

# GIM

INTERNATIONAL

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



ISSUE 5 • VOLUME 30 • MAY 2016

## Inspiring and Empowering the Agents of Change

The FIG Young Surveyors Network

**PIPELINE INTEGRITY MANAGEMENT FROM SPACE**

**SUPPORTING POLIO ERADICATION WITH SATELLITE IMAGERY**

**UAS FOR ARCHAEOLOGICAL EXPLORATION**

# Aiming at the future together!

# PENTAX



**D-200**  
**Multicopter**



**H-1000C**  
**Unmanned Helicopter System**



**R-400VN**  
**Reflectorless Total Station**

Efficient accuracy at your fingers!



**R-1500N**  
**Reflectorless Total Station**

Total surveying solution



**R-2500N**  
**Reflectorless Total Station**

Advanced Pentax EDM technology



**W-1500N**  
**Windows CE Total Station**

A truly integrated system



**G3100-R2**  
**Positioning System**

Precision satellite surveying, with wireless communications



**W-800N**  
**Windows CE Total Station**

A highly sophisticated system with auto focus function

**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/](http://www.pentaxsurveying.com/en/)



**INTERVIEW PAGE 12**

**Inspiring and Empowering the Agents of Change**

GIM International interviews Eva-Maria Unger



**FEATURE PAGE 17**

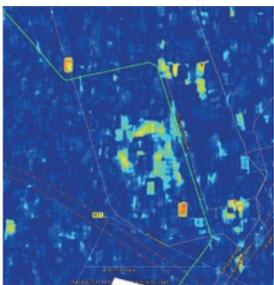
**Supporting Polio Eradication with Pléiades Satellite Imagery**

Reaching Every Household in Nigeria



**TECHNOLOGY IN FOCUS PAGE 21**

**Satellite Radar Interferometry**



**FEATURE PAGE 25**

**Pipeline Integrity Management from Space**

Transmission Pipeline Monitoring Using Copernicus



The front cover of this month's edition shows the Mergui Archipelago in the Andaman Sea, situated in the southernmost reaches of Myanmar along the border with Thailand. This natural colour image was acquired by Landsat 5, a low-Earth orbit satellite launched in 1984 and deactivated in June 2013. (IMAGE COURTESY: NASA EARTH OBSERVATORY)

**ADVERTISERS INDEX**

Beijing UniStrong, <a href="http://www.unistrong.com">www.unistrong.com</a>	27	RIEGL, <a href="http://www.riegl.com">www.riegl.com</a>	16
CHC, <a href="http://www.chcnv.com">www.chcnv.com</a>	44	Ruide, <a href="http://www.ruideinstrument.com">www.ruideinstrument.com</a>	24
ComNav Technology, <a href="http://www.comnavtech.com">www.comnavtech.com</a>	4	Sanding, <a href="http://www.sandinginstrument.com">www.sandinginstrument.com</a>	7
FOIF, <a href="http://www.foif.com">www.foif.com</a>	38	South Surveying, <a href="http://www.southinstrument.com">www.southinstrument.com</a>	30
Geo-allen, <a href="http://www.geoallen.com">www.geoallen.com</a>	24	Spectra Precision, <a href="http://www.spectraprecision.com">www.spectraprecision.com</a>	8
Harris Geospatial, <a href="http://govcomm.harris.com">govcomm.harris.com</a>	32	Teledyne Optech, <a href="http://www.teledyneoptech.com">www.teledyneoptech.com</a>	22
Hi-Target Surveying, <a href="http://www.zhdgps.com">www.zhdgps.com</a>	43	TI Asahi, <a href="http://www.pentaxsurveying.com/en">www.pentaxsurveying.com/en</a>	2
Kolida Instrument, <a href="http://www.kolidainstrument.com">www.kolidainstrument.com</a>	19	TI Linertec, <a href="http://www.tilinertec.com">www.tilinertec.com</a>	35
LidarUSA, <a href="http://www.lidarusa.com">www.lidarusa.com</a>	20	Zenith Survey, <a href="http://www.zenithsurvey.co.uk">www.zenithsurvey.co.uk</a>	10

**YOUNG GEO IN FOCUS PAGE 28**

**In Search of Georgian Artefacts**

UASs for Archaeological Exploration

**REPORT PAGE 33**

**Easy Access to Relevant Space Data**

Review of the 8<sup>th</sup> Conference on European Space Policy

**COMPANY'S VIEW PAGE 36**

**Geospatial Data Game Changer**

4DMapper

**News & Opinion page**

Editorial	5
Insider's View	6
News	7

**International organisations page**

FIG	39
GSDI	39
IAG	40
ICA	41
ISPRS	41

**Other page**

Advertisers Index	3
Agenda	42

**Get your back-issues in the store**

[www.geomares.nl/store](http://www.geomares.nl/store)



# GNSS RECEIVER T300



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

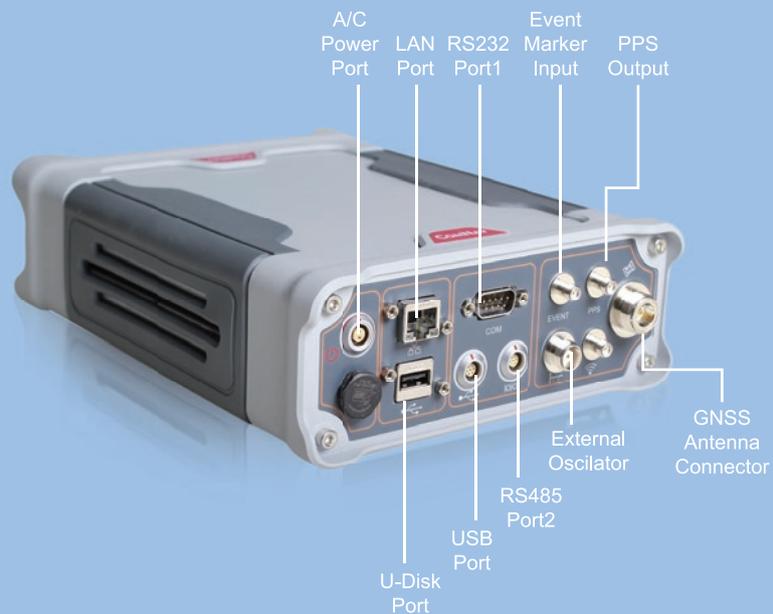
Hot swappable battery design

Compatible with other brands GNSS RTK

Many user-friendly conveniences built in  
Low power consumption  
Built in memory card slot

## THE NEXT LEVEL RTK

# GNSS RECEIVER M300 Pro



## THE NEXT GENERATION CORS RECEIVER

**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, Martin Kodde MSc, Ir. Danbi J. Lee, Frédérique Coumans, Ir. Sabine de Milliano  
**EDITORIAL MANAGER** Wim van Wegen  
**COPY-EDITOR** Lynn Radford, Englishproof.nl  
**KEY ACCOUNT MANAGER** Sybout Wijma  
**MARKETING ASSISTANT** Trea Fledderus  
**CIRCULATION MANAGER** Adrian Holland  
**DESIGN** VRHL Content en Creatie, 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 Ottichilo (Kenya), Dr Carl Reed (USA), Dr Aniruddha Roy (India), Prof. Dr Heinz Rütler (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 €120 with. 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 key 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 © 2016, Geomares Publishing, The Netherlands  
 All rights reserved. ISSN 1566-9076

## Continuous Surveying

Surveyors have been working for centuries on creating cadastres, measuring buildings and other construction works, building roads and suchlike. Whenever there was a need for measuring with coordinates, the surveyor was called in. And, in effect, nothing has changed – and yet everything has changed too. After all, no one can claim that surveyors are working in the same way and at the same pace as they did decades ago. While it is true that the surveyors are called upon whenever measurements are needed, nowadays measurements are needed everywhere and on a continuous base. In April, Greg Bentley, CEO of software company Bentley, held a keynote at this year's SPAR 3D Expo at The Woodlands Convention Center in Houston, Texas, USA. He shared details of the amazing project his company has carried out in conjunction with a number of partners to 'model' the papal visit to Bentley's hometown of Philadelphia last September. To do justice to this honour, the company utilised the newest techniques in order to minimise safety risks and create the optimum set of circumstances under which Pope Francis could attend the World Family Meeting in the city. Bentley

explained how everything started with a 3D reality mesh of Philadelphia, enriched with some 28,000 digital images. A model was made not just of the outdoors, but also of the indoor environments, such as the inside of the Cathedral Basilica where the pope would celebrate mass. The reality mesh was also used to draw and plan all the safety barriers that needed to be set up for security reasons or to guide the crowds, as well as water stations, traffic routes, decorations, etc. The whole visit could be visualised upfront – it was even possible to show the influence of different weather situations. The surveying in this project was no longer the work of the specialists alone; a lot of other people were involved too, helping to photograph the interior of the cathedral and other places the helicopter and unmanned aerial vehicle (UAV) were unable to capture from the right angle. Engineers, planners and processors joined in, envisioning the real world in a model. The papal visit to Philadelphia was a success, probably not just because of the reality mesh that Bentley made, but it certainly contributed to the flawless logistics of the event and generated experience that can and will be put to good use in the future. In his keynote at SPAR 3D Expo, Bentley identified 'continuous surveying' as being key in the future of the profession due to a number of factors: increasing geocoordination of all data captured, extremely high-quality digital photography that can be used in seamless 3D models, real-world engineering models, and last but not least the ubiquitous UAVs that are creating so many more possibilities to conduct surveys quickly, cheaply and at all times. As a result, it will no longer be necessary to call in the surveyors for a particular project; they will already be there, because they will be continuously surveying.



▲ Durk Haarsma, publishing director

**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**

Past 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 BETT**

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

# Landsat Archive for Monitoring Coastline Changes

Based on some predictions, sea levels may rise by up to 1.5m by 2100. Such rises are likely to have severe effects on some coastal regions around the world, including many large cities. Regular monitoring of coastal areas contributes to understanding the current seasonal and long-term effects of changes. For me, an advantage of working with civil engineers at the University of NSW, Australia, is being able to tap into the outcomes of continued research into sea levels on beaches to the north of Sydney. Staff there have been monitoring the changes in coastlines for about four decades in one of the best datasets worldwide. They have been able to demonstrate the periodic changes in the coastline using the latest technologies, which currently include GNSS equipment, airborne Lidar and UAS-derived imagery.

The data archive of Landsat Thematic Mapper (TM) satellite images with 30m spatial resolution, such as USGS Landsat TM Global Archive, could provide important data for monitoring the evolution of the coastlines over the past four decades and consequently also the changes due to sea-level rise over that period. SPOT satellite data with 10m spatial resolution might also have been appropriate for this purpose but, apart from SPOT data acquired and held in France, most SPOT data acquired over Australia by local ground stations in the past is no longer available due to the production systems no longer being operational. The best available archival SPOT data is probably only about ten years old, although the first SPOT satellite was launched 30 years ago. This seems to be a tragic loss of archival SPOT satellite data that could have

been used for reviewing past and present aspects of the environment, including coastline changes. As a result, the primary archive available for reviewing the positions of coastlines and effects of sea-level rise is Landsat.

**SUB-PIXEL MAPPING**

Given that the best available data for long-term monitoring of the coastline is likely to be the 30m-resolution Landsat TM, there is a need for innovative image processing based on methods such as sub-pixel mapping to improve the resolution and test the reliability of the coastline extraction in Australia against the past monitoring records. Generally, to realise the classification at sub-pixel level based on the original pixel-level images, two main steps are implemented: soft classification which predicts the percentage of each class inside a pixel, and sub-pixel mapping which determines the distribution of sub-pixel labels. Soft classification, also called sub-pixel classification, allows multiple class membership for each pixel in order to overcome the mixed pixel problem. The estimation of class proportions inside each pixel leads to the generation of multiple fraction/abundance images which are required for the sub-pixel mapping step. To date, considerable research effort has been directed towards the development of sub-pixel mapping techniques.

Our experimentation with the sub-pixel mapping method has been based on a Markov random field developed under the Gaussian class conditional densities assumption, which utilises the local properties of the spatial and spectral information to manage the contributions of spatial and spectral energy. To optimise the MRF energy minimisation, the simulated annealing method has been commonly used by many researchers while the graph-cut optimisation method with comparable accuracy to simulated annealing has been found to be a much faster alternative. Besides, the image edge information can be extracted to enhance the sub-pixel mapping accuracy. Sub-pixel mapping has led to improvements in accuracy of pixel-level classification and will be tested to determine its potential for more accurate coastline monitoring.



▲ John Trinder

## Consortium to Produce New Digital Maps for French Ministry of Defence



Pléiades satellite.

France's IGN has awarded Airbus Defence & Space and Thales the so-called GeoMaps contract to supply the French Ministry of Defence database with digital geographic data on a range of scales, including city maps. They will mainly be based on images acquired by the two Pléiades satellites, significantly increasing the accuracy

of the maps to be produced. This contract runs from 2016 to 2021 and guarantees the consistent geometry and formatting of all reference mapping data to optimise interoperability between the French Ministry of Defence's different systems and services, as well as with its allies and partners.

► <http://bit.ly/1Q2GCsu>

## Pix4D and Parrot Present New UAV Solution

UAV manufacturer Parrot and mapping software developer Pix4D recently presented their new drone solution for 3D modelling at the MIPIM Conference in Cannes, France. Pix4D's flight planning mobile app can now fly Parrot's Bebop 2 UAV, enabling automatic capture of images of buildings for the creation of digital 3D models using Pix4D software. When used with the Pix4Dcapture mobile flight planning app, the 500g Bebop 2 UAV automatically scans selected areas by taking images customised for Pix4Dmapper Mesh desktop software, where they are processed to produce photorealistic 3D models.

► <http://bit.ly/1UUhvB>

Most shared during the last month from [www.gim-international.com](http://www.gim-international.com)



1. A New Era in Land Administration Emerges - <http://bit.ly/1TIE7a1>
2. Indoor Wayfinding at Amsterdam Airport - <http://bit.ly/26eDntV>
3. Geomatics: Education is Key - <http://bit.ly/1VDT1LE>
4. Building a Global 3D Routing Map - <http://bit.ly/26eDMwn>
5. UAS Experiences in Africa: Heat, Dust and Distrustful Locals - <http://bit.ly/22Ng3Pm>



Parrot Bebop 2.



# SANDING

GNSS POSITIONING SYSTEM

## T66

- Innovative design with smallest size 12.9cm X 11.2cm
- Bluetooth 4.0
- Tilt survey up to 30°
- Electronic bubble calibration
- Wide Range of Satellite signals
- Trimtalk Protocol

<http://www.sandinginstrument.com>

No 2985

# Grow with Your Needs



**CenterPoint  
RTX**

**GEO Business 2016**  
London, UK – 24-25 MAY  
Come visit us at booth #L6

## Features

- Extended survey scalability
- New 240-channel 6G ASIC
- Z-Blade GNSS-centric
- CenterPoint® RTX capable
- Internal TRx UHF radio
- Long Range Bluetooth
- Anti-theft protection



## SP60

### The most versatile GNSS solution

Have you ever dreamed of a product that would grow with your needs? The Spectra Precision SP60 is a new generation GNSS receiver offering a high level of flexibility to cover any survey demand from simple post-processing, through UHF or Long Range Bluetooth base and rover systems to sophisticated RTK and RTX rover solutions. Combining the unique all-signals-tracking and processing Z-Blade GNSS-centric technology and L-band capability for satellite-delivered CenterPoint® RTX service, the SP60 GNSS receiver provides the most reliable measurements and the highest possible accuracy under any conditions, anywhere in the world.

### SP60 : Simply Versatile

AMERICAS: +1-720-587-4700 or 888-477-7516 (Toll Free in USA)

EUROPE, MIDDLE EAST AND AFRICA: +33-(0)2-28-09-38-00

ASIA-PACIFIC: +65-6348-2212

[www.spectraprecision.com](http://www.spectraprecision.com)

CONTACT YOUR LOCAL  
SPECTRA PRECISION DEALER



© 2016, Trimble Navigation Limited. All rights reserved. Spectra Precision is a Division of Trimble Navigation Limited. Spectra Precision and the Spectra Precision logo are registered trademarks of Trimble Navigation Limited or its subsidiaries. CenterPoint, RangePoint, RTX and StepDrive are trademarks of Trimble Navigation Limited. Windows Mobile is a trademark of Microsoft Corporation, registered in the United States and/or other countries. Ashtech, the Ashtech logo, Z-Blade and ProMark are trademarks of Ashtech S.A.S. or its subsidiaries. All other trademarks are the property of their respective owners. (2016/03)



## Students Encouraged to Attend ISPRS Prague Congress

Just like the Olympics, ISPRS Congresses are held only once every four years and they visit a different part of the world each time. Previous locations have included Vienna, The Hague, Ottawa, Istanbul, Beijing and Melbourne, to name but a few. The XXIII Congress will be held from 12-19 July 2016 in Prague, Czech Republic. Especially students and young professionals in photogrammetry, remote sensing and spatial information systems are encouraged to seize this opportunity to make new friends, form life-long connections and create memories of their first ISPRS Congress.

► <http://bit.ly/1Q2GSrf>

## MoLaS: Mobile Laser Scanning Technology Workshop

The collection of 3D data from moving platforms such as vehicles or aircraft is one of the most interesting challenges in the area of object detection and reconstruction. Laser scanners, which collect data rapidly, reliably and with high precision, play a key role in this context. High-precision systems, calibration and referencing are therefore the central aspects of current research activities and applications. From 23-24 November 2016, Fraunhofer IPM is hosting the second international MoLaS workshop on the subject of mobile laser scanning at its premises in Freiburg, Germany.

► <http://bit.ly/23wvNly>

## Supergeo Expands Smart Mobile Solution for Cadastral Mapping

Supergeo has announced the development of an international version of its SuperGIS mobile solution. The Mobile Cadastral app is a land management and cadastral survey work application developed for the Android platform. The international version will not only prepare the localisation on a country-by-country basis but will also provide a more convenient way to preprocess the cadastral data and base map. Mobile Cadastral GIS is developed through SuperGIS Runtime SDK for Android, which is designed for cadastral data positioning, query and measurement. Integrating GIS, GNSS and e-Compass technologies, this app assists surveyors in comprehending the current position and cadastral data and in conducting tasks more efficiently. Users of Mobile Cadastral GIS are able to position, display cadastral maps and overlay layers on mobile devices directly. This application also allows surveyors to record and manage waypoints and track data through the built-in GNSS for even greater traceability of the daily fieldwork.

► <http://bit.ly/22nSBRE>



Supergeo's Mobile Cadastral app.



## interaerial SOLUTIONS UAS Event Scheduled alongside Intergeo 2016

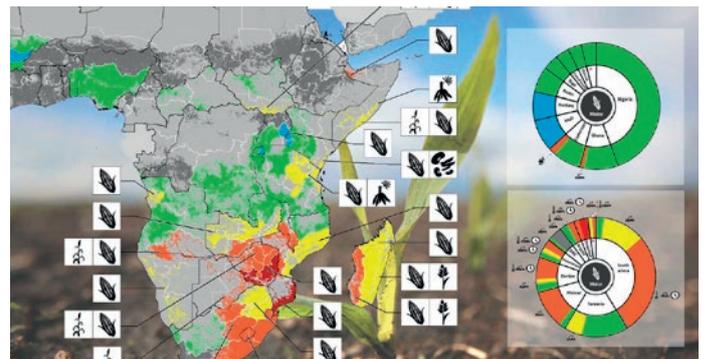
The interaerial SOLUTIONS event will serve as a showcase for UAS manufacturers, drone-as-a-service providers, UAS users and operators, accessories, software and end-to-end solutions during Intergeo from 11 to 13 October 2016 in Hamburg, Germany. A dedicated website has been launched to support and promote this marketplace for UAS business applications. Following on from the flight zone at Intergeo 2014 in Berlin, interaerial SOLUTIONS last year celebrated its première as an integrated topic platform at Intergeo. At Intergeo 2016, interaerial SOLUTIONS will run as a free-standing UAS platform for the first time.

► <http://bit.ly/1NjRbaJ>

## Early Warning Crop Monitor: a New Tool to Fight Food Insecurity

The Group on Earth Observations has announced the launch of the Early Warning Crop Monitor, a new tool to fight food insecurity. The announcement was made during the GEO 36<sup>th</sup> Executive Meeting held in Geneva, Switzerland, on 8 and 9 March 2016. Developed by the GEO Global Agricultural Monitoring Initiative (GEOGLAM), initiated by the G-20 Agriculture Ministers, the Early Warning Crop Monitor (EWCM) provides consensus reports on crop conditions in countries at risk of food insecurity in Central and South America, Africa, the Middle East and Central and East Asia. The March EWCM Bulletin reports that countries in Southeast Asia, and even more so in Southern Africa, face severe droughts attributed to the ongoing El Niño.

► <http://bit.ly/1S4EswT>



GEOGLAM Early Warning Crop Monitor.

## Securing Land Tenure in South Africa with Three Words

In October 2015, Gugile Nkwinti, the Minister of Rural Development and Land Reform (DRDLR) South Africa, launched the 'One Household, One Hectare' programme. The plan is to allocate a one-hectare allotment to every needy household to enable people to cultivate and grow enough fruit and vegetables to feed their families. Each beneficiary will receive a certificate describing the location of the parcel of land. A three-word address will identify the centre point of each of the land parcels. But how can a parcel of land be described in places where there are no street addresses? Landmark-based descriptions are not accurate enough and latitude/longitude, GPS and coordinates are unwieldy to use and prone to significant errors in transcription and communication. To solve this, DRDLR is piloting the use of three-word addresses to identify the centre point of each of the land parcels.

► <http://bit.ly/1Ss1eMm>



*Small South African farmers working on their land.*



*PolaRx5.*

## Septentrio Launches New-generation Multi-constellation CORS for DOTs

Septentrio Americas has announced the availability of its new PolaRx5 continuously operating reference station (CORS) platforms optimised for state DOTs and other RTK network operators. The PolaRx5 CORS receivers can be purchased at special pricing by UNAVCO member organisations and affiliates. Septentrio has been selected by UNAVCO as the preferred vendor of CORS receivers under a multi-year agreement. The PolaRx5 is powered by Septentrio's AsteRx4 next-generation multi-frequency engine. It offers 544 hardware channels and supports all major satellite signals including GPS, GLONASS, Galileo and BeiDou, as well as regional satellite systems such as QZSS and IRNSS.

► <http://bit.ly/1qIZs3l>

# ZENITH

SURVEY AND SAFETY EQUIPMENT

## RECONDITIONED SURVEY EQUIPMENT

Used Survey Equipment, fully Serviced with Calibration Certificate and Warranty



For latest availability visit <http://www.zenithsurvey.co.uk>  
Call 00 44 1924 263346 or email [sales@zenithsurvey.co.uk](mailto:sales@zenithsurvey.co.uk)

## GIM International Summit Videos Now Available



Ed Parsons, Google, delivering his keynote.

From 10-12 February 2016 the GIM International Summit was held in Amsterdam, The Netherlands. The programme comprised thought-provoking topics presented by top speakers from both inside and outside the geomatics field. Furthermore, the audience was engaged

in interactive workshops on global issues such as urban planning, social justice and climate change. The conference concluded with an interactive session in which the Summit Declaration was drawn up. It was agreed that, to face the global challenges of the future, the geomatics industry should look beyond technology and further improve collaboration with other industries and the people involved in them. You can now visit [www.gim-international.com/gimsummit-2016](http://www.gim-international.com/gimsummit-2016) to watch the keynotes and interviews and to get a good impression of this three-day summit.

► [www.gim-international.com/gimsummit-2016](http://www.gim-international.com/gimsummit-2016)

## Google Rebrands Satellite Start-up Skybox as Terra Bella

Google-owned satellite imaging company Skybox Imaging has changed its name to Terra Bella. The company, founded in 2009 to develop small, high-resolution imaging satellites, was acquired by Google in 2014 for USD500 million. Seven years ago, founders Dan Berkenstock, John Fenwick and Ching-Yu Hu started Skybox Imaging with the vision of a new era in space technology. Small satellites with big capabilities were no longer just a dream. The SkySat-1 satellite was launched on 21 November 2013 from Yasny, Russia aboard a Dnepr rocket. The second identical satellite SkySat-2 satellite was launched as a secondary payload on a Soyuz-2-1b Fregat-M on 8 July 2014. The SkySat satellites are based on the CubeSat concept with optimised design using inexpensive automotive grade electronics as well as fast, commercially available processors. The cameras use two-dimensional imaging sensors.

► <http://bit.ly/1SYRTyp>



SkySat-1.

## Vexcel Imaging Unveils the New UltraCam Condor

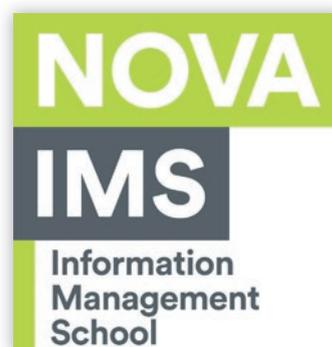
From the IGTF Conference in Fort Worth, Texas, USA, Vexcel Imaging has announced the introduction of the new camera model, the UltraCam Condor. Designed for high-altitude mapping, the UltraCam Condor frame combines a high-resolution RGB image at 37,800 x 5,200 pixels with a lower resolution PAN data capture for automated DSMOrtho and DTMOrtho image generation that is consistently sharp, geometrically accurate and of superior radiometry. According to Vexcel, its expansive footprint, along with the camera's fast frame rate, allows capture of large regions – even continents – in record time. This all-in-one system is complemented by an NIR channel, making the UltraCam Condor a solution for agriculture, forestry and land management applications. The UltraCam Condor will be available in autumn 2016.

► <http://bit.ly/1qCL4t6>



UltraCam Condor.

## NOVA IMS Receives USGIF Accreditation for GEOINT Programme



United States Geospatial Intelligence Foundation (USGIF) has added NOVA Information Management School of the Universidade Nova de Lisboa (NOVA IMS), located in Lisbon, Portugal, to its growing list of USGIF-accredited GEOINT programmes. Through the USGIF Academic Accreditation programme, universities

and institutes of higher education around the globe have the opportunity to receive accreditation for their geospatial intelligence degree programmes. Students who meet high academic standards and graduate from accredited programmes receive USGIF's GEOINT Certificate. This helps to ensure a robust workforce in the GEOINT community, both now and in the future. To date, nearly 600 students have graduated with USGIF GEOINT Certificates.

► <http://bit.ly/1T0nqWb>

# Inspiring and Empowering the Agents of Change

Eva-Maria Unger is chair of the FIG Young Surveyors Network. This network wants to increase the number of young professionals participating within FIG. To help young professionals make valuable contacts in the early phase of their careers, the network increases cooperation between the FIG commissions and the younger generation. *GIM International* recognises the need to secure the future of the surveying profession and took the opportunity to interview Eva-Maria about the network's vision.

## **Who are the 'young surveyors'?**

To be a 'young surveyors' you must be under 35 years old and either a student of surveying or surveying-related subjects or a young professional who completed an undergraduate or graduate programme a maximum of ten years ago. But that's the formal definition. In terms of who the young surveyors actually are, beyond obviously being young they are also enthusiastic and either in the midst of completing their studies or embarking on a professional career. So, as young surveyors, we are eager to learn, to embrace the latest concepts and paradigms and, with the appropriate guidance, we can definitely make a valid contribution within our profession and society. All the young surveyors out there have strong skills and great potential that can make a real difference. They can be sources of inspiration, and their open outlook and affinity with technology can be key in today's rapidly changing world.

## **What is the Young Surveyors Network?**

The FIG Young Surveyors Network (FIG YSN), which I currently chair, was established in 2009. The previous chairs were Cecilia Linden from Sweden and Kate Fairlie from Australia. FIG YSN only exists today thanks to the dedication and energy of those two

women. We bridge the gap so that young surveyors can engage and get involved in the many activities within FIG – which is the association that brings together and facilitates collaboration between surveyors from all around the world. For us, cooperation between generations is the key to success. We work with the FIG commissions, task forces, other networks as well as the council to advance the aim and goals of FIG. I would invite anyone who is interested in finding out more about FIG YSN to take a look at the FIG homepage and at our current work plan. In our working groups and mission statements, we explain how we inspire and empower young surveyors to be the agents of change in the surveying world. Together we explore, prepare, encourage, collaborate, support and facilitate to benefit the future of our profession.

## **What have been the network's key achievements so far?**

There are many achievements but I think the most obvious is that more young surveyors than ever are informed about and involved in regional and global activities within FIG and its national member associations. The number of young surveyors participating in FIG activities, meetings and workshops has increased significantly, and this has helped

us to gain recognition worldwide. Thanks to the establishment of regional young surveyors' networks we are working more efficiently and also effectively, thus reaching





◀ *Eva-Maria Unger:*  
*“For us, cooperation  
 between generations is  
 the key to success.”*

an ever-increasing number of young surveyors. We also took a lead role in FIG's ongoing work with GLTN on STDM (GLTN stands for the 'Global Land Tool Network' and STDM for the 'Social Tenure Domain Model', a tool for recording and recognising people-to-land relationships, Ed.) and we became acknowledged as key players in the STDM advancement and training programmes. Furthermore, we co-organise workshops within conferences, 'training-of-trainers' sessions and summer schools.

Thanks to our flexibility, the Young Surveyors Network has been able to react to situations immediately after a disaster, for example with our Mapping for Nepal session during the FIG Working Week 2015 in Sofia, Bulgaria. But the network's greatest achievements are the personal ones: seeing your colleagues and friends benefiting from the network, particularly through peer-to-peer learning, is a sign that the concept of the Young Surveyors Network is working.

#### ***What are the benefits for young surveyors?***

Networking! The most important benefits, I would say, are the friendships, the contacts and the activities. These help members to develop skills that cannot be taught at university, the 'soft skills'. The network creates possibilities, whether as the chance to

give a presentation to a surveying audience, play a key role in organising a workshop, provide some training or just be involved and active within a worldwide surveying community. It's important to note that the network is a platform for opportunities, but that the young surveyors themselves are responsible for making the most of them. But let's just say that anything is possible. The benefits of involvement for young surveyors are endless.

#### ***How are young surveyors from developing countries involved in your activities?***

We have a lot of active young surveyors from developing countries within the network. However, it is important to recognise that FIG is working through national associations that are members of FIG and thus we encourage young surveyors to engage with and become involved in national activities, to seek support including nomination to be involved in FIG and with the Young Surveyors Network. But we are creative in the ways that young surveyors, especially from developing countries, can be involved within our network. They can join or follow our Facebook, LinkedIn or Twitter accounts and become involved through these social media channels. Especially during events, these channels are constantly updated and young

surveyors worldwide can follow, comment, interact and contribute remotely. We also support young surveyors who have an outstanding idea or paper but cannot afford to attend a FIG event by enabling them to give a presentation via Skype, for example. We do seek financial support so that outstanding young surveyors can attend FIG events, and we are grateful to the FIG Foundation for its contribution towards the professional development of young surveyors and thus the Young Surveyors Network.

#### ***What is the younger generation's attitude towards crowdsourcing?***

#### ***Will we still need surveying professionals in the future?***

The younger generation is embracing these new ways of data gathering. We are not threatened by it and we don't see it as a danger for us as professionals. Instead, we see potential: another data gathering channel can only be a good thing. It can strengthen our position as experts dealing with big data and specifically knowing what is needed in order to utilise the data accordingly. Of course, there is a lot of learning and work to do in order to be or become such experts, but crowdsourcing opens up a broader base of application for us. It is already present; it's now up to us to make more out of it. ▶

# FIG Working Week 2020: Destination Amsterdam?



FIG WORKING WEEK 2020

As the Dutch members of FIG, we invite you to come to our capital in 2020! The Netherlands is known for its tulips, windmills and polder landscapes, but did you know it is also one of the best-surveyed countries in the world? Every square metre has been investigated, registered and documented based on the very latest mapping and surveying techniques.

Our proposed theme for the FIG Working Week 2020 will be 'Smart Surveyors for Land and Water Management'. Together with you, we are keen to further develop our profession and discuss what skills are needed to address the global challenges for a sustainable world.

On 6 May 2016, your national association will vote for the

FIG Working Week 2020 destination. If you want to experience The Netherlands for yourself and exchange ideas about our profession in a contemporary yet historic setting, ask your representatives to vote for Amsterdam for 2020.

**Come and visit the Dutch delegation in the exhibition hall at stand 19!**



***New developments such as fit for purpose (FFP) and STDM may not always be in alignment with what has been learned. What is YSN's stance in terms of how this should be handled?***

It's true that these developments are not totally in alignment with what many of us have studied at university. But during our studies we have been taught that we have a duty to

***And how are young surveyors contributing to societal development?***

This is a difficult question for me to address and I think the readers themselves are a better judge of whether the young surveyors are contributing to society as a whole. I would like to think that our active involvement in initiatives such as STDM Training-of-Trainers events and Awareness

Development showed the way forward and the challenges we are facing.

We will need to be more open to new and innovative approaches and concepts and to new skills. The future will be challenging because we have a role to play in this agenda as well as in issues such as climate change, disaster preparedness, urbanisation and food security. And the future is always unpredictable! Whoever would have thought that Dolly the sheep would become acceptable or 20 years ago envisaged that we would be able to gather terabytes of data in seconds. BIM (building information modelling, Ed.), Bitcoins/Blockchain and standardisation processes are opening up new worlds for our profession, and surveyors are at the forefront of technologies such as unmanned aerial vehicles and Lidar. Last but not least, it will be exciting because the profession is opening up, and it is becoming more and more important to cooperate with other professionals, such as legal experts, building experts and anthropologists. I am particularly excited to be able to witness and be a part of how our profession will adapt and progress to these developments.

***THE FUTURE WILL BE CHALLENGING BECAUSE WE HAVE A ROLE TO PLAY IN THIS AGENDA AS WELL AS IN ISSUES SUCH AS CLIMATE CHANGE, DISASTER PREPAREDNESS, URBANISATION AND FOOD SECURITY***

serve the people. We've learned to determine boundaries, that land is a limited but vital resource for all. So in a sense there is a general alignment on what is needed out there. Today's approaches are more appropriate and a transition is underway, both within the surveying community and in university curricula, towards accepting and including alternative approaches and new concepts. In our activities and events, we provide scope for information, teaching and debate about these new developments. As an example, FIG YSN is working together with GLTN on training the so-called 'barefoot surveyors' who are working closely with the people on the ground. We train young surveyors all over the world in the use and application of STDM. But it is important to point out that STDM is not the only tool out there. The emphasis is on fit-for-purpose approaches, identified by experts who have an open mind and are receptive to new ideas.

Workshops – which involved young professionals from various parts of world and encouraged them to become agents of change after these events in their respective communities – is good for society.

***How do you see the future of young surveyors and land professionals?***

I see a shining and bright future ahead, but at the same time a challenging and unpredictable one. But it will definitely be exciting. It is shining and bright because our skills will be needed now more than ever in a world of constant change. The 2030 Agenda for Sustainable

***What would be your message for our readers?***

Young surveyors should be at the forefront of global change and innovation in the surveying profession. Employed and empowered, we are key agents of change – the surveyors of tomorrow, committed to the betterment of the world. ◀

***How do the young surveyors contribute to the development of the profession?***

Under FIG President Chryssy Potsios, the current council's theme is 'Rapid Response to Change will be done by the Surveyor of Tomorrow'. This requires us all to work together on the development and the future of the profession, to be ready to respond. YSN members see themselves as the surveyors of tomorrow! Our efforts to promote a vibrant and energetic network for young surveyors, providing the scope and opportunity to be involved and also contribute, are part and parcel of how we are helping to develop the profession.



**Amsterdam 7-9 June, 2016**  
**4th FIG Young Surveyors European Meeting**  
 European Young Surveyors Together for Tomorrow's Challenges  
 Held in connection with the Common Visions Conference 2016



***Eva-Maria Unger***

Eva-Maria Unger, chair of the FIG Young Surveyors Network (FIG YSN), obtained a master degree in geodesy and surveying from Vienna University of Technology, Austria, in 2011. She joined the Federal Office of Metrology and Surveying (the Austrian Cadastre, BEV) as a surveying engineer in the Information Management Department in 2011. Since 2006 she has been on the board of the Austrian Society for Surveying and Geoinformation. Eva-Maria became involved within FIG in 2009 and was the general secretary of FIG YSN from 2010-2014, during which period she was also the first young surveyors' representative on the CLGE Executive Board. Eva-Maria has been chair of FIG YSN since 2015, and in the same year she became a member of the advisory board of the Social Tenure Domain Model (STDM) of the Global Land Tool Network. Eva-Maria is currently enrolled as a PhD candidate at the Faculty of Geo-Information Science and Earth Observation (ITC) of the University of Twente in Enschede, The Netherlands.

**NEW**

# RIEGL VZ-400i

## High Performance 3D Laser Scanner



- » *Ultra High Speed Data Acquisition*
- » *Survey-Grade Accuracy*
- » *Extremely Robust & Reliable*
- » *Real-Time Registration & Processing*
- » *Cloud Connectivity via Wi-Fi and 4G LTE*



GEOSPATIAL  
WORLD  
FORUM



May 23-26, 2016  
World Trade Center,  
Rotterdam  
The Netherlands  
Visit us at Booth 36

**Farther, Faster, Better: The NEW RIEGL VZ-400i is Redefining Productivity!**

This evolution of laser scan engine technology is based on its new innovative processing architecture. With advanced processing technology, data acquisition and simultaneous geo-referencing, filtering and analysis in real-time. The new VZ-400i is an extremely fast field-to-office Terrestrial Laser Scanning Solution, setting the benchmark in 3D Laser Scanning, again!

Ultra High Speed Data Acquisition with 1.2 MHz laser pulse repetition rate | 1 m – 800 m range | 5 mm survey grade accuracy | real-time registration & processing | Cloud Connectivity via Wi-Fi and 4G LTE | user friendly touchscreen interface | MEMS IMU for pose estimation | advanced flexibility through support for external peripherals and accessories | high end camera option



Stay connected with RIEGL



[www.riegl.com](http://www.riegl.com)



**RIEGL**<sup>®</sup>

No 2974

*REACHING EVERY HOUSEHOLD IN NIGERIA*

# Supporting Polio Eradication with Pléiades Satellite Imagery

In September 2015, the World Health Organization announced that there had been no cases of wild poliovirus in Nigeria since 24 July 2014 and a full 12 months had subsequently passed without any new cases. That is extremely good news. Nigeria was one of the world's three remaining polio-endemic countries and 122 new polio cases were identified in 2012. To achieve full eradication, a fast and exhaustive vaccination programme was implemented. To reach every child in the country, the campaign was optimised using Pléiades satellite imagery. Mapping settlements based on that imagery fostered more efficient organisation of the massive deployment of health professionals.

Polio, or infantile paralysis, was claiming many victims in Nigeria. As part of the Global Polio Eradication Initiative various non-government organisations (NGOs) put their weight behind a large-scale vaccination campaign, since every child needed to be vaccinated in order to put an end to the virus once and for all. eHealth Africa, an NGO that is headquartered in Nigeria and works across West Africa, came up with a plan to improve the effectiveness of the vaccination campaigns of UNICEF, the World Health Organisation (WHO) and the Nigerian government based on geoinformation technology. This was the challenge undertaken by Airbus Defence and Space and GIM, a Belgian company specialised in processing very-high-resolution imagery for urban applications, in partnership with eHealth Africa.

GIM was commissioned by eHealth Africa to map the whole of the Nigerian states of Kaduna and Bauchi. The vast area, comprising 100,000km<sup>2</sup>, posed a huge challenge, as did the great morphological diversity of the features that needed to be automatically extracted from the images: urban areas, villages and settlements, paved roads and paths, waterways, lakes, etc.

Project partner Airbus Defence and Space was able to cover the whole area in record time. The very-high-resolution satellite imagery from Pléiades served as a basis for mapping the various features automatically using object-based image analysis (OBIA) techniques. eCognition software was used to complete the work in the space of less than six months.

## CLOUD-FREE IMAGE

The Pléiades constellation is meant to maximise coverage in cloudy areas despite poor weather conditions, which was the case in Nigeria. In a record time of one month, the first cloud-free cover of an area measuring 50,000km<sup>2</sup> was collected by Pléiades. This was then extended to a total of 225,000km<sup>2</sup>. This record achievement was possible ▶



▲ Feature extraction results in the Nigerian state of Bauchi. Orange polygons represent hamlets and yellow ones represent small settlements.



◀ One challenge was to extract hamlets from desert terrain. (Photo: Andy Didyk)

because the lead time between a tasking request and image acquisition has now become very short, thanks to Pléiades but also to the SPOT 6 and 7 satellites. Work plans are uploaded to the satellites several times a day by two stations around the world, meaning that tasking requests can be submitted up to two hours before entering into a new tasking area. These multiple work plans per day are a major improvement compared to previous satellites.

Inaccurate weather forecasts contributed to a low success rate in acquiring data over some areas. However, this was improved by the capacity to update the cloud prediction models four times a day instead of one, which enabled mission plans to be adapted accordingly. It also enabled last-minute opportunities to maximise the collection of cloud-free images. As a result, the ratio of images collected with less than 10% cloud cover doubled from 30% to around 60%.

Apart from the collection capacity of the Pléiades satellite constellation and its very-high-resolution products, the success of projects like this also depends on effective collaboration between the project partners, and that was definitely the case during this initiative in Nigeria.

#### **AUTOMATED FEATURE EXTRACTION**

The main difficulty that GIM faced while processing the imagery was the diversity of the landscape. The landscape changes dramatically as one moves from north to south and there were big differences, not only between Nigeria's states but also within those states. For that reason, the processing trees in eCognition needed to be adapted depending on the area.

A second challenge was to extract urban areas – especially hamlets – from bare soil, specifically in the northern part of the state of Bauchi which consists mainly of desert. The eCognition software performs image processing and feature extraction based on OBIA techniques. It uses not only spectral

to create processing chains, giving a high degree of automation, and the output can be in GIS layer format (vector).

eCognition was therefore used for the extraction of urban areas (as objects) and dividing them into different types depending on their size (number of houses and total area). The urban areas were classified into three different types (hamlets, small settlements and built-up areas). Besides the urban areas, details of the road networks and the bodies of water were also extracted.

#### **GRIDS DEFINED FOR VACCINATION TEAMS**

Once the GIS layers were ready, the neighbourhoods to be vaccinated were divided into 50m<sup>2</sup> grids superimposed on the

## ***THANKS TO THE SATELLITE MAPS AND GPS-ENABLED SMARTPHONES, THE HEALTH WORKERS COULD SEE WHERE THEY WERE IN REAL TIME***

information (pixel-based image processing) but also texture, shape and neighbouring objects (contextual information). Ancillary data (Lidar, GIS layers) can also be used in the image processing. It offers the possibility

satellite image. GPS-enabled smartphones recorded the movements of the vaccination teams, with green squares showing visited areas and red squares showing missed ones. GPS tracking of teams also reduced

the likelihood of data falsification since the coverage was being monitored in real time. eHealth Africa and its partners were sure that no village – however small – would be overlooked in Kaduna and Bauchi. They could determine the precise location of extremely remote villages and households where children needed to be vaccinated for the first time. Thanks to the satellite maps and their GPS-enabled smartphones, the health workers could see where they were in



▲ Feature extraction results in Kaduna City. Orange points represent the hamlets and yellow ones represent small settlements. Rivers are shown in blue and roads in red (paved) and light yellow (unpaved).

real time and ensure they visited each and every house. The GPS maps also improved the efficiency of their vaccination routes.

**VIGILANCE**

The campaign in Nigeria was very successful, but the absence of new cases does not mean that the situation no longer requires attention. Vigilance must be maintained to ensure that all children receive polio vaccines, perhaps even for the fourth or fifth time, as certain strains of polio are resilient. WHO only declares a country completely clear of the disease after three full years with absolutely no trace of the virus among the population and/or in the environment. Surveillance systems remain alert to polio viruses and vaccination campaigns must be continued.

Airbus Defence and Space has therefore launched speculative acquisitions over northern Nigeria, where the virus used to be prevalent, in order to be ready to deliver fresh data as soon as needed. Pléiades has completed the coverage of 178,000km<sup>2</sup> in

this region. With these ever-fresher images of such high resolution, local organisations will be able to optimise their physical interventions for environmental sampling by knowing where to focus and by obtaining high-standard support for those missions. Furthermore, the Nigerian experience suggests that geoinformation projects like this could bring relief in similarly remote, poorly mapped areas of other countries. Likewise, by adapting the parameters, it is possible to transfer the chains for processing big data from space in a limited amount of time, to enable the extraction of any feature type in any type of landscape. ◀

**FRÉDÉRIQUE COUMANS**



Frédérique Coumans is contributing editor for *GIM International*. For more than 20 years, she has been covering all aspects of spatial data infrastructures as editor-in-chief of various magazines on GIS, data mining and the use of GIS in business. She lives near Brussels, Belgium.

✉ [fcoumans@vbkcontent.com](mailto:fcoumans@vbkcontent.com)

WWW.KOLIDAINSTRUMENT.COM

**KOLIDA K5 ROVER**

THE PURSUIT TO  
NEW HEIGHTS WILL NEVER STOP

- 13.4cm 11.8cm
- 1kg
- Tilt survey
- All Constellations
- Cloud Service
- Build-in Radio
- Dual Bluetooth
- IP67

No 2977



# LIDAR USA



FAGERMAN  
TECHNOLOGIES

Prices starting at

## \$29,990

and up

### Mounts to any vehicle

Complete UAV ready package



#### ScanLook Snoopy A Series

- Supporting scanners with single or multiple lasers with ranges of 85 to 350 meters and relative accuracy of 2 to 50mm.
- INS systems vary from L1 GPS (sub-meter) to L1/L2 GNSS systems (2cm).
- Systems weigh 1 kg to 8 kg.
- Complete RTF UAV systems are available and are fully field tested.
- UAV & Car mountable.

256-274-1616

Email: [jeff@LIDARUSA.com](mailto:jeff@LIDARUSA.com)  
[www.lidarusa.com](http://www.lidarusa.com)

No 2986

# GIM

INTERNATIONAL

# Mapping the world

Stay informed with *GIM International* - anytime, anywhere

*GIM International*, the independent and high-quality information source for the geomatics industry, focuses on worldwide issues to bring you the latest insights and developments in both technology and management.

**Sign up** for a free subscription to the **online magazine** to ensure you have:

- The very latest edition in your inbox
- An archive of back issues at your fingertips
- Online access - anytime, anywhere

[www.gim-international.com/onlinemagazine](http://www.gim-international.com/onlinemagazine)



geomares  
PUBLISHING

# Satellite Radar Interferometry

Interferometric Synthetic Aperture Radar (InSAR) is a beautiful and powerful technology for surface deformation modelling and elevation mapping. However, InSAR also has the reputation of being a complex technology which is challenging to understand. This edition of Technology in Focus aims to explain the concept of InSAR in just two pages.

Synthetic Aperture Radar (SAR) is an active remote sensing technique that acquires images of the Earth in the microwave spectrum with wavelengths in the order of centimetres. Electromagnetic waves of this size can penetrate clouds, which makes SAR an all-weather remote sensing system operating day and night. SAR instruments

a 3D effect (similar to how we see depth with our eyes) which can be used for topographic mapping.

Most SAR satellites operate with C-band wavelengths, but in the last decade X-band and L-band systems have been launched as well. Knowing both the wavelength and the

on the viewing direction of the satellite, each fringe corresponds to a decrease or increase in range of half the SAR wavelength along the line of sight of the satellite. These wrapped phase differences are often suitable for visualisation purposes, but many other applications need unwrapped (continuous) phase difference information which can be obtained by applying advanced mathematic phase unwrapping algorithms.

## ***THE DISTANCE BETWEEN TWO ACQUISITION SPOTS PERPENDICULAR TO THE SATELLITE VIEWING DIRECTION IS KNOWN AS THE 'PERPENDICULAR BASELINE'***

for Earth observation are found on airborne, space-borne and even terrestrial platforms and are based on the same principles, but this article will focus on satellite radar systems. Various SAR satellites have been developed and launched since the 1990s, with the European Sentinel-1A satellite being the most recent addition to the skies.

### **BASELINES**

SAR satellites orbit the Earth at an altitude of about 500-800km and revisit every location on Earth after a specific time. The time period between two successive visits – the repeat cycle or 'temporal baseline' in InSAR terminology – depends on the satellite orbit and is usually in the order of several days to roughly a month. However, the satellite may not be in the exact same location again during acquisition of the next radar image due to limitations in orbit control. The distance between two acquisition spots perpendicular to the satellite viewing direction is known as the 'perpendicular baseline'. With InSAR, this distance causes

baselines between SAR image acquisitions is important for using InSAR and interpreting the results, as will be explained further on in this article.

### **PHASE INFORMATION**

SAR satellites emit radar waves and measure the amplitude and phase (fraction of the full wave) of the reflected waves for each pixel in the image. The phase information can be measured very precisely by the satellite and forms the basis for radar interferometry. In its simplest form, InSAR combines two (accurately aligned) SAR images of the same scene into an 'interferogram' by computing the differences in the phase of the radar waves. The resulting interferogram is usually displayed in colour, based on the differences in phase between the two images – resulting in the colourful imagery which InSAR is famous for (Figure 1). The phase difference cycles in an interferogram are called 'fringes' and are caused by phase wrapping as the observed wave fraction is never more than one wave cycle. Depending

### **BOUNDARY CONDITIONS FOR INSAR**

The temporal and perpendicular baselines (in combination with the region of interest and the availability of data) set boundary conditions for applying InSAR. As the technique relies on comparing the phase of each pixel in two or more images, the phases should still be coherent enough in their radar reflection in order to be comparable. The more time that has passed between two images, the larger the chance that some object or element which contributes to the reflection within that pixel will have changed. This causes a loss of coherence and eventually leads to complete decorrelation between the two pixels. The maximum temporal baseline depends on the region, but ranges between weeks in areas with growing crops to years for arid areas. Loss of coherence also occurs with

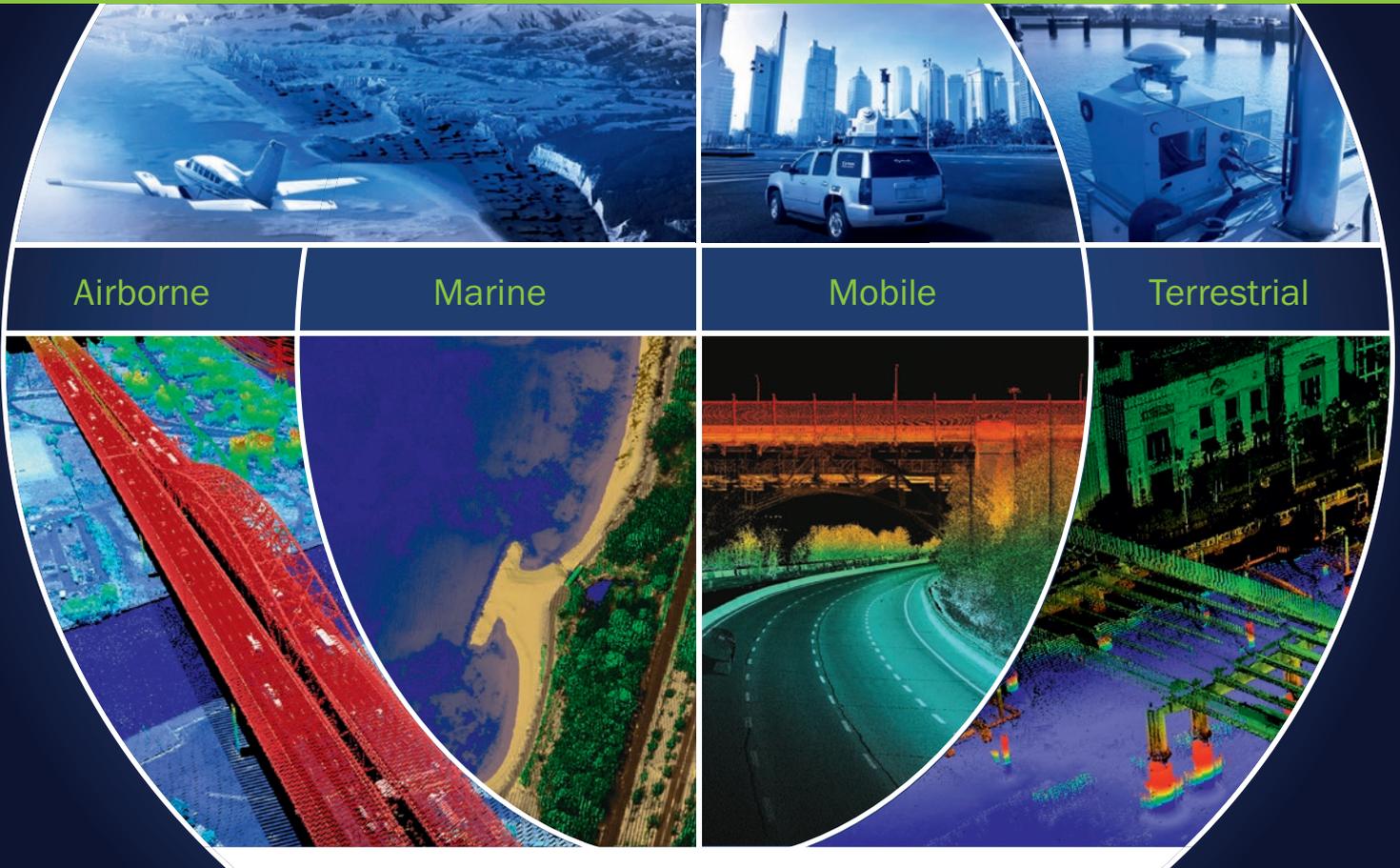
### **Technology in Focus**

Over recent decades, many of the geomatics processes which were previously performed by humans have been automated. Software modules running on powerful computers are now doing much of the work. What are the principles behind the algorithms? Which concepts underpin these techniques? The Technology in Focus article provides you with a bimonthly, in-depth insight into the complex underlying technology.



**TELEDYNE OPTECH**  
Everywhere you look™

# Industry-leading **Lidar & Camera** Solutions



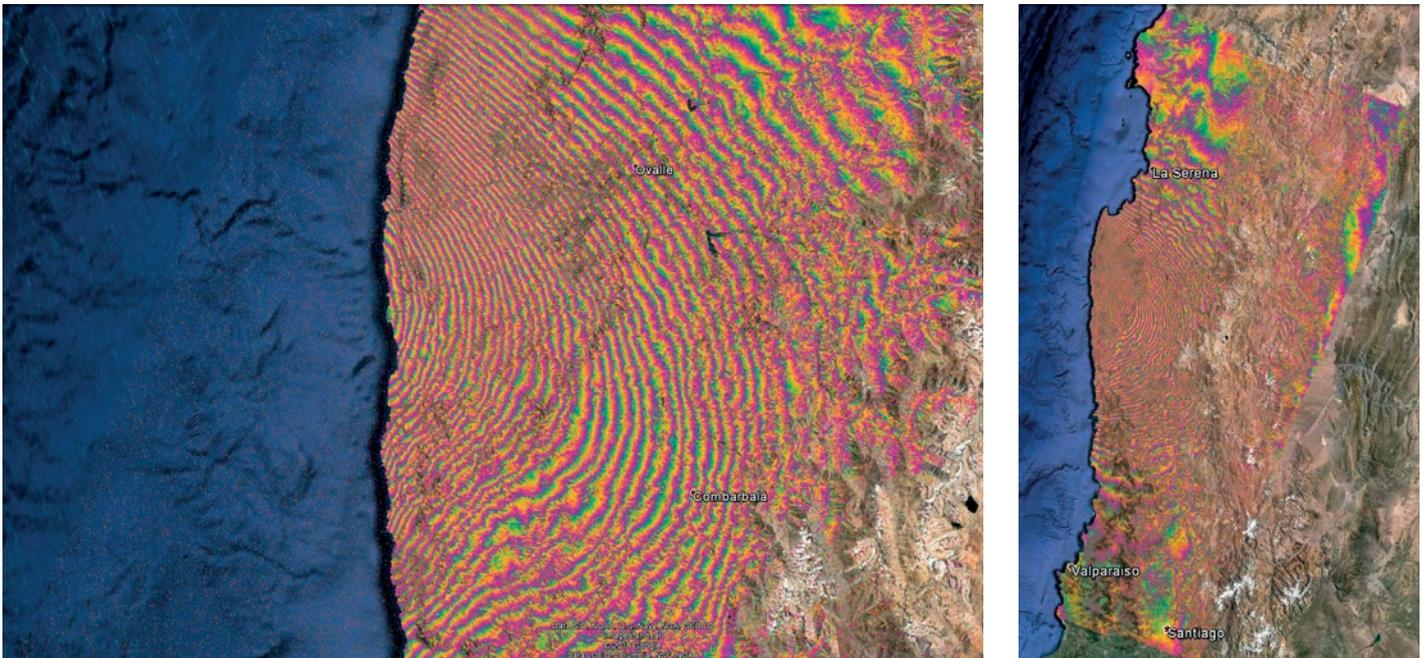
## Because **Accuracy & Productivity** Matter

The world is changing fast, and Teledyne Optech sensors are evolving to meet the increasing demand for accurate and timely geospatial information. Whether it's airborne, marine, mobile or terrestrial surveying, Teledyne Optech high-precision lidar sensors and metric cameras provide state-of-the-art solutions that meet or exceed survey project requirements. Coupled with unique and innovative productivity enhancements, as well as fully-automated and integrated workflows, Teledyne Optech survey sensor solutions are a class above the rest.

**Contact a Teledyne Optech representative today, and they will help you configure the appropriate sensor mix for your specific project needs.**

Please join us at: GeoBusiness 2016 • London, UK • May 24-25 • Booth #M10

[www.teledyneoptech.com](http://www.teledyneoptech.com)



▲ Figure 1, Interferogram showing the Chilean earthquake that occurred on 16 September 2015 (the image on the left is a detailed view of the overview on the right). The SAR images that have been used to create this interferogram are Sentinel-1A images from 24 August 2015 and 17 September 2015. Each fringe corresponds to a displacement of approximately 2.8cm in the viewing direction of the satellite. Image courtesy: ESA SEOM INSARAP study PPO.labs/NORUT. Contains modified Copernicus Sentinel data (2015).

larger perpendicular baselines, since objects look different when seen from different viewing angles.

#### CONTRIBUTIONS TO INTERFEROGRAMS

To understand the results of radar interferometry it is important to know the factors that influence phase differences. The most important contributions to the observed phase differences are caused by

temporal baseline will show local topography very well, but only limited surface deformation. Which part of the phase difference needs to be corrected for depends on the application (although satellite orbit errors always need to be corrected during post-processing). When modelling surface deformation, for example, one typically uses an elevation model of the area in the interferogram and calculates the phase differences that are caused by

scatterer interferometry (PS-InSAR). An example of its application is the monitoring of subsidence of buildings, an effect which can be as small as just a couple of millimetres over the course of several years. PS-InSAR finds objects in the area of the image that produce a constant and characteristic radar reflection over time. Such 'persistent scatterers' are points that are tracked over time in a stack of many radar images. However, the number and distribution of these points depends on the region of interest and they can be difficult to find in dynamic areas where many changes occur (such as vegetation growth).

## LONG-TERM DEFORMATION MONITORING WORKS WITH A SPECIAL FORM OF INSAR KNOWN AS PERSISTENT SCATTERER INTERFEROMETRY (PS-INSAR).

local topography (through the 3D effect of the perpendicular baseline), surface deformation over time, uncorrected satellite orbit errors and atmospheric signals due to spatial and temporal differences in atmospheric delay. These contributions are always present, but they have a highly variable influence on the result. For example, an interferogram with a moderate perpendicular baseline and small

the topography. When this interferogram is subtracted from the original interferogram, only the signals for surface deformation and atmospheric delay differences will remain visible.

#### PS-INSAR

Long-term deformation monitoring works with a special form of InSAR known as persistent

#### POTENTIAL

Satellite radar interferometry has many different applications, ranging from natural hazard mapping (such as earthquakes and volcanoes) to monitoring subsidence and stability in structural engineering. With the ability to measure and monitor down to centimetre-level or even millimetre-level scale using satellites that are hundreds of kilometres away, InSAR is both a very useful and a very impressive technology with large potential for the geomatics industry. ◀

**RUIDE**

IMAGINATION  
**RIS**



“A buddy  
I rely on.”

No 2978

RUIDE\_  

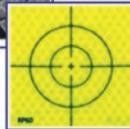
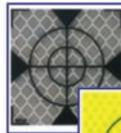


**GEO-ALLEN CO., LTD.**  
Punctuality / Quality / Rigor / Service

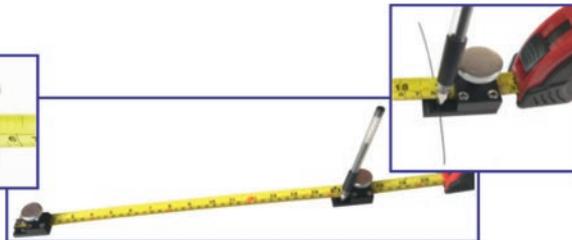
(Founded in 2002)



Patent No.  
ZL 2013 2 0115329.3



Exclusive Design as required



[www.geoallen.com](http://www.geoallen.com)

e-mail:[geoallen@vip.163.com](mailto:geoallen@vip.163.com)

Fax:+86-512-6862-9776

Tel:+86-512-6802-6320

No 2980

**TRANSMISSION PIPELINE MONITORING USING COPERNICUS**

# Pipeline Integrity Management from Space

Pipeline operators are responsible for the safe transport of oil and gas through high-pressure transmission pipelines. In the Western world, these transmission pipelines are buried in the public space at a depth of about 1.5 metres. Operators are concerned with monitoring the integrity of their pipelines on a regular or even continuous basis, as pipeline failures can cause severe damage to people, infrastructure and the natural and built environment. This article discusses the use of Copernicus Sentinel-1 satellite radar imagery to provide pipeline operators with a continuous source of information for monitoring and managing their assets from space.

In a densely populated country such as The Netherlands, the total length of the public motorway network is about 2,700km while the total length of the high-pressure gas transmission pipelines belonging to the largest operator is roughly 12,000km (Figure 1). This means that, at least in The Netherlands, you are always many times closer to a buried high-pressure gas transmission pipeline than to a motorway. Failures in transmission pipelines are high-impact events with a large risk of severe damage. In Europe, the main causes of failures in high-pressure gas transmission pipelines are so-called third-party interferences (TPIs). Examples of TPIs are excavations, deep ploughing, construction activities and city encroachments. These TPIs are responsible for almost 50% of all failures in Europe.

**HELICOPTER SURVEYS**

To minimise the threats caused by TPIs, as a mitigating measure pipeline companies survey their pipeline routes regularly using

altitude of 300ft and at a speed of approx. 200km/h. However, in a number of countries – especially in areas with a high risk of terrorism – the minimum allowed flying height for helicopters has recently been raised to 1,000ft as a result of anti-terrorism measures. This complicates close inspection in these areas. In general, helicopter surveys have a number of drawbacks, such as low visibility or no flight being possible at all due to bad weather conditions (rain, fog), safety concerns, noise, emissions and the relatively high costs associated with helicopter surveys in general. Pipeline operators therefore require other information sources that can reduce their need for helicopter surveys.

**COPERNICUS**

To detect threats to the integrity of transmission pipelines, a new method based on synthetic aperture radar (SAR) satellite data has been developed by Orbital Eye, a Dutch start-up in the space industry and alumnus of the ESA Business

observation (EO) satellites. The Sentinel-1 satellite was launched in April 2014 and mainly features a 12m-long C-band SAR instrument which operates day and night in all weather conditions. The satellite orbits the Earth at an altitude of 693km and has a repeat cycle of 12 days. Sentinel-1 is part of a constellation of two satellites, the second one of which is planned for launch later this year. Together they will revisit every place on Earth every six days.

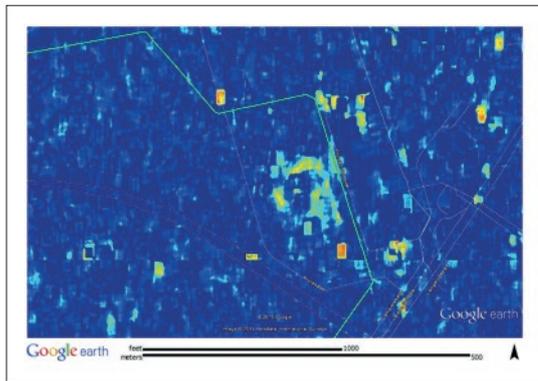
**PIPELINE OPERATORS REQUIRE OTHER INFORMATION SOURCES THAT CAN REDUCE THEIR NEED FOR HELICOPTER SURVEYS**

helicopters. Depending on the risk profile of the pipeline route, these surveys occur with a frequency of once per one to three weeks. Normally the helicopters fly at an

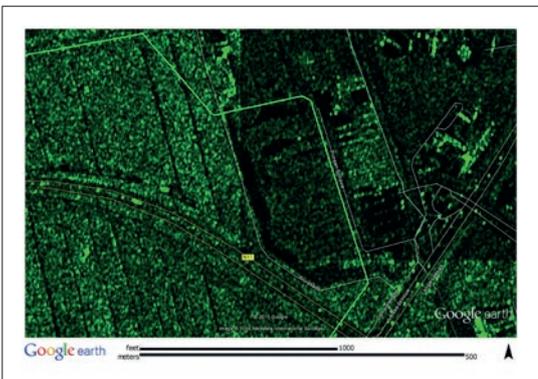
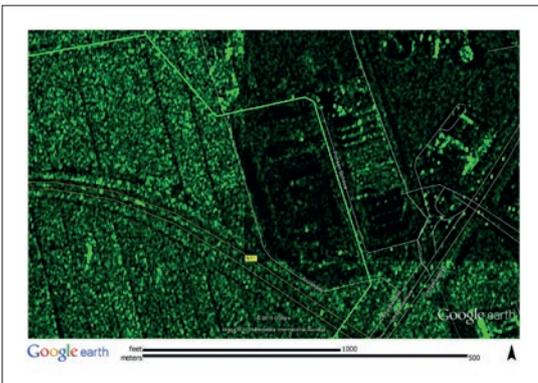
Incubation Centre in Noordwijk. The method – named PIMSyS – uses images that are acquired by Sentinel-1, one of the European Copernicus programme's Earth



▲ *Figure 1, The dense network of high-pressure transmission pipelines in The Netherlands; generally speaking, Dutch citizens are always closer to a transmission pipeline than a motorway.*



▲ Figure 2, Satellite-derived differences between 12 December 2014 and 14 January 2015 for a small area in The Netherlands. The transmission pipeline is shown in green. The colour scale runs from blue (no change) to red (relatively large change).



▲ Figure 3, Individual SAR satellite images for the change detection image shown in Figure 2. The radar images were acquired on 12 December 2014 (top) and 14 January 2015 (bottom).

## EVIDENCE-BASED INSPECTION

The proposed satellite-based method is a cloud service to support pipeline operators with additional information about possible TPI threats to their pipeline infrastructure. The service facilitates evidence-based inspection: it supports the optimisation of the scheduling of inspections by providing information about the location of potential TPI threats so that real threats actually have a higher probability of being detected. Potential threats are identified through change detection based on amplitude and phase information in two radar images of the same area (that are acquired successively in time). The observed changes are then evaluated and filtered according to their probability of being a change in reality (in order to avoid a large number of false positives). The resulting change information can be complementary to other surveying methods or can partly – or even completely – replace current methods.

## PROCESSING CHAIN

So far, a fully automated processing chain has been developed for Sentinel-1, TerraSAR-x and RadarSAT-2 images. The chain detects when new satellite images are available for areas with pipeline systems that are currently being monitored. The data is then automatically downloaded and processed. TPI threats are detected by comparing sets of two images for the same area. The time interval between two successive images depends on the satellite used. The intervals for Sentinel-1, TerraSAR-X and RadarSAT-2 are respectively 12, 11 and 24 days. The detected TPI threats that are not in the vicinity of the pipeline are filtered out to reduce data storage and transfer. All reports are sent via a secure internet connection to a client system located at the pipeline company. The client system consists of a spatial database, a mobile application (for tablets used by field operators) and a desktop application (for use at the office). The client system supports the display of maps, the location of pipelines, and display and interactive retrieval of detected TPIs, helicopter reports, vehicle reports and other observation reports. This information can be further combined with additional information about municipalities and landowners (where available).

## VALIDATION PROJECT

The satellite-based service was validated during an eight-month project executed together with a pipeline operator. During this

project the identified threats were compared to the results of helicopter surveys. The validation project was executed in 2014-2015 in an area measuring 30km by 50km in the western part of The Netherlands. The original plan was to utilise Sentinel-1 data for this project. However, Sentinel-1 was not yet operational in this period so TerraSAR-X imagery was used instead. The total length of the pipeline route monitored during the project was approx. 238km, with a total pipeline length of approx. 366km (some routes contained more than one pipeline). For the eight-month period, six satellite images were available which were acquired at intervals varying from 22 to 66 days. For this time period, all reports of helicopter surveys (with a surveying frequency of once per three weeks) were also provided by the pipeline operator. In addition, a list was made available of all locations in the vicinity (within 50m) of the pipeline route where third-party excavation activities were planned. The pipeline company selected four locations in the project area where its own activities were planned during the validation project. For these four locations, the detected changes showed a perfect match with the actual start and end dates of the activities. However, these locations together represented no more than approx. 1km to 2km of the total pipeline route. For that reason, a statistical analysis was made for the entire validation period and for the total project area. This analysis proved a strong correlation of the results with other activities executed by the pipeline company for extension and maintenance of the pipeline system.

## CORRELATION

For approximately 90km of pipeline route, the correlation was investigated between detected TPI threats and the results of the helicopter surveys and planned third-party excavation activities. In The Netherlands, planned excavations are registered through a central system known as KLIC. During the validation project, the helicopter and satellite-based method detected events at 152 unique locations. For 80 of those 152 locations (53%) there was information available via a helicopter report and for 134 of the 152 locations (88%) information was available via the PIMSyS satellite-based method. Table 1 shows the number of locations for which a certain combination of data sources was available. For example, only 4.6% of the 152 unique locations were covered by all available information sources. In 7.2% of the number of locations, a helicopter report matched with

a KLIC registration (the sum of the number of locations in rows 'Helicopter + Satellites + KLIC' and 'Helicopter + KLIC' in Table 1). Similarly, the correlation between KLIC and the satellite-based method was 23.7%. One of the reasons for the relatively low correlation is that most third-party excavation registrations are active for only a short period of time (a few days up to two weeks) while the surveying frequency is once per three weeks for helicopters and 22-66 days for the radar satellites.

**FURTHER INTERPRETATION**

There are 14 helicopter reports for locations that were not detected by the radar satellites. Analysis of these 14 reports showed that 10 reports were related to short-lived events that most likely both started and ended in the period between two satellite images. In addition, two helicopter reports showed no activity (false alarms) and two reports showed longer-lived activities that were not detected with satellite imagery. Of the 43 locations that were only reported by the satellite-based

method, 33 were related to a major pipeline extension activity executed by the pipeline company. The helicopter did not report these events, even though the helicopter observer is instructed to report all activities including the activities of the pipeline company itself. In conclusion, the correlation between KLIC and PIMSyS was roughly three times higher than for helicopter reports. Furthermore, 88% of all locations were detected in total. This shows that the satellite-based TPI detection method is more reliable and provides pipeline operators with a valuable source of additional information for monitoring and managing their pipelines. ◀

TPI detected by	Helicopter		PIMSyS satellite-based method	
	Number of locations	Percentage of locations	Number of locations	Percentage of locations
Helicopter + Satellites + KLIC	7	4.6%	7	4.6%
Helicopter + Satellites	55	36.2%	55	36.2%
Helicopter + KLIC	4	2.6%		
Satellites + KLIC	29	19.1%		
Helicopter	14	9.2%		
Satellites			43	28.3%
<b>Total</b>	<b>80</b>	<b>52.6%</b>	<b>134</b>	<b>88.2%</b>

▲ Table 1, Number and percentage of detected TPI threats based on the various combinations of available information sources, showing the correlation between different TPI detection methods.

**JAN RIDDER**



Jan Ridder holds a university degree in applied physics. He has worked in various positions in R&D organisations in The Netherlands, both as a researcher and as a manager. Before joining Orbital Eye he was the director of an international technical service company. He has been managing director of Orbital Eye, a company specialised in pipeline safety management using satellite data, since 2012.

**GINTEC**

**G5**

Cloud Service  
GINTEC

**NEW CHOICE NEW FUTURE**

**G5 portable multi-function GNSS receiver**

http://www.gintec.cn  
E-mail: overseas@gintec.cn

No 2983

## UAS FOR ARCHAEOLOGICAL EXPLORATION

# In Search of Georgian Artefacts

Over the past nine years, a team of Australian archaeologists has visited Georgia every year as part of the Georgian-Australian Investigations into Archaeology (GAIA), a partnership between the University of Melbourne and the Georgian National Museum. As part of our final year of the Master of Engineering (Geomatics) programme, we were fortunate enough to capitalise upon this strong relationship and based our year-long research project at an archaeological site in Dzveli, Georgia. Here, the primary objective was to survey and map the site where a preliminary investigation had already revealed remains of the Kura-Araxes culture dating from approximately 3500 BC.

Our team consisted of four final-year students, industry partner Eldar Rubinov (Rubikon Geosystems) and Cliff Ogleby, senior lecturer and research project supervisor at the University of Melbourne. Together we travelled to the beautiful country of Georgia in July 2015. After spending a couple of days taking in the sights in the capital Tbilisi, we headed west to Dzveli in a

minibus organised by the National Museum of Georgia. Four hours later, after some very bumpy and winding roads and a quick pit stop for some khachapuri (a traditional Georgian dish of cheese-filled bread), we had made it to our base for the next ten days. We stayed in a local house that had also been used by the GAIA team for the past eight seasons. This year it was relatively quiet with

only a small team of landscape archaeologists and surveyors, as no excavations were currently taking place.

We expected a tough site but nothing prepared us for what we saw (Figures 1 and 2). Surprisingly steep terrain, large vegetation coverage (including stinging nettles) and some territorial local cows were just some of the obstacles we encountered. It proved a perfect testing ground for non-invasive archaeological exploration given the challenges terrestrial-based techniques would face.

The remains of a mediaeval castle (or rabat, as such castles are known in Georgia) can be found throughout Dzveli and a wide range of other archaeological features also needed to be surveyed and visualised to support further analysis and cultural interpretation. We saw an opportunity to use new surveying technology to provide an accurate geospatial site record and visualisation in an accessible manner.

### EQUIPMENT

High-resolution aerial imagery is highly sought after by archaeologists as it provides them with a complete and accurate aerial perspective of the site. We chose a fixed-wing senseFly eBee, commonly used throughout the industry, and a small multi-blade quadcopter with an attached GoPro (Figure



▲ Figure 1, The vast valley in Dzveli, overlooking the Kūr Çayı River.

3). This appealed to us because of the large discrepancy in costs and their differing characteristics. The quadcopter's ability to rotate the GoPro enabled us to capture images perpendicularly rather than top-down aerial views, demonstrating the flexibility of the quadcopter. This feature proved to be beneficial in areas of high relief where traditional airborne approaches have typically struggled to capture data with adequate detail for archaeological exploration. The senseFly eBee has the ability to capture images with an NIR camera and, when combined with the standard RGB-enabled multispectral imagery, a normalised difference vegetation index (NDVI) image can be generated. This was an exciting feature as multispectral analysis of archaeological sites has often helped identify possible underground features or patterns.

#### FIELD WORK

Large protruding ruins of the mediaeval rabat ran along the east end of the site: a clear gateway was present and some walls were very well preserved (Figure 4). The steep terrain abutting them made them a prime target for close-range photogrammetry taken with the inverted GoPro on the quadcopter. A rough estimate of the earlier excavations (in the 1960s) and the visible ruins of the rabat allowed us to determine the extent of the site. Given that it was a relatively large area (300m<sup>2</sup> to 400m<sup>2</sup>), it was interesting to test how the quadcopter could cover the site.

Control points around the site were placed using GNSS to achieve relatively accurate control points (Figure 5). Understandably, the equipment shed was quite limited but we improvised and managed quite well (including fashioning a plum bob from some string, the tip of a pole and the thread from a tripod). The quadcopter was piloted by Cliff and we completed five aerial flights of no more than 15 minutes each. The limited battery life and the difficult controls of the quadcopter meant that experience and patience were required to adequately capture the required data. We set the GoPro to take a shot every two seconds regardless of position, given the inability to precisely mitigate external factors such as altitude and exact path direction. The errors were minimised in the two additional flights along the protruding ruins. These flights were conducted at a much lower altitude, providing greater control over the data captured, and the quadcopter's GoPro was rotated to capture the ruins more effectively.



▲ Figure 2, The Dzveli site with its mountainous background. From left to right: Brett, Eldar, Steve, Emma, Ella and Cliff.



▲ Figure 3, The quadcopter with GoPro inverted.

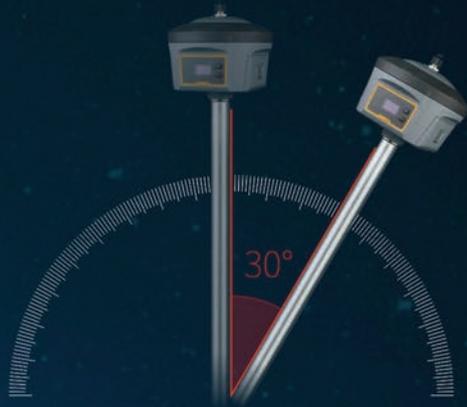
The eBee arrived with pilot Eldar Rubinov (Rubicon GeoSystems). We were all excited by its arrival given its complicated journey to Georgia. The eBee provided the certainty we were looking for, collecting data of known quality for us to access almost immediately after the flights themselves. The self-planning flight path, resolution control and image overlap percentage allowed us to capture nearly 0.5km<sup>2</sup> in one single flight with a resolution of around 4.5cm/pixel. The eBee was launched from a nearby football field and all that was left to do was to keep an eye out for any circling eagles. Luckily our two flights (one with the RGB camera and the other with an NIR) were successful, leaving the eBee free to capture aerial images of countless other GAIA sites.

#### RESULTS

Back in Melbourne, plans to finish processing the data began with help from Think Spatial. The processing was fairly automated and quite straightforward to complete. Outputs of the NIR camera could be similarly processed and an NDVI was generated in ArcGIS. We

#### YOUNG GEO IN FOCUS

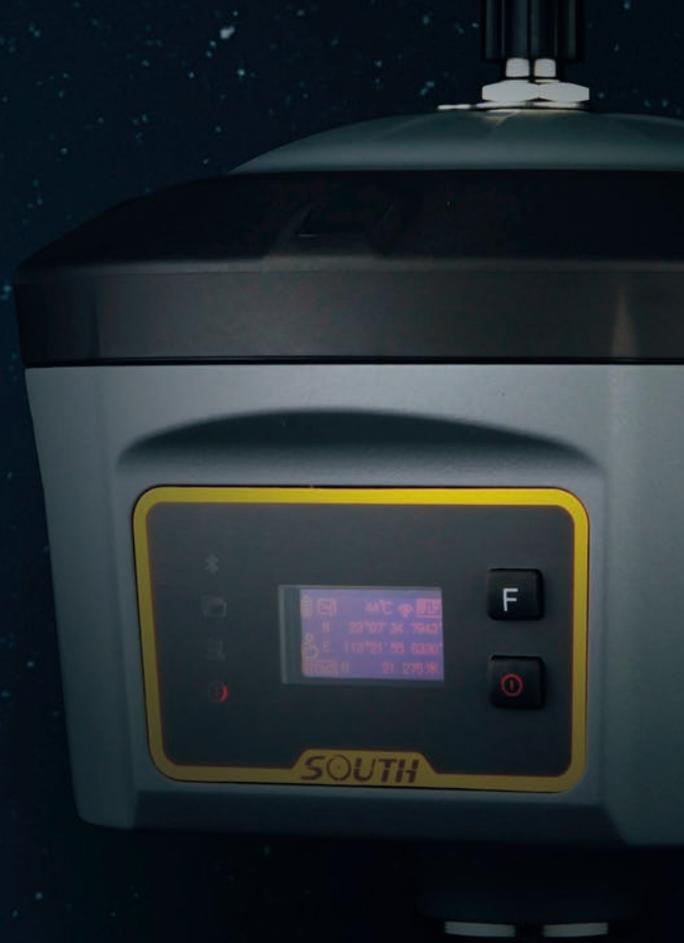
'Young Geo in Focus' offers recent graduates or postdocs the opportunity to share their experiences with our worldwide audience. If you've just completed an innovative project with your first employer or finalised your PhD research with results that are of interest to practitioners feel free to contact the editorial manager at [wim.van.wegen@geomares.nl](mailto:wim.van.wegen@geomares.nl).



## GALAXY G6

Intelligent Inertial RTK

- Linux operating system
- Attractive OLED display
- WIFI hotspot & connection
- Radio router
- Electronic bubble correct
- Tilt Compensation
- NFC(Near Field Communication) function
- Positioning rate is up to 50Hz
- Rinex storage support
- Complete NTRIP Caster
- 8GB SSD storage
- OTG host



## GALAXY G1

Intelligent Inertial RTK

- Magnesium alloy housing
- Innovative structure design
- 12.9cm × 11.2cm dimension, compact & lightweight
- Full satellite constellations support
- Electronic bubble correct
- Tilt compensation
- NFC(Near Field Communication) function
- Advanced datalink module
- Powerful new Bluetooth module
- Cloud service



were especially impressed with the co-registration of the images (RGB and NIR) leading to a greater belief in the benefit of the NDVI.

The data from the quadcopter turned out to be quite useful, especially along the protruding ruins where high-quality 3D models were generated using photogrammetric software. Images suffered from the lack of resolution from the wide GoPro lens, limiting the quality of the orthoimages generated despite the lower flying altitude. We utilised a platform called MangoMaps to help visualise the data in a manner that facilitated analysis and accessibility (Figure 6). By presenting multiple layers including the RGB orthoimage, contours, geotagged images and the NDVI, the online platform enabled analysis to be conducted remotely with ease. To further extend the online presence of the project, the 3D models were uploaded to Sketchfab, a 3D model-hosting platform that provided great benefit to the project.

To improve our understanding, we arranged a meeting with lead GAIA archaeologist, Antonio Sagona, from the University of Melbourne's School of Historical and Philosophical Studies. He was able to study the site data in great detail despite not having made the trip to Georgia in 2015. This allowed preliminary decisions about the site to be made. The excitement Antonio brought to our project was especially encouraging, as he



▲ Figure 4, A picture taken from the quadcopter while the GoPro is inverted. This allowed a much better 3D representation of the ruins to be generated.

discovered areas he considered to be of significance using the data. He was able to make connections with other sites, bringing together a wealth of knowledge and deciphering the data in ways we could not have envisioned. As a team and given the amount of work we had put into the project, it was really fulfilling to get such a great response from Antonio. It illustrated the importance of spatial information and how it can directly influence real decisions.

The project tested us in ways we would not have predicted, but more importantly it allowed us all to gain a once-in-a-lifetime experience we are unlikely to forget. We are proud that we produced meaningful work, exposing yet another industry to which geomatics experts can contribute. As students, we were happy to have been able to organise a trip to Georgia into our final year and we hope that our work will ultimately inform future research expeditions by GAIA in 2016 and beyond. ◀



▲ Figure 6, A screen capture of the web map generated through MangoMaps, with the NDVI image. The web map can be viewed at <http://mgo.ms/s/zxdyt>.



▲ Figure 5, Emma, Brett and Steve improvising a static GNSS survey technique.

#### ADDITIONAL INFORMATION

For the Pix4D eBee model: <https://skfb.ly/HMKD>  
 For the quadcopter model: <https://skfb.ly/HJxz>

#### ACKNOWLEDGEMENTS

The authors wish to thank Cliff Ogleby (supervisor), GAIA, Eldar Rubinov (Rubikon Geosystems) and Think Spatial for their support throughout the entire research project.

#### THE AUTHORS



Ella Doolan, Emma Eltringham, Brett Sheehan and Steve White all graduated from the Master of Engineering (Geomatics)

programme at the University of Melbourne in Australia in December 2015. This project enabled them each to identify which parts of the industry they had personally become passionate about. Ella has taken her passion for geomatics into the cadastral surveying field and hopes to become a licensed cadastral surveyor. Emma particularly enjoyed the GIS side of the geomatics programme and hopes to move into a GIS role helping to manage mining operations. Brett loved the use of cutting-edge technology and is currently focusing on its different applications within a large engineering consultancy. Steve is looking for a role that will combine his passion for geology, geomatics and technology as his first step towards an exciting career.



TECHNOLOGY TO CONNECT,  
INFORM AND PROTECT™

# GEOSPATIAL DATA, ANALYTICS, AND CUSTOM SOLUTIONS

Whether you need a finished geospatial product, a custom solution, or data and analytics to support a project, **Harris Geospatial Solutions** can meet your needs. Advanced ENVI® analytics extracts actionable information from geospatial data. Our Geiger-mode LiDAR sensor collects high-resolution data faster and more cost effectively than traditional sensors. If you're looking for other data types, the Harris Geospatial Marketplace provides access to the world's premier satellite, aerial, elevation and vector data. And our industry experts deliver custom products and solutions or over-the-shoulder consulting to meet your project needs.

[HarrisGeospatial.com](http://HarrisGeospatial.com)

**REVIEW OF THE 8<sup>TH</sup> CONFERENCE ON EUROPEAN SPACE POLICY**

# Easy Access to Relevant Space Data

The 8<sup>th</sup> Annual Conference on European Space Policy recently took place in Brussels, Belgium. Higher investments, cost reductions and united policy are wished for, but European success in the space industry is determined by the extent to which it fulfils needs on Earth. The sector realises that user experience – included preventing the user from drowning in space data – will be key. The first priority of the European Commission (EC) is to strengthen the Copernicus and Galileo space programmes.

“We need to ensure that the benefit of the Galileo and Copernicus programmes creates growth and jobs,” said European Commissioner Elżbieta Bieńkowska at the Annual Conference on European Space Policy 2016. That growth and those jobs must come both from stimulating commercially

**GALILEO**

Elżbieta Bieńkowska also confirmed that this year the Ariane 5 launcher will be used for Galileo deployment; Ariane 5 can carry four Galileo spacecrafts to be put in medium Earth orbit. The infrastructure for Galileo, the European navigation system, must be ready

strong return on investment for developed services and applications by ensuring easy access to Copernicus data,” promised commissioner Bieńkowska. The aim is to create 85,000 new European jobs in the next 15 years. They can arise from new business opportunities as the result of merging datasets relevant for policymaking, government and private services. “The users can define an area of interest, let’s say a country, region or city, and download only the relevant data, as often as every three to six days,” explains Volker Liebig, director at ESA and responsible for Copernicus, from his office in Rome, Italy. But the main success of the programme will not come from (raw) ‘data/images as a service’ but rather from ‘information as a service’. That is where small

**IN FOUR YEARS’ TIME THERE WILL BE ENOUGH SATELLITES AT THE ALTITUDE OF 23,222 KILOMETRES TO START ENJOYING ITS HIGH-PRECISION NAVIGATION TO THE FULL**

successful services and applications, and from the space industry itself; the satellite launching market alone is worth EUR7 billion. Space is becoming a crowded place. In December 2015 there were 1,381 satellites at work: 759 in low Earth orbit, 92 in medium Earth orbit and 493 in geostationary orbit. The more (commercial) satellites that European companies can launch, the better the earnings will be. Today, the most important markets are telecom and meteorology. During the conference, the European Commissioner stipulated that the EU will “do its maximum” to support the development (coordinated by the European Space Agency, ESA) of the more flexible, heavyweight Ariane 6 and the smaller launcher, Vega. Many participants in the audience showed some relief after this statement.

by 2020, and ESA is starting with initial services this year to allow businesses to prepare applications on Galileo. For now, with eight full operational capability (FOC) satellites in orbit, a position can be fixed whenever four satellites are visible at the same time. In addition there are the initial operational capability (IOC) satellites. If all goes according to plan, in four years’ time there will be enough satellites at the altitude of 23,222 kilometres to start enjoying its high-precision navigation to the full. As with GPS, there will be a civil navigation channel for use by everybody without costs.

**COPERNICUS**

For Copernicus, the EU Earth monitoring system that is being built around the Sentinel satellites, all data is open and freely available. “I want to create the optimal conditions for a





▲ *Elżbieta Bieńkowska has been a European Commissioner since 2014, responsible for the internal market, industry, entrepreneurship and SMEs. Before this post, she was minister of infrastructure & regional development and vice-president in Poland.*



▲ *Dr Volker Liebig has been ESA director and head of ESA's centre for Earth Observation (ESRIN) since 2004. Before joining ESA he was programme director of the German Space Programme.*

and medium-sized enterprises (SMEs) can play a role in developing algorithms and big data processing tools to create new business opportunities. Many of them have already developed commercial information services, and turnover from such initiatives has risen above EUR800 million. Liebig sees more potential for growth: "There are around 550 Earth observation service companies in Europe and Canada and their combined

the Sentinel satellites will be sending back 10 terabytes of data every day, amounting to approximately 7 petabytes in 2017. Big data techniques (data mining, artificial intelligence, machine-to-machine dialogue) will be crucial to prevent the user communities from 'drowning' in the data. They must ensure that the users receive the information and the performance they expect. The access time has to be short and parallel processing on different computer

Added value must come from a combination of satellite data and data from both traditional and still-to-be-developed sources: the Internet of Things. We will be surrounded by sensors spewing out data all around us. "We must shift the data from pictures into movies. If you can't compete in this high velocity data world, you are commercially dead," cautioned Laurent Maury, vice president of the Thales Group, during the conference.

## **THE PESSIMISTS BELIEVE THAT THE SUCCESSFUL EUROPEAN APP-BUILDING START-UPS WILL END UP IN SILICON VALLEY**

revenue has grown at about 8 percent annually in recent years. The beneficiaries of these services are located worldwide as the data is freely available for everybody, but Europe is of course the main target group. Some 80 European governmental services, plus many national services, already exist."

### **SEVEN PETABYTES BY 2017**

'Easy access' can actually create a new barrier in some respects. Already next year,

platforms should be possible at any time and in any place. The bandwidth must be able to handle that and networks must be enforced.

Thematic platforms, which will share their infrastructure in the cloud, will be crucial to be able to download and process the masses of data effectively and offer data protection. Customers will expect the same interface and the highest performance of each device everywhere: user experience is key.

But for some companies that is an opportunity rather than a threat. At the conference in Brussels, several speakers said that it is necessary to avoid large US firms becoming 'monopolies'; Europe is investing in building the best Earth observation programme, but US-based giants like Google and Amazon enjoy tremendous benefits from its data. And the pessimists said that the successful European app-building start-ups will also end up in Silicon Valley. The ESA director comments: "Monopolies or oligopolies always – as in the so-called 'old' economy – damage market principles. To tackle this challenge, the regulations must be adapted fast to the emergence of global players. This includes that these 'new' economy companies should not be able to monopolise big data, must adhere

to European data and privacy laws, should ensure the survival of competitors and pay adequate taxes. None of this is guaranteed at the moment which is why measures are needed, both in Europe and elsewhere.”

#### NATIONAL MAPPING

The free Copernicus data can also be used effectively and efficiently by national mapping agencies in some of their tasks. Volker Liebig: “The resolution of the optical Copernicus data is 10m, but it is available at least every five days and is usually not older than three hours. Since the datasets are freely and openly available, they are very interesting for monitoring, agriculture and forestry purposes. Depending on the scale of the map, the data might also be very useful for mapping, even though the system was designed for monitoring products.”

That could affect the market position of surveying companies. However, Liebig does not regard this as a problem of competition but rather a changing playing field: “Big data

#### COPERNICUS AND GALILEO

Copernicus is a European system for monitoring the Earth. It consists of a set of systems which collect data from multiple sources: earth observation satellites (the Sentinels) and in situ sensors (ground, airborne and sea-borne). It provides users with reliable and up-to-date information, initially related to environmental and security issues such as a natural disaster or a humanitarian crisis, but all kinds of other uses are also possible. All the data is open and freely available. Studies show that Copernicus, which by 2025 will include more than a dozen satellites, could generate a financial benefit of some EUR30 billion and create up to 85,000 jobs in Europe by 2030. The Copernicus programme is coordinated by the European Commission. The development of the space component in the observation

infrastructure is performed under the aegis of the European Space Agency (ESA), which also performs the same role for Galileo.

Galileo is Europe’s global navigation satellite system under civilian control. It is interoperable with GPS and Glonass. By offering dual frequencies as standard, Galileo is set to deliver real-time positioning accuracy down to the metre range. Four pairs of FOC satellites have so far been launched. By 2020, the fully deployed Galileo system will consist of 24 operational satellites plus six in-orbit spares, positioned in three MEO planes. The three active spare satellites per orbital plane will ensure that the loss of one satellite would have no discernible effect on the user.

and the Internet of Things are challenging all traditional approaches. Every branch will include all types of data, obtained from satellites and planes but also from an

increasing number of new sources such as smartphones, crowd sourcing or even cars. Services will change completely. This is the challenge in the coming years.” ◀

# LINERTEC

**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

**Cutting-Edge Technology  
at an Affordable Price**

No 2565

TI Asahi Co., Ltd.

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

4DMAPPER

# Geospatial Data Game Changer

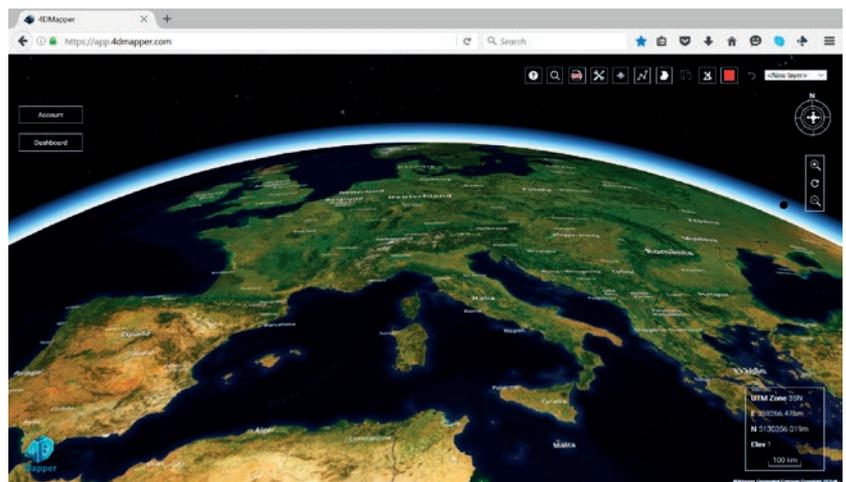
Australian technology company 4DMapper designs, develops and markets a web-based platform for streaming and sharing big geospatial data. Massive amounts of geospatial data can be imported to the cloud, then viewed immediately by an expanded audience in 3D via a URL, without any extra software being required.

Based in Sydney, Australia, 4DMapper is changing the way people view and share geospatial data, with no delays waiting for data to arrive and load nor the need for specialised, expensive software and hardware. Rich, visual, powerful 3D data from UAVs, laser scanners, high-resolution satellites and aerial mapping can be easily uploaded and streamed. 4DMapper enables professionals and decision-makers to work collaboratively on a project, seeing each other's work as it happens for real-time problem-solving.

## MOVING GEOSPATIAL DATA EFFICIENTLY

4DMapper is a private company formed in 2014 by highly experienced geospatial professionals Rob Klau and Adam Chabok. Big geospatial data has traditionally required big data handling, powerful processing hardware and expensive software to manage and access. The duo recognised a void in effective delivery of geospatial data to people who need it. They worked with a team of software engineers to develop a platform for streaming these massive files without the need for expensive software or hardware. 4DMapper has become a game changer in the geospatial data realm with a broad range

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.



▲ 4DMapper changes how geospatial data is accessed and delivered.

of users in the areas of agriculture, mining and resources, waste management, environmental monitoring, insurance, government and defence. One application keenly supported by the company is crowdsourcing of drone mapping and inspection data for humanitarian projects such as disaster management and environmental monitoring.

## RAPID GROWTH

The company has grown from being a start-up operated remotely between Sydney, regional NSW and Adelaide to a global enterprise. Sydney's central business district (CBD) has become the central location for technical development, while marketing and operations are now headed up in North America. Staff numbers continue to rise and 4DMapper is in a significant growth phase,

actively seeking further private investment.

Rob Klau explains the platform's significance: "4DMapper lets the genie out of the bottle, is original and disruptive to a very major industry. Massive, visual, geospatial 'big data' now becomes a fast-moving, accessible, powerful tool on the desks of decision-makers."

## ADAPTIVE PLATFORM

The founders originally worked on developing 4DMapper as a platform for geospatial data to be uploaded and streamed, with a focus on speed, cost savings and data leverage for its users. However, early client feedback asked for tools on the platform to measure points, lines, areas and volumes, to mark up and digitise with the ability to export those annotation layers as DXF or CSV files. On building these tools, the team realised

4DMapper's potential as a collaboration platform and collaborative work tool. For example, as one user draws mark-ups on a shared project, all others sharing the data see these changes as they happen. This opens up opportunities not previously imagined, such as multi-operator teams rapidly digitising a site, crowdsourcing of drone data for wide-area insurance inspections and team collaboration on new development projects. 4DMapper is a powerful tool: like Netflix and Google Docs combined for the geospatial data realm.

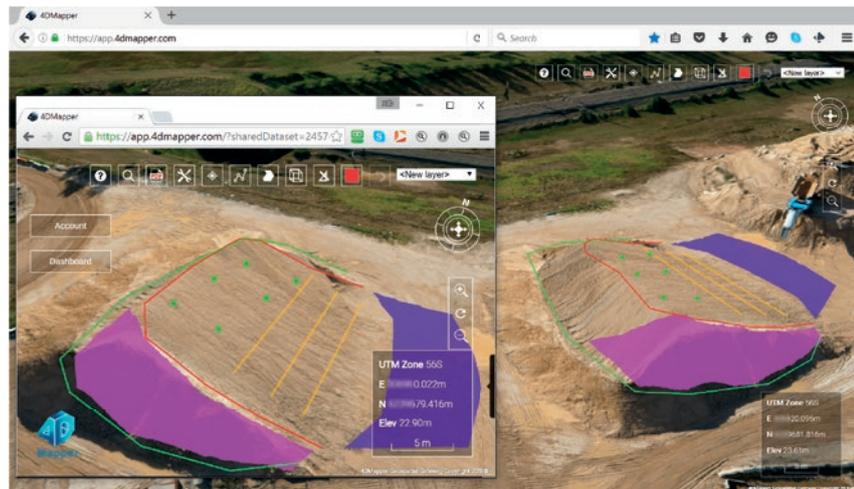
### SIMPLE AND AUTHENTIC

Users face a serious obstacle with most mapping software products: the complexity is overwhelming, and companies often have limited skilled personnel able to use the software to access the data. 4DMapper is working to make big geospatial data accessible to the widest possible audience with effective levels of functionality balanced with a simple, logical user interface.

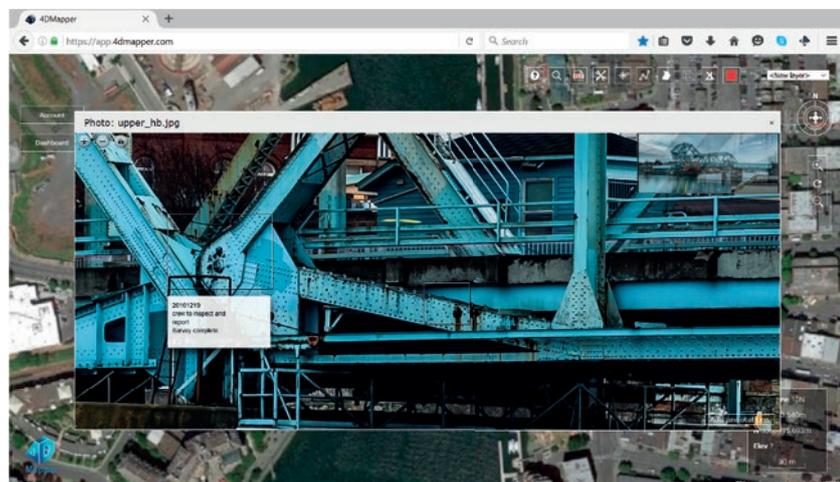
4DMapper takes care of the complexities of data ingestion by automating the entire process, from analysing file attributes before upload to tiling and streaming. The platform supports many formats of orthophoto imagery, 3D digital terrain, point clouds and vector data in more than 4,000 coordinate systems worldwide. While 4DMapper makes it faster to view geospatial data through streaming, its users maintain full control of their data, its management and distribution. The platform is a non-prescriptive environment maintaining the integrity of the original data. Users' data in the cloud is secure thanks to both AWS and internal IP security measures.

### CUSTOMERS AND MARKETS

4DMapper is currently working with data providers such as satellite and aerial imagery companies and operators of UAVs and laser scanners, leveraging their products by offering them to a far larger audience. The company is forming partnerships by offering a direct-upload API to integrate 4DMapper into the workflows of desktop software. It is also building relationships with cloud-based processing services, inviting them to this environment and enabling them to add value to products then efficiently deliver them to the client. 4DMapper's philosophy is 'enablement': to enable data to move quickly and seamlessly between providers, software companies, data analysts and end users.



▲ Real-time multi-user access and collaboration.



▲ A collaborative platform for asset inspection.

4DMapper is globally accessible and able to bring immediate access and collaboration among users worldwide. With the interest shown to date, the company is preparing for massive global growth with governments, corporations, software partners, small and medium-sized enterprises (SMEs) and individual users. Chairman of 4DMapper, Trevor Bourne, explains the platform's potential: "4DMapper provides an unparalleled opportunity to manage data and increase company efficiency by aiding the spread of information which in turn will improve business performance and profitability. The company is entering an exciting growth phase, which will show the true potential of this technology to customers and investors."

### FUTURE

4DMapper has a development plan to continue adding support and functionality to the platform. Recent developments have added support for asset inspection photos

and videos, and imagery animation to show changes over time or with different imagery types. The scope of further functionality is boundless. The team is currently building support for 3D vector data including rendered mesh products and 3D city models. As technology continues to evolve, so too will 4DMapper.

Geospatial data acquisition technology is booming. 4DMapper makes big geospatial data accessible on a massive scale and will continue to open up new markets and opportunities for its users. Growth of the geospatial industry is not only about new technology and more data, but also about access to that data, making it more useful and more valuable. ◀

More information  
[www.4DMapper.com](http://www.4DMapper.com)

# FOIF

## Working Under $-40^{\circ}\text{C}$



### RTS340 Total Station

Display no delay with highlighted colour screen(QVGA) at freezing condition

Working temperature:  $-40^{\circ}\text{C}$  to  $50^{\circ}\text{C}$

500m or 1000m reflectorless measuring distance

**FOIF** <sup>®</sup> Since 1958  
It's professional

SUZHOU FOIF CO.,LTD.



[www.foif.com](http://www.foif.com)

## FIG Young Surveyors Events



On 10 February 2016 the 2<sup>nd</sup> FIG Young Surveyors North American Meeting (FIG YSNAM) was held in Minneapolis, Minnesota, USA. The meeting was hosted by and held in conjunction with the Minnesota Society of Professional Surveyors (MSPS) Annual Conference. The theme of the meeting was 'The Future of Surveying... YOU!!!'. Key industry leaders were invited to inspire the participants about the future ahead of them. The event attracted 60 participants from six countries and 23 different US states. For many participants it was their first young surveyor event.

As first keynote speaker Mr Mooyman from Hexagon GeoSystems set the scene. He spoke about the current explosion of maps and geolocation, and how professionals must be sure that those maps and geolocations are accurate, complete and fit for purpose. Mr Mooyman believes that we are entering the 'Golden Age of Surveying' and that young surveyors are the ambassadors that will lead the way.

Mr Fosburgh, Trimble Navigation, challenged the participants to think outside the realm of what they might consider to be surveying. There is a vast array of spatial data out there that needs to be managed. Who better than

surveyors to fill those roles! Mr Fosburgh cautioned the young surveyors not to miss out on the next big technological advances in surveying by being unwilling to embrace a technology not historically considered in surveying.

The young surveyors exchanged experiences about their work and their networks. The international activities of the FIG Young Surveyors Network were highlighted. NSPS Young Surveyors Network gave an overview of the developments of the Young Surveyors Network in the USA. Four young surveyors from Canada, USA and Jamaica shared their experiences and showed how diverse a career as a surveyor can be.

Last October, around 500 students from nine different states in Argentina participated in the 5<sup>th</sup> Young Surveyors Meeting, and they were joined for the occasion by some young surveyors from Uruguay. The purpose of the meeting was to exchange knowledge and experiences on new trends in scientific and technological aspects of the practice of surveying. The meeting was held at the National University of Littoral (UNL) Santa Fe in Argentina. The event was endorsed by the Faculty of Engineering and Water Sciences



▲ Group picture of participants at 2<sup>nd</sup> FIG Young Surveyors North American Meeting (2YSNAM). Photo: Joe Paive (Geolearn)

and attracted the interest of the Senate of the Province of Santa Fe. Argentina has 14 universities with surveying programmes. The National Standing Committee of Surveying Students includes two surveying student representatives from each university and as a result of this event two student representatives from Uruguay are included. ◀

Paula Dijkstra (The Netherlands) and Melissa Robert (Uruguay), FIG Young Surveyors Network.

**More information**  
[www.fig.net](http://www.fig.net)

## Share SDI Practices and Broaden Your Network



Preparation for the 15<sup>th</sup> Global Spatial Data Infrastructure World Conference (GSDI 15, <http://gsdi15.org.tw/>) is well underway. The GSDI Association and the Local Organising Committee have been busy making arrangements for the conference. The organisers are excited to continue the GSDI World Conference series, which began in 1996 and now will take place in 2016 in Taipei, Taiwan (Republic of China) from 28 November to 2 December 2016. The Taiwan Association of Disaster Prevention Industry (TADPI) is hosting the event, with strong support from Ministry of the Interior.

Under the theme of 'Spatial Enablement in the Smart Homeland', GSDI 15 is bringing together

engaging speakers and inquisitive participants to explore the challenges and innovations related to increasing access to and use of geospatial data. Presentations will cover the full range of practice, development and research experiences that advance the objective of spatially enabling citizens, government and industry. The conference also will showcase strategies, policies and best practices that are driving collaboration and interoperability with respect to spatial data collection, integration, discovery, visualisation and analysis.

Two of the keynote addresses have been confirmed. Mark Reichardt, president of the Open Geospatial Consortium (OGC), and Barbara Ryan, secretariat director of the

intergovernmental Group on Earth Observations (GEO), will share their perspectives on the status, trends and future of spatial data infrastructure. The conference programme will include oral presentations of abstracts and papers (refereed and non-refereed), posters and a refereed publication. The deadline for abstracts has been extended to 15 May; the deadline for the submission of workshop proposals is open until 1 June and the deadline for submission of full papers and posters is 1 July.

In the coming months, the GSDI 15 organising team will continue with preparations to ensure that researchers, coordinators and technicians working at the

interface of spatial data handling, location-based services, territorial planning, open data governance, citizen science and evidence-based decision-making can effectively interact, share practices, broaden their professional networks and showcase their products and services. ◀

**More information**  
[www.gsdi.org](http://www.gsdi.org)



## IAG on the Internet

For many years the IAG has maintained a website as a valuable source of information about not only the association itself, but also its scientific disciplines and activities. The primary goal of the website is to communicate with IAG members and to make information available to the wider geosciences community across the globe.

The maintenance of the IAG website is one of the activities of the Communication and Outreach Branch (COB), hosted by the Department of Geodesy and Surveying of the Budapest University of Technology and Economics, Budapest, Hungary. The figure shows the geographical distribution of the

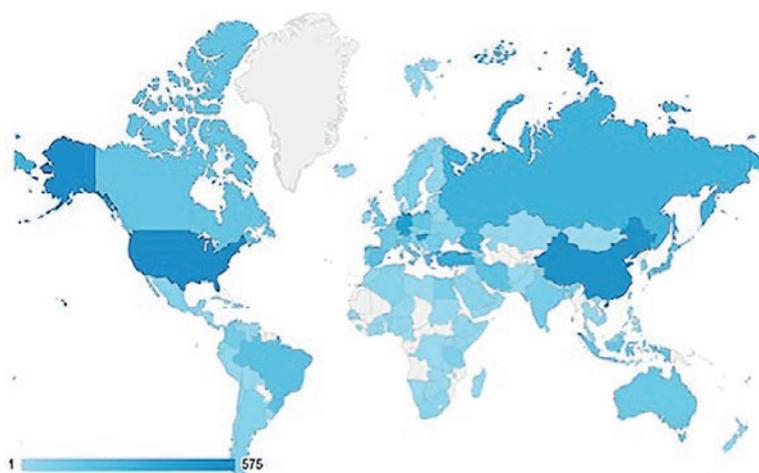
visitors to the IAG website for the period September 2015 to January 2016.

During the past four years, the layout of the website has been redesigned. For example, the Topic of the Month section on the home page aims to promote important scientific activities to a general readership. The latest scientific results, the establishment of significant research projects and news of important initiatives which may have a great impact on the geodetic and geosciences communities are posted to this section of the website. Geodesists are kindly encouraged to submit new topics to the COB e-mail address: [iagcob@iag-aig.org](mailto:iagcob@iag-aig.org). The IAG COB encourages

all IAG members, and geodesists in general, to publish information on the IAG website. Relevant news items, conference calls and reports, job announcements and suchlike can be submitted to the IAG COB for publication.

In order to address the younger generation of geodesists the COB has established an IAG presence on Facebook and Twitter. As of 22 February 2016, the Facebook page [facebook.com/InternationalAssociationOfGeodesy](https://www.facebook.com/InternationalAssociationOfGeodesy) had 347 'likes'. The announcement regarding the release of ITRF2014 in the February issue of the IAG Newsletter (and reported in the March issue of *GIM International*) generated more than 1,400 reaches on Facebook. The IAG Twitter site is available at: [www.twitter.com/iag\\_cob](https://www.twitter.com/iag_cob). Everyone with an interest in geodesy is encouraged to follow these pages as followers are automatically notified about the latest IAG news. A good example is the announcement by the Norwegian Mapping Agency regarding the Svalbard Observatory. However, the IAG presence on social media needs more frequent geodesy news so please contact the COB regarding any relevant news ideas. ◀

Szabolcs Rózsa, IAG Communication and Outreach Branch



▲ Geographical distribution of page visits to IAG website between September 2015 and January 2016.

**More information**  
[www.iag-aig.org](http://www.iag-aig.org)

# At the Summit of Cartography



The International Cartographic Association (ICA) and Esri hosted a Cartographic Summit from 8-10 February 2016 in Redlands, California, USA. This meeting of invitation-only guests from a broad array of associated fields assessed the state of play in mapping and visualisation and discussed where the sector is headed. Leading thinkers from academia, government and industry explored trends and how they are shaping the work that is being done.



▲ *Cartographic Summit delegates.*

The three broad themes of Data, Media and Design provided a focus for open sharing of views and experiences, to learn from each other, examine best practices and find new or proposed solutions. The summit intended to draw together a plan for research, innovation and strategic thinking to support mapping and visualisation needs as things move forward. The intent was to set a marker for understanding common challenges from a range of perspectives within and outside the traditional cartographic communities; to draw together different ways of thinking and working; and to build bridges across the many communities in the map-making and visualisation fields.

Each of the three topics was addressed in a dedicated half-day with three speakers (a keynote and two lightning talks), and breakout sessions based on the top five keywords generated by the audience after the talks. The findings of the four groups were reported after each session.

For the 'Data' theme, the keynote was presented by Katy Börner (Indiana University), with lightning talks by James Cheshire (University College London) and Alan McConchie (Stamen Design). The keywords generated were 'data design', 'data analysis', 'domain expertise', 'user and applications' and 'conceptualisation'. Under the heading 'Media', Gary Gale (what3words) presented the keynote, with talks from Kaitlin Yarnall (National Geographic) and Robert Roth (University of Wisconsin, Madison), and the keywords derived were 'storytelling', 'technology to create interaction', 'ethics, tracking', 'purpose of map' and 'user, human maker and using the maps'. Finally, the 'Design' topic was covered by Nigel Holmes (Explanation Graphics), with further contributions from Jeremy Crampton

(University of Kentucky) and Sara Fabrikant (University of Zurich). Key issues here were 'clarity', 'user/audience', 'privacy', 'uncertainty' and 'issues of design for big data'.

Menno-Jan Kraak (University of Twente), ICA president, synthesised all the discussion, and the integration of these ideas with those of the host, Esri, was considered as developments from the 'Esri Kitchen' were presented. All the sessions were widely reported on Twitter (#cartosummit) and follow up will include more formal output in Esri News, ICA News, the new *International Journal of Cartography* and recordings of the event: [www.esri.com/events/cartographic-summit/recordings](http://www.esri.com/events/cartographic-summit/recordings). ◀

**More information**  
[www.icaci.org](http://www.icaci.org)

## ISPRS in Africa

Africa has a long association with ISPRS. Africa has a total of 27 members, comprising 17 Ordinary Members, one Associate Member, six Regional Members and three Sustaining Members. The association between Africa and ISPRS is spearheaded by the African Association of Remote Sensing of the Environment (AARSE) and EIS Africa – a pan-African membership organisation working to improve use of geospatial and environmental information to enrich policy debate and support decision-making for the well-being of Africa's people – and also supported by the UN Economic Commission

for Africa (UNECA). In 2010 in Addis Ababa, Ethiopia, one memorandum of understanding (MoU) was signed between ISPRS and AARSE and another between ISPRS and EIS Africa. The MoUs are to support the promotion of the use of geospatial science and technology for sustainable development in Africa. ISPRS also supports AfriGEOSS which is an initiative by the intergovernmental Group on Earth Observations (GEO) aimed at building infrastructural capacities in Africa to enable nations to benefit from geospatial data for sustainable development. ISPRS supports activities in Africa through attendance at the

AARSE and GIS Africa conferences and also through sponsoring workshops.

The 10<sup>th</sup> ISPRS Student Consortium & WG VI/5 Summer School was successfully held in November 2013 in Addis Ababa during the AfricaGIS2013 conference. The local organising committee was composed of personnel from the Regional Centre for Mapping of Resources for Development (RCMRD), Ethiopian Mapping Agency (EMA) and the UN Economic Commission for Africa (UNECA). The summer School brought together 30 young scholars and scientists ▶



from ten countries. The main theme focused on 'Geospatial Science for Monitoring of Environment for Sustainable Development' and included topics on food security, agriculture monitoring and disaster monitoring. The training schedule comprised lectures and practical sessions where the participants were allowed to carry out exercises designed to improve their skills and educate them on the use of synthetic aperture radar (SAR) data for various applications, tools for change detection and disaster monitoring using different Earth observation datasets. The AARSE2014 conference was held in October 2014 in South Africa. The theme of the conference was 'Space Technologies for Societal Benefits in Africa'. This event is the largest and premier forum in the African continent for researchers on remote sensing technologies and geospatial information science, gathering together leading scholars from the remote sensing and related communities. The second vice president of ISPRS, Prof Marguerite Madden, gave a keynote address titled 'Remote Sensing in a

Changing World: Can we Serve Society from Local to Global Scales?'

The latest course supported by ISPRS provided five days of training on free open-source geospatial software at the Regional Centre for Mapping of Resources for Development in Nairobi in August 2015. In recent years the use of Earth observation in societal benefit areas and in support of sustainable development has been increasing at a fast pace in Africa. Free open-source geospatial software will greatly contribute to the uptake and the wider use of geospatial information in this region, which will provide a big boost to ISPRS's efforts to encourage wider use of geospatial information in all sectors of national development in Africa.

ISPRS also attended the Geospatial Conference in Tunis and, in 2014, organised a workshop funded by the ISPRS Scientific Initiatives to develop a curriculum for the African Geospatial Sciences Institute (AGSI),



▲ *Course on use of open-source geospatial software held at RCMRD, Nairobi, Kenya.*

which is based in Tunisia. In summary, ISPRS has strongly supported photogrammetry and remote sensing in Africa and would welcome any opportunity to increase involvement in the continent. ◀

Hussein Farah and Ian Dowman

**More information**  
[www.isprs.org](http://www.isprs.org)

**FUTURE EVENTS**

**AGENDA**

► **MAY**  
**XPONENTIAL**  
 Atlanta, USA  
 from 2-5 May  
 For more information:  
[www.xponential.org/auvsi2016](http://www.xponential.org/auvsi2016)

**FIG WORKING WEEK 2016**  
 Christchurch, New Zealand  
 from 2-6 May  
 For more information:  
 E: [nzis@surveyors.org.nz](mailto:nzis@surveyors.org.nz)  
[www.fig.net/fig2016](http://www.fig.net/fig2016)

**GEO BUSINESS 2016**  
 London, UK  
 from 24-25 May  
 For more information:  
 E: [info@geobusinessshow.com](mailto:info@geobusinessshow.com)  
[www.geobusinessshow.com](http://www.geobusinessshow.com)

**EUROPEAN SPACE SOLUTIONS 2016**  
 The Hague, The Netherlands  
 from 30 May - 3 June  
 For more information:  
[www.european-space-solutions.eu](http://www.european-space-solutions.eu)

► **JUNE**  
**NORDIC UAS EVENT**  
 Odense, Denmark  
 from 1-3 June  
 For more information:  
[www.nordicuasevent.com](http://www.nordicuasevent.com)

**4<sup>TH</sup> YOUNG SURVEYORS EUROPE MEETING**  
 Amsterdam, The Netherlands  
 from 7-10 June  
 For more information:  
[www.fig.net/organisation/networks/ys](http://www.fig.net/organisation/networks/ys)

**HXGN LIVE**  
 Anaheim, CA, USA  
 from 13-16 June  
 For more information:  
[hxgnlive.com](http://hxgnlive.com)

**ESRI USER CONFERENCE**  
 San Diego, CA, USA  
 from 27 June - 1 July  
 For more information:  
[www.esri.com](http://www.esri.com)

► **JULY**  
**XXIII ISPRS CONGRESS**  
 Prague, Czech Republic  
 from 12-19 July  
 For more information:  
 E: [info@isprs2016-prague.com](mailto:info@isprs2016-prague.com)  
[www.isprs2016-prague.com](http://www.isprs2016-prague.com)

► **SEPTEMBER**  
**GEOBIA**  
 Enschede, The Netherlands  
 from 14-16 September  
 For more information:  
[www.geobia2016.com](http://www.geobia2016.com)

**INSPIRE CONFERENCE 2016**  
 Barcelona, Spain  
 from 26-30 September  
 For more information:  
<http://inspire.ec.europa.eu>

► **OCTOBER**  
**INTERGEO**  
 Hamburg, Germany  
 from 11-13 October  
 For more information:  
[www.intergeo.de](http://www.intergeo.de)

**CALENDAR NOTICES**

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

For extended information on the shows mentioned on this page, see our website: [www.gim-international.com](http://www.gim-international.com).

# HI-TARGET

Surveying the world, Mapping the future



Much in little

## V90 Plus

- 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



[www.hi-target.com.cn](http://www.hi-target.com.cn)

[info@hi-target.com.cn](mailto:info@hi-target.com.cn)



IP67

# NEW



# i80

GNSS Receiver

Combining quality, support and leading-edge GNSS Performance

- **TRUE AUTONOMOUS OPERATION WITHOUT A DATA COLLECTOR**

The user-friendly LCD interface allows for common workflows without any external device.

- **DESIGNED FOR THE FIELD**

The ultra-rugged alloy cased i80 is the smallest and lightest receiver with dual hot swappable batteries, allowing continuous work and reduced user fatigue.

- **FLEXIBLE AND SCALABLE**

Internal UHF, Cellular data modems, Wi-Fi, Bluetooth, Serial, and USB communication supports varied processes and any peripheral device.

- **TRACKING ALL SIGNALS AND SATELLITES**

GPS, GLONASS, Galileo, Beidou, SBAS, QZSS; L1-L2-L2C-L5: every satellite and every signal tracked for the most reliable and accurate RTK solutions.



[www.chcnav.com](http://www.chcnav.com)