

National Report from Denmark September 2003

for the Civil GPS Service Interface Committee - International Information Subcommittee

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1. National Activities

Land

GPS is widely used in Denmark for fleet management e.g. for emergency vehicles and by taxi companies, and also for vehicle navigation and route planning especially in the metropolitan area around Copenhagen. Also GPS is used for collecting and updating data for geographical information systems (GIS).

Marine

Navigation in Danish inland water ways is carried out using GPS in accordance with the IALA recommendations. Danish water ways are narrow and shallow, and DGPS provides an excellent tool for both small and large vessels.

Space

GPS equipment is mounted on the first Danish nationally funded research satellite - the Orsted satellite. The purpose with the satellite is primarily to collect information on the geomagnetic field. The GPS equipment has been used for both positioning and for extracting meteorological information for atmospheric profiling. GNSS equipment will also be employed in future Danish national satellite missions.

Survey/geodesy/GIS

WGS84/ITRF has been introduced as the national reference frame for geodesy, surveying and mapping purposes, and is now being used for all national mapping activities in both Denmark and Greenland. As a consequence more and more survey activities are carried out using the GPS reference frame. The national Danish permanent GPS reference stations became part of the European Permanent Network in 2002, and most of the stations in Greenland are IGS-stations.

2. Differential Services

Land use

DGPS

Public: Two DGPS services are provided for land use by the National Survey and Cadastre in cooperation with two different telecommunication companies.

Private: A private DGPS service for land use is provided by the company Gpsnet.dk.

RTK

Public: No high accuracy RTK-corrections are made available by the Danish national or regional authorities. However, a few municipalities have established services to suit their own needs within the community, and data might be available upon request.

Private: RTK corrections are available nationwide on a commercial basis from the company gpsnet.dk (www.gpsnet.dk). RTK corrections are also distributed nationwide by Andelsforeningen GPS-Referencen (www.gps-referencen.dk), a co-op with participation of several smaller Danish companies.

Marine use

A DGPS service for the Danish inland waters is provided by the Royal Danish Administration of Navigation and Hydrography in accordance with the IALA recommendations.

3. Research and Development Activities

Universities:

GPS related research activities are taking place at three different Danish universities as described below. Courses in GPS theory and practice are offered at all of the universities, and a number of graduate students are working on GPS related projects.

Department of Geophysics, University of Copenhagen:

Research activities are focused on GPS for geodetic and geophysical applications. The group is involved in the European gravity space mission GOCE, and the group is internationally acknowledged for their work on geoid modeling. A permanent GPS receiver is mounted at the University of Copenhagen, and data is available via the internet.

The Danish GPS Center, University of Aalborg:

The research is focused on the processing part of GPS positioning, and on the mathematics of GPS. But also applications of GPS within the meteorological sector e.g. for water vapor profiling is a research area. A permanent GPS receiver is mounted at the University of Aalborg, and data is available via the internet.

Department of Development and Planning, University of Aalborg, the Geomatics group:

Research activities are focused on various modeling aspects related to GPS positioning, and the implementation of these into primarily geodetic and surveying applications. Another research area is automated mapping e.g. generation of elevation models, where GPS plays a major role.

Technical University of Denmark:

Research activities related to GPS applications for surveying and navigation, including the integration of GPS with other sensors. Also research on the use of GPS for geology and glaciology in arctic areas is carried out. Error modeling in the general GPS positioning process is an area of interest, and new techniques for dealing with

primarily the tropospheric error have been developed. A permanent GPS receiver is mounted at the Technical University of Denmark, and data is available via the internet.

Government sector research organizations:

Research is also carried out at a number of government organizations:

The National Survey and Cadastre:

The Departments of Geodesy and Geodynamics hold the responsibility for developing and maintaining the basic GPS infrastructure including reference systems and reference networks in Denmark, Greenland and the Faroe Islands. Research related to the development of the GPS infrastructure is also carried out. Three geodynamic grade permanent GPS stations are operational in Denmark, and are used for geodetic and geodynamical research. In Greenland four geodynamic grade permanent GPS stations are operated and used for geodetic and geodynamical research activities. Also the groups are performing research related to geoid modeling and to kinematic and static high accuracy applications of GPS.

The Danish Road Directorate:

Research and development related to the use of GPS for vehicle navigation and for road maintenance is carried out. The GPS-based research is centered around the integration of GPS with other sensors such as INS, laser, digital cameras, accelerometers, and tilt meters.

Danish Space Research Institute:

The objective of the institute is to conduct space research with the purpose of obtaining a better understanding of the universe and the planet. However, also instrumentation and space technology is part of the scope of the institute. The GPS-related research is mainly carried out in cooperation with the Danish Meteorological Institute, see below.

The Danish Meteorological Institute:

GPS related research is focused on the use of GPS as a tool for probing the atmosphere, and the projects deal with subjects like radio occultations and methods for extracting meteorological information from ground based permanent GPS stations. This research is internationally acknowledged, and is one of the GPS research areas where Denmark is contributing the most on an international scale. Research related to the ionospheric part of the atmosphere is also carried out, and there is some focus on improvement of ionospheric modeling.

4. Industrial Aspects

Land

Several Danish companies are developing systems for land navigation, fleet management, precision farming etc. where GPS is used as an integral part.

Marine

Several Danish companies are developing marine navigation and guidance systems, and equipment, where GPS is used as an integral part. Simrad, a Kongsberg company, has an extensive production of marine GPS receivers, and it is the only Danish company with a full production line of GPS-receivers.

Aviation

A few Danish companies are developing software, systems, and units for airborne navigation and guidance.

Space

Several Danish companies are developing equipment for installation and use in space vehicles.

Military

The Danish company Terma A/S has a long line of contracts with various military agencies. The products include e.g. units for electronic airborne warfare, missile guidance, land based data communication, and naval navigation systems. A few smaller Danish companies are also involved in developing systems and software for military applications.

Survey/geodesy/GIS

All leading producers of GPS equipment for high accuracy applications are represented in Denmark through various agents. Integrated surveying systems and software for survey, geodesy, and GIS is developed by a few Danish companies.

5. National Policy Activities and Decisions

The National Survey and Cadastre is responsible for coordination of GPS activities carried out by the various Danish government organizations. Also it is the responsibility of the National Survey and Cadastre to provide the basic infrastructure for geodesy and surveying. In these roles the National Survey and Cadastre participates in international cooperations as for instance the International GPS Service, the European Permanent Network, and the Civil GPS Service Interface Committee.

6. National Responsible Authorities**Land**

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7. Conferences/Seminars/Exhibitions

Smaller seminars are organized every year by various organizations as for instance the Society for Danish Engineers, the Danish Association of Land Surveyors, and the Danish Hydrographic Society.

8. National Point of Contact

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