PROCEEDINGS OF SPIE

Defense Transformation and Net-Centric Systems 2012

Raja Suresh
Editor

24–25 April 2012
Baltimore, Maryland, United States

Sponsored and Published by
SPIE

Volume 8405

Proceedings of SPIE, 0277-786X, v. 8405

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

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 *Defense Transformation and Net-Centric Systems 2012*, edited by Raja Suresh, Proceedings of SPIE Vol. 8405 (SPIE, Bellingham, WA, 2012) Article CID Number.

ISSN 0277-786X
ISBN 9780819490834

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 © 2012, 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/12/$18.00.

Printed in the United States of America.

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

SPIEDigitalLibrary.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

v *Conference Committee*
vii *Introduction*

NET-CENTRIC ARCHITECTURES AND SYSTEMS

8405 02 **Defining and using open architecture levels (Invited Paper)** [8405-01]
M. A. Cramer, U.S. Navy (United States); A. W. Morrison, Metron, Inc. (United States); B. Cordes, Naval Surface Warfare Ctr. (United States); J. R. Stack, Office of Naval Research (United States)

8405 03 **Models and algorithms for determining inter-unit network demand** [8405-02]
J. P. Ridder, S. W. Brett, Evidence Based Research, Inc. (United States); C. M. Burris, J. G. McEver, J. E. O'Donnel, The Johns Hopkins Univ. Applied Physics Lab. (United States); D. T. Signori, Evidence Based Research, Inc. (United States); H. W. Schoenborn, Office of the Secretary of Defense (United States)

8405 04 **A flexible tool for scenario analysis of network demand** [8405-03]
J. E. O'Donnel, The Johns Hopkins Univ. Applied Physics Lab. (United States); A. S. George, D. M. Wynn, S. W. Brett, J. P. Ridder, D. T. Signori, Evidence Based Research, Inc. (United States); H. W. Schoenborn, Office of the Secretary of Defense (United States)

8405 05 **The Ozone Widget Framework: towards modularity of C2 human interfaces** [8405-04]
D. B. Hellar, L. C. Vega, Next Century Corp. (United States)

8405 06 **Military clouds: utilization of cloud computing systems at the battlefield** [8405-05]
S. Süleyman, K. Volkan, K. İbrahim, Ş. Ahmet, Air War College (Turkey)

8405 07 **Overcoming the challenges of secure mobile applications for network-centric, data-sensitive applications** [8405-06]
B. S. Farroha, D. L. Farroha, U.S. Dept. of Defense (United States)

8405 08 **Securing services in the cloud: an investigation of the threats and the mitigations** [8405-07]
B. S. Farroha, D. L. Farroha, U.S. Dept. of Defense (United States)

8405 09 **A framework for developing reliable corporate services in an agile environment** [8405-08]
D. L. Farroha, B. S. Farroha, U.S. Dept. of Defense (United States)

8405 0A **Modeling socio-cultural processes in network-centric environments** [8405-09]
E. E. Santos, Univ. of Texas at El Paso (United States); E. Santos, Jr., Thayer School of Engineering at Dartmouth (United States); J. Korah, R. George, Univ. of Texas at El Paso (United States); Q. Gu, K. Kim, D. Li, J. Russell, Thayer School of Engineering at Dartmouth (United States); S. Subramanian, Univ. of Texas at El Paso (United States)

COMMUNICATIONS AND NETWORKS

8405 0B **Protection without detection: a threat mitigation technique** [8405-10]
J. White, J. R. McCoy, Everis, Inc. (United States); P. Ratazzi, Air Force Research Lab. (United States)

8405 0C **Dynamic routing control in heterogeneous tactical networks with multiple traffic priorities** [8405-11]
M. A. Fecko, L. Wong, J. Kang, A. Cichocki, V. Kaul, S. Samtani, Applied Communication Sciences (United States)

8405 0D **Proactive and adaptive reconfiguration for reliable communication in tactical networks** [8405-12]
H. Zeng, K. J. Kwak, J. Deng, Intelligent Automation, Inc. (United States); B. Fu, Y. Xiao, The Univ. of Alabama (United States); J. Jeski, US Army CECOM (United States)

8405 0E **Addressing security, collaboration, and usability with tactical edge mobile devices and strategic cloud-based systems** [8405-13]
C. J. Graham, Raytheon Co. (United States)

8405 0F **A decision and utility theory construct for dynamic spectrum access systems** [8405-14]
T. W. Martin, K.-C. Chang, George Mason Univ. (United States)

8405 0G **Information dissemination in disadvantaged wireless communications using a data dissemination service and content data network** [8405-15]
M. Gillen, J. Loyall, K. Zita Haigh, R. Walsh, C. Partridge, G. Lauer, T. Strayer, Raytheon BBN Technologies (United States)

WIDE AREA PERSISTENT ISR AND NETWORKED SENSORS I: JOINT SESSION WITH CONFERENCE 8389

8405 0I **Advanced thermal management technologies for defense electronics (Invited Paper)** [8405-17]
K. P. Bloschock, System Planning Corp. (United States); A. Bar-Cohen, Defense Advanced Research Projects Agency (United States)

WIDE AREA PERSISTENT ISR AND NETWORKED SENSORS II: JOINT SESSION WITH CONFERENCE 8389

8405 0J **Wide area persistent surveillance with no gimbal** [8405-18]
G. Egnal, Argusight, Inc. (United States)

8405 0L **Kestrel: force protection and Intelligence, Surveillance, and Reconnaissance (ISR) persistent surveillance on aerostats** [8405-20]
D. R. Luber, J. E. Marion, D. Fields, Logos Technologies, Inc. (United States)

Author Index

Conference Committee

Symposium Chair

Kevin P. Meiners, Office of the Secretary of Defense (United States)

Symposium Cochair

Kenneth R. Israel, Lockheed Martin Corporation (United States)

Conference Chair

Raja Suresh, General Dynamics Advanced Information Systems (United States)

Program Committee

Vasu D. Chakravarthy, Air Force Research Laboratory (United States)
John S. Eicke, U.S. Army Research Laboratory (United States)
Bassam S. Farroha, U.S. Department of Defense (United States)
Deborah L. Farroha, U.S. Department of Defense (United States)
Paul Gaertner, Embassy of Australia (United States)
Gayle D. Grant, U.S. Army Communications-Electronics Command (United States)
Michael A. Kolodny, U.S. Army Research Laboratory (United States)
Leo J. Rose, U.S. Air Force (United States)
Larry B. Stotts, Defense Advanced Research Projects Agency (United States)
Venkataraman Sundareswaran, Teledyne Scientific Company (United States)
Guy Vézina, Defence Research and Development Canada, Valcartier (Canada)

Session Chairs

1 Net-Centric Architectures and Systems
Raja Suresh, General Dynamics Advanced Information Systems (United States)
Deborah L. Farroha, U.S. Department of Defense (United States)

2 Communications and Networks
Raja Suresh, General Dynamics Advanced Information Systems (United States)
Deborah L. Farroha, U.S. Department of Defense (United States)

3 Multi-Robot Control: Joint Session with Conference 8387
Raja Suresh, General Dynamics Advanced Information Systems (United States)
Grant R. Gerhart, U.S. Army Tank Automotive Research, Development and Engineering Center (Retired) (United States)

4 Wide Area Persistent ISR and Networked Sensors I: Joint Session with Conference 8389
Raja Suresh, General Dynamics Advanced Information Systems (United States)
Tien Pham, U.S. Army Research Laboratory (United States)

5 Wide Area Persistent ISR and Networked Sensors II: Joint Session with Conference 8389
Raja Suresh, General Dynamics Advanced Information Systems (United States)
Tien Pham, U.S. Army Research Laboratory (United States)

Introduction

These are the proceedings of the seventeenth Defense Transformation and Net-centric Systems conference. The papers presented at the conference strongly reflected the inexorable trend towards net-centric systems and multi-INT layered sensing architectures. The conference included the following joint sessions:

1. Self-organizing Collaborative Unmanned ISR Robotic Teams, held jointly with the Unmanned Systems Technology conference. Collaborative autonomous systems portend the increasing use of autonomic sensor and shooter platforms to perform the D3 (Dirty, Dull and Dangerous) missions in an era of declining force structures.
2. Sensor Networks and Wide Area Persistent Surveillance, held jointly with the Ground/Air Multi-sensor Interoperability, Integration, and Networking for Persistent ISR conference.

The conference also included invited papers by Dr. Megan Cramer, et al (US Navy) on levels of openness in Open Architecture Systems, and by Dr. Avram Bar-Cohen, et al (DARPA) on thermal management technologies for low SWaP electronic packages.

Looking ahead, we expect Net-centric systems to increasingly focus on Open Architectures (OA) and Open Business Models (OBM). Such OA/OBM systems seek to mimic the successful PC industry and hold the promise to dramatically reduce the acquisition and life cycle costs of military systems, and tremendously accelerate the rate of technology refresh in military systems.

It is gratifying to see the high level of audience interest in this conference. Particularly gratifying is the fact that this conference has resulted in the "spin-off" of several new conferences at SPIE. My sincere thanks to the distinguished invited speakers, authors, attendees, and my associates on the program committee for another successful conference.

Raja Suresh