

## Cooperation on GPS-Meteorology between the United States and Cuba

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It is a truism that the atmosphere does not recognize geographic or political borders, and because of this there has often been cooperation between meteorologists in countries that are at odds on many other issues. A prime example of this cooperation was the visit of the American Meteorological Society (AMS) delegation to China in April and May 1974 (Kellogg et al. 1974).

Interactions between Cuba and the United States have been minimal in most respects since the Cuban Revolution (1953-1959) and the U.S. embargo of Cuba that began 19 October 1960. The embargo, which continues today, is a commercial, economic, and financial embargo – it prohibits all exports to Cuba except for some food and medicine. Cuba is a member of the World Meteorological Organization, through its Instituto de Meteorología (INSMET). INSMET is a government organization that carries out many of the functions of the U.S. National Weather Service (NWS) and National Oceanic and Atmospheric Administration (NOAA) research labs.

Travel of U.S. citizens to Cuba and Cubans to the United States has also been severely restricted since 1960. The economic embargo forbids the spending of money in Cuba by U.S. citizens without a license from the U.S. Department of the Treasury. However there is a General License in effect for people in certain categories, including diplomats, journalists, and academics. This means that U.S. university scientists are free to travel to Cuba, as long as they work on academic pursuits during the visit, with the intention to produce scientific publications. This license has allowed the U.S. authors of this article to travel to Cuba several times. But the existence of the General License is not widely known. As a result, scientific interactions between the two countries, which are generally apolitical in nature, have been rare. As described in a recent *Science* editorial, “The official relationship between Cuba and the United States has been frozen for over half a century, restricting scientific cooperation in many fields” (Fink et al. 2014 and related letter Marrero et al. 2014)).

\*\*\*\*\*BOX\*\*\*\*\*

### **General License for U.S. scientists to cooperate with Cuban scientists**

The U.S. Treasury rules for cooperation with Cuba may be found at <http://www.treasury.gov/resource-center/sanctions/Programs/Documents/cuba.pdf>. Specifically, the relevant portion of the general license for scientists is that the General License includes:

#### **“E. Full-time professionals conducting professional research or attending certain professional meetings**

“1. Professional research. Full-time professionals are authorized to engage in Cuba travel-related transactions and such additional transactions that are directly incident to conducting professional research in their professional areas pursuant to § 515.564(a)(1) of the Regulations, provided that their research (1) is of a noncommercial academic nature; (2) comprises a full work schedule in Cuba; (3) has a substantial likelihood of public dissemination; and (4) does not fall within certain categories listed in § 515.564(c)-(e).”

\*\*\*\*\*end of Box\*\*\*\*\*

An exception to the rule has been the cooperation between Cuban and U.S. meteorologists in the respective national weather services (the NWS in the U.S. and INSMET in Cuba) on tropical cyclone forecasting. Since the days of the Jesuit priest Father Benito Viñes (Ramos<sup>1</sup>, 2014), Cuban meteorologists have been leaders in forecasting Atlantic hurricanes, and have shared their forecasts and research methods freely with the U.S. Even with the restrictions on discourse between the two countries, hurricane forecasters in Havana and Miami freely share their data and forecasts, and hold frequent telephone conferences when tropical storms threaten the region. The hurricane center frequently flies their hurricane hunter aircraft over Cuba when the island is threatened by approaching storms.

However, aside from the cooperation between operational forecasters, interactions between U.S. and Cuban research meteorologists over the past 60 years have been rare. It therefore seemed like somewhat of a miracle when in May 2014 a team of atmospheric and geodetic scientists from UNAVCO and the University Corporation for Atmospheric Research (UCAR) sent and helped set up a Global Positioning System (GPS) receiver to measure atmospheric water vapor at the Grupo de Óptica Atmosférica de Camagüey (GOAC) at the Camagüey Meteorological Center in Camagüey, Cuba. GOAC (<http://www.goac.cu>) is part of INSMET. The GPS receiver immediately began to produce observations that can be used to estimate precipitable water (Fig. 1).

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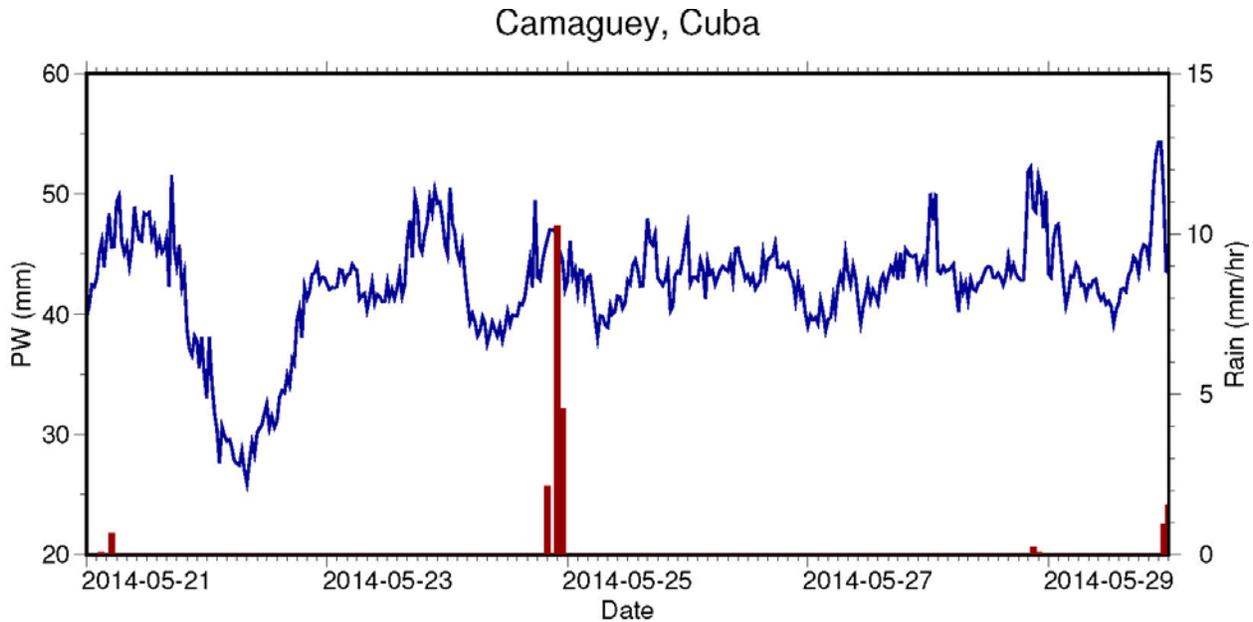


Fig. 1: Time series (21 May 2014 to 29 May 2014) of precipitable water (PW) in mm at INSMET site in Camaguey Cuba as measured by GPS receiver. Also shown (red bars) are rainfall collected from the Vaisala WXT collocated with the GPS. The time series starts on 21 May 2014, the first full day of data collected from the GPS station.

Even with slowly thawing political relations between the two countries, with the embargo still in full force, and the strict International Traffic in Arms Regulations (ITAR), how could scientists in the U.S. send any technical equipment to Cuba, much less sensitive instrumentation involving GPS technology?

This success story in scientific cooperation has several threads dating back over two decades. It was not a result of anyone’s long-range strategic plan, nor a piece of some larger diplomatic strategy to bring about a rapprochement between the two countries. Instead, like many international success stories, it resulted from individuals from both countries who over the years found common interests and developed mutual trust, and were willing to work hard on overcoming the bureaucratic and political restrictions on both sides. It also involved a lot of luck and serendipity.

We begin the story with a workshop held 20 years ago at a NATO Advanced Research Workshop on “The Effects of the Mt. Pinatubo Eruption on the Atmosphere and Climate,” Rome, Italy, 26-30 September 1994. Here Alan Robock (then at the University of Maryland) met Juan Carlos Antuña (research scientist at INSMET). Juan Carlos had contacted Alan by email expressing his desire to attend the University of Maryland as a graduate student working on observing the stratosphere after volcanic eruptions. Like most other graduate programs, Maryland requires scores from the Graduate Record Exam (GRE) and Test of English as a Foreign Language (TOEFL), but GRE and TOEFL exams are not offered in Cuba. As a result of their personal meeting, Alan vouched for Juan Carlos, and Maryland made an exception, offering him admission to the graduate program with a research assistantship, supported by a NASA grant.

Following their meeting in Rome, Robock accepted Antuña as his graduate student at the University of Maryland. It took a full semester for Alan to get the Treasury Department to agree

to pay Juan Carlos as a Graduate Research Assistant under his NASA grant, so Juan Carlos did not arrive in Maryland until January 1996. There had been an unusual 50 cm snowfall the day before, and when Juan Carlos arrived he saw snow for the first time in his life. The next day, as a house guest of Alan, he shoveled snow for the first time.

In 1998 Juan Carlos received his M.S. from the University of Maryland working on lidar and satellite observations of stratospheric aerosols for use in climate modeling. Three years later (6-8 March 2001), Alan and Juan Carlos organized the 1st Workshop on Lidar Measurements in Latin America, in Camagüey. In 2002 Juan Carlos earned his Ph.D. from Rutgers University working with Alan. His dissertation title was “Comparison of SAGE II and lidar stratospheric aerosol extinction datasets after the Mt. Pinatubo eruption.” Antuña then returned to Camagüey to continue his meteorological research.

A second thread of this story begins in July 2003 when Oswaldo Garcia, Professor of Meteorology, then Chair of the Geosciences Department, now Department of Earth & Climate Sciences, at San Francisco State University (SFSU) met Mayra Santana, then working for INSMET, at the Sixth International Conference on School and Popular Meteorological and Oceanographic Education that was held at Madrid, Spain. Oswaldo was born in Havana in 1947. His interest in meteorology was sparked as a small child by the spectacle of the “nortes,” the local name for the occasional cold air outbreaks from North America during the winter. Nortes interrupt the placid trade winds that characterize the climate of Havana and generate huge waves that crash over the city’s iconic Malecón seawall. Oswaldo immigrated to the United States as a 13 year old with his family after the revolution and continued to pursue his interest in meteorology. He received his Ph.D. from the Atmospheric Science Department at the University at Albany, State University of New York, did postdoctoral work at the University of Hawaii and worked at the NOAA Environmental Research Labs in Boulder Colorado before joining the faculty at SFSU.

The 2003 meeting in Madrid led to an invitation for Oswaldo to attend the Third Congress of the Cuban Meteorological Society in December 2005 in Havana. At this meeting, Oswaldo’s first trip back to Cuba since he left in 1961, Oswaldo made a presentation describing SFSU’s outreach efforts to increase interest in meteorology as a career among underrepresented minorities and took the opportunity to meet with many Cuban meteorologists. During this visit he was impressed by the eagerness of Cuban meteorologists to learn more about their American counterparts and made a commitment to help increase the meteorological collaborations between the two countries.

The third and final thread in the story was also developing about this time. A heterogeneous network of GPS stations in the Caribbean was taking shape, primarily focusing on the use of GPS for surveying and solid earth science applications. John Braun, a scientist at UCAR who had a close relationship with scientists and engineers at UNAVCO, received funding from the National Science Foundation (NSF) to install a small network of ground-based GPS stations in the Caribbean for atmospheric applications.

A few months after Oswaldo’s trip to Havana, on 18 April 2006, San Francisco State University hosted a meeting of UCAR’s University Relations Committee. Oswaldo had met Rick Anthes, President of UCAR, two years before in Boulder during a meeting of the UCAR Academic Affiliates and they became good friends and colleagues. Alan Robock was also at the 18 April

meeting. During dinner Oswaldo and Rick discussed the possibilities of scientific collaboration with Cuba and begin making plans for the visit of a UCAR/SFSU delegation to visit Cuba at the earliest opportunity.

The opportunity came earlier than expected, when Rick Anthes was elected President of the AMS in late 2006, to serve in 2007. Oswaldo put him in touch with the President of the Cuban Meteorological Society (SOMETCUBA) Andrés Planas, who invited him to visit Cuba to discuss possible collaborations between the two societies and the UCAR and Cuban scientific communities. This led to a visit on 27-30 March 2007 by Rick, Oswaldo, Karyn Sawyer (Director of UCAR Joint Office for Science Support-JOSS) and Tim Spangler (Director of UCAR Cooperative Program for Operational Meteorology Education and Training (COMET)). During meetings with SOMETCUBA and INSMET, the delegation discussed several potential joint research projects with their Cuban hosts. On the afternoon of March 28, the UCAR delegation visited the INSMET headquarters in Casablanca, across the bay from Havana, and one of numerous topics discussed was the possibility of installing a ground-based GPS receiver in Cuba. John Braun had asked Rick to bring this opportunity to the attention of INSMET leadership. According to Rick's summary of the meeting, written shortly after the visit:

“Rick Anthes invited Tomás Gutierrez (INSMET Director) and collaborators to write a paper for the *Bulletin of the American Meteorological Society* (BAMS), focused on the present state of meteorology in Cuba. He then presented INSMET with a book on the use of GPS for obtaining precipitable water estimates, and urged Dr. Gutierrez to consider John Braun's invitation to set up a GPS station in Havana that would help expand SuomiNet into the Caribbean. Drs. Gutierrez and Mario Carnesoltas led the visitors on a tour of INSMET's facilities and viewed UCAR's website. Dr. Gutierrez showed strong interest in obtaining real-time precipitable water vapor information for the Caribbean basin and agreed to consider the possible deployment of a GPS station at INSMET's headquarters.”

The presence of Oswaldo during this first meeting was an essential part of its success. He not only acted as chief translator and active participant in all the discussions throughout the meetings, but his being a native Cuban helped us in building an open and trusting relationship between the two sides.



Fig. 2: Oswaldo Garcia, Mayra Santana (INSMET), Rick Anthes, Karyn Sawyer, Mario Carnesoltas, and Mirella and Andrés Planas on roof of INSMET site in Casablanca, Havana, 28 March 2007. Photo by Rick Anthes.



Fig. 3: Tim Spangler (Director of COMET, UCAR), Luis E. Ramos Guadalupe, and Rick Anthes in front of SOMETCUBA headquarters 28 March 2007. Photo by Rick Anthes.



Fig. 4: Rick Anthes demonstrating SuomiNet, a network of GPS receivers in the U.S., at INSMET, Casablanca, March 2007. Behind Rick are Oswaldo Garcia, Jesus Dole (head of IT for the Institute), Daniel Martinez (head of the Physics of the Atmosphere section of INSMET), and Mario Carnesoltas. Photo by Tim Spangler.

In a completely independent event, two weeks before the UCAR-SFSU visit to Havana, Alan Robock had visited Camagüey 11-14 March 2007 to discuss continued collaboration with Juan Carlos, and also visited Havana and INSMET. During his visit, Alan made Juan Carlos aware of the UCAR's upcoming visit to Cuba to explore scientific cooperation, and a few months later Juan Carlos wrote on August 2007 to Rick and Oswaldo expressing his interest in establishing cooperation and setting up the preliminary basis for future contacts.

Soon after the March visit, SOMETCUBA President Andrés Planas invited Rick to give the keynote talk at the V Congress of the Cuban Meteorological Society. Rick and his wife Susan visited Havana on 1-5 December 2007. Oswaldo had planned to accompany them, but had difficulties obtaining his visa. As the days to departure from Miami counted down, he optimistically expected the visa to arrive at any moment, and even travelled from San Francisco to Miami at his own expense the day before the scheduled flight to Havana. But in the end his visa did not arrive, and Rick and Susan, neither one speaking Spanish, went to Havana anyway. The venue of the V Congress of Cuban Meteorological Society was held in the spectacular El Capitolio (National Capitol Building). In spite of not having Oswaldo as a translator, Rick had further discussions with INSMET about putting a ground-based GPS receiver at the INSMET weather observatory in Casablanca. It was clear that the Cuban scientists were still interested in this instrument and its observations, and collaborations with the U.S., but little visible progress had been made since March.



Fig. 5: Salon de los Pasos Perdidos, inside El Capitolio in Havana, venue of the V Congress of the Cuban Meteorological Society, 4 December 2007. Photo by Rick Anthes.

While little visible progress was being made in the next two years, Oswaldo continued to work quietly with both sides to keep the GPS-MET idea alive. On 1-3 December 2009, Oswaldo Garcia and John Braun visited Cuba and continued discussions on putting a ground-based GPS receiver in Cuba. The discussions between John Braun and Mario Carnesoltas held during this meeting helped clarify some technical questions and gave both sides a better understanding of the many hurdles, both technical and bureaucratic, that needed to be overcome before this project came to fruition.

On January 12, 2010, a magnitude 7.0 ( $M_w$ ) earthquake occurred near Leogane, Haiti, killing at least 100,000 people and highlighting the susceptibility of the Caribbean to a range of geohazard events. In response to this catastrophe, the National Science Foundation (NSF) funded a project called COCONet (the Continuously Operating Caribbean GPS Observational Network). The aim of this infrastructure project is to develop a large-scale network of geodetic and atmospheric infrastructure in the Caribbean that will form the backbone for a broad range of geoscience and atmospheric investigations and enable research on process-oriented science questions with direct relevance to geo-hazards (Braun et al. 2012). This significance of this project was that it created momentum in the Caribbean region for an international observational network to support geo-hazard research with an accompanying free and open data policy.

In the fall of 2010 the Alan Robock thread began to connect with the UCAR thread. As described in detail at <http://climate.envsci.rutgers.edu/Cuba/>, Fidel Castro Ruz, now retired as President of Cuba, had discovered Alan's work on nuclear winter and asked Tomás Gutiérrez to invite Alan to Cuba to give a "lecture on climate change." Tomás contacted Juan Carlos, who was in a working visit at the University of Valladolid, Spain asking him to contact Alan and to invite him

to attend a workshop on Climate Change to give a talk on his work. After arriving for his 14-16 September visit, Alan, now at Rutgers University, was asked if he minded that the Comandante attend his talk. Alan agreed and Fidel not only attended the talk, but participated vigorously in the discussion (Figure 6). On this visit he also met Fidel's son, Fidel Castro Diaz-Balart (or Fidelito), who is Science Advisor to the President of Cuba, and is shown with Alan, Juan Carlos, and Tomás Gutierrez at the Hotel Nacional in Fig. 7.



Fig. 6: Fidel Castro making point to Alan Robock, September 14, 2010 in Havana. Photo taken by Fidel Castro's photographer, signed by Fidel Castro, and presented to Alan Robock after his lecture.



Fig. 7: Juan Carlos Antuña-Marrero, Alan Robock, Fidel Castro Diaz-Balart (son of Fidel Castro and Science Advisor to the President of Cuba), and Tomás Gutierrez (Director of INSMET) at the Hotel Nacional in Havana, 15 September 2010. Photo by Alan Robock.

A month later, in October 2010 at the annual UCAR meetings in Boulder, Alan described his trip to Cuba and his meeting with Fidel Castro to Rick and Oswaldo, who mentioned that they had been trying for three years to send a GPS receiver to Cuba. Alan met with John Braun and agreed to help. Alan made Juan Carlos aware of the COCONet interest to install a GPS receiver in Cuba, establishing contact between him and John and Oswaldo. Juan Carlos expressed the GOAC interest to have access to GPS technology for continuing the building state of the art instrumental research capacities locally at Camagüey. It was at this time that the effort to establish a GPS receiver in Cuba shifted from Havana to Camagüey, largely because of Juan Carlos' and GOAC's strong interest and efforts on the Cuba side.

The week after Alan returned from the trip to Cuba, he received a phone call from the Cuban Ambassador to the U.S. Jorge Bolaños, who told him how happy Fidel was with his visit, and inviting him to lunch at the United Nations that week. Alan could not make that, but the week after the October UCAR meeting, he accepted Bolaños's invitation to visit him in Washington, DC. At that meeting, among other things, Alan asked Bolaños for help in arranging for the GPS to be installed in Cuba.

Meanwhile, the COCONet project was moving forward and on 3-4 February 2011 the COCONet Workshop for Community, Science, Station Siting, and Capacity Building was held in Puerto Rico. Juan Carlos Antuña was invited to attend the meeting and had his trip supported by UNAVCO using the general OFAC license. Juan Carlos flew from Cuba to Panama, but was not allowed to board the plane to Puerto Rico. He had previously applied to travel to NASA's Goddard Space Flight Center (GSFC) for an extended visit and there was a snafu in his passport and visa status. Juan Carlos had to return to Cuba on next plane. Despite the travel problems, Juan Carlos was able to communicate to the workshop participants his continued interest and desire to participate in the project. At this point, the newly created COCONet siting committee made a commitment to provide instrumentation for Camagüey, assuming all logistical paperwork was approved.

Juan Carlos eventually resolved the issues with his passport and visa and was able to travel to GSFC for a visit there, under the Yoram Kaufman Visiting Fellowships Program, 12 March to 30 April 2011. Because of bureaucratic obstacles on the Cuban side, the visit, planned for five months, was reduced to seven weeks. The leadership and decisive support from NASA and the University of Maryland Baltimore County through the Goddard Earth Sciences and Technology (GEST) Center Visiting Fellows Program (Raymond Hoff, Director) and the office of Maryland Senator Barbara Mikulski, made possible the first extended visit of a Cuban scientist to a NASA facility that we know of<sup>2</sup>. (Alan had once arranged for Juan Carlos to visit NASA GSFC while a student at the University of Maryland College Park to attend a seminar on lidar observations of the stratosphere.) The visit was conducted under the guidance and scientific support from Dr. Loraine Remer who granted Juan Carlos the opportunity to learn about the state of the art capabilities of the MODIS aerosols dataset and ongoing NASA aerosol research. While at GSFC

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<sup>2</sup> The sponsorship of this visit was made possible by a relaxation of the rules of academic interactions between the U.S. and Cuba by President Obama in January 2011. The modified General License allowed "sponsorship, including the payment of a stipend or a salary, of a Cuban scholar to teach or engage in other scholarly activity at the sponsoring U.S. academic institution" (*Federal Register* /Vol. 76, No. 19 / Friday, January 28, 2011 /Rules and Regulations)

Juan Carlos was free to travel within the U.S. and on 21-23 April 2011 he visited Boulder, spending time with COSMIC (Constellation Observing System for Meteorology, Ionosphere and Climate) and UNAVCO and staying at John Braun's house. Logistics of his visit to UCAR were complicated as there were many limitations put on what UCAR staff could do for him during his visit (by the State Department and UCAR's attorney). Most of discussions were on putting a GPS receiver at the INSMET weather station in Camagüey. A key outcome of this visit was a signed MoU between UCAR, INSMET/GOAC, and UNAVCO to pursue collaborative research.

On 28-29 June 2011 Juan Carlos was able to attend the COCONet Network Operators Meeting in Port-of-Spain, Trinidad, where he reiterated the commitment by his research group to participate in COCONet. He was befriended by a number of Latin American scientists at the conference who assured him of their support within the broader COCONet community.

Over the U.S. Thanksgiving holiday (22-25 November 2011) Rick Anthes and his wife Susan, John Braun and a professor from San Francisco State University, Andrew Oliphant, visited Juan Carlos in Camagüey to tour his research facility and discussing siting of a GPS receiver. The Camagüey Chapter of SOMETCUBA (President René Estevan) hosted the visit ([http://www.goac.cu/sometcuba/act\\_vams.php](http://www.goac.cu/sometcuba/act_vams.php)). Oswaldo had planned to accompany them, but once again his visa did not arrive on time and at the last minute he had to cancel. After their meetings in Camagüey, Rick, Susan, John and Andrew rented a car and drove to Ciego de Ávila, Cienfuegos, and then to Havana for meetings with INSMET and SOMETCUBA. On this trip we learned that progress was being made on getting Cuban authority approvals for a GPS receiver sent to Camagüey.



Fig. 8: Group in front of GOAC in Camagüey 23 November 2011. Back row from left to right: Dositeo García Bargados, (Director Camagüey Meteorological Center (CMC)); Juan Carlos Antuña Marrero (GOAC); Karel Agüero Rodríguez (Forecast Department, CMC and member of SOMETCUBA board); Carlos E. Hernández Bruneta (GOAC and member of SOMETCUBA board); Iomaris Pérez Abraham (Clima Department, CMC and Member of SOMETCUBA board), John Braun (UCAR COSMIC), and Rick Anthes (UCAR President and AMS President). In front from left to right: René Estevan Arredondo (Director GOAC and President of Camagüey Chapter of SOMETCUBA), Boris Barja González (GOAC and member of SOMETCUBA board) and Andrew Oliphant (Professor of Geography, San Francisco State University). Photo by Rick Anthes.

Three weeks later on 12-16 December 2011, Alan Robock was part of an American Association for the Advancement of Science (AAAS) delegation visit to Havana to enhance scientific cooperation (Antuña et al. 2012b). During the visit he met again with Fidel Castro Diaz-Balart and urged the approval of the GPS installation in Camagüey. Alan emphasized that there were no security concerns for Cuba with the installation. Dr. Castro responded that he knew that, but that we had to convince the Cuban military. Anne Thompson (President of the Atmospheric Sciences Section of AGU) and Alan Robock (Past-President of the Atmospheric Sciences Section of AGU) continued discussions on US-Cuba scientific collaboration with Juan Carlos, and made a plan to have him attend the 2012 AGU Fall Meeting, supported by AGU.

During the AAAS visit Tomás Gutierrez instructed Armando Muñoz, who was in charge of all the required paperwork to be conducted in Havana, to work with Juan Carlos. Armando played a key role in the process of getting the approvals from all the involved Cuban institutions. He demonstrated professionalism and persistence to comply with each one of the formality procedures requested by the several Cuban institutions that were required to approve the import of the instrument. In some cases, he had to draft more than one version of the same document, each time getting the signatures and approval stamps of the required officers.

Armando's efforts succeed and on 23 October 2012, Cuba granted a Cuban GPS Import License, valid until 23 April 23, 2013. (The Import License was later renewed on April 8<sup>th</sup>, 2013 until October 8<sup>th</sup>, 2013).

At the December 2012 AGU meeting in San Francisco, an informal meeting attended by Alan Robock, Juan Carlos Antuña, John Braun, and UNAVCO (UNAVCO President Meghan Miller, Glen Mattioli, Karl Feaux, and Jim Normandeau) was held to discuss logistical constraints in exporting equipment from the US to Cuba. UNAVCO agreed to take the lead in applying for an export license. This process was tedious, with multiple resubmittals and clarifications, but eventually, on 6 June 2013, the Department of Commerce approved an Export License for UNAVCO to ship a GPS receiver to Camagüey, leading to the establishment of the station as part of the broader COCONet project.

However, the U.S. approval of the Export License did not end the bureaucratic process. On 9 October 2013 Juan Carlos wrote to Alan Robock:

*Dear Alan:*

*We are now dealing with the Agency in Charge of the Import. Having all the official documents in their hands (because it is an import from the US) they are requesting additional approval letters from the Foreign Affairs Offices of the Ministry of Sciences, the Ministry of Commerce and International Cooperation.*

*Interviews have already been requested with the people in charge of those offices to hand them letters (signed by Tomás) explaining why their letters are required and handing then copies of all the official documents. Then we should wait from then to produce the letters to be back to the Import Agency. I told you it reminded me of Kafkian literature.*

*Funny and sad at the same time.*

*Regards, Juan Carlos*

But on 22 November, Cuba renewed the GPS Import License for the third time until 22 May 2014, and on 10 January 2014 Juan Carlos announced that the GPS import permission for Cuba had finally been granted by all the different authorities. All the necessary approval documents were provided by the Import Agency to Cuban Customs, paving the way for UNAVCO to ship the GPS receiver from Boulder to Havana in April via DHL, where it cleared customs and was then moved from Havana to Camagüey.

After the GPS receiver arrived in Camagüey, GOAC personnel led by its Director, René Estevan Arredondo, conducted refurbishing of the GOAC instruments site, setting up electrical and network connections for the GPS receiver and the associated automatic weather station. Both instruments plus a camera (for remotely monitoring the instrument's status and its security) were installed in advance of the arrival of the UCAR-UNAVCO team.

With the instrument and site prepared, John Braun and Jim Normandeau (a UNAVCO field engineer) traveled to Camagüey 19-25 May 2014 to help install the GPS receiver and get it running properly. The first successful observations were made during this trip, and on 22 May 2014 Juan Carlos wrote

*Dear Alan, Rick and Oswaldo:*

*The GPS has been installed and it is running taking measurements. There is only one pending things that Jim will do at UNAVCO (setting up an IP address) for finishing the real time transfer of the measurements.*

*Our team had a very fruitful exchange with John and Jim and Rene I think that we will be able to keep it running and the data flowing to UNAVCO. We also learned how to get the meteorological data on real time for future local uses.*

*We have enjoyed the visit of John and Jim both in the professional and personal sides.”*

*Best Regards  
Juan Carlos*



Fig. 9: Group on roof of GOAC's instrument site in Camagüey after installation of GPS receiver (white domed instrument center). In front: John Braun (UCAR COSMIC). Behind John, left to right: Nelson Diaz Spencer (GOAC); Jorge Rosas Santana (GOAC), Jim Normandeau (UNAVCO); Iralmis Yipsy Platero Morejón (GOAC), René Estevan Arredondo (Director GOAC); Juan Carlos Antuña-Sánchez (GOAC); Frank García Parrado (GOAC), Albert Rodríguez Vega (Clima Department, CMC, Ph.D. student GOAC); Juan Carlos Antuña-Marrero (GOAC). Photo by John Braun.

With the successful establishment of the GPS receiver in Camagüey and the joining of Cuba into the international COCONet research network, our story ends. But the collaborations, friendships and collegial relationships established since 1994 leading to this milestone will go on for many years.

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