MAUI[HAWAII]

AMOS winter 2002

Air Force Research Laboratory DETACHMENT 15

Air Force Awards Supercomputer Contract to the UNIVERSITY OF HAWAI'I

The Air Force Research Laboratory (AFRL), Directed Energy Directorate announced their selection of the University of Hawaii (UH) for the operations and management of the Maui High Performance Computing Center (MHPCC) on May 31, 2001. After a three-month phase-in period, July through September, the new contract for the Operations, Maintenance, Program Management, and Business Development activities of the computing center was exercised on October 1, 2001.

"I am most pleased that the University of Hawaii has been awarded this Supercomputer contract by the Air Force," said United States Senator Daniel K. Inouye. "It has long been my hope that the University play a greater role in concert with the Department of Defense in Hawaii in utilizing the Supercomputer for the benefit of its faculty and students. The presence on Maui of a new world-class telescope at Maui Space Surveillance System (MSSS) and a world-class supercomputing center offers tremendous opportunities to advance the frontiers of scientific inquiry and positions Hawaii at the forefront of high tech research and development."

The first day of the new contract was marked by two highlights. Shortly before midnight on Sunday evening, 30 September, several AFRL and MHPCC personnel gathered at MHPCC to mark the beginning of the new contract with full-time, 24 x 7, operations. Later, during the morning of October 1, MHPCC conducted its dedication ceremony to commemorate the start of the new contract. Reverend Kealahou Alika presided over the traditional Hawaiian blessing ceremony, with several dignitaries in attendance. Speakers on the dedication ceremony program included Governor Benjamin J. Cayetano, Maui County Mayor James "Kimo" Apana, University of Hawaii President Evan S. Dobelle, Chief of Staff for United States Senator Daniel K. Inouye, Ms. Jennifer Sabas, and the Commander of AFRL Detachment 15, Major Raley Marek. Additionally, congratulatory letters were read from United States Senator Daniel K. Akaka, United States Senator Daniel K. Inouye, and United States Congresswoman Patsy T. Mink.

"We have long encouraged the University of Hawaii to expand its high technology and biotechnology research programs," said Governor Ben Cayetano. "This contract is a proud achievement toward that end. It caps off months of hard work by the UH, the State, our Congressional delegation, and Maui County. Most importantly, it continues to enhance the University's reputation as a strong research institution and to attract interest in its sophisticated research."

The period of performance for the research & development and operations & management contract includes a base 4-year ordering period, with three, 2-year extension periods, resulting in a maximum ordering period of 10 years. The maximum estimated ordering value of the contract is $181 million, making it the single largest contract award for the University of Hawaii.

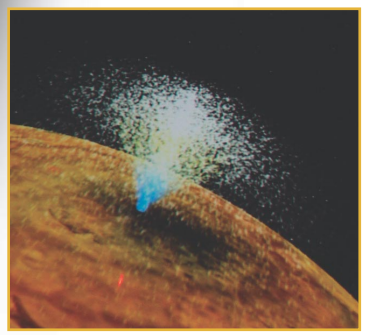
AFRL's primary MHPCC contract objectives are to provide high performance computing (HPC) support to the Department of Defense High Performance Computing Modernization Program (HPCMP), the Maui Space Surveillance System, other AFRL projects, and other government users of HPC-related capabilities.

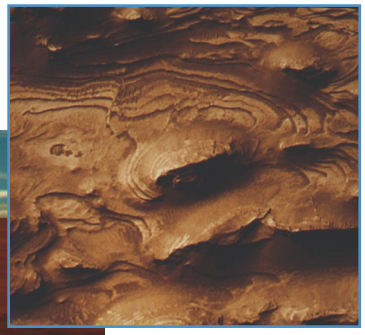
MHPCC's principal HPC resources are comprised of a suite of technology offerings from the Nation's HPC companies, and showcases a range of technologies from massively parallel distributed memory, multinode, IBM Power3, 16-way configurations to Linux clusters, including the largest Linux cluster in the HPCMP inventory, Huinalu. Overall, MHPCC is ranked in the top 20 supercomputing sites in the world, and is one of the premiere HPC sites in the Department of Defense.

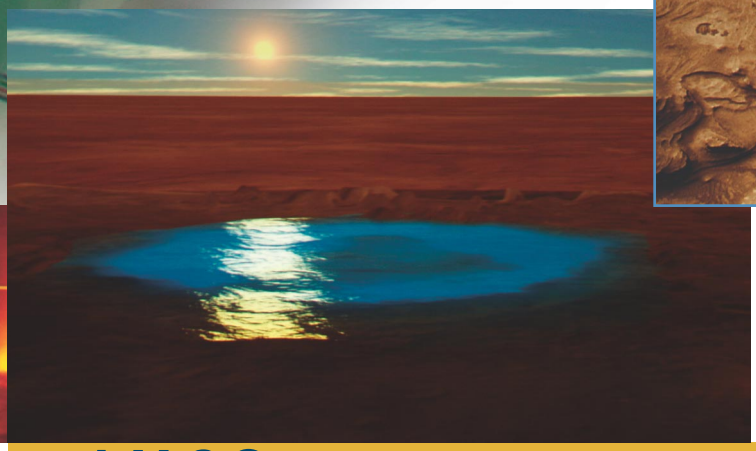
AMOS Technical Conference

The successful AMOS Technical Conference was held September 10-14, 2001

Some 270 participants—representing an array of various government agencies, academicians from 13 universities, observatories, contracting organizations, and international concerns—had already gathered on Maui for the start of the conference prior to the unprecedented national tragedy that occurred that week.

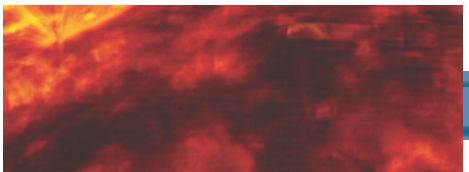






The Air Force Research Laboratory responded to the unforeseen security concerns by postponing the conference for two days. Once given approval to convene, the schedule was accelerated by compressing the planned 65 presentations into two days. The sessions covered a range of topics including laser applications, high performance computing, orbital debris, astronomy, adaptive optics, imaging, and non-imaging space object identification thus providing the participants with good opportunities for networking and business development. One of the keynote speakers was Dr. Eric Dejong of the Jet Propulsion Laboratory. The images shown here are from his talk, entitled "Views of the Solar System: A 3D HDTV Presentation."

The conference was so well received by participants and AFRL decision-makers alike, that it is now an annual event.



AMOS Expands Research Capabilities

Since resuming oversight of operations in October 2000, the Air Force Research Laboratory (AFRL) reemphasized the research mission of AMOS. Two large steps were taken in that direction recently with the creation of the AMOS basic research program and the addition of several new members to the lab team.

Basic research is defined as research to gain more complete knowledge or understanding of the fundamental aspects of phenomena and of observable facts, without specific applications toward processes or products in mind. The primary goal of the basic research program is to take advantage of the world-class facilities and experience available at AMOS to further scientific understanding in Air Force mission areas. Another important program goal is to better link the research interests of the Air Force with visiting scientists and other researchers in the Hawaiian Islands. Through this effort, AFRL hopes to foster a relationship that is mutually beneficial to both the Air Force and the community.

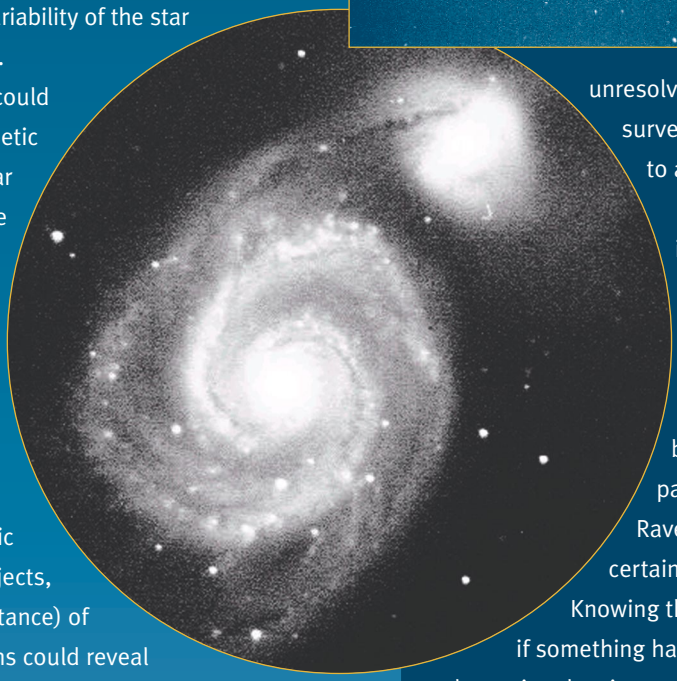
As a display of their commitment to research at AMOS, AFRL has brought several new faces to Maui to help establish the basic research program. Most notably, Dr. Joseph Janni, the Director Emeritus of the Air Force Office of Scientific Research (AFOSR), is working half-time as a resident scientist at AMOS and has already energized the technical team on the benefits of a successful basic research program. Dr. Janni is also serving as a research ambassador to the many science professionals of the University of Hawaii on the islands.

Basic research is continually successful since knowledge is gained regardless of the outcome of the research. With the AMOS basic research program, our resources can be better applied to the pursuit of knowledge resulting in benefits to the Air Force and a stronger scientific community for Hawaii.

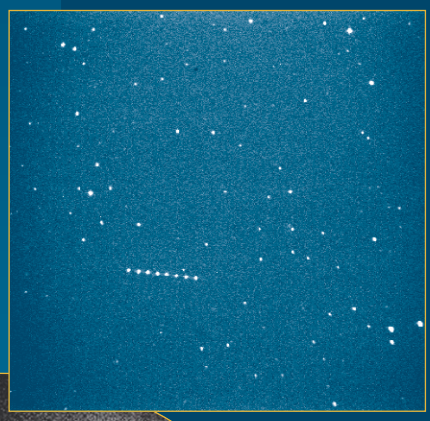
When an image is not worth a thousand words!

Man has been looking at the heavens for thousands of years. Until Galileo

first trained his telescope on Venus and Jupiter, the only two astronomical objects that were resolved were the Moon and the Sun. Since Galileo's time, astronomers have been devising innovative observational techniques to understand objects that cannot be resolved or understood using conventional imaging techniques. Some of the observational techniques developed by the astronomical community include filter photometry, polarimetry, spectroscopy, and radiometry. While the image below is spectacular (taken with the 1.2 m telescope), not much can be learned about the galaxy or the individual stars from just this one image. However, the stars in this image could be characterized using filter photometry, that is, photometry using optical filters. Photometry over an extended period of time could reveal the presence of variable stars indicating intrinsic variability of the star or the existence of multiple objects. Polarimetry of the individual stars could reveal the presence of strong magnetic fields indicating the presence of star spots (equivalent to sun spots). The time variation of the photometric or polarimetric observations could reveal the rotation rates of the stars and possibly time scales of the star spots. Spectroscopic observations can reveal the presence of multiple star systems, rotation rates, existence of magnetic fields, elemental makeup of the objects, and the red shift (related to the distance) of the galaxy. Radiometric observations could reveal the existence of dust clouds around the stars and in the galaxy. If any of these objects happens to be an asteroid, then the combination of photometry and radiometry could reveal the size of the asteroid. Radiometry can also provide temperature information about the objects.



How is all of this relevant to space surveillance and AMOS? After all, the objects that astronomers are interested in are often millions of light years away. Most of the manmade satellites are only hundreds of miles away, or at most about 20000 miles away. With the new AEOS facility, shouldn't it be able to image all of the objects we are interested in? The answer to this question is no! At present there are about 8900 catalogued objects tracked by the Space Surveillance Network. Only about 600 of these objects are active payloads and about half are in geosynchronous orbit (GEO). The image below is an observation of an active payload in GEO. The object is not resolved. However the brightness of the object changes during the exposure indicating some sort of rotational variation of the spacecraft. The percentage of active payloads that AEOS will be able to image and resolve in the future will likely decrease with the advent of micro and pico-satellites. Hence, a non-imaging method to identify these satellites is needed. The techniques developed by astronomers for obtaining information on unresolved objects will need to be employed by the space surveillance community. These techniques are referred to as non-imaging space object identification (SOI).



The Space Object Technology program at AMOS is doing this by exploring a variety of optical non-imaging SOI techniques. Recent observations taken with the spectrograph on the 1.6 m telescope have shown that it is fairly easy to distinguish between different types of rocket bodies and payloads, and to discriminate payloads from rocket bodies. Photometry from Raven is indicating that each space object has a certain range of brightness over the course of a year. Knowing this could help to identify an object or determine if something has changed. Thermal models have been developed to determine the size and temperature of space objects from data obtained from the AEOS radiometer.

During the next several months, the use of polarimetry for non-imaging SOI applications will be investigated. Polarimetry may provide useful information about whether the surface material is made of mostly conductors, semi-conductors, or insulators.

Using these techniques, we will gain knowledge about small or distant manmade satellites even if we cannot resolve the images of those satellites.

Maui High Performance Computing Center

Opens State of the Art Visualization Facility

For more than twenty years, scientific visualization has grown steadily in its ability to provide insight for the research and development community.

From its early roots in computer-aided design and engineering to sophisticated simulators and training devices that we utilize today, computer graphics technology has steadily advanced to the point where scientists can now take massive amounts of information generated by high-performance computing systems and "immerse" themselves into it.

The Maui High Performance Computing Center (MHPCC) now joins that scientific visualization community with the completion of its new state-of-the-art, multi-media Visualization Facility to complement its world-class computational resources. This facility includes an 8 foot x 16 foot working video wall with Barco projectors that have been designed to project a single large image consisting of 3,200 x 1,200 pixels in either mono or stereo (3D). NuVision Liquid Crystal Display (LCD) glasses provide users with an immersive experience by simulating depth in a physical environment. The heart of this facility is a Silicon Graphics Incorporated (SGI) Onyx 3400 system that includes 8 high-speed processors and a single Infinite Reality (IR) graphics "pipe" that is capable of rendering and displaying complex images from data generated by any of the MHPCC computing complexes. This hardware suite is supported by visualization software, which includes IBM's Data Explorer and Alias Wavefront/ Maya, to provide applications developers with the tools that are required to maximize scientific insight.

MHPCC's interactive visual computing capability will provide scientists with a method for "seeing the unseen" by transforming data into 3D images using high resolution, true-color graphics, three-dimensional solid modeling, and animation. Scientists will be able to communicate with this data by manipulating its visual representation during processing, allowing them to steer and dynamically modify computations while they are occurring. Visual representations will provide researchers with the ability to see features that would have otherwise been hidden in the data. Scientific visualization compresses data into a single image through a technique known as data browsing, reveals correlations between different parameters in both space and time, and creates the capability to view data selectively and interactively in "real-time."

It is anticipated that this new theater-like facility will be utilized for scientific conferences, providing speakers with the capability to easily share the results of their research using multi-media presentations. Additionally, this facility is capable of hosting small training sessions, interactive research discussions, and remote video teleconferencing sessions. MHPCC's new Visualization Facility is an ideal environment for conducting research and development of new methods to analyze scientific and engineering data. As part of MHPCC's focus on image processing, the new Visualization Facility will enhance existing capabilities to support the AMOS programs, providing research scientists with improved capabilities for refining image reconstruction algorithms and fusing data from multiple sensors.

Other military applications of MHPCC's Visualization Facility may include a variety of modeling and simulation applications, such as virtual 3D battlefield environments, computational chemistry applications in the development of new materials, computational fluid dynamics simulations to replicate ship hydrodynamics for improved submarine and ship design, and simulated aerodynamics for improved aircraft design. Other potential application areas include remote medical diagnostics training, immersive visualization of virtual 3D patients for surgical planning, and environmental modeling.

The Visualization Facility is also the new site for MHPCC's Access Grid node, which uses the Internet as a communications medium for video teleconferencing. This capability supports collaborative, long-distance meetings by transmitting a single stream of data, whether audio, video, or presentation material, to multiple sites simultaneously.

MHPCC is making organizational investments to increase expertise in computer visualization technology to maximize the applicability of this world-class facility in support of critical DOD research initiatives. MHPCC's goal is to provide superlative visualization facilities to match its extraordinary high performance computing capabilities and expert applications analysts in providing value-added capability to enable research.

Raven Team Earns TOP USAF SCIENCE AWARD

The Maui Raven team was recently named recipients of the prestigious Air Force Science and Engineering Award.

The Raven team of Paul W. Kervin, Capt Robin E. Orth and Tech Sgt David L. Covey designed a low-cost operational telescope system from readily available commercial, astronomical components. They received the award in the Engineering Achievement category. The team also demonstrated that the system could meet deep-space track requirements, and freed larger telescopes at the complex for more demanding tasks.

The Science and Engineering Award recognizes "working level" Air Force personnel for their outstanding contributions in research, development, or engineering. Although the award is for Air Force personnel, the success of the Raven program would not have been possible without the outstanding effort of the Boeing and Oceanit personnel, including John Africano, Vicki SooHoo, Paul Sydney, Daron Nishimoto, and Kris Hamada.

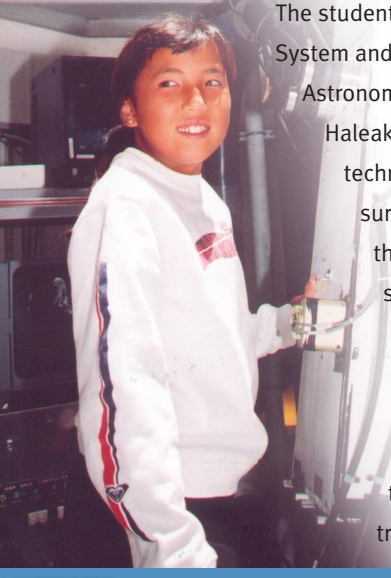
Pictured above, on the right is Dr. R. Earl Good, Director of the Directed Energy Directorate, Air Force Research Laboratory (AFRL) presenting award to Paul Kervin and Captain Robin Orth of AFRL, Detachment 15.

Hawaiian Students Visit Air Force Telescope Complex

Thirty native Hawaiian middle school girls toured the Air Force Research Laboratory telescopes as part of a 3-day program that exposes the students to math, science, and engineering opportunities on Maui.

The Excite camp was the result of a collaboration between the U.S. Air Force, Kamehamea Schools, the Women in Technology Project of the Maui Economic Development Board, the University of Hawaii Institute for Astronomy, and the Maui Community College.

The activities included planning a mission to Venus to learn about the math and science behind space exploration. Simulated "radar" was used to collect data on the surface of Venus, which was encoded in binary form, transmitted through "space," and interpreted into a 3D map of Venus to determine the best landing site for a spacecraft of their own design.



The students visited the Maui Space Surveillance System and the University of Hawaii Institute for Astronomy, located at the 10,000-ft summit of Haleakala, to witness state-of-the-art technologies being used for modern space surveillance. The students learned about the latest technologies used in space surveillance as they saw the world's largest telescope capable of capturing images of quickly moving satellites passing overhead. This 3.67-meter telescope and several other smaller telescopes are used to image and track objects in space.

The students had a chance to build small spectroscopes and learn how today's astronomers use advanced spectroscopes to determine the makeup of stars from the different colors of light that are emitted. They also learned how infrared sensors are used to make temperature-maps. This was demonstrated by having the students cool parts of their faces and hands with ice cubes, then watch on camera monitors while infrared (temperature-sensitive) sensors used different colors to display the temperature changes.

The significance of Haleakala in Hawaiian culture and religion was discussed with the students as were the Air Force efforts to protect the environment on the mountain. Also discussed were the legends of Maui, Pele, and other figures in Hawaiian tradition, and how ancient Polynesians used the sun, stars, and ocean currents to navigate across great distances on the Pacific Ocean.

The camp culminated with the students learning basic circuitry, followed by a tour of the Trex Enterprises coating facility, which manufactures computer components, and the Maui High Performance Computing Center, both of which are located in the Maui Research & Technology Park. The program provided the girls with confidence-building exercises in math and science using models that have had demonstrated success, as well as providing the girls exposure to educational opportunities in math and science.

CONTACTS

Air Force Research Laboratory
808.874.1541
Web site: http://ulua.mhpcc.af.mil
Email: amostech@maui.com

Maui High Performance Computing Center
808.879.5077
Web site: www.mhpcc.edu
Email: info@mhpcc.edu

Maui Economic Development Board, Inc.
808.875.2326
Web site: www.medb.org

MSSS NEAT

Program on the BBC

THE MSSS WAS RECENTLY FEATURED IN A TELEVISION EPISODE ENTITLED HYPERSPACE, PART OF A BBC SERIES "SPACE" WHICH AIRED IN THE UNITED STATES ON THE LEARNING CHANNEL IN OCTOBER. The BBC is a world leader in program production, pioneering communications in radio, television, and online technologies in the United Kingdom.

The BBC crew that filmed the AMOS portion came out in December 2000 and spent several days filming. They featured the Near Earth Asteroid Tracking (NEAT) program run by the Jet Propulsion Laboratory. The observations use the 1.2 meter telescope at MSSS. The narrator of the feature was Sam Neill. The image is from the program, showing the MSSS in the foreground.