Petroleum Studies 101: Sandia economist Arnie Baker lists multiple reasons for gasoline price jump

THE ANSWER IS IN FRONT OF YOU — Early morning traffic on Juan Tabo Boulevard in Albuquerque's Northeast Heights stacks up on a cold winter morning. In the distance, Sandia's solar tower, its mirror reflecting the New Mexico sunlight, suggests an energy future that will see less reliance on fossil fuels and more on alternative sources. (Photo by Randy Montoya)

Shock at pump reflects 21st century global market realities

By Chris Burroughs

Next time you visit the gas station and fill your tank with $3.30 a gallon gasoline, reflect on this. Nine years ago you could have bought that same gas for 98 cents a gallon.

What is going on?

Sandia's chief economist Arnie Baker (0320) says quite a lot, actually.

From a declining US dollar to restricted oil production in the Middle East, Russia, and Venezuela to increased oil demand by China and India, the price of gasoline and oil is on a seemingly endless upward spiral.

Last month natural crude oil hit $110 a barrel, compared to an average $72 a barrel in 2007. And just 10 years ago oil prices were at $14.80 a barrel in inflation-adjusted dollars.

Rising demand

Arnie says that at the top of the list of reasons for the high prices is a larger than expected demand for oil in industrialized countries and China's rapidly expanding economy. The US consumed the most oil — 20.6 million barrels per day in 2006 — but China is playing a quick catch-up at 7.3. Other countries consuming large amounts of oil are Japan at 5.2, Russia at 3.1, Germany at 2.6, and India at 2.5 million barrels a day. The world as a whole consumes 86 million barrels a day and 31

(Continued on page 4)

Sandians, as part of the month-long Mission Hope series of events, share their stories of courage, survival, pain, and affirmation in their battles with cancer. Story on **page 8.**

Sandia LabNews

Vol. 60, No. 7 April 11, 2008

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Sandia National Laboratories

Global warming, energy security are drivers behind ERN's 'big idea' initiative

By Mike Janes

The US must develop and execute a coherent energy strategy to maintain national security, dramatically reduce greenhouse gas emissions, and ensure long-term economic prosperity. The US energy community — including the national labs, industry, and academia — must rally around a nationwide initiative and contribute in a meaningful way if a US energy enterprise is going to be successful and truly secure the nation's energy future. The role of the nation's science, technology, and engineering communities is critical to the success of this effort.

That's a tall order, but it's the context in which Sandia's Energy, Resources, and Nonproliferation (ERN) Strategic Management Unit is funding a "big idea" proposal that it hopes will engage a broad community and influence national decision makers to lead the country down the path of American competitiveness, energy security, and environmental stability.

THE BIG IDEA — Center 8300 Director Terry Michalske discusses concepts that together comprise the visionary National Energy Innovation Initiative. (Photo by Randy Wong)

The proposal is being developed under an ERN-funded effort. It will initially focus on a Low-Carbon Transportation Energy concept and examine the value proposition and business model that could be employed as a public/private endeavor. Though the ERN's management team is calling it the "Big Idea," Terry Michalske (8300) and Margie Tatro (6200) explain that the Low-Carbon Transportation Energy investment is actually part of a much grander vision.

"This may be the first 'big idea,' but it's really meant to plant the seed for an even bigger idea, one that we hope will lay the groundwork for a federal initiative," says Terry.

Starting with the Low-Carbon Transportation Energy concept, the ERN's "board of directors" aims to advance a national framework for energy policy that supports what the federal government might call the National Energy Innovation Initiative (NEII). "Other topics, such as electric grid integration and nuclear energy security, offer potential

(Continued on page 3)

Poll places Sandia as a top 10 workplace for postdocs in life sciences

Relatively new Sandia research area shines unexpectedly

By Neal Singer

One sign of changing times is that, in an opinion poll, the Sandia workplace is listed in the US top 10 for postdoctoral students in the life sciences.

The poll was undertaken by Philadelphia-based magazine *The Scientist*, known for its statistical surveys and life sciences orientation. Results were published in its March issue (*Lab News*, March 14).

"This is a major achievement and great step in the evolution of the bioscience program at Sandia," says Sandia researcher George Bachand (8331). "We are ranked in very elite company."

Postdocs are sometimes referred to as the "lost tribe

(Continued on page 2)

Tauscher on Sandia

In remarks at Sandia/California last month, Rep. Ellen Tauscher, D-Calif., told Sandians they will play an essential role in addressing the great challenges facing the nation across a broad spectrum of issues in the 21st century. Story on **page 3.**

Inside . . .

Bingaman on energy

Sen. Jeff Bingaman, D-N.M., told a standing-room-only crowd at the Steve Schiff Auditorium March 27 that Sandia is poised to meet the energy challenges this country is "just now waking up to." Story on **page 5.**

What's what

Have you noticed how technology has changed not just the way we work, but the nature of the relationships we have with our colleagues? It struck me the other day that I've never actually "met" a lot of the folks I work with here at Sandia, folks with whom I've developed a great (I hope) working relationship over the years. Take, for example, Jim Muntz. He's a member of the technical staff in Infrastructure Computing Services Dept. 9329. For I don't know how long, Jim has been providing solutions for me and for the *Lab News* when we run into technical snags, stuff that's outside the purview of the CSUs. I always start my notes to him with a "Hi Jim," and then I go on to describe some problem that's got me bogged down. Jim always replies - promptly - "See if this works." And of course, it does. Jim's been a great guy, and, in a professional sense, at least, a great friend. And I've never met him. There are lots of Jims out there in my worklife today, and I'll bet there are more than a few in yours, too.

* * *

If you're of a certain age, you remember when air travel was something glamorous, exotic, really special. Heck, I can remember when people actually got dressed up to take a trip by jet plane. I remember when "leaving on a jet plane" sounded pretty darned absolute; it was for sure that if you were leaving on a jet plane, you were going someplace really far away and likely weren't coming back. I just came back from a very delightful vacation and I can tell you: getting there was not half the fun. It wasn't even a quarter of the fun. With apologies to Steve Jobs, the journey was most emphatically not the reward.

On this particular trip, watching the proverbial little old ladies partially disrobing before walking through the metal detectors at the airport, I thought about a scene from the novel *Nineteen Eighty-Four*. Winston Smith, the novel's protagonist, is sitting in a drab cafeteria, eating another in an endless stream of depressing meals. He begins to ruminate on things: "Had it always been like this? Had food always tasted like this? He looked round the canteen....It was true that he had no memories of anything greatly different.... Why should one feel it to be intolerable unless one had some kind of ancestral memory that things had once been different?"

As I sat in the airport, I had my own Winston Smith moment, with a vague ancestral memory that it hadn't always been this way. And I also thought this: Will it be this way from now on?

* * *

Did you see that note the other week from Al Romig about keeping politics out of the workplace? That's always a good idea, especially in this era where "the personal is political." I've noted over the past 15 or 20 years that there's almost no such thing anymore as a simple political disagreement. Today, it's more like, if you disagree with me, you're not only wrong, you're evil. So, yeah, nowadays it's a good idea to keep this stuff out of the workplace. Otherwise, pretty soon you end up with half the labs convinced that the other half — folks you're supposed to work with — are the dark spawn of the Abominable Dr. Phibes (look him up).

See you next time.

Bill Murphy (505-845-0845, MS0165, wtmurph@sandia.gov)

Sandia LabNews

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LOCKHEED MARTIN

Take Our Daughters and Sons to Work Day is April 24

Sandia employees and contractors can bring children and guests in grades 5-12 to work on Thursday, April 24.

All participants must complete a registration form which can be found at the website. Guests are invited to job shadow their hosts. Through job shadowing, TODSTWD provides opportunities for guests to see career opportunities available to them, learn about the exciting work being done at Sandia, and enjoy lunch and other fun activities that will be held at Hardin Field. The event is being sponsored by the Community Involvement Department, and any questions can be directed to Amy Tapia (3652) at astapia@sandia.gov. If your department is interested in hosting an activity for guests to visit, please contact Amy. Check the website (www-irn.sandia.gov/todtwd) for more information, which is updated daily.

For the record

The March 28 *Lab News* incorrectly reported that Kerry Kampschmidt had been promoted to director of Center 1700. He has, in fact, been made director of Legal Business Development Center 11700. Gil Herrera is — and remains — director of Microsystems Science, Technology, and Components Center 1700.

Top 10 workplace

(Continued from page 1)

of science" or as indentured servants, underappreciated and ignored. That Sandia ranks high in an opinion poll of postdocs is encouraging, George says. That it does so in its relatively new focus area of life sciences is startling, he adds.

The survey tabulated 3,086 "usable responses" from 44 questions offered to the magazine's postdoc audience. Sufficient responses — a minimum of five — were received from each of 82 institutions considered in the rankings.

Sandia/New Mexico placed third, behind only the J. David Gladstone Institute (affiliated with the University of California, San Francisco), and the Denver-based National Jewish Hospital, an internationally noted respiratory research center.

Sandia/California placed 10th, behind Genentech and MD Anderson Cancer Center in Houston but ahead of the Whitehead and Novartis institutes for biomedical research (both in Cambridge, Mass.), Lawrence Livermore and Argonne national laboratories, Emory University, the Mayo Clinic, and others.

The Scientist has long been a respected compiler of statistics. Probably its best-known effort is its tabulation of the frequency with which a technical article is referenced by other technical articles. The ranking has become one means of establishing an article's importance in its field.

In the postdoc poll, respondents were asked to assess their working environment in 11 areas, agreeing or disagreeing on a one-to-five scale with statements posed.

Categories included the quality of training and mentoring, career development opportunities, quality of communication, networking opportunities, value of the postdoc experience, quality of facilities and infrastructure, funding, equity, remuneration and compensation, benefits, and family and personal life.

The magazine's caveats to its own poll include cautions that small sample results may have led to bias in the results, and that no attempt was made to measure the statistical significance of the results.

Sandia/New Mexico was praised most highly by respondents for its pay scale and faulted worst for its equity provisions. Sandia/California was praised most highly for its benefits but faulted worst for its career development opportunities.

Sandia postdocs at both locations, asked about their positions after the survey appeared, also cited the ready availability of partnerships with engineers, reasonable odds on getting funding for projects, and respectful management attitudes toward family obligations.

"Our survey is based on what our readers tell us," says Edyta Zielinska, associate editor at the magazine. "That Sandia came out on top means respondents think well of it in a number of categories."

IES all-hands meetings scheduled for May 5, 7

Div. 9000 VP Joe Polito, who heads up the Integrated Enabling Services Strategic Management Unit (IES SMU), and Tom Blejwas, director of Management Systems and Support Center 9700, will host 2008 IES all-hands meetings in New Mexico and California.

The New Mexico session will be in the Bldg. 962 auditorium in Tech Area 4 May 5, 1-3 p.m. MDT. The California session will be in the Bldg. 904 auditorium May 7, 1-3 p.m. PDT. The May 5 session will be videostreamed live at http://ln.sandia.gov/IES-SMU-May-2008.

Joe and Tom will provide an overview of the near- and long-term direction of the IES SMU and will highlight the year's accomplishments and lessons learned.

A question-and-answer session will follow the presentations. At the May 5 session questions will be fielded from both the virtual and live audiences. To submit questions confidentially ahead of time, email New Mexico ombud Don Noack at ddnoack@sandia.gov or California ombud Reese Ramos at maramos@sandia.gov by April 25. Specify on the subject line: "Question for IES All Hands."

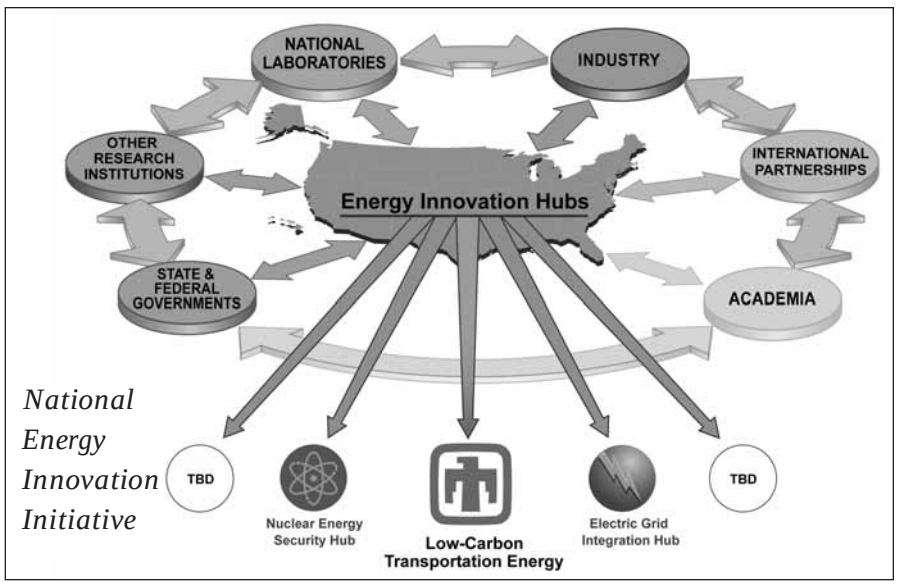
IES management and staff who work in Divisions 3000, 4000, 9000, 10000, 11000, or 12000 (except 12300) or in Center 0330, 8500, or 8900, are encouraged to attend. Address questions about the sessions to Jane Zingelman (9710) at jtzinge@sandia.gov.

Big idea

(Continued from page 1)

for other innovation 'hubs' that could conceivably be led by Sandia," says Margie.

When successfully developed, the low-carbon proposal will be presented to DOE decision makers as a potential model for an energy innovation hub, another important component to the NEII idea. Energy innovation hubs would have a clear, distinct, outcome-oriented focus (low-carbon transportation energy and renewables grid integration, for example) and would anchor the NEII and promote international knowledge sharing.



National Energy Innovation Initiative

CRF and CINT demonstrate new approach

Two distinct examples — one with a rich history, the other with a more recent but no less successful blueprint — inspired ERN management to think differently about how Sandia works and motivated DOE to explore models that are open and inclusive.

"DOE's leadership believes it needs to develop a more effective framework for linking science and innovation," says Terry. To that end, the Combustion Research Facility (CRF) and its more than 25 years of success in information sharing, leading-edge science, and commercial partnerships offers one viable model, one that DOE uses as an example of a facility where scientists and engineers work together to bridge the "valleys of death" in technology development efforts, he says.

"Securing America's energy future will not be possible through technology development alone," says Julia Phillips (1100). "Fundamental scientific inquiry is needed to provide the understanding that will enable revolutionary technologies we can't imagine today. We need a mechanism, such as the Energy Innovation Hubs, to accelerate the translation of scientific discoveries to technologies," she says.

Similarly, the recent success of Sandia's Center for Integrated Nanotechnologies (CINT) project presents another example that Sandia's ERN leadership is drawing upon as it considers how to advance a new national energy initiative. CINT is one of five Nanoscale Science Research Centers (NSRC) that, together with other elements, form the National Nanotechnology Initiative (NNI). That endeavor, launched under the Clinton administration, addresses the diverse aspects of nanoscience and technology. Terry likens each NSRC concept to an energy innovation hub, and the NNI to NEII.

"The CRF and CINT have both proven to be invaluable resources for universities, other research institutions, and the commercial sector," says Terry. "They are the cornerstones of their respective disciplines — combustion research and nanoscience — and, in their own ways, have helped jump-start the science and research activities devoted to each of those fields. Similarly, a low-carbon transportation energy program, developed as one of several energy innovation hubs, could be an important piece of the overall energy puzzle."

Focusing on the transportation sector

Andy McIlroy (8350) spearheaded the Low-Carbon Transportation Partnership concept, which was selected from a handful of other ideas. He says the other proposals, themes of which included dedicated research programs into the electric grid, renewable energy sources, and nuclear power, are also viable energy innovation hub ideas and could very well be revisited by Sandia in the future.

"It makes sense right now to focus on the transportation sector," says Andy. "Sandia is already considered a leader in combustion science and a growing leader in alternative fuels development. We have demonstrated a unique ability to integrate science into the marketplace. That's what we hope to achieve with the low-carbon transportation energy idea."

The Transportation Energy Innovation Hub proposal that Andy, Ellen Stechel (6338), and others are developing will contain a number of key elements, including a focus on knowledge-generation and a workable path to innovation. It will also feature a private sector leadership component (currently being identified) that is integrated with DOE science and energy program activities. Other elements will include:

- A clear focus on transportation energy systems
- An open network knowledge community that includes academia and the private sector
- A regional focus that connects with and strengthens local government, academia, and private sector partners
- The assemblage of unique facilities and expertise that provides value to the broader community of scientists and engineers
- A core set of resources, facilities, and expertise
- A campus design that promotes success for key elements of a transportation energy innovation hub

The hope, says Center 8300 Director Terry Michalske, is that a successful low-carbon transportation energy investment will position Sandia as an early "pilot energy innovation hub" and be used to demonstrate the concept to DOE. Such initial successes, he adds, will help build acceptance for the "energy innovation hub" model and lead to follow-on strategies in anticipation of a future, large-scale DOE program.

Sandia an essential part of solution to nation's challenges, says Congresswoman Ellen Tauscher

By Patti Koning

Sandia CaliforniaNews

At a visit to Sandia/California March 26, Congresswoman Ellen Tauscher, D- Calif., laid out many of the problems the country is currently facing — the ongoing war in Iraq, its impact on the economy and troops, the need to shrink the nuclear weapons complex, and energy insecurity.

"We need leadership that will say we're not going to be held hostage any longer by fossil fuels and countries far away with governments that we would never support ourselves. And how do we get this right?" asked Tauscher. "Voila! It will be you. And that is so terribly exciting.

". . . If we do not take this opportunity and take this facility, the smartest people we have, the innovation and great work here . . . and leverage it for the future and get ourselves out of the situation, once again we will be shocked, appalled, and embarrassed that we haven't done it right for future generations."

Tauscher described the Stewardship Transformation Proposal, the transformation of Sandia's California site, as sound, fundamentally innovative, and what the American people require. "What Paul [Hommert], the management, and many of you have proposed is innovative and worth examining as one possible model with lessons learned for the broader complex innovation," she said.

Tauscher, now in her sixth term, is the only member of the US House of Representatives with two national defense laboratories in her district, a fact that makes her proud. "It's a pretty cool place to be. I've been able to look my colleagues square in the eye and say I represent the smartest people in the world," she said.

Last January, with Democrats in the majority in both the House and Senate, Tauscher assumed the lead of the Strategic Forces Subcommittee of the House Armed Services Committee, which has responsibility over DOE national security programs. She's the third woman in history to chair an Armed Services subcommittee. More significant, she says, is the impact her role can have on Sandia and the nuclear weapons complex.

Recently, the Strategic Forces Subcommittee formed a Commission on the Strategic Posture of the United States to examine America's strategic posture and the appropriate role of nuclear weapons.

"The purpose of this committee is to inform Congress as to what exactly we need to be doing to make the right investments and the right choices on how we move forward toward transformation — a more responsive, smaller complex that has bigger, broader missions that include not only national security, but energy security and certainly a big science and technology agenda," said Tauscher.

MAPPING THE FUTURE — Div. 8000 VP Paul Hommert and Congresswoman Ellen Tauscher look at a map depicting how Sandia/California might look if the Stewardship Transformation Plan is implemented. (Photo by Randy Wong)

Former Defense Secretary William Perry is the commission's chair and James Schlesinger, who served as secretary at both DOE and DoD, is the vice chair. There are 10 members, including Lee Hamilton, a former congressman and vice chair of the 9/11 Commission; John Glenn, a former senator and NASA astronaut; Bruce Tarter, former Lawrence Livermore National Laboratory (LLNL) director; and James Woolsey, former CIA director.

Tauscher said she is hopeful that the commission can return other lawmakers and leaders to the concept of the Reliable Replacement Warhead, or RRW. She likens the current Life Extension Program (LEP) to having a fleet of seven cars to make sure you can absolutely ensure that you'll have a car to drive to work each day.

"What if someone came to me and said I'm going to take one car and fix the engine so you absolutely positively know it is going to start every time? But while I have it up there I'm going to add more security, and by the way, I'll make it more environmentally sound," she said. "I've added good things but I haven't changed the nature of what it is. It's not a new car, but it is safer, better, and more reliable.

"People started saying 'new weapons' and that's where RRW went off the tracks. We're not building new weapons. We're trying to make a smaller composite of the weapons we have that is safer, more environmentally sound, and more sure and get rid of the other six cars. Because I've got [other] stuff to do for the people who are maintaining those other six cars."

Tauscher spoke to a full crowd in the Combustion Research Facility auditorium. In attendance were Div. 4000 VP Mike Hazen; Bruce Goodwin, associate director for Defense and Nuclear Technologies at LLNL; Michael Nacht, dean of the Goldman School of Public Policy at University of California, Berkeley; and Garry George of Britain's Atomic Weapons Enterprise (AWE).

To watch Tauscher's speech and the question and answer session, go to http://surf.ran.sandia.gov/streaming/2008/tauscher.html.

Sandia licenses its less-than-lethal flash-bang technology

New device safer for law enforcement, military

By Stephanie Holinka

THINGS THAT GO BANG — Sandia Pro Force Lt. Chris Dallas and Pro Force officer Tristan DeSantis (both 4211) demonstrate a new safer flash-bang grenade, the latest version of a device developed at Sandia more than 20 years ago. (Photo by Randy Montoya)

Sandia has licensed its safer, nonexplosive fuel-air diversionary device technology to Defense Technology Corporation of America, located in Casper, Wyo.

Diversionary devices — also called stun grenades or flash-bangs — are less-than-lethal devices used in a wide variety of law enforcement and military operations. Like a grenade, the device is activated by pulling a pin. When thrown, the flash-bang creates a loud sound and bright flash of light to temporarily distract or disorient an adversary.

Flash-bangs are used in law enforcement and military operations such as hostage rescue, room clearing, crowd control, and other specialized operations. Military or law enforcement personnel will typically break down a door or smash a window of a building and toss in the diversionary device during a forced entry.

More than 20 years ago, Paul Cooper and Ed Graeber, both now retired from Sandia, created the original Mk 141 flash-bang diversionary device, which was intended for limited (and specialized) applications. It was state of the art for its day. Paul's protégé, Mark Grubelich (6331), built on that original groundbreaking work and came up with an improved flash-bang — far safer for law enforcement and the military.

Flash-bangs that use existing pyrotechnic technology function like explosive devices — once ignited a "flash powder" mixture of aluminum and potassium perchlorate powders quickly reacts, resulting in an explosive output, Mark says. "They function like any other grenade-type explosive device but without any shrapnel, just a flash and a bang."

Like any other explosive device, flash-bangs can be damaged in the field, poorly manufactured, or incorrectly deployed. With the older pyrotechnic technology employed by the previous generation of flash-bangs, any of these types of problems can result in horrific injuries.

"There are a number of disadvantages associated with currently available diversionary devices," Mark says. "Serious injuries have resulted from their use both operationally and in training." Because safety is of paramount importance, the new fuel air technology was developed to address the issues associated with the severe over-pressure produced in the proximity of current diversionary devices.

In this new diversionary device, Mark says, the flash-bang produces a dust explosion on a very small scale — a gas generator rapidly ejects and ignites aluminum powder. That deflagrating cloud of burning aluminum powder provides an intensely bright light and an "explosive" noise. The body of the diversionary device itself does not explode, making the operation safer for the person deploying the item and for anyone in the area. This lessens the likelihood of injury and the severity of the consequences should a mishap occur.

Mark recently appeared on the History Channel series *Modern Marvels* where he explained how the improved technology functions and also demonstrated the device.

The new flash-bang can be made into many body styles appropriate for fielding by the military and law enforcement for a variety of applications, says Mark. Economical and refillable versions can be made for training purposes. A heavier version of the flash-bang could also allow it to be thrown through windows.

The technology was originally licensed in 2002 to a different company, but the licensee did not bring the product to market. "Sandia looks forward to Defense Technology making a safer device available to the military and to law enforcement agencies all over the country," says Mark.

Oil prices

(Continued from page 1)

billion barrels a year.

"The world economy has been growing at a pretty good clip," Arnie says. "As a result, oil demand has remained high in the oil-hungry United States while it has been increasing sharply in developing countries like China and India."

In February alone oil demand by China rose 6.2 percent, exceeding the 3.3 percent rise in January and the 3.5 percent increase for all of 2007. Also during February 2008, China increased its purchases of crude oil by 18.1 percent compared to a year earlier.

Stagnant oil production

At the same time the thirst for oil is on the rise, Organization of the Petroleum Exporting Countries (OPEC) and other oil producing nations are not increasing their output as much as they otherwise might, largely because they don't need to. Rising oil prices have poured billions of dollars into their economies and reduced their need to produce more oil, Arnie says.

The only OPEC country that has agreed to significantly increase its oil production capacity is Saudi Arabia, but that process is taking longer than anticipated. Instability in other countries in the region, such as Iraq, is causing stagnant production levels, and Russian production, while still increasing, is less than it would have been if President Vladimir Putin had not reasserted control over that country's oil and natural gas sector. Venezuelan President Hugo Chavez has "redirected" the national oil company PDVSA, disrupting what would have otherwise been higher levels of Venezuelan oil production.

"OPEC, especially Saudi Arabia, Kuwait, and the UAE [United Arab Emirates], acts as a balance wheel in the oil market through their surplus oil production capacity, which began to decline in 2003. By 2005 it was down to 1 million barrels a day, though it rose to 2.2 million barrels a day last year," Arnie says. "When the ability to produce extra oil is low, any disturbances in the market — like instability in Nigeria, the war in Iraq, or problems with Iran over nuclear power — cause prices to rise. While excess capacity is expected to fall this year, it may grow to 3.6 in 2009 and begin to provide the market with some breathing room."

Falling dollar

A third thread to the oil price increase is the falling US dollar, which is very low against other major currencies. During the first three months of this year, the euro rose 7.5 percent against the dollar. The dollar also tumbled 10.5 percent versus the yen.

Since oil is priced globally in dollars, any big markdown in the dollar gives oil exporters incentives to try to charge higher dollar oil prices. It also affects the US and its trading partners differently. For foreign buyers, whose currency is rising in value against the dollar, the effect of any oil price increases is much less. But American consumers have to pay 100 percent of any oil price increase with their dollars.

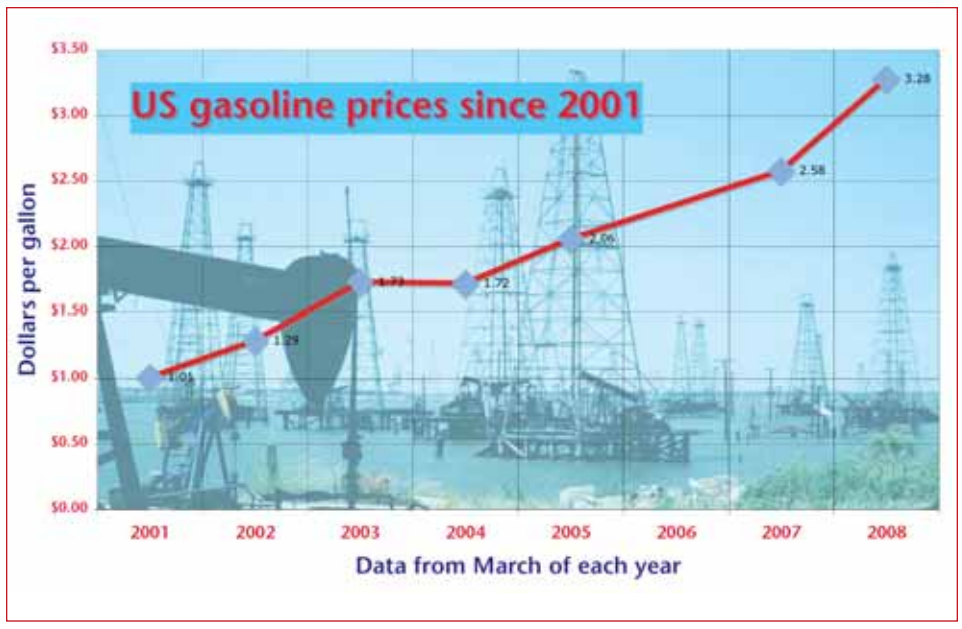
China can afford $100 a barrel oil

China is an example. That country's currency is rising in value, but it still can sell its wares overseas cheaply — and it sells a lot. As a result, China has a huge financial reserve and can afford $100-a-barrel oil.

As the dollar's value slips, the stock market gets more and more "nervous," Arnie says, causing people to move speculative money from stocks into commodities such as oil, metals, livestock, corn, and soybeans. The new speculative money pushes the commodity prices higher. "All this helped oil prices leap to $110," he says.

Arnie cites one more reason for pain at the pump — not enough US oil refining capacity. Existing refineries in the US produce gasoline and other end-use products in the 90 percent plus range of capacity. While refining capacity has crept up a small amount since 2005 through operating efficiencies, the solution — adding significant refinery capacity — is more easily said than done. People don't want to live near refineries, and refineries are subject to tight environmental restrictions. No new refinery has been built in the US since 1976. The lack of enough refineries is being made up for by imported products such as gasoline and other refined products — averaging about 13.4 million barrels per day in 2007.

"These reasons and more have led to the increase in oil prices," Arnie says. "Some oil analysts believe that between 2009 and 2011 prices will return to the 80 dollars a barrel level or below. Others think prices will remain in the $90 range or above. To me it's a big toss-up right now, but markets eventually work, and not only on the way up."



Petro-facts

- US is the largest oil consumer in the world — 20.6 million barrels per day
- US has the largest economy in the world — $13.8 trillion
- US produces 25 percent of the world's gross domestic product (GDP)
- US consumes 23 percent of the world's oil
- US emits the largest amount of carbon dioxide from fossil fuels — 22 percent (2004)

Sen. Jeff Bingaman tells standing-room-only crowd that Sandia is poised to help meet nation's pressing energy challenges

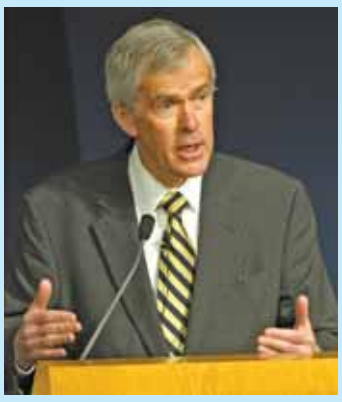


Photo by Bill Doty

SEN. JEFF BINGAMAN

Sen. Jeff Bingaman, D-N.M., told a standing-room-only crowd at the Steve Schiff Auditorium March 27 that Sandia is poised to meet the energy challenges this country is "just now waking up to."

He said Sandia can play a crucial role by creating balanced analyses and robust models to answer specific energy policy questions and help prioritize energy technology options.

It is crucial, Bingaman said, that Sandia function as a resource to the entire nation, and not just for the US nuclear weapons deterrent. "In fact," he said, "exercising your capabilities through your energy and other civilian-related missions enhances your ability to carry out your defense programmatic missions." He noted that Sandia has functioned as "just such a resource to the nation for over 50 years," citing Sandia's "major contributions" to the science and technology of combustion, in solar power, in microelectronics, and in "a host of other areas."

"Sandia is well positioned," Bingaman said, "to continue to contribute to the nation as it addresses an imposing array of energy challenges in the years ahead. Your core competencies in combustion, advanced materials, microelectromechanical systems, and nanotechnology, to name a few, will be greatly needed and appreciated."

Among some of the key energy policy questions Bingaman sees that must be addressed are location of new energy supplies, efficient use of energy sources, balance between energy use and the environment, and finding new ways around difficult policy problems.

As chairman of the Senate Committee on Energy and Natural Resources, Bingaman is well positioned to ask these questions and seek answers — none of which, he said, will come easily.

The senator displayed a chart that showed a ranking and a sense of the economic costs and benefits of various technological options for reducing carbon dioxide emissions. "This sort of ranking is potentially quite useful to the Congress and the country as we formulate budget, regulatory, and tax policy regarding global warming," he said. If the Energy Information Agency agrees with the economic analysis depicted in the chart, Bingaman said he intends to use the information to push for more aggressive action by the federal government to require the sorts of interventions that actually save people money while helping to abate greenhouse gas emissions.

"I hope that you [at Sandia] can help out me and my colleagues in Congress in a similar way [by providing complex technical analysis] when it comes to energy technologies. . . . You have a strong population of top scientists and engineers who are interested in energy. We need to find better ways to access your technical strengths, to make sure that we are making good choices when confronted with difficult energy problems.

"We need this strong and balanced technical input," he said.

Bingaman noted that the public wants Congress to move ahead in answering these questions more rapidly than it has. But that has resulted in a good thing — a bipartisan interest in energy in Congress as seen in the Energy Policy Act of 2005 signed at Sandia and the Energy Independence and Security Act of 2007.

Sandians shine at March meeting of American Physical Society

By Neal Singer

More than 7,000 physicists converged in New Orleans for the American Physical Society's March meeting, the largest annual meeting in the world for physicists.

At least 60 papers had at least one Sandia author — about, roughly, one in 100, a sizable percentage.

Interestingly, out of 15 prizes and awards offered by the society, two were won by Sandians — about, roughly, one in seven.

Does that mean that Sandia is doing something right?

Computation/Simulation

Gary Grest (1114), winner of the Anessur Rahman Prize, gave a Monday morning, conference-opening lecture on his groundbreaking computational methods as successfully applied to the study of polymers and complex fluids. (Anessur Rahman was the founder of molecular dynamic simulations.)

Polymeric properties, Gary said, make them ideal for materials incorporated in a variety of technologies, from space shuttle and automobile parts to medical implants, lubricants, and nanoelectronics.

But the seemingly opposite qualities of robustness yet flexibility that characterize polymers were hard to explain until Gary's team provided an insight into the dynamics of the large molecules: They could be characterized as moving in the equivalent of a tube that itself was formed by neighboring chains.

Using this concept and others, Gary's team was the first to offer computational evidence that the properties of polymers are due in part to long-chain molecules moving in a snake-like manner — a concept, called reptation, first proposed by Nobel laureate Pierre de Gennes.

"The challenge isn't to do simulations that match what researchers can do experimentally," Gary said. "The challenge is to use simulations to obtain scientific input that cannot be achieved experimentally."

Energy security

At lunchtime, Julia Phillips (1100) had the challenge of following MIT's Millie Dresselhaus, possibly the holder of more awards and decorations than any American since Gen. George Patton. Dresselhaus was celebrated again for pioneering work elucidating the electronic properties of novel forms of carbon — a hot topic at the overall meeting.

Julia, director of Sandia's Physical, Chemical, and Nanoscience Center, captured the attention of several hundred people in one of the larger convention center rooms as she presented the George Pake lecture — an honor awarded "for her leadership and pioneering research in materials physics for industrial and national security applications."

She described the significant reduction in the world's energy use that would be possible were the so-called Edison light bulb universally changed out for light-emitting diodes. She spoke of efforts led by Sandia to improve LED efficiency.

Sustained financial investment is critical, she emphasized, to achieve energy security. "The efforts that really make a difference require the long-term engagement of the best minds in the US and the world," she said. "These individuals have many options, and if they cannot be assured continuous support over a reasonable period of time, they will do something else.

"Government labs are, at least in this country, the last-standing large interdisciplinary bastions that can put together large teams to address issues of truly national importance. Energy security clearly needs to be at the top of that list."

Graphene

Sandia senior manager Carlos Gutierrez (1114) suspected that "as many as one in six talks at APS will be graphene-related." While *Lab News* didn't attempt to count the number of graphene-related talks, there were quite a few.

Sandia researcher Taisuke Ohta (1114) — a recent arrival from Lawrence Berkeley National Laboratory — gave an invited so-called "focus" talk on "Electronic structure and morphology of graphene films on silicon carbide."

"We plan that Taisuke will work with other SNL staff and help us launch new high-impact graphene research activities at Sandia," Carlos wrote in an email.

Graphene is a two-dimensional arrangement of carbon atoms that, according to Taisuke, has "a unique electronic structure, high electron mobility, and excellent thermal conductivity [i.e., it cools fast and easily]."

"We need to develop synthesis routes for large-area graphene films, but how?" he asked his audience rhetorically. "Can we really make devices using SiC-based graphene? How can we control film thickness and morphology, as well as the electronic structures of graphene on a substrate?"

Low-energy electron microscopy, he said, with its atomic-layer resolution and micron field of view, is useful to control the film thickness and to optimize its morphology.

Generally speaking

Other talks at the conference showed physicists — who believe their science underpins all others — weighing in on the right way to characterize global warming and how to achieve better economic forecasting tools, as well as (with a lighter touch) on the materials science of superheroes, the art and materials physics of the motorcycle, and "Sox and drugs: Baseball, steroids, and physics."

Sandia titles tended to be more workaday, but possibly more useful in moving the world's work forward, like "Coulomb Blockade in Double Top-Gated Si MOS Nanostructures," by Eric Nordberg, Malcolm Carroll, Kevin Eng, and Joel Wendt (all 1725), Mike Lilly and Lisa Tracy (both 1132), Kent Childs (1748), Robert Grubbs (2452), and Jeff Stevens (17461), with Mark Eriksson from the University of Wisconsin at Madison.

Sandia researchers: Global water shortage looms

By Chris Burroughs

A crisis is looming over water shortages worldwide. By 2025 more than half the nations in the world will face freshwater stress or shortages and by 2050 as much as 75 percent of the world's population could face freshwater scarcity.

So say Mike Hightower (6332) and Suzanne Pierce (6313), Sandia water experts, in an article in a recent issue of *Nature*.

"This growing international water crisis is forcing governments to rethink how they value and use and manage water, especially because economic development hinges on water availability," they say. "Drinking water supplies, agriculture, energy production and generation, mining, and industry all require large quantities of water. In the future, these sectors will be competing for increasingly limited freshwater resources, making water supply availability a major economic driver in the 21st century."

Withdrawals already exceeding precipitation

Freshwater withdrawals already exceed precipitation in many parts of the US, with the worst shortfalls often in areas with the fastest population growth, particularly in the Southwest. But this is also very much a global problem.

What can be done to help solve the water dilemma? The answers are not simple, say Mike and Suzanne, and will involve usage of all water sources — more than just freshwater supplies as has been the primary focus in the past. Innovative treatments will have to be used — treatments using advanced membrane separation technologies, as well as treatment of nontraditional water sources such as wastewater, brackish groundwater, seawater, and extracted mine water.

Mike and Suzanne say that to some extent this is already happening. In the United States, wastewater reuse is growing by 15 percent per year.

"There are other, cheaper ways to increase water productivity, such as improving water conservation and efficiency," Mike and Suzanne write in the *Nature* article. "But water reuse can help to expand these traditional approaches by matching the quality of water supplies to needs, and substituting nontraditional water for freshwater where appropriate."

As an example, wastewater, seawater, or brackish groundwater could be used by electric power plants for cooling and processing instead of freshwater. Another example: Power plants could begin switching to renewable energy technologies that do not need water for cooling, such as wind and solar electric; and introducing technologies to condense evaporation from cooling towers and capture and reuse the water.

Mileposts

New Mexico photos by Michelle Fleming
California photos by Randy Wong

Steven Arroyo
30 9329

Bruce Malm
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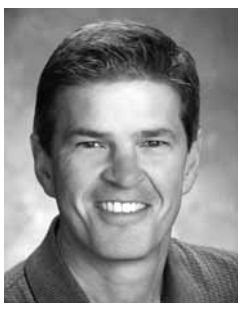

Thomas Raber
25 8772

John Wagner
25 6341

Carl Hayden
20 8353

Mark Mitchell
20 8949

Stephen Parker
20 10011

Paula Provencio
20 1111

Bradford Skinner
20 4855

Duane Sunnarborg
20 8362

Sylvia Thomas
20 2021

Steve Trujillo
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Sandra Warner
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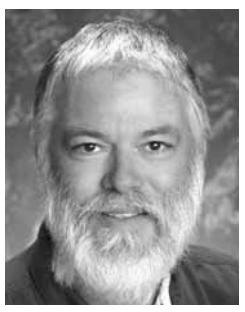


Robert Whiteside
20 8964

Linda Wilson
20 3521

Luis Bernardez
15 8238

Rick Calvert
15 6031

Bradley Elkin
15 4128

David Heckart
15 9312

Gail Hughes
15 9343

Cheryl Huppertz
15 2733

Barbarba Jaramillo
15 6038

Greg Mace
15 4018

Linda Smith
15 3521

H. Patty Srader
15 6034

Denise Taylor
15 3554

Phillip Van Buren
15 511

Recent Retirees

Susie Malonado
31 215

Sheryl Stewart
28 3522

Pat Miller
26 4826

Ruth Padrick
26 7234

Ireena Erteza
15 5937

Carol Garcia
15 10265

Jerry McClellan
15 2958

Kate Sauer
15 4232

CINT wins DOE Secretary's Achievement Award

Secretary of Energy Samuel Bodman presented the DOE Award for Achievement to the Sandia/Los Alamos joint Center for Integrated Nanotechnologies (CINT) at the biannual DOE project management workshop in Washington, D.C., last month.

CINT is a DOE Office of Science Nanoscale Science Research Center operating as a national user facility. Its purpose is to help establish the scientific principles that govern the design, performance, and integration of nanoscale materials.

As one of two DOE engineering/construction projects receiving recognition, the CINT project team was praised for effective management in the construction and instrumentation of two new research facilities, totaling more than 130,000 square feet of laboratory, cleanroom, storage, and office space.

The new facilities provide space for hundreds of researchers who come to CINT to make use of a comprehensive array of capabilities and technical expertise.

The $75 million project was formally completed in April 2007 on schedule and under budget, although initial operations in the new facilities were able to start much earlier in 2006.

SECRETARY SAMUEL BODMAN (far left) conveys the DOE Award of Achievement to (from left to right) William Ortiz, NNSA Sandia Site Office federal project director; Altaf (Tof) Carim, DOE's Office of Basic Energy Sciences CINT program manager; Neal Shinn, Sandia CINT user program manager; and Ingrid Kolb, DOE Office of Management director. (Photo by Ken Shipp, DOE)

The integrated Sandia/LANL project team credited extensive intra-team communication and planning for its ability to respond to unanticipated challenges such as the LANL "stand-down," federal budget continuing resolutions, and construction cost escalations.

Now in its second year of operations, CINT is managed by a joint Sandia/LANL team and led by codirectors Robert Hwang (1130) and Antoinette (Toni) Taylor (LANL).

—Neal Singer

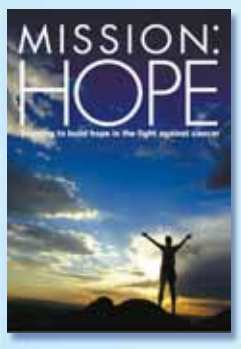
Mission Hope survivor stories — Support vital in beating cancer and for living each day

By Jan Kohler (6482)

"If you haven't had it, you are extremely lucky and very fortunate."

— Les Shephard (6000)

About a year ago, Div. 6000 VP Les Shephard phoned longtime colleague, personal hero, and cancer survivor Dick Fate (6486) about heading a fundraiser to spotlight cancer awareness. Les' only stipulations were that he wanted local charitable organizations to benefit from this event, and he wanted the event to coincide with Sandia's Cancer Awareness Month in April.



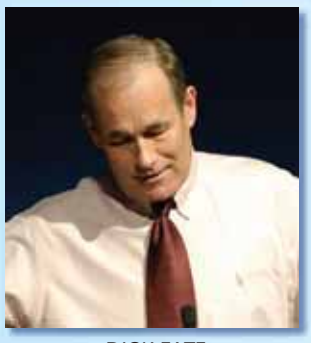
After much thought, Dick concurred. He invited two local organizations, instrumental in his own recovery, to help with lunchtime presentations at Steve Schiff Auditorium: the University of New Mexico Cancer Center (UNMCC) and People Living Through Cancer (PLTC).

Les kicked off the first of five presentations April 2 at the Steve Schiff Auditorium. The presentations are designed to illustrate a subject that will touch almost everyone sometime in their lives. Those who spoke shared their insightful, often touching personal messages in beating cancer.

* * *

"Look at every day and enjoy the day."

— Dick Fate (6486)



DICK FATE

To begin his presentation, Dick asked the audience to hold up a hand if they or an immediate family member had ever had cancer. Almost every hand went up.

Like all cancer patients, Dick has faced many sides of cancer: medical, social, emotional, and financial. He said he appreciates the support that gets him through each day, from individuals as well as organizations like UNMCC and PLTC.

* * *

"Your whole world changes."

— Jim Stephens (6435)

That's what happens when you're given the diagnosis.

JIM STEPHENS

Although it's been just over five years since Jim first heard "the word," the emotions are still vivid and raw as he recalls how powerful the message was when he learned he had prostate cancer. He described, with obvious pain and emotion, having to call his wife with the news.

He stressed the importance of being aggressive in demanding answers about dealing with cancer. "Get a second opinion and analyze your treatment options. You can't rely on others; your treatment plan is your choice," he told the audience.

* * *

"There's something about surviving cancer that makes life better."

— Linda Lovato-Montoya (3654)

At 37, Linda was involved in a busy career, newly married, and caregiver for her aging parents. She didn't have time for breast cancer. But, she says, "Something was put in front of me that made me look at the most important thing in my life."

LINDA LOVATO-MONTOYA

Part of her survival included writing in a journal. Her thoughts are compiled into a booklet called "One Day at a Time." If you're interested in reading it, contact Linda at lflmont@sandia.gov.

"I can raise a boy, but I can't raise a girl."

— Dr. Ed Cazzola, Sandia Medical (3300)

DR. ED CAZZOLA

"You think you can do it; you think you can handle it, until it comes knocking on your door." Dr. Cazzola feared raising a 5-year-old daughter without her mom there, but he knew he might have to. He became a caregiver to his wife who was stricken with breast cancer. He said that as a physician, he hadn't appreciated the support cancer patients needed, until he became that support.

* * *

Les praised the Mission Hope program as "a super event that touches all of us at Sandia." He noted that since many at Sandia are impacted by cancer, they may want to contribute to a cancer charity. These websites offer a starting point: www.pltc.org and www.cancer.unm.edu.

Presentations in the Mission Hope series continue at the Steve Schiff Auditorium as follows:

- Tuesday, April 15, noon: "Intimacy in relationships," ACTIVE (After Cancer Treatment: Involved, Vocal & Engaged) by PLTC and UNMCC
- Wednesday, April 23, 11 a.m.: On Borrowed Time, PLTC cancer survivors demonstrate art and dance, and local humorist Bill Resnik revisits Sandia to lighten the mood in "Dare to Laugh"
- Wednesday, April 30, 12:15 p.m.: Clinical trial review, "Hope Through Research," by Dr. Melanie Royce of UNMCC

Dried gourds become Evan Harrison masterpieces

By Iris Aboytes

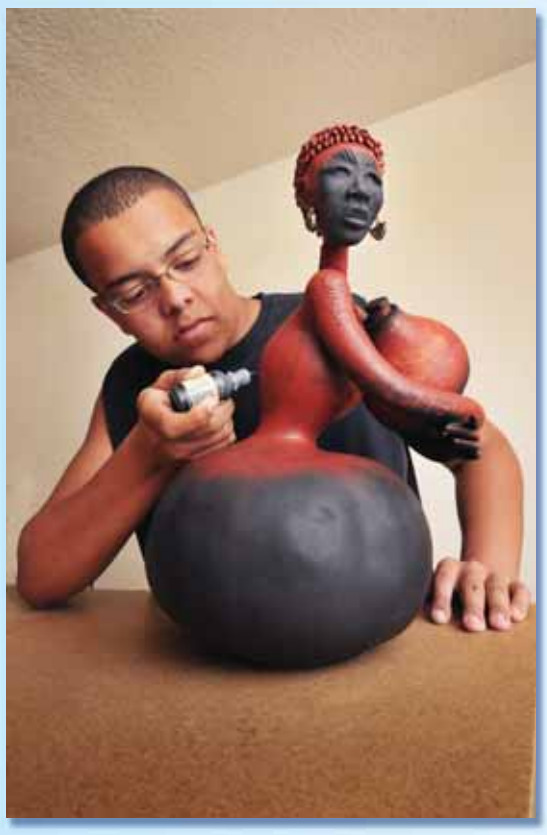
"Evan creates magic," says Alice Baltz (3654). "He has a vision."

One could say Alice is partial if it weren't for the fact that her teenage son has sold every figurative African-themed sculpture he has created. Evan's masterpieces, created with dry gourds, clay, and paint, all have sold on opening night.

When he was two years old, Evan was drawing dinosaurs. In elementary school his classmates began requesting specific drawings of favorite cartoon characters. In third grade he won first place in an elementary watercolor painting exhibit.

Fourth grade required a family tree. "Evan was not particularly thrilled, but he approached it in his own unique way," says Alice. "Instead of a tree, he designed a pyramid. Family names were written in hieroglyphics on each generation's level, using Egyptian names for the living and English for deceased relatives' names within the interior of the design. He could take the pyramid apart."

Tattoos were popular in middle school. Evan drew them on students with Sharpies for a fee.



CREATING MAGIC — Evan Harrison applies paint to one of his many sculptures made from gourds. His art has attracted a lot of interest at art shows and galleries.

(Photos by Randy Montoya)

He has explored many artistic venues in high school. His entry into gourd sculpture occurred during the past year.

While participating in the local chapter of ACT-SO (Academic, Cultural, Technology, and Scientific Olympics), a major youth initiative of the National Association for the Advancement of Colored People (NAACP), Evan met noted gourd artist Robert Rivera, who agreed to be his mentor.

Evan won three gold medals in regional competition, which qualified him to go to ACT-SO nationals in Detroit. Out of 300 artists, he was selected to present his artwork to an audience of 2,000 attendees.

Using gourds Evan creates sculptures of African people from different tribes. The beadwork, the design — Evan does it all. "Through my sculptures I hope to preserve the original culture of the people in sub-Saharan Africa," says Evan. "These people have made important contributions to all of civilization. I also do it because it is part of my culture."

Evan works on two or three gourds at the same time.

Both his parents and other family members are involved with art in one way or another. He has been like a sponge in learning from them.

He recently participated in Soul Expressions at the South Broadway Cultural Center in Albuquerque. Both of his pieces sold the first night. "I was sort of standing around and this couple asked me if I knew the artist. They told me they were looking for him," says Evan. "I listened to them for a while, and eventually told them I was the artist. They seemed surprised. I don't think they expected to see a teenager." Evan is a high school senior.

When his sculptures won first and second place at the New Mexico State Fair, Fred Wilson, president of the New Mexico African American Artist Guild, invited Evan to join the organization. Evan became the youngest member of the guild.

Evan's aspirations aren't any different than any teen's. He wants to be successful. He wants to go to college, continue to grow in his art, and eventually have art galleries across the United States or at least one on the East Coast and one on the West Coast, he says.

EVAN HARRISON puts final touches on his gourd art.