal imaging applications and the infrared industry in general. No additional charge to participate. Reservations are open now, with limited time slots available.

If you are interested in participating, or have more questions, please contact moderators:

Andres E. Rozlosnik, SI Termografía Infrarroja (Argentina), aer@termografia.com

Sheng-Jen (Tony) Hsieh, Texas A&M Univ. (USA), hsieh@tamu.edu

Save the date

ABSTRACTS DUE: 7 OCTOBER 2020

AUTHOR NOTIFICATION: 4 DECEMBER 2020

The contact author will be notified of acceptance by email.

MANUSCRIPTS DUE: 17 MARCH 2021

PLEASE NOTE: Submission implies the intent of at least one author to register, attend the conference, present the paper as scheduled, and submit a full-length manuscript for publication in the conference proceedings.

Laser Radar Technology and Applications XXVI

(SI207)

Conference Chairs: **Monte D. Turner,** National Geospatial-Intelligence Agency (United States); **Gary W. Kamerman,** FastMetrix Industries, LLC (United States)

Program Committee: **Philip Gatt,** Lockheed Martin Coherent Technologies (United States); **Hans D. Hallen,** North Carolina State Univ. (United States); **Richard M. Heinrichs,** MIT Lincoln Labs. (United States); **Thomas J. Karr,** Office of the Undersecretary of Defense for Research and Engineering (United States); **Martin Laurenzis,** Institut Franco-Allemand de Recherches de Saint-Louis (France); **Lori A. Magruder,** Applied Research Labs., The Univ. of Texas at Austin (United States); **Vasyl Molebny,** National Taras Shevchenko Univ. of Kyiv (Ukraine); **Upendra N. Singh,** NASA Langley Research Ctr. (United States); **Ove Steinvall,** FOI-Swedish Defence Research Agency (Sweden); **Grady H. Tuell,** 3D Ideas, LLC (United States); **Andreas Ullrich,** RIEGL Laser Measurement Systems GmbH (Austria); **Christopher R. Valenta,** Georgia Tech Research Institute (United States); **Andre van Rynbach,** Air Force Research Lab. (United States)

Laser radar, lidar and laser remote sensing methods continue to evolve with the development of the enabling component technologies, advanced systems concepts, integration with new platforms, and innovative employment strategies. Combined with advances in signal processing, data fusion, and visual display, the diversity and sophistication of these capabilities continue to grow in support of a wide range of defense, scientific, and commercial applications. The opportunity for participants in these communities to interact, collaborate, and foster innovation in the development of these laser radar systems is central to the success of this field of research and development and is the focus of this conference.

While the development of technology is an important and interesting topic in and of itself, the development of technology is much more effective when considered within the context of the applications of that technology. Furthermore, emerging and difficult defense, security, counter terrorism, and natural disaster and emergency response requirements demand innovative solutions for which laser radar techniques appear to be well suited. These new applications may create additional demands upon the supporting technologies. As a result, this conference will focus not only on laser radar technology, but also on the practical applications of that technology. Separate sessions in this conference will be devoted to specific application areas including military, industrial, scientific and commercial applications.

Papers are solicited in the following areas:

- lidar for self driving vehicles and autonomous systems
- laser radars for defense applications, target detection, identification, and accurate geolocation
- laser systems remote detection of mines, explosives, and weapons of mass destruction
- design, development, or testing (laboratory or field) of laser radars including laser radar calibration standards, testing standards, and quality assurance procedures
- scanning, scannerless, and flash imaging laser radar systems
- spacecraft docking systems, inspection systems, and sensors for space exploration
- collision avoidance sensors for aircraft and marine vessels
- topographic mapping and bathymetry systems, their testing, calibration, and applications
- foliage and camouflage poke-through 3D laser radar systems and methods
- obscured imaging methods using laser radar to penetrate dust, fog, rain, and clouds
- modeling, simulation, verification and validation of laser radar systems performance
- automated target recognition based on laser radar methods
- processing, interpretation, segmentation, classification, and object recognition or exploitation of 3D data
- utilization of machine learning, deep learning and convolutional neural networks in exploitation of 3D data
- near realtime processing architectures supporting navigation and object recognition
- atmospheric lidar sensing systems including meteorological applications and atmospheric monitoring (e.g., airport hazard warning, wind-shear detection, tornado detection, wind field mapping, etc.)
- integrated active ladar and passive imaging systems, and passive and active 3D data fusion
- non-contact metrology, multispectral lidar, and laser polarimetry
- coherent (e.g., FMCW 3D) and shot noise limited systems
- Geiger mode and single photon sensitive laser radar
- digital holography and computational laser imaging
- vibration and acoustic detection, dynamics and microdynamics measurements via laser vibromtery
- new laser radar materials, novel laser sources enabling new applications and component technology
- advanced laser radar detectors
- novel pointing, scanning, beam-steering and control technologies
- ladar for autonomous navigation and hazard avoidance for air and ground vehicles (Smart Cities)
- hostile environment applications (e.g., underwater, high radiation, high or low temperatures, etc.)
- medical applications of imaging/sensing methods employing laser systems
- advanced cost-reduction techniques and more effective system architectures
- laser radar techniques used in any new or unconventional applications.

Passive and Active Millimeter-Wave Imaging XXIV (SI208)

Conference Chairs: **David A. Wikner,** U.S. Army Research Lab. (United States); **Duncan A. Robertson,** Univ. of St. Andrews (United Kingdom)

Program Committee: **Roger Appleby,** InnovaSec Ltd. (United Kingdom); **Jeffrey Barber,** U.S. Dept. of Homeland Security (United States); **Erich N. Grossman,** National Institute of Standards and Technology (United States); **Arttu R. Luukanen,** Asqella Corp. (Finland); **Markus Peichl,** Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); **David M. Sheen,** Pacific Northwest National Lab. (United States); **Okan Yurduseven,** Queen's Univ. Belfast (United Kingdom)

The purpose of this conference is to provide a technical forum for the community working to develop technology and applications in the area of millimeter-wave and sub-millimeter-wave passive and active imaging, seeking to bring together customers, end users, industry, and academia.

The two driving attributes of this region of the electromagnetic spectrum are that the atmosphere has good transmission under conditions of poor visibility such as cloud, fog, and dust, and that many materials are semi-transparent. These properties open up two core applications: one in poor weather imaging and the other in the security screening of people. In addition, the higher frequencies of the millimeter-wave regime offer improved spatial resolution, more compact imaging systems and suffer from less electromagnetic interference than the crowded microwave spectrum.

CURRENT TOPICS IN TECHNOLOGY AND APPLICATIONS THAT ARE SEEN AS CENTRAL TO THIS CONFERENCE INCLUDE:

- new sub-millimeter-wave band technology which facilitates the transition to more compact systems
- non-mechanical beam steering for higher frame rate millimeter-wave imaging
- innovative device technology for higher pixel count and more affordable millimeter-wave imaging systems
- poor weather imaging for assisted navigation in fog, cloud, or dust conditions
- polarimetry and/or multi-frequency techniques to exploit material and atmospheric properties.
- millimeter-wave imaging based on novel passive or active illumination architectures.
- computational imaging techniques based on coded apertures, compression in hardware and signal processing layers, structured illumination patterns and data sparsity.
- machine-learning based solutions for solving inverse-problems, super-resolution, and threat detection/identification.

THE CONFERENCE SEEKS TO COVER VARIOUS TOPICS INCLUDING:

- applications and phenomenology of millimeter wave imaging
- novel imaging systems (active and passive)
- enabling technology (transmitters, receivers, optical materials, and packaging)
- non-mechanical beam-steering (fundamentals, calibration, technology, and systems)
- computational imaging and compressive sensing (hardware and signal processing)
- image processing and simulation (reconstruction algorithms and modeling).

This conference provides an opportunity for users and technologists to update their knowledge in this growing field. Papers are solicited which address passive and active imaging applications and technology in the millimeter and sub-millimeter bands.

Save the date

ABSTRACTS DUE: 7 OCTOBER 2020

AUTHOR NOTIFICATION: 4 DECEMBER 2020

The contact author will be notified of acceptance by email.

MANUSCRIPTS DUE: 17 MARCH 2021

PLEASE NOTE: Submission implies the intent of at least one author to register, attend the conference, present the paper as scheduled, and submit a full-length manuscript for publication in the conference proceedings.

Submit your abstract today: **spie.org/dcs21call**

Artificial Intelligence and Machine Learning for Multi-Domain Operations Applications III (SI209)

Conference Chair: **Tien Pham,** CCDC Army Research Lab. (United States)

Conference Co-Chairs: **Myron E. Hohil,** CCDC Armament Ctr. (United States); **Latasha Solomon,** CCDC Army Research Lab. (United States)

Program Committee: **Tarek Abdelzaher,** Univ. of Illinois (United States); **Nathaniel Bastian,** DoD Joint Artificial Intelligence Ctr. (United States); **Erik Blash,** Air Force Office of Scientific Research (United States); **Addison Bohannon,** CCDC Army Research Lab. (United States); **Gerome Bovet,** Armasuisse (Switzerland); **Kevin Chan,** CCDC Army Research Lab. (United States); **Geeth del Mel,** IBM United Kingdom Ltd. (United Kingdom); **Tim Hanratty,** CCDC Army Research Lab. (United States); **Brian J. Henz,** CCDC Army Research Lab. (United States); **Brian Jalaian,** CCDC Army Research Lab. (United States); **Nandi O. Leslie,** CCDC Army Research Lab. (United States); **Henry Leung,** Univ. of Calgary (Canada); **Gavin Pearson,** Defence Science and Technology Lab. (United Kingdom); **Alun D. Preece,** Cardiff Univ. (United Kingdom); **Katie Rainey,** Naval Information Warfare Ctr. Pacific (United States); **Peter Schwartz,** Mitre (United States); **Maggie B. Wigness,** CCDC Army Research Lab. (United States); **Robert Williams,** Discovery Lab. Global (United States)

AI/ML applications are critical to the success of future Multi-Domain Operations (MDO). Joint Forces and Coalition Partners require the ability to converge capabilities from across multiple echelons at speeds and scales beyond human cognition. At the tactical edge, future military operations will involve teams of highly-dispersed warfighters and agents (robotic and software) operating in distributed, dynamic, complex, cluttered environments. Military domains are frequently distinct from commercial applications because of: rapidly changing situations; limited access to real data to train AI; noisy, incomplete, uncertain, and erroneous data inputs during operations; and peer adversaries that employ deceptive techniques to defeat algorithms. Most current research in AI/ML is accomplished with extremely large collections of relatively clean, well-curated training/operational data with little background noise and no deception.

The military has unique technical challenges that the commercial sector will not address as it will increasingly: (i) engage in distributed operations in complex settings, (ii) operate with extreme resource constraints (communications, computational, and size-weight-power-cost-time), (iii) learn in complex data environments with limited and potentially compromised data samples; and (iv) rely on rapidly-adaptable teams of autonomous AI systems that interact and learn from human understanding of high-level mission goals. Most importantly, reliance by the warfighter on AI at the tactical edge will require AI that is reliable and safe, robust to multiple, varying adversarial attacks and adaptive to evolving environments and mission tasks.

The goals of this conference are (i) to promote understanding of near-term and far-term implications of AI/ML for MDO and (ii) to gain awareness of R&D activities in AI/ML that are applicable to MDO. Topics include but not limited to the following:

- Learning and reasoning with small data samples, dirty data, high clutter, and deception
- Autonomous maneuver in complex environments
- Federated/distributed AI/ML
- Human agent teaming
- AI-enable context-aware decision making
- Resource-constrained AI processing at the point-of-need
- Adversarial machine learning
- nterpretable and explainable AI
- Novel AI/ML algorithms, frameworks and applications
- Modeling & Simulation Platforms for AI
- Safety, ethics and governance
- Future trends in AI to including broad AI, quantum AI, AI with additive manufacturing, AI with synthetic biology...

JOINT SESSION

For 2021, we plan to have joint sessions with other SPIE DCS conferences in the Next Generation Sensors & Applications track including:

- Virtual, Augmented & Mixed Reality (XR) Technology for Multi-Domain Operations II
- Unmanned Systems Technology XXIII
- Disruptive Technologies in Information Sciences V.

Advanced Environmental, Chemical, and Biological Sensing Technologies XVI (SI210)

Conference Chairs: **Tuan Vo-Dinh,** Fitzpatrick Institute for Photonics, Duke Univ. (United States); **Eiichi Tamiya,** Osaka Univ. (Japan)

Conference Co-Chairs: **Laura Maria Lechuga,** Institut Català de Nanociència i Nanotecnologia (ICN2) (Spain); **Dmitri B. Papkovsky,** Univ. College Cork (Ireland)

Program Committee: **Francesco Baldini,** Istituto di Fisica Applicata Nello Carrara (Italy); **Jesus Delgado Alonso,** Intelligent Optical Systems, Inc. (United States); **Edgar A. Mendoza,** Redondo Optics, Inc. (United States); **Anna Grazia Mignani,** Istituto di Fisica Applicata Nello Carrara (Italy); **Klaus Schäfer,** Karlsruher Institut für Technologie (Germany); **David L. Stokes,** Parsons (United States)

In situ characterization and quantification of environmental, industrial, cultural, and biotechnology samples in complex systems is increasingly required for applications ranging from environmental sensing and industrial control to waste minimization, sequestration, and remediation. Micro- and nanoscale technologies, including plasmonic structures and metamaterials have begun to successfully address these analytical challenges. Standalone micromachined sensors as well as miniaturized chemical analysis systems that automatically perform multiple steps including sampling, sample transport, separation, and detection have the potential to greatly advance the field of analytical sciences. At the other end of the length scale, sophisticated distributed sensing techniques, including intrinsically distributed sensor elements and large-scale sensor networks are revolutionizing the speed and resolution with which "whole-field" characterization can be accomplished. An urgent application is surveillance and early warning of accidental or purposeful release of chemical or biological substances as well as early detection of emerging infectious diseases.

The development of advanced chemical and biological sensors and analytical systems requires an integration of micro- and nanosystem technology, analytical chemistry, physics of sensors, microfluidics, and biomolecular recognition methods. The primary aim of this conference is to focus on recent advances in the development of photonic monitoring methods, the design, fabrication technologies, and applications of optical chemical nano/microsensors and nano/micro-analysis systems, and nanoscale devices. The conference will also focus on promoting interdisciplinary interaction between scientists and engineers from industry, academia, and federal laboratories.

The research and development community is encouraged to submit contributions in, but not limited to, the following:

- indoor and outdoor environmental chemical sensors and biosensors
- advanced photonics for spectroscopic trace detection (fluorescence, phosphorescence, Raman, SERS, IR, UV absorption, microwave, RF, LIBS, x-ray, terahertz)
- chemically active sensors (optrodes, coating-based distributed sensors)
- instrumentation for air, liquid, and surface pollution
- detection of toxic industrial compounds (TICs) in air and water
- sensors for down-hole monitoring of waste injection and CO_2 sequestration
- chemical and physical characterization of environmental sensors
- instrumentation for air pollution and ozone sensing
- global atmospheric monitoring systems
- ground water, river water, and waste water monitoring
- multi-analyte sensors, sensor array devices, and biochips
- sensors for emerging infectious diseases
- distributed and multiplexed chemical and biological sensor networks
- nano/microchemical analysis systems, lab-on-a-chip for environmental analysis (electrophoresis, flow injection analysis, chromatography, etc.)
- nanotechnology/plasmonic/metamaterial-based sensors and systems
- nano/microfluidics for sensors (sample handling, fluidic mechanics, microvalves, bioreactors, etc.)
- high-throughput detection methods and systems
- sensors for industrial waste control and environmental remediation technologies
- sensors for art identification and cultural heritage preservation
- artificial intelligence and machine learning sensor signal processing technologies.

Autonomous Air and Ground Sensing Systems for Agricultural Optimization and Phenotyping VI (SI211)

Conference Chairs: **J. Alex Thomasson,** Mississippi State Univ. (United States); **Alfonso F. Torres-Rua,** Utah State Univ. (United States)

Program Committee: **Christoph Bauer,** KWS SAAT AG (Germany); **Subodh Bhandari,** California State Polytechnic Univ., Pomona (United States); **Andrew N. French,** Agricultural Research Service (United States); **Yufeng Ge,** Univ. of Nebraska-Lincoln (United States); **Xiongzhe Han,** Kangwon National Univ. (Korea, Republic of); **Seth C. Murray,** Texas A&M Univ. (United States); **Haly Neely,** Texas A&M Univ. (United States); **Carl Salvaggio,** Rochester Institute of Technology (United States); **Michael Sama,** Univ. of Kentucky (United States); **Sindhuja Sankaran,** Washington State Univ. (United States); **Ajay Sharda,** Kansas State Univ. (United States); **Yeyin Shi,** Univ. of Nebraska-Lincoln (United States)

The use of optics and photonics in agriculture is a rapidly emerging and promising area of study, given the potential impact these technologies offer for rapid crop improvement through breeding and genetics as well optimization of on-farm crop production. The field is in an exciting period of exploration and expansion, as the use of ground- and air-based sensor platforms now permits revolutionizing the measurement of plant traits by adding great detail, high throughput, and concomitantly large data volumes. This conference brings together researchers and practitioners in this field to discuss the latest technologies, methods and findings.

Proximal and remote sensing systems including point and array detectors and automated ground-based and aerial vehicles applied to agriculture and high-throughput phenotyping are within the scope of this conference. Both active and passive sensing methods as well as sensors based on material reflectance and transmission and such physical phenomena as fluorescence and Raman scattering are pertinent to this conference. Optical sensing extending from the UV through the IR where thermal imaging becomes an important methodology is yet another area of active research of interest.

This conference will place emphasis on the use of unmanned aerial vehicles (UAVs) and ground-based robotic platforms equipped with various sensing technologies for the purpose of plant and crop phenotyping studies as applied to improving crop characteristics including yield, drought tolerance, stress detection, etc.. Contributions are sought on sensing technologies; sensor platforms; and data collection, analysis and visualization schemes. Contributions are welcome which contain results from field studies on topics such as, but not limited to:

- UAVs for remote sensing in agriculture, including autonomous control issues, imaging workflow issues, and imaging software issues
- Ground-based robots for phenotyping
- Hyperspectral imaging
- Multispectral imaging
- Lidar
- Thermal-infrared cameras
- Fluorescence cameras
- Mobile Raman spectrometers
- Image analysis, data management and data visualization
- Theoretical and empirical estimation techniques including machine learning.

BEST PAPER AWARDS:

The Conference Chairs and Program Committee would like to recognize pioneers in the field with a Best Paper Award sponsored by Syngenta. Two candidates will be selected: one winner for the Best Paper Award and a Runner-up. This award is open to student and postdoctoral lead authors who present in this conference.

2020 BEST PAPER AWARD WINNERS

Award Winner

Implications of Soil and Canopy Temperature Uncertainty in the Estimation of Surface Energy Fluxes Using TSEB2T and High-resolution Imagery in Commercial Vineyards [11414-14]

Given to: **Ayman Nassar,** Utah State Univ. (United States)

Runner-up

Faster-R-CNN based deep learning for locating corn tassels in UAV imagery [11414-5]

Given to: **Aziza Al-Zadjali,** Univ. of Nebraska-Lincoln (United States)

Autonomous Systems: Sensors, Processing and Security for Ground, Air, Sea and Space Vehicles and Infrastructure 2021 (SI212)

Conference Chairs: **Michael C. Dudzik,** IQM Research Institute (United States); **Stephen M. Jameson,** BAE Systems, FAST Labs (United States); **Theresa J. Axenson,** National Reconnaissance Office (United States)

Program Committee: **Rita Barrios,** Ford Motor Co. (United States); **Jeremy P. Bos,** Michigan Technological Univ. (United States); **Andrew Dallas,** Soar Technology, Inc. (United States); **Jason M. Eichenholz,** Luminar Technologies, Inc. (United States); **Raj P. Malhotra,** Air Force Research Lab. (United States); **Paul F. McManamon,** Exciting Technology, LLC (United States); **Brad McNett,** U.S. Army TARDEC (United States); **Matt Mickelson,** The MITRE Corp. (United States); **Jeremy Salinger,** General Motors Co. (United States); **Shawn Taylor,** Sandia National Labs. (United States); **Simon Verghese,** Waymo, LLC (United States)

Advances in autonomous vehicle sensors (visible, electro-optical, radar, acoustic), onboard navigation, image processing, sensor fusion techniques, wireless communications, and advanced servo controls are rapidly transforming the domain of personal, business, commercial, and military platforms for ground, air, sea and space applications. Enabled by artificial intelligence (AI) and machine learning, these platforms are undergoing a rapid transition from augmented assistance to fully autonomous operations, opening up a range of new applications while raising challenges for security, infrastructure, testing methodologies, and public policy.

Dependence of autonomous auto and truck systems on sensor derived and wirelessly transmitted digital information raises challenges for assurance of correct and safe operation in complex environments. Furthermore, widespread use of autonomous systems requires infrastructure to provide GPS, V2V and V2I to augment system-level and on-board systems performance metrics to support wide deployment in cities. Critical to both new platforms and supporting infrastructure is the implementation of cyber security standards and software IV&V.

Emerging applications for autonomous systems for air, sea and space applications are also rapidly driving a need for new sensor technologies, architectures and methodologies to support system-level and system-of-systems level verification and validation. New policies, informed by an understanding of both the technologies and their limitations, will be needed to provide governance and regulation these new capabilities.

This conference provides a forum to discuss advances that close the gap between research and development; technology demonstrations; policy and regulation; and product qualifications for self-driving vehicles, autonomous air, sea and space systems, and their supporting infrastructures. Papers are solicited from academia, industry, and government stakeholders.

Topics include, but are not limited to the items listed below:

OBJECT SENSORS FOR DETECTION AND IDENTIFICATION

- 3D LIDAR/LADAR sensing
- Radar systems
- Visible/EO cameras
- Ultrasonic sensors
- Novel sensing methodologies
- Remote sensors

SENSOR PROCESSING AND FUSION FOR VEHICLE APPLICATIONS

- Precision navigation
- Obstacle detection/characterization
- Terrain matching systems
- Sensor fusion
- Distributed sensing and intelligence
- Situation awareness/understanding for autonomous operation

CYBER SECURITY STANDARDS AND SOFTWARE IV&V

- Vehicle cyber threat attack surfaces
- Embedded processors and applications
- Cyber security standards in development and sustainment
- Software IV&V
- Software security and reliability testing
- Modeling and simulation of physical systems for software vulnerability testing
- Automated vulnerability discovery
- Adversarial machine learning

NETWORKED AUTONOMOUS SYSTEMS

- Networked control infrastructures
- V2V and V2I systems and standards
- Serial telemetry/vehicle platooning
- Robust command and control
- Remote access.

AUTONOMOUS SYSTEM TESTING

- Field testing & demonstrations
- Test infrastructure and instrumentation
- System IV&V
- Model and simulation for system reliability testing.

SPECIAL JOINT SESSIONS WITH OTHER DEFENSE + COMMERCIAL SENSING CONFERENCES:

Joint session on Sensing for Navigation is planned with the Unmanned Systems Technology Conference.

Chemical, Biological, Radiological, Nuclear, and Explosives (CBRNE) Sensing XXII (SI213)

Conference Chairs: **Jason A. Guicheteau,** U.S. Army Edgewood Chemical Biological Ctr. (United States); **Chris R. Howle,** Defence Science and Technology Lab. (United Kingdom)

Program Committee: **Justin Bickford,** U.S. Army Research Lab. (United States); **Christopher C. Carter,** Johns Hopkins Univ. Applied Physics Lab. (United States); **Darren K. Emge,** U.S. Army Edgewood Chemical Biological Ctr. (United States); **Augustus Way Fountain III,** U.S. Army Edgewood Chemical Biological Ctr. (United States); **Timothy J. Johnson,** Pacific Northwest National Lab. (United States); **Lars Landström,** FOI-Swedish Defence Research Agency (Sweden); **Aaron LaPointe,** U.S. Army RDECOM CERDEC NVESD (United States); **Morgan Minyard,** Defense Threat Reduction Agency (United States); **Tanya L. Myers,** Pacific Northwest National Lab. (United States); **Paul M. Pellegrino,** U.S. Army Research Lab. (United States)

While the modern era of chemical warfare began over 100 years ago, armies have been using toxic gases, biological threats, as well as incendiary and explosive devices for most of recorded history. The threats of chemical, biological, radiological, nuclear and explosive (CBRNE) hazards continue to advance. However, warring parties with limited resources improvise or reuse older technologies with great effect. Today's military and homeland protection forces must therefore be prepared for a wide range of threats including many "old ones". The rising global trend for civil war and internal conflict, especially in large cities, increases the probability that industrialized chemicals will either intentionally or accidentally become a hazard to military and security forces or the localities' residents. A greater proliferation through the internet of the knowledge necessary to make CBRNE threats, coupled with the trends of rapid innovation and improvisation witnessed in Iraq and Afghanistan with IEDs, will make threat prediction difficult. The non-attribution of strategic CBRNE acts will also make a response difficult without a strong reliance on forensics to narrow down or identify the person(s) or group(s) responsible.

For those of us trying to develop detection capabilities for military, security, and emergency response forces, the current and future strategic environment means that there are literally thousands of lethal materials that can be used as weapons. The sensing of CBRNE threats is important to obtain "real-time" answers that allow actionable decisions to be made on-the-spot; to reduce the logistical burden by moving the analysis closer to the source of the sample; to rapidly screen materials to identify samples that need to be sent to a lab for additional analysis and minimize the number of these samples; and to non-destructively analyze large, valuable, or immovable objects for which excising samples is not possible. The Department of Defense is increasingly interested in offloading forward decision making and analysis from soldiers to software. This will increase the need for signal processing to be more robust and accurate. This conference will also provide a forum for discussion of advances in algorithms for sensor signal and data processing, including signal detection and sensor fusion. Of interest is the detection of low signal-to-noise signals in cluttered signal spaces, for the detection of biological/chemical threats.

In addition to protecting against battlefield CBRNE threats, there is an increasing demand to protect borders, ports, and other geographical points of entry, from the emergent threats of improvised explosive devices (IEDs), homemade explosives (HMEs), nuclear devices, radiological dispersal devices, and illicit narcotics. These threats have elevated the importance of technologies for the reliable detection, classification, and identification of asymmetric threats.

The scientific principles behind many CBRNE detection technologies are similar, despite their diverse application areas. Technologies such as laser induced fluorescence, Raman and infrared spectroscopy, LIBS/LIPS, mass spectrometry, chromatography, specifically labeled antibodies, DNA/RNA extraction and analysis, biomimetic sensors, micromechanical devices and microfluidics have found recent applications in chemical, biological, radiological and explosives sensing. In addition, methods for electro-optical biological monitoring and biomarker sensing technologies are needed to quantify and detect physical and health indicators of exposure to CBRNE materials. Also, new and sophisticated radiation detection systems are needed for better protection of military personnel and civilians from radiological threats.

This conference provides an unprecedented forum for authors from Government, industry, and academia to address a wide variety of CBRNE sensing issues, technologies, and advances in algorithms and signal process of threat related scenarios. Suggested topics for presentation include, but are not limited to:

- SARS-CoV-2/COVID-19 detection and diagnostic methods
- novel CBRNE detection modalities and materials
- disposable or miniature sensors for CBRNE threats
- integrated photonic applications for CBRNE threats
- biological surveillance and monitoring, methods, and analysis
- through barrier detection techniques for CBRNE sensing of hidden threats
- quantum sensing applications for CBRNE detection
- machine learning for detection and identification
- low signal-to-noise or clutter processing
- signal processing and data analytics for detection and identification

- CBRNE detection in congested urban environments
- modeling of sensor phenomenology and performance
- unmanned and/or autonomous ground or aerial CBRNE detection
- environmental monitoring of CBRNE or hazardous materials
- atmospheric transport phenomena for CBRNE releases
- environmental fate and transport of CBRNE materials
- novel decontamination and remediation technologies
- micromechanical components/nano-composite materials for CBRNE sensing
- biologically inspired or biomimetic CBRNE sensors
- active/passive detection and identification
- results/status/methods of laboratory and field testing (live or attenuated agents, simulants)
- gamma and neutron detection techniques
- standoff detection of ionizing radiation.

Save the date

ABSTRACTS DUE: 7 OCTOBER 2020

AUTHOR NOTIFICATION: 4 DECEMBER 2020

The contact author will be notified of acceptance by email.

MANUSCRIPTS DUE: 17 MARCH 2021

PLEASE NOTE: Submission implies the intent of at least one author to register, attend the conference, present the paper as scheduled, and submit a full-length manuscript for publication in the conference proceedings.

Submit your abstract today: **spie.org/dcs21call**

Detection and Sensing of Mines, Explosive Objects, and Obscured Targets XXVI (SI214)

Conference Chairs: **Steven S. Bishop,** U.S. Army Night Vision & Electronic Sensors Directorate (United States); **Jason C. Isaacs,** Naval Surface Warfare Ctr. Panama City Div. (United States)

Program Committee: **Canicious G. Abeynayake,** Defence Science and Technology Group (Australia); **Derek T. Anderson,** Mississippi State Univ. (United States); **Benjamin E. Barrowes,** U.S. Army Engineer Research and Development Ctr. (United States); **Leslie M. Collins,** Duke Univ. (United States); **Anthony A. Faust,** Defence Research and Development Canada, Suffield (Canada); **Tesfaye G-Michael,** Naval Surface Warfare Ctr. Panama City Div. (United States); **Pete Howard,** U.S. Army CERDEC NVESD (United States); **James M. Keller,** Univ. of Missouri-Columbia (United States); **Aaron LaPointe,** U.S. Army Night Vision & Electronic Sensors Directorate (United States); **Motoyuki Sato,** Tohoku Univ. (Japan); **Waymond R. Scott Jr.,** Georgia Institute of Technology (United States); **Alina Zare,** Univ. of Florida (United States)

Papers and presentations providing historic perspectives and reflections of accomplishments for this year's 25th anniversary conference are sought. In the terrestrial realm, both hastily scattered, and buried minefields, complex obstacles or engineered barriers and isolated improvised explosive devices can be a major impediment to military operations. For this reason the remote detection of buried explosive objects, surface-laid mines, and minefields is a key to the implementation of new Army warfighting doctrine based on rapid movement. Detection of mines and explosive objects to address Naval doctrine in the marine environment, whether in the surf zone, near-shore region, or in deep water is also a continuing technical challenge. Additionally, the use of mines as effective defensive weapons and improvised explosive objects and homemade explosives as inexpensive terrorist alternatives have proliferated worldwide during the last decade. As a consequence, the detection of mines, explosive objects, and obscured targets remains an ever important topic, not just because of its military related applications, but also for its humanitarian and environmental impacts. It is relatively easy to lay a minefield or use an explosive device but very dangerous, costly, and time consuming to detect, localize and to clear it. In the humanitarian context, the threat of a minefield is that it remains active and in place for a very long time, generally outlasting any minefield documentation. Improvised devices can cause massive personal trauma and these devices present unique detection challenges.

Unexploded ordnance presents a hazard for military operations during and civilian operations after conflicts, as well as a tremendous environmental liability on lands where it is present as the legacy of decades of testing and training. It is very important, therefore, to directly address these issues in a broad forum. The detection of mines/minefields/complex obstacles, other explosive objects like improvised explosive devices, and unexploded ordnance is a challenging problem because of the variability in target shape and size, material, color, and backgrounds and because they can undergo changes once deployed. In general, mine detection is hampered by problems of low detector signal under common environmental conditions. Detection frequently occurs in the presence of significant amounts of both natural and anthropogenic clutter. In order to increase the effectiveness of mine detection it is essential to develop technically superior sensor modalities, better understand environmental effects on sensors, implement innovative uses of sensors, and enhance sensor fusion and data fusion capabilities.

SUGGESTED TOPICS FOR SUBMISSIONS:

- mine sensor technologies of all kinds (including acoustic, electro-optics, magnetics, active and passive UV to LWIR, GPR, passive mm-wavelength imaging, terahertz technology, nuclear methods (including imaging), multispectral and hyperspectral imaging, polarization imaging, x-ray tomography, seismic imaging, vibrometric lasers and radars) as well as research systems applied to detection of mines, UXO, IED, wire, or hazardous objects buried underground or obscured by foliage, atmosphere, ocean water, or buildings
- multispectral and hyperspectral imaging technologies applied to the detection of landmines, UXO and IED, both surface and buried/obscured
- novel biological and chemical approaches to explosives sensing in the context of landmine, UXO, and IED detection
- autonomous and unmanned robotic technologies for mine detection, localization, and neutralization
- new and emerging technologies for the detection and identification of minefields, landmines, and IED from airborne platforms and commercial satellites
- the effects of dynamic soil processes and environmental conditions on clutter and false alarms as well as on the geophysical signatures of landmines, UXO, and IED
- evaluation tests of geophysical sensors for humanitarian demining
- system applications of technology addressing the detection of buried or underwater minelike targets, ordnance, hazardous waste materials in plastic or metallic containers, and obscured structures of all kinds
- measurement instruments and systems for the acquisition of data for the detection of buried and obscured targets, including ground-based, airborne, shipborne, and underwater systems, and related research investigations sensor and target models, and their predictive capabilities and limitations
- 2D and 3D synthetic aperture processing techniques for acoustics, sonar and radar technologies
- multisensor signal processing and fusion techniques
- image and signal processing algorithms and related performance evaluation measures, such as probability of detection and false alarm rate

- results of measurements addressing the detectability of targets that are buried, obscured, or in shallow water or coastal environments using both multispectral and hyperspectral systems, active laser systems, synthetic aperture radar, and other systems such as biological, chemical, and olfactory robotics
- the effective analysis of the operator as a signal processing component in a detection system, cognitive engineering
- other enhancements to improve detection of surface mines and minefields, especially in areas to improve night operations, increase area coverage rates, and increase standoff distances or operational altitudes
- passive and active detection of primitive tunnels, underground passageways and bunkers, and tunneling activity.

Save the date

ABSTRACTS DUE: 7 OCTOBER 2020

AUTHOR NOTIFICATION: 4 DECEMBER 2020

The contact author will be notified of acceptance by email.

MANUSCRIPTS DUE: 17 MARCH 2021

PLEASE NOTE: Submission implies the intent of at least one author to register, attend the conference, present the paper as scheduled, and submit a full-length manuscript for publication in the conference proceedings.

Submit your abstract today: **spie.org/dcs21call**

Disruptive Technologies in Information Sciences V (SI215)

Conference Chairs: **Misty Blowers,** Datalytica, LLC (United States); **Russell D. Hall,** Zel Technologies, LLC (United States); **Venkateswara R. Dasari,** U.S. Army Research Lab. (United States)

Program Committee **Gustave W. Anderson,** Lockheed Martin Corp. (United States); **Brian Henz,** U.S. Army Research Lab. (United States); **Josep Miquel Jornet,** Univ. at Buffalo (United States); **Georgiy M. Levchuk,** Aptima, Inc. (United States); **Raju Namburu,** U.S. Army Engineering Research and Development Ctr. (United States); **Jon R. Williams,** Johns Hopkins Univ. Applied Physics Lab., LLC (United States)

Disruptive and emerging technologies include innovative products and services that have the power to revolutionize their industry and have a transformative influence over the target group they are designed to support. Innovations in in- formation sciences coming to fruition in 2021 and beyond are poised to redefine business and connections as we know them. This conference is looking for your innovative ideas and projects to showcase as the next profound advancement in the information sciences domain. Some examples of these emerging and disruptive technologies include: autonomous systems and autonomy enablers, blockchain inspired architectures, software defined networking, advanced hardware architectures, quantum information sciences, and more!

Blockchain technologies, distributed ledger systems, and other decentralized applications (DAPPs) have applicability across many domains. Building on the foundational concepts of peer to peer (P2P) networks, game theoretics, and cryptography; the cryptocurrency market has seen the emergence of architectures which offer unprecedented capability to anonymize transactions, ensure proof of trust, and verifiability of message traffic across numerous digital eco- systems. This conference seeks novel applications of these technologies to both the government and commercial sectors.

Advances in autonomous systems over the next five years will be significant across a global community. Creative solutions which cover the full spectrum of autonomy will be considered; from human augmentation and human guided learning to fully autonomous system design which is functionally independent from human interference. Assured communications between these systems is essential and capabilities which enable natural language software agents will be transformative enablers as we see these technologies transition into operational environments. We encourage submission of work on XML dialects like the Artificial Intelligence Markup Language (AIML). AIML assisted optimizations are significantly improving the efficiency of computing platforms in resource constrained environments.

Counter Artificial Intelligence and Adversarial Machine Learning techniques are evolving. These are techniques employed in the field of machine learning which attempt to fool models through malicious input or by exploiting model failure points. This technique can be applied for a variety of reasons, the most common being to attack or cause a malfunction in standard machine learning models.

Ternary computers, quantum computing and quantum networking will allow for speeds exponentially faster than traditional systems of today as they are not limited by a single binary state. With the explosive growth of big data, rapid software execution will allow us to shift through more data than ever thought possible. In addition to the hardware architectures, software based advanced analytics are of high interest as transformative necessities in future years.

This conference also seeks to cover the implications of these technologies on computer security. For example, the increased computation speeds of quantum architectures will vastly improve the ability to break encryption schemes making today's legacy systems vulnerable and insecure. Data poisoning strategies expose insecurities in our machine learning algorithms and allow adversarial machine learning strategies to create distrust in the much needed autonomous capabilities of the future.

Softwarization is key to new innovations in networking, computing and storage technologies. It will lead to the realization of Software Defined Everything (SDx) which will replace the hard-coded static intelligence from hardware and network systems with software based programmable and hardware agnostic intelligent control plane agents. These technologies are rapidly being adopted in the industry and government enabling new control functions, abstractions and decision-making algorithms specific to networks, storage and computational environments. SDx makes it easy for integration of additional emerging hardware architectures, like quantum computers and heterogeneous Internet of Things (IOT) ecosystems.

Finally, there will be a growing need for advanced security schemes, sensors, data storage, and resilient systems which have inherent security mechanisms as communications between these sensors and sensing systems becomes faster and more complex. This complexity will result in the realized growth of novel advancements in technologies like distributed cloud and blockchain architectures which subvert an adversary or ill-intended user from targeting a single source vulnerability.

This conference is the place where we will look to the future to discover the technologies that will be game changers when considering the next generation of information sciences. Sessions will be driven by the submissions received but will generally be structured according to the suggested topic areas below.

Summary of Topics covered in this conference:

AUTONOMY, ARTIFICIAL INTELLIGENCE MARKUP LANGUAGE AND INTELLIGENT ALGORITHMS

- Adaptive intelligence
- Distributed algorithms
- Counter-Artificial Intelligence
- Adversarial Artificial Intelligence
- Artificial Neural Networks
- Deep Learning Systems
- Behavior Based and Pattern Analysis
- Multi-Agent Systems
- Robotics and Distributed Autonomous

BLOCKCHAIN, EMERGING SECURITY TOOLS, AND SECURE ARCHITECTURES
- Advanced Blockchain architectures
- Distributed tactical ledgers
- Hardware secured by design
- Distributed AI on the blockchain
- Smart contracts
- Biometrics
- Quantum key distribution
- Distributed surveillance

ADVANCED COMPUTING AND NETWORKS>
- Quantum Computing Architectures
- Adaptive computing
- Heterogeneous computing
- Programmable networks
- Computational off-loading
- New network architectures
- Disruptive computing architectures

SOFTWARE DEFINED EVERYTHING
- Internet of Things
- Advanced Sensors
- Virtualized network functions
- Unified control plane for IOT objects
- Optimization
- Distributed Cloud Architectures
- Modeling, simulation, and emulation

COMPUTATIONAL INTELLIGENCE AND MISSION EFFECTIVENESS
- Tactical computing and mission effectiveness
- Mission planning and execution
- Optimized computing for mission deployment
- Tactical wireless networks and optimizations

VISUALIZATION
- Augmented/Virtual Reality
- Big Data Visualization
- Scientific visualization and complexity reduction
- Visual UI optimizations for human sensory input

Student sponsorship may be provided to undergraduate students who submit abstracts based upon their own independent research or ideas and who have their ideas accepted by the program committee. Students should indicate in their abstract submission that they are an undergraduate seeking sponsorship.

Save the date

ABSTRACTS DUE: 7 OCTOBER 2020

AUTHOR NOTIFICATION: 4 DECEMBER 2020

The contact author will be notified of acceptance by email.

MANUSCRIPTS DUE: 17 MARCH 2021

PLEASE NOTE: Submission implies the intent of at least one author to register, attend the conference, present the paper as scheduled, and submit a full-length manuscript for publication in the conference proceedings.

Submit your abstract today: **spie.org/dcs21call**

Ocean Sensing and Monitoring XIII (SI216)

Conference Chair: **Weilin "Will" Hou,** U.S. Naval Research Lab. (United States)

Conference Co-Chairs: **Linda J. Mullen,** Naval Air Systems Command (United States); **Michael J. Wardlaw,** Office of Naval Research (United States)

Program Committee: **Robert A. Arnone,** The Univ. of Southern Mississippi (United States); **Brandon Cochenour,** Naval Air Warfare Ctr. Aircraft Div. (United States); **Fraser R. Dalgleish,** Harris Corp. (United States); **Alex "Sasha" Ignatov,** National Oceanic and Atmospheric Administration (United States); **Brittany Lynn,** Naval Information Warfare Ctr. Pacific (United States)

Open and coastal oceans, including littoral zone, are key areas to comprehensive understanding and prediction of long and short term climates, assessment of resources and environments, as well as defense and security applications. This conference is intended to cover the R&D efforts in the ocean and littoral sensing community to provide better tools, planning and solutions to the overall science, industry, as well as defense and security market by addressing current technology and environmental limitations, system decision, and implementation issues, as well as new technology that could be applied to ocean sensing problems. Specifically, these include topics associated with in situ and remote monitoring of the ocean surface, water column, deep sea, bathymetric and benthic features, impacts on sensor performance and calibration, data assimilation, and forecasting.

Traditional ocean research techniques are widely augmented today with in situ sampling packages on moorings, buoys, floats, flow-through systems, mobile platforms (UAVs, gliders, AUVs and ROVs), integrated sensor networks, and observatories. These are vibrant research and development areas and generate the most accurate data available, 3D, often in real-time, and are less affected by adverse conditions. However, spot sampling lacks the rapid, broad coverage that is critical in high-level real-time tactical decision making. In situ observations at times are not available for unsafe or denied-access environments. Remote sensing techniques (both active and passive) have been proven to offer synoptic surface coverage with adequate accuracy, when sensors are calibrated and validated correctly. The session will address calibration and validation of ocean sensors for both in situ and satellite monitoring. It is essential to establish and maintain precise protocols for deciding the appropriate mix and application of different sensor systems in order to maintain data coherence and comparability. It is equally important to understand how the ocean environment affects sensor performance, and what techniques are being developed to enhance sensor performance in challenging ocean environments. Further, modern defense and security needs demand that accurate information be provided when and where it is needed. Ocean sensing must provide not only timely and accurate data, but also offer insights regarding overall 3D and future environmental conditions, i.e. forecasting. The combined use of in situ observations, remotely sensed data and physical models is a rapidly evolving field, although improved assimilation of available data into models still poses a challenge. The ability to sense, integrate, and predict is vital in establishing a true real-time 4D cube of verified and validated information for ocean nowcast and forecast. Cutting edge development from other disciplines including robotics, artificial intelligence, quantum computing, communication are of special interests to this conference. We aim to bring together research and technical personnel, as well as managers from industry, governments, and academia, to foster cooperation to reduce the gap between legacy ocean sensing techniques and breakthroughs in other disciplines. **A BEST PAPER award** will be given based on votes from committee members, at the conclusion of the sessions.

In summary, this conference will focus on addressing recent changes related to the hydrosphere where oceans, lakes and rivers interconnect, as well as new methods and sensors used to characterize water quality and harmful events, amongst technical and scientific discussions on these and related topics listed below. **A townhall meeting will be held to discuss challenges and funding opportunities.**

SMART SENSING (AI/MACHINE LEARNING) AND SMART SENSORS

- Design concepts and solutions to ocean sensing issues
- Embedded real-time sensors
- Compact, passive/active sensors; compressive sensing
- In-stride processing, real-time multi-view/multi-sensor fusion

UNMANNED SYSTEMS SENSING: UAV (AERIAL) & UUV (UNDERWATER)

- drone-based sensing applications, sensors and algorithms
- underwater unmanned platforms (gliders, AUVs, ROVs), sensors and applications
- novel concepts on hybrid platforms, endurance, stealth and SWaP improvements
- advancements in platform (eg UAV, glider, ROV, AUV), payload and data collection
- novel concepts from any disciplines that could be applied in ocean sensing
- COTS integration for real world sensing applications

OCEAN REMOTE SENSING: LIDAR, OCEAN COLOR, SST, SAR

- active and passive remote sensing of the ocean and atmosphere (visible, IR/SST, microwave/SAR)
- inversion techniques for active and passive measurements
- calibration and characterization of satellite sensors
- cloud screening and effect of ambient/residual cloud on retrievals
- Cal/Val, quality control and consistency checks of satellite products, inter-sensor comparisons
- uncertainty evaluation
- radiative transfer in the ocean and atmosphere

IN SITU SENSING AND MONITORING

- advancements in instrumentation
- novel underwater navigation solutions
- emerging sensing and monitoring techniques, especially chemical and biological
- sensors and platforms: ship-based, buoys, observatories, moorings, UUV/gliders

- real-time observation systems
- hydrographic surveys and ocean mapping
- adaptive sampling strategies
- data management: automated data collection, reduction and quality control

SENSING, COMMUNICATIONS, AND SIGNAL PROCESSING

- underwater EO sensors & systems: gated, modulated, scanned, polarized, 3D, stereo, video
- Wireless communications and networks (Acoustic, Optical, EM)
- novel imaging sensors
- acoustical imaging & sonar: synthetic aperture, scanning, 2D & 3D, multibeam, sidescan
- image processing techniques, compressive sensing, super resolution
- particle/plankton imaging and identification
- imaging through air-sea interface
- effects of particles, turbulence, bubbles, surface & internal waves, salinity and thermal structures

CHARACTERIZATION AND FORECASTING OF OCEANIC, AND COASTAL ENVIRONMENTS

- surface and internal waves, currents, tides, small-scale eddies, and turbulence
- coastal ocean observation, modeling, data assimilation and predictions
- benthic and bathymetric properties; sediment transport and suspension
- model and data assimilation; uncertainty assessment

TOWNHALL MEETING: ROUND TABLE DISCUSSION ON CHALLENGES AND FUNDING OUTLOOKS

- Overview of challenges by sponsors and funding agencies
- Background discussion by experts on associated topics
- Discussion of potential solutions.

Save the date

ABSTRACTS DUE: 7 OCTOBER 2020

AUTHOR NOTIFICATION: 4 DECEMBER 2020

The contact author will be notified of acceptance by email.

MANUSCRIPTS DUE: 17 MARCH 2021

PLEASE NOTE: Submission implies the intent of at least one author to register, attend the conference, present the paper as scheduled, and submit a full-length manuscript for publication in the conference proceedings.

Submit your abstract today: **spie.org/dcs21call**

Open Architecture/Open Business Model Net-Centric Systems and Defense Transformation 2021 (SI217)

Conference Chairs: **Raja Suresh,** General Dynamics Mission Systems (United States); **Tim Ibrahim,** L3Harris Technologies, Inc. (United States)

Program Committee: **Joseph Borden,** Teledyne Benthos (United States); **Vasu D. Chakravarthy,** Air Force Research Lab. (United States); **Patrick Jungwirth,** U.S. Army Research, Development and Engineering Command (United States); **Robert Matthews,** L3Harris Technologies, Inc. (United States); **Wilmuth Muller,** Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany); **John Polson,** General Dynamics Mission Systems (United States); **Jonathan D. Shaver,** Air Force Research Lab. (United States); **Russell Shirey,** Air Force Research Lab. (United States); **Jason R. Stack,** Office of Naval Research (United States)

An open architecture (OA) is defined as a reference architecture that adopts open standards supporting a modular, loosely coupled and highly cohesive systems structure that includes publishing key interfaces within the systems. The key enabler for open architecture is the adoption of an open business model (OBM) which requires doing business in a transparent way that leverages the collaborative innovation of numerous participants across the enterprise permitting shared risk, maximized asset reuse and reduced total ownership costs. The combination of open architecture and an open business model permits the acquisition of Open Systems Architectures (OSA) that yield modular, interoperable systems allowing components to be added, modified, replaced, removed and/or supported by different vendors throughout the life cycle in order to drive opportunities for enhanced competition and innovation.

Military systems are also undergoing a radical transformation away from singular, exotic platforms to disaggregated Systems of Systems (SoS) with low cost platforms networked with secure, resilient communications. Such SoS lead to lower cost instantiations, while imposing an inordinate cost on adversaries to counter them. SoS will also increasingly rely on unmanned systems enabled by AI and Machine Learning technologies. The overall outcome will be the emergence of highly survivable, rapidly deployable forces.

PAPERS ARE SOLICITED IN ALL AREAS OF OA/OBM SYSTEMS AND SOS, INCLUDING, BUT NOT LIMITED TO THE FOLLOWING TOPICS.

- national strategies and acquisition plans for defense transformation and OA/OBM philosophies, concepts, and enabling technologies
- metrics and methodologies for measuring openness, quantifying the return on investment for undertaking OA, and estimating the appropriate amount of and approach to OA for new programs
- allied interoperability, consolidation and reconciliation of standards
- best practices and approaches for designing and/or managing reference architectures, procurement approaches, intellectual property/data rights, and interoperability and standardization (e.g., across technologies, across allied nations, etc.)
- strategies and approaches to incentivize the appropriate use of OA in government and industry
- modeling and simulation techniques for development and validation of OA net-centric systems, as well as for planning, training, and mission rehearsal
- affordability considerations in military systems enabled by OA
- SoS architectures, rapid SoS composition technologies and Mosaic warfare
- autonomy technologies for unmanned systems and swarming technologies
- SoS enabling technologies to include AI, machine learning, neural networks, cloud computing and block chain technologies
- Manned/unmanned teaming, visualization technologies, display systems, and the human dimension of C2
- communications and networking, with special emphasis on ad hoc wireless mobile networks, cross-layer techniques, network aware applications, spectrum management, cognitive sensor systems
- information assurance and security enabled digital policy management and policy-based routing in net-centric systems
- SoS instantiations and case studies—ISR systems, kill webs, gray zone operations, and hybrid warfare
- SoS operational test, evaluation, experimentation, and lessons learned.

SPECIAL SESSION ON Self-Organizing, Collaborative Unmanned ISR Robotic Teams

A special session on Self-Organizing, Collaborative ISR Teams is jointly planned with the Unmanned Vehicles Systems Technology conference. Net-centric systems are spawning a revolutionary transformation in multi-vehicle collaboration for autonomous teams of UVs with ISR missions. Human/robot partnerships can provide RSTA-on-demand and area effects operations. Special emphasis will be given to RSTA systems.

SPECIAL SESSION ON
Lessons Learned and Best Practices for Rapid Transition, Operationalization, and Fielding

While open architectures and open business models are key ingredients for rapidly fielding and/or upgrading technologies, they do not form necessary and sufficient conditions for success. To that end, this Special Session solicits papers that examine particular successes or failures in taking technologies through rapid transition, operationalization, and fielding and distills the underlying and generalizable principles that contributed to that success or failure. The goal of this Special Session is to go beyond the implementation and achievement of open architecture / open business models and to understand how these attributes (among others) are combined in action to rapidly move technologies from prototype to the field. Particular emphasis will be on concrete examples accompanied by analysis to extract the underlying principles that can be broadly generalized.

SPECIAL SESSION ON
Autonomy

Autonomy of unmanned systems is viewed as a major force multiplier in the Pentagon's Third Offset strategy. Recent advances in Artificial Intelligence, Machine Learning and Neural Networks will be key enablers for autonomous behavior of unmanned systems. We invite papers in all areas of Autonomy, including for single unmanned platforms, teams of unmanned platforms and swarming.

SPECIAL SESSION ON
Mosaic Warfare and Internet of Military Things (IoMT)

Mosaic warfare seeks to evolve from hardwired Kill Chains (Find, Fix, Track, Target, Engage and Assess) to Kill Webs, permitting the construction of the most effective objective architectures at mission timelines. The IoMT similarly seeks to create Software Defined Kill Chains that share information in a cloud based architecture. The Air Force ABMS is one example of such an IoMT.

Save the date

ABSTRACTS DUE: 7 OCTOBER 2020

AUTHOR NOTIFICATION: 4 DECEMBER 2020

The contact author will be notified of acceptance by email.

MANUSCRIPTS DUE: 17 MARCH 2021

PLEASE NOTE: Submission implies the intent of at least one author to register, attend the conference, present the paper as scheduled, and submit a full-length manuscript for publication in the conference proceedings.

Submit your abstract today: **spie.org/dcs21call**

Sensing for Agriculture and Food Quality and Safety XIII (SI218)

Conference Chairs: **Moon S. Kim,** USDA Agricultural Research Service (United States); **Bryan A. Chin,** Auburn Univ. (United States); **Byoung-Kwan Cho,** Chungnam National Univ. (Korea, Republic of)

Program Committee: **Kuanglin Chao,** USDA Agricultural Research Service (United States); **Stephen R. Delwiche,** USDA Agricultural Research Service (United States); **Ana Garrido-Varo,** Univ. de Córdoba (Spain); **Ki-Bok Kim,** Korea Research Institute of Standards and Science (Korea, Republic of); **Naoshi Kondo,** Kyoto Univ. Graduate School of Agriculture (Japan); **Kurt C. Lawrence,** USDA Agricultural Research Service (United States); **Renfu Lu,** USDA Agricultural Research Service (United States); **Bosoon Park,** USDA Agricultural Research Service (United States); **Yankun Peng,** China Agricultural Univ. (China); **Dolores Pérez-Marín,** Univ. de Córdoba (Spain); **Amrita Sahu,** Altria Group, Inc. (United States); **Paul J. Williams,** Stellenbosch Univ. (South Africa); **Haibo Yao,** Mississippi State Univ. (United States); **Yibin Ying,** Zhejiang Univ. (China); **Seung-Chul Yoon,** USDA Agricultural Research Service (United States)

Based on physical and chemical characteristics, optical sensing methods for real-time inspection of food, water and agricultural products can produce rapid, accurate, and consistent inspection solutions for product quality and safety. Advances in sensing technology have broadened the field of applications suitable for computerized optical instrumentation. No longer restricted to detailed laboratory analyses or simplified implementation in industrial or commercial settings, optical sensing technologies now can accommodate non-destructive, comprehensive, high-resolution spectral and image analyses for real-world safety and quality inspection on rapid food-processing lines.

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

Contributed papers are solicited concerning, but not limited to, the following areas:

- high-throughput spectral imaging inspection system
- Vis/NIR spectroscopic inspection system
- hyperspectral imaging applications
- multispectral imaging applications
- time-resolved spectroscopy
- fluorescence imaging
- surface-enhanced Raman scattering (SERS) spectroscopy
- optical scattering
- nanomaterials and nanosensors
- biosensors
- terahertz sensing
- chemical imaging applications in food adulterants and contaminants detection
- handheld optical devices.

Sensors and Systems for Space Applications XIV

(SI219)

Conference Chairs: **Genshe Chen,** Intelligent Fusion Technology, Inc. (United States); **Khanh D. Pham,** Air Force Research Lab. (United States)

Program Committee: **Xiaoli Bai,** Rutgers, The State Univ. of New Jersey (United States); **Trevor J. Bihl,** Air Force Research Lab. - Sensors (United States); **Erik P. Blasch,** Air Force Research Lab. (United States); **Janette C. Briones,** NASA Glenn Research Ctr. (United States); **Yu Chen,** Binghamton Univ. (United States); **Joseph L. Cox,** Leidos, Inc. (United States); **Roger Cutitta,** U.S. Army Research Lab. (United States); **Thomas George,** SaraniaSat Inc. (United States); **Ricardo Lent,** Univ. of Houston (United States); **Uttam Kumar Majumder,** Air Force Research Lab. (United States); **Brian K. McComas,** Raytheon Missile Systems (United States); **Jeremy Murray-Krezan,** Air Force Research Lab. (United States); **Elias T. Naffah,** NASA Glenn Research Ctr. (United States); **Tien M. Nguyen,** The Aerospace Corp. (United States); **Andre Samberg,** i4-Flame OÜ (LLC) (Estonia); **Carolyn Sheaff,** Air Force Research Lab. - Rome (United States); **Dan Shen,** Intelligent Fusion Technology, Inc. (United States); **Ryan M. Weisman,** Air Force Research Lab. (United States); **Hao Xu,** Univ. of Nevada, Reno (United States); **Yufeng Zheng,** Alcorn State Univ. (United States); **Peter Zulch,** Air Force Research Lab. (United States)

Space systems include launches, payload adapters, on-orbit systems, communications links, ground systems, and user equipment. The popular appreciation for the effects of space weather, orbital debris, the proliferation of space launch capability within the third world, and the halt of manned space flight have all increased the demand for contextual understanding for both challenges and possibilities for the future of space. Developments in small satellites and constellation technologies, coupled with more affordable launch services such as the pioneering Space X enterprise, may vastly transform space activities for knowledge discovery, economic prosperity, and national security. Specifically, sustained excellence in space environments, space communications and navigation technologies, advanced space resilient technologies, and awareness and command and control are vital to the future conduct of space policies and operations. Toward that end, effective research and development ranges from operational concepts to subsystems and component level innovations that cover all aspects of the design process, end-user requirements and how those requirements would affect design and operational decisions. A wide array of scientific and defense-related topics will foster multidisciplinary discussions that allow participants to gain an understanding of the technological issues being addressed by their counterparts working in different areas such as: i) sensors and sensor control for resiliency operations; ii) dynamic data, information processing, computation, learning, and fusion for space awareness and command and control; iii) secure and distributed design principles for information-centric satellite networking with interoperable, robust blockchain systems resilient to cyber attacks; iv) network based enterprise-wide management and control of military and commercial satellite communication services; v) policy implications for better utilization, transition and integration of 5/6G wireless cellular technology with space communications; and vi) flexible and resilient timing, navigation, and communications with civilian and military purposes alike.

This conference captures the uses and issues involving both civil and military space systems and provides a forum for cross-fertilization between international civil space, military space, and the intelligence community. Papers are solicited on the following and related topics:

This conference captures the uses and issues involving both civil and military space systems and provides a forum for cross-fertilization between international civil space, military space, and the intelligence community. Papers are solicited on the following and related topics:

SENSORS AND SENSOR CONTROL

- sensors and systems for space situational awareness
- color photometry of multiple resident space objects
- dual-use subsystems such as sensors used for communications purposes
- active illumination for non-imaging optical sensors
- indication and warning data fusion and decision support
- innovative tasking and dissemination architectures
- missile defense sensors and applications
- small-sat, micro-sat, and nano-sat technologies
- microservices architecture for space sensing systems

REMOTE SENSING AND SPACE CONTROL

- mitigation of space environment effects, such as radiation hardening
- optical contamination detection, abatement, effects and response
- change detection
- closely spaced object determination
- resident space object track association, trajectory inference and prediction
- persistent monitoring for time sensitive and critical engagement

ASSURE ACCESS AND SECURITY IN SPACE

- high assurance internet protocol encryption
- robust and secure machine learning
- security, privacy and trust in edge-fog-cloud computing based space systems
- blockchain enabled decentralized security solutions
- information priority and scheduling
- information interoperability

continued next page

Sensors and Systems for Space Applications XIV (SI219 continued)

COGNITIVE RADIO AND NETWORKS

- cognitive techniques in neural networks
- resource management and beam communications
- network coding and caching
- secure and dependable software-defined networking
- reinforcement learning for network access optimization
- machine learning and deep learning in space communications

OPTICAL AND QUANTUM INFORMATION TECHNOLOGIES

- visible light communications
- modeling, simulation, and analysis of time transfers in optical crosslinks
- distributed time synchronization in optical crosslink satellite constellations
- quantum networks of clocks
- quantum communications

EMERGING TECHNOLOGIES

- 3D Printing/ Additive manufacturing for space application
- Virtual reality (VR)/ AR (augmented reality) for space application
- AI, Counter-AI, and Machine learning for space application
- Digital Twin technology for space application
- 5G LTE and intelligent space communications.

BEST PAPER AWARDS

We are pleased to announce Best Paper Awards in Sensors and Systems, sponsored by Intelligent Fusion Technology, Inc., will be awarded to the best paper and best student paper in Sensors and Systems for Space Applications. Qualifying papers will be evaluated by the awards committee. Manuscripts will be judged based on scientific merit, impact, and clarity. The winners will be announced during the conference and the presenting authors will be awarded a cash prize.

TO BE ELIGIBLE FOR THE BEST PAPER AWARD, YOU MUST:

- be listed as an author on an accepted paper within this conference
- have conducted the majority of the work to be presented
- submit your manuscript online by **17 March 2021**
- present your paper as scheduled

TO BE ELIGIBLE FOR THE BEST STUDENT PAPER AWARD, YOU MUST:

- be a student without a doctoral degree (undergraduate, graduate, or PhD student)
- submit your abstract online, and select "Yes" when asked if you are a full-time student, and select yourself as the speaker
- be the presenting author on an accepted paper within this conference
- have conducted the majority of the work to be presented
- submit your manuscript online by **17 March 2021**
- present your paper as scheduled.

Save the date

ABSTRACTS DUE: 7 OCTOBER 2020

AUTHOR NOTIFICATION: 4 DECEMBER 2020

The contact author will be notified of acceptance by email.

MANUSCRIPTS DUE: 17 MARCH 2021

PLEASE NOTE: Submission implies the intent of at least one author to register, attend the conference, present the paper as scheduled, and submit a full-length manuscript for publication in the conference proceedings.

Submit your abstract today: **spie.org/dcs21call**

Signal Processing, Sensor/Information Fusion, and Target Recognition XXX (SI220)

Conference Chairs: **Ivan Kadar,** Interlink Systems Sciences, Inc. (United States); **Erik P. Blasch,** Air Force Research Lab. (United States); **Lynne L. Grewe,** California State Univ., East Bay (United States)

Conference Co-Chairs: **Bhashyam Balaji,** Defence Research and Development Canada (Canada); **Thia Kirubarajan,** McMaster Univ. (Canada)

Program Committee: **William D. Blair,** Georgia Tech Research Institute (United States); **Mark J. Carlotto,** General Dynamics Advanced Information Systems (United States); **Alex L. Chan,** U.S. Army Research Lab. (United States); **Kuo-Chu Chang,** George Mason Univ. (United States); **Chee-Yee Chong,** Independent Consultant (United States); **Frederick E. Daum,** Raytheon Co. (United States); **Jean Dezert,** The French Aerospace Lab. (France); **Laurie H. Fenstermacher,** Air Force Research Lab. (United States); **Jon S. Jones,** Independent Consultant (United States); **Georgiy M. Levchuk,** Aptima, Inc. (United States); **Martin E. Liggins II,** Independant Consultant (United States); **James Llinas,** Univ. at Buffalo (United States); **Ronald P. S. Mahler,** Random Sets, LLC (United States); **Uttam Majumder,** Air Force Research Lab. (United States); **Raj P. Malhotra,** Air Force Research Lab. (United States); **Alastair D. McAulay,** Lehigh Univ. (United States); **Raman K. Mehra,** Scientific Systems Co., Inc. (United States); **Harley R. Myler,** Lamar Univ. (United States); **David Nicholson,** BAE Systems (United Kingdom); **John J. Salerno Jr.,** Harris Corp. (United States); **Robert W. Schutz,** Consultant (United States); **Andrew G. Tescher,** AGT Associates (United States); **Stelios C. A. Thomopoulos,** National Ctr. for Scientific Research Demokritos (Greece); **Shanchieh Jay Yang,** Rochester Institute of Technology (United States)

The conference addresses advances in all aspects of systems and algorithms used in all levels of information fusion. This conference encourages a range of issues pertinent to the target presence/recognition, such as signal/image data processing, exploitation, and dissemination; feature extraction and tracking; multisensor/data/information fusion; resource management, processing and computational complexity, decision-making and human's role, and deployment image compression, compressive sensing, and processor architectures. Defense, security as well as dual-use and commercial applications of the acquisition, signal processing, and information fusion problems will be considered.

Papers are solicited, but not limited to, the following and related topics:

- multisensor and multisource information fusion
- random sets and conditional event algebra applications
- commercial applications of multisource information fusion
- target detection, tracking and sensor/data fusion using centralized and/or distributed multisensor architectures
- biological and cognitive foundations for information fusion
- big data analytics/processing with applications to information fusion
- application of context to enhance information fusion
- information fusion in contested environments
- application of information fusion to smart cities
- signal processing, information fusion, understanding and networking aspects of cyber physical systems (CPS) and related internet-of-things (I-o-T)
- distributed Information Fusion, Detection and Networking
- deep Machine Learning and AI applications to Information Fusion, Image Processing and (target) Recognition
- maximum Entropy Methods applications information Fusion, Target Detection, Image Processing and (Target) Recognition
- predictive Analytics methods application to all areas of Information Fusion
- quantum information processing applications to information fusion, cyber and networking, (CPS), (I-o-T), Big Data Analytics, and related areas
- situation/threat assessment and intent modeling
- behavior modeling
- social/cultural modeling
- cyber and networking aspects of information fusion
- adaptive, robust, and knowledge-based information/sensor fusion
- physics derived and human derived (aka hard and soft) information fusion
- resource and connection/communications management
- human-computer interface and modeling
- measures-of-performance, measures-of-effectiveness and evaluation methods
- sensor and target modeling, and implementation issues
- evidential reasoning including Dempster Shafer, DSmT, and neural networks and fuzzy logic techniques
- image models, registration and compression
- compressive sensing applications
- computational and optimization techniques.

NOTES: This conference plans to host in 2021 an Invited Panel composed of internationally recognized experts. The topic will be announced at a future date.

Smart Biomedical and Physiological Sensor Technology XVIII (SI221)

Conference Chairs: **Brian M. Cullum,** Univ. of Maryland, Baltimore County (United States); **Douglas Kiehl,** Eli Lilly and Co. (United States); **Eric S. McLamore,** Univ. of Florida (United States)

Program Committee: **Alper Bozkurt,** North Carolina State Univ. (United States); **Jonathan C. Claussen,** Iowa State Univ. (United States); **Matthew B. Coppock,** U.S. Army Research Lab. (United States); **Mikella E. Farrell,** U.S. Army Research Lab. (United States); **Moinuddin Hassan,** U.S. Food and Drug Administration (United States); **Ellen L. Holthoff,** U.S. Army Research Lab. (United States); **Ilko K. Ilev,** U.S. Food and Drug Administration (United States); **Yong Lin Kong,** The Univ. of Utah (United States); **Benjamin Leever,** Air Force Research Lab. (United States); **K. D. Mandal,** Institute of Technology, Banaras Hindu Univ. (India); **Jennifer Martin,** Air Force Research Lab. - Wright Patterson AFB (United States); **Heather McCauley,** U.S. Food and Drug Administration (United States); **Olga S. Ovchinnikova,** Oak Ridge National Lab. (United States); **T. Joshua Pfefer,** U.S. Food and Drug Administration (United States); **Shiv K. Sharma,** Univ. of Hawai'i (United States); **Narsingh B. Singh,** Univ. of Maryland, Baltimore County (United States); **Dimitra N. Stratis-Cullum,** U.S. Army Research Lab. (United States); **Michael Weinrich,** Univ. of Maryland, Baltimore Country (United States); **Sheng Xu,** Univ. of California, San Diego (United States)

Technological advances in sensor development and sensing applications have had major impacts on the fields of biomedical diagnostics and biological research in the past two decades. This conference on Smart Biomedical and Physiological Sensor Technology, provides an interdisciplinary forum for scientists, engineers, clinical researchers, medical doctors and industrial partners, from a variety of disciplines, who are engaged in the development and application of smart sensor technologies to problems in the biological and biomedical sciences to interact and explore cutting edge research and development. Medical doctors, biomedical clinicians, and basic bioscience researchers will present recent results and share examples of challenges they face in terms of detection, diagnosis, treatment and integration of new technologies into the field. Scientists, engineers and other researchers who are developing sensors and novel sensor technologies, will present the latest in smart sensor and sensing technology concepts and research. Industrial representatives will present the latest innovations and available technologies for biomedical and optical sensing applications.

This conference includes basic research in sensor development and instrumentation through clinical studies and practical applications of sensing and therapeutic methodologies (e.g., minimally and non-invasive sensors, lab-on-a-chip, etc.), all having the same common theme of biological or medical sensing/imaging. It will focus on the development and applications of novel smart sensor materials and technologies capable of providing additional information and/or more robust analyses than conventional techniques. Smart sensors employ many different diagnostic/therapeutic methodologies (i.e., optical spectroscopy, electrochemical analyses, etc.) as well as advanced analytical instrumentation and sophisticated approaches for evaluating complex multidimensional datasets. Several sessions, devoted to diverse aspects of biological and biomedical sensor development and their application to civilian and defense related challenge will exist, focusing on specific aspects in the technology development, validation and application. Contributed papers are solicited concerning, but not limited to the following areas:

- Nano-biotechnology
- Bio-compatible and smart sensing materials
- Implantable sensor technology
- Tissue Optics and Non-invasive sensing and imaging
- Micro- and Nano-bio instrumentation
- Point-of-care medical diagnostics
- Wireless signal transmission
- Wearable sensor technologies
- Assistive wearable technologies
- Photoacoustic sensing and imaging
- Raman and SERS sensing and imaging
- Infrared/NIR sensing and imaging
- Microfluidics
- "Lab-on-a-chip" technologies
- Paper based sensing technologies
- Multiplexed and high throughput screening
- Mobile medical apps
- Remote biological/biomedical sensing
- Space-based health monitoring
- Multivariate sensor response
- Pre-symptomatic detection
- Clinical application of biomedical sensors
- Biomedical forensics
- Drug Delivery/Therapeutics
- Nanovectors/Nanocarriers
- Smart molecular signaling probes
- Forensic Sensing and Diagnostics.

Unmanned Systems Technology XXIII (SI222)

Conference Chairs: **Hoa G. Nguyen,** Office of Naval Research Global (United States); **Paul L. Muench,** U.S. Army Ground Vehicle Systems Ctr. (United States); **Brian K. Skibba,** U.S. Air Force Civil Engineer Ctr. (United States)

Program Committee: **Michael H. Bruch,** Naval Information Warfare Ctr. Pacific (United States); **Jared Giesbrecht,** Defence Research and Development Canada, Suffield (Canada); **Sridhar Lakshmanan,** Univ. of Michigan-Dearborn (United States); **Larry H. Matthies,** Jet Propulsion Lab. (United States); **Camille S. Monnier,** Charles River Analytics, Inc. (United States); **Dilip G. Patel,** General Dynamics Robotic Systems (United States); **Philip Root,** Defense Advanced Research Projects Agency (United States); **Raja Suresh,** General Dynamics Mission Systems (United States)

This conference explores research and development for teleoperated, semi-autonomous, and autonomous unmanned systems (UxS). It examines the technology requirements and operational capabilities of unmanned system programs for air, ground, surface, under water, and planetary exploration applications. Also of interest are issues involved in fielding UxS, including standards and manufacturing. This conference brings together the technologist, developer, and user communities to discuss requirements, challenges, and technical approaches for commercial and military UxS technology. It seeks to provide a balanced perspective on (a) programs and applications, and (b) theory, algorithms, designs, and implementation. It provides an avenue for UxS program managers and users to present their unique requirements and perspectives on the important technical issues, and the technologists and developers to present their latest discoveries, results, and ideas.

This conference also provides the opportunity for hands-on demonstration of robot systems and component technologies. Researchers who would like to demonstrate their robotic vehicles and unique capabilities are strongly encouraged to contact one of the program chairs.

PAPERS ARE SOLICITED, BUT NOT LIMITED TO, THE FOLLOWING TOPIC AREAS:

- autonomy and autonomous vehicles
- biological inspiration
- commercial and civilian applications
- communication and networks
- distributed, swarm, and collaborative robotics
- driver assist, active safety, and other automotive technology
- government programs: technical and performance challenges
- human machine interface
- image processing and robot vision
- intelligent behaviors
- learning systems
- manipulation for mobile platforms
- metrics and regulations
- micro robotics
- mission execution
- open architecture and systems
- path planning and navigation
- payloads and auxiliary functions
- perception and semantic understanding
- power and energy
- sensor fusion and integration
- shared man-machine control
- standards and open architectures
- system performance modeling and simulation
- system performance testing and evaluation
- unmanned system ethics, trust, and safety
- vehicle mobility and motion control
- world and vehicle modeling.

SPECIAL JOINT SESSIONS WITH OTHER DEFENSE + COMMERCIAL SENSING CONFERENCES:

Joint session on self-organizing, collaborative, unmanned robotic teams is planned with the Open Architecture/Open Business Model Net-Centric Systems and Defense Transformation conference.

JOINT SESSION ON

Artificial intelligence/machine learning and unmanned systems is planned with the Artificial Intelligence and Machine Learning for Multi-Domain Operations Applications conference.

JOINT SESSION ON

Sensing, processing, and safety for unmanned ground vehicles is planned with the Autonomous Systems: Sensors, Processing and Security for Vehicles & Infrastructures conference.

Virtual, Augmented, and Mixed Reality (XR) Technology for Multi-Domain Operations II (SI223)

Conference Chairs: **Mark S. Dennison Jr.,** U.S. Army Research Lab. (United States); **David M. Krum,** California State Univ., Los Angeles (United States); **John (Jack) N. Sanders-Reed,** The Boeing Co. (United States)

Conference Co-Chair: **Jarvis (Trey) J. Arthur III,** NASA Langley Research Ctr. (United States)

Program Committee: **Brendan W. Blanton,** Northrop Grumman Corp. (United States); **Michael P. Browne,** SA Photonics, Inc. (United States); **Damon M. Conover,** U.S. Army Research Lab. (United States); **Michael D'Zmura,** Univ. of California, Irvine (United States); **Venkateswara R. Dasari,** U.S. Army Research Lab. (United States); **Celso de Melo,** U.S. Army Research Lab. (United States); **Daniel D. Desjardins,** Air Force Research Lab. (United States); **Gary W. Jones,** NanoQuantum Sciences, Inc. (United States); **Michael N. Geuss,** U.S. Army Research Lab. (United States); **Glenn Hodges,** MOVES Institute at the Naval Postgraduate School (United States); **Shanalyn A. Kemme,** Sandia National Labs. (United States); **Peter Khooshabeh,** U.S. Army Research Lab. (United States); **Joshua Kvavle,** Naval Information Warfare Ctr. Pacific (United States); **James E. Melzer,** Thales Visionix, Inc. (United States); **Niklas Peinecke,** Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); **Kim Pollard,** U.S. Army Research Lab. (United States); **Tiffany Raber,** CCDC Data & Analysis Ctr. (United States); **Adrienne J. Raglin,** U.S. Army Research Lab. (United States); **Chris Reardon,** U.S. Army Research Lab. (United States); **Simon M. Su,** U.S. Army Research Lab. (United States); **Evan Suma Rosenberg,** Univ. of Minnesota, Twin Cities (United States); **Theron T. Trout,** Stormfish Scientific Corp. (United States); **Suya You,** U.S. Army Research Lab. (United States)

Papers are sought on all aspects of Situation Awareness using augmented, virtual, and mixed reality (XR) for multi-Domain operations (MDO) in complex and degraded environments. Applications include both civilian and military use cases involving dismounted operators, surface vehicles, air vehicles and can include a priori databases as well as live local / remote sensors.

Degraded Visual Environments (DVE) are described as obscurants which reduce operator visibility such as smoke, haze, fog, dust, rain, snow, or reduced illumination (night). Vehicle structure which reduces direct external viewing (e.g. embedded cockpits or armored vehicles) represents another form of DVE. Degraded Environments also include Electro-Magnetic Effects (EME) such as GPS jamming or denial and degraded radio frequency environments (loss of communications). Optical degradation includes the effects of dazzlers or laser illumination. Papers discussing Phenomenology of Degraded Environments and Sensing for pilotage, targeting, Intelligence, Surveillance, and Reconnaissance (ISR), threat detection, and other functions are sought.

Technologies that allow the perception of virtual, augmented, or mixed reality (collectively XR) will provide operators with novel ways of accessing, consuming, and interacting with heterogeneous information and accelerate and augment their decision-making and situation awareness. Factors which support situation awareness include sensing (both on-board and off-board sensors), databases (e.g. terrain and cultural features), sensor processing (fusion, stitching, feature extraction and threat detection), data integration, display, and human factors. The intersection of data integration, display, and human factors is of interest to support human situation awareness and decision making in high tempo operations with many near simultaneous events which could lead to high operator workload. Papers are invited which explore concepts for collaboration of manned-unmanned teaming to extend sensor range and provide improved situation awareness. It also includes system concepts which couple sensor processing directly to vehicle or body-worn control systems.

XR has recently experienced explosive technological growth in both hardware and software solutions, making the bleeding edge a moving target. Despite this, a significant divide exists between industry goals, foundational academic research, and understanding of military requirements. As the literature on immersive analytics is in its infancy, it necessitates XR experts to collectively pave the roadmap for future essential research topics.

The primary goal of this conference is to (1) spark discussion of current and future challenges for integrating XR systems into combat operations in degraded and complex environments and (2) highlight collaborative R&D activities in technologies that support Multi-Domain Operations applications.

The topics for this conference include, but are not limited to:

OPERATIONS IN DEGRADED VISUAL AND COMPLEX MULTI-DOMAIN OPERATIONS

- operational surveys, studies, and trials
- flight qualification and certification issues
- operations through DVE weather, smoke, and other obscurants
- windowless cockpits
- runway and taxiway following
- runway incursions, collision avoidance
- automated landing systems
- development of DVE system requirements: methodology and results
- techniques for cross-domain information transfer and visualization
- human-agent teaming: embodied agents, virtual humans, asset control
- training and simulation: realistic virtual environments, user studies, teleoperations, mission rehearsal and debriefing

DVE-PENETRATING SENSORS AND SYSTEMS

- enhanced, low-light CCD
- long-wave, mid-wave, and short-wave infrared
- active millimeter-wave radar
- passive millimeter-wave imaging
- terahertz imaging for obscurant penetration
- obscurant penetrating 3D lidar
- night vision, color night vision
- weather radar exploitation
- sensor operation and control
- multi-band/multi-phenomenology approaches
- dual- or multi-use sensors
- sensor, weather, and environmental effect simulation
- airport surface characterization at low-grazing angles (MMW effects)
- phenomenology

SENSOR PROCESSING ALGORITHMS, ARCHITECTURES, AND CAPABILITIES

- image enhancement, registration, exploitation
- multispectral image fusion, feature extraction, obstacle and wire detection
- coupling sensor processing to vehicle control systems
- dangerous weather identification (microburst, wind shear, etc.)
- airport, runway, and taxiway feature matching
- world-conformal display alignment methods
- system latencies, refresh rates
- architectures for sensor and information management and distribution
- terrain and obstacle database management, including sensor driven real-time updating
- database acquisition, generation, verification, certification, formats
- efficient rendering techniques for terrain and high volume ladar/lidar data
- embedded graphics systems, multicore GPU algorithm acceleration
- system inputs and interaction: virtual locomotion and haptics, input and interface techniques for AR, VR, MR
- cross-reality networking and interoperability: distributed and local systems, multi-user synchronization, sensor and data I/O, constrained and ad-hoc mobile networks, edge computing

DISPLAY SYSTEMS AND PRESENTATION FORMATS

- head-up, head-down, head-worn display formats
- heads up/eyes out flight information and formats
- 360° viewing, picture-in-picture windows
- photo-realistic display, 3D stereo display formats
- value and limitations of color information display
- dynamic perspective flight guidance, 4D pathway, highway in the sky
- flight-management and planning systems integration
- electronic Flight Bag integration
- information management, integration, and presentation
- user studies examining human perception capabilities
- User experience and multi-sensory integration: perception and cognition, physiological responses, motion sickness, telepresence, multi-user interaction.

Save the date

ABSTRACTS DUE: 7 OCTOBER 2020

AUTHOR NOTIFICATION: 4 DECEMBER 2020

The contact author will be notified of acceptance by email.

MANUSCRIPTS DUE: 17 MARCH 2021

PLEASE NOTE: Submission implies the intent of at least one author to register, attend the conference, present the paper as scheduled, and submit a full-length manuscript for publication in the conference proceedings.

Submit your abstract today: **spie.org/dcs21call**

EVENT DATES: 11–15 APRIL 2021
The 2021 event will run from Sunday through Thursday.

VENUE

Gaylord Palms Resort & Convention Center
6000 W Osceola Pkwy, Kissimmee, FL 34746

REGISTRATION

All participants, including invited speakers, contributed speakers, session chairs, co-chairs, and committee members, must pay a registration fee. Fee information for conferences and courses, a registration form, and technical and general information will be available on the SPIE website late December 2020.

HOTEL INFORMATION

Reservations are scheduled to open in December 2020. SPIE will arrange special discounted hotel rates for attendees.

STUDENT TRAVEL CONTINGENCY GRANTS

A limited number of SPIE contingency student travel grants will be awarded based on need. Applications must be received no later than 10 weeks prior to the meeting. Eligible applicants must present an accepted paper at this meeting. Offer applies to undergraduate/graduate students who are enrolled full-time and have not yet received their PhD.

APPROVAL INFORMATION

If government and/or company clearance is required to present and publish your presentation, start the process now to ensure you receive approval if your paper is accepted. If you need a written rationale for your conference participation, visit www.spie.org/dcsbenefits for a resource listing the benefits of attending. For those needing to request approval 6 months prior to the event, please note that date is 26 October 2020.

VISA INFORMATION

If you need a travel visa, begin the visa application process now. Strict security requirements may cause delays in visa processing. More information about applying for a USA visa is available at: www.national-academies.org/visas

LETTERS OF INVITATION FOR VISA PROCESS

Individuals requiring letters of invitation to obtain travel visas to present their papers may access and print an Invitation Letter Request Form found on the event website.

SPIE. SPIE is the international society for optics and photonics, an educational not-for-profit organization founded in 1955 to advance light-based science, engineering, and technology. The Society serves more than 255,000 constituents from 183 countries, offering conferences and their published proceedings, continuing education, books, journals, and the SPIE Digital Library. In 2019, SPIE provided more than $5.6 million in community support including scholarships and awards, outreach and advocacy programs, travel grants, public policy, and educational resources.

Present your research at SPIE Defense + Commercial Sensing

Follow these instructions to develop a successful abstract and accompanying manuscript for the conference and for publication in the Proceedings of SPIE in the SPIE Digital Library.

How to submit an abstract

1. Browse the conference program and select conference(s) that most closely match the topics of the research you wish to present. *Important: each abstract may be submitted to one conference only.*
2. Click "Submit an Abstract" from within the conference you've chosen, and you'll be prompted to sign in to your spie.org account to complete the submission wizard.

What you will need to submit

A completed electronic submission should include the following:

- Title
- Author(s)' information
- 250-word abstract for technical review
- 100-word summary for the program
- Keywords used in search for your paper (optional)
- Your decision on publishing your presentation recording to the SPIE Digital Library (slide capture and audio)
- Some conferences may indicate additional requirements in the Call for Papers (for example: instructions for competing for awards)

  Note: Only original material should be submitted. Commercial papers, papers with no new research/development content, and papers with proprietary restrictions will not be accepted for presentation.

Submission agreement

Presenting authors, including keynote, invited, oral, and poster presenters, agree to the following conditions by submitting an abstract:

- Register and attend the meeting.
- Present as scheduled.
- Publish a 6- to 20-page manuscript in Proceedings of SPIE in the SPIE Digital Library.
- Obtain funding for registration fees, travel, and accommodations, independent of SPIE, through their sponsoring organizations.
- Ensure that all clearances, including government and company clearance, have been obtained to present and publish. If you are a DoD contractor in the USA, allow at least 60 days for clearance.

Important dates

Abstracts Submission Deadline	7 October 2020
Acceptance Notification Sent to Contact Author	4 December 2020
Manuscripts Due	17 March 2021

Review and program placement

- To ensure a high-quality conference, all submissions will be assessed by the Conference Chair/Editors for technical merit and suitability of content.
- Conference Chair/Editors reserve the right to reject for presentation any paper that does not meet content or presentation expectations.
- Final placement in a speaker or poster session is subject to the Chairs' discretion.

Publication of Proceedings in the SPIE Digital Library

- Conference Chair/Editors may require manuscript revision before approving publication and reserve the right to reject for publication any paper that does not meet acceptable standards for a scientific publication.
- Conference Chair/Editors' decisions on whether to allow publication of a manuscript is final.
- Authors must be authorized to transfer copyright of the manuscript to SPIE, or provide a suitable publication license.
- Only papers presented at the conference and received according to publication guidelines and timelines will be published in the conference Proceedings of SPIE in the SPIE Digital Library.
- Oral presentations are recorded, capturing the slides synced with the presenter's audio. Only those with author permission will be published in the SPIE Digital Library.
- SPIE partners with relevant scientific databases to enable researchers to find the papers in the Proceedings of SPIE easily. The databases that abstract and index these papers include Astrophysical Data System (ADS), Ei Compendex, CrossRef, Google Scholar, Inspec, Scopus, and Web of Science Conference Proceedings Citation Index.
- More publication information available on the SPIE Digital Library.

Contact information

For questions about your presentation, submitting an abstract post-deadline, or the meeting, contact **Kirsten Anderson** or **Aron Miller**, your Conference Program Coordinators..

For questions about your manuscript, contact **AuthorHelp@spie.org**.

SHARE YOUR WORK AND YOUR INSIGHTS WITH OTHER EXPERTS

Share advancements with colleagues—present your work at the leading global event on sensing, imaging, and photonics technologies.

SPIE. DEFENSE+ COMMERCIAL SENSING

11–15 April 2021
Orlando, Florida, USA

40+ Conferences in 4 Core Technology Tracks

MATERIALS AND DEVICES

- Single photon sources and detectors, image sensors, spectroscopic instrumentation, energy harvesting systems, and quantum technologies
- Applications include low-light imaging, free-space communications, energy generation and storage, cybersecurity and cryptography, time-of-flight imaging, and drone-mounted sensing, imaging and detection

IMAGING AND ANALYTICS

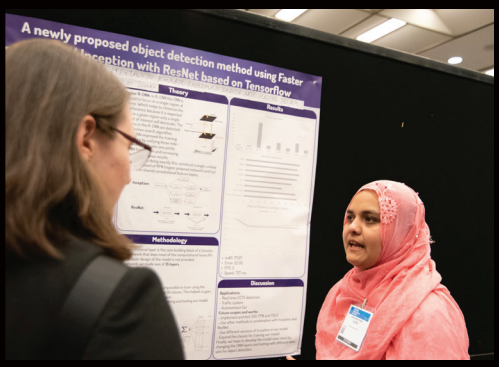
- Spectral imaging technologies and algorithms; big data, machine learning (ML) and artificial intelligence (AI); point cloud processing, 3D imaging and vision, and computational image processing
- Applications include homeland security and defense; target detection, recognition, and tracking; optical metrology and inspection; augmented reality and virtual reality (AR/VR); 3D displays; and geospatial informatics

ADVANCED SENSING AND IMAGING

- Infrared (IR) detectors, sensors, optics and imaging systems; radar; LiDAR; millimeter-wave and terahertz (THz) imaging systems; x-ray imaging systems; and optical waveguides and laser sensors
- Applications include surveillance; guidance systems; handheld and body-mounted imagers; anomaly detection; navigation and targeting; leak detection; environmental monitoring; and advanced driver-assistance systems (ADAS) and autonomous systems

NEXT GENERATION SENSOR SYSTEMS AND APPLICATIONS

- Ground-penetrating radar, cyber-sensing technologies, terahertz (THz) imaging, sensor fusion, compressive sensing, AI/ML, blockchain architectures, AR/VR, and spectroscopic inspection systems
- Applications include multi-domain operations, situational awareness, Chemical, Biological, Radiological, Nuclear, and Explosive (CBRNE), unexploded ordnance (UXO) and IED detection, autonomous systems, ocean monitoring, food safety, and phenotyping



Exhibition: See what's new in the photonics industry

Find the latest solutions powered by photonics that are driving today's technology markets. The technical exhibition for researchers, engineers, product developers, and purchasers who specialize in optics and photonics. Meet suppliers who provide everything from components to the most advanced sensor systems.

Today's advancements for tomorrow's applications

Stay ahead of the fast-changing technology curve with insight from leading researchers. Come hear recent technical advancements and collaborate with other experts working on materials, components, systems, and analytics for defense and commercial applications in sensing and imaging:

- LiDAR
- Radar
- Hyperspectral imaging
- IR sensors and systems
- Lasers and systems
- Imaging sensors
- Fiber optic sensors
- AI and machine learning
- Cybersecurity
- AR/VR
- Quantum Sensing and Computation

Explore the Call for Papers to see where your research fits

- Present to experts
- Publish your results internationally
- Gain exposure and visibility within the scientific community
- Connect with researchers from other disciplines
- See where your work fits into global optics and photonics research

Submit abstracts by 7 October 2020

www.spie.org/dcs21call