

PROCEEDINGS OF SPIE

***Optics and Photonics for  
Counterterrorism, Crime Fighting and  
Defence IX; and Optical Materials  
and Biomaterials in Security and  
Defence Systems Technology X***

**Douglas Burgess  
Gari Owen  
Roberto Zamboni  
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Attila A. Szep**  
*Editors*

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- 1 Detection and Recognition of Dangerous Materials I  
**Douglas Burgess**, Burgess Consulting (United Kingdom)

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**Douglas Burgess**, Burgess Consulting (United Kingdom)
- 3 Identifying Suspicious Activity I  
**Andrew Powell**, SASD, Ministry of Defence (United Kingdom)
- 4 Identifying Suspicious Activity II  
**Gillian F. Marshall**, QinetiQ Ltd. (United Kingdom)

Panel Discussion: What identifies a terrorist - recognising their faces or understanding what they are doing?

**Douglas Burgess** (*Moderator*), Burgess Consulting (United Kingdom)

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## **Introduction to Part A: Optics and Photonics for Counterterrorism, Crime Fighting and Defence IX**

Welcome to the proceedings of the 2013 conference 8901-A on Optics and Photonics for Counterterrorism, Crime Fighting and Defence. We dedicated the conference to the memory of Professor Colin Lewis who died recently, and who had led this conference series since its start in 2004.

The conference concentrated on two themes. The first was the detection and identification of dangerous and suspicious materials and substances, including weapons; the second was watching and interpreting the actions of people caught on cameras. Detection and identification then separated into two parts: we call these screening when the area is sterile, uncontaminated or controlled, and sensing when the user has no control over environments at greater distances. In parallel with the presentations there was a strong set of posters on topics ranging from improvements to detectors up to the installation and evaluation of equipment to counter naval piracy. We were particularly pleased to welcome researchers from as far away as Argentina who had been sponsored by SPIE to attend the conference.

In the dangerous materials theme we began with papers describing screening techniques that could be used at short range, up to a metre or so. We learned of developments in the detection of explosives left as residues on surfaces, of solutions to the threat at airports from bottled liquid explosives, how THz frequencies could be used to sense the contents of packages, and how X-ray baggage screeners could be trained using artificially - created threat images. A presentation on the isomers of uranium oxide showed that sometimes we don't fully understand the true composition of such dangerous materials. But when we do, we learned how detector numbers could be reduced if only the crucial wavelengths were sensed. When there is a need for a wider area threat alert, we learned how lidar and laser induced fluorescence techniques could be combined to provide a timely warning of clouds of biological materials.

With so much imagery being captured from installed security cameras, automatic techniques to help operators find and track people behaving suspiciously are essential. Presentations included detecting people, extracting their movements, pose and gait, and using such measures to classify their threat level. We learned how better to understand what is happening by observing eye reflections to discover what people are looking at, and by interpreting their lip movements to learn what they are saying.

We concluded the conference with an open discussion on how to identify a terrorist from TV images – is it recognising their faces (from a database) or

understanding (from TV imagery) what they are doing. We highlighted the uncertainty in defining what type of activity constituted a threat, and recognised that optical sensing technologies and the interpretation of imagery were not the complete solution for alerting security staff to a terrorist bent on exploding his concealed bomb. Could a warning of changes in behaviour from healthcare professionals alert security staff to people who might pose a new threat? We concluded that these problems and their solutions require a multidisciplinary approach of which optics and photonics is a key element along with human sciences.

If you came to the 2013 conference, or if you are reading this book or CD and wished you'd been there, or feel you can contribute to next year's event, then please note that we shall be meeting in Amsterdam in September 2014.

**Douglas Burgess**  
**Gari Owen**