

ISPRS 2000 Technical Exhibition

The ISPRS Congress is held only every four years and its Technical Exhibition provides a most important opportunity for all those engaged in photogrammetry and remote sensing to obtain an overview of technical progress in these areas over the period since the previous Congress. Often it is the platform for system suppliers to introduce new developments and to launch new products. In between these Congresses, the ASPRS Annual Convention (which has a similar number of participants) and its accompanying Exhibition (which is of a comparable size) provide a comparable platform and perform a similar function - but only to a mainly North American audience. For practitioners outside North America, and especially those from Europe and Asia, the ISPRS Congress Technical Exhibition is an absolute must. In fact, the ISPRS 2000 Exhibition fully lived up to expectations and there were very many interesting exhibits on the stands. At the top of the agenda was the eagerly awaited introduction of the new airborne digital imagers to the photogrammetric and remote sensing mainstream. However, besides these landmark events, there were a myriad of other interesting systems and applications on show. Your reviewer has picked out only those that appeared significant to him. Those who have not been mentioned should not feel offended: it is impossible to cover every exhibitor even in this rather long review.

By Prof. Gordon Petrie

Before dealing with each particular area of activity, an overall impression given to the author was the very considerable contribution being made to this particular Exhibition by the German photogrammetric and remote sensing community. As will become clear, the new generation of airborne digital imagers is

largely German in origin. In this respect, the long-standing and steadfast support of the German Aerospace Agency (DLR) for the development of the three-line pushbroom scanner over a 25 year period lies behind its introduction in a production form. A further spin-off from DLR's activities is the Aero-Sensing

Radarsysteme company, which is now providing a European commercial capability in airborne radar - a field dominated previously by North American service providers. Furthermore the rapid development of the new metric digital frame cameras has taken place largely in German labs and factories. As will be seen later, the Inpho company has also spearheaded a significant revival of the digital photogrammetric workstation (DPW) and its software in Europe - an activity which, over the last ten years, had largely migrated elsewhere, mostly to North America. The introduction of the innovative eCognition software was yet another significant event from a German company. To your reviewer, there seems little doubt that, along with the activities of DLR, the excellent research and teaching of the German universities that are active in this area - Stuttgart, Hannover, TU Munich, TU Berlin, Bonn, etc. - have laid the foundations for many of the significant advances seen at this particular Exhibition.

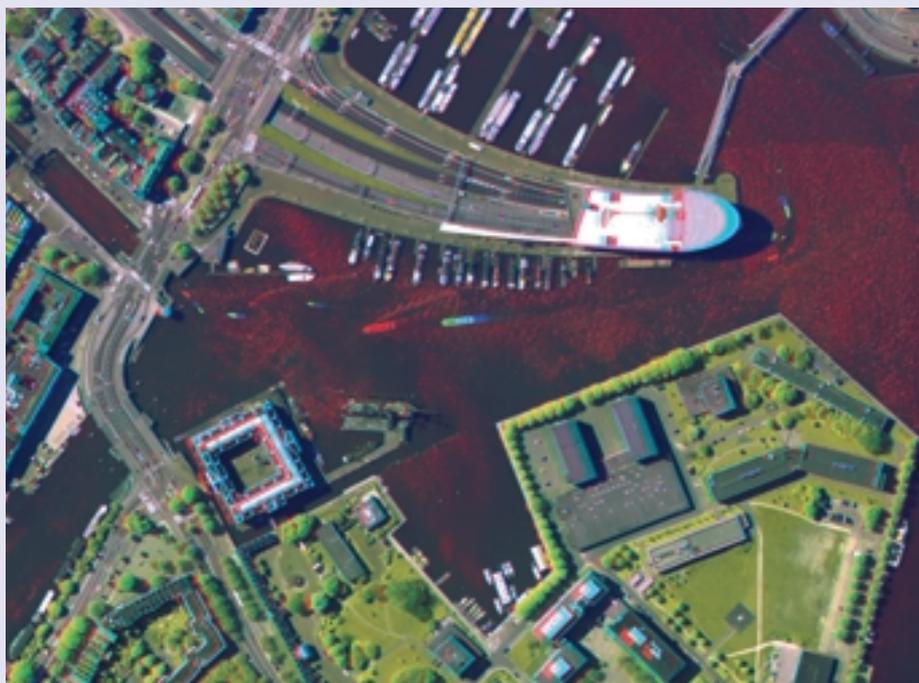
Airborne Digital Cameras

The introduction of airborne metric digital cameras was, of course, one of the highlights of the Exhibition.

• DMC 2001 Camera - Pan Imagery

The centre-piece of the Z/I Imaging stand was understandably the company's new Digital Modular Camera (DMC). While the basic concept had been announced and disseminated

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This picture of Amsterdam was taken during a flight campaign on may 5th 2000 with the digital camera system HRSC-A (High Resolution Stereo Camera - Airborne), a development of the German Aerospace Center (DLR). Flight Altitude was 6000m, the ground resolution is 24cm. The colour composite of a stereo band, nadir and blue is a 3d-view showing the area near the central station with the NewMetropolis and the Dutch Scheepvaartmuseum. Using anaglyph glasses the third dimension can be explored. (Image courtesy: DLR, with thanks to Geodan)

A First-Rate Show with Lots of Innovation!

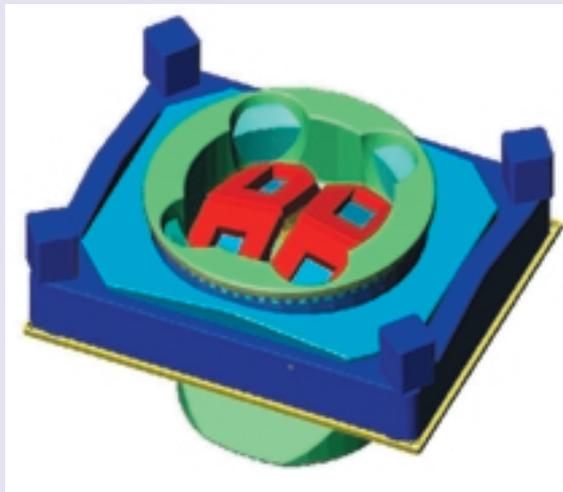


Fig. 1 - (a) The new Z/I Imaging DMC 2001 Digital Modular Camera mounted on a T/AS gyro-controlled mount. (b) The diagram shows the arrangement of the four-coupled panchromatic frame camera - with each individual camera utilising an areal CCD array.

among the mapping community via a series of papers and magazine articles over the nine month period prior to the Congress, none-the-less it was extremely interesting to be able to see and touch the DMC 2001 imager in its actual glass and metal form. As the modular name in the title suggests, it will be available to acquire pan imagery, either using a single camera or as an integrated assembly of two or four of these frame cameras, which operate synchronously and are tilted to give contiguous images to provide a greater ground coverage. The idea is that a user can start with a single module at a relatively low entry price and gradually augment and build up the capabilities of the imaging system by purchasing additional modules. Each DMC camera module utilizes a $7k \times 4k = 28$ Megapixel areal array supplied by Philips and features an $f = 120\text{mm}$ lens having a maximum aperture of $f/4$. With the twin-camera arrangement, this particular combination provides a $7k \times 7.5k = 52.5$ Megapixel image with a $39^\circ \times 42^\circ$ field of view (FOV); while the four-coupled camera arrangement provides a $13.5k \times 8k = 108$ Megapixel image giving a $74^\circ \times 44^\circ$ FOV. As the camera's name suggests, first deliveries of this camera system are scheduled for 2001.

• **DMC 2001 - Colour & False-Colour Imagery**

For the acquisition of colour (RGB) and false-colour (RGB + NIR) frame imagery, Z/I Imaging's solution again utilizes multiple (three or four) cameras. However each of these cameras is equipped with a much smaller sized ($2k \times 3k$) areal array than those utilized in the DMC pan cameras and they are used in combination with much shorter focal

length ($f = 25\text{mm}$) lenses. Furthermore the cameras are mounted and operated with parallel optical axes, with each lens having a different filter. While this configuration provides a comparable angular coverage (FOV) of $72^\circ \times$

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50° to that of the four-coupled panchromatic camera assembly, inevitably it does so at the cost of a considerable reduction in the ground resolution (cf. $f = 25\text{mm}$ v. $f = 120\text{mm}$) from the same flying height. Only too obviously, one simply needs to change the photographic film (from pan to colour or colour infra-red) with an analogue film camera. However the need to provide a separate camera and filter for each of the component bands or colours to achieve a composite colour or false-colour

digital image is an unavoidable consequence of using the particular approach used in the DMC. It would be interesting to know if consideration has been (or is being) given to the alternative approach of using a single lens camera equipped with a beam splitter and dichroic filters to provide the separation into the appropriate colour bands. This was done with the prototype multi-band film camera built by Perkin-Elmer for the US Army ETL some twenty years ago.

• **Z/I Imaging Products & Partners**

In parallel with the introduction of its new digital cameras and the huge amounts of digital data being produced through the scanning of film photography, Z/I

Imaging has moved into the business of managing these enormous data sets. On the one hand, it has introduced its own TerraShare software to track and disseminate not only the actual imagery but also other types of raster data (DEMs, orthophotos, raster maps) across the whole of an organisation's network. At the Congress, Z/I Imaging also announced a cooperative agreement with Ness, a large Israeli IT company, to market its Military Photography Intelligence System (MPHIS) originally developed for the Israeli Air Force. This is a computer-based system dealing with all aspects of processing, storing, retrieving and disseminating imagery acquired from both airborne and spaceborne platforms. It also handles the raster and vector maps and the DEMs and orthophotos generated from this imagery. It has been implemented incorporating several of the hardware and software elements from Z/I Imaging's product range - the PhotoScan film scanner; the ImageStation SSK for its photogrammetric operations; and the I/RAS-C software for processing and displaying imagery. Besides which, Z/I also announced a cooperation with the IGI company from Germany in the further development of the latter's CCNS (Computer Controlled Navigation System) using a Litef INS and a differential GPS system.

• **Inpho inCAM SF Camera**

With no prior publicity, another digital modular camera was introduced at the Exhibition by Inpho in the shape of its inCAM SF. Apparently this had been developed over quite a short time period in cooperation with another German company, SensorVision. Again, as with the DMC, it offers the use of

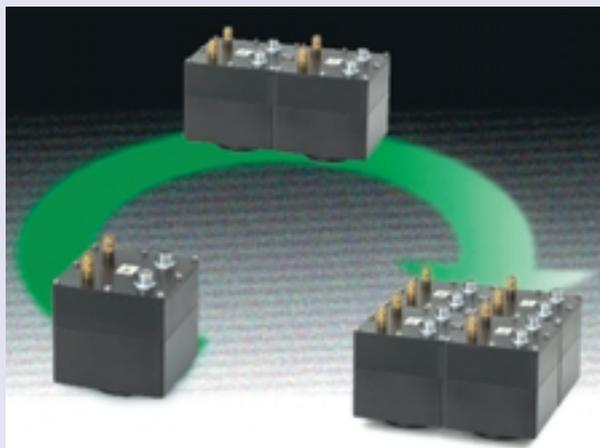


Fig. 2 - The new Inpho inCAM SF digital modular camera showing some of the alternative configurations - including a single camera; a two-camera arrangement; and a four-camera arrangement.

multiple camera modules. These can either be mounted on suitably tilted plates to give increased ground coverage or used with parallel optical axes to provide a multi-spectral capability. The main difference compared with the Z/I Imaging DMC is the use of much smaller sized (2k x 3k = 6 Megapixel) areal arrays in the individual inCAM SF camera modules - which are available in both pan and colour form. Each camera module uses an $f = 28.5\text{mm}$ Zeiss Biogon lens with an $f/2.8$ maximum aperture; alternative lenses, e.g. $f = 50\text{mm}$, to provide greater ground resolution but smaller angular coverage, are available if required. Obviously the ground footprint resulting from this smaller array will be substantially less than that of the DMC pan camera, but then so will the price of an inCAM system. It will be most interesting to see if users take up this tiny and very neat small-format metric camera for local use in small aircraft - as has occurred with the Kodak DCS 460 CIR digital frame camera.

• **Rolleimetric**

Just to complete the notable German contribution to this particular field, Rolle showed its d-Metric series of digital SLR cameras, complete with a tiny integral monitor and using a 1,280 x 1,024 pixel areal array as its sensor. This camera can be used with a range of lenses, including a fixed focus ($f = 7\text{mm}$) lens and two different zoom lenses. The obvious application area for this camera would seem to be close-range photogrammetry, supplementing the company's Rollei 35 and 6008 metric film cameras, but obviously it can be operated from light aircraft as well.

Airborne Pushbroom Scanners

Just as with the airborne digital cameras, so with the airborne pushbroom scanners, there was a new but well publicised and expected imager and also another somewhat unexpected entrant to the field.

• **LH Systems ADS 40 - Pan Imagery**

The introduction of what LH Systems calls its Airborne Digital Sensor (ADS) was always going to be another highlight of the Exhibition. Again the basic concept had been well publicised in advance, both in print and through the display and distribution of imagery taken with the engineering and prototype models of the imager. But now we saw the finished article with its outer case partly cut away to display, in a most interesting fashion, various aspects of the scanner's design and construction. As expected, the

ADS40 featured the three-line pushbroom arrangement with forward, nadir and backward pointing linear arrays imaging through a single new and specially designed lens having a focal length (f) of 63mm; a cross-track angular coverage of 64° ; and a maximum aperture of $f/4$. In fact, it turned out that each of the linear arrays comprises two 12,000 pixel lines of CCDs, each of which is offset horizontally with respect to the other by half a pixel (3.25 μm). This arrangement appears to be quite similar to that of the so-called Supermode sensor developed and demonstrated by the French CNES organisation for use with the forthcoming SPOT-5 HRG (High Resolution Geometric) sensor - see the article on Supermode published in SPOT Magazine no. 31 earlier this year. The read-out rate of the ADS40, which largely governs the data acquisition rate of the scanner, is 800Hz. As

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promised, the ADS40 incorporates an IMU internally within the imager forming part of the Applanix POS/DG sub-system that is an integral part of the imager. Of course, the overall concept of the pushbroom scanner is familiar enough to those (relatively few) photogrammetrists who have had to deal with SPOT, IRS and MOMS stereo-imagery. However it will be most interesting to see how mainstream photogrammetrists - previously accustomed to only handling aerial frame photography - will take to the very different geometric processing involved with the ADS40 imagery. However LH Systems announced at the

Congress that they have already secured an order for two ADS40 units from the Japanese Pasco aerial mapping company to be delivered in 2001.

• **LH Systems ADS 40 - Multi-Spectral Imagery**

Besides its pan sensors, the ADS40 has four other 12,000 pixel linear arrays covering the Red, Green, Blue (RGB) and Near I-R spectral bands respectively - all mounted side-by-side in a forward-pointing (RGB) or near nadir-pointing (NIR) orientation. After passing through the scanner's lens, the incident light from the ground is split into its three RGB components using dichroic beam splitters before being passed on to the appropriate linear array. In this way, the possibility of colour fringing occurring within the visible spectrum has been removed. Of course, as with Landsat TM satellite imagery, purely monoscopic (non-stereo) multi-spectral scanner imagery results from the pointing arrangements - there is no possibility of colour or false-colour stereopairs being produced, as can be done with both analogue and digital frame cameras.

• **DLR HRSC-A Developments**

The ADS40 has been developed by LH Systems in close collaboration with the Institute of Space Sensor Technology of DLR in Berlin - which had already developed a series of three-line pushbroom scanners intended for use over the planet Mars. A direct derivative of this development has been DLR's own HRSC-A (High Resolution Stereo Camera - Airborne) imager. Over the last three years, this device has been used by DLR and the French ISTAR company to acquire imagery over 50 European cities - with the Dutch Geodan company collaborating in the development of automated techniques for the interpretation and usage of the resulting imagery. Currently the HRSC-A scanner is being flown in a similar manner over cities in the U.S.A. in a joint programme between ISTAR and ORBIMAGE. In view of DLR's involvement in the development of the ADS40, it came as a considerable surprise to most people to learn from the presentations and literature available on the ISTAR and Geodan stands that, quite independently, DLR has also constructed and is bringing into operation two new models of its own scanner this summer. These are called the HRSC-AX - which is equipped with a narrow-angle ($f = 150\text{mm}$) lens - and the HRSC-AXW - equipped with a wide-angle ($f = 47\text{mm}$) lens. Both models feature a 12,000 pixel linear CCD array (double the length of that used in the HRSC-A) operating at a maximum frequency of 1,640Hz, together with an Applanix POS/DG unit. One awaits further news of this parallel development from DLR with great interest - especially in relation to the introduction of the ADS40. Presumably, as an agency of the German government, DLR will not be able to

sell the HRSC imagers to customers. So the further presumption is that it will continue to offer users an extensive data acquisition service in conjunction with its partners. But then again, this may not be a correct assumption!

• **Digital Photogrammetric Systems**

Another major component of the Technical Exhibition comprised the photogrammetric system suppliers offering their DPWs together with a great range of software packages covering every conceivable aspect or application of photogrammetry - including triangulation, feature extraction, DEM and orthoimage generation, etc. Since gradually, over the years, this whole area has come to be dominated by North American suppliers, it was interesting to note something of a revival or renaissance in Europe.

• **Inpho**

The biggest impact by far was that of the Inpho company from Germany. Of course, the company has been well known for some time for its high-quality MATCH (-AT, -T and -I), PAT (-B and -M), SCOP and SKIP software products that have been sold both directly by Inpho and through DPW suppliers, especially Intergraph, Zeiss and DAT/EM. While apparently this arrangement will continue, what was quite startling at the Exhibition was the introduction of a further large range of products. This has been produced partly by Inpho and partly by a group of partners coordinated by Inpho - the whole combination being called the GeoToolBox Team. The inCAM SF digital modular camera produced in collaboration with SensorVision has already been mentioned above. Besides this, the Team partners also include Vexcel Imaging Austria with its UltraScan 5000 high-precision film scanner and DAT/EM with its Summit-PC DPW. Rather more unexpectedly, Inpho have established

another even closer relationship with the small X-Position firm from Finland, previously best known for its specialist geodetic packages - X-Net, GPS-Net and X-Tra. Out of this last relationship has come a new package, OrthoWarp, for orthophoto generation. This includes a variant called OrthoWarp ER that has been developed specifically as an add-on module to the well-known image processing software from ER Mapper - whose Image Web Server is also being offered by Inpho. These products join the OrthoVista digital orthophoto mosaicing package from the Stellacore Corporation. Inpho had already added this to its product line after it had been dropped by Zeiss following the formation of Z/I Imaging in its joint venture with Intergraph (which already had its own orthophoto products). Furthermore Inpho has recruited Dr. Gulch, who has been a close collaborator of Prof. Forstner at the University of Bonn on the development of semi-automatic feature extraction. This has now had its commercial realization in the form of a new product for this type of operation from Inpho called inJECT. Apparently this transformation of Inpho into a major player with a large and varied product range has taken place over the last six months or so. All the participants in the new Team must be somewhat breathless at this rapid development!

• **More Finnish (and Chinese!) DPWs**

Besides X-Position, two other Finnish companies appeared with what to most people were new digital photogrammetric products - although they seem to have been available in Finland for some time. One was the Stora Enso Forest Consulting group, which has been involved for some time in forestry mapping and GIS activities both in Finland and abroad. Now it has produced its own aerial imaging and processing system under the title of EnsoMOSAIC. This includes modules for GPS-

controlled flight planning and navigation and data acquisition using either small-format digital or video cameras, together with modules for block triangulation and adjustment and the production of rectified images and mosaics. The application orientation appears

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to be primarily towards thematic mapping of land use, agriculture and forestry. The second Finnish company was ESPA Systems. This has produced quite a wide range of digital photogrammetric software products called Espa Kernel, Espa Block and Espa Bundle (for aerial triangulation), Espa Ortho (for orthophoto generation), Espa City (for 3D data acquisition) and Espa Gate (for the exchange of 3D data with MicroStation and the Smallworld GIS environment). The Espa software seems more oriented towards the photogrammetric mainstream than that of Stora Enso. Then yet another Finnish company, Novosat Oy, owned jointly by the National Land Survey of Finland and the Novo IT Group, used the Congress to launch the China Swei JX-4 DPW on to the European market in collaboration with the Chinese State Academy of Surveying & Mapping. Thus it joins the already established VirtuoZo DPW produced originally by a group from the Wuhan University of Surveying & Mapping and now being developed by their spin-off company, Supresoft. On the Exhibition, VirtuoZo was demonstrated by Survey & Development Services from the U.K. - who are the representatives for Europe, the Middle East and Africa.

• **Eastern European DPWs**

The ISPRS Congress Exhibition constitutes one of the few occasions when photogrammetrists can view the products originating from the former Soviet Bloc countries. At the Vienna Congress in 1996, the Ukrainian GeoSystem

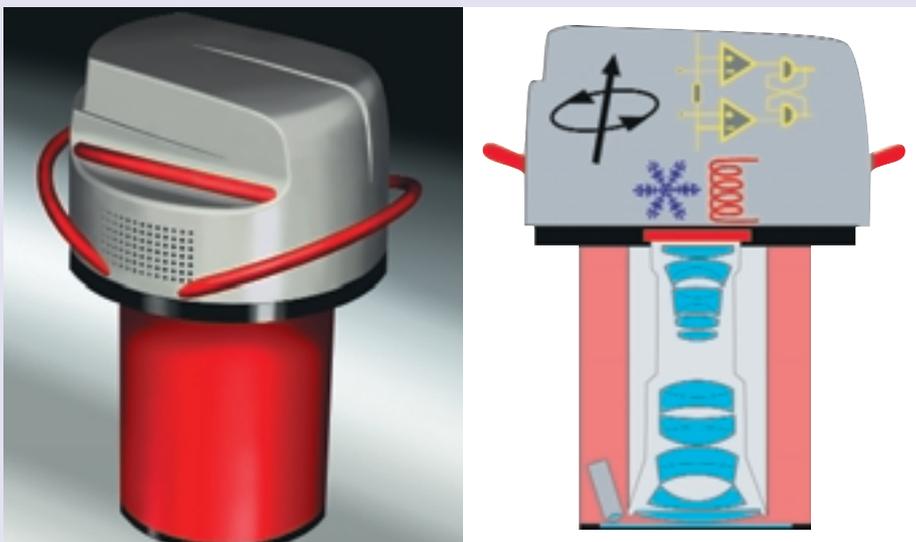


Fig. 3 - (a) The new LH Systems ADS40 imager based on the three-line pushbroom scanning principle. (b) A cross-section of the ADS40 showing the multiple elements of the new $f = 63\text{mm}$ lens having an angular field of 64° . The other elements contained in the SH40 sensor head (lying above the focal plane) include the electronics; the internal IMU; and the heating/cooling system (all shown in iconic form).



company showed its wares, including its DeltaScan high-precision film scanner, its Stereoanagraph analytical plotter and its Delta DPW. All of these were shown in a more developed form in Amsterdam at what are, by Western standards, truly amazingly low prices. As a result, the company is beginning to sell these products in Western Europe, Asia and Africa. If the quality control and technical support of the GeoSystem products is adequate, then they must become serious competitors in certain markets. Another vendor at the Amsterdam show was the Czech company, TopoL Software, which, besides its TopoL GIS software, showed its PhoTopoL DPW which appears to be geared towards DEM and orthophoto generation, but also provides stereo-compilation and updating capabilities. Finally it would have been very interesting to have seen and tried out the PHOTOMOD DPW of the Russian Racurs company. However the company did not show up at the Exhibition, although it was in the original list of exhibitors.

• **Other DPWs**

All of the discussion above about the new or unfamiliar DPWs (mainly from Europe) that were shown at the Amsterdam Congress Exhibition may make it appear that the familiar and well established DPW companies from North America that appear regularly at ASPRS and ISPRS meetings were not active. Nothing could be further from the truth. Most had well staffed and busy stands that reflect their current domination of the market. A review of their numerous offerings has already been given in the article published in the June issue of Geoinformatics, so there is no need to repeat it here. Nearly all of these DPWs feature small but worthwhile improvements or developments. Some of these developments will have been new to the European and Asian photogrammetric communities, but in fact virtually all had been shown at the ASPRS Annual Meeting held in Washington at the end of May and have been reviewed in the September issue of Geoinformatics. They included the Stereo Analyst from ERDAS (whose close relation with ESRI was reflected in their shared stand); DAT/EM's Summit PC (now a member of Inpho's Team); and the PC/NT-based version of Autometric's SoftPlotter. Others were the DVP Stereo Index product; the latest version of ISM's DiAP; and the Z/I Imaging ImageStation 2000. Then there was the latest edition of SOCET SET from LH Systems (complete with its new TopoMouse for 3D stereo-measurement); and KLT's Atlas DPW and the Amsatek/ABC DPW (both of which also had a new mouse).

Remote Sensing

(a) In this area, we first come to the satellite operators. SPOT Image and Space Imaging both had prominent stands showing examples of the latest images from SPOT-4 and IKONOS respectively. Sovinformsputnik also showed examples of the latest Russian space photos, including, for the first time, 1m resolution images. The Brazilian INPE organisation also had a stand on which the first images of Brazil acquired from the CBERS (Chinese/Brazilian Environmental Remote Sensing) satellite were shown. Needless to say, for almost all of the Congress participants, this was the first time that they had seen this interesting imagery.

(b) There was also the considerable presence of two of the main suppliers of large fixed ground receiving stations. Thus the Datron/Transco company from the U.S.A. gave out a lot of information on its stations and major systems. These have been supplied to Korea, Singapore and Taiwan in Asia and to SSC (Sweden) and TSS (Norway) in Europe - as well as to EarthWatch and EROS/USGS in the U.S.A. The Canadian MacDonald Dettwiler company had a similarly informative stand. In its case, has been supplying its ground receiving stations for the USGS, ORBIMAGE, INPE (Brazil), NTT Data (Japan) and ACRES (Australia).

(c) The downstream satellite image suppliers and image processing service providers such as ISTAR (France) and NRSC (UK) were also prominent, though both also showed quite a lot of very interesting airborne digital scanner imagery (in the case of ISTAR) and thermal imagery (in the case of NRSC). A very much smaller but still interesting company was EO Works from Belgium, which, besides marketing and selling space image data in the Benelux countries, provides a number of specialised software tools for use with both airborne and spaceborne data. It also carries out the interpretation and mapping of land cover, vegetation and agriculture from this image data in much the same way as the larger companies.

(d) The leading remote sensing system suppliers - ERDAS and PCI - were present, as were both Sensor Systems and Research Systems, the latter represented by its European distributor, Creaso. However other well known American companies such as MicrolImages, Logicon and Paragon Imaging were not present. A relatively new entrant to the field was the Delphiz Creative Technologies company from Germany (soon to be re-named

Definiens) which showed its interesting and innovative eCognition object oriented and multi-scale software for image analysis. In fact, PCI will distribute this software on a global basis.

• **Dutch Remote Sensing (& Mapping)**

Needless to say, there was a very strong Dutch presence in this particular area with local companies and organisations relishing the chance for international exposure of their competence and the range of their activities. On the commercial side, these included the Arcadis, Geodan, Geoserve, Orangewoud and Synoptics companies. The government sector was also well represented. The stand of the TNO Physics & Electronics Lab was mostly concerned with airborne microwave imaging and SAR processing. That of the Netherlands Remote Sensing Board (BCRS) showed an almost bewildering range of water, land and atmospheric applications of remote sensing imagery acquired from both airborne and spaceborne platforms. Also the National Aerospace Lab (NLR) demonstrated its RAPIDS transportable ground receiving station produced through an Anglo-Dutch cooperation and described in detail in the July/August issue of Geoinformatics. This unit was mounted on a trailer located just outside the Exhibition Hall. The whole operation looked so easy and simple in what were very impressive demonstrations of its capability. On another stand, the various Dutch government mapping agencies - Kadaster, Topografische Dienst and Rijkswaterstaat - and the National Clearing House for Geoinformation (NCGI) all showed something of their activities supplying digital map data for GIS/LIS applications.

• **Radar Imaging**

Given the current mission of the European Space Agency (ESA) to spend billions of euros on satellite radar imaging trying to beat the cloud cover of Western, Central and Northern Europe - first with ERS-1 and -2 and now with Envisat - it must be said that there was little evidence in the Exhibition to show for this enormous expenditure. ESA had a stand where information on its activities was given out quite grudgingly - or so it seemed! In fact, more information on Envisat seemed to be available on the stand of MacDonald Dettwiler, which is supplying the ground-based processing facilities for Envisat, besides being the constructor of the new RADARSAT-2 satellite. The Canadian capabilities in airborne radar were also emphasized with the STAR-3i system from Intermap Technologies which has been deployed on a commercial basis to undertake radar imaging of extensive areas in North & Central America and the Caribbean

from which DEMs (using InSAR techniques) and orthoimages have been generated. However, as noted above in the Introduction, a similar commercial capability in airborne SAR is now being developed in Europe through the activities of Aero-Sensing Radarsysteme. This is a spin-off company from DLR's Oberpfaffenhofen facility. In the Exhibition, it showed an impressive portfolio of successfully completed projects in the field sciences, hydrology and environmental monitoring, besides numerous examples of DEMs and perspective views of different types of terrain constructed from InSAR data. All of these were based on the use of its airborne X-, P- and L-band SARs.

• **Airborne Laser Scanning**

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laser scanning for DEM generation, it was a little bit surprising and somewhat disappointing to see relatively few of the companies engaged in this activity actually showing their products and results in the Exhibition. However Optech from Canada is one of the leading system suppliers and it did have an impressive stand. Also the German TopoSys company shared a booth with Aerodata International Surveys from Antwerp which undertakes much of the flying on behalf of Toposys in Western Europe. The Dutch Geodan company also showed some examples of the extensive airborne laser surveys that have been carried out along rivers, canals and coasts in Holland. So did the NRSC company for the U.K. Finally it must be noted that plenty of attention was being paid to the ground-based laser scanning systems shown by Cyrax Technologies.

GIS

This Congress was not primarily about GIS, so there were only a few of the GIS system sup-

pliers present in the Exhibition. However these few were of a high quality. On a shared stand, ESRI was emphasizing its cooperation and links with ERDAS in the areas of remote sensing and photogrammetry - e.g. using the newly released Stereo Analyst that can operate within the ARC/INFO environment. Also LH Systems SOCET SET now has a 3D bi-directional link to ESRI's SDE product. Laser-Scan from the U.K. also featured its cooperation with LH Systems in integrating its LAMPS2 object-oriented mapping system into the SOCET SET environment, besides demonstrating its own integrated IGIS system. Also the Congress Exhibition was the occasion for PCI to launch its new integrated Geomatica product on to the European market. Finally, the Star Informatic company from Belgium, which has a strong presence in French-speaking countries, showed its wide range of digital mapping and GIS products.

Aerial Film Photography

(a) Having started with airborne digital imagery, it does seem to be appropriate to close the circle and complete this review with some words about "old-fashioned" aerial photography - which is still the dominant source of imagery for both mapping and interpretation work. Thus the two main vendors of the new digital imagers - Z/I Imaging and LH Systems - still had a prominent place for their RMK-TOP and RC30 aerial photogrammetric film cameras, supplemented, in Z/I Imaging's case with examples of their reconnaissance cameras. The Japanese Osaka Optical company also showed its HIEI SE-IIa metric camera using 5 inch wide film. The Z/I and LH metric cameras still provide a superior performance in terms of angular coverage at a given image resolution at one-half of the price of one of the new digital imagers. So one can understand why both suppliers still see room for considerable sales of metric film cameras for quite some time to come.

(b) The main photographic material suppliers - Kodak and Agfa - also had large stands at the Exhibition with Kodak introducing its new high-resolution Aerocolour III negative film and Agfa showing its high-quality large-format output printers - as did the Cymbolic Sciences company from Canada. In this area, an interesting and somewhat unexpected exhibitor was the Russian FoMos company. It showed its quite extensive range of black-and-white and colour photographic materials, including a two-layer spectrazonal film. Besides which, two of the suppliers of electronic dodging printers - Egoltronics (American) and Scanatron (Swiss) - also showed their devices (the latter on the Capi Lux Vax stand) that produce such excellent results for most applications.

(c) Then there were several of the well-known commercial companies from Western Europe that carry out the actual aerial photographic missions. Prominent among these was the Italian CGR company from Parma which once again showed numerous eye-catching air photos on its stand. Others included Aerodata (Belgium); Arcadis/KLM Aerocarto (Holland); NRSC (U.K.); and Hansa Luftbild (Germany) - the last having its presence on the Z/I Imaging stand. Of course, all of these companies are photogrammetric service providers as well. In this context, it was also very interesting to note the information that was being given out in the Exhibition about the capabilities and activities of other commercial aerial photographic and mapping companies from further afield. These included Neshor Aerial Photography & GIS, Advanced Digital Mapping and Halperin-Felus from Israel; Geodis Brno and Nadir Fotogrammetrie from the Czech Republic; and GeoAnalysis from Greece. Presumably all of these companies are hoping for a share of the international mapping market as national boundaries are lowered, especially in Europe.

(d) Then, of course, there were the high-precision scanners used for the conversion of the film photography to digital form. On the evidence of the Exhibition, this market appears to have split into two distinct parts. At the top end of the range in terms of both sophistication and pricing, are the very successful Z/I Imaging PhotoScan TD and LH Systems DSW500 units. However the news at the Congress was that Vexcel Imaging in the U.S.A. has ceased production of its VX range of scanners that also lay towards the top end of the market. However there was much activity and interest in the other (much lower priced) end of this particular market. In this group, besides the well-known Wehrli scanner, the relatively new Vexcel Imaging Austria UltraScan 5000 attracted a lot of interest as did the DeltaScan from GeoSystems. One can expect that, with their low cost of ownership and their relatively good price:performance ratio, these scanners will also find a good market.

Conclusion

It was a first-class Exhibition, full of interesting exhibits and singularly informative in terms of keeping abreast of the rapidly changing photogrammetric and remote sensing scene.

Professor G. Petrie (g.petrie@geog.gla.ac.uk),
Department of Geography & Topographic Science,
University of Glasgow, Glasgow, G12 8QQ,
Scotland, U.K.
Internet: www.geog.gla.ac.uk/~gpetrie