

PROCEEDINGS OF SPIE

Electro-Optical and Infrared Systems: Technology and Applications X

**David A. Huckridge
Reinhard Ebert**
Editors

**23–24 September 2013
Dresden, Germany**

Sponsored by
SPIE

Cooperating Organisations
Fraunhofer-Gesellschaft (Germany)

Published by
SPIE

Volume 8896

Proceedings of SPIE 0277-786X, V. 8896

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

Electro-Optical and Infrared Systems: Technology and Applications X, edited by David A. Huckridge, Reinhard Ebert,
Proc. of SPIE Vol. 8896, 889601 · © 2013 SPIE · CCC code: 0277-786X/13/\$18 · doi: 10.1117/12.2051252

Proc. of SPIE Vol. 8896 889601-1

The papers included in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. The papers published in these proceedings reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from this book:

Author(s), "Title of Paper," in *Electro-Optical and Infrared Systems: Technology and Applications X*, edited by David A. Huckridge, Reinhard Ebert, Proceedings of SPIE Vol. 8896 (SPIE, Bellingham, WA, 2013) Article CID Number.

ISSN: 0277-786X

ISBN: 9780819497659

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA

Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445

SPIE.org

Copyright © 2013, Society of Photo-Optical Instrumentation Engineers.

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 0277-786X/13/\$18.00.

Printed in the United States of America.

Publication of record for individual papers is online in the SPIE Digital Library.



SPIDigitalLibrary.org

Paper Numbering: Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print and on CD-ROM. Papers are published as they are submitted and meet publication criteria. A unique, consistent, permanent citation identifier (CID) number is assigned to each article at the time of the first publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online, print, and electronic versions of the publication. SPIE uses a six-digit CID article numbering system in which:

- The first four digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc.

The CID Number appears on each page of the manuscript. The complete citation is used on the first page, and an abbreviated version on subsequent pages. Numbers in the index correspond to the last two digits of the six-digit CID Number.

Contents

vii *Conference Committee*

SESSION 1 OPTICS AND MATERIALS

- 8896 02 **Investigation of index of refraction changes in chalcogenide glasses during molding processes** [8896-1]
J. Novak, R. Pini, W. V. Moreshead, LightPath Technologies, Inc. (United States); E. Stover, M³ Measurement Solutions (United States); A. Symmons, LightPath Technologies, Inc. (United States)
- 8896 03 **Hyper-hemispheric and bifocal panoramic lenses** [8896-2]
C. Pernechele, INAF - Osservatorio Astronomico di Padova (Italy) and CISAS - Ctr. of Studies and Activity for Space, Univ. di Padova (Italy)
- 8896 04 **Two-lens designs for modern uncooled and cooled IR imaging devices** [8896-3]
N. Schuster, J. Franks, Umicore Electro-Optic Materials (Belgium)

SESSION 2 ACTIVE SENSING

- 8896 06 **Comparison of flash and accumulation mode in range-gated active imaging (Invited Paper)** [8896-5]
F. Christnacher, M. Laurenzis, S. Schertzer, Institut Franco-Allemand de Recherches de Saint-Louis (France)
- 8896 07 **Advanced range imaging with gated viewing: compressed sensing and coding of range gates** [8896-6]
M. Laurenzis, E. Bacher, S. Schertzer, F. Christnacher, Institut Franco-Allemand de Recherches de Saint-Louis (France)
- 8896 08 **Comparison of three methods reducing the beam parameter product of a laser diode stack for long range laser illumination applications** [8896-7]
Y. Lutz, J.-M. Poyet, N. Metzger, Institut Franco-Allemand de Recherches de Saint-Louis (France)
- 8896 09 **Surface enhanced vibrational spectroscopy for the detection of explosives** [8896-8]
F. Büttner, J. Hagemann, M. Wellhausen, S. Funke, C. Lenth, F. Rotter, L. Gundrum, Laser-Lab. Göttingen e.V. (Germany); U. Plachetka, C. Moormann, AMO GmbH (Germany); M. Strube, Micromata GmbH (Germany); A. Walte, Airsense Analytics GmbH (Germany); H. Wackerbarth, Laser-Lab. Göttingen e.V. (Germany)
- 8896 0A **A novel Sagnac fiber optic sensor employing time delay estimation for distributed detection and location** [8896-9]
Y. Wu, P. Bian, B. Jia, Q. Xiao, Fudan Univ. (China)

SESSION 3 DETECTORS

- 8896 0B **Large format, small pixel pitch and hot detectors at SOFRADIR** [8896-10]
Y. Reibel, A. Rouvie, A. Nedelcu, T. Augey, N. Pere-Laperne, L. Rubaldo, D. Billon-Lanfrey, SOFRADIR (France); O. Gravrand, J. Rothman, G. Destefanis, CEA-LETI-Minatec (France)
- 8896 0C **InGaAs infrared detector development for SWIR imaging applications** [8896-11]
F. Rutz, P. Kleinow, R. Aidam, W. Bronner, L. Kirste, M. Walther, Fraunhofer-Institut für Angewandte Festkörperphysik (Germany)
- 8896 0E **Plasmonic absorption nanoantenna for frequency selective mid-infrared detection** [8896-13]
Y. Li, Y. Guo, L. Su, B. Wang, Northwestern Polytechnical Univ. (China); Z. Xu, Dalian Univ. of Technology (China); Z. Zhou, Science and Technology on Metrology and Calibration Lab. (China)

SESSION 4 PROTECTION AND THREAT DETECTION

- 8896 0G **Research on laser protection: an overview of 20 years of activities at Fraunhofer IOSB (Invited Paper)** [8896-15]
G. Ritt, D. Walter, B. Eberle, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany)
- 8896 0H **Gun muzzle flash detection using a CMOS single photon avalanche diode** [8896-16]
T. Merhav, V. Savuskan, Technion-Israel Institute of Technology (Israel); Y. Nemirovsky, Technion-Israel Institute of Technology (Israel) and Kinneret College on the Sea of Galilee (Israel)
- 8896 0I **Combined hostile fire and optics detection** [8896-17]
C. Brännlund, J. Tidström, M. Henriksson, L. Sjöqvist, Swedish Defence Research Agency (Sweden)
- 8896 0J **Analyzing the effectiveness of flare dispensing programs against pulse width modulation seekers using self-organizing maps** [8896-18]
M. C. Şahingil, M. Ş. Aslan, TÜBİTAK BİLGEM İLTAREN (Turkey)

SESSION 5 IMAGER TESTING, CALIBRATION AND SIMULATION

- 8896 0K **Image quality testing of assembled IR camera modules** [8896-19]
D. Winters, P. Erichsen, TRIOPTICS GmbH (Germany)
- 8896 0L **Improving cooling of cavity blackbodies** [8896-20]
C. Barrat, G. Chauvel, HGH Systèmes Infrarouges (France)

- 8896 OM **Performance simulation model for a new MWIR camera for missile plume detection** [8896-21]
J. Yoon, LIG Nex1 Co., Ltd. (Korea, Republic of); D. Ryu, S. Kim, S. Seong, Yonsei Univ. (Korea, Republic of); J. Kim, Agency for Defense Development (Korea, Republic of); S.-W. Kim, W. Yoon, Yonsei Univ. (Korea, Republic of)

SESSION 6 IMAGING SYSTEMS

- 8896 OO **Results from the electro-optic sensors domain of the materials and components for missiles innovation and technology partnership (phase 1) (Invited Paper)** [8896-23]
M. E. Bray, R. A. Shears, SELEX ES Ltd. (United Kingdom)
- 8896 OP **Feature-based automatic configuration of semi-stationary multi-camera components** [8896-24]
A.-K. Grosselfinger, D. Münch, W. Hübner, M. Arens, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany)
- 8896 OR **A Long Wave Infrared (LWIR) spectral imager (7.7 to 12.3 μ) based on cooled detector array and high resolution Circular Variable Filter (CVF)** [8896-26]
D. Cabib, M. Lavi, A. Gil, E. Ohel, J. Dolev, U. Milman, CI Systems Ltd. (Israel)
- 8896 OS **A novel sampling method for the sparse recovery of infrared sea surveillance images** [8896-27]
S. Cakir, H. Uzeler, T. Aytaç, TÜBİTAK BİLGEM İLTAREN (Turkey)
- 8896 OT **Image generation for single detector infrared seekers via compressive sensing** [8896-28]
H. Uzeler, S. Cakir, T. Aytaç, TÜBİTAK BİLGEM İLTAREN (Turkey)

POSTER SESSION

- 8896 OW **Deformation measurement for satellite antenna by close-range photogrammetry** [8896-31]
S. Jiang, L. Yang, J. Xu, J. Yu, China Academy of Space Technology (China)
- 8896 OX **Optical design of a large-scale in-door illumination simulating system** [8896-32]
J. Xu, S. Jiang, Q. Xiao, P. Zhang, L. Yang, H. Li, Y. Xiang, China Academy of Space Technology (China)
- 8896 OY **Determination of the microbolometric FPA's responsivity with imaging system's radiometric considerations** [8896-33]
S. Gogler, G. Bieszczad, M. Krupinski, Military Univ. of Technology (Poland)
- 8896 OZ **System for critical infrastructure security based on multispectral observation-detection module** [8896-34]
P. Trzaskawka, M. Kastek, M. Życzkowski, R. Dulski, M. Szustakowski, W. Ciurapiński, J. Bareta, Military Univ. of Technology (Poland)
- 8896 IO **Determining the range parameters of observation thermal cameras on the basis of laboratory measurements** [8896-35]
J. Bareta, M. Kastek, K. Firmanty, P. Trzaskawka, Military Univ. of Technology (Poland)

- 8896 11 **Test stand for non-uniformity correction of microbolometer focal plane arrays used in thermal cameras** [8896-36]
M. Krupiński, J. Bareła, K. Firmanty, M. Kastek, Military Univ. of Technology (Poland)
- 8896 12 **Analysis and design of infra swing scanning control system** [8896-37]
X. Tian, X. Liu, M. Tan, W. Wang, D. Li, China Academy of Space Technology (China)
- 8896 13 **Charge control of electrostatically actuated micromechanical infrared Fabry-Pérot filters** [8896-38]
S. Lehmann, M. Ebermann, N. Neumann, InfraTec GmbH (Germany)
- 8896 14 **Design, fabrication, and applications of ultra-narrow infrared bandpass interference filters** [8896-39]
J. Kischkat, Humboldt-Univ. zu Berlin (Germany); S. Peters, Sentech Instruments GmbH (Germany); M. P. Semtsiv, T. Wegner, M. Elagin, G. Monastyrskiy, Y. Flores, S. Kurlov, W. T. Masselink, Humboldt-Univ. zu Berlin (Germany)
- 8896 15 **Trends in infrared imaging detecting technology** [8896-40]
J. Fan, Shanghai Mechanical-electronic Engineering Institute (China); J. Yang, Univ. of Electronics Science and Technology of China (China)
- 8896 16 **Reliability-based structural design for infrared cryostat** [8896-41]
S. Yu, C. Wang, North China Research Institute of Electro-Optics (China)
- 8896 17 **Application of infrared uncooled cameras in surveillance systems** [8896-42]
R. Dulski, J. Bareła, P. Trzaskawka, T. Piątkowski, Military Univ. of Technology (Poland)
- 8896 18 **A new method for discriminating the Moon interference based on CES software** [8896-43]
Z. Tu, Z. Mei, J. Yuan, L. Deng, Beijing Institute of Control Engineering (China) and National Key Lab. Science and Technology Space Intelligent Control (China)

Author Index

Conference Committee

Symposium Chair

David H. Titterton, Defence Science and Technology Laboratory
(United Kingdom)

Symposium CoChair

Reinhard Ebert, Fraunhofer-Institut für Optronik, Systemtechnik und
Bildauswertung (Germany)

Conference Chairs

David A. Huckridge, Malvern Innovations (United Kingdom)
Reinhard Ebert, Fraunhofer-Institut für Optronik, Systemtechnik und
Bildauswertung (Germany)

Conference Programme Committee

Christopher C. Alexay, StingRay Optics, LLC (United States)
Jan Yngve Andersson, Acreo AB (Sweden)
Gisele Bennett, Georgia Institute of Technology (United States)
Rainer Breiter, AIM INFRAROT-MODULE GmbH (Germany)
Gordon A. Cain, Vision4ce Ltd. (United Kingdom)
David J. Clarke, Placing Value Co., Ltd. (Thailand)
Gérard L. Destéfanis, CEA-LETI-Minatec (France)
Jean-Claude L. Fontanella, Thales Optronique S.A.S. (France)
Natan S. Kopeika, Ben-Gurion University of the Negev (Israel)
José Manuel López-Alonso, Universidad Complutense de Madrid (Spain)
John F. Parsons, Thales UK Ltd. (United Kingdom)
Stanley R. Rotman, Ben-Gurion University of the Negev (Israel)
Armin L. Schneider, Institut Franco-Allemand de Recherches de Saint-
Louis (France)

Session Chairs

- 1 Optics and Materials
Reinhard Ebert, Fraunhofer-Institut für Optronik, Systemtechnik und
Bildauswertung (Germany)
David A. Huckridge, Ridgeway Consulting Ltd. (United Kingdom)
- 2 Active Sensing
Armin Schneider, Institut Franco-Allemand de Recherches de Saint-Louis
(France)

- 3 Detectors
Reinhard Ebert, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany)
David A. Huckridge, Ridgeway Consulting Ltd. (United Kingdom)
- 4 Protection and Threat Detection
David A. Huckridge, Ridgeway Consulting Ltd. (United Kingdom)
Reinhard Ebert, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany)
- 5 Imager Testing, Calibration and Simulation
David A. Huckridge, Ridgeway Consulting Ltd. (United Kingdom)
Reinhard Ebert, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany)
- 6 Imaging Systems
David A. Huckridge, Ridgeway Consulting Ltd. (United Kingdom)
Reinhard Ebert, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany)