

## A Synopsis of the Carl Pulfrich Award

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### ABSTRACT

The Carl Pulfrich Award is a prestigious award for recognizing cutting-edge innovations, hard- and software developments and integrated systems design in geodesy, photogrammetry and the Earth sciences. Launched in 1968 it is announced biennially and attracts nowadays nominations and recommendations for candidates from all over the world. Originally launched by Carl Zeiss, Oberkochen, then re-launched by Z/I Imaging and Intergraph it has been adopted by Hexagon Geosystems in 2011. The donation of this award to recognize and motivate scientists for more than four decades is gratefully acknowledged.

### 1. IN MEMORY OF CARL PULFRICH

Carl Pulfrich was born on September 24, 1858 as first son of a school teacher in *Burscheid* near Dusseldorf. After primary and secondary school he studied Physics, Mathematics and Mineralogy at Bonn University. Right after graduation Carl Pulfrich started as a researcher in optics and finished a PhD thesis in 1881. He accepted a position as assistant and lecturer at the Institute of Physics (chaired by Prof. Rudolf Clausius +1888, afterwards by Prof. Heinrich Hertz) at his Alma mater (1885-1890) and started collaborations with chemists to design and build a new refractometer. This kind of instruments delivers measurements for the determination of the refraction index of optical media using the refraction or total reflection of light. He finished his Habilitation (1889) at the University of Bonn in Experimental Physics to be ready for an appointment as professor in academia. During this work he attracted the attention of Dr. Ernst Abbe, who, as Partner of Carl Zeiss, built a refractometer as well. In 1890, Dr. Abbe invited Dr. Pulfrich to become an associate of the Carl Zeiss Jena enterprise, mainly to design optical and physical measurement devices. He accepted, joined and headed the department of physical measurement devices (1892). He stayed with Carl Zeiss all the time until he mysteriously died on August 12, 1927.

Most probably, Abbe and Pulfrich discussed also the methods of photogrammetry, when Pulfrich entered Carl Zeiss. In 1896 Pulfrich had to solve the task to advance the stereoscopic distance meter, which was invented by H. de Gousilliers and continued by Abbe. Simultaneously with this development, Pulfrich followed the idea to decompose the measurement principle of the stereoscopic distance meter into two temporally independent views, which were photographed through spatially separated lenses and could be measured afterwards stereoscopically. Herewith, Pulfrich became father of stereo photogrammetry!

In restless activity Pulfrich developed the theory and instruments of stereo photogrammetry. In 1901 he presented the stereo comparator, a versatile instrument for topographic and astronomic mapping applications. This successful development gave birth to the next generation of mapping instruments: the stereo autograph plotter of E. von Orel in 1908 (and not 1911 as reported by many books). The ideas of Pulfrich and the expertise of the "Zeissians" helped to make this big instrumental progress, all based on a mechanical spacerod restitution. With this instrument the first-ever automatic mapping was made possible, using two photographs of arbitrary terrain, a real breakthrough. One can definitely say, that starting with 1900 the company Carl Zeiss, Jena, and later – after World War II – Jena and Oberkochen, have pioneered and actively promoted photogrammetry for about one century. Having strong expertise in the field of optics combined with the craft of instrument making the company was predestined to meet most of the challenges of mapping. Parallel to the developments in photogrammetry classical surveying instruments were

build and have made Carl Zeiss a worldwide brand standing for high-quality surveying products and workflows of all kinds – for leveling, electronic direction and distance measurements and the collection of aerial photos and stereoscopic restitutions. Unfortunately, Carl Zeiss, Oberkochen, closed its photogrammetry and surveying divisions 1998 and started the joint venture Z/I Imaging together with Intergraph, Huntsville, USA, to develop digital aerial camera systems and digital workflows. Intergraph owned 100% shares of Z/I Imaging 2002, when Carl Zeiss got finally rid of the geospatial business.

It is interesting to note, that the long-time competitors of Carl Zeiss in the fields of photogrammetry and surveying, the companies Wild Heerbrugg AG and Kern Aarau – both located in Switzerland – made a merger in 1988 when Wild Heerbrugg AG acquired Kern. 1989 Wild Heerbrugg AG became Wild Leitz AG and made a joint venture with Cambridge Instruments Co. Ply in 1990. The new affiliated group was renamed to Leica Plc and was restructured in the late 1990s with Leica Geosystems AG, Heerbrugg, as the successor offering instrumentation and software for surveying, mining and photogrammetry. Leica Geosystems was acquired by Hexagon, Stockholm and London, in 2005 and could operate under the old label until the end of 2010. Hexagon acquired Intergraph 2010 and is now offering Leica Geosystems, Intergraph and Z/I Imaging under the new label Hexagon Geosystems (beginning 2011). Thus the ideas, innovations and products of the pioneer Carl Pulfrich have emerged 100 years later under the umbrella of an international and world-wide operating company. It seems therefore logical, that Hexagon Geosystems is now the donor of the Carl Pulfrich Award. Although the enterprise landscape has changed a lot during the last 100 years, the spirit of Carl Pulfrich is still guiding researchers at universities, research institutes, and industry likewise.

The abundance of Pulfrich's work and contributions to the field of stereo photogrammetry is even more astonishing, as he got blind with one eye in 1906, obviously as a consequence of a bloody eye injury in his youth and therefore was not able to see stereoscopically. But his lively spirit overcame the lack of exact spatial perception. He died on August 12, 1927 when his rowing boat turned down in the Baltic Sea during his vacation.

### **1.1. Carl Pulfrich, the Founder of the Photogrammetric Week Series**

If one considers the invention of the stereo comparator in 1901 by Dr. Carl Pulfrich as the starting point of stereo photogrammetry, we probably can better understand his intention to start a “vacation course in stereo photogrammetry”. The real achievement was to add the third dimension by measuring the parallax/disparity in baseline direction in a pair of stereo photographs, but obviously not many took notice of this revolutionary breakthrough. Therefore, there was a real need for technology transfer, what means, simply to make the technology known at all. In June 1909 Pulfrich sent out a call in the German *Zeitschrift fuer Vermessungswesen (ZfV)* for such a vacation course, which then took place in Jena from October 4<sup>th</sup> to 9<sup>th</sup>, 2009. It is known that 46 participants came together – apart from Germany they came from Austria (4), former Yugoslavia (2) and one representative each from Russia, former Czechoslovakia and Hungary. The course contained lectures and instruments training with instruments made available by Carl Zeiss Jena. From a management point of view the course was run and managed on a more or less private basis by Pulfrich himself. The fee was 20 Marks. Carl Pulfrich invited for the Photogrammetric Week Series annually until 1913. Thereafter a first break in the series occurred due to World War I and the following political changes. The story of success of the Photogrammetric Week Series is remarkable and was reported in more detail by F. Ackermann (1985) and D. Fritsch (2005).

## 2. HISTORY OF THE CARL PULFRICH AWARD

Carl Zeiss, Oberkochen, launched the Carl Pulfrich Award 1968 in memory of the outstanding employee with great impact on the developments of photogrammetric and geodetic instrumentation, for the period of 1890 until 1927. For this award a clear dedication and bylaws were given. It was pointed out, that those persons (individuals or group of persons), who contributed outstandingly to the progress in geodetic and photogrammetric instrumentations should be awarded a sum of DM 10.000. Parallel to the Carl Zeiss foundation another foundation for the Carl Pulfrich Award was constituted. The award has been announced biennially from the beginning and at least 5 national and international renowned experts represented the Carl Pulfrich Award committee.

For quite a long time, the award was managed by Carl Zeiss, Oberkochen (1968-1998). The laureates of these three decades were awarded at some events of the Photogrammetric Week Series and the Geodaetentag, the annual huge German fair of the surveying and geospatial business. Due to the joint venture of Carl Zeiss and Intergraph, called Z/I Imaging, the award was paused and was re-launched 2001 by Z/I Imaging, but more focused on photogrammetry and remote sensing. When Intergraph became 100% owner of Z/I Imaging (2002), the award paused again and was re-launched 2005. Since then the focus of the award has directed to photogrammetry, remote sensing and the Earth sciences. The value of the award is US\$ 7.500.

For the Carl Pulfrich Award 2011 a committee of 10 internationally renowned experts in the fields above have been appointed, who made a clear recommendation for the laureate.

### 2.1. Laureates of the Carl Pulfrich Award

Since 1968 the Carl Pulfrich Award is recognizing cutting-edge innovations, hard- and software developments and integrated systems design in geodesy, photogrammetry and the Earth sciences. The first laureate became Dr. Manfred Bonatz (1969), Institute of Theoretical Geodesy, University of Bonn, for his remarkable contribution to improve the quality and recording of gravimetric instrumentation. In total 29 scientists have been awarded so far, including the 2011 laureate (see Table 1).

Table 1: Laureates of the Carl Pulfrich Award

Year	Name	Univ./City	Country
1969	Dr.-Ing. Manfred Bonatz	Bonn	Germany
1971	Dr.-Ing. Karl Kraus	Stuttgart	Germany
1973	Dr.-Ing. Jürgen Müller	Hannover	Germany
1975	Prof. Dr.-Ing. Manfred Roupp	Stuttgart	Germany
1977	Dr.-techn. Juhani Hakkarainen	Helsinki	Finnland
	Dr.-Ing. Hartmut Schmidt	Bonn	Germany
1979	Dipl.-Math. Hermann A. Klein	Stuttgart	Germany
1981	Prof. Dr.-Ing. Heribert Kahmen	Hannover	Germany
1983	Prof. Dr. Charles C. Counselman III	Cambridge	USA
1985	Dr. W. Göpfert	Frankfurt	Germany
1987	Dr.-Ing. W. Förstner	Stuttgart	Germany
	Dipl.-Ing. H. Schewe	Stuttgart	Germany
1989	Dr.-Ing. Peter Lohmann	Hannover	Germany

1991	Dipl.-Ing. H. Haggrén Dipl.-Ing. A. Wehr	Helsinki Stuttgart	Finnland Germany
1993	Ir. B. Beers Dr. Kurt Novak	Vught Columbus	The Netherlands USA
1995	Dr.-Ing. H.-G. Maas Dr.-Ing. H.-J. Mönicke	Zurich Stuttgart	Switzerland Germany
1997	Dr. Peter Frieß Dr. Joachim Lindenberger	Stuttgart/Rheine Stuttgart/Rheine	Germany Germany
1999	_____		
2001	Dr. Claus Brenner	Stuttgart	Germany
2003	_____		
2005	Dr. Li Zhang	Zurich	Switzerland
2007	Markus Gerke, Sönke Müller, and Dr. Andreas Busch	Hannover Frankfurt/Main	Germany
2009	Dr. Devrim Akca Dr. Michael Cramer	Zurich Stuttgart	Switzerland Germany
2011	Dr. Heiko Hirschmüller	Oberpfaffenhofen	Germany

### 3. CONCLUSIONS AND RECOMMENDATIONS

The Carl Pulfrich Award was originally donated to recognize outstanding performance in the development of geodetic and photogrammetric instrumentation, obviously in the sense of Carl Pulfrich, the great physicist and father of many breakthrough innovations in the mapping business. Since about 10 years the focus of this award has changed, for the advantage of photogrammetry, remote sensing and the Earth sciences. Though the award has been given to researchers more or less located in the DACH region (Germany, Switzerland and Austria) it has been announced by an international call of nomination/recommendation since 2005. Nowadays it attracts applications from all over the world.

It is highly recommended to adapt the original dedication recognizing innovations and developments in geodesy and photogrammetry (including remote sensing and the Earth sciences). The spectrum of the geospatial business of today is very fascinating and includes basic surveying, Terrestrial Positioning, GNSS Positioning, airborne and spaceborne photography, LiDAR (from air, ground, mobile) and RADAR. The geospatial professionals deliver simple points, point clouds, photos, videos, 2D and 3D databases, 3D CAD models, and fully textured 3D city and landscape models (including digital globes). The combination of outdoor 3D with indoor 3D is the next challenge. There are many innovations in this fascinating geospatial business, with many players who are worth to get awarded.

Carl Pulfrich was always interested in developing and to build instruments for mapping – today mapping includes system design, hardware, software and workflows. If we could recognize innovative and outstanding contributions for mapping of all kind, no matter for which application, Carl Pulfrich would be very excited!

#### 4. ACKNOWLEDGEMENTS

The long-time commitment of Carl Zeiss, Oberkochen, Z/I Imaging, Aalen, Intergraph, Huntsville, and now Hexagon Geosystems, Heerbrugg, to maintain the Carl Pulfrich Award is gratefully acknowledged. It is the hope of the author that this award will be preserved for the next decades.

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