

National Report to 9th CGSIC/IISC European Meeting in Monaco, 30th Nov. 2000

Switzerland

1. National activities

a. Time / frequency activities

The Swiss Federal Office of Metrology (OFMET, <http://www.ofmet.ch>) routinely uses GPS time transfer techniques for the comparison and synchronization of its eight atomic clocks with the clocks at the Observatoire de Neuchâtel. Moreover, the readings of these clocks are transferred by GPS to the Bureau International des Poids et Mesures (BIPM) in Paris as a contribution to the international atomic time (TAI).

b. Survey / geodesy / GIS activities

The Astronomical Institute of the University of Berne (AIUB, <http://www.cx.unibe.ch/aiub/gps.html>) hosts the Center for Orbit Determination in Europe (CODE) as one of the analysis centers of the International GPS Service (IGS, <http://igsceb.jpl.nasa.gov>) (see 3.g below).

The Federal Office of Topography (Swisstopo, <http://www.swisstopo.ch>) operates a network of permanent GPS receivers at 20 sites, called AGNES (Automatic GPS Network Switzerland). The receiver at the station "Zimmerwald" operates as an IGS tracking station.

The GPS-based high-precision geodetic control network LV95 with 104 main stations has been densified so far by 92 additional stations. The complete network of all stations was reobserved in 1998, resulting in a coordinate precision [rms] of 1 cm for the horizontal position and 2-3 cm for the height (ellips.) for all 200 stations.

Complete university tracks in geodetic/geomatic sciences are available at ETH Zurich (<http://www.geod.ethz.ch>) and EPF Lausanne (<http://dgrwww.epfl.ch/index.fr.html>). Different courses on partial aspects of GPS and Satellite Geodesy are available at the AIUB and the FHBB (school of engineers at Basel, <http://www.fhbb.ch/vermess>).

c. Navigation activities

Swisstopo offers a DGPS service called *swipos*[®]-NAV via FM/RDS over the whole country.

The Swiss Institute of Navigation (ION-CH) has been founded in 1999 (<http://www.ion-ch.ch>).

2. Differential services

Ref. Station	Operator	Distribution	Charges	Users
Zimmerwald and Zürich	Swisstopo with SRG, Swisscom and DCI Inc.	VHF radio (FM/RDS)	1-2 m level: CHF 1320.- / year	375 (mainly for GIS applications and general navigation)

3. Development activities

a. Land use

Swisstopo is setting up a service called *swipos*[®]-GIS/GEO for real-time positioning applications with cm-accuracy using the AGNES network. The navigation corrections and GPS carrier phase data (RTCM format) for real-time Precise Differential GPS (PDGPS) are available for a small fee via GSM data channel.

b. Maritime use

No special activities

c. Aviation use

The Federal Office for Civil Aviation (FOCA, <http://www.aviation.admin.ch>) has published the Swiss Radio Navigation Plan. A joint project of FOCA, swisscontrol, Crossair and IGP/ETHZ investigating GPS-based approaches at Lugano airport has been accomplished.

d. Space use

No special activities outside ESA. For more information please contact the Swiss Space Office, <http://www.sso.admin.ch>

e. Military use

No information available

f. Time / frequency use

see above

g. Survey / geodesy / GIS

AIUB (<http://www.cx.unibe.ch/aiub/gps.html>): The daily processing of IGS data at CODE allows to monitor coordinates and velocities of about 140 tracking stations (continental drifts), troposphere parameters for the stations (atmospheric water vapor content), earth rotation parameters (polar

wobble, length of day), and electron content of the ionosphere (which is closely related to the solar activity). For all these parameters long time series are available covering several years. Other activities at AIUB involve the orbit determination for GLONASS satellites as well as for low earth satellites carrying GPS receivers, a time transfer experiment over an intercontinental baseline using GPS carrier phase, or the generation of 'observations' for a virtual reference station based on GPS observations of a reference network.

IGP/ETHZ (<http://www.geod.ethz.ch>): Different applications and investigations in engineering surveying, crustal movements (Greece) and in dynamic airborne remote sensing (gravimetry, laser scanning) using GPS have been developed and carried out. GPS meteorology (tomography, radiometry, spectrometry, 4D-modelling) as well as error influences are investigated.

IGMIGEO/EPFL (<http://dgrwww.epfl.ch/TOPO/index.fr.html>): A combined GPS-INS system for direct camera orientation onboard a helicopter is under development, as well as a combined GPS-video system for the survey of road infrastructure. The prototype of a miniature GPS-INS datalogger has been realized, as well as algorithms for applications with pedestrians and during sport training (e.g. skiing).

Swisstopo is working on the definition and realization of a new (orthometric) height system (LHN95), which is GPS compatible together with the new Geoid CHGEO98.

Coordinate transformations and the calculation of local geoid undulations can be done on the website of Swisstopo (<http://www.swisstopo.ch>, registration requested).

4. Industrial aspects

Leica AG (Heerbrugg, CH, <http://www.leica-geosystems.com>) is a leading manufacturer of GPS products for geodesy, surveying and navigation. Leica AG also sells the scientific Bernese GPS software package of the AIUB. All other major companies for GPS (surveying) equipment are also represented in Switzerland.

µ-blox AG (<http://www.u-blox.ch>) is a newly founded spin-off company of the ETHZ which manufactures one of world smallest GPS-chip set.

5. National policy activities and decisions

A new national reference system (CH1903+) and its transformation parameters to global reference systems have been defined by Swisstopo.

6. Responsible national authorities (names given in German)

a. Land use

Bundesamt für Landestopographie (<http://www.swisstopo.ch>), Seftigenstr. 264, CH-3084 Wabern. Tel. +41 (0)31 963 21 11

b. Maritime use (no national authority)

c. Aviation use

Bundesamt für Zivilluftfahrt (<http://www.bazl.admin.ch>), Maulbeerstr. 9, CH-3003 Bern. Tel. +41 (0)31 325 80 39

d. Space use Swiss Space Office (<http://www.sso.admin.ch>), CH-3003 Bern.

e. Military use

Several institutions, e.g. the Bundesamt für Luftwaffen und Führungssysteme, Kasernenstr. 19, CH-3003 Bern, Tel. +41 (0)31 324 58 20

f. Time / frequency use

Eidg. Amt für Messwesen (<http://www.ofmet.ch>), Lindenweg 50, CH-3084 Wabern. Tel. +41 (0)31 323 31 11

g. Survey / geodesy / GIS

Bundesamt für Landestopographie (<http://www.swisstopo.ch>), Seftigenstr. 264, CH-3084 Wabern. Tel. +41 (0)31 963 21 11

h. Industrial affairs (not appropriate)

7. Relevant conferences / seminars / exhibitions held within the country

- 27.-28.6.2000: Séminaire Navigation et Télématique, EPF-Lausanne (in coop. with ION-CH).
- 9.5.2000: 1. Space Science and Technology Day, FSRM Neuchâtel (in coop. with Swiss Space Office and others)

- Periodical Seminars: Continuous education for engineers, GIS (including some aspects of GPS), at ETH Zürich

8. Details of the formally notified National Point of Contact

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