

Bernhard Heck and Hungary

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Abstract

A personal welcome greetings of the Budapest University of Technology and Economics (BME) and the Earth Sciences Section of the Hungarian Academy of Sciences (HAS) in a commemorative publication book compiled on the occasion of the retirement of Professor Dr.-Ing. habil. Dr. h.c. Bernhard Heck.

On behalf of the Hungarian geodesists, and representing the BME and HAS I would like to congratulate and to express our grateful thanks to Professor Bernhard Heck, *Doctor honoris causa* (Dr. h.c.) of our Technical University (BME) and *Honorary Member* of our Academy of Sciences (HAS) on the occasion of his retirement. He is well-known and held in great respect among geodetic community of Hungary.

The scientific activities of Professor Heck include various branches of Geodesy and related geosciences, such as mathematical and physical geodesy, analysis of geodetic networks, GNSS positioning and GNSS meteorology, as well as geodynamics. The most prominent achievements refer to the mathematical and numerical analysis of the geodetic boundary value problem (GBVP), local and regional gravity field modelling, definition of a global vertical datum, study of atmospheric effects on GNSS observations and GNSS remote sensing of the water vapour distribution in the troposphere. Furthermore, he founded the “Karlsruhe approach” into deformation analysis of geodetic networks, based on rigorous statistical tests, and applied these theories to data from extended campaigns performed at various natural laboratories, such as the Upper Rhine Graben, the Antarctic Peninsula, and the

Sóskút region of Hungary. He has contributed to the development of geodetic science with a text book on geodetic reference systems, numerous scientific papers published in scientific journals and proceedings of symposia, and a great number of scientific presentations at national and international symposia and workshops.

International relationships always have been in the focus of Professor Bernhard Heck. This fact is primarily expressed by various international research projects jointly performed with colleagues from the University of Strasbourg (France), Delft Univ. of Technology (The Netherlands), Minia University (Egypt), Curtin University (Perth, Australia), Universidade Federal do Paraná (UFPR; Curitiba, Brasil), National Geodetic Survey (USA) and others. We are very proud that most probably, the longest scientific cooperation exists with the Department of Geodesy (since 1999 Department of Geodesy and Surveying) at Budapest University of Technology and Economics (BME, earlier Technical University of Budapest), extending over 35 years. In addition, Professor Heck works as Senate Commissioner for the cooperation between University of Karlsruhe (since 2009 Karlsruhe Institute of Technology, KIT) and BME since 2001.



The first contact between geodesists of our Universities goes back to the turn of 1960/1970's. There was a close cooperation between Professors Heinz Draheim (University of Karlsruhe) and Lajos Homoródi (TU Budapest). A personal acquaintance developed between them at the international meetings of the FIG (Fédération Internationale des Géomètres, International Federation of Surveyors) because that time Professor Draheim was the President of the FIG and Professor Homoródi was the President of the Hungarian Society of Surveyors and Cartographers. They met usually at the different FIG meetings. Professor Draheim as a FIG President supported the Hungarian geodesists. The most favourable condition for cooperation is a bilateral cooperation agreement between our Universities signed on May 8th, 1970. The University Fridericiana of Karlsruhe was the first University among German Universities to find and make contact with my TU Budapest (Homoródi, 1974).

Later Professor Péter Biró had a close scientific cooperation with Professor Dr.-Ing. habil Hermann Mälzer of the Geodetic Institute of Karlsruhe University in 1970's and 1980's. In this intensive scientific cooperation Professor Bernhard Heck was gradually involved which resulted in excellent and important common papers (Biró and Heck, 1986; Biró et al., 1986). From that time Professor Heck is in tight cooperation with our University, BME. Thus his Chair of Physical and Satellite Geodesy of the Geodetic Institute and my Department of Geodesy (now Department of Geodesy and Surveying) in BME has a cooperation in scientific researches as well as in students exchange programmes for more than 35 years.

Another contact at BME is related to myself where I'm working since the early 1990's. Although we first met at the international scientific symposia in early 1980's, we worked together for a longer time at the Geodetic Institute of Stuttgart University in 1985. Both of us stayed there for a research work with Professor Erik W. Grafarend as our host. My stay was supported by the Alexander von Humboldt Foundation, while Bernhard stayed with a Heisenberg Research Fellowship of the German Research Foundation. Later we spent overlapping research times together at the Department of Geodetic Science and Surveying, OSU, Columbus, Ohio in 1989/1990. I'm in close cooperation with him personally for more than 30 years (since our Stuttgart

period). We met at numerous international scientific symposia, just mention a few, as follows: a) Int. Symp. on Figure of the Earth, the Moon and other Planets (Prague, 1982), b) I. Hotine-Marussi Symposium on Mathematical Geodesy (Rome, 1985), c) Int. Symp. on Figure and Dynamics of the Earth, Moon and Planets (Prague, 1986), d) 1st Continental Workshop on the Geoid in Europe (Prague, 1992), e) 7th Int. Symp. on Geodesy and Physics of the Earth (Potsdam, 1992), f) Joint IGC/ICG Symposium on Gravity and Geoid (Graz, 1994), etc.

Bernhard attended the international symposia organized in Hungary as well (e.g. at the Third International Symposium on Deformation Measurements by Geodetic Methods, Budapest, 25-27 August, 1982; Heck et al. (1983)). Early of 1990's he visited me at the Satellite Geodetic Observatory (KGO) of the Institute of Geodesy, Cartography and Remote Sensing (FÖMI), Station Penc.

Intensive institutional cooperation between us started when I started my university career at the BME. In the frame of the official bilateral cooperation agreement between BME and KIT we actively organized the collaboration in scientific researches as well as in student programmes between our institutions. Many BME staff members (e.g. Károly Dede, László Szűcs, Erik Papp, Péter Bóna and others) had research stays in Karlsruhe, his KIT staff members (Hansjörg Kutterer, Kurt Seitz, Michael Kuhn, Klaus Kaiser and others) made observations in our geodetic-geodynamic networks (at the banks of Danube and in the Sósút test network) in Hungary in common research projects and the observations have been processed commonly in Budapest as well as in Karlsruhe. The necessary financial sources for our scientific and educational collaboration were given by the Offices of the International Affairs of our Universities.

An other way for having financial support was to prepare application to DAAD (Deutscher Akademischer Austausch Dienst). In the past Professor Heck submitted numerous such applications ("Sondervereinbarung"). Having a successful application for such a project, the DAAD usually paid the travel costs for the German participants into Hungary, and the living costs for the Hungarian partners in Karlsruhe. The following research projects ("Sondervereinbarung") were carried out (perhaps the list is not full):

1) Geodätische Deformationsmessungen und Deformationsanalyse unter besonderer Berücksichtigung von GPS-Messverfahren (1999-2000 period), 2) Nutzung des GPS zur hochgenauen Bestimmung von Deformationen (2002-2004 period), 3) Integrierte geodätische und geodynamische Untersuchungen in verschiedenen natürlichen Labors in Ungarn and Deutschland (2005-2007 and 2007-2009 period), 4) Bestimmung des integrierten atmosphärischen Wasserdampfgehaltes aus GNSS-Beobachtungen (2014-2016). Some early results on the GPS observations in the Sós-kút geodetic-geodynamic network and deformation analysis were published by Ádám et al. (2002). Professor Heck was officially invited to take part in the lecturing at the Department of Geodesy, Faculty of Civil Engineering, TU Budapest as “University Guest Professor” supported by the “Pro Renovanda Cultura Hungariae”-Foundation in 1996. He gave lecture and seminar series in our PhD course for the section of Geodesy, Surveying and Geoinformatics of the BME on the following topics: a) Error sources and mitigation in highly precise GPS positioning, b) Geodetic Reference Frames and Systems, c) Gravity field and vertical reference frames. These seminars were delivered in two different weeks, that is: 1) September 30-October 4, and 2) October 29-31, 1996. In the audience there were students, graduate students, collaborators of several Hungarian institutions, and colleagues of the Department.

Mr. Klaus Kaiser from the University of Karlsruhe spent a period of three months (between September and December in 1996) at the Department of Geodesy, BME to prepare his diploma thesis. The subject of his work was “Measurements and Deformation Analysis at the Banks of the Danube”. The whole diploma work was done in close cooperation between our two institutions. Mr Klaus Kaiser was dealing with the classical terrestrial measurement techniques, such as precise levelling, distance and angle measurements. He was responsible for the checking of the instruments, the organisation of the work, the measurements itself and for the data analysis. He had to improve also the GPS-technology in his work. He measured a large part of the deformation network, which was used as a first-time epoch for further control measurements. His advisor, Dr. Károly Dede of my Department was very satisfied with the way he was dealing things.

Three years later Professor Heck presented an other lecture at my Department in October 8th, 1999 under the title “Recent investigations on atmospheric effects in GPS positioning”.

In 2010 Professor Heck was invited to join the Advisory Board of *Acta Geodaetica et Geophysica Hungarica*, a Quarterly of the Hungarian Academy of Sciences, jointly published by the Akadémiai Kiadó (Budapest, Hungary) and by Springer (Dordrecht, The Netherlands). It is an other possibility for him to collaborate with his Hungarian colleagues and friends in the Advisory as well as the Editorial Board.

In all Professor Bernhard Heck kindly received for common researches in his Institute and hosted two BME’s colleagues of my Department; namely Dr. Szabolcs Rózsa (for a research stay of three years: from September, 2001 to September of 2004), and Mr. Bence Ambrus (for a half year stay: from September, 2015 to February, 2016). The three-year research stay in Karlsruhe for Szabolcs was very efficient and useful to make a deepened and high level scientific work which resulted in two excellent publications (Rózsa et al., 2005a,b). My colleagues (Szabolcs Rózsa and Bence Ambrus) were at the Geodetic Institute of the KIT from 25th to 29th of September, 2017 in order to prepare the collaboration between our institutions for the near future. Note that Dr. habil Szabolcs Rózsa is my successor as Head of the Department of Geodesy and Surveying, Faculty of Civil Engineering, BME since 2014.

For several years, that is since 2001 Professor Heck has been the Senate Commissioner of the Karlsruhe University for the collaboration with my University, BME. He coordinates the activities of the faculties in the common education program in German language and supports the studies for one semester of about 50 Hungarian students annually in Karlsruhe. He is annually travelling to Budapest in order to attend the diploma celebration of the German speaking courses at the BME.

It is a great recognition and pleasure for us that the Senate of the Karlsruhe Institute of Technology (KIT) has agreed to presenting the honour of a “Dr.-Ing.E.h.” to Professor Péter Biró. The official presentation and celebration took place on February 13th of 2003 at the “Fakultat für Bauingenieur-, Geo- und Umweltwissenschaften”, KIT in which frame his sci-

entific presentation was delivered under the title “Modellbildungen für geodätisch-geodynamische Forschungen”. As I know, only Professor Péter Biró was awarded with this honorary doctor (Dr.-Ing.E.h.) degree from Hungary initiated by this KIT Faculty since 1901. (Great honour, indeed!)

In order to express our honour and gratitude in appreciation of Professor Heck’s scientific activities as well as his intensive cooperation with our Department and our University (BME) he was awarded with the Doctor *honoris causa* (Dr. h.c.) of the Budapest University of Technology and Economics (BME) in 2006. The corresponding diploma was handed over to him by the Rector Magnificus Professor Károly Molnár in the frame of an official BME’s Senate meeting in March 4, 2006 (Ádám, 2006). From the University of Karlsruhe, earlier (to my knowledge, as geodesist) only Professor H. Draheim was awarded by the Doctor *honoris causa* (Dr. h.c.) degree in 1973 (Homoródi, 1974).

Furthermore, Professor Bernhard Heck was elected as Honorary Member of the Hungarian Academy of Sciences in 2013 and kindly asked to present an inaugural address. His scientific presentation was delivered at the famous headquarter of the HAS under the title “Potential of Geodetic Approaches to the Determination of Recent Crustal Movements and Deformations” in September 19, 2013, and was published by the HAS in the series of “Inaugural Lectures at the Hungarian Academy of Sciences” (Heck, 2014).

All in all, Professor Bernhard Heck’s active connection with my University, BME, and especially with my

Department of Geodesy and Surveying has been fruitful for many decades. Dear Bernhard, please accept our sincere thanks for all your efforts. Hopefully our young colleagues are ready and willing to continue the collaboration between our institutions in the future as well.

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