

Focus on diversity

Small and NM businesses key factors in Sandia's economic impact

By Nancy Salem

Sandia spent more than \$1 billion on goods and services in fiscal year 2016, up more than \$56 million from the previous year, and New Mexico businesses received more than \$381 million, or 37 percent of the total, according to the Labs' latest economic impact report.

US small businesses received 51 percent of the available dollars, about \$530 million in Sandia contracts. New Mexico small businesses received \$240 million, or 63 percent of contract payments to New Mexico companies.

The 2016 *Sandia National Laboratories Economic Impact* brochure breaks down Sandia's spending and spotlights its role in the economy. The 2016 data, reflecting actual payments made, is based on Sandia's fiscal year from Oct. 1, 2015, to Sept. 30, 2016.

Compared with fiscal year 2015, spending was down about \$900,000 with New Mexico businesses and about

(Continued on page 5)

BUSINESS PARTNER — Kirk McWethy, owner and president of SDV Construction Inc. of Albuquerque, has been a Sandia contractor since 2006. His service-disabled veteran-owned small business has 44 employees and has completed numerous construction projects at the Labs, including an addition to Bldg. 905 shown in this photo. "I love being a Sandia contractor because it is a true partnership. Both sides work to make the other successful," says McWethy, an Air Force veteran. "The people at Sandia want us to succeed and continue to grow." (Photo by Randy Montoya)



Exceptional service in the national interest

Sandia LabNews

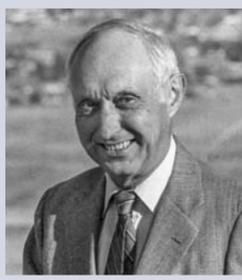
Since 1949 Managed by Sandia Corporation for the National Nuclear Security Administration

 Volume 69, No. 2
January 20, 2017

Former Sandia Corp. President Irwin Welber dies at age 92

Headed Labs from 1986-1989

Story on page 4



'An opportunity to render an exceptional service in the national interest'

Sandia M&O contract history Honeywell



SANDIA NATIONAL LABORATORIES is a Federally Funded Research and Development Center whose facilities are owned by the US government. The government manages and operates Sandia and the other national laboratories using a government-owned, contractor-operated (GOCO) model. Sandia Corp., a wholly owned subsidiary of Lockheed Martin Corp., is the contractor that operates Sandia. Here's the history of the contract:

- 1945: Sandia began as Z Division, the ordnance design, testing, and assembly arm of Los Alamos National Laboratory, and in 1948 became Sandia Laboratory, a branch of Los Alamos.
- October 1949: The Atomic Energy Commission, Western Electric, and Sandia Corporation signed the original contract to manage Sandia Laboratory. The contract covered operation of the lab until Dec. 31, 1953.
- Nov. 1, 1949: Sandia Corp. took over management of the laboratory. Sandia Corp. was a wholly owned subsidiary of Western Electric, an AT&T company.
- March 8, 1956: A second site officially opened in California's Livermore Valley.
- Dec. 6, 1979: Congress made Sandia a Department of Energy (DOE) national laboratory, and the action became law on Dec. 29.
- Oct. 1, 1983: AT&T assumed the corporate charter of Western Electric.
- Oct. 5, 1993: The management and operating contract was competitively awarded to Sandia Corp. as a wholly owned subsidiary of Martin Marietta. It originally was set to expire Sept. 30, 1998.
- March 15, 1995: Martin Marietta and Lockheed Corp. merged to form Lockheed Martin Corp.
- Sept. 28, 1998: DOE noncompetitively extended Sandia's contract, with the expiration date of Sept. 30, 2003.
- Sept. 30, 2003: DOE noncompetitively extended the contract again for five years

with up to five additional one-year award periods. Sandia Corp. earned four one-year award periods, causing the contract to expire on Sept. 30, 2012.

- Dec. 16, 2011: DOE and the National Nuclear Security Administration (NNSA) announced it would competitively compete the management contract for Sandia.
- Sept. 28, 2012: DOE/NNSA signed a contract modification for a one-year extension through Sept. 30, 2013, with two additional three-month options if needed.
- Aug. 27, 2013: DOE/NNSA extended the contract through March 31, 2014.
- March 17, 2014: DOE/NNSA announced it was moving forward with a noncompetitive extension for two years, with an option for a third year, while it prepared for a full and open competition.
- March 27, 2014: DOE/NNSA extended the M&O contract to April 30, 2014, to allow extension negotiations to continue.
- April 30, 2014: The modification was signed on April 30, 2014, extending the Sandia contract to April 30, 2016, with an option for a third year.
- May 20, 2015: DOE/NNSA announced extension of the contract through April 30, 2017, and posted the "Sources Sought" solicitation. The solicitation states that, "NNSA will conduct a full and open competition for a follow-on management and operating (M&O) contract consisting of a four-month transition and a five-year base period with options for up to five additional years."
- March 21, 2016: NNSA released a draft RFP seeking input/feedback by April 1, 2016, from prospective bidders.
- Dec. 16, 2016: NNSA awards Sandia National Laboratories Management & Operating Contract to National Technology and Engineering Solutions of Sandia (NTESS), a wholly owned subsidiary of Honeywell International. Northrop Grumman and Universities Research Association will support NTESS in the performance of this contract.

STOPPING KILLER ASTEROIDS & BETTING ON CLIMATE CHANGE



Page 8

Inside ...

Mike Lopez honored by American Vacuum Society ... 2

Employee death: Mike Ortega remembered fondly ... 3

Two (labs) can play that game ... 3

Panelists debate future nuclear deterrence ... 6

Employee death: Saying goodbye to Brenda Rinaldi ... 7

FOR FRANK JENNINGS ...



GIVING IS IN THE BLOOD Page 6

That's that

As we begin the new year, the matter of contracts and transitions is on everyone's mind around here. Evoking images of the Fountain Paint Pot feature in Yellowstone National Park's Geyser Basin, rumors bubble up, leave an impression, and then sink back down the memory hole. I try not to pay much attention; the fact of the matter is that as I write this, details of the new contract and the intentions of our new management team headed by Honeywell are closely held within DOE and NNSA. In other words, we don't know much. But I'm optimistic that things will work out fine for us for the very simple reason that I believe in Sandia. I am confident that any entity that aspires to manage this laboratory sees only great things for our future.

And after all, we've been through transitions like this before and each iteration of the laboratory has only made us stronger.

A little history: Sandia began its life in 1945 as Z Division of Los Alamos National Laboratory. In 1949, President Harry S. Truman sent a letter to AT&T President Leroy Wilson encouraging his company to take on the management of Sandia.

It was an inspired move by the Truman administration – AT&T owned Bell Labs, the premier private sector research organization in the world. That experience and expertise, Truman's team figured, would be essential in transitioning the nation's nuclear weapon program from a laboratory-focused effort to an all-out industrial enterprise. AT&T agreed and Sandia Corporation was born on Nov. 1, 1949.

The timing is interesting. At Sandia's 50th anniversary celebration in 1999, I had a chance to talk to Arkady Brish, chief designer emeritus at the All-Russian Scientific Technical Institute of Automatics. He had come to participate in a colloquium marking the occasion. With what I recall as an almost mischievous grin, Brish noted that in Russia, "We just commemorated 50 years since the first Russian [nuclear] bomb was exploded. That was in late August 1949. A couple of months later, Sandia was founded. There is, perhaps, a connection?"

It's an intriguing thought – the Soviets test an atomic bomb and we double down by expanding our weapons complex. Makes sense, but Truman's letter to AT&T dates back to May 1949, months before the Soviet test. But in the larger sense, Brish was probably spot on – we knew the Soviets were seeking a nuclear weapon and that we were poised at the cusp of an arms race, one that cost us dearly over the decades and arguably resulted in the ultimate collapse of the Soviet Union. AT&T guided us through the entire course of that part of our history.

As the Cold War drew down, the challenges evolved and AT&T for a number of reasons decided it was time to hand off management of the laboratory to someone else. In the ensuing contract competition coordinated by DOE, Martin Marietta – later to become Lockheed Martin – made the best case. It assumed ownership of Sandia Corporation in 1993 during an era where stockpile stewardship, global terrorism, environmental concerns, cyber threats, alternative energy, and fundamental changes in the ways we conduct our research have made us in many ways a very different institution than we were during the Cold War.

Now we're at the brink of another transition. It will be an exciting time as we welcome new leaders with new ideas and new ways of doing things. But it will be a bittersweet time, too. We'll be saying goodbye to a leadership team that collectively has dedicated hundreds of years to this laboratory. They've forged deep personal connections with scores of us over the years and have been our champions, our mentors and even our role models. I'm sure I express the sentiments of people across the Labs when I say we wish each one of them well. "Thanks for everything."

Among the few things we know for sure is that after almost 70 years, Sandia Corporation is going away. Our new management group is called National Technology and Engineering Solutions of Sandia. That's a mouthful, but we'll get used to it. And no matter what the letterheads may say, we'll always be Sandians. And we'll continue to embrace and embody the mission expressed by President Truman to Leroy Wilson all those years ago: "In my opinion you have here an opportunity to render an exceptional service in the national interest."

See you next time.

– Bill Murphy (MS 1468, 505-845-0845, wtmurph@sandia.gov)

Sandia technologist honored with national award from American Vacuum Society

By Sue Major Holmes

The American Vacuum Society (AVS) has recognized Sandia technologist Mike F. Lopez with its Thin Film Division Distinguished Technologist Award for his exceptional technical support of thin film research and development.

The society's Thin Film Division presented the award to Mike (2723) in November at the society's International Symposium & Exhibition in Nashville, Tennessee. The inaugural Distinguished Technologist Award in 2015 also went to a Sandia technologist, Catherine Sobczak.



THIN FILM AWARD — Sandia technologist Michael Lopez received the Thin Film Division Distinguished Technologist Award in 2016 from the American Vacuum Society. Lopez poses in a Sandia clean room with the latest generation of the type of machines he started working with at Sandia two decades ago. In 1996 (photo below) Mike worked on the first generation of a Sandia-built neutron tube exhaust-bake station. (Photos by Randy Montoya)



Mike says he was shocked, surprised, "and, of course, very excited" when he received a phone call telling him he'd been chosen for the national award.

He says he believes he was recognized because of his longevity, more than 25 years, in the field of thin film and vacuum technology rather than for a specific achievement. "I've seen the technology evolve, I've seen the advancements, and I've helped in many aspects of thin film technology over the years," he says.

Mike's work largely involves physical vapor deposition, also known as PVD coating, a variety of thin film deposition in which solid metal is vaporized in a high-vacuum environment and deposited on electrically conductive materials as a pure metal or alloy coating. The process transfers the coating material on a single atom or molecule level, providing extremely pure and high-performance coatings, which is preferable to electroplating for many applications.

Mike praised Sandia for encouraging staff members to participate in professional societies and for fostering interactions with colleagues both inside and outside the Labs.

More than willing to share expertise

David Goy (2723), who nominated Mike for the award, says Mike is more than willing to share his expertise with others.

"He's helped our production operators, other technologists, and engineers learn about thin film, residual gas analysis, vacuum technology, and leak detection, using a very hands-on approach," David says. "Mike is a leader in our center," Sandia's Neutron Generation Enterprise Center 2700.

Mike joined Sandia in 1994 and was promoted to distinguished technologist 10 years later. He has been a major contributor in the design, layout, fabrication, installation, and check-out of high-vacuum equipment used to manufacture neutron tubes and switch tubes for generators.

He holds an associate's degree from Central New Mexico Community College and is co-author or contributing author on several Sandia papers. In addition, earlier this year he helped develop an American Vacuum Society short course called "Working with Tritium."

The New Mexico Chapter of AVS created and endowed the national award to honor its founders and their contributions.

Exceptional service in the national interest

Sandia LabNews

<http://www.sandia.gov/news/publications/labnews/>

Sandia National Laboratories

Albuquerque, New Mexico 87185-1468

Livermore, California 94550-0969

Tonopah, Nevada • Nevada National Security Site

Amarillo, Texas • Carlsbad, New Mexico • Washington, D.C.

Sandia National Laboratories is a multiprogram laboratory operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corp., for the US Department of Energy's National Nuclear Security Administration.

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Classified ads 505/844-4902

Published on alternate Fridays by Internal & Digital

Communications Dept. 3651, MS 1468

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Lab News Reader Service

The Sandia Lab News is distributed in-house to all Sandia employees and on-site contractors and mailed to all Sandia retirees. It is also mailed to individuals in industry, government, academia, nonprofit organizations, media, and private life who request it.

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To notify of changes in address, contact Benefits Dept. 3332, Customer Service, at 505-844-4237, or Mail Stop 1021, Sandia National Laboratories, Albuquerque, NM 87185-1021.

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To receive the Lab News or to change the address (except retirees), contact Michelle Fleming, Media Relations and Communications Dept. 3651, 505-844-4902, email mefleml@sandia.gov, or Mail Stop 0148, Sandia National Laboratories, Albuquerque, NM 87185-0165.

Employees:

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Two (labs) can play at that game: Lab collaboration through tabletop gaming

By Aimee Kelly

According to SAPLE, Sandia's internal online staff directory, Steven Paradise (8226) is an optical engineer in the Weapons Subsystems 1 group. However, on Wednesdays and Thursdays at lunchtime, he's the founder of gaming collaboration groups across the Labs, bringing together members of the workforce in a previously unexplored way. Thanks to Steven's work, Sandia/California and Lawrence Livermore National Laboratory (LLNL) are exploring professional collaboration through a new medium: tabletop gaming.

A different type of game

Most Americans grew up playing classic board games like Monopoly, Chutes and Ladders, and Sorry! Steven was no exception and he still harbors fondness for those tried-and-true games. However, when a cousin returned from an exchange program in Germany, the Paradise's game cupboard gained a new addition: The Settlers of Catan.

At the time, Catan was a new board game by Klaus Teuber that was slowly introducing American players to a different style. Unlike gaming heavyweights like Monopoly and Sorry! it relied less on luck and player elimination and more on strategy and collaboration. And it was gaining fans, fast.

"There are a bunch of different genres of tabletop games beyond 'roll the die and move your piece,'" says Steven. "Catan has served as a 'gateway game' for a lot of gamers. It's a classic."

Since then, Catan has sold more than 22 million copies in 30 languages and helped make way for other similar tabletop board games. These new tabletop games usually allow different ways to gain points and avoid player elimination. Thanks to the strategy-heavy requirements, unexpected winners are not uncommon.

Gamers unite

When Steven heard murmurs of interest from other Sandia gamers in October 2011, he decided a little organization was in order.

"I was the one who got roped into founding it," laughs Steven. "When someone tells me they don't like to play games, I just tell them, 'You haven't found the right game, yet.' We love to play a variety of different games and have people join us."

For five years, the Sandia League of United Gamers (affectionately abbreviated as "SLUGS") gathered at lunch to play games and form friendships with other members of the Sandia workforce. These days, weekly



GAMESMANSHIP — Employees from Sandia/California and Lawrence Livermore National Laboratory are exploring professional collaboration through a new medium: tabletop gaming.

email announcements go out to about three dozen members. Busy schedules keep the group dynamic fluctuating. Most weeks, though, there's a small but friendly group congregated around a table in the 915 café, playing old favorites or learning new ones.

Getting in on the action

In August 2016, members of the LLNL workforce caught wind of the Sandia group and expressed interest in starting their own group. Health educator Joy MacPherson (8527) heard about this and reached out to Steven.

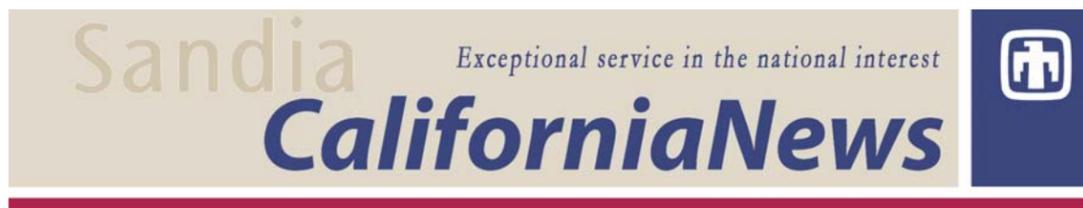
"Board games are such a great way to socially interact and connect with anyone, regardless of their age or physical capabilities, without a screen," says Colin Yamaoka, a member of the LLNL group. "We've grown to have more than 60 members in three months."

And so on Wednesday afternoons, Steven and other Sandians began making the trip across the street to LLNL to play a wide variety of games with other members of the LLESA Tabletop and Board Game Networking Group. Members look forward to networking with peers, regardless of home lab. Both groups have an open attendance policy, badge access allowing.

"It's a way to connect and network with people you never would encounter on a day-to-day basis," says Colin. "For anyone new to tabletop gaming: Come out to the Wednesday meetups."

"It's still early to say," says Steven, "but we hope that we'll have some friendly networking and work collaboration."

Interested parties can find more information about the Sandia League of United Gamers by contacting Steven Paradise at sparadi@sandia.gov.



Mike Ortega remembered for being an accomplished machinist with glowing personality



MIKE ORTEGA and family. Mike touched nearly everyone he met. He was an incredible father, husband, son, brother, uncle, and friend.

Mike Ortega may have only worked for two weeks as a machinist in Sandia/California's machine shop, but he's remembered fondly by colleagues as an accomplished machinist with a charming, easygoing personality.

On Dec. 18, Mike died following a battle with Acute Lymphoblastic Leukemia at the age of 38. He is survived by his wife, Robyn, and two kids, Mila and Jason. At his funeral, neighbors said Mike inspired them to be better parents, because he loved his kids so much. One of the things he enjoyed about working at Sandia was

cutting his commute time by three hours a day so that he could spend more time with his family.

In addition to being a devoted father, he was also an extremely dedicated employee.

"During his time at Sandia he exhibited strong skills, competence, and a tremendous work ethic," Russ Miller, Center 8200 director, wrote in a site-wide email. "He had a positive impact on many of us."

Brian Cass (8247-2), who served as Mike's team lead, was immediately impressed with Mike's commitment to his work for his previous employer. Mike came from

Lockheed Martin and delayed his work start date at Sandia because he wanted to make sure he completed a project.

"His commitment to his previous employer was something that really stood out," Brian says.

In addition to his dedication to Sandia's mission and to his family, Mike was stellar in his education, skill level, and experience.

"Good machinists are hard to find," Brian says. "He was a great fit for the team."

Mike Ortiz (8247-2) who served as Mike's mentor, says he was a good man ready to take on any challenges given to him.

"What stood out most to me was his excellent demeanor toward me, as well as the rest of my co-workers," Ortiz said. "I am sure he would have accomplished many great things here at Sandia."

At Sandia, Mike was training on Creo 3 software and was learning various programming skills used in the machine shop. He was an expert in translating designs quickly into machine code.

Manager Larry Carrillo (8247) was impressed with Mike's passion, motivation, and work ethic.

"Mike was an obvious fit to the machine shop team," Larry says. "Not only did he have the experience, education, and training, Mike was a real team player. He had the perfect attitude and always had a smile on his face."

Larry says Mike often had to be reminded to take breaks. "Mike would come in early and was busy from the time he got here until the time he would leave," Larry says.

According to a family website, "Mike touched nearly everyone he met. He was an incredible father, husband, son, brother, uncle, and friend." — Michael Padilla

Irwin Welber, Sandia's 9th president, passes away at 92

A quick wit, a fine mind, and a common touch marked his tenure at Labs

When Sandians who have been around a while think about Irwin Welber, who served as Sandia president and Laboratories director from 1986-1989, they remember an engaged and engaging leader who made a special effort to connect with members of the workforce across the entire Labs. They also remember him as a steady hand in a time of federal budget uncertainties and layoff rumors.

Irwin, who came to Sandia from Bell Laboratories in 1985 as executive VP to then-President George Dacey, passed away on Dec. 17 at age 92.

In an interview with the *Lab News* upon assuming Sandia's top job, Irwin said, "In taking on this responsibility I am most fortunate in being able to work with George [Dacey] during my first few months on this job. Sandia has earned and holds the respect of many key government people. I saw this first-hand during my recent visit to Washington, when I was introduced to them. The people of Sandia National Laboratories, because of their contribution to the nation's security, are viewed as a national resource. And George has been instrumental in projecting these contributions. In one of our meetings with someone who had not met George before, he was greeted with, 'It is an honor to meet a legend in his own time!'"

Irwin told the *Lab News* that the job offer to lead Sandia was a life-changer.

"A year or two ago," he recounted, "I said to my wife that the only thing that could really change my future plans would be to be offered a job at Sandia. I didn't even say president, just 'a job at Sandia,' I said, 'but that's impossible.' But, I said, that might change my plans. And, lo and behold, it came to pass. Again, I did not lobby for the job, I did not seek it, but having been offered it, I will serve. And with pleasure."

Irwin was respected for actively trying to understand the Sandia workforce and the work done here. He was noted for lunching in the cafeteria with staff members, who found him receptive and likable, an impression reinforced by the observations of Rosalie Crawford, secretary to nine Sandia presidents, including Irwin. She described him as having "a wonderful, dry sense of humor; it sometimes hit you when you least expected it. Quick mind, fast on his feet, a real delight."

In a tribute to Irwin on the Albuquerque-based



IRWIN WELBER greets Edward Teller during one of the famed scientist's visits to Sandia. (Photo by Randy Montoya)



IRWIN WELBER, at left, with Executive VPs Lee Bray, center, and Orval Jones.

(Photo by Randy Montoya)

French Funerals website, former Sandia VP Roger Hagengruber wrote, "I worked for Irwin at Sandia as one of his vice presidents. I found him to be a great boss and a truly delightful person. He had a warm personality and a tremendous sense of humor. . . . I found him to be a very capable and mentoring person who was a pleasure to work for and with at Sandia. I will miss him and value the time we had together. May God be with him."

Irwin began his career at Bell Labs in 1950. An electrical engineer, his work focused on transmission systems. He was responsible for ground communication equipment and technical coordination with foreign partners during the Telstar satellite program of the early 1960s and went on to oversee AT&T's transmission systems.

Upon becoming president of the Labs, Irwin understood that people, some of the most gifted and technically accomplished people in the world, would have questions. As he put it to the *Lab News*, "It is natural to ask, 'What prepared me for this position?' If I fully understood the job, I could answer the question. But what I can tell you are some of the things I have done that seem to relate to Sandia's activities. During the early 1960s I dealt with NASA on satellite communications projects. Since that agency and AT&T were both launching their own version of a satellite in the same time frame, there were delicate negotiations required to meet a tight schedule for our Telstar satellite.

"For the past nine years I have worked with the National Security

Agency [NSA] on enhancing the security of our Common Carrier microwave systems. Most recently, we have bid and been awarded a development contract by NSA for an advanced version of a secure telephone. . . . The major part of my time at Bell Labs, however, has been occupied with the design of the transmission network for the Bell System and now AT&T."

Irwin's tenure at Sandia facilitated the push for transferring technology from government laboratories to the private sector, particularly in support of industries considered vital to national defense. This included a deliberate increase in interactions regarding compound semiconductor R&D and manufacturing.

In the late 1980s, congressional concern about maintaining a competitive edge in semiconductor manufacturing led to additional funding for new facilities. These and expanded collaboration with universities increased Sandia's research profile, while procedures were established to increase partnerships with industry, including the SEMATECH consortium of semiconductor manufacturers.

Supported important new initiatives

Irwin also actively supported both existing lines of work and new initiatives. Sandia's energy research received a boost in advanced coal technologies and geosciences, as well as in the nuclear power plant arena, which resulted in the creation of the new Exploratory Nuclear Power Development directorate (6500). Sandia hosted the Stocktake meeting between the US and UK for the first time in 1987.

The Labs became involved in research in support of the Strategic Defense Initiative. And, in 1986, at Irwin's request, the Office Automation Subcommittee embarked on a quest for a single word processing application to be the standard across Sandia.

Reflecting the increase in systems work and the regular realignment of different areas of work, Irwin also instituted a major reorganization within the Laboratories in late 1986, creating an Exploratory Systems Division headed by Roger Hagengruber and a new Computer Sciences and Mathematics directorate. A variety of other organization mergers and moves took place as well.

Irwin presented a calm face to the Labs during more disruptive moments, including budget concerns raised as a result of the Gramm-Rudman-Hollings Deficit Reduction Act that placed constraints on the federal budget.

Stating clearly that Sandia's purpose was to serve national needs, not preserve itself, he nevertheless quelled rumors of layoffs and oversaw the complexities of maintaining a relatively level workforce in the face of budget uncertainties. He consistently expressed a belief in the importance and effectiveness of Sandia's workforce, insisting that, "The key is a good tech base and the kind of people who understand what the problems are, creative people."

Born on March 3, 1924, in Amsterdam, New York, Irwin is survived by his sons, Peter, Paul, and David; brothers Herb and Jack; sister, Shirley Stone; and grandchildren Jeff and Kelsey Welber. His beloved wife, Ellen, passed away in February of 2015. — Rebecca Ullrich

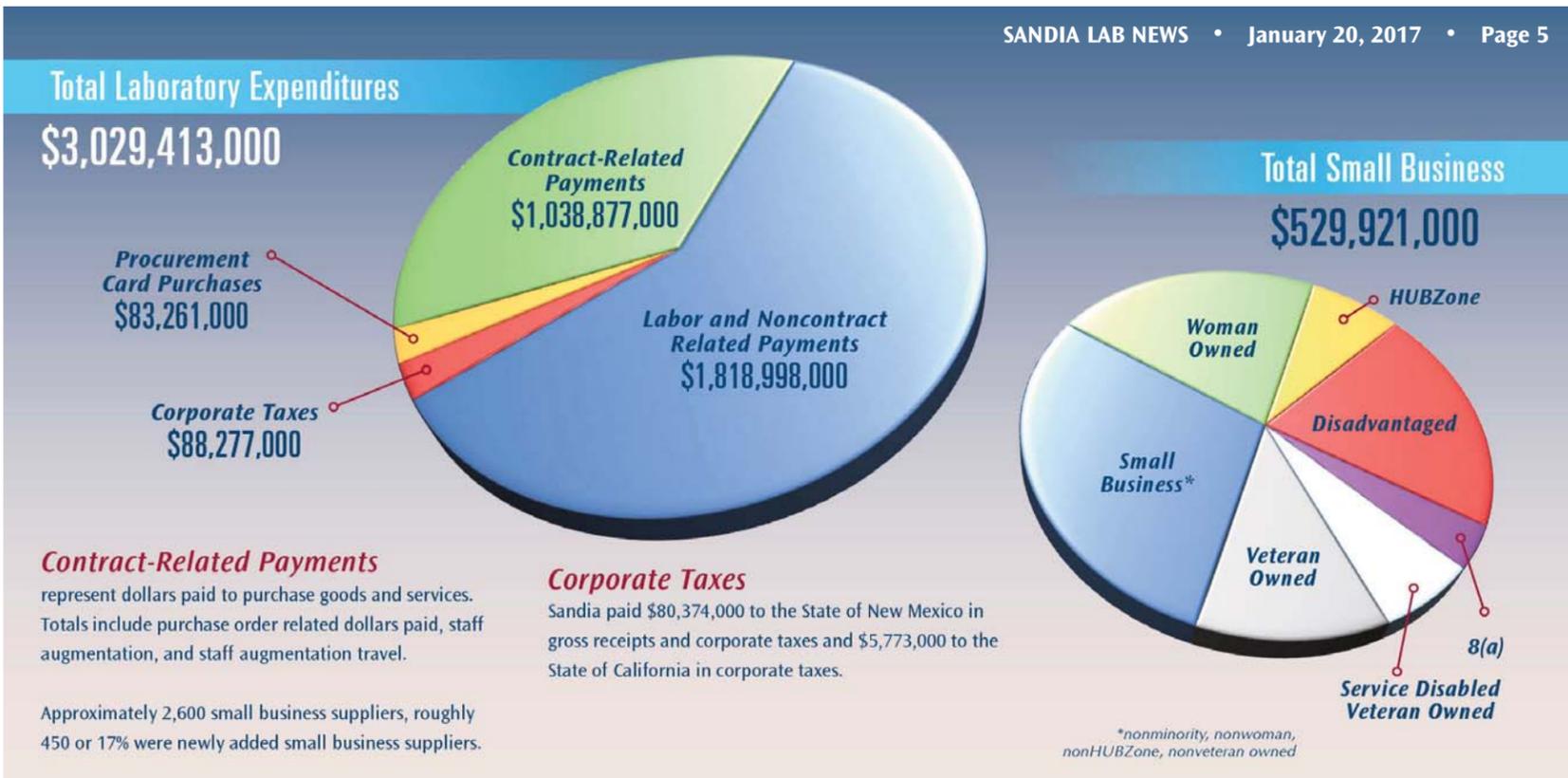
Irwin Welber career highlights

Sandia President — February 1, 1986-March 31, 1989
Sandia Corporation's ninth president

1948B.S., Electrical Engineering, Union College
1950M.S., Electrical Engineering, Rensselaer Polytechnic Institute
1950Joined AT&T Bell Laboratories
1965Director, Overseas and Microwave Transmission Laboratory, AT&T
1971Associate Executive Director, Transmission Systems, AT&T, Merrimack Valley
1975Executive Director, Transmission Systems, AT&T, Merrimack Valley
1981VP, Transmission Systems, BTL, Holmdel, NJ
1985Senior Executive Vice President, Sandia Corporation
1986President, Sandia Corporation
1989Retired

Professional associations

1973 Fellow, Institute of Electrical and Electronic Engineers
Member, American Association for the Advancement of Science
Member, National Academy of Engineering, elected 1988 in the Primary Section 07. Electronics, Communication & Information Systems Engineering.
Citation: "For major contributions to the advancement of capacity and economy in satellite, microwave radio, submarine cable, and digital transmission systems."
Member, New York Academy of Sciences
Member, Sigma Xi



Economic impact

(Continued from page 1)

\$19 million with the state’s small companies, while procurement card purchases to New Mexico businesses were up more than \$1 million. Total US small business spending increased about \$11 million.

“These annual numbers show that Sandia continues to make an impact to New Mexico’s economy,” says Delfinia Salazar, manager of Supply Chain Risk Management and Supplier Diversity Dept. 10222. “We continue to set aggressive small business and supplier diversity goals and work diligently to meet or exceed those goals. An example of our commitment is seen in our increased awards to Historically Underutilized Business Zone [HUBZone] companies, where those dollars are critically needed.”

Small businesses, diverse suppliers wanted

Sandia reaches out to local businesses through a variety of programs. It holds public forums with suppliers and civic leaders to discuss contracting opportunities, and lists contracts on its Business Opportunities website. It supplies small and diverse business owners with information on doing business with Sandia and seeks qualified suppliers. In October, Sandia also began hosting open house hours to meet personally with business owners and representatives.

Sandia’s overall economic impact in 2016:

- \$1.8 billion was spent on labor and non-contract-related payments.
- \$1 billion went to contract-related payments.
- \$80.4 million went to the state of New Mexico for gross receipts and corporate taxes.
- \$83.3 million was spent through procurement card purchases.

The report demonstrates Sandia’s continued commitment to small business, Delfinia says. The Small Business Act mandates that federal contractors use

small businesses, including those that are small disadvantaged, owned by women or veterans and service-disabled veterans, and small businesses in impoverished, HUBZone areas. Sandia’s Supplier Diversity oversees the mandate and negotiates small business subcontracting goals with NNSA.

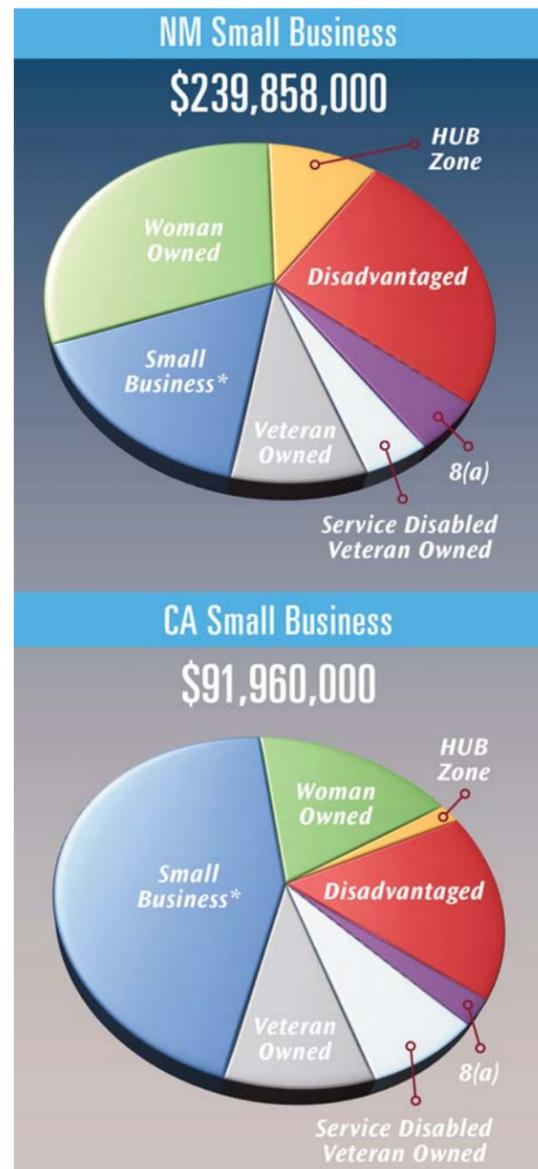
Building on success

“Looking ahead to fiscal year 17, Sandia’s Supply Chain team and Small Business function are committed to identifying and partnering with a diverse supplier pool in support of Sandia’s national security mission and small business goals,” Delfinia says. “We will continue to build upon our successes with HUBZone, veteran, and small disadvantaged businesses, where we exceeded our goals last year, to drive future success.”

Sandia also helps the state’s economy through the New Mexico Small Business Assistance (NMSBA) program. In 2000, the state Legislature created the Laboratory Partnership with Small Business Tax Credit Act to help companies get technical support from the national labs. In 2015, the Sandia NMSBA provided \$2.4 million in assistance to 205 New Mexico small businesses in 18 counties. It has provided \$48.5 million in assistance since 2000.

Sandia employees gave more than \$6.9 million in 2016 to nonprofits in New Mexico, California, and the nation. They also contribute their time as volunteers, supporting STEM (science, technology, engineering, and math) education through a variety of community programs, such as family science and math nights and engineering challenges, that reached thousands of students.

Delfinia says Sandia is committed to strengthening its existing relationships in the New Mexico business community and building new and enduring partnerships. “Sandia has a long and distinguished record of partnering with highly qualified, diverse small business suppliers,” she says. “We value their professionalism, innovation, and responsiveness. Sandia continues to be fully committed to maximizing small business opportunities and making a difference to the New Mexico economy.”



Small business contract-related payments for fiscal year 2016 with breakouts for its New Mexico and California labs

	National	New Mexico	California
Total small businesses:	\$529,921,000	\$239,858,000	\$91,960,000
Woman-owned small businesses (WOSB):	\$90,184,000	\$60,044,000	\$12,958,000
Businesses in impoverished areas (HUBZone):	\$34,058,000	\$25,513,000	\$214,000
Small disadvantaged business (SDB)	\$130,580,000	\$55,558,000	\$14,878,000
Business owned or co-owned by socially and economically disadvantaged person 8(a):	\$18,853,000	\$7,261,000	\$214,000
Veteran-owned small businesses (VOSB):	\$59,504,000	\$23,971,000	\$9,445,000
Service-disabled, veteran-owned small businesses (SDVOSB):	\$34,756,000	\$9,936,000	\$6,561,000
Small business (non-minority, non-woman, non-veteran owned)	\$161,986,000	\$57,575,000	\$47,690,000

For Frank Jennings, giving is in the blood

When Frank Jennings was 16 he had to have his mom sign a permission slip — not to go on a class field trip to Six Flags Over Texas or join the Civil Air Patrol, but to donate blood.

Today, some 30 years later, Frank has just earned his 8-gallon pin from United Blood Services, the nonprofit community blood center that provides blood and blood products for local area hospitals. According to Michele Moore Wright, senior donor recruitment representative with the Albuquerque United Blood Services, one unit of blood — that's one pint — can save three lives. That means that Frank, through his donations over the years, has been directly responsible for saving as many as 192 lives. And Frank is just one of many Sandians who roll up their sleeves to donate blood each year.

"Sandia National Laboratories provides more life-saving blood to our community than any other organization in our state," Wright says. Last year, she adds, Sandians donated 1,167 units of blood, "potentially saving more than 3,500 lives." The 2016 figure, she adds, represents a 10 percent increase over 2015.

Frank says his initial motivation to donate blood was that "it is a really easy way to help others and save lives; people need blood and currently there's only one way to get it."

Says Wright, "Our partnership with Sandia ensures that blood is available daily for the patients in need of a blood transfusion, including cancer patients receiving chemotherapy — as much as 8 units a week — heart surgery patients, automobile accident



FRANK JENNINGS donated his first unit of blood when he was 16. He's now reached the 8-gallon milestone. "It's a really easy way to help others and save lives. People need blood, and currently there's only one way to get it," he says. (Photo by Randy Montoya)

victims, complicated childbirths, and premature babies."

Frank says he didn't set out to break any records. "I don't remember having an initial vision of a lifetime of donating blood, but once I realized that it was pretty quick and painless, there wasn't any reason not to continue."

Frank understands that some potential donors are a bit wary of giving that first pint. To them, he says, "I'd say just try it. It's really not that bad or scary, and if you hate needles, you can always look away. The folks at United Blood Services and the Red Cross are super friendly and willing to go the extra mile to help allay any fears."

Frank says he doesn't have any particular long-term goal but says he intends to keep giving blood regularly as long as he can.

"While it's nice to know how much I've donated, it's really about helping others."

Noting that UBS bloodmobiles are on site at Sandia every week, Wright challenges Labs employees to donate blood and make 2017 the best donor year ever.

"We can always count on you," she says.

Check out the UBS bloodmobile schedule for Sandia at <https://goo.gl/TIQJpd>. Search by city and scroll through the listings for locations, times, and dates.

Panel of experts debates future nuclear deterrence

By Sue Major Holmes

Former US Ambassador Thomas Graham sees climate change as a threat to nuclear nonproliferation as shrinking farmland and water resources send countries looking for ways to support their people.

Climate change will mean rising seas, coastlines, and other territory gradually going underwater, expanding deserts, dwindling arable land for crops and livestock, and the disappearance of many potable water sources, Graham warned.

Countries without large armies could ignore the Nonproliferation Treaty (NPT) and seek "a nuclear military equalizer" to gain food and water or to defend their country against other nations seeking the same, he said.

Graham was one of four nuclear weapons strategy and deterrence experts who spoke at a Dec. 14 National Security Speakers Series panel on "Effective Nuclear Deterrence Strategy, 2030 & Beyond." Graham, who was involved in negotiations for every international arms control and nonproliferation agreement from 1970-1997, was joined by Elbridge Colby, Robert M. Gates Senior Fellow at the Center for a New American Security; Christopher Yeaw, director of the Center for Assurance, Deterrence, Escalation, and Nonproliferation Science & Education at Louisiana Tech Research Institute; and Thomas Nichols, a professor at the US Naval War College and the Harvard Extension School.

Arsenal of 'reasonable and prudent size'

With the threat of more severe climate change and NPT weakness, the US must have an effective nuclear weapon arsenal "of reasonable and prudent size" because it might need "to defend what we have by any means we have," Graham said.

The 1970 NPT balanced obligations between nations with nuclear weapons and those without, and included a call for a test ban, which nonproliferation states viewed as essential. The United Nations adopted the Comprehensive Test Ban Treaty in 1996. But only 38 of the required 46 nations have approved it, and it won't go into effect until they all adopt it.

Most nations that haven't are waiting on the US, Graham said. The US Senate rejected the treaty in 1999 and has not attempted another vote. However, nations except North Korea voluntarily refrain from nuclear weapons testing.

Graham quoted President John F. Kennedy as saying

in 1963 that his greatest fear would be 10 countries with nuclear weapons by 1970 and 15 or 20 by 1975. This, Kennedy said, would be "the greatest possible danger and hazard."

"The United States has to be prepared for a situation where President Kennedy's nightmare could possibly become a reality," Graham said.

Colby said the world is seeing renewed geopolitical and major power competition. He cited Russia and China as potential opponents with conventional forces in key regions of influence and with nuclear forces as well.



ELBRIDGE COLBY, with microphone, makes a point during December's National Security Speakers Series on "Effective Nuclear Deterrence Strategy, 2030 & Beyond" as panelists, left to right, Thomas Nichols, Christopher Yeaw, and Thomas Graham listen. (Photo by Lonnie Anderson)

Conventional forces critical

It's crucial that the US keep a lead in conventional forces and needs a nuclear force to negate an opponent's attempt to use nuclear weapons to lock in a conventional lead in their favor, he said. In short, America needs a flexible deterrent adapted to what it actually faces "to push the onus of escalation and the risk of mutual Armageddon onto the other side."

However, Colby said, the believability of a threat rests on the legitimacy of one's cause and the perception of the nature of the adversary. A country is hard to hurt if it's viewed as following through on threats, he said.

"We want to ensure that our nonnuclear [forces] do as much as possible to achieve our political, strategic, and military goals while forcing the onus of escalation onto the opponent. ... We want the adversary to be the one who has to cross the nuclear threshold first — nobody's going to think that's the good guy," he said.

"The United States has to be prepared for a situation where President Kennedy's nightmare could possibly become a reality."

— Former US Ambassador Thomas Graham

Yeaw said deterrence requires specifics: "I like to say you're deterring actor X from action Y in condition Z." He views North Korea as the most rapidly changing challenge to deterrence and allied assurance because it's moved from having no nuclear weapons to having an arsenal, shifting the dynamics between nations. North Korea's actions also affect China, South Korea, and Japan. "That tightly coupled, unstable situation really demands a little bit of attention," Yeaw said.

China's growing conventional forces and economy mean the US shouldn't restrict its options today by canceling nuclear programs and shouldn't take nuclear first use off the table, Yeaw added.

Nichols said that as nuclear nations think about what they and their opponents can do and build in the future, he's haunted by a question from a British strategist 35 years ago: "I ask myself in bewilderment, this war they're describing, what is it about?"

Nichols said he has the same problem. "I'm very concerned that we don't link operational concepts and capabilities and the capabilities of the opponent and what we are capable of developing to strategic thought," Nichols said.

He called for a nuclear posture review that presents real options and "does something that reaches a conclusion besides 'We're brilliant and what we're doing is great except we can do it smaller and cheaper.' We need a 10-year window of guidance to say what kind of world do we want to create."

The US must invest "in a robust conventional force that takes away the incentive to gamble to the point where this could become a nuclear issue," said Nichols, who described himself as a former Cold War hawk who's no longer convinced of the value of creating hundreds of options for fighting nuclear war.

Instead, he favors minimum deterrence with a nuclear arsenal numbering in the low hundreds. "I think we have to wrench ourselves away from thinking about solving our problems with nuclear weapons in the final result. ... That's a crutch, that's a placeholder for where our strategy ought to be," he said.

SANDIA CLASSIFIED ADS

MISCELLANEOUS

SKIS, Telemark, Karhu Outbound, 170 cm, 90-70-80 sidecut, cable bindings, \$100. Lorence, 237-1205.

SKIS, XC/Touring, 2, size 200 & 210, Golden Team, w/bindings & poles, \$65. Jaeger, 505-299-0860.

ROOF RAILS & 2 CROSS BARS, for '08-'13 Toyota Highlander, used once, paid \$270, asking \$150. Goy, 505-410-0514.

ELLIPTICAL, Sole E-95, excellent condition, \$250; dresser w/mirror, \$75. Ontiveros, 293-5779.

LAPTOP, 14-in., Dell, <1 yr. old, internal optical drive, Windows 7, MS Office 2013, core i3, several in/out ports, \$195. Cochran, 842-1528.

DINING TABLE, antique, mid-late 1800s, quarter-sawn oak, 52-in. round, empire pedestal, excellent condition, not restored, \$1,500. Hubbard, 293-2819.

GIRL'S BEDROOM SET, 4-pc., white, wood, twin bed, nightstand, mirrored dresser, desk, great condition, photos available, \$325. Hernandez, 857-9233.

SCUBA: women's adjustable, weight integrated, BCD (like new), \$300 OBO; Oceanic GEO 2 dive computer, \$150 OBO. Schriener, 505-275-3312.

iPAD 2, black, 32 GB, Verizon 3G, w/grey protector cover, new charger, original box & contents, hardly used, restored to factory settings, cond. 9+ out of 10. Mann, 505-604-4236, ask for Brandon.

LEATHER RECLINER, La-Z-Boy, cream color, \$75; brushed nickel & glass coffee table/end tables, \$100/set. Overholt, 505-250-7905.

DIGITAL CAMERA, Panasonic DMC-GH2, w/image stabilized 14-140 mm, f/4.0-5.8 zoom lens, great stills/movies camera, \$600 OBO. Poulter, 505-503-9803.

POOL TABLE, Olhausen, 8-ft., York, traditional mahogany over maple, like new, \$1,700 OBO. Lawson, 934-3242.

PROJECTION TV, Sony, 57-in., free-standing, still works great, has good color, free. Lunsford, 286-4850.

HIGHCHAIR, Peg-Perego Tatamia, \$175; Serta Tranquility crib/toddler mattress, w/pads/liners, \$60. Martinez, 702-6767, ask for Sharon.

TWIN BED, white head/footboards, like new, \$200; washer, gas dryer, \$200/for pair, will sell separately, \$100 ea.; futon, \$100. Baswell, 805-910-9653.

TIRES, 4, 205/55R16, Continental ProContact TX, taken off new vehicle, 600 miles, \$350. Smith, 505-269-1211.

CAR MATS, Honda Civic, black, '06-'09, paid \$60, make offer. Ortiz, 450-6608.

LARGE NON-FICTION & LP COLLECTIONS, books: philosophy, religion, history of science, humor, more; LP's mostly classical; few to sell, most donate, available to view Mon-Wed, 10 a.m.-3 p.m., Sat. & Sun. appointment only. Joseph, 480-521-4989.

CHILD CAR SEATS, 3, \$50 ea.; microwave, \$25; double child stroller, \$100; single child stroller, \$50. Walkington, 505-301-5175.

ELLIPTICAL TRAINER, Precore EFX 5.33, excellent condition, \$300 OBO. Nunez, 505-515-9084.

FUTON, deluxe queen mattress, light color, hardwood frame, like new, text or call for photos, \$200 OBO. Mooney, 505-553-0256.

BRIGHT LIGHT THERAPY LAMP, never used, great for winter blues/jet lag/shift work adjustment, \$130. Kaplan, 298-7953.

CONVECTION OVEN, white, smooth-top range, JennAir, 30-in., excellent condition, photos available, best reasonable offer. Luciano, 518-441-7766.

How to submit classified ads

DEADLINE: Friday noon before week of publication unless changed by holiday.

Submit by one of these methods:

- EMAIL: Michelle Fleming (classads@sandia.gov)
- FAX: 844-0645
- MAIL: MS 1468 (Dept. 3651)
- INTERNAL WEB: On internal web homepage, click on News Center, then on Lab News link, and then on the very top of Lab News homepage "Submit a Classified Ad."

If you have questions, call Michelle at 844-4902.

Because of space constraints, ads will be printed on a first-come basis.

Ad rules

1. Limit 18 words, including last name and home phone (If you include a web or e-mail address, it will count as two or three words, depending on length of the address.)
2. Include organization and full name with the ad submission.
3. Submit ad in writing. No phone-ins.
4. Type or print ad legibly; use accepted abbreviations.
5. One ad per issue.
6. We will not run the same ad more than twice.
7. No "for rent" ads except for employees on temporary assignment.
8. No commercial ads.
9. For active Sandia members of the workforce, retired Sandians, and DOE employees.
10. Housing listed for sale is available without regard to race, creed, color, or national origin.
11. Work Wanted ads limited to student-aged children of employees.
12. We reserve the right not to publish any ad that may be considered offensive or in bad taste.

INFINITI ALL WEATHER FLOOR MATS, beige, for G35/G37 sedan, 2 front/2 back, like new, \$40. Hall, 280-4344.

BERNHARDT CHAIRS (2) & OTTOMAN (1), mid-century modern 'Cooper', ebony finish, photos available, \$400. Nagel, 507-6357.

JAPANESE FISHING FLOATS, authentic, various sizes. Church, 505-821-0268.

PUB MIRROR, retro Coca Cola, wood frame, ~27"W x 37"H, \$50 OBO. Pechewly, 505-856-6878.

'06 FOUR WINDS ULTRA-LIGHT, 26-ft., tow behind trailer, excellent-good condition, \$11,500. Mathews, 505-321-7650.

REAL ESTATE

3-BDR. HOME, 2-3/4 baths, 2,512-sq. ft., pool w/new cover, new carpet, paint, La Cueva schools, MLS#879729, \$340,000. Kyle, 505-280-3308.

4-BDR. HOME, 2,093-sq. ft., recently built, 2-car garage, great amenities, 98th & Ladera, \$235,000 OBO. Marquez, 505-293-7246, ask for Alicia.

3-BDR. HOME, new, just built, never lived in, moving out of state, must sell, high-end NW subdivision, call for more info. \$225,000 OBO. Joseph, 505-515-5997.

2-ACRES, level building lot, Sandia Park, views of ski area/mountains, borders open space, \$120,000, east terms. Mihalik, 281-1306.

4/5-BDR. HOME, 2-1/2 baths, 3,300-sq. ft., 3-car garage, pool, 15 mins. from base, MLS# 874650, \$375,000. Fitzpatrick, 505-269-0069.

3-BDR. HOME, 2,722-sq. ft., enormous 3-car garage, Volterra subdivision, built 2012, \$325,000. Bondi, 505-352-2676.

VACANT LAND, Tome NM, near Tome Hill & UNM extension, \$55K/acre, owner will negotiate price. Ramos, 304-593-3425 or 304-561-5612.

TRANSPORTATION

'01 TOYOTA SOLARA SLE, V6, \$3,500. Torres, 505-401-6900.

'02 CHEVROLET SILVERADO LT, K2500HD, extended cab, Duramax, single owner, \$14,500. Tucker, 281-5693.

'99 FORD TAURUS, small AC & oil leak, 161K miles, good condition, \$1,000 OBO. Hautzenroeder, 505-715-3745.

'10 TOYOTA COROLLA LE, silver, 73K miles, excellent condition, call for more info. \$8,500. Cover, 505-331-2846.

'08 JEEP WRANGLER RUBICON, 4x4, V6, 2-dr., lifted, deluxe sound, metallic green, 1 owner, 74.8K miles, excellent condition, \$16,000. Johannes, 505-301-8238.

'09 MUSTANG, V6, premium coupe, silver, 104K miles, very good condition, \$6,000. Cramer, 453-1584.

'98 FORD F150, Super cab, V8, 4.6L, AT, new tires, 163K miles, very good condition, \$3,800. Vigil, 505-553-9596.

'99 FORD F250, Super Duty, V10, long bed, extended cab, 4x4, 59,535 miles, 1 owner, 5th wheel hitch, new tires/wheels, \$8,750 OBO. Saladin, 505-881-2219.

RECREATION

'86 HARLEY-DAVIDSON FXSTC, good condition, \$4,000 OBO. Romero, 505-307-9389.

'03 FLEETWOOD RV TIOGA, 26-ft., sleeps 6, 26K miles, call for more info & photos, \$17,500 OBO. Ortiz, 505-917-7372.

WANTED

GALAXY NOTE 5/s6, or newer phone, to purchase, for use with Samsung Gear VR for son. Lane, 505-414-5554.

UPRIGHT STATIONARY BIKE OR TREADMILL, newer condition, small footprint. Turgeon, 970-799-7430.

Employee death

Brenda Rinaldi was a mentor, friend, and invaluable team member

For Brenda Rinaldi, the personal and professional meshed like a seamless garment. The consummate professional and team member extraordinaire, Brenda (10625), was the administrative support professional for the Center 2500 Business Operations Dept. She cared deeply about the team's success but she cared even more about the people.

Brenda, who was hired at Sandia in 2002, passed away on Jan. 4 at age 50.

Laura Owens (10625) tells a story that is characteristic of Brenda's personality. "I met Brenda when I became her manager four years ago," Laura says. "I was relatively new to my position when she stopped by my office one day to share with me a book she had recently read called *Getting Things Done*. I looked at her, smiled, and asked if she was trying to give me a not-so-subtle hint. Over the next few years, I grew to understand this was just Brenda. She was a caring person and always offering her services to help others and take administrative burdens off their plate. She always took the time to ask how coworkers were doing; she always had the pulse of the environment in Bldg. 905."

'Made me feel welcomed'

Tiffany Enoch-Flora (10625), who joined the department three years ago, says Brenda made her feel welcomed from day one. "She gave great advice on everything whether it was personal life-related or business-related," Tiffany says. "She loved her husband, Bryan, and her son, Phillip, of whom she was so very proud. She was a great friend and very compassionate,



ACCORDING TO A COLLEAGUE, Brenda Rinaldi "happily learned new skills to help out the team and contributed in many quiet ways to make the work go more smoothly."

well-liked by all who knew her."

Brenda worked hard to integrate herself with the technical side she supported, Tiffany says. "She went to all of her technical member meetings to gain better insight into what was going on with her projects, and she got to know the team members on a personal level. She was a part of their family."

Tony Bryce, team lead, R&D Science and Engineering (2522-1), experienced Brenda's blend of the personal and professional first-hand. He met Brenda about 10 years ago when he became a team lead in Bldg. 840 shortly before the machine shop was closed. "It was a rather stressful time," Tony recalls, "and Brenda had to

deal with a lot of difficult issues related to staffing with closing down the Bldg. 840 operations. She was always very professional and worked hard to help make things go easier. I appreciated her personal approach in dealing with staff during this difficult time."

'A caring and wonderful mentor'

Allyson Beck, a project controller in Dept. 10625, says Brenda helped her navigate the culture of the department when she was a new staff member.

"Although we had different job functions," Allyson says, "Brenda was very willing to share her own experiences in an effort to help me avoid certain pitfalls or leverage tips and tricks that helped her successfully partner with her teams. She was very caring and a wonderful mentor who will be greatly missed."

Yolanda Rodriguez, the Office Administrative Assistant in Dept. 2552, says Brenda "took me under her wing as the new hire in the building. She didn't hesitate to share her gifts and knowledge. I am truly thankful for her willingness to share her expertise and for her friendship."

During the course of her career at Sandia, Brenda provided support to many different Product Realization Teams. Tracy Zullo (2552) says she was "lucky enough" to lead several of those teams, noting that Brenda "always went above and beyond the call of duty, ensuring that all team members were made welcome."

"Brenda took on impossible tasks joyfully, including the herculean effort of trying to keep the PRT lead organized. She happily learned new skills to help out the team and contributed in many quiet ways to make the work go more smoothly. Her ability to jump in where needed will be greatly missed by the teams she supported and by team members at all levels of the organization."

Brenda left a lasting legacy among her colleagues. As her manager, Laura Owens, put it: "Brenda's passing has made me realize that even though things are happening around us every day and we are busy keeping up with the latest demands, it's important to stop and have a conversation with your coworkers and appreciate them for who they are."

SOUNDING THE ALARM

Mark Boslough: He's everywhere at AGU, raising the specter of killer asteroids and what to do about them

He's also deadly serious about monitoring climate change

NASA / JPL-Caltech

By Neal Singer

Think you might be more careful in asserting your opinion on climate change if you were putting money on it? A poster session of the fall meeting of the American Geophysical Union, "Using Bets to Reveal People's Opinions on Climate Change," delivered some conclusions on that very subject. The meeting was held in San Francisco in mid-December.

Primary session convener Mark Boslough (1446) — an asteroid impact-effects physicist and climate-change gadfly — along with co-organizers Stephan Lewandowsky of the University of Bristol and James Risbey of Australia's Commonwealth Scientific and Industrial Research Organization (CSIRO) — wrote that "A long-standing means of revealing people's actual preferences . . . involves gambles and bets. People tend to place bets when they are confident of their opinions." Furthermore, "We [authors] relate bets and gambles to actual information on climate change and propose ways in which the scientific community can use markets of bets as a tool to resolve



MARK BOSLOUGH at the fall meeting of the AGU.

ambiguities and to communicate scientific facts with an appropriate level of certainty to the public."

While this Skinnerian approach — incentivizing beliefs about climate change to conform to facts, with a penalty

"There were palm trees in Alaska and crocodiles swimming in the Arctic. It's very relevant to today because it was another case of very rapid CO₂ increase and very rapid warming, just like now. In fact, we're putting CO₂ into the atmosphere faster than it came into the atmosphere during the [Paleocene-Eocene Thermal Maximum]."

for guessing wrong — might seem far-fetched in its small sampling (six individual bets) and speculative conclusions, a poster from England (which lists Mark's work first in its source list) a few feet away proposed to start an actual market in climate temperature and airborne carbon dioxide. "The person who presented it [Mark Roulston of Winton Capital Management in the UK] is serious," Mark says. "A betting market is legal in England."

Other posters in the session focused on different aspects of climate betting, such as insurance plans. "We're going to hold this session again next year, but we're going to promote it, so I think we'll get more abstracts," Mark says.

Thus far, he says, "We show that for the last few decades, most bets placed [on climate change] would have been lost by contrarians and would have been won by people who endorse the mainstream scientific position."

The point, says Mark, is "When people talk, they talk across each other; they're not talking about the same thing. So create a bet with unambiguous terms: the high tomorrow will be 77 degrees or not. When you make a bet and you lose, you have to admit your position was wrong."

Work on the betting approach is continuing beyond the AGU meeting. On Jan. 30 in London, Roulston emails, Winton Capital Management and the London School of Economics are hosting a lecture "to give exposure to the idea for creating a climate prediction market," where participants can bet on the value of climate variables up to several decades in the future. Mark Boslough also has submitted an abstract to talk about the subject at a Santa Fe climate conference in February.

Nudging asteroids as planetary defense

But this is only one of Mark's ideas. Earlier that day, in one of the larger convention halls, in a session titled "Asteroid, Impact Risk, and Planetary Defense," he hosted a session with 35 abstracts on methods to nudge — either by nuclear, direct physical impact, or gravitational means — offending asteroids out of paths that

would collide with Earth, while using telescopes to identify and help characterize the qualities of particular asteroids. "It was a broad-ranging session about discovering, characterizing, and assessing risks from asteroids for planetary defense," says Mark. Researchers from Los Alamos and Lawrence Livermore national laboratories, NASA, and various university researchers were among those participating.

The AGU media group held a press conference on this subject and invited Mark to participate, but he preferred to sit in the audience, waving when referenced, as LANL folk weighed in on the strategies for nuclear weapons to deter hostile asteroids.

On the same day, Mark presented a poster with 18 co-authors on the possible effects of asteroid-driven tsunamis striking a coast, should an asteroid strike the ocean directly or explode above its waters. The paper summarized the result of a workshop held last summer with many of the co-authors.

Not willing to communicate on a solely academic basis, Mark then put out an email broadside to 30 or so geophysical scientists, detailing an inexpensive but tasty restaurant to purchase burritos for dinner at 6 p.m., and then gave directions to a particular bar "for interesting discussions throughout the night."

How warm did things get?

Three mornings later, he co-hosted and was primary convener for a prized [American Geophysical] "Union" session, which highlighted controversial high-profile research about the Paleocene-Eocene "Thermal Maximum," (PETM) 56 million years ago, when CO₂ and temperature rapidly increased more or less simultaneously.

How warm did things get? "There were palm trees in Alaska and crocodiles swimming in the Arctic," Mark says. "It's very relevant to today because it was another case of very rapid CO₂ increase and very rapid warming, just like now. In fact, we're putting CO₂ into the atmosphere faster than it came into the atmosphere during the PETM."

The relevance of the session was the reason why it was given the status of a Union session, he says. Twelve speakers, all with "invited" status, included Richard Alley, a recent lecturer at Sandia and host of the TV series, *Earth: The Operator's Manual*. Wally Broecker, who coined the term "global warming" in a landmark 1975 paper, was a co-organizer. The session was recorded and is available online.

He may use some of his organizing energy at Sandia, he says, "to help smooth the upcoming transition for our technical people working on climate security."

Other Sandia conference contributions focused more on the basic technical building blocks that Sandia researchers generally provide.

Selected at random from more than 50 presentations, there were a laboratory-scale method for more quickly analyzing noble gases migrating through rock, providing input parameters for improved gas migration models (led by Scott Broome, 6914), reducing errors in satellite-simulated views of clouds with an improved parameterization of unresolved scales (Benjamin Hillman, 6913), a computational method to help more efficiently place sensors around a gas-emitting area to determine if a problem exists and where (Katherine Klise, 6912), and a description of an upcoming NNSA book that takes a physics-based approach to discussing trends in nuclear explosion monitoring research (Megan Slinkard, 5752).

The Applied Biosciences Laboratory has been added to Sandia's Virtual Tours. Learn how scientists use engineering and biology to solve national security problems



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<http://tours.sandia.gov>