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**THE OTC CONTRIBUTION TO THE NORTH
AFRICAN REFERENCE PROJECT
- NAFREF -**

By

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On the Unification of the Geodetic References**

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- NAFREF -

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I. Introduction

The International Association of Geodesy (IAG) and the African Association of Cartography (actually African Organization of Cartography and Remote Sensing (AOCRS)) initiated the ADOS Project in 1981. 307 stations have been observed by Doppler satellites, covering 49 countries. The general accuracy was +1.5 m [1].

Actually, the Global Positioning System (GPS) gives the highest precision (subcentimetric) and is the best technology for African countries to realize the **AFRICAN GEODETIC REFERENCE**.

The objectives of such reference are:

- to define an unified geocentric reference for Africa for geodetic purposes and geodynamic projects on the African plate,
- to unify the geodetic references for positioning, mapping and navigation, which facilitates regional and economical projects and management of natural resources,
- to increase the number of permanent GPS stations,
- to prepare Africa to have international GPS data processing centers.

The OTC took the initiative to organize the First Maghrebien Geodetic Workshop in May 2000, on the theme ‘Definition and Realization of the Unified North Africa Geodetic Reference and Frame Network’. The workshop was a success and the main recommendations are [2]:

- to start the project as soon as possible,
- to coordinate its realization with the AOCRS and the Commission X ‘Regional and Global Networks ‘ of the IAG,
- to create a technical commission for the project.

By a letter received last month, on behalf of the IAG, the Chairman of the Commission X and the Director of the International GPS Service (IGS) Central Bureau invited the African professional community to participate with goal being the realization of the African Reference System ‘**AFREF**’. The OTC agrees to participate in AFREF project by its participation in the **NAFREF** project.

The objectives of the Second North African Geodetic Workshop are to carry out the practical aspects of the realization of the Project. The aim of this paper is to present an essay for that realization.

II. The Steps of Realization

II.1. The Organizational Structure

As recommended in the resolutions of the First Workshop, the organizational structure consists of a Technical Commission representing the National Mapping Agencies which are participating in the Project. This commission is under the auspices of the OACRS. Concerning the IAG, a sub-commission for Africa is to be created under the Commission X, for the AFREF Project. The members of this sub-commission are the Technical Commission members and other people interested in the project.

The role of the Technical Commission is to:

- to do an inventory of the technical personnel, receivers and software available for use in the project execution, and the needs (human, material and financial) to start the project,
- establish the number of stations to be observed in the project and their positions,
- select the dates of the observations and fix their norms,
- decide on the strategy of processing the data and the choice of the processing centers.

II.2. Choice of the stations of the NAFREF Project

Following the IAG recommendations and using the EUREF guidelines, the stations of the NAFREF Project must fulfill the conditions:

- to be first order geodetic points or located on sites where orthometric high precision heights are easily obtainable,
- easily accessible,
- forced centering to remove related errors,
- easy to be leveled,
- clear horizon and no obstacles that could produce multipath effects,
- not to be disturbed by radios and transmitter frequencies,
- with a distance between 2 stations of 300 - 200 kms.

For Tunisia, the OTC proposes 7 geodetic points that are:

- Chott El Khanfous,
- Bou Rebeh,
- Gour,
- Lafaya,
- Ain Abdour,
- Mednine,
- Hagfat El Khalifa.

These stations belong to the Tunisian GPS Network of zero order observed in 1998.

II.3. The Observations

Dual-frequency GPS receivers will carry out the observations. The duration of the observations must be 5 days of 24 hours each, with a maximum elevation of 10° and the measurements of the meteorology parameters every 2 hours. For the ADOS project, the number of stations was 76 with 58 stations sited in of the countries of the UMA and 18 stations in Egypt. Following the number of the stations and the availability of the receivers, the observations could be done in 2 phases with a number of common stations.

For the Tunisian observations, the OTC has 4 GPS Ashtech XII receivers, three others receivers will be obtained from other Tunisian companies.

An appropriate date for the campaign of observations would be the month of October 2001.

II.4. The Strategy of Processing

The strategy of processing will be defined while we are together; below is given the strategy applied for the Moldavia EUREF Campaign99 [3]:

1. The software used is the Bernese software version 4.2,
2. The standard procedures are:
 - 15° cutoff elevation,
 - no elevation dependant weighting,
 - troposphere zenith delay parameters with estimation every 2 hours,
 - cosz mapping function used for all processing runs,
 - resolution of ambiguities baseline by baseline,
 - resolution of the ambiguities using QIF(Quasi Ionosphere Free) strategy with the processing of each baseline,
 - global ionosphere maps from the Center for Orbit Determination in Europe(CODE) and the Saastamoinen model were used as a priori ionosphere and troposphere model,
 - IGS stations located around the project network included in the processing in order to connect the project to ITRF,
 - Orbits and pole information obtained from IGS,
 - Precise orbits in SP3 format in ITRF96 and a file containing Earth Rotation Parameters,

II.5. The Data Processing Centers

During the ADOS project, The African Consortium for Data Processing (CATD) was created which grouped together Algeria, Ivory Coast and Tunisia. The OTC proposes that CATD will be revived with the two North African centers: INCT (Algeria) and OTC (Tunisia) as the NAFREF Regional Data Processing Center (RDPC).

The OTC is disposed to be a regional data processing center of the Project. The contribution of the IAG is to:

- provide 1 license of the Bernese software,
- support the training of the OTC personnel on the Bernese software.

III. The Maintenance of the Referential

In order to maintain the referential, permanent GPS stations should be installed in each

country. The integration of some stations of the NAFREF referential to the IGS network is necessary. In the geodetic development program of the OTC, a permanent GPS station is planned to be installed at the OTC office.

IV. Conclusion

Contrary to the ADOS Project, most countries have actual GPS receivers and have some experiences with the GPS positioning technology, so the realization of the NAFREF as a part of the AFREF Project can be done easily and with a minimum delay. The Project will be the first important realization in the Third Millennium for Africa. It opens the doors to others projects.

V. References

[1] African Doppler Survey, 1981-1986. Results. International Union of Geodesy and Geophysics. International Association of Geodesy. Commission on International Coordination of Space Techniques for Geodesy and Geodynamics. Commission for Geodesy in Africa. African Association of Cartography. RCSSMRS. SGSS/Ohio State University. 1987.

[2]. Les résolutions du 1er Atelier Maghrébin de Géodésie, Tunis, 18-20 Mai 2000. Revue Géo-Top ,n°3, Septembre 2000,OTC.

[3]. Report on the Symposium of the IAG Sub-commission for Europe (EUREF) held in Tromsø 22 – 24 June 2000. Publication N°9. IAG. Section I Positioning, Commission X. Bayerische Kommission für die Internationale Erdmessung, Astronomisch-Geodatische Arbeiten n°61. München 2000.