

Metrological Comparison of Length and Azimuth Standards between German and Czech Geodetic Laboratories According to ISO Standards

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ABSTRACT

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EXTENDED ABSTRACT

In agreement with the plan of activities of FIG Commission 5 (Positioning and Measurement), WG 1 (Standards, Quality Assurance and Calibration) for the period 1998 – 2002 the Metrological Laboratory of the UNI Bw Munich and the Research Institute of Geodesy, Topography and Cartography (VUGTK) Prague agreed to carry out Inter-Comparison of lengths and azimuth standards.

First preparatory talks on the inter-laboratory Comparison took place on 12 and 13 August 1999 in Munich and resulted in a proposal for a project funded by the European Commission within the 5th Frame Programme. The original proposal included three partners: UNI Bw Munich, VUGTK Prague and the Land Survey of Sweden. Due to a lack of time and financial and human resources for the preparation of the project proposal it has been decided to limit the program to a bilateral action between the UNI Bw Munich and VUGTK Prague.

In the mean time the Geodetic Metrological Laboratory of the VUGTK had been accredited by the Czech Institute for Accreditation according to ISO/IEC 17025 “General Requirements for the Competence of Testing and Calibration Laboratories” for calibration of distance and

angle (azimuth) measuring instruments and devices. Following this Accreditation the Czech Metrology Institute to nominate the VUGTK for a member of EUROMET in order to represent the Czech Republic in the field of distances together with the Czech Metrology Institute.

In order to maintain this important position in the field of Czech geodetic metrology and the accreditation the VUGTK had to carry out an inter-laboratory comparison of its length standards and azimuth standard with a well recognised geodetic laboratory abroad, as there does not another accredited laboratory in the Czech Republic in this field.

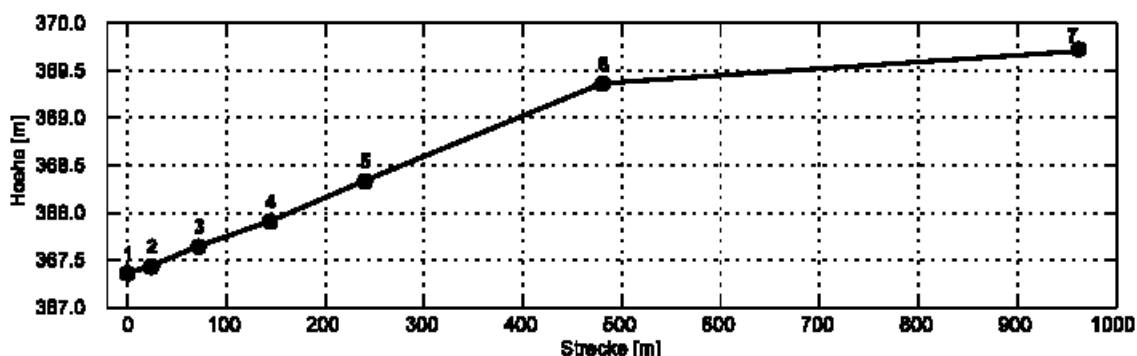
A successful inter-comparison should also facilitate the harmonisation of the Czech and the European Standards and help to prepare the future accession of the Czech Republic to the European Union.

Accreditation would also enable the Metrological Laboratory of the VUGTK to issue internationally recognised calibration and test certificates.

The paper describes the standards and their development in time, the methods, procedures and instruments used and the results obtained.

The inter-comparison concerned two reference base lines (length standards): HVEZDA in Prague and KOSTICE in Northern Bohemia. Further on the Azimuth Standard ZIDOVSKÉ PECE in Prague was remeasured.

Reference base line HVEZDA in Prague consists of 7 stations marked with granite stones with brass bolts at the ground level. The total length of the base line is 960 m. It is oriented in east-west direction protected from the sunshine the whole day by high trees. This base line is



also of great historical importance. See the cross-section at Fig. 1

Fig. 1: Position and heights of stations at base line HVEZDA

Reference Base Line KOSTICE in Northern Bohemia is situated about 60 km north-east from Prague consists of 12 aligned pillars (Nos. 1 to 12) of total length 1450 m and of 3 pillars positioned aside (Nos. 13, 14, 15) for extra long distances from 3,2 km to 10,4 km.

This base line has been established recently as a national reference for long distances. See the cross-section at Fig. 2.

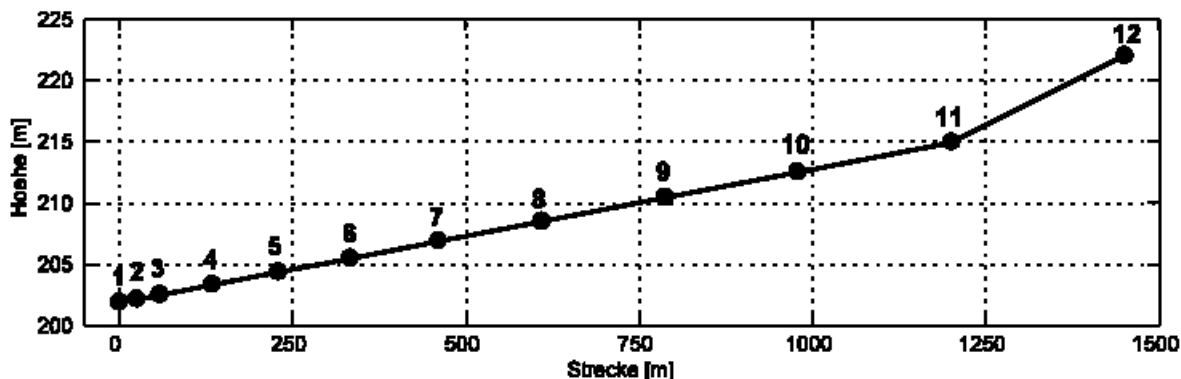


Fig. 2: Position and heights of stations at base lin KOSTICE

The distances have been observed with 3 EDM: Leica TDA 5005, standard deviation 1 mm + 1 ppm (Uni BW), Mekometer 5000, standard deviation 0,2 mm + 0,2 ppm (Uni BW) and Sokkia PowerSet 2000 2 mm + 2 ppm (VUGTK) for an independent check.

The campaign resulted in scale transfer with accuracy characterised by standard uncertainty 0,8 mm + 1,0 L_[km] mm for both HVEZDA and KOSTICE base lines. The results confirmed that the previous dimensions of both base lines are in good correspondence within the newly determined uncertainty.

The azimuth standard ZIDOVSKE PECE in Prague consists of a survey station marked by a concrete block with a brass bolt at the ground level and three direction marked by metallic plates fixed at building walls in distances from 350 to 650 m.

The new azimuths were derived from observations by LEICA TDA 5005 with standard uncertainty 0,08 mgon.

CONCLUSION

The inter-comparison and the scale transfer resulted issuing of calibration lists for the two base lines and for the azimuth standard, which enables to the geodetic laboratory of the VUGTK to fulfil the requirements of the ISO for laboratory accreditation. The results of the inter-comparison campaign are documented in detail in:

HEISTER, H., LANG, M., KLÖCKER, W.: Bericht über die Messkampagne Prag 2001: Übertragung eines Strecken- und Winkelnormals auf Referenzlinien ZIDOVSKE PECE (Winkel), HVEZDA und KOSTICE (Strecken) der VUGTK Prag. Uni Bw, München, 2001.

BIOGRAPHICAL NOTES

Hans Heister received the degree Dipl.-Ing. at the University of Bonn in 1969. During 1970 – 1974 he was assistant at the Geodetic Institute of the TU Munich. 1974 he became director of the Geodetic Laboratory of the Bundeswehr University Munich (UniBwM), 1987 Dr.-Ing.habil., and since 1991 he is apl. Professor for Geodetic Metrology at the same University. Main activities: GPS, land navigation, kinematic survey, gyro-measurements, calibration of geodetic instruments, engineering and industrial surveying. Many professional activities abroad, numerous lectures at foreign universities and congresses. Member of FIG commission 5 "Positioning & Measurement".

Jiri Lechner – Head of the geodetic metrological laboratora at the Research Institute of Geodesy, Topography and Cartography in Prague. Studied surveying at the Moscow Technical University and worked with a German engineering surveying company in Leipzig, Specialised in engineering surveying and stadarisation of surveying in construction.

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Vaclav Slaboch, Director of the Research Institute for Geodesy, Topography and Cartography, Vicechairman of the Czech Union of Surveyors and Cartographers Studied geodetic surveying at the Czech Technical University in Prague, worked with Fairey Surveys Ltd., in England. In 1979 as consultant for a UNDP Project in West Africa, and recently in Malta. Chairman of FIG WG 5.1 Quality Assurance. Quality Control and Standards, and teacher of Engineering Surveying at the Czech Technical University in Prague.