A Report on the Croatia 2008 Conference

From Imagery to Map: Digital Photo

This well-established annual conference, which is now in its eighth year, was held in Porec, Croatia between 15th and 18th September 2008. As with the two previous meetings (which were held in Montenegro and Bulgaria), it took place in a Balkan country – on this occasion, being held in the conference hall of a hotel complex [Fig. 1] located in a beautiful wooded part of the coast of Istria on the Adriatic Sea. The conference was organised in a most competent manner by the Racurs company, the vast majority of the participants being users of the company's PHOTOMOD software products. Thus nearly 80 of the 120 participants were Russian-speaking, the rest being English-speaking. The format followed last year's very successful meeting in Bulgaria with coverage of airborne imaging and mapping on the first day and spaceborne imaging and mapping on the second day, while the third day was devoted to current and future developments in the Racurs company's software products. The final (fourth) day was spent on a sightseeing tour to Pula (with its magnificent Roman amphitheatre), Lim Fjord (with a marvellous seafood lunch) and Rovinj (with its wonderful old medieval town).

By Gordon Petrie

Figure 1 – The Conference in session at the Hotel Plavi, Porec [Source: Racurs].

I – Airborne Imaging & Mapping

National & Regional Mapping

After a brief but warm welcome from Dr. Adrov, the managing director of Racurs [Fig. 2 (a)], the conference started with a number of presentations devoted to national and regional mapping. These began with an account by E. Polanova – made on behalf of Prof. Katzarsky from ***GIS-Sofia*** – of the development of Bulgarian photogrammetry and its relations with ISPRS. This was followed by N. Liba of the ***Estonian University of Natural Sciences*** who presented an interesting discussion of the development of photogrammetry in her country since it regained its independence from the Soviet Union. Another speaker covering similar post-independence developments was G. Rumsas of the ***Institute of Aerial Geodesy*** in Lithuania. Initially help was given by donor countries such as Switzerland and France. However, over the last five years, PHOTOMOD has come into widespread use within the country after first being utilized in the mapping of the 650 km long border between Lithuania and Belarus. In the case of Belarus, I.G. Nayfeld of the ***Belgiprozen Design Institute*** described how airborne and spaceborne image data is being used to renew and update land use maps throughout the country, again using PHOTOMOD for the required photogrammetric processing operations.

Figure 2 – (a) Dr. Adrov, the Managing Director of Racurs, welcomes the participants to the Conference.

Commercial Mapping

Turning next to the commercial sector, another contribution came from L. Afanasyeva of the Russian ***Meridian+*** company - which is one of the biggest single users of PHOTOMOD software (with over 80 licences) - in which she described her experiences during the first year of a new branch office that has been opened by the company in the city of Tula. Dr. Zunino of the ***Studio SIT*** company in Italy also gave an account of the somewhat traumatic experiences of setting up a small company and getting it established in the mapping and GIS field. This included the purchase and use of a Sky Arrow microlight aircraft and a Rollei medium-format digital frame camera

grammetric Technologies

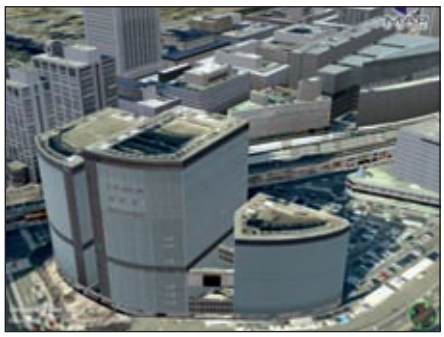


Figure 3 – A 3D perspective view of part of the city of New Delhi based on a digital model formed from stereo-photogrammetric measurements of the buildings with the textures added from a photographic library. [Source: MapWorld Technologies Ltd.]

mounted on a GGS Speyer stabilized platform and, of course, the use of PHOTOMOD for the photogrammetric processing of the resulting imagery. After which, V. Petrova of the ***GIS-Sofia*** company described the biggest large-scale mapping project ever undertaken in Bulgaria. This involved the company using PHOTOMOD to carry out the photogrammetric processing of 61 strips containing 6,912 aerial photos that had been acquired on its behalf by the German Hansa Luftbild company using an Intergraph DMC large-format digital camera. Then M. Gromov from the ***Geo*** company in Omsk made a presentation on the projects performed by his company during last 8 years. His company produces orthophotos and digital maps from airborne and spaceborne images. Stereo and mono plotting is used for making digital plans and maps over the scale range 1:500 to 1:10,000. Some of the plans are delivered to the customers in AutoCAD format. Finally, within this section, there was a most interesting presentation by S. Kumar of ***MapWorld Technologies***, which acts as the Indian agent for the PHOTOMOD software and is also a major photogrammetric service provider within India. The main part of his presentation was devoted to the New Delhi 3D Project. This involves the photogrammetric plotting (at 1:2,000 scale), DEM production and video mapping of all the buildings in the city, together with the mapping of its underground utilities and the digitization of existing property records for the whole city. Based on the massive data sets resulting from all of these operations, 3D models of the extensive urban area [Fig. 3] are being created, together with a cadastral information system for the whole of India's capital city.

Economic Considerations

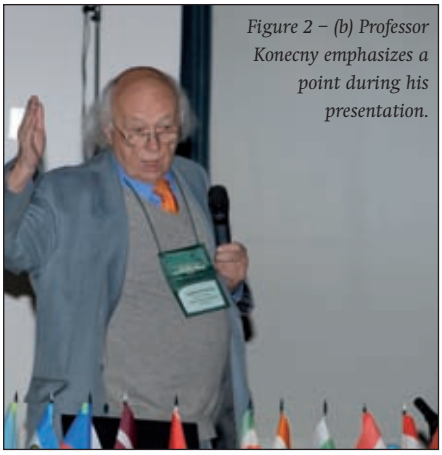


Figure 2 – (b) Professor Konecny emphasizes a point during his presentation.

Next came a presentation on more general matters pertaining to photogrammetric mapping operations. This was given by Prof. Konecny of the ***University of Hannover*** [Fig. 2 (b)]. He first outlined what he considered to be the most significant steps in the development of photogrammetry and then followed this rapid historical survey by turning to his main theme of the economic considerations that are significant in photogrammetric mapping. Important current events and trends include (i) the buying up of a significant number of smaller local mapping companies by multi-national organisations such as Blom and Fugro; (ii) the outsourcing of a great deal of photogrammetric mapping work to countries with low labour costs; (iii) the trend for much hardware and software development to be controlled from afar by large U.S.-based companies such as Microsoft, Intergraph, Trimble and ERDAS; and (iv) the haphazard, misguided and quite unjustified issue of patents covering quite tiny technical modifications to long-established photogrammetric procedures, especially in the U.S.A.

Airborne Digital Imaging Technologies

All of which led to a series of presentations on current and future developments in the airborne digital imaging technologies. Dr. Sechin of ***Racurs*** gave his personal observations and experiences resulting from the increased use of these technologies, comparing the various parameters – GSD values, framing rates, colour generating methodologies, GPS/IMU performance, etc. – for a number of airborne digital imaging systems that are now in widespread

Figure 2 – (c) Professor Leberl (on right) making his presentation, watched by his chairman, Mr. Schreiber (on left). [Source: Racurs]

use. Of particular note is that, due to the limitations in the format size of current digital imagers, the typical value of the base:height ratio - which is or was regarded as a vital parameter - has fallen to half (0.3 versus 0.6) of that of the Wild/Leica and Zeiss wide-angle metric film cameras that are still in common use. Prof. Leberl of the ***Technical University of Graz*** [Fig. 2 (c)] gave one of his typically flamboyant presentations (with really excellent graphics) on the Microsoft Virtual Earth Project and on the contribution of the related photogrammetric imaging technologies to this project, especially the UltraCam series of large-format digital frame cameras [Fig. 4] that he has developed for Vexcel Imaging, which is now part of the Microsoft empire. In this, he was backed up by a much shorter presentation given by Dr. Medvedev of ***Geolidar***, which distributes the UltraCam and puts the cameras into operation within the CIS countries. The total number of UltraCam cameras that have been sold has now passed the 100 mark.

P. Schreiber of ***Leica Geosystems*** then gave a systematic account of his company's digital airborne solutions with a strong emphasis on the new products - the ADS80 large-format pushbroom line scanner and ALS60 laser scanner [Fig. 5] - that had been introduced at the recent ISPRS Beijing Congress and also on the RCD105 medium-format digital frame camera that was introduced last year. Next the present writer (G. Petrie of the ***University of Glasgow***) gave an overview of the acquisition of systematic digital oblique aerial photography using multiple

Figure 4 – This example of a Vexcel UltraCam-X large-format digital frame camera, mounted on a Somag GSM3000 gyro-controlled platform, is operated by the Croatian company, Geofoto, based in Zagreb. [Source: Geofoto]

cameras. These included (i) various fan configurations providing increased cross-track coverage of the ground; (ii) block configurations to provide larger formats and improved ground area coverage and to carry out persistent surveillance of specific areas; and (iii) those systems that are designed to produce deliberately highly oblique photography for visualization, modelling and rendering purposes. This was followed by a presentation by Y. Raizman of ***VisionMap Ltd.*** from Israel who described his company's A3 stepping frame camera [Fig. 6] that produces a systematic series of digital oblique photographs at high speed in the cross-track direction to provide a very wide angular coverage of the ground. This camera had been discussed previously in the Conference on Laser Scanning & Digital Aerial Photography held in Moscow in December 2006 that was reported in the issue of GeoInformatics for January/February 2007, but obviously the system has been developed further since then.

Airborne Laser Scanning & SPAN Technology

To round off this first day, there were two other short contributions. The first of these on the use of airborne laser scanning in conjunction with digital imaging was given by Dr. Medvedev and A. Likhobabin of the ***Geolidar*** company, which represents Optech within Russia. Finally A. Yankush of the ***GNSS Plus*** company, which represents NovAtel in Russia, outlined the latter's SPAN technology. This combines GNSS receivers and inertial systems to provide positional and attitude values, even when satellite reception is restricted and a purely GNSS position cannot be obtained. His presentation was backed up by the results of various case studies.

II - Spaceborne Imaging and Mapping

Spaceborne Image Data Acquisition & Processing

As in last year's conference held in Bulgaria, this second part of the programme started with contributions from two of Russia's leading companies in the area of remote sensing image data acquisition and processing. The first of these two companies, ***Sovzond***, contributed two presentations. One, given by S. Lyubimtceva, discussed the concept of a branch or local monitoring centre that would feature the following sub-systems – (i) on-line data acquisition; (ii) image data processing; and (iii) automatic analysis and further thematic processing of the image data. It appeared from this presentation that Sovzond is more interested in supplying and setting-up such local centres for various government agencies rather than implementing the concept on its own account. The second presentation by O. Kolesnikova gave detailed information on Sovzond's processing solutions which are based on ITT's ENVI and IDL software products and on the Bentley Map GIS system for which Sovzond acts as the agent for the CIS countries.

The second company, ***ScanEx***, is very well known as a constructor and major supplier of ground receiving stations. However, the company's Business Development Manager, A. Golovina, chose to highlight the company's continuing development of its geo-portals such as Kosmosnimki [www.kosmosnimki.ru]. An example of the content is shown in Fig. 7. These portals are strongly linked with the three powerful regional ground stations that the ScanEx company operates on its own account, providing coverage of all of Russia from the French SPOT and Indian IRS satellites. This coverage is expected to be supplemented in future by the higher resolution imagery that is available from the new Indian Cartosat-1 and -2 satellites and from the Formosat-2 and Kompsat-2 satellites, whose image data is being downloaded by SPOT

Figure 5 – (a) The new Leica ADS80 large-format pushbroom digital line scanner; and (b) the ALS60 airborne laser scanner, were both introduced to the market at the recent ISPRS 2008 Beijing Congress. [Source: Leica Geosystems]

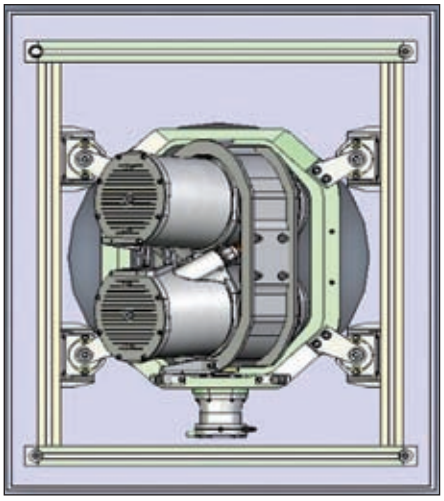
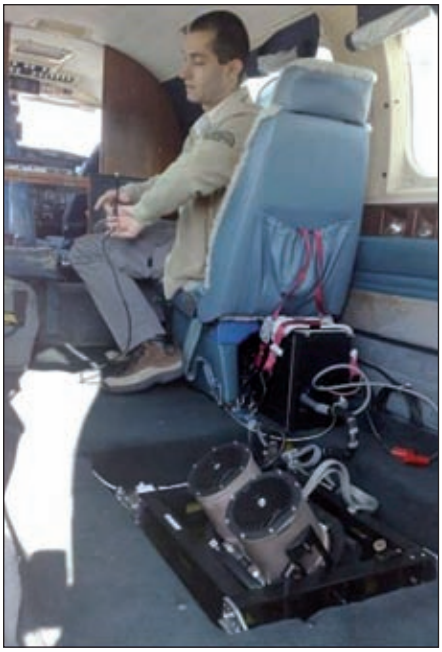


Figure 6 – The VisionMap A3 digital stepping frame camera generates oblique images cross-track - showing (a) a plan drawing, and (b) an example of the camera mounted in an aircraft. [Source: VisionMap Ltd.]



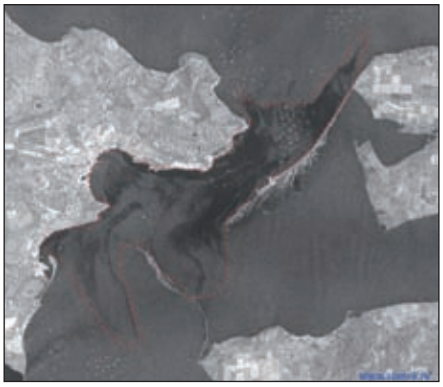


Figure 7 – A Radarsat image of the Kerch Strait which connects the Sea of Azov to the Black Sea; the extent of the area covered in oil that was spilled from a tanker that was damaged in a violent storm during November 2007 is shown in red. [Source: Radarsat, via ScanEx]

Image. The final speaker in this section was A. Shumakov of ***GeoEye*** who had the distinct pleasure of reporting the successful launch of the new GeoEye-1 satellite [Fig. 8] only a day or so before the Conference began. He also announced the simplification of GeoEye's imagery products into three categories – (i) Geo, which is a radiometrically corrected and map oriented image supplied in RPC format; (ii) Geo Professional, which provides an orthorectified image; and (iii) GeoStereo, which, as the title suggests, provides a stereo-pair of images for DEM production and 3D feature extraction. Mr. Shumakov also revealed that GeoEye has already ordered certain of the long-lead items that are needed for the construction of its next GeoEye-2 satellite.

Photogrammetric Processing of Optical Imagery

The first contribution to this topic came from V. Razumova of ***Surgutneftgaz***, which is engaged in the exploration and development of new oil and gas deposits. Within this context, the company makes extensive use of spaceborne imagery, in particular optical image data from the QuickBird, ALOS/AVNIR and Aster satellites. This is used to produce orthoimages at scales of 1:5,000 (QB), 1:50,000 (AVNIR) and 1:100,000 (Aster) respectively using the various different modules for each image type that are available within PHOTOMOD 4.3. Next, J. Jovic of the Croatian company ***Geofoto*** gave details of Project Leon that aims to develop the rural infrastructure of Leon Province in Nicaragua. As part of this project, Geofoto has produced orthoimage maps of the city of Naragote using QuickBird imagery in conjunction with the PHOTMOD software. After which, there was a report from Dr. M. Sinkova of the ***Goszemcadastrsyomka (VISKHAGI)*** cadastral organisation on the tests that she has carried out into the feasibility of creating orthoimages at 1:10,000 scale using the high-resolution (1 m GSD) imagery that is available from the Russian Resurs DK-1 satellite [Fig. 9], again using PHOTOMOD. The geometric accuracy of the resulting orthoimage was very satisfactory when compared with existing large (1:2,000) scale orthophotos of the test area. The interpretation of linear features was also satisfactory, though long shadows were a problem since the Sun elevation angle was low at just less than 12 degrees above the horizon when the DK-1 images were acquired. I. Strashko from the ***Belgeodesia*** company then outlined how the revision of the 1:100,000 scale topographic map series of Belarus is being carried out using pan imagery with a GSD value of 5 m that has been acquired by the SPOT-5 satellite. Finally E. Babeeva of the ***Aerogeofot*** company gave an account of the successful construction of mosaics from SPOT-2, -4 and -5 imagery from different years and with different GSD values using the PHOTOMOD GeoMosaic stand-alone module that first carries out the geo-referencing of raster images, followed by their mosaicing.

Spaceborne Radar Sensors & Processing

This session was led off by the present writer (G. Petrie) who outlined the transformation that is currently taking place regarding the operational availability of spaceborne SAR imagers. These include (i) the several X-band SARs that are being made operational by German and Italian space and defence agencies and the Israeli TecSAR mini-satellite; (ii) the continuity in C-band SAR imagery that is now being offered by the recently launched Radarsat-2 and the Indian RISAT that will be launched soon; (iii) the Russian Kondor-E and Chinese HJ-1-C satellites that will operate in the hitherto little-used S-band; and (iv) in the L-band area, the PALSAR imager mounted on the Japanese ALOS satellite that is already operational and will be followed by several other similar SAR imagers that are currently under construction in Russia (Akron-2), Argentina (SAOCOM) and Brazil

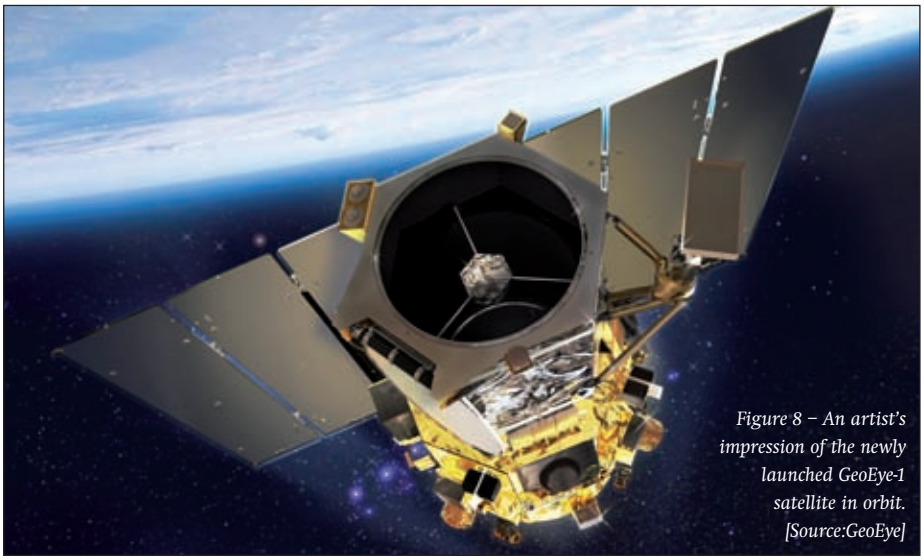


Figure 8 – An artist's impression of the newly launched GeoEye-1 satellite in orbit. [Source:GeoEye]

Figure 9 – High-resolution images of the area lying behind the sea-front in the city of Izmir, Turkey acquired from (a) the Resurs-DK1, and (b) QuickBird satellites, are quite comparable in terms of their quality. [Sources: (a) NTs OMZ, Moscow; and (b) Digital Globe, via Europa Technologies Ltd. & Google]

(MapSAR). His presentation was followed by that given by R. Lanzl from ***Infoterra***, Germany. He discussed in detail the products that are now available from the TerraSAR-X mission [Fig. 10] and those that will be produced by the TanDEM-X satellite when it is launched and will come into a tandem operation with TerraSAR-X next year (2009). Then followed another interesting contribution made jointly by A. Vasileyskiy of ***NIIAS*** and R. Shuvalov of ***Racurs***. This was concerned principally with the monitoring of the railway infrastructure in karst areas (with sink holes and surface subsidence) and also in the mountainous area of the North Caucasus lying behind the coastal cities of Sochi and Tuapse on the Black Sea (which will be the site of the Winter Olympics in 2014). For these tasks, they employed the SAR interferometric techniques that are available in the PHOTOMOD Radar software.

Interpretation of SAR Imagery

The next group of papers were mainly concerned with the interpretation of SAR imagery. The first was given by L. Shagarova from the ***NCSRT*** company in Kazakhstan, who concentrated on oil spill detection in the Caspian Sea using Radarsat images in conjunction with a combination of ENVI and the Racurs PHOTOMOD Radar software package. The second paper given by V. Lazareva of ***Racurs*** gave an interesting assessment of the image interpretation properties of TerraSAR-X imagery based on tests carried out over three different areas (Moscow, New Urengoy and Saratov) within Russia. Large buildings, main roads and railways and wide rivers are easily recognised and mapped from the TerraSAR-X imagery, but smaller buildings, narrow roads and small streams are not. Then followed two detailed papers presented by I. Kantemirov and B. Baranov of the ***VNIIGAZ*** company that gave the results of constructing DEMs and monitoring ground movements using interferometric SAR (InSAR) techniques over the vast territories of various oil and gas fields within Russia. These projects used SAR images acquired by the Envisat and ALOS satellites with their respective ASAR (C-band) and PALSAR (L-band) radar imagers.

Forest Mapping from RS Data

This topic had only two presentations. The first of these was given by T. Chernenkova of the ***RAS Centre for Problems of Ecology and Forests*** that forms part of the Russian Ministry of Forest Management. This covered the utilization of spaceborne image data for the cartographic mapping and modelling of the vast areas of forest that exist within Russia, carried out in conjunction with forest mensuration and field survey operations. Because of its availability and its suitability for this particular purpose, Landsat GeoCover imagery is used widely. One of the test areas was the nickel mining area near Murmansk where the pollution generated from the resulting metallurgical production has had a markedly negative impact on the surrounding vegetation and forests. The affected area has been mapped successfully in detail using the imagery. The second paper was given by A. Bonyad of ***Guilan University*** in Iran and was concerned with a statistical analysis of the satellite remote sensing data used for forest cover mapping in Northern Iran.

III – Racurs & PHOTOMOD

To help mark the 15th anniversary of the founding of the Racurs company, the third day started with an account by Professor Bykov of ***Goszemcadastrsyomka (VISKHAGI)*** of the progress in the development of the PHOTOMOD software – between Version 1.52 and the current Version 4.3 – that his organisation had utilized over the years. It now has over 70 work stations in Omsk using the software; the total number of workstations in all VISKHAGI branches now exceeds 300. This account was followed by a presentation by M. Boroumand of the ***NPR*** company, which acts as the agent for PHOTOMOD in Iran. He strongly advocated the development of new video-based multi-media presentations to be used both to train users of PHOTOMOD and for marketing and distance learning purposes – since apparently the text-based manuals that are currently available are used mainly for reference purposes.

These two introductory papers were followed by three presentations made by staff members of the ***Racurs*** company who outlined both the current and the planned developments in the PHOTOMOD software. D. Kochergin, the head of the company's technical support department, described the main features of the new GCP Survey module. This allows field survey measurements, sketches, photos and diagrams to be accommodated directly into the relevant photogrammetric project for which copies of the aerial photos and the block layout are available for reference during the field work. Dr. A. Sechin, the scientific director of Racurs, then outlined the new possibilities of Version 4.4 of PHOTOMOD. Besides the GCP Survey module, there are new capabilities for distributed processing and the 3D modelling and rendering of buildings within cities, with an extended library of symbols for trees, street furniture, etc. A Stereo AutoCAD module is also

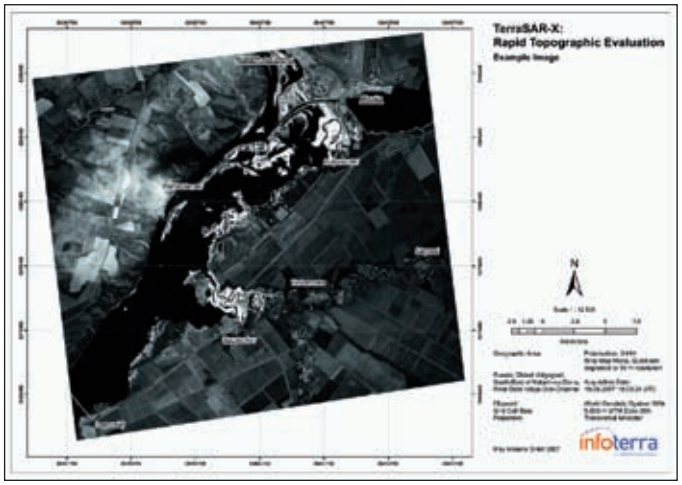


Figure 10 – This radar image map of an area of the River Don in Russia has been produced by Infoterra GmbH, based on a TerraSAR-X image acquired in strip-map mode with a GSD value of 10 m. [Source: Infoterra GmbH]

now available in addition to the existing MicroStation module. Finally A. Elizarov gave the audience some idea of what is planned for the next major release (Version 5.0) which will become available next year. This will include improved project management and a more flexible work flow; improved raster image support; an improved correlator; a new stereo-processing module that will combine the features of the current DTM and StereoDraw modules; distributed batch processing; a new optimized data structure to support very large blocks; and the use of professional video cards that support and make use of the Open Graphics Library (OpenGL) to draw complex 3D models from simple primitives. After this series of presentations, there were separate Master classes held simultaneously both in Russian and in English where most of these developments were demonstrated in detail.

Conclusion

In summary, the Conference provided a very busy three days of presentations and discussions that were really valuable in providing an insight into many of the developments and applications in mapping and photogrammetry that are taking place in Russia and some of the countries of Eastern Europe. Further added value was given by the Conference in providing the opportunity for Western participants to make new contacts and renew previous contacts in these countries. While, for the participants from the Eastern countries, the Conference offered them the chance to hear and see something about the developments in the photogrammetric and remote sensing hardware, software and systems that are taking place in the West. It was a really interesting, informative and very enjoyable Conference.

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