

ISPRS Technical Commission V
Close-Range Sensing: Analysis and Applications

President: Jon Mills (UK)
Secretary: David Barber (UK)

Commission Website: <http://www.commission5.isprs.org/>

1. 2011 Report of Commission V President

A. State of science and technology of Commission V topics

The individual WG reports below document the ongoing scientific and technological progress being made in the different fields of Commission V activity (note, ICWG I/V's report can be found in the Commission I Annual Report).

B. Accomplishments of Commission V during 2011

It has been an active year for Technical Commission V, with WG officers and members engaged in a wide variety of events and projects, as outlined in the individual WG reports provided below. The Commission President has served on a number of scientific programme committees over the last year. He has also had the pleasure of attending and presenting at two of the main TC V-led events of the year, the WG V/4 Joint Workshop on 3D City Modelling and Applications in Wuhan, China, in June, and the WG V/2 conference on Cultural Heritage Data Acquisition and Processing in York, UK, in August. The special issue of the Photogrammetric Record, based on the best papers delivered at the 2010 TC V Symposium is scheduled for publication in December 2011. There are many more activities to also report by the individual working groups and sincere thanks are due to all TC V Officers for their efforts.

C. Other relevant information

WG V/5 reported that no WG activity occurred during 2010 but has been more active this period and retains its status as an ISPRS WG.

D. Commission Officer Address Updates

Up-to-date addresses and contact details for all WG officers is provided on the Commission V website and also on the ISPRS homepage at http://www.isprs.org/technical_commissions/wgtc_5.aspx. Persons who wish to participate in Commission V activity should make contact with the relevant WG Officers, listed together with their respective WG reports, below.

Jon Mills; Newcastle University, UK

2. Working Group activities during 2011

WG V/1: Vision metrology - best practice, systems and applications

Chair: Stuart Robson (UK)
Co-Chair: Jean-Angelo Beraldin (Canada)
Co-Chair: Thomas Luhmann (Germany)

A. State of Science and Technology of Working Group Topics

Our last report, made in November 2010, described the increasingly mature nature of non contact optical 3D measurement systems and its supporting community. This report directs those interested in advances over the past year towards the published papers and programmes of the following events, all of which were attended by at least one working group leader:

January 2011: SPIE 3D Imaging Metrology; San Francisco, USA: http://spie.org/x648.html?product_id=799250

January 2011: Germany's Oldenburger 3D-Tage; Oldenburg, Germany: www.jade-hs.de/3dtage

May 2011: SPIE Videometrics XI; Munich, Germany: <http://spie.org/x6511.xml>

July 2011: Coordinate Metrology Systems Conference, Phoenix, Arizona, USA: <http://www.cmssc.org/agenda/index.php>

The terms of reference of the Working Group (www.commission5.isprs.org/wg1) are proving well founded as we continue to focus our efforts towards establishing and promoting best practice.

B. Accomplishments of Working Group during 2011

There are many international meetings organised through both academic and commercial interests in this discipline. The working group seeks to actively support events through technical sessions, tutorials, presentations and paper reviewing. The following details events where the working group has convened and made major contributions in 2011:

23rd – 27th January 2011: SPIE 3D Imaging Metrology; San Francisco, CA, USA. This event was convened by Angelo Beraldin and follows the success of the 2009 inaugural event. Co-organisers were Geraldine Cheek from NIST, Michael MacCarthy from NPL and Dr Irich Neuschaefer-Rube from PTB. A key aim of the conference is to bring industry, national standards and academics together. Some 20 papers were presented, ranging from artefacts and verification to best practice and Instruments and Methods for 3D Metrology from Images.

2nd -3rd February 2011: Germany's 10th Oldenburger 3D-Tage; Oldenburg, Germany. This event, coordinated by Thomas Luhmann, continues to demonstrate the strength of our discipline in Germany! This year the 10th Anniversary Event was enjoyed by 220 participants with 50 papers and 20 exhibitors. Actions with Stephen Kyle of UCL aim to achieve cross collaboration between 3D-Tage and the UK's LVM Conference which will be held in November 2011.

Thomas Luhmann gave an invited paper on "3D imaging - How to achieve highest accuracy" to SPIE Videometrics XI in Munich. Stuart Robson also presented a paper and invited participants to engage with our Working Group.

C. Working Group News

We are presenting and disseminating 3D industrial artefact datasets collected with state of the art optical systems so that researchers can assimilate and understand current capabilities and limitations. If you are interested in these data, please contact Stuart Robson.

Stuart Robson and Mark Shortis (ISPRS Congress Technical Director) developed and presented one day imaging metrology workshops to Airbus, the National Physical Laboratory and the Joint European Torus. Discussions are on-going to offer this workshop at the ISPRS Congress in Melbourne.

WG V/2: Cultural heritage data acquisition and processing

Chair: Paul Bryan (UK)
Co-Chair: Bharat Lohani (India)
Co-Chair: Fulvio Rinaudo (Italy)

A. State of Science and Technology of Working Group Topics

The cultural heritage application of close-range photogrammetric and laser scanning technologies continues to attract widespread interest from all sectors of the heritage community. Be it academia, commerce or simply interested individuals, this is borne out by interest in WGV/2's own conference (see below) and through application of current 'state-of-the-art' technology at prominent world heritage sites e.g. Stonehenge and the wide-scale media interest such projects generate. The increasing resolution and speed of capture of terrestrial laser scanners, coupled with a reduction in their inherent data 'noise', is providing more and more detail for the heritage user to work with. However increased detail brings increased data sizes which in turn demands higher and higher computer specifications to enable the full value of the data to be exploited without resorting to decimation. Although some solutions, such as Meshlab, are increasingly finding application within heritage projects it is vital that both post-processing and viewing software also keep pace with the scanning hardware, be it through paid-for licenses or 'free', open-source solutions.

Most laser scanners and some survey equipment now incorporate digital imagery. Some sensors are built into the device, and hence record the image co-axial to the measuring beam, whilst others are off-set. Both approaches have pros and cons however the sensor resolution for the built-in devices currently appears limited by the manufacturers to 5MP. When compared to the >10MP resolution that a typical DSLR now provides, this appears a limiting factor for the heritage user where the image plays an important and fundamental role in the recording and documentation process. Although an offset sensor requires calibration, to allow accurate pixel registration with the point data, it does allow other sensors to be used. These currently include High Dynamic Range (HDR) and panoramic and as well as providing

useful image based resources in their own right, future integration with other remotely sensed datasets can potentially provide a whole new level of texture overlay for point-based data heritage survey.

The last year has seen a significant rise in heritage projects using Unmanned Aerial Vehicles (UAVs). Typically used to capture still and video imagery, their controllability and remote viewing capabilities often provide unique low-level vantage points for the heritage user and potential application in photogrammetric, condition assessment and presentational surveys. Previously limited by payload, many will now carry a DSLR camera thus significantly improving the quality of image that can be captured. Some, such as the new Unmanned Aerial Systems (UAS), can autonomously capture a series of overlapping imagery on a pre-determined flight-line, allowing more automated capture and post-processing potential, albeit generally restricted by local civil aviation regulations that might demand continuous operator control.

B. Accomplishments of Working Group during 2011

The principal emphasis for the current period has been in organising the working group's own conference. Taking place in York, UK from 17th - 19th August this has attracted a lot of interest from across working group membership, academia and commerce. Following announcement via the purpose-designed ISPRS York 2011 conference website (www.isprs-york2011.org), 45 abstracts were submitted, 25 of which were accepted for oral presentation and which now form the basis for five technical sessions on the themes of:

TS1: Sensor Development & Mapping Solutions

TS2: Imaging Solutions from Aerial to Underwater

TS3: Remote Sensing Technologies & Single/Multi Image Approaches

TS4: Data Processing & 3D Modelling Solutions

TS5: Development of Standards & Best Practice Application.

A total of 16 papers have also been invited for publication within a suitable journal e.g. special heritage issue of the Photogrammetric Record, with the remaining 20 abstracts forming the basis for the poster session. Currently 74 delegates from 14 different countries are registered to attend this three-day event.

C. Working Group News

Meetings planned for the coming year include:

- Participation within XXIII International CIPA Symposium, Prague, Czech Republic, 12-16 September 2011;
- ISPRS Congress 2012 Congress, Melbourne, Australia, 25 August – 1 September, both working group and themed CIPA/Australia ICOMOS sessions.

WG V/3: Terrestrial laser scanning and 3D imaging

Chair: Derek Lichti (Canada)
Co-Chair: Hans-Gerd Maas (Germany)
Co-Chair: Marco Scaioni (Italy)
Secretary: Pedro Arias-Sánchez (Spain)

A. State of Science and Technology of Working Group Topics

The scientific programme of the Laser Scanning 2011 Workshop gives a good indication of the current state of research in terrestrial laser scanning. There are many groups worldwide concentrating on object recognition from point clouds with several investigating the integration of laser scanner data with that from other sensors and from a priori CAD models. Registration remains an important topic, particularly the registration of point clouds and imagery. Important applications of terrestrial laser scanning receiving continued attention include forestry, cultural heritage recording and mobile mapping.

B. Accomplishments of Working Group during 2011

Membership: Excluding the executive (Chair, etc.) there are 48 working group members.

Conferences and Workshops: The primary focus of the Working Group this year has been the ISPRS Laser Scanning 2011 Workshop to be held in Calgary, Canada, 29-31 August 2011. Final preparations are being made to hold this event for which 81 participants have registered. On 1 September Wolfgang Förstner will give a one-day tutorial entitled Probabilistic Data Analysis Using Graphical Models, for which 27 people have registered.

The Working Group officers have been involved in many capacities (scientific committee member; session chair; keynote address) for several international conferences, including: the 2011 International Workshop on Multi-Platform/Multi-Sensor Remote Sensing and Mapping held in Xiamen, China; Range Imaging Sensors and Applications (RISA) 2011 and 3D-Arch 2011, both held in Trento, Italy; the XV Brazilian Remote Sensing Symposium in Curitiba; and Videometrics, Range Imaging, and Applications, held in Munich, Germany.

On-line Database: Work on the database continued consistently in 2010-2011. A new University of Calgary student, Xiaojuan Qi, has been appointed to maintain and populate the on-line terrestrial laser scanning bibliography funded under the ISPRS Science Initiatives program (the previous student, Sonam Jamtsho, having graduated). The database currently contains 542 entries.

C. Working Group News

Plans for the next reporting year include:

- Completion of the Guest Co-Editorship for a Special Issue of the Photogrammetric Record of selected papers from the ISPRS Commission V Symposium;
- Completion of the Guest Editorship for a Special Issue of Remote Sensing on terrestrial laser scanning;
- Entries will be continually added to the on-line database.

WG V/4: Image-based and range-based 3D modelling

Chair: Fabio Remondino (Italy)
Co-Chair: Jan Boehm (UK)
Co-Chair: Qing Zhu (China)

A. State of Science and Technology of Working Group Topics

Image- and range-based 3D modelling is receiving more and more requests everyday and this has broadened the field of applications where reality-based 3D models are employed and required. At research level, different open-source photogrammetric software are now available, while at sensor level, laser scanner prices have slowly started to decrease. But the key solution in practical application, and in cases of large and complex scenes, is the integration of image and range data. This allows the exploitation of the intrinsic advantages of each technique and, as demonstrated by many recent scientific publications, is the optimal 3D surveying and modelling methodology. But there is still a great amount of work to be done in the image- and range-based 3D modelling domain. Range-based approaches are still facing problems of handling large data sets and lack automation in data registration, editing and segmentation. Image-based approaches are still missing commercial dense image matching algorithms which are reliable in all possible cases (convergent, nadir, large baseline, etc.) and commercial automatic markerless image orientation tools.

B. Accomplishments of Working Group during 2011

The WG has organized or participated in the organization of:

- International Workshop 3D-ARCH 2011, 2-5 March 2011, Trento, Italy;
- SPIE Videometrics XI, 22-26 May 2011, Munich, Germany;
- Joint Workshop on 3D City Modelling & Applications, 26-27th June 2011 Wuhan University, P.R. China.

C. Working Group News

Forthcoming Events:

- International Summer School "3D Modeling in Archaeology and Cultural Heritage 2011", 29 August – 3 September, Grosseto, Italy;
- International Workshop on "Reality-based 3D modeling – with applications in Medical Sciences, Cultural Heritage, Engineering and 3D GIS", 20-21 October 2011, Bandung, Indonesia.

Journal issues:

- Theme Issue "Terrestrial 3D modelling" of the ISPRS Journal of Photogrammetry and Remote Sensing; all reviews done; expected publication: December, 2011;
- Special issue "3D modelling of large and complex sites" in Applied Geomatics Journal (submission of the best paper awards and invited talks of the 3D-ARCH 2011 conference); papers submitted; review under process; expected publication: February, 2012.

WG V/5: Image sensor technology

Chair: Ralf Reulke (Germany)
Co-Chair: Michael Chapman (Canada)
Co-Chair: Martin Smith (UK)
Secretary: Andres Luber (Germany)

A. State of Science and Technology of Working Group Topics

In the last few years 3D devices have become available for the consumer or gaming market. Meanwhile they are also used for professional applications. Such devices include stereo cameras from Fuji and Panasonic. About two years ago Fuji released the FinePix REAL 3D W1. Meanwhile, a new model the W3 is offered. The Panasonic SDT750 delivers 3D images by attaching the 3D conversion lens that comes with this camcorder. LG has just released a mobile phone that is equipped with a stereo camera and an autostereoscopic display. Particularly successful is the solution of the X-Box games console, which is provided with the Kinect. Many academic institutions use these solutions for their research.

B. Accomplishments of Working Group during 2011

The WG has participated in the organization of 3D Object Recognition and Tracking 2010 (part of 3D-NordOst).

C. Working Group News

Forthcoming events:

- 3D Object Recognition and Tracking 2011 (part of 3D-NordOst);
- Low-Cost 3D (Sensors, Algorithms, Applications).

WG V/6: Close range morphological measurement for the earth sciences

Chair: Jim Chandler (UK)
Co-Chair: Simon Buckley (Norway)
Co-Chair: Dirk Rieke-Zapp (Switzerland)
Secretary: Rene Wackrow (UK)

A. State of Science and Technology of Working Group Topics

Spatial measurement of natural objects at close range continues to be an important application area for photogrammetry and laser scanning. The number of users and applications continues to grow, but many new users remain unaware of technical issues or indeed the activities/expertise within ISPRS. This growth has been fuelled by user requirements and, perhaps more significantly, the availability of software and hardware technologies that are heavily marketed as "easy-to-use". This overselling has created some difficulties for some users!

B. Accomplishments of Working Group during 2011

Working Group membership is currently 93 with members distributed in 20 countries around the world, including Africa, South America, China, Japan as well as North America, Australasia and Europe.

The working group coordinated two technical sessions in 2011. Dirk Rieke-Zapp (co-chair) co-convened a full day session at the EGU in Vienna in early April, entitled "Digital Landscapes: Acquisition (close range measurement and laser scanning) to Quantitative Interrogation" (<http://meetingorganizer.copernicus.org/EGU2011/session/6522>).

Jim Chandler (chair) also convened a WG V6 session at the Association of American Geographers (AAG) Annual Conference (<http://meridian.aag.org/callforpapers/program/SessionDetail.cfm?SessionID=11575>). This was held in April in Seattle, US, where it was felt that it was important to spread the ISPRS V6 message. It was pleasing that one of our American presenters is eager to reconvene at the AAG next year (see below).

C. Working Group News

The main event scheduled for 2012 is clearly the Melbourne Congress where two sessions are currently planned. One of these is a "themed session" entitled "morphological change detection" and is being held in collaboration with ISPRS WG IV/8. The working group has also organised a keynote presentation from Prof Stuart Lane.

Finally, James Dietrich is coordinating a second WG V6 session at the forthcoming AAG annual conference, which is to be held in New York in February 2012 (<http://www.aag.org/cs/annualmeeting>).

ICWG V/I: Land-based mobile mapping systems

Chair: Jonathan Li (Canada)
Co-Chair: Qingquan Li (China)
Co-Chair: Antonio Maria Garcia Tommaselli (Brazil)
Secretary: João Fernando Custódio da Silva (Brazil)

A. State of Science and Technology of Working Group Topics

In 2011, the ICWG V/I officers have been very actively involved in organizing or attending EOGC2011 (Germany), LiDAR & SAR 2011 (China) and MMT 2011 (Poland). These events have shown continued R&D research interests and activities in the field of mobile mapping technology. In particular, the recent R&D efforts in mobile lidar have focused on applications in transportation, power line mapping, urban infrastructure mapping, underground and super speed train infrastructure monitoring, as well as cultural heritage documentation. The experiences learnt in 2011 have proved that the ICWG V/I terms of reference are well founded.

B. Accomplishments of Working Group during 2011

Conferences:

- ICWG V/I co-organized the 3rd International Conference on Earth Observation of Global Change, jointly with other WGs from ISPRS, ICA and IAG, 13-15 April 2011, Munich, Germany. Jonathan Li (Chair) served as Co-Chair of the Scientific Committee.
- ICWG V/I co-organized the Joint International Symposium on LiDAR and Radar Mapping Technologies and Applications in Nanjing, China, 26-29 May 2011. This event was jointly supported by ISPRS, ICA, FIG and SPIE. Jonathan Li (Chair) served as Co-Chair of the Scientific Committee. Qingquan Li (Co-Chair), Antonio Tommaselli (Co-Chair), and João Fernando Silva (Secretary) and several ICWG members served on the SC.
- The 7th International Symposium on MMT was held in Poland, 13-16 June 2011. Jointly supported by ISPRS, FIG, IAG and ION. ICWG V/I officers and several members served as SC members.
- Jonathan Li and Qingquan Li served as SC members of the Joint ISPRS Workshop on 3D City Modelling & Applications and the 6th 3D GeoInfo, <http://www.lmars.whu.edu.cn/3DCMA2011/>, 26-28 June 2011, China.
- ICWG V/I is involved in co-organizing the ISPRS Workshop on Laser Scanning 2011, jointly with WG V/3, I/3, and other WGs of ISPRS, <http://www.ucalgary.ca/laserscanning2011/>, 29-31 August 2011, Calgary, Canada.

Publications:

- A special Issue of Photogrammetric Engineering and Remote Sensing (PE&RS) (ASPRS: SCI), entitled "Advances in Terrestrial Laser Scanning" including 8 peer reviewed papers are currently under peer review and will be published in spring 2012. Jonathan Li serves as guest editor (with Bruce King).
- A theme issue featured terrestrial laser scanning: from static to mobile, Call for Papers due on 1 October 2011, will consist of 12-16 papers to be published by International Journal of Remote Sensing (Taylor and Francis: SCI) in 2013. Jonathan Li served as the Guest Editor (with Michael Chapman).

C. Working Group News

Upcoming events in 2012:

- ICWG V/I will be involved in co-organizing the International Summer School on Mobile Mapping Technology, 30 Apr - 4 May 2012, Tainan, Taiwan.
- ICWG V/I will organize technical sessions in land-based mobile mapping systems in XXII ISPRS Congress, 25 Aug-1 Sep 2012, Melbourne, Australia.