Netherlands Positioning Service (NETPOS)

– A Real Time Kinematic Network for Governmental Authorities of the Netherlands –

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1. Introduction

NETPOS (Netherlands Positioning Service) is an RTK (Real Time Kinematic) service for satellite positioning by surveyors of governmental authorities. It will supply the surveyors with a correction signal that enables them to do GNSS (Global Navigation Satellite System) measurements with centimetre precision with a single geodetic receiver everywhere in the Netherlands. This service will be available continuously. For the time being however, support will only be given during business hours.

1.1 Cooperation

Although NETPOS is built by *Kadaster* there's a close cooperation with *Rijkswaterstaat* (part of the Ministry of Transport, Public Works and Water Management) and *KNMI*(Royal Dutch Meteorological Institute). Firstly, these organisations supply locations for antennas. Secondly, they will be provided with NETPOS services. *Rijkswaterstaat* will use the correction signal for their own surveyors and will demand other surveyors who execute projects for *Rijkswaterstaat* to use NETPOS. *KNMI* will be provided with RINEX data for water vapour estimation.

1.2 Motivation

Kadaster decided to end the use of the RTK network operated by 06-GPS, a private company, for reasons of independency. This independency will safeguard the continuity of a RTK service for the surveyors of *Kadaster*, which is important for the primary legal task of *Kadaster*. This will also safeguard the continuity of a RTK service in the Netherlands in general, which is important for the national geometric infrastructure, another legal task of *Kadaster*. *Kadaster* expects that it is not more expensive to deploy a service themselves that is at least as good as the commercial service. Finally, being independent gives the possibility to innovate, when needed.

2. Design

NETPOS will have high performance (reliability) because of short distances between reference stations, the use of in-company data communication networks to connect the reference stations and receiving signals of both GPS and GLONASS.

2.1 Efficient use of existing provisions

The use of buildings with an existing connection to the in-company data communication networks of *Kadaster* and *Rijkswaterstaat* for mounting the antenna's results in low costs per reference station. This made it possible to design the RTK network with a typical distance of 40 km between reference stations (see figure 1).

Fig. 1. 31 NETPOS reference stations (triangles) with an average distance of 40 km and the coverage (line) of the RTK service.

The only new data communication network connections to be established are a link between the *Kadaster* network and that of *Rijkswaterstaat* and DSL connections to four locations without a in-company data communication network. These connections are used to transport the raw GNSS data every second from the receiver to de computing centre. The surveyors will connect to the computing centre by GSM modem.

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2.2 Selection of hardware and software

As a receiver the Topcon Odyssey RS was selected, although it was not the lowest in price. It has the ability to receive both GPS as GLONASS signals and some other good aspects, like 40 channels and a 20 Hz sampling rate. After that the Topcon PG-A1 antenna was selected for its small size (14 cm), lightweight (0,5 kg) and signal reception at the same level as a choke ring CR-3 antenna. This in spite of some more multipath for the PG-A1 compared to the choke ring antenna. To mount the antenna a steel pipe mast was chosen, which can be mounted on top of a flat roof or attached to a wall. Although a steel pipe mast is not as stable as a skeleton mast of the same weight, this is a simple construction that should move only 2,5 mm in the heaviest storm. Finally, we selected the GNSMART network software of the company Geo++, because of the price, scalability and a proven performance. The little bit complicated user interface is no problem, as skilled employees will operate NETPOS.

2.3 GPS + GLONASS

The combined use of GPS and GLONASS results in an increased number of situations in which it is possible to perform GNSS measurements. Results of field tests indicate an increase from 30% to 50% for cadastral measurements. More over, the time to initialise would improve to 15 seconds. At the moment the rovers of the surveyors of *Kadaster* are not able to receive GLONASS. By building a reference network that supports GLONASS now, *Kadaster* can decide to buy combined GPS and GLONASS rovers later.

3. Planning

In the first half of 2004 a business case study was executed to estimate the needed recourses. After that we started selecting the locations for the reference stations. From January 2005 hardware and software were selected and purchased. At the same time we started realising the data communication network connections. Next the computing centre will be established and a selected installation company will start setting up the reference stations. This will result in an operational network of three or more stations on the first of August the latest. Afterwards the other stations will be added as soon as they are ready. Finally, test measurements are planned before the service will come in full operation for *Kadaster* use no later than the first of December 2005.

4. Conclusion

A RTK network named NETPOS, consisting of 31 combined GPS and GLONASS reference stations, will be established in the Netherlands with off the shelf hardware and software. This will be realised in less than one year, for an investment of 10 000 per station and 130 000 for the computing centre and software.