

Africa GNSS Workshop *The Sequel*



Patricia Doherty,
Institute for Scientific
Research, Boston College



Prof. Sandro M. Radicella,
Aeronomy & Radiopropagation
Laboratory, Abdus Salam
International Centre for
Theoretical Physics



The authors with Larry Amaeshi, University of Lagos, Nigeria, at the final ceremonies.

*Sponsored by
The Institute of
Navigation, the second
workshop for African
scientists and engineers
included two weeks
of satellite navigation
education and intense
discussion of common
interests — enlivened
by the eruption of the
Iceland volcano. The third
workshop will take place
in Abuja, Nigeria in 2011.*

Volcanic ash and space weather were hot topics at the second workshop on Satellite Navigation Science and Technology for Africa last month. (And LEGO® MINDSTORMS® robot kits and Boston College baseball hats proved as popular as they did at the first meeting last year.)

Held from April 6 to 23 at the Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste, Italy, the ION-sponsored event brought together U.S. and European experts in GNSS and African university professors and graduate students in an intensive program on uses of GNSS for social and economic development in Africa.

The two-week long program featured formal lectures with hands-on practice in GNSS architecture, signal structure, hardware design, state of the art applications, and scientific exploration using GNSS.

An on-site computer laboratory gave participants ample opportunities to perform positioning calculations; to plan a precision farming procedure; and to analyze atmospheric and ionospheric data – all from GPS measurements.

The 60 African participants included university professors and graduate students from 15 countries including: Algeria, Cote d'Ivoire, Egypt, Ethiopia, Ghana, Kenya, Madagascar, Malawi, Namibia, Nigeria, Rwanda, Senegal, South Africa, Uganda and Zambia.

Institute of Navigation members supporting the workshop included Chris Hegarty, Phil Ward, John Raquet, Mikel Miller, Carrie New, Casey Miller, Jade Morton, Reza Ehsani, Jim Doherty, Demetrios Matsakis, Susan Delay, Gopi Seemala, Cesar Valladares and me.

Volcano Eruption

The timing of the workshop was somewhat challenging because Iceland's Eyjafjallajökull volcano erupted during the workshop generating an ash cloud that disrupted air travel over much of the European continent.

Naturally, the volcanic ash was a prime topic of conversation during our workshop; so, we spent an afternoon accessing and processing ionospheric data to determine if the volcanic ash had an effect on ionospheric propagation. Unfortunately, there were no effects on the ionosphere!

Equally unfortunate, the travel disruptions had significant effects on the lecturers traveling during the last week of the program.

In particular Jim Doherty, former ION President, had to delay his return to the U.S. by nearly a week. Since other lecturers had to cancel their participation for travel reasons, Jim helped out with a few more presentations – Thanks Jim! The very disappointed ION members who were not able to attend included Anthea Coster, Larry Hothem, Susan Skone, Todd Walter, and A.J. van Dierendonck.

Second Time Around

Although this workshop was just the second of the series, we have already seen many benefits from these meetings between scientists and engineers of Europe, the USA and Africa.

We have had productive discussions about common interests. For example, a number of research programs use GPS ground and space based measurements to observe ionospheric and space weather phenomenon. Africa's proximity to the magnetic equator makes the continent of great interest to space weather scientists.

Unfortunately, studies over the region have not been possible due to the lack of dependable, long-term measurements. This workshop gave us an opportunity to establish a base of measurements for joint studies with our African colleagues.

In the past year, we have also seen initiation of programs for GNSS studies and research at several universities in Africa, as reported in some of the presentations made by African scientists this year.

In addition, participants of the first workshop initiated regional workshops in Nigeria and Egypt to further introduce the topics and benefits of GNSS to university administrations and local officials.

In the coming months, another regional workshop will be held in Kenya. Sandro Radice and I have acted as international advisors and participants for these programs.



Aderonke Adekemi Akerele and Olusola Fasunon of Nigeria with Andry Ramanantsoa of Madagascar – collaborating on a Mindstorm robot.

Hands On!

*Lectures, colloquia, meetings ... they're all fine.
But engineering creativity requires something more.*

One of the workshop laboratories was designed to demonstrate the basics of autonomous navigation with the use of LEGO®



Participants from Nigeria, Egypt and Algeria posing with Mikel Miller, Rachel Morton (Jade's daughter), Casey Miller, Carrie New and Jade Morton following the presentations on Autonomous Navigation.

MINDSTORMS® robots. During this lab participants were taught the basics of autonomous navigation and then were coached to build a robot. This exercise continued with a contest for the most clever and sophisticated design.

The winning designs included a Segway-like robot with an impressive capability of maintaining its balance, and a robot who walked, spoke in several languages, recognized colors, and a great "moon walk" when he was pleased.



The MINDSTORM kits were donated to the workshop by The Institute of Navigation and they were awarded to the African universities with the greatest interest in using the kits in their university programs.

Participants were also involved in a dynamic precision farming laboratory where they designed a fertilization-monitoring scheme.

Precision farming software was donated to the participants by Reza Ehsani, as part of this laboratory.

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Photos from top left to right: Aderonke Adekemi Akerele and Pat Doherty – both in Nigerian dress; Pat Doherty, Paul Omeno of the University of Nairobi and Phil Ward; John Raquet conferring with Amira Shimeis of Helwan University in Egypt; Jim Doherty answering some tough questions from Funmilayo Erinfolami of Osun State, Nigeria.

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Participants also went geocaching. They used single-frequency GPS receivers in a treasure hunt that was creatively planned by our instructors. Teams of four to six participants departed at 10 minute increments to navigate a course that spanned the ICTP campus.

The winning team returned in just over an hour while other teams took *much* longer.

At the end of the workshop, participants were given textbooks on GNSS, certificates of completion and, last but not least, Boston College baseball caps!



Next Workshop in Nigeria 2011

From all reports, the workshops are an enriching teaching experience for lecturers and useful for and appreciated by the African participants. Visiting dignitaries and sponsors from the African Union, the Economic Commission of Africa, the Italian Space Agency, the European Space Agency, The Institute of Navigation, Boston College, the ICTP, the United Nations, the National Science Foundation, the U.S. State Department and the U.S. Air Force Research Laboratory were impressed by the program and encouraged us to continue this effort.

We plan to continue with a workshop in spring 2011 in Abuja, Nigeria, which will make it more accessible to more participants.

We sincerely thank our prime sponsors for this workshop including: the ICTP, Boston College, The Institute of Navigation, the Federal Aviation Administration, the Air Force Research Laboratory, the Air Force Office of Scientific Research, NASA, NSF, the United Nations Office for Outer Space Affairs, and the Trimble Corporation. ♦

About the authors:

Patricia Doherty directed the Africa workshop with Sandro Radicella, head of the Radio-propagation Laboratory at ICTP. Doherty is ION Eastern Region Vice President and director of the Institute for Scientific Research at Boston College.

Due June 30 Kepler Award Nominations



The purpose of the Johannes Kepler Award is to honor an individual for sustained and significant contributions to the development of satellite navigation. The winner of this award will be determined by a special nominating committee. The Kepler Award is presented only when deemed appropriate. All members of The Institute of Navigation are eligible for nomination. You are encouraged to submit the names of individuals for consideration.

To submit a nomination, go to the ION website at www.ion.org. Click on Awards, scroll down, click on Kepler Award, then click on the Awards form for complete nomination instructions. *Nominations must be received by June 30.* Nomination packages may be sent to: Satellite Division Awards Committee Chair, The Institute of Navigation, 8551 Rixlew Lane, Suite 360, Manassas, VA 20109.

Due June 30 Parkinson Award Nominations

Graduate students in GNSS technology, applications, or policy who have completed a single-author thesis or dissertation and who are ION members are eligible for this prestigious award and \$2,500 honorarium. Nominations are to be submitted by a regular or research faculty member of a college or university.

This award honors Dr. Bradford W. Parkinson for establishing the U.S. Global Positioning System and the Satellite Division of The Institute of Navigation.

For application details and entry rules go to www.ion.org. *Nominations must be received by June 30.*



LET'S PLOW!

The First Annual ION Autonomous Snowplow Competition

Sponsored by the ION Satellite Division

January 27–30, 2011 • St. Paul Minnesota

The ION & the ION North Star Section each encourage teams to apply, enter, and compete in this new competition, being held at the St. Paul Winter Carnival. To enter the ION Autonomous Snowplow Competition, please complete and submit the contest application form — go to <http://www.autosnowplow.com> for further information.

Deadline has been extended to September 10, 2010!

Bring on the snow!