

Vexcel Corporation:

Now a Major Player in Mapping & GIS

Over the last twenty years, the Vexcel Corporation has been well known among remote sensing specialists as a supplier of ground stations receiving satellite image data and of the hardware and software required to carry out the data processing activities associated with these stations. In particular, the company's expertise in SAR image processing is widely recognized and highly acclaimed internationally. However gradually, over the years, the company has extended its activities into the area of photogrammetry, mapping and GIS, offering both software solutions and mapping services to the user community. Most recently, with the introduction of its new airborne digital camera and its acquisition of the ISM company with its DPW expertise and substantial customer base, it is now starting to be a serious competitor to the long-established across-the-board system suppliers such as Leica Geosystems and Intergraph (including Z/I Imaging). Since Vexcel is perhaps less well known to the mainly European readership of *GeoInformatics* than it should be, the publishers decided that a profile outlining the main activities of the company would be of interest and value to its readers.

By Gordon Petrie



Figure 1. The two principal contributors to the development of the Vexcel Corporation - Franz Leberl (left) and John Curlander (right).

Company Background

The Vexcel Corporation was founded in 1985, principally by Dr. Franz Leberl, the well-known photogrammetrist from Austria. He had worked previously on research into mapping from radar imagery, first at the ITC in the Netherlands between 1969 and 1974 and then at NASA-JPL in California between 1974 and 1976. After which, he was professor of photogrammetry and remote sensing at the

Technical University in Graz between 1976 and 1984. Returning to the U.S.A. in 1984, he set up the Vexcel Corporation in Boulder, Colorado, where it still has its headquarters. Initially the company concentrated mainly on the development of SAR data processing systems. Leberl remained with Vexcel till 1992 when he returned to Graz to become professor at the University's Institute of Computer Graphics & Vision. From 1992 onwards, the Corporation has been led by the present CEO, Dr. John Curlander, who had also worked on SAR ground data systems at NASA-JPL. Under his leadership, Vexcel has steadily expanded its activities within remote sensing and has moved into photogrammetry and mapping. In 2000, Ball Aerospace - which builds remote sensing satellites such as QuickBird and which is also located in Boulder - acquired a minority interest in the Vexcel Corporation. On Prof. Leberl's return to Graz in 1992, he founded a separate company, Vexcel Imaging Austria. First it produced the very successful UltraScan 5000

photogrammetric film scanner. Then in 2003, it released its new UltraCam D airborne digital camera. Shortly afterwards, in May 2003, Vexcel Imaging Austria was acquired by the Vexcel Corporation. The Corporation now leads a group of companies, including Vexcel Imaging Austria, Vexcel ISM, Atlantis Scientific and Vexcel UK, with a total of roughly 140 employees world-wide. Currently the Vexcel Corporation conducts its business under three main headings:- (i) Mapping & GIS; (ii) Advanced Radar Systems; and (iii) Satellite Ground Systems.

I - Mapping & GIS

Under this general heading, Vexcel has developed a range of **turnkey systems** for various government and commercial customers. This activity began with its **OrthoGIS** product which allowed users to produce vector data layers containing information on parcel boundaries, street centre-lines, sidewalks, street and building addresses, and environment data. Another turnkey system is Vexcel's VexLink Web-based tool that can be used for the analysis and qualification of wireless communication links. A customized version of ESRI's GIS software connects this tool to the vector database on which the analysis will be carried out. **VexLink** has since been developed for homeland security applications, e.g. for emergency response simulations. More recently, Vexcel has become a major supplier of **mapping and GIS data**, especially for urban areas. In particular, it has generated high-resolution 3D building and terrain models of numerous cities in North America from stereo-coverage of aerial photographs. Elsewhere, it has generated similar 3D data for a number of cities in South America, Africa and Asia. In certain areas where it is difficult to acquire suitable aerial photography because of security restrictions, the 3D model data has been extracted from QuickBird satellite imagery. Major clients for these 3D city models have been telecommunications providers. They use them for the planning and deployment of cellular phone systems and high-speed data networks This includes the determination of line-of-sight visibility between base stations and customers' sites and the analysis of radio frequency (RF) interference between base stations. Besides this



Figure 2. A perspective visualization of part of New York city. This is based on the accurate 3D terrain and building model data extracted from stereo-pairs of aerial photographs of the city by Vexcel's mapping and GIS group.

major application, Vexcel offers its 3D urban data for visualization and simulation purposes off-the-shelf under its **Global Landscape** product label.

I (a) - Airborne Imagery Products

These mainly comprise the hardware and software products that have been developed by Prof. Leberl and his team at Vexcel Imaging Austria. The first of these was the **UltraScan 5000** precision photogrammetric film scanner that was first introduced to the market at the GIS/LIS Conference held in Fort Worth, Texas in November 1998. In this context, it is worth noting that Leberl had previously designed and built the VX series of film scanners at yet another of the companies [now called VX Imaging Services] that he had founded in Boulder while he was in the U.S.A. This flatbed scanner utilized a small-format digital camera in conjunction with a high-precision reseau (grid of crosses) that allowed the systematic scanning of the photo on a patch-by-patch basis. However the UltraScan 5000 instrument uses a rather different technology, employing a linear CCD array to scan the film systematically in a series of parallel swaths. As with the VX scanner, the individual scans (patches or swaths) are then stitched together and merged to form the final digitized version of each photo that has been scanned. The UltraScan 5000 has been produced and sells at a considerably lower cost than its main rivals. Well over 400 units have been built to date, the instrument having been sold into the medical imaging market for the scanning of X-ray films as well as aerial photographic films - though the latter remains its principal market. Besides the UltraScan 5000 product, Vexcel Imaging Austria also developed the EskoScan 1318 film scanner that was sold by the Danish company, Purup-Eskofot, into the graphic arts field. The **UltraCam D** large-format

mat digital frame camera system comprises two sets of four cameras that generate panchromatic and multi-spectral images respectively. It has already been described in previous issues of Geoinformatics. Although it was only introduced at the ASPRS Annual Conference held in Alaska in the spring of 2003, it has already obtained a comparable number of orders to those gained by its main rivals (Intergraph and Leica Geosystems) whose large-format airborne digital imagers were first introduced in 2000. Customers include Sanborn in the U.S.A.; Simmons Aerofilms and GetMapping in the U.K.; IFMS in Germany; Meixner in Austria; Aerodata in Belgium; and Pasco in Japan. To date, eleven cameras have been delivered. Much of the manufacture of the mechanical components, together with the assembly of the UltraScan and UltraCam instruments, is carried out by the Wild Austria company which is located in the province of Carinthia in the southern part of Austria. The company was originally part of Wild Heerbrugg and manufactured components for the main factory in Switzerland. The **Wild Austria** operation was then bought out by its management at the time of the formation of the Leica Geosystems company - one of the main components of which was Wild Heerbrugg. To an outside observer, it does seem slightly ironic that Wild Austria now acts as the major sub-contractor building a competitor to the ADS40 imager that is being built in the Heerbrugg factory by Leica Geosystems. Given the enormous volumes of digital image data that are being generated by the UltraScan 5000 and UltraCam D instruments, it was a natural development for the Vexcel Corporation to develop its **UltraMap Server** data management system. This is an Oracle-based system that is used for the archiving, cataloguing and browsing of digital airborne image data or scanned aerial photography. The system is based on Vexcel's EarthFinder product that was developed originally to support satellite image data. Its Java-based graphical user interface (GUI) allows the UltraMap software to be operated either as a stand-alone system or over the Internet using a standard Web browser. In addition, the UltraMap Server forms the basis for a suite of photogrammetric application programs that allow high levels of

automation to be implemented in a production environment.

I (b) - Close-Range Photogrammetry

FotoG is advanced close-range photogrammetric software that has been steadily developed over a considerable period of time in the main Boulder office of Vexcel. Originally it provided an in-house capability to generate very accurate measurements that could be used to create 3D CAD models direct from film or digital photographs. The system is widely applicable to numerous industrial fields such as shipbuilding, petrochemical plants (including pipe layouts), paper and pulp mills, automotive factories (including tooling and assembly lines), architecture, etc. For some of these applications, Vexcel has provided the ground control, taken the required photographs and carried out the photogrammetric processing and measurements - thus acting as a service provider. In other cases, Vexcel has licensed the FotoG product to user organisations and companies, including the provision of training for the client's personnel, either at Vexcel's headquarters in Boulder or at the client's own site. The data produced by FotoG is compatible with AutoCAD, MicroStation and other well known CAD packages and with the CATIA suite of engineering design programs. NASA has used FotoG to provide accurate measurements of many components built for inclusion in the International Space Station (ISS). In 2003, Vexcel received the Construction Innovation Forum's NOVA award "for outstanding innovation in construction" in respect of the FotoG software. In September 2004, General



Figure 3. The Vexcel UltraCam D large-format digital aerial camera system showing the camera unit with its multiple lens cones (left) and the storage and computing unit (right).

Motors (GM) gave its approval for FotoG to be used for the measurement of automobile tooling equipment in GM manufacturing plants world-wide.

I (c) - Vexcel ISM

As mentioned above in the introduction, the ISM company was acquired by Vexcel in May of this year (2004) and was re-named Vexcel ISM. Based in Vancouver, British Columbia, ISM was founded in 1987 and has been a mainstream provider of digital photogrammetric software. Its principal product is its **DIAP** digital photogrammetric workstation (DPW) together with the associated modules that implement aerial triangulation and data capture. Other products that are offered include its **SysImage** digital orthophoto system and its **TIN/CIP** terrain modelling package comprising TIN generation and contour interpolation. ISM has a very substantial user community, the software having been installed in over 50 countries world-wide. It has a large number of users in North America, especially in Canada, and also in Japan. In Europe, ISM has sold a large number of licences to Spanish aerial mapping companies and has a significant presence in Eastern Europe. A recently announced order since the ISM company was acquired by Vexcel has been for the supply of twelve DIAP systems to the Instituto Geografico Militar in Chile.

II - Advanced Radar Systems

As noted in the introduction to this profile, Vexcel made its name initially through its expertise in SAR image processing techniques and it still remains in the forefront of this field today. In particular, it offers a varied range of SAR processors. One of these is the **Focus** processor that can handle SAR image data from the existing Radarsat, JERS-1 and ERS-1 & -2 radar satellites and is now being developed further to handle data from the forthcoming PALSAR radar mission mounted on the Japanese ALOS satellite. European readers will also be interested in the development of Vexcel's Envisat-ASAR processor, which has been delivered to various American customers, including the Lawrence Livermore National Laboratory (LLNL), the Alaska SAR Facility (ASF) and the University of Miami's CStars ground station. Another product is the **Phase** system that processes interferometric SAR data to form digital elevation models (DEMs). It can also be used to produce maps showing (i) the

displacement of features in areas affected by earthquakes; or (ii) the subsidence being experienced in areas where either underground mining or oil and water extraction has been taking place.

On the radar mapping side, Vexcel offers its **OrthSAR** product for the automated production of ortho-rectified SAR image data and the **RaMS** radar mosaicing software for the automated production of DEMs and ortho-rectified mosaics. The RaMS system was developed originally to produce the SAR ortho-image mosaic of Antarctica from the hundreds of SAR image swaths obtained during the Radarsat Antarctica Mapping Project (RAMP) - which received a Group Achievement award from NASA. Other large SAR mapping projects in which Vexcel has been involved in recent years include its support for the Shuttle Radar Topography Mission (SRTM) for the production of DEMs covering North America and East Asia. This project was carried out in collaboration with the ADR Division of BAE Systems on behalf of NIMA (now NGA). Yet another large project was the production of a stereo-derived DEM of the cloud-covered area of Southern Colombia from Radarsat imagery.

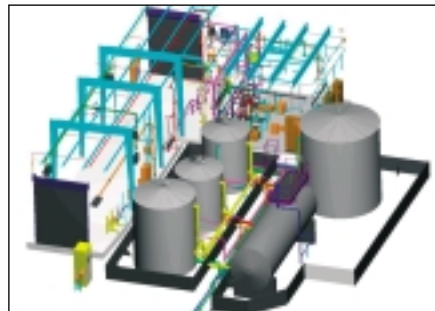


Figure 4. A perspective view of a chemical transfer facility based on the accurate 3D CAD model produced from measurements on multiple photographs carried out using Vexcel's FotoG close-range photogrammetric system.

II (a) - Atlantis Scientific

In 2001, Vexcel took over the ownership of Atlantis Scientific Inc. (ASI) based in Ottawa, Canada. Originally formed in 1981, the company is best known for its **EarthView** software. This includes its Advanced Precision Processor (APP) offering a full range of SAR processing algorithms and its InSAR processor which produces DEMs from repeat-pass interferometric SAR data. A new product is EarthView Stereo, which, as the name suggests, produces a DEM from a pair of stereo-SAR images. Atlantis has also undertaken numerous SAR application projects, including the monitoring of Popocatepetl Volcano in Mexico; the measurement of subsidence in

the Belridge oil fields in California; and the generation of a DEM over the extensive NATO training range based around Goose Bay airfield in Labrador - in all three cases, using ERS InSAR data.

III - Satellite Ground Stations

Last, but certainly not least, in view of the high value of the business, are Vexcel's satellite ground receiving stations and their associated image processing systems. In some cases, complete satellite data reception and processing systems, such as the **Apex** ground station, have been supplied to customers. Such turnkey systems comprise (i) the tracking antenna; (ii) the high-speed data reception and capture equipment; and (iii) the data processing hardware and software required to handle both optical and radar data. Vexcel's **MODIS** ground station is a much lower cost but complete turnkey system designed specifically to receive and process the MODIS image data being broadcast by NASA's Terra and Aqua satellites. Besides these complete systems, Vexcel also supplies units that form substantial parts of other suppliers' systems. Examples of these are the well established Vexcel Direct Capture System (**VxDCS**) with its large user base and the new **Proton** high-speed telemetry and data capture system. Among the many notable ground stations that are using Vexcel's equipment extensively are the ground stations at the University of Miami's Center for Southeastern Tropical Advanced Remote Sensing (CSTARS) that cover the sub-tropical area of the Atlantic, the Caribbean and Gulf of Mexico, monitoring the approach of the hurricanes that cause so much devastation in the area. Other examples include the Alaska SAR Facility (ASF) located at the University of Alaska in Fairbanks, which is NASA's specialist facility for handling SAR data.

Conclusion

As this account has shown, Vexcel is now a heavyweight player in the fields of photogrammetry, mapping and remote sensing with a portfolio of products that is attracting attention (and orders) from all parts of the industry.

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