AFRICAN GEODETIC REFERENCE FRAME (AFREF)-NEWSLETTER

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Introduction

The purpose of this newsletter is to create a forum for discussions and exchange of information and experiences in the implementation of AFREF. The objective of the AFREF initiative is to unify and modernize the geodetic reference frame for Africa. When fully implemented, it will consist of a network of continuous, permanent GPS stations such that a user anywhere in Africa would have free access to the generated data.

In this issue we report on Modernization of Geodetic Network in Cameroon, 1st International Conference on New Trends and Applications of Global Navigation Satellite System (GNSS) Cairo Univeristy, Giza, Egypt. Mozambique: Protocol on Global Navigation Satellite Systems, Update on Continous Operating Reference Stations (CORS) Projects in Botswana and Rwanda. We also report on the upcoming training and workshops in GNSS technologies.

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Modernization of Geodetic Network in Cameroon

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When Cameroon's Ministry of State Property Survey and Land Tenure (MINDCAF) recently embarked on a vast programme of land reform that included the modernization of its national cadastre, one of the very first tasks was to establish a modern national geodetic network. Completing this important task in a country with such varied terrain and climate required careful planning, experienced surveyors and state-of-the-art technology. The resulting geodetic network was completed within a year and includes 25 reference points and 500 base points. A law will soon be passed in Cameroon requiring all future surveying and mapping activities to be based on this modern system.

Modernizing the National Cadastre

Until very recently, information on land tenure and ownership in Cameroon has relied on data from various branches of government and has been based on several, different coordinate systems. Therefore, the first step in the modernization program was to establish a single national geodetic network on which all cadastral surveys and maps would be based. The scope of work consisted in identifying, marking and measuring a total of 525 points throughout the 475,000 square kilometre territory. The project was divided into four main phases:

- Preliminary study and terrain reconnaissance to identify suitable sites for network points
- Building the monuments and markers on the ground for each network point
- On-site GPS observation of each network point and levelling
- Data processing to calculate the final precise coordinates of the network

Site Selection and Observations

Since the network would serve as the basis for future cadastral mapping, it was important that points be selected inside villages, preferably in accessible and open areas with no overlying vegetation or other obstacles. Selected locations included schoolyards, police stations and other public areas where the monuments were less likely to be damaged or removed. During the reconnaissance phase Fugro worked with MINDCAF representatives from each of the ten administrative regions to select suitable locations. Once the points had been identified and approved by the government, the next two overlapping phases consisted of building the monuments and undertaking precise GPS observations and levelling

A Challenging Environment

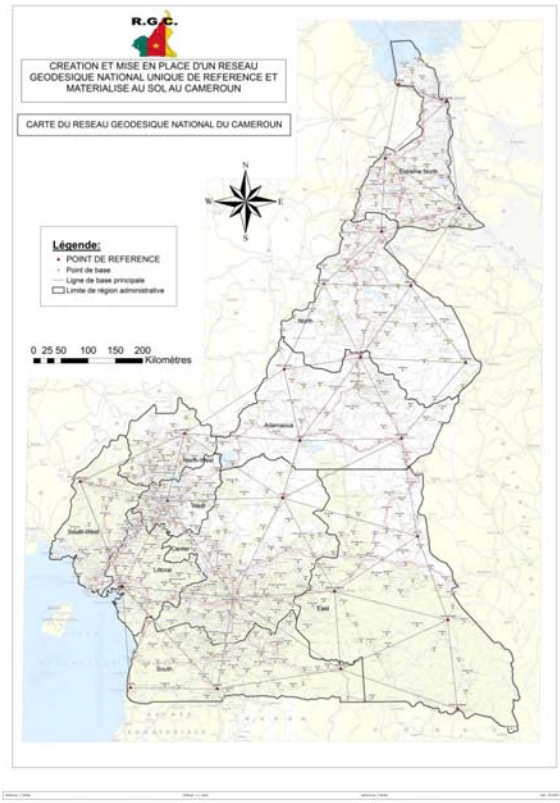
Throughout this phase of the project, Fugro worked extensively with MINDCAF staff and local teams to increase efficiencies and to provide the necessary local knowledge and logistical support. The toughest part of the project was coordinating the survey teams on the ground during the on-site construction and GPS measurement phases. Cameroon is a very challenging country for this type of operation. Cameroon is a country with high mountains in the west of the country, mangrove swamps on the coastal plain, jungle terrain in the east and savannah and desert further inland. Fugro and its local partners faced many obstacles, including flooded rivers and roads and other technical and administrative constraints.

Data Processing

The final phase of the project was the desktop processing of all the collected terrain data to calculate the final coordinates and orthometric heights of the entire network. The reference network of 25 stations was processed with GAMIT/GLOBK software. The final geodetic solution was calculated in four iterations based on the 58 most relevant permanent stations maintained by the International GNSS Services for Geodynamics (IGS) – selected stations were located in Africa, Europe and the Middle East. The resulting root mean square values for the 25 reference stations were better than 5 millimetres horizontally and 9 millimetres in heights.

A Reliable Foundation

Final project deliverables were submitted to the MINDCAF and IGN France International for final quality control and approval. This phase also included additional training of MINDCAF personnel to ensure the transfer of technology and know-how, so that the agency may become self-sufficient in maintaining the network. Over the course of the next few years, MINDCAF intends to densify this base network with several thousand more points.



The final geodetic network includes 25 reference stations and 500 network points

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1st International Conference on New Trends and Applications of Global Navigation Satellite System (GNSS) 21-24 May 2012 Cairo University, Giza, Egypt

Satellite constellation is expanding and planning to offer update services and signals.

However, there are several players in the market including GPS GLONASS, and GALILEO.
The GNSS landscape is rapidly changing towards a GALILEO.

The new trends and applications need to be considered in the light of GNSS itself in relation to GIS, remote sensing, civil aviations and other geospatial trends with agriculture and industry.

The topics of the conference will include (but not limited to):
1. Space physics of GNSS (effects of ionosphere on GNSS, Doppler Effect, rain attenuation, etc)
2. Space dynamics of GNSS (GNSS constellation architecture, GNSS station keeping strategy, etc)
3. Mathematical algorithm of the GPS
4. Application of GNSS (civil aviation, maritime navigation, agriculture, etc)

More information may be accessed at: http://www.ssc-cu.edu.eg/content/first-international-conference-new-trends-and-applications-gnss

Mozambique: Protocol on Global Navigation Satellite Systems

The mining company Rio Tinto Coal Mozambique signed a cooperation protocol on Friday with the Mozambican Ministry of Agriculture on establishing and maintaining permanent GNSS (Global Navigation Satellite Systems) stations in Mozambique.

These stations make it possible to improve GPS (Global Positioning System) signals, thus allowing greater efficiency and precision in collecting geo-referenced information.

According to a Rio Tinto press release, the purpose of the protocol is to define forms of technical and scientific cooperation in setting up, using and maintaining Permanent Satellite Stations in Mozambique. The Protocol will be managed by the National Mapping and Remote Sensing Centre (CENACARTA).

Currently the GNSS network in Mozambique has only four permanent stations, in the cities of Maputo, Inhambane, Nampula and Pemba. "To ensure coverage of the entire national territory, other stations must be built in the interior of the country", said the release.

Rio Tinto had already set up a station of its own in Tete province, where it is operating a gigantic open cast coal mine. This week Rio Tinto handed management of the station over to CENACARTA. It claims that the Tete station increases the capacity of the network by 50 per cent.

Further stations are planned for Beira, Quelimane and Lichinga. Construction should be concluded by the end of the year, and between them the stations should provide total coverage of Mozambique.

The Permanent Satellite Stations are owned by the Mozambican state and the information they provide is for public access. "This will be fundamental for improving the collection of geographical data for developing structured plans for urban planning, 4-D monitoring systems, and control of dredging, among others", added the release.

Through the protocol, Rio Tinto and the Ministry of Agriculture pledge to promote joint studies to improve the skills of local technical staff, and consolidate their

capacity to intervene in development projects. Mozambican universities will also be supported in promoting such disciplines as surveying, geomatics and geography in general.

The Chief Executive Office of Rio Tinto in Mozambique, Eric Finlayson, said "This protocol is an important landmark in the efforts of Rio Tinto to promote cooperation with the Mozambican government in order to develop the country".

He added that the partnership "will place CENACARTA in the technological vanguard", and would drive the development of Tete, and eventually of the rest of Mozambique and of SADC (Southern African Development Community).

Further information may be accessed at http://allafrica.com/stories/201203161416.html

Update on CORS Projects in Botswana and Rwanda

Department of Survey and Mapping (DSM) of Botswana has acquired 5 GNSS Receivers and Kgatleng Land Board has ordered 2 GNSS Receivers. DSM is also exploring the possibility of acquiring 2 additional GNSS Receivers via Improvement of Land Administration Procedures, Capacity and Systems (LAPCAS) project. The Government of Botswana has identified an improved Land Administration system as a prerequisite for economic development that has the potential to unlock the potential of the country to diversify its economy from over reliance on its major export earner; diamonds. The CORS installation in Botswana is expected to be undertaken jointly by DSM and RCMRD in July 2012.
More information about LAPCAS may be accessed at: http://www.fig.net/pub/fig2011/papers/ts05f/ts05f_malatsi_finnstrom_5233.pdf

The Rwanda Natural Resources Authority (RNRA) funded by the Government of Sweden through SIDA has advertized a tender for the Supply and Installation of CORS-GPS OF GNSS CLASS. The CORS will assist in the ongoing country wide demarcation and adjudication of land parcels

7th Annual AFREF & GNSS Data Processing Course

RCMRD in conjunction with the Center of Geophysics of the University of Lisbon (CGUL), Portugal and HARTRAO South Africa have been conducting a course on African Reference Frame (AFREF) and Global Navigation Satellite System (GNSS) Data Processing at RCMRD offices in Nairobi Kenya annually since 2006.

This year the training is scheduled to take place from 3rd September to 14th September 2012 in Nairobi, Kenya. The Objectives of the course is to provide technical skills in the installation and management of GNSS base stations, data handling, dissemination and processing towards AFREF realization. Registration is currently going on. For more information, contact Mr. Muya Kamamia at muyack@rcmrd.org