## **December 2019 Newsletter**

#### **SRI International**

# **Alumni Association**



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## **MESSAGE FROM ARCHIVES CHAIRMAN DON NIELSON**



Don Nielson

As you dip into this issue, you will first get a glimpse of our annual reunion. It's a shame that many of you live so far away, but there are many regulars who drive several hours to attend, for which we are most grateful. Longtime alum Stellare Griffin came all the way from Round Rock, Texas, and it was a treat to see her again. *Thanks, Stellare!* Those of you just a zip code or two

away should have it a bit easier. Hint!

The SRI cafeteria was being remodeled, so the normal reunion venue was not available. The new cafeteria officially reopened on Tuesday, December 3rd. Please note all those who worked so hard to make the reunion so well done.

We had good speeches by SRI's CEO, Bill Jeffrey, and an education project area presentation by Phil Vahey. They were followed by two inductions into the Alumni Hall of Fame. You will find much more detail than usual about the inductees—not only the basis for their awards but also how they responded in accepting them. You now get to know Don and Ripu even if you have never met them—sort of the whole picture.

Caren Rickhoff has again compiled news of interesting projects now ongoing at SRI. It is really an eclectic set showing how SRI is retaining the breadth of research we all have grown to admire.

Our History Corner is filled with an excellent account of one of SRI's projects of great impact, NEXRAD, which prepared for our country's present generation of weather radars. Please read it; you will be surprised at the completeness of SRI's assistance in determining not only the optimum locations for necessary coverage, both in the continental United States and abroad, but all the follow-up work for a variety of government agencies. In spite of notable challenges, it was a *tour de force* of competence across a broad spectrum of needed talent.

Then there is the welcome experiential note from Peter Weisshuhn, making us wonder how many such encounters many of us might have had that would interest fellow alums. Feel free to submit your stories.

Finally, we must recognize the passing of one of us who left a truly indelible mark on SRI: Phil Green, whose innovations and commercialization savvy in ultrasound and remote surgical technology brought a world of value to SRI and to our own medical future. We'll delve further into that story in the next issue. Now please enjoy your holidays in a safe and memorable way, and may the new year bring you good health and purpose.



#### Annual Reunion, October 10, 2019

#### By Don Nielson

Well, the 2019 SRI Alumni Reunion is in the books. We had a change of venue because the SRI café has been occupying the I-Building dining room while its regular space is being remodeled. Our space was a bit smaller but well set up, and it worked just fine.

The turnout was pretty good, with about 70 attending; 4 others had prepaid but didn't make it. Eleven guests were speakers and honorees. Some people came from afar, and it was pleasing to see them again. Arturo's food was great, and there was plenty for everyone.

The program was traditional. CEO Bill Jeffrey gave us a picture of how SRI is operating, and there is clearly more emphasis on the transfer of research into potential products or services than we saw during our stay. We didn't get a financial picture, but we did hear how the institute functions with an ongoing scattering of operating sites.



CEO Bill Jeffrey.

Phil Vahey of the Education Division gave us a broad rundown of how their research spreads across grade levels and a variety of new educational methods. A lot of the work addressed preschool and elementary grade levels, and their innovative, personalized, and team-building engagement of students has had a provable



Dr. Phil Vahey.

This year's inductees into the SRI Alumni Hall of Fame were Don Shockey and Ripu Malhotra. Both were very deserving and gave warm and humble accounts of their life's work.

educational payoff.

Just as baseball managers have their overpowering ninth inning "closer," we have our chocolate fountain, which helps assure that we finish strong. I wish those of you who couldn't make it could sample this elixir. It is a great leveler, for almost everyone wears the telltale drippings as they leave for home. Finally, I received some appreciative responses to the event. And although it is fun to meet new alumni, greeting those you have known is a major reason for coming. That works best, of course, when the likelihood that such friends are attending goes way up. So, we'll keep trying to grow attendance. We'll post next year's date early so you can get it on your calendar.

As always, thanks are due to the many people who contributed to the success of this event. The reunion was coordinated by Augustina Biosic and Joyce Berry, who greeted the attendees as they arrived, and was staged by Arturo Franco and his SRI Conference Services crew. Martha Agreda, Linda Jansen, Katie Kaattari, and Sally Longyear staffed the reception table. Linda Hawke-Gerrans created the reunion flyer and the Hall of Fame poster; Joyce Berry produced the Hall of Fame awardees' certificates, as well as the name tags for attendees. The Credit Union donated the door prizes, and Gary Bridges took the many excellent photos. Thank you all!



## 2019 ALUMNI ANNUAL REUNION (Continued)



## 2019 ALUMNI ANNUAL REUNION (Concluded)



## 2019 HALL OF FAME

#### 2019 SRI Alumni Hall of Fame Recipients



Two former SRI staff members, Ripudaman Malhotra and Donald Shockey, were inducted to the SRI Alumni Hall of Fame at this year's reunion. They received this honor in recognition of their exceptional contributions to the success of SRI.

#### Ripudaman Malhotra



One of the greatest quandaries of our age is energy and how it can be made sufficiently available at acceptable financial and environmental costs. Ripudaman Malhotra has produced numerous insights into this huge issue from his technical contributions, including energy transfer and conversion mechanisms such as the

liquefaction and gasification of coal and the mitigation of fuel residues.

As Associate Director of the Energy and Environment Center at SRI for 35 years, Dr. Malhotra managed and contributed to projects encompassing process development, mechanistic studies, and chemical analysis of resources and fuels. The work on coal liquefaction and pyrolysis identified novel pathways for hydrogen transfer and changed conventional views of coal conversion processes. The Energy and Fuels Division of the American Chemical Society acknowledged this accomplishment by presenting Dr. Malhotra with the 2015 Henry H. Storch Award. He also received the SRI 2005 Fellows Award, the highest honor SRI bestows on its employees for technical excellence and professional contributions.

Grasping the bigger picture, he is educating the world about its energy consumption and sourcing using easily grasped metrics. For example, he coauthored the book *A Cubic Mile of Oil:*  *Realities and Options for Averting the Looming Energy Crisis* (with Hewitt Crane and Edwin Kinderman), proposing to use a cubic mile of oil as a standard measure of energy from all sources, thus simplifying analysis and tracking of worldwide energy use. He continues to publicize energy and environmental issues with his blog (also titled *A Cubic Mile of Oil*) and with frequent presentations to audiences around the nation and the world. He has delivered invited/plenary presentations at technical symposia and at universities and gives numerous talks at smaller public forums.

#### Lessons in Energy Learned over 36 Years

Ripudaman Malhotra's acceptance speech at his Hall of Fame induction (to the best of his recollection)

Thank you very much, Dave [Golden], for those kind remarks and summarizing the trajectory of my career at SRI. I am deeply grateful for this honor and for the opportunity SRI afforded me during my tenure. I came to SRI in 1979 as a postdoctoral fellow, and a couple of years later I was hired as a staff chemist, where I worked for 36 years until my retirement. I remember being told at the time I was converted from a postdoc to a staff member that at SRI I would have the freedom to do research on any topic as long as (a) it was legal and (b) I could find a client to pay for the research. To be sure, SRI engages in research on a wide range of topics, and I had my fair share of that diversity, although the principal area of interest for me was energy.

My interest in energy was sparked during my Ph.D. years. It was during the time when President Carter had called for a "moral equivalent of war" to gain energy independence, and I was inspired to contribute toward that goal. Initially, my research was directed at converting coal to oil. Many of us in this room can remember the shortage of oil and the gas lines. While there was a shortage of oil, there remained abundant supplies of coal. Because liquefaction of coal necessarily entails increasing its hydrogen content, my studies focused on the mechanisms by which hydrogen is transferred between various molecular and radical species. These studies were greatly aided by SRI's unique capabilities in field ionization mass spectrometry. Later, with increasing awareness about climate change and greenhouse gas emissions, I undertook research on processes for clean combustion and gasification of coal, as well as for its conversion to transportation fuels. These efforts culminated in a DARPA-funded project on developing a process for and demonstrating the feasibility of converting coal and natural gas into liquid fuels without using any water or emitting any carbon dioxide.

I had a great ride at SRI. I had the privilege of working with many extremely smart and capable people who taught me as well as challenged me to become a better scientist. I am particularly thankful that at SRI I got to meet Ed Kinderman and Hew Crane. I did not work with them on any SRI project. It was our common interest in global energy that brought us together. I had heard that they were working on a book on global energy that used a cubic mile of oil as a unit of energy to facilitate discussion of the subject. You may have read in the newspapers that the world consumes about 90 million barrels of oil per day. Over a year, the volume of oil consumed is just about one cubic mile of oil. However, although I had been citing their work for years, the book hadn't been finished. When I was named an SRI Fellow, I decided to use some of my "Fellows" time to help them finish the book. For health reasons, Ed and Hew could not put in the necessary time. They handed me their notes, and I ended up writing the final version and getting the book published in 2010. The book, called A Cubic Mile of Oil, is published by the Oxford University Press.

Ever since my retirement in 2015, I have been on a mission to educate the public about the need to address the dual challenge of meeting global energy needs and mitigating the threat of climate change. I maintain a blog where I post updates to the book and commentary on energy news. I also speak on the subject at academic and community fora. The world's energy sector has to be decarbonized steeply. Yet, it is frustrating to note that, despite public pronouncements, very little progress has been made in curtailing greenhouse gas emissions. After several decades of exponential growth, renewables like wind and solar barely account for 3% of total primary energy. It is abundantly clear that substantial reduction in carbon emissions can only be achieved by embracing nuclear power. It is the one source of carbonfree electricity that is scalable, has the best safety record, and has the smallest environmental footprint. For more information, please browse through my blog (cmo-ripu. blogspot.com) or view my talks on YouTube. Getting the public to embrace nuclear power is a Herculean task, but it must be undertaken, and I do not miss any opportunity to speak about it.

#### Donald Shockey



Donald Shockey is an internationally renowned expert in the fracture behavior of materials and an authority on material failures under impact and explosive loads. For more than four decades, he and his colleagues developed and presented to the world an SRI capability that few could match. It is the field of fracture physics—why

and how all kinds of materials fail under both normal and catastrophic conditions, under great load, or on high-velocity, even explosive impact. Notably, his and his team's research pioneered an approach that links microscopic failure processes with the macro behavior of structures, leading to better prediction and control of material failures. His contributions have helped solve many difficult problems for NASA, the Department of Defense, and countless other clients.

Since 1971, Don has been a true SRI Ambassador through his technical contributions, development of strong customer relationships, and dedicated service to the Fellows and Alumni organizations. In recognition of his career achievements, he was selected as an SRI Fellow in 1990 and a Fellow of ASM International in 1993; and he received the DYMAT Association's Year 2000 John Rinehart award for pioneering work in the field of dynamic fracture, and the 2006 Society for Experimental Mechanics' W. M. Murray Medal for excellence in experimental mechanics.

Don founded the Poulter Lab's Center for Fracture Physics in 1998 and led the Center until his retirement in 2018. His technical talent and insights, his ability to mentor young engineers and look out for the well-being of his colleagues, his leadership in Poulter Lab, and the high honors his professional field has bestowed on him have shown him to be an exemplary member of SRI's best.

#### I Was So Lucky

Don Shockey's acceptance speech at his Hall of Fame induction

How improbable that a little boy born and raised in rural Pennsylvania, the son of a steelworker, with no money for college, would become a research scientist in Silicon Valley. No one in my family had ever gone to college or moved far from the small town of Apollo. I was destined to be a farmer or a laborer in the local steel mill. But an unlikely series of open doors led me to SRI.

#### Getting into college

At the end of my senior year in high school, I was offered an athletic scholarship to Grove City College (GCC), a small liberal arts school about 40 miles from my home. The requirements were that I had to play football, run track, maintain a B average, and wait tables in the women's dormitory (I hated the last one). I accepted and started on my journey.

#### To graduate school at Carnegie Mellon University

As I was completing my senior year at GCC and interviewing with various companies for a job, I received a mysterious letter offering me a research assistantship to graduate school at the Carnegie Institute of Technology in Pittsburgh, one of the highest-tech schools in the nation. I accepted the opportunity but had no idea of the origin of the letter.

Well, I nearly flunked out that first year. My classmates were from MIT, Columbia, and other high-tech schools in India, China, and Europe, and I was way behind. (Plus, stupidly, I was working out on the track daily, keeping alive a dream to compete in the 800-meter run at the upcoming Olympics. Moreover, I had accepted an offer to be an assistant football coach and had been put on the Carnegie Tech payroll.) When midterm grades came out, I had a C flush, which was a polite way of telling a student he wasn't making it. It was decision time. With considerable pain, I chose academics over athletics. I stopped track workouts, football season ended, I signed up for undergraduate courses to acquire the background I was missing, and I dedicated myself wholeheartedly to my studies. Things got better, and two years later, I was getting a master's degree in metallurgy and materials science.

It was then that I was invited to give a talk at Parents' Day at GCC. The topic requested was how GCC prepared me for graduate school in a high-tech university. That's when I learned the origin of that letter. I was an experiment. At a conference of university presidents, there was a discussion and a wager about whether a student from a small liberal arts school could survive in a high-tech graduate program. To find out, the Carnegie Tech president told the GCC president to pick out a GCC student; he would provide financial support to that student, and they would see hence the surprise letter.

*Note:* In gratitude for the unanticipated opportunity to enter graduate school, which subsequently led to a hugely interesting life, and in the desire to provide that opportunity for another, Don established the Shockey Graduate Scholarship, an award offered each year to a Grove City College senior who is motivated and academically qualified, but not financially able, to begin a program of postgraduate study in science, engineering, and mathematics.

#### To Germany as a postdoc

Well, after getting the master's I embarked on the Ph.D. program, and three years later, as I was completing a doctorate in metallurgy and materials science, I gave a talk at a technical symposium. Afterwards, a German scientist in the audience approached me and asked if I would show him my lab. After the tour, he asked me if I would consider a postdoctoral appointment at the Ernst-Mach Institut für Werkstoffmechanik in Freiburg, Germany, if he could get the funding. It seemed like an exciting and career-furthering opportunity—I had never been out of the country—so I accepted. That was February 1968. I got my Ph.D. in June, married my wife in July, flew to Germany in August, and began researching materials response to ballistic and explosive loads.

## To the Stanford Research Institute and Menlo Park, California

Three years later, when Janet and I felt it was time to return to the States, an American whom I met and worked with in Germany and who was on staff at the Stanford Research Institute, Don Curran, offered me a position in shock wave physics. My decision to accept led to my immensely satisfying career. Continuously throughout my more than 45 years at SRI, world events provided interesting challenges that required the boundaries of material and fracture science to be expanded, and I was able to conduct creative, meaningful, leading-edge fracture physics research and address important fracture problems with teams of talented colleagues-missile defense in the early '70s, the energy crisis later in the decade, a major armor/anti-armor initiative in the '80s and '90s, and continuous instances of failure of our aging infrastructure (aging aircraft and buried gas pipelines, for

## 2019 HALL OF FAME (Concluded)

example). I feel fortunate to have had such stimulating technical problems to address during my career. And though retired, I'm still at it—I love breaking things.

### I'm truly grateful!

Well, I can't take credit for this improbable journey from backwoods Pennsylvania farm boy to research scientist at this incredible research institute. I didn't plan the path or make the effort to achieve the steps. As you see, at each





For the chance to go to college, the opportunity to go to graduate school, the invitation for a postdoc appointment, and the offer of a position at this prestigious research institute in this beautiful part of the world, I am truly grateful.







## NEWS FROM SRI

## 5-Year-Olds Can Learn Science and Engineering

SRI and the nonprofit Education Development Center (EDC) conducted a study to investigate the premise that digital media platforms—television, video, apps, and digital games—can be powerful tools to support young children's science and engineering learning. The study's goal was to understand the extent to which providing access to media resources that are focused on critical science and engineering concepts can help children 4 to 5 years old living in low-income households learn.

SRI Education

## Early Science & Engineering

The Impact of The Cat in the Hat Knows a Lot About That! on Learning

The cover of the study report.

A 2017 national survey (conducted by SRI and EDC) found that parents want to support children's science learning but need more help to do so. However, until now, no largescale rigorous experimental studies examined the effects of the existing science- and engineering-focused educational media on children's learning.

The study was commissioned as part of the U.S. Department of Education's Ready To Learn Initiative, a federal program that supports the Corporation for Public Broadcasting and the Public Broadcasting Service (PBS). Through the initiative, programming for season three of *The Cat in the Hat Knows a Lot About That!* was reimagined to meet the learning needs of today's children, including active early science and engineering learning. The eight-week study involved a diverse sample of 454 children, all living in lowincome households. Each child was randomly assigned to either a treatment (*The Cat in the Hat Knows a Lot About That!*) or control condition.

The study found that providing children with access to these new resources had positive, meaningful effects on their knowledge of physical science and their ability to engage with science and engineering practices.

Shelley Pasnik, EDC vice president and principal investigator of the joint EDC-SRI research team, notes, "This in-depth study provides clear evidence that media that model science practices can help children from financially under-resourced communities learn real-life science. This is promising news for anyone giving serious thought to opportunity gaps and affordable ways to address them."

The study report is available online at https://www.edc. org/sites/default/files/uploads/Early-Science-Engineering-Report.pdf

SRI press release: https://www.sri.com/newsroom/pressreleases/new-study-edc-and-sri-international-demonstratespositive-effects-pbs-kids

### Seeing Welds in 3D



In collaboration with Kawada Technologies, Inc., (KTI) and Kawada Industries, SRI is developing Xtreme Dynamic Range (XDR) weld visualization technology in the form of a welding helmet that provides a three-dimensional (3D) vision stream to increase welding quality and productivity through higher visibility of the welding

3D-welding helmet.

tip, welds, and surrounding welding scene. Moreover, SRI is doing this using ordinary image sensors rather than special high-cost image sensors.

"Kawada came to SRI with a need to greatly shorten the time required to train new welding technicians while continuing to pass down welding knowledge in an effective manner to new welders," said Mike Piacentino, SRI's Senior Technical Director of Vision Systems. "The real-time weldvisualization technology developed by SRI provides higher

## **NEWS FROM SRI (Continued)**

dynamic range to allow humans and robotic welders to see more than just the welding tip. The ability to view real-time welds maintains quality and informs the welder of low-quality or possibly failing welds, which is a critical advantage over conventional welding where precision welds are critical to structural integrity and public safety of infrastructure such as construction and bridge engineering."

"Welding is the most important and difficult skill to transfer from skilled welders to novice welders," said Noriyuki Kanehira, Project Leader and Director, Kawada Technology Research Center. "Visualization is the key."

The welding helmet equipped with XDR acquires and synthesizes images as a stereo camera unit. These images are displayed, with minimal delay, inside the helmet on a head-mounted display as a stereo image. This helmet system runs on wearable hot-swappable batteries and therefore can be used indefinitely in environments that have no external power source. A welder wearing this helmet will be able to view weld beads, the welded items, and the working environment, which are collectively difficult to see using traditional welding helmets, and will thus be able to weld more reliably. The helmet also displays and records various real-time status parameters related to welding (for example, temperature, voltage, current) that allow welders to review information needed to ensure a high-quality weld, which in turn accelerates the learning curve. Finally, the welder's eyes are completely protected from arcs because the weld is viewed indirectly through the screen in the helmet.

The next-generation 3D-welding helmet will be improved over the next year and will be used to teach technical welding skills at Kawada Industries. The KTI Kawada group is expected to gain insights that can be applied to support new technological and product developments.

SRI press release: https://www.sri.com/newsroom/pressreleases/sri-international-partners-kawada-technologiesand-kawada-industries

## The Brain Intentionally Forgets

Rapid eye movement (REM) sleep, a crucial stage in the sleep cycle, is characterized by darting eyes, rapid heart rates, paralyzed limbs, awakened brain waves, and dreaming. Studies in mice showed that during sleep—including REM sleep—the brain selectively prunes synaptic connections made between neurons involved in certain types of learning. However, until this study, no one had shown how this might happen.

In this study, Thomas Kilduff, Ph.D., Director of SRI's Center for Neuroscience, worked with Akihiro Yamanaka, Ph.D., at Nagoya University in Japan and Akira Terao, D.V.M., Ph.D., at Hokkaido University in Japan to look at cells that produce melanin-concentrating hormone (MCH), a molecule known to be involved in the control of both sleep and appetite. In agreement with previous studies, the researchers found that a majority (52.8%) of hypothalamic MCH cells fired when mice underwent REM sleep, whereas about 35% fired only when the mice were awake and about 12% fired at both times.

They also found that many of the hypothalamic MCH cells sent inhibitory messages, via long stringy axons, to the hippocampus, the memory center of the brain. To their surprise, they found that "turning on" MCH cells during retention worsened memory, whereas turning the cells off improved memory.

"These results suggest that MCH neurons help the brain actively forget new, possibly unimportant information," said Dr. Kilduff. "Since dreams are thought to primarily occur during REM sleep, the sleep stage when the MCH cells turn on, activation of these cells may prevent the content of a dream from being stored in the hippocampus consequently, the dream is quickly forgotten."

"Understanding the role of sleep in forgetting may help researchers better understand a wide range of memoryrelated diseases like post-traumatic stress disorder and Alzheimer's," said Janet He, Ph.D., program director at the National Institute of Neurological Disorders and Stroke (NINDS), part of the National Institutes of Health. "This study provides the most direct evidence that REM sleep may play a role in how the brain decides which memories to store."

SRI press release: https://www.sri.com/newsroom/press-releases/brain-may-actively-forget-during-dream-sleep

NIH study description: https://www.nih.gov/news-events/ nih-research-matters/rem-sleep-may-help-brain-forget

# SRI Beacons Launched for NASA Research on Signal Disruption

In July, SRI announced that the Enhanced Tandem Beacon Experiment (E-TBEx) was launched on June 25, 2019, as part of a mission supported by NASA to gather atmospheric data and study effects of atmospheric "bubbles." Bubbles in the electrically charged layers of Earth's upper atmosphere disrupt key communications and GPS signals that we rely on down on the ground. Because these bubbles appear and evolve unpredictably, it is difficult for ground-based scientists to study how the bubbles alter and disrupt radio signals and thus impact our communication and navigation systems.

E-TBEx uses two CubeSat satellites complemented with six larger COSMIC-2 satellites to send test signals, similar to those used by communications and GPS satellites, at various frequencies. SRI researchers will observe how the signals are received on the ground, and then measure where and how the signals are distorted by these atmospheric bubbles as they evolve in real time. The combination of measurements from all eight satellites will give scientists an unprecedented opportunity to study these bubbles from multiple angles at the same time.



SRI engineers validate COSMIC-2 RF beacons. Photo credit: Surrey Space Technology Ltd.



Artist's rendering of E-TBEx CubeSats in orbit. Illustration credit: NASA

The experiment will be completed after 1 year in orbit, and researchers plan to apply the findings to improve forecasting models and strategies to mitigate the harmful impacts to commercial navigation systems and tactical military communications.

"This research has the potential to be a transformative step in identifying and preventing disturbances to the critical communication and navigation systems we rely on daily," said E-TBEx Principal Investigator at SRI, Roland Tsunoda, Ph.D. "If we can better understand bubble generation and growth, then we can mitigate future interferences and bring an even greater degree of precision, reliability, and safety to our communication systems."

SRI press release: https://www.sri.com/newsroom/pressreleases/sri-international-beacons-launched-nasa-researchsignal-disruption

NASA summary of E-TBEx: https://www.nasa.gov/content/goddard/e-tbex-enhanced-tandem-beacon-experiment

## Now Your Car Understands You—at Least Your Mood

SRI's advanced Emotional Artificial Intelligence (AI) automotive technology will enable the next generation of vehicles to detect the driver's emotions and respond accordingly, thus allowing humans and automobiles to become mobile partners. Toyota Motor Corporation will incorporate the first phase of SRI's Emotional AI technology—vision—into the "LQ," a concept car it introduced this fall at the Tokyo Motor Show. Sample cars will be ready by the Tokyo 2020 Summer Olympics.

The vision AI will observe drivers and monitor their emotional and physical state. It will learn to pick up gestures and nonverbal behaviors, such as the driver's expressions and actions. For example, it can detect the alertness or drowsiness of the driver by eye movement, blinking patterns, and patterns of head movement, and decrease the chance of an accident by playing sounds to wake up the driver, blowing cold air, or directing the driver to immediately pull over.

Amir Tamrakar, Senior Technical Manager at SRI's Center for Vision Technologies, introduced SRI's new emotional vision AI feature for cars during a panel discussion on conversational applications at the October 2019 AI World conference in Boston. According to SRI's William Mark, President of Information and Computing Sciences, "We embarked on a mission to enable cars to understand and partner with drivers. For in-car AI to succeed, it has to recognize human emotion and physical state. SRI's developments in emotional AI vision technology will lead to an enriched driving experience. For the first time your car will understand you."

"Imagine a vehicle that applies deep learning AI to infer emotions and estimate the driver's state," said Daisuke Ido, Chief Engineer of Toyota LQ. "By working with SRI to develop AI technology that monitors the driver, Toyota can advance safety technology and peace of mind to a higher level."

SRI press release: https://www.sri.com/newsroom/pressreleases/sri-international-debuts-emotional-ai-visiontechnology-advance-driving

Toyota announcement of LQ: https://global.toyota/en/ newsroom/corporate/30063126.html



Features tracked by SRI's vision AI technology.

## **HISTORY CORNER**

## SRI's Role with the Next Generation Weather Radar System

#### By Linda Hawke-Gerrans and Patti Burns

When you listen to the daily weather report on your local news channel, do you ever wonder where the radar that provides the basis for that forecast is located? Did you know that a group at SRI was responsible for finding the best possible location for each of the National Weather Service's current network of Doppler radars?



Next Generation Weather Radar (NEXRAD) project work began at SRI in 1983 (continuing with the award of a competitive followon contract in 1991) under the Engineering Division's Geoscience and Engineering Center. The project, known at SRI as the

NEXRAD program, eventually involved the siting effort to facilitate deployment of 160 Weather Surveillance Doppler radars, also known as WSR-88Ds, across the continental United States (CONUS), Alaska, Hawaii, the Caribbean, and Department of Defense (DOD) overseas locations. The WSR-88D is an automated, signal-processing, high-resolution S-band Doppler weather radar, which replaced the obsolete WSR-57 developed in 1957 and the WSR-74 developed in 1974. NEXRAD was jointly sponsored by the U.S. Departments of Commerce, Defense, and Transportation to fulfill their mutually supporting missions for (1) prediction of severe weather conditions, (2) safety in flight, and (3) water resource management.



Typical WSR-88D installation.

The selection of SRI to manage and coordinate all key aspects of siting the National Weather Service (NWS) network highlighted SRI's multidisciplinary expertise. The SRI program's mission was to assist agencies in locating and deploying new facilities and technologies to best meet their needs. It was not so much a technological development program as a provider of integrated, well-researched scientific services. The program team provided expertise across many fields, including electronics and electrical engineering, radiation physics, groundwater hydrology and quality, geology and seismicity, air quality, meteorology, transportation analysis, land-use management, endangeredspecies biology, noise reduction, socioeconomics, visual resources, and environmental justice; the team also handled compliance with federal environmental regulations.

After extensive map searches and preliminary visits, SRI staff performed a physical site survey, including electromagnetic interference analysis, environmental analysis, and Federal Aviation Administration (FAA) airspace analysis, for each proposed radar location. SRI personnel drove an instrumentation van to each site to perform the initial analysis, including barging the van to Alaska and the Caribbean. The NEXRAD program generated intense public exposure, scrutiny, and frequent challenges in securing the optimal radar locations. SRI staff were often the first contact the public and local governments had with the federal government's plans to install the new radars. SRI also assisted with obtaining land-use permits, conducting hazardous-waste and property transfer audits, and developing community outreach programs.



SRI instrumentation van and trailer.

The work done at SRI included completing the *NEXRAD Programmatic Environmental Impact Statement* to conform with National Environmental Policy Act requirements. SRI also prepared a Supplemental Environmental Assessment that was initiated in response to the public's concern about the potential health effects of non-ionizing radio-frequency radiation introduced into the environment at NEXRAD facilities.

Individual radar sites needed to be strategically located to optimize nationwide coverage and allow accessibility for maintenance. To do so, SRI attained and maintained digital radar coverage maps to help analyze the coverage as new sites were chosen. The detailed quantitative comparisons of coverage and clutter, as a function of location and antenna height, were combined with topographical data to aid in deciding a radar's location. Clutter, as a result of echoes from terrain or structures, needed to be minimized to achieve valid weather radar returns.

Work was well under way installing the new WSR-88Ds at approximately 100 locations in 1995 when the Department of Commerce (DOC) commissioned SRI's help with the Secretary's Report to Congress on Adequacy of NEXRAD Coverage and Degradation of Weather Services Under National Weather Service Modernization for 32 Areas of Concern. For this study, SRI examined and evaluated the performance of operational NEXRADs in relation to their coverage and ability to detect significant weather, as well as the coverage of the pre-NEXRAD and the proposed NEXRAD networks and areas for decommissioning existing radars. As a result of this study, SRI was tasked with finding sites for three additional radars covering Northwest Alabama, Western Arkansas, and Northern Indiana. The map below shows the final CONUS site locations with radar coverage at 4,000 ft, 6,000 ft, and 10,000 ft above ground level.

By 1999, the NEXRAD program at SRI had evolved into the Envirotechnical Program. Clients of the Envirotechnical Program now included the FAA, the Federal Highway Administration (FHWA), the NWS, the National Oceanic and Atmospheric Administration (NOAA), the National Environmental Satellite Data and Information Service (NESDIS), the National Polar-Orbiting Operational Environmental Satellite System (NPOESS), and the DOD. Project work for the FAA included environmental compliance services for the nationwide installation of Airport Surveillance Radars Model 11 (ASR-11), Airport



NEXRAD site locations and radar coverage in the continental United States.

Surface Detection Systems Model X (ASDE-X), Air Route Surveillance Radars (ARSR), and Terminal Doppler Weather Radars (TDWR). Work for the FHWA aided in developing site-selection criteria for a series of radio ground stations to augment Global Positioning System (GPS) satellite signals to increase accuracy for a myriad of uses, such as navigation of ships and barges in confined waterways and precise tracking of trains in transit.

Expanded work for NOAA included help in relocating a fleet of research vessels in Seattle, Washington. New project work for the NWS included siting and environmental surveys for numerous Weather Forecast Offices across CONUS as well as the North Pacific (Guam, Majuro, Palau, and Yap). The program supported similar work for NESDIS and NPOESS in locating satellite ground stations in Alaska, Antarctica, Australia, Brazil, Chile, South Africa, Spain, and Svalbard, Norway; and DOD required SRI's assistance in locating a WSR-88D facility in South Korea. Other efforts assisted the National Marine Fisheries Service and Marine Sanctuaries in locating new facilities.

The final NEXRAD project that the Envirotechnical Program worked on at SRI was assisting the NWS in finding a new site for an additional weather radar to serve the Coastal Washington state area. The objective of adding this radar to the nationwide network was to improve analysis and prediction of strong winter storm systems that frequent the region and to optimize radar coverage over areas not adequately served by the existing NWS radars in Seattle and in Portland, Oregon. SRI completed this work in early 2011, and the radar was fully operational by September 2011.

The following example of SRI personnel's first contact with the public regarding NEXRAD is quoted from the July/ August 1999 issue of SRI's *ERGO Engineering Sciences Newsletter*.

"We take science from theory to practice for the public good," said Jim Manitakos, highlighting the smooth match to SRI's charter. Jim tells a story that reminds us that the public good can sometimes arise from good fortune. The NWS and DOD needed to find a site for a NEXRAD in upstate New York. The agencies had been searching for years to find a suitable site, but due to strict technical requirements, had met with no success. So, the SRI Envirotechnical team took on the challenge, braving snow and sleet and ice in a January winter to drive back roads in an area roughly halfway between Fort Drum and Syracuse. One day, Jim's vehicle became stuck in the snow in remote Montague, New York (pop. 38). He trudged to the nearest house and found a man who helped dig his car out of a snowbank. When the man heard what SRI was doing, he said "Why don't you use my land," pointing up a nearby hillside.

The team researched the site and found it ideal, meeting all technical requirements with good road access and nearby utility lines. The government was incredulous. But in record time, the local man got \$16,000 for five acres, the government got its NEXRAD built, and SRI chalked up another satisfying success.

The team, of course, experienced plenty of potential roadblocks and challenges when siting facilities, especially due to environmental issues and the need to secure permits from government agencies. Vulnerable gopher tortoises threatened the selection of the radar site in Melbourne, Florida. A biologist had to bucket trap them to get a count by age and sex before moving them to the adjacent Cape Canaveral Air Force Station. But more tortoises showed up, and a special partial underground fence was installed at the site to keep them out. SRI also had to find solutions at numerous other facility locations to mitigate any negative impacts on many other species of concern, including the red-cockaded woodpecker, Kirtland's snake, gnatcatcher, desert tortoise, burrowing owl, pygmy rabbit, bat, bald eagle, and black-footed ferret.

But it wasn't only vulnerable species. At the Atlanta, Georgia, site, if any unmarked graves were found during construction, a permit was needed to move the remains (fortunately, none were encountered). The van survey was interrupted at Flagstaff, Arizona, and the SRI crew were chased out when the Coconino National Forest was shut down because of an escaped convict. SRI also oversaw extensive hazardousmaterials surveys at the New York City location (on Long Island). SRI even helped negotiate agreements regarding radar scan pattern impacts on observatories in Flagstaff, Hawaii, the San Francisco Bay Area, and Tucson. Two team members flew with a kahuna (wise elder or shaman) around the north shore of the Big Island of Hawaii in a helicopter to get his blessing for a suitable site that would not adversely affect cultural beliefs. Finally, the Los Angeles area site was challenged in court by activists, somewhat led by the actor Larry Hagman, who all thought the NEXRAD was a "tower of death" and would irradiate them and cause cancer. Hagman even challenged the Director of the NWS in an appearance on the Montel Williams TV talk show because of it. A lot of the motivation for the activists had to do with visual and "not in my backyard" (NIMBY) issues. In this

## **HISTORY CORNER (Continued)**

case and several others, SRI participated in open community meetings sponsored by the NWS or FAA to help the public understand the NEXRAD technology and its usefulness, and provide a forum for the public to ask questions.

The many radar siting challenges were documented in the humorous illustration shown below, done in 1993, by former SRI staff member Ron Moore. His depiction of the many obstacles faced by the SRI team was produced during TDWR siting efforts, but it fully reflects situations also encountered at potential NEXRAD sites.

The NEXRAD program (and subsequent Envirotechnical Program) received accolades and awards over its almost 30year existence at SRI. For example, in 1992, SRI's Business and Policy Group (BPG) awarded BPG Professional Excellence Awards to 20 interdivisional team members for work on the NEXRAD project. The Envirotechnical team was then selected for SRI's 1993 Quality Award for Outstanding Customer Satisfaction. At that time, one government program manager commended the team for their "proactive...and comprehensive approach... characterized by readiness to exert the extra effort required to solve the many vexing and sometimes unpredictable problems that surface in this program."

In 1997, the Department of Commerce recognized SRI with an Award of Excellence for its 14 years of service and support on the NEXRAD program, by then a network of about 160 units, the world's largest weather service network. "The success of NEXRAD underscores SRI's ability to bring together scientists, technologists, and analysts with diverse areas of expertise, and to create a project team to match a client's exact needs," said Patti Burns, Envirotechnical Program Manager, who accepted the award on SRI's behalf at a Silver Springs, Maryland, ceremony along with



NEVER-NEVER LAND . WHY DOES THE DIRT GLOW ? . WHO EVER HEARD OF QUICK-MUD? . WHO PAINTED THE SPOTS ON THIS OWL ? .

A humorous view of the challenges of siting a weather radar system.

John P. McHenry, Senior Vice President, and William B. Mohr, Director of Program Development.

For those of you who live in the San Francisco Bay Area, the next time you're driving on Highway 101, south of the interchange with Highway 85, look west up toward Mt. Umunhum. On the ridge line south of the large concrete block house you'll see the San Francisco Bay Area NEXRAD. It was commissioned in May 1995.

In the 21st century, weather monitoring capabilities have been enhanced with sophisticated new technologies, including satellite-based systems. But NEXRAD continues to operate, with updated software, carrying out the functions for which it was originally developed. So whenever you need to keep an eye on the weather outlook, whether you're planning a picnic or preparing for possible severe weather, you can thank SRI for helping to make the NEXRAD system possible. Linda Hawke-Gerrans worked on the NEXRAD program at SRI for 25 years producing report illustrations, radar coverage maps, FAA airspace compliance analyses, and GIS (Geographic Information System) generated environmental resource maps. She left SRI in April 2011, and as an employee of Sensor Environmental LLC later in 2011, helped complete a Supplemental Environmental Assessment for the Coastal Washington WSR-88D that studied the electromagnetic effects of lowering the radar scan angles.

Patti Burns worked on the NEXRAD program a total of 26 years, serving as the NEXRAD Project Leader and then the Envirotechnical Program Manager for 17 of those. She retired from SRI in 2009.

## **INTERNATIONAL JOURNAL**

#### The Scream

#### By Peter Weisshuhn

In the 1960s I was a student in Montreal, living in a rooming house. It had once been a fine upper-middle-class home, but now it was divided into small rooms sharing a kitchen, shower room, and toilet. I was the only student there; the others all made a modest living in various jobs. My room was next to the kitchen.

There was a small room, reached through the kitchen, perhaps the former scullery. It had long been unlet, as the least desirable in the house, with a very small window.

But eventually it was let, and had been for a week or so before I met the tenant. He was an older man, had seen better days, and currently was looking for a job that paid more than he was getting in a scrap yard. He did not go out of his way to meet the others, and I was the only one to talk to him and share a cup of coffee with him in the morning. He had had a hard life, was divorced, and had lost contact with his children, who moved away when their mother remarried. He liked his drink. I slept more deeply in those days than I do now, half a century later, and was well away when a scream tore me out of my slumbers. As I sat up in bed, the scream was repeated, at length, heartrending, insufferable. It was a woman's tortured cry for help, impossible to ignore. I was



out of bed in a flash, grabbed the hammer that I had used to repair my clothes chest, and tiptoed into the dark kitchen. The scream had clearly come from the room behind, the door of which was ajar. A bluish glow flickered on the door's frosted glass. An argument was going on. I approached silently on bare feet, the hammer raised to deal with the tormentor as I pushed the door fully open.

There was no woman. But spread on the floor before me lay the old boy, with the TV screening a horror movie, turned up to full volume. I turned it off and inspected the prostrate victim—knocked out by alcohol, as the nearly empty bottle beside him and the smell in the room proved. His breathing was audible.

I returned to bed confident that he would live—and he did.



The SRI Alumni Association welcomes new members:

Aurora Allen James Centis Wan-Ru Chao James Gran Thomas Hedges Marjorie Henry James A. Holland Ruth Krasnow Michelle L. Morton Walter Ogier Scott Taper Margarita Vargas Karen Withington

We look forward to your participation in the Alumni Association and hope to see you at our next group event.

## **Directory Addendum**

The enclosed directory addendum (covering the period August 1, 2019, to November 30, 2019) contains new members and corrections. Please add it to your 2019 Directory.



## Who Do You Believe Made an Exceptional Contribution to the Success of SRI? Nominate That Person for the SRI Alumni Hall of Fame!

The SRI Alumni Hall of Fame honors former staff members who made exceptional contributions to the success of SRI. We are seeking nominations for Hall of Fame candidates by June 1, 2020.

All former staff members are eligible, but nominees should meet the following criteria:

- Significant, lasting contributions to the success of SRI
- Contributions recognized by staff, management, or clients
- Contributions in any area of research, management, or service, such as
  - Establishing a new laboratory or a new field of research
  - Performing an outstanding recognized service
  - Clearly demonstrating qualities of leadership, vision, and creativity
- What did the person leave behind?
  - Enhanced reputation for SRI
  - New or enhanced research, business, or support activity or facility.

Please prepare a write-up of about 300 words indicating how your nominee meets these criteria. If you have questions about the nomination process, members of the Steering Committee will be happy to answer them. Send the writeup or questions to steering-committee-alumni@sri.com or SRI Alumni Association, 333 Ravenswood Avenue, AC-108, Menlo Park, CA 94025-3493. Again, the due date is June 1.

## Wanted: Your Submissions

We welcome articles and shorter items from all Alumni Association members to be considered for publication in the newsletter. Have you done something interesting or traveled to interesting places? Received any awards or honors? Your fellow alumni want to know! Please send items to steering-committee-alumni@sri.com.



Happy Holidays from the SRI Alumni Association!

## **CREDIT UNION NEWS**



#### **Richard Bard Battelle**



Bard Battelle, a former SRI electronic systems expert, died on June 10, 2019, at the age of 93.

Born in Dayton, Ohio, Bard attended local schools there before joining the Army in 1943. He was assigned to the First Radio Squadron, and his first assignment

was to install new VHF radios in P-47 aircraft in the New Guinea theater of World War II.

Bard's next assignment was aboard an instrumented B-17 aircraft as a backup radio operator during flights to Fairbanks, Alaska, and the Aleutian Islands to measure the buildup of electron charges on aircraft when flying in snowfall. His final assignment was in a team of four enlisted men and one officer to monitor the installation of new radio and navigation equipment in C-54 aircraft at East Coast airfields.

After his service, he completed his education at Ohio Wesleyan and MIT.

Bard worked for the Air Force at Wright Field Antenna Lab in Dayton, Ohio, before joining the staff at SRI in 1957, where he became an expert on Soviet Russian electronic systems over a 30-year career.

Bard and his wife, RoseAnn, raised their children in a home they built in Portola Valley's Alpine Hills neighborhood in 1957. The couple moved in 1991 to The Forum at Rancho San Antonio in Cupertino, where Bard was editor of the monthly newsletter and enjoyed participating in music programs.

In addition to RoseAnn, his wife of 66 years, Bard is survived by daughters Elizabeth, Sarah, and Martha, and by three grandchildren.

Based on an obituary published in The Almanac.



Mark Bleackley\*

Mark Bleackley, a Senior Management Consultant in SRI's Croydon office from 1987 to 1991, died on August 6, 2019, at age 60, after becoming ill on a flight back to the UK from Dubai, where he had been on a business trip.

Mark was born and grew up in Bolton, England, near Manchester,

and joined SRI's Croydon office in 1987, after completing his MBA at the London Business School (LBS). At SRI, he focused on consulting work in business management and business development. He is remembered by former Croydon colleagues as a hard-working young man, with a great sense of humour and a wide range of interests.

After leaving SRI in 1991, Mark worked as a freelance academic and consultant lecturer at the London School of Economics, teaching international business (MSc elective), and as a residential tutor for the Open University teaching strategy (MBA).

In 2004, Mark returned to the London Business School, where he worked as an independent consultant. He developed and participated in executive training programs at LBS clients such as KPMG, British Airways, British Aerospace, IBM Europe, and Mitsubishi Electric. He also directed the Senior Executive Programme, Executive Education's flagship general management programme, from 2013 to 2015; more recently, he led its groundbreaking and award-winning programme for ING, which was delivered to nearly 6,000 executives in the United States, Netherlands, Germany, Turkey, and Poland.

Tributes from his colleagues and clients testify to his "exceptional facilitation skills, his unique sense of humour and his ability to listen profoundly to people, connecting ideas and concepts in the moment, which made him a favourite with every audience."

## **IN MEMORIAM (Continued)**

As a lifelong supporter of the Bolton Wanderers Football Club, he used to regularly return "home" to see them play. He was actively involved in the work of the Samaritans charity organization and was a supporter of Greenpeace.

Mark is survived by his mother, Dorothy, and by sisters Sarah and Rachel, brother Tim, and daughter Hannah.

Obituary provided by David Gibby.

#### Alan Alexander Burns\*



Alan Burns, a former SRI staff scientist and longtime resident of Portola Valley, died at home on August 20, 2019, after several years fighting a rare form of Parkinsonism, Progressive Supranuclear Palsy. He was 79 years old.

Alan was born in Buenos Aires, Argentina, to a Tasmanian

mother and a U.S.-Irish father. His family moved to Menlo Park after his father retired. Alan earned a B.S. (with Great Distinction), an M.S., and a Ph.D., all in electrical engineering (EE), at Stanford University. He later received an M.B.A. from Santa Clara University.

After summers and a part-time job at Hewlett-Packard, he received an assistantship from Stanford's EE Department, which led to his Ph.D. in 1968. His thesis involved studying the moon using a pair of radars—one at 25 MHz with an antenna array that was dismantled years ago, and another at 50 MHz in Stanford's "Big Dish." It was basically a data salvage operation, but he was able to use the ionosphere as a polarimeter to separate the expected and depolarized lunar echoes. During his time at Stanford, he went on a research vessel to Antarctica, for which he was awarded the Antarctica Service Medal by the National Science Foundation in 1965.

After Stanford, he joined SRI, where he worked for 17 years in the then Radio Physics Lab, and where he met his wife, Patti, who eventually became an SRI program director. At SRI and afterward at a small contract research firm, Alan conducted various and sometimes weird projects involving radars, lasers, avionics, electronics, and applied science. This included three summers at sea ('72, '73, '74) researching radar effects of the French nuclear tests in the Pacific. For this work, he was awarded a Defense Nuclear Agency Meritorious Public Service Medal. Alan also led major projects involving simulations of the effects of nuclear explosions on radars in New Mexico and Arizona. During the 15 years following SRI, he was a principal inventor of the FoxTrax "glowing" hockey puck. He also held an Amateur Radio License.

Alan "retired" in 1999 but continued trying to be a successful inventor, holding 10 patents ranging from tire pressure sensing to airliner missile defense. He was a passionate pilot, once owning an Aerobat 150, but he did the most flying with Patti in their Cessna TR182 RG for 30 years, mainly in the western United States (especially to the Grand Tetons almost every year). For both work and pleasure, he enjoyed worldwide traveling, as well as driving his '56 Porsche, hiking, swimming, bicycling, and cooking. He bought a little house in Los Trancos Woods in 1972, remodeled it a few times, and also spent a lot of time at a second cottage in Kauai.

Besides his wife, Patti, who was with him for 42 years, Alan is survived by son Ian, daughter Adrian, brother Richard, sister Jane, four grandchildren, and several cousins, nieces, and a nephew scattered around the United States, Europe, and Australia.

Obituary provided by Patti Burns.

## **Rolf Buchanan Dyce**



Rolf Dyce, a former SRI staff member, died peacefully at home with his wife, Carole, by his side on March 11, 2019, in Aguadilla, Puerto Rico. He was 89 years old.

Rolf was born and lived for his first 11 years in Guelph, Ontario, Canada. The Dyce family moved to Ithaca, New York, in 1940, when Rolf's father took a position as a professor of entomology at

Cornell University. Rolf attended Ithaca High School (Class of '47), followed by Cornell University, where he earned a B.A. in physics in 1951 and a Ph.D. in electrical engineering in 1955.

After serving as a lieutenant in the U.S. Air Force at the Griffiss Air Force Base in Rome, New York, Rolf moved to California in July 1957 to join SRI, where he worked on classified research including auroral, meteor, and lunar

studies; satellite radar echoes; high-altitude nuclear weapons effects on the ionosphere; and the electromagnetic effects of missile flight.

In January 1964, Rolf joined the staff of Cornell University's newly constructed Arecibo Ionospheric Observatory in Puerto Rico, the world's largest radio telescope at that time. Rolf was named associate director of the Arecibo Observatory in 1965. Here he conducted radar studies of the surface of the moon and the behavior of Mercury, Venus, and Mars (including their rotation and position in the solar system). With his colleagues, he made a significant contribution to improving scientific knowledge of the astronomical unit, a measure of the scale of our solar system, critical to the subsequent navigation of spacecraft to other planets. In 1978, Rolf left the Observatory to become Chief Scientist of Equatorial Communications, a start-up company based in Sunnyvale, California. He retired to Puerto Rico in 1993, where he enjoyed living in a tropical paradise and many pursuits such as hiking, swimming, sailing, tuning pianos, helping neighbors, and volunteering for community causes.

Rolf was adored by his family and appreciated by so many in his community. His family, friends, neighbors, and colleagues will miss his welcoming attitude, pursuit of knowledge, and jovial spirit.

Rolf is survived by Carole, his wife of 30 years; daughter Karen; son Eric; two grandsons, Alex and Gavin; two stepsons, Adam and David; and four granddaughters, Anna, Karina, Celia, and Helen.

Based on an obituary published in the Ithaca Journal.

### Edward Tuckerman Esty II



Edward Tuckerman Esty II, a former SRI education researcher, died peacefully on August 23, 2019, with his wife, Mary Lee, at his bedside.

Born in New York, Ed grew up in New Canaan, Connecticut. He attended Deerfield Academy, then graduated from Harvard College in 1961 with a major in mathematics.

He went on to receive a master's degree in education the following year. After completing his master's, Ed chose to teach fifth and sixth grades in Evanston, Illinois, in order to truly understand the world of classroom teachers and the challenges of teaching mathematics. While next pursuing his doctorate in education, he served as a researcher for the University of Illinois Arithmetic Project, Education Development Center in Newton, Massachusetts. Ed's academic work was awarded the Phi Delta Kappa and Pi Lambda awards for Distinction in Studies for the Degree of Doctor of Education by the Harvard Graduate School of Education faculty in 1970.

From 1970 to 1974, Ed was a research scholar in mathematics education for the Comprehensive School Mathematics Program, one of the early innovative mathematics curriculum projects that focused on problem solving rather than rote drill, under the auspices of CEMREL, a National Education Laboratory based in Saint Louis. At the National Institute of Education, part of the then Department of Health, Education, and Welfare in Washington, D.C., Ed became an influential figure in American mathematics education. After leaving government, Ed was a senior project director at the Mathematical Sciences Education Board of the National Academy of Sciences, contributing to its many seminal reports in the field.

In the 1990s, his work with colleagues at SRI, funded by the National Science Foundation, produced engaging, awardwinning video-based materials promoting mathematical problem-solving skills for elementary and middle school students. One of his collaborators, Andy Zucker, particularly recalls two of their NSF projects. One was to develop Becoming Successful Problem Solvers, a series of instructional videos for teaching and learning mathematics in grades 4 through 8. The other was a video called *Making Money* with Major Munchy, which promotes hands-on learning for middle schoolers through a variety of activities involving problem solving, statistics, probability, and connecting math to real-life experiences. Both video kits won awards, including, for Major Munchy, first prize in the education category of an International Film and Video Festival. Ed left SRI in 2008.

As the mathematics and research consultant for Square One Television, an educational series that the Children's Television Workshop produced for PBS, Ed influenced the mathematical development of a generation of viewing children. Square One won multiple Emmys and awards for mathematics education during its four seasons on air. Ed also consulted with the John Glenn Commission, chartered by the U.S. Secretary of Education, which produced a wellknown report, "Before It's Too Late," on preparing the math and science teaching force for the 21st century, and with Change the Equation, a nonprofit launched at the

## **IN MEMORIAM (Continued)**

White House by President Obama to dramatically improve education in science, technology, engineering, and math (STEM). Ed went on to consult in mathematics education with school systems throughout the country.

An anniversary trip to Maui led Ed and Mary Lee to fall in love with the island. Ed embarked on a project to develop a former farm in Maui into a residential community, Omaopio Ridge. He and Mary Lee restored the land with native plantings and discovered and protected ancient petroglyphs they found on the property. The development is now home to ten families who love the land as much as Ed did.

Ed was a talented composer and pianist. His piano was given a workout daily, and he could improvise any piece of music in creative and sometimes humorous ways. He performed and composed throughout his life, beginning at Deerfield as the pianist for the school's jazz ensemble. Ed continued to perform through college and at jazz bars in the summers on Cape Cod. The accompaniments he wrote for the Suzuki violin repertoire continue to be used regularly by violin students around the world.

Ed is survived by Mary Lee, his wife of 56 years, and by two children, Scott and Elizabeth, and five grandchildren, Sophie, Isaac, Willem, Odin, and Julia. He will be deeply missed.

Based on text from Ed's memorial service and on information from Andy Zucker.

#### Wilbur Ray Vincent\*



Ray Vincent, a former SRI staff scientist and research manager, died peacefully at home in Davis, California, on October 10, 2019, at age 97.

Born in Saginaw, Michigan, he grew up near Freeland, Michigan, and attended a nearby grammar school, followed by high school in Midland, Michigan.

During the Depression, Ray took an additional year of high school because of the excellent facilities funded by Dow Chemical. He was able to take advanced classes in physics, chemistry, and other sciences. Also, he passed exams by the FCC to operate commercial radio stations. Ray obtained an advanced amateur radio license toward his goal of becoming a marine radio operator so he could go off and see the world.

After graduation from high school, he worked for a year in the Physics Research Laboratory of Dow Chemical as a laboratory assistant. This provided enough money for his first year at Michigan State University. The second year was made possible by working in the college radio station, WKAR. He enlisted in the U.S. Army Reserve to be able to complete his sophomore year of college and was later called to active duty in World War II. He saw overseas duty maintaining and operating radio-intercept sites at the southern tip of New Guinea, the Philippines, and Okinawa.

On discharge from the Army, he returned to Michigan State, where he received bachelor's and master's degrees in electrical engineering. After graduation, he worked for some years at Bell Aircraft in Niagara Falls, New York, doing electronics work on early supersonic missiles and aircraft.

In the mid-1950s, Ray joined SRI in Menlo Park, where he worked as a research scientist and as a laboratory manager. As a research manager in the Communications and Propagation Laboratory, he led much of the communications activity, which in those days was dominated by shortwave radio, the only communications with worldwide reach. Around 1961, this very large lab was split into two parts. The propagation part was named the Radio Physics Lab, and Ray became the manager of the new Communications Laboratory. Aside from shortwave radio, Ray contributed to other major efforts. One of the first was as part of the team that made the first radar contact with an artificial satellite, Sputnik. He also won SRI's participation in communications via meteor trails. Finally, he was instrumental in bringing to SRI important field projects in measuring and modeling the impact of high-altitude nuclear detonations on shortwave communications.

Ray left SRI in 1987 to undertake consulting work, mainly for the Naval Postgraduate School in Monterey. In 1989, he was asked to join the faculty of the school as an associate professor, and he spent 20 years happily associated with that institution.

After Ray retired from the Naval Postgraduate School in 2009, he continued to work on special tasks as an engineering consultant for a number of clients. His career provided many unusual opportunities, including participating in detailed scientific and technical work at more than 60 overseas locations. He authored several hundred scientific papers and publications and coauthored more than a hundred more.

## **IN MEMORIAM (Concluded)**

Ray was blessed with enthusiasm for his work and loved to introduce his ideas to the point of winning ongoing work, both while at SRI and afterward. He was renowned for his stellar work and attention to detail and was respected and admired by his peers.

Ray is survived by his wife, Georgia; by son Christopher; and by grandchildren John, Matthew, Rebekah, Deanna, Christopher, Travis, Garrett, Marshall, and Justin.

Based on an obituary published in the Davis Enterprise and on information from Don Nielson.

*Note:* Obituaries for three other former SRI staff members—**Philip Green**, who died November 13, 2019, **Norman McEachron**\*, who died August 23, 2019, and **Richard S. Rich**\*, who died April 12, 2019—will be published in the April 2020 newsletter, when more complete information is available.

The SRI Alumni Newsletter is published three times a year (in April, August, and December) by the SRI Alumni Association.

Editorial committee: Mimi Campbell, Klaus Krause, and Caren Rickhoff Design & layout: Linda Hawke-Gerrans

<sup>\*</sup>Member of the SRI Alumni Association