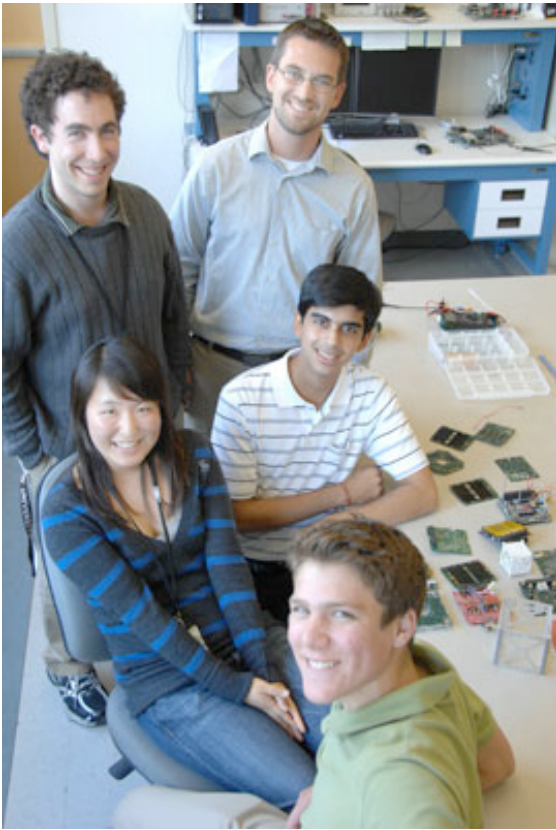


## NPS Hosts Young Scientists, Engineers for Hands-on Internships

Article By: Amanda Stein



In addition to being a key research institution for the Navy, NPS reaches beyond the gates surrounding the campus to connect with students in the science, technology, engineering and mathematics (STEM) fields. The various schools, departments and Institutes on campus host dozens of high school, undergraduate and graduate level students from schools locally and across the country with a desire to learn from some of the most seasoned researchers at NPS. The internships foster a sense of continuous learning and networking while encouraging budding scientists and engineers to pursue careers within the Department of Defense.

“These internships are important for the students because it gives them the opportunity to do hands-on laboratory work on focused research projects of national interest,” noted Jim Newman, a professor in the Space Systems Academic Group (SSAG). “This kind of project-based learning and experience set the basis for my own career, and I feel that it really creates a very powerful environment for learning.”

During the summer, the NPS campus is like a school within a school, bringing in dozens of interns to work alongside experienced faculty, researchers and graduate students on various projects. This summer, more than 180 interns, both new and returning, joined the NPS community. Funding for the interns comes from various grants either

through NPS or the college where the students come from. In the fall, most of the students will return to their studies, while some will continue to work throughout the year.

The Space Systems Academic Group currently has 10 high school, undergraduate and graduate level students from Salinas, San Luis Obispo, Montana, Michigan, Tennessee and the Monterey Peninsula, getting hands-on lab experience alongside NPS students and faculty. Under the direction of Professor Newman and Professor Rudy Panholzer, the interns are paired up throughout the group with different researchers and projects that fit their interests or funding. Newman worked as an astronaut for NASA for almost 20 years before taking a teaching position in the Space Systems Academic Group at NPS. He brings a wealth of experience to the SSAG, making it an ideal place for aspiring young aerospace engineers to intern.

Included in the group of interns working in the SSAG are York High School graduates Wilson Mefford and Michael Weissman. Both interns have worked in the SSAG lab for the past two summers and are working on various projects related to CubeSat development and testing, and with equipment like the Helmholtz coil. Mefford will begin studying Mechanical Engineering at Northeastern University in the fall, while Weissman will be entering his Junior year at Brown University where he is studying Physics. The two noted the value of their experiences in the lab for both their resume and their understanding of the steps it takes to fund and execute a research project.

“Having someone like Dr. Newman writing a letter of recommendation for anything you are going towards is really something wonderful to have,” said Weissman. “And as far as jobs in the community are concerned, coming home for the summer, for a college student to have a job like this ... and the experience you get is invaluable.”

Shane Driscoll, a yearlong senior intern on Newman's team, has been with the lab over a year. While attending Montana State University (MSU), he heard from a professor that NPS was looking for lab assistants. He took the internship to gain valuable lab experience, and has begun taking classes at NPS to further his education in Aerospace Engineering. In the fall he will return to MSU to pursue his Masters degree. For young scientists working their way into the STEM fields, the networking and contacts that NPS internships afford are often as valuable as the experience itself.

"We've been to a lot of different facilities where aerospace engineering is being done at the very top level when it comes to experience," explained Driscoll. "And we get to see how those people work and what the processes are. And to actually present at Critical Design Reviews, which is a very big deal in Aerospace. So we've had the opportunity to experience a lot of different aspects of aerospace application."

The contributions the interns make is often vital to the graduate student population as well. One of the projects in the works in the SSAG would bring laboratory classes to Distributed Learning (DL) students who may be taking classes through NPS but are unable to attend on campus. The proposed Innovative Spacecraft Laboratory Techniques Course is one of the first of its kind for NPS, factoring in hands-on lab experiments using computer, electrical and mechanical components to provide DL and in-residence students a learning experience that includes an online lab course. SSAG intern and Hartnell student Ernesto Yzquierdo is a new addition to the team, getting a running start in helping to bring various aspects of the course together. In particular, he hopes to fly an instrumented balloon to over forty thousand feet. While the completed project is still a few years away, the end result may benefit DL and in-residence students across the services.

Yzquierdo was hired through a partnership that NPS' Cebrowski Institute has maintained with Hartnell College for the past four years to place STEM students into labs on campus. In 2008, NPS was presented with the Hartnell President's Partnership of Excellence Award for contributions made in support of Hartnell's science program. The program is also unique in that students are exposed to defense-based projects and research, offering a connection between science and national security.

"From the Department of Defense aspect, it is important to replenish the work force in science, technology, engineering and math disciplines. That's the real criticality of what we are doing here. The workforce is aging," explained Sue Higgins, Deputy Director of the Cebrowski Institute. "This program helps us create a great building block to a variety of national labs. So whether it's Office of Naval Research or DARPA, two labs that we have research projects with, this kind of building block approach helps grow a new generation that will potentially lead in those directions."



Several interns have been granted the NASA Motivating Undergraduates in Science and Technology (MUST) award, and opportunities to work for NASA. Being in the graduate school environment provides interns with both a glimpse of what a graduate program is like and the options available to scientists and engineers with advanced degrees. Many NPS staff and faculty have taken part in internships across the country and express the value of being exposed to industry careers as an undergraduate.

The students coordinated by the Cebrowski Institute represent just a fraction of the total number of interns participating in laboratory research on campus, preparing them for future careers in the STEM fields. The top quality equipment and access to knowledgeable researchers working on various projects around campus provides a unique learning environment for students looking at a future in any of the laboratory and research sciences.

“I was an intern at both IBM and PSG&E during the summers as an undergrad while attending Cooper Union in New York,” said Physics Professor Jose Sinbaldi. “My internships in the industry made me realize how important an advance degree would be so that I could do the type of things that were intellectually stimulating. I realized that I did not want to take the jobs that were available with just a basic degree in science. And that made me stay in school instead of taking a job.”

Throughout NPS, the roles and responsibilities of dozens of student interns vary. Those in the STEM fields learn not only how to conduct research, but also how to handle the clerical details that go along with their projects, offering a well-balanced picture of the inner workings of a laboratory. Like the graduate students studying at NPS who represent many different cultures, ethnicities, backgrounds and interests, the student interns bring

## Rapid Pro VIRT Aims to Deliver Valued Information to Marines

By Amanda D. Stein

In an age of information overload, students and faculty at NPS are working on eliminating the excess and providing only the most valuable information to Marines in the field. A project known as Valued Information at the Right Time, or VIRT, aims to sift through the constant flow of information streaming to decision makers in order to identify mission-critical information.

“VIRT is something that was created here at NPS,” explained VIRT developer and NPS Information Sciences Professor Rick Hayes-Roth. “It’s been an area of my focus for six years now. I created it in part to counteract what I consider to be a naive tendency to look at information superiority as a thing that can be achieved merely by the production and availability of a huge amount of relevant data. But a huge amount of relevant data, which we already have, often translates into an information glut for the average user, especially one who might be flying a helicopter, or carrying a heavy pack and a rifle.”

A member of NPS' Cebrowski Institute, Hayes-Roth developed the concept for VIRT as a way to filter out unwanted or unneeded information to deliver only the most significant data to end users, providing a clear picture of mission-critical factors. After teaching the concept of high value information management in his classroom, Hayes-Roth was visited by a former student serving as team leader for a rapid prototyping initiative at Marine Corps Systems Command. He proposed a project to combine the abilities of the VIRT program with the need for a reliable Persistent, Intelligent, Surveillance, Reconnaissance (PISR) system, at a rapid prototyping speed.

The Marines need a way to collect, organize and filter data that can enable the warfighters to maintain an accurate and timely understanding of dynamic battlefield situations. In addition to identifying what information is valuable, the Marines need flexible ways to deliver information to the troops with a format that can be adjusted to fit various communication technologies, including small computers, radios, PDAs, headsets and phones. The brainchild of the partnership between Hayes-Roth and the Marines is known as Rapid Prototyping VIRT (RPV).

RPV is designed to eliminate the need for a person to be sitting behind a computer screen, surrounded by phones and monitors, sifting through incoming data to determine what is most significant to the mission at hand.

“VIRT is the name that we have given to a kind of service that we think should be present in all information rich environments where you are trying to help time-stressed people,” said Hayes-Roth. “What VIRT refers to is a service that gives each person timely significant data by automatically filtering out all the other data. So, this isn’t magic but it has extraordinary performance advantages. And while it can’t solve all problems, it can solve a few problems really well if implemented appropriately.”

In January, Hayes-Roth began assembling a research and development team to create the PISR product line architecture. This type of software product line enables developers to create a series of specialized products, all sharing a common architecture. Producers can then serve various market niches with different combinations of architecturally-compatible components. Adopting this practice for military systems, Hayes-Roth noted, dramatically



reduces the time required to produce systems tailored to specific mission requirements, allowing the Marines to make use of new capabilities quickly rather than waiting 10 or more years as is typical of system procurements.

Information manipulated by the PISR systems can have extraordinary potential for Marines whose lives depend on factors that can routinely change in a moment's notice. A terrorist rounding a corner, a suspicious object on the side of the road or inclement weather on the day of an operation all represent significant factors that could ruin an operation. The goal is to detect these events automatically and notify Marine personnel in time to make appropriate changes to their plans.

The in-field application for RPV will provide warfighters a program to input conditions or factors upon which a plan is contingent. Through multiple sensors, cameras and incoming recorded data, the program will detect any factors that differ significantly from what the decision makers expected. The program is intended to automatically filter out all of the insignificant or irrelevant information bombarding warfighters in the field, so they can focus on only mission-critical information.

Imagine a group of two or three Marines setting up a tent in a remote area, Hayes-Roth explained. The kinds of communication capabilities can vary anywhere from a basic handheld radio to a laptop or PDA with Internet connectivity. The system is designed to deliver notifications in various forms depending on the technology available in the field. A radio transmission might broadcast information to the squad leaders or a box will pop up on the computer screen notifying them of a sniper at 200 meters, 15 degrees East of North from the village center, for example.

***“Rather than thinking that the answer to our problems is to gather an infinite amount of potentially relevant data and have people somehow find what is important, VIRT suggests that’s the perfect application for computer processing power,”*** explained Hayes-Roth.

VIRT serves mission planning as well. For example, if Marines planned a hostage rescue operation and intended to refuel at a specific landing zone, VIRT would be useful in assuring the assumed factors were all in line for a successful mission. Factors that might be input include weather conditions, the number of available refuelers, how far they can fly, and so forth. Let’s suppose the unit is expecting three refuelers, five helicopters and clear weather on the landing pad on the day of the mission, in order to ensure all runs according to plan. Once all factors are entered into the program, continuous monitoring of these conditions determines any variance from the plan’s assumptions. If the weather suddenly takes a turn for the worse, or one of the helicopters is out of commission three hours before the plan is to be executed, decision makers will be notified of the violated assumptions, allowing them to determine the best way to proceed.

In addition to battlefield applications, VIRT has potential to be useful in homeland security and other surveillance efforts. Professor Hayes-Roth notes the increasing trend in camera surveillance throughout large cities. More cameras require more bodies monitoring them, which tends to eat up already strapped budgets, often removing vital police forces from patrolling the streets where they are needed most. He offered the recent Time Square bombing attempt as an example.

“You might think that high value information delivery would be natural or not need to be explicitly called out, but we have lots of surveillance systems in the world. Most of them look like video cameras that project real time video images into a center where people sit in front of lots of screens and the humans are expected to observe and detect important things. But in the case of the Time Square bomber, nobody detected anything in the videos. It was a guy

selling T-shirts on the street who noticed something. There's an implicit assumption that as we collect more and more video, we'll just put more and more humans sitting in front of these screens. The bang for the buck is very low there, and since the budgets are finite, you have to ask how you can spend money so that I would assuredly improve mission performance."

For deployed soldiers and Marines, manpower is critical to both safety and success. The number of people available to monitor television screens, or filter incoming data that may or may not be relevant is limited. Instead, the Marines demand a more efficient way of monitoring information to free up manpower and focus on executing field missions.

As new technologies are developed, and sensors become more advanced, RPV-architected PISR systems will adapt and maintain a clear picture of the mission at hand. As with many new technologies, however, the process of going from lab testing to field application can be a long one. Through rapid prototyping, the NPS team anticipates being able to produce the structure, process and methods over the next three years to enable the Marines to produce mission-tailored PISR systems in 18 months from concept to field.

## Brown Bag Lecture Explores Energy Costs at the Tactical Edge

Posted July 22, 2010

Colonel T.C. Moore, the Military Assistant to the Director and Marine Operational Liaison at the Defense Advanced Research Projects Agency (DARPA) points to delivery routes for water and fuel to Forward Operating Bases (FOB) in the Helmand Province, Afghanistan during a Cebrowski Institute sponsored Brown Bag Lecture, July 21.



Moore led the Marine Energy Assessment Team (MEAT) into Afghanistan in August 2009, and brought back some eye opening reports on wasteful resource practices and how they are directly tied to the extremely high risks of their delivery to the FOBs. He is adamant that something must be done to reduce the cost of fuel and water delivery at the tactical edge.

***“I’m not a tree hugger but I do believe that we can stop this cycle of waste and leave Afghanistan a better place to live.”***

“I’m not a tree hugger but I do believe that we can stop this cycle of waste and leave Afghanistan a better place to live,” said Moore, who admits he is on a mission to capture the intent of a new DoD regulation which specifically calls for its agencies to consider the fully burdened energy costs in all trade-offs. Ground, air and maritime platforms, as well as communications and network systems, all use a variety of renewable and disposable energy sources. Acquisition agencies have developed methodologies to calculate the fully burdened cost of fuel as delivered energy in defense systems, but for Moore’s findings, it is the last few kilometers of the distribution for these resources that can be made more cost efficient.

Marine bases are classified by maturity and command responsibility but Moore believes that there is no incentive for the camps, FOBs and the smaller patrol bases to increase their efficiencies as they either mature or move on from mission to mission. Moore mentioned that contract support for temporary bases should contain provisions that reward the contractor for efficiency. Moore showed that the ‘\$400 per gallon of gas’ is really a myth, but not by enough. While local contractors do deliver fuel and water to major distribution sites in the Helmand Province (about 250 kilometers distance from point of origin), costs nearly double to bring them to bases in the final leg of the trip, which is executed by military transport convoy and supported by the Mine Resistant Ambush Protected vehicle. Bridge crossings are susceptible to stress failures because of the severe cargo weight in the convoys, but the greater threat of course is attack. In the first week that Col. Moore was in country, there were 19 hostile attacks to convoys!

Moore also noted that an important environmental lesson could be made from history. “Centuries ago when the Romans were here they built fortifications with indigenous materials [mud] that kept the heat out and cool air in. They are still standing! Perhaps we should do the same,” he added.



## VADM Arthur Cebrowski

The institute is named after Vice Admiral Arthur Cebrowski, a distinguished graduate of the Naval Postgraduate School in Computer Systems Management in 1973, and retired director of the Defense Department's Office of Force Transformation. Known as the Father of Network Centric Warfare, he spent the last six years of his DOD service leading transformation in a cultural climate resistant to change. VADM Cebrowski passed away Nov. 12, 2005 after a long battle with cancer.

VADM Cebrowski entered the Navy through the Reserve Officers Training Corps in 1964. He was a Naval Aviator and commanded Fighter Squadron 41 and Carrier Air Wing EIGHT. He commanded the assault ship USS GUAM, the aircraft carrier USS MIDWAY and the USS AMERICA Battle Group. He had combat experience in Vietnam and Desert Storm. His Joint assignments included service as the Director, Command, Control, Communications and Computers (J-6), Joint Staff. Admiral Cebrowski retired from the Navy on October 1, 2001 with over 37 years of service, after serving as the President of the Naval War College in Newport, Rhode Island.

***“My role is to look in those areas that we call the intersection of unarticulated needs and non-consensual change ... those places where the institution would say, “I don’t need it and I don’t want it.” In other words, we look downstream and say is there a market or potential that the institution should be interested in, but isn’t and they aren’t naturally inclined. We have no trouble coming up with examples.”***

VADM Arthur Cebrowski