

National Report of Austria

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1. Introduction:

The department „Control Survey“ of the Austrian Federal Office of Metrology and Surveying (BEV) is responsible for the realization of reference frames for horizontal and vertical control as well as for the establishment and maintenance of the gravity base network and the determination of the local gravity field. Within these tasks a close cooperation with the Observatory Lustbühel-Graz (OLG) of the Austrian Academy of Sciences has been established especially concerning projects related to satellite geodesy.

Further cooperations have been initiated with university institutes in Vienna and Graz as well as with private firms in the sense of PPP (Private-Public-Partnership).

The following projects are at this time still in progress:

- Fundamental GPS-Networks and Permanent Stations
- Densification of GPS-Reference-Networks for Practical Purposes and Transition to ETRS/UTM
- UELN 95/Vertical Control
- Gravity and Gravity Field Determination

2. Fundamental GPS-Networks and Permanent Stations:

- EUREF Data and Analysis Centre OLG

OLG provides data from more than 20 international stations, including all CERGOP stations, mirroring additional 20 stations from within Europe and the Mediterranean countries. Of those about 10 stations deliver hourly RINEX data which are stored for about 10 days separately.

About 40 stations are analysed on a weekly basis for EUREF reference and geodynamic purposes. The national stations are monitored additionally for DGPS maintenance.

- CERGOP-2

The campaign CEGRN'99 was joined June 1999 observing 5 permanent and epoch stations. The whole campaign of more than 50 stations was adjusted. The first results show a repeated accuracy below 10 mm of all components.

- Permanent Stations

A new permanent station RTMN (Rottenmann) was established in 1999. The number of stations with accessible data via internet increases therefore to 10, including the twin station at Graz (GRAB, GRAZ, HFLK, PATK, PFAN, SBGZ, Rottenmann, St. Pölten, Villach, Wien). Two stations (GRAB, Rottenmann) provide GLONASS data too.

The new station SRJV (Sarajevo) was established together with the Geodetic Survey of Bosnia-Herzegovina. Since June 2000 it is possible to deliver hourly data.

A further station in NW-Styria (Hauser Kaibling near Schladming) should be operable in the mid of 2000.

- Antenna investigations

Local combination of different antenna types have been performed at testbeds of GRAZ, PFAN and Vienna. Most of them were used to test new antenna types using the phase files of IGS, NGS and the manufacturers. Some tests have been made investigating doubtful antennas or influences of the Radom cupolas.

- High precision applications

Some methods of positioning with high precision have been installed and partly developed. Using zero differences (phase) and precise models of orbit and tropospheric parameters the accuracy may reach a few centimetres. They are also used to determine undifferenced tropospheric slant range delays.

A client-server application called "Instant-GPS" was developed to process GPS-observations in near-real time. The server runs the Bernese Software to process the data using data from GPS permanent stations. The client software runs on a laptop, controls the GPS-receiver and transfers the measurements of the server via a GSM data link. The result is displayed almost immediately (3 minutes) on the laptop. The advantage to traditional kinematic surveys is mainly the unlimited distance to the reference station.

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3. Densification of GPS-Reference-Networks for Practical Purposes and Transition to ETRS/UTM:

As mentioned in the last National Report the Austrian National Survey is running a project which should finally realize the international reference system ITRS/ETRS as the national reference frame for all geodetic applications in Austria.

This transition includes not only the definition of nationwide transformation parameters but also – and this is the hard core of the project – the improvement of the quality of the existing point field and therefore in detail the elimination of long wavelength and high frequency distortions, which amount to more than one meter in several regions.

The final 3D-coordinates should be the result of a combination of existing conservative measurements with GPS, linked to the Austrian fundamental GPS-network AGREF.

In detail the fieldwork includes also the remeasurement of so called "Einschaltpunkte" (densification points), originally determined with photogrammetry, with an rms of ± 10 cm, which can not fulfil modern demands.

Till now the corresponding measurements cover approximately 50 % of the entire area of Austria. The whole project is planned to come to an end till 2004/2005.

The last stage should be the transformation of the whole cadastre and other point related information into the new system.

The final goal of the project is amongst other arguments the preparation of a high precision control point field with vigorous reduced density, which can be combined and supplemented with DGPS without constraints.

4. UELN 95/Vertical Control:

The computation of the new Austrian Height System is continued. For 70 % of the Austrian precise levelling points (30.000 bench marks in total) the geopotential value C was computed with reference to the UELN95/vers.13.

To derive the orthometric height, the mean value of the gravity g^* between the surface point and the geoid has to be known. Due to the great height differences which occur in Austria (about 2400 m for the levelling network of 1st

order) the computation of the g^* had to be improved. The use of the mean value of the gravity, derived only from the surface and the geoid point, is not accurate enough for all Austrian regions. Therefore a so called "layer-model" is being used, which uses the DTM of Austria for the computation of g^* on n different points along the plumb line (n : 3 to 5). The differences between the two layer-model and the n -layer model are up to 5 cm.

A renewal of two UELN-connections has been performed: Höchst (Austria) – St. Magrethen (Switzerland) and Schwarzenbach (Austria) – Walserberg (Germany). Some local levelling connections between Austria, Germany and Switzerland have been renewed, too.

5. Gravity and Gravity Field Determination:

– UNIGRACE (Unification of Gravity Systems in Central and Eastern Europe). The Austrian absolute gravimeter participated in the first UNIGRACE-campaign in 1998 successfully. The final results of the observed stations in Bulgaria (Sofia, Plana, Varna) and of the reference stations in Jozefoslaw (Poland), Wetzell (Germany) and Graz (Austria) have been published during the Workshop in Fulda, Germany, in October 1999.

The second measurement campaign is planned to be finished until September 2000. The following stations are to be occupied by the Austrian group: Trieste, Bogensperg (Slovenia), Modra-Piesky (Slovakia) + reference stations

– Geoid 2000:

A local geoid determination in Austria has been performed in 1987, only using c. 700 vertical deflections and a high resolution terrain model. The accuracy was ± 5 cm/100 km in geoidal heights.

Geoid 2000 will additionally include gravity data (c. 14 000 values in a 2×2 km² grid) and GPS. The accuracy should increase to ± 1 cm/100 km. An improved terrain model has been prepared by the BEV, including also digital height information of the neighbouring countries. Preliminary combined solutions have been executed by the Institute of Theoretical Geodesy of the Technical University of Graz. A final solution should be at hand at the end of 2000.