PROCEEDINGS OF SPIE

Technologies for Synthetic Environments: Hardware-in-the-Loop XVII

James A. Buford, Jr. R. Lee Murrer, Jr. Gary H. Ballard Editors

25–26 April 2012 Baltimore, Maryland, United States

Sponsored and Published by SPIE

Volume 8356

Proceedings of SPIE, 0277-786X, v. 8356

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

Technologies for Synthetic Environments: Hardware-in-the-Loop XVII, edited by James A. Buford Jr., R. Lee Murrer Jr., Gary H. Ballard, Proc. of SPIE Vol. 8356, 835601 © 2012 SPIE · CCC code: 0277-786X/12/\$18 · doi: 10.1117/12.934821

Proc. of SPIE Vol. 8356 835601-1

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 Technologies for Synthetic Environments: Hardware-in-the-Loop XVII, edited by James A. Buford, Jr., R. Lee Murrer, Jr., Gary H. Ballard, Proceedings of SPIE Vol. 8356 (SPIE, Bellingham, WA, 2012) Article CID Number.

ISSN 0277-786X ISBN 9780819490346

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

SESSION 1 IR SCENE PROJECTORS

- 8356 02 Spectral shift of infrared LEDs and resistive sources [8356-01] M. L. Fedde, H. S. Lowry, J. H. Mansfield, Aerospace Testing Alliance (United States)
- 8356 03 Contrast analysis for DMD-based IR scene projector [8356-02] J. Rentz Dupuis, D. J. Mansur, S. Grant, S. P. Newbry, OPTRA, Inc. (United States)
- 8356 04 Large-scale silicon photonic infrared scene projector by down conversion [8356-03] V. K. Malyutenko, V. Lashkaryov Institute of Semiconductor Physics (Ukraine)
- 8356 05 **Performance of bottom emitting isolated LWIR LED devices for IR scene projection** [8356-04] N. C. Das, U.S. Army Research Lab. (United States)
- Bassed Large format IR scene projection technology
 [8356-08]
 J. A. Wilson, Cyan Systems (United States); B. Burckel, Sandia National Labs. (United States);
 J. Caulfield, Cyan Systems (United States); S. Cogan, M. Massie, Nova Teledyne (United States);
 R. Rapp, R. Rose, D. Snyder, Air Force Research Lab. (United States)
- 8356 0A Liquid crystal on silicon (LCOS) devices and their application to scene projection [8356-09]
 T. Ewing, J. Buck, S. Serati, A. Linnenberger, H. Masterson, J. Stockley, Boulder Nonlinear Systems, Inc. (United States)

SESSION 2 RESISTOR ARRAY PROJECTORS

- 8356 0D A hybrid approach to non-uniformity correction of large format emitter arrays [8356-12] J. LaVeigne, M. Prewarski, G. Franks, S. McHugh, Santa Barbara Infrared, Inc. (United States)
- 8356 OE Ultra high temperature (UHT) infrared scene projector system development status [8356-13]
 K. Sparkman, J. LaVeigne, S. McHugh, Santa Barbara Infrared, Inc. (United States);
 J. Lannon, S. Goodwin, RTI International (United States)
- 8356 OF **Radical rise-time enhancement of a resistive IRSP array** [8356-14] G. Franks, J. LaVeigne, S. McHugh, Santa Barbara Infrared, Inc. (United States)
- 8356 OG **Design considerations for a high-temperature, high-dynamic range IRSP** [8356-15] J. LaVeigne, Santa Barbara Infrared, Inc. (United States); B. Sieglinger, MacAulay-Brown, Inc. (United States)

SESSION 3 FACILITIES, SCENE GENERATION, AND FLIGHT SIMULATORS

- 8356 OK Scene projection technology development for imaging sensor testing at AEDC [8356-19] H. Lowry, M. Fedde, D. Crider, H. Horne, K. Bynum, S. Steely, J. Labello, Aerospace Testing Alliance (United States)
- 8356 OL Application of scene projection technologies at the AMRDEC SSDD HWIL facilities [8356-20] J. P. Gareri, Simulation Technologies, Inc. (United States); G. H. Ballard, J. W. Morris, U.S. Army Aviation & Missile Research, Development and Engineering Ctr. (United States); D. Bunfield, The AEgis Technologies Group, Inc. (United States); D. Saylor, Optical Sciences Corp. (United States)
- 8356 0M Infrared projector optical system characterisation and its application to nonuniformity correction [8356-21]
 L. Swierkowski, R. A. Joyce, C. L. Christie, Defence Science and Technology Organisation (Australia)
- 8356 0N **Performance parameters in the design of flight motion simulators** [8356-22] R. W. Mitchell, Ideal Aerosmith, Inc. (United States)
- 8356 00 Common hardware-in-the-loop framework development [8356-23]
 H. Kim, U.S. Army Aviation & Missile Research, Development and Engineering Ctr. (United States); R. Billings, WideBand Corp. (United States); R. D. Mohlere, Simulation Technologies Inc. (United States); S. G. Moss, The AEgis Technologies Group, Inc. (United States); C. B. Naumann, Optical Sciences Corp. (United States)

Author Index

Conference Committee

Symposium Chairs

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

Symposium Chairs

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

Conference Chair

James A. Buford, Jr., U.S. Army Aviation and Missile Research Development and Engineering Center (United States)

Conference Cochairs

R. Lee Murrer, Jr., Millennium Engineering and Integration Company (United States)

Gary H. Ballard, U.S. Army Aviation and Missile Research Development and Engineering Center (United States)

Program Committee

James A. Annos, Naval Air Warfare Center Weapons Division (United States) David B. Beasley, Optical Sciences Corporation (United States) Dennis H. Bunfield, The AEgis Technologies Group, Inc. (United States) Raul Fainchtein, The Johns Hopkins University Applied Physics Laboratory (United States) Kevin Fisher, ACUTRONIC Switzerland Ltd. (Switzerland) William L. Herald, MacAulay Brown Inc. (United States) Hajin J. Kim, U.S. Army Aviation and Missile Research Development and Engineering Center (United States) John M. Lannon, Jr., RTI International (United States) **Heard Lowry**, Aerospace Testing Alliance (United States) William M. Lowry, U.S. Army Redstone Technical Test Center (United States) Robert W. Mitchell, Ideal Aerosmith, Inc. (United States) Scott B. Mobley, U.S. Army Aviation and Missile Research Development and Engineering Center (United States) **Ronald J. Rapp**, Air Force Research Laboratory (United States) Richard M. Robinson, The AEgis Technologies Group, Inc. (United States) **Donald R. Snyder**, Air Force Research Laboratory (United States)

Florence C. Solomon, U.S. Air Force (United States)

- Leszek Swierkowski, Defence Science and Technology Organisation (Australia)
- **Owen M. Williams**, Defence Science and Technology Organisation (Australia)
- Brian K. Woode, Naval Air Warfare Center Aircraft Division (United States)
- Mark Umansky, U.S. Army Aviation and Missile Command (United States)

Session Chairs

 IR Scene Projectors
 Heard Lowry, Aerospace Testing Alliance-Arnold Engineering Development Center (United States)
 Robert W. Mitchell, Ideal Aerosmith, Inc. (United States)
 Gary H. Ballard, U.S. Army Aviation and Missile Research Development and Engineering Center (United States)

2 Resistor Array Projectors

 Raul Fainchtein, The Johns Hopkins University Applied Physics Laboratory (United States)
 David B. Beasley, Optical Sciences Corporation (United States)
 James A. Buford, Jr., U.S. Army Aviation and Missile Research Development and Engineering Center (United States)
 Brian K. Woode, Naval Air Warfare Center Aircraft Division (United States)

 Facilities, Scene Generation, and Flight Simulators
 Kevin Fisher, ACUTRONIC Switzerland Ltd. (Switzerland)
 Richard M. Robinson, The AEgis Technologies Group, Inc. (United States)
 Leszek Swierkowski, Defence Science and Technology Organisation (Australia)