

EXPANSION OF SCIENTIFIC AND EDUCATIONAL COOPERATION OF SURVEYORS OF UKRAINIAN AND GERMAN UNIVERSITIES

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In the period from June 13 to June 23, 2014, a group of postgraduates and students of the Institute of Geodesy of Lviv Polytechnic National University in the number of six persons headed by the dean of the full higher education prof., ScD. Ihor Trevoho and prof. Volodymyr Zadorozhnyy, deputy chairman of Western Geodetic Society of Ukrainian Society of Geodesy and Cartography on the International Affairs conducted research and training activities at the University of Applied Sciences Neubrandenburg.

The work started with a meeting with the rector of the University of Applied Sciences Neubrandenburg prof. Micha Teuscher, who presented prof. Ihor Trevoho with a diploma "For merits in the international cooperation between Lviv Polytechnic National University and the University of Applied Sciences Neubrandenburg. Prof. Micha Teuscher noted that this is a new German honorary award and prof. Ihor Trevoho receives the award number 1, which highlights the achievements for contribution to the development of geodetic science and practical steps to increase the prestige of Geodesy on international level.

Rector emphasized the fruitfulness of international scientific and educational contacts and the importance of involving young students and postgraduates to solve pressing engineering and surveying problems that our societies face.

Ukrainian representatives were also received by Dean of the University of Applied Sciences Neubrandenburg prof. Teschke noting that German teachers gladly work with Ukrainian youth that features high professional competence in geodesy and well acquires new knowledge and technologies.

Ukrainian delegation consisting of postgraduate students of the Department of Higher Geodesy and Astronomy Ihor Savchyn and Bohdan Dzhuman and students Olena Lisnyk, Dariya Kereush, Tetiana Nasadyk, Myroslav Leshchuk and professors Ihor Tryvoho and Volodymyr Zadorozhnyy visited Helmholtz-Centre Potsdam – GFZ German National Research Center for Geosciences, which is part of the German Research Society, that combines 18 natural, medical and industrial research institutions in Germany. GFZ is a powerful scientific center of Europe, which is equivalent to the Academy of Sciences. The budget of the Center is about EUR 3.8 billion/year; the center

includes some 250 scientific institutes, including the Institute of geodetic problems with more than 36 thousand employees, among which 6,360 have scientific degrees.

4 reports by workers of GFZ describing the main activities of the center were presented for the attention of our delegation. The center launches its own satellites such as GRACE (worked 5 years) and CHAMP, and in 2017, it is planned to launch GRACE-FO, which will increase the amount of information transmitted by 50 times.

The purposes of launching such satellites are the following: study of gravity field of our planet; study of giant glaciers in Greenland; change in groundwater levels in different regions of the Earth; research and geotechnics and geothermics of the Earth; study of the Earth's magnetic field.

Of particular interest for our delegation was the report by prof. Frank Flechtner about global geomonitoring of the Earth that Institute of Physics of the Earth deals with. Another research focus of the institute is the forecasting of weather and study of the loss of ice mass. It has been observed that 230 Gt of ice melt in Greenland per year. It has been noted that the level of water of the oceans is increasing by about 1 mm per year. Institute of Physics of the Earth is systematically using GNSS (GPS, GLONASS, Galileo, WTO etc.) data for atmospheric monitoring, forecasting of tsunamis, geophysical and geodetic studies across the globe.

Our delegation also took part in the traditional international scientific and technical geodesic conference which gathered many scholars, professionals and students from leading universities from Germany and from abroad. The working language of the conference was English. The opening speeches were held by prof. Wilhelm Heger and prof. Ihor Trevoho. The conference heard many interesting presentations, including three presented by Ukrainian delegation, namely by postgraduates Ihor Savchyn, Bohdan Dzhuman and student Olena Lisnyk.

The report of postgraduate student Ihor Savchyn under the guidance of prof. Kornilyy Tretyak, director of the Institute of Geodesy, called "A Posteriori Optimization of Active Geodetic Monitoring Networks" has attracted great interest. The speaker noted that some measurements in active geodetic monitoring networks are distorted by errors that exceed the general background of all measurement errors.



At the meeting with the Rector



Awarding prof. Trevoho with the honorary diploma for merits in the international cooperation



At the meeting with the dean



Visit to GFZ in Potsdam



Standardization of station rods



Measurements with FARO-Arm



Experiments measurement field in Ganzkow



Participation in international scientific and technical geodesic conference

These measurements significantly understate accuracy. The author argues that the identification and elimination of such measurements will allow to improve significantly the accuracy of compensation. The paper proposes to conduct the a posteriori optimization of networks within the parameters of accuracy and reliability.

In the report by Dzhuman B.B., "Approximation of gravity anomalies by ASHA in the Arctic Region" questions of construction of local gravitational fields using nonorthogonal functions by ASHA have been solved. A quick-finding algorithm of finding a matrix of normal equations and harmonic coefficients has been used for this. Thus a local field of gravity anomalies in the Arctic area has been built.

An interesting report has been presented by student Olena Lisnyk under the supervision of prof. Ihor Trevoho, dean of the Institute of Geodesy. The work called "Features of tachometrical surveying in reflectionless mode" analyses and compares different uses of reflective surfaces in tachometrical surveying of different scales. Plans in scales 1:500, 1:1000, 1:2000 have been built in accordance with each type of reflector. As a result, conclusions about the accuracy and range of measurements have been made.

Ukrainian speakers presented their reports in English and thoroughly disclosed subject matter and answered numerous questions. After the conference, all participants received certificates.

Ukrainian delegation has successfully completed another phase of German-Ukrainian cooperation in the field of geodesy and cadastre. Students and postgraduates of the Ukrainian delegation were invited to study at the University of Applied Sciences Neubrandenburg.

New horizons in science and opportunity to get double degrees open to Ukrainian and German students and young scientists thanks to productive collaboration in 2008 between the Lviv Polytechnic National University and the University of Applied Sciences Neubrandenburg (Germany). In 2013, rectors of both

universities signed an agreement of intent for phased implementation of such education.

A meeting dedicated to development of a joint educational program for the double degree took place on Thursday (18.06.2014) chaired by deans Prof. Trevoho and prof. Teschke. A fundamentally new concept of education that should be discussed at two universities and finally adopted at a joint meeting in Lviv in September was developed.

On a daily workshops Ukrainian students were acquainted with:

- Work of automated geodetic monitoring system DaBaMoS;
- Work of coordinate manipulator FARO-Arm;
- Work of automatic and mechanic standardization base of lines in the code station rods;
- Hydrostatic leveling;
- Conducting photogrammetric measurement of objects with complex shapes using AICON DPA-Pro;
- Attestation of electronic tachymeter Leica Viva TS15i on measurement field of 1st grade in Ganzkow.

Ukrainian delegation is grateful to German colleagues for acquired practical skills in modern geodetic techniques and is sure to continue the fruitful scientific and practical cooperation.

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The article presents results of scientific and educational cooperation between the Institute of Geodesy of Lviv Polytechnic National University and University of Applied Sciences Neubrandenburg. Opportunities of practical application of the most modern surveying equipment are shown.