From Sensor to Information – The Evolution Continues

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ABSTRACT

The speed of innovation in our industry is faster today than at any point in history. Despite the increase in velocity, we are just keeping up with the demands of our Geospatial consumers. In 2011, during Photogrammetric week, we discussed, in detail, the generation of digital surface models automatically – generating dense point clouds from imagery. During the 2013 Photogrammetric week, we will discuss the generation of 3D City models from Stereo Imagery and LIDAR point clouds. This paper will discuss the concept of "Dynamic GIS" and what we are doing at Hexagon to keep pace with the demands our professional market.

1. DYNAMIC GIS

Historically the GIS delivered via Photogrammetry has been the highest accuracy. The markets we served in the past accepted that high accuracy equated to slow updates. The output in most cases was an Orthophoto or a base map. The age of the digital sensor in the early 2000s signaled the beginning of change. Orthophotos that took months using film were now possible in weeks and then days. Today we see the GIS we produce continuing to evolve rapidly as the GIS solutions become more sophisticated and the base Orthophoto in many cases is an intermediate product on the way to a final GIS product. We will now take a look at the progress made by Hexagon since the last Photogrammetric week, two years ago.

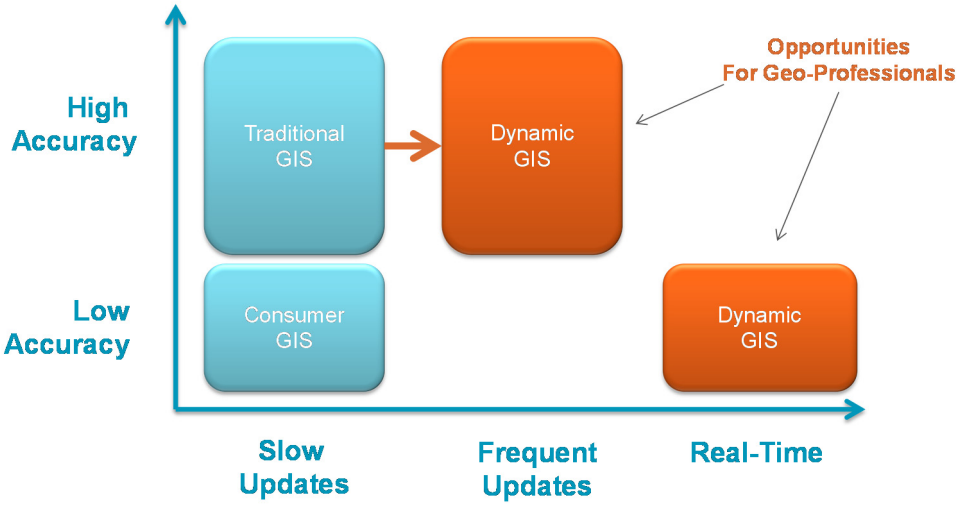

Figure 1: Dynamic GIS.

2. SENSOR EVOLUTION

Hexagon remains committed to developing leading-edge sensors for the professional GIS market. We will now take a look at the sensors we have developed since the last Photogrammetric week in 2011.

2.1. ADS100

The next Generation ADS – designed specifically for large scale acquisition products was announced early in 2013. First customer shipments took place in June of 2013.

Figure 2: ADS 100.

- Increase in Swath width from 12K to 20K
- Highest productivity – Twice the efficiency!
- First TDI available in a Line Sensor
- Spectral Bands
  Red: 619-651nm
  Green: 525-585nm
  Blue: 435-495nm
  NIR: 808-882nm
- Pixel Size: 5um
- Dynamic Range of CCD: 72dB

2.2. DMCIIe

Back in 2011, Hexagon made a commitment to continuing both the large-format ADS line and the DMC frame sensor product lines. Since the last Photogrammetric week in 2011, we have continued to improve the DMCII product line: improving efficiency and consolidating on a unified aircraft installation.

Figure 3: DMCIIe.

- Single large format CCD for precise geometry and high radiometric image quality
- Dynamic Range of CCD: 72dB
- 14 bit A/D converter
- Four color channels RGBNIR
- Pixel Size: 5.6um
- Dynamic Range of CCD: 72dB
- Extended airborne storage of 4.8 TByte
- Integrated sensor management
- Embedded Novatel SPAN GNSS/IMU system with tightly coupled processing to reduce fuel consumption

2.3. RCD30 Oblique

Back in 2011, Hexagon made a commitment to continuing both the large-format ADS line and the DMC frame sensor product lines. Since the last Photogrammetric week in 2011, we have continued to improve the DMCII product line: improving efficiency and consolidating on a unified aircraft installation.

Figure 4: RCD30 Oblique.

- Multispectral Oblique System
- 60/80MP sensor
- Based on RCD30 MF Camera
- Photogrammetric design with bi-directional motion compensation
- Integrated GNSS/IMU system
- Available as Trio and Penta
- High Frame Rate (1.8 sec Penta)
- Produces distortion-free imagery with post-processed exterior orientation.

2.4. Mobile Mapping Solution

Hexagon entered into the Mobile Mapping market with the acquisition of GeoSoft in June of 2013. With this acquisition, we announced the launch of Pegasus One at the HxGN 2013 conference in Las Vegas.

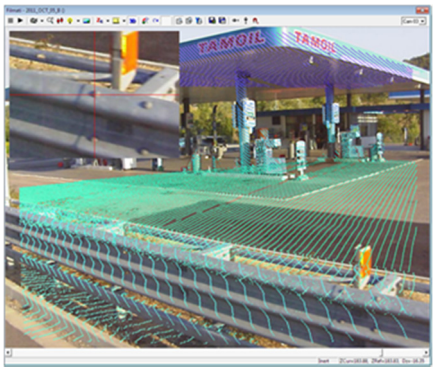

Figure 5: PegasusOne Mobile Mapping Solution.

3. EXPANDED WORKFLOW – GEOSPATIAL SOLUTIONS

It is not enough to provide world-class sensors. For sure you must have radiometric and geometric stable sensors for accurate results across temperature, pressure and other environmental conditions – that is a given. You must add efficient workflows to lay the foundation for true Geospatial solutions. Within Hexagon, we have been very busy since we last met at Photogrammetric week in 2011. Through internal development and acquisition we have made great strides in a) strengthening our sensor workflows and b) expanding them into Geospatial solutions. We will now take a look at several examples and I am sure you will agree and will see the power of Hexagon Geospatial.

3.1. "Pure Color" Radiometric Enhancements

We continue our work towards Absolute Radiometry. Latest improvements in the DMC workflow include "Pure Color" radiometric enhancements with atmospheric correction included. The result is efficient, natural-looking imagery – automatically.

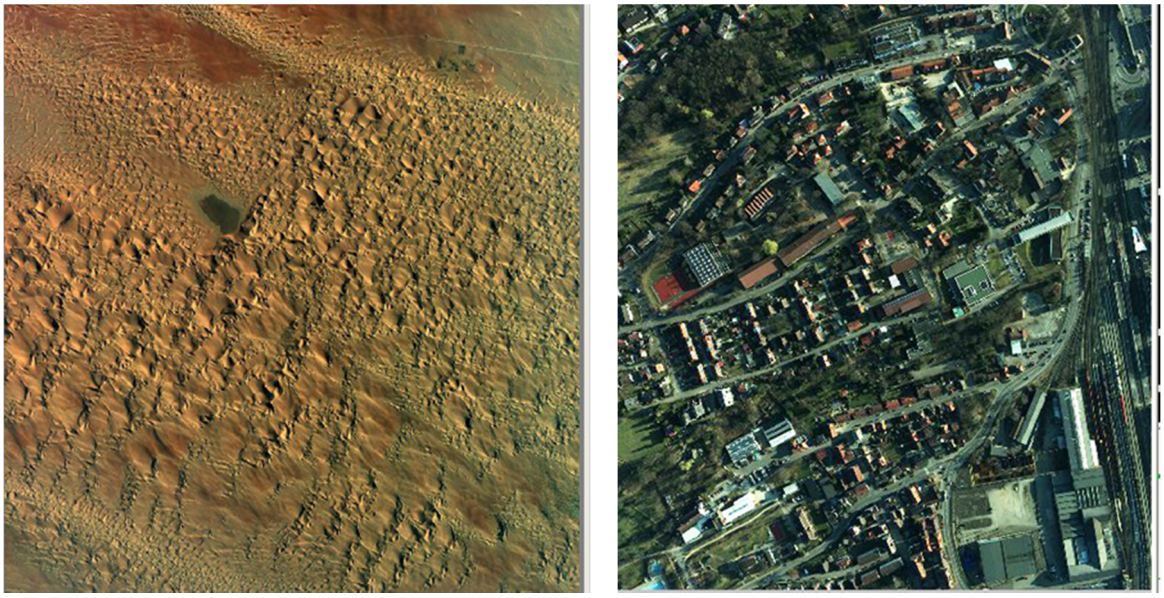

Figure 6: DMC "Pure Color" Technology.

3.2. SGM-Based Change Detection using Spatial Modeler and Apollo.

As we discussed, Dynamic GIS requires accurate data with fast update cycles. A very natural extension of fast update cycles is change detection. If you can acquire updated GIS information over a city every 3 months – it is an overwhelming amount of data. In many cases, the intelligence that is of interest is what has changed since the last update. Below is an example of change detection results using Intergraph's Spatial Modeler and Apollo.

These images are not flown under special conditions – they are from Northwest Geomatics' 2010 and 2012 NAIP program. They are 1 meter GSD. They use different sensor technologies – ADS40–II on 2010 and ADS80 on 2012. They were flown at 32,000 feet above ground while travelling 500km/hr and capturing a 12km wide swath of data – 40 million pixels a second! The magic is the sensor quality and the unique Intergraph software tools that the extraction, even on 3 year old data, generates new information. The data captured in 2010 was not thrown away 'pretty content' – it is rich information that as the technology to process and extract information improves, so does the usability of the old data.

Figure 7: The new commercial building is in the upper left corner and is mainly red (large vertical change). Some new houses have been added and they are shown in yellow (moderate vertical change).

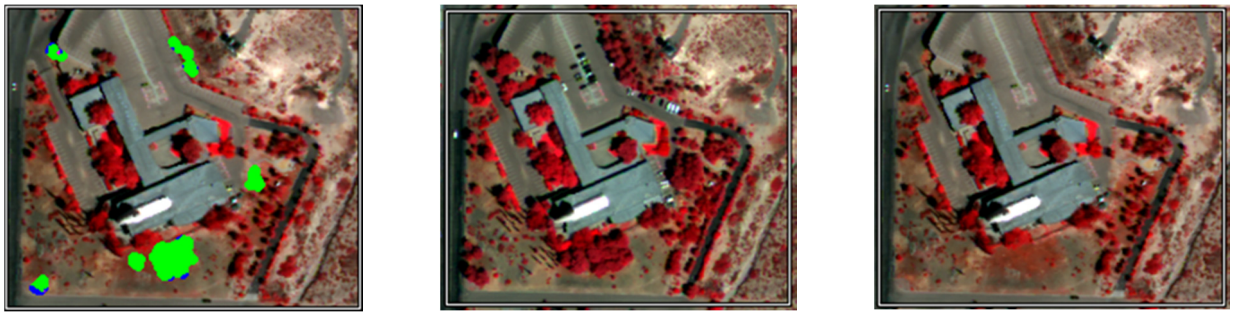

Figure 8: The green area show where trees have been removed.

3.3. 3D City models using 3DCon Software

In late 2012, Hexagon acquired Tridicon located near Berlin, Germany. Tridicon produces software that can generate 3D City models from stereo imagery and point clouds. Tridicon software is a natural extension of Hexagon sensor workflow – allowing a seamless process from mission planning to 3DCity models.

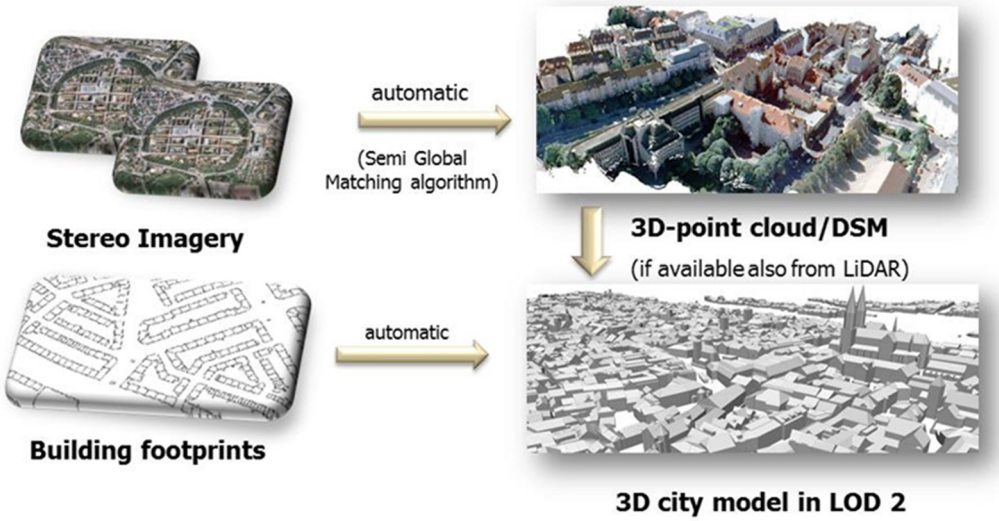

Figure 9: 3D City models using Tridicon software.

4. CLOSING

It is amazing to me that 2013 is here and we are now attending Photogrammetric week once again. The velocity of change in today's world is incredible. Our industry is moving at a rapid pace. It is exciting and sometimes exhausting. Photogrammetric week is an excellent time to reflect on what we have accomplished as an industry in the last two years. What new products have come to market and what scientific advancement within the academic community will lay the foundation for technology of the future. I am excited to be a part of Hexagon and Photogrammetric week. I look forward to sharing Hexagon's progress, seeing what others have done, renewing old friendships and making new ones. I am confident the new technologies and products discussed at the 2013 Photogrammetric week will be educational and amazing.