## PROCEEDINGS OF SPIE

## XII Conference on Reconnaissance and Electronic Warfare Systems

**Piotr Kaniewski** *Editor* 

19–21 November 2018 Ołtarzew, Poland

Organized by Military University of Technology (Poland)

Sponsored by
General Staff of the Polish Armed Forces (Poland)
Electronics and Telecommunications Committee of the Polish Academy of Sciences (Poland)

Published by SPIE

**Volume 11055** 

The papers 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. Additional papers and presentation recordings may be available online in the SPIE Digital Library at SPIEDigitalLibrary.org.

The papers 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 these proceedings:

Author(s), "Title of Paper," in XII Conference on Reconnaissance and Electronic Warfare Systems, edited by Piotr Kaniewski, Proceedings of SPIE Vol. 11055 (SPIE, Bellingham, WA, 2019) Seven-digit Article CID Number.

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510627857

ISBN: 9781510627864 (electronic)

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA Telephone +1 360 676 3290 (Pacific Time)· Fax +1 360 647 1445 SPIF org

Copyright © 2019, 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/19/\$18.00.

Printed in the United States of America 'Vm7 i ffUb '5 ggc WJUhY gž ⊕ Wži bXYf '']WY bgY 'Zfca 'GD-9.

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



**Paper Numbering:** Proceedings of SPIE follow an e-First publication model. A unique citation identifier (CID) number is assigned to each article at the time of 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 and print versions of the publication. SPIE uses a seven-digit CID article numbering system structured as follows:

- The first five 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.

## Contents

Vii	Authors		
ix	Conference Committee		
xiii	Introduction		
	XII CONFERENCE ON RECONNAISSANCE AND ELECTRONIC WARFARE SYSTEMS		
11055 01	Onboard image recorder simulator for analysis of operation of vision-based navigation system [11055-1]		
11055 02	Semi-insulating GaP as a material for manufacturing photoconductive semiconductor switches [11055-2]		
11055 03	Echoes cancellation in hydroacoustic channel: experimental research [11055-3]		
11055 04	Parameters of quality of radar terrain images [11055-4]		
11055 05	Optical-radio hybrid technology in military wireless communication systems [11055-5]		
11055 06	Application of dynamic games with incomplete information to optimisation of performance of military radio networks (jamming avoidance) [11055-6]		
11055 07	Synchronization methods in mobile wireless links based on OFDM modulation technique [11055-7]		
11055 08	Koshelev antenna as an element of the antenna array [11055-8]		
11055 09	Instantaneous frequency estimation for radar NLFM signal using combined STFT and TFD ridge smoothing technique [11055-9]		
11055 0A	Continuous wave ground penetrating radars: state of the art [11055-10]		
11055 OB	Method of radiolocation object shield zone calculation for ground jammer stations [11055-11]		
11055 0C	Recognition of electromagnetic sources with the use of deep neural networks [11055-12]		
11055 0D	Assessment of voice call quality in SCIP encrypted traffic [11055-13]		
11055 OE	Smoke detection in a digital image with the use of convolutional network [11055-14]		

11055 OF	Mechanisms of immunization of broadband radio stations for targeted interference [11055-15]
11055 0G	Testing of the detector based on the Faraday effect for the detection of high-power electromagnetic pulses [11055-16]
11055 0H	Selected properties and parameters of radio channel impulse response estimation in ISM 2.4-GHz band [11055-17]
11055 OI	Verification of the criterion and measures of interferences used in radio planning systems [11055-18]
11055 OJ	The assessment of efficiency of the automatic speaker recognition system for voices registered using a throat microphone [11055-20]
11055 OK	The efficiency evaluation concept of the HF jamming based on propagation prediction model ITU-R P.533 [11055-21]
11055 OL	Electronic warfare systems supporting the database of the Radio Environment Maps [11055-22]
11055 0M	Synchronous surge generator: source of ultra-high power pulses [11055-23]
11055 ON	Properties of the monopulse direction finding of microwave sources in an environment with many emitters [11055-25]
11055 0O	A concept of a microwave seeker designed for an anti-radiation missile [11055-26]
11055 OP	Prospects of simultaneous localization and mapping algorithms application in imagery intelligence [11055-27]
11055 0Q	Secure voice transmission in the coalitional communication [11055-28]
11055 OR	Removal of conflicts in fusion of identification information from ELINT-ESM sensors [11055-29]
11055 OS	<b>PSO</b> algorithm for UAV autonomous path planning with threat and energy cost optimization [11055-30]
11055 OT	The algorithm for computation of the time difference of arrival for a secure zone monitoring system [11055-31]
11055 OU	Comparison of two classifiers based on neural networks and the DTW method of comparing time series to recognize maritime objects upon FLIR images [11055-32]
11055 0V	Analysis of estimation algorithms for electromagnetic source localization [11055-33]
11055 OW	Processing output voltages of a single-function microwave frequency detector [11055-34]
11055 OX	Tracking of land vehicle motion with the use of distance measurements [11055-35]
11055 OY	Application of fusion of two classifiers based on principal component analysis method and time series comparison to recognize maritime objects upon FLIR images [11055-36]

	11055 OZ	Use of cognitive radio in electromagnetic warfare [11055-38]
	11055 10	The use of shunt-stubs for impedance matching improvement in planar antenna arrays [11055-39]
•	11055 11	Analysis of imagery interpretability of open sources radar satellite imagery [11055-41]
-	11055 12	Evaluation of the interpretability of satellite imagery obtained from open sources of information [11055-44]
-	11055 13	Will WPA3 really provide Wi-Fi security at a higher level? [11055-45]
-	11055 14	Verification of the results of numerical simulations of a high power pulsed L-band magnetron in experimental conditions [11055-47]
•	11055 15	Method of synthesis of signal-code constructions for secretive noise-proof data transmission radio systems [11055-49]
	11055 16	Traffic congestion detection algorithm for a radar freeway monitoring system [11055-50]
-	11055 17	The diagnostics and repair of contemporary Electronic Warfare systems [11055-51]
•	11055 18	Radar air picture simulator for military radars [11055-52]
	11055 19	IEEE 802.11ax: giant leap in WLAN evolution [11055-53]
	11055 1A	Frequency resources sharing in FH radio networks [11055-54]
•	11055 1B	Detection, direction finding and localization of selected radio emissions with swarm technology [11055-55]
•	11055 1C	Detection of complex impulse stochastic signals on the background of quasi-periodic deterministic interferences [11055-56]
•	11055 1D	Analysis of main beam adaptive beamforming effect on accuracy of monopulse angle estimation in jammed environment [11055-58]
	11055 1E	Analysis of using a MicroBlaze processor for hardware implementation of algorithms for data processing in electronic recognition devices and systems based on the example of a XILINX FPGA system [11055-59]
•	11055 1F	Location errors of directional emitters in AOA system for non-line-of-sight conditions [11055-60]
•	11055 1G	SDN implementation in regard to network elements security [11055-67]
•	11055 1H	The idea of hidden data layer in software defined network [11055-68]