Annual Report for Period: 09/2011 - 08/2012
Submitted on: 07/19/2012
Principal Investigator: Miller, M. Meghan .
Award ID: 1042906
Organization: UNAVCO, Inc.
Submitted By:
Miller, M. Meghan - Principal Investigator
Title:
Collaborative Instrumentation: COCONet (Continuously Operating Caribbean GPS Observational Network) An Infrastructure Proposal for a Multi-hazard Tectonic and Weather Observatory

Project Participants

Senior Personnel

Name: Miller, M. Meghan
Worked for more than 160 Hours: No
Contribution to Project:

Name: Calais, Eric
Worked for more than 160 Hours: No
Contribution to Project:

Name: Wang, Guoquan
Worked for more than 160 Hours: No
Contribution to Project:

Name: Meertens, Charles
Worked for more than 160 Hours: No
Contribution to Project:

Name: Feaux, Karl
Worked for more than 160 Hours: No
Contribution to Project:

Name: Bohnenstiehl, Kyle
Worked for more than 160 Hours: No
Contribution to Project:
Land user permitting support

Post-doc

Graduate Student

Undergraduate Student

Technician, Programmer

Name: Nolting, Robert
Worked for more than 160 Hours: No
Contribution to Project:
Warehouse support

Name: Friesen, Barrett

Worked for more than 160 Hours: Yes
Contribution to Project:
Lead Installation Engineer

Name: Dausz, Korey
Worked for more than 160 Hours: Yes
Contribution to Project:
Secondary Installation Engineer

Name: Borsa, Adrian
Worked for more than 160 Hours: No
Contribution to Project:
Lead Data and Data Products Manager

Name: Bassett, Andre
Worked for more than 160 Hours: No
Contribution to Project:

Name: Seider, Emily
Worked for more than 160 Hours: Yes
Contribution to Project:
Installation Engineer

Name: Enders, Max
Worked for more than 160 Hours: No
Contribution to Project:
Installation Engineer

Name: Austin, Ken
Worked for more than 160 Hours: No
Contribution to Project:
Engineer

Other Participant

Name: Jackson, Michael
Worked for more than 160 Hours: No
Contribution to Project:

Name: Mattioli, Glen
Worked for more than 160 Hours: No
Contribution to Project:

Name: Normandeau, Jim
Worked for more than 160 Hours: No
Contribution to Project:
Management for COCONet Field Operations

Research Experience for Undergraduates

Organizational Partners

Purdue University

UCAR

Other Collaborators or Contacts

We have a broad range of national and international collaborators and contacts. A summary list can be found on pp. 23-27 of the 2011 COCONet Workshop Report (Puerto Rico) and on pp. 20-24 from the 2011 COCONet Operators Meeting Report (Trinidad):

2011 COCONet Workshop Report:
http://coconet.unavco.org/lib/downloads/coconet_report_final_english(2).pdf

2011 COCONet Operators Meeting Report
http://coconet.unavco.org/lib/downloads
COCONet_operators_mtg_report.pdf

Activities and Findings

Research and Education Activities:
Please see attached report for research and education activities.

Findings:
Please see attached report for findings.

Training and Development:
Please see attached report for training and development.

Outreach Activities:
Please see attached report for outreach activities.

Journal Publications

Braun, J. J., G. Mattioli, E. Calais, D. Carlson, T. Dixon, M. Jackson, E.R. Kursinski, H. Mora, M. Miller, R. Pandya, R. Robertson, and G. Wang, "2012: Multi-Disciplinary Natural Hazards Research Initiative Begins Across the Caribbean Basin.", EOS, Transactions American Geophysical Union, p. 89-90, vol. 93 (9), (2012). Published, 10.1029/2012EO090001

Friesen, B., K. Dausz, K. Feaux, "COCONet, The Continuously Operating Caribbean GPS Observational Network: Construction Progress and Highlights", EOS Transactions of the American Geophysical Union, p. , vol. , (2011). Published, 2011AGUFM.G53B0901F

Braun, J. J., UCAR, Boulder, CO; and E. Calais, K. Feaux, G. Mattioli, M. Miller, and G. Wang, "The Continuously Operating Caribbean Observational Network (COCONet): Improved Observational Capacity in the Caribbean", American Meteorological Society, p. , vol. , (2012). Published, http://nldr.library.ucar.edu/repository/collections/OSGC-000-000-009-040

Books or Other One-time Publications

Web/Internet Site

URL(s):
http://coconet.unavco.orgCOCONet project website went live in FY2012:

Description:
COCONet project website went live in FY2012.

Other Specific Products

Contributions

Contributions within Discipline:

Contributions to Other Disciplines:

Contributions to Human Resource Development:
During the reconnaissance, permitting, and construction phase of the project, COCONet engineers have worked closely with local technicians, engineers, and emergency management officials in the Caribbean region to develop working relationships and collaborations.

Contributions to Resources for Research and Education:
This is addressed in the attached report.

Contributions Beyond Science and Engineering:

Conference Proceedings

Special Requirements

Special reporting requirements: None
Change in Objectives or Scope: None
Animal, Human Subjects, Biohazards: None

Categories for which nothing is reported:

Any Book
Any Product
Contributions: To Any within Discipline
Contributions: To Any Other Disciplines
Contributions: To Any Beyond Science and Engineering
Any Conference

COCONet EAR 1042906 Annual Report

July 2011 - June 2012

SUMMARY

This annual report covers the COCONet project (EAR-1042906/EAR-1042909) activities for the time period July 2011 - June 2012. The COCONet grant was awarded to UNAVCO on September 14, 2010 and a collaborative grant (EAR-1042909) awarded to J. Braun, University Corporation for Atmospheric Research. The project is under the direction of M. Meghan Miller, Eric Calais, Guoquan Wang, John Braun, Glen Mattioli, and Karl Feaux.

The work completed during this reporting period includes efforts based on recommendations made during the second community station siting and planning meeting held in Port of Spain, Trinidad in late June 2011. At the Trinidad meeting, the participants developed a final COCONet siting plan, which included the installation of 50 new stations, 15 refurbished stations (existing stations that will require COCONet hardware to become operational), and 61 existing GPS stations operating in the region. Given the additional stations included in the Trinidad siting plan, UNAVCO project managers developed a new project plan, which modified the installation schedule from three years to four years and made some cost-savings modifications to the station hardware. During this reporting period, UNAVCO also hired a third COCONet engineer, completing the hiring plan for the project. UNAVCO also developed and translated into Spanish the Memorandum of Understanding (MOU) documents that will be used to define the working relationships between UNAVCO and host institutions in the Caribbean region. During the last year, COCONet personnel made progress in developing contacts in Venezuela and Cuba, two countries in which we anticipated difficulty in obtaining permits.

UNAVCO engineering personnel have followed the revised project schedule to conduct site reconnaissance at 58 locations in 24 countries, submitted land use permits for 49 sites, had permits accepted for 36 sites, and currently have completed eighteen stations installations (Figure 1). Education and outreach efforts include hosting students for the RESESS program in the summer of 2011 and 2012, the creation of numerous handouts and support materials, as well as presentations at community meetings such as American Geophysical Union Annual Fall Meeting, the UNAVCO Science Meeting, and the 30th Conference on Hurricanes and Tropical Meteorology. In addition, UNAVCO staff have designed a new COCONet website, which includes extensive background information related to the project goals, participating individuals and institutions, current status of sites, and links to other portals to access raw data as well as processed data products (http://coconet.unavco.org/coconet.html). Support staff coordinated with US State Department officials to utilize the diplomatic pouch, a means of expediting the shipment of equipment to US embassies abroad, alleviating the need to donate government-owned equipment. Diplomatic pouch has now been utilized to ship equipment to Mexico, Dominican Republic, and Colombia. With COCONet stations now installed and operating, maintenance activities have begun including activities in the Bahamas, Jamaica, and Nicaragua.

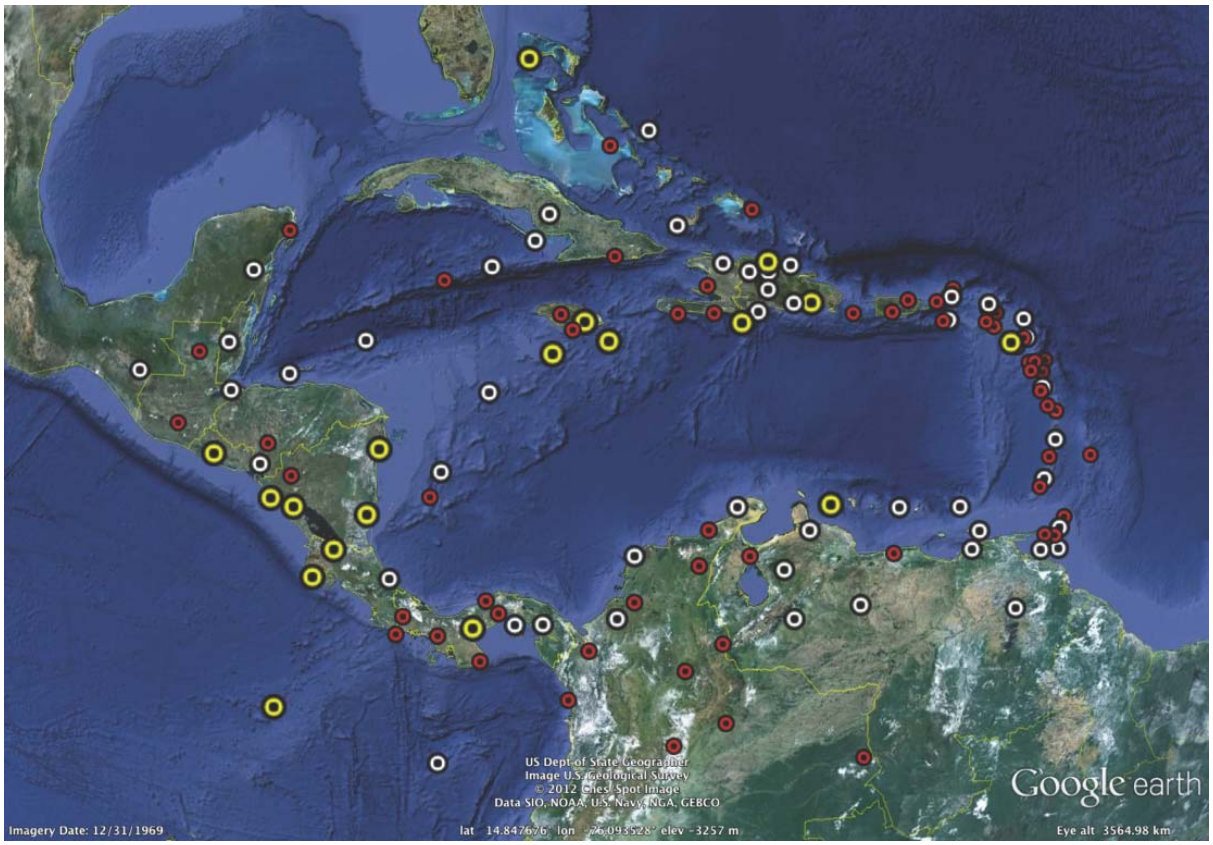


Figure 1. The final COCONet siting plan from the siting meetings in Puerto Rico and Trinidad. White dots represent planned new or refurbished stations, yellow dots represent the 18 installed stations, and red dots represent existing stations (61).

Major Research and Education Activities Of The Project

Field Operations Summary

During the last three months, the following field operation milestones were completed:

• Three new stations were installed in the COCONet region. In the Dominican Republic, short-drilled braced monuments were built in competent substrata near the towns of Puerto Plata and Cabo Rojo. The station at Puerto Plata, built at the airport, will utilize a radio link to the airport offices for data communications. In Cabo Rojo, the station was built on property owned by a cement factory, and will use a cellular data communications. The third station built was located on the small island of Redonda, part of Antigua & Barbuda near Montserrat. This station will relay data via the Montserrat radio network.

• Two refurbished stations were completed, SPED in the Dominican Republic and SSIA in El Salvador. The station SPED required a WXT520 meteorological instrument, while SSIA required a new NetR9 receiver and a meteorological instrument. A Zephyr Geodetic 2 antenna

was also provided for SSIA, although it is not yet installed, in order to preserve the existing position time series. The antenna may be replaced in the future, if needed. COCONet engineers conducted station maintenance at CN10 Morant Cay and CN11 Pedro Cay, both south of mainland Jamaica. This maintenance consisted of the installation of BGAN satellite modems for data transmission, as the Cays are too far from the mainland to use other types of data communications. In addition, a meteorological instrument was installed at MANA (Managua, Nicaragua) and data communication upgrades were completed at two other Nicaragua stations, Poneloya (CN22) and Puerto Cabezas (CN29).

• Permitting documents were finalized for two sites in Mexico, three sites in Trinidad, and two sites in Antigua and Barbuda (Barbuda and Redonda).

Table 1. COCONet Status: Tasks completed to date and in FY2012-Q3.

	Cumulative	**Since Previous Quarter**	**Details From Current Quarter**
Station Recons	58	8	Venezuela, Mexico, Costa Rica, Honduras, Dominican Republic
Permits Submitted	49	10	Venezuela, Mexico, Honduras
Permits Accepted	36	9	Bahamas, Honduras, Mexico
Stations Installed/Refurbished	18	5	Dominican Republic, El Salvador, Antigua and Barbuda
Data Flow	16	5	Jamaica, Nicaragua
Maintenance Visits	6	5	Jamaica, Nicaragua
Next Quarter Projection	Recons: 0, Permits Submit: 4, Installs: 4, Refurbishments: 5		

Operations Highlight #1:

In September 2011, three COCONet installations were completed in Jamaica, a collaborative effort between UNAVCO and the University of the West Indies (UWI) Mona Campus. A roof mount monument was installed on the top of Physics building at UWI, the fist such installation with the GPS roof-mount designed by UNAVCO for the COCONet project. In addition, two stations were built on the remote islands of Pedro Cay and Morant Cay (Figure 2). The island stations will utilize BGAN (satellite-based system) for data communications. A chartered boat was required to transport personnel and equipment due to the remoteness of the islands. These installations would not have been possible without the support and field assistance from personnel from UWI-Mona.

Figure 2. CN10 located on the remote island of Morant Cay, SE of Kingston, Jamaica.

Operations Highlight #2: Colombia Reconnaissance

During the period December 4-12, 2011, Kyle Bohnenstiehl (UNAVCO) and Dr. Hector Mora of the Colombian Geological Survey (formerly INGEOMINAS), completed reconnaissance of four new COCONet sites in Colombia, including Galerazamba, Monteria, Providencia Island, and Puerto Bolivar. All of the sites had been prescreened by Dr. Mora and were found to be of excellent quality.

Galerazamba is located at an active salt evaporation mine, between Cartagena and Barranquilla, and is within 50 meters of the ocean in limestone/coral bedrock and has excellent security and cell phone communications. Monteria Airport will host the designated site, which will be constructed using a hand-augured hybrid short-drilled braced monument. Bedrock is not exposed; accordingly, siting reconnaissance was concentrated in areas that had excellent data communications, access, and security. Providencia Island creates the opportunity to have a site well out into the Caribbean on a unique volcanic island. A private landowner on the island generously agreed to host the site for COCONet. The fourth site will be located at the Puerto Bolivar airport, operated by the Cerrejon Mining Group. Puerto Bolivar serves as an ocean shipping point for one of the largest coalmines in the world, located 170 Km south by rail from

the site. The site provides excellent bedrock, security, and cell phone data communications. Despite severe rains, the trip was a great success. In addition to the reconnaissance completed, UNAVCO staff now has a better understanding of the logistics involved in working in Colombia. New relationships were formed with landowners and old relationships were rekindled. Three of the four new sites in Colombia have been permitted. The equipment is currently being staged for shipment to Colombia and installation will begin later this summer. The Colombian Geological Survey/GEORED will provide logistical support during the installations. In addition, five other existing GPS stations in Colombia, part of Dr. Mora's GEORED, will be included as existing stations within the COCONet framework.

Figure 3. Dr. Mora examines a rock outcrop near Puerto Bolivar, Colombia.

Operations Highlight #3: Dominican Republic Station Installations

In April 2012, COCONet engineers installed two new COCONet stations in the Dominican Republic at Cabo Rojo and Puerto Plata. Claudio Martinez of Oficina Nacional de Meteorología (ONAMET) and members of his field team joined COCONet engineers on site and made invaluable contributions to both installations.

As a result of our comprehensive reconnaissance efforts, both GPS monuments were installed in highly competent limestone formations in locations with excellent sky view and tight security.

The Cabo Rojo station is located on a headland southeast of the town of Pedernales, behind a guarded security gate on land owned and operated by IDEAL Dominicana S.A./ Cementos Andinos. The short-drilled braced monument was anchored into the rock at the top of a 50-foot limestone sea cliff. After the removal of one tree, the site was cleared of obstructions to atmospheric wind and sky view. The cell signal at the site is excellent, so the station was brought online via a Proxicast Lancel-2 cellular modem. The Puerto Plata site is located behind airport security gates in the yard between the main runway and the terminal buildings. Just over 10 meters above sea level and 700m from the coast, the whole airport is constructed on a limestone shelf, with limestone outcropping throughout the yard. Along with the inherent security and sky view that comes with siting at an airport, this station also benefits from proximity to the ONAMET office in the terminal, which is generously providing a connection to their network via radio telemetry.

In addition to station installations, the COCONet field team also completed reconnaissance of a new site in the north central part of the Dominican Republic at Cabo Frances Viejo. COCONet engineers confirmed the feasibility of using radio telemetry to connect the Valle Nuevo station to the Internet at the ONAMET office in Santo Domingo. During this installation trip, another success was the strengthening of the ONAMET-COCONet partnership. Claudio Martinez from ONAMET was deeply involved in station siting as well as logistics of working in the Dominican Republic. Claudio also brought several members of his field team to assist with both installations, learn about the operation of the COCONet stations, and teach the UNAVCO engineers some valuable lessons in return.

Figure 4. Building relationships, COCONet style. COCONet and ONAMET field team with the meteorological sensor at the completed Puerto Plata station.

Data Summary

The Port of Spain planning meeting resulted in 50 target locations for new stations, 15 targets for refurbished stations, and 61 existing stations for integration into the COCONet network. The COCONet data plan calls for at least 10 stations to provide high-rate real-time GPS data streams. COCONet is currently downloading mostly 15-second data (some exceptions for BGAN sites) and processing daily time series from 11 of the 18 new and refurbished COCONet stations. Processing of station data by the PBO GPS Analysis Centers is yielding high-quality time series. Table 2 shows the current data summary for COCONet stations.

Table 2. COCONet Data Summary.

	New Stations	Refurbished Stations	Existing Stations	Notes
Standard data archived at UNAVCO	6 of 13 stations installed currently archiving 15-sec data 2 of 13 stations installed currently archiving 30-sec data (BGAN stations)	3 of 5 refurbished stations currently archiving 15-sec data	UNAVCO has received data from 21 existing stations. 16 currently online and operational.	CN07, CN08, CN22, CN29, CN49, RDSD, and GRZA do not have data flow – plan in place to repair or install data communications at these stations CN33 has data communications, station is currently down
Stations Streaming 1-Hz Data	(4) CN15, CN40, ISCO, CN12	0	(1) P780	

The UCAR/COSMIC program is participating in COCONet under support from NSF grant (EAR-1042909). UCAR produces continuous estimates of atmospheric precipitable water vapor (PW) using a heterogeneous network of GNSS stations, including those stations that are part of COCOnet. These data are produced and distributed through the Suominet (www.suominet.ucar.edu) web portal as well as with the local data management (LDM) system to automatically distributed data through the internet to stream subscribers. As of June 1, 2012 UCAR was including data from 22 new and existing COCONet sites into its analysis system, and was preparing to ingest data from six other sites that had recently begun producing sub-daily data streams for near real time analysis.

Budget and Schedule

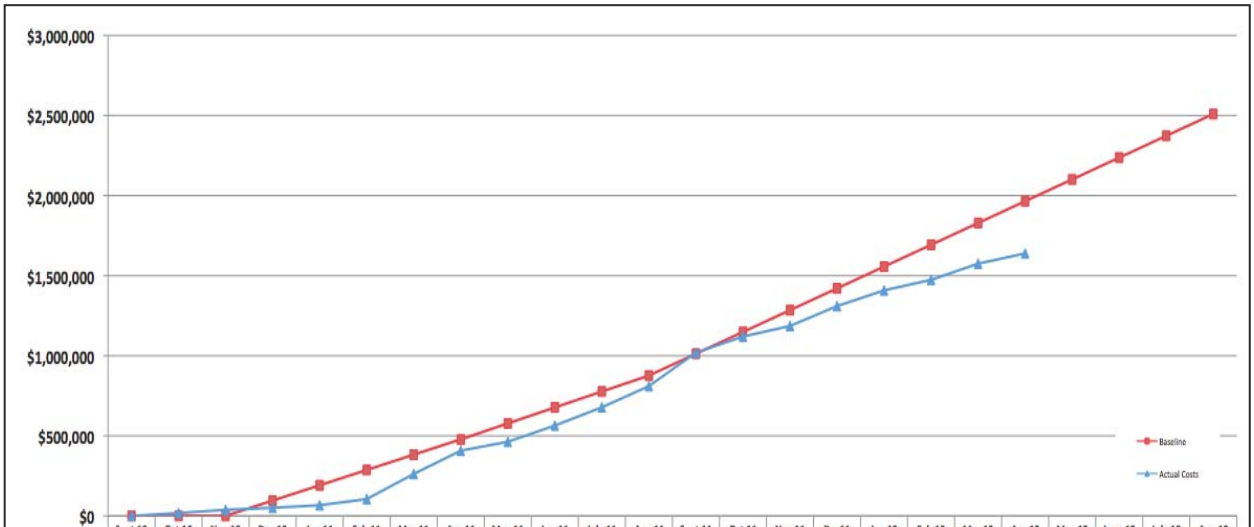
The COCONet project uses earned value to manage construction. The baseline was refined after the Trinidad siting meeting and now includes a revised budget and schedule to reflect changes to the siting plan. In May 2012, the COCONet Year 3 budget request was completed and submitted to NSF.

The revised schedule includes 50 new station installations, 15 refurbished stations, and 61 existing stations. Refurbished stations are defined as stations that were operational in the past, but now require some equipment upgrades to become compatible with COCONet

standards. Existing stations are assumed to require no additional hardware to be compatible with the COCONet network. The installation schedule was extended to four years, given the delay in starting the field component of the project needed to refine the siting plan in light of new information that was not available at the time the proposal was developed.

Overall project expenditures are over $1.7M spent to date (Figure 5). Reasons for the discrepancy between the actual and budgeted expenses result because neither the Purdue subaward nor the archiving and processing costs have been invoiced at this time. Field crews concentrated on reconnaissance and permitting efforts and stayed ahead of scheduled reconnaissance. Some of the Dominican Republic installations, scheduled for May 2012, were delayed due to difficulties in obtaining signatures for permitting documents. As agreements with host institutions are put into place, the next three months should see a spike in station installations in the Dominican Republic, Mexico, and Colombia.

Earned value management (EVM) techniques were applied to the construction and field operations components of the project (removing education and outreach, participant support, and subawards). Using EVM (Figure 6), the construction/field operations component of the project is shown to be slightly ahead schedule (1% positive schedule variance) and under budget (21% positive cost variance).



	Sept 10	Oct 10	Nov 10	Dec 10	Jan 11	Feb 11	Mar 11	Apr 11	May 11	Jun 11	July 11	Aug 11	Sept 11	Oct 11	Nov 11	Dec11	Jan 12	Feb 12	Mar 12	Apr 12	May 12	June 12	July 12	Aug 12
Baseline	$0	$0	$0	$95,568	$191,135	$286,703	$382,271	$477,838	$577,426	$677,014	$776,601	$876,189	$1,012,27	$1,148,35	$1,284,44	$1,420,52	$1,556,61	$1,692,69	$1,828,78	$1,964,86	$2,100,95	$2,237,03	$2,373,11	$2,509,20
Actual Costs	$0	$17,702	$37,822	$50,638	$66,605	$104,969	$262,032	$407,170	$462,925	$563,916	$678,047	$810,167	$1,019,61	$1,119,82	$1,185,72	$1,310,02	$1,408,15	$1,474,00	$1,574,87	$1,638,95				

Figure 5. Total project actual costs vs. budget. Red line is budget and blue line is actual expenditures.

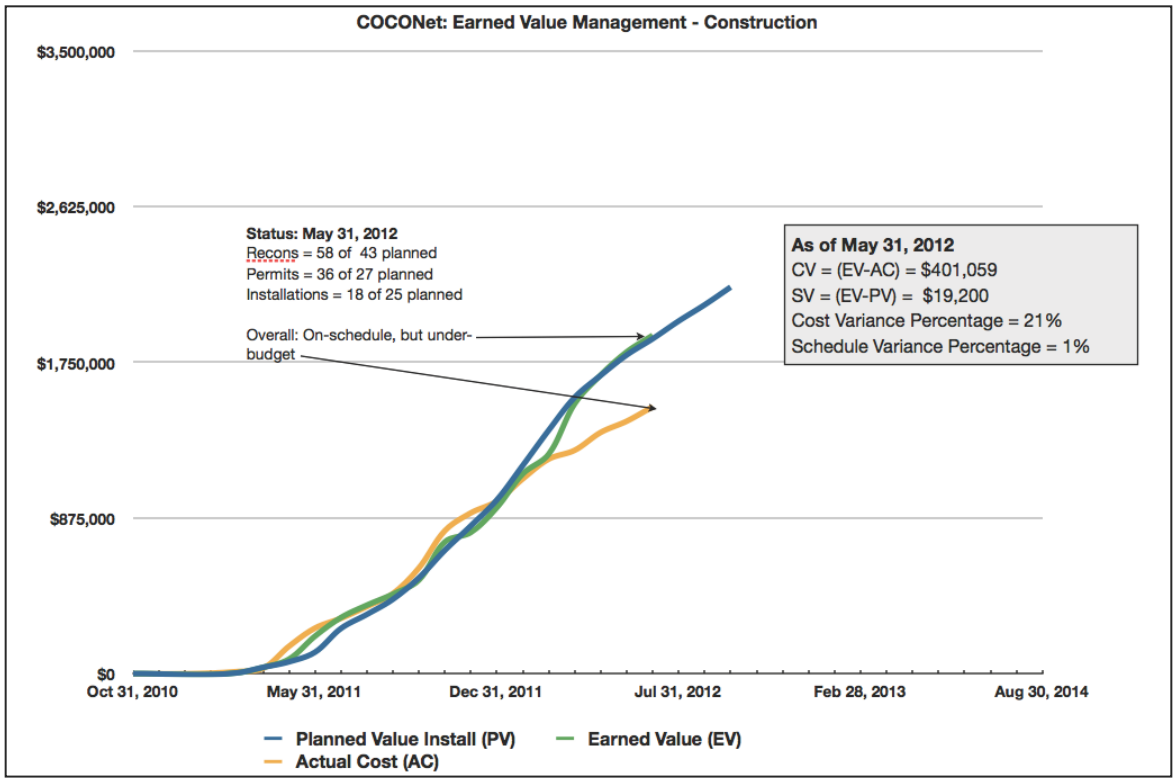


Figure 6. COCONet Earned Value Management – Field Operations

Describe The Major Findings Resulting From These Activities

This project is still in the construction phase and there are currently no major findings or results from our activities.

Describe the Opportunities For Training, Development, and Mentoring provided By Your Project

RESSES Student Summer 2011

During the Summer 2011, the COCONet project supported a summer research intern in the RESESS program, Angel Torrens-Bonano, from the University of Puerto Rico Mayaguez. RESESS is a bridge-to-graduate school internship program that aims to engage and support students from underrepresented communities in the geosciences through doing authentic research. Angel is a junior in the Department of Geology. Angel's research focused on measuring and analyzing slip movement across the San Andreas Fault (SAF) in California. In June 2011, Angel worked with UNAVCO staff members Adrian Borsa on the geophysics of the SAF and Jim Normandeau on learning how to use GPS. Angel also participated in a one-day RESESS-UNAVCO workshop on GPS instructed by Dr. Mike Floyd from M.I.T. In July 2011, Angel worked in California measuring and analyzing slip rates across the fault with Sally McGill at UCSB in a joint RESESS-SURE (SCEC program) internship endeavor. Angel presented his research results at the SCEC (Southern California Earthquake Center) Annual Meeting in September 2011 and at the annual meeting of the Geological Society of America in

Minneapolis, MN, in October 2011. He is an enthusiastic student who has been energized by this research experience, and who has consequently developed a keen interest in going to graduate school to study geophysics.

Plan For RESSES Student Summer 2012

A RESESS intern, Rachel Medina, is a senior at Fort Lewis College and President of the college chapter of Engineers Without Borders. Rachel is doing her 2012 summer research project on how water vapor in volcanic plumes can cause tropospheric delays in GPS multipath signals. She is working with Dr. Glen Mattioli (soon to be at UNAVCO) and Dr. John Braun (UCAR) to determine whether GPS position time series observations over a several hour time period on July 13, 2012, which were initially attributed to surface elevation changes caused by volcanic dome collapse and subsequent explosions, are better explained by changes in regional water vapor around Montserrat can be attributed to the presence of volcanic plumes. The hypothesis will be tested by examining time series of GPS-derived zenith wet delay estimates and comparing these to other remote sensing and local geophysical data. The title of Rachel's project is: Correlation of Zenith Wet Delay estimates from cGPS and vis/IR RS Images of Soufriere Hills volcano, Montserrat during the July 2003 Dome Collapse: Implications for Detection of Ash Plumes and Vertical Deformation.

Figure 5. Map showing the location of the island of Monserrat in the Lesser Antilles volcanic arc in the West Indies.

The Soufrière Hills volcano (or "sulfur outlet") is an active, complex stratovolcano on the Caribbean island of Monserrat. While the volcano was dormant for years, it became active in 1995, and has continued to erupt ever since. Large variations in surface elevation were

indicated by GPS data following the July 12-13 dome collapse and eruption in 2003. Further examination of the data over a few hour period corresponding to peak dome collapse showed large variations in the surface elevation in the vertical component and minimal variations in the horizontal component over a period of hours, which does not correspond with what would be expected with volcano dome expansion and collapse.

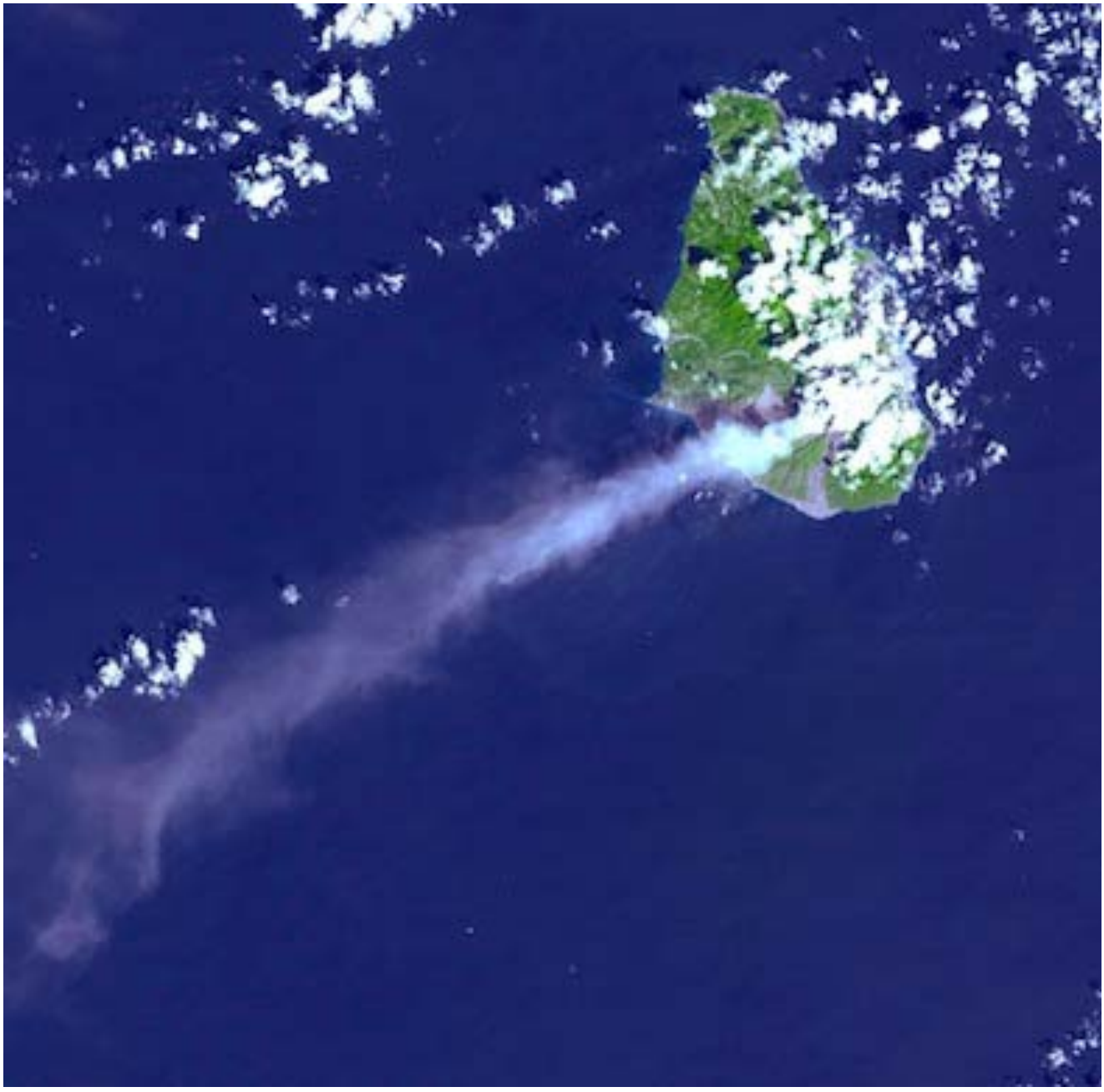


Figure 6. An October 29, 2002 ASTER image of Soufrire Hills Volcano on Montserrat in the Caribbean showing extensive smoke and ash plume streaming towards the west-southwest.

Satellite imagery will be searched for images capturing volcanic plumes, and corresponding GPS data will be matched with those events. The multipath signals will be examined for the

dates of those images for significant tropospheric delays at sites that appear to be located where the plume is. Rachel will overlay the map of the GPS sites and images of volcanic plumes, using GIS. The goal is to determine whether the volcanic plume is co-located with the GPS site at times when there is observable tropospheric delay in the multipath signal.

In late May, the RESESS intern, Rachel Medina, two science mentors, Glen Mattioli and John Braun, the COCONet co-PI Karl Feaux, and Director of RESESS, Valerie Sloan at UNAVCO, met and developed the research question to be studied, and created a plan for meeting up again throughout the summer. The student began work on the project in the last week of May.

Describe Outreach Activities your Project Has Undertaken

The COCONet Siting and Planning Workshop, Port-of-Spain

A second project-planning meeting was held in Port-of-Spain, Trinidad on June 28-29, 2011 to solicit input from regional scientists and geodetic network operators for COCONet. Fifty-one participants representing 39 institutions in 18 countries took part in discussions on the project's progress to date, finalizing the location of new and existing stations in support of COCONet science goals, and mutual capacity building for data collection, archiving, and processing, and strengthened international collaboration.

The goals of the Port-of-Spain meeting were (1) to modify and complete the initial station list based on UNAVCO's permitting and installation activities during the 5 months elapsed from the Puerto Rico workshop and the further input of Caribbean investigators, and (2) to develop a consensus plan for international collaboration activities. Most attendees had attended the Puerto Rico meeting and came prepared with considerably more information about the location and operational status of stations in their countries. Five sessions over two days were reserved to review station siting for each region of the Caribbean, and the result was a list and map of 50 new, 15 refurbished, and 61 existing stations that represent the consensus opinion of the workshop participants about the distribution of the COCONet network. Further, the discussions informed priorities for international community building, geodetic and network tools supported by technical training, and long-term aspirations to translate COCONet results into products that inform hazards mitigation and risk management.

Cuba Reconnaissance

A small group of scientists traveled to Cuba in November 2011 to interact with atmospheric scientists in the country who had previously expressed interest in participating in the COCONet project. The group included Dr. Richard Anthes, president of UCAR, Dr. Andrew Oliphant, a micro-climatologist at San Francisco State University, and Dr. John Braun. This group participated in discussions with the Society of Meteorology in Cuba (SOMETCUBA) in both Camaguey and Havana, as well as the Group of Atmospheric Optics in Camaguey (GOAC). The group also attended the VI Congresso Cubano de Meterologia in Havana. Dr. Anthes gave presentations in both Camaguey and Havana on improved hurricane forecasting using advanced numerical weather models and observational systems (such as COCONet). Dr. Braun gave presentations describing the COCOnet project and the use of continuously operating GNSS instrumentation to observe the hydrological cycle.

There is strong potential for synergy between Cuban research interests and COCONet objectives. The focal point for this synergy is the selection of Camaguey as a potential COCONet site. Camaguey is a region of high agricultural productivity and an area where Cuban scientists are currently conducting research on convective initiation, rainfall enhancement, and improved numerical weather prediction. The GOAC research team would be ideal collaborators for COCONet. They have demonstrated a high level of observational expertise in their collection of optical aerosol measurements using both a sun photometer and previous measurements from an atmospheric lidar they can provide a secure site location with robust power and internet connectivity and they have clear scientific interest in using PW estimates from the site. Dr. Juan Carlos Antuna, the lead researcher at GOAC, previously attended the COCONet siting meeting in Port of Spain, Trinidad. He is the lead contact regarding COCONet activities in Cuba.

A proposal was put forward by the Cubans regarding the training of one or two of their young research scientists on high resolution numerical weather prediction and a potential field experiment in Camaguey that would facilitate the installation of one (and possibly a second) cGNSS instrument in the country as part of COCONet. UCAR is now exploring the feasibility of this training and field experiment concept.

Cuba Update: At the request of the Cuban Foreign Affairs Office of the Ministry of Sciences, Dr. Juan Carlos Antuna presented a collaborative research plan that includes the use of a GPS station at their Camaguey station. Pending approval of this research plan, the proposal will be forwarded to the military office that is in responsible for review of all scientific proposals. Progress updates will be provided to NSF as they become available.

PASI Proposals

In an effort to augment the education and outreach goals of COCONet, two PASI proposals were submitted by COCONet community members: one focused on atmospheric applications and the other on the interactions between magmatic systems and tectonics in the Americas. UCAR/COSMIC has submitted a proposal to the NSF (solicitation NSF 12-535) to conduct a Pan American Advanced Studies Institute (PASI) on Atmospheric Processes of Latin America and the Caribbean: Observations, Analysis, and Impacts. This short course is intended to foster a community of early career scientists who are interested in regional atmospheric processes, and as a way of introducing these researchers to the COCONet project. This course will provide a comprehensive summary of the state of knowledge of the key processes that are important to the region including global tele-connections, regional monsoon systems, ocean-air interactions, hurricanes, and regional sources of moisture and its transport. The course will contain lectures, computing exercises, exposure to observational datasets and atmospheric model fields, and software training. The confirmed lecturers, identified in Table 1, represent a broad collection of international scientists. The proposed time window for the course will be sometime in May or June of 2013, in Cartagena, Colombia. We are expecting to accept up to thirty participants with PASI support, half of these will come from the United States and the other half will come from the other countries in the Americas and the Caribbean through a selection process that ensures a highly qualified and diverse pool.

Table 2: PASI Organizing Committee and Lecturers

Name	Affiliation	Expertise	Country
Organizing Committee			
John Braun	UCAR/COSMIC	GPS Remote Sensing	USA
Angel Garcia	CMC	Atmospheric Modeling of the Americas	Venezuela
Hector Mora Páez	Colombian Geodetic Survey	GPS Geodesy	Colombia
Olga L Mayol-Bracero	University of Puerto Rico–Rio Piedras	Aerosols and Saharan Air Layers	USA (Puerto Rico)
Lecturers			
Tom Yoksas	UCAR/Unidata	Unidata Software Tools	USA
Lidia Cucurell	NOAA/NCEP	Data Assimilation and Numerical Weather Prediction	USA
Shuyi Chen	U. Miami	Hurricanes, Air-Sea Interactions and Numerical Weather Models	USA
Lisa Goddard	Columbia University	Large Scale Climate Teleconnections	USA
Carolina Vera	University of Buenos Aires	American Monsoon Systems	Argentina
Ana María Durán-Quesada	U. Costa Rica	Mesoamerican Climate, Caribbean LLJ	Costa Rica

Penn State proposed a second Pan-American Advanced Studies Institute (PASI) to be held in Nicaragua. The goal is to address fundamental issues related to magma-tectonic interactions, in order to better understand volcano-magmatic plumbing systems and thus help mitigate associated hazards, risks, and vulnerabilities. The workshop will address four key scientific aspects, which will allow us to improve the science in significant ways: (**1**) Magma-tectonic interactions; (**2**) Deep vs. shallow magma plumbing systems; (**3**) Eruption trigger mechanisms; and (**4**) New approaches, methods, and technologies for volcano monitoring. Arc volcanism is an ongoing threat along the backbone of the Americas from the Alaskan Aleutians to near the southern tip of South America. The hazards highlight the significant risk to people living close by, to civil aviation in terms of volcanic ash, and also regionally in the case of particularly large eruptions. Three types of volcanoes pose distinct challenges for monitoring and eruption prediction. Subduction zones can generate large magnitude earthquakes that may trigger eruptions. Furthermore, there is extensive diversity in the kinematics and upper plate tectonics

amongst the subduction zones of the Americas that lead to increased seismic hazards in the over-riding plate and therefore the potential for magma-tectonic interactions. In order to examine these issues in a meaningful and novel manner, this PASI will comprise sessions on three distinct yet clearly related and overlapping themes: (**1**) geophysical processes, (**2**) geochemical processes, and (**3**) integrated studies of magma-tectonic interactions. By using these three approaches in an interdisciplinary fashion, we will be able to gain new and important insight into subsurface magma behavior before eruptions, inter-relationships and feedbacks between magmatic and tectonic processes, and the event or events, which initiate periods of volcano restlessness including eruptions. This PASI will bring together scientists from across the Americas for training in the latest scientific advances and technologies in volcano monitoring and modeling of magmatic and tectonic processes. It will give advanced graduate students and post-doctoral researchers from the US the opportunity to initiate collaborations with their Latin American counterparts, and will allow our Latin American colleagues to promote a professional network of scientists from across the region. This PASI will utilize data from the NSF MARGINS program and COCONet initiative and train scientists to utilize and apply these data and their results to investigating magmatic and tectonic systems across the Americas. This will result in improved understanding of magmatic and tectonic processes, as well as, hazard assessments for these tectonically active regions.

Preparation for the 3rd COCONet Community Workshop

Preparations began for the 3rd COCONet community workshop, tentatively scheduled for late September of 2012. A number of locations in the region are being evaluated based on cost, including Costa Rica, Panama, Mexico (Yucatan), and Nicaragua. Dr. Alberto Lopez from the University of Puerto Rico, Mayaguez will lead the workshop planning committee, which will consist of representatives from COCONet partner organizations, UNAVCO, and representatives from the atmospheric science community. The workshop will consist of plenary speakers and breakout sessions for special topics, but will focus on COCONet data, including archiving, distribution, processing, and data analysis.

PROJECT CONCERNS

• Relationship building between UNAVCO and host institutions in the Caribbean region continues to be an ongoing challenge for the project. Looking forward to the operations and maintenance phase, strong partners are critical to the long-term success of the project. In the past few months, there has been limited communication between UNAVCO and the University of the West Indies, Trinidad. This is a concern because joint COCONet-UWI station installations are tentatively scheduled for summer 2012. **Mitigation:** UNAVCO will invite our COCONet contacts from UWI-Trinidad to visit the UNAVCO Facility in Boulder in order to discuss details of the upcoming COCONet installations in St. Lucia, Dominica, Antigua, and Carriacou. Also, Dr. Joan Latchman, the newly appointed Director of the Seismic Research Center at UWI has been invited to be a member of the COCONet 3rd Workshop planning committee.

APPENDIX A – SUMMARY OF STATION STATUS

CNUM	Siting Location	Country	Status
CN00	Barbuda	Antigua and Barbuda	Permit Accepted
CN01	Antigua	Antigua and Barbuda	Reconnaissance Complete
CN02	Anguilla	British W.I.	Permit Accepted
CN03	Virgin Gorda	British V.I.	Permit Accepted
CN04	St Coix	U.S. V.I.	Permit Submitted
CN05	Punta Cana	Dominican Republic	Removed
CN06	Valle Nuevo	Dominican Republic	Permit Accepted
CN07	Puerto Plata	Dominican Republic	Built
CN08	Cabo Rojo	Dominican Republic	Built
CN09	Cap Haitien	Haiti	Permit Submitted
CN10	Morant Cay	Jamaica	Built
CN11	Pedro Cay	Jamaica	Built
CN12	UWI Mona	Jamaica	Built
CN13	San Salvador	The Bahamas	Permit Accepted
CN14	Great Inagua	The Bahamas	Permit Accepted
CN15	Grand Bahama	The Bahamas	Built
CN16	Camaguey	Cuba	No Action
CN17	Cayo de los Doce Leguas	Cuba	No Action
CN18	Swan Island	Honduras	Permit Submitted
CN19	Guanaja	Honduras	Removed
CN20	Cayman Brac	Caymans	Permit Submitted
CN21	San Lorenzo	Honduras	Permit Submitted
CN22	Poneloya	Nicaragua	Built
CN23	Belmopan	Belize	Permit Accepted
CN24	Riviera Maya	Mexico	Permit Accepted
CN25	Comitan	Mexico	Permit Accepted
CN26	Puerto Barrios	Guatemala	Permit Submitted
CN27	Cabo Frances Viejo	Dominican Republic	Permit Accepted
CN28	Islas de Perlas	Panama	Permit Accepted
CN29	Puerto Cabezas	Nicaragua	Built
CN30	Bluefields	Nicaragua	Built
CN31	Limon	Costa Rica	Reconnaissance Complete
ISCO	Cocos Island	Costa Rica	Built
CN33	Penenome	Panama	Built
CN34	Darrien	Panama	Permit Submitted

CN35	Providencia	Colombia	Permit Accepted
CN36	Monteria	Colombia	Permit Accepted
CN37	Galerazamba	Colombia	Permit Accepted
CN38	Puerto Bolivar	Colombia	Permit Accepted
CN39	Quebrada Arriba	Venezuela	Permit Submitted
CN40	Curacao	Curacao	Built
CN41	El Baul	Venezuela	Permit Submitted
CN42	Los Roques	Venezuela	Permit Submitted
CN43	Blanquilla	Venezuela	Permit Submitted
CN44	Margarita	Venezuela	Permit Submitted
CN45	Toco	Trinidad and Tabago	Permit Accepted
CN46	Carriacou	Grenada	Reconnaissance Complete
CN47	St Lucia	St Lucia	Reconnaissance Complete
CN48	Dominica	Dominica	Reconnaissance Complete
CN49	Redonda	Antigua and Barbuda	Built
CAYS	Serranilla	Colombia	No Action
MALO	Malpelo	Colombia	No Action
GRZA	Garza	Costa Rica	Refurbished
VERA	Veracruz	Costa Rica	Refurbished
BARA	Barahona	Dominican Republic	Permit Submitted
LVEG	La Vega	Dominican Republic	Permit Submitted
RDSD	Santo Domingo	Dominican Republic	Refurbished
SPED	San Pedro	Dominican Republic	Permit Submitted
SROD	Santiago Rodriguez	Dominican Republic	Permit Submitted
SSIA	San Salvador	El Salvador	Refurbished
ROA0	Roatan	Honduras	Permit Accepted
MANA	Managua	Nicaragua	Refurbished
FORT	Point Fortin	Trinidad and Tabago	Permit Accepted
GALE	Galeota	Trinidad and Tabago	Permit Accepted
Barinas	Barinas	Venezuela	No Action
Ciudad Guayana	Ciudad Guayana	Venezuela	No Action
Coro	Coro	Venezuela	No Action
Cumana	Cumana	Venezuela	No Action