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The Norwegian Mapping Authority carries out the following geodetic works in the EUREF-related subjects:

#### 1. Densification of the national GPS network

As previous reported the new national geodetic network in Norway, called "Stamnettet", was finished in 1997, and measurements in the densification network, "Landsnettet", started up immediately. Currently the densification program includes 82 % of a total of 434 Norwegian municipalities. In populated areas the distance between neighbour stations is 3 to 5 km, in other areas about 10 km. It is now 8 600 stations completed national wide in this densification network. The overview map shows the current situation for the network, where the white areas are those to be surveyed next, the coloured areas are more or less finished.

## 2. Transformation aktivity

For the parts of the country covered by Landsnettet a specific transformation formula is developed. The number of points with coordinates in both the old and the new geodetic datums is dense enough to get residuals, after the transformation, at the level of less than 3 cm. In the map showing the current transformation situation, the coloured areas are those finished. They cover approximately 80 % of the country

#### 3. Permanent stations and positioning service

Norwegian Mapping Authority operates the permanent stations of the national SATREF-system in three different categories of accuracy. CPOS cover the cm-level. At the moment CPOS has been developed to be in operation the southern and northwestern part of South NorwayNorway. Currently the CPOS network consists of 24 base stations in the mentioned areas, and more base stations are under preparations. The system is run by the government to self cost. Coordinates are given in EUREF89 (ETRS89), and CPOS covers about 10 % of the Norwegian land area, in which more than 45 % of the country's population are living. At the moment 124 users are registered for the CPOS system. Most of them are municipalities, road constructors, power suppliers and private surveying companies.



The map shows the area covered by CPOS.

4. Levelling

In the new national levelling network 80 % of the survey is completed. Last year 250 km double levelling was carried out. The remaining lines are 580 km. A total of 1900 benchmarks have got ellipsoidal height.

5. Coordinate determination for Egnos RIMS and NLES sites.

EGNOS is a satellite-based augmentation system to improve the accuracy and ensure the integrity of information coming from GPS and Glonass. It will allow users in Europe and beyond to determine their position to within 5 m compared with about 20 m at present

The Norwegian Mapping Authority has been responsible for a project for European Space Agency (ESA) concerning their GNSS-1 program. The purpose of the project has been the determination of geodetic coordinates for the antennae at a network of ground reference stations (EGNOS RIMS and NLES stations).

In this respect, there has been carried out geodetic field survey in 35 stations spread primarily in Europe, but also in Africa, North- and South America and Turkey in Asia.

The campaign has been run with geodetic Ashtech ZSurveyors receivers with Dorne Margolin Choke Ring antennae receiving data for at least two complete days. The coordinates have been generated by processing with three different GPS processing programs. Final coordinates are delivered with an accuracy (1 sigma) less than 3 cm in the reference frame ITRF2000.

## 6. Test Bed for EGNOS

NMA has been involved in the operation of EGNOS System Test Bed (ESTB) since 1998. The SATREF control center managed by NMA is hosting and operating the Central Processing Facility (CPF) which is connected to reference stations all over Europe. The system has been tested outside Europe as well, with temporary stations in China, and Latin America. The ESTB has been a successful test bed from which guidelines for the operations of EGNOS have been worked out. The operation of the ESTB will end when EGNOS changes to be a test operational service. Most of the existing reference stations connected to the ESTB will then be moved to Africa in effort to establish the African System Test Bed (ASTB).



