

The AFREF Project: Background Rationale and Progress

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Overview

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- The Africa Doppler Survey (ADOS)
- Progress to Date
- Windhoek Declaration
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Introduction

- New Partnership for Africa's Development (NEPAD) - 2001
 - African leaders have pressing need to eradicate poverty and place countries on path of sustainable development.
- Six sectoral priorities of NEPAD
 - Bridging infrastructure gap
 - Water
 - Transport
 - Energy
 - ICT
 - Human resource development
 - Reverse brain drain
 - Agriculture
 - Environment initiatives
 - Culture
 - Science and Technology platforms
 - GIS

Introduction

- Many objectives of NEPAD rely on sound and reliable geo-spatial information.
- It is essential then, that the co-ordinate reference system and its related reference frame on which this geospatial information is based be both uniform and based on modern positioning technology

Rationale & Background

- The concept of basing all geospatial information on an uniform reference frame is not new. In 1905 Sir Sydney Burrard expressed the following views:
 - Geodetic control prevents accumulation of errors not only in the country but between neighbouring countries;
 - Geodetic control is of great benefit for the unification of disparate surveys within a country to base all surveys on one origin and to free the country from internal and external boundary disputes; and
 - Geodetic control reduces the cost of topo, cadastral, engineering and mining surveys.

Rationale & Background

- Fundamental point of departure for projects, services or products requiring geo-spatial information is a uniform & reliable co-ordinate reference frame.
- Over 50 countries in Africa each with their own system and frame and some with 2 or more systems.
- Although there are many areas of conflict there are also areas where peace has been restored and require a lot of development.
- It is known that many private commercial enterprises are setting up own reference frames particularly in the oil industry.
- AFREF is, therefore, an African initiative to unify reference frames based on the ITRF through network of GPS base stations at spacing such the users will be at most within ~1000 km of a base station.

Africa Doppler Survey

- Used US NNSS (TRANSIT) commonly known as Doppler.
- Difficult logistics with simultaneous observations – inter-stations spacing ~500 km.
- ADOS was designed to unify geodetic frames in 1980's using Doppler to provide
 - Zero order control for mapping
 - Control datum for unification and strengthening
 - Accurate geoid for Africa
- Project didn't fully meet its planned objectives
 - Essential to have simultaneous observations – difficult without IGS
 - Rationale not fully understood by participating countries
 - Project planned entirely by IAG with little input from African countries
 - No set standards resulting in unacceptable standards

Africa Doppler Survey (cont)

- Difference between ADOS and AFREF
 - Using GNSS/GPS with better availability
 - GPS equipment much more readily available
 - African NMO's involved from the start
 - Have IGS with
 - Infrastructure of continuous base stations
 - Standards
 - Dedicated professional and technical support
 - Willingness of International community to support project

Progress to Date

- Global Spatial Data Infrastructure (GSDI) meeting in Cape Town 2000
 - Need expressed for unified reference frame
- Perhaps 1st AFREF dedicated meeting held in Tunisia in May 2000 to find ways and means of unifying countries in North Africa – 6 countries attended
- Similar meeting in Cape Town March 2001:
 - to gauge level of interest among NMO's in region.
 - to inform potential international partners.
 - 8 countries attended and supported project.
 - IAG/IGS, EUREF, NIMA supported project.
 - Meeting requested that project go under IAG banner.

Progress to Date (cont)

- In 2002 UNOOSA / USA sponsored series of workshops on Use and Applications of GNSS
 - 1 of 4 held in Lusaka July 2002
 - Large number of African countries represented
 - One major outcome was recommendation to
 - Establish a continental reference for Africa or AFREF consistent with ITRF
- Windhoek Declaration Dec 2002
- August 2004, UNECA CODI (Addis Ababa)
 - Accepted "Windhoek Declaration" and
 - Established a Working Group on AFREF
 - Nominated a Steering Committee

Progress to Date (cont)

- October 2004, African Association of Remote Sensing of Environment (Nairobi)
 - Proposed organizational structure for AFREF;
 - Proposed terms of reference for SC; and
 - Proposed terms of reference for second level of WG.
- November 2004 UNOOSA meeting of GNSS experts (Vienna)
 - Endorsed project and pledged continued support
- April 2005 FIG Working Week, Cairo.
 - Three AFREF related papers presented
 - Commenced planning for a Technical Workshop to be held in Cape Town in Jan/Feb 2006
 - Drafted a Call for Participation in AFREF

Windhoek Declaration

- Windhoek Dec 2002
 - Meeting held prior to RCMRD technical meeting (Regional Centre for Mapping Resources for Development)
 - 8 Southern and East African member states represented
 - Prepared a selection of provisional cities / towns for permanent GPS base stations
 - Representative from UN ECA CODI also present
 - Prepared what has become known as "Windhoek Declaration"

Windhoek Declaration

In broad terms the Declaration is a commitment by the 8 signatory countries to:

- Support the AFREF project;
- Publicize & promote the project within their respective Governments and international organizations;

and that

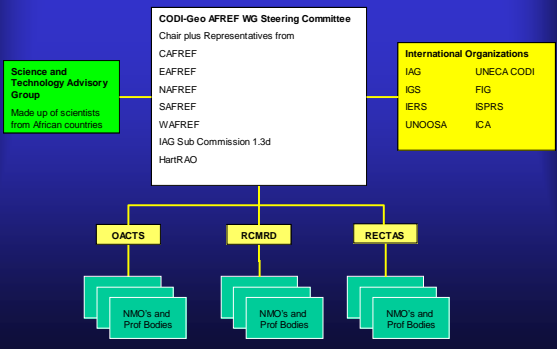
- The UNECA should accept the principles & concepts of AFREF and these be accepted and implemented by UNECA CODI;
- UNOOSA be requested to support the project; and
- The IAG and the IGS be requested to continue to support the project and assist with it's implementation.

Organizational Structure

The structure reflects the broad concepts of AFREF that:

- It is to be designed, managed and executed from within African;
- It is to be organized on a regional basis;
- It is to be executed at the national level; and
- Technical expertise and support will come from the international geodetic community.

Organizational Structure



Objectives of AFREF

- To determine a continental reference system for Africa consistent and homogeneous with the global reference frame of the ITRF as a basis for national 3-d reference networks.
- To realize a unified vertical datum and to support efforts to establish a precise African geoid.
- To establish continuous, permanent GPS base stations at a spacing such that the users will be within 1000km of a base station and that data is freely available to all nations.

Objectives of AFREF

- To provide a sustainable development environment for technology transfer so that these activities will enhance the national networks and other applications.
- Understand the necessary geodetic requirements of participating national and international agencies
- Assist in establishing in-country expertise for implementation , operation, processing and analysis of modern geodetic techniques, primarily GPS

Present situation

- There are about 15 IGS stations in Africa
- There are others which have been installed at academic institutions or airports but are not registered as IGS stations.
 - Many of these stations need little or no upgrade to meet IGS standards.
 - Côte d'Ivoire has a network of XXX permanent base stations
 - South Africa has network of 38 continuous base stations.
- There are a number of contractors setting up own local systems such as in oil industry.

Present situation (cont)

Number of countries in which activities are underway to install permanent base stations or move towards ITRF such as:

Algeria	Mozambique
Angola	Namibia
Botswana	Nigeria
Côte d'Ivoire	South Africa
Egypt	Swaziland
Ethiopia	Zambia
Kenya	Zimbabwe
Morocco	

Present situation (cont)



Institutional Acceptance

- UN ECA CODI (Committee on Development information)
 - Have adopted the Windhoek Declaration
 - Have accepted the importance of AFREF and created a Working Group to deal specifically with AFREF
- UN OOSA (UN Office for Outer Space Affairs)
 - Have recognized importance of AFREF for variety of applications
 - Have been approached to assist with securing project funding
- IAG (International Association of Geodesy)
 - Have recognized importance of AFREF and have committed support
 - Have created structures to co-ordinate project and provide technical assistance expertise
- IGS (International GNSS Service)
 - Has strong commitment to support AFREF
- FIG (International Federation of Surveyors)
 - Has sponsored workshops in Cairo and now Accra

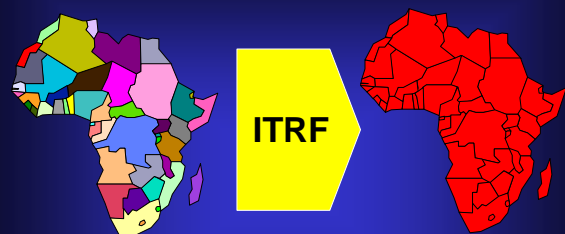
Way Forward

- Publicity
 - Convince NMO's, Govts and International Agencies of importance AFREF – can't plan or do things unless you know where you are!!
- Steering Committee has prepared "Call for Participation" which has been distributed to:
 - African NMO's
 - International Organisations
 - Funding agencies
 - Appropriate equipment manufacturers and vendors
- Effort to go into getting commitment from NMO's and role players.
- Get project "NEPAD" registered

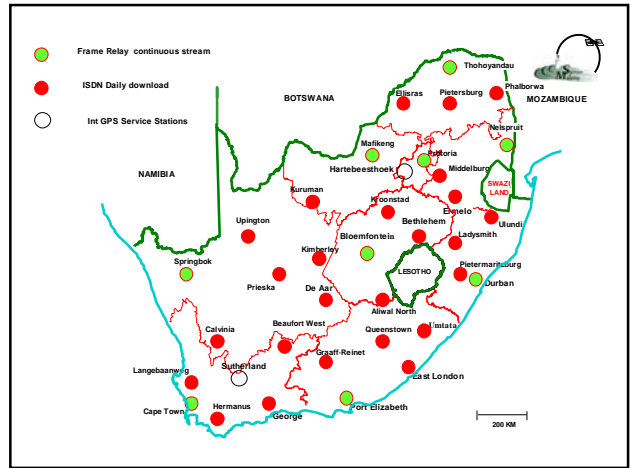
Way Forward (cont)

- Funding
 - Seek assistance to source funding
 - Funding includes donation of equipment and material
- Start planning and implementing:
 - Planning workshop of experts and African geodesits to:
 - To design network
 - To discuss practicalities of station installation etc.
 - Cape Town July 2006
- Web site hosted by UN ECA has been established:

<http://geoinfo.uneca.org/afref>



THANK YOU



Progress (cont.)

UNOOSA GNSS Workshop - Lusaka, July 2002

Surveying, Mapping and Earth Science, Recommendation 1: "Establish a continental reference for Africa, or African Reference Frame (AFREF), consistent with the International Terrestrial Reference Frame"

- A uniform coordinate reference system is fundamental to any project, application, service or product that requires some form of geo-referencing.
- used for national surveying, mapping, photogrammetry, remote sensing, Spatial Data Infrastructure (SDI), Geographical Information Systems (GIS), development programs, and hazard mitigation (earthquake studies, fault motion, volcano monitoring, severe storms).
- making cross-border or regional mapping, development, and project planning very difficult.
- The benefits of GNSS technology cut across applications and across countries.
- It is further emphasized that the importance of simultaneous development of information and communications technology (ICT) and related infrastructure

Progress (cont.)

- Windhoek Dec 2002
 - Meeting held prior to RCMRD meeting
 - 8 Southern and East African member states represented
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(See "Objectives" later)

Progress (cont.)

- IAG re-organization adopted in 2003. Implemented a new structure that
 - Will have a focus
 - Is based on the three pillars of modern geodesy, namely
 - geometric shape of the Earth
 - Earth's gravity field, and
 - orientation of the Earth in space
 - Will better incorporate the very successful IAG services, among others, by representation in the IAG Executive Committee
- AFREF initiative has strong support of the IAG Exec. Committee
- IAG new structure is a mechanism to engage and support AFREF
 - Commission 1, Reference Frames (Prof. Herman Drewes)
 - Sub-commission 1.3 Regional Reference Frames (Zuheir Altamimi)
 - Sub-commission 1.3(d) Africa (Richard Wonnacott)
- IAG new project the Global Geodetic Observing System (GGOS)
 - Focuses on importance of long term geodetic measurements as integral component of Earth system science

<http://www.iag-aig.org/>

Progress (cont.)

- International GPS Service
 - The economics of GPS make the measurement technology readily available and globally accessible to all users
 - The organization and outreach of the IGS enables users to take advantage of data, systems, and products developed cooperatively with the top international GPS/GNSS experts
 - Standards are developed and adopted worldwide through the IGS activities
 - contributing to robust, homogenous reference system
 - implementing common processes
 - IGS is a supporting global foundation for nearly all regional and national GPS and GLONASS geodetic networks, projects, and numerous applications worldwide
 - Must ensure appropriate evolution, coordination, and interoperability of multiple GNSS systems for *societal and scientific benefit*
 - IGS has long term commitment to AFREF
 - AFREF is for Africa, must be an African led project
 - Success is a long term effort
 - Count on strong partnership with IGS

Progress (cont.)

- UN ECA CODI (Committee on Development Information)
 - Adopted the Windhoek Declaration April 2004
 - Established a Working Group on AFREF
- African Association of Remote Sensing of the Environment (AARSE) (October 2004)
 - Pre-conference AFREF meeting
 - Representatives from all regions
 - Settled on WG structure
 - Drew up Terms of Reference for various levels in structure

Progress in Southern Africa

- Botswana
 - Converted to ITRF 2000 ~2 years ago
 - Has 1 known permanent IGS base stations
 - Used GPS data from South Africa
- Namibia
 - In process of establishing base stations
 - Windhoek has number base stations + 1 IGS base station
- Mozambique
 - US AID interested in installing stations
- South Africa
 - Converted to ITRF 91 (1994.0) ~5 years ago
 - Has network of 35 TrigNet + 4 IGS base stations
- Zambia
 - Has 1 permanent IGS base station

Terms of Reference

ToR for Steering Committee:

- Co-ordinate the implementation of the AFREF project at the continental level;
- Coordinate data processing, storage and dissemination at the continental level;
- Set guidelines and standards to be used for the AFREF project;
- Provide justification, communication and publicity for the project to political groupings, stake holder international organisations and other users. Political groupings will include NEPAD while ICAO is an example of a stake holder international organisation;
- Secure funding and other resources such as equipment to ensure the success of the project;
- Liaison with international organisations to provide guidance, expertise and training;
- Co-ordinate training, workshops and seminars and;
- Report to CODI and funding agencies with respect to progress and future actions.

Terms of Reference

ToR for Regional Centres:

- Provide justification, communication and publicity for the project to political groupings, stake holder organisations and other users at regional level;
- Coordinate the implementation at regional level;
- Assist member states to secure funds;
- Carry out trainings specific to AFREF requirements;
- Liaise with international bodies;
- Assist member states in selection and installation of CORS;
- Coordinate data processing, storage and dissemination at the regional level;
- Act as regional data holding centres and;
- Make six monthly progress reports to the steering committee.