

GIM

INTERNATIONAL

THE GLOBAL MAGAZINE FOR GEOMATICS
WWW.GIM-INTERNATIONAL.COM



ISSUE 6 • VOLUME 29 • JUNE 2015

No Nationally Coherent Cadastral in the USA

Need for Comprehensive Parcel Database

BUILDING UAS CAPACITY for the Land Administration Sector

MICROMETRE-LEVEL Deformation Monitoring of a Concrete Dam

INTERVIEW Prof Tom Veldkamp, ITC, University of Twente

Leica ScanStation P30/40

Because every detail matters



The right choice

Whether you need a detailed as-built representation of a façade, a 2D floor plan or 3D data for integration into Building Information Modelling (BIM), real-time planning of architecture and building projects with fast and accurate deliverables is important. The new ScanStation laser scanners from Leica Geosystems are the right choice, because every detail matters.

High performance under harsh conditions

The Leica ScanStations deliver highest quality 3D data and HDR imaging at an extremely fast scan rate of 1 mio points per second at ranges of up to 270m. Unsurpassed range and angular accuracy paired with low range noise and survey-grade dual-axis compensation form the foundation for highly detailed 3D colour point clouds mapped in realistic clarity.

Reduced downtime

The extremely durable new laser scanners perform even under the toughest environmental conditions, such as extreme temperatures ranging from -20°C to $+50^{\circ}\text{C}$ and comply with the IP54 rating for dust and water resistance.

Complete scanning solution

Leica Geosystems offers the new Leica ScanStation portfolio as an integrated part of a complete scanning solution including hardware, software, service, training and support. 3D laser scanner data can be processed in the industry's leading 3D point cloud software suite, which consists of Leica Cyclone stand-alone software, Leica CloudWorx plug-in tools for CAD systems and the free Leica TruView.

HxGN
HEXAGON'S GLOBAL NETWORK

LIVE



LAS 1-4 JUN 2015
HKG 18-20 NOV 2015
hxgnlive.com

PART OF
HEXAGON



Leica Geosystems AG
Heerbrugg, Switzerland

scanstation.leica-geosystems.com



- when it has to be **right**

Leica
Geosystems



INTERVIEW PAGE 12

Blending Trade, Aid and Capacity Development

GIM International Interviews Prof Tom Veldkamp



FEATURE PAGE 16

Micrometre-level Deformation Monitoring of a Concrete Dam

Accurate and Frequent Deformation Monitoring Using Fibre-optic Cables



FEATURE PAGE 21

From Barefoot to 'Air-foot' Surveyors

Building UAS Capacity for the Land Administration Sector



FEATURE PAGE 24

No Nationally Coherent Cadastre in the USA

Need for Comprehensive Parcel Database



This month's cover shows the continental United States at night. The image is a composite assembled from data acquired by the Suomi NPP satellite. The image was made possible by the satellite's 'day-night band' of the Visible Infrared Imaging Radiometer Suite (VIIRS), which detects light in a range of wavelengths from green to near-infrared and uses filtering techniques to observe dim signals such as city lights, gas flares, auroras, wildfires and reflected moonlight.

(IMAGE COURTESY: NASA EARTH OBSERVATORY/NOAA NGDC)

ADVERTISERS INDEX

| | | | |
|---|--------|---|----|
| Al-Top Topografia, www.settopsurvey.com | 9 | Optech, www.teledyneoptech.com | 18 |
| CHC, www.chcnv.com | 8 | Sanding, www.sandinginstrument.com | 20 |
| ComNav Technology, www.comnavtech.com | 42 | South Surveying, www.southinstrument.com | 4 |
| Effigis, www.effigis.com | 28 | SRM Consulting, www.srmconsulting.es | 23 |
| FOIF, www.foif.com | 36 | Supergeo, www.supergeotek.com | 7 |
| Hi-Target Surveying, www.zhdgps.com | 38 | TI Asahi, www.pentaxsurveying.com/en | 26 |
| KCS TraceMe, www.trace.me | 40, 47 | TI Linertec, www.tilinertec.com | 28 |
| Kolida Instrument, www.kolidainstrument.com | 32 | Trimble Geospatial, www.trimble.com | 48 |
| Leica Geosystems, www.leica-geosystems.com | 2 | Trimble Integrated, intech.trimble.com | 10 |
| Microsoft, www.microsoft.com/ultracam | 14 | Ushikata, www.ushikata.co.jp | 46 |
| MicroSurvey, www.microsurvey.com | 44 | | |

REPORT PAGE 29

Let's Cadastre Our World...

World Cadastre Summit, Congress & Exhibition

COMPANY'S VIEW PAGE 30

Imaging the Environment

L'Avion Jaune

REPORT PAGE 33

RIEGL Lidar User Conference in Hong Kong and Guangzhou

New Small Laser Scanners and Focus on Unmanned Lidar Systems

| | |
|---------------------------|-------------|
| News & Opinion | page |
| Editorial | 5 |
| Insider's View | 6 |
| News | 7 |
| Endpoint | 11 |

| | |
|------------------------------------|-------------|
| International organisations | page |
| FIG | 37 |
| GSDI | 39 |
| IAG | 41 |
| ICA | 43 |
| ISPRS | 45 |

| | |
|-------------------|-------------|
| Other | page |
| Advertisers Index | 3 |
| Agenda | 46 |

Get your back-issues in the store

www.geomares.nl/store



GALAXY G1

Miniaturization

Extremely small and compact design

Tilt compensator

The built-in tilt compensator can correct the coordinates automatically

Universal data communications

Compatible radio communication protocols

Intelligent platform

Intelligent voice, intelligent diagnosis, intelligent power saving



SOUTH
Target your success

www.southinstrument.com

gnss@southsurvey.com



PUBLISHING DIRECTOR Durk Haarsma
FINANCIAL DIRECTOR Meine van der Bijl
SENIOR EDITOR Dr Ir. Mathias Lemmens
CONTRIBUTING EDITORS Dr Ir. Christiaan Lemmen, Dr Rohan Bennett, Mark Pronk BSc, Martin Kodde MSc, Ir. Danbi J. Lee, Dr Ir. Marlies Stoter-de Gunst, Frédérique Coumans
EDITORIAL MANAGER Wim van Wegen
COPY-EDITOR Lynn Radford, Englishproof.nl
EDITORIAL BOARD Dr Ir. Paul van Asperen, Dr Bharat Lohani
ACCOUNT MANAGER Sybout Wijma
MARKETING ASSISTANT Trea Fledderus
CIRCULATION MANAGER Adrian Holland
DESIGN Media Supporters BV, Alphen aan den Rijn
www.vrhl.nl

REGIONAL CORRESPONDENTS

Ulrich Boes (Bulgaria), Prof. Dr Alper Çabuk (Turkey), Papa Oumar Dieye (Niger), Dr Olajide Kufoniya (Nigeria), Dr Dmitry Kurtener (Russia), Dr Jonathan Li (Canada), Dr Carlos Lopez (Uruguay), Dr B. Babu Madhavan (Japan), Dr Wilber Otichilo (Kenya), Dr Carl Reed (USA), Dr Aniruddha Roy (India), Prof. Dr Heinz Rüter (South Africa), Dr Tania Maria Sausen (Brazil)

GIM INTERNATIONAL

GIM International, the global magazine for geomatics, is published each month by Geomares Publishing. The magazine and related e-newsletter provide topical overviews and accurately presents the latest news in geomatics, all around the world. *GIM International* is orientated towards a professional and managerial readership, those leading decision making, and has a worldwide circulation.

PAID SUBSCRIPTIONS

GIM International is available monthly on a subscription basis. The annual subscription rate for *GIM International* is €140 within the European Union, and €200 for non-European countries. Subscription can commence at any time, by arrangement via our website or by contacting Abonnementenland, a Dutch subscription administration company. Subscriptions are automatically renewed upon expiry, unless Abonnementenland receives written notification of cancellation at least 60 days before expiry date. Prices and conditions may be subject to change. For multi-year subscription rates or information on current paid subscriptions, contact Abonnementenland, Postbus 20, 1910 AA Uitgeest, Netherlands
 +31 (0)251-257926
 (09.00-17.00 hrs, UTC +1)
paidsubscription@geomares.nl

ADVERTISEMENTS

Information about advertising and deadlines are available in the Media Planner. For more information please contact our account manager: sybout.wijma@geomares.nl.

EDITORIAL CONTRIBUTIONS

All material submitted to Geomares Publishing and relating to *GIM International* will be treated as unconditionally assigned for publication under copyright subject to the editor's unrestricted right to edit and offer editorial comment. Geomares Publishing assumes no responsibility for unsolicited material or for the accuracy of information thus received. Geomares Publishing assumes, in addition, no obligation to return material if not explicitly requested. Contributions must be sent for the attention of the editorial manager:
wim.van.wegen@geomares.nl.



Geomares Publishing
 P.O. Box 112, 8530 AC Lemmer,
 The Netherlands
 T: +31 (0) 514-56 18 54
 F: +31 (0) 514-56 38 98
gim-international@geomares.nl
www.gim-international.com



No material may be reproduced in whole or in part without written permission of Geomares Publishing.
 Copyright © 2015, Geomares Publishing, The Netherlands
 All rights reserved. ISSN 1566-9076

Worthwhile

How worthwhile is geomatics? What does geomatics contribute to society at large? What are the economic and non-economic benefits of geomatics? Which changes are being initiated or shaped by geomatics? All of these questions definitely merit research because they help to put the field in perspective for the policymakers and entrepreneurs whose task it is to answer the following question: Should we be investing in geomatics? Hickling Arthurs Low Corporation (HAL) and associates carried out a study of this subject on behalf of Natural Resources Canada, and published the findings in a report called 'Canadian Geomatics Environmental Scan and Value Study' (www.nrcan.gc.ca). The highlights of the report provide a good overview of the size of the sector – both in terms of number of firms and the contribution to Canada's gross domestic product (GDP). In Canada there are some 2,450 firms active in the geomatics industry, generating about CAD2.3 billion in revenue in 2013. 75% of those companies are relatively small, with fewer than 50 employees. Most of the companies were established between 1970 and 1990, with a steep decline in the number of new companies from the year 2000 onwards. Geomatics technologies are contributing CAD21 billion of value to Canada's GDP, which equates

to 1.1% and accounts for approximately 19,000 jobs in the country. The uptake of open data – available at very little or no cost and for use without restriction – was good for an additional CAD695 million in the GDP and CAD635 million of real income in 2013. Numerous sectors – including mining, oil & gas extraction, utilities, public administration, construction, agriculture, forestry, fishing & hunting, and enterprise management – have managed to perform better over the years thanks to the use of geospatial information. Therefore, the bare figures themselves clearly illustrate the value of geomatics. However, the story behind those figures is equally interesting. The Canadian researchers found that, although much more difficult to measure, the social and environmental benefits should not be underestimated. The growing geomatics sector is enabling better responses to outbreaks of disease, faster deployment of disaster response when needed, and significantly better-coordinated and more timely management of physical infrastructure. Technological advancements have blurred the boundaries between geomatics and other fields, putting geomatics activities in reach of other specialists and leading to useful applications for geospatial information in other industries. The same holds true in education, with universities increasingly embracing geomatics as a new aspect of existing, previously unrelated courses. The Canadian study reveals not only the value of the geomatics sector itself, but also the spread of geomatics – geospatial information – into almost every other sector. Hence, this proves what most of us already knew: geoinformation is all-encompassing and has earned a place – through its usefulness and applicability – in Canada's economic reality. Moreover, this study is not only worthwhile for Canada alone, but also for the whole world. It demonstrates to governments that they can utilise geoinformation – in private and public environments alike – to improve society and strengthen the economy. At the same time, it challenges those governments to keep their IT infrastructures up to date in order to reap the full benefits.



▲ Durk Haarsma, publishing director

Photography: Arie Bruinsma

EAB

The Editorial Advisory Board (EAB) of *GIM International* consists of professionals who, each in their discipline and with an independent view, assist the editorial board by making recommendations on potential authors and specific topics. The EAB is served on a non-committal basis for two years.

PROF ORHAN ALTAN

Istanbul Technical University, Turkey

PROF DEREN LI

Wuhan University, China

MR SANTIAGO BORRERO

Secretary-general of Pan American Institute of Geography and History (PAIGH), Mexico

PROF STIG ENEMARK

Honorary President, FIG, Denmark

DR ANDREW U FRANK

Head, Institute for Geoinformation, Vienna University of Technology, Austria

DR AYMAN HABIB, PENG

Professor and Head, Department of Geomatics Engineering, University of Calgary, Canada

DR GABOR REMETÉY-FÜLÖPP

Secretary General, Hungarian Association for Geo-information (HUNAGI), Hungary

PROF PAUL VAN DER MOLEN

Twente University, The Netherlands

PROF DR IR MARTIEN MOLENAAR

Twente University, The Netherlands

MR JOSEPH BETIT

Senior Land Surveyor, Dewberry, USA

PROF SHUNJI MURAI

Institute Industrial Science, University of Tokyo, Japan

PROF DAVID RHIND

ret. Vice-Chancellor, The City University, UK

PROF DR HEINZ RÜTHER

Chairman Financial Commission ISPRS, University of Cape Town, Department of Geomatics, South Africa

MR FRANÇOIS SALGÉ

Secretary-general, CNIG (National Council for Geographic Information), France

PROF DR TONI SCHENK

Professor, The Ohio State University, Department of Civil and Environmental Engineering, USA

PROF JOHN C TRINDER

First Vice-President ISPRS, School of Surveying and SIS, The University of New South Wales, Australia

MR ROBIN MCLAREN

Director, Know Edge Ltd, United Kingdom

Integrated Land Management – A Dream?

Land sectors in many countries are under-performing and creating significant risk that deters investment in land, restricts the land market and is slowing the transition to a viable modern economy. The initial remedy is to implement projects to increase security of tenure through land administration systems as a tool for fostering good governance and socio-economic development. However, security of tenure is not the end game in solving land issues. A much wider set of interventions in a national reform programme is required across the land sector to create stability in society, provide opportunities for citizens to participate in economic development, to promote better environmental stewardship and to encourage responsible private investment in land. The other land administration components to determine valuation and taxation of land and to manage the use of land and land development are needed. Land management strategies are also required across the land sector in areas such as agriculture, forestry, tourism and infrastructure.

Too often, these interventions are performed in isolation. The lack of joined-up management of land leads to disjointed leadership in the land sector, fragmented institutional arrangements, inconsistent legal and regulatory frameworks, difficulties in sharing land information and conflicting sectoral land policies. Many donors and countries are guilty of contributing to fragmented land solutions. Even my home country of Scotland is about to implement a significant land reform programme without an overarching national land policy and without a comprehensive national spatial data infrastructure to support evidence-based decision-making.

A more holistic approach is required to achieve integrated and sustainable land



▲ Robin McLaren.

management and to close the cadastral divide. Fundamental to this approach is the early formulation of a national land policy that goes beyond land administration into land management and land markets and delivers significant benefits. This policy framework provides a wider, longer-term vision of land, offers a cohesive framework for associated sectoral policies and allows all stakeholders to cooperate more effectively across the sector.

This holistic management of land will not be easy to achieve. We will have to rethink the roles and structures of land institutions and how they can engage more effectively with the increasing function of the citizen in administering and managing land. Our legacy legal frameworks are restricting new, innovative approaches and need to be refreshed to create the necessary flexibility. The current education systems are only enforcing the current fragmentation. Therefore, capacity building is required to create a new generation of land professionals who have such a wider understanding of the holistic and sustainable management of land. This journey of change towards more integrated and sustainable land management needs to start now.

Most shared during the last month from www.gim-international.com

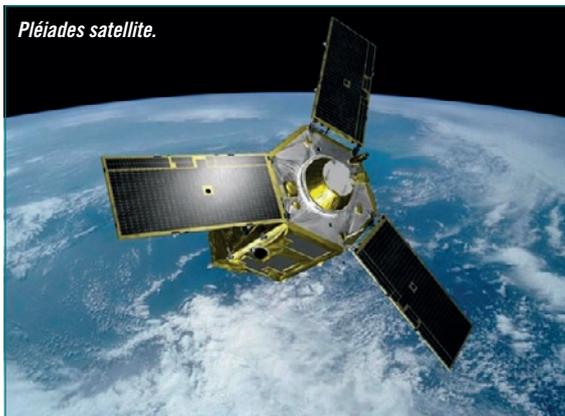


1. Lidar's Next Geospatial Frontier - <http://bit.ly/1aRTGUi>
2. Celebration of Maps during International Map Year - <http://bit.ly/1aRTtR9>
3. Serious Gaming Meets City Planning - <http://bit.ly/1Cl5M3u>
4. OGC and ILA Join Forces on Indoor Positioning - <http://bit.ly/1Cl6vCO>
5. Survey Value Takes off with UAV - <http://bit.ly/1KfswWX>

Hemisphere GNSS Releases New GNSS RTK Engine

Hemisphere GNSS has announced the launch of Athena, the next-generation GNSS engine. According to the company, the new core engine has been designed to maximise the ability to excel at the rigorous GNSS requirements of multiple market segment customers in machine control, survey and GIS.

► <http://bit.ly/1JEEdKWu>



Airbus Defence and Space Enters the Field of Precision Farming

Airbus Defence and Space and Simplot, an agribusiness firm headquartered in Boise, Idaho, USA, are launching a project to deliver Pléiades very-high-resolution satellite imagery to Simplot customers. In the United States, Simplot will monitor fields distributed over several states during the growing season. The imagery will be acquired at key crop growth stages and will be assessed for in-season adjustments.

► <http://bit.ly/1JEcsdS>

Your best mobile GIS choice

Perfectly bundle your devices with all-in-one SuperGIS Mobile Apps



- External GNSS Supported



- NTRIP Solution
- Free Post Processing



- NTRIP Solution
- External GNSS Supported



Hardware partners wanted.
staff@supergeotek.com



©2015 Supergeo Technologies Inc. All rights reserved. Supergeo, the Supergeo logo, SuperGIS, SuperPad, SuperSurv, and www.supergeotek.com are trademarks of Supergeo Technologies Inc. Other companies and products mentioned herein are trademarks or registered trademarks of their respective trademark owners. Android Robot is modified based on work created and shared by Google and Windows Mobile logo is modified based on work created and shared by Microsoft.



NEW LT500 Series

Ultimate GIS Mapping Solution

- **Multiple Models**
Covering Centimeter to Sub-meter accuracies
- **High-end Specifications**
From its blazing fast processor to its 4-constellation 3-frequency GNSS RTK engine the LT500 Series is the most capable handheld available
- **Cost-effective**
Complete units including software starting under \$3,000 bring high-performance GNSS handhelds to all users
- **More Options**
Laser Plummet, eCompass, eBubble/Gyro, Accelerometer, RFID, 1/2D Barcode Scanner, WiFi BGN, Bluetooth, USB, Camera w/Flash, Phone and Data Modem



Before-and-after Satellite Images of Kathmandu Support Earthquake Relief Effort



Kathmandu before and after the earthquake.

Following Nepal's devastating magnitude-7.8 earthquake on Saturday 25 April 2015, Airbus Defence and Space has acquired Pléiades satellite imagery to support the International Charter and Copernicus Emergency Management Service. The data acquired will assist in assessing the damage and help rescue organisations in the delivery of humanitarian aid.

► <http://bit.ly/1JEcUJ8>

Teledyne Technologies Acquires Remaining Optech Shares

Teledyne Technologies, through its Teledyne DALSA subsidiary, now fully owns Optech after acquiring the remaining shares. The company will be adopting the name Teledyne Optech, thus joining the Optech and Teledyne brands together. Teledyne has been the majority owner of Optech for the past three years so 100% ownership will not result in any significant operational changes for the organisation. Don Carswell continues as president of Teledyne Optech with all existing duties.

► <http://bit.ly/1JEcCSz>

Brand-new Event for the Geospatial Industry: GIM International Summit

GIM International, the global print and media platform for geomatics, is excited to announce the inaugural GIM International Summit which it will be organising from 10-12 February 2016 in Amsterdam, The Netherlands. The conference is a brand-new event for the geospatial industry. Building on 30 years of leadership as a global geospatial publication, *GIM International* is now leveraging its print and online prowess to facilitate a cutting-edge forum for geomatics professionals. The event will go beyond industry borders, challenge conventions and look ahead to future developments. Influential speakers from both within and beyond the sector will provide an inspiring practical perspective.

► <http://bit.ly/1Agda0u>



SETTOP

SETTOP REPEATER
RTK BRIDGE:
TRANSMITS CORS/VRS
CORRECTIONS VIA
RADIO/RS232.

The user will benefit from working with CORS corrections in areas of low or no GSM coverage.



www.settopsurvey.com

No. 2808

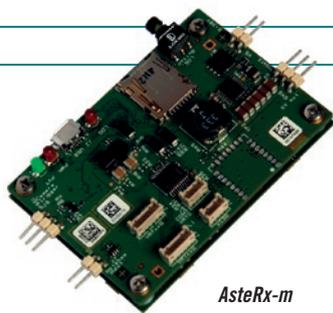


info@settopsurvey.com (+34) 93 700 44 66

Centimetre-accurate GNSS Solution for UASs

Septentrio has announced the launch of AsteRx-m UAS, an RTK-accurate GNSS receiver solution specially designed for the drone market. The AsteRx-m UAS provides high-accuracy GNSS positioning with low power consumption. The launch of the AsteRx-m UAS board is complemented by the release of the GeoTagZ software suite which works together with the UAS camera and image processing solution to provide centimetre-accurate position tagging of the images without the need for a real-time data link.

► <http://bit.ly/1JEcvGG>



AsteRx-m
UAS.

GSDI Announces Passing of Former President Bas Kok

It is with great sadness that GSDI has announced the recent passing of its former president, Prof Bas Kok, of cancer. Bas Kok was known to very many of the association's members for his long support for developing spatial data infrastructures, both in Europe and globally. He helped to found the initial GSDI Conference series, attending the very first conference in Bonn, Germany, in 1996, and remained directly involved in the global SDI initiatives up to his death in April 2015.

► <http://bit.ly/1JEckKle>



Bas Kok.

GNSS + Inertial Precise Positioning and Orientation

THE TRIMBLE BD935-INS — A PRECISION GNSS + INERTIAL MODULE DELIVERING RTK AND ORIENTATION IN REAL TIME

The BD935-INS is a compact module that integrates triple frequency GNSS and MEMS Inertial sensors to provide precise real-time position and attitude.



60mm x 67mm

FOR HIGH-PERFORMANCE, PRECISE POSITIONING IN A COMPACT, MOBILE-READY DESIGN

- 336 Channels
- GPS, GLONASS, Galileo and BeiDou
- Integrated 3-D MEMS Sensors
- 100Hz RTK Position and Orientation
- Also available in IP67 enclosure

The BD935-INS module features a high accuracy GNSS receiver for precise position and an integrated MEMS inertial sensor package for 3-D orientation to serve applications requiring position and attitude. The GNSS + Inertial combination delivers more stability and robustness than GNSS alone.



Trimble GNSS OEM

InTech.trimble.com

TNW Conference Honours Neelie Kroes with Lifetime Achievement Award

Neelie Kroes, the former European Commissioner for the Digital Agenda, has received a Technology Lifetime Achievement Award in recognition of her impact on the technology landscape over the last decade. The award was presented collaboratively by The Next Web co-founder and CEO, Boris Veldhuijzen van Zanten, and Kajsa Ollongren, the deputy mayor of Amsterdam, at the annual TNW Europe Conference in The Netherlands on 23 April.

► <http://bit.ly/1JEd2IH>

Satellite Navigation Applications for Agriculture

The European space programmes Galileo and EGNOS have opened the door to myriad new agriculture applications with the potential to improve production, efficiency and profitability and to reduce environmental impact. The European Satellite Navigation Competition (ESNC) is looking for groundbreaking business ideas, services or products addressing the topic of precision agriculture. Since 2004, the international ideas competition has been rewarding innovative downstream applications using satellite navigation. The competition is open to everyone, from entrepreneurs, SMEs and start-ups to researchers.

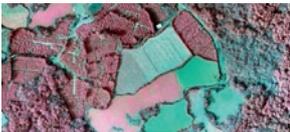
► <http://bit.ly/1zXafdU>

New Showcase for UAS Exhibitors during Intergeo

Intergeo's integrated 'interaerial SOLUTIONS' platform is a response to the rapid development in data acquisition, analysis and applications for unmanned flight systems. The recently agreed partnership with the German-speaking Unmanned Aircraft Vehicle Association (UAV DACH) underlines the commitment of Intergeo, the world's largest industry platform, to remaining the leading trade fair for UAS manufacturers and service providers in the German-speaking region and to further developing its international profile.

► <http://bit.ly/1JEdwyG>

UAS Captures Near-infrared Mapping Data



DroneMetrex NIR imagery of a farm.

DroneMetrex has announced that near-infrared (NIR) mapping data has been captured with the TopoDrone-100.

The radiometric quality has been achieved because DroneMetrex specialists performed the necessary camera modifications and have designed the external filters specifically to match the requirements for accurate, discriminative vegetation mapping. According to DroneMetrex, this is the first time in the UAV's mapping history that NIR imagery has been captured at this level of quality.

► <http://bit.ly/1zXau8S>

36th Asian Conference on Remote Sensing

The organisation committee of the 36th Asian Conference on Remote Sensing (ACRS) is inviting remote sensing professionals to join the conference. ACRS 2015 is being held from 19-23 October 2015 in Quezon City, Philippines, and is one of the largest remote sensing conferences in Asia. Last year, more than 400 participants attended ACRS 2014, which was organised in Nay Pyi Taw, Myanmar.

► <http://bit.ly/1JEe6w9>

Semantic Nonsense



The human mind is gifted with the ability to boil down complex parts of reality into one comprehensive representation, and numbers come in very useful. Surveyors, for example, are used to accompanying their measurements with accuracy indicators, including root mean square error (RMSE), 1 sigma or circular error at 90% confidence. The economy, on the other hand, is often described in terms of gross domestic product (GDP). Now, as we seem to be emerging from eight years of economic crisis, the European future is expressed as follows: 'The economic growth for the EU will rise to 1.7% in 2015 and 1.3% for the euro zone. In 2016, economic activity should grow by 2.1% and 1.9% respectively.' The decimal point in the percentages suggests that the numbers are exact to one part per thousand, but are they? Let's take a closer look. The concept of GDP was developed by the US Ministry of Commerce in 1934 to measure the economic well-being of the country during the Great Depression and its developer, Simon Kuznets, received the Nobel Prize for his achievements in 1971. Once the aggregated number has been compiled, the growth of the economy – positive or negative – can be calculated from quarter to quarter and from year to year. The number also acts as the sole measure to determine the tax and development aid contributions to be paid to Brussels by EU member states. It enables comparisons of a nation's military spending, educational

budgets and healthcare expenditure and a global ranking according to economic success. An overarching measure is convenient, but it does not tell the whole story. For example, from 2013 to 2014 the GDP of Nigeria increased overnight from 42.4 trillion naira to 80.2 trillion naira (USD510 billion) – an 89% increase. Nigeria is now ranked 26th based on GDP per country and number 121 for GDP per capita. The reason: 'rebasings'. One of the inputs used to compute GDP is the growth of industries weighted according to their importance to the economy. Since those weightings are related to the base year and are not updated annually, fast-growing industries retain the same low weighting and the figures gradually drift away from reality, ultimately underestimating the economy by as much as half a percent. The previous calculations referred to 1990 as the base year. Rebasings occurred in 2010 and the proper weightings were given to mobile telecom providers, the movie industry and other budding sectors. So, have the Nigerians become wealthier? Only on paper. But what effect can readjusted GDPs have in the political arena? When Simon Kuznets developed this method of measuring the national income, he indicated its limitations and foresaw abuses. He warned that a quantitative measure brings the illusion of precision and may be abused. Furthermore, GDP is not able to measure welfare adequately unless the personal distribution of income is known. Other economists have argued that GDP cannot really distinguish between wealth-generating activities contributing to the well-being of individuals and capital consumption. Hence, the numbers may merely indicate the pace of money pumping through the system. The recalculation of Nigeria's GDP took place 50 years after Darrell Huff published his book *How to Lie with Statistics*, in which he states that statistics "is employed to sensationalise, inflate, confuse and oversimplify. Statistical methods and terms are necessary in reporting the mass data of social and economic trends [...] But without readers who know what they mean, the result can only be semantic nonsense". ◀

Blending Trade, Aid and Capacity Development

ITC, a Dutch knowledge institute with more than 60 years of experience in education, research and capacity development, merged with the University of Twente in 2010 to become the Faculty of Geo-Information Science and Earth Observation. At the same time, Professor Tom Veldkamp commenced as the dean. He faced the challenges of responding to impending government budget cuts and guiding the organisation through the transition period. In January 2015, Veldkamp was reappointed for a further five years. *GIM International* caught up with the influential dean to learn how things have changed and what lies ahead for ITC.

COURTESY: JOHN HORN



For those readers who are unfamiliar with the institute's activities, can you give us a brief overview of ITC and particularly the three pillars?

Today, the three pillars of ITC are research, education and capacity development in the specific domain of geoinformation science (GIScience) and Earth observation (EO). When ITC was founded in 1950, the main pillars were education and capacity development. Research has become more important over time as the level of education both demanded and provided has increased; MSc degrees have a research component, for example. Moreover, when we merged with the University of Twente in 2010, we also developed our own PhD programme which furthered our research interests. Overall, our research involvement and output has grown tremendously over the last decade, although education certainly remains the central pillar.

Since its establishment, ITC's right to exist has been linked with Dutch international development cooperation policy, yet public support for such policies has decreased recently. Will this decline jeopardise ITC's future?

I don't think community views are radically changing; rather they are going through a process of reorientation. The 'giving away for free' ideals that existed in the post-war era have been replaced by a more pragmatic if not realistic period. Countries and their citizens are more conscious of getting a return on investment. In this respect, ITC's

attitude is also changing. We are still building capacity at individual and organisational level, but we're also asking the question: what will the stakeholders, including ITC, get out of the investment? A future trading partner? Collaboration on projects? The interesting thing is that these questions are making the whole process more sustainable. Although we focused heavily on environmental and social improvement in the past, we never considered the issue of profit. We are now combining all three perspectives, and the resulting projects appear more economically viable, particularly after initial funding ends.

Regardless of the funding issue, ITC and its ongoing mission and work will remain hugely relevant in the next decade. We are unashamedly focused on developing countries; our areas of interest usually differ from most Dutch academic institutions. The grand challenges of developing countries are quite different to the local priority areas in The Netherlands. They impact upon millions of people, cut across international boundaries, and won't be solved overnight. We will continue to collaborate with our international partners to find spatial solutions to the challenges.

Now, as a faculty of a Dutch university, ITC will increasingly be treated like any other faculty under the Dutch university system, i.e. in terms of budgeting and performance indicators. How can ITC uphold its focus in this situation?

Yes, we are now a 'normal' Dutch academic faculty with all the associated requirements and expectations, but these help to keep us 'lean and mean'. I have no problem with that. Overall, the change actually makes things easier for ITC; we consider the world as our playing field. We are already set up to engage in global collaboration and international research-funding opportunities. We do many projects for the Asian Development Bank, African donors and the World Bank. These are money sources that our Dutch counterparts do not have access to. They tend to focus on the Dutch Science Foundation (NWO) and European grant channels. We focus on these too, but a whole range of additional funding sources are available thanks to ITC's emphasis on capacity development. We know our strengths and limits – and we carefully target where and how we apply our efforts.

Meanwhile, we've actually been quite successful at obtaining funds over the last four

or five years – much to our own surprise as anyone else's. There were numerous sceptics early on, particularly after our 20% budget cut in 2010, but through the recent successes in project acquisition we've already compensated for those losses. For us, this really helps to show how relevant ITC's work really is, both nationally and internationally. In fact, it's attracting quite a lot of attention within The Netherlands, particularly within the University of Twente. We're seeing the university begin to adopt more of our policy stances, rather than vice versa –

WE SHOULD ALWAYS BEAR IN MIND THAT IT IS ACTUALLY THE PUBLIC WHO PAY FOR MUCH OF THE WORK

particularly with regards to internationalisation. Indeed, the new president of the University Board sees ITC as a shining example for the rest of the university in that area.

ITC is increasingly publishing in highly recognised journals but on a global level the amount of scientific output continues to grow rapidly. How can ITC's research remain distinguishable from the thousands of other papers and articles, whilst also being accessible for the developing world?

ITC's policy is that all academic data and publications should be made available to everyone. We already have specific agreements with certain journals. For example, we still hold the editorship of the former ITC in-house journal, the International Journal of Applied Earth Observation and Geoinformation, and through this we maintain an agreement that a certain number of copies must be disseminated to universities around the globe. We're also part of the efforts to stimulate more open-access publishing. New deals are being struck between Dutch knowledge institutions and the large international publishers. More openness and availability is being demanded by academia. Some of the publishers are already on board, but others are still far from happy as it impacts upon their bottom line. In the end, we feel that they have to change; if all scientists decided not to publish anymore – and this is the ultimatum – it would be the end of the line for those publishers. We should always bear in mind that it is actually the public who pay for much of the work which is published in these prestigious journals.

Much ITC research takes place in the developing world, especially in Africa. There

are so many Western universities present there that one sometimes feels as if Africa is a scientific colony, where Western scientists observe and browse to their hearts' content. Harvard historian Niall Ferguson was said to be embarrassed that the discussion about Africa's future was dominated by white non-African men (note: preface in Dambisa Moyo's *Dead Aid*, 2009). What can ITC do to encourage African universities and scientists to take the lead? Or, put simply, when will Africa being sending students with

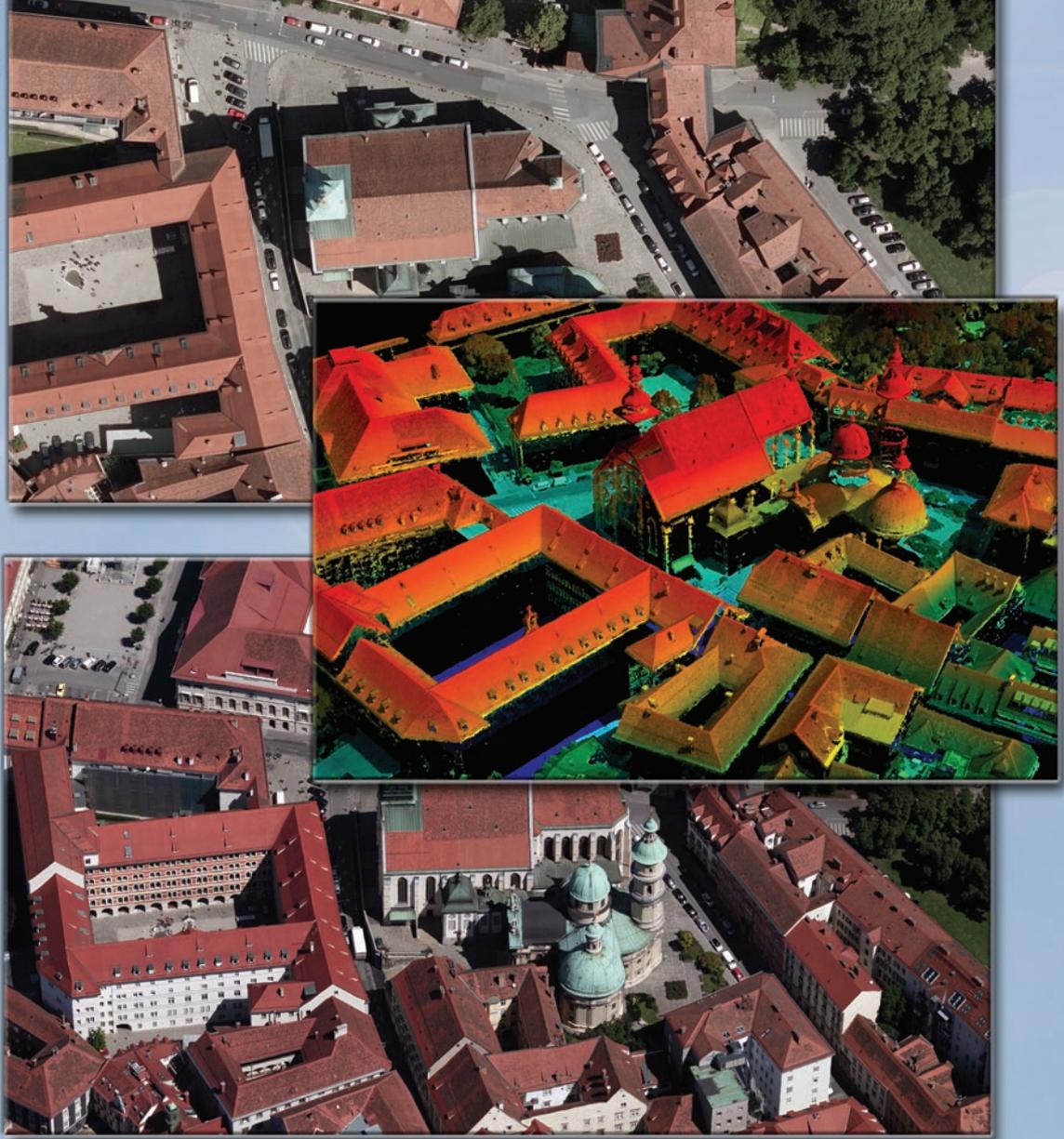
questionnaires to remote Dutch communities?

Well, I once had a Columbian student who did some questionnaires here in The Netherlands – and quite a few other ITC alumni have gone down that path with their MSc and PhD work, so perhaps it's already happening! On a more serious note, we need to give our counterparts a voice and empower them. Our training is intended to do that. We aim to help our students find that voice – to enable them to speak up and form their own views and opinions – so that they can participate in, if not lead, scientific and political debates back home. This does not always happen – particularly in some parts of the world where cultural norms make it difficult to participate in such public debates, but it's something we don't shy away from and something we strive to build in our students.

Strong engagement with our alumni is also important. In this domain, our network is extensive; we have over 20,000 alumni across 177 countries. We regularly support them by organising refresher courses, tailor-made training and other events to help them keep their technical prowess up to date. This also continually reminds them that, no matter which challenges they might be facing, they're part of something bigger, something global, and that friends and colleagues are always close by.

In her speech at the opening of ITC's academic year the Dutch Minister for Foreign Trade and Development Cooperation called for worldwide attention to private and communal land issues – a subject to which ITC is particularly able to contribute. Yet the number of students on the land administration course has not really

We have you covered



from all angles.

Need a large format camera system for low-altitude, corridor missions? High-altitude ortho collections? Something in between?

Need to be able to collect oblique imagery? How about oblique and nadir imagery in panchromatic, color and near-infrared all in the same pass?

Need a software system that will allow you to take that aerial imagery and create point clouds in LAS format, digital surface models, and orthomosaics? **No problem.**

The UltraCam series of large format photogrammetric digital aerial sensors includes systems of varying image footprints and focal lengths. Whether you need multi-spectral nadir imagery or obliques—or both from the same camera—we have a system for you.

Meanwhile, our highly automated UltraMap photogrammetric workflow software enables you to process UltraCam data to Level 3, radiometrically corrected and color-balanced imagery, high-density point clouds, DSMs, DSMorthos and DTMorthos.

We've got you covered.



iFlyUltraCam.com

ULTRACAM

 **Microsoft**



COURTESY: JOHN HORN

▲ Professor Tom Veldkamp during the interview with Rohan Bennett.

increased over the past decade. What is ITC doing to make its educational opportunities and curricula known to prospective students worldwide?

Whilst land is obviously central to the Ministry's key areas of interest, for example food security and water security, it is not mentioned explicitly in policies so therefore we do not get any special treatment with regards to the provision of scholarships and suchlike. Nevertheless, our student numbers have remained rather steady. We have a strong history in land tenure and its administration and will continue to explore options for growing the course. The ongoing collaboration with Kadaster International, through the shared School for Land Administration Studies, will continue to be a key element in these developments. Together we have a lot to offer and this has been recognised in many countries, particularly -in Asia and Sub-Saharan Africa.

Traditionally ITC's students have been mid-career professionals. Given the changes already discussed, will that demographic remain the focus or is ITC also looking to attract younger students without professional experience, straight out

of BSc programmes?

We are currently serving both, but a gradual shift towards younger student profiles is already underway. That said, as long as the demand from mid-career professionals remains, we will continue to serve that market segment. We envisage that shorter tailored courses will gain in popularity for the more mature groups; spending a full 18 months away from one's employer is becoming more difficult. A targeted three- to nine-week course might be more useful since it reduces the burden on families and employers alike.

As required by Dutch law, ITC's research and educational programmes have recently been reviewed and accredited. Such accreditations

are about guaranteeing staff, curricula and scientific quality. How do students benefit from this certified high level?

The accreditation process is about formalising the seal of quality. It provides another source of information for prospective students about the nature and value of our courses, supervision and so on. This applies both for MSc and PhD students. The accreditation provides a guarantee that we delivering up-to-date information and excellent standards, and that students are getting what they expect. We were quite happy with the recent positive accreditation results. All our research groups received 4s and 5s for all criteria (on a scale of 1 to 5), which reaffirms that we have a high – or even world-leading – international standing.

Observers say the digital divide between the rich and poor countries is growing every day. Does ITC also see evidence of this in its domain? And does it have a special policy or approach to bridge that divide? If so, how will the developing world benefit from it?

No doubt there is a digital divide, but the mobile phone revolution is a real equaliser in terms of access to digital telephony and digital data. We are seeing the impact across much of our work – be it in relation to water access or the creation of community maps. It enables a new way of creating, collecting, manipulating and disseminating spatial data – and much of the community already has access to the tool. At ITC and the University of Twente, we have a special focus on entrepreneurship, and we feel this can also accelerate the closing of the gap. Small businesses drive much innovation and development, and we are working to support the further development of our students in that regard. ◀

Acknowledgement

With thanks to Paul van der Molen for question development.

Tom Veldkamp

Professor Tom Veldkamp is dean of the Faculty of Geo-Information Science and Earth Observation (ITC) at the University of Twente, The Netherlands. He holds MSc and PhD degrees from Wageningen University in tropical soil science and environmental science respectively. Following these achievements he worked for the Dutch Geological Survey before returning to Wageningen University. He was appointed as professor and chair of land dynamics in 2002. He moved to the University of Twente at the end of 2009 and maintains a research line focused on land use science.

Micrometre-level Deformation Monitoring of a Concrete Dam

Highly accurate measurements with a high temporal resolution have always been a challenge, especially for locations that are hard to reach since conventional geodetic deformation methods are often unsuitable for such locations. With fibre-optic deformation monitoring, cables can be embedded in an object and left alone to provide permanent deformation monitoring measurements. Such a system was installed in a dam in Austria to provide insight into the expansion of joints inside the dam when the reservoir level changes.

Hydroelectric power plants are an important source of energy in mountainous regions. The large reservoir lakes behind dams often create a picturesque scene, despite the fact that the dams are made of huge, vertically aligned, reinforced-concrete blocks. There are more than 160 such dams in Austria alone. However, these dams can pose a risk to the environment if structural damage occurs. Hence, deformation monitoring measurements are carried out at regular intervals to ensure dam safety. Traditionally, such measurements are taken using total

stations and GNSS, whereby points are surveyed on the crest of the dam and inside the inspection corridors every three months.

In the past decades, many hydroelectric power plants have been converted into pump-storage plants. When demand for power is high the plants operate as usual, providing energy by releasing water from the reservoir lake through the turbines. During off-peak hours, low-cost electricity is used to pump water from a collection basin into the reservoir lake at high altitude. As the water

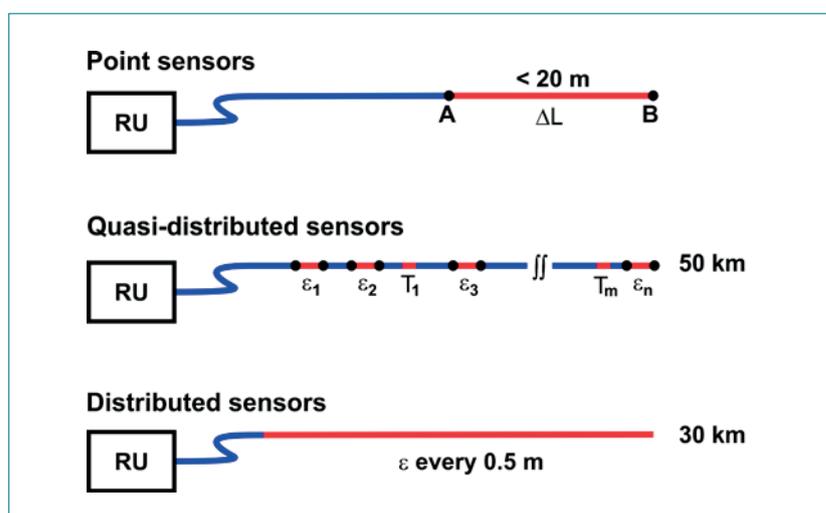
can be pumped with a relatively high energy efficiency of 80%, this is an effective way of storing surplus energy during periods of low demand.

In the traditional method of operation, the water level changes slowly in line with a yearly cycle. In contrast, on-demand pumping and discharge of water leads to an increased and more erratic load cycle of the dam. This requires new monitoring techniques with greater precision and a higher temporal resolution. Using traditional survey equipment, it is not feasible to achieve a very short measurement interval cost-effectively in the harsh alpine environment. Therefore, in the case of the Kops dam in Austria, a fibre-optic monitoring system was installed to conduct permanent deformation monitoring.

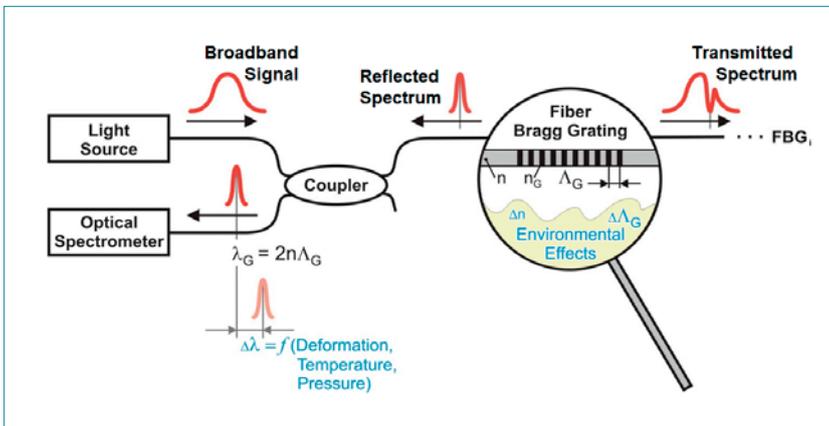
FIBRE-OPTIC MONITORING

Fibre-optic sensors are a useful alternative to deformation monitoring because they can supply very high-precision measurements for hard-to-reach locations. They are based on a fibre-optic cable which is embedded into an object and can supply measurements with a frequency of several kHz.

Fibre-optic measurement systems emit light into glass fibres and analyse the returning signal. The light source and the



▲ Figure 1, Three different set-ups for fibre-optic monitoring. The red sections indicate the sensitive areas.



▲ Figure 2, The transmitted and reflected spectrum of an FBG.

signal analyser are usually integrated in one instrument called the reading unit. There are various types of fibre-optic measurement systems (Figure 1). The simplest installation is the point sensor, which measures changes in length in the sensitive area at the end of the fibre-optic cable. In this sensitive area the signal path is split up into one stable path and one variable path. The phase difference between the returned light from both paths can be depicted by an interferometer.

DISTRIBUTED SENSORS

The point sensors can give a very precise reading of changes in length at one single position. With quasi-distributed fibre-optic sensors it is possible to obtain measurements at many points along the fibre-optic cable. In a quasi-distributed system, sensors are

An FBG follows the deformations of the object if the cable is fixed to the monitoring object on both sides of the FBG. In this case an elongation or shortening of the distance between the fixation points results in FBG wavelength shifts which can be measured and converted into strain values (ϵ). Achievable accuracies are in the range of $1\mu\epsilon$. This corresponds to $1\mu\text{m}$ if the distance between the fixation points is 1m.

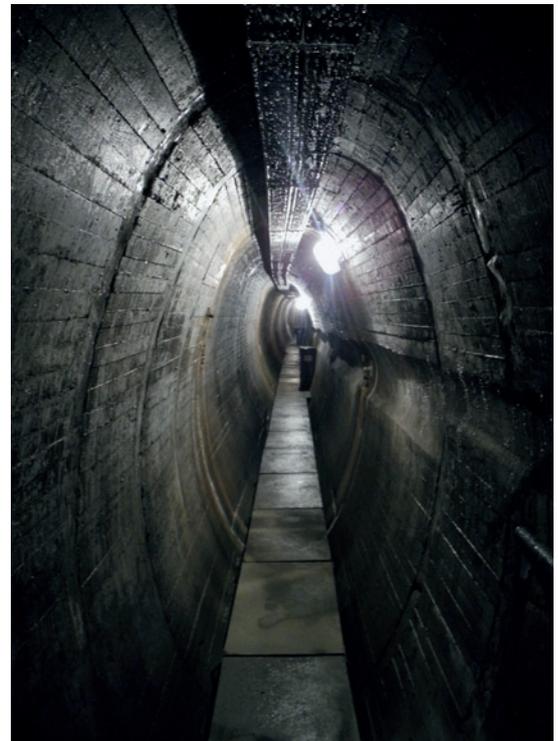
INSTALLATION

The Kops dam in Vorarlberg, Austria, is a concrete arch dam with a height of 122m and a crest length of 614m. A quasi-distributed system was installed in one of the inspection corridors of the dam in the autumn of 2013 (Figure 3). 15 expansion joints were equipped with FBG sensors. To enhance the robustness

DURING OFF-PEAK HOURS, LOW-COST ELECTRICITY IS USED TO PUMP WATER FROM A COLLECTION BASIN INTO THE RESERVOIR LAKE AT HIGH ALTITUDE

physically placed at the desired measurement locations. These systems use Fibre Bragg Gratings (FBG) which are periodic refractive index changes inscribed into the fibre. Light with the Bragg wavelength gets reflected at the position of the grating. This reflected signal can be measured with an optical spectrometer. When the length of the FBG changes, the spacing of the grid also changes and thus the reflected wavelength shifts. This wavelength shift can be measured and converted into length changes (Figure 2).

of the fibre-optic sensors, the bare fibres were protected by a polyamide tube. Metal anchors at each end of the sensor ensured a rigid connection to the concrete dam and therefore the cable could be used to measure length changes of the concrete joints (Figure 4). The 15 sensors were placed on three measurement chains to cover the entire length of the dam. Thus, only three fibre-optic leading cables were required to connect all sensors to the reading unit, which was placed about 500m away from the sensors in a



▲ Figure 3, The inspection corridor where the fibre-optic cable was mounted.

maintenance building beyond the dam. The reading unit took measurements automatically in a predefined interval and fed the data into the dam owner's control software.

MEASUREMENTS

Figure 5 shows the results of five sensors in the first measurement chain during a two-week time frame. It can be seen that during the first seven days the water level was almost constant. The joint deformations in the range of $15\mu\text{m}$ that were observed during that time (Figure 5-a) were therefore mainly caused by temperature changes. During the second seven days the water level increased by several metres. As a result the concrete joints were closing (Figure 5-b). It can also be seen that the same water-level rise caused different degrees of deformation for different joints. A one-metre water-level increase caused block joint deformations of $-1.1\mu\text{m}$ for sensor location A2 and $-5.5\mu\text{m}$ for sensor location A3. Such small deformations can only be depicted due to the high precision of the fibre-optic monitoring system. Considering the precision of the FBG measurement system of $1\mu\epsilon$ and the distance of 40cm between the anchor points the concrete joint deformations can be measured with $0.4\mu\text{m}$ precision ▶



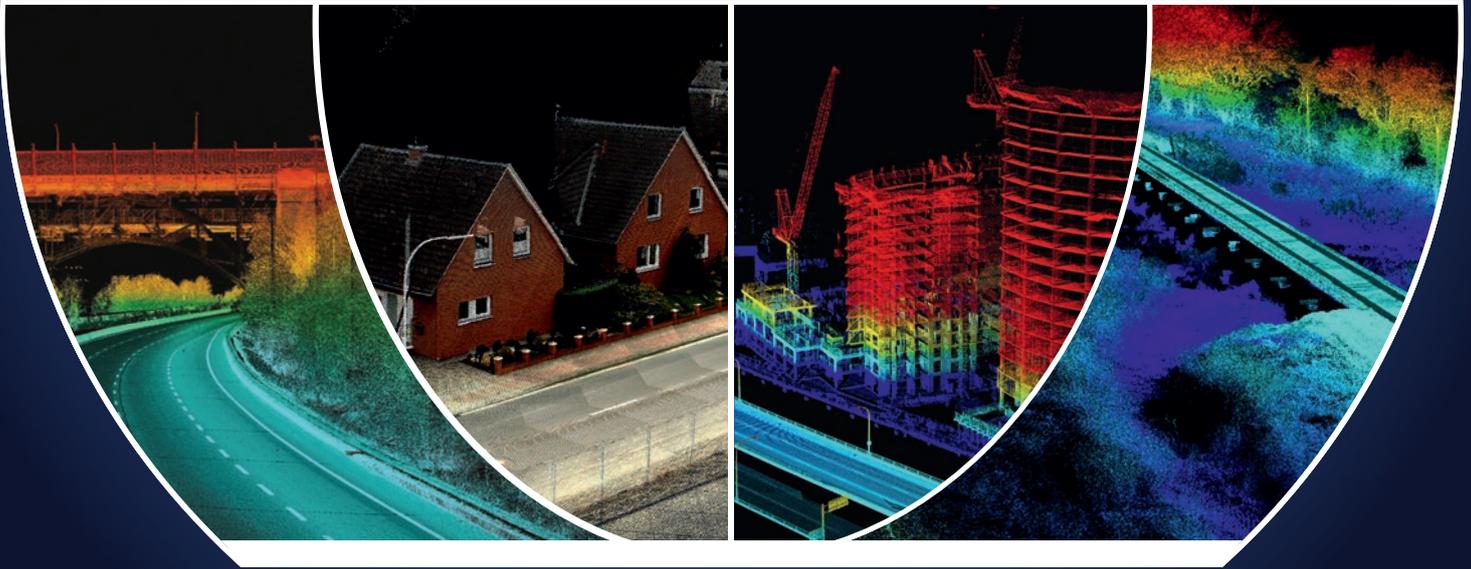
TELEDYNE OPTECH
Everywhere you look™

Lynx 3D Mobile Mappers

Because **Accuracy & Productivity** Matter



Bridge Clearances • Road Engineering • Rail Engineering • Power Distribution



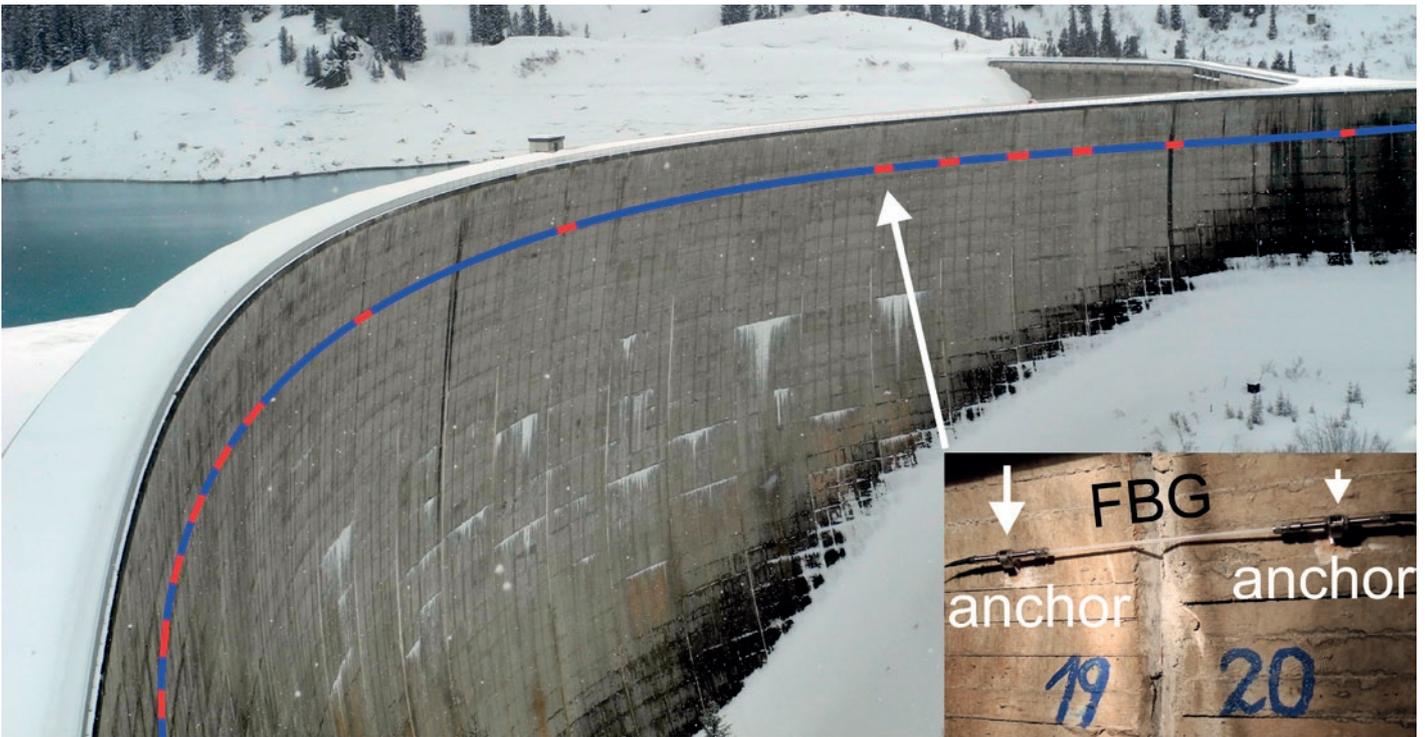
Precise Measurements • Faster Algorithms • Higher Accuracy • Efficient Workflow

The fully scalable Lynx SG1 and MG1 mobile mapping systems are the only systems offering consistently superior results by leveraging cutting-edge lidar, 360° cameras, and the processing automation of the new Optech LMS Pro 3.0 workflow.

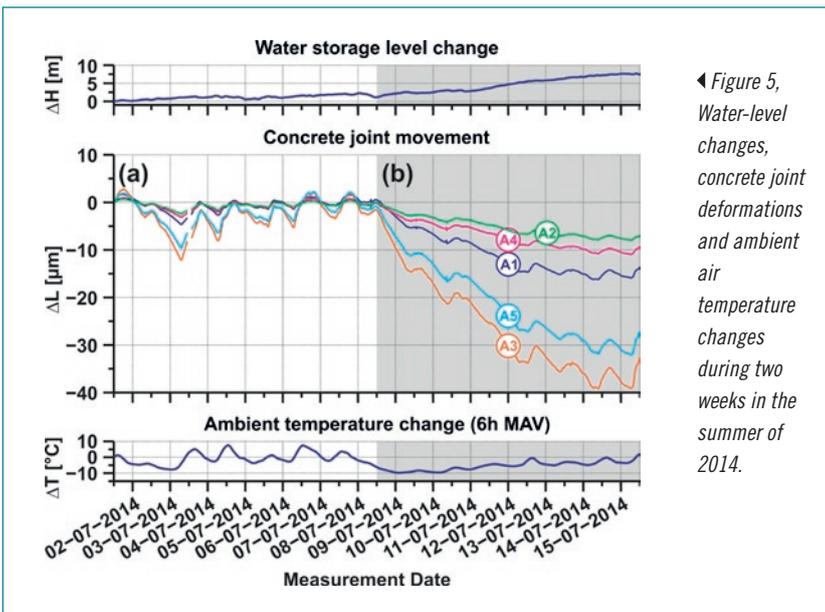
- Achieve survey accuracy levels in the most challenging conditions
- Market-leading measurement precision and data density provide accurate 3D models
- Real-time data display and live diagnostics ensure on-time and on-spec data collection
- Leverage managed workflows with sophisticated built-in algorithms to minimize processing costs

Contact an Optech representative today for the ideal solution to your mobile survey needs!

www.optech.com



▲ Figure 4, The Kops dam showing the locations of the fibre-optic cable (blue) and sensors (red).



◀ Figure 5, Water-level changes, concrete joint deformations and ambient air temperature changes during two weeks in the summer of 2014.

which was also verified empirically. Using the fibre-optic monitoring system, a change of the deformation behaviour of the dam can be detected immediately which is critical for early-warning systems. Furthermore, there is no need to access the dam to perform the concrete joint measurements.

CONCLUDING REMARKS

This monitoring example at a dam in Austria demonstrates the huge benefits of fibre-optic sensors. Due to their high precision, high spatial resolution and high temporal resolution, they are very suitable

for monitoring purposes. As they can be embedded into structures, they also enable permanent monitoring of locations that are otherwise hard to reach. This makes them a perfect complement to conventional geodetic sensors in challenging monitoring projects. It has to be noted that, as with all sensors, thorough calibration and the compensation of adverse temperature effects are crucial to achieving highly accurate results.

ACKNOWLEDGEMENTS

Thanks are due to the funding partner of this monitoring project, Vorarlberger Illwerke AG. ◀

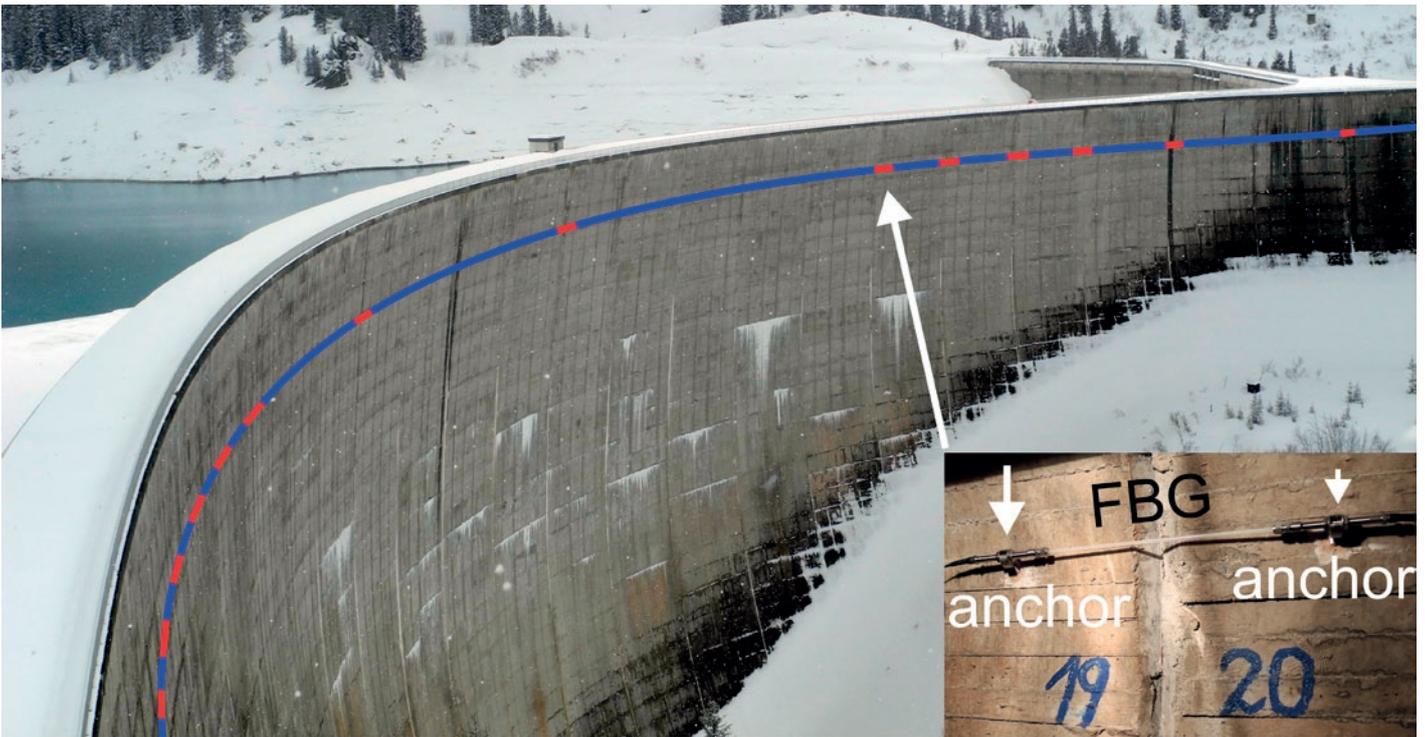
FURTHER READING

- Habel, W., Krebber, K., 2011. Fiber-optic Sensor Applications in Civil and Geotechnical Engineering. *Photonics Sensors*, 2011, Vol. 1, Nr. 3, 268-280
- Klug, F., Lienhart, W., Woschitz, H., 2014. High-resolution monitoring of expansion joints of a concrete arch dam using fiber-optic sensors. Proc. 6th World Conf. of the Int. Assoc. for Structural Control and Monitoring (IASCM), 3164 - 3176.
- Lienhart, W., Lackner, S., Moser, F., Woschitz, H., Supp, G., 2013. Deformation Monitoring of Flood Prevention Dams Using Geodetic and Fibre-Optic Measurement Techniques. Proc. 6th Int. Conf. on Structural Health Monitoring of Intelligent Infrastructure - SHMII-6, 8 p.
- Woschitz, H., Klug, F., Lienhart, W., 2014. Design and Calibration of a Fiber-Optic Monitoring System for the Determination of Segment Joint Movements Inside a Hydro Power Dam, 2014, *Journal of Lightwave Technology*, Vol. 32, 6 p.

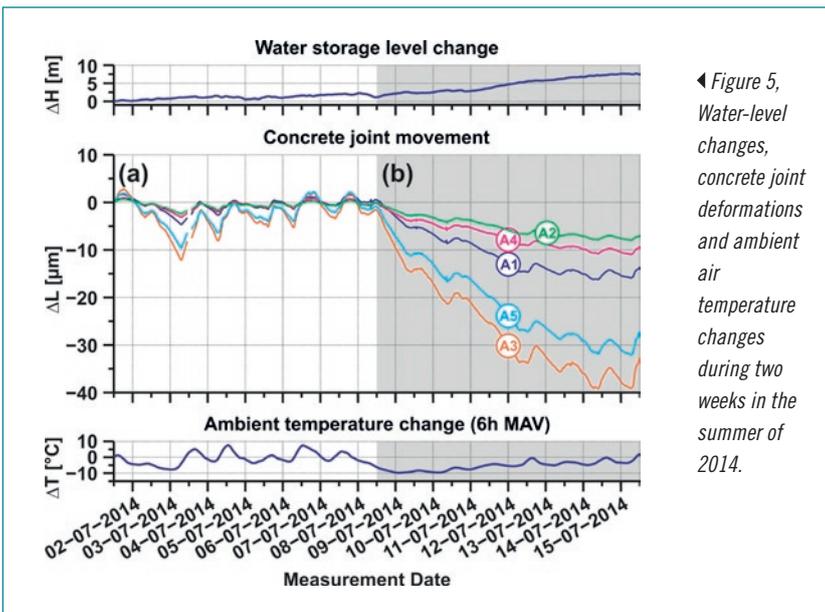
WERNER LIENHART



Werner Lienhart is professor and head of the Institute of Engineering Geodesy and Measurement Systems at Graz University of Technology, Austria. Prior to his current position he was product manager innovation at Leica Geosystems AG's headquarters in Switzerland. His main research interests are the development and calibration of geodetic and fibre-optic sensors and the analysis of inhomogeneous structural monitoring data.
✉ werner.lienhart@tugraz.at



▲ Figure 4, The Kops dam showing the locations of the fibre-optic cable (blue) and sensors (red).



◀ Figure 5, Water-level changes, concrete joint deformations and ambient air temperature changes during two weeks in the summer of 2014.

which was also verified empirically. Using the fibre-optic monitoring system, a change of the deformation behaviour of the dam can be detected immediately which is critical for early-warning systems. Furthermore, there is no need to access the dam to perform the concrete joint measurements.

CONCLUDING REMARKS

This monitoring example at a dam in Austria demonstrates the huge benefits of fibre-optic sensors. Due to their high precision, high spatial resolution and high temporal resolution, they are very suitable

for monitoring purposes. As they can be embedded into structures, they also enable permanent monitoring of locations that are otherwise hard to reach. This makes them a perfect complement to conventional geodetic sensors in challenging monitoring projects. It has to be noted that, as with all sensors, thorough calibration and the compensation of adverse temperature effects are crucial to achieving highly accurate results.

ACKNOWLEDGEMENTS

Thanks are due to the funding partner of this monitoring project, Vorarlberger Illwerke AG. ◀

FURTHER READING

- Habel, W., Krebber, K., 2011. Fiber-optic Sensor Applications in Civil and Geotechnical Engineering. *Photonics Sensors*, 2011, Vol. 1, Nr. 3, 268-280
- Klug, F., Lienhart, W., Woschitz, H., 2014. High-resolution monitoring of expansion joints of a concrete arch dam using fiber-optic sensors. Proc. 6th World Conf. of the Int. Assoc. for Structural Control and Monitoring (IASCM), 3164 - 3176.
- Lienhart, W., Lackner, S., Moser, F., Woschitz, H., Supp, G., 2013. Deformation Monitoring of Flood Prevention Dams Using Geodetic and Fibre-Optic Measurement Techniques. Proc. 6th Int. Conf. on Structural Health Monitoring of Intelligent Infrastructure - SHMII-6, 8 p.
- Woschitz, H., Klug, F., Lienhart, W., 2014. Design and Calibration of a Fiber-Optic Monitoring System for the Determination of Segment Joint Movements Inside a Hydro Power Dam, 2014, *Journal of Lightwave Technology*, Vol. 32, 6 p.

WERNER LIENHART



Werner Lienhart is professor and head of the Institute of Engineering Geodesy and Measurement Systems at Graz University of Technology, Austria. Prior to his current position he was product manager innovation at Leica Geosystems AG's headquarters in Switzerland. His main research interests are the development and calibration of geodetic and fibre-optic sensors and the analysis of inhomogeneous structural monitoring data.
✉ werner.lienhart@tugraz.at



REACH
FURTHER



The new SANDING EDM technology now provides you more possibilities to reach further.

Total station STS-752R6C now measures up to 600m without prism, and STS-762R6C up to 800m.

Think further, reach further.



SANDING

www.sandinginstrument.com

No 2805

BUILDING UAS CAPACITY FOR THE LAND ADMINISTRATION SECTOR

From Barefoot to 'Air-foot' Surveyors

Unmanned aerial systems (UASs) have the potential to revolutionise land administration activities. The latest products are relatively inexpensive, automated, easy to use and are able to deliver the spatial accuracies and high-quality imagery required for the sporadic updates of cadastral boundaries. Consequently, there are opportunities for streamlined legal frameworks, new technical processes and improved organisational work-flows. Seizing these opportunities will require substantial capacity development. Here the authors explore how UAS technology could have a significant and immediate impact on land administration activities in sub-Saharan Africa, with specific focus on the experiences during a recent field demonstration in Rwanda.

As covered in the January 2015 edition of *GIM International*, land administration is changing. The historic, well-meaning conservatism inherent in conventional cadastral laws, administrative processes and technological applications is being superseded by the 'fit-for-purpose' mantra. In developing countries especially, the focus should be placed on approaches that are inclusive, participatory, affordable, reliable and scalable. New land policies developed over the last decade, particularly those from sub-Saharan African countries, have driven this change in approach. Evidence from Rwanda, Ethiopia and Namibia already suggests that fit-for-purpose methods allow land administration systems to be established faster and at a lower cost.

UASs are an emerging part of the fit-for-purpose toolkit. Imagery capture can be undertaken locally (e.g. in areas of between 1 and 400ha) in an affordable and timely fashion. The results can be used to support flexible and participatory land-rights mapping or to upgrade previous mapping work. Studies by the World Bank demonstrate the application in Albania. Meanwhile, new research conducted by ITC (University of Twente, The Netherlands) in association with Micro Aerial Projects L.L.C. demonstrates the potential utility of UASs in both informal settlements and customary areas of Namibia.

However, as with many disruptive technologies, there are various potential



◀ Figure 1, Preparing for the launch.

barriers to adoption. First, legal restrictions relating to the use of UASs usually apply. Second, production workflows for adjudication and surveying activities may require redesign. Third, capacity needs to be developed within the surveying and para-surveying community with regards to flight planning, field expertise, processing and data analysis.

TECHNICALLY READY

As a geospatial technology, the UAS is reaching technical maturity and is already used in applications as diverse as topographic mapping, agriculture, construction, mining and emergency management. The land administration sector has been slower to recognise the opportunities offered by UASs (Kelm, 2014). In countries with developed cadastres and accompanying processes, UASs may not provide much benefit or

impact in the short term. However, in developing countries where there is often a shortage of trained surveyors, the UAS could be an immensely useful tool for mapping or updating cadastral boundaries. In these contexts, the identification, registration and maintenance of large numbers of land interests require quick and cost-effective solutions. Even with modern GNSS tools, using traditional ground-based methods simply takes too long. UASs provide an alternative for some parts of the cadastral establishment and maintenance cycle.

From a technical perspective there are two main types of UASs – fixed-wing and rotary-wing systems. Each type has distinctive features that make it more or less suitable for particular applications. Fixed-wing models tend to have greater flying time and are more suited for mapping larger areas. ▶



▲ Figure 2, Sample eBee imagery: cadastral boundaries and monuments are potentially identifiable. ▲ Figure 3, ThinkMap showing INES Ruhengeri campus.

Rotary-wing models have the advantage of vertical take-off and landing, which means that they can be launched from tight spaces. They also have the ability to hover, which makes them an ideal tool for inspection of buildings, bridges, pipelines and other structures.

CAPACITY GAP

A lack of capacity potentially impedes the proliferation of UASs in land administration. The operation of a UAS as a mapping tool requires either the existing workforce to be upskilled or a new workforce to be created. Over the last decade, two trends have been observed in the land administration workforce. Firstly, conventionally trained surveyors have seen their role change from data capture to information management, mainly due to the emergence of new technologies. Secondly, these same technologies have resulted in a new type of surveyor: the barefoot, grassroots or para-surveyor who knows how to use specific tools to undertake a specific part of the cadastral workflow. These surveyors are trained in a fraction of the time needed to become a conventional, fully trained surveyor.

In the fit-for-purpose world, both the conventionally trained and the para-surveyor appear to have a place. But what about in relation to UASs? Who should be doing this kind of work? Is it a job for the fully fledged professional or perhaps 'air-foot' surveyors can do the work? What level of qualification is actually required? Should such training be incorporated into existing surveying and mapping educational programmes? If so, how and when? Although UASs are seen as easy to use, using them for mapping certainly requires some training if not expertise. In some countries it may involve licensing or certification, prescribed by law. For example, to fly a UAS commercially in Australia, certification is required from the Civil Aviation Safety Authority (CASA) at the organisational and individual (pilot/operator) level. Similar requirements are in place, or under development, in other countries. The choices governments and the land administration sector make on these issues could have a large impact upon how readily UASs are adopted into cadastral workflows and existing educational programmes.

RWANDAN OPPORTUNITY

In Rwanda, the use of UASs in land administration appears to have significant relevance. In the early 2000s, the land administration system went through the highly innovative Land Tenure Regularisation (LTR) programme. The intention was that all rightful landholders were given legally valid land documents. Through a systematic land registration process, led by the Rwandan Natural Resources Authority (RNRA), para-surveyors demarcated land parcels using aerial images and a general boundary approach. To support the system a web-based Land Administration Information System (LAIS) was developed. LAIS connects

to the 30 districts charged with maintaining the land registration information and also to financial institutions through an electronic mortgage registration system.

However, there remain obstacles in the update procedures that discourage people from reporting changes. These include a long update process caused by a mixture of general and fixed boundary surveying approaches, the analogue nature of the system and a flat right-transfer fee that does not consider the value of the land dealt with in the transaction (Biraro, 2014). Some of these obstacles are being dealt with by the Rwandan government in conjunction with INES Ruhengeri, an institute of applied sciences, which is contributing by training professionals in land administration and land surveying.

With the capacity development issue in mind, staff from ITC, INES Ruhengeri and ThinkSpatial (an Australian geospatial consultancy) met in Rwanda to explore the idea of embedding UASs into the land administration educational programmes of INES and Rwandan land administration more generally.

ORTHOMOSAIC

ThinkSpatial operates a Sensefly eBee, which is a fixed-wing ultra-lightweight UAS with a 1m wingspan. It carries a 16MP camera capable of providing 3.5cm imagery at a flying height of 115m. In Rwanda, the team captured imagery over the INES Ruhengeri campus in Musanze District to demonstrate the operation of the aircraft to staff and students and to illustrate the workflows and final products to the local land administration stakeholders. The demonstration, which took 15 minutes, covered an area of 12.5ha over

FURTHER READING

- Biraro, M. (2014). *Land Information Updating: Assessment and Options for Rwanda*. Master of Science thesis, University of Twente, Enschede, The Netherlands.
- FIG (2014). *Fit-for-Purpose Land Administration, FIG Publication 60*, Copenhagen, Denmark.
- Kelm, K. (2014). UASs Revolutionise Land Administration, *GIM International*, 28(10), 35-37.
- Lemmen, C.H.J., Bennett, R.M., McLaren, R. and Enemark, S. (2015). A New Era in Land Administration Emerges, *GIM International*, 29(1), 22-25.

which 120 images were captured to produce an orthomosaic of the campus.

The processing of the dataset took 4 to 5 hours with the resulting products being orthoimagery, a digital surface model (DSM) and a 3D point cloud. The products were then loaded into ThinkSpatial's cloud-based ThinkMap product. ThinkMap is a multi-device web-mapping tool that allows users to examine imagery, geospatial datasets and documents.

INES Ruhengeri students and staff quickly grasped the potential role UASs could play in their training programmes. However, any plans to incorporate the use of UASs for land administration in Rwanda will need to carefully address how a sustainable workforce capacity can be established.

LOOKING AHEAD

The field demonstration carried out in Rwanda revealed that, despite the clouds, curious hawks and hilly terrain, UASs could be readily applied to land administration applications. The high-quality, high-resolution imagery and fast turnaround times appear to offer a great deal to the

fit-for-purpose land administration model that has been adopted in Rwanda. Further work is needed to explore how best to undertake the vectorisation of parcel boundaries in a way that rekindles the participatory spirit inherent to LTR. The field visit also revealed that, whilst there is plenty of surveying equipment already within Rwanda, there is a lack of trained surveyors

ready to use it. Although the country is investing in its professional land administration workforce (through the programmes offered at INES Ruhengeri and ITC), capacity development takes time. In the meantime, tools such as UASs and the para-surveying workforce could play a key role in delivering sustainable and fit-for-purpose cadastral updates. ◀

ELDAR RUBINOV



Eldar Rubinov studied geomatic engineering at the University of Melbourne, Australia, where he also completed a PhD in high-precision GNSS. In 2014 he joined ThinkSpatial as a GNSS and UAV specialist.
✉ erubinov@thinkspatial.com.au

SIMON FULLER



Simon Fuller graduated from the University of Melbourne in 2001 and founded ThinkSpatial, a surveying and spatial information company, with fellow graduate Lynden McGregor.
✉ sfuller@thinkspatial.com.au

MIREILLE BIRARO



Mireille Biraro holds an MSc in geo-information science and Earth observation for land administration from the University of Twente, The Netherlands. Currently, she is an assistant lecturer in the Department of Land Administration and Management at INES Ruhengeri, Rwanda.
✉ biramireille@yahoo.fr

ROHAN BENNETT



Rohan Bennett is an assistant professor in land administration at the University of Twente, The Netherlands. He holds a PhD from the University of Melbourne and degrees in geomatic engineering and information systems.
✉ r.m.bennett@utwente.nl

ortoSky - Geospatial Integration

οιζροζκλ - ε60ε2β9τ19τ 1υτ6εδλ9ατ1ου

photogrammetry GIS 3D LiDAR
pairs technology digitation
mapping raster vector
geoprocessing UAV stereo
aerotriangulation

srm CONSULTING

For further information visit www.srmconsulting.es

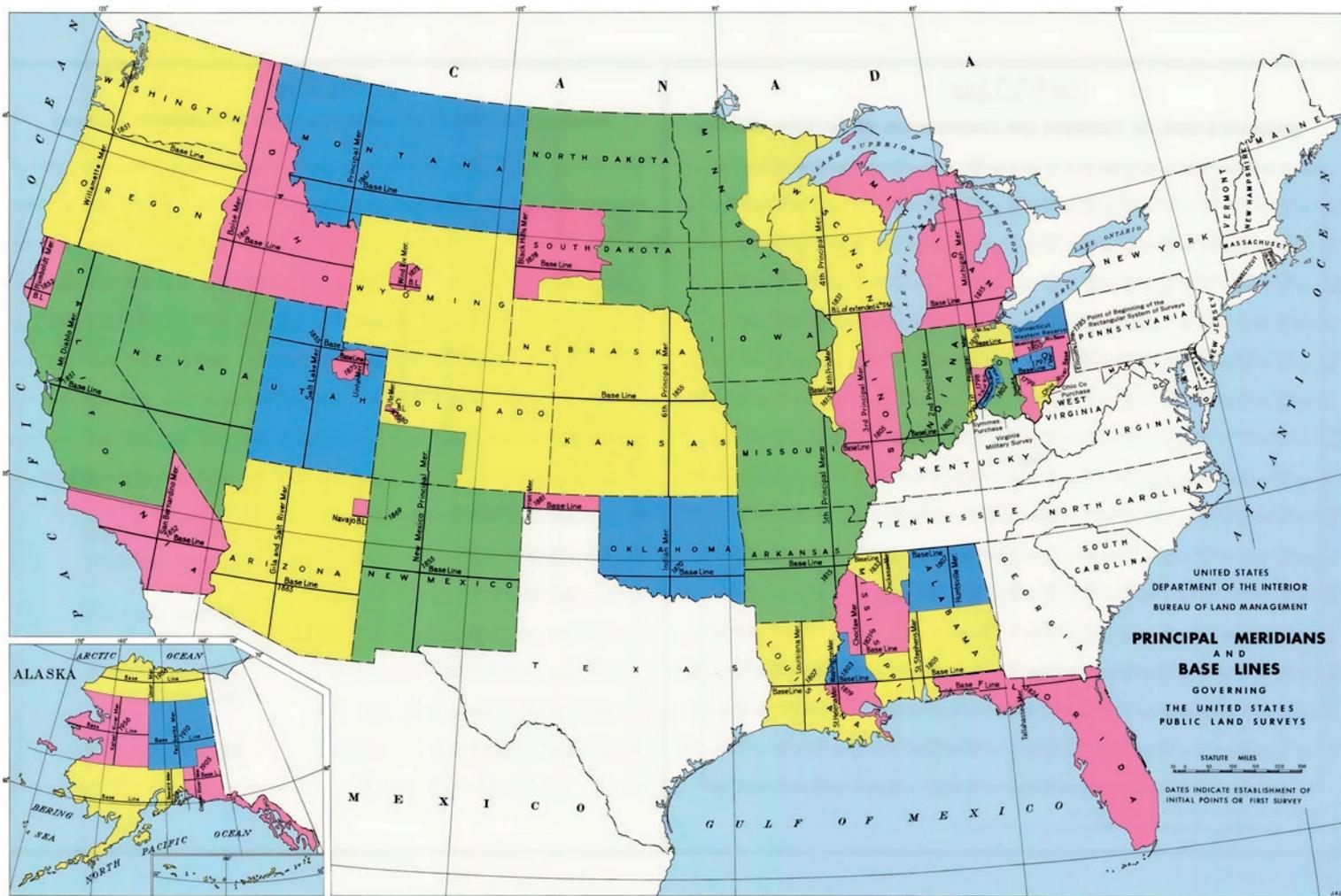
Twitter Facebook LinkedIn YouTube

No 2747

NEED FOR COMPREHENSIVE PARCEL DATABASE

No Nationally Coherent Cadastre in the USA

An extensive Report Card on the U.S. National Spatial Data Infrastructure (NSDI) was published earlier this year, initiated by the Coalition of Geospatial Organizations (COGO). Of the seven data themes assessed, the Cadastral Data theme scored particularly low. There is no government-coordinated national cadastre database or portal, and the evaluating panel of experts does not see evidence of much progress in recent years in establishing a National Cadastral dataset.



▲ A U.S. Bureau of Land Management map showing all the principal meridians and baselines in the U.S. Public Land Survey System.

The panel of experts awarded the cadastral data in the USA a grade of D+, based on the fact that there is no comprehensive parcel database for cadastral information. A comprehensive parcel database would include past, current and future rights and interests in real property, including the spatial information necessary to describe geographic extents. In addition, no framework exists for the creation of a sustainable and equitable intergovernmental funding programme for the development and maintenance of parcel data. The data for approximately 150 million non-federal land parcels is maintained by approximately 6,700 land-record (cadastral or parcel) data stewards, covering over 3,200 counties and equivalent units of local government.

The D+ grade also reflects the fact that the federal government is unable to adequately address the needs of federal agencies for parcel data and to coordinate the development of a national parcel dataset. Until a comprehensive approach to assembling parcel information from local stewards is adopted, it should be acknowledged that the United States does not have a programme to create and support a national cadastral data theme in the NSDI.

IMPACT

According to the panel of experts, the lack of comprehensive cadastral data is significant and its impact is illustrated by a number of recent events. First, the collapse of the mortgage market shone a spotlight on the consequences of the United States' failure to maintain cadastral data. It is clear that risky securities based on bundles of U.S. mortgages were an underlying cause of the banking crisis which led to a wider financial crisis and almost worldwide recession. Both before and after the start of the crisis, various reports stated that the lack of a sound property rights data infrastructure in the U.S. contributed to the unforeseen collapse of its real estate market and to the subsequent mortgage crisis. Second, the nation's poor response to Hurricane Katrina also highlighted the need for better parcel information that could help officials prepare for and respond to major disasters more effectively. In addition, wildfires like those in the western United States have caused extensive damage to suburban/wildland property, thus showing the need for a parcel data infrastructure to

protect communities from disaster and also help them recover afterwards. Last but not least, from the local level to the national level, cadastral data that describes the geographic extent of rights, titles and interests in land parcels is used in many aspects of government and business. Such data is essential to property assessment, law enforcement, business location, transportation planning, national disaster response, environmental management, etc. The economic costs of the lack of cadastral data have not been calculated, but the example of the mortgage crisis alone shows that these costs can easily run into billions of dollars.

FRUSTRATED LEAD AGENCY

Cadastral data coordination is carried out under the policy guidance and oversight of the Federal Geographic Data Committee (FGDC). The Bureau of Land Management (BLM) has stewardship of the following four datasets: Federal Parcels Dataset, Geographic Coordinate Data Base, U.S. Official Cadastral Survey Records, and Public Land Survey System (PLSS) Dataset. The PLSS data has been published in the FGDC-endorsed CadNSDI2.0 data standard. A few years ago, the BLM and other partners commissioned an objective evaluation of the need for federal coordination of the cadastral data theme. The evaluation concluded "that it does not have either the mandate or the proper incentives to assemble parcel data as a standardised public domain database for the nation". The resulting plan and recommendations were endorsed by the National Geospatial Advisory Committee. The BLM asked for resources to implement the plan and recommendations. However, additional resources or a mandate to implement such a programme were not provided. The BLM stewardship situation has been further weakened by duplication of 20 different cadastral datasets that were identified as data managed by nine different federal agencies. Under the new realignment, it is not clear which of the 20 datasets actually comprise the cadastral theme. However, the BLM and the FGDC Cadastral Subcommittee have worked diligently to coordinate cadastral information across the country. The FGDC Cadastral Subcommittee has been a collaborative forum that has engaged stakeholders from federal land agencies, states, counties, tribes and the

GRADE REPORT OF: National Spatial Data Infrastructure (NSDI) SEMESTER: Fall 2014

| Subject | Dept. | Grade | Subject | Dept. | Grade |
|-----------------------|------------|-------|-------------------------|---------|-------|
| CADASTRAL DATA | DOI | D+ | CAPACITY | FGDC | C |
| GEODETIC CONTROL | DOC | B+ | CONDITION | FGDC | D |
| ELEVATION DATA | DOI | C+ | FUNDING | Various | D |
| HYDROGRAPHY DATA | DOI | C | FUTURE NEED | FGDC | D |
| ORTHOIMAGERY DATA | DOI & USDA | C+ | OPERATION & MAINTENANCE | FGDC | C |
| GOVERNMENT UNITS DATA | DOC | C | PUBLIC USE | FGDC | C |
| TRANSPORTATION DATA | DOT | D | RESILIENCE | FGDC | C |
| OVERALL DATA GRADE | | C | COMPREHENSIVE GRADE | | C- |

TO: Federal Geographic Data Committee
590 National Center
Reston, Virginia 20192

FROM: Coalition of Geospatial Organizations (COGO)
<http://www.cogo.org>
See the full report for an explanation of each grade.

▲ *The Report Card shows the D+ grade for the Cadastral Data theme. D = AT RISK. The data theme is in poor to fair condition and mostly below the goals envisioned for the NSDI.*

private sector. Working closely with its members, it developed a consensus-based standard that was approved in 2008.

The subcommittee continues to maintain a website that provides online access to a number of reports, standards, cost estimates, best practices, inventories and updated datasets for the PLSS.

NO ACCURATE TALLY OF FEDERAL LANDS

The federal government has an obligation to maintain a cadastre of federal land. Nevertheless, the coordination of federal property is in such a state of flux that the Congressional Research Service found that a coordinated approach to federally managed parcel data still did not exist, and that the best method for obtaining an accurate tally of federal lands is to contact each land management agency individually. The total is estimated to be about 650 million acres or about 28% of the U.S. land area. The inventory of federal lands may require legislation to fix the problem. Much of the confusion is based on the inherent ambiguity in the integration of databases and the poor articulation of responsibilities. Several federal committees have addressed the coordination of federal land data since the 1980s. The Federal Lands Workgroup that represents all stakeholders was created in 2012 and is now a subgroup of the National Boundaries Group, which includes 25 federal agencies. This new arrangement for the coordination of governmental units may make sense, according to the panel of experts in the Report Card. ▶

PENTAX

Scanning System S-3180V

3D laser measurement system



- + Integrated HDR camera allows combination of brilliant colours with high-resolution scan data
- + The fastest laser-scanner over 1 million points/second
- + Eyesafe laser class 1
- + IP53 dust & water resistance

TI Asahi Co., Ltd.
International Sales Department
4-3-4 Ueno Iwatsuki-Ku, Saitama-Shi
Saitama, 339-0073 Japan
Tel.: +81-48-793-0118
Fax: +81-48-793-0128
E-mail: International@tiasahi.com

www.pentaxsurveying.com/en/

EVALUATION

Earlier this year, the Coalition of Geospatial Organizations (COGO) in the U.S. published a Report Card that is intended to address the condition of the U.S. National Spatial Data Infrastructure and help spur additional progress. The completeness and suitability of data on the basic themes – from cadastral to transportation – was evaluated during 2014 by a seven-member expert panel chaired by (former Governor of Wyoming) James E. Geringer, who is currently the director of policy and public sector strategies with Esri. The panel also included vice-chairs Dr David Cowen, Professor Emeritus of the University of South Carolina, and John J. Moeller, former staff director of the Federal Geographic Data Committee. The April 2015 edition of *GIM International* covered the evaluation of orthoimagery data and the May 2015 edition published an interview with COGO chair Mike Vanhook. COGO is a coalition of 13 national professional societies, trade associations and membership organisations in the geospatial field, representing more than 170,000 individual producers and users of geospatial data and technology. For more information visit www.cogo.pro.

LIMITED ACCESS

Measuring the current status of cadastral data in the United States is not a straightforward process. The creation and maintenance of the geometric features and related attribute data are primarily functions of local government. The data only has limited sharing among state and federal agencies through partnerships, most of which are voluntary.

It is estimated that there are approximately 150 million privately owned properties which define the majority of parcel records in the United States and another 8 to 10 million which represent public lands. Surveys conducted by the FGDC Cadastral Subcommittee suggest that about 123 million or 82% of the private parcels and only about 55% of the public land areas are 'GIS ready'. In addition, the National States Geographic Information Council estimated that 17 states do not have state-wide parcel datasets in development.

The Department of Housing and Urban Development (HUD) hired consultants to assemble parcel data from 127 counties. After months of effort the consultants were only able to obtain useful data from 86% of the counties. Their HUD 2013 report noted major challenges including: (1) lack of full data documentation from many of the counties, (2) variations in each dataset's comprehensiveness, attribute definitions and formats, and accuracy, (3) unclear

and very diverse methods for internally validating data in each county, (4) wide variations in nomenclature and definitions for attributes (from land use codes to even basic assessment values), and (5) incorrectly identified or duplicate values for similar attributes within datasets. Although an increasing number of states have worked to create consistent, state-wide coverage, many of these efforts are limited to government-to-government access agreements.

As noted by the Government Accountability Office, the numerous federal programmes that require access to parcel data license the data from the private sector. While several firms create, consolidate and standardise parcel data for parts of the country, Core Logic, a publicly traded company, is building a national geospatial solution that captures boundary and centroid data for 2,658 counties accounting for 140.8 million parcels nationwide, 137.1 million of which are actual parcel boundaries.

NO WILL FOR ACTION

The conclusions and recommendations provided in the COGO Report Card regarding the status of the cadastral theme of the U.S. NSDI are clear. Years of trying have resulted in some progress towards a nationally coherent cadastre that serves multiple purposes, yet the prospect of a complete national cadastral data layer remains dim at the present time. Based on past

performance, it is apparent that collaboration and voluntary efforts alone will not work in such a complex situation. New authority and legislative action will be needed to turn a national parcel dataset into reality.

In view of this situation, a new model for NSDI framework data that acknowledges the importance of local partners must be adopted. This model should be transaction-based and emphasise the use of current information technologies, federated and web-based capabilities, and should support web-based services and applications. Since local partners hold responsibility for most of the parcel data in the United States, budgetary and leadership investments need to support a 'bottom-up' rather than a 'top-down' approach that must be considered in order to facilitate the creation of a national cadastral/parcel data layer. If such investment in current information technology does not occur then national efforts will remain divided among local responsibilities and redundant collections. ◀

FRÉDÉRIQUE COUMANS



Frédérique Coumans has more than 20 years of experience of covering all aspects of spatial infrastructures as editor-in-chief of magazines on GIS and datamining. She regularly contributes to *GIM International*.

✉ fcoumans@vbkcontent.com

LINERTEC

Cutting-Edge Technology
at an Affordable Price

LGP-300 Series
WinCE Reflectorless
Total Station

LTS-200 Series
Reflectorless
Total Station

LTH-02/05
Electronic
Theodolite

LGN-200 GNSS

A-100 Series
Automatic
Level

No 2565

TI Asahi Co., Ltd.

www.tilinertec.com | contact us at trade@tilinertec.com

ASK FOR YOUR FREE TRIAL
→ effigis.com/ezsuvr

POWER AND PRECISION AT YOUR FINGERTIPS

EZSURV[®] POST-PROCESSING SOFTWARE PROVIDES YOU WITH:

- ▶ Access to more than 8,000 CORS stations data all around the world
- ▶ Support multiple receiver native data format
- ▶ State-of-the-art processing engine
- ▶ Easy-to-use application
- ▶ Flexible licensing mechanism
- ▶ White Label version available for manufacturers

effigis
GEO SOLUTIONS

Compatible with
MicroSurvey
FIELDGenius

OnPOZI
Precision Positioning

No 2807

WORLD CADASTRE SUMMIT, CONGRESS & EXHIBITION

Let's Cadastre Our World...



▲ At the front: Young participants.

The first World Cadastre Summit, Congress & Exhibition (WCS-CE) took place in Istanbul, Turkey, from 20-24 April 2015. İdris Güllüce, Turkish Minister of Environment and Urbanisation, was the initiator of this largest-ever cadastre event and participated actively. The interest was so overwhelming that after 3,200 sign-ups from 90 countries – developed as well as developing – registration had to be closed two weeks before the start of the event due to capacity limitations.

Over 150 prominent speakers showed the inevitable value of cadastre and land administration for sustainable development. But the path to realisation requires new technology, new thinking and new leadership. The wide variety of demands and innovations required were presented in plenary sessions chaired by Tahsin Yomrakioglu, Ian Williamson and Orhan Ercan. Switzerland elucidated its successes but also its struggles. Speakers from Turkey outlined the many challenges confronting the national cadastre, and Malaysia revealed its high ambitions in diverse presentations. Trends recurrently identified include: fit-for-purpose approach; importance of standardisation (especially ISO 19152, Land Administration Domain Model); relating cadastre and valuation; including the marine environment; improved data acquisition (surveying, GNSS, photogrammetry, remote sensing); and 3D cadastre – with no less than 20 presentations held on the latter

topic. Increasing demands and advancing technologies mean that even well-functioning cadastrals cannot afford to rest on their laurels since effective, fast and affordable solutions require continuous innovation. The bustling exhibition floor comprised 60 stands displaying a variety of geomatics technologies including surveying, GIS, GNSS and remote sensing. The International Federation of Surveyors (FIG) promoted its 2018 congress, which will likewise be held in Istanbul. It was encouraging to see such a high number of student participants representing the new and up-and-coming generation of cadastral professionals. Another great measure of success was the presence of no less than 16 ministers who presented their statements on cadastre and land administration. Congratulations to Prof Dr Tahsin Yomralioglu, chairman of WCS-CE, and his team on the success of this timely event. The proceedings and presentations are available online at: <http://wcadastre.org/page/52-en-proceedings>. ◀



▲ Keynote speakers, from left to right: Kees de Zeeuw, The Netherlands; Brent Jones, USA; Gerda Schennach, Austria; Vanessa Laurence, UK; Stig Enemark, Denmark.



▲ Keynote speaker Peter van Oosterom, The Netherlands.



▲ WCS-CE attracted overwhelming interest from 90 countries.



L'AVION JAUNE

Imaging the Environment

L'Avion Jaune is a service company located in Montpellier, France, providing aerial imagery for environmental studies and precision agriculture. A pioneer in the French market of unmanned aerial vehicle (UAV) mapping services, the company focuses on multispectral imagery and tailor-made operations for research organisations and governmental agencies. To provide such services, L'Avion Jaune has developed unique know-how about specific remote-sensing hardware for UAVs and ultralight aircraft.

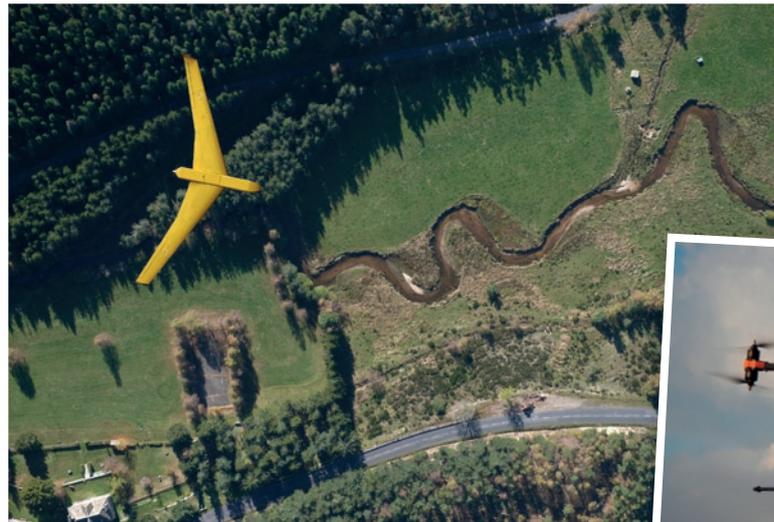
L'Avion Jaune is an independent private company which was founded in 2005 by three associates in Montpellier, France. The founders came from various public research institutes (climatology, mapping, agronomy) and had a strong background in optimisation, modelling and remote sensing. The initial business consisted of providing RGB and NIR

imagery to public research institutes using small RPAS. The company then decided to use manned planes for the main production, which was the only way to survey hundreds of square kilometres, as well as carrying heavy and expensive sensors (thermal imagers or multispectral sensors). For specific work, a fully automated system was developed in 2009: a gas-powered fixed-wing UAV with a 4.2m wingspan which is capable of flying for several hours at a pace of about 100km/h. This has allowed L'Avion Jaune to survey the Mururoa and Fangataufa atolls in the South Pacific for the French Alternative Energies and Atomic Energy Commission (CEA). The mission was extremely demanding in terms of operational capabilities: flying autonomously

at high altitude (2,000 to 4,500ft), under precise solar angle and sea-state constraints at a remote distance of 45km. 9,000 images were collected on a 60km linear length of the main atoll, and processed into 5cm and 20cm-resolution orthomosaics. In the following years, other contracts have been fulfilled by mapping power plants and rivers in France. Co-founder Bruno Roux comments: "We had the intuition that a company able to deliver aerial images from UAVs could find its way in the geomatics world. The idea was simple, but it took a while to produce the right results." In response to market demands, thermal imagery and laser scanning systems have subsequently been integrated into the company's offering.

Every month *GIM International* invites a company to introduce itself in these pages. The resulting article, entitled *Company's View*, is subject to the usual copy editing procedures, but the publisher takes no responsibility for the content and the views expressed are not necessarily those of the magazine.

▼ Bruno Roux and Michel Assenbaum, the co-founders of L'Avion Jaune.



▲ The Altium: a gas-powered, fixed-wing UAV with a 4.2m wingspan.

▼ The YellowScan laser scanner system on board an octocopter.



PRIORITISING QUALITY

Today, L'Avion Jaune continues to map the environment and to unveil features using bird's-view and non-visible imagery. Special attention is given to innovative research projects on remote sensing hardware and survey methodology.

At L'Avion Jaune, a main priority of the management team is quality, both in terms of products and the working atmosphere. The company is led by the belief that quality is primarily ensured by commitment and competence, much more than by formal procedures. Hence, the employees enjoy a very large degree of autonomy, a flat hierarchy and a flat revenue structure. As a result, the company is successful in retaining its experienced workforce – people are more likely to stay in a team where most colleagues become friends, and everyone is committed to providing the best possible customer experience. With a staff of eight and an expected turnover of EUR1 million in 2015, L'Avion Jaune relies on its highly competent team to handle challenging service and R&D contracts, where accurate remote sensing experience is compulsory. Michel Assenbaum, CEO, states: "I'm so happy to work with the staff at L'Avion Jaune and to see everyone's commitment to getting the best possible data and squeezing every piece of information out of it. We have already come a long way from our early beginnings to reach our present level, and yet we are still improving every day."

INTERNATIONAL FOCUS

L'Avion Jaune operates mainly in the field of environmental monitoring and agriculture for research and industrial organisations. Its

involvement in the French Association for Environmental Engineering (UPGE) brings many opportunities to collaborate on projects that are ethically and technically rewarding. The company provides highly specialised and tailor-made services to its customers all around the world, with the primary focus being in Europe, North America, South Africa and South America.

Photogrammetry surveys require clear skies and favourable conditions, and a quick response according to the weather forecast is mandatory. To meet the increasingly high demand for surveys, L'Avion Jaune is setting up an international team able to operate anywhere in the world, either with its own UAVs or with manned aircraft and helicopters hired from third parties. In this context, reliable partnerships with local pilots are preferred for manned aircraft, and compact and lightweight materials are used to facilitate logistics.

YELLOWSCAN

The company's largest hardware development to date is YellowScan, an ultralight laser scanner system for UAVs. It rose to the challenge and succeeded in designing a fully functional ALS system, including positioning sensors and power supply, within a 2kg box making it one of the lightest fully integrated laser scanning systems in the world, especially suited for UAVs. This new kind of Lidar sensor allows data to be collected cost effectively on projects of just a few square kilometres, which are too small for traditional airborne surveys and too large for TLS. This offers very promising global export opportunities, and the company is currently building up a network of local distributors and resellers who are able to provide YellowScan

demonstrations, training, after-sales services and even surveying services to end customers.

FUTURE OUTLOOK

The enthusiastic market response for YellowScan has triggered a new stage in the evolution of the company. The instrument development has now become mature and the next step is industrialisation. Since the YellowScan business is now becoming so large and hardware production is a very different kind of activity than providing services, a new company is being created in the course of 2015 to host instrumental developments and production. The aim is to develop a product range around ultralight laser scanning systems combined with RGB and multispectral cameras in the short term and hyperspectral and thermal cameras in the longer term.

The growing UAV market will probably experience some ups and downs as a result of changes to flight regulations and further technological advances. Many of the newly founded service companies may merge or even disappear if they fail to respond adequately to the market requirement for high-quality data. However, with more than ten years of experience within the UAV remote sensing market and a highly qualified workforce that is comparable to that of a research institute, L'Avion Jaune has the skills and expertise to add value to its clients' most demanding projects. ◀

More information

www.lavionjaune.fr

www.yellowscan.fr

K96-T The third generation of **KOLIDA GNSS** receiver
With an extreme ability to track satellite signals, and superior speed to analyze the data, K96-T is going to be the king of the GNSS jungle.



● All-frequency Signal Capturing Technology

With upgraded all-frequency Antenna, K96-T well supports satellite signals from GPS+ GLONASS+COMPASS. After Galileo Positioning System completely comes to use in the future, K96-T need no modification in hardware, but only some upgrade in firmware to trace and analyze its signals.

● World Class GNSS Motherboard

220 channels, most advanced processing technology. 3mm+0.5mm RMS precision for horizontal measurement (static), 8mm+1ppm RMS precision for horizontal measurement (RTK).

● Flexible Working Mode

Built-in transceiving radio (emitting range 1-5km), compatible with all brands receiver; Seamless access to all brands CORS system; Workable under 2.5G/ 3G/ 3.5G mobile network.

● Optimized Design

With optimized design for hardware as well as firmware, K96-T provides higher work efficiency. Enhanced industrial level of waterproof, dustproof and shockproof ability (IP67) guarantees it to survive 1m-deep water long time immersion, and 2.5m natural drops.



KOLIDA INSTRUMENT CO., LTD.

Add: 2/F, Surveying & Mapping Building (He Tian Building), NO.24-26, Ke Yun Road, Guangzhou 510665, China
Tel: +86-20-85542075 Fax: +86-20-85542136
E-mail: export@kolidainstrument.com <http://www.kolidainstrument.com>

NEW SMALL LASER SCANNERS AND FOCUS ON UNMANNED LIDAR SYSTEMS

RIEGL Lidar User Conference in Hong Kong and Guangzhou

On 5 May 2015, the RIEGL Lidar User Conference was opened by Dr Johannes Riegl, CEO of the company. Over 300 attendees were present at the event, which was held in two cities: Hong Kong and Guangzhou, the nearby city in mainland China. Following the previous user conference in Austria, this year's location in China reflects the rapidly developing Lidar market in Asia.



RIEGL took the opportunity of the conference to introduce a number of new products, with the highlight being the launch of new range of small, lightweight laser scanners for kinematic scanning. This VUX-1 series builds on RIEGL's UAV scanner that was introduced in 2014. That product range is now extended with scanners for higher accuracy and longer range. The long-range scanner is also available with an integrated camera in a new helipod for efficient use from helicopters. In addition, RIEGL unveiled a new entry-level mobile mapping system based on a single scanner.

FROM STATIC TO DYNAMIC

The keynote was given by Lawrie Jordan, director of imagery at Esri, who outlined his vision on the rapidly developing market for imagery and Lidar data. According to Jordan, while the GIS world may have been too static in the past, it is now rapidly evolving towards a continuously changing and interconnected

3D GIS. Imagery and Lidar data are enablers of this development. Plenty of captivating images of Lidar data were shown on screen to illustrate the point. One major development is that users want simple and fast access to the data through apps. Esri's new ArcGIS Pro product is a first step in that direction. Work still needs to be done to reduce the time between data collection and service delivery to the user. Among other challenges, this requires different ways of storing data, most prominently by storing data in the

the risks would be too high for users in the defence and oil & gas industries, for example. Hence, a seamless transition between the public and private cloud is crucial. According to Jordan, these developments are moving at a tremendous pace and will significantly change the way we work with GIS.

UNMANNED LIDAR SYSTEMS

Much attention was paid to the evolving concept of unmanned Lidar systems (ULSs). According to RIEGL, laser scanners mounted

ACCORDING TO RIEGL, LASER SCANNERS MOUNTED ON A UAV FILL THE GAP BETWEEN STATIC, MOBILE AND AIRBORNE LIDAR

cloud. Here, it is essential to differentiate between the public and private cloud. Due to the nature of the GIS business, not all data is suitable for storage in the public cloud;

on a UAV fill the gap between static, mobile and airborne Lidar since they supply the overview of airborne scanning, the detail of terrestrial scanning and the scale of mobile scanning. ▶

GIM

INTERNATIONAL

SUMMIT 2016

SEEKING SPACE FOR FUTURE DEVELOPMENT. JOIN THE GIM INTERNATIONAL SUMMIT

The GIM International Summit is a brand-new event for the geospatial industry. Building on 30 years of leadership as a global geospatial publication, *GIM International* is now leveraging its print and online prowess to facilitate a cutting-edge forum for thought-leaders and decision-makers. The event will go beyond industry borders, challenge conventions and look ahead to the future. Influential speakers from both within and beyond the sector will provide an inspiring practical perspective on the spatial dimension of global development.

Save the date: 10 - 12 February 2016

5 good reasons not to miss it!



Seek space for future development



Enjoy the city of Amsterdam to the fullest!



Meet your peers within the geomatics world



Only 15 minutes from the airport and in the heart of Amsterdam



Celebrate 30 years of geospatial knowledge by innovating the future!

Visit www.gimsummit.com for the programme!

Partners

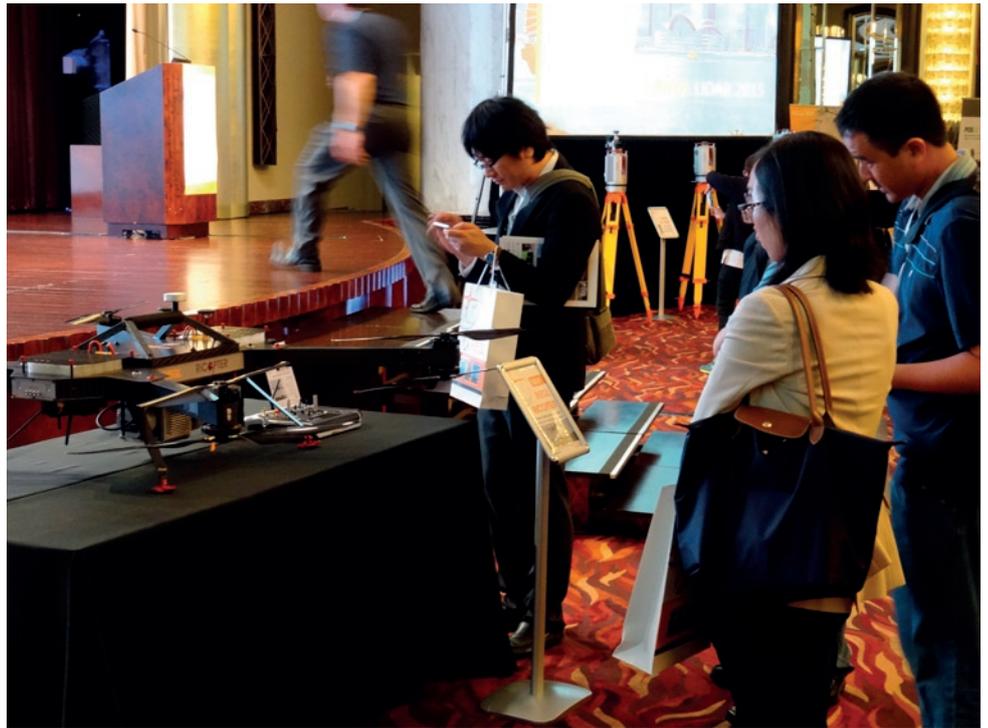


UNIVERSITY OF TWENTE.





▲ Lawrie Jordan of Esri during his keynote speech.



▲ Attendees could view RIEGL's unmanned Lidar system.

In comparison to UAV systems based on images, an unmanned Lidar system has the advantage that it requires less ground control and that the scanner looks sideways and downwards. This means that a greater spatial extent can be covered with fewer flight lines. Objects such as poles and trees can easily be scanned from all sides. However, due to the weight of the laser, GNSS and IMU, a large UAV is required which is capable of carrying a payload of up to 15kg. These larger UAV systems come with more stringent requirements for pilot certificates and flight permission, plus they are considerably more expensive.

Both the Technical University of Vienna and the Japanese company Nakanihon Air Service presented results of some early tests with the VUX-1UAV scanner. Some extensive accuracy comparisons had been conducted in Japan at various flying heights. In the vertical, they found a standard deviation of a little over 2cm. On top of this was a systematic error of 1.2cm at an altitude of 150m. For the horizontal accuracy, Nakanihon found values below 5cm. More details on the use of unmanned Lidar systems will be presented in future issues of *GIM International*.

SOFTWARE EVOLUTION

Both RIEGL and its partners demonstrated the importance of software for laser scanning. Processing software is evolving and now allows multiple pulses in air, analysis of the full wave



▲ Line-up of the new VUX-1 series and the helipod.

form and calibration. Especially the alignment of multiple scan paths is of great importance to ensure that all point clouds fit together well. This is especially true for ULS scanning, where the UAV flight operations do not allow for long dynamic and static alignments that are typically needed when using an IMU. Some of RIEGL's partners illustrated the developments in automating the processing of data. In particular the automation of object extraction remains a key challenge that is currently being addressed by many companies. In addition, now that many more scanners supply the full waveform of a scan, Martin Isenburg, the developer of LASzip and PulseWaves, called for better use to be made of such full waveform data.

CONCLUSION

After two days in Hong Kong, the conference moved on to Guangzhou in mainland China. In addition to the conference being a venue for RIEGL to present its latest technology to potential clients, it was also a unique opportunity for many attendees in the Asia-Pacific region to learn more about Lidar technology. Indeed, RIEGL expects the majority of unmanned Lidar systems to be sold in that very region. ◀

More information
www.riegl.com

FOIF



- Smart Design
- Maximum Productivity

A50 GNSS Receiver

- Professional GNSS satellites tracking (GPS, GLONASS, Galileo, Beidou)
- Industry standard GNSS engine (Trimble, Novatel...)
- Multiple communication modules (Radio,GSM...)
- Incline Measuring:
Get the right point data by automatic correct system with the pole tilted in $\pm 30^\circ$
- WIFI Connection:
Realizes WebUI control which is designed to modify settings and monitor the receiver status



FOIF [®] Since 1958
It's professional

SUZHOU FOIF CO.,LTD.



www.foif.com

Meeting of Preparatory Committee for Habitat III in Nairobi

Prof Chryssy Potsiou, FIG president, and Ms Gerda Schennach, FIG Commission 7 chair, participated in the Second Session of the Preparatory Committee (PREPCOM2) for the United Nations Conference on Housing and Sustainable Urban Development (Habitat III) in Nairobi, Kenya, from 14-16 April 2015. Habitat III is scheduled to take place in Quito, Ecuador, in October 2016 and will focus on the implementation of a New Urban Agenda, building on the Habitat Agenda of Istanbul in 1996.

Close to 800 participants from 90 countries attended the preparatory meeting, while more than 100 partner organisations were represented. Stakeholders and partners discussed the most important topics for the New Urban Agenda in 36 side events, and 21 exhibitors demonstrated their work around the world. The Future of Places was represented in several ways during this event.

Dr Joan Clos, UN-Habitat executive director, described the meeting as the opportunity to solidify UN-Habitat's responsibilities in leading the New Urban Agenda before the United Nations Conference on Housing and Sustainable Urban Development in 2016 as well as the establishment of the post-2015 Sustainable Development Goals and the climate change summit later this year. In her capacity as board member of the Advisory Group on Gender Equality Issues across the work of UN-Habitat advising the secretary-general Dr J Close, vice-president Diane Dumashie also attended the opening of the UN-Habitat General Assembly, where Kenya's president Uhuru Kenyatta delivered a keynote speech to mark the start of the five days of proceedings and assemblies.



▲ Photo taken during the visit to Mashimoni, Nairobi, Kenya.

During the FIG president's trip to Nairobi the continuation of the Agreement of Co-operation between FIG and the Global Land Tool Network (GLTN) was signed for 2015 regarding FIG's role in supporting the GLTN Phase 2 implementation programme including tool development, capacity development, initiatives and knowledge awareness. The general project goals of the Global Land Tool Network focus on the development of pro-poor, gendered and large-scale land tools which currently do not exist systematically at country and global level. It is expected that, when identified and sufficiently supported, these land tools will unblock current development obstacles and enhance the delivery of Millennium Development Goals (MDGs).

In addition, FIG president Prof Chryssy Potsiou, FIG Commission 7 chair Ms Gerda

Schennach and Cyprian Selebalo from GLTN/ UN-Habitat visited Mashimoni in Nairobi, an informal settlement of 4,000 families. GLTN/ UN-Habitat is supporting implementation of the Social Tenure Domain Model (STDM) in co-operation with the community leaders and the 4,000 families in the area. The STDM is a pro-poor, participatory and affordable land tool for representing a person-to-land relationship along the land rights continuum. The STDM can be used by communities such as slum dwellers, and has already been implemented in settlements in Uganda, Kenya, Colombia, Zambia and Congo. The software and its applications were discussed during this visit. ◀

More information
www.fig.net



FÉDÉRATION INTERNATIONALE
GÉOMÈTRES

INTERNATIONAL FEDERATION OF
SURVEYORS

INTERNATIONALE VEREINIGUNG
DER VERMESSUNGSINGENIEURE

PRESIDENT
Chryssy Potsiou, Greece

VICE PRESIDENTS
Bruno Razza, Italy
Diane Dumashie, United Kingdom
Pengfei Cheng, China
Rudolf Staiger, Germany

**REPRESENTATIVE OF THE
ADVISORY COMMITTEE OF
COMMISSION OFFICERS**
Brian Coultts, New Zealand

COMMISSION 1
Brian Coultts, New Zealand

COMMISSION 2
E.M.C. (Liza) Groenendijk,
The Netherlands

COMMISSION 3
Enrico Rispoli, Italy

COMMISSION 4
Angela Etuonovbe, Nigeria

COMMISSION 5
Volker Schwieger, Germany

COMMISSION 6
Ivo Milev, Bulgaria

COMMISSION 7
Gerda Schennach, Austria

COMMISSION 8
Kwame Tenadu, Ghana

COMMISSION 9
Liao Junping (Patrick), China

COMMISSION 10
See Lian ONG, Malaysia

FIG OFFICE
Louise Friis-Hansen, manager

**INTERNATIONAL FEDERATION
OF SURVEYORS, FIG, KALVEBOD**
Brygge 31-33
DK-1780 Copenhagen V
Denmark
Tel + 45 3886 1081
Fax + 45 3886 0252
Email: fig@fig.net
Website: www.fig.net



Much in little

V90Plus

- Small and lightweight
- Supports GPS, GLONASS, GALILEO, BDS, SBAS
- Supports tilt survey and electronic bubble calibration
- WIFI, NFC, and optional transceiver UHF radio
- IP67 dustproof and waterproof



GSDI Focus on Disaster Management, Monitoring and Mitigation

One of the ways that the GSDI Association raises attention for global issues such as disaster management is via its World Conferences and publications arising from the conference proceedings or other joint publishing ventures.

In 2010, GSDI 12 was held in Singapore, with the theme 'Realising Spatial Enabled Societies'. This introduced *Geoinformation for Disaster and Risk Management: Examples and Best Practices* [1], a joint publication of the UN Office for Outer Space Affairs (UNOOSA) and the Joint Board of Geospatial Information Societies (JBGIS), of which GSDI is a contributing member. Another publication resulting from the conference was *Spatially Enabling Society* [2], with chapters focusing specifically on integrating spatial planning and disaster risk reduction at the local level and the role of local SDIs in volcanic disaster risk management.

In 2012, GSDI 13 was held in Quebec City, Canada, with the theme 'Spatially Enabling Government, Industry and Citizens'. The conference covered topics such as space-based information for disaster management and emergency response (UN-SPIDER), estimating population exposed to cyclone storm surges, and integrating spatial planning and disaster risk reduction at the local level in the context of spatially enabled government. A book resulting from the conference has chapters focusing on 'Spatially Enabled Risk Management: Models, Cases, Validation' and 'Assessment of the Contribution of VGI during Recent Natural Disasters' [3].

In 2013, GSDI 14 was hosted by GSDI member the UN Economic Commission for Africa, with the theme 'Spatial Enablement in Support of Economic Development and Poverty Reduction'. The conference included a special session on risk and security that



▲ *Managing the different aspects of disaster management and risk reduction.*

covered topics such as improved disaster risk management, GIS integration of multi-hazards and vulnerability to support risk management, correlating land use dynamics and flood risk disaster, and disaster risk-reduction capacity development in eastern Africa using geospatial technologies.

In 2016, the GSDI 15 World Conference will be held in Taiwan involving GSDI member the Taiwan Association for Disaster Prevention Industry (TADPI), a non-profit advocacy organisation representing industry, government and academia. Taiwan faces a number of natural disaster threats, from earthquakes to flooding, and multiple risks from high wind and excess rain arising from typhoons which can potentially damage infrastructure and local economies and pose a threat to public safety. Hence, unsurprisingly, the theme of GSDI 15 relates to damage monitoring, management and mitigation in conjunction with regional 'smart city' innovations.

Founded in March 2013, TADPI coordinates organisations and experts in various fields and technologies related to disaster prevention and risk management. TADPI's work is structured around six committees: Earthquake Disaster Prevention, Insurance and Enterprise Risk Management, Climate Change Adaptation, and Disaster Monitoring and Geospatial Information Analysis, Information and



Communication Technology, and International Affairs. TADPI advocates strategies for climate change adaptation, formulation of a Business Continuity Plan (BCP) for cooperation amongst partners, and ways to facilitate building resilient and sustainable societies worldwide.

We look forward to welcoming members of the global SDI community to Taiwan in 2016 to see for themselves the value of the networking and information exchange opportunities offered by the GSDI World Conferences. ◀

*Roger Longhorn, secretary-general, GSDI Association
rlonghorn@gdsi.org*

More information

- [1] *Geoinformation for Disaster and Risk Management: Examples and Best Practices*, Eds. O. Altan, R. Backhaus, P. Boccardo, S. Zlatanova, by Joint Board of Geospatial Information Societies (JB GIS), 2010.
- [2] *Spatially Enabling Society: Research, Emerging Trends and Critical Assessment*, Eds. A. Rajabifard, J. Cromptvoets, M. Kalantari, B. Kok, by GSDI Association Press, 2010.
- [3] *Spatially Enabling Government, Industry and Citizens – Research and Development Perspectives*, Eds. A. Rajabifard and D. Coleman, by GSDI Association Press, 2012.
- www.gdsi.org



PRESIDENT & EXECUTIVE DIRECTOR
David Coleman, Canada

PAST PRESIDENT
Abbas Rajabifard, Australia

PRESIDENT ELECT
David Lovell, Belgium & UK

SECRETARY GENERAL
Harlan Onsrud, USA

SECRETARY
Alan Stevens, USA

TREASURER
Eddie Pickle, USA

BUSINESS MANAGER
Marilyn Gallant, USA

OPERATIONS & COMMUNICATIONS
Roger Longhorn, Belgium & UK

RECRUITMENT MANAGER
Bruce Westcott, USA

NEWS EDITOR
Kate Lance, USA

GSDI STANDING COMMITTEES

1) LEGAL AND SOCIOECONOMIC
Chair: Dr ir Bastiaan van Loenen, Delft University of Technology, The Netherlands
Chair: Dr ir Joep Cromptvoets, KU Leuven Public Governance Institute, Belgium

2) TECHNICAL
Chair: Eric van Praag, Venezuela

3) OUTREACH AND MEMBERSHIP
Chair: Denise McKenzie, UK

4) SOCIETAL IMPACTS
Chair: Carmelle Terborgh, USA

International Geospatial Society
President: Sives Govender, South Africa
President-elect: Dav Raj Paudyal, Australia

GSDI OFFICE
GSDI Association

Attention: Marilyn Gallant, Business Manager

946 Great Plain Avenue,
PMB-194 Needham,
MA 02492-3030, USA

www.gdsi.org

KCS TraceME

2G 3G 4G LBS

LoRa™ BLE M2M

Iridium Sensor



Bluetooth®

iBeacon™

SMS

Glonass GPRS

RF GPS

Internet of Things



LoRa™ Internet of Things

KCS has extended their successful TraceME product line with an advanced module, targeted for worldwide mobility in the Internet of Things era. The latest development of the TraceME GPS/GPRS Track and Trace module will combine the RF location based positioning solution with the LoRa™ technology. This combination offers 'smart objects' being even smarter, since LoRa™ enables long range, battery friendly communication in a wide variety of (M2M) applications. Supporting GPRS/SMS and optional 3G, Wi-Fi, Bluetooth LE, ANT/ANT+ and iBeacon™ provides easy integration with existing wireless networks and mobile apps. Other variants in the high/mid-range and budget-line will follow soon.

ANTI-THEFT module based on RF

KCS TraceME product line offers an intelligent location based positioning solution for indoor and anti-theft applications. The solution is based on RF with an intelligent algorithm of measuring the propagation time of transmitted (proprietary protocol) signals. Unique features are: minimum size (46x21x6.5mm), weight (7 grams for fully equipped PCB) and a standby battery lifespan of more than 10 years. 'Listen before talk' algorithm makes it practically impossible to locate the module, which secures the valuable vehicle or asset. Supporting GPRS/SMS and optional 3G, Wi-Fi, Bluetooth LE, ANT/ANT+ and iBeacon provide easy integration with existing wireless networks and mobile apps.

www.Trace.ME

All trademarks mentioned herein belong to their respective owners.

Review of the SIRGAS School on Vertical Reference Systems and the Symposium SIRGAS 2014

The Geocentric Reference System for the Americas (SIRGAS) is the fundamental geodetic layer for all positioning and geoinformation applications Latin America, from Mexico to Tierra de Fuego. SIRGAS was established in 1993 by the International Association of Geodesy (IAG), the Pan-American Institute for Geography and History (PAIGH) and the US Defense Mapping Agency (DMA, now NGA) with the following objectives: to define a reference system for South America, to establish and maintain a reference frame, and to define and establish a geocentric datum. In 2001 it was extended to all the Americas by a resolution of the United Nations Regional Cartographic Conference (UNRCC) for the Americas. Since then, nearly all Latin American countries have adopted it as their official reference system for scientific and practical geospatial applications. Presently there are more than 300 permanently observing GNSS stations, the data from which is analysed on a weekly basis by nine local (national) processing centres and integrated by two combination centres, namely in Brazil and Germany. The results (time series of station positions, cumulative multi-year solutions with station velocities, daily ionosphere parameters) are accessible at the SIRGAS website. Besides the geocentric reference system and frame for the region, SIRGAS is responsible for the definition and realisation of a gravity field-related vertical reference system that guarantees consistency and reliability continent-wide (heights with the same accuracy everywhere) and long-term stability (heights with the same order of accuracy at any time). The current activities, progress and new challenges of SIRGAS are reported, discussed



▲ Attendees of the Symposium SIRGAS 2014.

and re-oriented (if required) at the annual SIRGAS meetings which have been held since 1993. In this series, the Symposium SIRGAS 2014 took place in La Paz, Bolivia, from 24-26 November 2014. In the days prior to the Symposium (20-22 November), a SIRGAS School on Vertical Reference Systems was held. Both events were hosted by the Instituto Geográfico Militar of Bolivia.

The SIRGAS School was attended by 34 participants from 13 countries: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, Guatemala, Panama, Paraguay, Peru, Uruguay and Venezuela. The theme concentrated on the continental adjustment of the first-order national vertical networks based on geopotential numbers. This included a study of height systems, least squares adjustment and processing of gravity and vertical networks. Attendees were provided with computation software so that the theoretical lectures were complemented by practical exercises.

The Symposium SIRGAS 2014 itself was attended by 260 participants from 19 countries (as above plus the Dominican Republic, Germany, Honduras, Mexico, Puerto Rico and USA). In 39 oral presentations

and 24 posters, the following topics were presented: gravity and geoid modelling in the SIRGAS region, developments related to vertical reference systems and frames, geodetic estimation of geophysical parameters, report of the SIRGAS reference frame analysis centres, national reference frames and related applications, geodetic modelling of the Earth's crust deformations (in particular in the Andean orogeny) and practical usability of the SIRGAS reference frame. Presentations and extended abstracts of the contributions are available at the SIRGAS website.

Thanks to the support of the International Union of Geodesy and Geophysics (IUGG), IAG and PAIGH, it was possible to provide 19 SIRGAS colleagues from 8 countries with partial travel grants. SIRGAS deeply acknowledges this support. ◀

Claudio Brunini, SIRGAS president

Laura Sánchez, SIRGAS vice-president

More information

www.sirgas.org

www.iag-aig.org



The mission of the Association is the advancement of geodesy.

IAG implements its mission by:

- advancing geodetic theory through research and teaching,
- collecting, analysing and modelling observational data,

- stimulating technological development, and
- providing a consistent representation of the figure, rotation and gravity field of the Earth and planets, and their temporal variations.

IAG EXECUTIVE COMMITTEE 2011 - 2015

President:
Chris Rizos,
c.rizos@unsw.edu.au

Vice-President:
Harald Schuh, harald.schuh@gfz-potsdam.de

Secretary General:
Hermann Drewes,
iag@dgfi.badw.de

Immediate Past President:
Michael Sideris,
sideris@ucalgary.ca

President of Commission 1 Reference Frames:
Tonie van Dam,
tonie.vandam@uni.lu

President of Commission 2 Gravity Field:
Urs Marti,
urs.marti@swisstopo.ch

President of Commission 3 Rotation & Geodynamics:
Richard Gross,
richard.gross@jpl.nasa.gov

President of Commission 4 Positioning & Applications:
Dorota Brzezinska,
dbrzezinska@osu.edu

Chair of Global Geodetic Observing Systems (GGOS):
Hansjörg Kutterer,
hansjoerg.kutterer@bkg.bund.de

President of Communication & Outreach Branch (COB):
József Ádam,
jadam@sci.fgt.bme.hu

Representatives of the Services:
Riccardo Barzaghi, riccardo.barzaghi@polimi.it
Tom Herring, tah@mit.edu
Ruth Neilan,
ruth.e.neilan@jpl.nasa.gov

Members at large:
Claudio Brunini,
claudiobrunini@yahoo.com
Richard Wannacott,
rwannacott@gmail.com

President of the ICC on Theory:
Nico Sneeuw, sneeuw@gis.uni-stuttgart.de

Assistant Secretary:
Helmut Hornik,
hornik@dgfi.badw.de

COMNAV

T300 GNSS RECEIVER

Choose Right, Measure Right!



Built in 3G modem

Easy to use

Super light (less than 1kg with two batteries)

GPS L1/L2/L5, BeiDou B1/B2/B3, GLONASS L1/L2

Built in Tx&Rx

Ultra small

Hot swappable battery design

Compatible with other brands GNSS RTK

Many user-friendly conveniences built in

Low power consumption

Built in memory card slot

Defining Our Terms

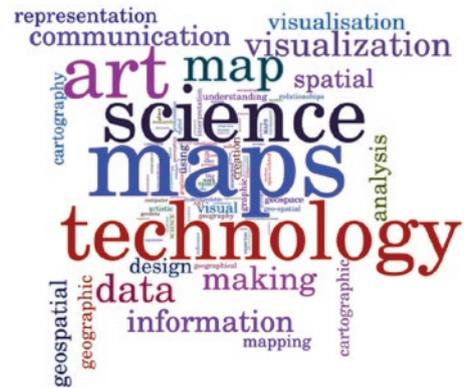
As we approach the next quadrennial General Assembly of ICA and the gathering of the world's cartographers at the International Cartographic Conference (ICC) in Rio de Janeiro, Brazil, in August, it is a good time to reflect on the changing nature of our discipline, but also its fundamental principles. One of those must be an acceptable definition of what 'cartography' is, and what cartographers do, and following from that, a firm idea of what defines 'a map'.

The most recent formal definition of cartography was developed for the Strategic Plan for the ICA 2003-2011 [1], where there are two versions. The short definition reads: "Cartography is the art, science and technology of making and using maps". Meanwhile the long version states: "Cartography is a unique facility for the creation and manipulation of visual or virtual representations of geospace – maps – to permit the exploration, analysis, understanding and communication of information about that space". The short is directly derived from a definition given in the *Multilingual Dictionary of Technical Terms in Cartography* (published in 1973): "Cartography is the art, science and technology of making maps, together with their study as scientific documents and works of art". However, definitions written some time ago cannot address the changed context in which cartography is realised today, for several reasons: the technology has advanced rapidly and become more accessible to all; more 'mappable' data is produced; more people make maps nowadays – cartographers work alongside (GI)scientists, other professionals

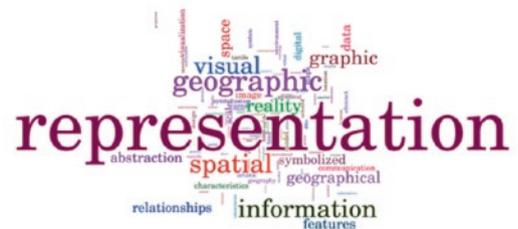
unaware that they practise cartography and members of the general public; and the map use environment has gone mobile.

During the last ICC in 2013, ICA launched a survey to gather thoughts on what to call the domain and how to describe a map. Although open to the world on the ICA website, the exercise mainly targeted attendees at the conference; it is clear that this is an 'internal' view from those with an ICA affiliation. Several questions were posed including "What should we call our domain?" – the universal response was to use the word 'cartography' – and "Give three words which characterise our domain" – with the resultant word cloud (Figure 1) aligning to the short definition of cartography given above. When further asked "How would you define our domain?" the answers corresponded well with the word cloud from the previous question. Defining a map was more variable: the previous ICA-approved statements indicated that "A map is a symbolised representation of a geographical reality, representing selected features and characteristics, resulting from the creative effort of its author's execution of choices, that is designed for use when spatial relationships are of primary relevance" (from the 2003 Strategic Plan); whilst the 1990 report of the Working Group on Cartographic Definitions suggested "A representation or abstraction of geographic reality, a tool for presenting geographic information in a way that is visual, digital or tactile".

The keywords for the nature of a map (Figure 2) included the main terms from the previous definitions including "representation",



▲ Figure 1, Word cloud characterising the domain of cartography.



▲ Figure 2, Word cloud characterising a map.

"abstraction", "geographic" and "symbolised". The free-text answers also indicated respondents' general agreement about current definitions. If and when the definitions are updated, it is very likely that these terms will remain. ◀

Menno-Jan Kraak, ICA vice-president

More information

1. www.icaci.org/files/documents/reference_docs/ICA_Strategic_Plan_2003-2011.pdf
www.icaci.org



EXECUTIVE MEMBERS

PRESIDENT

Georg Gartner, TU Wien, Austria

SECRETARY-GENERAL & TREASURER

Laszlo Zentai, Eotvos University, Hungary

VICE-PRESIDENTS

Derek Clarke, Surveys and

Mapping, South Africa
 Menno-Jan Kraak, ITC, The Netherlands
 Sukendra Martha, Bakosurtanal, Indonesia
 Paulo Menezes, Federal University of Rio de Janeiro, Brazil,
 Anne Ruas, IFSTTAR, France
 Tim Trainor, Census Bureau, USA
 Liu Yaolin, Wuhan University, China

PAST-PRESIDENT

William Cartwright, RMIT University, Australia

EDITOR ICA NEWS

Igor Drecki, University of

Auckland, New Zealand
COMMISSION CHAIRS
Cognitive Visualisation
 sara.fabrikant@geo.uzh.ch
Map Design

kfield@esri.com

Art & Cartography

scaquard@gmail.com

History of Cartography

elri@worldonline.co.za

Map Projections

mlapaine@geof.hr

Theoretical Cartography

qydu@whu.edu.cn

Data Quality

chenxy@ecit.cn

Atlases

peter.jordan@oew.ac.at

Mapping from Remote Sensor Imagery

xyang@fsu.edu

Geospatial Analysis and Modeling

bin.jiang@hig.se

Geovisualisation

gennady.andrienko@iaais.fraunhofer.de

Maps and the Internet

rcammack@mail.unomaha.edu

Ubiquitous Cartography

arikawa@csis.u-tokyo.ac.jp

Digital Technologies in Cartographic Heritage

livier@topo.auth.gr

Open Source Geospatial Technologies

suchith.anand@nottingham.ac.uk

Generalisation and Multiple Representation

dirk.burghardt@tu-dresden.de

Planetary Cartography

hhargitai@gmail.com

Mountain Cartography

karel.kriz@univie.ac.at

Neocartography

s.l.chilton@mdx.ac.uk

Maps and Graphics for Blind and Partially Sighted People

acoll@utem.cl

Maps and Society

chris.perkins@manchester.ac.uk

Use and User Issues

elzaker@itc.nl

Cartography and Children

jesus@map.elte.hu

Education and Training

dave.fairbairn@newcastle.ac.uk

GI for Sustainability

vstikunov@yandex.ru

Map Production and Geobusiness

philippe.demaeyer@ugent.be

Cartography in Early Warning and Crises Management

undatra@yahoo.com

Geoinformation Infrastructures and Standards

acooper@csir.co.za

GIM CORRESPONDENT

David Fairbairn, Newcastle University, UK

YOUR SOFTWARE DECISIONS ARE NOT SET IN STONE

TRADE-IN AND TRADE UP. You don't have to settle for your current software package.

MicroSurvey has numerous upgrade/trade-in options to ensure surveyors have the best drafting and calculation solutions right at their fingertips.



ENGINE



STANDALONE APPLICATION



PLUG-IN



Field to finish has never been this easy. Available in 5 different editions, MicroSurvey CAD is a design solution that is powerful, flexible, and affordable.



Runs on IntelliCAD



Standalone software package



Powered with Autodesk technology™. A strong CAD application that has survey tools embedded within; COGO, DTM, and design functions – built for surveyors.



Runs on AutoDesk® OEM Engine



Standalone software package



Transform AutoCAD® into a survey and design solution. The MicroSurvey inCAD plug-in brings the full features of MicroSurvey CAD into AutoCAD.



Runs on AutoCAD



Installed as plug-in

MicroSurvey offers upgrades, crossgrades, and even competitive trade-ins. Leverage your existing investment to get the exact tools you need. Visit us for more info, or to download a free demo:

www.microsurvey.com/tradeup

© MicroSurvey is registered in the U.S. Patent and Trademark Office by MicroSurvey Software Inc. MicroSurvey is part of Hexagon.

© Autodesk, Inc. All rights reserved. Autodesk, AutoCAD, DWG, DWG (design/logo), Powered with Autodesk Technology are registered trademarks or trademarks of Autodesk, Inc.

FREE DEMO

MicroSurvey

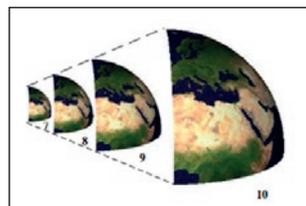
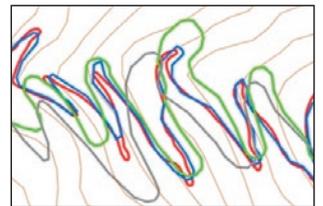
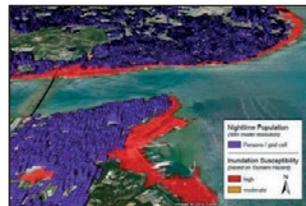
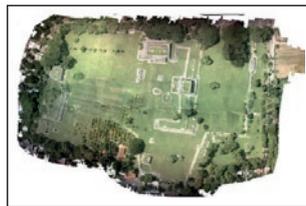
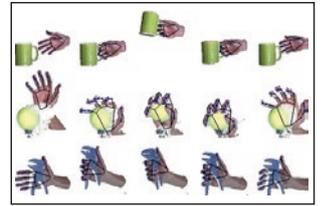
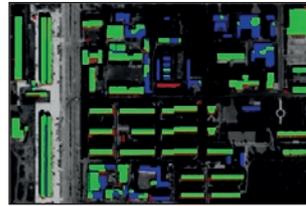


Invitation to Attend the ISPRS Geospatial Week 2015

ISPRS invites all readers of *GIM International* to attend the ISPRS Geospatial Week 2015 [1] from 28 September to 2 October in La Grande Motte (Montpellier), France. The focus will be on discussing recent research developments and future trends in geospatial information acquisition and extraction from remotely sensed imagery and VGI-based sensing, in geospatial quality control, in geospatial information management and Big Data processing, in geospatial visualisation and in service development for innovative applications.

The event will be built around a full working week comprising a rich scientific programme (for which more than 300 high-quality papers have been submitted). Attendees will be able to meet and exchange knowledge with scientists who share the same interests as well as to cross-fertilise ideas by networking with scientists coming from connected fields. The ISPRS Geospatial Week gathers together leading specialists, experts and researchers in the fields of photogrammetry, remote sensing and spatial information sciences from a wide variety of universities, research foundations, mapping agencies, public organisations and private companies.

The exhibition held alongside the event for the duration of the week will also give



▲ Each image symbolises one of the workshops to be organised at the ISPRS Geospatial Week 2015.

participants an opportunity to gain an update on the latest advances in terms of new geospatial technologies and solutions (Lidar, hyperspectral, Big Data, UAVs, visualisation, etc.).

The ISPRS Geospatial Week 2015 is being organised by the French Society of Photogrammetry and Remote Sensing (SFPT), the French national mapping agency (IGN) and the National Research Institute of Science and Technology for Environment and

Agriculture (IRSTEA). We very much hope to see you there. ◀

Nicolas Paproditis
Organiser of the ISPRS Geospatial Week 2015

More information

1. www.isprs-geospatialweek2015.org
www.isprs.org



ISPRS COUNCIL 2012 – 2016

CHEN JUN
PRESIDENT
National Geomatics Centre of China

28 Lianhuachixi Road Haidian District, Beijing 100830, PR CHINA
Email: chenjun@nsdi.gov.cn

CHRISTIAN HEIPKE
SECRETARY GENERAL
Leibniz Universität Hannover
Insitut für Photogrammetrie und GeoInformation (IPI)
Nienburger Str. 1,
30167 Hannover, GERMANY

Email: isprs-sg@ipi.uni-hannover.de

ORHAN ALTAN
1ST VICE PRESIDENT
Istanbul Technical University
Faculty of Civil Engineering
Department of Geomatic Engineering
34469 Ayazaga-Istanbul, TURKEY
Email: oaltan@itu.edu.tr

MARGUERITE MADDEN
2ND VICE PRESIDENT
Center for Geospatial Research (CGR)
Department of Geography
The University of Georgia
Athens, Georgia 30602-2305, USA
Email: mmadden@uga.edu

LENA HALOUNOVA
CONGRESS DIRECTOR

Czech Technical University
Faculty of Civil Engineering
RS Laboratory
Thakurova 7 166 29 Prague, CZECH REPUBLIC
Email: Lena.Halounova@fsv.cvut.cz

JON MILLS
TREASURER
School of Civil Engineering and Geosciences

University of Newcastle
Newcastle upon Tyne,
NE1 7RU UNITED KINGDOM
Email: jon.mills@ncl.ac.uk

ISPRS HEADQUARTERS
see address of secretary general

► **JUNE**

HXGN LIVE

Las Vegas, NV, USA
 from 01-04 June
 For more information:
 E: contactus@hxgnlive.com
 W: <http://hxgnlive.com/las.htm>

28TH INTERNATIONAL GEODETIC STUDENT MEETING (IGSM)

Espoo, Finland
 from 01-06 June
 For more information:
 E: felix@igsm.fi
 W: www.igsm.fi

INTERNATIONAL CONFERENCE ON UNMANNED AIRCRAFT SYSTEMS

Denver, CO, USA
 from 09-12 June
 For more information:
 W: www.uasconferences.com

OPTECH IMAGING & LIDAR SOLUTIONS CONFERENCE

Toronto, Canada
 from 09-12 June
 For more information:
 E: inquiries@optech.com
 W: www.optech.com

WORLD GEOSPATIAL DEVELOPERS CONFERENCE 2015

Beijing, China
 from 10-11 June
 For more information:
 E: lily.liu@3snews.net
 W: <http://wgdc2015.3snews.net>

35TH EARSEL SYMPOSIUM 2015

Stockholm, Sweden
 from 15-19 June
 For more information:
 E: secretariat@earsel.org
 W: www.earsel.org/symposia/2015-symposium-Stockholm/index.php

ADVANCING GEOGRAPHIC INFORMATION SCIENCE: THE PAST AND NEXT TWENTY YEARS

Vespucci Institute Bar Harbor, ME, USA
 from 29 June – 03 July
 For more information:
 W: <http://giscienceconferences.org/vespucci2015week2/>

► **JULY**

FOSS4G-EUROPE CONFERENCE

Como, Italy
 from 14-17 July
 For more information:
 E: contact-foss4ge@osgeo.org
 W: <http://europe.foss4g.org/2015/>

ESRI INTERNATIONAL USER CONFERENCE

San Diego, CA, USA
 from 20-24 July
 For more information:
 E: uc@esri.com
 W: www.esri.com/events/user-conference

13TH SOUTH EAST ASIAN SURVEY CONGRESS (SEASC 2015)

Marina Bay Sands, Singapore
 from 28-31 July
 For more information:
 E: pat@eventspeople.com
 W: www.seasc2015.org.sg/index.html

► **AUGUST**

27TH INTERNATIONAL CARTOGRAPHIC CONFERENCE

Rio de Janeiro, Brazil
 from 23-28 August
 For more information:
 E: christina@congreg.com.br
 W: www.icc2015.org

UAV-G CONFERENCE 2015

Toronto, Canada
 from 30 August-02 September
 For more information:
 W: www.uav-g-2015.ca

► **SEPTEMBER**

PHOTOGRAMMETRIC WEEK 2015

Stuttgart, Germany
 from 7-11 September
 For more information:
 W: www.ifp.uni-stuttgart.de/phowo

INTERDRONE 2015

Las Vegas, NV, USA
 from 09-11 September
 For more information:
 W: www.interdrone.com

INTERGEO 2015

Stuttgart, Germany
 from 15-17 September
 For more information:
 W: www.intergeo.de

SUMMIT ON EARTH OBSERVATION BUSINESS (PART OF THE WORLD SATELLITE BUSINESS WEEK)

Paris, France
 from 17-18 September
 For more information:
 E: joly@euroconsult-ec.com
 W: www.satellite-business.com

CONVENTION OF SURVEYING "AGRIMENSURA 2015"

Havana, Cuba
 from 23-26 September
 For more information:
 E: silvia@unaicc.co.cu
 W: www.agrimensuracuba.com

CALENDAR NOTICES

Please send notices at least 3 months before the event date to: Trea Fledderus, marketing assistant, email: trea.fledderus@geomares.nl

For extended information on the shows mentioned on this page, see our website: www.gim-international.com.

LASER MEASUREMENT RAISES THE OPERATIONAL EFFICIENCY AND PRECISION REMARKABLY

Laser distance meter-tripped pocket compass

PocoRay Made in Japan

PocoRay is a small, portable laser distance meter-carrying compass. The laser distance meter can measure distances quickly and accurately, eliminating the need for equipment such as measuring tapes and other such systems.

- Measuring range : 50m (reflector less)
150m (with reflector)
- Weight : 1,120g including batteries
- Battery life : 10,000 shots available
- Speed : Quick measurement for 0.5 sec at shortest.

Ushikata Mfg. Co., Ltd. 4666 Ikebe-cho Tsuzuki-ku Yokohama Kanagawa 224-0053 Japan
 +81 45 345 0001 Phone www.ushikata.co.jp No. 2735

KCS TraceME

INTELLIGENT GPS WILDLIFE TRACKING



Size comparison with a coin

Never lose the ones we love

KCS has extended its successful TraceME product line with the TM-230 module, targeted for tracking wildlife and advancing wildlife science into the Internet of Things era. The TM-230 module is one of the smallest and lightest track-and-trace units in the world. The modules' minimum size of **29.7 x 20 mm** and extremely small weight of only **3.5 grams** enable tracking of very small animals e.g. endangered species and small birds. It can be attached easily to various parts of the animal. Successful field trials by wildlife science experts have proven that the unit does not affect the natural behaviour of the animal. Solar powered GPS/GPRS offer long-term accurate location data, to be connected to the Internet of Things.



www.Trace.ME

All trademarks mentioned herein belong to their respective owners.



FULLY LOADED FOR MAXIMUM FLEXIBILITY AND PERFORMANCE.

Imagine needing just one total station on the job site to perform all of your data capture. Imagine just one powerfully equipped total station to handle scanning, imaging and surveying. A total station you can use to create 3D models, process highly accurate visual site documentation, point clouds, and much more. That total station is the Trimble® S7.

The Trimble S7 comes fully loaded with Trimble's most advanced features and technologies, giving you the flexibility and performance you need, no matter the project.

Trimble S7 Total Station



Perform feature-rich scans with Trimble SureScan™



Track your instrument's location in real-time with Trimble Locate2Protect



Document the job and create a variety of deliverables using Trimble VISION™ technology



Measure farther and faster with Trimble DR Plus EDM



Produce comprehensive geospatial deliverables in Trimble Business Center

Learn more at Trimble.com/geospatialTS