PROCEEDINGS OF SPIE

Infrared Remote Sensing and Instrumentation XXIV

Marija Strojnik
Editor

29–30 August 2016
San Diego, California, United States

Sponsored and Published by
SPIE

Volume 9973

Proceedings of SPIE 0277-786X, V. 9973

Infrared Remote Sensing and Instrumentation XXIV, edited by Marija Strojnik, Proc. of SPIE
Vol. 9973, 997301 · © 2016 SPIE · CCC code: 0277-786X/16/$18 · doi: 10.1117/12.2260575

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 *Infrared Remote Sensing and Instrumentation XXIV*, edited by Marija Strojnik, Proceedings of SPIE Vol. 9973 (SPIE, Bellingham, WA, 2016) Six-digit Article CID Number.

ISSN: 0277-786X
ISSN: 1996-756X (electronic)
ISBN: 9781510603370
ISBN: 9781510603387 (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
SPIE.org

Printed in the United States of America.

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

SPIE. DIGITAL LIBRARY
SPIEDigitalLibrary.org

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 six-digit CID article numbering system structured as follows:

- 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.

Contents

Authors

Numbers in the index correspond to the last two digits of the six-digit citation identifier (CID) article numbering system used in Proceedings of SPIE. The first four digits reflect the volume number. Base 36 numbering is employed for the last two digits and indicates the order of articles within the volume. Numbers start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B...0Z, followed by 10-1Z, 20-2Z, etc.

Conference Committee

Program Track Chair

Allen H.-L. Huang, University of Wisconsin-Madison (United States)

Conference Chair

Marija Strojnik, Centro de Investigaciones en Óptica, A.C. (Mexico)

Conference Program Committee

Gabriele E. Arnold, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany)
Gerald T. Fraser, National Institute of Standards and Technology (United States)
Sarath D. Gunapala, Jet Propulsion Laboratory (United States)
Maureen L. Savage, SOFIA / USRA (United States)
Stanley J. Wellard, Space Dynamics Laboratory (United States)

Session Chairs

1 Advances in Detector Technology and Materials for Space Exploration
Sven Höfling, Julius-Maximilians-Universität Würzburg (Germany)
Sarath D. Gunapala, Jet Propulsion Laboratory (United States)

2 IR Instruments and Calibration
Marija Strojnik, Centro de Investigaciones en Óptica, A.C. (Mexico)

3 SOFIA's Engineering Advances in the Last 20 Years
Eric Becklin, SOFIA / USRA (United States)

4 Planetary and Comet Exploration
Gabriele E. Arnold, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany)
Marija Strojnik, Centro de Investigaciones en Óptica, A.C. (Mexico)

Introduction

This year, the conference on IR Remote Sensing and Instrumentation XXIV was held again in San Diego, California, 29-30 August. It is part of the conference that has traditionally been known as the Annual Meeting. As we are approaching the twenty-fifth conference in this series, to be held next year (2017) the first week of August, it is probably appropriate to reflect on many changes that we have experienced. During the first few years, while we were still the only conference in the Remote Sensing track, we were growing every year eventually spanning four conference days regularly by the end of the first decade. Then, the Remote Sensing track grew by increasing the number of conferences, while we started losing participants, both speakers and audience, to other conferences.

The conference size during the last decade has basically stabilized at two days even though it fluctuates around this number. Last year it was actually three days when we brought in many scientists who study surfaces both to include radiative absorption and radiative cooling in support of wiser utilization of non-renewable energy. This year many of our invited speakers from last year's conference were featured in the ever more important nanotechnology part of the conference program. This year, the conference included 34 talks, with some more conveniently presented in a poster format. Thirty presenters were able to include their reports in time for inclusion for the publication of these proceedings. The rest will seek other opportunities to have their printed work made available to a wider international audience.

Over the years our conference has become quite established as an instrumentation conference bringing scientists and engineers to report on significant developments within their areas of endeavor. This year we had four sessions dealing with diverse missions and technological development in support of future missions. The conference was opened with a session on detectors, an important instrumentation development in support of space exploration. The title of the first session was, Advances in Detector Technology and Space Exploration. Dr. Sven Hoffling, from Julius-Maximilians University in Wurzburg, Germany, chaired the first half of the session. Dr. Sarath D. Gunapala, from the NASA Jet Propulsion Laboratory, United States, conducted the second half of the detector session. Both hardworking chairs enthusiastically committed themselves to participating next year by organizing two full, expanded sessions, the first session dealing with advances in detector technology and the second one focusing on mid-infrared lasers for communications.

The 2nd session was going to be chaired by a colleague from Purdue University who last year presented an invited talk and mentioned that chairing sessions is helpful to his career. As he is additionally a pleasant and talkative engineer, it seemed a great idea to assign him chairmanship of this session. The conference

chair was added as a second chair, because in the design of the space instrumentation, we always strive to have redundancy…just in case the first path or a primary component fails. Nothing actually failed. The programmed chair was invited to deliver a plenary address during his session, and there was no time to add another session chair before the conference program went to print. The conference chair was selected by default to conduct this session, titled IR Instruments and Calibration.

The SOFIA mission was the crown jewel of the conference this year, offered as the third session. The SOFIA program used to have dedicated sessions at Infrared Remote Sensing conferences during the nineties, while it was still in the early development stages. After the successful demonstration of its performance, its successes were reported at astronomy conferences. The participants at our conference would hear about the status report, usually presented by some key participant. Fifteen years after the initial mission demonstration, various instruments are being replaced, more modern technology has been implemented in key modules, and so the upgraded engineering was reported in this year's session. This historical perspective landed the title to the session, SOFIA's Engineering Advances in the Last 20 Years. Ms. Maureen Savage actually organized the session, but was called away on urgent business during the conference. Dr. Eric Becklin, from SOFIA management at USRA, at the NASA Ames, stepped in smoothly to run the conference as if planned.

Another challenge was awaiting the chair in the last session on Planetary and Comet Exploration. Both chairs experienced health issues and were forbidden to travel due to their delicate situations. After the start of the conference, the second chair experienced unexpected issues, so the management of the session fell on the conference chair. As the audience was anxiously awaiting current results from the Rosetta mission dealing with the comet exploration and research findings, Dr. Gabriel Arnold kindly sent her presentation in the pdf format for the chair to deliver in her place. This was just to give a small preview of what we can expect next year after a second major research effort is accomplished toward the end of September 2016. The presentation was so well prepared that the audience could appreciate the significant advances despite the presenter's short preparation time on the subject. We might consider sending complete presentations to the chair earlier so that she can study the presentation in detail when a conflict schedule in travel might be encountered in the future. Considering the sequence of unfortunate consequences that is only matched by unmanned space travel we are pleased with the overall outcome. We are currently planning on an expanded session on comet and planetary exploration during the conference in August 2017.

I wish to express my appreciation to the chairs, authors, presenters, and the audience for providing such an interesting and lively exchange. There were always more questions than time allotted, and the conversations often extended into the breaks and visits to the exhibition. Technical interchanges will continue also through

e-mail, and during the next conference, which is only short ten months away, 6-10, August 2017.

Special thanks are also due to the SPIE staff that works first to organize everything in support of the conference, assuring that at the end it is as smooth-running always. A few weeks before the conference, the editor starts working on the proceedings papers so that they may be uploaded to the SPIE website within a few short weeks, two to three usually, for world-wide availability.

Marija Strojnik