

The ISPRS 2004 Technical Exhibition

Airborne Imaging Dominates the Show

The 20th ISPRS Congress was held in the Istanbul Convention & Exhibition Center between 12th and 23rd July. During the last four and a half days of this period (19th to 23rd July), the Technical and Scientific Exhibitions were held in the new Rumeli Hall located adjacent to the main Convention building. However this location caused no difficulty either to the participants or the exhibitors since an escalator gave a direct connection between the two buildings. In fact, the Hall proved to be a first-class venue for the two Exhibitions.

By Gordon Petrie

The stands forming the main part of the Technical Exhibition were set out in the upper floor of the Hall. Indeed it was full to overflowing, so much so that a very small number of the exhibitors (presumably the latecomers) had to be accommodated in the lower floor of the hall. However the matter of this latter group feeling a little bit cut off was alleviated to some extent by the fact that this lower floor was also the venue for the Scientific Exhibition and acted as the Poster Hall for the numerous large and well attended afternoon poster sessions held dur-

ing the Congress. These brought in substantial numbers of participants who could also inspect the overflow booths from the Technical Exhibition.

I had participated in the ASPRS Annual Conference held in Denver only six weeks before the ISPRS Congress. Both meetings had a similar attendance (1,900 at Denver; 2,300 at the ISPRS Congress) and both had a technical exhibition of a comparable size. So it was interesting to observe the similarities and differences between them. Of course,

many of the principal imaging, photogrammetric and remote sensing system suppliers were at both meetings - as were the three major American companies (Space Imaging, DigitalGlobe and ORBIMAGE) supplying high-resolution space imagery. But several of the European photogrammetric system suppliers, especially those from Eastern Europe, who were not at Denver, had stands at the ISPRS meeting, as did a number of the major European mapping and imaging service providers. Besides which, as at the previous ISPRS Congress held in Amsterdam in 2000 (where there were lots of Dutch exhibitors), there were quite a number of stands exhibiting the mapping and other services provided by local Turkish organisations and companies. What were noticeably missing at the Istanbul meeting were the several suppliers of airborne multi-spectral imaging systems that were so prominent at Denver. I confess to some surprise too at the fact that there was no participation in the Technical Exhibition by the many large service providers from Asia (principally India) who currently provide so much photogrammetric mapping for clients in Europe and North America. In this respect, there were large numbers of individual participants in the Congress from the East Asiatic countries (China, Japan, South Korea and Taiwan), but no exhibitors from these countries other than the Chinese Academy of Surveying & Mapping and its associated companies.

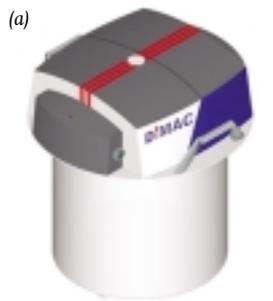
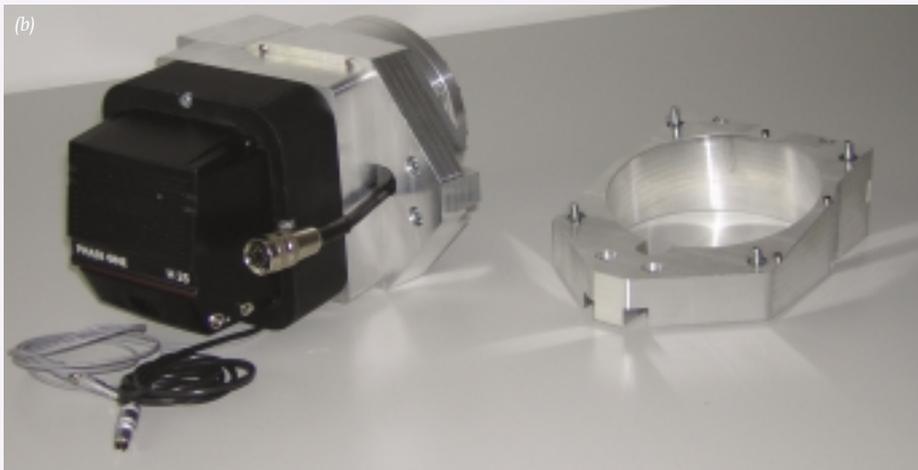


Figure 1. (a) - The new DiMAC Digital Modular Aerial Camera. (b) - On the left is one of the camera modules used in the DiMAC digital frame camera; the black part is the Phase One digital back. On the right is the one of the tilt adapters for the camera module. (Source: AeroPhoto DiMAC)



A - AIRBORNE SENSORS, SERVICES AND PRODUCTS

There was no doubt that, for the second Congress running, much of the attention of Congress participants visiting the Technical Exhibition was focused on airborne imagers, services and products.

I - Airborne Digital Frame Cameras

(a) Large-Format Digital Frame Cameras

Starting at the large-format end of the digital frame camera market, although it had been introduced at an ASPRS meeting held in Alaska a year ago, for most people, the ASPRS and ISPRS meetings gave them their first chance to inspect the **Vexcel UltraCam D** camera system. It comprises two groups of cameras, all with parallel optical axes pointing

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towards the ground. The CCDs are from Dalsa; the lenses are from Schneider-Kreuznach; while the main camera body is produced by Wild Austria which also assembles the overall camera system. The first group of four cameras acquire the panchromatic image, with each of the cameras contributing one or more patches towards the final image which is $11.5k \times 7.5k$ pixels = 86 Megapixels in size. The second group of four cameras acquire the corresponding multi-spectral image, with each camera contributing an image within a specific spectral band. The final colour or false-colour image has a very much smaller format, $4k \times 2.7k$ pixels = 10.8 Megapixels in size, and a correspondingly lower ground resolution. The UltraCam has also been provided with an electronic, mechanical and software interface that allows it to be used with the CCNS flight management system and its AEROcontrol GPS/IMU option from IGI.

Obviously the UltraCam promises to be a strong competitor to the **Z/I Imaging DMC** (Digital Mapping Camera) that was first introduced at the previous ISPRS Congress in Amsterdam four years ago. The current version of the DMC has been steadily developed and refined and is now beginning to acquire a user community. Indeed, in an interview given by Dr. Keating of Z/I Imaging, he mentioned that there is now a waiting list for the DMC. It was interesting to note too the alliance between Z/I and Optech to sell the DMC and Optech's ALTM laser scanner as a bundled solution at a special (bundled) price. Presumably this is intended to compete with Leica's ADS40 (imager) + ALS40/50 (laser scanner) combination. What was also noticeable is that, now that the Z/I company is wholly owned by Intergraph, the Z/I products (camera, film scanner, DPW) are being viewed mainly as products of Intergraph Mapping & Geospatial Solutions. I was told on the stand that Z/I Imaging is now regarded simply as a brand belonging to Intergraph!

As discussed in my Congress preview article published in the June issue of Geoinformatics, potentially the DMC and UltraCam frame cameras now face competition from the new **DiMAC** (Digital Modular Aerial Camera) system from the AeroPhoto-DiMAC company based in Luxembourg. Like the other two large-format frame cameras, the DiMAC was shown at both



Figure 2. The Applanix DSS 4k x 4k digital frame camera which is based on the Contax 645 film camera. To the right is part of the Applanix POS/AV system. (Source: Applanix)

the ASPRS and ISPRS meetings. As its title suggests, it is modular in its construction, with from one to four cameras forming the basic building blocks of the frame imaging system - which is mounted on a gyro-stabilized base. The lens of each camera is from Rodenstock; the electronic shutter is from Rollei; the digital back from Phase One is based on a Kodak $5.4k \times 4k$ pixel = 22 Megapixel CCD; while the camera body and tilt adapters are purpose-built depending on the lens being used. When only a single camera is being utilized, the DiMAC competes with the medium-format cameras being discussed below. However, when used in its full four camera configuration, it competes with the large-format Vexcel UltraCam and Z/I DMC cameras. In between these two ends of its configuration range, there are numerous alternative configurations of the DiMAC using two or three cameras. The use of the Phase One digital back produces colour images directly, thus dispensing with the need for the second group of four cameras producing multi-spectral images that are a feature of both the UltraCam and DMC cameras - albeit at the cost of losing out slightly in terms of the format size of the final image.

(b) Medium-Format Digital Frame Cameras

However, it is evident that the sheer scale of investment needed for the present generation

of large-format digital cameras is either too great or too risky for many mapping companies and organisations. So quite a number of medium-format frame cameras, mostly producing $4k \times 4k$ (16 Megapixel) images have been developed and were shown in the exhibitions at Denver and at Istanbul. Some are modifications of film cameras with digital backs replacing the film magazines; others are purpose-built units. Prominent among the first group was the **Applanix DSS** (Digital Sensor System) based on the Contax 645 film camera and featuring a MegaVision back. Another was the ALTM 4Koz camera being offered by **Optech** in Canada for use with its ALTM airborne laser scanners. However I was informed by a representative of Optech on its stand that this was essentially a re-badged version of the DSS for use with their airborne laser scanners.

Rollei showed a version of its Rolleimetric 6008 metric film camera equipped with a digital back from Phase One on its stand. The company also introduced a purpose-built version of this camera for airborne operations called the Aerial Industrial Camera (AIC) which generates either a 16 Megapixel ($4k \times 4k$) or 22 Megapixel ($5.4k \times 4k$) image. Only a couple of stands away from the Rollei booth was the **IGI** stand on which new further examples

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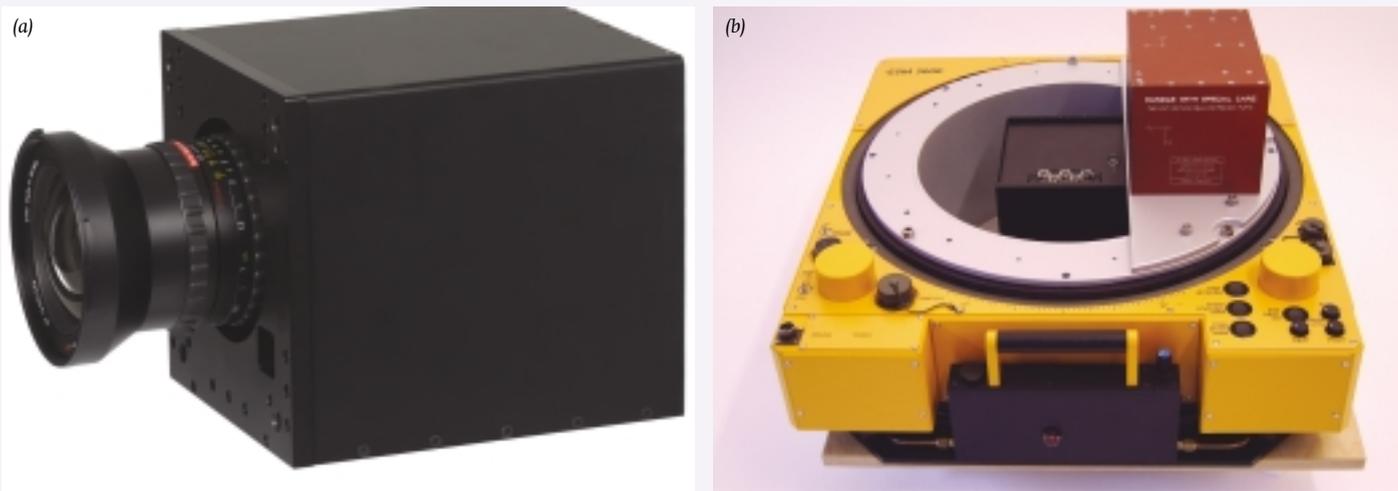


Figure 3. (a) - The new IGI GigaCAM 22R digital frame camera based on the Rolleimetric film camera and fitted with a digital back. (b) - The IGI GigaCAM 22R camera sitting in a GSM 3000 gyro-controlled mount. The AEROcontrol IMU/GPS box is mounted on a bracket above the camera. (Source: IGI)

of medium-format cameras could be seen on wall posters. One of these, called the DigiCAM 14K, was based on the Kodak DCS Pro 14n camera; the other, called the GigaCAM 22R, was based on the Rollei camera. These cameras can be supplied by IGI mounted on a gyro-controlled mount, together with an IMU/GPS unit. One presumes that these cameras will also be offered as companion units to the new IGI LiteMapper airborne laser scanner. Indeed this combination of a medium-format digital frame camera and a laser scanner is currently proving to be one of the main application areas for these cameras. At the Denver ASPRS meeting, **Spectrum Mapping** exhibited its new NexVue medium-format camera that has been built in-house and designed specifically for use with laser scanners. Unfortunately Spectrum did not appear at the Istanbul Congress.

Another venture that has resulted in the development of a new metric camera (NMC) is the **GeoPIE** project funded through the EU's CRAFT Programme. The goal of GeoPIE (Geoinformation via Parallel Image Engineering) is to develop a European-based high-performance mapping system. It includes a modular optical sensor system utilizing off-the-shelf components and an image exploitation system based on parallel computing. Several of the companies and institutes participating in the project - Inpho and Hansa Luftbild (Germany); VTT (Finland) and the Institut de Geomatica (Spain) - had stands at the Congress. However information on the project and, in particular, on the frame camera was difficult to find. It seems that prototypes of the NMC camera do exist, having been constructed by VTT. Photos of the new camera, together with some images, were displayed on the Institut de Geomatica stand. The NMC is a modular digital frame camera with two or more camera heads placed on a

stabilized mount. Each individual camera head employs a highly rectangular 10,020 pixel (cross-track) x 1,600 pixel (along-track) sensor. From the wall poster, it appears that each camera head is mounted in a tilted position - though whether to produce overlapping convergent images along-track or low obliques cross-track was not too clear. We await clarification and further information on this interesting project with a keen interest.

(c) Small-Format Digital Frame Cameras

One of the most interesting items in this area was given as a poster by Wen-Ling Xuan from the **Chinese Academy of Surveying & Mapping**. She discussed the use of multiple inexpensive FujiFilm FinePix small-format digital frame cameras for mapping applications. Both three-camera and four-camera systems have been tried out on various airborne platforms. The former combination consists of a vertical camera and two oblique cameras firing to the left and right of the flight line. The latter system has four tilted cameras arranged in a star configuration similar to that of the DMC. Detailed results were given of the calibration of the camera systems. Apparently the three-camera system has been used to acquire aerial images of a Beijing suburb flown in a UAV constructed by the Academy. I formed the impression that, while it was a perfectly serious, interesting and worthwhile project, it had all been great fun!

II - Airborne Pushbroom Line Scanners

The **Leica Geosystems** ADS40 pushbroom line scanner with its 12,000 pixel wide swath - which was first introduced at the Amsterdam Congress four years ago - is of course the principal player in this particular class of airborne imager. It now has a substantial cadre of users, including some of the largest aerial data acquisition companies in different parts of the world - EarthData, Horizons Inc. and

3001 Inc. in the U.S.A.; NorthWest Group in Canada; and Pasco in Japan. European operators are Terra Digital in Germany and CSR in Italy. From the technical point of view, it was interesting to note that Leica have implemented four quite different arrangements of the pan and multi-spectral linear arrays for the focal plates of the ADS40s supplied to customers. Two of these have now been adopted as standard offerings for the ADS40: the other two were specially bespoke items.

Much attention in the area of airborne pushbroom line scanners at the Congress was given to the new 3-DAS-1 scanner from **Wehrli Associates**. It is a three-line scanner equipped with tri-linear arrays from Kodak that acquire their images in the forward, nadir and backward directions along-track. For this purpose, it utilizes three separate lenses, one for each individual set of linear arrays, instead of the single lens utilized on the ADS40. The three lenses are sourced from Rodenstock, while the main body and other mechanical components of the scanner are manufactured by the Ukrainian company, **Geosystem** - which already manufactures all the optical and mechanical components of the Wehrli photogrammetric film scanners. Closely associated with the 3-ADS-1 is Wehrli's new ASP-1 stabilized mount which is clearly needed to ensure that the tilts of the pushbroom line scanner are kept to an absolute minimum. The inputs to this stabilized mount are derived directly from the IMU/GPS unit - which is a further necessity for all airborne pushbroom line scanners.

Further innovation in the airborne line scanner area was presented at both the Denver and Istanbul meetings by **ITRES Research** from Canada. The company is already well known among environmental scientists for its CASI hyperspectral line imager that

acquires images in the VNIR wavelength region. The company has now introduced improved versions of the CASI with up to 1,500 pixels swath width and 288 spectral channels. However ITRES is also offering two new pushbroom scanners - the SASI hyperspectral instrument with a 640 pixel swath width and 160 channels operating in the SWIR region and its TABI instrument with a 320 pixel swath width operating in a single channel covering the thermal (LWIR) region. Yet another pushbroom line scanner was introduced at both meetings by the **TopoSys** company from Germany. However, in this case, the four-channel line scanner is intended to provide RGB and CIR images to complement or supplement the company's Falcon II airborne laser scanner. The pushbroom line scanner has a relatively narrow scan width of 682 pixels; the resulting imagery is then ortho-rectified by the digital surface model (DSM) produced by the laser scanner. It gives an interesting alternative to the airborne digital frame cameras used by most other lidar service providers.

III - Airborne Laser Scanners

The two leading suppliers of airborne lidars - **Optech** and Leica - each had a substantial presence at both meetings. In the case of Optech, last year (2003), it introduced a new model, the ALTM 30/70, which allowed scanning speeds up to 70 kHz when operated from an altitude of 1,500m. Now it has introduced a new and still faster scanning model, the ALTM 3100, that allows scanning speeds of up to 100kHz when operated from the low altitude of 1,100m. As noted above, Optech are offering as options either a 4k x 4k medium-format digital frame camera or the large-format DMC to generate the imagery that complements the elevation data produced by the laser scanner - which increasingly is the combination being demanded by users and service providers. At Istanbul, Leica displayed its small and very neat ALS50 laser scanner. Besides which, on a neighbouring stand, one of Leica's customers, Terra Digital from Germany, had a large display showing the results (DEM + imagery) from the combination of the combination of an ALS50 laser scanner and an ADS40 pushbroom scanner. Similar combinations are in use by EarthData, Horizons Inc. and the NorthWest Group in North America. As a lower-cost alternative for those customers without the need for the full-blown and expensive ADS40 imager, Leica is offering either the Applanix DSS or the Spectrum Mapping NexVue 4k x 4k frame cameras for use with the ALS50. Besides these two market leaders, two other companies, both from

Germany, showed their products. **TopoSys**, which both builds its own laser scanners in-house and acts as a service provider, was promoting its latest Falcon II airborne lidar emphasizing the feature that the scanner's laser pulses are both transmitted and received through arrays of glass fibres. The other interesting newcomer to this field of laser scanning was **IGI**, whose CCNS flight management and navigation systems are already well established and much used throughout the aerial mapping industry. IGI showed its new LiteMapper airborne laser scanner developed in collaboration with GeoLas Consulting from Munich. This unit is based on a **Riegl** scanning laser integrated with IGI's own AEROcontrol DGPS/IMU unit based on the use of Litef fibre-optic gyros and a NovAtel L1/L2 GPS receiver. Two models of the LiteMapper are being offered - LiteMapper 1400 for low-altitude operations from helicopters and LiteMapper 2800 for higher-altitude operations from a fixed wing aircraft. It will be interesting to see how the Falcon II and LiteMapper fare in the market. Presumably they will be somewhat lower in cost than the Optech and Leica products.

The Riegl company (from Austria) also had a stand which gave out information on its new LMS-Q560 waveform-processing airborne scanning laser. However this unit is not integrated with a DGPS/IMU unit to form a complete operational system. The same remarks apply to Riegl's existing short-range LMS-Q240 and longer-range LMS-Q280i scanning lasers. However the required integration has been achieved in the **Helimap** system. This is the result of a joint effort by the well-known photogrammetric institute of the EPFL in Lausanne and the UW+R commercial surveying company also from Switzerland. Helimap is a complete hand-held [!!!] integrated airborne imaging system comprising a Riegl LMS-Q140i laser scanner; a Hasselblad SWCE 903 frame camera equipped with a Kodak 16 Megapixel digital back; a Litton LN200 gyro unit; and a Javad L1/L2 GPS unit. The complete system is designed to be operated from the side of a helicopter. The operator sits on the floor of the aircraft with his legs dan-

gling in the slipstream while he operates the integrated hand-held unit from the side of the aircraft. Certainly I am not brave enough to volunteer for this position.

IV - Airborne SAR

This was a comparatively disappointing area with only **Intermap** being present. It had quite a small stand among the late-comers on the lower floor. There really isn't a lot to report except to say that the company is putting most of its efforts into its gigantic NEXTMap USA project. The already completed NEXT Map Britain project was very successful. It was based on a demand from the U.K. insurance industry for a country-wide DTM on which it could base its flood risk modelling. This was backed up by the fact that the GetMapping company had just completed its air photo coverage of most of Great Britain and the Intermap DTM data could be used to ortho-rectify the photography. This created a further demand for the DTM data. Obviously the situation in the USA is very different - especially given the size of the country and the sheer scale of the project - and it remains to be seen how this will work out. Intermap is intending to use **AirPhotoUSA** as its partner in somewhat the same role as GetMapping has played in the U.K.

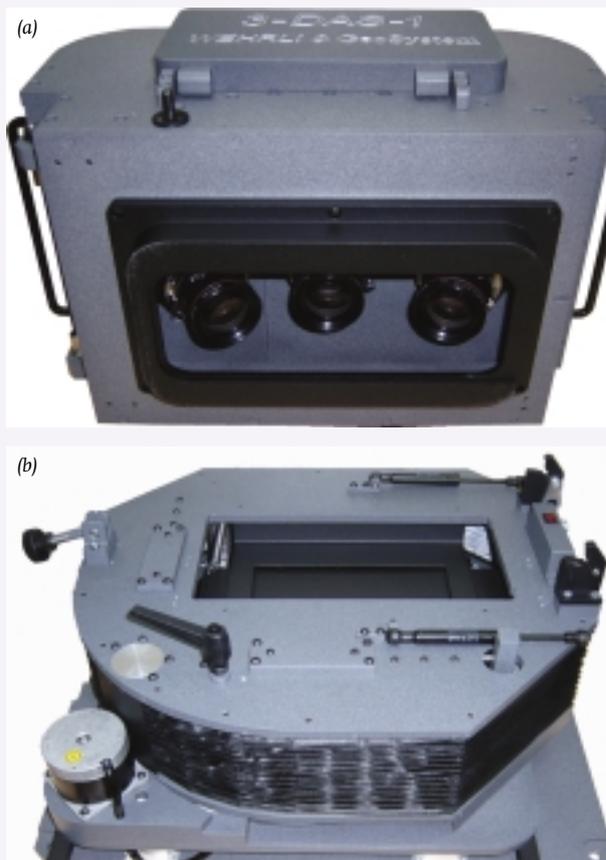


Figure 4. (a) - The new Wehrli 3-DAS-1 pushbroom line scanner with its three lenses as seen from below. (b) The Wehrli ASP-1 stabilized mount that was also introduced at the ISPRS Congress. (Source: Wehrli Associates)

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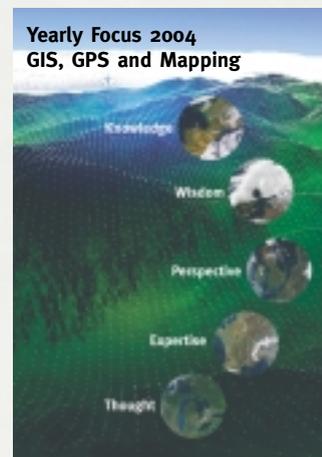
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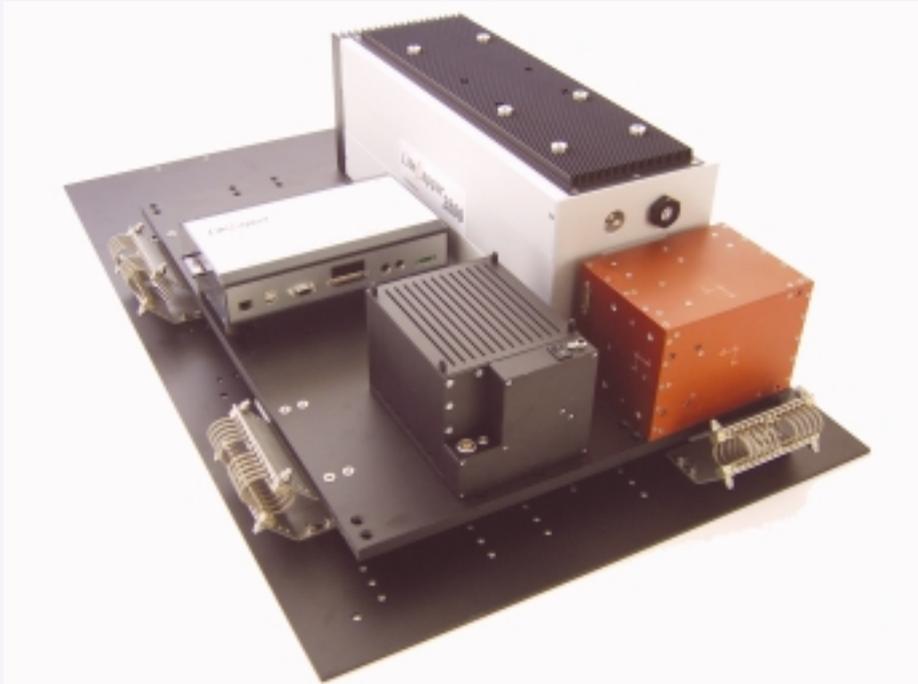


Figure 5. The IGI LiteMapper airborne laser scanner built in collaboration with GeoLas Consulting. (Source: IGI)

V - Unmanned Aerial Vehicles

A real innovation at this ISPRS Exhibition was to be seen on the stand shared by two Belgian organisations - (the Flemish Institute for Technological Research) and the **Alcatel Bell** company. Their stand was largely devoted to the Pegasus HALE (High Altitude Long Endurance) UAV project. This involves the development of a relatively small and lightweight solar-powered UAV that would be raised to its operational altitude of between 14 and 20 km using a balloon. Once the technology has been fully developed, the aircraft will be able to fly at high altitude for weeks at a time sending back its image data continuously to a ground station. Various alternative imaging sensors, including multi-spectral and thermal line scanners, a SAR and a laser scanner, are being proposed for inclusion in the UAV's payload. The overall proposal is somewhat similar to NASA's solar-powered Helios UAV, but whereas Helios flies under its own power to its operational altitude, the Pegasus UAV would be raised up to this height using a balloon, so ensuring a smaller and lighter aircraft.

VI - Aerial Film Photography

Both Agfa-Gevaert and Kodak had stands at the Exhibition. In the case of **Agfa-Gevaert**, it used the ASPRS and ISPRS meetings to introduce its new high-speed Aviophot Color X400 and N800 color negative photographic films. Besides which, it also introduced its AperTune software. This appears to be a sort of automated Photoshop-like software that carries out the enhancement of the digital image data produced by film scanners from aerial photographic film. The operations include dodging, noise reduction

and even scratch and dust removal. In contrast to the **Kodak** stand at the ASPRS meeting, the company's booth at the ISPRS Congress was limited to handing out the company's literature.

B - AERIAL PHOTOGRAMMETRY

I - Systems Suppliers

A large number of the exhibitors at the Congress were of course concerned purely with the supply of digital photogrammetric workstations (DPWs) for aerial mapping applications. However it is not too easy to write about them since the basic aspects of nearly all of them were established quite some time ago. Indeed most of them have been on the market for at least five years or more. Nowadays the changes are small and incremental, rather than fundamental. Gradually more functions are being added; new geometric models are being added to cope with the ever-widening range of airborne and spaceborne imagers; and, even in some cases, the operator interfaces are being made easier to use. However the fundamental algorithms and solutions remain the same.

(a) North American Suppliers

For the record, the three largest suppliers - **Intergraph** (Z/I Imaging), Leica Geosystems and BAE Systems - all now based in the U.S.A. - had large stands on which their DPWs were being demonstrated. Now that its agreement with BAE Systems in respect of the distribution of SOCET SET has been terminated, Leica demonstrated instead its Leica Photogrammetry Suite (LPS). This includes elements from the former ERDAS OrthoBase soft-

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ware together with the ORIMA (aerial triangulation) and Pro600 (stereo-compilation) packages from the Leica side. The company also showed a new photogrammetric film scanner in the shape of its DSW700. This gives a 30% improvement in scanning speeds over previous models in the DSW series. Intergraph (Z/I Imaging) showed the latest version of its ImageStation DPW and also demonstrated its new Z-mouse. This combines force sticks and an optical thumb-wheel to generate 3D inputs to the ImageStation. BAE Systems gave a preliminary glimpse of their new SOCET GXP product that features a new architecture and user interface that will eventually be applied to all of its photogrammetric and image processing systems. It is first being applied to its VITec PC product. Later it will be used with VITec ELT and eventually (in 2005) it will contain all the functionality of the present SOCET SET software. **Vexcel** announced its acquisition of the Canadian ISM company at the ASPRS meeting in Denver. In Istanbul, the re-named Vexcel-ISM DiAP DPWs appeared on the Vexcel stand as the company continues its drive become a major across-the-board system supplier to the photogrammetric and remote sensing communities in the same way as Intergraph and Leica. Turning next to the other DPW suppliers from North America, **KLT Associates** gave me a first-class demonstration of its Atlas/DSP DPW. Like the other vendors, **DVP-GS** showed lots of small improvements in its DVP software, including, in this case, the creation of a TIN and contours on-the-fly from vector data. The small **Immersion** company made the journey all the way from California to show its sophisticated SoftMouse 3D positioning and height measuring device that can be used with any DPW.

(b) Western European Suppliers

With the development of Intergraph (Z/I Imaging), Leica and Vexcel DPW software now being carried out in the U.S.A., **Inpho** is now the major European photogrammetric software house. At the Congress, it concentrated its efforts strongly on demonstrating its new inBLOCK multi-sensor block adjustment tool and its inJECT software for semi-automatic feature extraction. Inpho also showed its new DT Master software that is used for the fast editing of DTM data, whether produced from airborne laser scanning or through the automatic image matching of stereo-pairs of aerial photos. The company also introduced its OrthoMaster package which carries out the ortho-rectification of digital images on the basis of measured in-flight orientation data and an existing DTM. However **DAT/EM** - another American supplier based in Alaska

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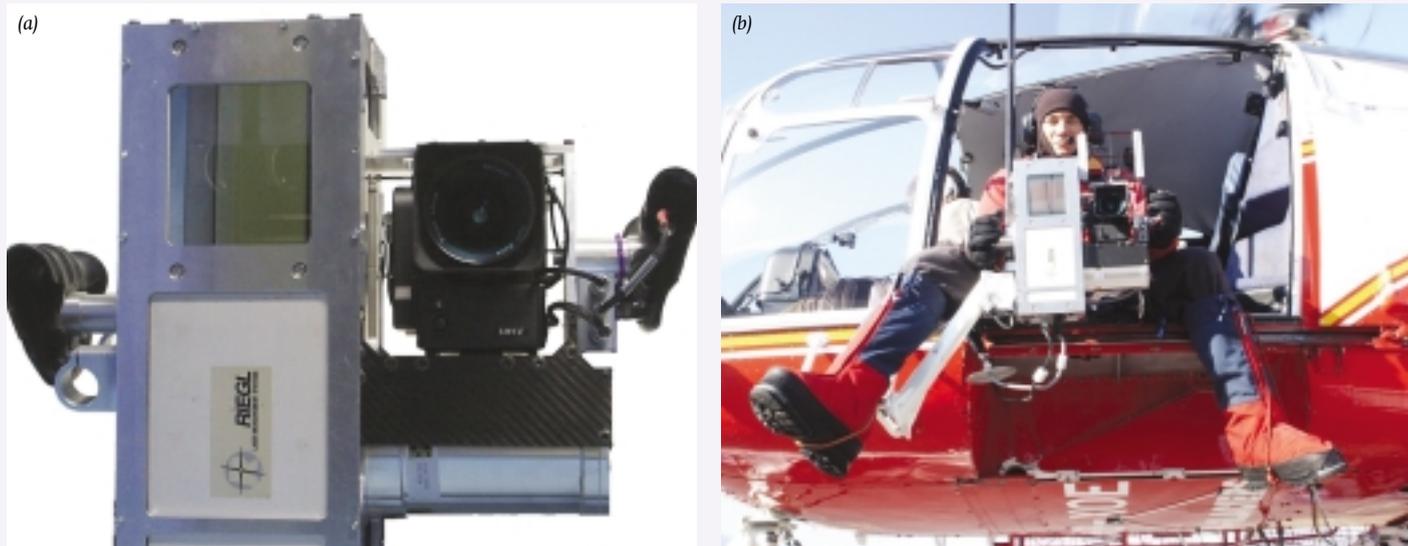


Figure 6. (a) - The Helimap system with the Riegl laser on the left and the Hasselblad frame camera fitted with its digital back on the right. (b) - The Helimap system being operated from the side of a helicopter. (Source: EPFL)

- is Inpho's partner in terms of supplying its Summit Evolution DPW to its customers.

A well-known exhibitor and supplier of digital photogrammetric software is **Stora Enso** from Finland which once again showed its EnsoMOSAIC image rectification and mosaicing software. Its main market appears to be companies and organisations concerned with forestry and natural resource management. The examples of its use that were shown seem to involve the use of images acquired by small-format airborne digital frame cameras. A new European DPW supplier - at least in terms of the ISPRS Congress Exhibition - was **Digi 21**, which appears to have a large market share in Spanish-speaking countries.

(c) Eastern European Suppliers

Then from Eastern Europe, we had the Ukrainian supplier, **GeoSystem**, which is known mostly in western countries for its manufacture of the mechanical and optical components of Wehli's film scanner and airborne line scanner products. However it also has its own range of DPW software that covers the whole of aerial photogrammetry from triangulation (with its own bundle adjustment programs) to stereo-plotting and orthophoto production. Much the same sort of remarks about the completeness of its photogrammetric capabilities can be made about the PHOTOMOD DPW software that was demonstrated by the **Racurs** company from Russia. It has installed 600 systems to date. Besides being a software supplier, Racurs also has a production department undertaking photogrammetric mapping projects. From the Czech Republic came the **Topol** company that we first saw at the previous Congress in Amsterdam. It does appear that all of these suppliers still find their main market in Eastern European countries.

I also include under this heading the Geoionics company, which, although it is registered in Torrance, California, only too obviously originates from Russia - everyone on the stand spoke Russian to one another. In my opinion, the **Geoionics** products were quite simply the most innovative to be seen in the Congress Exhibition. They comprise a suite of programs and hardware (which includes a pair of video cameras monitoring the user's eyes) that carry out the high-speed tracking and analysis of the movements of the eyes of an analyst observing either an image, a map or a stereo-model. The basic eye-tracking program is called 'i-See'. Then there is a photogrammetric eye-tracking and measuring system called 'i-Measure'; a second program called 'i-Know' that acts as a feature extraction and classification tool; and finally a program called 'i-Map' that is intended to carry out the interactive management of map and GIS data. The whole concept is so novel that it is quite difficult to fully understand it and grasp its implications in a short demonstration. Whether it will be useful in a production (as distinct from a research) environment remains to be seen, but innovative it most certainly is. I found it quite astonishing!

(d) Chinese Suppliers

I had fully expected to see the VirtuoZo DPW software from Suprosoft that has been shown on several occasions at past ISPRS and ASPRS conferences, but it was not to be seen at the Istanbul Congress exhibition. However what the Istanbul exhibition did have from China were two stands - one from the **Chinese Academy of Surveying & Mapping** (CASM); the other from the **Beijing Geo-Vision Technology Company**, which is a fully owned subsidiary of CASM. CASM showed its Imagenfo image processing software that

includes a geometric rectification module. The main product of the Geo-Vision company is its JX4C DPW which has had 1,000 licences issued over the past seven years, mostly to Chinese organisations. (Previously the JX4 had been sold by the China Swei company which is also a subsidiary of CASM.) The JX4C offers much the same type of photogrammetric processing that most DPWs offer. However what was still more intriguing was the news that CASM and GeoVision are developing a "JXDC8K Super Aero Digital Camera" that will produce 8k x 8k images. There was even a small photo of this camera, though it wasn't very informative. Still it is something to look out for in the future - especially if it can be offered at Chinese prices!

II - Service Providers

As at previous ISPRS Congresses, only a very few of the largest European mapping and imaging service providers find it worthwhile to promote their services. In Istanbul, three of them (who also appeared at Amsterdam) were Hansa Luftbild (Germany), CGR (Italy) and ISTAR (France). **Hansa Luftbild** has always been very active in the Middle East with offices in several countries in the Arabian Peninsula. The company's work in mapping and defining the boundaries of Saudi Arabia with its neighbours (Oman, Yemen, etc.) has long been notable. **CGR** has this large fleet of aircraft ranging from a Learjet down to several slow-flying Partenavia planes. These can carry a large range of imaging sensors including film cameras, an ADS40 and a MIVIS multi-spectral scanner, plus a battery of different laser rangefinders. **ISTAR** still carries out satellite image processing but increasingly it undertakes the processing of airborne scanner imagery. In fact, the company does not own aircraft and imagers like the other service sup-

pliers. However no one has as much experience as its 'Pixel Factory' in being able to process airborne linescan imagery - first obtained by leasing HRSC-A scanners from DLR and now using the ADS40 imagery from Terra Imaging. A newcomer to the Congress was the Russian **Geokosmos** which is a commercial surveying and mapping company based in Moscow. In the Congress Exhibition, it concentrated its display on its airborne and ground-based laser scanning services.

As in Amsterdam, where many local Dutch service companies and organisations had booths, so did several Turkish companies at the Istanbul Congress. A major government organisation that carries out mapping is the **Cadastral General Directorate**. Two large commercial air survey companies that participated in the Exhibition were **EMI Harita** from Istanbul and **Mescioglu** from Ankara. All of these purely serve the Turkish market.

C - SPACE REMOTE SENSING

I - Image Suppliers

It goes virtually without saying that the three American suppliers of high-resolution imagery were represented at both the Denver and Istanbul meetings. At the Istanbul Congress, Space Imaging was particularly well represented on three quite different stands. That of the local **Inta Space Turk** company, which also operates as Space Imaging Eurasia, had one of the largest stands in the Exhibition, displaying SPOT-5 imagery as well as scenes from IKONOS. A second large and quite separate stand was that of **Space Imaging Middle East** (SIME) of Dubai, U.A.E. on which **European Space Imaging** (EUSI) was also represented, together with a Saudi Arabian station. A third (unmanned) stand, that of **Space Imaging** itself, presented a gallery of eye-catching IKONOS images. **Digital Globe** had a manned stand with much of the equally impressive QuickBird imagery that was on display being supplied by Eurimage, its master distributor for Europe, and by Maps Geosystems, its distributor for the Middle East. Finally **ORBIMAGE** had a more modest stand giving out information on the image products from all of its OrbView satellites.

As well as the big American suppliers, **SPOT Image** had a small booth dispensing literature and displaying various applications of SPOT imagery. A potentially important piece of news displayed prominently on one of the walls of the booth was that SPOT Image has been selected by the Taiwanese National Space Program Office (NSPO) to market and distribute

the imagery from the newly launched ROCSAT-2 high-resolution satellite on a world-wide basis - except for the coverage of Taiwan and China. To an outside observer, this seems a smart piece of business - since effectively it gives SPOT Image access to a high-resolution satellite without having had to pay for its construction and launch. In this context, one notes that ROCSAT-2 and its imager were largely built in France by Astrium and Alcatel respectively with the Taiwan government paying the costs.

Besides the SPOT-5 imagery being taken down by Inta Space Turk in Ankara, another local Turkish ground station - that of the Center for Satellite Communications & Remote Sensing (CSCRS) of **Istanbul Technical University** (ITU) - receives image data from SPOT-2 and -4. The station also takes down SAR imagery from the Radarsat and ERS-2 satellites. All of these different types of image were to be seen on the ITU stand. The local **NIK System** company, which supplies all types of satellite imagery and image processing software to users throughout Turkey also had a stand, with particular attention being paid to the images from the Japanese ASTER scanner mounted on board NASA's Terra Satellite.

An interesting stand was that of **Sovinformputnik**, which, although it did not have much to show in the way of new imagery, did give details of the new Resurs-DK (optical) and Resurs-DK-R (radar) satellites that are being developed in Russia. Yet another interesting booth was that manned jointly by **IAI** (the satellite builder) and **Elta** (the SAR constructor) which featured the new Israeli TECSAR radar technology demonstration satellite that is currently being constructed by these two companies. In fact, I also attended the showcase presentation on this development which revealed a quite surprising amount of detailed information about its characteristics and performance - given the fact that it obviously has an all-weather intelligence gathering capability. Its high-resolution X-band SAR will feature all the main SAR operational modes - spot; strip; scan; and mosaic - plus a multi-polarization capability - all in a spacecraft weighing only 300kg. This is a very impressive figure when compared with any other SAR satellite having a similar performance - e.g. the SAR-Lupe high-resolution SAR satellites currently being built in Germany will each weigh 770kg, while the comparable Italian COSMO-SkyMed satellites will each weigh 1.7 tons.

II - Software Suppliers

Three of the principal suppliers of remote sensing image processing software - **PCI Geomatics**, **Leica Geosystems** and **Definiens** -

showed their Geomatica 9 (PCI), ERDAS Imagine (Leica) and eCognition software packages respectively. The first two companies also showed new products that emphasized their support for the raster image data that can be stored and managed using the new Oracle 10g Spatial Database and GeoRaster software. A newcomer to the area was PromptServer, which is software developed by **Maps Geosystems** that is designed to handle very large numbers of geo-referenced images and of processing the image data on-the-fly, including enhancement, pan-sharpening and mosaicing operations. Another relatively unfamiliar exhibitor was **Pixoneer** Geomatics from Virginia in the U.S.A. It offers a quite sophisticated image processing package called PC-Steamer that appears to be heavily oriented towards the education market.

GIS

There was only a very small presence of the main GIS suppliers at this Exhibition. **Intergraph** had of course part of its stand devoted to its mapping and GIS products alongside its Z/I photogrammetric and imaging products. While **ESRI** had quite a small booth - at least by comparison with its presence at American meetings. A local (Turkish) software supplier, **NetCAD**, also showed its GIS solutions and software products that have a wide currency among government and municipal agencies in Turkey. **EastView Cartographic** from Minneapolis in the U.S.A. supplies topographic maps on a global scale, especially for areas and countries where it is difficult to acquire data. In particular, it sells a vast range of Russian maps and, in Istanbul, it was offering complete map cover of Iran and Iraq.

Surveying

Again, like GIS, this formed a very small part of the overall Exhibition. **Leica** showed many of its surveying instruments on its stand. More unusual was the presence of **DataGrid**, a small spin-off company from the Laboratory for Astrophysics of the University of Florida. It showed its range of sophisticated GPS receivers, data collectors and antennas.

Conclusion

It was a really excellent Exhibition, well organised and held in a beautiful hall, with plenty of technical interest and innovation to satisfy the most discerning and demanding of customers. I enjoyed and benefited from it enormously.

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