The International Society for Photogrammetry and Remote Sensing (ISPRS) is one of the leading organisations within the geomatics sector and has a long-standing partnership with GIM International. We spoke to Christian Heipke, secretary general of the ISPRS, during the 2013 Geospatial World Forum in Rotterdam, The Netherlands. Here, he shares his views on topics such as the growing role of unmanned aerial systems (UAS) and oblique imagery — just two examples of major developments in data acquisition at the moment — as well as the future challenges for the industry.

Congratulations on receiving the Photogrammetric (Fairchild) Award, the highest scientific recognition from the American Society for Photogrammetry and Remote Sensing (ASPRS), in March 2013. How did that feel?

The award came as a big surprise. Of course, I felt very honoured to have been selected. But when I saw the list of previous winners, I felt that my name didn’t really belong among them. Firstly because the award seems to honour lifetime achievements, and I still feel too young for such recognition. And secondly, I don’t think my contributions are significant enough for this award. But then, I did feel proud as well …

Two recent major developments in photogrammetry are oblique imagery and unmanned aerial systems (UAS). Which key opportunities does oblique photogrammetry offer in terms of 3D city modelling?

First of all, oblique images — which have actually been around for many decades — provide formidable facade texture for automatically rendering 3D city models. Obviously, if doors, windows, balconies and suchlike need to be entered into the models as spatial objects (in contrast to pure texture), these can be extracted from oblique images. In addition, monitoring activities taking place in urban settings are largely facilitated using facade views. Other applications comprise determining the facade material — such information can be useful for sound simulation — and monitoring a building’s heat flux using thermal oblique images. In short, oblique images are a valuable tool for visualisation, and they can be used to derive a lot of information which is not accessible from aerial images.

Which geo-related applications are likely to benefit most from using UAS? As a platform, the type of UAS we are talking about in photogrammetry closes the gap between terrestrial and aerial imaging. A UAS is much easier to employ than aircraft, and at least for small projects it is much more economical. Possible applications include archaeology, precision farming and mapping small areas in general. If monitoring is part of the job and the area needs to be revised frequently, for instance in construction site documentation or when monitoring traffic jams or sporting events, this is of course an added bonus. One can also envision a UAS being equipped with a thermal camera to detect heat leakages in industrial plants. In disaster management, of course, rescue crews can benefit from using UAS to quickly obtain an overview of the situation, and security applications also profit from UAS.

What will be the role of UAS for modelling the built environment in 3D? Since the built environment is of course an area where much change happens, monitoring is a major task. UAS can be used for checking if a database of the neighbourhood is complete and up to date by comparing its content to UAS images, or for acquiring newly constructed buildings, annexes, etc. As mentioned before, oblique images taken from a UAS can also be used to render the 3D city model for visualisation purposes.

Are there any major obstacles blocking the path to UAS becoming an established photogrammetric technology? In terms of technology, power is one of the most limiting factors today. Batteries are very heavy, thus UAS can only stay in the air for a relatively short amount of time. For rotary wing UAS such as quadcopters and octocopters as well as for some fixed wing systems, wind and weather can be another limiting factor — flying in rough meteorological conditions is not advisable. On the non-technical side, flight permits are sometimes hard to obtain for safety reasons, and data privacy may become an issue, as was the case with Google Streetview in a number of countries. But with proper planning, these issues should not be a real obstacle for photogrammetric projects.

Research into image matching has been taking place for more than three decades now, and many of the multitude of methods developed have been implemented in commercial Digital Photogrammetric Workstations (DPWs). Nevertheless, it is still an active research area. Could you explain this?

Indeed, image matching has a
long history, and from a superficial point of view, one might argue that the research should have been finished long ago. But we should not forget that matching serves very different purposes. The first goal was to produce a digital terrain model from aerial images in open areas. First attempts date back to at least the 1960s, and useful solutions appeared together with the first DPWs. Attention then shifted to automating image orientation, thus to automatically deriving tie points in aerial triangulations. Commercial solutions first became available some 15 to 20 years ago and have been refined ever since. In the meantime, we are able to use a very large set of images from the web, which were never intended to be used for photogrammetric purposes, for automatically reconstructing a model of the depicted scene. Nowadays, researchers aim at reproducing 3D city models with many height discontinuities in extremely high resolution, and also at recognising obstacles in autonomous driving applications. The latter obviously needs real-time solutions. Matching results also start to be a very valuable piece of information for automatic image understanding, which is a major driving force for today’s research into dense matching. For instance, when we want to extract buildings from images, we are well advised to take into account that buildings are higher than the surroundings. If this height information is available, it makes it much easier to discern buildings from other objects with similar grey values such as roads. Stereo operators have known that for a long time.

In a nutshell, when we talk of image matching we talk of a very broad range of methods with rather different applications. While some have been solved decades ago, research still struggles with others. I actually believe this situation will continue for a while. The spatial resolution of today’s satellite imagery is 40cm, although this figure is effectively 50cm due to the US government’s restrictions on civilian imaging. The trend is towards increasingly higher resolution. Will such imagery eventually become a competitor for aerial photogrammetry?

The answer is a clear yes. At a ground resolution of 50cm, we already see severe competition. Of course, celestial mechanics can’t be beaten – the satellites must follow their orbits. Hence, today, images from space cannot be acquired with the same flexibility as those from the air. But this situation may change once we have access to satellite constellations, and these have started to appear in recent years. RapidEye with five satellites in medium resolution and the French Pléiades system with two high-resolution satellites are only two examples.

On the other hand, there is a clear demand for even higher ground resolution for many applications. Many of the aerial images acquired today have a pixel size on the ground of 10cm or less. Thus, it seems that there will still be a market for both satellite and aerial imagery in the foreseeable future. UAS can operate autonomously as a result of digital flightplans, while today’s software enables automatic generation of digital elevation models and orthoimagery. How do conventional DPWs need to be adapted in order to become UAS software? Most DPW software is optimised with respect to aerial image blocks with parallel viewing direction and regular overlap in and across the flight direction. However, UAS produce many more and often smaller images with rather varying exterior orientation and irregular overlap, and the viewing direction may be oblique or nadir. In order to handle such images, DPW software must become more flexible and more robust – this also goes for input formats, but primarily for automatic generation of approximate values to run matching and bundle adjustment processes, and for a proper consideration of distortion during image exploitation. Furthermore, manual inspection of oblique images is a necessity. Finally, due to the many images, a free and smooth roaming across different stereo models without operator intervention is a must.

Which major developments do you foresee, in geodata acquisition technology in general and in photogrammetry specifically, in the next five years? I guess what we will see is an even closer integration between methodologies from aerial and close-range photogrammetry –
and of geospatial information; (2) analysis of any kind of images is the premier global player in the science of acquisition and automatic processing of data from images. The society embracing the areas of photogrammetry, remote sensing and geomatics is right when he says environmental issues are among the answers to global problems. The development of the internet, satellite technology, and robotics applications is of vital importance to ISPRS, an organisation unique in its three dimensions: (1) ISPRS is a scientific society embracing the areas of photogrammetry, remote sensing and geomatics; (2) ISPRS is a truly international in the sense of acquisition and automatic processing of data from images; (3) ISPRS is a truly global society serving the needs of geomatics professionals from all nations around the globe.

Attracting sufficient students is a major issue for geomatics programmes all over Europe. As a consequence, we need to present the different facets of our profession, as the employers will then be able to convince students to choose geomatics. We are addressing both students-to-be and people already within our profession in order to try to change the situation.

Also in Hanover, we would like to attract more students than we presently do. We are active in a number of initiatives to attract students to our profession. The German Society of Geodesy and Geoinformatics and the German Association of Young Professionals have joined forces with private companies to present the different facets of our profession to students. On 15 June 2013, we hold the first of a number of seminars to inform students about our profession. Attracting enough students has been a challenge for many years. We are addressing both students-to-be and people already within our profession in order to try to change the situation.

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