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Welcome to new ISPRS Sustaining Members
• Stora Enso Forest Consulting Oy Ltd •

Profile of New Sustaining Members

Stora Enso Forest Consulting Oy Ltd

Stora Enso Forest Consulting Oy Ltd (SEFC) is an international forestry consulting company with unparalleled practical experience. Our expertise covers essential areas of remote sensing and natural resource management.

SEFC has gained experience of remote sensing especially in the tropics. We are utilising both satellite images and airborne data in our projects. The most typical SEFC customers are forestry companies and institutions. We have especially developed stratified sampling techniques with satellite data in order to optimise the need of ground truth.

For cloudy conditions we have developed EnsoMOSAIC, a digital small scale imagery system which enables us to carry out imagery below the clouds. The development work has been done in cooperation with VTT (Technical Research Center of Finland). The system produces high-resolution, geo-referenced true or false color image mosaics. The whole EnsoMOSAIC process is fully digital, from image capturing to the creation of the image mosaics. Imaging is controlled by PC software that triggers the camera and labels the images with GPS coordinates. The EnsoMOSAIC image processing software semi-automatically rectifies hundreds of images at a time, applying a bundle adjustment, and joins them into a large geo-referenced mosaic. In addition to the image mosaics, the system creates also a Digital Terrain Model of the imaged area. All the image processing is done on a standard PC with a high-capacity hard disk for data storage. The digital data facilitates flexible printing of mosaic maps on any scale and importing the data into a GIS for further processing.

EnsoMOSAIC system is currently under installation in the Sarawak Forest Department. The mosaicking software

is also used for research and training in the University of Helsinki, the University of Joensuu and the University of Turku. Imagery services have been carried out mostly in Latin America and South East Asia.

Simultaneously with the PC system, a prototype of a fully automatic image processing system based on parallel computing has been created. This new version will result in even faster mosaic creation and more accurate Digital Terrain Models.

GIS is a natural tool for applying the digital mosaics. Furthermore, we are applying GIS tools in our Forest Resource Information System (EnsoFRIS), which combines GIS, DBMS, remote sensing and other needed applications. Currently we are installing EnsoFRIS for the Turkish Ministry of Forestry.

Our special knowledge in GIS and remote sensing is briefly described in our web page in http://www.storaenso.com/sefd/eng/index.html.

News from Sustaining Members

Space Imaging

First Image from the IKONOS Satellite Shows Washington, D.C. World's First High-Resolution Commercial Earth Image Reveals Remarkable Detail

Today Space Imaging released the world's first high-resolution commercial satellite image of the Earth. The one-meter resolution black-and-white image of Washington, D.C., collected by Space Imaging's IKONOS satellite, has unprecedented clarity and detail for commercial space imagery. The image <http://www.spaceimaging.com/ikonos/firstimage.htm> showcases part of the Mall area in the heart of Washington D.C., and is downloadable from the Space Imaging Web site <http://www.spaceimaging.com/ikonos/firstimage.htm> (see details below). The image caption is also available on the Web.

"The clarity and detail of this first IKONOS image is validation of the leadership position of Lockheed Martin and Raytheon in optical imaging systems," said John Copple, Space Imaging's chief executive officer. "The launch was perfect and was itself a major milestone. Just three days after launch we were able to activate systems and start testing the collection capabilities of IKONOS – bringing us even closer to providing this new source of information to our customers. This is a remarkable achievement that would only have been possible with the heritage technology of Lockheed Martin and Raytheon."

Copple continued, "The CARTERRA™ image of Washington, D.C., taken September 30, was validation that the satellite was in perfect working order. Although we still have to calibrate the system to further improve and characterize the imagery, we are very pleased of the results so far. I want to thank all of our customers, vendors, and investors for the support that has made this possible."

Jeff Harris, Space Imaging's president, added, "Space Imaging employees huddled together and watched the image come up on a large projected screen. Their awe-inspired reaction will no doubt be echoed by our customers and the industry. We are all so excited about this momentous event – the result of several years of hard work, dedication and commitment of our employees, and the patience and faith of our customers."

The Washington, D.C. image is an example of the IKONOS satellite's collection capabilities. The image has not been processed to have a map-accuracy quality. The IKONOS satellite also has a sensor that collects four-meter multispectral (color) imagery. As satellite calibrations and check-out continue, imagery from the multispectral sensor will be released. IKONOS imagery and products, marketed under Space Imaging's CARTERRA™ brand name, will be available for sale to customers by the end of this year. Initial product orders are being taken by Space Imaging's Customer Service Center (+301-552-0537 or 800-232-9037).

The IKONOS satellite orbits the Earth in a sun-synchronous orbit - meaning it simply follows the sun as it travels around the globe - and its Eastman Kodak-built camera is an optical imaging device. The near-perfect optical sharpness of Kodak's telescope has never been achieved in any commercial space camera. The satellite circles the globe 14 times per day, or once every 98 minutes. The imagery is stored in Space Imaging's digital CARTERRA™ archive and can be made available to customers very quickly - in as little as a few hours or days.

Images from the IKONOS satellite will have unlimited utility in a number of markets including state and local government, mapping, agriculture, forestry, emergency response, utilities, telecommunications, real estate, environment, national security, transportation, and insurance and risk management. Highly detailed maps of entire countries can be made for the first time. Farmers can more precisely monitor the health of crops and estimate yields. Scientists can look at environmentally sensitive areas and predict trends. Government officials can monitor and plan enlightened land use policies. City planners can further the development of new housing communities. New and emerging uses include measuring and mapping damage to properties after natural disasters, planning for emergency

response, mapping transportation networks, developing in-vehicle navigation systems, and planning and developing real estate.

"The potential uses for IKONOS imagery are vast and we have just begun to scratch the surface," said Copple. "The value of this new source of information will create a demand like we've never seen before for imagery of the Earth."

The name IKONOS is derived from the Greek word for "image." The name is pronounced "Eye-KOH-nos."

Space Imaging is a leading supplier of space imagery, aerial photography, mapping services, and derivative geographic information products and services. In addition to selling imagery from its IKONOS satellite, Space Imaging collects and distributes Earth imagery from the Indian Remote Sensing satellites, the U.S. Landsat, Canada's RADARSAT, the European Space Agency's ERS satellites and the Japanese JERS imaging system. The company also collects aerial images using its Digital Airborne Imaging System, DAIS 1™.

Investors in Space Imaging's IKONOS system include Lockheed Martin Corp., Raytheon Company, Mitsubishi Corporation, Singapore's Van Der Horst Ltd., Korea's Hyundai Space & Aircraft, Europe's Remote Sensing Affiliates, Swedish Space Corporation and Thailand's Loxley Public Company Ltd.

(Press release 12-10-99)

Z/I Imaging

DMC: Designed with the End-use in Mind

Z/I Imaging has chosen the 47th German Photogrammetric Week (20-24 Sep) to present its expected answer to the digital sensor system which LH Systems announced earlier this year (see GIM International's May issue). The design concept of Z/I's Digital Modular Camera system is currently aimed at applications additional to Zeiss's existing photographic mapping and reconnaissance systems and fits in its entire product line. Z/I's statement regarding the date of introduction was: 'We will not necessarily be the first, but we are not interested in being second. Of course Amsterdam is a keyword in this respect'.

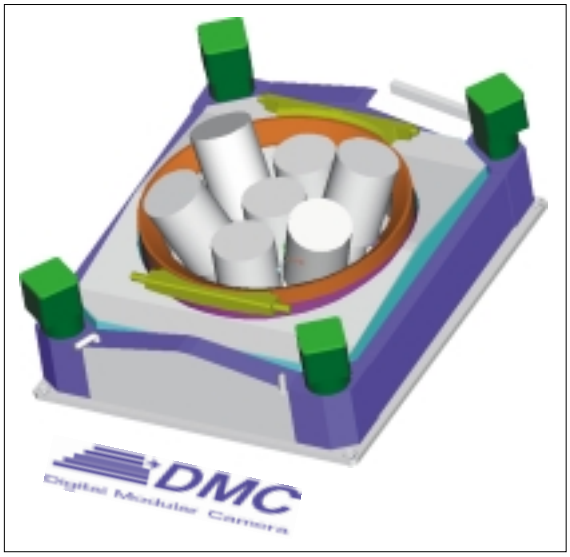

Figure 1, Arrangement of a 7-head camera in a standard gyro-stabilised RMK mount: 3 parallel oriented heads are for recording multi-spectral colour composite images; four converging heads acquire data for a single mosaiced panchromatic image

Showing up in Amsterdam with something real is a tough goal, but Rudi Spiller and his DMC project leader Dr Alex Hinz and product manager Helmut Heier are confident of hitting the target in time. First of all the approval of the Z/I Imaging joint venture by the US Department of Justice on the 23rd of August has rocketed the spirit in Oberkochen. Other contributions to this confidence have to be named as well. The company did an extensive and expensive marketing study, which revealed a wider range of applications in their existing market. The relationship with Intergraph is instrumental as a lot of software development is required for the DMC system. Last, and most instrumental according to Rudi Spiller, is the young team working on the DMC project in Oberkochen. Z/I recently hired a few bright young scientists to bring in the latest knowledge acquired during PhD research, to speed up the development of the DMC.

Modular Array Concept

Regarding the outcome of the market research, a customer-oriented system had to be designed. Rudi Spiller likes to use the term 'applicationised' in this respect. Modularity is the key to enabling customisation without (partial) redesigning. The modular approach, which is reflected in the registered trademark 'Digital Modular Camera'. The recording sys-tem is basically mod-ular in that it comprises a variable number of synchronously operating array cameras which can be built together in different ways to fit Zeiss's standard gyro-stabilised camera mount. In order to enable a sufficiently high ground resolution, the minimum number of camera heads will be two. Up to seven camera heads can be built together depending on the application; see Figure 1. In that specific configuration three parallel cameras in a row generate multi-spectral three-band imagery for the acquisition of colour composites. Four panchromatic images from converging cameras, two at each side of the multi-spectral cameras, are mo-

This one-metre resolution black-and-white image of Washington D.C. was collected by Space Imaging's IKONOS satellite on 30th September 1999. This image showcases several major landmarks including the United States Capitol, the Washington Monument and its shadow, the Department of Commerce and several museums of the Smithsonian.
(Source: Space Imaging – www.spaceimaging.com)

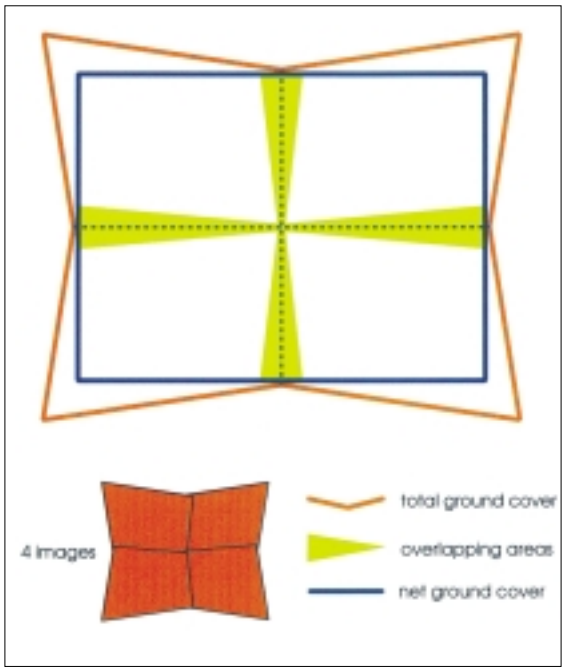

Figure 2, Ground coverage of a single panchromatic image (blue rectangle) originating from four synchronously operating digital camera heads. The yellow cross indicates overlapping areas between the four images

saiced digitally to form a single image; see Figure 2. The colour composite image and the composed panchromatic image have the same ground coverage. Though the actual size of the array has not yet been revealed, the cross track resolution for a single camera head will be somewhere between 4,000 and 8,000 pixels. The number of camera heads can be changed and their resolution can be upgraded rapidly with higher resolution arrays, as this is part of the DMC's modular concept.

Basic Design Criteria

Z/I decided to design an integrated system in which the camera is only one component within this entire system. Moreover, that system had to be consistent with current work flows in mapping and reconnaissance, which are based on using a photographic camera in combination with a scanner. This condition implied that the next process after digital image recording (the image processing) is the current matrix-oriented one. As the DMC system has to be used for both mapping and reconnaissance (about 50/50), both vertical and side-looking views are required and forward motion of the image needs to be compensated. An airborne line-scanning system not only requires incorporation of an INS, it also needs real-time kinematic GPS positioning to improve the geometric accuracy, otherwise it cannot compete with high-resolution satellite imagery. Currently, in most areas, a permanently installed real-time GPS reference system is still lacking. Hence, the final decision was for a frame sensor.

Complementary and Integrated Systems

Currently, the advantage of using a digital camera is only in a small part of the applications, as it cannot replace the photographic camera. Thus it is better to develop a special camera for those applications which need the timeliness offered by a digital system and where the lower resolution is not a problem; for instance in recording linear objects like roads, power lines and coastlines. When introducing a digital recording system, Z/I is eager to prevent this system becoming a competitor with the current analogue system, which is one of the com-pany's cash cows. So the new, fully digital DMC system is designed as an add-on and is meant to be used in an integrated way with current analogue-digital systems. By consequence the DMC data processing needs to be integrated as far as possible too. The envisaged mosaiced panchromatic imagery will be recorded with two (or four) synchronously operating digital camera heads. In order to use the current Phodis and Image Station software, the panchromatic imagery must be pre-processed in such a way that it is equivalent with scanned photographic imagery. This process condition implies that the two (or four) projection centres of the mosaiced images must be replaced by one virtual projection centre. Hence, pre-processing is needed to integrate digital imaging data into current digital image-processing work flows.

From 3-block to 2-block System

A digital system has the advantage that the scanner between the imaging phase and the image-processing phase, doing the A-D conversion, can be left out. In consequence the 3-block analogue- digital system can be replaced by a 2-block fully digital system. But this change has its influence on the remaining two blocks as well. Dispensing of the scanning block in a fully digital system, implies that without additional measures there is not an intermediate product anymore, like the developed film, which allows for an evaluation of the recorded data before further processing begins. Hence, companies now using analogue imagery need to get acquainted with digital data processing in the imaging phase. An additional pre-processing step needs to enable evaluation of digitally recorded imagery. The mosaicing of tiled images mentioned above, needs to be part of that pre-processing. Part of the pre-processing phase can be executed already onboard the aircraft as the computer, which is integrated into the recording system, will not be permanently occupied. In-flight pre-processing will result in 'visible' information before landing. This is a big improvement compared to film, especially in reconnaissance applications, which form half of the envisaged market for the DMC.

Looking into the Future

As mentioned above, Z/I doesn't expect the analogue camera to be replaced by a digital equivalent before 2005-2010. That replacement will not depend on the increase in array size, but mainly upon the whole system performance, because there are bottlenecks in the entire digital processing chain. A manufacturer of imaging systems like Z/I cannot afford to develop dedicated digital components by itself to overcome these bottlenecks. It is forced to follow technological developments in the digital industry and to optimise its imaging systems by integrating affordable commercially available components. The real bottleneck in overall DMC system performance is in the bandwidth of the data transfer. And that will not change in the foreseeable future. On the contrary, for commercially available products it is expected that the increase in capacity of data transfer devices required for an imaging system will not keep pace with that of sensors, processors and storage media. Hence, the resolution of the DMC cannot increase at the same rate as the expected growth in array size, as seems to be predicted.

Further Reading

Initial information about the DMC system is published in the proceedings of the 47th Photogrammetric Week:
Heier, Helmut: 'Applications and market for digital airborne cameras', pages 43 - 49
Hinz, Alexander: 'The Z/I-Imaging digital aerial camera system', pages 109 - 115u

This article appeared in the October issue of GIM International and is now published with kind permission of GITC bv.