

# A Report on the Bulgaria 2007 Conference

## From Imagery to Map: Digital Photo



*The 7th International Scientific & Technical Conference with the title "From Imagery to Map: Digital Photogrammetric Technologies" was held in Nessebar, Bulgaria between 17th and 20th September 2007. The Conference was organised jointly by the Racurs and GIS-Sofia companies from Russia and Bulgaria respectively. The previous six conferences in the series had been held as International PHOTOMOD Users Conferences - PHOTOMOD being the principal software product from the Racurs company. The change in the Conference title reflected the desire of the organisers to widen the scope of the meeting with speakers and participants from Western Europe and from Racurs' partners in Russia and elsewhere.*

By Gordon Petrie

**Fig. 1 - (a)** - The Conference participants assembled on the staircase to the Hotel pool and garden.

**(b)** - The audience listening to a presentation in the Neptune Hall.  
(Source: Racurs)

### Conference Facilities & Programme

The Conference was held in the Nessebar Bay Hotel - one of three large IFA hotels linked together and located on a single site on Bulgaria's Black Sea coast just south of the town of Nessebar. The facilities were excellent, both in terms of the hotel accommodation and food and the actual Conference venue - which was the hotel's Neptune Hall [Fig. 1]. The Conference was well organised, had good audio and projection facilities and featured a really excellent Russian/English translation service. Furthermore a booklet containing the abstracts and summaries of almost all the presentations was issued to all the participants on their arrival at the Conference registration desk. There were 110 participants, 60 of whom were from Russia and Belarus - who all arrived together as a group on a char-

# grammetric Technologies

ter flight from Moscow. The lecture programme was divided into three roughly equal parts. The first day was devoted to airborne imaging and mapping; the second day to spaceborne imaging and mapping; and the third day to recent developments in Racurs' software products. On the fourth day, most of the Conference participants went on a sightseeing tour along the coast northwards to the city of Varna. Besides which, a comprehensive series of dinners and social events took place in the evenings.

## I - Airborne Imaging & Mapping

After the formal opening speeches of welcome from the Conference organisers and sponsors [Fig. 2] and from Mr. T. Boev, Head of the Bulgarian Cadastral Agency, the first lecture was delivered by Prof. Katzarsky from Sofia, who is an honorary member of ISPRS. He first outlined briefly the development of photogrammetry in Bulgaria and then covered the mapping and cadastral activities of the municipally-owned *GIS-Sofia* company for which he acts as a consultant. The PHOTOMOD software is used by GIS-Sofia to process airborne, spaceborne and terrestrial imagery for its mapping applications [Fig. 3]. The next speaker on the programme was Prof. Konecny from the University of Hannover and a former president of ISPRS [Fig. 4]. He was in his usual excellent form, discussing all the various current issues of digital mapping, and providing some very interesting data on the pricing and relative costs of orthophoto production and line mapping. He also highlighted the increasing tendency for photogrammetric mapping operations to be oriented towards the generation of data that has been



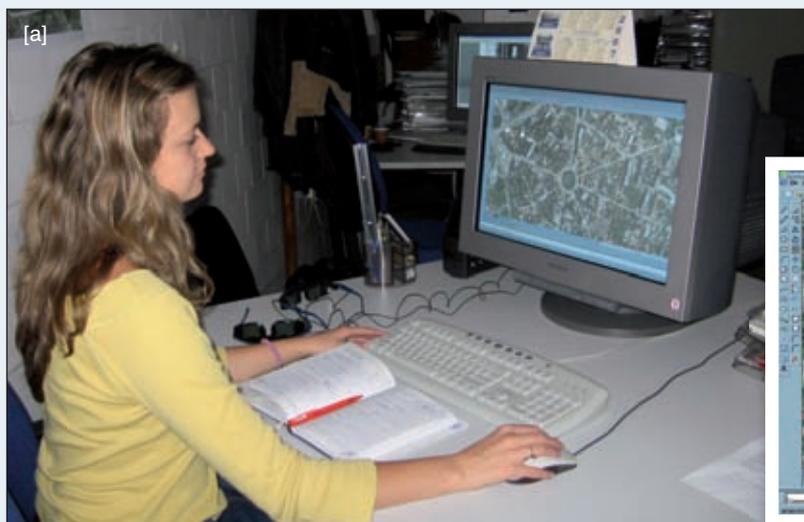
**Fig. 2 -** The Conference organisers - (a) Dr. Adrov, managing director of Racurs; and (b) Prof. Katzarsky of GIS-Sofia - together with (c) Dr. Gershenzon, managing director of the ScanEx company - which acted as sponsor of the Conference. (Source: Racurs)

structured specifically for inclusion in GIS databases instead of the CAD (MicroStation and AutoCAD) data that has been produced in the past. He was followed by G. Goldberg from the Metrum company who gave an account of the development of digital photogrammetry and the automated processes that it allows - as seen from his own personal perspective within Latvia.

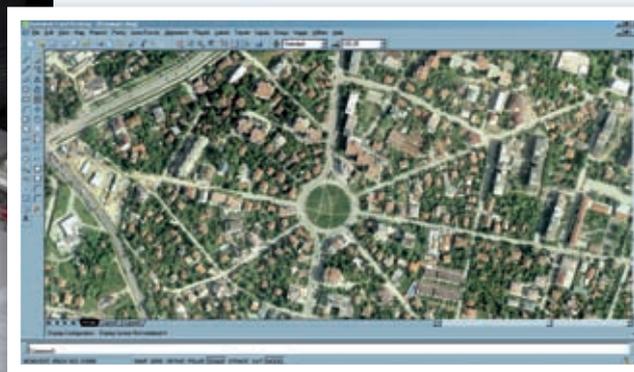
## Airborne Digital Imaging

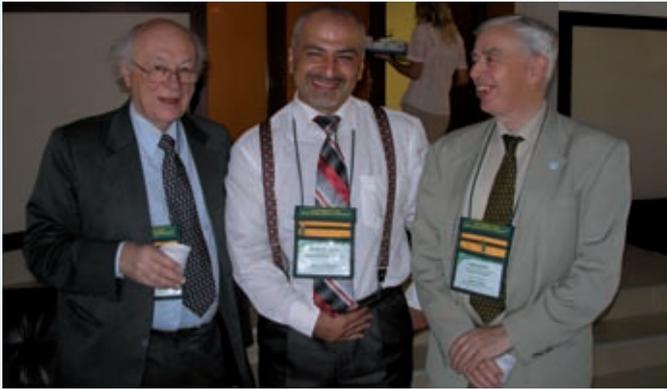
The second part of the airborne section commenced with present writer (G. Petrie) giving an overview of airborne digital data capture systems, including both frame and line imaging technologies together with radar and

laser scanning systems. The growth in multiple lens frame camera systems having many different geometric configurations is a noticeable trend at the moment. After this, came a series of presentations devoted to the *Leica ADS40* pushbroom line scanner - apparently designed to provide a balance to the various presentations on the processing of Vexcel UltraCam digital frame camera data using PHOTOMOD that had been given in the previous (6th) conference held in Montenegro last year (2006). This



**Fig. 3 - (a)** - A photogrammetrist operates a digital photogrammetric workstation (DPW) carrying out orthophoto production in the GIS-Sofia office using the PHOTOMOD software. (b) - The resulting digital orthophoto of a part of Sofia. (Source: GIS-Sofia)





**Fig. 4** - Two of the invited speakers - Professors Konecny (left) and Petrie (right) - together with Mr. Bouroumand (centre), managing director of the Nama Pardaz Rayaneh (NPR) company, which acts as the distributor of PHOTOMOD software in Iran (Source: Racurs)

series of presentations started with one by V. Zaitsev from Leica Geosystem's Moscow office who reviewed the company's latest airborne products. Besides the second-generation ADS40 scanner, these included the new Leica RCD105 medium-format digital frame camera and the ALS-CM Corridor Mapper (an airborne laser scanner) [Fig. 5]. It also contained the interesting news that his company has now supplied five ALS50 airborne laser scanners to various Russian companies. He was followed by Dr. Titarov from Racurs who outlined in a very clear manner the overall approach and the detailed procedures used to process ADS40 line scanner data within PHOTOMOD after the preliminary processing had been carried out using Leica's GPro and ORIMA software. This presentation was reinforced by another contribution by Dr. Sinkova of the research division of the Goszemcadastrsyomka (VISHKHAGI) cadastral organisation which operates two ADS40 scanners. She dealt with the processing of ADS40 image data for the production of orthophotomaps for an area near Moscow from imagery flown at altitudes of 1,500 m and 2,500 m respectively.

### Aerial Film Photography

After which, the remaining presentations in this section were concerned with more traditional methods using photos acquired by metric film cameras - which still constitute the vast majority of air-

borne imagers being used for mapping purposes in Russia. They included a paper given by Prof. Bykov of the West Siberian branch of Goszemcadastrsyomka (VISHKHAGI) on the field calibration of a Leica RC30 metric film camera (and a Hasselblad digital camera) using a test field established near the city of Omsk. This was followed by (i) a detailed paper by V. Petrova and Prof. Katzarsky of GIS-

Sofia on the accuracies of aerial triangulation achieved using PHOTOMOD with a block of photographs acquired over a test field using a Z/I Imaging RMK 30/23 film camera; and (ii) an amusing account of the trials, tribulations and success encountered in setting up a new photogrammetric production office in the city of Tula that was given with great enthusiasm by L. Afanasieva of the Meridian company.

Finally, within this section, there was a presentation by Prof. A. Guk, head of the Photogrammetry & Remote Sensing Dept. of the Siberian State Academy of Geodesy (SSGA) based in Novosibirsk. He outlined the changes to education within his institute arising from the adoption of a two-tier Bachelor/Master's degree structure that is now being implemented in Russian universities. Prof. Guk was somewhat sceptical about the value of these changes.

## II - Spaceborne Imaging & Mapping

This part of the programme held on the second day comprised a number of overview presentations followed by several application papers.

### Sovzond

The first of the overview presentations - given by M. Bolsunovsky of Sovzond - provided a systematic review (i) of the non-military remote sensing satellites that are currently in operation world-wide; and (ii) of the coverage of Russia that is available from these satellites. The Sovzond company acts as a distributor of spaceborne imagery of all types. What was of particular interest to western participants was the news it gave about the current status of Russian remote sensing satellites. The **Monitor-E** satellite that was launched in August 2005 has provided pan and three-band multi-spectral images with 8 m and 20 m GSD (Ground Sampled Distance) values respectively. However apparently the satellite is not working too well at the moment and only a limited amount of Monitor-E imagery is available. The **RESURS-DK** satellite was launched in June 2006 and is delivering high-resolution pan images with 1 m GSD and three-band multi-spectral images with 3 m GSD.

### ScanEx

The interesting introductory paper by M. Bolsunovsky was supplemented by another overview of Geo-Portals. This was presented by Dr. Gershenson, managing director of the ScanEx company - which was acting as the sponsor of the Conference. Again this presentation was of very considerable interest. The ScanEx company is well known both as a supplier of its large UniScan ground receiving stations and of a large number of smaller and less powerful stations. Indeed it has supplied a comprehensive network of these stations to national agencies and regional authorities right across Russia [Fig. 6]. Besides which, ScanEx operates three powerful stations on its own account, located in Moscow, Irkutsk (Baikal) and Magadan (in the Far East). The resulting image data - especially that received from the French SPOT and Indian IRS satellites - has allowed a number of portals to be established to help disseminate the space imagery of Russia to a wider audience. These include the portals set up by **Yandex** ([www.yandex.ru/](http://www.yandex.ru/)) and **ScanEx**



**Fig. 5 - (a)** - The new Leica ALS Corridor Mapper (CM) airborne laser scanner complete with its control electronics cabinet and its aircraft-certified LCD displays used for flight management and system control purposes.

**(b)** - The new Leica RCD105 medium-format airborne digital frame camera that produces 39 Megapixel colour images. The camera is designed to be used in conjunction with the company's ALS scanners, but it can also be used as a stand-alone imager. (Source: Leica Geosystems)

(<http://catalog.scanex.com/> and <http://eostation.scanex.ru/>). Besides which, ScanEx appears to be the main inspiration and driving force behind the establishment of other Web sites such as *Transparent World* ([www.transparentworld.ru/en/](http://www.transparentworld.ru/en/)) and *Kosmosnimki* (<http://new.kosmosnimki.ru/eng/>) that are oriented towards the supply of low-cost space imagery over the Internet for environmental monitoring and education purposes respectively.

### DMCii

Yet another overview paper in the same general area of spaceborne remote sensing was given by O. Hawkins of the DMC International Imaging (*DMCii*) company from the U.K. [Fig. 7]. In many ways, it provided an update to the article on the DMC (Disaster Monitoring Constellation) that was published in the March/April (3/2007) issue of *Geoinformatics*. The new UK-DMC-2 and Spanish Deimos-1 micro-satellites - which are scheduled to be launched and join the existing constellation in 2008 - will provide very wide-swath (660 km) multi-spectral imagery with a GSD of 22 m. Furthermore, when it is launched and joins the DMC constellation in 2009, the new larger and heavier NigeriaSat-2 mini-satellite will combine a high-resolution imager producing 2.5 m GSD pan and 5 m GSD multi-spectral images over a 20 km swath with a medium-resolution imager generating 32 m GSD multi-spectral images over a 300 km swath. Besides which, the DMCii company is now able to supply pan and three-band multi-spectral imagery with 2.8m and 5.6 m GSD respectively that has been acquired by the TopSat micro-satellite which was built for the UK Ministry of Defence and the British National Space Centre (BNSC) and launched in October 2005. On the other hand, the Turkish Bilsat micro-satellite has dropped out of the DMC constellation - "since it has now completed its mission!"

### KB Panorama

This is another Russian company with strong links to Racurs. N. Panteleeva presented an account of its activities to the Conference participants. Apparently the photogrammetric data that is generated by PHOTOMOD is fully compatible with the software that has been developed by KB Panorama. The company's software developments include a *GIS Toolkit* that can be used to develop GIS applications within a Delphi and C++ environment. The company has also developed a *GIS WebServer* that allows remote access to geospatial databases and electronic maps. This is based on ASP.NET technology and functions under the control of Internet Information Services (IIS) within the .NET Framework 2.0 environment. It provides the user with a Web interface to work both with



**Fig. 6 - (a)** - A map showing the locations of the network of UniScan ground receiving stations. They include stations installed in Valladolid (Spain), Baku (Azerbaijan), Tehran (Iran), Dubai (U.A.E.) and Almaty (Kazakhstan) as well as those located within the Russian Federation. (Source: ScanEx)

**(b)** - The receiving antenna of the ScanEx UniScan ground receiving station installed in the city of Samara which is located on the Volga River in the south-eastern part of European Russia.

digital maps and with the geospatial data that is contained in the tables of a database. The results are generated in the form of Web pages.

### Geo-Alliance

This Russian company is also involved in the processing of a large variety of high-resolution space imagery. In her presentation, O. Gromyko from Geo-Alliance outlined the imaging characteristics, including the different operational modes, of the newly launched TerraSAR-X radar satellite for which her company is the Russian agent. She also discussed the various potential applications of the resulting high-resolution SAR imagery.

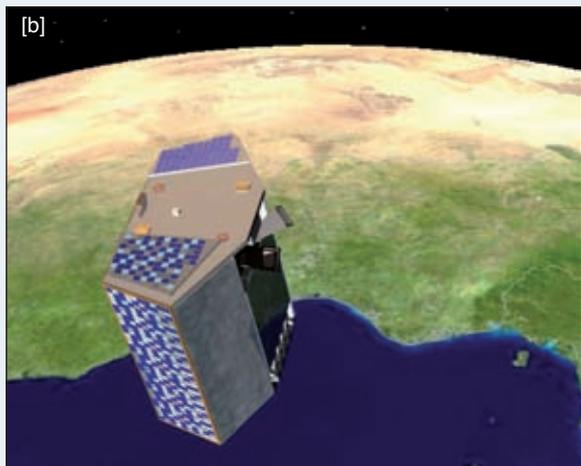
### Mapping @ Medium Scales

The *Sovzond* company, already mentioned above, contributed a further two papers concerned with this subject area, both of which were presented by A. Belenov. The first of these outlined the technical solutions and procedures being implemented by his company to process spaceborne image data. This involves the use of ITT's ENVI software for thematic mapping and spectral analysis and the Bentley Geospatial desktop software for the incorporation of the resulting data in a GIS database. His second paper outlined the procedures being used to update 1:25,000 scale topographic maps. Apparently there are 300,000 individual sheets in this Russian series, a large percentage of which now need revision. He outlined

the use of medium-resolution and fairly high-resolution imagery from the ALOS, Cartosat-1, SPOT-5 and Formosat satellites for the purpose. Another pair of papers about the revision of the 1:25,000 scale map series from spaceborne imagery were contributed by the *Goszemcadastrsyomka (VISKHAGI)* cadastral organisation. These two papers were presented by T. Osintseva and I. Nizhegovodtsev from the organisation's West and East Siberian offices located in the cities of Omsk and Irkutsk respectively. In each case, SPOT-5 imagery was processed using PHOTOMOD to produce orthoimages at 1:25,000 scale in conjunction with DEM data derived from digitized contour lines extracted from existing topographic maps of the areas that were being revised.

### Mapping @ Large Scales

E. Kokhava from the *Belgiprozem* organization in Belarus provided an account of its use of PHOTOMOD in processing spaceborne image data for the generation of orthoimages, land use maps and the data required for inclusion in land information systems (LIS). SPOT-5 and ALOS image data is being used to generate maps at 1:10,000 scale for rural areas, while QuickBird and IKONOS high-resolution data forms the basis for mapping at 1:2,000 scale. Next E.Kubzeva from *UralGeoInform* based in Yekaterinburg also provided a report on the use of PHOTOMOD to carry out the photogrammetric processing required for the updating of urban master plans at 1:2,000 scale using



**Fig. 7 - (a)** - Spaceborne images showing the flooding along the River Danube that occurred in Northern Bulgaria during June 2005. The upper photo is a Landsat-7 reference or baseline image showing the area without flooding. The lower photo is a mosaic compiled from space imagery acquired by DMCII satellites showing the actual flooding. (Source: DMCII; Images processed by SERTIT, Univ. of Strasbourg) **(b)** - An artist's impression of the NigeriaSat-2 mini-satellite which is now under construction at SSTL in the U.K. The satellite is planned for launch in 2009. (Source: SSTL)

stereo-imagery acquired by the IKONOS satellite. Finally M. Gromov of the **NPF Geo** company based in Omsk provided still more examples of the monitoring of changes and the updating of large-scale maps, both in large urban areas such as the city of Omsk and in smaller towns and villages in Siberia using data from the QuickBird satellite. It was really quite unexpected, indeed surprising, to hear about all these examples of change detection and map revision based on spaceborne imagery from Russian users - especially when the same tasks are more often undertaken using airborne imagery in Western countries.



**Fig. 8** - Map showing the overall distribution of PHOTOMOD licences. (Source: Racurs)

### III - Racurs & PHOTOMOD

#### Status & Developments of PHOTOMOD

The third day was concerned with the overall scope and current activities of the Racurs company and with recent developments of its PHOTOMOD software. Dr. Adrov, the managing director of the company, gave the introductory overview. Racurs has now issued 895 licences for PHOTOMOD, of which 219 are network licences. In total, there are around 3,500 workplaces licensed to use PHOTOMOD world-wide [Fig. 8]. The Russian VISKHAGI cadastral organisation has 250 licences, while in Belarus, the Belgiprozem organisation has over 50 licences. Recently Racurs has been gaining many new customers in Asia. Dr. Adrov also outlined the new features that have been incorporated in the latest release (4.3) of PHOTOMOD and those that users can expect in version 5.0 of the software which will be released in 2008. These new features were expanded upon by Dr. Y. Sechin, the scientific director of Racurs. In particular, he concentrated on the new bundle adjustment of aerial triangulation of frame images that is available in PHOTOMOD 4.3 and gave the results of extensive processing of blocks of both synthetic photos and real photos using both the existing independent model method and the new bundle adjustment. Future developments will include the incorporation of self-calibration and robust blunder detection and an increased speed of processing using sub-blocks. Finally, in this section, D. Kochergin described the new PHOTOMOD ProRaster module which allows the spatial, radiometric and spectral enhancement of multiple images. Further developments will see the functionality of the ProRaster and GeoMosaic modules being integrated into a single program.

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#### Master Classes

These presentations covered a variety of topics, but, in my opinion, two of them were quite outstanding. Dr. Titarov gave his on the photogrammetric processing of spaceborne pushbroom line scanner images

from each (different) satellite that is currently operational. He presented a really excellent systematic and comprehensive overview of the topic, full of interesting points, based on his extensive experience of this type of processing. His presentation should be compulsory reading for every lecturer and student of photogrammetry. His colleague, R. Shuvalov, was perhaps slightly less confident in his command of English, but this could not hide the fact that he has an equally comprehensive and insightful knowledge of the complex and sometimes abstruse field of spaceborne SAR image data processing and its radargrammetric procedures [Fig. 9]. I was so impressed with the knowledge and abilities of these two talented young men - the Racurs company simply cannot afford to lose them to an academic institution, government agency or a rival company!

#### Conclusion

As the above account has shown, the Conference was really well worth attending. Quite apart from the considerable amount of technical information that was communicated to the participants via the presentations, overall it offered a quite different perspective on Russian activities in mapping and photogrammetry to that given at the Conference on Laser Scanning & Digital Aerial Photography held in Moscow last December (2006) - which was reported on in the January 2007 issue of Geoinformatics. However, the two conferences, when taken together, have really shone a light into the very interesting developments and applications of modern photogrammetric technology that are currently taking place within Russia. Given the strong economic growth that has been a feature of the country in recent years, undoubtedly we can expect further rapid developments in this area in the coming years.



**Fig. 9** - The user interface of the InSAR Processor for the generation of DEMs from spaceborne SAR imagery within the PHOTOMOD Radar program using the interferometric technique. (Source: Racurs)

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