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Z/I Imaging: A New System Provider for Photogrammetry and GIS

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ABSTRACT

The world of photogrammetry has changed dramatically. This could be a short description of what has happened in the past few decades. The fact that Z/I Imaging is entering this market as a new vendor is simply the outcome of what is happening in the world's industry. Key words such as globalization, complexity management, key competence, refocusing, shareholder value, access to new markets, are only a few of the driving factors behind such developments as we see them at Z/I Imaging. For most people in the photogrammetry community, it is still not understandable that a vendor like the Carl Zeiss Photogrammetry Division should no longer exist.
This paper gives an overview of the way the Carl Zeiss Photogrammetry Division has had to go and also shows how Z/I Imaging is positioning itself in the GIS and Photogrammetry world. It also attempts a view to the midterm future of photogrammetry as a part of the GIS market.

1. INTRODUCTION

After more than 100 years of involvement in the photogrammetry sector with pioneering inventions, Carl Zeiss is now incorporating its photogrammetry business into a joint venture with Intergraph.
The invention of the stereocomparator by C. Pulfrich in 1901, of the stereoplanigraph by W. Bauersfeld in 1923 and the development of many other 'marvels of optics and precision engineering' were milestones in a long history of technical excellence which, it would appear, have not been repeated. On closer examination, however, Carl Zeiss has successfully mastered the transition from analog instruments to analytical systems. A large number of analytical plotters 'fathered' by Dierk Hobbie are still on the market to this day. But even when the change from analog to analytical instruments was taking place, it was already obvious that the capabilities of state-of-the-art systems were no longer determined solely by precision engineering and optics, but also by the performance of computers and the software implemented in them. The transition to digital system commencing in the mid-/ late 80s has led to the necessity for Carl Zeiss to reposition itself on the market. The presentation of the first PHODIS modules in 1992 heralded the age of digital photogrammetry at Carl Zeiss.
The development of the camera systems followed a parallel course. Again, it was Carl Pulfrich who developed the first metric, balloon-borne camera in 1910. Before and even after World War II, the development of metric large-format cameras was promoted both in Jena and Oberkochen. The era of aerial survey cameras began with the RMK 21/18 presented in 1953 by Zeiss-Aerotopograph. In the following years and after the transfer of Aerotopograph to Carl Zeiss, systems with different focal lengths and enhanced performance were launched on the market. In Oberkochen, these developments were primarily conducted by Hans-Karsten Meier. The current RMK TOP camera system comprises an extended functionality with the T-FLIGHT photoflight management system and other functions such as forward motion compensation which are nowadays taken for granted.
Since the mid-1960s a separate product family of aerial reconnaissance cameras has been developed on the basis of the RMK experience. This successful concept is based on a multi-frame-on-one-film principle and has led to a preprogrammable compact trilens camera for unmanned vehicles and a

modular camera system (KS 153) for military aircraft with trilens and pentalens versions as well as a telelens configuration with a directable optical axis.
Initial digital sensor systems for aerial photography have been discussed for several years and would appear to be ready for market launch in the near future. The Carl Zeiss Photogrammetry Division has also performed extensive studies on this topic and has even developed initial prototypes to a stage permitting them to be operated by users.
The link between analog camera systems and digital image processing systems is provided by image scanners. The PS 1 flat-bed scanner was launched in 1992, followed in 1995 by the SCAI scanner system for automatic roll film digitization.
All developments - whether in aerial photography, in the transfer of information to the digital world via scanners systems, or in image processing - require fundamentally different knowledge and approaches today.
In addition, the market is undergoing a dramatic reorientation process. The age of digital systems for aerial photography and plotting has given rise to new customer requirements, new possibilities for system manufacturers and a wider range of alternatives in applications technology. All this inevitably leads to a reorientation of system manufacturers such as Carl Zeiss. Figure 1 shows the

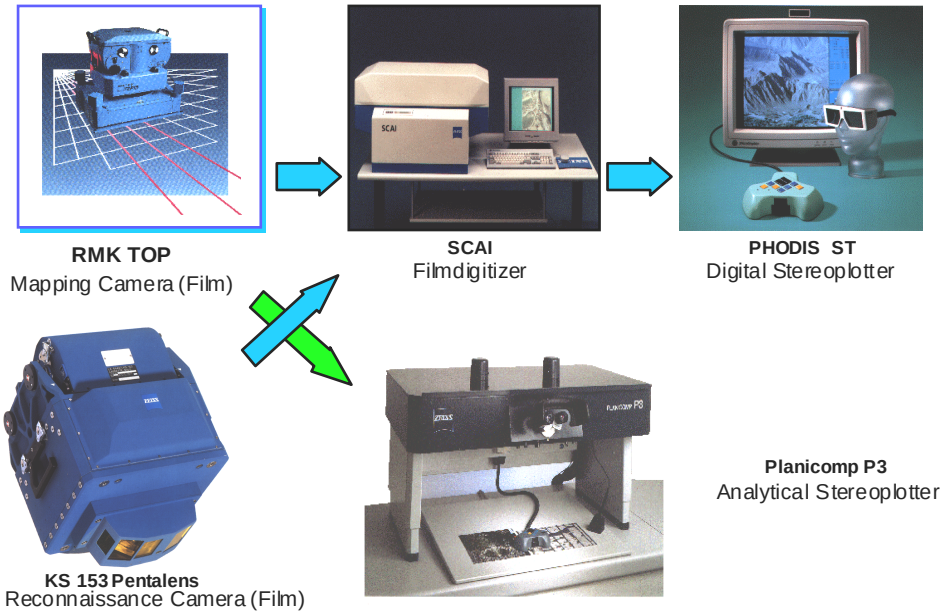

Figure 1: Products within the process.

products presently offered by Z/I Imaging GmbH.

2. THE ROAD OF THE ZEISS PHOTOGRAMMETRY DIVISION TO A JOINT VENTURE

The structural change which had become necessary to rise to the challenges of the future was initiated by the Carl Zeiss Photogrammetry Division in 1997 on the basis of internal and external studies. These studies, prompted the decision to enter into a strategic cooperation to be better equipped for the necessary structural changes and the requirements resulting from it.

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The number of potential partners was limited at that time. Initial contacts with Intergraph, a partner with whom joint development and sales activities had been conducted for many years, remained inconclusive as Intergraph was fully committed to the Windows NT porting then in progress.
This situation changed after an intermezzo with LH Systems and problems concerning the necessary approval by the EU antitrust authorities.
Intergraph now also saw the necessity for strategic cooperation to master the challenges of the future.
After both parties had come to this realization, the structuring of the new company was very rapidly and successfully achieved. In addition, the strategic targets for its development and marketing activities were set.
We share the opinion that the strategy we have defined will permit us to remain an efficient system provider in the future. Our plans cover the following aspects:

- implementation of a fully digital end-to-end system from image gathering to plotting,
- development of a digital camera,
- continuation of the development activities for digital image processing software,
- opening to Geographic Information Systems
- making our tools accessible via the Internet,

3. POSITIONING OF Z/I IMAGING

Z/I Imaging GmbH headquartered in Oberkochen officially started business operations on April 1st, 1999. The sole shareholder of Z/I Imaging GmbH is Carl Zeiss.

In the USA, the Photogrammetry and GIS Imaging areas were also incorporated in Z/I Imaging Corp. with effect from May 15, 1999. The sole shareholder of this company is Intergraph.
Now the only remaining requirement for the founding of the Z/I Imaging joint venture is the approval by the US Department of Justice. The German Cartel Office raised no objections to this joint venture. The shareholders of the joint venture Z/I Imaging will be Intergraph with a stake of 60 percent and Carl Zeiss with 40 percent.
This means that Z/I Imaging is taking over the development, sale and support of photogrammetric instruments and systems of both vendors. Carl Zeiss and Intergraph have been working closely together for decades on the standardization of photogrammetric systems.
The Z/I Imaging portfolio comprises aerial survey cameras for both military and non-military use, and analytical and digital photogrammetric plotting systems. This allows Z/I Imaging to offer state-of-the-art, all-round systems ranging from aerial photography to topographic and GIS data acquisition - all from a single source. Thanks to the seamless extension of this product range by Intergraph's GIS software, an unprecedented end-to-end workflow is achieved.
As the legal successor of Carl Zeiss and Intergraph, Z/I Imaging (Figure 2) will enter into their obligations from all current quotations and contracts concerning photogrammetric systems. As a result, Z/I Imaging GmbH in Oberkochen is now responsible for the sale and support of photogrammetric and military systems in Germany.
In addition to the headquarters of Z/I Imaging Corporation in Huntsville/ Alabama, the company's European headquarters will continue to be in Oberkochen, at the location of the Carl Zeiss. There are also plans to open branch offices in the United Kingdom, France, Greece, South-East Asia and the USA (Denver/Colorado). Z/I employs a workforce of approx. 120 and has representatives in

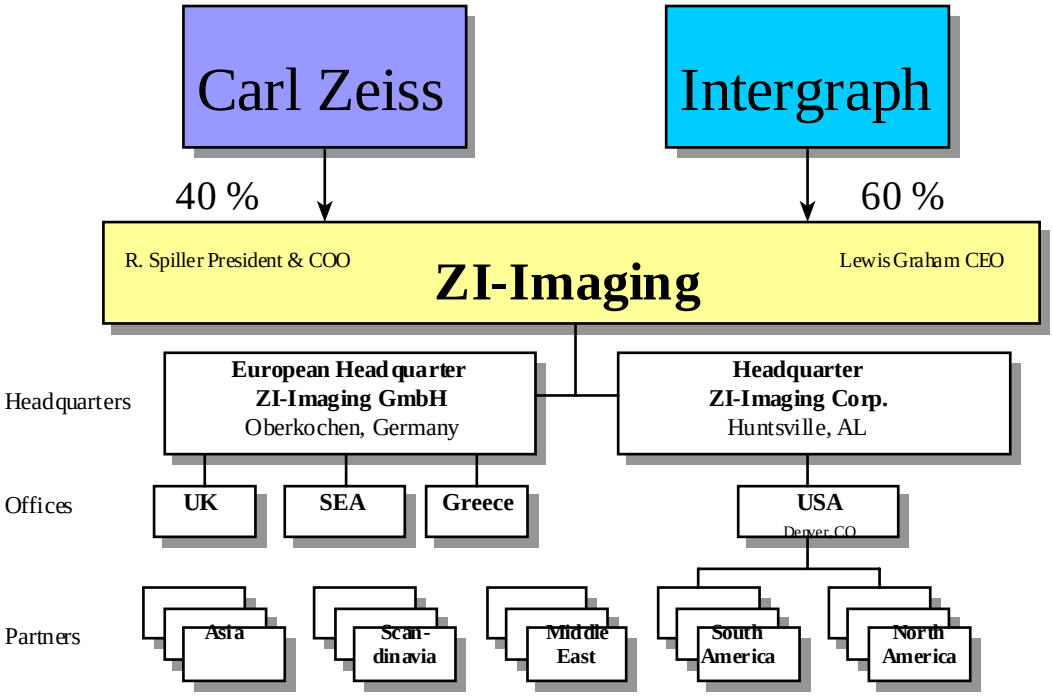

Figure 2: Company structure and ownership.

more than 75 countries.

4. MARKET REQUIREMENTS

In view of the constantly increasing performance of state-of-the-art computer systems, permitting the processing and transfer of huge data volumes, there has been a growing demand that these capabilities should be utilized to enhance the performance of aerial camera systems and plotting systems. Despite the availability of a large number of analytical plotting systems and analog camera systems, the trend is clearly pointing towards an increasingly automated, fully digital end-to-end process (Figure 3).

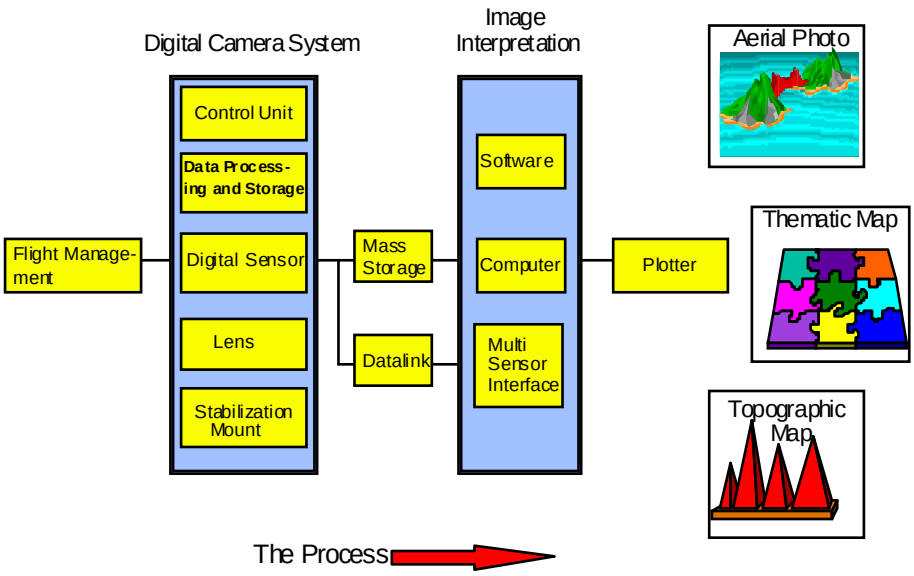

Figure 3: Customer Needs.

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4.1. Requirements made on the camera systems

Satellite-borne, high-resolution sensor systems which have been in the offing for several years now will lead to an entirely new situation in the generation of geo information. Even initial setbacks will not be able to stop this trend. Expectations that it will be possible to generate scales of up to 1:25,000 from satellite-based photography would seem to be realistic (Figure 4).

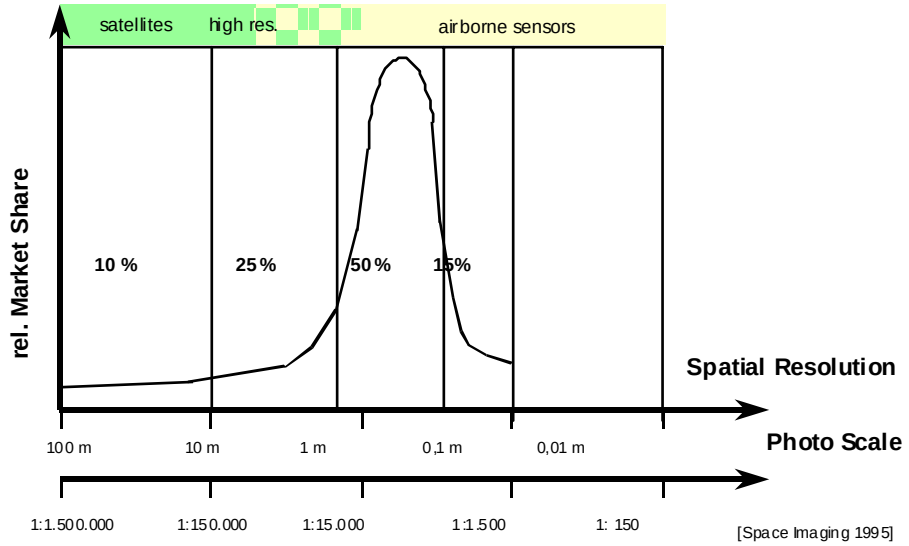

Figure 4: market share spaceborne + airborne.

If this was the only aspect of the matter, the prospects for air-borne sensor systems would indeed be rather bleak. In particular from the economic viewpoint, the market launch of a digital sensor system would be difficult. Two decisive benefits of digital sensor systems, however, deserve to be mentioned in the discussion about this technology:

- **Enhanced technical features** (Figure 5)
  - Increased radiometric resolution
  - Higher precision in georeferencing
  - Acquisition of image information from extended spectral regions

- **Extended possibilities of application**
  - Reduced throughput time up to the final result
  - Possibility of data telecommunication
  - Elements of data recording and evaluation will tend to be air-borne
  - In-flight computation of Digital elevation models
  - In-flight evaluation of the mission results
  - On site orthophoto generation
  - Landing with results

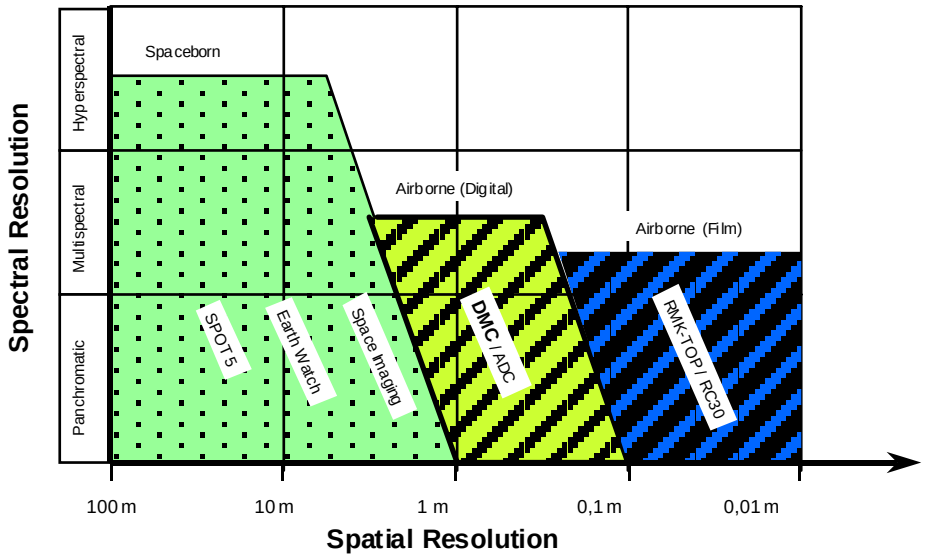

Figure 5: Positioning of Sensorsystems.

4.2. Requirements made on plotting systems

Today we recognize that the standard requirements for the Photogrammetry like Aerotriangulation, Orthophotogeneration, Stereoplotting and the generation of terrainmodells could be fulfilled with modern digital systems. Several providers of components or complete systems are offering such solutions into the market. Next-generation plotting systems are confronted with a number of customer requirements. New alternatives to the UNIX like Windows NT platforms have emerged. In addition, the following requirements need to be taken into account:

- Multisensor interfaces
- Sensor fusion
- Further extension of automatic feature extraction
- Automated change detection
- Automated environmental monitoring

Scientists and the Industry are facing these requirements and will fulfill them in the future.
The real challenge coming up is almost a paradigm shift. The real time processing of 3 D data within GIS systems, which means the management of geometric based information besides image related information and their related feature based information within an environment, that allows a totally different user group to use this information. The Internet will help to provide these user group with visualization tools and the access to huge data bases. There has to be several improvements like fast netconnections, however the Photogrammetry can provide the front end necessary to allow the enduser the extraction of features out of image data which will have to be of actual status. The enduser will not be interested in the methods used to provide these data but rather in the possibility to decide which data out of a wide range of available data will fulfill his requirements.

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This all is not changing anything within the entire community of the Photogrammetry science, but in the way the tools provided by the industry should work.

5. GOALS FOR Z/I IMAGING

Z/I Imaging is meeting the requirements of the market for state-of-the-art, highly integrated, digital end-to-end systems by investing on a large scale in R & D activities. These include the development of a digital camera system and the upgrading of digital plotting systems on the basis of current products. A further requirement is for image data to be made available in such media as the Internet in a way that permits the user, in simplest case scenario, to view this data in a PC configuration, while at the same time providing the trained photogrammetrist with a georeferenced database for further processing.
To achieve these goals, Z/I Imaging can rely on personnel with international experience and the expertise required for the definition of innovative, competitive products.

6. CONCLUSIONS

The envisaged strategic partnership between the Carl Zeiss Photogrammetry Division, including reconnaissance sensors, and the Photogrammetry and GIS Imaging areas of Intergraph guarantees continued technical development on the basis of existing products and customer relationships. The necessary funds are available, and the goals of these developments have been substantiated by studies and proofs of principle.