

Sensors to Solutions – Data to Information Providing Accurate Answers Fast is Crucial

An Overview

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Introduction

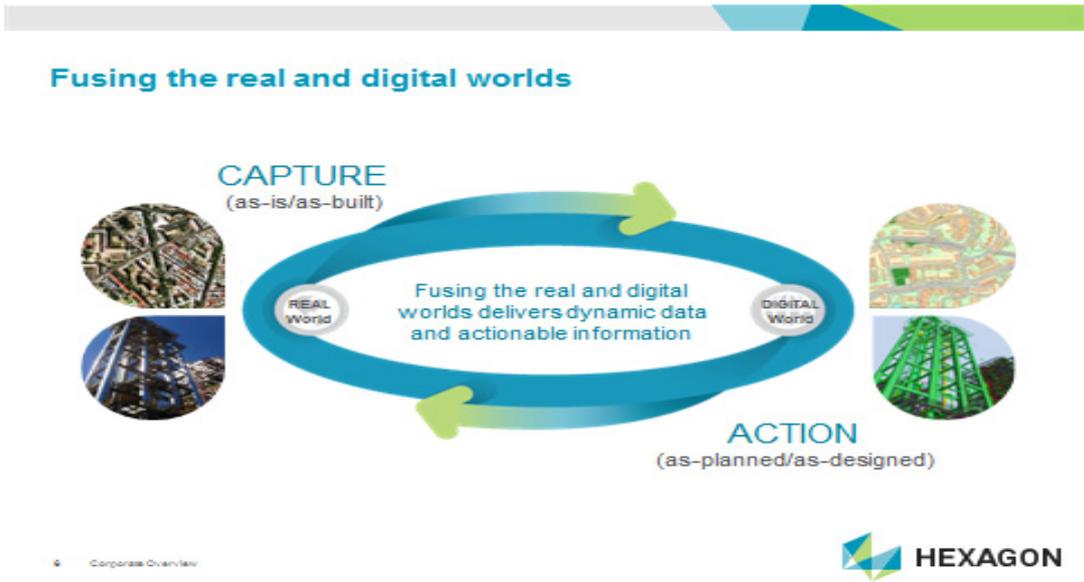
Carl Pulfrich started this event in 1909 as a “vacation course in photogrammetry”. Today, the programme of the 55th Photogrammetric Week is “Excellence in Photogrammetry, Computer Science and Geoinformatics”. So, since 1909 a lot of things have changed and, as we all know, this speed of change is increasing. Talking about photogrammetry today means also talking about new developments of data capturing, computer science and geoinformatics. Juergen Dold, our president from Hexagon Geosystems said in an interview with the Germany’s “Business Geomatics”: “In the future nobody will ask with which method data was captured. Today, and even more within the next years, it will be crucial to provide accurate data fast and make them easily available – including mobile devices.” Therefore, our goal is to provide professional data with accuracies of centimetre or millimetre and make them available as one is used to from consumer markets.

The data have to be cost-efficient, fast and easy accessible as from Google, Apple or Microsoft. That means not just providing cartographic data in the long term, but new applications have to improve the flow of data from the sensor to the internet – selected by different applications. That is the key idea of Dynamic GIS as we use it in the Hexagon world. For us, it means to combine know-how, technologies and experiences out of all company areas. An example is the product portfolio of Intergraph which is equipped with the same sensor intelligence from Leica Geosystems and NovAtel. Vice versa there are many products from Leica Geosystems that use analysing and presentation features out of the GIS world.

This paper will give you a strategic overview where we as Hexagon see the main challenges of the future, how we are structured to master those, and what we do to help our customers to work more efficiently and more comfortably.

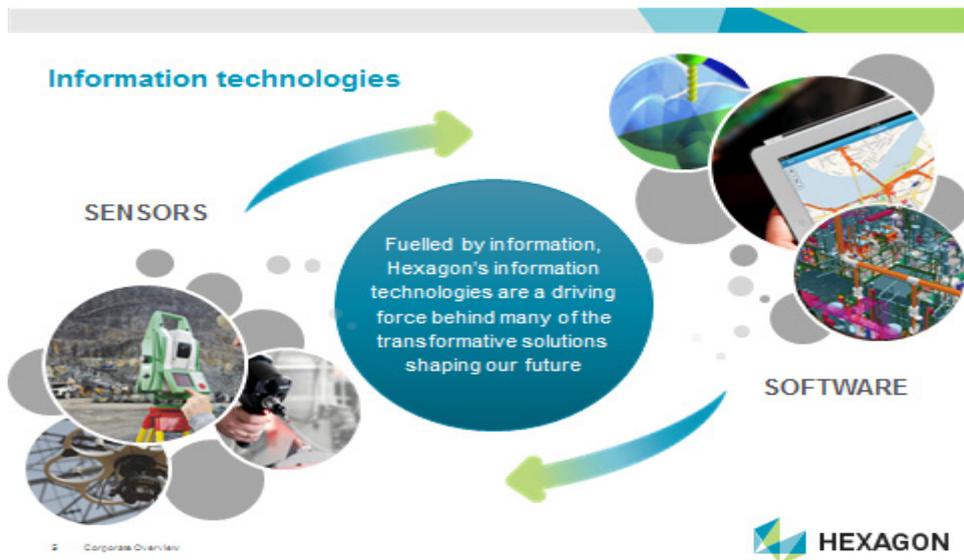
An Introduction to Hexagon – Fusing the Real and Digital Worlds

Hexagon is a leading global provider of information technologies that drive quality and productivity improvements across geospatial and industrial enterprise applications. Hexagon’s solutions are fusing the real and digital world to deliver dynamic data and actionable information.



Sensors to Solutions – Data to Information

Leica Geosystems, and even more Hexagon with all its different brands, has a large number of customers from differing markets. Important for all of them is the connectivity of platforms and the data. We meet this in two ways: First, all Hexagon solutions promote open interfaces, can be embedded and data can be shared across a variety of platforms. Second but more important, we try to improve the quality of the data and thus the derived information for all users. Utilising “big data” is a good example. To be able to do so, traditional hardware-oriented solutions are no longer good enough. Without seamless and effective workflows, these improvements are not possible. With our sensors, we generate a mass of high-quality data. For our customers, it is important to develop processes to generate valuable information from this data to support smart decision-making.



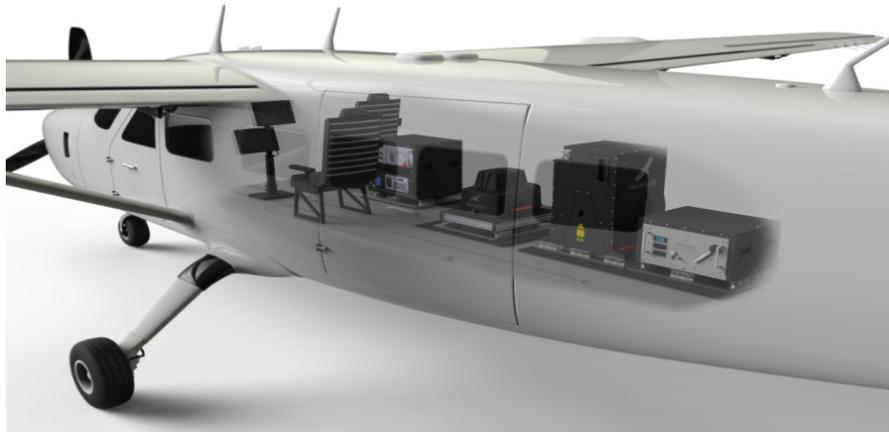
With these new technologies available today, we can answer some of the key questions more efficiently. For example: It is possible to detect change in existing building development in a particular area somewhere in Germany and check if taxes paid adequately reflect these building

changes. Another example is to monitor sedimentary inflow in rivers or along coastal zones to predict sea level changes along shipping routes.

The Leica Geosystems Airborne Portfolio

The airborne business of Leica Geosystems is bundled in the Geospatial Solutions Division, separated into two business lines:

- Airborne Imaging
- Airborne LiDAR



The Airborne Imaging business line contains the largest available airborne imaging portfolio today. It offers a unique variety of different technologies to best meet the demands of our customer base and the many applications where airborne data is used. Our efforts to consolidate the portfolio of Leica Geosystems and Z/I Imaging have resulted in a common sensor platform that reduces investment and training costs and offers high flexibility, while we were able to concentrate on sensor head innovations: The multispectral RCD30 and RCD30 oblique, the large format pushbroom ADS100, soon with a choice of two lens variations, and our latest ground-breaker the Leica DMCIII, which is the first large format airborne camera that offers CMOS technology and 50% performance increase due to an incredible 25k plus pixel swath. This unique suite of sensors are combined with some of the most innovative workflows on the market today. The 3D modelling capabilities from tridicon have become a standard in automated building detection.

The Airborne LiDAR business line consists of the latest Leica Geosystems development the ALS80 with its 3 configurations HP, HA and CM, presented for the first time at Intergeo in Berlin, and three new sensors for the complete new service bathymetry. These sensors were brought into the Leica Geosystems business by acquiring the Swedish company AHAB – Airborne Hydrography AB, in September 2013. The new bathymetry sensors are: Chiroptera II, DragonEye Dual Head and HawkEyeIII.

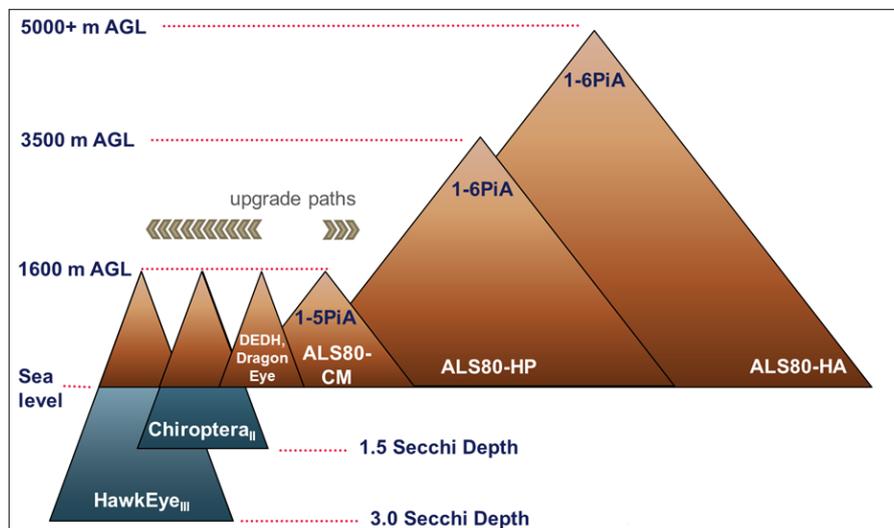
Airborne Imaging



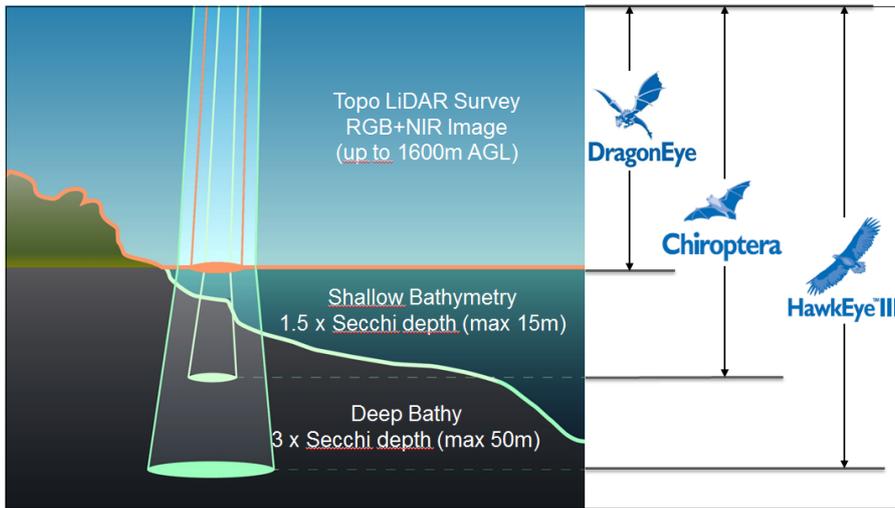
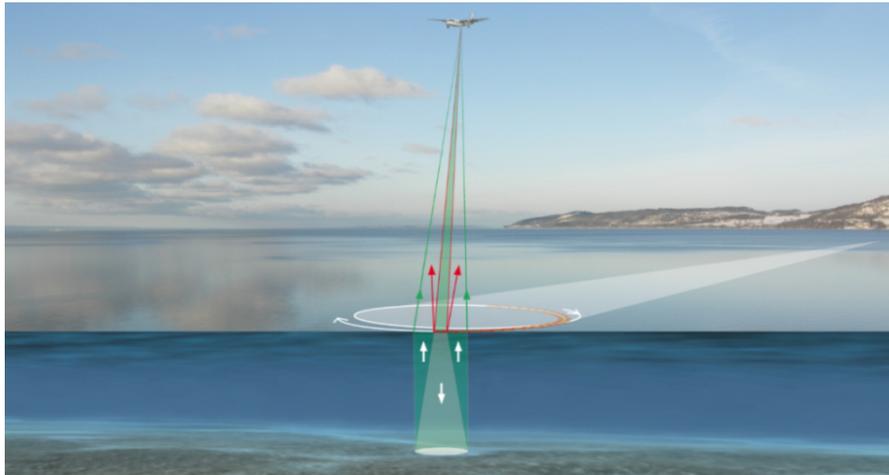
			
DMC III	ADS100	RCD30 Penta Oblique	RCD30
<ul style="list-style-type: none"> • 50% performance + • 26,112 px in swath • 25% more area • CMOS technology • 5cm GSD at 1,180m 	<ul style="list-style-type: none"> • Full multispectral color swath width • 20,000 pixels • Select TDS stages • Full color RGBN 	<ul style="list-style-type: none"> • World's first 80MP multi-spectral MFC • High accuracy urban and 3D corridor map • CH82 multi-spectral 	<ul style="list-style-type: none"> • Only one: 80MP RGBN co-registered • FMC along two axis • Rugged and thermal stabilised lenses

Airborne LiDAR

Leica Airborne LiDAR sensors – a comprehensive product portfolio



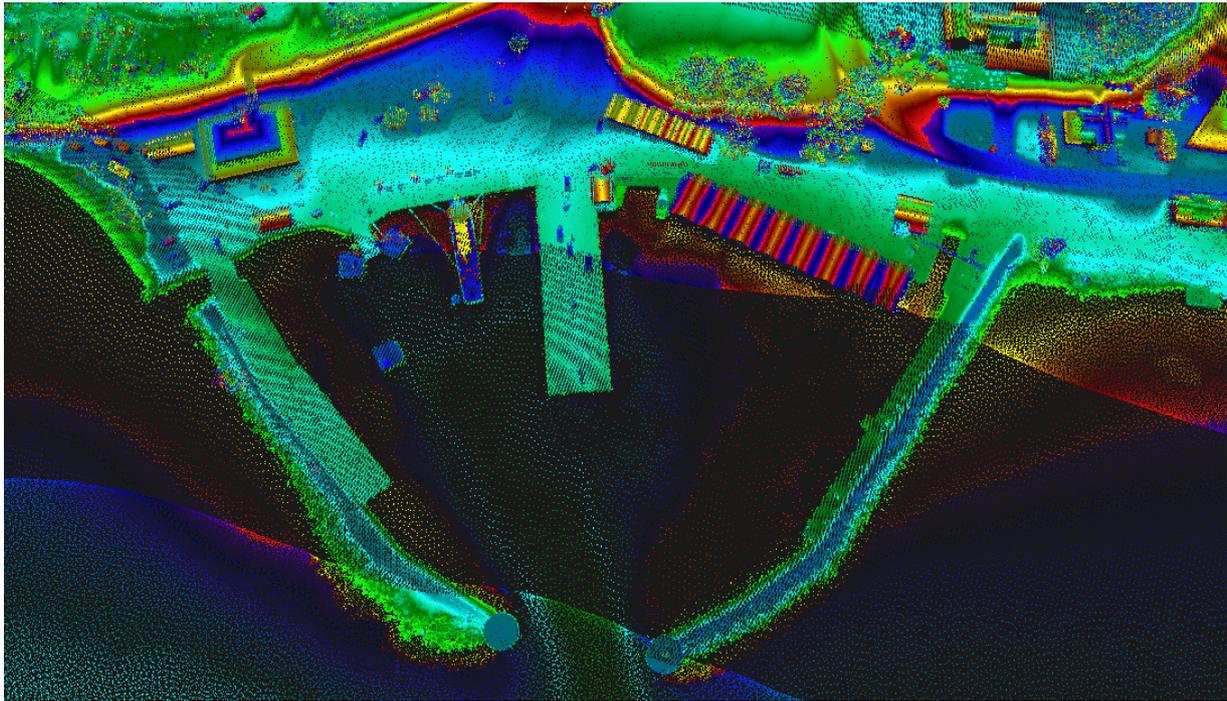
A series of sensors for simultaneous survey of land and sea floor



Conversion between sensors – allows multiple applications use



Airborne Topo LiDAR



			
Topo LiDAR ALS80 HA, HP, CM	Topo LiDAR DragonEye DH	Topo, Shallow Bathy Chiroptera II	Deep Sea Bathy HawkEye III
<ul style="list-style-type: none"> • 1,0 MHz pulse rate • Nearly 8km swath • 50% less flight time • Max height: 5,000m • FOV 0-75 deg (HA) 	<ul style="list-style-type: none"> • 2 oblique scanners • RCD30 • Capture, degitise, analyse full waveform in real time 	<ul style="list-style-type: none"> • Down to 15m • Record Japan: >31m • Simultaneously full waveform 35kHz bathy + 500kHz topo 	<ul style="list-style-type: none"> • Down to 50m • 2 bathy channels: 10kHz, 35kHz • Optional 500kHz topo or RCD30

Lidar Survey Studio (LSS)

- Conversion all LiDAR waveforms to LiDAR returns
- Flight trajectory import and transformation
- Automatic water refraction correction
- Automatic data classification
- Turbid water enhancement

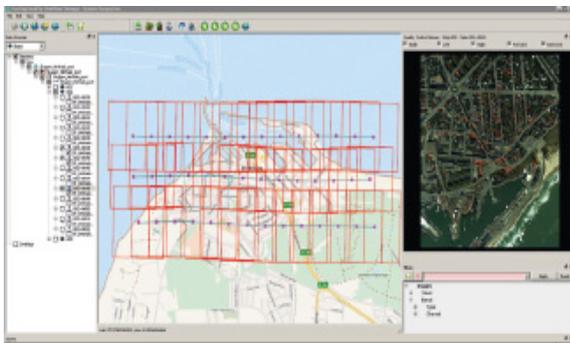
Workflow and Solutions

State-of-the-art sensors are important – but intelligent, high performance and easy to use software is it even more. A simple equation: To be No. 1, the most efficient sensor relies on the most efficient data processing.

High productivity = Leica DMC III + HxMAP Real City

Based on the acclaimed Leica XPro processing suite, Leica Geosystems is introducing HxMAP RealCity, a new and intuitive common data processing platform to support all sensors in the world's most comprehensive airborne mapping portfolio. Now available, HxMAP Enabler & Provider for Leica DMC II and DMC III offers state-of-the-art project management, radiometric tools and production tools for efficient processing of even the largest blocks.

HxMAP RealCity – processing suite



- Enabler: Pushbroom/Frame/Oblique
- Provider: Image Ingest, RawQC
- Core: APM Triangulation, Ortho, etc.
- 3D Modeller: TextureMapper, 3D Editor
- 3D Presenter: 3D Viewer, Geospatial Portal
- **Optional**
- Stereo Mapping: Photogrammetry Workstation
- 3D Modeller: BuildingFinder 3D Mesh
- 3D SDK: HxMAP SDK

Software for the Automatic Generation of 3D Models

Leica BuildingFinder and Leica CityModeller are just two pieces out of the complete software suite (former tridicon) to generate 3D models automatically – with or without existing footprints.

Leica BuildingFinder



- Produces high quality Digital Surface Models
- Uses them for object recognition and 3D reconstruction
- Generates building footprints, 3D buildings and textures from the used imagery automatically
- Does not require the input of existing building footprints for detecting buildings
- Very useful in areas for which no building footprints are available

Leica CityModeller



- Enables the automatic generation of 3D city models in LoD1 and LoD2 from building footprints and stereo aerial imagery and/or airborne LiDAR and/or other point clouds
- Using stereo satellite imagery is possible
- The source data can be combined and individually prioritised
- More applications are available with the 3D Editor and Texture Mapper etc.

Dynamic GIS – New Products, Services, Applications

Mobile Mapping

The concept of Dynamic GIS is also used in products and applications of Mobile Mapping. Last year, we presented at Intergeo in Berlin “Pegasus:Two” the platform independent M3D-system. This year, we presented the wearable mobile mapping system Pegasus:Backpack, new rail applications from technet-rail, a company we acquired recently in Berlin, and Pegasus:Stream, a ground penetrating systems we offer together with IDS, our system development partner from Italy, at our biggest yearly conference HxGN live in Las Vegas. Even if there are already some early adopters, we are expecting a great interest. Pegasus is a very exciting, fascinating and prosperous product line.

<p style="text-align: center;">Pegasus: Two</p>	<p style="text-align: center;">Pegasus: Backpack</p>
<ul style="list-style-type: none"> • Vehicle independent, data economical, multiple sensor platform • Fully calibrated imagery and point cloud • 7 cameras for full dome imagery • Easily extract features and line work from imagery AND point cloud data 	<ul style="list-style-type: none"> • Indoor and outdoor mapping in one single solution • Marries imagery and point cloud data into a single calibrated, user-intuitive platform • Full calibrated spherical view • Software enables access to ESRI ArcGIS for d-top

	
	
<p style="text-align: center;">technet-rail</p>	<p style="text-align: center;">Pegasus: Stream – GPR</p>
<ul style="list-style-type: none"> • Automated rail line extraction with accuracy and reliability values • Collision detection with any structure gauge profile • Axis based section profiles and vectorisation of detected objects • Documentation of clearance objects in chainage based system 	<ul style="list-style-type: none"> • Underground and above-ground 3D digitalisation solution in a single vehicle towed platform • Speed – can be towed by a vehicle up to 15km/h and can be run continuously without blocking traffic • Accurate to 5cm – provides accurate geolocalisation of pipes, cables and anomalies detected.

Unmanned Airborne Vehicles – UAV

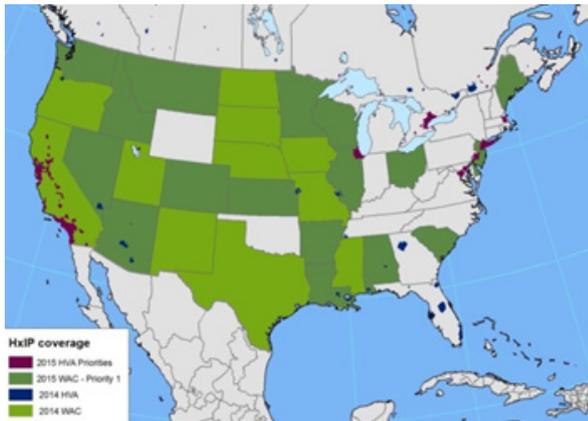
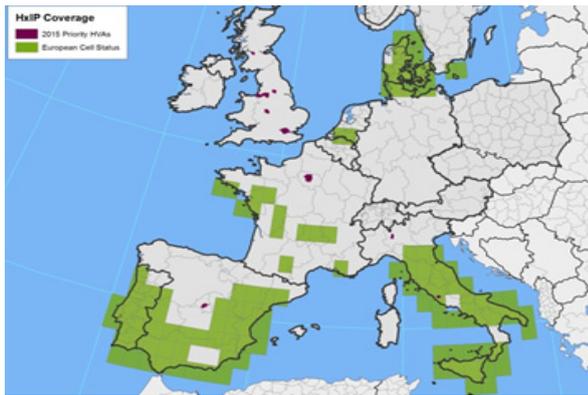
The UAV business is a very fast growing market. With the acquisition of Aibotix we took an important step in this direction. Leica Geosystems has worked in the airborne business for more than 80 years. For us this is more than a fashionable trend but a serious new fields of applications for surveying in the future or to supplement traditional workflows in more innovative ways and to provide a higher degree of automation. For example, a power line will be flown fast and effectively with an ALS80 CM (corridor mapping) LiDAR sensor, while the power pole inspection can be done according to a precisely planned flight with the Aibot X6, equipped with a small digital camera. In addition, an Aibot X6 multicopter can now be navigated with a MS50 total station for inspection of bridges and dam walls.

	
	
<p style="text-align: center;">Aibot X6</p>	<p style="text-align: center;">Swissdrone Dragon 50 with Leica RCD30</p>
<ul style="list-style-type: none"> • Fully integrated geo-referencing • Mapping/GIS: 3D models, point clouds, ortho-photos, high precision GNSS • Inspections: power lines, bridges, dams, large façades, TPS navigation • Indoor inspections with TPS navigation • Maximum collision protection • Payload 2kg 	<ul style="list-style-type: none"> • Payload: 50kg • Rotor diameter: 2x2,80m • Max time of flight: up to 2,5h • Service ceiling up to 10,000 feet MSL • Max airspeed: 54km/h • Pipeline, power line, wind turbine inspections • Roadwork, ramp, bridge, canal inspections

Content as a Service – HxIP, the Hexagon Imagery Program

The Hexagon Imagery Program, or HxIP, is part of the strategy to develop the Dynamic GIS. It also shows that interesting synergies can be developed inside the Hexagon family. To strengthen our service offering we acquired the Canadian company North West Geomatics a longtime leader in airborne surveying and Valtus, a leader in offering cloud based imagery services. Valtus contains not only with data from NWGeo but also with data from other service providers. In addition, customers can customize these data to their unique needs. HxIP based on Valtus, the HxIP offers Hexagon customers and partners an innovative way to resell their data to a wider audience. At the same time, a partnership agreement with other market leaders such as ESRI allows an even bigger audience to make use of our fantastic data.

HxIP – Hexagon Imaging Program



- Orthorectified aerial imagery program for industry professionals
- Partnering with some of the most notable aerial acquisition firms across the globe
- This system of valuable data and content streams: enhanced resolution, four-band orthos, point clouds, stereo imagery
- Providing on-demand aerial imagery:
 - 30cm resolution
 - Four-band (RGB and NIR)
 - Metadata
 - Planned refresh schedule
- Basemap service
- Multispectral imagery service
- HxIP is available through the cloud via multiple content providers
 - ESRI's ArcGIS Marketplace
 - Hexagon Geospatial's Power Portfolio
 - Valtus
- Unlimited use in all applications
- Annual subscription basis

Conclusion

It was Heraclitus of Ephesus who said: *“The only thing that is constant is change.”* How true that is can you see what has happened just in our organisation between the last PhoWo in 2013 till now.

- With the Swedish company AHAB, Hexagon acquired a complete new business line becoming one of the leading providers for bathymetry in both shallow water and deep sea measurement.
- With Aibotix, Hexagon acquired a company that produces flying platforms, that offers innovative ways to combine traditional surveying methods with this new UAV technology.
- In June of this year, Pegasus:Backpack was presented. A wearable mobile mapping system, which is able to work in very tight environments without satellite connection and even indoor without any GPS orientation.
- And, the Hexagon Imagery Program, HxIP, was introduced - available through the cloud, offering premium imagery captured with Leica Geosystems' airborne sensors, and partnering with customers across the globe.

Besides delivering on the promise to continue innovation in the traditional areas, Leica Geosystems has created a number of complete new solutions to meet the demands and challenges in the fast changing GIS world.