

PROCEEDINGS OF SPIE

***Optical Technologies for Arming,
Safing, Fuzing, and Firing IV***

Fred M. Dickey
Richard A. Beyer
Editors

13–14 August 2008
San Diego, California, USA

Sponsored and Published by
SPIE

Volume 7070

Proceedings of SPIE, 0277-786X, v. 7070

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 *Optical Technologies for Arming, Safing, Fuzing, and Firing IV*, edited by Fred M. Dickey, Richard A. Beyer, Proceedings of SPIE Vol. 7070 (SPIE, Bellingham, WA, 2008) Article CID Number.

ISSN 0277-786X
ISBN 9780819472908

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 © 2008, 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/08/\$18.00.

Printed in the United States of America.

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

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 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 INITIATION

- 7070 02 **An evaluation of the T-6A Texan (JPATS) functional performance of the CFIS laser assemblies (Invited Paper)** [7070-01]
T. J. Blachowski, G. Eccard, Naval Surface Warfare Ctr. (United States)
- 7070 03 **Small-scale laser ignition of a transparent liquid propellant** [7070-02]
R. A. Beyer, Army Research Lab. (United States)
- 7070 04 **Determination of critical energy criteria for hexanitrostilbene using laser-driven flyer plates** [7070-03]
M. D. Bowden, M. P. Maisey, Atomic Weapons Establishment (United Kingdom)
- 7070 05 **Beam shaping for laser initiated optical primers** [7070-04]
T. E. Lizotte, Hitachi Via Mechanics USA, Inc. (United States)
- 7070 06 **A comparison of two prototype laser-optical firing systems** [7070-05]
G. L. Morelli, M. R. Bright, Honeywell Federal Manufacturing & Technologies (United States)
- 7070 08 **Large quartz crystals for high power optical and laser applications** [7070-33]
V. A. Klipov, Sawyer Technical Materials LLC (United States)

SESSION 2 HARSH ENVIRONMENTS I

- 7070 09 **Applications of optical fiber assemblies in harsh environments: the journey past, present, and future (Invited Paper)** [7070-08]
M. N. Ott, NASA Goddard Space Flight Ctr. (United States); F. LaRocca, W. J. Thomes, R. Switzer, R. Chuska, S. Macmurphy, MEI Technologies (United States)
- 7070 0A **Vibration performance comparison study on current fiber optic connector technologies (Invited Paper)** [7070-07]
W. J. Thomes, Jr., F. V. LaRocca, R. C. Switzer, MEI Technologies/NASA Goddard Space Flight Ctr. (United States); M. N. Ott, NASA Goddard Space Flight Ctr. (United States); R. F. Chuska, S. L. Macmurphy, MEI Technologies/NASA Goddard Space Flight Ctr. (United States)
- 7070 0B **Fiber optic cable thermal preparation to ensure stable operation** [7070-09]
W. J. Thomes, Jr., R. F. Chuska, MEI Technologies/NASA Goddard Space Flight Ctr. (United States); M. N. Ott, NASA Goddard Flight Ctr. (United States); F. V. LaRocca, R. C. Switzer, S. L. Macmurphy, MEI Technologies/NASA Goddard Space Flight Ctr. (United States)
- 7070 0C **Lightning vulnerability of fiber-optic cables** [7070-10]
L. E. Martinez, M. Caldwell, Sandia National Labs. (United States)

SESSION 3 HARSH ENVIRONMENTS II

- 7070 OD **An assessment of a variety of optical fibers in ionizing radiation environments for use in a high-power optical system** [7070-11]
M. C. Cheeseman, M. D. Bowden, Atomic Weapons Establishment (United Kingdom)
- 7070 OE **Radiation effects on laser diodes: a literary review** [7070-12]
S. L. Waterhouse, K. K. Jobbins, Atomic Weapons Establishment plc (United Kingdom)
- 7070 OF **Permanent and transient response of Nd:YAG and Cr:YAG to ionizing radiation** [7070-13]
B. L. Glebov, K. Simmons-Potter, Univ. of Arizona (United States); D. C. Meister, Sandia National Labs. (United States)
- 7070 OG **Post mortem results of laser-optical system packaged for use in harsh environments** [7070-14]
M. R. Bright, NNSA's Kansas City Plant (United States)

SESSION 4 LASERS AND APPLICATIONS I

- 7070 OH **Beam shaping diffractive optical elements for high power laser applications** [7070-15]
A. J. Waddie, A. J. Caley, M. R. Taghizadeh, Heriot-Watt Univ. (United Kingdom);
K. K. Jobbins, Atomic Weapons Establishment plc (United Kingdom)
- 7070 OI **Remote triggering of high voltage systems by laser-induced plasmas** [7070-16]
N. J. West, I. R. Jandrell, Univ. of the Witwatersrand (South Africa); A. Forbes, CSIR/NLC (South Africa) and Univ. of KwaZulu-Natal (South Africa)
- 7070 OJ **Use of fiber optic tapers to increase connector tolerance for DOI systems** [7070-17]
M. D. Bowden, Atomic Weapons Establishment (United Kingdom)
- 7070 OK **Forensic firearm identification of semiautomatic handguns using laser formed microstamping elements** [7070-18]
T. E. Lizotte, O. Ohar, Pivotal Development Co. (United States)

SESSION 5 LASERS AND APPLICATIONS II

- 7070 OL **Porro prism lasers: a new perspective** [7070-19]
L. Burger, A. Forbes, CSIR National Laser Ctr. (South Africa) and Univ. of Kwazulu-Natal (South Africa)
- 7070 OM **Dynamics of flashlamp pumping a Nd:Cr:GSGG laser** [7070-20]
M. V. Pack, P. A. Miller, J. Shelton, Sandia National Lab. (United States)
- 7070 ON **Power scaling of passively phased fiber amplifier arrays** [7070-21]
S. A. Shakir, B. Culver, B. Nelson, Y. Starcher, Northrop Grumman, NGIT/DES (United States);
G. M. Bates, J. W. Hedrick, Jr., Northrop Grumman, NGES (United States)
- 7070 OO **System response in passively phased fiber amplifier arrays** [7070-22]
S. A. Shakir, B. Culver, B. Nelson, Y. Starcher, Northrop Grumman, NGIT/DES (United States);
G. M. Bates, J. W. Hedrick, Jr., Northrop Grumman, NGES (United States)

SESSION 6 DIAGNOSTICS AND SENSORS

- 7070 OP **Characterization of detonator performance using photonic Doppler velocimetry (Invited Paper)** [7070-25]
M. P. Maisey, M. D. Bowden, Atomic Weapons Establishment (United Kingdom)
- 7070 OR **Series connected photovoltaic array performance under non-uniform illumination** [7070-32]
J. W. Shelton, F. M. Dickey, Sandia National Labs. (United States); S. Krishna, The Univ. of New Mexico (United States)
- 7070 OS **Vibrational spectroscopy of HNS degradation** [7070-26]
M. K. Alam, L. Martin, R. L. Schmitt, G. A. Ten Eyck, E. Welle, Sandia National Labs. (United States)
- 7070 OT **Fiber-optic current sensors based on polarization coherence and power scattering in magneto-optical films** [7070-27]
A. Y. Hsu, A. M. Robinson, R. W. Cernosek, Sandia National Labs. (United States)
- 7070 OU **Packaging and thermal management of photovoltaic cells for high-power applications** [7070-28]
J. A. Humphries, Honeywell Federal Manufacturing & Technologies (United States)
- 7070 OV **VCSEL-based microsensors for photonic proximity fuzing of munitions** [7070-29]
G. A. Keeler, A. Mar, K. M. Geib, A. Y. Hsu, D. K. Serkland, G. M. Peake, Sandia National Labs. (United States)

POSTER SESSION

- 7070 OX **In-situ strain monitoring in liquid containers of LNG transporting carriers** [7070-31]
M.-C. Oh, J.-K. Seo, K.-J. Kim, S.-M. Lee, M.-H. Kim, Pusan National Univ. (Korea, Republic of)

Author Index

Conference Committee

Program Track Chair

José M. Sasian, College of Optical Sciences, The University of Arizona
(United States)

Conference Chairs

Fred M. Dickey, Sandia National Laboratories (United States)
Richard A. Beyer, Army Research Laboratory (United States)

Program Committee

Adrian A. Akinci, Los Alamos National Laboratory (United States)
Ron Bechtold, Alfalight, Inc. (United States)
Thomas J. Blachowski, Naval Surface Warfare Center (United States)
Mike D. Bowden, Atomic Weapons Establishment (United Kingdom)
David P. Bour, Photodigm, Inc. (United States)
David W. Ewick, Ensign-Bickford Aerospace & Defense Company
(United States)
Andrew Forbes, Council for Scientific and Industrial Research (South
Africa)
Everett S. Hafenrichter, Sandia National Laboratories (United States)
Christopher R. Hardy, Kigre, Inc. (United States)
Keren K. Jobbins, Atomic Weapons Establishment (United Kingdom)
Todd E. Lizotte, Hitachi Via Mechanics USA, Inc. (United States)
Stephen R. Lerner, Tyco Electronics Corporation (United States)
Keith L. Lewis, Electro Magnetic Remote Sensing Defence Technology
Center (United Kingdom)
Mikhail Maiorov, Akela Laser Corporation (United States)
Robert V. McDaniel, Kollsman, Inc. (United States)
Gregg Leo Morelli, Honeywell Federal Manufacturing & Technologies
(United States)
Barry T. Neyer, Perkin Elmer Optoelectronics (United States)
Adam Parker, QinetiQ Ltd. (United Kingdom)
Alex Rosiewicz, EM4, Inc. (United States)
Raymond J. Silva, BAE Systems North America (United States)
Kelly Simmons-Potter, The University of Arizona (United States)
Bolesh J. Skutnik, CeramOptec Industries, Inc. (United States)
Gabriel L. Smith, U.S. Army Research, Development and Engineering
Command (United States)
John G. Smith, MEMS Optical, Inc. (United States)
Donald R. Snyder, Air Force Research Laboratory (United States)

Louis S. Weichman, Sandia National Laboratories (United States)
James A. Wilder, Jr., Sandia National Laboratories (United States)

Session Chairs

- 1 Initiation
Todd E. Lizotte, Hitachi Via Mechanics USA, Inc. (United States)
- 2 Harsh Environments I
Richard A. Beyer, Army Research Laboratory (United States)
- 3 Harsh Environments II
Richard A. Beyer, Army Research Laboratory (United States)
- 4 Lasers and Applications I
Mike D. Bowden, Atomic Weapons Establishment (United Kingdom)
- 5 Lasers and Applications II
Mike D. Bowden, Atomic Weapons Establishment (United Kingdom)
- 6 Diagnostics and Sensors
Gregg Leo Morelli, Honeywell Federal Manufacturing & Technologies
(United States)