A Report on the Moscow 2008 Conference

Laser Scanning & Digital Aerial Photo Today

The 8th Conference on Laser Scanning & Digital Aerial Photography was held, as in the previous two years, at the President Hotel in Moscow on 10th and 11th December 2008. The Conference attracted over 200 participants, principally from Russia and the CIS countries. However there were 20 or so participants from Western countries, mainly from the system and software suppliers, most of whom made presentations at the Conference, besides promoting their products in the Conference exhibition.

By Gordon Petrie

Fig. 1 – Part of the Conference audience seated in the lecture theatre at the President Hotel. (Source: RSPRS)

The Conference was organised by the Russian Society of Photogrammetry & Remote Sensing (RSPRS) with the Russian Society of Mining & Sub-Surface Surveying acting as co-organisers. The general sponsors of the Conference were Geokosmos and its associated companies, Geolidar, Geopolygon and TerraImaging. As usual, staff members from this group of companies played a large part in the excellent organisation and running of the Conference. The other sponsors came from abroad in the form of Microsoft Vexcel and Trimble.

I – Plenary (General) Sessions

The opening plenary session included a series of short welcoming addresses that were given by Prof. Tyuflin, the President of RSPRS, and Professors Savinykh and Malinnikov, who are currently the two most senior officers of the Moscow State University of Geodesy & Cartography (MIIGAiK). These welcoming addresses were followed by two papers given by S. Melnikov, the Chairman of the Board of Directors of the Geokosmos Group of Companies, and S. Miller, the President of the Russian GIS Association – both of whom gave their personal assessments of the current geoinformatics market within Russia and their predictions for the future. In particular, Mr. Melnikov provided some interesting information about the adoption of airborne digital imaging and laser scanning technologies by Russian companies and agencies. With regard to large-format airborne digital imagers, there are now 8 Vexcel UltraCam and 2 Intergraph DMC frame cameras and 3 or 4 Leica ADS pushbroom scanners in current operation within Russia. As for airborne laser scanners, there are 16 Optech ALTM scanners, 5 Leica ALS scanners and 2 Riegl-based scanners currently in use. Seven of these scanners are being operated by Geokosmos and five by the OPTEN company.

These initial presentations were followed by three more that were delivered by V. Gritzkov, Chief Executive of the Russian Society of Surveyors; L. Kushnir, President of the Russian State Association for Engineering & Construction Surveying; and E. Kisilevskiy of Gasprom. All of them had much to say about the inability of the regulatory side of the profession – covering matters such as licensing, accuracy specifications, instrument calibration, and the standardization of documentation – to keep pace with the rapid adoption of digital surveying and mapping technologies within Russia. Judging from the strong reaction to these three presentations, both from the Conference audience [Fig. 1] and later at a press conference [Fig. 2], these matters appear to be of such high concern that they need fairly urgent attention both at government level and on the part of the appropriate professional bodies and those federal agencies that are concerned with surveying and mapping within Russia.

Finally, within this general area, S. Vatslid – who is the Managing Director of TopoSys, the German laser scanning systems supplier and service provider that has recently been acquired by ***Trimble*** – presented Trimble's global strategy for the development of geospatial imaging. First he outlined Trimble's strength and depth in terms of supplying systems and solutions to the closely related fields of surveying, photogrammetry, mapping and GIS. After which, he announced the formation of a new Geospatial Division within Trimble. This will comprise the four companies – Inpho, Geo-3D, Rolleimetric and TopoSys – that have been acquired by Trimble since 2007. Giving my own personal comments on this particular development, it was noticeable that this new division does not include the Applanix and Mensi companies that also operate within this general area and had been acquired by Trimble earlier in 2003. Matters that will need to be sorted out by the top management within Trimble include the fact that, up till now, Applanix with its DSS products and Rolleimetric with its AIC series have been strong competitors against one another in the field of medium-format airborne digital cameras.

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Fig. 2 – The top table of speakers from the plenary sessions, comprising from right to left - E. Kisilevskiy (Gasprom); S. Melnikov (Geokosmos); E. Medvedev (Geolidar); S. Vatslid (Trimble): and P. Goellner (Geokosmos) – answering journalists' questions during the press conference. (Source: RSPRS)

II – Laser Scanning

Turning next to the technology side and, in particular, to laser scanning, the main focus for the system suppliers who serve this area was the presentation of several recently introduced products that are designed specifically for airborne and mobile (ground-based) mapping applications.

Airborne Laser Scanners

Dr. V. Ussyshkin of ***Optech*** first discussed her company's new and very compact ALTM Orion airborne laser scanner [Fig. 3 (a)] that is designed specifically for corridor mapping from lower altitudes. With a volume of one cubic foot, the system is seven times smaller and three times lighter than the company's larger ALTM Gemini model that is designed for wide area laser scanning from higher altitudes. A. Ekelund of ***AHAB*** also introduced a new and similarly compact and lightweight airborne scanner product in the form of his company's DragonEye topographic laser scanner [Fig. 3 (b)]. This generates an elliptical (Palmer) scan pattern over the ground with the laser having a pulse repetition frequency (PRF) of 300 kHz when operated from a low altitude of 200 m. A complete DragonEye system – which comprises the scanner; control electronics; twin small-format cameras; the positioning and orientation system; and data storage units – weighs only 25 kg. Next N. Studicka of ***Riegl*** gave some details of his company's new lightweight and compact VQ-480 airborne laser scanner [Fig. 3 (c)]. Again it is designed for use from lower altitudes with the laser rangefinder having a PRF of up to 200 kHz. It utilizes the typical Riegl arrangement of a continuously rotating multi-faced scanning mirror to generate a parallel pattern of measured scan lines over the ground. It also features the continuous digitization of the complete waveform of the signal returned from each successive pulse that strikes the ground objects, while analyzing the waveforms online to provide data with properties that are quite similar to those produced by full waveform analysis sytems. Finally, Dr. E. Medvedev of Geolidar, in his presentation on the products of the German systems supplier, ***IGI***, (which is represented in the Russian market by Geolidar) gave the latest information on the well known LiteMapper 5600 airborne laser scanner.

Mobile Mapping Systems

Regarding mobile mapping systems, Dr. Ussyshkin also gave details of the new ***Optech*** Lynx Mobile Mapper [Fig. 4 (a)]. Each laser scanner unit that is incorporated into a Lynx system generates a 360 degree field of view in the vertical plane, allowing the continuous measurement of profiles of the surrounding road or railway surfaces, adjacent structures and overhead objects. The Class 1 lasers used in the Lynx scanners are of course designed specifically to be eye-safe, yet they are still capable of measuring ranges up to 100 m.

Fig. 3 – Three of the new compact airborne laser scanners that were introduced to the participants of the Conference – (a) the ALTM Orion (Source: Optech); (b) the DragonEye (Source: AHAB); and (c) the VQ-480. (Source: Riegl).

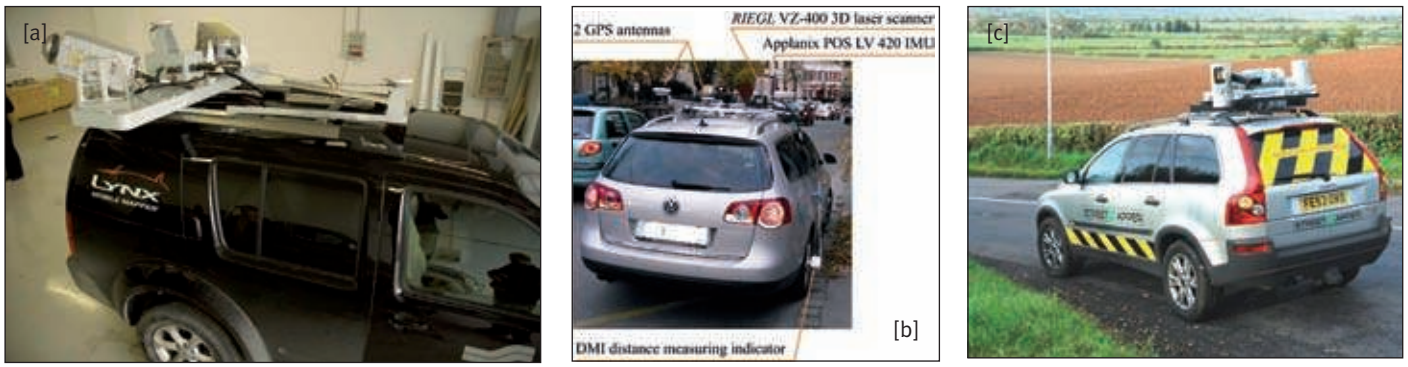

Fig. 4 – Three of the mobile mapping systems that were discussed at the Conference – (a) the Lynx Mobile Mapper (Source: Optech); (b) an experimental system based on the VZ-480 terrestrial laser scanner (Source: Riegl); and (c) the StreetMapper. (Source: 3D Laser Mapping).

Mr. Studnicka in his presentation also mentioned the ***Reigl*** VQ-180 and VQ-250 2D laser scanners that are designed specifically for use in mobile mapping systems: the former with a 100 degree field of view; the latter has a full 360 degree rotation. However he also showed how the new Riegl VZ-400 3D terrestrial (ground-based) laser scanner has been mounted experimentally on a vehicle to form the basis of a mobile mapping system [Fig. 4 (b)]. Within this context, he outlined a bore-sight alignment method that is based on the analysis of the laser pulse data that is being reflected from common planar surfaces.

Finally, also falling within this area of mobile mapping systems, both V. Egorov of Geokosmos and Dr. Medvedev of Geolidar covered the ***StreetMapper*** system [Fig. 4 (c)], which has been developed by the 3D Laser Mapping company from the U.K. in collaboration with IGI, the German system supplier. This system has been operational for two or three years, combining three or four of the earlier Riegl Q120 short-range (up to 150 m) laser scanners with the TERRAcontrol GPS/IMU positioning and orientation system from IGI. However, what was a real surprise for most of the Conference participants was the appearance of an actual StreetMapper system mounted on an SUV vehicle that had been parked at the front door of the President Hotel in order to demonstrate its capabilities. This particular StreetMapper system has already been used by Geokosmos to survey over 1,000 km of roads in the Moscow area since its arrival in Russia in September 2008.

III – Airborne Digital Photography

Within this second main declared area of interest of this Conference, on this occasion, the focus was more on medium-format digital cameras rather than the large-format digital imagers that had been highlighted in the previous three conferences in the series. The present writer (G. Petrie) gave an overview of the numerous systems that have been and are being developed for the acquisition of systematic oblique photography for mapping, reconnaissance and visualization purposes using multiple small- and medium-format digital cameras. They include fan, block and five-camera "Maltese Cross" configurations, the main suppliers of these systems being European system houses such as Track'Air, Rolleimetric, IGI and ***DiMAC Systems***. Then J. Losseau of DiMAC Systems presented an account of his company's current offerings – comprising its single-camera 'Ultra-Light' [Fig. 5 (a) & (b)] and 'Light' systems and the twin-camera 'Wide' system. He laid special emphasis on the fact that these are the only medium-format airborne digital cameras that are available with forward motion compensation (FMC). Also interesting from his account was the prospect that all the cameras in the DiMAC range will soon be utilizing the new P+ digital backs that are becoming available from the Danish supplier, Phase One. These will offer images that will be 8.9k x 6.7k = 60 Megapixels in size in the case of the 'Ultra-Light' and 'Light' systems; and 8.9k x 13k = 116 Megapixels in the case of the twin-camera 'Wide' system.

In his overview of ***IGI***'s products, Dr. Medvedev also drew attention to the several IGI systems that utilize multiple DigiCAM medium-format cameras [Fig. 6]. These include two (Dual-DigiCAM), three (Triple-DigiCAM), four (Quattro-DigiCAM) and five (Penta-DigiCAM) camera systems. Indeed Dr. Medvedev was by far the busiest person in the Conference, not only chairing most of the sessions, but giving a whole series of presentations on the products of the various companies that are represented by Geolidar. In this latter role, he also delivered a separate presentation on Microsoft's Virtual Earth products, a large part of which was concerned with a detailed description of the characteristics and performance of the ***Vexcel*** UltraCam large-format digital frame camera, of which the 100th example has recently been delivered to Geokosmos. In yet another paper, Dr. Medvedev also covered the pushbroom line scanners that are being built by the Canadian ***ITRES Research*** company. Besides the established CASI (VNIR) and SASI (SWIR) hyperspectral scanner systems, he discussed the new MASI-600 hyperspectral scanner that operates in the medium-wave infrared (MWIR) part of the spectrum [Fig. 7]. This generates a 600 pixel wide swath over the ground and provides 64 spectral samples for each pixel. In prospect for 2009 is

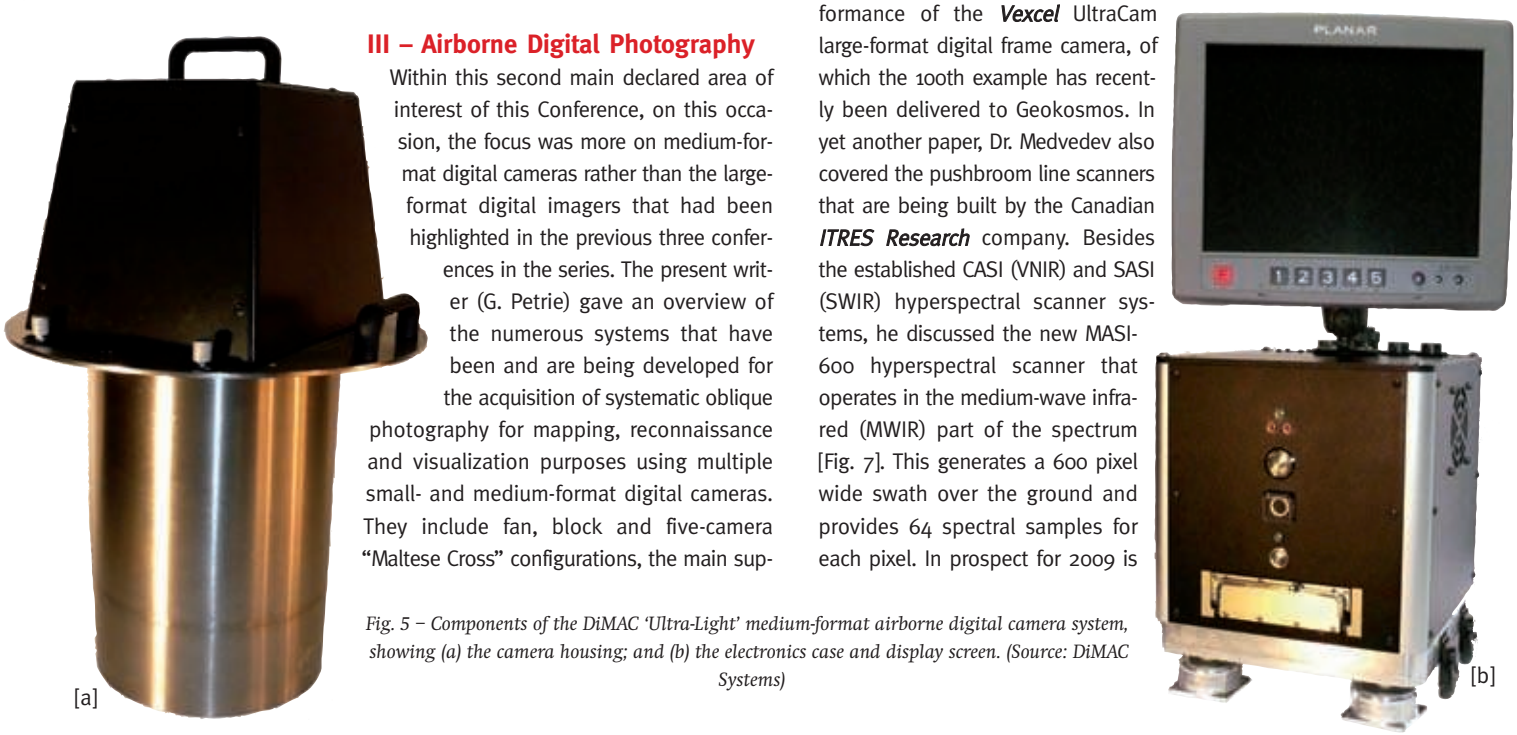

Fig. 5 – Components of the DiMAC 'Ultra-Light' medium-format airborne digital camera system, showing (a) the camera housing; and (b) the electronics case and display screen. (Source: DiMAC Systems)

Fig. 6 – This multiple camera system comprises four IGI DigiCAM medium-format digital cameras. Each camera is acquiring oblique aerial photos at angles of 45 degrees to the vertical. Two of the cameras point in opposite directions cross-track, while the other two point in opposite directions along the flight line. In the background is a Vexcel UltraCam large-format digital camera that acquires vertical aerial photography simultaneously. (Source: Geokosmos)

the ITRES company's new TABI-1800 single-channel thermal (LWIR) line scanner with a ground swath that is 1,800 pixels wide. Attention was also drawn to the capability to carry out geo-correction processing of the recorded imagery in-flight that has also been developed by ITRES Research.

IV – Software Developments

Closely associated with the hardware and system developments that have been discussed above were a series of presentations about the parallel developments in software.

Terrain Modelling

O. Kolesnikova, who heads the software division of ***Sovzond*** – which is one of Russia's leading companies in the field of remote sensing – spoke first about her company's general activities within this field. However the rest of her presentation was concerned with the photogrammetric software products from ***Inpho***, for which Sovzond is the distributor within the CIS countries. In particular, she discussed the SCOP software that can handle DTM projects of any size and the DTMaster system that can be used for the editing and quality control of laser scanned data. Of especial interest were the results that have been obtained by Sovzond in the processing of the three-line PRISM pushbroom stereo-scanner imagery (with 2.5 m GSD) from the Japanese ALOS satellite, which now covers virtually the whole of Russia [Fig. 8]. The ***Terrasolid*** company from Finland is also very well established in the area of software that can be used in the processing of airborne laser scanned data. H. Korpela described the extension of this software to the processing of data obtained from mobile mapping systems. With these systems, the frequent interruptions in the measurement of position that is caused by buildings, trees and other obstructions,

Fig. 7 – The new MASI-600 pushbroom line scanner produces hyperspectral imagery in the medium-wave infra-red (MWIR) part of the electro-magnetic spectrum. (Source: ITRES Research)

Fig. 8 – This map shows the coverage of Russia that has been acquired by the PRISM three-line pushbroom stereo-scanner which is mounted on the Japanese ALOS satellite. (Source: Sovzond)

when using GPS satellite receivers, are a special problem. Data calibration is a key issue in order to achieve an acceptable accuracy in the final data that is delivered to the customer.

M. Doghali of the Lupos3D company, which is based in Berlin, described the LupoScan software that has been developed by his company to analyze the 3D laser scanned data that is derived from terrestrial (ground-based) laser scanners. In a second (later) presentation, he showed examples of projects that have been carried out by his company in Vienna, Berlin and Hamburg using this software. Finally, within this particular subject area, there was a joint presentation by T. Ivanov and K. Saraev. The former described a terrain mapping and modelling project which has been carried out by Geokosmos for an area that is being considered for the development of a hydro-electric plant, while the latter described the new 3D Modeller software package for terrain elevation modelling and visualization and the generation of cross-sections that has been developed by Geokosmos.

GIS Software

The Conference also received two presentations from I. Wetzel of ***ERDAS***. The first covered the TITAN network software. This provides users with a single personalized and secure space that can be used to share geospatial data, Web services and location-based content with other TITAN network users, if permission is granted by the owner of the space. Her second presentation was a more general coverage of the ERDAS photogrammetric software products – including LPS, PRO 600, APM (Automated Point Measurement) and ATE (Automated Terrain Extraction) – that can be used to generate 3D data for input to a GIS.

V – Production & Applications

This is an area that is always of much interest to Western participants in the Conference since it allows them to see and hear something about how imaging and mapping are actually being carried out inside Russia and the CIS countries.

Starting with those located furthest from Moscow, there was a rather surprising presentation by A. Okhotin about the activities of the ***Baikal GeoService***. This organisation seems to have strong links with a local university in Irkutsk, whose students appear to man many of the company's operational systems. The latter comprise several state-of-the-art systems, including an Optech ALTM laser scanner; a Vexcel UltraCam-D large-format camera; and a Riegl LMS-Z420i terrestrial scanner, plus a number of Trimble GPS receivers and total stations. Using this equipment, a large range of

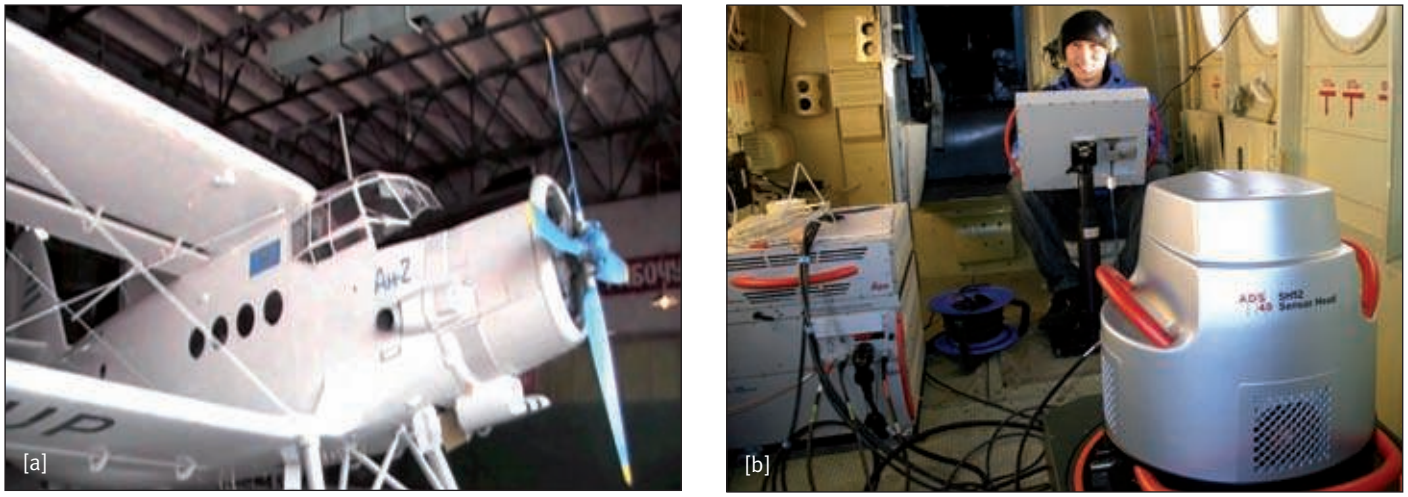

Fig. 9 – (a) This Antonov An-2 biplane is being used as a photographic aircraft by the Astanatopografiya mapping company from Kazakhstan. (b) The interior of the An-2 aircraft with a Leica Geosystems ADS40 large-format three-line pushbroom stereo-scanner in the foreground. (Source: Astanatopografiya)

surveying and mapping tasks are being undertaken in the eastern part of Siberia. There were also two presentations from aerial mapping companies based in Kazakhstan. The first was given by N. Khatiev of ***Astanatopografiya*** and described the use of a Leica ADS40 large-format imager in an aerial imaging and mapping project carried out for the capital city, Astana, and the adjacent district of Tselinograd in Northern Kazakhstan. The second was given by N. Fomenko of ***KazGeoCosmos (KGC)***, which is based in the country's largest city, Almaty, located in Southern Kazakhstan. He gave an interesting account of (i) the airborne imaging and mapping operations that his company carries out using a Vexcel UltraCam-X camera and an ITRES Research CASI-1500 hyperspectral scanner; and (ii) its ground surveying operations using a ScanStation from Leica Geosystems. Truly the new airborne digital photographic and laser scanning technologies are reaching into what most people from Western countries would regard as rather remote parts of Asia. What also took my attention was the fact that these very modern instruments are – in the case of the Baikal and Astanatopografiya companies – being mounted and flown in examples of the ultra slow-flying Antonov An-2 biplanes [Fig. 9 (a), (b)] that were first produced and operated in the late 1940s and have long since gone out of production!

Turning next to those mapping companies that are based in European Russia, A. Mikheev from the large ***Meridian+*** company described the generation of true orthophotos within urban areas using airborne digital imagery that had been captured using Intergraph DMC and Leica ADS40 large-format imagers in conjunction with laser scan data. Then A. Akopov from the ***Airspace Technologies*** company – which is based in Krasnodar in Southern Russia and was only formed in the Spring of 2008 – gave an account of its initial operations using Vexcel UltraCam-X and Rolleimetric frame cameras; an IGI LiteMapper laser scanner; and a FLIR ThermoVision A40 thermal imager. I. Danilin of the Forestry Institute of the ***Russian Academy of Sciences*** described the monitoring of forested land in the Krasnoyarsk area of Central Siberia for management and research purposes using airborne digital photography and laser scan data. The final paper in this section was contributed by A. Skripkin of ***Jena Instrument***, which, in spite of the company title relating to the German town famed for its optical technologies, is based in Moscow. This particular paper was very different to all the other presentations on applications. It involved the detailed survey of an existing large aluminium refining plant located in Guinea, West Africa, using ground-based surveying techniques in order to reconstruct the missing documentation and drawings for this plant [Fig. 10]. This difficult task was undertaken successfully using a wide variety of instruments, including Optech ILRIS and Faro LS-880 terrestrial laser scanners, Topcon tacheometers and NovAtel GPS receivers.

Fig. 10 – Showing some of the CAD drawings of the Friguia aluminium refining plant in Guinea, West Africa that have been derived from a ground-based laser scan survey. (Source: Jena Instrument)

The remaining papers included one on ***Geolidar***'s training programmes, which was contributed by the indefatigable Dr. Medvedev. Another was a highly controversial contribution by E. Eremchenko of ***R&D.CNews***, which is a popular on-line portal in Russia [http://rnd.cnews.ru/] that provides information on innovations in science and technology, including those relating to the geoinformatics sector. He spoke about the concepts of Neogeography (involving tools and techniques that do not adhere to those used in a traditional GIS) and Situation Awareness (involving the perception of the environment that is present within complex and dynamic situations). His presentation certainly stirred up the audience and incited a battery of very vocal sceptics and critics to offer their doubts, especially regarding the first of these two concepts.

Conclusion

It was a busy two-day Conference that, as usual, provided a very interesting and revealing insight into the rapid adoption and widespread applications of airborne laser scanning and digital aerial photography that are taking place within Russia and the CIS countries, together with a valuable update on the technologies from the Western countries that underlie these developments and applications.

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