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EOS SPHERES

Institute for the Study of Earth, Oceans, and Space • A University of New Hampshire Research Institute • Morse Hall, Durham, NH

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More Than the Sum of Their Parts

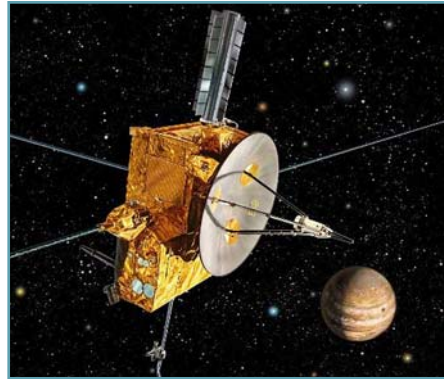
Somewhere in space above us, and in the white-hot haze around the Sun, John Alexander Simpson's legacy lives on, bleeping measurements relentlessly across the void back toward Earth.

—Chicago Tribune obituaries, September 2, 2000

Toward Earth and, eventually, right here to Durham. The legacy of John Simpson - cosmic ray pioneer, inventor of the neutron monitor, and a scientific group leader for the Manhattan Project - lives on at UNH through the work of Bruce McKibben, Jim Connell, and Clifford Lopate. The three astrophysicists came to UNH and EOS from the University of Chicago where they were part of the legendary John Simpson Cosmic Physics Group a.k.a. "The Chicago Mafia." Simpson was the don, and when he passed away at the age of 83, McKibben, Connell, and Lopate needed to find a new home.

"The interests of most of the rest of the faculty had moved on so we were sort of isolated there. It wasn't a viable place to stay," says McKibben, who spent 35 years working with Simpson and is the elder statesman of the three. The move to Durham was a natural one. "We had known for years that UNH has one of the strongest space physics programs in the country" McKibben says in reference to UNH's general reputation and their own experience collaborating with UNH scientists. With their arrival, space physics at UNH is that much stronger. Moreover, notes Jim Ryan of the Department of Physics and the Space Science Center, since the three bring with them the neutron monitor programs based in Climax, Colorado and Haleakala, Hawaii, UNH now has bragging rights. "Our collection of neutron monitors in the U.S. is second to none," says Ryan. UNH has had two neutron monitors (one atop Mt. Washington, and one discreetly tucked under a red dome at DeMeritt Hall) for decades. The Climax neutron monitor, built by Simpson in 1950, is the oldest continuously operating neutron monitor in the world. Its archival data set of cosmic ray activity is used to analyze the Sun's 22-year cycles and gives insight into the structure of the heliosphere (the region of space through which the solar wind extends) and the way particles propagate and travel through the Sun's magnetic fields. All this, in turn, is useful in helping explain how particles flow through the solar wind and how "space weather" works.

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Ulysses was launched in 1990 to study interplanetary space at high solar latitudes. A Jupiter fly-by in 1992 boosted the spacecraft into an orbit over the Sun's polar regions. Photo courtesy of European Space Agency.

Amitava Bhattacharjee Named Peter Paul Chair




Amitava Bhattacharjee

Professor Amitava Bhattacharjee of the University of Iowa has been named the Peter T. Paul Chair within the Space Science Center and the Physics

Department. Dr. Bhattacharjee is currently Director of the Center for Magnetic Reconnection Studies in the Department of Physics and Astronomy. His research interests include magnetohydrodynamics, magnetic reconnection, turbulence theory and singularity formation, free-electron laser theory, and dusty plasma theory.

He received his Ph.D. at Princeton University (1981) in theoretical plasma physics from the Department of Astrophysical Sciences. He and his students and postdoctoral colleagues have authored over 130 refereed publications with broad applications to laboratory, space and astrophysical plasmas. At the University of Iowa, he has received the James Van Allen Natural Sciences Fellowship (1996) and the Faculty Scholar (1997-2000) award.

The Center for Magnetic Reconnection Studies (CMRS) is a multi-institutional consortium established in August 2001 under the auspices of the Scientific Discovery through Advanced Computing (SciDAC) initiative of the Department of Energy. Understanding magnetic reconnection is one of the principal challenges in plasma physics. Reconnection is a process by which magnetic fields reconfigure themselves, releasing energy that can be converted to particle energies and bulk flows.

Look to the next issue of Spheres for more on the Bhattacharjee appointment. - DS 



From left to right, Cliff Lopate, Jim Connell, and Bruce McKibben with a "flight spare" portion of the COSPIN package aboard Ulysses, which includes the High Energy Telescope they built.



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From the Director

A Time to Grow

Turn, turn, turn. To everything, there is a season. It is now springtime in New Hampshire and we are delighted that in this season of change and renewal the Institute itself is being replenished – to the bursting point! We are currently welcoming the largest addition to the EOS faculty in our history.

The creation and filling of the Peter T. Paul Chair in Space Physics marks a sea change for the Institute, and we are delighted that Professor Amitava Bhattacharjee has accepted the appointment. Prof. Bhattacharjee joins our Space Science Center from the University of Iowa, where he held the prestigious University Professorship appointment (*see page 1*). Coming from Iowa with Prof. Bhattacharjee will be Research Assistant Professor Chung-Sang Ng.


In conjunction with Prof. Bhattacharjee's arrival, Prof. Joachim Raeder of UCLA has accepted an appointment as Associate Professor in the Space Science Center (SSC). The Bhattacharjee, Raeder, Ng team, coupled with our Solar-Terrestrial Theory Group, will allow us to start a major new initiative in the computational approach to plasma physical problems, in the laboratory, in the solar system, and in far-away astrophysical objects.

Preceding these most recent additions, earlier this year Professor Charles Smith from the Bartol Research Institute at the University of Delaware accepted a Research Professorship in the SSC, and there was also the appointment of our three new colleagues from Chicago

(*see the page 1 story*). That makes seven new faculty and perhaps ten post-doctoral fellows, and this is just in the Space Science Center! The

Physics Department is sharing our pride since these are all joint appointments.

We have also grown in our centers that investigate things closer to home. In the Earth Sciences, Professor James E. Bauer from the School of Marine Science at the College of William and Mary has accepted a joint position of Professor within the Ocean Process Analysis Laboratory (OPAL) in EOS and the Department of Earth Sciences. Earlier in the year Senior Research Scientist Mark Dowell (OPAL) was promoted to Research Assistant Professor and Prof. Rob Griffin from Duke University accepted a joint appointment as Assistant Professor in our Climate Change Research Center (CCRC). Since Rob arrived from southern climes in January 2003, he is particularly pleased (relieved) to see the seasonal turning.

Ten new faculty in less than ten months. With this renewal, we again express our commitment to understanding the fundamental processes that control the universe and shape life on Earth and our dedication to creating an intellectual and scientific environment that advances visionary scholarship and leadership in the Earth and space sciences. 



More Than the Sum of Their Parts continued from page 1


Lopate is now the Principle Investigator for Climax as well as the IMP-8 satellite.

McKibben is the PI for the Cosmic and Solar Particle Investigation (COSPIN) instrument aboard the Ulysses spacecraft. Launched in October of 1990 to explore the uncharted regions of the Sun's north and south poles, Ulysses is still "bleeping measurements relentlessly across the void." However, the success of the Advanced Composition Explorer (ACE) satellite, launched in 1997, muscled into a portion of Ulysses' territory. "ACE ate our lunch," McKibben says referring to ACE's ability to measure the isotopic composition of galactic cosmic rays much more rapidly than the COSPIN instrument on Ulysses. The advance was no small thanks to Eberhard Moebius, UNH's lead investigator on the ACE mission. Moebius calls the addition of the Chicago group "a coup." Now occupying the same physical space, McKibben says he and his colleagues are looking forward to increased collaboration with the UNH ACE investigators "to tease out the similarities and differences between observations in the ecliptic with ACE and observations over the Sun's poles with Ulysses."

Although the three do indeed carry on Simpson's legacy, Lopate points out that, perhaps more importantly, they have inherited the principles that guided Simpson's own work: following the "interesting" science, orienting one's work towards areas most likely to produce significant discovery, and trying to be in the forefront with innovative instrumentation to address the scientific goals. To that end, each have initiatives underway to develop improved instrumentation for cosmic ray studies that are smaller and more powerful than current instruments. This will allow comprehensive studies of radiation environments in space with relatively simple

instrumentation suitable for even small and inexpensive spacecraft - an approach, it should be noted, that many scientists and researchers here at EOS are currently pursuing.

One of those instruments is Connell's Angle Detecting Inclined Sensors (ADIS) system - a system so simple in its design that it could be the poster child for the "KISS" principle cherished by some space scientists. "Keep It Simple, Stupid," Connell explains, adding, "Simplicity is an enormous virtue in space flight" where a premium is placed on instruments that are light, require less power and electronics, and provide more bang for the

buck. The idea for ADIS came to Connell, a naval history buff, while he was out walking one day thinking about battleships. Specifically, he was thinking about the "inclined armor belts" of post-World War I battleships and how this same design would apply to determining the angle of incidence of energetic charged particles. It was an interesting thought process to be sure, and one that McKibben and Lopate understand and complement. Having worked together for all these years, the three had no desire to go separate ways when John Simpson passed away because, says Connell, "We are more than the sum of our individual talents." - DS 


What Goes up Must Come Down

Balloons are on the horizon for two key EOS projects - AIRMAP and GroundWinds. And, to get the inflatables up in the air to do their work, existing instrumentation must be downsized. For AIRMAP, the instruments for analyzing aerosols and ozone at the Thompson Farm station must be re-engineered to fit on a balloon. Likewise, the instruments at the GroundWinds facility at the Mauna Loa Observatory in Hawaii will have to be scaled down to a size appropriate for a balloon gondola. In both cases, shrinking the instrumentation is no small feat, but the balloon-based approach will provide advantages over current research strategies. Both AIRMAP and GroundWinds are aimed at improving forecasting capabilities.

The AIRMAP balloon will allow for the vertical air profiling that is not possible using airplanes or satellites. This "targeted wind sensing" will employ mini chemical sensors dropped from the balloon to "fill in the data void" that satellites cannot provide, according to Bob Talbot, the AIRMAP Principle Investigator. The balloon launch will be an integral part of AIRMAP's second major campaign set for 2004 and the lead U.S. component of an international, interagency effort called The Observing System Research and Predictability Experiment or THORPEX. While China, Japan, the United Kingdom and other nations have been conducting proof-of-concept balloon programs, the U.S. has lagged behind. Talbot says there is a "strong desire" for the U.S. to show its commitment to the international THORPEX agenda. The upcoming balloon work will launch that commitment.

Although a new, autonomous platform will ultimately be developed for the THORPEX effort, the initial test during the 2004 AIRMAP

campaign will use an existing, advanced balloon technology - the "Smart Balloon" developed by Steve Businger of the University of Hawaii. The Smart Balloon has the ability to adjust its altitude within a column of air and can withstand the rigors of violent weather. GroundWinds is also working with Businger and his balloon technology.

For GroundWinds, which has as its ultimate goal a satellite-based instrument, launching a balloon to a height of 100,000 feet will provide near-space conditions. This will not only aid in predicting how the instrumentation will behave above 96 percent of the Earth's atmosphere but will also for the first time allow the laser used in the system to be shot down toward the ground rather than upwards through the atmosphere. "Working from the balloon will be more reflective of the 'real' world, the space world," says GroundWinds Principle Investigator Berrien Moore. The GroundWinds balloon launch is targeted for the fall of 2005. - DS 




Opening New Doors

Troy Hartley, Executive Director of the Northeast Consortium, says the most frustrating thing for commercial fishermen is when their knowledge of fish and the ocean seems to be ignored by managers and researchers. "It frustrates the hell out of them. With 20 and 30 years on the water, they've observed patterns - they just haven't used the terms or tools recognized by the scientific community," Hartley says. The key to overcoming this impasse is to bring the parties together for face-to-face discussions and the exchange of ideas. "We already see fishermen here at the table, sitting with scientists. This is a more comfortable space for that, and that's important."

Established in 1999 with the support of NH's Senator Judd Gregg, the Northeast Consortium is led by UNH in partnership with the University of Maine, Massachusetts Institute of Technology, and Woods Hole Oceanographic Institution. More than 70 cooperative research projects involving more than 250 commercial fishermen are currently in the water.

The Northeast Consortium shares its new offices with the NH Sea Grant Management office, which provides on-campus access for researchers, staff, and students, and complements NH Sea

Grant Extension offices at Kingman Farm. A NH Sea Grant communications office completes the suite in the atrium.

Together, the Northeast Consortium and NH Sea Grant help showcase UNH's research and outreach activities. The EOS home base is attractive both for its visibility in the atrium and the new opportunities it offers for programmatic integration. - DS 



Bookmark this COOA Web Site Redesigned

The web site for the UNH Center of Excellence in Coastal Ocean Observation and Analysis (COOA) has a new look and feel. The revamped site provides a lean-looking homepage and a menu of navigational links to additional information.

Still under development at press time, look for it soon at <http://www.coaa.unh.edu>.



Where the Buffalo Roam and the Snowmobilers Play


At Yellowstone National Park in Wyoming these days, the skies are cloudy and there are some discouraging words – among them, toluene, benzene, and carbon monoxide. Classified under the Clean Air Act as a “Class 1 Airshed,” Yellowstone’s “pristine” air is more akin to that above a Los Angeles freeway. And while cars and other vehicles outnumber snowmobiles by 16-to-1 in the park, studies have shown that snowmobiles – some 55,000 of them per year – are responsible for the bulk of the pollution.

Analytical and atmospheric chemist Barkley Sive of the Climate Change Research Center (CCRC) and his team of researchers are currently conducting the most comprehensive study thus far done on Yellowstone’s air quality. “We’ve got the entire park,” Sive says. The study, funded in part by the National Park Service, is analyzing the impact on air quality from snowmobile emissions for the whole of the Yellowstone basin. What Sive and his colleagues (including Eric Scheuer, Kevan Carpenter, and Yong Zhou of UNH) have found is that even in well-mixed air far from the entrance gates and snowmobile trails, Yellowstone’s air is rife with toxins. For example, they found carbon monoxide levels of 30 to 40 parts per million (ppm) at the West Entrance (the EPA standard for exposure is 9 ppm over an 8-hour period), nitrogen oxide (NO) at some 2.5 ppb (100 parts per trillion or less is what would be expected in a remote area), and benzene and toluene levels reaching 100s of ppb in some areas but approximately 1 ppb in the remote regions. “The kicker to me was the hourly lakeside samples. You’re in the middle of nowhere but you’re seeing huge enhancements,” Sive says.

Isolated, but hardly alone. The researchers found themselves sampling in a battlefield. While they were there, protesters clad in respirators and brandishing signs proclaiming “The public’s will was Bushwhacked” and “Seniors For Silence” stood on the sidelines as a steady stream of 2-stroke snowmobiles flooded into the park leaving in their wake a blue-gray fog. The Bush administration overturned the ban on snowmobiles established during the Clinton administration. Sive’s study will be used by the park service as it considers policy changes.

Sive brought his Yellowstone research with him when he left Central Michigan University (CMU) to join the EOS faculty last August. He also brought graduate student Zhou and 70 state-of-the-art canisters used to collect air samples. However, to do the ambitious air study, he needed a total of 250 “cans,” each of which cost \$500. So Sive called upon his former colleagues, including F. Sherwood Rowland and Donald R. Blake, at the University of California, Irvine, where Sive took his masters and doctorate degrees. Rowland, a 1995 Nobel Laureate in chemistry was one of Sive’s undergraduate and graduate advisors.

“There are only a couple of research groups in the world that have the capacity to do this,” Sive says. That capacity is based not only on being able to collect a quarter of a million dollars worth of the pollution but also on the labor-intensive effort it takes to pull the numbers out of thin air and assure the very highest levels of quality control.

“The park service is already planning on changing their winter use policy again,” Sive says. “We need to get our final report to them by July 30 so that they can use our numbers to justify what they want to do and what direction they want to go in.” -DS 



Barkley Sive and his research team analyzed air samples from Yellowstone Park and found “air toxins on the order of urban levels” for this “pristine” environment.

Faculty/Staff News

Earth System Science

John Aber spoke at the National Press Club in Washington, D.C. March 25 in support of establishing a system of environmental monitoring stations dubbed the National Environmental Observatory Network or NEON. This “network of networks” would be connected by high-speed data links to allow disparate research facilities to function as one, integrated research tool. While advances in scientific observation and measurement have provided a wealth of solid information, much remains to be discovered about how ecosystems interact and change. NEON could, quite literally, help provide the missing link.

Mike Prentice reports that the CCRC has started a collaborative with the US Geological Survey to design a prototype Geospatial Information System (GIS) for the National Science Foundation Office of Polar Programs-Antarctica that will unify, using database and visualization technology on the Internet, polar-earth science information served from a variety of websites. Among other things, the project will fund students working at EOS this summer, with the USGS footing the bill.

Karen Von Damm was asked to join the NSF Advisory Committee for Geosciences. The committee provides guidance and input on how the Directorate of Geosciences (GEO) mission, programs, and goals can best serve the scientific community, and how the GEO can promote quality geoscience education at all levels and increase diversity of the geosciences workforce.

An article by **Scott Ollinger** entitled “Forest Ecosystems” was published in February as part of *Nature* magazine’s Encyclopedia of Life Sciences (ELS). The article was an invited contribution, based on the curriculum from his Forest Ecology course. ELS is intended to serve as a reference for students, educators and scientists and is the largest work ever published in the biological sciences. Also, the April issue of

the journal *Bioscience* presented findings from a new study on nitrogen pollution done by scientists affiliated with the Hubbard Brook Research Foundation (HBRF) in Hanover, NH, including John Aber and Ollinger.

Space Science

Eberhard Moebius reports that musician Marty Quinn of Lee, N.H. has just completed another piece of music using data gathered by satellites carrying UNH-made instruments. “Rock Around the Bow Shock” is the new “sonification” and was created using data from the four Cluster satellites named, appropriately, Rumba, Samba, Salsa, and Tango. This “symphony,” which is reminiscent of the works of Phillip Glass but with a more metallic, mechanized edge, joins previous works created by Quinn in collaboration with UNH/EOS scientists, including “Solar Songs” and “The Climate Symphony.” Moebius says turning the “squiggly” spectrographic lines of Cluster data into something audible and more tangible is part of the overall effort to make scientific discovery and information more meaningful to a larger audience.

In March, **Vania Jordanova** was awarded a grant from the NASA “Living with a Star” program for a period of three years. The research project, entitled “Geoeffectiveness of Solar Cycle 23 from a Physics-Based Storm Model” will investigate the causes for particle acceleration and loss during geomagnetic storms and how they relate to interplanetary parameters (magnetic field, solar wind velocity, etc.).

Toni Galvin reports that the Space Science Center was “pretty much evacuated” during the week of March 17 as she, **Eberhard Moebius, Harald Kucharek, Lynn Kistler, Mark Popecki, Charlie Farrugia, Mike Vosbury, Steve Longworth, Matthias Boehm, Steve Turco**, and Ph.D. candidate **Lukas Saul** all attended a STEREO/PLASTIC team meeting in Bern and Schwarzsee, Switzerland. Moebius and Kucharek also attended a meeting at the International Space Science Institute on this trip.

Student News

Katherine Singer, a senior undergraduate in the Department of Physics, went to the University of Bern during the week of March 17 to test the microchannel plate detectors for PLASTIC. She was part of the SSC crowd that left en masse for Switzerland that week.



Katherine Singer

"Interstellar Pickup Ion Flux Variations" was the title of **Lukas Saul's** presentation to the SOHO/CELIAS meeting in Schwarzssee, Switzerland.

Rachel Gallant, Sea Grant's current Knauss Fellow and a student of Karen Von Damm of EOS and Earth Sciences, is spending the year working in Washington, D.C., at the office of Rep. Thomas Allen (D-ME). She recently attended the official NOAA ceremony honoring the 2003 fellows and received her NOAA pin from Retired Navy Vice Admiral Conrad C. Lautenbacher, Undersecretary of Commerce for Oceans and Atmosphere and NOAA Administrator.

Manoel Cardoso talked about his work on fire modeling for the 9th Brazilian Remote Sensing Symposium in Belo Horizonte, Brazil in early April. His presentation also included preliminary results from two methods of interpreting remote sensing fire data that he is developing as part of his Ph.D. research.

Research and Discover Summer Interns



Janet Campbell, Catherine Denoncourt, and George Hurtt review GSFC information.


This summer marks the second year of the Research & Discover program and a full slate of student interns are coming to UNH and departing for NASA's Goddard Space Flight Center (GSFC) in Maryland. The program is a joint educational initiative between UNH and NASA to recruit outstanding undergraduate students into research careers in Earth science and remote sensing. In most cases, this is their first experience doing scientific work at a large, top-flight graduate research institution. This year's students will be working on topics ranging from oceanography to terrestrial ecosystems. They will be using state-of-the-art tools that include satellites, computer models, and advanced field methods. Their work will add to the body of knowledge about the functioning of the Earth system.

"We're trying to launch these outstanding students into Earth science and then stay with them," says George Hurtt (Faculty Coordinator). In other words, the EOS & GSFC student advisors mentor the students through two internships and, it is hoped, right into graduate studies in their chosen field. "We get outstanding students and we hope some of them will seek to come here for graduate studies," says Hurtt. He adds, "We also hope to foster increased collaboration between our faculty and NASA staff scientists" because of the program. Hurtt himself has recently submitted a grant proposal with a new colleague at GSFC whom he met through the program.

The list of 2003 UNH/EOS summer interns, the institution they're from, their UNH advisor(s), and their field of study is as follows:

- Erin Atkinson**, University of Chicago, Mark Dowell, Oceanography;
- Erica Darken**, Bryn Mawr College, Janet Campbell, Oceanography;
- Lorraine Beane**, Colby College, Charles Vorosmarty, Hydrology;
- Sarah Silverberg**, University of Vermont, Scott Ollinger, Terrestrial ecosystems.

The summer interns at NASA-GSFC are (with UNH/NASA advisor):

- Bill Sacks**, Williams College, Rob Braswell/Jon Ranson, Terrestrial ecosystems;
- Tom Daigle**, Union College, Cameron Wake/Chris Shuman, Climate change;
- Catherine Denoncourt**, UNH, Jack Dibb/Robert Bindschadler, Climate change;
- Heather Bain**, Holy Cross, George Hurtt/Jeff Morisette, Terrestrial ecosystems. 


Student Profile

For Sam Miller, Getting a Ph.D. Has Been a (sea) Breeze

He will soon be Dr. Sam Miller but his career beginnings might have suggested a less ambitious future. He dropped out of school at age 16, bummed around for a year, and then joined the Air Force to work as a gas pump fixer. "I worked in a shop with three other guys and we sort of waded around in jet fuel all day long fixing blown gaskets and worn-out valves. It stunk," says Miller with quick smile. Stunk, yes, but it propelled him into the opportunity of a lifetime and, for the past two decades he never looked back. The Air Force guaranteed job cross training and when a position opened up for a weatherman, Miller jumped at it. "I didn't know a thing about it but it sure beat fixing gas pumps," he says adding, "and here it is, 22 years later, and I'm still at it." Miller has been working part-time as a meteorologist at the Pease International Tradeport while pursuing his Ph.D. He's had a lot of practice at this dual tasking.

During the years he was a full-time military "weather observer" in Turkey, California, New York, and Maine, he perfected the observer's art of making the most of your time. An observer looks out the window, records the conditions, checks instrument gauges, assembles the data into a "metar," and ships it off. This all takes about one minute. It's done once an hour. There is a lot of downtime to the job. Says Miller, "As is true with lots of

weather observers, you use the opportunity to do something constructive. I used eight and a half years worth of those 59 minutes to get my bachelor's and master's degrees."

For his doctorate, Miller has been studying the behavior and structure of the sea breeze between Newburyport, MA and just north of Portland, ME. A doctorate in the sea breeze? You bet. This seemingly simple phenomenon is in fact a complex, multi-part physical system with significant climatic influences – but it's predictable. Says Miller, "I've found that you can use measurements in meso-alpha or regional scale to determine whether or not the sea breeze is going to occur, how strong the front will be, how far inland it will penetrate, when it will first touch land, and what the shape of the gravity current will be at its most mature point." He adds, "AIRMAP is interested in eventually making much better predictions of air quality and it has been shown that the sea breeze is a significant player in the air quality and the climate of the coastal region." - DS 



Water World

Charles Vörösmarty's world is awash in aquatic acronyms and he himself has added another to the alphabet soup of water-related organizations. With GWSP, for Global Water Systems Project (of the Global Environmental Change Programmes), joining the ranks, Vörösmarty says, "It's a testament to the importance of this particular resource." It is also, he points out, one reason why an effort like GWSP is needed to help focus the disparate efforts of this jumble of organizations who may share the same concerns about water but don't necessarily talk the same talk. And this presents impediments.

"Over the last few years we've tried to move forward on a consolidated, global change program focused on water, but we've struggled a bit to find our niche. The reason it's been so difficult is that the world of water is one in which there is a plethora of organizations with each having their unique perspective on things," he says.

The GWSP was mapped out by GEC Programmes representatives during the Amsterdam Open Science Conference in July 2001. This conference of several hundred global change scientists produced the Amsterdam Declaration, which, with respect to global water research, states, in part:

- The global water system behaves as a unified, self-regulating system composed of physical, chemical, biological, and human components;
- Human activities are significantly influencing the global water system in many ways in addition to greenhouse gas emission and climate change;
- Global change and the hydrosphere cannot be understood in terms of simple cause-effect relations.

From Vörösmarty's perspective, the biggest immediate challenge on this front is to create an appropriate nomenclature, a lexicon of terminology and methods that can be shared by the scientific community. "We each speak a different language, we each have a different scope of analysis," Vörösmarty says. While the physics people and the biogeochemical people might be close (talk the same language, publish in the same journals) and have a fully global perspective, bridging the gap between the socioeconomic and


biology folks and those with an established global perspective will take some doing. "We don't have a history of working together as a community."

And this cuts to the heart of the matter because GWSP is dedicated to new, interdisciplinary and global-scale research on water issues from a holistic perspective, and this will require a meeting of minds. At its heart, the GWSP is a vehicle for catalyzing interdisciplinary understanding of the role of water in the Earth system and of humans in the global water system.

Says Vörösmarty, "When we talk about global change it's important to remember that it's not just climate change, it's land cover change and how that changes the water cycle and changes the movement of sediment through the landscape. It's water engineering like big reservoir systems" and the cascade of related effects brought about by human activities.

The GWSP casts its work around three core questions which, it is asserted, must be resolved before coherent strategies for managing the global water system can be designed: What are the relative magnitudes of global-scale changes in the Global Water System that are attributable to changing human activities? What are the main mechanisms by which human activities are affecting the Global Water System? To what extent is the Global Water System (from the perspective of its living and social components) resilient to global change?

To help answer these questions, GWSP will foster and promote an open dialogue with the water science community. To that end, Vörösmarty reports, there will be an Open Science Conference entitled "Global Water Systems: Toward a Hydrological Mauna Loa Curve of Human Impact" this coming October in Portsmouth. Convened by GWSP, the International Association of Hydrological Sciences (IAHS) and others, the conference will bring together some 100 global change scientists.

"This issue now is one that goes well beyond the climate change question. It's a multi-headed beast and in order to tackle the question in a coherent manner, we ought to start thinking about ways in which we can integrate the physical, biogeochemical, biological, and socioeconomic systems." Vörösmarty adds, "The whole point is that humans are now part of the system and we ought to begin to understand that the impact of humans is quite important in this realm." - DS 



Space Grant News: Of Heaven and Earth

Last January, the NH Space Grant Consortium realized its goal of combining NASA's sky-high reach with the down-to-earth services of NH Cooperative Extension by creating the position of Geospatial Technologies Extension Specialist. In doing so, says David Bartlett, Director of the NH Space Grant Consortium, "Space Grant brings space-based technologies to a wider constituency." This will, in turn, provide for better natural resources planning and conservation efforts across the state as these technologies advance activities ranging from forest resource inventory and management, planning for open space, wildlife habitat assessments, to community master planning. The three core technologies used are Geographic Information Systems (GIS), Global Positioning Systems (GPS), and remote sensing. GPS and remote sensing can provide sources of spatial data; GIS is a tool to map, manage, integrate, query, and analyze the data.

Anne Deely, the new specialist, is based at Cooperative Extension in Manchester. "One of my hopes for this position is to expand access to GIS resources across the state. Manchester is more central to users throughout the state, and thanks to our mobile laptop lab, we can provide training on-site wherever it is needed," Deely says. Deely worked for three years with Fay Rubin of CSRC as a GIS analyst on a variety of projects, including coordinating the development of a statewide land cover assessment. Rubin says Deely's work will help keep pace with current demand. Extension Specialist Nancy Lambert has developed and conducted GIS and GPS training throughout the state for years, but the programs have been so popular that there are frequently waiting lists of potential students. In her current position, Deely helps keep up with the growing demand for these programs, and, importantly, serves as a follow-up resource for people attempting to apply these tools in their individual decision-making environments.

In addition to Space Grant, the NH Charitable Foundation is sponsoring the position. - DS 



Remotely sensed images like this one of Great Bay provide a growing body of data for GIS and are used for natural resources planning and conservation efforts across the state.

Sea Grant News

For both fishermen and researchers, accurate and timely oceanographic and weather information is critical to their jobs.

To address the need for this information, NH Sea Grant helped launch FleetLink, a partnership among academic, government and industry representatives to outfit commercial fishing vessels as ocean observing platforms. With funding from the National Ocean Partnership Program (NOPP), FleetLink developed a customizable sensor system to mount aboard fishing vessels. The system autonomously collects and transmits data hourly via satellite to shore-based stations and then integrates that data into a system accessible to both researchers and fishermen through the Internet.

“In many ways, commercial fishing vessels are the best platform for coastal ocean observing,” says Ann Bucklin, NH Sea Grant Director and PI for the FleetLink project. “They’re inexpensive, and you get wonderful time-space coverage and

flexible, strategic sampling. In addition, the person behind the wheel is a knowledgeable and educated guide for the phenomenon that you might be studying.”


Fishermen also benefit from the system. In addition to providing access to a wide range of pertinent data, the system software also includes an interface for recording catch data and sending confidential email messages to local fishing cooperatives and auctions.

Recently the FleetLink project entered a new phase: development of a definitive model of the sensor system for commercial production. With funding from the new Center of Excellence in Coastal Ocean Observation and Analysis (COOA) at EOS, headed by Director and EOS Research Professor Janet Campbell, Clearwater Instrumentation, Inc. (Watertown, MA) will produce FleetLink sensor systems for purchase by researchers to install on fishing vessels and other ships.



FleetLink partners (left to right in photo) Gary Williams, Ann Bucklin, Bob Groman, Cliff Goudey, and Craig Pendleton meet on Craig's boat, the F/V Susan & Caitlyn, docked in Portland Harbor.

NH Sea Grant will continue its involvement in the project by providing outreach to the fishing community and helping to identify customers.

–Kathleen Schmitt, Sea Grant 


<http://www.seagrants.unh.edu>

Twelve Good Reasons Why EOS Works

Referring to what she and her Business Service Center (BSC) cohorts – all twelve of them– do for EOS, Jeanne Bartlett says in her characteristic deadpan delivery, “We keep the auditors at bay.” Take, for instance, the time Bartlett, Susan Roy, Pat Stevenson, and Donna Thibault of the Space Science Center BSC defended an audit done on an 11-year, \$16 million project. “Grueling” might best describe the task, which took four months, many late nights, and hours of retrieving obscure documents to satisfy the gimlet-eyed auditors. Bartlett and crew got the job done and got kudos for the flawless report.

But on a more mundane level, the day to day business of what all the people in the separate BSCs do – Bartlett, Stevenson, Roy and Thibault of the SSC, Karen Bushold, Linda Tibbetts, Susan Sosa, and Gary Desjardins of CSRC, Cheryl Moore and Theresa Hamer of OPAL, Suki Easter and Belinda Camire of CCRC – is what keeps the four EOS centers ticking. Everything from ordering a box of pencils to developing the budget for a multi-million dollar grant falls under the bailiwick of the BSCs. So do the matters of payroll, travel, and compliance with federal regulations. In a

very real sense, the BSCs create the unfettered space in which EOS scientists and engineers can do their work.

The BSC “lifers” have been creating that space for a remarkable number of years. Karen Bushold, for example, has 22 years of experience in university research and administration, including 15 years at EOS, while Linda Tibbetts has 26 years at UNH under her belt. Bartlett and Stevenson weigh in with a combined 45 years at SSC while Roy’s UNH tenure is going on 20 years. Bartlett’s been at UNH since 1975, when typewriters ruled the office. There have been other big changes as Bushold points out. In 1987, there were 40 projects managed by (what would become) CCRC and CSRC. Today, there are over 200 projects for 29 principle investigators. Similarly, in 1987, SSC/OPAL had 25 projects and 10 faculty while today there are 83 projects and 32 faculty – numbers that will soon be increasing. - DS 

Pictured below, from left to right, Karen Bushold, Jeanne Bartlett, Donna Thibault, Belinda Camire, Susan Sosa, Cheryl Moore, Pat Stevenson, Sue Roy, Linda Tibbetts, Suki Easter, Theresa Hamer, and Gary Desjardins.





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CPR Training Draws Crowd

Morse Hall will soon sport an Automatic External Defibrillator (AED) thanks to a grant proposal written by Jim Connell of EOS and the Department of Physics and submitted to the University of New Hampshire Parent's Association. And, thanks to the Durham Fire Department, many people here in Morse will know just how to use the instrument should the need arise. Free CPR classes were conducted by DFD on April 2 and 18 and more training may occur due to interest. Paramedic Jim Lapolla and firefighter/EMTI Scott Campbell provided the training.

Connell was motivated to write the proposal because high voltage electrical equipment is an indispensable tool in the study of physics and one result of serious electrical shock is ventricular fibrillation. Use of an AED can return the human heart to its normal rhythm. AEDs were requested for both Morse Hall and DeMeritt Hall. The Parent's Association provided \$2,700 (or half of each unit), with EOS and Physics each kicking in the remainder of \$1,350. - DS



Pat Stevenson practices CPR with the new AED.

EOS Events

Astronaut Piers Sellers to Land at EOS June 27

NASA astronaut and good friend Piers J. Sellers, Ph.D., will be coming to EOS on Friday, June 27 to share highlights of his experiences in space and to present the International Geosphere-Biosphere Programme (IGBP) patch he carried with him on board the Space Shuttle Atlantis mission in October, 2002. NASA allows astronauts to "fly ten mementos" to present to select groups or organizations back on Earth. Sellers chose to recognize the work of IGBP. EOS Director, Berrien Moore, was chair of the IGBP Science Committee during the Atlantis mission.



Selected as an astronaut candidate by NASA in April 1996, Sellers completed his first flight on the Space Shuttle Atlantis (STS-112) mission October 7-18. During this International Space Station assembly mission, the crew delivered and helped install the third piece of the station's 11-piece Integrated Truss Structure. To outfit and activate the truss, Sellers performed three spacewalks and logged a total of 19 hours and 41 minutes of EVA. Sellers is assigned to the crew of STS-120, which is slated for launch in early 2004.

The presentation ceremony is tentatively set for 10 – 11:30 a.m. in the atrium of Morse Hall. Check the EOS web site for developing details. - DS

<http://eos.sr.unh.edu/About/Events>