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and
OPTICAL SYSTEMS DESIGN

2021 CALL FOR PAPERS

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Conferences: 13–16 September 2021
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IFEMA
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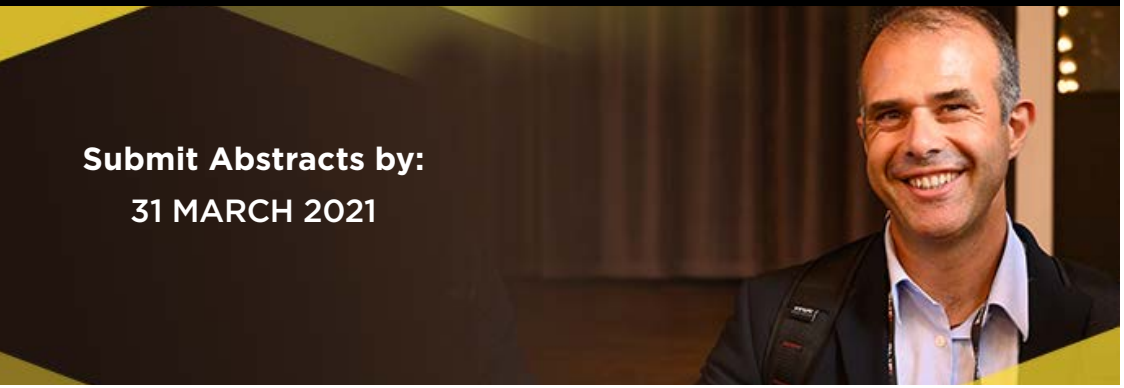

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Connect with Your Community

Participate in the international conference for engineers and scientists involved in surity and defence systems

Make plans to participate in the 2021 conference.

Each year scientific topics are presented in sensing, data and signal analysis, optronics, quantum science, and optical technologies .

The event provides a unique opportunity for scientists, engineers, programme managers and policy makers from around the world to learn about the trends, recent developments and achievements in the area of security and defence. Attendees exchange ideas, as well as present and discuss the most recent developments and applications.

A home for your research

As an author, don't hesitate to submit an abstract. Although much in the world remains uncertain, the one constant is that your work is important. SPIE continues our commitment to providing a forum for information sharing, collaboration, and advancing research that is vital to your community. Prepare your abstract and by doing so you will guarantee that your research is ready to be shared.

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Plan to Participate

The Organising Committee of the 18th SPIE Security+Defence invites you to participate in this exciting meeting: this event crosses the divide between fundamental optical science and the application of the underpinning technologies in advanced defence and security systems.

This symposium will be co-located with the 28th SPIE Remote Sensing symposium, which enhances opportunities to identify new partners for collaboration from related fields of activity. Take the opportunity to learn about the latest scientific results in both topics " Defence & Security" and "Remote sensing".

Although we missed hosting the in-person conference in Edinburgh due to the global COVID-19 health crisis, we were grateful for the enthusiastic participation of over 1,880 academics, researchers, engineers, and scientists who were able to connect online during the Digital Forum. Amazing research was shared, products were demonstrated, and networking discussions had - thanks to your continued commitment to advancing science.

This unique symposium will offer many opportunities to network with colleagues from a variety of disciplines in academia, industry, and government from all over the world, whilst still maintaining a distinctly European focus. SPIE Security + Defence will consider all aspects of this evolving field of optronics and photonics:

- Materials
- Optical devices
- Enabling technologies
- Advanced concepts
- Sensors (including their design, fabrication and exploitation)
- Micro- and Nanosystems in Security and Defence
- Bio-inspiration and bio-mimetics
- Signal processing and control
- Laser technologies and their application (including high-power devices and applications)
- Electro-optic systems and concepts
- Modelling and simulation
- Quantum information science and technology
- Emerging security and defence requirements
- Target and background signatures
- Human observer performance
- Autonomy in sensing
- Cyber defence
- Big Data in Security and Defence
- Artificial Intelligence and Machine Learning in Security and Defence

Other relevant topics are also welcome to ensure a vibrant meeting. Engineers and researchers from government, military, academia and the commercial sector will discuss current status and future directions of a wide range of R&D projects. Participation from academic institutes is especially encouraged; graduate and undergraduate student researchers are invited to submit their work and interact with international leaders. All papers presented at this event will appear in the SPIE Digital Library.

We look forward to seeing you at Security + Defence 2021 where opportunities abound for combining cutting-edge science and technology.

2021 SYMPOSIUM CHAIR

Karin Stein
Fraunhofer Institute of Optronics, System Technologies and Image Exploitation IOSB (Germany)

2021 SYMPOSIUM CO-CHAIR

Ric Schleijpen
TNO Defence, Security and Safety (Netherlands)

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Contents

Target and Background Signatures VII (SD101)

Conference Chairs: **Karin U. Stein,** Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany); **Ric Schleijpen,** TNO Defence, Security and Safety (Netherlands)

Programme Committee: **Joanne B. Culpepper,** Defence Science and Technology Group (Australia); **Willem H. Gunter,** Institute for Maritime Technology (South Africa); **Daniela H. Heinrich,** Norwegian Defence Research Establishment (Norway); **Stacy E. Howington,** U.S. Army Engineer Research and Development Ctr. (United States); **Katrin Idla,** Tallinn Univ. of Technology (Estonia); **Hans M. Kariis,** Swedish Defence Research Agency (Sweden); **Luc Labarre,** ONERA (France); **Alexander Schwarz,** Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany); **Peter Wellig,** Armasuisse (Switzerland)

This conference deals with algorithmic and experimental approaches for distinguishing the weak signals of targets from a cluttered background, form sensors covering the spectral region from the visible up to the thermal infrared. Making this distinction requires characterization of the target properties and characterization of the backgrounds. Knowledge of target and background signatures is essential for various applications such as systems engineering and evaluation (e.g. electro-optical sensors or for camouflage design), operational planning and development of ATR algorithms. The conference also covers methods for assessing the influence of signature reduction and signature management at different levels such as platform signature, tactical application and operational capabilities.

Contributions are invited on the following topics and those related to them:

- signature modeling and validation
- background properties
- aided and automatic target typing, classification, and discrimination
- low signal-to-clutter ratio processing
- tracking in complex backgrounds
- signature management and signature monitoring
- signature reduction methods and materials
- advances in algorithms for sensor signal and data processing
- simulation and performance evaluation
- sensor data fusion, multiple source integration
- adaptive processing methods
- artificial intelligence techniques for target – background discrimination
- processing multi-/hyperspectral data
- multisensor signature prediction model
- camouflage effectiveness
- human observer performance.
- application Big-data in target-background discrimination
- signature features in relation to sensor capabilities
- signature features in relation to sensor processing.

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Electro-optical and Infrared Systems: Technology and Applications XVIII (SD102)

Conference Chairs: **Duncan L. Hickman,** Tektonex Ltd. (United Kingdom); **Helge Bürsing,** Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany)

Programme Committee: **Piet Bijl,** TNO Defence, Security and Safety (Netherlands); **Rainer Breiter,** AIM INFRAROT-MODULE GmbH (Germany); **Judith Dijk,** TNO Defence, Security and Safety (Netherlands); **Bernd Eberle,** Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany); **Natan S. Kopeika,** Ben-Gurion Univ. of the Negev (Israel); **Robert A. Lamb,** SELEX ES (United Kingdom); **Daniel A. Lavigne,** Defence Research and Development Canada, Valcartier (Canada); **Gino Putrino,** The Univ. of Western Australia (Australia); **Stanley R. Rotman,** Ben-Gurion Univ. of the Negev (Israel); **Frank Rutz,** Fraunhofer-Institut für Angewandte Festkörperphysik IAF (Germany); **Philip J. Soan,** Defence Science and Technology Lab. (United Kingdom)

Developments in electro-optical (EO) and infrared (IR) systems are key to providing the enhanced capability needed by military forces to meet the current and emerging challenges created through an increasingly difficult and complex range of operational conditions. Such enhanced operational capability must often be delivered against commercial demands for lower costs and reduced timescales together with operational requirements for size weight, and power (SWaP) reductions. This conference will address current and emergent sensor technology and system developments which will deliver the required future capability of EO/IR systems. It will consider a wide-range of applications across the maritime, land, and air domains together with a diverse range of platforms such as dismounted soldier sensors, UAVs and drones, robotic platforms, and multi-sensor systems. The performance challenges faced by future military systems will continue to evolve and grow. To address these challenges, EO/IR system designers will need to draw upon the ongoing developments in underpinning technologies such as new materials, focal plane arrays, image processing, data fusion, and emergent sensor concepts such as spectral processing, computational imaging, and polarimetry. Modelling and simulation is increasingly becoming an enabler for maximizing performance and optimizing operational adaptability and its interaction with trials and validation is a subject of topical concern.

EO and IR systems are likely to benefit from recent advances in material research, for example new carbon-based materials (including graphene), nano-materials and metamaterials. These new materials promise new EO properties that could significantly change the way EO and IR systems are designed and built, e.g. new detector systems with enhanced properties or negative refractive index materials which could radically change the way optics are designed.

Computational Imaging, e.g. Pupil Plane Encoding, Coded Aperture Imaging, Compressive Imaging, etc, is another family of emerging technologies that will radically alter the way sensor systems are designed. These techniques combine optics and processing to provide a useable output from the sensor and can provide functionality not possible or practical with conventional system designs. Computational Imaging will require developments in specialist sub-components, non-standard optics design and algorithm development to reconstruct the image.

Quantum techniques are also being investigated to assess their potential for sensing systems. Quantum Imaging and Ghost Imaging are examples of quantum techniques being investigated by different teams. Any Quantum system will require specialist components e.g. sources, optics, detectors, electronics and processing as well as providing scope for unconventional system design. Processing of sensor information has become a vital component of EO/IR sensor systems for display-driven, semi-autonomous, and autonomous applications. The timely extraction and presentation of pertinent information in a usable format is the ultimate goal in most developments, although the design flexibility to support hardware upgrades and meet emergent operational needs must be considered. Dual and multi-sensor system designs provide additional information and offer increased performance under a wider variety of conditions. The combination of such sensor information to provide both increased performance and robustness continues to present many design challenges despite the ongoing research into data fusion technology.

Advanced technology by itself is not sufficient to give new and/or advanced capabilities. Systems have to be designed and developed in a way that will enable their reliable and cost-effective manufacture. This will involve adopting rigorous development and system engineering techniques. These are as crucial for the successful exploitation of sensor technology as the detector, optics and electronics. The performance and required characteristics of sensor systems are critically dependent on the platform and the application. Many sensor payloads are now being fitted to autonomous vehicles and drones which present new challenges in design and integration. Applications areas that are currently receiving interest include target detection and tracking, area monitoring, mine and IED detection, environmental monitoring, and border security. There is also growing interest in wearable imaging devices which have their own unique challenges at the sensor design level, the exploitation of the sensor data, and the interconnection of multiple sensors.

The innovation required to meet these future challenges will be drawn from a broad spectrum of organisations ranging from government laboratories, through international companies to SMEs and research centres. This conference will provide a technology and applications forum for EO/IR research and development teams, academia, and business and government stakeholders. Contributions from a diverse range of disciplines covering areas using as sensor components and supporting technology, EO/IR systems engineering, optical materials and design, sensor manufacture and test, materials science, image processing algorithms design and associated software methodologies, and modelling and simulation are also sought. Presentations are encouraged on dual-use applications, and for active and passive technologies systems covering the wavebands from UV to LWIR.

Papers are solicited in the following specific areas:

- advanced materials for EO/IR, e.g. metamaterials, nano-materials, carbon based materials and their application
- focal plane array detector technologies, covering wavebands UV to LWIR including multi-band FPAs
- detector packaging, temperature stabilization and integration technologies
- passive imaging: technology, modelling, system design and hardware
- active imaging: technology, modelling, system design and hardware
- novel sensor technologies and their applications
- integrated and miniaturized sensors – reduced SWaP+C for applications such as robotic and remote control vehicles and the dismounted soldier
- computational imaging: techniques, components, designs and algorithms
- optical domain processing methods
- broadband, multiband and hyperspectral sensors
- polarisation sensitive sensors
- imaging through the atmosphere
- signal and image processing
- autonomous processing including detection, tracking and classification
- data fusion technology including image fusion and sensor fusion concepts
- modelling and analysis of EO/IR systems and sub-systems
- test, verification, and validation techniques
- compressive sensing in imaging systems
- quantum sensing components and system designs: theory and implementation
- defence and security applications of EO and IR sensor technology
- sensor payloads for autonomous vehicles and drones
- design and applications of wearable sensor systems
- dual-use of military EO/IR sensor technology for environmental imaging and analysis (including ocean monitor)
- border and area security including air to ground detection and tracking for applications such as drug trafficking
- system integration design and development issues
- sensor demonstrators and prototypes
- sensor trials and performance evaluation
- system engineering approaches.

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Electro-Optical Remote Sensing XV (SD103)

Conference Chairs: **Gary W. Kamerman,** Argo AI, LLC (United States); **Ove Steinvall,** Swedish Defence Research Agency (Sweden)

Programme Committee: **Robert J. Grasso,** NASA Goddard Space Flight Ctr. (United States); **Laurent Hespel,** ONERA (France); **Martin Laurenzis,** Institut Franco-Allemand de Recherches de Saint-Louis (France); **Peter Lutzmann,** Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany); **Kenneth J. McEwan,** Defence Science and Technology Lab. (United Kingdom); **Vasyl Molebny,** National Taras Shevchenko Univ. of Kyiv (Ukraine); **Gunnar Rustad,** Norwegian Defence Research Establishment (Norway); **Monte D. Turner,** Air Force Research Lab. (United States)

Over the last half century, electro-optical remote sensing has developed into an essential military technology. The efficiency and efficacy of thermal imagers, light amplification sights, laser designators and rangefinders, and video trackers have been well established. New technologies now permit thermal imaging systems to operate in new spectral domains with improved efficiency. Passive RF devices can image through walls, and laser systems have moved past simple rangefinders to permit high-fidelity, three-dimensional imaging at extended ranges. Synthetic aperture optical radar has the potential to significantly extend the range of three-dimensional imaging. Laser Doppler vibrometry can now identify vehicles well beyond visual ranges. Passive hyperspectral imaging and remote laser spectroscopy can identify material types and even detect the presence of specific chemical species.

Meanwhile, fully automatic target detection, recognition, and identification have been highly desirable, but equally elusive objectives. The development of advanced and affordable signal and high-speed data processing, coupled with these new sensing technologies, now opens the opportunity for both automatic and autonomous target detection, recognition and identification. High-speed digital processing and advanced algorithms enable the fusion of the data from multiple sensors having different resolutions, perspectives and modes of operation at the pixel, feature or detection level to enhance the recognition and identification process.

These advances are coming available at a very opportune time. Low-intensity conflicts, unconventional warfare, urban combat, border security and the continued rise in terrorism has created a need for new and innovative application of these technologies in very unconventional ways. As a result, these technologies are finding their way into civil defense, law enforcement and counterterrorism efforts.

This conference will focus on new and improved methods, techniques, and applications of electro-optical remote sensing. Recent advances which make electro-optical remote sensing technically or economically viable for an even wider variety of applications will be emphasized. However, the development of technology cannot be effective without serious consideration of the applications of that technology. Papers on military, industrial, and commercial applications are solicited, including:

- robotics, 2D and 3D machine vision, autonomous land vehicle navigation and control, spacecraft docking system, collision avoidance for ground vehicles, aircraft and marine vessels
- remote detection and analysis of chemical explosives, mine-like objects, weapons of mass destruction, water and air pollution
- compact sensor systems suitable for unmanned air vehicles, umqanned ground vehicles and/or unmanned underwater vehicles
- automatic target detection, recognition and identification, signal and data processing, image segmentation, machine vision and information processing
- non-contact metrology, vibrometry, dynamics, and microdynamics measurement modeling, simulation and model validation
- surveillance sensors, short and long distance ranging systems, topographic mapping and bathymetry systems, remote sensing of vegetation, surveying and image building, emergency response (disaster management) as well as component technology and novel system architectures and applications
- surveillance sensors for detection, tracking and identification of small air vehicles (e.g., UAVs, ultralights and hang gliders)
- sensors for border security, perimeter control and intrusion detection
- security issues such as remote explosive detection, general dangerous materials, person recognition at distance, weapon detection, see-through media (vegetation, water, smoke and fire) etc.
- calibration standards, testing standards and quality assurance procedures.

The objective of this conference is to bring together engineers and scientists from academia, industry and government from around the world to exchange results and ideas for future advancement of electro-optical remote sensing.

Save the date

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Technologies for Optical Countermeasures XVIII (SD104)

Conference Chairs: **David H. Titterton,** UK Defence Academy (United Kingdom); **Robert J. Grasso,** NASA Goddard Space Flight Ctr. (United States); **Mark A. Richardson,** Cranfield Univ. (United Kingdom)

Programme Committee: **Frances Bodrucki,** The Univ. of North Carolina at Charlotte (United States); **Christopher D. Burgess,** Defence Science and Technology Lab. (United Kingdom); **Bernd Eberle,** Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung IOSB (Germany); **Marc Eichhorn,** Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (France); **M. J. Daniel Esser,** Heriot-Watt Univ. (United Kingdom); **Markus Henriksson,** FOI-Swedish Defence Research Agency (Sweden); **James P. Hitscherich,** U.S. Army Combat Capabilities Development Command (United States); **Itor James,** Defence Science and Technology Lab. (United Kingdom); **Arkadiy A. Lyakh,** Univ. of Central Florida (United States); **William Ted Masselink,** Humboldt-Univ. zu Berlin (Germany); **Richard Maulini,** Alpes Lasers SA (Switzerland); **Eric D. Park,** Q-Peak, Inc. (United States); **Jasbinder S. Sanghera,** U.S. Naval Research Lab. (United States); **Ric H. M. A. Schleijpen,** TNO Defence, Security and Safety (Netherlands); **Ove Steinvall,** Swedish Defence Research Agency (Sweden); **Alexander M. J. van Eijk,** TNO Defence, Security and Safety (Netherlands); **Dorota S. Temple,** RTI International (United States); **Hans-Dieter Tholl,** Diehl BGT Defence GmbH & Co. KG (Germany); **Laura R. Vanderhoef,** U.S. Army Research Lab. (United States); **Marijke Vandewal,** Royal Military Academy (Belgium)

Optical Countermeasures continue to evolve and expand as new threats emerge and new technologies evolve to detect and defeat this ever-present threat. Additionally, new countermeasure methods continue to evolve and improve with the development of enabling component technologies, advanced systems concepts, integration with new platforms, and innovative technology employment strategies. Combined with advances in threat detection, laser and source technology, advanced pointer/tracker architectures, signal processing, data fusion, and advanced techniques, the diversity and sophistication of these capabilities continue to grow in support of a wide range of defense application. This conference presents an opportunity for experts, and those who wish to stay current on the latest advances in enabling technology, to interact, collaborate, and foster innovation in the development of these advanced countermeasure systems.

Further, while enabling technology development is an important and exciting topic in itself, development of enabling technology can be more interesting and exciting when considered within the context of application of that technology to address a specific problem. Examining enabling and emerging technology as the device level, system level, problem level, and application level can help to define future application of this technology to both general and specific problem areas for difficult defense, security, and counter terrorism application. These new applications may create additional demands upon the supporting technologies, and, as a result, this conference will focus upon not only on enabling optical countermeasures, but also upon the practical applications of those discrete enabling technologies, and, in particular, new applications of optical countermeasure technology. Papers on military, commercial, laser/source, effects, and applications are solicited.

Papers are solicited in the following areas:

- quantum cascade lasers
- solid state and fibre lasers
- mid-IR lasers and sources
- nonlinear optics
- DIRCM systems
- countermeasures for UAV's, drones, and non-traditional platforms
- advances in lasers and nonlinear optics
- pyrotechnic, flares, and expendable countermeasures
- smokes and obscurants
- beam steering, guiding, and control
- laser beam pointing
- threat detection, warning, and discrimination
- hostile fire detection, indication, and suppression
- threats and threat properties
- modelling and simulation
- aberration issues and compensation methods
- laser dazzling and effects
- mid-IR transmission fibres
- platform protection
- external/platform effects
- threat properties and characteristics
- multi-mode/multi-function operation
- closed-loop countermeasures
- non-traditional countermeasures
- laser propagation and effects
- atmospheric and background effects
- military/commercial application of technology
- enabling component/system technology
- alternative countermeasures
- counter-swarms
- novel optical devices and technology
- "homeland defence" and border protection
- other civil and military applications.

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High Power Lasers: Technology and Systems, Platforms, Effects V (SD105)

Conference Chairs: **Harro Ackermann,** Joint Directed Energy Transition Office (United States); **Willy L. Bohn,** BohnLaser Consult (Germany); **David H. Titterton,** UK Defence Academy (United Kingdom)

Programme Committee: **Pierre Bourdon,** ONERA (France); **Martin C. Richardson,** CREOL, The College of Optics and Photonics, Univ. of Central Florida (United States); **Jasbinder S. Sanghera,** U.S. Naval Research Lab. (United States)

The purpose of this conference is to provide a technical forum for the exchange of information related to aspects of high power laser research and development, and for the discussion of latest demonstrations of laser systems in defense and security relevant scenarios, in particular advanced military applications. Numerous demonstrations have shown the capability of laser weapon systems in negating targets of military interest with the standard attributes of lasers preserved, such as precision, timelines, and minimal collateral damage. Many challenges remain and are being addressed to bring laser weapon systems to the maturity required for military field applications. Among these are power scaling, energy conversion efficiency, wavelength control, beam quality, thermal and power management, a variety of optical issues, as well as packaging and ruggedization. In addition platform considerations and special laser effects will be considered.

A viable laser weapon will provide the battlefield commander with new engagement options and capabilities in defensive or offensive scenarios, and in a variety of environments. It can potentially provide improved stand-off range, cause covert effects, handle extremely short time-line engagements, and enable precise control of damage in the target area. The requirement exists to develop efficient, effective laser weapon systems capable of depositing required amounts of energy on selected stationary or mobile targets to affect their negation.

Papers are solicited in the following broad areas of laser technology and laser development:

LASERS AND LASER ARCHITECTURES SUITABLE FOR POWER SCALING
- advanced gas lasers (including DPAL, rare gas)
- solid state lasers, slabs, disks, fibers and diode arrays
- efficiencies and thermal control
- beam combination: coherent, spectral, other
- packaging: size, weight, ruggedness.

LASER DEMONSTRATORS
- ground based and at-Sea Tests
- airborne applications
- lasers on UAVs

COMPONENTS
- diode pumps -efficiency, wavelength, linewidth, stability, cost
- optics, coatings
- couplers, combiners, isolators
- beam directors & adaptive optics.

NOVEL DESIGN IN FIBER AND SLAB LASERS
- photonic crystal fibers, other
- eye-safe fibers, Er ,other
- single, multimode, gain, transport
- thermal management.

LASER MATERIALS
- optical/mechanical/thermal
- ceramics
- manufacturing.

PLATFORMS
- mobile
- ground based
- airborne
- UAVs.

EFFECTS
- laser filamentation
- interaction with advanced materials
- long-range propagation of high-power lasers, including vortex beams.

Millimetre Wave and Terahertz Sensors and Technology XIV (SD106)

Conference Chairs: **Neil A. Salmon,** MMW Sensors Ltd. (United Kingdom); **Frank Gumbmann,** Rohde & Schwarz GmbH & Co. KG (Germany)

Programme Committee: **Amir Abramovich,** Ariel Univ. (Israel); **Sherif Sayed Ahmed,** Rohde & Schwarz GmbH & Co. KG (Germany); **Hakan Altan,** Middle East Technical Univ. (Turkey); **Nicholas J. Bowring,** Univ. of Huddersfield (United Kingdom); **Stephan Dill,** Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); **Charmaine Cisneros Franck,** NASA Langley Research Ctr. (United States); **Marcin Kowalski,** Military Univ. of Technology (Poland); **Wojciech Knap,** Univ. Montpellier 2 (France); **Steven R. Murrill,** U.S. Army Research Lab. (United States); **Markus Peichl,** Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); **Douglas T. Petkie,** Wright State Univ. (United States); **Christopher A. Schuetz,** Phase Sensitive Innovations, Inc. (United States); **Vyacheslav A. Trofimov,** Lomonosov Moscow State Univ. (Russian Federation); **Vincent P. Wallace,** The Univ. of Western Australia (Australia)

OBJECTIVES

The conference provides a technical forum for a raised awareness of novel sensor architectures, enabling component technologies, signal and image processing, phenomenology and applications over the band from 10 GHz to 10 THz. Market awareness and user requirements are understood in the forum, these following the changing drivers from the world of security and defence to offer the unique selling propositions of sensors in this spectral band for the benefit of society.

Powerful drivers in this band are the need for sensors that penetrate materials and media that are opaque in other spectral regions. This enables a diversity of imaging and non-imaging sensors for the security screening of packages, people and their bags, and provides penetrative imagery through atmospheric obscurants such as fog, cloud, rain and smoke.

Specific applications and techniques for this spectral band are:
- airport security screening: walk-through 'all-seeing' portals and stand-off screening
- application of Deep Learning and Machine Learning to millimetre wave and terahertz sensors
- explosives & contraband detection
- people screening at entrances to shopping centres, arenas, transport networks, public/private buildings, schools
- non-metallic & metallic knife/gun detection
- quantum sensing capabilities, technologies and sensor architectures.

THE MILLIMETRE WAVE BAND (10 GHZ - 300 GHZ)

Recent growth in the availability of low-cost radars operating at 24 GHz, 60 GHz, 77 GHz and 120 GHz is enabling the emergence of novel systems. Most of these radars have gigahertz of radiation bandwidth and megahertz of signal bandwidth and are integrated into a development module with driver software and USB connectivity. These systems can be used independently or to augment radiometric (ie passive) systems.

Radiometers and radars in this band can be used for the applications of:
- all-weather (rain, fog, cloud) imagers for helicopters, (autonomous) aircraft landing/runway taxiing
- maritime surveillance for the detection of small boats close to the shore in rain or coastal fog
- screening for people trafficking in canvas and fibre-glass sided (refrigerated) vehicle compartments
- shoe scanning for airport security
- drone detection.

Techniques often employed in this band (but not exclusively) are:
- late time response and ultra-wide band (UWB) radar
- full polarimetric radar with decomposition for target identification
- synthetic aperture radar (SAR) for high quality imagery
- aperture synthesis exploiting high-speed digital cross-correlators.

CONTINUED NEXT PAGE➡

Millimetre Wave and Terahertz Sensors and Technology XIV continued (SD106)

THE TERAHERTZ BAND (300 GHZ TO 10 THZ)

The terahertz band is attracting increased interest from the military and security sectors as more information is available here from spectral signatures, with innovation emerging in spectrometer design and radar systems. Furthermore, the longer-range capability of this band is enabling stand-off security screening, exploiting the latest closed cycle coolers for compactness and practicability for low noise receivers. The transparency of paper and packaging materials is enabling quality imagery of mail packages, exploiting technologies associated with glow discharges and gold nanobars. In summary highlights in this band are:

- novel THz spectrometers
- glow discharges and gold nanobars as sources, mixers and detector arrays
- screening of mail packages and hand baggage for metal and non-metallic threats
- stand-off security screening of personnel using the latest close cycle cryogenic coolers
- THz radar systems.

BIOLOGICAL AND MEDICAL APPLICATIONS

Research into biological and medical applications is gradually revealing how the 10 GHz to 10 THz band may be exploited. Since radiation in this band only propagates a short distance into the skin, it is particularly suited to diagnosing conditions in the skin and the underlying areas where there is circulation. Areas of current activity and potential applications:

- screening passengers for infection by measuring raised whole body levels of temperature and perspiration
- diagnosis of malignancy or diabetic ulcers below the skin surface (not apparent in the visible band)
- non-contact under-bandage (burn) wound inspection
- near-field scanning microscopes and imagers
- diagnosing local circulatory disorders (vascularisation or cessation of circulation).

BROAD APPLICATION AREAS

Papers are also solicited in the following broad areas of sensors, component technologies and applications:

- handheld screening systems
- sensors using drones
- biomedical imaging (micro-Doppler & spectral breath analysis)
- novel materials (stealth, chiral, left-handed)
- resolution enhancement/super-resolution
- contraband detection
- modelling, simulation and phenomenology
- nondestructive testing for industry
- adverse weather intelligence, surveillance and reconnaissance imaging
- THz tomography
- THz secure communications.

Save the date

NEW EXTENDED DATE
ABSTRACTS DUE: 28 APRIL 2021

AUTHOR NOTIFICATION:
18 JUNE 2021

The contact author will be notified of acceptance by email.

MANUSCRIPTS DUE: 16 AUGUST 2021

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Emerging Imaging and Sensing Technologies for Security and Defence VI (SD107)

Conference Chairs: **Gerald S. Buller,** Heriot-Watt Univ. (United Kingdom); **Richard C. Hollins,** Defence Science and Technology Lab. (United Kingdom); **Robert A. Lamb,** Leonardo MW Ltd. (United Kingdom); **Martin Laurenzis,** Institut Franco-Allemand de Recherches de Saint-Louis (France)

Programme Committee: **Giulia Acconcia,** Politecnico di Milano (Italy); **Gareth Brown,** Defence Science and Technology Lab. (United Kingdom); **Markus Henriksson,** FOI-Swedish Defence Research Agency (Sweden); **Keith L. Lewis,** Sciovis Ltd. (United Kingdom); **Heli Lukner,** Univ. of Tartu (Estonia); **Jonathan C. Matthews,** Univ. of Bristol (United Kingdom); **Robert P. J. Nieuwenhuizen,** TNO (Netherlands)

Challenges posed when sensing under the difficult conditions encountered in military environments lie at the heart of many applications of photonics. This conference brings together emerging activities in sensor and optical technologies within the context of their associated defence and potential civilian application. As interests shift towards the exploitation of autonomous platforms, unmanned systems and small satellites, there are requirements to address size, weight, power and manufacturing cost issues for those components and devices.

Emerging microscale and nanoscale device concepts can support the realization of low-cost, power-efficient solutions, especially those required for use in hand-held systems. For example, the understanding of plasmonics and sub-wavelength scale metallo-dielectric structures is advancing, as is the realization of metamaterials at optical wavelengths. New approaches exploiting micro and nano-technologies can also provide for unprecedented advance in the ability to control the propagation of light, providing the basis for devices capable of being exploited in adaptive optical systems. In addition, techniques to understand and improve target discrimination, to enable more accurate target tracking and provide vision through turbulent atmospheres, can benefit from the application of both pre-detector and post-detector processing techniques. The relevance of embedded software is becoming increasingly important, driving the search for improved algorithms to support the management of large streaming datasets to avoid adverse impact on communication channels in networked environments.

Improved active and passive components are required, including laser sources, modulators and photo-detectors, which in some cases can be brought together in photonic integrated circuits. New materials eg graphene are emerging, as well as those exploiting quantum-scale effects (eg quantum dots) that offer the potential for disruptive advance in many areas of photonics. Spectral filters are used widely in optics for security and defence, and technologies that offer a better trade-off between bandwidth and field of view are being sought for many applications. New optical techniques and devices can enable the processing of RF signals as well as the evolution of new techniques for the extraction of patterns in data streams as would be relevant to challenges in cyber security.

In the area of chemical and biological sensing, some existing capabilities already exploit photonic devices such as quantum cascade lasers, but these can also support the detection of concealed energetic materials and the remote sensing of precursor materials.

New modalities in quantum technology are welcome, especially with consideration for improvements in size, weight and power requirements in quantum-based measurement. Advanced quantum detection technologies provide the basis for wide area terrain mapping as well as quantum communications, navigation, quantum sensing, quantum-enhanced imaging and other applications, especially when there are requirements for operating in covert environments. New approaches in the area of single-photon avalanche diode (SPAD) detector array technologies are relevant here to allow operation across wide spectral ranges, especially in the SWIR band. New approaches to the processing of images in the sparse photon regime are also highly relevant.

This conference seeks papers ranging from the underlying physics associated with photonic device technologies through to the exploitation of those devices in defence systems, including the following areas of activity:

CONTINUED NEXT PAGE➡

Emerging Imaging and Sensing Technologies for Security and Defence VI continued (SD107)

- novel lasers, modulators, switches, filters and detectors
- materials, especially emerging 2D materials and those exploiting quantum-scale effects
- additive manufacturing techniques
- low-cost sensors for unmanned systems and small satellites
- microwave photonic devices including integration and interconnect techniques
- metamaterials and plasmonics, both for the microwave and optical regimes
- nanophotonics including plasmonic filters, optical antennae, moth eye coatings and ultrathin lenses
- advanced focal plane detector concepts, including on-chip optics and processing
- techniques for exploiting heterogeneous integration eg III-Vs on silicon
- architectures and techniques for discriminative imaging, including active imaging and imaging through turbulence
- new techniques for imaging through turbid media
- computational imaging techniques and compressive sensing, including image reconstruction from under-sampled data sets (sparse imaging), computational multispectral imaging using mosaic filters and SAR techniques
- devices and architectures to support the evolution of quantum sensing, quantum imaging, quantum communications and navigation
- enhancement of measurement using quantum metrology techniques
- exploitation of low-cost imaging techniques into civilian applications such as those relevant to healthcare
- micro-optical-electro-mechanical systems
- algorithms and software for improving sensor exploitation
- novel approaches to micro- and nanophotonics
- devices for chemical and biological sensing exploiting photonic techniques
- optical components including coatings, films, and devices for control of spectral and polarimetric characteristics
- bio-optics, bioinspiration and biometric techniques.

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Advanced Manufacturing Technologies for Micro- and Nanosystems in Security and Defence IV (SD108)

Conference Chairs: **Andrea Camposeo,** Istituto Nanoscienze, CNR (Italy); **Yuris Dzenis,** Univ. of Nebraska-Lincoln (United States); **Maria Farsari,** Foundation for Research and Technology-Hellas (Greece); **Luana Persano,** Istituto Nanoscienze-CNR (Italy)

Programme Committee: **Tommaso Baldacchini,** Newport Corp. (United States); **Lynda E. Busse,** U.S. Naval Research Lab. (United States); **John T. Fourkas,** Univ. of Maryland, College Park (United States); **Jesper Glückstad,** Technical Univ. of Denmark (Denmark); **Andreas Heinrich,** Hochschule Aalen - Technik und Wirtschaft (Germany); **Natalia Vladimirovna Kamanina,** S.I. Vavilov State Optical Institute (Russian Federation); **Eunkyoung Kim,** Yonsei Univ. (Korea, Republic of); **Norihisa Kobayashi,** Chiba Univ. (Japan); **Beata Luszczynska,** Lodz Univ. of Technology (Poland); **Andreas Ostendorf,** Ruhr-Univ. Bochum (Germany); **Alberto Piqué,** U.S. Naval Research Lab. (United States); **Dario Pisignano,** Univ. of Pisa (Italy); **Bastian E. Rapp,** Karlsruher Institut für Technologie (Germany); **Haizheng Zhong,** Beijing Institute of Technology (China)

Advanced systems based on micro- and nanostructures are essential to the development of next generation imaging, sensing, light amplification and energy harvesting devices for security and defence applications. These systems are expected to be portable, wearable, self-powering and self-healing, while featuring high sensitivity and selectivity, intrinsic signal amplification and fast response times. Current micro- and nanotechnologies have enabled a novel range of structured and architected materials, which possess enhanced properties compared to their bulk equivalent. Such structures can be realized by optical and electron beam lithographies, advanced chemical synthesis and deposition processes, soft lithographies, electrospinning, biomimetic fabrication approaches, among the others. In addition, the availability of technologies allowing for precise manipulation and assembly of micro- and nanostructures, combined with the emerging additive manufacturing technologies, will enable the fabrication of high-performance functional integrated systems, which can be produced by remotely-controlled and autonomous equipment even in harsh and dangerous environments.

This conference aims at establishing an interdisciplinary platform for researchers and engineers both from academy and industry to exchange knowledge in new and cutting-edge manufacturing technologies for micro- and nanostructured devices, with potential application in security and defence. The conference will emphasize those approaches allowing multi-material processing, the realization of multifunctional components and fully functional 3-dimensional (3D) systems.

Original technical and scientific papers are solicited on, but are not limited to, the following topics:

- laser micro- and nanomachining for security and defence
- additive manufacturing of metals, alloys and multi-materials
- bio-inspired fabrication technologies
- 3D printing of functional devices for security and defence
- technologies for the modification of the properties of surfaces and interfaces
- synthesis of nanostructured and 2D materials
- production of polymer and hybrid nanofibers for sensing and energy harvesting systems
- soft and nanoimprint lithographies pushed to sub-micron scale, or applied to unconventional materials
- technologies for assembly and manipulation of nanostructured components
- microscale devices for manipulation and analysis of fluids
- advanced fabrication approaches for wearable sensors and electronics
- methods for gas and energy storage
- autonomous micro- and nanofabrication systems
- real-time monitoring and quality control of advanced fabrication systems
- technologies for miniaturized imaging devices for security applications
- systems for amplification of low-intensity optical signals.

Optical Materials and Biomaterials in Security and Defence Systems Technology XVII (SD109)

Conference Chairs: **Roberto Zamboni,** Istituto per la Sintesi Organica e la Fotoreattività (Italy); **François Kajzar,** Univ. Politehnica of Bucharest (Romania); **Attila A. Szep,** Air Force Research Lab. (United States)

Programme Committee: **Chantal Andraud,** Ecole Normale Supérieure de Lyon (France); **André-Jean Attias,** Univ. Pierre et Marie Curie (France); **Carrie M. Bartsch,** Air Force Research Lab. (United States); **Werner J. Blau,** Trinity College Dublin (Ireland); **Fabrice Charra,** Commissariat à l'Énergie Atomique (France); **Beata J. Derkowska,** Torun Univ. (Poland); **James G. Grote,** Air Force Research Lab. (United States); **Emily M. Heckman,** Air Force Research Lab. (United States); **Loïc Mager,** Institut de physique et chimie des matériaux de Strasbourg (France); **Ana-Maria Manea-Saghin,** Univ. Politehnica of Bucharest (Romania); **Antoni C. Mitus,** Wroclaw Univ. of Technology (Poland); **Jaroslaw Mysliwiec,** Wroclaw Univ. of Technology (Poland); **Jacek Niziol,** AGH Univ. of Science and Technology (Poland); **Yoshiko Okada-Shudo,** The Univ. of Electro-Communications (Japan); **Fahima Ouchen,** Air Force Research Lab. (United States); **Agnieszka Pawlicka,** Instituto de Química de São Carlos (Brazil); **Luana Persano,** Istituto Nanoscienze (Italy); **Ullrich Pietsch,** Univ. Siegen (Germany); **Ileana Rau,** Univ. Politehnica of Bucharest (Romania); **Ifor D. W. Samuel,** Univ. of St. Andrews (United Kingdom); **Niyazi Serdar Sariciftci,** Johannes Kepler Univ. Linz (Austria); **Kenneth D. Singer,** Case Western Reserve Univ. (United States)

This conference will highlight state of the art and emerging nano-bio materials and devices and their role in the development of new security and defence systems. The aim is to review materials and device R&D, in progress, in both Europe and the USA, based on nano-bio materials technologies for photonic, electronic and optoelectronic applications and to promote closer collaboration and awareness of common objectives and potential advances. It will also seek to bring together researchers from different materials science, physics, chemistry, biology and engineering areas. The conference should be of interest to research scientists and engineers, project managers, senior scientific staff, materials producers and device manufacturers in Europe and the USA.

Papers should focus on short technology reviews or recent results of new materials processes and devices, with particular application to security and defence technologies. The materials and devices may be based on nano-, bio- and metamaterials-based technologies including inorganics, organics, biopolymers, and hybrids as well as devices that take advantage of these materials technologies. Papers may address practical, theoretical and modeling aspects of the subject. Fields of study will include:

- organic, inorganic and hybrid-based photonics and optoelectronics
- organic inorganic and hybrid-based laser and amplifier materials
- smart materials, systems and devices for sensing and diagnostic
- organic and inorganic-based photodetectors
- organic and inorganic-based displays
- nanophotonic and nano-optoelectronics structures
- photonic bandgap materials
- biomolecular recognition materials
- biopolymer-based photonics
- biotronics
- biomaterials
- plasmonic structures and applications
- metamaterials and metamaterials-based devices
- nonlinear optical materials and devices
- predictive modeling of materials parameters for specific applications
- electroluminescent materials and devices
- photorefractive and photochromic materials and processes
- polymer optical waveguides and fibres
- multiphoton processes
- charge transport in organic materials
- simulation of physical processes in molecular media
- organic materials for night vision and border control
- biopolymers for display and camouflage
- biolasers
- electrospinning
- organic field effect transistors.

Quantum Technologies and Quantum Information Science VI (SD110)

Conference Chairs: **Mark T. Gruneisen,** Air Force Research Lab. (United States); **Miloslav Dusek,** Palacký Univ. Olomouc (Czech Republic); **Paul M. Alsing,** Air Force Research Lab. (United States); **John G. Rarity,** Univ. of Bristol (United Kingdom)

Program Committee: **Konrad Banaszek,** Univ. of Warsaw (Poland); **Jan Bouda,** Masaryk Univ. (Czech Republic); **Robert W. Boyd,** Univ. of Ottawa (Canada); **Michael Brodsky,** U.S. Army Research Lab. (United States); **Gerald S. Buller,** Heriot-Watt Univ. (United Kingdom); **Ryan M. Camacho,** Brigham Young Univ. (United States); **Marcos Curty,** Univ. de Vigo (Spain); **Michael L. Fanto,** Air Force Research Lab. (United States); **John D. Gonglewski,** Air Force Research Lab. (United States); **Gregory S. Kanter,** NuCrypt LLC (United States); **Prem Kumar,** Northwestern Univ. (United States); **Norbert Lütkenhaus,** Univ. of Waterloo (Canada); **Vadim V. Makarov,** Univ. of Waterloo (Canada); **Ronald E. Meyers,** U.S. Army Research Lab. (United States); **Momtchil Peev,** Huawei Technologies Co., Ltd. (Germany); **Renato Renner,** ETH Zürich (Switzerland); **Andrew J. Shields,** Toshiba Research Europe Ltd. (United Kingdom); **Kathy-Anne Soderberg,** Air Force Research Lab. (United States); **Rupert Ursin,** Austrian Academy of Sciences (Austria)

The purpose of this conference is to provide a technical forum for discussions on the latest developments in quantum technologies and quantum information science. Quantum information is a broad area of study regarding the information processing tasks that can be accomplished using quantum mechanical systems. Its applications include quantum computation, quantum communication, and quantum cryptography. Quantum technology refers more broadly to techniques and applications that are based on principles of quantum mechanics where commercial development is now realizable through recent advancements in the fields of cold atoms, matter-wave quantum interferometers, quantum entanglement, squeezed states of light, and single-photon sources and detectors. These advancements open new perspectives in the simulation of complex physical systems, precise sensing, and imaging. Applications include quantum accelerometers, gravimeters, magnetometers, and precise clocks.

Quantum technologies have important implications for security and defence. Progress in quantum computing threatens classical techniques for encryption whose security relies on computational complexity. Quantum-physics-based approaches to key sharing however are theoretically unbreakable. Quantum cryptographic systems are already commercially available. There are, however, many challenges to developing quantum technologies to a position where they can provide robust capabilities in defence applications. These include the development of quantum networks, fiber and free-space quantum channels, photon sources and detectors, integrated photonics for quantum circuits, chip-scale atomic clocks, quantum memories, quantum gates, quantum relays, quantum repeaters, quantum inertial navigation systems, etc.

Original papers are sought on, but not restricted to the following categories and topics.

CYBERSECURITY IN POST-QUANTUM WORLD

- quantum key distribution and quantum data encryption
- quantum digital signatures and authentication
- finite-key security analysis for general attacks
- device-independent security proofs
- security proofs for DV and CV QKD systems
- analysis of side-channel attacks and other loopholes
- certification of QKD devices
- quantum-cryptography primitives and protocols.

QUANTUM HACKING

- implementation loopholes
- quantum computing threats to cryptography.

QUANTUM CHANNELS AND QUANTUM NETWORKS

- quantum hubs and quantum communication networks
- earth-satellite and satellite-satellite links
- multi-channel and multi-level encoding techniques
- photon orbital angular momentum
- spatial, temporal, and frequency encoding and multiplexing techniques.

CONTINUED NEXT PAGE➡

Quantum Technologies and Quantum Information Science VI continued (SD110)

QUANTUM SENSORS AND CLOCKS: OVERCOMING CLASSICAL LIMITS
- quantum accelerometers, gravimeters, and gyroscopes
- quantum magnetometers
- advanced interferometric sensors using squeezed light
- quantum technologies for precise timing and time synchronization
- quantum imaging.

QUANTUM SIMULATORS
- quantum simulators of complex systems
- applications in solid state physics and chemistry
- technologies for quantum simulators.

ALGORITHMS AND QUANTUM COMPUTATION
- quantum computation theory and implementations
- topological quantum computation
- fault-tolerant quantum computation
- quantum algorithms
- quantum software and quantum programming languages
- quantum randomness extractors
- quantum error correction
- quantum means for distributed computations.

CONTRIBUTING TECHNOLOGIES
- cold atom technologies
- superconducting qubits
- single-photon sources, detectors, and filters
- entanglement sources and detection
- space-qualified quantum sources and detectors
- random number generation
- probabilistic qubit amplifiers and their use in QKD
- quantum memories, gates, relays, and repeaters
- signals processing and computer architectures for quantum cryptographic systems
- integrated photonics for quantum circuits.

RELATED FUNDAMENTAL PHYSICS
- tests of quantum theory
- quantum causal structures.

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Counterterrorism, Crime Fighting, Forensics, and Surveillance Technologies V (SD111)

Conference Chairs: **Henri Bouma,** TNO (Netherlands); **Radhakrishna Prabhu,** The Robert Gordon Univ. (United Kingdom); **Robert James Stokes,** Agilent Technologies (United Kingdom); **Yitzhak Yitzhaky,** Ben-Gurion Univ. of the Negev (Israel)

Programme Committee: **Maria Andersson,** FOI-Swedish Defence Research Agency (Sweden); **Stefan Becker,** Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany); **Felicity Carlysle-Davies,** Univ. of Strathclyde (United Kingdom); **Brian E. Foulger,** Ministry of Defence (United Kingdom); **Gennadii E. Kotkovskii,** National Research Nuclear Univ. MEPhI (Russian Federation); **Gillian F. Marshall,** QinetiQ Ltd. (United Kingdom); **David Muench,** Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany); **Niamh Nic Daeid,** Univ. of Dundee (United Kingdom); **Salman Rosenwaks,** Ben-Gurion Univ. of the Negev (Israel); **Andre Samberg,** Estonian Academy of Security Sciences (Estonia); **Neil C. Shand,** Defence Science and Technology Lab. (United Kingdom); **Berkan Solmaz,** ASELSAN A.S. (Turkey); **Piotr Szynkarczyk,** Industrial Research Institute for Automation and Measurements (Poland); **Paul A. Thomas,** Defence Science and Technology Lab. (United Kingdom)

This conference brings together emerging technologies for countering terrorism and crime and providing support to forensics, surveillance, security and defence forces. It addresses the big issue of maintaining security and safety by detecting and identifying dangerous, hidden and camouflaged materials and recognizing suspicious behavior from video imagery, all the while working within a legal and moral framework that respects individuals' rights.

PART 1: DETECTION AND IDENTIFICATION OF MATERIALS

Sensors for explosives, narcotics, and chemical and biological warfare agents must provide a prompt alert with fast, wide area coverage and must cope with unexpected hiding places. If they are to be routinely deployed, such sensors must offer accurate detection and low false alarm rates, use few consumables and need little operator involvement. Optical sensing now extends from UV, through visible and infrared, into terahertz and RF wavelengths, offering novel imaging systems with increased penetration through barriers, and spectroscopic techniques that can help characterize suspicious materials.

PART 2: COMPUTER VISION AND VIDEO CONTENT ANALYSIS

The threat from people's activities can be reduced by identifying suspicious behaviour and by tracking individuals across multiple TV cameras. Increased computing power and advanced algorithms are expected to help in difficult scenarios such as crowded environments (face and iris recognition or other biometrics), and longer range imagery through turbulent atmospheres. Improved handover techniques from TV imaging will reduce the burden placed on local sensors.

This conference provides a forum for researchers, product and system engineers and military and government officials to present and discuss the latest developments in optically-based sensor and diagnostic technologies and their applications. Original papers are sought on, but not restricted to, the following topics:
- detection and identification of CBRNE materials
- spectroscopy, Raman/LIBS and multi-spectral imaging
- sensor modelling, algorithms for sensor signal and data processing
- computer vision and image/video content analysis
- person and object detection and tracking
- big data analysis and deep learning
- Internet of Things (IoT), wearable, micro-/nanosensors
- autonomous sensors and mobile robots
- action recognition and behavior analysis in video imagery
- forensic and surveillance sensors and systems
- biometrics, security screening and systems for border security
- document security, document verification, watermarking, fingerprinting, RFID tags
- techniques for long-range and wide-area sensing and surveillance.

Artificial Intelligence and Machine Learning in Defense Applications III (SD112)

Conference Chair: **Judith Dijk,** TNO Defence, Security and Safety (Netherlands)

Programme Committee: **Christopher R. Bell,** Defence Science and Technology Lab. (United Kingdom); **Fabrizio Berizzi,** European Defence Agency (Belgium); **David K.J. Gustafsson,** FOI-Swedish Defence Research Agency (Sweden); **Michel Honlet,** HENSOLDT Sensors GmbH (Germany); **Sidonie Lefebvre,** ONERA (France); **Andre Samberg,** Estonian Academy of Security Sciences (Estonia); **Christopher J. Willis,** BAE Systems (United Kingdom)

The main application of military imaging systems is situational awareness: knowing who and what is in the vicinity and gaining an understanding of their behavior. Image analysis techniques support the key tasks that enable situational awareness: detection, tracking, classification, identification and behavior recognition of targets or objects, while avoiding too many false alarms or missed detections. Artificial Intelligence and Machine Learning are increasingly used to assist in these tasks, as the amount of sensor data increases while there are fewer analysts and camera operators available.

This conference will focus on technology development in artificial intelligence and machine learning techniques for automatic and machine assisted image and video analysis for defense applications, including enhancement, target detection, classification/recognition, identification, tracking and threat assessment. Both model-based approaches and data-driven methods such as neural nets are considered. Sensors considered will include EO/IR, SAR, multi- and hyper-spectral imagers.

As in civil applications algorithms must be able to deal with noisy data and varying conditions.

One of the additional challenges encountered, compared to civilian/commercial applications, relates to the fact that for defense applications only limited operational data is available for training, testing and evaluation. This is especially the case for event detection, where interesting events rarely occur. For defense applications, the technology will ideally be robust to inputs that are adversarial examples, i.e., inputs that are intentionally designed to cause the model to make a mistake. The processing should also be able to detect, classify and identify camouflaged objects. Evaluation and performance prediction of these algorithms for varying circumstances is also part of this conference.

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

IMAGE ANALYSIS TECHNIQUES

- automatic target detection, classification, recognition and identification
- automatic tracking
- computational imaging
- image enhancement (denoising, super-resolution , filtering etc)
- inverse problems
- sensor fusion
- colorization.

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

- machine learning and deep learning for image and video processing systems
- transfer learning
- alternate learning strategies such as semi-supervised learning and generative adversarial learning
- hyper-parameter selection
- the use of synthetic data for training
- edge processing: low power (wattage) processing.

ROBUSTNESS, EVALUATION AND PERFORMANCE PREDICTION

- robustness of algorithms to extended operating conditions
- robustness of algorithms against adversarial examples
- transparency and explainability of algorithms.

DEFENCE APPLICATIONS FOR THESE TYPES OF TECHNIQUES

- maritime situational awareness
- unmanned sensor systems: UAVs, UGVs, UUVs
- unattended sensors and systems
- compound security and force protection
- border protection
- route clearance
- reconnaissance and surveillance
- vehicle situation awareness
- route planning
- improved visualization.

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Important dates

Abstracts Submission Deadline	28 April 2021
Acceptance Notification Sent to Contact Author	18 June 2021
Manuscripts Due	16 August 2021

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