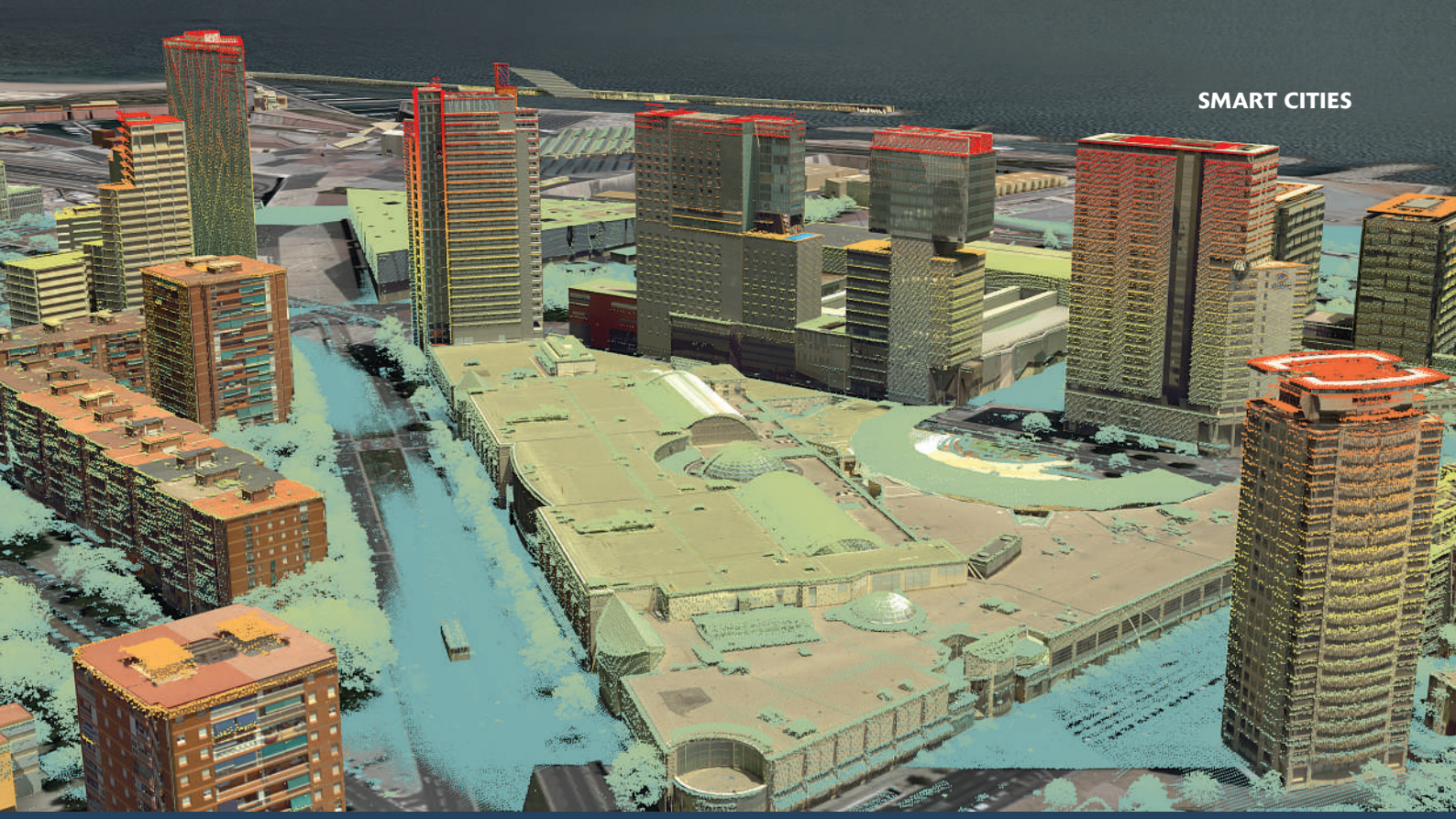

A VISION FOR SMART CITIES

RUEDI WAGNER PUTS FORWARD HIS VISION FOR WHAT GEOSPATIAL TECHNOLOGY AND DATA CAN DO FOR SMART CITIES – AND WHAT HARDWARE AND SOFTWARE VENDORS NEED TO BE DOING TO MAKE IT A REALITY

I have lived for prolonged periods of time in urban environments on several continents and through years of travel, I was lucky enough to have visited quite a few cities and metropolitan areas. I have experienced quite a number of examples that exude cohesion, vision and aim. I also work closely with professionals engaged in Smart City initiatives, and it is hard to ignore the attention and focus this concept quite rightly receives globally today.

What are we are trying to address with Smart Cities?

- Urban planners, who develop and act upon coherent visions and aims based on the best available information to align space and (natural) resources with the needs of citizens, and communicate those openly.
- Those in charge politically, who act transparently in the best interest of the people and the environment.
- All those people living in a city, who are highly engaged and communicate their needs to those in charge and wisely use resources.
- Technical innovations that are made available and are used to improve information flow and information sharing between all stakeholders.

But how far down the line in this process are we really from a geospatial perspective?

Globally, urban (3D) mapping seems to many to be the next growth market. In airborne mapping, airborne imagery and its derivative 2D products have become a commodity in many parts of the world. The question is no longer if the information is available, but in what resolution and quality and how old the information is. In contrast, 3D products seem to be only emerging. Cities are growing through urban sprawl outward and inner city rejuvenation upward. Having the third dimension – and with that an accurate digital representation of reality – is no longer important only to the construction industry; now, urban planners, surveyors, real estate agents, traffic planners, taxi drivers, car manufacturers, environmentalists, safety and security, the citizens themselves as well as game developers can take advantage of accurate and realistic 3D models.

In addition, LiDAR technology has also matured and at least in theory supplements imagery to create even better 2D and 3D products and to provide a more comprehensive information base through additional information derived for instance from waveform analysis.

Theory vs practice

Yet, theory and practice seem to differ. Over the years, I have spoken to many professionals in this field and what seems to be the norm rather than the exception is that very few have access to a complete data set of imagery and LiDAR products and derivatives thereof to assist in their decision-making. Sometimes both datasets are available, but acquired

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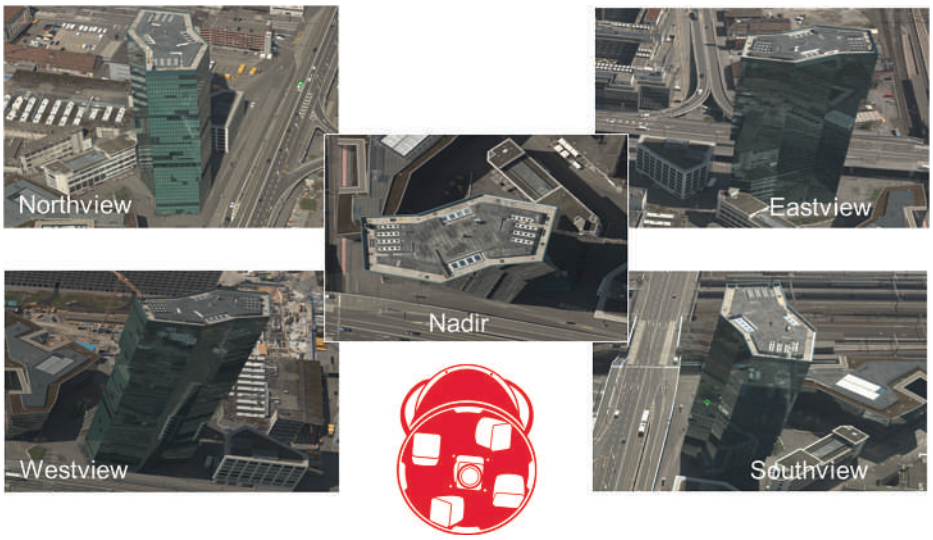
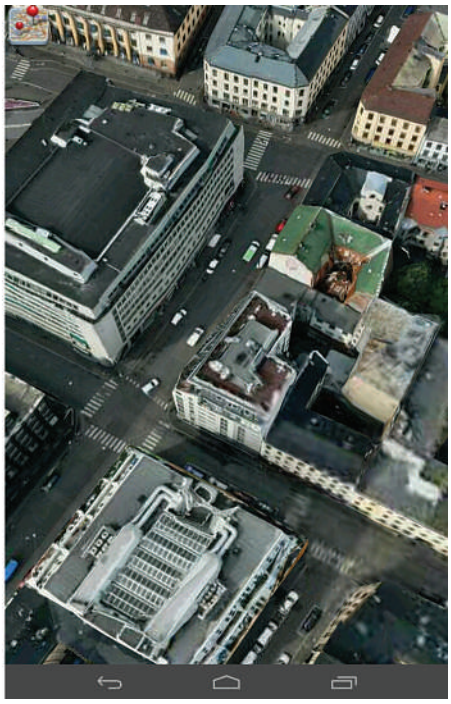




within years of each other or only covering parts of the project area. Increasingly, urban experts have access to oblique imagery and nadir imagery, but still not to derivate products for better visualisation and analysis. A number of them use publically available data, because it is better than what they can get through their official channels.

A healthy exception to this on a regional scale is China and some major cities worldwide. Chinese leadership early on has recognised the importance of geospatial data for successful Smart City initiatives, as most decisions in such a complex and fast-changing environment require an accurate and up-to-date planning base.

I think in this case it is fair to say that what is good for professionals in China is good for other experts, too. Having access to orthophotos, oblique images, digital surface models, digital elevation models, 3D model buildings and so on from the same day should be any urban planner's dream. Yet, the most frequently mentioned inhibitors to this remain cost and logistics. In many countries, municipal budgets are strained and money invested in geospatial surveys is limited. Up to now, combined imagery and LiDAR surveys were costly as they required two instruments and a dual-hole aircraft and thus most experts had to choose one over the other. Generating high-resolution data sets over large areas in the shortest possible time requires investments in adequate IT infrastructure to process, visualise and share the data. And last but not least, creating 3D products requires a different set of skills and as a consequence, where it cannot be automated, it requires qualified labour.

Hardware and software providers also have a responsibility to enable users and applications through innovation. Imaging and LiDAR technology need to come together, in the form of a hybrid sensor concept as well as combined aerial triangulation, merged point clouds, supplementary product generation and improved editing.

Collaboration

In an increasingly complex world, it is the duty of those in the lead to not only derive insights and decisions based on not only the best available information and data, but also inputs from those affected. Citizen engagement is the core concept of open government, but it is nowhere as obvious and necessary as in the Smart City paradigm.

I think there has been tremendous progress here, both through making professional GIS-type information available to the public through the web and advances in mobile technology. Many cities actively share information and engage their citizens in planning processes through access to all kinds of GIS layers and planning information.

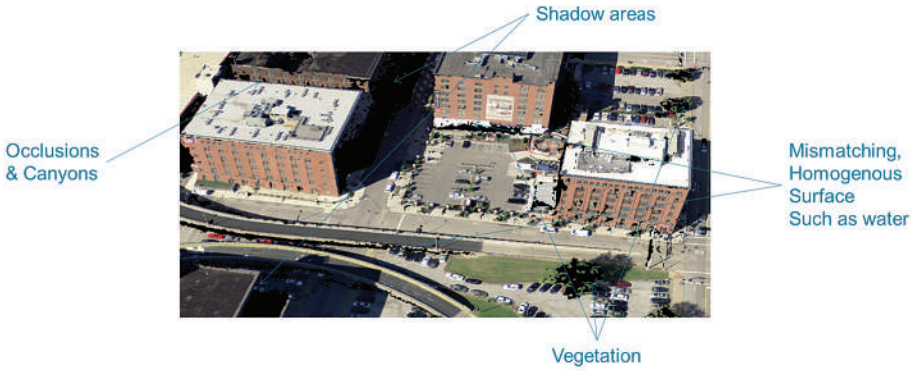
With the advent of smartphones, interactive apps and virtual reality games, many cities have embarked on citizen-engagement programmes such as 'improve my city' or 'explore my city'. With the location-based services market expected to explode, many more concepts are currently being tested or are on the way. One of the bigger geospatial technical discussions of recent years has been around what kind of 3D information should be made available and to whom and how it should be visualised or combined with other relevant information.

For once, a debate has been around building models vs mesh. This discussion seems to have settled in favour of letting both models live. Textured or untextured building blocks or GIS-ready building models are useful for planning purposes and are in many parts of the world now part of an obligatory deliverable for municipalities and national mapping agencies. In addition, because of their more realistic appearance, mesh models have become widely accepted as the visual representation in the digital world and on mobile devices, both in cities as well as in major tourist destinations, where they become a mobile component just as the weather forecast, major sites and ticketing. In fact, many major winter resorts are now including mesh models derived from winter survey flights in their offerings. Modern streaming technologies facilitate smooth access to even the largest data sets onto mobile devices in acceptable time frames

and without exuberant costs. In addition, improved mobile graphics and power management do not drain a phone within minutes of looking at 3D maps.

As more and more of these 3D data sets are included in professional and commercial decision making, the demand for quality and freshness will only increase. Major cities that previously conducted surveys once a year or every other year are now thinking of doing so every quarter. Previously, we assumed local updates would be collected using UAVs, but the latest advances in IT technology and the ability to distribute processes across server farms reduces the past challenge of processing large amounts of data as fast as possible to a question of scalability and a guarantee to maintain accuracy requirements.

Thus, the focus on high performance hybrid sensors is likely to expand to include high performance, multi-sensor production workflows that facilitate a high degree of throughput, automation and support scalable processes across ever-growing IT resources. With those workflows, and having supplementary imaging and LiDAR data from one flight to improve the quality of the product and drive automation, I would think that it will be possible to process 250,000 oblique and nadir images and millions of points into orthophotos, digital elevation models, building blocks and 3D city models in the matter of weeks, instead of months. Once this happens, major cities will be covered with up-to-date geospatial data every quarter, allowing professional and commercial users alike to make smarter decisions and thus play their role as engaged citizens and Smart City experts.



The future – now

Of course, even this is still a little visionary. But hybrid sensors and high production workflows have already become a reality. Using LiDAR sensors with imaging sensors is not a radically new concept. But being able to acquire multispectral nadir imagery, oblique imagery in four directions at 45° and more LiDAR data with 700kHz giving you more than eight points per m2 at 1,000m above ground level with one sensor and a standard aircraft installation, as just realised with the Leica CityMapper, is indeed a little revolution.

In addition, Leica's airborne sensor workflows have for many years been an essential pillar of success in the US's National Agriculture Imagery Program, which has a very tight acquisition/delivery timeframe. Expanding this concept to the new HxMap, which allows high performance processing for all Leica sensors, and to CityMapper is exciting. Bringing together both the Leica CityMapper and the HxMap software into a vertical solution aptly named 'Real City' is a first step to turn vision into reality, giving professionals as well as commercial users the most comprehensive geospatial base layer with the highest quality, in the shortest possible time at the most affordable cost.

HYBRID SENSORS AND HIGH PRODUCTION WORKFLOWS HAVE ALREADY BECOME A REALITY

Ruedi Wagner is the vice-president of airborne imaging at Leica Geosystems (www.leica-geosystems.com)