



During visit to DRI, Congressman Jim Gibbons maps out next phase of a long, distinguished career

DECORATED COMBAT PILOT, GEOLOGIST, LEGISLATOR WANTS TO SAMPLE LIFE AS A SCIENTIST

It was Congressman Jim Gibbons' first visit to DRI, but you can bet it won't be his last. "I've been a geologist, a lawyer, an airline pilot, a military pilot, a Nevada legislator and now a congressman in Washington, D.C. But I know what I'm going to be when I come back to Nevada," Gibbons, R-Nev., told an overflow crowd of faculty and staff at a post-tour reception in the E. W. Stout Conference Center.

"I'm going to be a scientist for DRI because of all the fascinating places you get to go. To think that some of you are going to take a snowmobile tour across the frozen icecaps of Greenland," Gibbons joked.

During an April 16 tour of the Northern Nevada Science Center, Gibbons "suited up" for an up-close view of the Ice Core Lab clean room hosted by Dr. Joe McConnell, DRI associate research professor, and Trace Chemist Steve Lambert. McConnell showed the congressman ice core samples from Greenland that DRI analyses for minute amounts of chemicals, lead and other elements.

McConnell's team has developed a unique system using chemical and



Congressman Jim Gibbons, center, gets an up-close and personal tour of DRI's Ice Core Lab clean room. Dr. Joe McConnell, left, explains how he analyzes ice cores from Greenland as a cameraman from Reno's NBC-TV affiliate, KRNV, Channel 4, chronicles the event for the evening news. *(Photo by Ron Kalb)*

elemental tracers to help determine how ocean circulation systems affect ice sheets. Gibbons learned that McConnell was soon heading back to Greenland where he would cross wide swaths of frozen tundra in a snowmobile moving about 6 mph, towing a ground penetrating radar system able to take readings down to 100 meters.

Dr. Jim Thomas discussed DRI's work for the Lake Tahoe Clean Water Initiative and conducted a tour of the Water Analysis Laboratory. Dr. Richard French briefed the congressman and his staff on flash flood issues in Nevada.

Gibbons' visit also included a briefing at the Soils Lab on DRI's desert terrain projects that will help U.S. military pilots, armored vehicle operators and ground troops deal with extreme temperatures and arid lands. Spearheaded by the Center for Arid Lands Environmental Management, the so-called Integrated Desert Terrain Forecasting for Military Operations project is sponsored by the Army Research Office's Environmental Sciences Division.

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DRI's one-of-a-kind EcoCELL facility allows unique experiment

RESEARCHERS EXAMINE LITTLE PIECE OF BIG PRAIRIE FOR IMPACT OF CLIMATE CHANGES ON ECOSYSTEMS

Take twelve 11-ton intact "soil monoliths" from the Oklahoma prairie, warm half of them at 4 degrees Celsius above average Oklahoma temperatures for one year, then bring them back to average climatic conditions. Carefully maintain the other half at average conditions all the time, then observe how the warmed monoliths respond to the rise and fall in temperature for two more years. Report to the National Science Foundation and the international scientific community when finished.

Though greatly simplified, this is the recipe that DRI scientist Dr. John "Jay" Arnone has been following since mid-2001 in a novel experiment that takes advantage of DRI's unique, large-scale, advanced controlled environmental facility in Reno.

Arnone heads an international team investigating how grassland ecosystems respond to year-to-year variation in climate conditions. Many believe this variation is increasing and that extreme climatic conditions are becoming more frequent. Scientists from the University of Nevada, Reno, the University of Oklahoma and Germany's Max Planck Institute are also involved in the project.

"Grassland ecosystems cover about 20 percent of the Earth's land surface," Arnone says. "Because of their ecological significance for agriculture, wildlife and global carbon storage, they are among the most studied in the world, so we knew a lot about them going into this study."

"What we learn from studying how grassland ecosystems respond to climate variability, however, can be extrapolated directly to understanding other kinds of ecosystems."

The study's focus is on carbon, the basic building block of living organisms. Scientists analyze the movement of carbon through ecosystems as a way of evaluating critical processes, measuring the system's productivity and understanding how ecosystems respond to environmental changes. This carbon exchange, or flux, occurs primarily as carbon dioxide, CO₂, which is absorbed by plants for conversion into sugars and other carbohydrates through photosynthesis to create plant material. CO₂ is then released again back into the atmosphere by plants and soil microbial decomposers via their respiratory processes.

The concentration of CO₂ in the global atmosphere is increasing steadily due to the burning of fossil fuels, reversing millions of years of photosynthesis in a couple of hundred years. CO₂ is the primary culprit leading to the "greenhouse effect," a heat-trapping blanket around the planet. Many scientists believe this also leads to increasing climate variability, and that is believed to affect the movement of CO₂ in and out of terrestrial ecosystems. This is the subject of the 5-year study Arnone and his colleagues are currently conducting.



Global question, local prairie. Dr. Jay Arnone stands inside of one of the "control" EcoCELLs for the study of grassland ecosystem responses to global warming. Colleague Paul Verburg examines the prairie foliage in the background. *(Photo by John Doherty)*

Inset Left: Slow and steady... Inside an EcoCELL, a workman nudges the third of three 11-ton soil monoliths carefully into place in November 2001, in anticipation of beginning the grassland ecosystem study. *(Photo by John Doherty)*

With a \$3 million grant from the National Science Foundation, Arnone and his colleagues extracted the huge monoliths and trucked them from Oklahoma to DRI's Reno campus in the fall of 2001. Cranes lowered the monoliths through the roof of DRI's greenhouse into four environmentally controlled chambers called EcoCELLs, an acronym for Ecologically Controlled Enclosed Lysimeter Laboratories. For a little more than a year, the monoliths were kept at average Oklahoma temperatures and precipitation levels.

Sensors, monitors and scales track multiple data points of factors such as humidity, CO₂ and water vapor fluxes, air and soil temperature, soil moisture, soil nutrients and solar radiation, all recorded automatically every five minutes since the study began. Far more than 50 million data points had been recorded by this summer.

"People tend to focus on what they see plants doing aboveground, but in grasslands, two-thirds of the real action goes on underground," Arnone says. "With these chambers we can watch all of these processes basically in real time."

On February 11, 2003, Arnone directed his laboratory technicians to turn up the temperature controls in two of the four EcoCELL chambers by 4 degrees Celsius—about 7 degrees Fahrenheit—above the average day-to-day temperature in Oklahoma. The monoliths in the other two EcoCELLs continued at the normal Oklahoma temperature as experimental controls.

Back on the real prairie, collaborating University of Oklahoma scientists began conducting parallel studies using twenty 4-foot by 8-foot plots, keeping some at normal conditions, some warmed by suspended heating elements, some treated with extra water and some with extra heat and water.

The response in the treated EcoCELLs, Arnone says, was almost immediate. Soil microorganisms and plants began respiring—exhaling—a larger amount of carbon dioxide into the chambers' atmosphere. Spring growth also started several weeks earlier in the treatment EcoCELLs than in the control chambers. These responses were expected.

Also anticipated was a subsequent earlier drying out of the ecosystems in the treated chambers as both warmer temperatures and greater plant activity consumed available soil water in the spring, with the resulting drop in late summer growth.

What was not expected was the dramatic shift observed in the mix of species of the plant communities in the treated chambers. "The dominant prairie grass species, big bluestem, declined dramatically, and broadleaf forb species took off and did really well."

Last February 11, Arnone returned the temperatures in the two treatment chambers to average Oklahoma conditions. This began another crucial phase of the experiment: observing how carbon flux in grasslands ecosystems would recover after the simulation of an unusually warm year.

Although a lot of data is still to be collected and analyses are far from complete, some results from the beginning of the third year of the project are already apparent. For one thing, spring in the treatment chambers started later than in the control chambers even though temperatures were now at the same level. Arnone thinks this was a lingering effect of the depleted soil moisture occurring in the warm year, in itself a significant response.

The project's primary hypothesis was that the experimental ecosystems would lose CO₂ during anomalously warm years, and, indeed, the carbon losses in the two heat-treated EcoCELLs matched the levels projected in the experiment, Arnone says. But it didn't happen the way their projections, or prevailing scientific theory, would suggest.

"We thought the system's CO₂ loss would come from the stimulation of microorganisms in the soil by the warmer temperatures. Instead, we found that it was the result of a decline in CO₂ uptake by the plants.

"Results from the Oklahoma plots will tell us how much this response may be caused by water restrictions," Arnone says. The results from the EcoCELL experiment also raise some pointed questions about the ability of ecosystems to absorb more of the increase in atmospheric carbon as global climatic extremes become more frequent.

"We've got our work cut out to integrate all our results and figure out what they all mean," he says. "But this facility is the only place in the world where this experiment could have been conducted, where we could even ask these questions. The answers will help us better project ecosystem responses to global change into the future."

—John Doherty

DRI graduate research assistant wins Colin Warden award

DRI Graduate Research Assistant Guadalupe Paredes-Miranda has won the \$1,200 Colin Warden Memorial Award for her laboratory study examining the influence of air pollutants on the size of cloud droplets produced by airborne particles. Paredes-Miranda is a Ph.D. candidate in the University of Nevada, Reno, Atmospheric Sciences Program.

The Colin Warden Memorial Endowment makes an annual award to a graduate student at the University of Nevada's Reno or Las Vegas

campus based on a competitive research paper. Applicants must be involved with a DRI research project or have a DRI faculty member direct their graduate research.

Colin Warden was a Washoe Medical Center electrician and an ardent environmentalist who died in 1991. His family and friends established the endowment to promote environmental research by graduate students.

Water 2025: Looking Ahead for the Arid West

“I tell you, gentlemen,” warned western explorer John Wesley Powell in an 1893 address to the International Irrigation Congress, “you are piling up a heritage of conflict and litigation . . . for there is not sufficient water to supply the land.”

More than 100 years later, Powell’s words seem prophetic, as fast-paced growth in the western United States threatens to overwhelm limited resources, and city residents, farmers, fishermen, Native Americans, recreationists and the environment itself all vie for the same finite supply of precious water.

Avoiding and mitigating water-driven clashes, and developing strategies to deal with the arid West’s imminent, and in many cases current, water crises, is the goal of a new initiative of the U.S. Department of the Interior known as Water 2025. And with a long track record of examining and finding solutions to just such crises in Nevada, DRI has been recruited to help develop a more forward-looking approach to water issues in the region.

“This really came about for us because Senator Harry Reid saw an opportunity for DRI to work with the Bureau of Reclamation on Water 2025,” explains Dr. John Tracy, Executive Director of DRI’s Center for Watersheds and Environmental Sustainability, “and because of his faith in DRI. We’ve done good work in the past addressing water conflicts on the Walker River and the Truckee, and conflict resolution is the whole purpose of this initiative.”



Sen. Reid, D-Nev., sees conservation as essential for the state. “We need to make sure we’re using our water supply as efficiently as possible so we can continue to meet the demands of Nevada’s growing population and its growing economy,” Reid says. “We need to focus both on specific ways to conserve more water right now, and on long-term, innovative ideas for the future. That’s why I’m glad to help get funding for the Desert Research Institute. They’re doing groundbreaking work on these issues, and their efforts will help us weather the drought.”

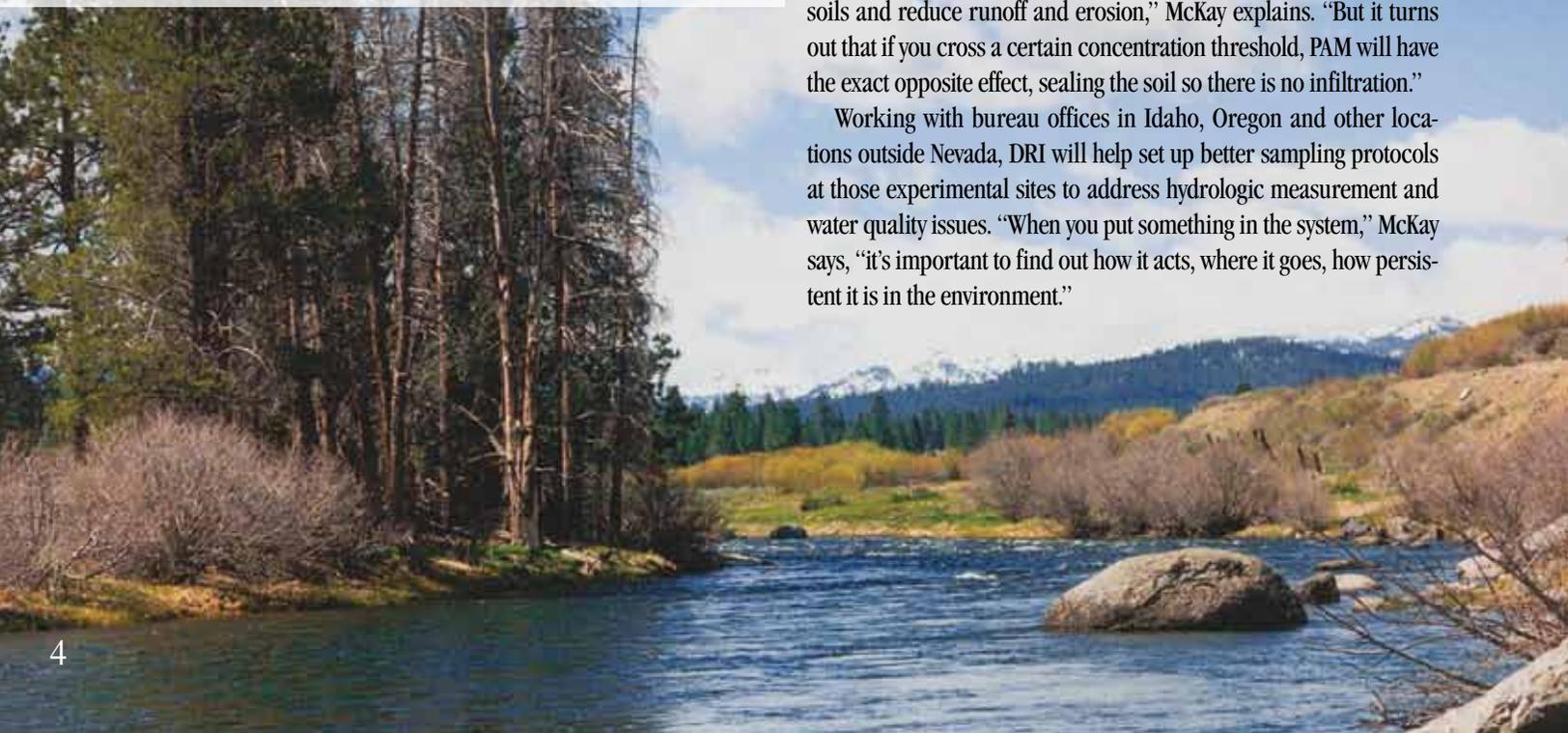
One way to stretch the current water supply is to prevent consumptive losses: water wasted or lost during transport or use. “For instance,” Project Manager Alan McKay explains, “the bureau manages a lot of unlined irrigation canals dug in natural earth and so they leak, or lose water to the ground. As there is more and more competition for this limited resource, they’d like to increase the efficiency of those canals that transport water.”

To this end, the bureau has several pilot projects in the western United States to test the effectiveness of the chemical Polyacrylamide, or PAM, in sealing canals and preventing seepage. “Polyacrylamide has traditionally been used in agriculture to enhance infiltration in soils and reduce runoff and erosion,” McKay explains. “But it turns out that if you cross a certain concentration threshold, PAM will have the exact opposite effect, sealing the soil so there is no infiltration.”

Working with bureau offices in Idaho, Oregon and other locations outside Nevada, DRI will help set up better sampling protocols at those experimental sites to address hydrologic measurement and water quality issues. “When you put something in the system,” McKay says, “it’s important to find out how it acts, where it goes, how persistent it is in the environment.”

The 32 mile-long Truckee canal connects the Truckee and Carson river systems and supports important agricultural areas. The canal was completed in 1905 as part of the Newlands Reclamation Project.

Below: The Truckee’s upper basin runs through California. Here it wends its way through some beautiful Sierra scenery. *(Photo by Laurel Saito)*



In the southwest, DRI will be working on the Colorado River with bureau researchers in Boulder City, Nev.

In northern Nevada, work will focus on the Truckee and Carson rivers—two little waterways with the big job of sustaining growing communities, flourishing agriculture districts and important fisheries. Researchers will look at irrigation techniques along the 32-mile-long Truckee canal, which diverts water to the Carson River, and supports development and agriculture in the Lahontan Valley.

Under scrutiny will be the system of “check dams” along the canal, used to control flow and aid in withdrawing water. “We’ll be trying to understand the relationship between particular check dams,” McKay explains, “to improve the efficiency of their operation.”

But beyond the important step of lessening waste, Water 2025 also aims to reduce the inherent uncertainty of predicting the availability of water resources—from year to year, and in the long-term. Of particular interest to the bureau is gaining a better understanding and an improved predictive capability for the Carson River. The Carson River feeds the Lahontan reservoir, with augmentation from Truckee River water that reaches it via the Truckee canal.

Tracy explains that the reclamation bureau has to decide “way in advance” how much water to divert from the Truckee to maintain desired levels at Lahontan. “We want to give them a better tool, an effective



Mature cottonwoods hug the banks in the Truckee River’s lower basin. This unassuming waterway must support the ever-growing needs of northern Nevada communities, fisheries, agriculture, recreation and wildlife habitats.

(Photo by Mary Patterson)

computer model, for predicting what flows will be and to help with that decision.”

And key to good water decisions, Tracy says, is a better understanding of the water system as a whole—both above and below the surface.

“Years ago, people didn’t view surface and groundwater as a single connected resource. In a lot of situations they are.” Flood irrigation, for instance, may seem to use excessive water, but that water also recharges aquifers and drains to streams. To make good long-term decisions and avoid future conflicts, he says, it’s crucial to understand this kind of interconnectedness.

“Canal seepage recharges the town of Fernley’s aquifer, so while reducing seepage may always seem like a good idea at first, this is a situation where you would want to avoid it to protect the water supply,” Tracy says.

And as the West continues to boom, planners will be called upon more and more often to predict the future, deciding the best ways to sustain a happy population and a healthy economy.

“Urban growth, open space preservation, agriculture—all of these will impact the water dynamic differently,” Tracy says. “We can develop the analysis tools that will allow agencies to set up better water management strategies, even let them test virtual strategies to avoid potential problems and conflicts.”

That’s because westerners have better things to do than fight over water.

—*Jackie Allen*

Fred Gibson, Jr., Harvey Whittemore, David Loeb honored with President’s Medal

Longtime Nevada business leader Fred Gibson, Jr., of Las Vegas, and Harvey Whittemore and the late David Loeb, founders of Wingfield Springs’ Red Hawk Golf Club in Sparks, Nev., have received the Desert Research Institute’s President’s Medals for their outstanding support of the institute. The medals, awarded as part of the institute’s annual Nevada Medal awards ceremonies each spring, are presented by DRI as its highest civic acknowledgment in lieu of traditional honorary doctorates.

In presenting the award, DRI President Dr. Stephen G. Wells noted that Gibson, a founding trustee of the DRI Research Foundation in the 1980s and currently a foundation board member, has provided “extraordinary service” as an advisor to several DRI presidents and as a leading advocate for the institute in business and government circles. Gibson, who recently retired as chairman, president and CEO at American Pacific Corp., currently serves on the Nevada

Commission on Economic Development and as chairman of the State of Nevada Commission on Mineral Resources. He serves on numerous other public and civic boards in Nevada.

Wells also cited Red Hawk Golf Club’s “value-added” role in supporting the institute’s annual fund raising golf tournament “beyond the level expected in a client-customer relationship.” He said the development’s environmental ethic, symbolized by its recognition as Nevada’s first Audubon International Signature Sanctuary—one of only 35 in the world—reflected the leadership values of financial industry magnate Loeb and Nevada attorney and legislative lobbyist Whittemore. Whittemore, a shareholder in the statewide law firm of Lionel, Sawyer & Collins, capped his acceptance at the March 9 Nevada Medal awards dinner with a surprise \$25,000 donation to the DRI Research Foundation, in memory of Loeb.

Ethiopia struggles to balance economic needs with environment

PILOT AIR STUDY MAY HELP CLEAR AIR IN AFRICA'S OLDEST INDEPENDENT COUNTRY

Some anthropologists call it “the cradle of humankind,” birthplace of the planet’s first homo sapiens.

Legend holds its emperors descended from the union of King Solomon and the Queen of Sheba, while many believe the storied Ark of the Covenant containing the tablets of the Ten Commandments still resides there.

Today, its population of some 66 million is almost evenly divided between Christians and Muslims.

Ethiopia. Most scholars would be hard pressed to find a country with a richer, more diverse, more complex history and prouder culture than this oldest of all independent African nations.

At the same time, decades of political upheaval, border clashes, drought and famine have ravaged its land, making hardscrabble survival this developing country’s top priority.

With life expectancy just slightly above 41 years and basic needs such as food production, clean water, health care and infrastructure maintenance topping its to-do list, it’s safe to say air quality hasn’t been “Job One” in Ethiopia.

Each day buses, trucks and heavy equipment belch dark plumes of diesel exhaust as they rumble across the country’s marginal, often unpaved roadways, stirring up dust clouds further tinting the skies of cities and villages. At the same time, the majority of cars in Ethiopia are at least 15 years old, and most leave a smoky trail of pollution in their wake.

Industrial processes, heating fuel, refuse burning and livestock also contribute to the growing urban smog problems. And, it’s probably no coincidence that lung disease rates are on the rise and getting the attention of health officials.

Now, a team of scientists from DRI, the Environmental Protection Authority of Ethiopia, the Clark County (Nev.) Department of Air Quality and others, is helping to move cleaner air higher up the priority list in Addis Ababa, the country’s capital city.

Dr. Vicken “Vic” Etyemezian, assistant research professor in DRI’s Division of Atmospheric Sciences, spent three weeks last January launching an air quality pilot study.

“Currently, there’s not much information about air quality in Ethiopia,” Etyemezian says. “But this we know—exhaust from vehicles is a big contributor to air pollution in urban centers there due to the widespread use of uncontrolled gasoline and diesel engines.”

According to Etyemezian, the project aims to measure the levels of pollutants such as particulate matter, lead, sulfur dioxide, ozone, carbon monoxide and other hazardous toxins that have yet to be quantified.

During his three-week stay in Addis Ababa, Etyemezian set up two monitoring stations in the capital city—one at a fixed location and a second that was moved around the city to obtain spatial representation—to examine concentrations of particulate matter, or PM, carbon monoxide and various other pollutants.

Traffic jams are commonplace at the Mercato bus station in Addis Ababa, Ethiopia’s capital city. As in other parts of the world, gasoline and diesel engines are major contributors to air-quality problems in the country. *(Photo by Vic Etyemezian)*

Inset right: DRI Assistant Research Professor Dr. Vic Etyemezian, right, explains to George Nikolich the inner workings of a portable filter sampler used in Ethiopia to collect particulate matter, known as PM₁₀. A graduate from UNLV’s electrical engineering program, Nikolich is a newly hired instrument technologist at the Southern Nevada Science Center. *(Photo by Ron Kalb)*

Inset below right: Old meets new—A “recycled” truck tire makes a serviceable water trough for these donkeys in an Ethiopian village. *(Photo by Vic Etyemezian)*





Grey skies over Addis Ababa as seen from this hillside are a frequent occurrence in Ethiopia's capital city. The country's EPA hopes working with DRI can help improve air quality in the days to come. (Photo by Vic Etyemezian)

Inset: Reflecting its proud people, Ethiopia's bold flag features the Pan-African colors green, yellow and red. The yellow pentagram represents the sun, which one day may shine more clearly through blue skies thanks to Ethiopia's EPA.

Using equipment on loan from DRI, an Ethiopian science team continued to capture air samples for another six weeks. Preliminary data show, among other things, "diurnal variations" or time-of-day effects on air pollution levels. Some collected filter samples that require more sophisticated chemical characterization are currently undergoing analysis at DRI's Environmental Analysis Facility. Results from those analyses should be available by late summer.

Etyemezian says the pilot project could lead to longer-term air quality monitoring programs. The Ethiopian team includes several people from the country's Environmental Protection Authority, the United Nations Environment Programme, Addis Ababa University and U.S. EPA. Their ongoing efforts could help the Ethiopian EPA better understand the links between air pollution and health problems while laying the groundwork for setting and enforcing air quality standards in Addis Ababa, which is home to about 3 million people.

"Fortunately, Ethiopia completed its phase-out of leaded gasoline earlier this year," Etyemezian says. "They did this as part of a larger global effort—led by the United Nations and the World Bank—to discontinue the use of leaded gas, especially in Sub-Saharan Africa."

But "getting the lead out" is just a first step toward cleaner air. Surrounded by mountains on all sides, Addis Ababa's monsoonal climate makes the city prone to seasonal episodes of stagnant air. "These conditions make the city extremely vulnerable to air pollution problems, given the high levels of vehicle exhaust combined with unchecked burning for industrial purposes, trash removal and home-heating," Etyemezian says.

Launched with DRI seed funding from the Division of Atmospheric Sciences, the Center for Arid Lands Environmental Management and the office of the Vice President for Research, the project is also partly a global outreach for DRI. As an international goodwill gesture, the cost of much of the pilot project is being absorbed by DRI.

"Ethiopia is the tenth poorest country in the world, and as such, has limited resources for environmental monitoring and remediation. We hope we can help jumpstart their efforts to improve air quality by providing them with as much useful information as possible from this effort," Etyemezian says.

Dr. Ali Yimer, an air quality specialist with Clark County and former UNIV/DRI post-doctoral researcher, is also helping by volunteering his

time in supporting technical and logistical aspects of the project. Yimer, who has family in Ethiopia, first brought the need for this project to Etyemezian's attention after a visit to the country's EPA.

"We hope to see this become a long-term project in which Ethiopian doctoral students can study at DRI and take what they learn back to Africa," Yimer says. "In addition, we want to establish an ongoing exchange of ideas between DRI and Ethiopian scientists."

A similar study is also taking place in Conakry, the capital of the West African nation of Guinea. Scott Hedges, an embassy science fellow for the U.S. Department of State, is conducting a short-term ambient air-quality study of greater Conakry. Hedges hopes to recommend a long-term monitoring program for local authorities that will help assess air pollutant impacts there.

"We've been sharing ideas and refining our data-gathering techniques with Scott and the U.S. EPA. We have found a lot of similarities between their experience in Conakry and ours in Addis Ababa," Etyemezian says. "For example, similar to Addis Ababa, preliminary results from Conakry show that much of the airborne inhalable particulate matter is likely to originate from activities within the transportation sector."

DRI President Dr. Stephen G. Wells sees the Ethiopia project as part of a larger picture. "DRI has conducted environmental research in every state in the union and on every continent on Earth. Our air quality studies, for example, have taken us to Mexico City, Cairo and China—and now Ethiopia," Wells says. "It's no secret that air-quality problems and other threats to ecosystems are borderless global issues affecting us all. By advancing scientific knowledge and understanding of the Earth's environment, we're helping not just our world neighbors but ourselves as well."

Wells says he is committed to expanding DRI's international portfolio as part of the institute's vision of being the world's scientific leader in investigating the effects of human-induced environmental change and advancing environmental technologies.

And, if Etyemezian and his international colleagues can make their vision a reality, Ethiopia may some day be known as much for its clean air as for its rich cultural heritage.

— Ron Kalb

A view of Nevada's interests from the Rockies

DRI'S STORM PEAK LABORATORY IN COLORADO HAS STATEWIDE, NATIONAL, GLOBAL RESEARCH INTERESTS

Their T-shirts proclaim it “the home of the world’s best weather!”

But consider that the people wearing them are generally atmospheric scientists to whom “good” weather is a raging snowstorm atop a two-mile-high peak in the Rocky Mountains. From this perspective, “the world’s best weather” is the greatest asset among many that make DRI’s Storm Peak Laboratory, or SPL, in Steamboat Springs, Colo., an ideal location for research.

Dr. Randy Borys, the lab’s resident director, oversees a broad research program that brings scientists from DRI’s Nevada campuses as well as universities and research organizations across the country to the mountaintop laboratory in the small mountain community. Borys says they come to take advantage of the opportunity to conduct state-of-the-art, continuous observations right inside the clouds and storms that occur frequently at the 10,500 foot peak of Mt. Werner. He says the fact that visiting scientists may have to take one of the famous ski resort’s chairlifts to work, and ski down to the valley when they’re through, hasn’t been a deterrent.

“The Steamboat Springs Ski Resort has been a long and generous supporter of our research efforts on the mountain,” Borys points out. “Our staff and visitors get special Storm Peak Laboratory lift access passes and, in addition to our snowmobiles, their snowcats assist in bringing supplies and research equipment during our busy season, which is also the resort’s busy season. Logistically, we couldn’t operate without them.”

Borys, an associate research professor in DRI’s Division of Atmospheric Sciences, says there’s only a handful of labs with similar capabilities in the world. Only Storm Peak Lab offers the ability to observe atmospheric processes in air transported from every corner of the continental United States.

If the Rocky Mountain site seems geographically distant from DRI’s main campuses in Reno and Las Vegas, the research conducted there continues major themes reaching back to the beginning of the institute’s atmospheric research programs:

How, exactly, do clouds produce precipitation, and how is humanity influencing this process?

“If there’s a winter storm in Colorado, the lab is usually well inside the clouds,” Borys says. “The crest of ridge where SPL is located is at the climatological snowfall maximum, meaning the point in a storm where it snows the most and the ideal spot from which to observe the microphysics of cloud processes—how cloud droplets and ice crystals are forming, and how pollutants and natural particles are interacting with the cloud.

“Typically, we’ll get a substantial storm every five to seven days that will last from 24 to 48 hours. When there’s a sampling program underway, our work is non-stop as long as the storm lasts. No one gets much sleep.”

Borys conducted research at the forerunner to the current lab facility as a graduate student at Colorado State University. The lab was located near the present site in a small travel trailer packed with instrumentation. After joining DRI’s research faculty, Borys convinced the Institute to take over management of the facility in 1990. It was fully rebuilt with donations and DRI funding in 1995.

One major SPL research topic that brings the focus back home to Nevada concerns the impact of air pollution on snowfall. Recent studies by DRI scientists and others indicate that pollutants may cause a reduction in the water content of mountain winter snowfall by as much as a quarter.

In storm clouds, tiny naturally occurring aerosol particles known as cloud condensation nuclei—or CCN—form microscopic cloud droplets. These droplets may form ice crystals or add to existing ice crystals to form snowflakes.

Other droplets freeze on mountain surfaces to form rime ice.

Research by Borys and DRI colleague Dr. Douglas Lowenthal, supported by that of other scientists at DRI and elsewhere, has found that CCN resulting from air pollution aerosols appear to reduce the average diameter of these microscopic cloud water droplets and



Sometimes you're in the clouds ... Sometimes you're above them at the Storm Peak Laboratory. Lab Director Randy Borys refers to this condition as “undercast.” The picture was taken from the top of an adjacent Steamboat Springs ski lift. *(Photo by Randy Borys)*

increase their numbers. This has the effect of essentially tying up more of the available moisture in the cloud with less of it ending up on the ground than would occur in the absence of air pollution.

“We have analyzed many storms at SPL, some containing natural CCN and others influenced by CCN from pollutant sources— basically sulfates and nitrates—and there is a direct, unmistakable reduction of snow water content in the polluted storms.” The next step in the research, he says, is to replicate the studies in the Sierra Nevada.

On a topic with a broader scale, a group of scientists from Colorado and Colorado State universities and the National Oceanic and Atmospheric Administration gathered at SPL in April and May for a study of the global transport of aerosol particles, particularly Asian dust, to understand their influence on high altitude cirrus clouds. The objective of that research is to determine whether increasing atmospheric dust will increase the extent of high clouds and the amount of solar radiation being reflected back into space. Borys noted that lower lying storm clouds also become more reflective when pollutants reduce the size of cloud water droplets.

Other SPL research activities take advantage of the elevation to examine the levels of ultraviolet radiation at the site, taking into consideration the thinner atmosphere at that altitude and the added reflective properties of snow and clouds on radiation exposure. Those studies are led by DRI faculty member Dr. Melanie Wetzel and are supported by the U.S. Department of Agriculture. Another initiative

utilizes the facility for biological research topics, such as long distance transport of microbes, expanding the year-round use of SPL.

SPL also has a strong educational program. Through DRI’s association with the University of Nevada, Reno, Atmospheric Sciences Program, an intensive graduate course on mountain meteorology has students designing and conducting projects, complete with a formal research report. Last fall, Wetzel took a break from her SPL research to become director of that UNR graduate program, which draws its entire teaching faculty from the ranks of DRI’s scientists.

SPL is also used by atmospheric scientists and students from Colorado State University, City College of New York, the University of Wisconsin, Colorado Mountain College and the University of Wyoming, as well as middle school students from Steamboat Springs and other nearby towns. Dr. Ward Hindman, a professor from CCNY who has brought his classes to the lab for years, also recently donated \$10,000 to the lab for the purchase of a specially equipped snowmobile. The vehicle, being built to order, will facilitate the movement of equipment and people up and down the rugged terrain in the winter.

Borys says the lab’s outstanding location and onsite research facilities are in demand from numerous federal and university researchers, and there is an ambitious program for expanding the range of research topics. “Even though we are already at the top of the mountain, I think we can only continue to reach greater heights.”

—John Doherty



Sampling ‘world’s greatest weather.’ University of Wyoming’s Dr. William Stump collects cloud water during a winter 2003 storm to study the transport of bacteria in the atmosphere. *(Photo by Randy Borys)*

Inset left: A ‘bad weather day’ for research at Storm Peak Laboratory. Dr. Randy Borys, SPL director, prepares a snow-and-rain precipitation gauge on the lab’s top deck for the next storm. Behind him is a Forward Scattering Spectrometry Probe that measures the comparative sizes of cloud droplets in storms that pass over the lab. *(Photo by Tyler Arroyo, the Steamboat Pilot newspaper.)*

Inset below: High altitude UV radiation assessment. On the roof of Storm Peak Lab, Dr. Melanie Wetzel adjusts instrumentation that measures direct and diffuse levels of solar radiation in ultraviolet and visible wavelengths. *(Photo by Randy Borys)*



Helping the public understand the importance of DRI's environmental research during four decades

DIRECTOR OF PUBLIC INFORMATION JOHN DOHERTY RETIRES

Understanding one area of science is difficult enough—but try keeping tabs on the scientific research of 450 faculty and support staff spread among two campuses, three divisions and three centers.

Welcome to John Doherty's world. But he's not complaining one bit—nor has he for the last 29 years.

"The best part of my job has been coming to work everyday and playing with scientists," says Doherty, who retires this month. "Far and away the best part is the time I spend talking with our scientists and hearing about the new approaches they are employing to solve problems or advance their fields of science. After about 30 years, I still find myself forgetting to take notes as I get wholly consumed with the excitement of what they're trying to do."

Those who have taken a tour of DRI's Northern Nevada Science Center with Doherty can see it, and his excitement is infectious.

"We've never had much of a budget for communicating our message; we don't have a basketball team and we're such an odd duck of an organization when it comes to university campuses that the public does not intuitively understand our story. They may know us as the organization that does cloud seeding or as the group that does studies at the Nevada Test Site or works on Lake Tahoe or Truckee River water quality—but

they seldom have a clear, coherent idea of our true entrepreneurial, multidisciplinary nature," Doherty says.

"But when I have an audience that can't run away, I almost always experience a response of amazement from listeners after I get through explaining the types of things we're working on."

While one of DRI's strengths is its research on environmental climate change worldwide, Doherty has watched the institute's own environment change dramatically, beginning with the move from the University of Nevada's campus to the Dandini Research Park in 1977.

Then came the opening of the Southern Nevada Science Center in Las Vegas in 1991, followed by the opening of the Northern Nevada Science Center expansion in 1999 and the Frank H. Rogers Science and Technology Building in Las Vegas last year.

As DRI's environment evolved, so did Doherty's position. When he first joined DRI, his job was split evenly between being assistant to the president and public information officer. For about a year and a half, he was also the institute's affirmative action officer. By the mid-1980s, his role was dedicated to the public information officer position.

"This place is brand new practically every day," Doherty says upon reflecting on his career. Many times, he is the voice for the scientists



Recollections of working with John

"John and I have interacted on the public information aspects of cloud seeding for at least 10 years. He trained me well in conversing with the media, and hopefully I imparted as much to him on the scientific side. He has always been a great listener. When cloud seeding is involved, we both get our share of some of the stranger calls coming into DRI. Some of my favorite conversations with John started with, "You're not going to believe the call I got this morning ..." So, there's the humorous side, but there have also been some really serious issues where John's help was a tremendous benefit to me. Luckily he's departing in the summer, so I won't have to be asked, as he goes out the door, if I remembered to post the cloud seeding status on our Web page."

Arlen Huggins

Associate Research Scientist, Division of Atmospheric Sciences

"John was great to work with at the DRI. He was punctual with everything, responded directly to what was needed and, refreshingly, was always enthusiastic and eager about the people and work he represented. If abstract science is to come alive for ordinary people—and it should—then it needs promoters like John, whose excitement rubs off

so easily on the people they meet. But more than promoters, science needs people who can explain it in terms that average people can understand. And at this John was so wonderfully good that I was always both grateful and amazed. He would come into my editorial office and in half an hour—an hour

at most—would translate complex ideas into clear patterns that I could grasp, and that I could make the newspaper's readers grasp when I wrote about them.

Of course, it helped that John came from my professional world—we worked together as reporters back in the '70s—but not everyone with a newspaper background can successfully manage the transition to the straightforward clarity required of a good publicist—the skinny without the bull. You could trust him absolutely, which to any news person is criteria Number One ... he could always make clear what the research and discoveries meant to the lives of individual Americans and to the future of their land, especially the arid West—make clear why the work of DRI matters so very much to all of us. While understanding John's wish to retire after all these years, I regret his departure because he has been so good both for DRI and the community around it. We have all been fortunate to have him around for so long."

Bruce Bledsoe

Former opinion page editor, Reno Gazette-Journal

who are immersed in their studies, getting the word out about their accomplishments.

John Watson, research professor for the Division of Atmospheric Sciences, recalls dispatching Doherty to Mexico City in 1997, where DRI was conducting an air-quality study and Doherty landed in the middle of a news media feeding-frenzy.

“He rounded up the photographers,” Watson says. “He didn’t speak much Spanish and they didn’t speak much English. He was hopping in vans, using hand signals to communicate and nothing stopped them—not even red lights. It was like Mr. Toad’s wild ride at Disneyland. John’s work resulted in the best media coverage we’ve seen on our projects—14 million residents saw it—that was seven times the population of Nevada at the time. When I went to drop off

some clothes at the dry cleaners the man behind the counter recognized me from the news the night before!”

The exemplary work of DRI’s scientists has put DRI on the map as one of the top environmental research organizations in the world, but its reputation can also be attributed to Doherty’s public affairs role, according to DRI President Dr. Stephen G. Wells.

“John has worked tirelessly for nearly 30 years to spread the word about DRI’s many achievements. DRI is grateful to John Doherty for setting a great example about the importance of DRI’s environmental research and its relevance to everyone’s health and quality of life,” Wells says.

— Heather Emmons

University system honors Walter Shingles as Outstanding Person award recipient for DRI

It was business as usual for Walter Shingles, facilities supervisor, as he finished up a few odds and ends to prepare for the Board of Regents meeting being held at DRI’s new Frank H. Rogers Science and Technology Building. One would never suspect that just a few days prior, Shingles played a major role in the grand opening of the 66,000-square-foot Rogers building, making sure all events went smoothly and helping assure that the building was completed on time and within budget.

Board of Regents Chair Stavros Anthony started the meeting with some positive remarks about how he was impressed by the number of outstanding individuals throughout the University and Community College System of Nevada. He said he had asked the presidents throughout the system to identify one individual at their respective institutions who helps make UCCSN successful. With that, Shingles was shocked to hear his name; but as anyone at DRI can attest, he shouldn’t have been surprised.

“DRI is proud to name Mr. Walter Shingles as recipient of our Outstanding Person award,” President Steve Wells said. “In professional football, outstanding performers and leaders like Johnny Unitas and Jerry Rice come along once a generation. The same can be said about Walter Shingles.”

After spending 15 years in construction, Shingles was working at a desk job auditing for the Flamingo Hilton and drove by the DRI facility every day as the original building was being built. And fortunately for DRI, one day he made a pit stop and inquired about a part-time night shift position as a custodian. Shingles came on board in 1992, and as he got to know the employees and the facility, he realized this was the place for him. He has been reclassified three times in recognition of his outstanding work.

Through the years, his biggest challenge was maintaining the original DRI building and keeping occupants satisfied while working on the construction of the new building. But he credits his staff for any and all success.

“It’s very rewarding at the end of the day,” Shingles says. “It’s like a well-oiled machine and there are no weak links.” Shingles’ talent as a supervisor stems from his own growth at DRI: making sure all make good use of their talents. “I am grateful to Peter Ross (DRI assistant vice-president of campus planning and physical plant), who assisted with my professional growth and supported me as I moved up the ranks,” Shingles says.

From his first days on the job at DRI last October, newly hired Director of Facilities Operations Randy Odden saw that well-oiled machine Shingles led. “Walter Shingles is the heart and soul of the facilities team in Las Vegas. He is that rare individual who possesses both the technical knowledge of our buildings as well as a genuine concern for the well being of people. With his enthusiastic approach, he continues to inspire and motivate every day.”

— Heather Emmons



‘Outstanding Person’ winner salutes his team. DRI facilities supervisor in Las Vegas, Walter Shingles, far right, says it’s his crew that makes it all happen. Back row, left to right: Amy McKinney, John Carr, Mike Fish, Chern Thomas, Rick Barrigan and Chris Heckman. Front row: Mick Jones, Damien Zoccole and Ralph Rivera. (Photo by Heather Emmons)

the 2004 Nevada Medal Dinners



1. In Reno, Regent Douglas Roman Hill and Susan Hill.
2. Harvey Whittemore and Heidi Loeb. Red Hawk and its founders, Whittemore and the late David Loeb, were honored in Reno with the DRI President's Medal.
3. In Reno, left to right: DRI Research Foundation Chair David Fulstone II, Annika Mosier and DRI President Stephen G. Wells. Mosier was named the recipient of the Governor Kenny Guinn Environmental Research Fellowship.



4. In Reno, left to right: Farouk El-Baz, Sen. William Raggio and Dale Raggio.
5. In Reno, DRI Research Foundation Trustee Skylo Dangler and Cathy Schmitz.
6. In Reno, Greg Bortolin (representing Gov. Kenny Guinn) and Farouk El-Baz.
7. Left to right: DRI Research Foundation Co-Chair Ken Ladd, Catherine "Pat" El-Baz, Farouk El-Baz and Dee Ladd. Ken and Dee Ladd served as MCs for the Reno event.



8. Regent Jill Derby and DRI President Stephen G. Wells at the Reno dinner.
9. In Las Vegas, left to right: DRI Research Foundation Trustee Jeanne Jones, Bethany Wells, DRI Research Foundation Trustee Terry Van Noy, Betsy Van Noy and Catherine "Pat" El-Baz.
10. In Las Vegas, the Gibson family turned out to see Fred Gibson, Jr. (third from left, back row) honored with the DRI President's Medal.
11. In Las Vegas, DRI Research Foundation Trustee Lou Emmert, Farouk El-Baz and Jerry Emmert.



12. In Las Vegas, left to right: Farouk El-Baz, SBC Nevada President Sylvia Samano and DRI President Stephen G. Wells.

13. At the Las Vegas event, left to right: Judge George Assad, William Monahan, University and Community College System of Nevada Board of Regents Chair Stavros Anthony, Paige Whipple, Mary Ellen Monahan, Regent Bret Whipple and Regent Thalia Dondero.

14. In Las Vegas, left to right: Be-Be Adams, Gov. Bob Miller, Tony Sanchez, Assemblyman William Horne and Assemblywoman Peggy Pierce.

15. In Las Vegas, left to right: Bonnie Bartlett, Julie Bartlett, Deanne Rymarowicz and Chelli Goldwater.

16. In Las Vegas, left to right: Maureen Brower (representing Gov. Kenny Guinn), Assemblyman Josh Griffin, Reenie Griffin, Teresa Gregory and Bill Gregory.

17. In Las Vegas, left to right: Jason Goudie, Kami Dempsey, Assemblyman David Parks and Assemblyman William Horne.

18. In Las Vegas, left to right: Melody Schreiber, Sasha Jackowich, Melissa Galvan and Allison Copening.

19. In Las Vegas, left to right: DRI Research Foundation Trustee Fred Gibson, Jr., UCCSN Chancellor Jane Nichols, Judy Romesburg and Henderson State College President Kerry Romesburg.

20. In Las Vegas, Fabian Vincent and DRI Research Foundation Trustee Selma Bartlett.

21. In Las Vegas, left to right: Sylvia Samano, DRI President Stephen G. Wells, DRI Research Foundation Co-Vice Chair Sandy Miller and Bethany Wells.

22. In Reno, DRI Research Foundation Trustee Nazir Ansari and Mary Ansari.

23. In Las Vegas, left to right: Shelley Bass, Bob Bass and John Doherty.



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Reno's Traner Middle School unveils Nevada's fourth GreenPower installation

Students, faculty, elected officials, other dignitaries and news media gathered at Traner Middle School in Reno, on May 5, to commemorate the opening of the state's fourth GreenPower installation. Solar panels and a wind turbine demonstrate clean power options to students, who study alternative energy as part of the math and science curriculum at the schools. Traner's system cost \$42,000 to purchase and install. The John Ben Snow Memorial Trust donated \$15,000 to the project, the Sierra Pacific Power Foundation gave \$10,000 and the balance came from DRI GreenPower funds and Sierra Pacific Power Co. customer contributions.



Right: Jeff Ceccarelli, Sierra Pacific Power Co. president, tells Traner audience that alternative energy sources are vital for a sustainable future.

DRI adds new faculty to accommodate growth in DEES, CALEM

Accelerated growth in DRI's Division of Earth and Ecosystem Sciences and Center for Arid Lands Environmental Management means adding new faculty to keep pace.

DEES is a remarkably diverse collection of scientists, with a range of research interests and expertise that defies simple categorization or a single research focus. In broadest terms, DRI's Earth and ecosystem scientists contribute to a greater understanding of the history and processes affecting landscapes, the Earth's surface and its living inhabitants.

Dr. Henry Sun, who joins DRI from the Jet Propulsion Laboratory, or JPL, in Pasadena, Calif., feels that fate played a large part in the evolution of his research and work in microbiology—and his new colleagues are thankful it landed him at DRI as an assistant research professor in DEES.

His research interest in endolithic microbes, or organisms living in rocks, is a narrow field, but one being highlighted nationally with NASA's Mars program. Dr. Sun received his bachelor's and master's degrees from Nanjing University, in China, and his Ph.D. from Florida State University.

JPL is well known as an engineering lab with a basic science component. Sun describes the environment there as “engineers who like to work with scientists who go to extreme environments.” And Sun is just that kind of scientist. His specialized research area focuses on finding life in the driest, coldest desert on Earth: Antarctica's Dry Valleys, where the environment was considered totally sterile until microbes were found in the rocks.

Sun says the Dry Valleys can be considered the best analog for what Mars is like. “My job is to ask where we can find life,” Sun says, “and locate what signals are being given off to indicate there is life. The Mars program is being beefed up right now, and hopefully the next mission will look at life on the planet.”

Sun was attracted to DRI because of the possibility of multidisciplinary collaborations, providing new opportunities to grow. His most recent collaboration with a crystallographer, for example, led to the discovery of a new crystalline form of phosphate.

When he is not searching for the smallest forms of life in Antarctica or the Mohave Desert, he is sharpening his skills at home in Las Vegas by playing hide and seek with his three- and six-year old children.

CALEM gears up

CALEM, an interdisciplinary research center with a worldwide focus on land, air and water issues, is gearing up for new projects like the desert terrain studies for the U.S. Army. Field studies, laboratory analysis and monitoring to ensure the reliability of data require an experienced approach, and CALEM is expanding to meet those needs.

Dr. Bryan Stevenson recently joined DEES as a postdoctoral research associate working with CALEM Interim Executive Director Eric McDonald and Assistant Research Professor Paul Verburg. Stevenson received his doctorate in soil science from Colorado State University, working on stable carbon and oxygen isotope relationships in soils.

His research interests include applications of stable isotopes to the soil system, soil-plant-microbial relationships in modern soils and paleosols, pedology, nutrient cycling and disturbance ecology. He recently completed a postdoctoral position in New Zealand. Stevenson will conduct research on U.S. Department of Defense-funded desert ecosystem restoration and a National Science Foundation project combining isotopic analysis and numerical modeling of soil carbonates at the FACE, or Free-Air Carbon Enrichment, site at the Nevada Test Site.

“I enjoy working outdoors and have always been interested in understanding nature,” Stevenson says. Good thing, too—he has already realized how diverse the work is, averaging two weeks in the field each month.

—Heather Emmons

continued from page 1

As a member of the House Armed Services Committee, Gibbons led the effort in the House to authorize funding. Sen. Harry Reid, D-Nev., and Sen. John Ensign, R-Nev., did the same in the Senate.

Congressman Gibbons serves on four committees that call on his military experience. They include the House Resources Committee, where he serves as Vice Chairman; the Armed Services Committee; the Select Committee on Homeland Security; and the Permanent Select Committee on Intelligence.

He is also chairman of the Homeland Security Subcommittee on Intelligence and Counterterrorism and serves as chairman of the Intelligence Subcommittee on Human Intelligence and Counterterrorism, Analysis and Counterintelligence.

A former combat pilot and decorated veteran of the Vietnam and Persian Gulf wars, Gibbons served in the United States Air Force from 1967 to 1971 and graduated from the U.S. Air Force Air Command and the Air War College.

He was also a commercial pilot for two major airlines and worked as a hydrologist for the Federal Water Master. He was also a mining and water rights attorney in Nevada.

DRI President Dr. Stephen G. Wells welcomed Congressman Gibbons and staff to DRI and later introduced him at a reception. Wells thanked Gibbons for his help in securing funding for desert terrain studies.

“Understanding desert landscapes is critical to our armed forces—not just because 40 percent of the Earth is arid land, but because these areas are home to so many global geopolitical flashpoints,” Wells said.



Congressman Jim Gibbons looks on as DRI President Stephen G. Wells presents him with a thank you gift. A framed photo signed by DRI faculty and staff includes a plaque acknowledging the congressman's support of DRI's desert terrain project for enhancing military operations.

(Photo by Ron Kalb)

Wells presented Gibbons with a photo of an Abrams tank with matting signed by DRI staff. A plaque within the frame reads: “Thank you Congressman Gibbons for supporting DRI’s project—Desert terrain analysis for enhancing military operations—April 16, 2004.”

During his remarks, Gibbons called DRI “an international treasure” that is recognized worldwide.

“So, for me to be able to stand on the sidelines, to be your cheerleader, is probably my greatest achievement . . . the greatest thing I can do is to support what you do,” he said.

According to Wells, several DRI researchers commented about the depth of the congressman’s scientific knowledge and the ease with which he was able to discuss technical issues. “There seems to be universal agreement that Jim Gibbons would fit right in, whether in a DRI lab or on snowmobile traversing the frozen north,” Wells says.

—Ron Kalb

DRI News is published by the Desert Research Institute, a nonprofit, statewide division of the University and Community College System of Nevada. DRI is internationally recognized for excellence in environmental research. Eighty-seven percent of the Institute’s budget comes from research grants and contracts. DRI operates the Dandini Research Park in Reno. Articles appearing in DRI News may be reprinted without restriction unless noted otherwise.

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