2022 CALL FOR PAPERS

SPIE. SENSORS+ IMAGING

REMOTE SENSING | SECURITY + DEFENCE

5–8 September 2022
ESTREL Convention Centre
Berlin, Germany

Abstract submission deadline has been extended
SUBMIT ABSTRACTS BY
6 APRIL 2022

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#SPIESensors
Remote Sensing and Security + Defence—two symposia joining together under one event name for 2022 and beyond

Plan to participate in the premier yearly European event that showcases the latest sensor and photonic technologies for imaging and monitoring the earth’s atmosphere and environment, as well as sensor technologies that address homeland security, defence, and counterterrorism.

Review the topic areas and see where your research fits best—submit an abstract and plan to join your colleagues in Berlin in September 2022.

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ABSTRACT SUBMISSIONS ARE DUE 6 APRIL

Join colleagues to learn and discuss the latest research

As we work to build yet another outstanding programme, we look forward to again gathering in person! We appreciate the continued support of our volunteers and our event leadership. This year marks a new chapter in the evolution of these two long standing events: Remote Sensing and Security + Defence. Each meeting continues to be held as an individual symposium with their unique individual contributions, but from now on will be announced under the single event name of Sensors + Imaging. The Organising Committees invite you to participate in this exciting meeting and to take the opportunity to learn about the latest scientific results within both symposia.

We remain grateful for the enthusiastic participation of academics, researchers, engineers, and scientists who were able to connect online during the Digital Forum in both 2020 and again in 2021. Amazing research was shared, products were demonstrated, and networking discussions had—all thanks to your continued commitment to advancing science. We now ask you to again share your work as we look forward to gathering at the ESTREL Convention Centre in Berlin.

These two unique symposiums will offer 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, both within the conference experience as well at the exhibition. SPIE Remote Sensing and Security + Defence will consider all aspects of the evolving fields of optronics and photonics.

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 in September of 2022 where opportunities abound for combining cutting-edge science and technology.
SPIE Remote Sensing

The leading European conference for researchers and scientists involved in emerging sensor and photonic technologies that enable satellite-based atmospheric monitoring and observation of the earth's ecosystems.

CONFERENCE RS101. Remote Sensing for Agriculture, Ecosystems, and Hydrology XXIV
Chairs: Christopher M. U. Neale; Antonino Maltese

Chairs: Charles R. Bostater Jr.; Xavier Neyt

CONFERENCE RS103. Sensors, Systems, and Next-Generation Satellites XXVI
Chairs: Sachidananda R. Babu; Arnaud Hélière; Toshiyoshi Kimura

CONFERENCE RS104. Remote Sensing of Clouds and the Atmosphere XXVII
Chairs: Adolfo Comerón; Evgueni I. Kassianov; Konstantinos G. Nikolakopoulos

Chairs: Karin Stein; Szymon Gladysz

CONFERENCE RS106. Microwave Remote Sensing: Data Processing and Applications II
Chairs: Fabio Bovenga; Claudia Notarnicola; Nazzareno Pierdicca; Emanuele Santi

Chairs: Lorenzo Bruzzzone; Francesca Bovolo; Jon Atli Benediktsson

CONFERENCE RS108. Earth Resources and Environmental Remote Sensing/GIS Applications XIII
Chairs: Karsten Schulz; Ulrich Michel; Konstantinos G. Nikolakopoulos

Chairs: Thilo Erbertseder; Nektarios Chrysoulakis; Ying Zhang

SPIE Security + Defence

The leading leading European conference for researchers and scientists involved in emerging sensor and photonic technologies that enable satellite-based atmospheric monitoring and observation of the earth's ecosystems.

CONFERENCE SD101. Target and Background Signatures VIII
Chairs: Karin Stein; Ric Schleijpen

CONFERENCE SD102. Electro-optical and Infrared Systems: Technology and Applications XIX
Chairs: Duncan L. Hickman; Helge Bürsing

CONFERENCE SD103. Electro-Optical Remote Sensing XVI
Chairs: Gary W. Kamerman; Ove Steinvall

CONFERENCE SD104. Technologies for Optical Countermeasures XIX
Chairs: David H. Titterton; Robert J. Grasso; Mark A. Richardson

CONFERENCE SD105. High Power Lasers: Technology and Systems, Platforms, Effects VI
Chairs: Harro Ackermann; Willy L. Bohn; David H. Titterton

CONFERENCE SD106. Millimetre Wave and Terahertz Sensors and Technology XIV
Chairs: Neil A. Salmon; Frank Gumbmann

CONFERENCE SD107. Emerging Imaging and Sensing Technologies for Security and Defence VII
Chairs: Gerald S. Buller; Richard C. Hollins; Robert A. Lamb; Martin Laurenzis

CONFERENCE SD108. Advanced Manufacturing Technologies for Micro- and Nanosystems in Security and Defence IV
Chairs: Andrea Camoseo; Lynda E. Busse; Maria Farsari; Luana Persano

CONFERENCE SD109. Optical Materials and Biomaterials in Security and Defence Systems Technology XVII
Chairs: Roberto Zamboni; Attila A. Szep; Chantal Andraud

CONFERENCE SD110. NanoSystems in Security and Defence IV
Chairs: Paul M. Alsing; Michael L. Fanto; John G. Rarity

CONFERENCE SD111. Quantum Technologies and Quantum Information Science VI
Chairs: Henri Bouma; Radhakrishna Prabhu; Robert James Stokes; Yitzhak Yitzhaky

CONFERENCE SD112. Counterterrorism, Crime Fighting, Forensics, and Surveillance Technologies VI
Chairs: Paul M. Alsing; Michael L. Fanto; John G. Rarity

CONFERENCE SD113. Artificial Intelligence and Machine Learning in Defense Applications IV
Chair: Judith Dijk

GENERAL INFORMATION

CONTENTS
Remote Sensing for Agriculture, Ecosystems, and Hydrology XXIV (RS101)

Conference Chairs: Christopher M. U. Neale, Univ. of Nebraska Lincoln (United States); Antonio Maltese, Univ. degli Studi di Palermo (Italy); Program Committee: Alessandra Capolupo, Politecnico di Bari (Italy); María Patrocinio González-Dugo, Instituto de Investigación y Formación Agraria y Pesquería (Spain); Antonio Maltese, Univ. degli Studi di Palermo (Italy); Christopher M. U. Neale, Univ. of Nebraska Lincoln (United States)

Remote sensing technology continues to play a significant role in the understanding of our environment. It has evolved into an integral research tool for the natural sciences. Disciplines such as agriculture, hydrology, and ecosystem studies have all developed advanced remote sensing components, facilitating our understanding of the environment and its processes over a broad range of spatial and temporal scales. This is highly important, especially in the management of land and water resources and for the detection of environmental changes. However, in spite of significant progress in recent years, there are still many areas where the potential of remote sensing has not been fully realized, and these are areas of active research.

Of unique importance are those efforts that are focused on gaining a better understanding of what sensors are actually measuring as well as new applications and inverse modelling techniques. For this Conference, contributions using visible, near- and thermal infrared, microwave and other wavebands are solicited, as well as applications using LIDAR or hyperspectral imaging. The conference is especially interested in papers, which emphasize the use of data from relatively new satellites, including Sentinel, hyperspectral satellites such as PRISMA, nanosatellites, airborne and Unmanned Aerial Systems (UAS)-platforms.

Documents concerning the application and the validation of products and services provided by the Copernicus program are welcome too. Indeed, although the Copernicus program supplies satellite-borne earth observation and in-situ data, and a services component that integrates these useful to address precision agriculture purposes, the assessment of their contribution and reliability is at its early stage and more attention should be deserved.

Supported applications are requested that review the early stage and more attention should be deserved. Indeed, geomatic techniques may be a powerful tool to detect changes over time and to predict future scenarios. That information may provide the essential substrate to develop proper management and control strategies and, thus, to design and implement specific institutional services.

In addition, distributed networks provide the opportunity for setting up integrated processing for near real-time regional or global monitoring products for hydrology, agriculture, and ecosystems: e.g., HF radar networks, ground stations, GNSS networks, flux towers, etc.

Modern technique for image processing and data analysis, with promising results and large potential, include deep learning and machine learning. These classes of algorithms have been successfully applied in various ecosystems.

Papers related to the above mentioned and the following topics are solicited:

**HYDROLOGICAL SCIENCES**
- hydro-geomatics (surveying work carried out above the surface areas of water and for hydrological applications)
- hydrological modelling
- sensors for monitoring water resources in hydrology
- data scaling and data assimilation in hydrology (interpolation, smoothing and filtering applications)
- water balance applications
- soil water content
- satellite-based rainfall estimation and modeling (e.g., meteorological RADAR)
- precipitation and ice hydrology
- water resource management
- drought monitoring, analysis and prediction
- sedimentation and erosion
- radar applications in hydrology (interferometry for land slide detection, canopy, soil moisture and soil roughness characterization; flooding)
- lidar applications in hydrology
- remote sensing in depth to ground water modeling and detection (passive and active microwaves, thermal infrared, gravimetry, ground penetrating radar)
- remote sensing in surface water topography
- water quality
- estuarine and coastal applications
- flood mapping and modeling
- dams and hydraulic infrastructures monitoring via interferometry
- studies of ice sheets: Cryosat, ICESat, IceBridge, GRACE, IceCube.

**AGRICULTURE BIOSPHERE**
- agro-geomatics (geomatics techniques application for a precise management of agriculture)
- smarter solutions for farmers based on IT, cloud computing, mobile technology, GPS
- design and implementation of institutional services for agriculture (controls and management) based on RS data and IoT technologies
- reliability and robustness of the products provided by Copernicus land monitoring service
- reflectance properties of soils
- soil organic carbon content
- crop yield modelling
- food production, energy and water nexus
- open data for agriculture and food production
- water securing for food
- agriculture disease detection
- fluorescence applications in agriculture
- canopy and leaf optical models
- vegetation indices applications
- biomass monitoring
- evapotranspiration and energy balance (EB) applications
- eddy covariance, surface renewal, Bowen ratio systems, scintillometry etc.
- support of environmental and agricultural policies
- crowd sensing, Artificial intelligence and advanced data analytics for crop monitoring and plant phenotyping
- upsampling of ground-based and RPAS-based observations.

**ECOSYSTEMS AND ENVIRONMENTAL CHANGE**
- wildfire applications
- forestry dynamics and carbon cycle studies
- ecosystem and ecological management
- climate modeling, prediction and environmental change
- forecasting techniques
- long-term data records for water cycle and climate
- big data for sustainable development
- new trends ingeospatial data analysis for change detection
- regional and global vegetation monitoring early warning techniques
- shallow and deep learning algorithms for ecosystems mapping
- unmanned aerial systems (UAS) applications in hydrology, agriculture and ecosystems monitoring.

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Supporting papers are requested that review the latest contributions of Earth Observations (EO) to water cycle and soil-vegetation-atmosphere sciences.
Remote Sensing of the Ocean, Sea Ice, Coastal Waters, and Large Water Regions 2022 (RS102)

Conference Chairs: Charles R. Bostater Jr., Florida Institute of Technology (United States); Xavier Neyt, Royal Military Academy (Belgium)

Programme Committee: Samir Ahmed, The City College of New York (United States); Jean-Paul Bruyant, ONERA (France); Alexander Gilsener, The City College of New York (United States); Carlton R. Hall, NASA Kennedy Space Ctr. (United States); Frederic Lamy, ONERA (France); Ana M. Martins, Univ. dos Açores (Portugal); Stelios P. Mertikas, Technical Univ. of Crete (Greece); Petri Pellikka, Univ. of Helsinki (Finland); Françoise Viallefont-Robinet, ONERA (France)

Remote sensing science is one of the most modern approaches for studying oceans, littoral regions, seas and large lakes, as well as sea ice covered regions. An important aspect of remote sensing science is the ability to monitor complex environmental media (air, land, water) and their interfaces (water surface wave, air-sea interaction, water-sediment, and internal interfaces). Understanding complex environmental system phenomena is key to scientific understanding of oceans, littoral zones, estuaries, coastal areas, large lakes, ports and waterways as well as sea ice dynamics since remote sensing data provides valuable monitoring information. This information often serves as input to complex numerical models of environmental systems, such as climate change models, coupled oceanic-atmosphere models at the global (planetary) scale as well as at the mesoscale space and time scales. Remote sensing techniques also provide the most valuable tool set and techniques for monitoring and mapping different bottom features in aquatic systems, such as coral reefs, submerged aquatic vegetation and other “targets” of interest to the oceanographic and aquatic community. Also of interest are robotic and mechatronic platforms for in-situ sensing of interfaces and unique sensing systems & platforms for coastal and ocean monitoring and associated data assimilation into predictive models.

There is a need to improve the accuracy and precision of retrieved geophysical parameters from remote sensing data, and a need to use optical signal processing or filtering of remotely sensed signals from instruments to help improve underwater visibility and atmospheric aerosol influences that affect mapping subsurface water properties, features, and targets. In this context, it is often necessary to integrate data from different sensors as well as to include the knowledge of different disciplines. This is especially important in remote sensing of water quality, submerged aquatic vegetation and coupled ocean-atmosphere models. From a remote sensing point of view, these data are mainly extracted from active or passive sensor systems, and models of complex phenomena are important. Techniques important to the above include radar, acoustic, optical, sensing systems and resulting data and EO sensing of aerosols and turbulence.

With reference to the above, this conference will address the above remote sensing systems and platforms with special emphasis on areas such as:

- detection of coastal & ocean currents and oceanic frontal features; radar and altimeter uses
- subsurface sensing using acoustics, optical, laser and magnetic systems, hyperspectral systems
- ocean sensing techniques and systems including microwave, acoustic and magnetic sensing and EO modeling
- ocean wave measurement & atlatmometry as well as coastal imaging systems and analysis including remote sensing of breaking waves, whitecaps, foam, bubbles, and aerosol exchanges
- use of remote sensing data in global and regional ocean observing platforms
- use of satellite & airborne data in ocean, coastal & lagoon water quality assessments
- coastal ocean, estuarine and large lake water-quality monitoring (suspended sediments, dissolved organic matter, phytoplankton pigments and biomass, submerged aquatic vegetation) as well as other bottom feature and target recognition studies
- oceanic photochemistry and hyperspectral remote sensing; coupled oceanic and mesoscale models at the air-sea boundary, remote sensing input and data assimilation into atmospheric sea breeze models, weather forecasting uses of marine remote sensing data & imagery
- sensors, imaging and modeling of microwave signatures of ocean and coastal waves and sea ice
- studies of glaciers, shore-fast ice; polar regions, sea ice prediction monitoring and modeling
- cubesats, international space station (ISS) and multisatellite sensor configurations, georegistration and sensor integration from various platforms aboard the ISS
- data fusion, image fusion, deep learning & artificial intelligence, optical signature analysis and modeling, hyperspectral imaging
- sensor calibrations, airborne sensors & systems and data analysis
- radar and related active-passive (Raman) sensing theory, applications, systems and techniques
- regional and global sea and ice monitoring in climate change research, particularly work related to new satellite and suborbital missions with the new SAR instruments designed to investigate continental and marine sea ice thickness change
- novel use of GNSS signals in large water regions, lakes & coastal regions sensing and deep learning
- operational glacier, sea ice, ice sheets monitoring and systems (Cryosat, ICESat, IceBridge, GRACE, IceCube)
- forecasting active remote sensing and techniques for improving underwater imaging for mapping ports, waterways and harbors, and effects of aerosols and turbulence in retrieving geophysical variables
- airborne (manned, UAV’s, drones) remote sensing missions for observation of oceanic, coastal, sea ice and large water regions, and nearby urban environments; natural disasters; sensor design and calibrations.

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NOTE: SPECIAL SESSIONS AND VOLUNTEER SESSION CHAIR CALL:

(a) Hyperspectral remote sensing, modeling & applications related to breaking waves, foam, whitecaps, bubbles, air-sea gas and aerosol exchange phenomena
(b) Coupled Ocean-Atmosphere Sea-breeze modeling with satellite & EO data assimilation, weather forecasting and climate change related satellite data use in marine environments
(c) AI and Deep Learning techniques
(d) CubeSats, Unmanned Aerial Vehicles or Drones

Abstracts and papers concerning the above topics and special sessions are invited for review and acceptance for presentation at the conference & publication in the proceedings. Those interested in developing the special session or joint sessions may contact the session chairs, members of the technical committee or contact Charles Bostater at Florida Institute of Technology: bostater@fit.edu
Many new remote sensing programs are under way throughout the world, in the U.S., Europe, Japan, and elsewhere. NASA’s Earth Science Division is developing and implementing a broad range of Earth spaceborne remote sensing missions to answer fundamental scientific questions requiring the view from space and to meet societal needs. These include missions and new program elements from the National Research Council’s Earth Science Decadal Survey, missions and selected instruments to assure continuity of long-term key data sets, missions to ensure sustained land imaging provided by the Landsat system, and small-sized competitively-selected small satellite and constellation missions and instruments belonging to the Earth Venture Program. The Japan Aerospace Exploration Agency (JAXA) is developing and operating the ALOS series, GOSAT series, GCOM series, GPM/DPR, Earth-CARE/CRP and ISS/MOLI series of programmes. The European Space Agency (ESA) is developing and implementing a wide range of Earth Observation missions, encompassing the Earth Explorer missions addressing key scientific issues, as well as operational missions including the Copernicus Sentinels in partnership with the European Union (EU), and the missions in partnership with the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT). A number of new remote sensing programmes are also under development by other organisations and nations for research and operational use. Many of the above are contributing to the Global Earth Observation System of Systems (GEOSS) as envisioned by the intergovernmental Group on Earth Observations (GEO). Each of these programs comprises a set of remote sensing systems to address their science and applications objectives.

Papers are solicited on the following and related topics:
- sensors being developed
- satellites being developed
- enabling technologies for sensors and satellites
- new design concepts for sensors, systems and satellites
- hyperspectral sensors
- sensor calibration techniques
- in-situ sensor measurement assimilation
- modeling and simulation techniques for sensor concept development
- focal plane assemblies including detectors and spectral filters
- future LIDAR missions
- system precursors including test beds and airborne simulators
- data systems being developed
- new data processing techniques (applications to Big Data and remote sensing, sensor and data interoperability).

Sessions on the following topics are being planned:
- Japanese missions and technologies
- European missions and technologies
- US missions and technologies
- small satellites (nano/cubesats, microsats) and constellations for Earth observation
- NASA Decadal Survey Designated Observable (DO), Venture Continuity, and Incubation studies
- commercial Earth observing constellations
- UAV systems for Earth observation
- sensor calibration
- focal plane technologies.

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ABSTRACTS DUE: 6 APRIL 2022
SPIE Remote Sensing

Environmental Effects on Light Propagation and Adaptive Systems V (RS105)

Conference Chairs: Karin Stein, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany); Szymon Gladysz, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany).

Programme Committee: Sukanta Basu, Technische Univ. Delft (Netherlands); Ivo Buske, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); Christian Eisele, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany); Michael Hart, Univ. of Arizona (United States); Andrey V. Kanaev, Office of Naval Research Global (United States); Luc Labarre, ONERA (France); Andrew J. Lambert, UNSW Canberra (Australia); Vladimir P. Lukin, V.E. Zuev Institute of Atmospheric Optics (Russian Federation); Florian Moll, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); Italo Toselli, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung IOSB (Germany); Alexander M. J. van Eijk, TNO Defence, Security and Safety (Netherlands); Arthur D. van Rheenen, Norwegian Defence Research Establishment (Norway); Marie-Thérèse Velluet, ONERA (France); Vladimir Yurievich Venediktov, Saint Petersburg Electrotechnical Univ. "LETI" (Russian Federation); St.-Petersburg State Univ. (Russian Federation); Oskar F. von der Lühe, Kiepenheuer-Institut für Sonnenphysik (Germany); Henry White, BAE Systems (United Kingdom).

The use of sensors for active and passive remote sensing of the Earth, its atmosphere and the oceans, for free-space laser communications, and for high-resolution imaging of ground-based, immersed and airborne objects are fields of growing interest for both civilian and military applications. Such high-resolution sensing systems use spectral regions varying from UV to Radar. However, they all must deal with detrimental environmental influences, be it over km-long ranges in the atmosphere or even over only several meters when light propagates through very turbid media such as ocean water. Instrument and measurement analysis therefore depends crucially on a thorough understanding of all optical effects, which limit the sensor performance operating in an absorbing, scattering, and radiating random medium. Increasingly important in this area are modern methods used to ameliorate these effects through compensative hardware, algorithms, and measurements of environmental parameters performed at various locations around the World. Contributions are invited on the following topics and those related to them:

**CHARACTERIZATION OF THE PROPAGATION ENVIRONMENT**

- measurements of the meteorological parameters relevant to the propagation of light, such as temperature, humidity, extinction, etc.
- updates on software for transmission and radiance computations
- measurements and modelling of size distributions and optical properties of aerosols
- modelling and measurement of backgrounds in the visible and infrared spectral ranges
- prediction and measurement of scattering, absorption and turbulence in water
- instances of non-Kolmogorov turbulence.

**PROPAGATION AND IMAGING THROUGH OPTICAL AND ANTHROPOGENIC TURBULENCE:**

- effects of atmospheric and underwater turbulence on laser beam propagation
- aero-optical and plume effects in airborne laser applications
- scintillation and surface speckle propagation
- anisoplanatism in imaging through turbulence.

**LASER-BASED SENSING IN THE ATMOSPHERE AND UNDERWATER:**

- active imaging and gated viewing
- LIDAR and its applications
- standoff vibrometry
- supercontinuum spectroscopy.

**FREE-SPACE OPTICAL (FSO) COMMUNICATION TECHNIQUES AND APPLICATIONS:**

- space-based, terrestrial and airborne FSO systems
- through-water and underwater optical communications
- modulation techniques and formats
- pointing, acquisition, and tracking
- transmitters, receivers, and subsystems
- quantum communications
- cyber security implications of FSO systems.

**TECHNIQUES FOR MITIGATION OF ATMOSPHERIC EFFECTS**

- adaptive optics
- image sharpening/de-blurring
- global and local image stabilization, de-warping, optical flow methods
- tracking through turbulence
- image fusion
- applications of machine learning to wavefront sensing and image processing.

**NEW DEVICES FOR ATMOSPHERIC MEASUREMENT OR COMPENSATION:**

- novel optical components such as liquid-crystal-, and MEMS-based devices
- novel wavefront sensors
- high-frame rate and low-noise visible and infrared detectors.

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ABSTRACTS DUE: 6 APRIL 2022
Microwave Remote Sensing: Data Processing and Applications II (RS106)

Conference Chairs: Fabio Bovenga, CNR IREA (Italy); Claudia Notarnicola, EURAC Research (Italy); Nazzareno Pierdicca, Univ. degli Studi di Roma La Sapienza (Italy); Emanuele Santi, Istituto di Fisica Applicata Nello Carrara (Italy)

Programme Committee: Richard Bamler, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); Maria-Paola Clarizia, Univ. of Michigan (United States); Fabio Covello, Agenzia Spaziale Italiana (Italy); Katarzyna Dabrowska-Zielinska, Institute of Geodesy and Cartography (Poland); Mihai P. Datcu, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); Fabio Del Frate, Univ. degli Studi di Roma “Tor Vergata” (Italy); Dara Entekhabi, Massachusetts Institute of Technology (United States); Carlos Lopez-Martinez, Univ. Politécnica de Catalunya (Spain); Simonetta Paloscia, Istituto di Fisica Applicata “Nello Carrara” (Italy); Luca Pulvirenti, CIMA Research Foundation (Italy); Stefan Schneiderbauer, EURAC research (Italy); David Small, Univ. of Zurich (Switzerland)

The main objective of the conference is to present an updated view of the state-of-the-art in active and passive microwave remote sensing techniques and to provide a playground for scientists coming from different microwave sectors and final application domains. In this context, the conference will offer a platform to exchange ideas and foster applications, which may take advantage from the use of microwave sensors (SAR, scatterometers, radiometers, altimeters, GNSS-R) alone, as well as their joint exploitation and combination with other sensors (optical, multispectral) to take advantage from complementarity of the different techniques. Particular attention will be given to applications and algorithms, including model based and machine learning algorithms, for exploiting data from currently operating sensors, such as Sentinel 1, Sentinel 3, ALOS2, TerraSAR-X, COSMO-SkyMed, RADARSAT-2, SAOCOM, AMSR-E/AMSR2, SSM/I / SSMIS, SMOS, Metop ASCAT, and SMAP and incoming missions such as Metop SG SCA, HydroGNSS, CyGNSS, Nisar, ROSE-L, COSMO SG, ALOS3, AMSR3 and CIMR. Airborne and ground based experiments will be also considered and applications based on time series analysis will be addressed as well. In fact, the incoming growing capabilities of the most recent sensors, in terms of temporal revisit time and electromagnetic spectrum sampling (in active and passive mode), offer a potential tool for new environmental applications especially related to the monitoring of natural disasters (such as earthquake, flood, drought, landslides, avalanches), environmental issues, and to the food and energy challenges, which can particularly benefit from multi-temporal image analysis.

Contributions are solicited on the following and related topics for both applications and processing techniques:

- application of microwave sensing to natural hazard, risk prevention and disaster management
- application of microwave sensing to food security, energy, and biodiversity
- microwave (active and passive) electromagnetic modelling and simulation in different scenarios (land and ocean, atmosphere)
- inversion algorithms for the retrieval of biophysical parameters from microwave data
- microwave data (radar and radiometer) processing techniques
- active and passive data merging, disaggregation approaches
- machine learning algorithms for classification and retrieval applications
- polarimetric methods, techniques and applications
- SAR interferometry techniques and applications
- bistatic radar, including GNSS reflectometry
- radar altimeter and scatterometer techniques and applications
- microwave remote sensing from UAVs.

Two joint sessions will be organized with the conferences “Image and Signal Processing for Remote Sensing XXVIII” and “Remote Sensing for Agriculture, Ecosystem and Hydrology”. In the latter, contributions are solicited for the topic monitoring of soil moisture and vegetation biomass by using optical and microwave data.

Image and Signal Processing for Remote Sensing XXVIII (RS107)

Conference Chairs: Lorenzo Bruzzone, Univ. degli Studi di Trento (Italy); Francesca Bovolo, Fondazione Bruno Kessler (Italy)

Conference Co-Chair: Jon Atli Benediktsson, Univ. of Iceland (Iceland)

Programme Committee: Selim Aksoy, Bilkent Univ. (Turkey); Luciano Alparone, Univ. degli Studi di Firenze (Italy); Gustavo Camps-Valls, Univ. de València (Spain); Jocelyn Chanussot, Lab. des Images et des Signaux (France); Chi-Hau Chen, Univ. of Massachusetts Dartmouth (United States); B. S. Daya Sagara, Indian Statistical Institute, Bangalore (India); Fabio Dell’Acqua, Univ. degli Studi di Pavia (Italy); Begüm Demir, Technische Univ. Berlin (Germany); Peijun Du, Nanjing Univ. (China); Andrea Garzelli, Univ. degli Studi di Siena (Italy); Jordi Ingliada, Ctr. d’Etudes Spatiales de la Biosphère (France); Jun Li, Sun Yat-Sen Univ. (China); Sicong Liu, Tongji Univ. (China); Claudia Paris, Univ. degli Studi di Trento (Italy); David Small, Univ. of Zurich (Switzerland); Benedikt von Poschinger, University of Rennes 1 (France); Josiane B. Zerubia, INRIA Sophia Antipolis - Méditerranée (France)

The main goal of this conference is to address advanced topics related to signal processing, image analysis, pattern recognition, machine learning and data fusion methodologies in the field of remote sensing.

Papers describing recent and original work in the following and related research topics are welcome:

- image enhancement and restoration
- edge detection and segmentation
- target detection and object recognition
- automatic classification
- estimation of geo-bio-physical parameters
- artificial intelligence
- machine learning and deep learning
- analysis of big data
- change detection and analysis of time series
- analysis of multispectral and hyperspectral images
- analysis of SAR and LIDAR signals
- multisensor and multisource data fusion
- data mining techniques
- image coding and data compression
- remote sensing applications
- satellite, airborne and UAV remote sensing. <li/>

Note: To assure a high quality conference, all abstracts will be reviewed by the conference scientific committee and co-chairs for technical merit and content.

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Tel: +1 360 676 3290 • help@spie.org • #SPIE Sensors
Earth Resources and Environmental Remote Sensing/GIS Applications XIII (RSI08)

Conference Chairs: Karsten Schulz, Fraunhofer-Institut für Optronik, Systemtechnik und Bildverarbeitung (Germany); Ulrich Michel, ROSEN Germany GmbH (Germany); Konstantinos G. Nikolakopoulos, Univ. of Patras (Greece)

Programme Committee: Maria Libera Battaglire, Agenzia Spaziale Italiana (Italy); Markus Boldt, Fraunhofer-Institut für Optronik, Systemtechnik und Bildverarbeitung (Germany); Dimitri Bulatov, Fraunhofer-Institut für Optronik, Systemtechnik und Bildverarbeitung (Germany); Valerio Gagliardi, Univ. degli Studi di Roma Tre (Italy); Pierre Karrasch, TU Dresden (Germany); Pablo H. Rosso, Leibniz-Zentrum für Agrarlandschaftsforschung (ZALF) e.V. (Germany); Ana Claudia Moreira Teodoro, Univ. do Porto (Portugal); Kyriacos Themistocleous, Cyprus Univ. of Technology (Cyprus); Christine Wessollek, TU Dresden (Germany)

Satellite remote sensing has become a common tool to investigate the different fields of Earth and environmental sciences. The progress of the performance capabilities of the optoelectronic and radar devices mounted on-board remote sensing platforms have further improved the capability of instruments to acquire information about the Earth and its resources for global, regional and local assessments.

With the advent of new high-spatial and spectral resolution satellite and airborne imaging new applications for large-scale mapping and monitoring have become possible. The integration with Geographic Information Systems (GIS) allows a synergistic processing of multi-source spatial data. The present conference will be an occasion to outline how scientists involved in the Earth and environmental studies can take advantage of new remote sensing techniques and the advances in spatial technology. Particular subjects are:

SENSORS AND PLATFORMS
- new sensor developments
- radiometric calibration studies
- geometric correction approaches
- mobile solutions
- simulation studies

PROCESSING METHODOLOGIES
- fusion of multi-source and multi-scale data
- multimodal remote sensing
- machine learning methods for remote sensing
- integration of remote sensing and GIS
- analysis of optical and thermal data
- hyperspectral analytical approaches
- 3D techniques: LiDAR and Stereo.

ENVIRONMENTAL MONITORING CONCEPTS
- land degradation studies
- natural hazards (floods, landslides)
- landscape modeling
- sustainability and planning
- coastal zone management
- interaction sea-land
- resource management
- global climate change.

HAZARD MITIGATION GEOLOGIC APPLICATIONS
- geological hazards, mine waste
- earthquakes and volcanoes
- lithological and mineral mapping
- mineral and petroleum exploration
- structural geology, tectonics
- hydrogeology.

INFRASTRUCTURES AND URBAN AREAS
- 3D urban modeling
- change detection
- remote sensing for urban information systems
- virtual city models
- urban feature extraction with high resolution SAR-sensors.

REMOTE SENSING FOR ARCHAEOLOGY, PRESERVATION OF CULTURAL AND NATURAL HERITAGE
- discovering hidden archaeological sites with remote sensing techniques
- generating digital twins of archaeological monuments and sites
- ground penetrating sensing
- detection and monitoring of wildfires and illegal deforestation

Theories and Applications of Satellite Remote Sensing and Ground-based Nondestructive Technologies in Civil and Environmental Engineering

Session Chairs: Luca Bianchini Ciampoli, Roma Tre Univ. (Italy); Francesco Soldovieri, Institute for Electromagnetic Sensing of the Environment (IREA)-CNR (Italy)

Session Committee: Valerio Gagliardi, Roma Tre Univ. (Italy); Fabio Tosti, Univ. of West London, (United Kingdom); Maria Libera Battaglire, Italian Space Agency (ASI) (Italy)

Satellite remote sensing is becoming popular for the assessment and the routine monitoring of civil engineering structures and infrastructures, such as buildings, railways, airports and highways and the surrounding environment. The tremendous progress made recently by this technology allows to control their conditions at the network level with a very high inspection frequency and resolution as well as to identify critical sections for an early-stage detection of decays. Parallel to this, ground-based non-destructive testing (NDT) methods have become established in structure, infrastructure, and environmental management systems due to their non-invasiveness, the rapidity of data collection and the provision of reliable information. Within this context, an integration between satellite remote sensing and ground-based NDT technologies (e.g. – but not limited to – GPR, GB-SAR, UAVs, LiDAR, FWD and Profilometers) can stand as a step forward in the development of new theoretical, numerical and experimental approaches towards the provision of smarter management systems in civil and environmental engineering.

Submissions related to the above mentioned, describing work in the following and related research topics are invited:
- remote sensing theories and applications in civil and environmental engineering
- medium- and high-resolution SAR sensors in civil and environmental engineering
- advanced assessment, monitoring and interpretation methods for transport infrastructures (roadways, railways, airfields), bridges, tunnels, and buildings
- design and development of new surveying protocols, equipment, and prototypes
- advances in ground-based nondestructive testing (NDT) methods, numerical developments and applications (stand-alone use of existing and state-of-the-art NDTs)
- data fusion, integration and correlation of multi-source, multi-scale, and multi-temporal data outputs for civil and environmental engineering applications.
Remote Sensing Technologies and Applications in Urban Environments VII (RS109)

Conference Chairs: Thilo Erbertseder, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); Nektarios Chrysoulakis, Foundation for Research and Technology-Hellas (Greece); Ying Zhang, Natural Resources Canada (Canada)

Programme Committee: Matthias Budde, Karlsruhe Institute of Technology (Germany); Thomas Esch, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); Wieke Heldens, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); Zina Mitraka, Foundation for Research and Technology-Hellas (Greece); Christopher Small, The Earth Institute (United States); Carlos Tavares Calafate, Univ. Politécnica de Valencia (Spain)

The global urbanization constitutes an epochal transformation of the Earth. Since 2007 for the first time in human history more people have lived in cities than in the countryside. According to the United Nations in 2050, around 75% of the worldwide population will be living in cities. The population density, traffic and infrastructure, environmental and energy problems, climate change, migration, demographic change, aspects of vulnerability and sustainability, new forms of mobility and sharing—unprecedented challenges and opportunities are continuously arising. In any case, the urban environment plays a major role in the development of humanity and the quality of life of the individual citizen.

The Corona-pandemic poses an unprecedented threat to the urban society. The resulting lockdowns in 2020 affected all areas of life to a considerable extent with impacts on the urban atmosphere, environment and landscape. Remote Sensing Technologies and Applications offer a wealth of possibilities and opportunities to monitor the urban environment, to support planning processes, to enhance the availability of relevant information, to shape the resilient and sustainable city and to improve the quality of life of citizens.

We invite papers related to advanced remote sensing technologies, applications and information systems focusing on the urban environment that push beyond the state-of-the-art. These include:

CORONA PANDEMICS (SPECIAL SESSION)
- impacts of Corona-lockdowns on urban atmosphere, environment and landscape
- EO-based analysis of public health risks.

REMOTE SENSING OF URBAN AIR QUALITY AND CLIMATE
- air pollution and greenhouse gas monitoring using satellites, aerial planes, UAV and mobile platforms
- urban atmosphere and local climate zones
- urban climate under global climate change
- CO2 emissions, capture and sequestration
- urban energy budget and heat fluxes
- integrated urban climate services
- urban Heat Island.

REMOTE SENSING FOR URBAN RESILIENCE AND URBAN PLANNING
- urban remote sensing based on satellite, aerial plane, UAV and mobile platforms
- urban land surface information extraction
- urban morphology, infrastructure and traffic
- urban land cover and biodiversity
- urban planning indicators
- sustainable Urbanization and Adapting and transforming towards sustainability
- strategies with respect to natural disasters
- urban metabolism
- nature-based solutions.

SMART CITIES
- information services and mobile applications
- AI methods and machine learning for mapping and monitoring
- Big Data processing and modeling
- crowd sourcing and microsensors
- data assimilation (combining measurements and models)
- quality of life services and support to people at risk.

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Target and Background Signatures VIII (SD101)

Conference Chairs: Karin 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); Maarten A. Hogervorst, TNO (Netherlands); Stacy E. Howington, U.S. Army Engineer Research and Development Ctr. (United States); Katrin Idla, Tallinn Univ. of Technology (Estonia); Hans M. Karlis, 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, for 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.

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
- methods and materials for signature reduction
- advances in algorithms for sensor signal and data processing
- simulation and performance evaluation

- sensor data fusion, multiple source integration
- artificial intelligence techniques for target – background discrimination
- processing multi-/hyperspectral data
- multisensor signature prediction model
- camouflage effectiveness
- human observer performance
- signature features in relation to sensor capabilities
- signature features in relation to sensor processing.
Electro-optical and Infrared Systems: Technology and Applications XIX (SD102)

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

Programme Committee: Gianni Barani, Leonardo (Italy); Piet Blij, 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). This conference will address current and emerging 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 domain and homeland together with a diverse range of platforms such as dismount-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 emerging 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 usable 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 emerging 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. Application areas that are currently receiving interest include target detection and tracking, area monitoring, mine and IED detection, environmental monitoring, and border security, all with 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 organizations 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, to academia, and business and government stakeholders. Contributions from a diverse range of disciplines covering areas using 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 expected to draw from new and emerging applications, and for active and passive technologies 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 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
- modeling 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 XVI (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. One important area is the use of laser sensors for autonomous cars.

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 and economically viable for an even wider variety of applications and uses will be emphasized. However, the development of technology cannot be effective without serious consideration of the applications of this 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, unmanned 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.

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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 applications. 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 VI (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 pumpers - 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); Charmaïne Cisneros Franck, NASA Langley Research Ctr. (United States); Marcin Kowalski, Military Univ. of Technology (Poland); Wojciech Knap, Univ. Montpellier 2 (France); Steven R. Nurrill, U.S. Army Research Lab. (United States); Markus Rechle, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); Douglas T. Petkie, Wright State Univ. (United States); Christopher A. Schuetz, Phase Sensive 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 dissemination and discussion of novel and emerging sensor architectures, enabling component technologies, signal and image processing, phenomenology and applications over the band from 10 GHz to 10 THz. A focus on market awareness and user requirements in the forum enables technical innovation to respond to the changing drivers from the world of security and defense, to offer unique selling propositions for sensors in this spectral band for the benefit of society.

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 imagery in visually degraded environments, such as those of 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 data science and machine learning to millimetre wave and terahertz sensors
- explosives & contraband detection
- people screening for shopping centres, arenas, transport networks, public/private buildings, schools
- non-metallic & metallic knife/gun detection
- quantum (superposition and entanglement) sensing architectures, technologies and capabilities.

**THE MILLIMETRE WAVE BAND (10 GHZ - 300 GHZ)**

Recent growth in commercially available low-cost radars at 24 GHz, 60 GHz, 77 GHz and 120 GHz is enabling the emergence of novel systems. 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 taxing
- 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 penetrative 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 into the skin, it is particularly suited to diagnosing conditions of the skin and the underlying tissues. Areas of current activity and potential applications:

• screening passengers remotely for infection by measuring whole body 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 circulation disorders).

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.

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Emerging Imaging and Sensing Technologies for Security and Defence VII

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 Laurensiz, 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 nanotechnologies 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 technologies 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 precursors.

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:
Emerging Imaging and Sensing Technologies for Security and Defence VII 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); Lynda E. Busse, U.S. Naval Research Lab. (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); Yuris Dzenis, Univ. of Nebraska-Lincoln (United States); John T. Foukas, 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); Eunyoung 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 constructed 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
- manufacturing of quantum devices for sensing and imaging
- 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 nanoprint 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
- artificial intelligence-enabled smart manufacturing processes
- 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); Chantal Andraud, Ecole Normale Supérieure de Lyon (France); André-Jean Attias, Univ. Pierre et Marie Curie (France); Attila A. Szep, Air Force Research Lab. (United States)

Programme Committee: Carrie M. Bartsch, Air Force Research Lab. (United States); Werner J. Blau, Trinity College Dublin (Ireland); Fabrice Charra, Commissariat à l’Energie Atomique (France); Beata J. Derkowska, Torun Univ. (Poland); James G. Grote, Air Force Research Lab. (United States); Emilie M. Heckman, Air Force Research Lab. (United States); François Kajzar, Univ. Politechnica of Bucharest (Romania); Loic 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); Yoshiko Okada-Shudo, The Univ. of Electro-Communications (Japan); Fahima Ouchen, Air Force Research Lab. (United States); Agnieszka Pawlicka, Instituto de Quimica de Sao 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 researchers in Europe and the USA.

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- polymer optical waveguides and fibres
- multifunctional materials
- charge transport in organic materials
- simulation of physical processes in molecular media
- organic materials for vision and border control
- biopolymers for display and camouflage
- biotronics
- electrospinning
- organic field effect transistors.

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, bio-polymers 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
Quantum Technologies and Quantum Information Science VI (SD110)

Conference Chairs: Paul M. Alsing, Air Force Research Lab. (United States); Michael L. Fanto, Air Force Research Lab. (United States); John G. Rarity, Univ. of Bristol (United Kingdom)

Programme 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); Miloslav Dusek, Palacky Univ. Olomouc (Czech Republic); Mark T. Gruneisen, 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-Ann 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.

OVERCOMING CLASSICAL LIMITS
- quantum computing and quantum data processing
- topological quantum computation
- quantum memories, gates, relays, and repeaters
- random number generation
- quantum error correction
- quantum means for distributed computations.

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Counterterrorism, Crime Fighting, Forensics, and Surveillance Technologies VI (SDTII)

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 Optoptronik, Systemtechnik und Bildauswertung (Germany); Felicity Carlyle-Davies, Univ. of Strathclyde (United Kingdom); Brian E. Fougler, Ministry of Defence (United Kingdom); Gennadi E. Kottkovskii, National Research Nuclear Univ. MEPhI (Russian Federation); William F. Marshall, DiinetIQ Ltd. (United Kingdom); David Muench, Fraunhofer-Institut für Optoptronik, Systemtechnik und Bildauswertung (Germany); Niels M. Niels Daae, Univ. of Dundee (United Kingdom); Salman Rosenwaks, Ben-Gurion Univ. of the Negev (Israel); Andre Samberg, i4-Flame OU (LLC) (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 behaviour 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 deployed in such sensors, such systems 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 hardware 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.

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Artificial Intelligence and Machine Learning in Defense Applications IV (SDI12)

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, i4-Flame OU (LLC) (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/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.

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 pipeline must 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:

- automatic target detection, classification and data processing
- 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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The city is home to world-renowned universities such as the Humboldt University, the Technical University, the University of the Arts, along with several more. The area is well known for its festivals, diverse architecture, nightlife, contemporary arts and a very high quality of living.

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- **Title**
- Author(s) information
- 250-word abstract for technical review
- 100-word summary for the program
- Keywords used in search for your paper (optional)
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- Submit a 4-page-minimum manuscript, by the advertised due date, for publication in the Proceedings of SPIE on 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
- Attend the meeting
- Present at the scheduled time

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