HAWAIʻI SPACE GRANT CONSORTIUM NASA

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The Voyages

Using a Different Kind of Robot

By: Dr. John Pye, Associate Director at University of Maui College

UH Maui College Astronomy students at the Faulkes Telescope, summit of Haleakala.

Changing the Way We Use Telescopes

When you think of robots, a telescope is probably not the first thing that comes to mind. Students at UH Maui College are getting first-hand experience using robotic telescopes to monitor celestial objects, some of which are on NASA's radar. Monitoring celestial objects with a telescope is nothing new; it has been going on for hundreds of years. What has changed is the way in which we interact with these instruments. Looking through a telescope and seeing an object with your naked eye can still be an unforgettable experience, but it's not an ideal way to make precise observations or measurements to record data on a celestial object.

Telescopes In The Digital Age

CCD (charge-coupled device) cameras, integrated with other astronomical instruments that interface with computers, produce a telescope system capable of collecting large amounts of data with high precision. The digital data are processed, analyzed, and shared with other researchers. Initially these instruments required an operator at the telescope. The equipment's limitations and the observing site also placed restrictions on data collection at the observatory. The emergence of the internet led to another innovation; the ability for anyone anywhere to access powerful telescopes at remote observing sites. Facilities that permit users to control telescopes and instruments using web interfaces are referred to as remote telescopes. These facilities still require real-time operation from an observer on site. Hence, observations requiring repetitive calibration and science images continue to be difficult and time-consuming tasks on remote telescopes.

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The Faulkes Telescope North, located on Haleakala, Maui, is a two-meter telescope that can be operated remotely to collect data for a variety of research projects.

A robotic telescope, on the otherhand, is an integrated system with the ability to store data for later retrieval without human intervention. It typically includes an observatory enclosure, telescope, and instrumentation for making observations. Other important operations can also be carried out automatically such as opening and closing the observatory enclosure at the start and end of each night's observing, telescope pointing, tracking, and focusing, and basic image calibration and processing. Many of these systems also have integrated weather stations to monitor sky conditions so the enclosure can close automatically in the event of bad weather. This requires complex, integrated hardware systems controlled through a series of sophisticated software programs operating together.

When using one of these telescopes to collect data for a research project, an observing request must be made to the system's master planning program. Requests from other observers may also be queued into the system for a night's observation. The program is set to carry out all the observing requests with maximum efficiency. Robotic telescopes can automatically perform large numbers of precise observations over long periods of time. This makes them ideal for projects involving the monitoring of periodic phenomena such as variable stars, exoplanet transits, and carrying out sky surveys for objects such as supernova or hazardous asteroids.

UH Maui College Space Grant Students Monitor the Heavens

Over the past two years UH Maui College (UHMC) Space Grant students have participated in projects utilizing both remote and robotic telescopes. Lauren Elder was part of an international collaborative effort to monitor the eclipsing variable binary star system EE Cephei with a period of about 5.6 years. She collected data using the Sonoita Research Observatory's robotic telescope, which took a series of images through different photometric filters on an almost nightly basis over a period of 4 months. Lauren then downloaded and performed a photometric analysis of the data, producing a light curve for the eclipse event in hopes of answering some fundamental questions about this system. Working with her mentor and a collaborator at the Hopkins Phoenix Observatory, Lauren was co-author on a paper published in the proceedings of two conferences. She also gave a talk on her project at the bi-annual HSGC Space Grant Fellowship and Traineeship Symposium. Upon graduation, Lauren decided to pursue a degree in either Physics or Astronomy at a mainland college and she attributes her interest in these areas to the experience she had working on her Space Grant project.

The robotic Sonoita Research Observatory located in Sonoita, Arizona (photo from AAVSO website).

UHMC student, Kevin Roy, analyzed data of asteroid 216 Kleopatra from a robotic telescope in the Sierra Stars Observatory Network. He produced a light curve showing the rotational period of the asteroid. Kevin also used remote telescopes in the Tzec Maun network located in New Mexico and Australia and the Faulkes Telescope on Haleakala, Maui to study asteroids and comets. His main work recently has been to monitor and track Near-Earth Objects and potentially hazardous asteroids. By imaging the same region of sky over a relatively short period of time on a given night, he uses the technique of blinking a series of images to look for moving objects. If he discovers one, he determines its coordinates then submits results to the Minor Planet Center for inclusion in their database. This helps to update the orbits and continue the monitoring process, which is of great interest to NASA and an important project for our Space Grant students to be involved with. Even though Kevin uses remote telescopes to perform his observations, many potential targets are detected by automated robotic sky surveys such as Pan-STARRS, the Lincoln Near-Earth Asteroid Research (LINEAR) Project, and others. Kevin's interest in Astronomy has peaked as a result of his Space Grant project and he is interested in transferring to UH Hilo to major in Astronomy after completing his coursework at UHMC.

In the future we hope to bring more students into the Space Grant Program and get them excited about science and STEM education by providing hands-on research projects utilizing the instruments we have access to. One of our goals is to provide projects that allow students to design and test hardware and software systems for telescopes we hope to automate. This will bring new and interesting opportunities to our students to work with cutting-edge technology and prepare for careers in science and engineering that have direct ties to NASA goals and objectives. Θ

Higher Education

"The View from the Pipeline"

By: Michelle Bradley, Teacher, Island Pacific Academy

While attending the University of Hawai'i at Mānoa, I was fortunate to become involved with the NASA Space Grant Consortium. In 2006, I was in my senior year as an education major in science and one of my instructors, Dr. Barbara Bruno, told me about the great opportunity. Born and raised in Hawai'i, I have always enjoyed the culture of our unique Pacific island community. With Dr. Bruno's help, I applied and received a full year of NASA Space Grant funding for my research into bridging Pacific Island cultures with science for primary school students. My research included traveling to public schools on O'ahu and Moloka'i to pilot my lessons and get feedback on my lessons from actual teachers.

What I developed during my fellowship was an eight-lesson unit called "Bringing Mars Science to Hawai'i's Students: Making Science Culturally Relevant to Pacific Islander and Hawaiian Students." Each lesson covers a different aspect of space science and is linked culturally to Polynesia and Hawai'i. The eighth lesson in the unit is a board game which is a fun, informal assessment tool for the students to play. The complete unit can be found at http://sites.google.com/site/mikalabradley/.

Through my experience and contacts with Hawai'i Space Grant Consortium (HSGC) I have been able to launch my teaching career. Following graduation from UH in the spring of 2007, I began working for Island Pacific Academy (IPA). IPA is a college preparatory pre-K thru 12th grade private school located in Kapolei (http://www.ipahawaii.org/). I was hired as a full-time teacher for the next academic year where I have been a teacher ever since.

During the 2009-2010 academic year, IPA asked me to pilot an integrated math and science class called Astronaut Academy. The class was structured with two teachers (a math and a science teacher) who are involved in both aspects of the class. Jen Higa was the math counterpart to this amazing class. Ms. Higa and I integrated the two subjects by aligning math content with lab experiments so the students were using skills learned in math on the data they collected in science. The year-long 7th grade class used the lens of Astronomy to look at the sciences that we covered. This opportunity would not have presented itself without the experience and knowledge that I gained through the NASA Space Grant Fellowship.

IPA Robotics high school student, Robyn Cabuslay, demonstrates the VEX robot to an IPA elementary school student at the school's 2011 Scholastic book fair.

Another way I have benefited from my work with HSGC is through my contacts gained from my fellowship. Mr. Art Kimura, considered to be an important founder of robotics programs in Hawai'i, was an important contact I gained from my fellowship. IPA was looking for a way to expand the STEM classes they offered, so they asked me to start a robotics program for the school. With the help of Mr. Kimura, I started the IPA Robotics program (grades 6-8) in 2010. The program meets during regular class time during the school day and is an International Baccalaureate Middle Years Program Technology class. During the 2011-2012 academic year, the IPA Robotics Team expanded to include grades 6-12 and we have entered three big tournaments: VEX, Botball, and FIRST. This could not have happened without the experiences and contacts I gained through the NASA Space Grant Fellowship. I owe a great deal to the Hawai'i Space Grant Consortium and the people who run the program. Θ

IPA Astronaut Academy (7th grade) integrated math and science class. Students use a slinky to model wave formation, while collecting data on frequency, amplitude, and wavelength.

Rocket Testing Over the Bay

By: Windward Community College Students

Rocket over Kaneohe Bay.

Rocket in Kaneohe Bay.

It was a windy and desperate day for us. One of the strictest requirements of the University Student Launch Initiative (USLI) is that there must be a Full Scale Low Power (FSLP) test of the rocket before the Flight Readiness Review (FRR), and the eventual competition flight at Huntsville. The previous week had seen a near failure in our USLI attempts, the drogue chute had deployed but the main chute only partially deployed. The rocket had landed hard and sustained some damage. As it stood, we were going to fail the FRR without a better result.

In the following week, we rebuilt the booster section, redesigned the deployment pyrotechnic charge, obtained permission from the Marine Corps Air Station for another launch attempt, and more importantly, another motor was sent to us from the mainland.

The launch-day weather conditions were not so good, cloudy with wind gusts up to 16 miles per hour, but with the FRR deadline 48 hours away, we had no choice but to launch. The launch was great, a slight weathercocking into the wind (which was expected), the drogue deployed at apogee, and a short time later the 12 -foot green and black main chute deployed! What a relief – that is until the high winds blew the rocket over Kaneohe Bay. The rocket came down about a quarter mile off shore and we needed the Navy Rescue team to help retrieve it!

If you are interested in the off-shore adventure, you can visit the USLI website (www.windward.hawaii.edu/usli2012).

Students learn GPS techniques, map reading, field navigation, and image interpretation.

GG 460

By: Dr. Scott Rowland, GG Specialist

We had 22 students in GG460 in spring 2011. This proved challenging in our 20-seat computer lab. Enrollment was high probably because 2010 was the first time we hadn't taught the class. As usual the class was a mix of undergraduate and graduate students, and in 2011 included 6 exchange students from Norway. Other students hailed from Hungary, Romania, the mainland, and Hawai'i. Our traditional field trip to ground-truth took place in late April where all U.S. citizens received travel support from HSGC to complete their field site requirement for the course. Between the time we planned the trip and when it took place, Kīlauea stopped producing accessible lava flows, so we were unable to spend our planned day studying active thermal properties. Never the less, we filled the weekend with geology.

Photos from the trip are on-line at: http://www.soest.hawaii.edu/GG/FACULTY/ROWLAND/GG460/2011/2011a.htm.

The entire class and Rob Wright about to "ground truth" their final-project maps.

On what would normally have been our day to study active lava and its thermal properties, we instead studied coastal erosion.

NASA Education: One Stop Shopping Initiative (OSSI)

for NASA Internship, Fellowship, and Scholarship Opportunities

An innovative, mission-enabling, NASA-wide approach to:

* Support strategic NASA and U.S. workforce needs in STEM and allied disciplines;
* Build awareness and provide access through a single portal to internship, fellowship and scholarship opportunities offered by NASA to all eligible students;
* Enable NASA to continually reengage students throughout their academic careers; and
* Bring together strategic partners (NASA Education, Human Capital, Diversity and Equal Opportunity Offices, and Mission Directorates, with competitively selected Business Management and Broker-Facilitators) to reach, engage, and support eligible students and afford them access to learning opportunities that may lead to job opportunities in either NASA or the nation's STEM workforce or allied professions.

How students can "shop" the universe of NASA opportunities:

1. View/search NASA opportunities at http://intern.nasa.gov.
2. Access NASA's new Student On-Line Application for Recruiting Interns, Fellows, and Scholars (SOLAR) to:
   - -Register
   - -Create an Interest Profile
   - -Complete an application (and attach supporting documents)
   - -Search opportunities
   - -Select and apply for up to 15 opportunities per session. Application dates for all sessions are posted on http://intern.nasa.gov
3. Student applications will be viewed for potential selection by mentors and education professionals across NASA.

Summer Internship Opportunities - 2011

Space grant funds allowed students to intern at NASA Centers/Academies and at local industries. Here are some highlights.

Carissa Nakao, NASA AMES Robotics Academy, California

Bio-Engineering at UH Mānoa

"The overall goal of this project was to create a lunar rover that was cheap and efficient instead of having to spend millions of dollars on a lunar project. I was placed in the thermal group, where we were trying to calculate the amount of heat that the rover was going to feel, at any position on the moon."

Adria (left) and Carissa (right) with prototype.

Adria Fung, NASA AMES Robotics Academy, California

-Robotics Engineering at Worcester Polytechnic Institute

"My project was to develop a camera payload that attaches to the Lunar Micro Rover. The camera recorded pictures and compressed them enough to be able to transfer the file back to Earth in as short a time as possible."

Amber (left) and Kevin (right) at the Fall 2011 HSGC Symposium.

Amber Imai, NovaSol, Hawai'i

-Electrical Engineering at UH Mānoa

"Since Nova-Sol is a small business, it was fun getting to know all of the different engineers, technicians, and staff members with varying levels of involvement on the project at hand and to see the other research projects being conducted simultaneously."

Kevin Shin, NovaSol, Hawai'i

-Mechanical Engineering at UH Mānoa

"Working at Novasol last summer was a very rewarding experience. It was my first internship and insight into the professional world. Another intern and I built a machine that would simulate the movement of a boat and programmed the software for it. Our mentors used the boat simulator to test the optical communication system they were developing."

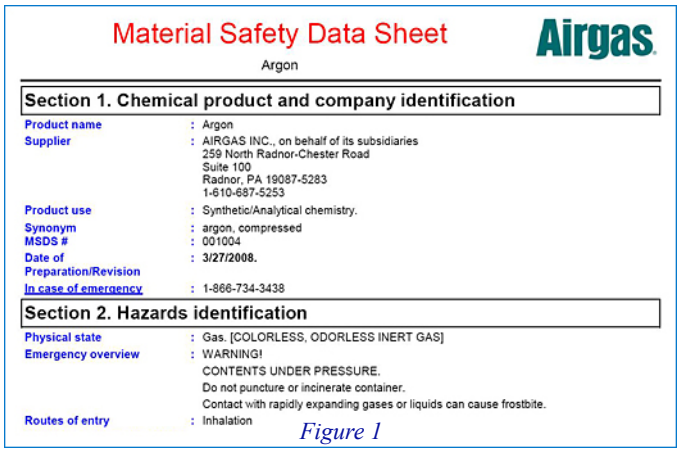
Hazard Communication Standards and Quality Control

By: Lyle Nemeth, Summer Intern at Trex Enterprises, Kauaʻi,

Trex Enterprises, in the Lihue Industrial Park on Kauaʻi, is the prestigious location where I completed my six-week summer educational experience. Trex Enterprises plays a leading role in the development of silicone carbide. Being able to complete my internship at Trex Enterprises was priceless because I will be attending the California Polytechnic State University at San Luis Obispo to earn a degree in civil engineering with a focus on environmental engineering. My main topic as a summer intern was hazard communication, which included safety and quality control.

One of my tasks was to complete a wall-to-wall chemical material inventory under OSHA's Hazard Communication Standard 1(910.1200 App E). Carrying out a chemical inventory is a very tedious and important task. I learned about new chemicals and was able to remember where they were located. After I had completed the inventory, my focus was on organizing and updating Trex Enterprises' MSDS inventory. The MSDS is a valuable document that a company must maintain. It provides vital information on chemicals and other controlled substances used by employees to perform their work. This information is required to properly manage an emergency situation. One example is the front sheet of the compressed gas Argon, created by Airgas, which is shown in Figure 1. I now understand the proper procedure behind obtaining a new material, and the importance of keeping the MSDS readily available. This will, without a doubt, help me in my career.

Another task that I was given was to take note of missing verification signatures or notes that had been recorded on the Standard Operating Procedure (SOP) for the Reactor Runs. I understood how an SOP worked but I asked myself, "Why would I need an SOP if I did the same job everyday?" The answer to this question came a day later when two employees and I calibrated pH sensors. I wondered how we were going to complete the task, when one of the employees came back with an SOP for recalibrating/changing the pH sensors. After the procedure was complete, I realized how valuable an SOP was for every procedure on site.



Material Safety Data Sheet

Airgas

Argon

Section 1. Chemical product and company identification

Product name	:	Argon
Supplier	:	AIRGAS INC., on behalf of its subsidiaries 259 North Radnor-Chester Road Suite 100 Radnor, PA 19087-5283 1-610-687-5253
Product use	:	Synthetic/Analytical chemistry.
Synonym	:	argon, compressed
MSDS #	:	001004
Date of Preparation/Revision	:	3/27/2008.
In case of emergency	:	1-866-734-3438

Section 2. Hazards identification

Physical state	:	Gas. [COLORLESS, ODORLESS INERT GAS]
Emergency overview	:	WARNING! CONTENTS UNDER PRESSURE. Do not puncture or incinerate container. Contact with rapidly expanding gases or liquids can cause frostbite.
Routes of entry	:	Inhalation

Figure 1

My third task was to build a solar evaporator to reduce the quantity of wastewater from one of Trex Enterprise's waste streams. I researched important aspects of an effective solar evaporator and logged the information on paper. To test my discoveries, I made a solar evaporator out of the lid of a 55-gallon drum. I spray painted it black so that it would absorb as much heat as possible and I added a plexi-glass cover above the lid so that no rain could enter, but wind could blow through and take away any evaporated water. I added one gallon of tap water to test if my specifications worked and within two-three days, all of the water had evaporated, leaving nothing behind. This was a fun task that I had at Trex and I definitely learned a lot about solar evaporators. Now, Trex has enough information to build an effective one in the future.

The other tasks I completed all dealt with the material that Trex Enterprises is famous for making, silicon carbide. I used a Coordinate Measuring Machine or CMM to measure blank pieces of silicon carbide to be logged into Trex's database for future reference. I did the final inspection of silicon carbide parts before they were shipped off. I had to measure and inspect all parts to make sure that they met customer-generated specification standards. After measuring and inspecting them, I labeled them and then packed them very carefully. This is the final step of the very long process to make silicon carbide parts. I felt helpful by participating in this critical quality control process.

This six-week internship was one of the most valuable learning experiences that I have ever had the honor to participate in. Before these six weeks, I did not know that engineers were in charge of important documents such as the SOPs and MSDSs. After completing all my assignments, I realize how crucial it is to have all these documents readily available. I learned at Trex Enterprises that safety for the workers, the community, and the environment is the number one concern. If it were necessary, they would shut down the entire plant to ensure everyone's safety. This is how a company should be run; this experience taught me that hazard communication is the main word; it sums up everything that I learned at Trex Enterprises, and it will be how I seek to run a business in the future. Θ

Undergraduate Fellows, Trainees, & Interns

Fellowships ***are awarded to U.S. citizens who are full-time students at the University of Hawai'i campuses at Mānoa and Hilo. Awards are given for space-related research with a mentor and provide a stipend of $3000/semester to the student. Fellows are also eligible for travel and supply funds. In previous semesters, these funds have been used for activities including observing runs at Mauna Kea telescopes, fieldwork to collect ground-truth information for interpreting satellite data of the Hawaiian Islands and other locations, and travel to meetings to present project results.***

Mānoa Fellows - Spring 2011

Jennifer Beyer, a junior in Geology and Geophysics used data from two observatories in the Wide Angle Search for Planets (WASP) research program to help find exoplanets. These planets orbit stars beyond our Solar System and are of astrobiological interest as possible habitable environments. She analyzed light curves to identify possible transiting planet systems. Jennifer's work, titled "Finding Companions of M Dwarf Stars Using Data from WASP," was conducted under mentor Dr. Eric Gaidos of the Department of Geology and Geophysics.

James Bishop, a junior in Geology and Geophysics, worked with mentor Dr. Jeffrey Gillis-Davis of the Hawai'i Institute of Geophysics and Planetology on lunar geology and remote sensing. With his project titled "Exploring Correlations Between Radar, Spectral, and Neutron Spectrometer Data to Determine TiO_2 Content of the Lunar Maria" James compared data sets from multiple missions to try to identify trends in lunar surface titanium concentrations.

Samantha Jacob, a junior in Geology and Geophysics, used lunar images and multispectral data to map and date overlapping lava flows on the surface of the Moon in her project titled, "Solar Wind Volatile Preservation." She worked with mentor Dr. Sarah Fagents of the Hawai'i Institute of Geophysics and Planetology. Samantha compared her mapped units to numerical models of heat transfer into buried regolith deposits to help find ancient regolith with preserved solar wind particles.

John Furumo, a senior in Mechanical Engineering, with mentor Dr. Weilin Qu of the Dept. of Mechanical Engineering, worked on experiments to improve space-craft thermal control. In his study titled, "Two-phase Micro-Channel Heat Sink Cooling Loop for Spacecraft Thermal Control" John concentrated on system assembly and determining the effects of gravity on thermal performance of the cooling loop.

Kimberly Rottas, a senior in Geology and Geophysics, worked with mentor Dr. Norbert Schorghofer of the Institute of Astronomy on a project titled, "Fading of Martian Slope Streaks." This work extends previous Fellows' projects dealing with the rates of fading and physical characteristics of these surficial mass movements by using new images from NASA's Mars Reconnaissance Orbiter.

Amanda Yamamoto, a sophomore in Mechanical Engineering, worked on a robotics project titled, "Underwater Sampling System for High Temperature Extremophiles" with mentor Dr. Brian Bingham of the Department of Mechanical Engineering. Amanda designed, built, and tested a prototype, autonomous sampling device that can be appended to a small ROV to collect seawater samples in hot shallow waters near volcanic activity. This work complimented the broad goals of NASA's Astrobiology program.

Hilo Fellows - Spring 2011

Ryan Bishop, a junior in Geology, worked on a project titled, "Mineralogical Study of Volcanic Sublimates from Halema'uma'u Crater, Kilauea Volcano" using spectro-meters and microscopes for element and mineral analyses. This work was relevant to research on the possible formation mechanisms of sulfates and associated alteration deposits on Mars. Serving as mentor was Dr. Kenneth Hon of the Department of Geology.

Toby Horner, a sophomore in Math and Computer Sci., worked to improve the performance of image processing algorithms for remote sensing data. Toby's project, "Evolving Matched Filter Transform Pairs for Satellite Image Compression," was directed by mentor Dr. Michael Peterson of the Department of Computer Science and Engineering. (Picture not available).

Briana Hurley, a junior in Astronomy and Physics, worked with mentor Dr. Jesse Goldman of the Dept. of Astronomy and Physics on statistical data analysis applied to large-scale phenomena of the universe. With her project, " Statistically Determining the Likelihood of Finding Cosmic Strings" Briana used computer models to determine the probability of finding cosmic strings, predicted by high energy physics theories.

Jamie Scharf, a senior in Geology, Astronomy, and Physics, worked on "The Calibration of the CCD for Hoku Keʻa." Obtaining observations under varied sky conditions, Jamie characterized the spectral and throughput performance of the new science camera on the telescope, and created an exposure time calculator for the facility. Dr. William Heacox of the Dept. of Physics and Astronomy served as mentor.

UH Maui College Fellow - Spring 2011

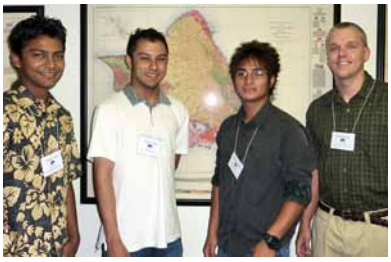
Kevin Roy, a sophomore in Liberal Arts, worked on "Searching For and Tracking Near-Earth Objects and Potentially Hazardous Asteroids." He used remotely-operated telescopes and performed image analysis to collect and submit astrometric data as part of a global effort to catalog these objects. Dr. John Pye of the STEM Unit served as mentor.

Traineeships ***are awarded to U.S. citizens who are full-time students at University of Hawaiʻi Mānoa and Hilo campuses, Community Colleges, and the University of Guam. Awards provide lab training and practical experience with a mentor in any space-related field of science, technology, engineering or math. Trainees receive a stipend of up to $1000/semester and may be eligible for supply funds.***

Kapiʻolani Community College Trainees - Spring 2011

Eric Jordan (left) and Jeffrey Griffith (right) are both Electrical Engineering majors enrolled at KCC and UHM. They worked on an Autonomous Mapping Platform, which was a remote-controlled robot designed to generate three-dimensional virtual maps of an area. Serving as mentor was Dr. Herve Collin from the Math and Science Department.

KCC CanSat Program



The KCC CanSat team consisted of (pictured from left to right) Shohan Islam, who is majoring in Mechanical Engineering and a co-team lead; Stanley Weber, majoring in Physics; Ghian Paolo Pajarillo, an Electrical Engineering major; and Mitchell Hines, who is the other co-team lead and majoring in both ICS and Electrical Engineering. The annual CanSat competition took place in Cross Plains, Texas, where KCC's CanSat Team competed against 20 international teams. Their mentor was Dr. Herve Collin, Math and Science Department.

Kauaʻi CC Trainees - Spring 2011

Kira-Ashley Taylan,Tisha Kurokawa, Robert Garvida and Cyril Botelho (pictured from left to right) worked on "HSFL Activity Related--Kauaʻi." They worked with mentor, Dr. Francis Takahashi, who assisted in the development of a CanSat and the design of a rocket to launch the CanSat from Kauaʻi and land it safely. The CanSat project helps to support the understanding of Earth, and inspires students to pursue a career in science and technology.

Windward CC Trainees - Spring 2011

WCC USLI Program

The University Student Launch Initiative (USLI), a NASA- hosted contest, tasks students to design, build, and launch a rocket and scientific payload to an altitude of exactly one mile. The Hawaiʻi WCC team: Patrick Lancaster, Jasmine Maru, Kristi Ross, and Todd Esposito (pictured from left to right) flew payloads with the help from mentors Dr. Jacob Hudson at Windward Community College and Mr. Helen Rapozo from Honolulu Community College.

Their web site is: www.windward.hawaii.edu/usli.

Application Deadlines

Application deadlines for undergraduate fellowships and traineeships are December 1 for Spring semester and June 15 for Fall semester. Download fillable application forms and get additional information from the HSGC website at www.spacegrant.hawaii.edu/fellowships.html.

Internships at Local Industries & Companies

are awarded to U.S. citizens who are full-time students at either a Hawai'i University or Community College or on the mainland. The main objective of the program is to promote use of NASA technology and educational science goals. In pursuit of the creation of a high-tech workforce, the HSGC Internship Program encourages all intern opportunities relating to the more general STEM disciplines.

UH Mānoa Intern - Spring 2011

Chester Lim was a graduate student in Electrical Engineering and was funded as an intern at the Jet Propulsion Laboratory for three summers. Last summer, he worked on a project titled, "Development of On-Board Aurora Image Processing Algorithms on the ISAAC Platform." It involved a 15-day mission in Antarctica, using high-altitude balloons and near-infrared cameras to observe auroras. His goal was to develop real-time, on-board processing algorithms that reduced the storage capacity for use on balloon observations.

Windward Community College Interns - Spring 2011

Nathaniel Hiraoka and Samuel Plunkett Jr. worked on their project titled, "Astronomical Research and Outreach at WCC's Lanihuli Observatory." This internship was funded under the New Horizons Innovation AOULI grant. It provided opportunities for students to train in telescope alignment and conduct research and public outreach in partnership with Williams College on an occultation of Varuna, one of the largest Kuiper Belt Objects (KBOs).

Landsat image of the island of Hawai'i.

Kaua'i Community College Interns - Summer 2011

There were six interns funded at four companies on Kaua'i. Dylan Cockerham trained at Oceanit as a Student Lab Technician. Kolby Javinar, Jacob Matutino, and Joshua Ponting interned at the Pacific Missile Range Facility as Communication Engineers. Lyle Nemeth interned as an Engineer at Trex Enterprises. Crystal Whitehill trained at General Dynamics also as an Engineer Intern.

NASA Interns - Summer 2011

Robert Albarran, NASA Goddard Space Flight Center
Michael Andonian, Jet Propulsion Laboratory
Adria Fung, NASA Ames Robotics Academy
John Furumo, NASA Marshall Space Flight Center
Arlen Kam, NASA Ames Academy
Carissa Nakao, NASA Ames Robotics Academy

NovaSol Interns - Summer 2011

HSGC funded three students at Innovative Technical Solutions (NovaSol) in Honolulu. James Bishop, a senior in Geology and Geophysics, interned as a Spectral Imagery Analyst. Amber Imai, a senior in Electrical Engineering, interned as an Optical Communications Lab Technician. Kevin Shin, a junior in Mechanical Engineering, interned as an Optical Communications Engineer.

Mānoa Fellows - Fall 2011

Justin Bergonio, a junior in Geology and Geophysics, used NASA orbital images of different resolutions spanning more than 30 years to study the surface of Mars; in particular, the rates of formation and fading of slope streaks. Justin's project titled, "The Lifetime and Abundance of Slope Streaks on Mars," follows a long line of fellowship projects on slope streaks with mentor Dr. Norbert Schorghofer of the Institute for Astronomy.

Emily Chang, a senior in Global Environmental Science, worked under the direction of mentor Dr. Eric Gaidos of the Department of Geology and Geophysics on the study of extra-solar planets. Emily worked with data from the Wide Angle Search for Planets (WASP) program, the Faulkes telescope on Haleakala, and NASA's Kepler mission on her project titled, "Prediction of SuperWASP Stars with Detectable Transits using Kepler Data."

Brian James, a junior in Geology and Geophysics, worked on developing new imagery sets from NASA data and inter-active educational presentations for display on digital video globes. Dr. Sarah Sherman of the Hawai'i Institute of Geophysics and Planetology served as mentor on Brian's project titled, "Bringing Mercury and the Moon to You Live and in 3-D: An Innovative and Engaging Multimedia Spherical Projection Using Data from Current NASA Missions."

Reina Ojiri, a junior in Mathematics, worked with mentor Dr. Monique Chyba of the Department of Mathematics on a project titled "Designing Space Craft Missions to NEOs." Reina's work emphasized spatial-mechanics algorithms to create computer simulations of the optimal trajectories of Near-Earth Objects for encounter by spacecraft.

Hilo Fellow - Fall 2011

Liliana DeSmither, a junior in Geology, worked on an Earth analog study for silica-rich deposits and soils found on Mars by the Mars Exploration Rover, Spirit. Mentor Dr. Ken Hon of the Geology Department, helped Liliana study the occurrence, mineralogy, and modes of formation of selected samples collected on the island of Hawai'i in her project titled, "Mineralogical Study of Volcanic Sublimates from Halema'uma'u Crater, Kilauea Volcano."

Mānoa Trainee - Fall 2011

Elyse Iseke, a sophomore in Food Science and Human Nutrition, used Lunar Orbiter Laser Altimeter data from NASA's Lunar Reconnaissance Orbiter mission to study one of the most important planetary surface features: impact craters. With mentor Dr. Jeffrey Gillis-Davis of the Hawai'i Institute of Geophysics and Planetology, Elyse measured crater dimensions to distinguish fresh craters from degraded craters and the floor-fractured craters that were modified by igneous activity.

Mānoa Intern- Fall 2011

Kale Nakata, a senior in Electrical Engineering interned at Innovative Technical Solutions (NovaSol) as a Software Engineer.

Kaua`i Community College Trainee - Fall 2011

Heather Prinzing, a sophomore in Electronics Technology worked on a project titled, "The Ground Station" with mentor Dr. Francis Takahashi.

Windward Community College Trainees - Fall 2011

Sean Alyward, Jasmine Maru, Kristi Ross, Lyra Hancock, Rose Wailehua, and Todd Esposito (left to right) participated in the ARLISS competition under the guidance of mentors Dr. Joe Ciotti and Dr. Jake Hudson from WCC, and Mr. Helen Rapozo from HCC.

Fellow & Trainee Symposium Candids

Undergraduate Research Fellowship & Traineeship Symposiums

Spring 2011

Front Row (L to R): Kimberly Rottas, Tisha Kurokawa, Briana Hurley, Kira-Ashley Taylan, Kristi Ross, Jamie Scharf, Jasmine Maru, Amanda Yamamoto, Samantha Jacob, and Jennifer Beyer. Second Row (L to R): Mitchell Heins, Ghian Paolo Pajarillo, Shohan Islam, Stanley Weber, Robert Garvida, Todd Esposito, Zachary Lee-Ho, Chester Lim, Eric Jordan, and Kevin Roy. Third Row (L to R): Cyril Botelho, Ryan Bishop, Patrick Lancaster, John Furumo, Samuel Plunkett Jr., Nathaniel Hiraoka, James Bishop, Jeffery Griffith

Fall 2011

Front Row (L to R): Justin Bergonio, Kolby Javinar, Crystal Whitehill, Carissa Nakao, Emily Chang, Reina Ojiri, Jasmine Maru, Kristi Ross, Lyra Hancock, Todd Esposito, and Zachary Lee-Ho. Second Row (L to R): Nathaniel Hiraoka, Joshua Ponting, Kale Nakata, Jacob Matutino, Michael Andonian, Elyse Iseke, Kevin Shin, Sean Alyward, Lilliana DeSmither, Brian James and Rose Wailehua

K-12 Education

A variety of K-12 education projects bring hands-on experiments, gadgets, and the excitement of space exploration to thousands of participants.

By: Arthur Kimura, HSGC Education Specialist

Future Flight Hawai‘i

http://www.higp.hawaii.edu/futureflight/

Future Flight Hawai‘i will be hosting a Family Exploration Program for students in grades 2-5 and their parents, from June 9-10, 2012, at the University of Hawai‘i at Mānoa, with a theme of Apollo: The Next Generation, Return to the Moon. Over the past 21 years, over 9,000 students and parents have participated in one or more of the Future Flight Hawai‘i residential and non- residential programs in exploring the Moon, Mars, and Earth. Learning modules this summer will include Earth-Moon ABCs, spinning satellites, resource analysis, center of gravity, robotics, math magic, illusion science, and science as a process for the young space explorers and their families. The program has been fully enrolled since mid-November 2011. Θ

Astronaut Ellison Onizuka Day of Discovery

http://www.spacegrant.hawaii.edu/OnizukaDay

The 12th annual Astronaut Ellison Onizuka Science Day held on January 28, 2012 at the University of Hawai'i-Hilo, featured 21 workshops, 19 displays, keynote speaker, Astronaut Michael Fincke, and the closing space science show by Future Flight Hawai'i's Dale Olive. Sponsored by the Onizuka family, the Astronaut Onizuka Space Center, the University of Hawai'i-Hilo, American Savings Bank, and the Hawai'i Space Grant Consortium, 600 participants and 200 volunteers joined together in honoring the legacy of Ellison Onizuka and the Challenger crew.

Workshops to inspire the next generation of explorers included hydraulic robotic arms, pocket rockets, the science of polymers, Mauna Kea Astronomy, computer 3D animation, flight simulator, wind turbines, Hawaiian seaweed, volcanoes, steam-powered boats, solar system simulation, forensic science, solar boat, water quality testing, adaptive optics, energy meter lab, Letry robotics, science of skulls, and wayfinding. Θ

(Left to Right): Art and Rene Kimura with Astronaut Mike Fincke, keynote speaker, 2012.

Astronaut Lacy Veach Day of Discovery

http://www.spacegrant.hawaii.edu/OnizukaDay

The 10th annual Astronaut Lacy Veach Day of Discovery, held on October 29, 2011 at Punahou School, featured an opening taiko performance and two Star Wars Storm Troopers. Keynote speaker Nainoa Thompson, master navigator of the Hokulea, Polynesian Voyaging Society, spoke of his friendship with Lacy Veach, including their first meeting, their study trips to Mauna Kea, the historic radio linkup between the Hokulea and the Space Shuttle Columbia, and their common dreams of sustainable stewardship of Hawai'i and planet Earth. Hawai'i Space Grant Consortium arranged a recorded video message from Space Station commander Astronaut Mike Fossum who (while floating in the ISS Cupola that is dedicated to Lacy) welcomed the participants and introduced Diana Barcena, Lacy's sister. The event was sponsored by the Hawaiian Electric Company, Punahou School, the family of Lacy Veach including the Chatlos Foundation, and the Hawai'i Space Grant Consortium. Two hundred volunteers supported the registration, workshops, and displays for the 600 registered students, parents, and teachers. Workshops included bottle rockets, straw rockets, electricity, bristlebots, hydraulic arms, ocean acidification, rocket racers, the science of FUN, spectroscopy, wireless communication, Lego robotics, Scratch programming, tracking the sun, food preservation, electronic blinky bugs, Letry robotics, wind turbines, mining simulation, and GPS mystery. The concluding afternoon assembly included Stevenson Middle School teachers who shared their Zero G flight experience, Art and Rene Kimura sharing how to eat, sleep, and use the bathroom in space, and the ever popular Science-is-Fun program by Future Flight Hawai'i's Dale Olive and Roger Kwok. The State Senate presented a Certificate of Recognition to Punahou School, the Hawaiian Electric Company, and the Hawai'i Space Grant Consortium. Θ

The perfect launch of a water bottle rocket.

Roger Kwok and Dale Olive demonstrate the effects of air pressure.

Marcia Rei Sistoso, HSGC Program Coordinator, is delighted with her working electronic blinky bug.

Here is a sampling of the feedback we received from Lacy Veach Day participants.

"Just wanted to thank you for another great day. Lacy Veach Day always inspires new projects at our house -- match rockets, dissecting an old CD player for speakers and drilling holes in paint stirrers this time! We appreciate all the work you all put into it! Also I'd like to say how much we enjoyed Nainoa Thompson's keynote address. He makes an extraordinary individual, Lacy-- astronaut, Thunderbird Pilot, Purple Heart Recipient -- seem like the local kid next door who made good and helps inspire kids to think they can do great things too." ~ Jan L Reichelderfer, a girl scout leader who has brought a group of girls for the past 3 or 4 years

"Hi - we just got home from Day of Discovery and were excited, inspired and had a really good time. I just wanted to give everyone big congratulations and a thank you for a job well done. As we walked out my 10 year old son said, 'There was only one problem with it. There's nothing they can do to improve it for next year, it was so great.'" ~ Tara Bennett, a mother who brought her 2 children

"I would like to start by saying thank you very much for setting up the Lacy Veach day the other weekend. I attended the Letry workshop, which was just amazing! The whole day was exciting and full of information! I am definitely going to push my students harder to sign up for it next year!! You are doing wonderful things for our kids, thank you!" ~ Amber Russell, Science teacher from St. Francis High School

Women in Aerospace Educator Award

http://www.womeninaerospace.org

Rene Kimura receives congratulations and a Senate certificate from Senator Wil Espero, honoring her selection for the 2011 Women Aerospace Educator Award.

Rene Kimura, Education Specialist, Hawai'i Space Grant Consortium, was awarded the 2011 Women in Aerospace Educator Award. Rene was co-nominated by Educator Astronaut, Barbara Morgan and NASA Administrator, Alan Ladwig. The Aerospace Educator Award is presented for excellence as an educator teaching aerospace topics at the K-12, collegiate, or graduate levels who motivates students to excel in aerospace-related educational endeavors, gives service to colleagues and community, commits to professional growth, and serves as a role model or mentor who shows dedication to the advancement of women in aerospace.

Barbara Morgan wrote in the nomination, "Rene Kimura serves as the perfect role model for all women in aerospace education. She is an excellent, veteran educator, who has devoted the past twenty-four of her forty-three year career, to aerospace education. Through her leadership and dedication, Rene has opened doors for thousands of students and fellow teachers to excel in aerospace-related educational endeavors. With her philosophy of 'one student, one teacher at a time' and her unwavering commitment to community and empowering others, Rene has developed a statewide network of educators, parents, and business, industry, and government leaders who share the common goal of inspiring the next generation through the context of aerospace. She is also a tenacious advocate for girls and young women in aerospace. "

Rene Kimura with the Women in Aerospace Awards.

Eisha Matsubara, electrical engineer, Jet Propulsion Laboratory, wrote a letter of support that included, "I am very fortunate to be working at JPL, and I know it is because of the many people who have helped and guided me along the way. One of the most important and influential mentors in my life has been Rene Kimura. She has been there at every step along my journey, encouraging and supporting my love of science and space. As a young child, I remember attending a space camp in Hawai'i called Future Flight that she created with her husband. Her enthusiasm and love of space was clearly evident as she energetically greeted us every morning to talk about all the exciting modules we were going to experience that day. That enthusiasm was infectious and I'm sure that every child in that camp, myself included, left loving science and planning a career in a science field. Through her encouragement and help, I attended the NASA SHARP program the summer after my junior year in high school. I had not had much exposure to engineering until that internship and was fascinated by the experience throughout that entire summer. That is when I decided to major in electrical engineering. While it is evident through my career path that Rene has had a large impact on my life, I feel the true testament to her dedication and talent is how she inspires those whom she has mentored to mentor others." Θ

An Innovative, Easy Biped Robot Developed in Hawai‘i

http://www.easybotics.com/

The Hawai‘i Space Grant Consortium submitted a proposal for a $120,000 grant (deposited in the Hawai‘i Island Economic Development Board) for statewide robotics workshops and the establishment of robotics camps. Four new scholastic robotics camps were initiated at Roosevelt/Radford High Schools, Moanalua Middle School, Stevenson Middle School, and Baldwin High School, using the templates from Future Flight Hawai‘i summer camps. The week-long programs included VEX robotics kits with students building and programming a binary robot. Working with Waiakea High School mentor, Chester Lowrey (www.easybotics.com), a two-day Biped robot workshop was held at the Hawai‘i Convention Center in August 2011, featuring the biped robot developed in Hawai‘i by Easybotics. The ease of building and text file programming of the biped has attracted the interest of an industry partner to assist in global marketing of this uniquely Hawai‘i-initiated product. A two-day workshop in August 2012 at the University of Hawai‘i at Hilo will feature an enhanced version of the biped robot using Arduino programming and bluetooth control via smart phones. Θ

(Left) Constructing a biped robot for competition. (Right) Speed racing bipedal robots.

VEX Robotics

http://www.vexrobotics.

VEX Robotics is the fastest growing middle and high school robotics program in Hawai‘i and around the world with over 5,000 teams globally and 170 teams in Hawai‘i. With eight regional and one state tournament, 24 Hawai‘i teams qualified for the VEX World Championships in April 2012 at the Anaheim Convention Center. Hawai‘i Space Grant Consortium played an integral part in coordinating and contributing to the success of the Big Island VEX Tournament at Waiakea High School and the Pan Pacific VEX Championship at the Hawai‘i Convention Center, which was the largest regional tournament in the world with 112 teams, including 10 teams from China, two teams from Taiwan, and three teams from the U.S. mainland. With sponsorship from the Hawai‘i Council of Engineering Societies and Pearlridge Shopping Center, HSGC coordinated an 18 team VEX tournament at the Pearlridge Center on February 19, 2012, to celebrate Engineering Week. The Team Excellence Award winner qualified for the VEX World Championships. The VEX tournament was produced by the McKinley High School Robotics Club; the Kalani High School Robotics Club hosted a brushbot hands-on activity for mall patrons. Θ

Teams compete at Pearlridge in the 2011-2012 VEX Gateway Competition

Making brushbots was a huge hit with kids at Pearlridge Shopping Center during the Engineering Week VEX Tournament.

Space Explorers Science FESTival
(FEST=Families Exploring Science Together)

http://www.flickr.com/photos/faye/sets/72157604065059412/show/

Schools in Hawai'i are hosting Future Flight Hawai'i's Science FESTivals. These free programs offered by Hawai'i Space Grant Consortium feature science demonstrations, information about NASA-supported educational opportunities, and selected hands-on activities for students and parents. Two versions are currently offered: Space Explorers FEST features living in space, Newton's Laws, and microgravity. The BrushBot FEST features the science of designing and building toothbrush robots. These evening family science programs encourage children and parents to work together, foster home/school partnerships, engage parents and students in thinking and working scientifically, assist parents to encourage an interest in science in their child, and help students to learn through active engagement in educational experiences.

Father and son learn about bouyancy and air pressure with a cartesian diver.

Parents and children learn about air pressure with the Bernoulli wind bag.

Art Kimura demonstrating how energy flows in a loop using a UFO ball.

"That was such an awesome event last night. My own two daughters are still talking about it this morning, and so was my husband. He's heard me talk about you for awhile, and this was the first time he was able to listen to your presentation, and learn about brushbots. There was such an excitement in the air last night, from both the children and adults, and yes, like you mentioned, we had to encourage some of the parents to let their child be the scientist, and that their role was to be the helper. Either way, though, I'm so happy that this seems to have created such an interest in science as a verb, like you said. I like that."

~Teresa Miyasaki, Enrichment Teacher, Liholiho Elementary School

"Thank you for sharing your passion of science with us. You both have been instrumental in keeping science alive in Hawai'i for many, many years and we are deeply grateful for your generosity of time and expertise. The children and parents were quite excited about "doing" science. It was important for the adults to experience that sense of wonder and discovery, just like the children."

~Susan Okano, Principal, Kamiloiki Elementary School

International Super Science Fair

http://www.ritsumei.ac.jp/fkc/jssf2011/

Overview of Ritsumeikan Super Science Fair.

In November 2011, Waiakea and Iolani students and teachers along with HSGC educational specialists, Art and Rene Kimura, participated in the 9th annual Ritsumeikan Super Science Fair/1st Japan Super Science Fair, hosted at Ritsumeikan University and High School in Kyoto, Japan. The goal of the fair is to foster a global perspective in how to work together as scientists and engineers to solve problems. Forty-six schools from 19 countries participated in this global exchange of science presentations and collaborative activities. Only five schools were invited from the U.S. Future Flight Hawai'i's Dale Olive of Waiakea High School led one of the five science workshops, and one of five team oriented project based activities. In addition, he was asked to do science demonstrations for 120 visiting 7th grade students and teachers. Art and Rene Kimura hosted a workshop for 100 elementary grade students and their parents on space exploration (http://www.ritsumei.ac.jp/fkc/jssf2011/newsletter/Day3.pdf). Waiakea and Iolani will be hosting Ritsumeikan students and teachers for two weeks in Hawai'i in July 2012 with overall coordination by Art and Rene Kimura. Ritsumeikan High School is one of 140 designated Super Science High Schools and one of five Core Super Science High Schools in Japan and has already invited Waiakea and Iolani Schools

and the Kimuras to the fall 2012 Super Science Fair. All sessions are conducted in English and the host pays for all ground expenses during the week-long program that includes visits to local science and technology industries and historic cultural sites.

A highlight of the Super Science Fair was the first Global BrushBot Olympics organized by Art and Rene Kimura and Dale Olive along with a committee of students from Ritsumeikan High School. Speed races representing summer Olympics, figure skating representing winter Olympics and sumo, a proposed new Olympic event were featured in the competition for the gold medals. Art Kimura was asked to write a letter to the young scientists gathered; the letter was printed in the day 5 newsletter (http://www.ritsumei.ac.jp/fkc/jssf2011/newsletter/Day5.pdf) and is reprinted below.

"Dear Young Scientists,

As a life long educator, we know that we are preparing our young scientists for a future that has not yet been defined, for jobs that have not yet been created, and for a world that requires increasing scientific and technological literacy by all. Given the rapidly increasing pressures on the world's resources including food and energy due to growing populations, climate change, and changing political and economic conditions, it would be easy to conclude that we are at a crossroads in our history. I remain optimistic that my children and my grandchildren will live in a world of hope and fulfillment, knowing the creative and collective genius that exist among all of the students at the 1st Japan Super Science Fair.

One person can change the world; Ritsumeikan Principal Hiroshi Tanaka's vision eight years ago to promote the exchange of students' scientific research and advance the internationalization of science education is why we are all here in Kyoto this week to share ideas, learn from one another, and expand the network. Only a precious few have been fortunate enough to be invited to attend the Ritsumeikan Super Science Fair. We are each responsible to geometrically expand the critical mass needed. I challenge each one of you to inspire a hundred, who in turn will inspire a thousand and then a hundred thousand through your thoughtful actions in your own communities and countries. Hawai`i's first astronaut, Ellison Onizuka, the first American Asian in space, said it best in a graduation speech to a high school class at his alma mater…. 'Your vision is not limited by what your eyes can see, but what your mind can imagine. Many things that you take for granted were considered unrealistic dreams by previous generations. If you accept these past accomplishments as commonplace then think of the new horizons that you can explore. From your vantage point, your education and imagination will carry you to places which we can't believe possible. Make your life count and the world will be a better place because you tried.' With grateful appreciation to Principal Tanaka and the many teachers and students at Ritsumeikan who make this amazing experience possible, mahalo (thank you)." ~Art Kimura, Hawai'i

(Left to Right) Brushbot Olympic events, speed racer and sumo-ground, Iolani students in front of their poster on their study of metal concentrations in the Ala Wai canal, Waiakea High Students at the Japan Super Science Fair.

Faculty Perspective

Stellar Occultation Observations with KBOs

By: Dr. Joseph Ciotti, Associate Director at Windward Community College

The Kuiper Belt Objects (KBOs), which include at least three dwarf planets and thousands of comet-like bodies, lie beyond the orbit of Neptune between 30 AU and 55 AU from the Sun. An Astronomical Unit (AU) is the average distance from Earth to the Sun (1.5×10^8 km). More than 70,000 KBOs over 100 km in diameter are believed to exist. Dwarf planets like Pluto, Makemake, and Haumea are distinguished from their regular planet counterparts in that they were unable to clear debris from their orbital paths.

Pluto's diameter (2800 km) is estimated to be about 2/3 that of our Moon. Its distant location and thin atmosphere of nitrogen, methane, and carbon dioxide add to the difficulty of determining its true solid size. Until the New Horizons spacecraft reaches Pluto in 2015 after its nine-year journey, astronomers must rely on other techniques to narrow down the error bar for Pluto's size. One such method is stellar occultation, which occurs when a star is obstructed by a passing object. The light curve resulting from this miniature eclipse can be analyzed to calculate the intervening body's size as well as to provide a profile of any

existing atmospheric pressure and temperature.

The NASA New Horizons Innovation augmentation grant that Windward Community College (WCC) received is being used in part to provide such observational experience for two student interns—Nathan Hiraoka and Samuel Plunkett, Jr. Along with their co-mentors (Marvin Kessler and Joe Ciotti), these students have teamed with researchers from MIT, Williams College Hopkins Observatory, and elsewhere to form a network of observatories around the Pacific-Asia region from which stellar occultations of KBOs can be conducted. In February 2011, Nathan and Sam assisted with the observation of the KBO Varuna, which was predicted to block out a star of magnitude of 15.5. Although no occultation was observed, these negative results are nevertheless useful for updating the ephemeris for this large KBO.

(Left to Right) Marvin Kessler, Samuel Plunkett and Nathaniel Hiraoka.

In June 2011, Nathan and Sam re-joined the same team of researchers to observe occultations by Pluto and two of its four moons, Charon and Hydra. A custom-built high-speed CCD camera designed by the lead team—called the Portable Occultation, Eclipse, and Transit System or POETS—was fitted to the 0.4-m Schmidt-Cassegrain telescope at WCC's Lanihuli Observatory. Although cloudy weather conditions interfered with these events for most of the observatories throughout the network, one set of measurements was successfully obtained from the Leeward CC observatory. The data were used to reduce the length of Charon's chord and will further serve to improve on the diameter of this satellite (approximately 610 km).

The New Horizons Innovation internships granted to these WCC students offered invaluable observational opportunities—among them, collaborating with wide variety of research groups, gaining hands-on experience with a research-grade CCD camera, and preparing the telescope pointing parameters for these extremely faint targets using coordinates that were constantly being updated until the very night of the event. For their effort and teamwork these student interns were listed as co-authors of a paper, "The Double-Double Pluto-Charon and Pluto-Hydra Predicted Stellar Occultation of June 2011," that was presented at the Division of Planetary Sciences meeting in Nantes, France in October 2011. Θ

Strategic Planning

RockOn Workshop

By: Dr. Jacob Hudson, Rocketry Coordinator / CanSat Liaison
Mr. Helen Rapozo, Information Technology Specialist
Dr. Gregory Witteman, Associate Director for Honolulu Community College

The RockOn workshop is about designing and building a sounding rocket payload. This workshop is similar to other BallonSat, and CanSat workshops in that teams learn through hands-on activities how to build a payload that is then integrated into, and flown in a balloon or rocket. During the flight, data are gathered and the efficacy of the payload is determined by reviewing the acquired data. However, RockOn is different in two important respects; firstly, the completed payload is flown into space using a Terrier-Orion sounding rocket, and secondly, this workshop does not target students - it targets teachers. The workshop is not about building or learning to build rockets, it is about building and learning to build sounding rocket payloads. Teams of three build their payloads from a kit in four days, and launch it in the sounding rocket on the sixth day.

The 2011 RockOn workshop was held at the Wallops Flight Facility and the Wallops Island Launch Facility, from June 18-23. Both of these sites are part of the Mid-Atlantic Rocket Spaceport (MARS), and are part of the NASA Sounding Rocket Program (SRP). This year, RockOn had a Hawai'i Team. Since this was a fishing expedition in the regard that we were interested in what MARS and the SRP had to offer, we called ourselves Team Humuhumunukunukuapua'a. The team consisted of Dr. Greg Whitteman (the assistant director of HSGC for HCC), Dr. Jacob Hudson (mentor of the UHCC USLI team of WCC), and Mr. Helen Rapozo (IT specialist at

HCC and IT resource for the UHCC USLI team).

The RockOn workshop was arranged by the University of Colorado, and organized by Chris Koehler, who is also noted for running the Starting Student Space Hardware workshops in Boulder. Not enough can be said about Chris; from the moment we checked in, to the last night of the workshop, we were kept busy, entertained, fed, and on schedule. One of the first things we had to decide, as a team, was who was going to do what. After an intense discussion of interests, desires, and parking lot fisticuffs, it was decided that Jake would do the payload construction, Helen would do the coding, and Greg was to do the payload integration with the rocket. Each completed step was to be checked by the other two so that complete agreement was had before going on to the next step.

The primary instrument of our payload package was a Geiger counter to measure all but the alpha radiation component of the background flux. Also included, was a three-axis accelerometer (actually there were two of these, one for low resolution—good for acceleration ranges out to 35 gees and the other was a higher resolution—which maxed out at 2 gees), a pressure sensor, and a temperature sensor. The whole assembly was controlled by an AVR microcontroller, and the data were stored to EEPROMs. The payload hardware was assembled over an intense two-day period. It took another day to write, compile and install the code that commanded the payload package.

Another day was spent checking the code, and testing all the payload sensors before integrating with the other teams' payload assemblies. On the fourth day, the entire payload assembly was mated together, spun, and shake tested at the giant T&E (Test and Evaluation) building, F-10, at the Wallops Flight Facility. After that, the teams were released to spend gobs of money at the Wallops Gift Shop. While the teams were practicing unbridled capitalism, the payload section was trucked to the Wallops Island Launch Facility, mated with the Terrier-Orion sounding rocket, and readied for its launch on the sixth day.

The day before the scheduled launch, the teams were given a tour of the Wallops machining shop and fabrication facility. Additionally, most of that day was spent viewing presentations made by other Universities that were attending Rock-C and Rock-X. What is the difference between RockOn, Rock-C, and Rock-X? RockOn, your payload is a kit that you put together, whereas Rock-C is a program where Universities design their own payloads. Basically, the learning institution participating in Rock-C buys space on a sounding rocket, its team undergoes a Preliminary Design Review (PDR), a Critical Design Review (CDR), and a Flight Readiness Review (FRR), before installing its designed payload into the rocket and having it flown with the RockOn payloads. Rock-X is like Rock-C but with a big difference; at apogee the outer sleeves of the payload section are ejected, and the project payloads are exposed to space. Because of the ejectable outer sleeve, the Rock-X sounding rocket is separate from, and flown at a later time from the RockOn/Rock-C flight. Two projects from Rock-X drew our attention. One project was from Colorado State, which measured atmospheric heating by dropping a plummeter that was extremely similar to the one designed by one of our Hawai'i teams from the Windward Community College ARLISS team. And the other project was by the University of Puerto Rico, which flew a custom-built mass spectrometer for analyzing particles in the upper atmosphere.

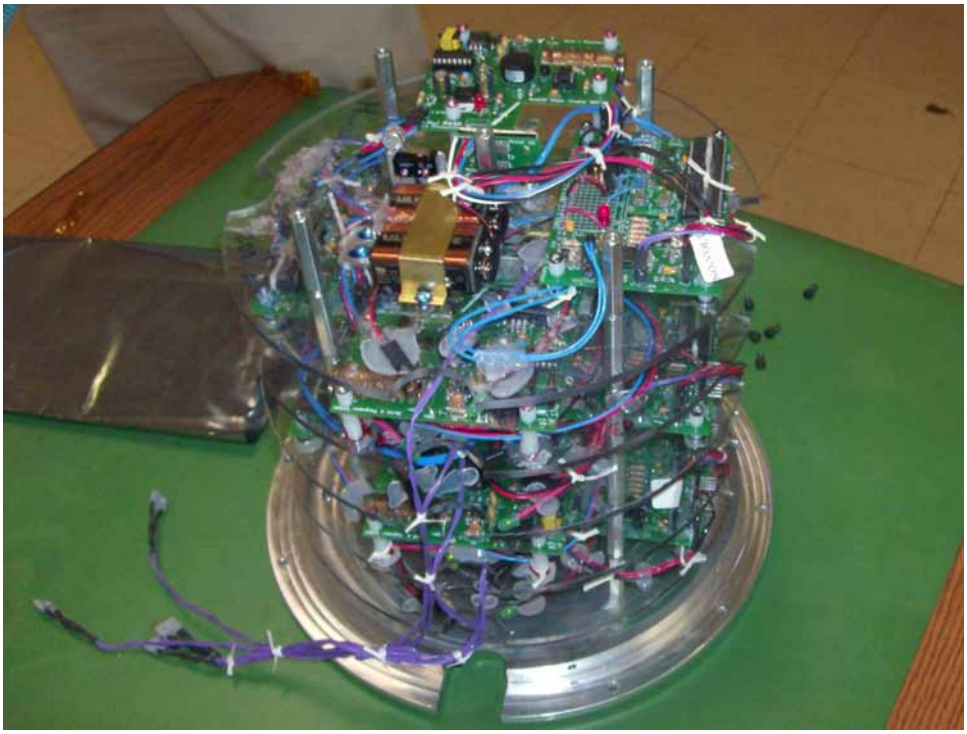
(Left to Right) Greg, Helen, and Jake with the sounding rocket on the gantry in the background.

The sounding rocket on the pad.

Finally, the big day came along and the RockOn/Rock-C launch was perfect. The rocket was aimed 10.7 degrees from vertical, with an azimuth of 89.5 degrees, to ensure that the payload came down in the desired Atlantic ocean recovery zone 32 miles away. The Terrier rocket booster ignited, on time, at 6:03 am EST, burned for 4.6 seconds, bringing the rocket up to a 20 gees acceleration coupled with a 3 Hz spin for stability. At launch, a 2+ gee inertial switched triggered, arming our payload, and starting the data collection routine. There was a 9.8 second inter-stage coast, where two steel springs were released, via capacitive discharge, separating the Terrier booster from the Orion sustainer. The Orion sustainer burned for 25.4 seconds, reaching a 15 gee maximum acceleration along with a 9 Hz stability spin. Less then a minute after lunch, the rocket had an estimated speed of 2,650 miles per hour! Apogee, 73 miles up, was reached 149 seconds after the Orion sustainer burned out. The payload section made a safe splash down 15.2 minutes after launch, and was brought to shore 5 hours later.

Upon review, the team Hawai'i payload data looked very good, and were consistent with our expectations. All systems worked as designed, and much discussion about future endeavors involving Rock-C and Rock-X followed. This had to be one of the most fulfilling experiences in all our years of rocketry! Helen, the guru of Laulima, has been working on a Website describing the RockOn experience (http://www2.hawaii.edu/rapozo/rockon2011.html). If you get a chance, please visit it.

One of the most beneficial aspects of our participation at the RockOn event was participating in an instructional version of a NASA design, build, test, and deploy process. At the event, each team was given complete documentation for each component, subsystem, assembly instructions, testing and integration step and then were lead through the processes of building a payload from a box of electronic and mechanical components. The structuring of the entire learning process has already been invaluable in joint community college projects between Honolulu and Windward. HCC's engine test stand documentation and the transition to AVR processors in WCC's payloads would not have been as successful without our team's experience at RockOn. Currently HCC and WCC are planning a Rock-X project that will culminate in the launch of a joint scientific payload that includes an independent, educational subsystem built by local high-school robotics teams. Not only has the RockOn experience benefited our current NASA student projects, but also the design and teaching methods learned there have found their way into the data-logging, control and student projects in aquaculture, aquaponics, and experimental agriculture systems at HCC. Dr. Gregory Witteman will be giving a series of AVR/Arduino project design talks that highlight the "RockOn method" at a PCATT event at the end of the spring semester 2012. Θ



Hawai'i's RockOn project (top) stacked with four other RockOn projects after the payload was recovered from the ocean.

Hawai'i Space Grant Consortium

Chartered under the National Space Grant College and Fellowship Program in 1990, the Hawai'i Space Grant Consortium develops and runs interdisciplinary education, research, and public service programs related to space science, earth science, remote sensing, human exploration and development of space, small satellites, and aerospace technology. We accomplish this through a variety of projects: Undergraduate research fellowships and traineeships, innovative college courses, workshops for educators, educational web sites, public exhibitions, lectures, tours, primary school programs, space-themed evening programs and summer camps for families, and more.

UH Mānoa,
Dr. Luke Flynn, Director
Ms. Marcia Rei Sistoso, Program Coordinator
Mr. Arthur Kimura, Education Specialist
Ms. Rene Kimura, Education Specialist
Dr. B. Ray Hawke, Associate Director for Outreach
Dr. Edward Scott, Associate Director for Fellowships
Dr. G. Jeffrey Taylor, Associate Director for Space Science
Ms. Linda Martel, Webmaster/Communications
Mr. Paul Fetherland, Industry Affiliate

UH Hilo
Dr. Kenneth Hon, Associate Director

Hawai'i Community College
Dr. Joseph Wilcox, Associate Director

Honolulu Community College
Dr. Gregory Witteman, Associate Director

Kapi'olani Community College
Dr. John Rand, Associate Director

Kaua'i Community College
Mr. Stewart Burley, Liaison/Industry Affiliate

Leeward Community College
Mr. Roger Kwok

Windward Community College
Dr. Joseph Ciotti, Associate Director
Dr. Jacob Hudson, Rocketry Coordinator

University of Guam
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