

# Cover story INNOVATION and *Discovery* at NMU



Professor Jeff Horn (on bench) and student Scott Balkonis with NMU's new Pioneer 3DX robot (in the foreground) and an older robot with which it will learn to communicate.

**W**hen Northern Michigan University's new Pioneer 3DX robot took its first stroll down a corridor of the New Science Building this semester, the Northern Evolutions and Robotics Lab literally took a giant step forward, moving to a whole new level of research capabilities.

"This is our most sophisticated research-level robot to date," says Jeff Horn, computer science professor and the lab's director. "It's the kind of robot that is used extensively at the top university robotics labs around the country."

This fall, Horn and NMU senior Scott Balkonis are working with the robot's software to try to understand its full capabilities. Balkonis will spend most of the rest of the year programming maps of the lower level of New Science for the robot to use. Next semester, students in Horn's robotics course will be creating a way for the new robot to "communicate" with the older NMU robots.

"Cooperative robotics, it's something we've never done," says Horn. "One day we might be able to coordinate them so that they can patrol a level of New Science—sort of like a police patrol where one can say to the other, 'I'll check out this hall, you go that way and we'll meet in the atrium.'"

In the past, the work NMU has done with robotics was a step up from what Horn would call "hobbyist."

"Basically, we've been building the robots ourselves, so they did not have the processing and sensing capabilities of something like the Pioneer 3DX. We mostly were teaching those robots simple reactions—to wander around and avoid obstacles, for example—basic stimulus-response behavior. This robot, however, will be goal-directed, with a hierarchy of diverse behaviors, such as navigating from point A to point B, localizing itself on its maps, and using the most efficient path while avoiding obstacles, both static and dynamic, like pedestrian traffic," says Horn. "Building new robots does have significant learning value, but being able to learn how to program a robot at a strategic level is cutting edge."

With the maps, the robot should be able to independently navigate the first level of the New Science Building and possibly parts of West Science—maybe even go to Starbucks via the underground tunnel if the obstacle of the fire doors can be solved. It will rely on sonar sensory information to figure out where it is and where it can and cannot go.

The ultimate goal? To eventually create a robot with true artificial intelligence and fully autonomous behavior.

"I hate to use R2D2 (of the "Star Wars" movies) as an example, but it's the type of robot that the general public recognizes—one that is truly intelligent. It's not something that has yet been created except in science fiction. Think about a robot that can 'think' logically using the sensory and other types of information we provide it to enable it to make critical, intelligent decisions. This is a tremendously hot area of study right now. For instance, consider how much the military is currently using drones in the field."

Is creating artificial, autonomous intelligence something that can be done on the NMU campus?

"Maybe," says Horn. "We're actually going to be taking a different approach in our research than most places. We've already done a considerable amount of work on artificial evolution in 3D simulated worlds. Through projects such as Virtual NMU, we have built artificial worlds and programmed simple agents to maneuver within them. On our Breve computer cluster we have evolved robots with self-replication capabilities. We're going to try merging those technologies with Pioneer's advanced sensors and navigation software to evolve higher levels of cognition for Pioneer."

When the Pioneer 3DX starts independently traversing the halls it may blend in with the NMU students more easily than one might think since the hope is that it'll be carting an NMU Thinkpad on its back. "It could process sensor information and send back to our servers a higher level perception of the environment," Horn explains. "Such peer-to-peer distributed thinking would be state of the art and offer a new way to showcase NMU's wireless technology on campus."

***"Building new robots does have significant learning value, but being able to learn how to program a robot at a strategic level is cutting edge."***

But the Pioneer 3DX will have some challenges that the typical NMU student doesn't. For one thing, it's only about 2-feet long, a foot-and-a-half wide and 16 or so inches tall. Also, it is still being called Pioneer 3DX.

"We typically just call the robots by their model names, but it's awkward to keep referring to it as Pioneer 3DX. It can't be Wildcat Willy—we've already got one of those on campus. The students will have to come up with a really good name," laughs Horn. "We're open to suggestions." ■

If you have a suggestion for NMU's new robot's name, e-mail it to [horizons@nmu.edu](mailto:horizons@nmu.edu). For more photos and information on NMU's Pioneer robot, visit <http://cc.nmu.edu/robots>.

## ROBOTS INVADE CAMPUS!



# In a Pinch

## Pioneering research on the world's endangered freshwater crabs

Over the past 20 years, NMU biology professor Neil Cumberlidge has been on a mission, on behalf of the world's crabs—the crustacean, not the curmudgeon variety. In the process he has described seven new genera and identified more than 30 new species. Unfortunately, his research has also contributed to the discovery that one-sixth of the world's freshwater crab species are critically endangered.

In an article in the August issue of *Biological Conservation*, Cumberlidge, his former graduate student **Lara Esser '08 MS**, and scientists from the Zoological Society of London reported on the "Red List" assessment of freshwater

crabs—the first assessment ever conducted—on behalf of the International Union for Conservation of Nature. They found that habitat loss and pollution are the largest threats to survival.

Freshwater crabs play a vital role in recycling dead material, helping to maintain the health of rivers. The disappearance of crabs from these ecosystems would break the nutrient cycle and open the flood gates for parasites and disease. They are also an important source of food for many animals.

Most recently, Cumberlidge has been focusing on the neglected and largely undocumented freshwater crab fauna of six East African

countries: Sudan, Somalia, Tanzania, Kenya, Ethiopia and Uganda.

"This will be the first time this region's freshwater crab fauna has been cataloged," he says. "It is important in that part of Africa from a public health standpoint because of the implications for river blindness."

The parasitic disease is transmitted through repeated bites from small black flies that breed only in cold, rapid-flowing streams and rivers. Freshwater crabs play a unique role in the life cycle of these flies. The insects lay their eggs in the water and the freshly hatched larvae must find a crab to cling to or they will die before they have a chance to develop into pupae from which black flies emerge.

"So far, researchers haven't been able to find the species of crab associated with the disease. The crabs that have been collected have not been identified properly. Now I have developed the skills at NMU to identify them with confidence."

Cumberlidge hopes this will lead to the development of control programs that can best limit the disease.

This summer, he traveled to London and Sweden to examine important specimen collections at museums, including one from a 1920's expedition to East Africa.

Now he is using specialized software to integrate his research and species descriptions with existing publications to produce a definitive volume titled *The Freshwater Crabs of Eastern Africa*. Cumberlidge also plans to post "much-needed" resources on Web sites devoted to biodiversity informatics—the burgeoning practice of applying IT tools and technology to global taxonomy data, bringing it into the electronic age.

"These resources will include first-time national species lists, identification keys and digital images.



**"There is still much that we humans do not know about the world, and taxonomy is the first step in discovery. We have to know what is there before we can learn anything about it."**

**—Kirstin Meyer**

"Because other scientists in Africa and other developing countries are my target audience, I only publish in open-access journals where they can gain free access," he adds.

Cumberlidge plans to seek funding for a scaled-up project encompassing all of Africa and the island of

Madagascar. It would target places where gaps exist in the knowledge of freshwater crabs. A \$17,500 Peter White Scholar award from NMU assisted with his latest research, upgrades in laboratory equipment and student involvement.

"When I started college, I never imagined that I would have the opportunity to work on a publishable paper," says Kirstin Meyer, a freshman fellow student who has worked with Cumberlidge on papers describing new species in Madagascar and Ethiopia. "I never dreamed that I would be a published scientific author at the age of 19!"

"I find the scientific process addicting. Most people think the only undiscovered species are bugs from the Amazon, but that is absolutely not the case. There is still much that we humans do not know about the world, and taxonomy is the first step in discovery. We have to know what is there before we can learn anything about it—ecology, physiology or conservation status."

This year they received funds through the University Scholars



Cumberlidge's former graduate student Lara Esser has gone on to further her expertise in ecology and conservation at universities in Hong Kong and London.

water crabs from Thailand, in which she challenged the theory that "freshwater crabs have no tolerance of seawater, cannot survive for long in the sea, and cannot disperse across the oceans." Her research disproved this belief. Esser also worked at the National University of Singapore on the IUCN red-listing project. She spent a year at Hong Kong University studying crab ecology and is now at Imperial College in London, working on a higher degree in Conservation Law.

A story by BBC News underscores the importance and impact of the research and Red List assessment conducted by the NMU team and Zoological Society of London: "The proportion of freshwater crabs threatened with extinction is equal to that of reef-building corals, and exceeds that of all other groups that have been assessed except for amphibians." ■

*Note: You can access Cumberlidge's freshwater crab Web site at <http://faculty.nmu.edu/ncumber/>*

# Encouraging Wildcat Innovation

**A**s part of NMU's Road Map to 2015, the Wildcat Innovation Fund has been formed to support new initiatives that advance the university's strategic goals. Faculty and staff are invited to propose new, innovative projects that will generate a positive impact on recruitment, retention, revenue generation and/or quality improvement (key areas targeted at this time), with collaborative projects especially encouraged. Awards of up to \$15,000 may be given to further evaluate or initiate the idea. Here are two of the first projects funded.

## College Prep Medicine Wheel Academy

NMU's Center for Native American Studies, along with the Nursing and Clinical Sciences Departments, are offering a new program for Native American high school students called "The College Prep Medicine Wheel Academy."

Forty Native American students will be introduced to health care professions via two multi-day visits to NMU. While on campus, they will engage in activities that teach about nursing and clinical sciences careers and degree programs, as well as tour Marquette General Hospital. The participants will also meet Native American professionals working in the health care fields.

The first academy was held Oct. 15-17, and students took part in shadowing MGH staff; hands-on workshops on respiratory therapy, speech pathology, clinical laboratory technology, nursing, surgical technology and clinical sciences; visits with Admissions staff; presentations on special topics; leadership activities; and sporting events.

Native Americans are severely underrepresented in the health care field. Of the 2.7 million licensed registered nurses in the United States, only 13,040 are American Indian or Alaska Native nurses.

The new academy reaches out to youth from the five federally recognized tribes of the Upper Peninsula, as well as from tribes in lower Michigan, northern Wisconsin and Minnesota.

### Native Americans are severely underrepresented in the health care field.

ties and understandings that Native American high school students have regarding health care in the United States."

Hannahville Indian School senior Betsy Trudeau agrees. "I now know that health care doesn't always have to mean being a doctor or nurse, but there are many people who go into fields like speech, physical therapy and hearing.... My favorite part was when I got to watch an open heart surgery at the hospital during my shadowing."

The next academy will be held in May.



Students from the Hannahville Indian School, Negaunee and Sault Ste. Marie high schools learn clinical science techniques from NMU faculty member Rick Lopez.

"Our goal is to see that Native American youth visit our campus and learn about NMU, as well as become exposed to our strong nursing and clinical sciences programs," says Adriana Greci Green, one of the NMU faculty spearheading the program.

Yearly the Center for Native American Studies, in collaboration with the Hannahville Indian School, hosts science programs for middle school students during the summer.

"We lose touch with them after middle school," says April Lindala, the center's director. "It's time for us to seek out those students now that they are in high school and further promote college life with these types of interactive programs. We need for these students to know that they have a place in our classrooms and labs."

Paul Lang, dean of the NMU College of Professional Studies believes that this program "has the potential to significantly impact the perceptions, reali-

## Center for Ecological Studies

A series of campus forums have been held this fall on the feasibility of an institute or center that will position NMU as the leader of environmental programs and activities in the Midwest. Most in attendance agreed that the idea warrants a closer look.

The concept was proposed by chemistry department head Suzanne Williams and biology professor Jill Leonard.

Online survey results showed that among nearly 1,300 undergraduate and employee respondents, approximately three-quarters were in

favor of reorganizing environmental activities, creating a new center or institute and developing more outreach activities and collaboration with community organizations. Students especially want to see new environmental academic programs.

Williams and Leonard visited other universities and reported on what they discovered: "No university is actually doing the global model we're envisioning," Williams says. "We like to think big and look for something novel and innovative that we can capitalize on."

Leonard echoes that sentiment: "A potential institute model is an approach to increasing cooperation on campus, creating opportunities for research, scholarship and internships and recruiting new students with

interests in these areas. NMU could create a niche for itself. We live in an amazing place from an environmental perspective. It makes no business sense to ignore that."

It's also agreed that finding funding to initiate such an institute will be a major challenge. But plans are progressing and a draft proposal will be submitted to the provost in January. ■

## Center of Resources for Enterprise

**N**MU has launched a new one-stop shop for local and regional entrepreneurs. With the intention of providing a starting point for business development assistance, the Center Of Resources for Enterprise at Northern Michigan

University—CORE@NMU—will serve as a primary source of business and economic information and expertise to entrepreneurs and small businesses in the Upper Peninsula. CORE@NMU will also assist businesses with identifying interns and class-based projects.

Partners in the center are Northern Initiatives, a community development organization that provides both business consultancy and financial loans to small businesses, and Lake Superior Community Partnership, Marquette County's chamber of commerce and economic development agency.

Services offered are:

- Design and Creative — Web and graphic design, digital video, photography, product design and prototypes, fabrication, 3D modeling, specialized research and sustainability specialization.

• Business — Business plan development, market research, surveys, database development, strategic planning, communications and advertising plans and materials, interns and employees and specialized staff training.

• Mechanical/Electrical/Technical — Component/system design and testing, CNC programming and cutting, drafting, welding, grinding, board layout and design, custom instrumentation and controls, PLC programming, technical writing and documentation.

• Public Sector — Research and analysis, assistance with state and local government, training and employee development and interns.

Interested entrepreneurs can e-mail core@nmu.edu. ■





## Keeping your head in the game

By Kristi Evans

**H**ead injuries are prevalent in sports, yet few in recent memory have garnered the media attention devoted to the one suffered by Tim Tebow. The Florida Gators quarterback was leveled by a harsh hit from a Kentucky defender in the third quarter of a late-September road game. Fans who had grown accustomed to the star's grit and durability were stunned to see him lying flat on his back, motionless and unresponsive. Tebow was diagnosed with a concussion and sidelined for almost two weeks.

Not all concussions are so obvious or treated as cautiously. Many athletes aren't knocked unconscious. The extent of injury can be difficult to gauge from outward appearances, especially when players walk off the field or skate off the ice under their own power, seemingly "shake it off" and then lobby their coaches to return to

action once the initial soreness subsides. Concussions require adequate time and rest to heal. Rushing the process or exercising poor judgment when an individual has had multiple head injuries can lead to permanent—even fatal—brain damage.

**Mark Lovell '77 BS** is a neuropsychologist and founding director of the University of Pittsburgh Medical Center Sports Medicine Concussion Program. It is the first and largest program of its kind to clinically manage and research the neurocognitive effects of sports-related concussion and develop better methods of post-injury evaluation to determine when it is safe for an athlete to return to sports. Through UPMC's research collaboration with the NFL's Pittsburgh Steelers, Lovell developed an ImPACT™ software package that helps team doctors and players make informed decisions.

"You can't just look at someone on the sideline and because they don't look goofy, send them back into the game," he says. "Specially designed tests need to be given for a more definitive evaluation. They test memory, reaction time, physical balance and other factors—things that can't be faked by athletes who want to play. The idea is to do a baseline before the season starts. That way, if someone sustains a head injury, you can test them again and compare that result with the baseline. If it doesn't measure up, you know they're not ready to play and you continue to operate on that assumption until they get a comparable result on the test."

**Now most professional sports leagues—from football, hockey and baseball to soccer and auto racing—have adopted his ImPACT software package to evaluate concussions.**

When Lovell started on his career path, concussion guidelines identified a specific recovery time in a one-size-fits-all treatment approach. But all cases are different and people recover at their own rate. Subjective scales that graded the severity of concussions from mild to severe were eliminated when Lovell and a committee of worldwide experts drafted a set of international guidelines.

Tests such as ImPACT, combined with sideline precautions like having athletes run sprints to make sure symptoms don't return when their heart rate increases, help eliminate the guesswork and enhance safety.

Some of the most common signs of a concussion are headaches, nausea, dizziness, a loss of balance, memory problems and difficulty sleeping. Lovell says because the brain is like gelatin and floats in the skull, it can tolerate significant movement. "But when it is hit hard or shaken, the brain chemistry gets thrown off and it takes a while to reconstitute and get back on track," he adds. "There is no bleeding or significant swelling to indicate a more severe brain injury. When you have multiple injuries, the cells can actually die and that can lead to long-lasting physical and structural problems."

One of the first athletes Lovell worked with in the Steelers research project was former NFL fullback Meryl Hoge, who's now an ESPN television analyst. After being traded to the Chicago Bears, Hoge suffered two head injuries in four weeks; the second proved to be career-ending. Hoge won a lawsuit claiming team doctors failed to reevaluate him for symptoms of post-concussion syndrome or warn him of the dangers of returning too soon.

Lovell also spent four years with the Detroit Red Wings and developed a concussion testing program for the NHL. Now most professional sports leagues—from football, hockey and baseball to soccer and auto racing—have adopted the ImPACT software package. So have about 3,000 high schools and most major colleges (Lovell donated one to NMU). The International Olympic Committee is also on board. When the Winter Games are held in February in Vancouver, Lovell will be there to assist the U.S. ski, snowboard, hockey, biathlon and bobsled teams. He also works extensively with the military.

Based on Lovell's clinical experience, football and hockey have the highest concussion rates for boys and men. Soccer is responsible for most girls' cases. He said the numbers have increased noticeably among youth, perhaps because concussions are being recognized for what they are and not attributed to something else. "Kids are also bigger, stronger and faster than they used to be, so the potential for injury is higher. In my clinic, we see over 200 kids a week."

The Centers for Disease Control estimates between 1.6 and 3.8 million concussions occur each year. While there has been increased awareness, challenges remain. The prevailing mentality in sports is to "tough it out," hide or play through injury and show no sign of weakness. There are even lighthearted references—from lights out and seeing stars to having one's bell rung, cage rattled



or eggs scrambled—that downplay the potential seriousness of head injuries. The culture of sports, in a sense, deters efforts to protect its own participants.

Lovell credits his experience at NMU, where he first became interested in the emerging field of neuropsychology, with laying the foundation for his chosen career. He went on to get his doctorate in clinical psychology at the Chicago Medical School. "The NMU psychology program is a true gem and I can't imagine having gone anywhere else. It was a great environment to study in because they pushed us to excel." ■



All photos courtesy of Andy Gregg, [bikefurniture.com](http://www.bikefurniture.com)

# Rebicycling

By Rebecca Tavernini

**M**ost people would agree that sitting on a bike for hours on end is not the most comfortable thing to do, but **Andy Gregg '93 BFA** has found a way to make bicycles not only irresistibly sitable, but also stylish works of functional art. In the process, he gives new life to used, obsolete, twisted or discarded rims, wheels, tubes, tires and other bike body parts that would end up in a landfill or haunt the rafters of garages.

"I started stockpiling innertubes when I worked at a bike shop in Aspen, Colo.," Gregg recalls—boomeranging back and forth to Aspen, Marquette, and Boulder, while studying at NMU. He was already finding inventive uses for them, such as forming a giant sling-shot to launch skateboarders. Then he had the idea of fashioning an elaborate river float from bike tubes stretched over a semitruck inner-tube. It worked well on the water and was a hit in the bike shop.



Back at NMU, he continued to use modest means to create a more sophisticated chair as a project for a sculpture class. "My friend had crashed his bike and bent his wheel in a potato chip shape," he says, inspiring the curvaceous finished product, which looked much like the Milano model pictured at right. "The only tools I used were scissors and a hacksaw."

But soon, in directed studies courses, professor Dale Wedig taught him how to weld and provided access to professional tools and materials. Gregg, a photography major who had been taking skateboarding and BMX action shots for years, also started studying mid-century and modern furniture design.

After graduating and moving to Chicago, he won a \$10,000 commission to design a bench for the children's museum that was being constructed on Navy Pier. That allowed him to buy tools of

his own. "I especially like when kids get fired up about a chair—you don't see that very often," he says. And with a job as director of Blackstone Bicycle Works—a shop run by the Chicago recycler The Resource Center—to hook up inner city kids with bike repair, sales and management skills, and bikes of their own—Gregg continued to have easy access to materials and a city full of inspiration.

He experimented with making carts and trailers out of bicycles and created a pedal-powered plastic shredder. All while visioning and constructing a broader line of furniture pieces.

He was invited to exhibit his designs in galleries and shows, and with each one, his exposure and orders for furniture grew.

While Gregg now lives in his hometown of Marquette, he rents a truck and drives to Chicago once a year to load up on great parts from a recycling center there. He also has relationships with manufacturers who send him materials when they change models or get warrantied parts back.

"When I first started I liked it because the materials were free," he says. "Now it takes a lot of effort to get the

**"When I first started I liked it because the materials were free. Now it takes a lot of effort to get the materials for certain designs, so I have to remanufacture some designs to fit the materials that are available. I like the challenge."**

auto glass for coffee tables.

Commissioned to create chairs for a new "green" building at Oberlin College, he repurposed the back seat from a Lincoln Continental.

He's been cruising the backs of car lots lately, given the abundance of Cash for Clunkers trade ins and their tempting, prime pieces.

"I see a lot of old Cadillacs, with good leather in there. It hurts me to see it go." He hopes he can eventually reincarnate what he can from such junkyard dinosaurs.

In the meantime, he's working on barstools and tables for a café in Coeur D'Alene, Idaho, just shipped a coat rack to Germany and packaged a crate load of furniture bound for Taipei.

His designs have been featured on HGTV's "I Want That" and on ABC's "Extreme Makeover: Home Edition." One of his chairs will be displayed at the Milwaukee Art Museum this winter.

"I don't even promote my photography anymore," he says, though he regularly shoots the Ore to Shore bike race and Noquemanon ski marathon and does freelance work ([see www.marquettephoto.com](http://www.marquettephoto.com)).



materials for certain designs. A lot of my original designs use chrome-plated steel rims, but bikes don't have that much anymore, so I have to remanufacture some designs to fit the materials that are available."

Actually, he welcomes the challenge of incorporating new materials and is working with state-of-the-art high-end aluminum or carbon fiber rims (though he wouldn't mind if some retro Schwinn parts came his way).

He is also branching out into using car parts, such as surplus seatbelt webbing for chair seats and backs or used

He says that keeping up with orders is becoming increasingly challenging.

Although he was heading up to Copper Harbor for a couple of weekend cyclocross races, that's one drawback to his creative success he really misses—a lot less time spent on a bicycle seat. ■

To see Andy Gregg's gallery, visit [www.bikefurniture.com](http://www.bikefurniture.com)



## A New Wave of Freedom

By Rebecca Tavernini

Photos courtesy of Eric Mueller and Tom Watkins

**O**ne day when **Eric Mueller '91 BS** was paddling his kayak up the North Channel of Lake St. Clair near his home on Harsens Island, he had a vision: of a kayak "system" that a person could re-enter if they did not have the use of their legs.

"The idea engulfed my thoughts, and I made some inquiries about what was out there, but that was about it," Mueller recalls.

In October 2004, he received a note in his paycheck stating that his job had been terminated. "I remember walking into my woodshop, wondering what was my next move in life. Standing in front of one of my kayaks with the adaptive image in my head, I thought to myself, 'you have the time now, just do it.'"

He started building, creating and recreating. He wanted someone to be able to get into the boat if it rolled, so he fashioned an aluminum outrigger that folded into the hull and could be deployed when needed. A person could hoist himself into the kayak backwards, with just his arms. By January, he was ready to test the customized kayak in a local indoor pool. Not only did the adaptation provide something to grab onto to pull oneself in, it also made

the kayak more stable.

"I realized that what I had was not only an adaptive kayak for people with disabilities, which is what I had set out to do," Mueller says. "It was also great for seniors, or anyone with a fear of flipping over."

It worked for him, but would it work for someone with a physical disability?

**More than 40 individuals with varying degrees of injury have paddled the Freedom, along with many able bodies who just want to try it out. "They are fulfilling my dream by exploring theirs."**

"At the time I had no friends or family that had a physical challenge," explains Mueller, who had been a health and fitness major at Northern. "So when I was at the grocery store and a guy whizzed by on a wheelchair, I followed him into the parking lot—I felt a little like a stalker—but when I told him what I was doing and offered him the chance to be a part of my endeavor, as well as try kayaking, he agreed with excitement."

That was Tom Watkins, who had been paralyzed in an auto accident nearly 20 years ago.

"Tom and I had numerous pool sessions," Mueller says, "After hours of tweaking, bending and rebuilding, I had a basic system that worked!"

As Mueller took photos of his friend paddling he asked what the first thing was he thought about when he

was in the kayak. "Freedom," Watkins replied.

When spring arrived the pair took to the open water with the Freedom Kayak. "I remember looking at him with a grin on my face, jokingly saying, 'Tom, I'm disappointed in you; you didn't flip over once.' He replied that he'd try harder next time.



"When I saw Tom in the kayak it was the exact image I had in my mind when I first got the idea," Mueller says. It was both an eerie and satisfying sight.

Since then, more than 40 individuals with varying degrees of injury have paddled the Freedom, along with many able bodies who just want to try it out. "They are fulfilling my dream by exploring theirs," he muses.

This summer, the first production Freedom Kayak emerged from the mold. The enclosure of the kayak hides a paddler's disability. And the kayak's retractable sponsons are molded right into the frame, so it looks like any other kayak.

Martha, a young woman with a wheelchair, says enthusiastically, "It's not just about your physical ability to get out, but to be out in nature again, to experience things that you maybe had done before, really impacts your whole emotional state."

Carol Fink, a West Bloomfield area farmer who teaches adaptive kayaking, says, "When I see people in it, it's joyful for them. It's amazing it works so well. I'm 61, and temporarily able bodied, and I popped myself right in."

Mueller is working with NMU, the NMU Foundation and Marquette General Hospital in looking at starting an adaptive kayaking program in the Health, Physical Education and Recreation curriculum and using the kayaks as a therapeutic device for hospital patients working with physical therapy students and therapists.

He has also started the nonprofit Freedom Outdoor Foundation in hopes of providing free or discounted

*The Freedom Kayak with the sponsons extended (left) and with them incognito in paddling position.*



kayaks to people who have been injured or born with a disability. "No one should be denied this recreation opportunity," Mueller says.

"Water is the ultimate equalizer," he adds. "It's not only individuals with a challenge who benefit from the experience of kayaking, it's anyone. The barriers to communication are broken down and simple interaction and shared experience can be the start of real conversation, change and a little freedom." ■

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**The Landing**  
Waterfront Living

# What's your P.O.V.?



By Kristi Evans



**S**uccessful entrepreneurship takes many forms. It might be effectively developing and marketing a single product that requires little variation to remain relevant and profitable. Or it might be more of an evolutionary process, in which a business model is adapted—even overhauled—to the point it bears little resemblance to the original. **David Ollila's '00 ascent** followed the latter scenario. His desire to promote mountain biking in the Upper Peninsula morphed into an Internet video service for outdoor recreation enthusiasts and ultimately a global consumer electronics company specializing in hands-free, point-of-view (P.O.V.) digital helmet cameras and recording devices.

There is no secret to Ollila's success. He pursued a passion, remained flexible in response to changing market conditions, incorporated advances in technology and embraced new opportunities to chart a different course despite the potential risk.

"I left a decent job to start my own business," he says. "It took guts

to make that leap. I feel incredibly fortunate that I found people who believed in the idea and I continued to grow it from there. It has involved some ingenuity, but also a lot of luck and good timing. You have to take advantage of opportunities when they arise."

Fueled by his love of mountain biking, Ollila hatched an idea for his first entrepreneurial endeavor: a magazine that would promote the sport throughout the Upper Peninsula. He secured enough advertisers to launch it as a free publication in 1996. The surging popularity of the Internet later convinced him to bring the magazine online in a more dynamic package with streaming video clips of progressive sports. This "video in and out" (VIO) advertising-based service became the Internet company [viosport.com](http://viosport.com).

"It was almost like a vertical YouTube with videos of skiing, biking and other activities," he says. "We had two NMU students editing videos part time. There were 15 correspondents nationwide. We supplied

them with gear and they would go to events, promoting our Web site and the companies that we had co-branded with. It was a successful advertising model."

Outdoor activities are not conducive to self-recorded video. With both hands gripping ski poles or handlebars, participants literally had to stop and pull out a video camera to capture the action around them. Recognizing this challenge, Ollila found some inspiration in the classic 1971 motorcycling movie "On Any Sunday," starring Steve McQueen. It represented one of the first uses of point-of-view helmet cameras. A betacam was attached to one side and a counterweight to the other for balance. But the setup, which preceded compact video equipment, was bulky and awkward.

"With the technology available to me, I found a way to make it better by repurposing a small security camera from a Taiwan company and connecting it to a camcorder in a backpack to record the visual. I can't take credit for inventing the idea. For

almost as long as there have been helmets, people have been trying to rig cameras to them, whether it was with duct tape or something else. But I saw a way to create and popularize a modern helmet camera. We started producing them, importing about 100 security cameras at a time to work on."

It's fortunate that he elected to diversify his business. The dot-com bubble burst shortly after and had a rippling effect on Ollila's Internet division. Despite the improved system for recording events, people stopped watching the videos and corporate partners lost interest. He was able to make a relatively seamless shift from a media company to a new consumer electronics company, V.I.O. Inc.

Ollila received a major publicity boost when *Outside* magazine ran a product review of his helmet camera in June 2002. That generated about \$30,000 in sales the first week after the issue came out. He invested the revenue from the first version of the camera back into the company to develop additional models with improved features. A digital recording device to complete the system was introduced in 2007.

Now the products have been sold in more than 60 countries. They are used to film programs for the Discovery Channel and MTV and by customers in security, law enforcement and the military.

"In a military environment, there's a place for the camera all along—from training to after-action reports from the field," says Ollila. "For example, in training you can show what a four-man stack is from each perspective and how to clear the

room. In the field, it can be used discreetly for reconnaissance missions by attaching it to the bumper of a Humvee and cruising through a city. Or if forces are holed up in a building, they could station cameras outside the window to monitor what's going on. After-action reports are always needed, but usually written. A lot can get lost when you remove a soldier from the heat of an event and try to reconstruct it. Video makes it more transparent."

Ollila partnered with a down-state company to have his camera factory-installed on the rope tower of MasterCraft ski boats. A monitor in front of the steering wheel helps drivers navigate the waters ahead while keeping an eye on the skiing or tubing action in back. His company also does co-branding with Rossignol and several other action sports brands.

**Now the products have been sold in more than 60 countries. They are used to film programs for the Discovery Channel and MTV and by customers in security, law enforcement and the military.**

With any successful product or service, there are bound to be imitators. Helmet cameras and recording devices are no exception. Ollila said there were no competitors when he started producing them; now there are more than 30.

"We invented the category, but there's incredible competition globally. Ours is a high-end, expensive product. There are inexpensive

alternatives. People have stolen from us and knocked off our ideas. Samsung and Sony have also entered the market. All of this only validates that our product is important. We can't worry about getting 100 percent of the pie. Our goal is to grow the entire pie and take our fair share."

Ollila has supported budding student entrepreneurs at Northern by serving as a judge for the new business venture competition. He enrolled in NMU as an outdoor recreation major, but soon gravitated toward marketing and advertising courses in the College of Business.

"It was one of the first times education wasn't a struggle for me. I found it intuitive and refreshing; a natural fit. It prepared me for the nuts and bolts of business operation."

He quickly put that into practice, making a decision to leave NMU early when \$50,000 in seed capital became available to start his business. Now Ollila's company has annual revenues of about \$6 million, mostly through European sales, and employs a staff of 20. His products have been manufactured in Asia, but the next generation will be produced at a former automotive electronics plant in Indiana.

"It's been a rollercoaster ride in many respects, but it's unique that a Marquette-based business has a worldwide footprint. I've been able to make something happen that others only dream about and I don't take that for granted. I wake up every day prepared for success or failure. It could be my last day in this business or it could be the first day I do something really fantastic." ■



## Simpler but better science

By Cindy Paavola '84 BS

For NMU alumni and U.S. patent holders **Karl Gust '97 BS** of Clawson, Mich., and **Bill Newman '83 BS** of Brooklyn Center, Minn., their respective work to address environmental concerns comes down to an equation that even non-scientific folks can appreciate: improve the science while making products better for the customer.

"I was always motivated by the idea that the science could be simpler, but better," says Gust, a technical market manager for BASF, one of the largest chemical companies in the world. Prior to his current position, he was a BASF research and development scientist—a position made possible by a shift in career exploration during his days at NMU.

Gust was a pre-med major before taking Jerome Roth's organic chemistry class.

"I quickly realized that being a straight chemistry major was more for me," said Gust. "Doing independent research projects for Dr. Tom Getman was eye-opening. NMU Chemistry faculty (Marquardt, McCormick, and Williams) encouraged me to apply to chemistry Ph.D. programs—something I never even considered previously."

After completing a doctorate at Wayne State in 2001, Gust joined BASF, where he did research that resulted in three patents with a fourth pending. His first two patents covered chemical processes that are used to increase the yield of the polymerization processes used in manufacturing nylon or polyether polymers. His third covered an improved UV-cured sealer for automotive coatings. This product was used on the Ford F-150 Sport and Cadillac XLR. The patent still in the approval process—a process that can take many years—is for a new urethane product that could be used in anti-ballistic applications.

"In the patent process, attention to detail is critical," he says. "The objective is to protect your invention and close out loopholes in which someone could try to get around the idea you are trying to protect. A positive of the experience is that you learn to effectively communicate with people who are not experts in the field, but who need to understand your objective, such as patent lawyers."

In 2008, Gust took on a new, multifaceted role at BASF. As a technical market manager he is involved with managing global research projects—"everything from budgets to the direction of the

science"—supplying account managers with needed information to sell products and, most importantly, working with current and potential customers to find technology that best fits their needs.

"The chemical industry is an exciting field to be in. The intricacy of customer relations, combined with the global market, makes every day a challenge, but I enjoy working with our customers from around the world. I'm in contact with colleagues and customers in Scotland, Germany, China and the Middle East, allowing me to learn a lot about different cultures. Also, working for a German company allows me to fall back on my German language skills that I learned at NMU."

A key component of his current job is finding ways to help the offshore subsea construction market build the infrastructure needed to tap into oil reserves in an environmentally safe way.

"Pumping oil out of the Gulf of Mexico involves an extensive infrastructure below the ocean surface. My focus is on polyurethane products involved with what's known as 'flow assurance.' These products protect and insulate pipes, manifolds and various other structures designed to keep the oil flowing. My customers build these structures and then coat them with the product my company supplies," says Gust.

Gust takes great pride in the fact that BASF has removed the mercury from the polyurethane products being used in the ocean.

"Mercury-cured polyurethane products have been a staple in the subsea construction market for 20 years. The mercury catalyst results in a very strong product that is easy to process. When BASF decided to

enter this market, the decision was made to do this with products that did not use mercury catalysts. To find a new way, we developed a global research team using BASF scientists in Northern America, the United Kingdom and Germany. Non-mercury catalysts hadn't been used previously for these products because no one had found a way to accomplish the task. Now we have. We've taken an innovative and environmentally correct approach to only introduce products that are 100 percent mercury free."

Gust says that one can't predict where the merging of science and technology will lead, but he knows he won't be bored watching it unfold.

"I sometimes wonder what I'd be doing now if I wasn't encouraged to be creative and expand my horizons by NMU faculty. Chances are I wouldn't be having near as much fun!"

**Gust is finding ways to help the offshore subsea construction market build the infrastructure needed to tap into oil reserves in an environmentally safe way.**

**B**ill Newman, founder and CEO of Remediation & Natural Attenuation Services, Inc. (RNAS), is having fun, too. Although running his small and very successful business keeps him hopping, he says, "I still get to play mad scientist/inventor often enough to make it fun." But he quickly adds, "I never expected to invent anything or grow a business into what we've become."

Practicality, as it turns out, has been the impetus at each turn of Newman's twisting career path.

After receiving a bachelor's degree in biology-water science from NMU, Newman completed a master's degree in environmental health science and environmental chemistry from the University of Michigan. He then became an analytical chemist and was involved in testing water samples at a large groundwater cleanup site on the Traverse City Coast Guard Air Station.

"During that time, EPA [Environmental Protection Agency] researchers from the RSKERL [Robert S. Kerr Environmental Research Laboratory] did a lot of the pioneering work in both natural attenuation and active bioremediation treatment. Being the only one at that site who understood biology or chemistry, I became the informal technical liaison between the geologists and engineers of the Traverse Group and the EPA scientists. My broad background in biology and chemistry served me well," he says.

In 1990, Newman went to work for Delta Environmental in Minneapolis. However, in 1998, the bottom dropped out of the petroleum product remediation market, which was Delta's primary business. The company laid off about a third of the staff, including Newman.

"I can really relate to some of the stories about things that happen to people due to today's economic situation. Then, I had just found a nice property on the Mississippi River and I really wanted to stay, so I decided the best option was to start my own consulting business within my specialty of bioremediation."



Newman in his home-based laboratory.

It was during the first four years of his new consulting business that Newman developed three new technologies, which would all be patented. The first was a bioreactor for treating groundwater.

"It worked, but not well enough, which just goes to show that not every idea that has a patent has commercial value," Newman says.

The second technology was O<sub>2</sub>Zone®, a system that oxygenates water for groundwater bioremediation. A chance meeting with the head of environmental compliance at Anderson Windows—Newman was an instructor of a sea kayaking course he was taking—led to the creation of O<sub>2</sub>Zone to clean up a site that held wood preservatives.

"That account taught me some interesting lessons in marketing, which are you never know who your next customer will be and, more importantly, give customers what they really need."

In 2002, Newman developed Newman Zone®, an emulsified vegetable oil for anaerobic groundwater bioremediation. More recently, RNAS has introduced a colloidal calcium carbonate buffer product,

Neutral Zone®, which is patent pending. Also, Newman's company is working on several other products including improved versions of NASA's emulsified zero valent iron (EZVI) technology, which would be used to clean marine sediment.

Last year, the company had sales of \$2.8 million.

**"I'd been involved in using other systems and I'd seen what a disaster some could be. This really helped me when I started designing my own."**

"I never dreamed RNAS would grow to that volume. Newman Zone was the big product that launched us. Millions of pounds of emulsified oil have been applied at hundreds of sites to treat chlorinated solvents, chromium, nitrate, perchlorate and explosives (RDX, TNT, HMX). Our clients have included H.B. Fuller, Dow, Dupont, Boeing, and large U.S. Department of Defense government projects.

"Throughout my career I worked with everyone from the

engineers and scientists to the guy out in the field trying to make a product work. Those who never had to actually use these systems didn't design them in an easy-to-use way. But I'd been involved in using other systems and I'd seen what a disaster some could be. This really helped me when I started designing my own. I knew what the customer needed were systems that were both practical and affordable. Still, I didn't spare any cost if I knew the consequence would be subpar reliability. Reliability is the bottom line. It has to work."

Newman said he was lucky when it came to the patent process for his systems in that his father was a former Dow Chemical employee, with nine patents of his own.

"I had access to some ex-Dow people who were willing to prepare the patent applications for me at a fraction of the cost. It's not hard to spend \$5,000 to \$10,000 on a patent," he says. "If they turn out to have commercial value, you then have to be prepared to defend them. And the process is very tedious, slow and in many ways inefficient. Getting a patent is not fun; it's work."

Still, for Newman, the quest for better science and meeting the needs of his customers is fun.

"After the layoff at Delta, I wasn't sure how it would all turn out, but it was a turning point for the better. Prior to that, I was always trying to solve the same problems for each environmental cleanup but didn't have the kinds of bioremediation systems I knew were needed. They just didn't exist. Being on my own, I didn't have a boss yelling at me to up my billable hours, so I had the time to tinker and try to make the science work better until it did.

"There was risk and at times it was tough, but, in the end, I was able to hang on to my view of the river." ■



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