hightechmaui
A Project of The Maui Economic Development Board

High Tech Maui Newsletter-E-Edition April 2008

In This Issue:

- Pan-STARRS marches across the sky in search of asteroids
- Shedding light on objects in space
- Palm size technology redefining high-speed communications

Pan-STARRS marches across the sky in search of asteroids

While fantasies of asteroids wreaking havoc on earth are usually reserved for the domain of Hollywood, Nick Kaiser has made asteroid detection the stuff of everyday business.

An England native and educated at Cambridge, Kaiser made his way here eleven years ago to join the University of Hawaii's Institute for Astronomy. The institute's vibrant community and Hawaii's pristine viewing conditions led him here; England's cloudy, he reminds me who spend our sunny days here.

One thing led to another, as he says, and today he finds himself head of an ambitious project that's using some of the world's most powerful telescopes – Pan-STARRS (http://pan-starrs.ifa.hawaii.edu/public/). Pan-STARRS is an acronym for panoramic survey telescope and rapid response system, and it's the technology developed by Nick and a team of others to survey the entire available sky, of which about three-quarters is visible from Hawaii.

Pan-STARRS is designed to map out large areas of the sky – to the tune of about forty times the area of the full moon at a time – and to great sensitivity. Such a wide field of view and fine detection capability separates this technology from other telescopes, Nick says, which typically allow you to view a single object and not much else.

Pan-STARRS works by looking at a selected patch of sky for about thirty seconds then downloads this image immediately to a computer, and moves onto the next patch, repeating the process. At this rate, about one-quarter of the sky can be surveyed each night.

These thirty-second snapshots are put together to create a kind of time-lapse movie of the entire sky, to the faintest levels. And when this movie is played, it becomes easy to detect anything that moves or changes, like asteroids.

Maui's Mt. Haleakala is home to this endeavor, which is in its observational infancy. The project will eventually employ four telescopes, compared to its one today, and is proposed to be located atop Mauna Kea on the island of Hawaii. The one operational telescope today, PS1, is undergoing final adjustments. Once commissioned in the coming months, it will embark on a three-and-a-half year mission.

The dome of PS1, atop Mt. Haleakala's 10,000 ft. summit

We catch a glimpse of the telescope through the dome's slit

Nick and his team will be looking for objects 1 kilometer across, which would alter life as we know it if they come into contact with earth. Once these objects are documented, they will track those 300 meters across, which can inflict extensive local damage.

Sound like a scary science fiction movie?

Nick likens his work to going to the doctor for a preventative check-up. His prognosis- there's a very small chance that something bad could happen in the next hundred years, so we're okay.

While Pan-STARRS' primary purpose is asteroid and other near object detection, Nick says the data collected will be instrumental in a great number of other efforts. He says there are currently 300 scientists signed up to do major projects, something he is very excited about.

Shedding light on objects in space

A before and after shot of a photo enhanced by PDS image processing technology

Just two short years ago a series of serendipitous events led Wes Freiwald and three others to start Pacific Defense Solutions (http://www.pacificds.com/). They brought with them years of experience and expertise, and now this young company is helping define the curve of their industry.

Wes, company president, and Pacific Defense Solutions (PDS) are in the business of creating technologies for ground- and space-based space situational awareness. Working from the Maui Research and Technology Park, Freiwald and company design and develop algorithms, software and provide analysis for some of the nation's top priority space situational awareness (SSA) programs. Sound like a mouthful? It may be closer to an eyeful.

Space-based SSA refers to the ability to gather an accurate picture of what and where an object in space is, using an object in space, such as a satellite. A satellite that is above the earth's atmosphere will be able to gain a clearer view, so to speak, of a space object than a telescope on the ground, which must contend with atmospheric effects to capture its image.

Such a telescope would be providing ground-based SSA, an area in which this company has several subject matter experts. PDS has been instrumental in the development of several major ground-based SSA systems, like the Advanced Electro-Optical System (AEOS) on Mt. Haleakala.

Some of PDS' specialties address the challenges that accompany getting accurate information on space objects, offering them an industry niche. Staff work on the difficulties posed by dim objects – those that don't emit much light – developing unique solutions to both identify and gather data on them. Optimizing the ability to see dim objects is now essential to detecting satellites, for instance, as they become increasingly small.

The importance of SSA technology continues to grow in today's world where space has become an extension of the nation, says Freiwald. He believes the technologies he is helping to develop are making a difference.

And Wes and this young company show no signs of slowing down. PDS continues to advance research for the next generations of SSA technology, and in the process is building robust partnerships with companies such as Boeing and the government. Freiwald has created relationships spanning the ocean, giving the company a mainland presence that could lead to future ventures.

He has future plans to bring PDS innovations to existing products in the commercial marketplace. This may mean that your cell phone will take a much crisper picture, or the security camera your bank uses will have much higher resolution, or the camera you use to take your home photos will take a clearer snapshot - making your talents look all the finer.

When asked how these technologies will be a part of tomorrow's world, Wes points to their role in the creation of smart systems involving cameras or telescopes, for example. With such a system a security camera could spot a novel activity and follow up on it by itself, unaided by anyone. This may make some folks' jobs a little bit easier and others' a bit harder.

Palm size technology redefining high-speed communications

For Dr. Ned Davis the prospect of combining a career in engineering with living on Maui felt too good to pass up.

Today he finds himself at home in the labs of CrossFiber (http://www.crossfiber.com/), a company that specializes in building optical networking equipment for high-speed communications networks.

Davis is the director of product development and manages daily operations at the Maui facility, which houses CrossFiber's control circuitry and R&D initiatives. Since 2006 he and his team have been creating products that are designed to revolutionize the way high-speed networks function.

CrossFiber's all-optical switch, fully connectorized and installed in a single 6" tall rack mountable tray

What's the secret to their success? A family of all-optical switch modules, with broad applicability that fits in the palm of your hand.

Current switch technology is bulky - modules stand several feet tall, and consume a lot of power, Ned explains. Additionally, typical optical switches are limited to moving light of a specific wavelength rather than a whole light beam, which limits their capability; those with increased capability tend to come with a significantly higher price tag.

CF's all-optical switching demo

What the CrossFiber team has done is create a module that stands in contrast to current products – it is low power, compact and offers increased capability, that is, it can move a whole light beam, says Davis. And, he is excited to say, the modules are priced at an affordable rate.

The technology is ready for the marketplace, and the company's San Diego headquarters is poised to introduce it to industry. How will their product potentially play out in the market? It may mean, for instance, big changes in the telecommunications industry.

Solving the spaghetti wire phenomenon: The central offices of today's telephone companies typically resemble a spaghetti-like mass of fiber optic cables. Over time it's easy to lose track of connections, leading to many redundant and useless cables, and making repairs difficult, Davis says. With all-optical switch technology, fiber optic management is automated and human error is eliminated - all connections are tracked and repairs become simplified, ultimately allowing the same amount of fibers to better serve customers.

Traffic management: For the many telecommunications companies that serve primarily one location by day and another by night, an automated system using all-optical switches can act as a seamless traffic regulator. A good Illustration is a major metropolitan area where the highest fiber optic demand during the day may be in the city, while at night it may be the suburbs. With the automated system, fibers can be appropriately allocated and automatically switched to best serve either location.

Davis is particularly excited about future applications of switch technology at the “edge of the network.” By applying all-optical technology to systems far from the telephone company’s central office – at the edge of the network -- fiber optic cables can be managed remotely. Remote control management could mean the end of manual service repairs at night in a storm, and even solar powered control systems due to their low power consumption.

As Ned and his team push forward, bolstered by their excitement, it appears the days of the telephone operator and spaghetti-like wires are drawing to a close.