Joint cyberdefense training session held at Sandia

Aim to help labs and agencies share information, identify attacks, minimize damage

By Neal Singer

For people entering offices in early morning, their desktop computer screens still dark, the world looks peaceful. The day hasn't quite begun.

But it's an illusion. According to a team of Sandia and Los Alamos technical experts and instructors,

"Attackers work in linked groups; we should respond the same way, notifying each other of incoming attacks and borrowing expertise from groups we know can best handle a particular problem."

— Kevin Nauer (9312)

there's a battle raging 24/7 over the "minds" of those computers, analogous to the silent struggle waged by interlocked tree roots fighting for water, though trees stand as peacefully as blank desktop screens.

The technobattle is about information.

Each year, according to some estimates, millions of sites are hacked, says Alex Quintana (9317), teaching at a first Sandia-led workshop meant to forge cooperative links among computer analysts at DOE labs and other

(Continued on page 3)

FEELING THREATENED? — Nothing concentrates the mind so wonderfully as being under attack (to modify an old saw). These computer analysts show their concern as they respond to a Red Team simulated cyberattack on the group's linked computers. The Red Team is behind curtains (very top left); the cyberdefenders are from a variety of DOE labs and government agencies. (Photo by Randy Montoya)

Sandia LabNews

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Sandia National Laboratories

Weapon Intern Program connects past, present, future of the nation's nuclear weapons enterprise

SANDIA'S WEAPON INTERN PROGRAM offers its students an in-depth, one-year curriculum that exposes them to every aspect of the nation's nuclear weapons enterprise. WIP students, from left, Don Dowdle (8229), Paul Freshour (2134), Dan Cordova (2132), Pauline Pham (Kansas City Plant), and Jim Herrmann (also KCP) examine a reentry vehicle mockup. (Photo by Randy Montoya)

By Bill Murphy

Sandia's Weapon Intern Program meets a need that has been 60 years in the making.

Born in the dark days of World War II in a race to build a weapon that could end the war, the nation's nuclear weapons efforts soon ramped up to become an industrial-scale enterprise designed to meet the challenges of the Cold War.

The first generation of America's nuclear weaponeers bought their experience the hard way — through years of intense intellectual effort and discipline, deep thought, and endless experiments in the laboratory and in the field. Subsequent generations of weaponeers, too, brought intellectual firepower to the lab bench and test sites. But they had an advantage: They could learn from the old hands and hone their skills under the watchful eyes and guiding hands of seasoned veterans. So it was that the nation maintained a cutting-edge capability to ensure the safety and security of the nation's strategic nuclear deterrent.

Nominations are being accepted through Wednesday, July 15, for the Weapon Intern Program class of 2010. General information, requirements, and the application process are available at the WIP website, under "Become an Intern." Questions to Beth Connors at 505-844-6440 or ejconno@sandia.gov.

But then the Cold War ended and the nation decided to stop developing new weapons and to stop testing weapons in the field. This posed a challenge to those charged with maintaining the nuclear weapon stockpile. The old hands, the seasoned veterans, began to retire, taking with them generations of knowledge that would remain relevant and significant as long as the nation deemed it important to maintain a nuclear

(Continued on page 6)

Sandian David Mackovjak and sons plan cross-country bike ride for Wounded Warriors

Have you ever burned 6,000 calories in a day? David Mackovjak (6432) and his 16-year-old twin sons John and James will be doing just that when they start their cross-country bike ride called Riding 4 Hope. Story on **page 8.**

That's that

If you're a regular reader of this column — and you are, aren't you? — maybe you remember the episode I wrote about a couple of weeks back, the one where I inadvertently hit the "reply all" button, sending a message out to the entire Labs. That single hapless, ill-advised click brought down heaps of ridicule on my poor beleaguered head, but it could have been worse. At least my reply was straightforward; I have to admit that over the years, I've sent a few emails — and I'll bet you have, too — that, if they landed in the wrong inbox would land me in hot water (at the very least).

Anyhow, that column item brought a response from a reader who shared a piece of sage advice, one that in this digital age of pervasive, persistent communication ought to be carved in stone: "Remember: Nothing can go wrong until you hit the 'send' button."

* * *

Speaking of emails, have you ever sent a hotheaded one, one you dashed off in the heat of the moment and then began to have second thoughts about? One that had, maybe, too much truth for your own good? I could tell you horror stories (can't we all?) about bosses I've had (not at Sandia; I've been blessed in that regard) who couldn't handle the truth and didn't want it pointed out to them. Not all bosses are like that, though. I'm reminded of the quote from 1930s movie mogul Sam Goldwyn, who once said, "I don't want any yes-men around me. I want everyone to tell me the truth — even if it costs him his job." Now there's an enlightened boss!

* * *

Last issue, we had a nice story by Iris Aboytes about women at Sandia who donate their hair to organizations that make wigs for cancer victims. Turns out, though, we were inadvertently sexist. I got a note from a male Sandian scolding me — gently — for not noting that there are Sandia men, too, who donate their hair for the same cause. A point well-taken. Sorry for the oversight.

* * *

Hairstyles change along with hemlines and heel lengths, of course, for both men and women. But, if I may indulge in a bit of good-spirited stereotyping, it seems like if you see a certain type of man with a ponytail, there's a pretty good chance he rides a Harley. Cool bikes, by the way. I happen to ride a motorcycle to work — not a Harley, unfortunately — and over the years I've noticed a certain behavior that strikes me as having some sort of sociological significance. Exactly what it means, I don't know, but . . . well, let me set this up.

On the road, when two motorcyclists pass each other, they offer a small wave or tip of the head to each other. But not always. It seems that riders who wear helmets nod to each other and riders who don't wear helmets nod to each other, but almost never do helmeted and nonhelmeted riders offer that little gesture of two-wheeled brotherhood. (On Kirtland Air Force Base, by the way, you have to wear a helmet, which I would guess cramps some riders' style.)

Anyway, here's what I began to notice within days of starting to ride: Guys on Harleys, in leathers, with ponytails would acknowledge each other but not us guys in helmets astride Japanese bikes. Pretty soon, discerning their palpable scorn, I stopped nodding to the unhelmeted, usually ponytailed Harley guys hanging from their handlebars. And I noticed that other riders like me in helmets and neon orange vests (without fringe) didn't bother to wave to the Harley riders, either. It's like we were from different tribes. I guess they figure we're wimps. And we figure . . . well, never mind.

A P.S. about the above: Women ride bikes, too, of course; my wife and I both owned bikes years ago and loved to ride together on the back roads of Maine.

See you next time.

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

Dennis Hayes named Fellow of APS

Retired Sandia director Dennis Hayes has been elected a Fellow of the American Physical Society. His election was based on his work during his career at Sandia from 1957-1995 and his post-retirement research at Los Alamos National Laboratory and Sandia (1997-2008). He was nominated by colleagues at Los Alamos.

DENNIS HAYES

According to the APS citation, Dennis is recognized "For pioneering work into the nature of shockwave-induced phase transitions in a broad range of materials and the development of multiphase equations-of-state for materials that can be used in computer codes for large-scale simulations."

Election to Fellowship in APS is limited to no more than one-half of one percent of the organization's 46,000-plus membership.

The citation will be formally presented to Dennis later this month at the biannual meeting of APS topical group on shock compression of condensed solids.

Labs' annual Retiree Social set for August 27

The 2009 Retiree Social — the event that brings together Sandia retirees and spouses — will be held Thursday, August 27, 6-8:30 p.m. at the Rio Grande Botanic Garden in Albuquerque. Attendees to past events have found the Botanic Garden to be the perfect setting for a gathering of friends, good food, reminiscing, and catching up on each others' lives.

Sandia will provide a park-and-ride service from Hoffmantown Church. An invitation with event details will be sent to retirees via mail in late July.

Recent Patents

Note: Patents listed here include the names of active and retired Sandians only; former Sandians and non-Sandia inventors are not included. Following the listing for each patent is a patent number, which is searchable at the US Patent and Trademark Office website (www.uspto.gov).

* * *

Anup Singh (8621): Apparatus and Method for Concentrating and Filtering Particles Suspended in a Fluid. Patent No. 7,534,334

Anup Singh (8621) and Tim Shepodd (8223): Method for Dialysis on Microchips Using Thin Porous Polymer Membrane. Patent No. 7,534,315

James Miller (1815): Regenerable Particulate Filter. Patent No. 7,527,671

Gary Hux (8362): Microfluidic Microarray Systems and Methods Thereof. Patent No. 7,524,672

Steven Goldsmith (6332): Flexible, Secure Agent Development Framework. Patent No. 7,516,112

Patrick Brady (6310), Brian Dwyer (6312), and James Krumhansl (6316): In-Tank Recirculating Arsenic Treatment System. Patent No. 7,514,004

Robert Moore (6771), Mark Tucker (6327), and Joseph Jones (6772): Strippable Containment and Decontamination Coating Composition and Method of Use. Patent No. 7,514,493

J. Chris Forsythe (6341), Patrick Xavier (6344), Robert Abbott (6341), Nathan Brannon (0413), Michael Bernard (6341), and Ann Speed (6343): Human-Machine Interactions. Patent No. 7,526,465

Perry Robertson (1711) and Edward Witzke (6432): Enhancement of Utilization of Encryption Engine. Patent No. 7,362,859

Retiree deaths

Edwin I. Opland (age 77)	April 17
Albert P. Disch (76)	April 17
John P. Trodden (75)	April 22
Lewis D. Ellis (85)	April 25
Gordon S. Worthen (75)	April 25
Patricio Sanchez (70)	April 27
Elsie B. Sandy (age 96)	May 2
Victor James Roh (87)	May 2
Grant John Lockwood (77)	May 10
Evelyn Rhodes (93)	May 14
Neal E. Counts (78)	May 17
Ivy Elmo Dunn, Jr. (83)	May 22
Esequiel K. Montoya (85)	May 23
John A. Beyeler (83)	May 23
James R. Yoder (67)	May 25

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Employee death

Chris Wright — a true friend and procurement genius

On May 23, Christine Wright died from complications due to an injury she suffered last year. She was 59 years old. Chris worked in Purchasing at Sandia, first in New Mexico and then in California, for nearly 30 years. She was a good friend, trusted coworker, and expert in the art of procurement, according to her colleagues.

"Chris never told you yes or no, she told you how to accomplish what you wanted. She was not a gatekeeper, she was a facilitator," says Len Napolitano (8900). "She was an absolute joy to work with. When we created the Distinguished Member of the Laboratory Staff category, she was the prototype member. I'm going to miss her."

CHRISTINE WRIGHT

Jay Keller (8367) recalls an unusual request that Chris handled with her usual expertise. "When we first started the hydrogen program, headquarters chartered an educational outreach activity. We had an outside firm lined up to make a video with Beakman [of the children's television show "Beakman's World," but to pull it off Chris had to process a contract that included the services of Lester the Lab Rat. When Chris took on a task, she made it happen. This made her a delight to work with. Her value went far beyond her job jar of 'purchasing.'"

Chris was well-known and respected at Sandia for her tremendous knowledge and work ethic. "In the 10 years we worked together in Procurement I never saw her cut a corner," says Bob Brandt (8531). "She always did the job as it should be done. Chris set a high standard in her work whether it was contract writing, negotiation, cost justification, policies and procedures, auditing, or training. I know many times she worked late into the evening or over a weekend and her resulting contract or justification was unsurpassed in quality."

"Chris was known as one of the most experienced and knowledgeable buyers at Sandia," says Jeff Manchester (8527). "Her ability to understand the customer's need and merge it with the strict regulations surrounding major purchasing initiatives made her the first choice for most managers at this site."

"Chris was our friend. She was the go-to person in Procurement," says Angela Griffin (8525). "For years she worked weekends because of her open door policy — it was the only time that she had the time to complete any of her assigned work. She was an avid animal lover and she had a great sense of humor and told the best stories. We miss her."

"Chris has been a good friend for the past eight years. We coordinated the student intern housing for several years and she was always gracious and willing to help. Intern housing had its fair share of challenges and she could always make me laugh. She was highly respected by upper management as well as her peers and she will be deeply missed," says Jan Bachman (8524).

"To say that she was an expert in her field is actually quite an understatement. I never asked her a question that she either couldn't answer or could not research and find it," says Carol Crown (8522). "My friendship with Chris was one that went beyond the constraints of words, but I suppose trustworthy would best describe her. We could discuss anything, I could tell her anything, I could say anything, and I knew that it went no further."

Carl Skinrood (8532) began working with Chris when he started at Sandia/New Mexico in Procurement 25 years ago and followed her out to California.

"I was a fresh-faced 23-year-old right out of college and Chris gave me great advice about both work and growing up," he recalls. "That advice continued when I transferred to California. Chris was always a good mentor and a person I could trust to do what she said she would do effectively and professionally. I will miss her."

Bob Brandt met Chris in July of 1985 when she was assigned to train him as a new-hire buyer in Procurement. He recalls that she was a natural teacher. "She would take all the time necessary to answer my questions no matter how busy she was (or how stupid my question). A simple question to Chris often brought a very long and extended answer," he says. "She answered the immediate question but had the knowledge and patience to anticipate what your next challenge might be. She'd then proceed to address potential future questions by giving you those answers in advance."

John Beitia (8525) recalls that Chris' two most important priorities were her husband Skip, who died last year, and her career at Sandia. "Skip was everything to Chris and she loved him with all her heart. She was a fountain of knowledge and she was loved and respected by her coworkers," he says.

Chris entertained her coworkers with stories about her two dogs, Fly and Gator Lu. "Those dogs were her and Skip's children. They never went on vacation without them. She told numerous stories and jokes about Skip, Fly, and Gator Lu and as she talked there was this big smile on her face," says Sandra Simmons (8527). "At the same time, she would listen to you with understanding and compassion and provide good advice. She will be greatly missed. Sandia lost a very dedicated worker and I lost a friend."

Dina Silveira (8525) remembers how Chris and Skip gave names to everything, such as their local grocery store ("Gracie and the dwarfs"). Her work computer was "Chris dude," her Sony Vaio computer was "little guy," and together Chris and Skip named their Dell computer "farmer in the dell."

"Chris and Skip were each other's best friends and partners for life. She was so lost without him. After his passing she kept in contact with us daily, talking to some of us in the department several times a day. She was concerned with our health and wanted to make sure no one was overworked," says Dina. "Chris was a great, special friend and she will be missed immensely."

Another of Bob's far-ranging memories of Chris is that she loved being told a joke but was challenged at the retelling. In fact, her misdelivery of the punch line was often as funny as the original joke. "She also had a very caring side," he adds. "On the evening of the 1989 Loma Prieta earthquake she tried my number all night, wanting to make sure my family and I were okay and our house was still standing. Chris defused the gravity of the post-earthquake situation with her opening words, 'Hey, guy, just wanted to make sure you weren't dead.' Not exactly a PC comment but it made us smile while sitting in the dark." — *Patti Koning*

Cyber training

(Continued from page 1)

relevant agencies.

"Our intent is to build an interlab community of skilled analysts so that we can cooperatively respond to network incidents," says Kevin Nauer (9312), who led efforts to bring about the four-day cyber training session last week. "Attackers work in linked groups; we should respond the same way, notifying each other of incoming attacks and borrowing expertise from groups we know can best handle a particular problem."

The interlab effort would use encrypted communication channels between partnering sites.

"To address technical issues collaboratively, we need relations of trust and personal contact so that there's no hesitation in calling on the right analyst at another lab to help with an attempted cyberattack," says Kevin.

The idea originated when other, smaller DOE sites were nearly compromised by external attacks, says John Abbot (9329). "We sent people to help, the other sites were happy, and [Chief Information Officer] Art Hale and [director of Computing and Network Services Center 9300] Rob Leland got interested in a more formal interlab arrangement. Kevin came up with the idea of cross-site training and an infrastructure to enable collaboration."

Attack and defend

The training sessions, consisting of lectures and a game of attack-and-defend on simulated networks, took place in two isolated, windowless rooms in Tech Area 1. There, 40 computer analysts from DOE labs and other agencies were instructed on how to better recognize and deal with the complex world of computer threats and how to coordinate a response.

Different DOE sites have their own pockets of expertise, says Kevin, and labs under attack should be aware of and use all the joint resources available. One lab may excel at intruder detection and another, for example, reverse engineering — taking code and working backward to figure out the code's intent.

Knowledge of Latin — helpful in reading some scientific literature — is useless in understanding the terms of cyberspace. There, hackers — kids, criminals, or sophisticated foreign teams — trying to break into lab computer systems use hopelessly distorted alphabets, words like "snortsnarf" and varied number groupings, along with truncated commands that require decoding to figure out.

"To counter this, we need seasoned analysts with different skills from various DOE/NNSA sites to work together to respond to these attacks" says Cyber Security Services Senior Manager Carol Jones (9310).

Yet, for all the incomprehensibility of code to ordinary computer users, attackers may follow a rule to "act openly and hide in what is normal," Alex tells the students.

For example, if a password is secured so well that a hacker can't find it, the interloper may lock the machine. To the user, this may seem just another small, inexplicable computer behavior not worth pondering. But it forces the user to reboot. Then the hacker, watching remotely, can see the credentials used to start up the computer.

Even opening a meeting request from an external source may open a computer to secret invasion.

In another trick, hackers may remotely turn on a computer's video or voice recording capability and capture what's being done or said in a room.

They may exploit trust relationships between users to pass malware from one computer to another.

"And they may implement countermeasures," says Alex, "to detect our response to their attack, in order to modify their next assault."

A USB thumb drive can not only record everything on a computer but implant malware as well.

Who are those guys?

So, who are the citizens standing at the gate to bar entry to these malefactors?

To judge from the trainees, they come from every age group, many ethnic groups, with dress and hairstyles one would have to say are not exactly corporate.

They are clean-shaven, sport beards, moustaches, van dykes, and mutton-chop whiskers; are shaven bald or maintain long hair tied in ponytails; wear restrained, checked sport shirts or brightly colored polo shirts and a variety of jewelry, and range from pale to sunburned.

The variety in responder dress, if similar to the variety in their approaches to code, may mean that these anti-cookie-cutter spirits will leave very few holes uncovered for adversary entrance. In other words, there is strength in diversity.

Each site paid its own way to Sandia, a testimony to the desirability of the training.

Because of the need to maintain a continuing cyberguard presence at each participating site, only some of each site's analysts could attend the training session. But that's fine with Sandia organizers, who envision a training session held every six months. "New problems and techniques arise all the time," says John. "The next group of participants will bring back different knowledge from the current ones."

Sandia would like to share the leadership and operation of TRACER FIRE cyber training with other DOE sites.

Says Kevin, "We'd like to have a training session every six months with rotating hosts, so every participating site gets a turn to lead and contribute to improving the strength of DOE/NNSA's cyber security."

This cyber exercise, says Rob, is one example of how Sandia is working to become a model laboratory for cyber security as defined in the Laboratory Strategy for Responding to the Nation's Cyber Dilemma.

SKYwatcher

Dick Spalding charts his own path to understanding the planet

Story by Bill Murphy • Photos by Randy Montoya

Editor's note: Sandia Senior Engineer Dick Spalding (5710) has been at Sandia since 1962. During those 47 years, he has been involved in a number of activities related to national security. He has also developed some unconventional ideas about geophysical phenomena based on the data he has gathered and associations he has made over the decades. Dick sat down recently with the Lab News *to talk about those ideas, which he acknowledges are considered eccentric today but which he believes will someday be accepted as mainstream science. The ideas he expresses here are his own and do not reflect the views of Sandia, Sandia management, Dick's colleagues, or anyone else.*

Watch the skies." In science fiction, it can be an admonition (*The Thing*) or an invitation (*Close Encounters of the Third Kind*), a warning of potential menace or a promise of imminent marvels.

For millennia, humans have watched the skies and seen in them portents and wonders and mysteries deep as time.

Sandia has a sky watcher too, and he, like the ancients, has read in the skies a profound story of powerful forces at work in the cosmos. His version of the story, though, isn't writ in Homeric verse, but in bits and bytes of data gathered over many years by a sophisticated suite of instruments and techniques.

Since Dick Spalding came to Sandia in 1962, he has spent much of his career watching the skies, looking for telltale signatures of nuclear detonations. His observations, gleaned from ground-based and sky-based platforms, served as a first-line early warning system for the nation: If that unexpected nuclear flash ever showed up in the data, the nation wanted — needed — to know about it.

But here's the thing: In the course of watching the skies, Dick saw things he couldn't explain, and in his business, unanswered questions were not only frustrating but potentially dangerous. One of the key functions for the skywatchers, after all, was to help the nation avoid technological surprise.

"There were a couple of observations we were able to make with our instruments that we didn't understand. We knew they weren't nuclear, but we didn't know what they were," he says.

Dick was seeing events in the Earth's atmosphere where the light intensity seemed to him to turn on and off too fast to be explained as a hydrodynamic process — that is, as ablation and expansion of the ablation that would be characteristic of a bolide or meteor. And the observations didn't jibe with conventional lightning explanations, either.

"I went to the articles out there that described the science. I was looking for some linkage to what I was seeing in the data. And that rather quickly resulted in a dilemma: I couldn't find any reference in the literature to the kind of behavior I was seeing. The more I looked into it, the more I was convinced that the literature failed to address these phenomena because researchers were simply unaware of them."

Something new to science

To be fair to the research community, how could they be aware of these things? The ability to watch the skies on a real-time global 24/7 basis, which is what Dick and his colleagues were doing, was something new to science.

"Looking into these dilemmas got me to thinking that, hey, science doesn't know everything about some of these phenomena," Dick says.

Dick's sense that he has been seeing something new may have been validated recently. Researchers from the Czech Republic, including an individual named Zdenek Ceplecha, widely considered the "grand old man" of meteor studies, have postulated that some of the fast meteor flares observed around the planet are a previously undescribed electrical phenomenon, Dick says.

The triboelectric hypothesis

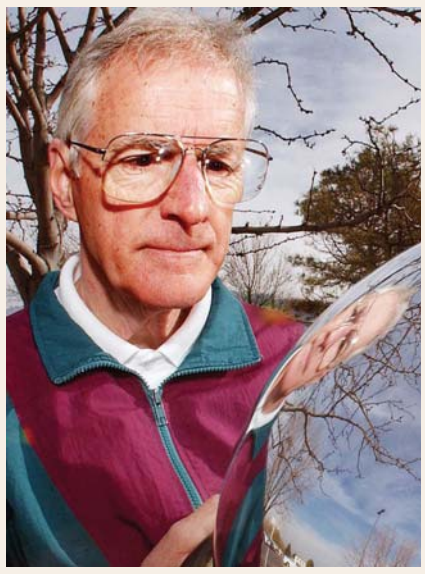
"They're saying not only that the turn-on, turn-off of the light is too fast, they're also saying there's too much light. And they're saying that an electrical — and only an electrical — phenomenon can produce that kind of light, that kind of effect. They are holding out their triboelectric hypothesis very tentatively; they're not suggesting that that is the definitive answer."

(Triboelectricity is electric charge such as you might generate by rubbing a cat's fur. When you get zapped by grabbing a doorknob after walking across a carpet, that's triboelectricity.)

Interestingly, the Czechs became aware of these fast flare processes using high-speed, all-sky radiometers designed and built at Sandia in the late 1990s by Cliff Jacobs (ret.), Tim Gibson (5719), and Jim Daniels (5337).

Dick's determination to understand these observations propelled him on an intellectual journey — via the scenic route — that took him to the very fringes of acceptable science.

"I began looking into fireball reports and UFO reports — if you want to call them that — and trying to correlate them with our data. Not successfully, by the way: We never picked up anything in our data that might be interpreted as a UFO, but I did end up becoming conversant with the UFO community and was convinced they weren't all crackpots, that there really are things happening out there in the atmosphere that science doesn't understand. Things like ball lightning."



DICK SPALDING

A momentous professional association

In a roundabout way, Dick's interest in ball lightning events led him to a momentous professional association that would have a profound affect on his thinking and largely shape the direction of his subsequent inquiries.

While studying — 16 years after the fact — a 1978 incident on Bell Island in Newfoundland that to Dick had all the hallmarks of a ball lightning occurrence, he heard about another researcher who was also fascinated by the event (look up "Bell Island event" on the web for more details); that researcher was Tom Gold, a Cornell astrophysics professor. In a career marked by controversial theories and predictions (many of which proved to be correct), Gold's most controversial stance was far afield from astronomy. He was the most visible and vocal proponent of the idea of the abiogenic origin of oil and natural gas. That is, Gold believed — and he could cite compelling scientific evidence — that coal and crude oil aren't based on decomposed biogenic material but are produced within the deeper Earth. Fossil fuels, in other words, aren't fossil-based at all. If Gold is right — and the vast majority of geophysicists consider his ideas to be bunk — but if Gold is right, the Earth has plenty of oil, most of it a lot deeper than in currently known reserves.

Part of Gold's thinking on the subject of abiogenic oil included the idea that the planet routinely outgases methane, sometimes in great, giant belches and sometimes in little bitty burps. It's that outgassing, he argued, that causes the well-known but not fully explained seabed pockmarks and other unexplained phenomena, including earthquakes.

When Gold pointed Dick to the literature on seabed pockmarks, he gained a convert.

"When I digested what they said [in the literature] and what Tom was saying," Dick recalls, "I figured he's gotta be on the right track."

At the same time Dick was absorbing Gold's theories, he was further refining his own thinking about electrical activity in the atmosphere. He was paying attention when Czech researchers (there were those Czechs again) reported on dramatic landscape-chewing events in Poland and Spain.

As Dick recounts it, "[In the Spanish event] people saw a fireball arc down, and then later found trees knocked down and the ground torn up in the woods on the hillside. The most profound statement Zdenek Ceplecha made about the event was 'I don't know what that was, but it was not a meteor.'" Subsequently, after studying the similar Polish incident, the Czech researcher told Dick that he believed the events were electrical in nature.

"From that point on," Dick says, "my thinking about what electrical actions can do changed a bunch: You can dig holes electrically, you can break rocks electrically. That was really where my change of attitude about atmospheric electricity came into being."

TWA Flight 800

Right after the TWA Flight 800 accident occurred in July 1996 claiming 230 lives, Tom Gold called Dick and suggested that a massive methane release and explosion caused the disaster.

"In the early months I considered Gold's methane explosion to be the most likely scenario and helped him to promote it. But, after learning of the electrical nature of the Spain and Poland events, I tried to get him to think along the lines of earth-gas releases into the air changing the local electrical properties of the atmosphere, thereby precipitating electrical events. Tom never signed on to that. He never went along with that. As scientifically diverse as he was, I think he had never really delved into the dilemmas of atmospheric electricity, even though he surmised the Bell Island explosion to be a ball lightning incident."

Clearly, neither Dick not Gold accepted the official explanation that vapors in the aircraft's center wing fuel tank ignited and exploded as a result of faulty wiring. Dick still doesn't accept the official account. At the same time, he doesn't buy the conspiracy theories about missiles fired from a boat at the surface.

In Dick's mind, TWA 800 happened as the result of accidental interference by the aircraft with an electrical connection between the ionosphere and the Earth's surface.

"I think that almost continuously," Dick elaborates, "there are connections between the ionosphere and the ground, and these are invisible and kind of filamentary in nature. That is, they're not diffuse connections but actually things that organize into channels.

"Anyway, the aircraft flies through or near to one of these channels; its exhaust trail is already ionized because combustion is ionization, if you will. Now what happens is that the connection that was already there [between the ionosphere and the ground] decides

DICK SPALDING"S CAREER has led him on a decades-long quest to unravel the mysteries he has encountered. Some of his ideas place him well outside the mainstream of science — a fact he's reconciled himself to.

this is a better connection — through the exhaust trail and the Flight 800 aircraft — and decides to use that."

The connection follows the exhaust trail back to the aircraft and either ignites fuel-air mixtures inside or uses its own energy to literally blow it apart, Dick argues. (His explanation for the mechanism of the accident is more detailed and much more nuanced than the summary here.)

Both Dick and Gold shared their ideas with the FBI, FAA, and National Transportation Safety Board, which were looking into claims by some witnesses that they saw a missile strike the aircraft. The investigators could not accept either methane gas explosion or the ionospheric connection theories.

Dick's thinking now was evolving, integrating concepts from Gold and from his conviction that the sky is alive with almost unimagined electrical potential. Both concepts began to factor into his view of the cosmos and Earth's place in it.

For example, Dick has taken Gold's ideas to what he considers their logical end. If, as Gold argued, hydrocarbons are coming out of the mantle due to a separation process, then surely other gases, other light materials, are coming out as well, Dick says. And what does that mean? A lot, for Dick.

"Where does the Earth's water come from?" Dick asks rhetorically, then answers his own question. "It came from the Earth just like the hydrocarbons, just another part of the chemistry of the mantle that separates out. The Earth's water, the air we breathe, all the rocks we stand on, all of those could easily have come out of the mantle, or are products of the outgassing of the mantle.

An expanding Earth?

"So that's my extension. If you then think that through, what you then end up saying is that, you know what, Earth is expanding. And the reason is, when this stuff is in the mantle, it's under great pressure, it's compressed and probably combined chemically with other parts of the mantle material. When it comes to the surface, it expands; it's bigger than it used to be, and if you carry that on for eons, you've got a bigger Earth than you started with. In other words, the Earth is continuing to grow all the time — in volume, not in mass."

An expanding Earth has some serious implications. Earthquakes? Caused by outgassing. Tectonic drift? Mountain building? All explained — better explained, says Dick — by an expanding Earth model than by the conventional explanations. Subduction? Isn't happening.

What kind of academic credentials does Dick bring to the discussion? "Almost the poorest for this," he cheerfully admits. "I'm an electrical engineer with a master's degree from Purdue in 1962 — the same year that I joined the Labs."

On the planetary scale, the biggest subject on the table today is climate change. Dick, unsurprisingly, isn't having a bit of it. One problem with climate change models is that they don't correctly figure in the action of electricity on greenhouse gases in the atmosphere.

"I contend that the atmosphere, with its electricity and ozone, is far more active than current scientific understanding allows."

Dick is fully aware that his ideas brand him as an eccentric (at best) in most polite scientific circles. He isn't bothered by that, though. He is serenely confident that some day ideas that now seem beyond the fringe will be accepted as conventional wisdom.

In the meantime, he will continue to watch the skies — for the nation and for himself — marveling at the wonders they hold and enthralled by the mysteries they yield so sparingly.

Dick Spalding's list of projects worthy of a national laboratory

With 47 years at Sandia, Dick Spalding has had plenty of time to develop a clear set of ideas about the kind of work a national laboratory is suited to. He recently put down on paper a list of technical challenges he believes Sandia could help address. Here are a few:

Fossil fuels: Are fossil fuels biological in origin — that's the overwhelmingly accepted explanation among geophysicists — or are they in fact abiogenic, an idea popularized in the West by Cornell astrophysicist Ted Gold? Dick believes a definitive answer to the question could have a profound impact on our understanding of oil reserves. (If fossil fuels are, in fact, abiogenic — that is, arising from nonbiological processes deep within the Earth — then there could be a lot more oil than current theory predicts.) A national laboratory (Sandia?) could address the question.

Methane hydrates: Linked to the above is the discovery that huge deposits of methane-loaded ice exist on deep-sea bottoms in numerous places around the globe. Some have estimated that these deposits contain more fuel than all the oil, coal, and natural gas deposits combined. Exploitation of this resource could do much to reduce world dependence on imported oil. An engineering laboratory (Sandia?) is the right place to develop the techniques to safely extract the methane from these deposits, Dick says.

Earthquakes: Dick believes the true cause of major earthquakes is not tectonic motion but is instead outgassing of the Earth's mantle, i.e., the liquid layer underlying the Earth's crust (lithosphere). Because the earthquake process is initiated by escape of trapped gases/fluids, detection of their escape is thus a means for predicting an impending quake. Dick believes the best prediction in earthquake-prone areas can be achieved by deploying ground sensors that detect temperature rise or escaping gases. Sandia, which has extensive experience in the ground sensor field, could make a major contribution to developing a new generation of earthquake-specific sensors.

Atmospheric electricity: A better understanding of the full range of atmospheric electrical phenomena — some not yet even characterized — could greatly enhance safety of operations such as coal mining, explosives handling, and nuclear weapon storage. With its breadth of scientific and engineering talent and facilities, Dick says, Sandia would seem an ideal place to carry out such research.

Center for short-lived phenomena: A couple of decades ago, the Smithsonian Institution sponsored an initiative called the Center for Short-Lived Phenomena, whose purpose was to investigate and document all manner of unusual natural occurrences, such as freak storms, rogue waves, whale beachings, bird kills, smell events, and ball lightning reports. The center produced an annual report summarizing its investigations. Because it employed scientists covering a wide range of disciplines, the center was potentially able to take a broader view of an event than is often the case when investigation is conducted only by specialists in the particular event discipline. Although the Smithsonian Center no longer exists, Dick believes a similar entity can provide indispensible insights into as-yet little-understood Earth processes. The US — or the world — should reestablish such an investigative entity, Dick says, adding that Sandia, or perhaps a joint DOE labs/university consortium, could gather the appropriate talents and tools to conduct such investigations.

Other: Dick also has ideas on hurricane prevention and mitigation, development of new freshwater resources, and methods for smog mitigation, all of which, he says, require the attention of a world-class engineering laboratory — like Sandia.

Weapon interns

(Continued from page 1)

weapon capability.

How do you fill that void? Sandia's answer — in response to a congressional mandate to preserve weapons knowledge — was to establish the Weapon Intern Program (WIP).

Since 1998, the program has brought students together with mentors, recreating in a classroom/field trip environment the kinds of relationships that used to occur in the laboratory and at field test sites.

The program, which until 2003 was a two-year curriculum, now takes place over one very intense, full-time, year-long course of study. Weapon Intern Program classes include up to 24 students selected from an applicant pool. Although the program was established and is managed by Sandia, its students have been drawn from around the NNSA complex and from the US military (both uniformed and civilian).

WIP manager Beth Connors (2916) says the aim of the program is to keep the post-Cold War "brain drain" from adversely affecting the Labs' ability to do its mission.

According to the WIP website, curriculum is delivered through a blended learning environment consisting of live and multimedia-based classroom instruction, individual and team research projects, hands-on activities, and various nuclear weapons complex and DoD facility and operations tours and briefings. The instruction is provided through a large contingent of subject-matter experts. The program also includes a strong senior mentor element that helps the weapon interns directly link the past to the present and future.

The Weapon Intern Program, says the website, "prepares its participants [to] contribute in a way that better serves themselves, their home organizations, and the nuclear weapons community once they graduate."

And Beth clears up one common misconception about the program: It's not aimed at "young" Sandians; it's designed for anyone involved in the nuclear weapons program who would like to advance their knowledge and better understand one of the nation's most complex technological enterprises.

Weapon Intern Program students speak

There are probably as many reasons why students choose to get involved in the Weapon Intern Program as there are students.

Don Dowdle (8229) came to Sandia in 2007. He applied for the 2008-2009 Weapon Intern Program class because "it is a great way to learn about the work being performed all across the complex. I wanted to see the big picture and understand why the complex faces the issues that it currently faces."

Joan Harris (0412, WIP class of 2007) says she had long wanted to be involved in the program "because it sounded so interesting and because I wanted to contribute more directly to Sandia's mission." Because her work wasn't directly weapons-related, she figured she'd never get into the program. Her chance to become a WIP student came when she joined Center 12300 (now Surety Assessment and Engineering Center 400).

Gaby Galaviz (2951, WIP class of 2008) was drawn to the program by, among other factors, its direct connection to the very origins of the nation's weapons enterprise. "One of the most important drivers for me to join the program," she says, "was that I would be taught by the people who designed, developed, and tested the nuclear weapons during the 1940s. I really wanted to be part of that world and wanted to learn all about the nuclear weapons complex."

You can't understand the nuclear weapons program without touching most of the endeavors at Sandia and the way money is distributed to the labs.

—Don Dowdle (8229)

Weapon Intern Program students and graduates are convinced that WIP has been good for their careers. Says Joan: "After I graduated, I returned to Center 12300 [now 400], but in a new job. I don't expect to benefit necessarily in the sense of being promoted or getting higher ratings for my work. But I have benefitted in achieving my goal of being in a position to contribute a little more directly to the nuclear weapons mission of the Labs, to be able to do interesting work, and to continue to learn and grow professionally."

"I have benefitted in achieving my goal of being in a position to contribute a little more directly to the nuclear weapons mission of the Labs."

— Joan Harris (0412)

Class of 2008 graduate Todd Hinnerichs (2613) agrees, noting that, "I believe the biggest benefit has been the increased network of SMEs [subject-matter experts] in key functional areas across the complex. This increased network has already allowed me to work more quickly and efficiently by knowing the right people to contact and the right questions to ask these folks."

Pauline Pham, a class of 2009 student from the Kansas City Plant, anticipates career benefits, too. Coming into the program, she says, she was only familiar with limited aspects of the weapons complex. Now, she says, "I've been exposed to so many areas of the business that opportunities have opened up for me. I have also gained a greater appreciation for the types of work I was not exposed to before the program."

"It is a once-in-a-lifetime experience. You will be very impressed by everything you will see and learn. . . . You will never regret a one-year commitment."

— Gaby Galaviz (2951)

"The weapon systems and their history are so complex. . . . The past nine months have been packed with valuable information that is often overlooked."

— Pauline Pham (Kansas City Plant)

Jim Herrmann, a program manager at the Kansas City Plant and a current WIP student, says the intern program will likely have applicability well beyond its nuclear weapons focus. "It is a leadership growth opportunity," he says. "It is also providing insights into how government works, policies are set, etc. It has also been a great networking opportunity with DoD personnel."

Don agrees. "You can't understand the nuclear weapons program," he says, "without touching most of the endeavors at Sandia and the way money is distributed to the labs. It has helped me understand some of the funding issues in many diverse types of programs and how the complex as a whole grows and contracts. Also, the program has shown me the level of technology used in the current weapons, future concepts, and how current nonnuclear research can complement the work being done across the lab."

The interns and graduates are all on the same page regarding the length of the course: The one-year program is about as compressed as it can get. In fact, several say they wish the program were still a two-year course, as it was until 2003.

"This increased network has already allowed me to work more quickly and efficiently by knowing the right people to contact and the right questions to ask these folks."

— Todd Hinnerichs (2613)

"If anything," says Todd, "I would recommend more time and larger-scale projects. This would give the nuclear weapons community the benefit of new ideas and concepts and would benefit the interns by having their concepts and ideas evaluated by some of the most experienced weaponeers — senior mentors — in the business."

Adds Pauline: "The weapon systems and their history are so complex, I would not recommend shortening the program. The past nine months have been packed with valuable information that is often overlooked. Although it is a major commitment, it is important to take the time to learn the weapons history and all its aspects."

Gaby says she would be glad to be a cheerleader for the program, encouraging others to dive in.

"It is a leadership growth opportunity. It is also providing insights into how government works [and] has also been a great networking opportunity with DoD personnel."

— Jim Herrmann (Kansas City Plant)

"It is a once-in-a-lifetime experience," she says. "You will be very impressed by everything you will see and learn. It goes beyond your expectations and you will never regret a one-year commitment. Be willing to adjust to the program's schedule so that you get the most out of it and don't miss a trip. As an intern you have privileges that you might not have had before or will not have after the program. Don't hesitate to join the WIP; you will make friends that will always be there for you and will help you on your way to reach your goals, both personally and professionally."

Jim Herrmann from the Kansas City Plant says the same thing, but in simpler terms: "Go for it. It has been a great experience." *— Bill Murphy*

Riding 4 Hope looks forward to an experience of a lifetime

THREE FOR THE ROAD — From left, identical twins John and James and their father David Mackovjak, of Silverdale, Wash., make up the Riding4Hope cycling team. All three will depart June 28 for a 3,900-mile coast-to-coast bicycle ride to raise awareness and funding for the Wounded Warrior Project and in support of Boys & Girls Clubs of America. (Photos courtesy of David Mackovjak)

By Iris Aboytes

Have you ever burned 6,000 calories in a day? David Mackovjak (6432) and his 16-year-old twin sons John and James will be doing just that when they start their cross-country bike ride called Riding4Hope.

The trek begins June 28 in Silverdale, Wash., where David is on assignment for Sandia, and the riders hope to reach Virginia Beach, Va., on Aug. 9. The team includes neighbor Skip Junis, who will be driving their support vehicle.

David and his sons are avid cyclists. Two years ago when they participated in a five-day, 250-mile Boy Scout trip, John and James, both Eagle Scouts, expressed their interest to bike across America. It has taken them a little over a year to put the 3,900-mile trip together.

The purpose of the trip is to raise awareness and money for the Wounded Warrior Project and their local Boys and Girls Club. The goal is to raise $10,000.

"As a retired naval submarine officer of more than 21 years, I can appreciate firsthand the sacrifices made by the men and women of today's military-family separations," says David. "With the Gulf War and the war on terrorism, military families have endured even more hardships. Our cycling team wanted to help these men and women by raising awareness of the Wounded Warrior Project. Additionally, we wanted to sponsor a local charity so we chose the Boys and Girls Club of South Puget Sound."

The bike ride will cross 10 states in 38 days. The riders will ascend more than 11,500 feet through Hoosier Pass in Colorado. Their goal is to average 104 miles a day. They plan to begin riding each day by 6 a.m. before it gets too hot. John or James will be the navigator on alternate days. They will review and brief the route the night before so that together they can plan the next day's events.

"We will bike until about 10 or 10:30 a.m. when we will meet Junis and stop for breakfast," says David. "Then we will bike for another 2 to 2-1/2 hours and stop for lunch, replenish our water, snacks, etc. To keep it fun and break up each day, we will be stopping at points of interest and taking pictures. We plan to ride six to eight hours a day, calling it a day by about 3 p.m. This will give us some time for exploration."

Their biggest concerns are safety related — keeping well-hydrated during the hot and humid days, eating properly, and biking defensively while sharing the road with vehicles.

Since they will be staying at hotels along the way, they look to the warm showers and swimming pools to help rejuvenate sore neck and leg muscles. "We can't afford to get blisters or saddle sores," says David. "There is just not enough recovery time. We need to address small things, like hot spots, before they become major issues, like blisters."

In addition to carrying snacks, supplies needed to fix tires, and other trip-related gear, the support vehicle will ensure that if anyone on the team is having an off day or not feeling well, a ride will be available. The team believes in safety first.

Riding4Hope will be offering bike safety workshops at some of the local Boys and Girls Clubs along the way. The boys hope to get some experience in public speaking as they offer encouragement and positive reassurance at the various clubs. They have also included stops at several military installations to talk about the Wounded Warrior Project.

Junis will document the trip through photography — "capturing the American spirit in these challenging times," he says. He also hopes to raise awareness about the Wounded Warriors Project and Boys and Girls Clubs.

"I hope I will be able to convey that America has a spirit that can overcome anything when we come together," says Junis. "I am looking forward to the adventure."

John says he will miss his mother Maria and her home cooking. "I will be in touch with my friends via my camcorder," he says. "We will record each day. At the end of the trip I hope to have the feeling of accomplishment for completing a demanding and challenging event. This will be a perfect bonding experience with my father and brother before we move on to the next chapter in our lives — college."

ON THE ROAD AGAIN — The Mackovjak family riders, father and sons, spin through the Washington countryside in a warm-up ride for their marathon cross-country bike trip.

"I think all of us being together for this period of time will be OK; we are all pretty close," says James. "We go on bike rides all the time. We think we will all be about 10 pounds lighter at the end. I'll look forward to getting off my bike for a while — maybe a long while," he adds with a smile.

David looks forward to seeing his wife Maria, who will meet them in Virginia Beach at the end of the ride. Her parents live there and the family will visit with them before returning home.

"I will look forward to getting home and thanking all the friends, coworkers, sponsors, and family members who made this event possible," says David. "I hope to share with them how they helped the lives of our service members and young people of this great country. As they say, it's not the destination that counts, but the journey, and this will have been quite the journey."

The Riding4Hope website at www.riding4hope.com will have daily updates.

MAP showing the 3,900-mile route the Mackovjaks will follow on their cross-country bike ride called Riding4Hope. (Map courtesy of Google Maps)