SRI International

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Alumni Association



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MESSAGE FROM ARCHIVES CHAIRMAN DON NIELSON



Don Nielson

Well, fellow alums, be prepared for perhaps the largest newsletter we have ever produced. Happily, its heft comes mostly from you and your willingness to share your reflections on SRI and your current activities. I hope this will inspire the rest of you to give us a glimpse of your reflections and interesting exploits.

First, a few thoughts on the content. From an SRI history perspective, the most important recent event was the 50th anniversary of the Engelbart et al. demonstration on December 9, 1968. Succinctly, on that day a half century ago they brought to life Doug's vision and showed the world for the first time how *everyone* would come to use computers! You will find it described from the SRI point of view and from mine. It is hard to overestimate its importance. Caren Rickhoff also relates how SRI still pursues related efforts plus a host of other announcements that show SRI still has that eclectic, wonderfully varied research involvement it has always had.

Thanks to Don Shockey for his comprehensive account of what his world consisted of at SRI. Clearly, we can all break things, but he and his colleagues made a science and a business of it, full of interesting solutions, for nearly four decades. And Andy Zucker recalls for us the impact of Stanford/SRI luminary Willis Harman. Long ago I took his excellent course in electronics, marred only by the periodic substitution of egoist William Shockley. But Harman then had a huge metamorphosis, and Andy tells it well. We also get our wonderful overseas fix in the newsletter as Gia Campari gives her surprising affirmations about the quality of business acumen in South America. It is very interesting reading. Finally, I just returned from Alaska and have flown over some of it. So, when I saw Jim Colton's account of visiting **all eight** National Parks in Alaska, I was totally flabbergasted! Alaska's vastness means access to them is difficult, to say the least, and something Alaskans themselves don't undertake.

Finally, if you live in the Bay Area, please sign up for the Spring Fling. I know there is no such thing as a free lunch, but this will seem so. Email us that you, and maybe your guest, will join us.



The Spring Fling is May 16, 2019, at the Hiller Aviation Museum in San Carlos. See announcement on page 19. The flyer for this event is enclosed with this mailing.

Use of "Extended Reality (xR)" in Education Today

In October 2018, SRI and EdTech Times released the results of a joint survey conducted to gain insights about the impact of extended reality in the classroom. Extended reality—xR for short—encompasses augmented (AR), virtual (VR), and mixed reality (MR). The Labster and Lifeliqe, organizations that provide educators with xR experiences for teaching and learning, were key partners in this work.

The Survey. The primary research question in this initial look into the awareness of, value seen in, and barriers to using xR was: what does adoption of augmented, virtual, and mixed reality in education look like? Additionally, the researchers were looking to understand what experiences these technologies could uniquely provide to learners. Results were shared at the annual xR in EDU conference in Boston last year.

Results of the Research. The majority of the respondents (92%) had more than 3 years of experience, and 23% of the respondents had more than 20 years of experience. Most taught in higher education (44%) or K–12 (36%). Science and Technology/Computer Science were the subjects most commonly taught by the survey sample. Of the 115 respondents who completed the survey, 71% said they would be interested in using xR with their students, 94% had experience using xR, and 49% had used it in the classroom. When asked how they felt xR impacted their students, the majority of respondents who had used these technologies in their classrooms (91%) said that xR had a medium to large positive impact.

Of the three types of xR, virtual reality was the one used most and mixed reality was used least. Results showed that the majority of teachers (85%) felt that virtual reality would have a positive impact on their students; however, only 2% were already using this technology in their classrooms.

Survey respondents expressed that xR is valuable for visual learning and for helping students take control of their own learning, that it provides a safe practice space for real-life learning, and that it allows students to virtually experience places and phenomena beyond the classroom.

Barriers to Adoption. The number one barrier to further use of xR in the classroom was the lack of needed hardware. The number two barrier was lack of training, with three-fourths of respondents indicating that they received no professional training for using the technologies.

To read the full findings of the study, please visit https://edtechtimes.com/xr-research.

Plans for a 2019 survey are under way.

The SRI press release is at https://www.sri.com/newsroom/ press-releases/edtech-times-and-sri-international-releasereport-use-xr-education-today

The Mother of All Demos Celebration at SRI

On December 9, 2018, SRI celebrated the 50th anniversary of the "Mother of All Demos"—the world debut of personal and interactive computing. On December 9, 1968, at the Fall Joint Computer Conference in San Francisco, SRI engineer Doug Engelbart was met with a standing ovation when he gave the first public demonstration of the computer mouse and many key fundamentals of modern computing that ushered in the Information Age.



Engelbart and his SRI team debuted numerous—and now ubiquitous—technology innovations, including hypertext linking, multiple windows with flexible view control, realtime on-screen text editing, shared-screen teleconferencing, and the computer mouse. Engelbart envisioned harnessing the power of computers as tools for collaboration and the augmentation of our collective intelligence to work on humanity's most important problems.

The demonstration was the first to show how a computer could be used as a tool to capture and share knowledge on a vast scale, a new and revolutionary idea at the time. The computer mouse was an important part of a much larger system to facilitate organizational learning and collaboration. It was the first public demonstration of a real-time collaborative environment between two computer users.

Looking Forward to the Next 50 Years

Today, projects across SRI build on the Mother of All Demos themes of augmenting human capabilities. Researchers are focused on developing technology that can improve human sensing, learning, and collaboration. Projects include:

- An artificial intelligence system that continuously learns and applies that learning to become better and more reliable. [DARPA's Lifelong Learning Machines (L2M) program]
- A speech-processing system that solves noise robustness, speed, and edge processing in a multitude of languages. [SRI's Open Language Interface for Voice Exploitation (OLIVE)]
- Human-machine interaction software to help people make snap decisions in time-critical situations when faced with an overwhelming amount of information. [SRI's bRIGHT]
- Visual storytelling platform for conversational AI that enables 3D spatial and temporal reasoning to support research in language, vision, and planning. [SRI's Aesop]

Note: See Don Nielson's take on the celebration in this issue, including links to other online resources.

The SRI press release is at https://www.sri.com/newsroom/ press-releases/sri-international-celebrates-50th-anniversarymother-all-demos-and-looks

SRI Supports Drug Development Work in Pediatric Autism

SRI will provide formulation development, preclinical development, and early clinical manufacturing of QBM-001 in support of Q BioMed's autistic spectrum disorder drug development program for nonverbal or minimally verbal autistic children. Q BioMed Inc. is a biotechnology acceleration company focused on licensing and acquiring undervalued biomedical assets in the healthcare sector.

QBM-001 targets toddlers with pediatric developmental nonverbal disorder, where an underlying commonality may lead to developmental delay, an autism diagnosis, and eventual nonverbal or very minimally verbal capability for the rest of their lives. QBM-001 is a combination therapy that is designed to reduce the levels of two molecules that are elevated in the target patient population by targeting multiple pathways. With this approach, QBM-001 may be able to overcome shortcomings of prior drug candidates that were limited by treatment resistance when only one pathway was targeted. The formulation team at SRI is led by Dr. Gita Shankar, who is experienced in the development of novel formulations that have reached clinical trials. The preclinical studies for QBM-001 are led by Dr. Stephen Morairty and his team in SRI's Center for Neuroscience. Dr. Morairty and his colleagues are experienced in working with several preclinical autism models.

SRI's experience with autism models and expertise in formulation of products such as QBM-001 will be a catalyst for several milestones for QBM-001 over the next few months. SRI anticipates formulation development being complete by the end of the second quarter in 2019, which will allow filing of an Investigational New Drug application with the Food and Drug Administration, the first regulatory step toward conducting trials in humans, such that clinical trials can begin in the third quarter of 2019.

The SRI press release is at https://www.sri.com/newsroom/ press-releases/q-biomed-announces-strategic-partnershipsri-international-formulation-and

SRI Obtains High-Resolution Images from Hobby Unmanned Aerial Vehicle



In February 2019, SRI researchers successfully demonstrated high-resolution synthetic aperture radar (SAR) imagery from a small, low-cost hobby unmanned aerial vehicle (UAV). The small form factor SAR instrument generates accessible radar imagery for detecting and measuring solid earth vertical deformation to improve prediction models for landslides, levee erosion, and earthquake and volcanic activity.

"SRI's SAR instrument on a small UAV enables rapid and frequent visits over an area of interest," said Simon Lee, senior program manager, Signals and Space Technology Laboratory at SRI. "This capability can provide scientists with the datasets needed to improve their models and forecasts." SRI's state-of-the-art SAR instrument is a compact radar system developed to generate high-resolution remote sensing imagery from small satellite and UAV platforms.

The SRI press release is at https://www.sri.com/newsroom/ press-releases/sri-international-demonstrates-highresolution-images-hobby-uav.

Speech Recognition Research Continues at SRI

Many of you know that SRI has been a leader in the development of speech recognition software. That research continues with the development of the Open Language Interface for Voice Exploitation (OLIVE). The OLIVE speech processing system is being developed to achieve robustness to high levels of noise and distortion in real-world data. Artificial intelligence algorithms underlying OLIVE enable the technology to:

- Detect the presence of speech, not just an open channel (speech activity detection).
- Find and/or track speakers of interest (speaker identification).
- Detect languages and dialects from a set of languages of interest (language and dialect identification).
- Detect specific keywords and phrases (keyword spotting).

Graphical user interfaces in OLIVE enable close editing of audio files, enrollment of new speakers, scoring of segments, speech activity segmentation, and semisupervised speaker diarization (identification of an individual person based on voice qualities).

Initially developed under the DARPA Robust Automatic Transcription of Speech (RATS) program, OLIVE is designed for easy integration into end user applications. Additionally, the technology is under continuous development and refinement based on user feedback.

OLIVE is described at https://www.sri.com/work/projects/ open-language-interface-voice-exploitation-olive.

Events Honoring the 50th Anniversary of the Engelbart Demo

By Don Nielson

Most of the celebration occurred at and under the auspices of the Computer History Museum, but the first event occurred at SRI on December 6, 2018. It was a panel of three, moderated by Pat Lincoln and consisting of Vint Cerf (Internet founder), Adam Cheyer (inventor of Siri and admirer of Engelbart), and Jeff Rulifson (key SRI player in the software of the 1968 Demo). Below are the panel and the first view of a replica of the workstation used by Engelbart at "The Demo" and built for the occasion by SRI and Herman Miller.



NEWS FROM SRI (Concluded)

This 50th anniversary of The Demo, in which Doug Engelbart and the balance of his proficient SRI lab showed the technical world how computing should and would evolve, yielded two subsequent events at the Computer History Museum. One was an all-day Symposium, held on the exact anniversary date, December 9. It covered the essentials of The Demo and what it implied, verified by a host of people who either participated or were directly influenced by it. The second event was more public and reflected on Doug's original vision of augmenting ourselves to tackle the world's important problems. Both events were under the auspices of the Computer History Museum, but SRI had an important role bringing them about.

ENGELBART SYMPOSIUM



The Symposium on December 9 was a well-orchestrated review of how Doug had influenced a specific set of individuals, as well as the computing world in general. Present were some of the luminaries of the Internet, including Sir Tim Berners-Lee (creator of the Worldwide Web) and Vint Cerf (Internet founder); information system creators like Alan Kay (Smalltalk and

Dynabook), Ted Nelson (hypertext), and Adam Cheyer (Siri and Change.org); Brewster Kahle (leader of the Internet Archive); and a few of Doug's collaborators from the 1968 Demo, both on the program and in the audience. Doug's daughter, Christina, was a presenter and was heavily involved in the Symposium. She also manages Doug's foundation and archives currently at SRI.



Also demonstrated at the Symposium were a dozen or so individual programs or applications those developers believed were traceable directly to Doug's influence. The day

left little doubt that those called on to speak or demonstrate were indebted to Doug and the world to which he opened their eyes. The above-mentioned workstation replica is again shown below with Bill English, who was the leading architect of The Demo and was at the back of the San Francisco Civic Auditorium managing all that went on.



On December 12, an evening reception and session were held at the Museum under the sponsorship of SRI and Logitech. This meeting, while honoring Doug through a video and some opening remarks, was geared mainly toward a few of the world's challenges, the likes of which he hoped during his later life would be tackled. The three chosen were nuclear proliferation, ocean warming, and one directly tied to his notion of network acceleration and enablement, Change.org. Though not directly linked to The Demo, the spokespersons repeatedly mentioned how what they were doing to meet their challenges had some root in Doug's thinking and writing.

One interesting aspect of the second day's panel discussions addressed the need to change people's behavior. Doug had always maintained that the tools he created would be of limited use if people themselves didn't change, both in advancing their use of his tools and in how they grew in intellect, determination, and proficiency. One very plain aspect of the human component was the notion of empathy—that to win the hearts and commitment of people to support a cause (challenge) they first had to empathize with the goal itself. This concept repeatedly arose in the panel discussion, and it reminds us of Doug's need for good and committed people to become engaged.

Note: Don's previous article about the anniversary in the December 2018 issue of the newsletter includes links to more online information about the event. A video of The Demo on YouTube is at https://www.youtube.com/watch?v=yJDvzdhzMY. The Doug Engelbart Institute website is at https://www.dougengelbart.org/.

SRI's Center for Fracture Physics

By Don Shockey

Certain researchers at SRI had a passion for breaking things-and also finding out why they broke, how to keep them from breaking, and sometimes breaking them more efficiently. We were materials scientists, mechanical engineers, computational physicists, and corrosion chemists who combined our knowledge and experience to advance fracture science and solve fracture problems through testing, modeling, and posttest damage assessment of metals, ceramics, polymers, composites, fabrics, and rock. We worked on enhancing resistance of materials and structures to explosives and ballistic impact, extending the lives of aging aircraft, stimulating oil and gas wells by explosively fracturing the deep-buried rock, enhancing the safety of nuclear power plants, precluding catastrophic bursting of decades-old gas pipelines, and many NASA and DoD issues from Star Wars to tank armor. (There were also some less earth-shaking projects involving ski bindings, pig bladders, bowling pins, and beer can lids, which I won't go into here.)

The Center for Fracture Physics, originally called the Department of Metallurgy and Fracture Mechanics, has provided solutions to material and structural failure issues for government and industry for 38 years. Incubated in the Poulter Laboratory, whose main activity was blowing things up at its explosive test site near Tracy, California (Figure 1). Center colleagues concentrated initially on analyzing impact- and explosive-induced damage and developing damage-resistant structures and materials. But over the years we've addressed failure under slowly applied loads and even failure at the extreme other end of the loading rate spectrum; that is, we analyzed structures that suddenly and unexpectedly failed, after withstanding loads for decades, thereby helping clients extend the lifetime of aging systems such as pipelines, aircraft, power plants, and electronics.





Figure 1. SRI's Corral Hollow test site and smoke from an explosive test.

Fracture under impact and explosive loads

Bulletproof vehicle windows and body armor

In the dynamic load category, military vehicles urgently needed lighter-weight protection from projectiles. A particular concern was vehicle windows—the most vulnerable locations on a battle tank (Figure 2). As threats became more and more formidable, the DoD response was to make the windows thicker and thicker. Glass windows got to be four and more inches thick and weighed nearly 100 pounds, so that 10 windows on a vehicle added 1,000 pounds to the vehicle weight. This added weight caused suspension systems and transmissions to wear out quickly, requiring that the vehicle be taken out of service for repair and maintenance after only a short duty period. Clearly, another solution was required. The Center worked with

HISTORY CORNER (Continued)

the military and glass manufacturers to identify materials and window geometries that were more weight efficient. Windows consisting of multiple glass plates bonded to each other with special epoxy resisted projectiles more efficiently. Cracks in the glass layers induced by projectile impact were arrested at the epoxy interfaces and required to reinitiate in the subsequent glass layers, substantially increasing the ballistic limit and reducing window weight.



Figure 2. Windows on a military vehicle made thick to resist projectile penetration.

Likewise, the ballistic resistance and weight of personnel armor have always been of major concern to the DoD. vests containing ceramic breastplates Bulletproof outperformed vests containing metallic plates (Figure 3), but both were heavy and unwieldy, limiting a soldier's activities and the time he/she could perform on the battlefield. By tracking and understanding the evolution of cracking patterns produced in ceramic plates ahead of an advancing penetrator, we were able to provide the understanding and data needed for developing computational models of armor penetration that were then used to design more efficient body armor.



Figure 3. Body armor (top left), ceramic breastplate inserts (top right), and a cross section (bottom) showing damage in a penetrating rod and partially penetrated steel plate.

In-situ fracture of deep-seated oil shale and metal-bearing ore

But we didn't always want a material to resist fracturesometimes we wanted to encourage fracture. For example, we worked with the government and national labs to develop explosive procedures for fracturing oil shale hundreds of meters underground (Figure 4), in ways that would produce a desired cracking pattern and allow enhanced extraction of the oil-bearing kerogen. Small-scale experiments were performed in pressurized explosive vaults at SRI. The stress-wave histories were measured with embedded piezoelectric and particle velocity gages, the crack pattern and resulting fragmentation were quantified after the test, and a computational dynamic fragmentation model was constructed from the results. The model was used to specify the amount, type, and density of explosive that would lead to enhanced oil extraction. A large mining company currently intends to exploit the model to facilitate extraction of copper from ore buried far beneath the surface.

HISTORY CORNER (Continued)



Figure 4. Explosive fracturing of deep-seated oil shale to produce and expose fracture surfaces, allowing extraction of oil.

The Port Neal chemical plant explosion

We were occasionally asked to provide independent analyses of structural failures that resulted in lawsuits. In December 1994, a tremendous explosion at an ammonium nitrate plant in Port Neal, Iowa, killed 4 employees, injured 18 others, and leveled all buildings and equipment within a 200-foot radius (Figure 5). A major lawsuit resulted. The operator of the neutralizer vessel and the designer of the vessel contested who was responsible, and each side retained a team of experts to determine the cause of the explosion.

The volumes of physical evidence amassed by the two investigative teams came down to one critical element: the deformation of the sparger, the circular pipe in the neutralizer vessel through which nitric acid was injected into the liquid ammonium nitrate solution. The responsibility for the incident would be determined if it could be established whether the explosion initiated inside or outside the sparger. The two teams reached opposite conclusions, and after five years of investigation and many inconclusive trials, the presiding judge ordered the appointment of an expert metallurgist on behalf of the court to resolve the impasse. SRI was selected to review the evidence, conduct an independent investigation, and provide its expert opinion. Only 12 sparger fragments were recovered, but their shapes and markings provided important facts. SRI applied its fractographic expertise to the fragments, deduced their deformation and failure history, and determined that neither an internal explosion nor an external explosion could produce fragments that had all of the observed deformation and failure features. However, one combined scenario-an external explosion followed by an internal explosion—would produce fragments consistent with all observations. Our computer simulations confirmed the explosion sequence,



Figure 5. The Port Neal ammonium nitrate plant before and after the explosion.

SRI submitted its finding to the court, and the five-year-old multimillion-dollar lawsuit was settled in five days.

Patents and the Sioux City airline disaster

Our failure analysis expertise also led to patents and new products. For example, our analysis of a commercial airline disaster led to two patents on barriers designed to prevent engine fragments from penetrating the fuselage.

In 1989, a DC-10 with 306 passengers on board crashed in a field near Sioux City, Iowa. The cause: a mid-flight burst

April 2019

of a propulsion engine that produced engine fragments that sliced through the fuselage and severed flight-critical hydraulic lines. Congress and the FAA immediately and urgently solicited the research community for ways to prevent similar incidents.

With financial support from the FAA, SRI set out to develop fragment barriers that could be placed inside fuselage walls. Realizing that barriers made of aluminum or steel could withstand fragment impact but would be too heavy to be practical, we examined the feasibility of polymeric fabrics. We used computational material models and finite element codes to simulate fragment/barrier encounters, estimate the number and type of fabric layers needed to resist fragment penetration, and determine how to attach them to the airframe. Next, we performed well-controlled, instrumented small-scale gas gun tests to evaluate the barrier designs. Finally, we conducted full-scale tests at the Navy facility at China Lake (Figure 6). We found that blankets made of multilayer Zylon, an advanced polymer fabric developed by SRI, withstood fragment impact with less than one-tenth the weight of barriers made from aluminum fuselage skin. High-speed photographs of the impact events matched well with the computer simulations, validating the barriers and resulting in the patents. The resulting technology has found spinoff applications in protective clothing, armored cars, embassy walls, industrial plant shields, and military vehicles.



Figure 6. Expanded view of the wall of a commercial aircraft and the full-scale test setup for evaluating the stopping ability of engine fragment barriers.

Fracture under slowly applied loads

But while many of our projects entailed fracture under highrate loads, we applied our fracture analysis capabilities to failures that occurred under quasi-static loads—for example, astronaut glove tearing and arterial stents.

Tearing in astronaut gloves

In 2006, astronauts were returning to the International Space Station after space walks with tears in the outer layer of their gloves (Figure 7). This was of great concern, since an astronaut would die if the pressure boundary of his/her suit were violated, and NASA immediately undertook an urgent effort to prevent future incidents. SRI and a team of NASA scientists examined the gloves and conducted laboratory experiments to determine the mysterious cause of the tears. We established that micrometeorites had impacted the handrails that the astronauts grasp as they move about the station during their spacewalks, and the sharp, ragged edges of micrometeorite craters had severed the yarns in the outer layers of the gloves as the gloves slid over the rails. Close examination of the failed textile fabric allowed us to develop guidelines for tear-resistant glove design. Our findings resulted in a glove redesign that entailed relocating stressconcentrating seams away from the gripping area, covering the outboard seam area of the index finger and thumb with a tightly woven fabric, and replacing the previously used silicone rubber coating with one that more strongly bonds to the Vectran yarns.



Figure 7. Tears in the outer layer of an astronaut's glove after a space walk.

HISTORY CORNER (Continued)

Fracture of stents

In the early 2000s, there was suddenly a need to make stents fracture resistant. Fracture of heart stents had never been a problem because the loads produced by the blood pumped by the heart are very low. But, understandably, the huge success of stents placed in heart arteries encouraged physicians to emplace stents in the blood vessels of the arms and legs. However, stents emplaced in the knee experience substantial loads when the knee is bent and straightened during walking, running, and other daily activities, and soon after stents began to be implanted in the superficial femoral arteries of the knee, a number of fractures occurred (Figure 8). As a result, the FDA required the stent manufacturers to deliver stents that were more fracture resistant.



Figure 8. The superficial femoral artery and a stent being mechanically tested.

Development of more fracture-resistant stents required a better understanding of (1) in-vivo loads, (2) how stents deform under these loads, and (3) the influence of the artery on stent deformation. None of the stent manufacturers had the expertise or equipment to generate the required understanding or data, so eight companies formed a consortium and jointly funded SRI to design and construct testing devices to measure loads in stents, mock arteries, and stents emplaced in mock arteries undergoing tensile, bending, and torsional deformation. It may seem unusual that companies competing in a market would collaborate in a research effort. In this case, they banded together to acquire the generic information needed to design stents. They then differentiated themselves and their products by using the information to design their specific stents.

Advancing Fracture Science—FRASTA

The Center for Fracture Physics achieved a leapfrog advance in fracture science that enables development of new, fracture-resistant materials and has proven to be a powerful tool for establishing the cause of structural failures. The FRASTA (FRActure Surface Topography Analysis) technology developed by SRI's Takao Kobayashi quantifies, juxtaposes, and incrementally displaces topographs of conjugate fracture surfaces to reconstruct a fracture event in microscopic detail, allowing crack initiation and growth to be replayed and revealing the interaction of the crack front with microstructure features. The SRI-developed FRASTAscope, a commercially marketed confocal optics instrument, produces topographic maps of fracture surfaces, manipulates the conjugate topographs, and displays images of microfailure evolution (Figure 9).



Figure 9. Dr. Kobayashi examines a fracture surface with the FRASTAscope.

By enabling a quantitative assessment of fracture surfaces, FRASTA enhances the information that can be obtained with conventional qualitative fractography, significantly improves current failure prognosis and diagnosis capabilities, and has produced results that benefited government and industry.

For example, a control thruster failed violently during a routine ground test at NASA's White Sands Test Facility in June 2010, creating uncertainty about the reliability of inflight thrusters. The next scheduled Space Shuttle launch was immediately put on hold, and a NASA investigative team began an urgent analysis of the failure. Their thorough and detailed evaluation of the thruster system and the events leading to the failure led them to postulate the root cause. But confirmation was needed. Conventional fractography could not provide conclusive answers, and NASA contracted SRI to apply FRASTA to reconstruct the entire fracture process and thereby confirm the root cause. The Center's work showed how a complicated dynamic failure event can be replayed through fracture surface topography analysis and how FRASTA could extract information on load conditions, relative crack growth rates, and fracture mechanics parameters from fracture surfaces. The effort, written up, submitted to, and published in the *Journal of Failure Analysis* in 2012, received the year's Best Paper Award at an international conference in 2018.

In another instance, and at a drastically different loading rate, FRASTA estimated the time a crack formed in a 22-year-old fossil-fired power plant and provided the history of the crack's growth. This information helped the plant operator set inspection intervals and plan for repair, rehabilitation, and component replacement, thereby reducing the probability of a catastrophic failure—think the deadly 2010 San Bruno gas pipeline explosion.

The future

FRASTA is expected to play a key role in developing additively manufactured (3D-printed) materials, a technology being hailed as the next industrial revolution, by providing a method to understand the role of microstructure in the fracture process and the influence of processing conditions on microstructure. This understanding is necessary to overcome the current uncertainties in mechanical behavior that prevent use of additive materials in fracture-critical parts, and FRASTA is perhaps the only technology that can deliver this understanding. Several of us SRI retirees are currently working with NASA to generate the required data.

In closing

Well, I think you can tell I enjoyed my 46.6 years at SRI. We had such interesting and varied projects to work on, the testing and analysis facilities to perform the work (including that nearly unique remote explosive test site in Figure 1), and enthusiastic and talented colleagues to work with (supplemented by a steady stream of postdocs and visiting scientists from Japan, Europe, and Asia), all of whom were fascinated by how things fail. We got to meet clients from foreign and domestic governments and industries, learn about their challenging technical issues, and help them solve those problems. In the process, we visited many agencies, institutes, companies, and countries and thereby obtained a broad perspective of failure issues in the world. All in all, the Center for Fracture Physics was a meaningful, rewarding, and fun experience, and I believe we contributed to making the world safer.

Don joined SRI's Poulter Laboratory in 1971 after earning a doctorate in materials science at Carnegie Mellon University and completing a 3-year postdoc at the Ernst-Mach Institut für Werkstoffmechanik in Freiburg, Germany. He founded SRI's Center for Fracture Physics in 1998 and led the Center until his retirement in 2018. He is an SRI Fellow and a Fellow of ASM International, and he currently serves on the NASA panel of Materials Experts. A long-time ski patroller, he enjoys winter mountaineering, backpacking, and ocean diving.



Don Shockey

Bill Harman: An Appreciation

By Andy Zucker

I deeply appreciate the many opportunities offered to me at SRI, where I worked from 1986 to 2003. One of the lasting benefits was learning how to contribute to, and then lead, effective teams. However, one of the greatest benefits of my association with SRI came years earlier when I took Willis W. (Bill) Harman's one-trimester graduate course at Stanford in 1969, 50 years ago. I was then in a master's program in science education.

An electrical engineer, Harman, who died in 1997, wrote engineering books and taught physics and engineering at Stanford. He was one of those remarkable individuals able to successfully reinvent himself, becoming director of an Educational Policy Research Center (EPRC) at SRI from 1967 to 1975, funded by the U.S. Office of Education. He was later invited by astronaut Edgar Mitchell to join the Institute of Noetic Sciences, where he served as president for 20 years. (See Wikipedia for Harman's biography.)

As the title of one of Harman's SRI reports suggests, the EPRC often focused on "Alternative Futures and Educational Policy." People often focus on "the problem" of climate change—but that problem is best understood as a constellation of problems. Seriously confronting climate change means addressing the world's energy supply, transportation systems, agriculture, building technologies, water supply, population, and more. At least as early as 1969, Bill Harman wrote about what he called "the world macroproblem" facing humanity. He understood that solving the world macroproblem would require the nations of the world to change their values, and therefore the education they provided to their young.

Harman's thinking made a deep impression on me. In about 1977, I introduced high school students to MIT's book *The Limits to Growth*, commissioned by the Club of Rome, and to an interactive computer model based on *Limits*, available just as schools were starting to use computers. *Limits*, published in 1972, used the term "problématique" rather than "world macroproblem," but the meaning is identical.

Harman was far ahead of his time in predicting how profoundly the nature of society might change were the world macroproblem not promptly addressed. By 1969, he had identified a variety of alternative futures and given them memorable names, such as "Exuberant Democracy," "Pollution Stasis," "1984' Theocracy," and "Collapse." Harman was a gentle man, but in view of events like the Pearl Harbor attack in 1941, he seemed realistic about human nature. Nonetheless, in his course The Human Potential, Harman introduced us to a variety of books and articles suggesting that the prevailing Western view of who we, *Homo sapiens*, are was too limited and should be expanded. He wrote reports about "changing images of man" (later the title of his book with Joseph Campbell and O.W. Markley), and claimed that the future depended on how people view themselves and one another.

This is a powerful idea, worth illustrating with several examples. For decades, economists and their computer models assumed that individuals are fundamentally rational decision makers, despite indications to the contrary. It was not until 2002 that Daniel Kahneman received the Nobel Prize in Economic Sciences after he, Amos Tversky, and others published experiment after experiment proving that the idea of "rational economic man" is deeply flawed. Today we understand the significant difference between, say, allowing people to opt out of retirement savings contributions versus opt in—something that the "rational economic man" theory simply does not predict. As another example, in the 1950s and 1960s, most people, even doctors, found it difficult to believe that mere feelings could influence people's bodies in dramatic ways, but now research shows that a surviving spouse's immune system may be compromised when he or she grieves, as an example. President John F. Kennedy's positive views of humanity engendered optimism and a cando spirit not only in America, especially among its young, but all around the world. Finally, in an example drawn from work at SRI conducted 30 years ago by the Health and Social Policy Division, as part of a study under Mike Knapp's leadership, research conducted by a large team over two years found that the narrow drill-and-worksheet instruction then widely used for poor and minority students-because so many people believed "that is all 'they' are capable of doing"-was less effective than a balanced approach that includes teaching for meaning and understanding. The U.S. Department of Education disseminated these findings nationally to managers of the largest federal program for elementary and secondary education, and over time views of disadvantaged students and of effective instructional practices shifted substantially.

As an engineer, Harman understood the value of rational thinking, yet he thought individuals and Western culture needed a broader view of human beings that encompasses intuition, ethics, a fuller understanding of consciousness, an appropriate image of humans' relationship to nature, and an incorporation of the deepest aspects of religious thought. He was especially interested in how people can enlarge their capabilities in order to become wiser and more effective. He studied creativity, wrote about it, and encouraged it. For me and many others, Harman modeled the importance of bridging academic and professional boundaries.

One of the greatest values of Harman's course was being introduced to the prolific and profound writer Idries Shah, a polymath who, like Harman, wrote that human beings limit themselves in unnecessary ways. Shah was a founding member of the Club of Rome, which commissioned *Limits*, and, like Harman, expressed deep concern about humanity's future unless the world changed its beliefs and actions.

These ideas to which I was exposed in Bill Harman's course the world macroproblem; the need for changing values; the importance of a broader view of human capabilities, ourselves, and others; the value of transcending disciplinary boundaries—have passed the test of time. The last words should come from Harman. What he wrote 50 years ago in an article published in *Stanford Today* seems equally relevant now, as people in the United States and across the world debate what to do about climate change, migration and immigration, international alliances, and other issues:

"It is strange to observe that at this point in history when we literally have the knowledge and material resources to do almost anything we can imagine—from putting a man on the moon, to exploring the depths of the oceans, to providing an adequate measure of life's goods to every person on earth—we also seem the most confused about what is worth doing."

Andy Zucker was an associate director of SRI's Center for Education Policy from 2001 to 2003. Now retired from a career in education, he has blogged about psychology and climate change and lobbied Massachusetts legislators to require electricity providers to buy energy generated by offshore wind turbines (which they did). He and a colleague, in collaboration with PBS NOVA staff at WGBH in Boston, recently developed a free one-week curriculum unit for science classes in grades 6–12 called Resisting Scientific Misinformation, available at https://tumblehomebooks.org/services/resistingscientific-misinformation/.

INTERNATIONAL JOURNAL

Business Lessons from South America

By Gia Campari

"We have nothing to learn from South America" was the reply I received from the CEO of a European organisation when I suggested he contact a South American sister company to find out how they approached internal communication. Prejudices die hard, and that is a great pity—for the people who are behind and who could avoid reinventing the wheel, not for those who are striding ahead.

My visits to South America had the specific purpose of assessing local partners of the UK-based charity Youth Business International (YBI). The local partners are expert organizations that do what all partners of YBI do: help underserved young people (18 to 35 years old) set up or grow their own businesses, usually by providing training, a loan, and a mentor. This formula has proved to increase the percentage of start-ups that are still ongoing after three years. Like all charities, YBI local partners finance their operations through public and private donations.

I was surprised to find so many excellent and innovative business practices during my assessments. On more than one occasion, I have been on the verge of telling managers I meet in Europe to get on a plane and go to South America to find out how to run a business efficiently!

One entrepreneur who founded a successful catering business moved from Uruguay to Paraguay to do that. His reasoning was that in Uruguay, which is one of the wealthier South American countries, businesses are more established and so is the way things are done. In Paraguay, which is one of the poorest countries, there are far fewer established ways of doing things, so he was able to create something from nothing, which is the required starting point of true creativity. Here are some other examples of creative business practices from South America.

Corporate social responsibility

The best example of corporate social responsibility (CSR) I've come across is in Peru. CSR is taken very seriously, and companies want to be seen to be doing the right thing.

The main economic activity in Peru is mining: copper, gold, zinc. Each mine has a limited lifespan (15–20 years). When a mine opens—usually in the middle of nowhere—it creates or boosts the local economy, often creating the only source of income in the area. Some mining companies have taken the following approach to CSR: They are aware that when they close the mine, the local economy will practically collapse. Therefore, they have decided to finance local startups will have become successful and will have created an alternative economy.

The mining companies fund the local YBI partner because they had commissioned an independent study to measure the success of start-ups in the YBI program compared with start-ups not supported by YBI, and the results were impressive. The number of YBI start-ups ongoing after two years was 69%, compared with 30% for non-YBI start-ups. The mining companies not only provide funds, they also meet the local partner at least once a month and want details on all the start-ups and the progress they are making. They take a genuine interest in this initiative and put a lot of pressure on the YBI partner to help make the start-ups successful. They see this as a 20-year commitment, the typical lifespan of a mine.

Employee engagement

The Uruguayan catering entrepreneur mentioned above asks his employees what bonuses they wish to receive at the end of the year. The employees produce a list and then vote for one. And they do not all vote for an increase in salary! I can recall only a couple of the bonuses chosen:

1. Having the day off on one's birthday. Apparently, this was very popular with employees. The CEO was surprised, but that is what the employees asked for, and that is what they got.

2. An "entertainment card"—a card loaded with a fixed amount of money that allows the holder to book theatre, cinema, concert, etc., tickets. It cannot be used for other purposes. This is part of an initiative to raise employees' standard of living. There are many ways of being poor, and being culturally poor is one of them. I found this truly innovative and showing a deep understanding of the many faces of poverty. I would hate to hazard a guess as to how many people in the developed countries are culturally really very poor.

If anyone knows of similar initiatives in Europe or the USA, I'd love to hear about them.

I could tell just by spending some time in the company that the level of employee engagement was through the roof!

Management meetings

The senior managers of an organisation of 500 people meet once a month and, without fail, get everything done in two hours. Their business is project based, and they use the standard traffic light system to gauge the status of each project. Only projects that are amber or red are discussed during the meeting. I contrast this with a senior management team I worked with that knew when the meeting would start but had no idea when it would end.

Information technology

In most of the organizations I visited, the IT systems were world class. All the information I requested was only a few clicks away. Also, entry to the office compound in one of these "developing countries" was via fingerprint, and it worked every time (yet I have never been able to unlock my iPhone with my fingerprint!).

Internal communication

For the Paraguayan company, the afternoon of the last Friday of the month is dedicated to internal communication. The CEO addresses the whole company in person at headquarters and via video link at other locations and tells employees what has been achieved during the past month and what the objectives are for the coming month; this is followed by Q&A. Everyone attends. I could have stopped anyone in the organisation and asked what the strategy was, and I would have received the same answer. Everyone is totally aligned with the organisational mission and strategy.

A business plan does not a business make

Most entrepreneurial training I have encountered in my very long career has been centered around the business plan. In Colombia, I found a partner organization that truly understands the meaning of entrepreneurship and that starts all entrepreneurial training with a socio-psychological assessment of the entrepreneur and his/her family. The organization's leaders know that being an entrepreneur takes a big toll on the family, and if the entrepreneur's family does not understand what is needed and does not provide the required support, the chances that the business will fail increase. The business plan and all the relevant "hard" training (marketing, finance, etc.) are developed in parallel.

All the entrepreneurs I interviewed in Colombia said how important this socio-psychological assessment and subsequent support had been for them. One in particular said that his business was putting a lot of strain on his relationship with his wife, but after the socio-psychological assessment and subsequent workshops, the marriage was back on track, as was his business. He could not praise the YBI partner enough.

I doubt that this aspect of entrepreneurship is adequately addressed in entrepreneurship courses run by business schools and universities.

It is well known that the less baggage we carry, the higher the chances of finding innovative solutions to our problems. We can start by keeping our minds, eyes, and ears open.

Note: The YBI website is at https://www.youthbusiness.org/.

A management and business strategy consultant at SRI Croydon from 1987 to 1996, Gia now is a well-established leadership and innovation consultant based in London (http://www. signalsofchange.com/index2.htm).

Gia also arranges occasional operatic concerts performed by friends and acquaintances. See the April 2005, April and August 2012, and April 2018 newsletters for her accounts of her Friends in Concert events (available online in the Alumni Association newsletter archive).



Entrepreneur and YBI team, Colombia (Gia is at the left).



Student entrepreneurs and teachers, Mexico (Gia is fifth from the left).



Entrepreneurship training at tech high school, Mexico.

Touring the Eight National Parks of Alaska

By Jim Colton

"Wilderness revives the spirit where one can let the spirit go with joyous abandon."

Olaus Murie

In July 2018, my wife, Mary Jo, and I visited all eight national parks in Alaska. We timed the trip to see the salmon run in Katmai National Park, where the grizzlies catch salmon at Brooks Falls. To get there, we flew commercial to Anchorage and then to King Salmon. Then we took a bush plane to Katmai, where we stayed for two days. The bears fishing for salmon were amazing! I got a callus on my shutter finger from this stop alone.



Grizzly about to lunch on a salmon.

After returning to Anchorage, we picked up a rental car and drove to Seward, the Halibut Capital of the World as far as we're concerned. The next day, we took a boat tour of Kenai Fjords National Park. The weather was cold, rainy, sunny, foggy, rainy, and cold, but the scenery was magnificent, especially near the Kenai Glacier. We also saw killer whales, humpback whales, sea lions, puffins, and other sea birds.

We then drove to the little town of Chitna, where we met a bush plane that took us over the mountains into Wrangell-St. Elias National Park. The park is famous for two things: the spectacular Kennicott Glacier and the Kennecott Copper Mill (yes, they are spelled differently!). We flew right next to the toe of the glacier.



Kennicott Glacier.

After two nights in the Kennecott Lodge, we took another bush plane back to Chitna and drove north along the Alaska pipeline. The pipeline was an impressive engineering feat in the 1970s. I recall that a few of the staff from Poulter Lab quit their jobs and worked on the pipeline for big bucks.

When we reached Fairbanks, we hopped on a really big plane—it held seven people—and flew to Bettles Lodge, which was our base to see the two national parks north of the Arctic Circle—Kobuk Valley and Gates of the Arctic. We planned to fly to both parks the next day. However, the weather didn't look good for the next day, so we headed straight to the parks that afternoon.

Now the trip got real exciting! We were flying in a fourperson bush plane and saw the most outstanding mountain scenery imaginable. We flew through mountain passes and flew around 18,000-foot peaks. You felt like you could reach out and touch some of the mountains.



On our way to Kobuk Valley.

WHAT ARE THEY DOING NOW? (Continued)

Part of Kobuk Valley National Park has the largest sand desert of any arctic region in the world. It extends for miles. We landed our little plane on the sand and had a picnic lunch. There are no facilities in Kobuk Valley—no rangers, no restrooms, no trails, no roads, not even a sign. So we brought our own sign and held it up for a photo.



On the ground in Kobuk Valley.

Then we flew for two hours through beautiful mountain wilderness that was part of Gates of the Arctic. The weather was moving into our pilot's favorite landing spot, so we looked for another place to land. After a while, he found a sand bar by a river that looked pretty good, so we checked it out at low altitude and then landed. I thought the sand was softer than we expected. Apparently our pilot did too, because he spent the next hour checking out the sand to find the hardest and longest stretch for our takeoff.



Mountains in Gates of the Arctic.

We were enjoying the fabulous views and taking photos. We took another photo with our sign, but of course we turned it over to where it read "Gates of the Arctic." When we were ready to go, the pilot showed us where he had dragged his toe in the sand for about a thousand feet. This was our runway! We got in the plane and he gunned it. We picked up speed as we rolled down the line he had drawn—but at a slower rate than on the other takeoffs?? When the plane lifted off the runway, I looked down and saw the river. I don't know how much runway we had left, but it wasn't much!



On the ground in Gates of the Arctic.

We flew back to Fairbanks and the next day boarded a private dome car on a train headed to the edge of Denali National Park. Many people visiting the park miss the view of Denali because it is clouded over 70% of the time. That's why there was so much excitement when we saw Denali from the train 100 miles away. It was also clear for the next three days, unheard of according to the locals.

There is only one road to the Kantishna Lodge 90 miles into the park. We took an old school bus to the lodge and stopped several times to view the scenery and wildlife. At one stop, we viewed Denali and the spectacular Alaska Range beyond Wonder Lake. That afternoon, the lake was disturbed enough so that there was no reflection of the mountains in the lake. To rectify this, I got up at 4:30 the next morning and rode a bike to the lake, which was perfectly still. I took a great panorama that is emblematic of our trip to Alaska.



Denali and the Alaska Range.

The bush plane we took out of the park flew straight at Denali. As we got near the mountain, we flew around the entire left side of Denali, then continued over the Alaska Range. This was one of the biggest thrills of our trip!

We took the train, this time to Anchorage, then flew in a bush plane to a lodge in Lake Clark National Park. It was foggy that day. We dipped down into the fog, hoping to get beneath it, but it was too thick. The pilot then flew up out of the fog while he sang a decent rendition of "Here Comes the Sun." This must happen frequently. We took another approach that worked out and got us into Lake Clark National Park.

One of the main attractions of this park is the grizzlies foraging in the meadow. However, we were several hundred yards from the bears and couldn't see them very well. This was a disappointment, but of course we were comparing it with our spectacular bear viewing at Katmai. However, the flight back to Anchorage was stupendous, with mountain scenery and braided rivers that change course in a matter of days.



Flying from Lake Clark to Anchorage.

Next was a commercial flight to Juneau (boring!) and a bush plane from Juneau to Gustavus and finally a bus to the lodge in Glacier Bay National Park. The big draw there was the humpback whales in the park. However some other travelers told us that they went on a boat tour in Icy Strait, where the boats can go much closer to the whales than in the park, so we went on a boat in Icy Strait. To get the best photos, I stood on the roof of the boat and couldn't always have my camera at the ready. At one time, a huge humpback breached 50 yards from our boat, and fortunately I was looking in the right direction and was able to get the shot. This was one of my 5-star photos from our trip, and I knew it couldn't be improved upon, so I put my camera away for the rest of the trip.



Breaching humpback whale.

Mary Jo and I have traveled extensively in my seven years of retirement. We both say that the trip to Alaska was the best trip we've taken and probably always will be. To see more photos of our Alaska trip, go to https://www. jimcoltonphotography.com/. Click on U.S. Travel, then on Alaska. On the website, you can also see photos from our other trips.

Note: In 1968, Jim joined Poulter Laboratory in what was then called the Stanford Research Institute. He worked in Poulter Lab for 45 years and was the laboratory director from 1988 through 2011. In retirement, he has enjoyed golf, travel, and photography. He has had several photography exhibitions in the area, most recently at the Rinconada Library in Palo Alto.



Plan to Attend the Spring Fling at the Hiller Aviation Museum in San Carlos on Thursday, May 16, beginning at 10:00 a.m.

Please join us for a visit to the Hiller Aviation Museum at 601 Skyway Road in San Carlos on Thursday, May 16. Driving directions, along with a museum map, are included on the event flyer. If you need a ride, please let us know by emailing steering-committee-alumni@sri.com.

You can explore numerous exhibits, including a Boeing 747-100 cockpit and first class cabin; a 1945 SFO airport beacon; Sky Portal, which allows you to view any place on Earth from miles above down to ground surface; or a display showing real-time air traffic around the San Francisco Bay Area. Your options are limitless!

There won't be an organized tour, so please explore on your own starting at 10:00 a.m. until lunchtime. A free lunch (box assortment) will be served on the tables located in the Doyle Room starting at 11:30 a.m.

This is a free event for all alumni members and their guests. When you arrive at the museum, you must check in at the front entrance with Dave Harvey (wearing an SRI Alumni hat). Please send in your completed reservation form, including the number of box lunches you'll require, to the SRI Alumni Association by the deadline of May 9. If you'd prefer, you can email the required information to steering-committee-alumni@sri.com. For questions, please contact Dave Harvey at dave.harvey620@gmail.com. We hope to see you there!

ALUMNI NEWS (Continued)



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.

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.

SRI International Alumni Association

Cash Flow/Income and Expense

Year ending December 31, 2018

CASH BALANCE as of 01/01/18		\$19,292.06
INCOME Cash income from membership dues and fees	\$8,350.00	
Dividend income from SRI Federal Credit Union account funds	\$11.37	
Contributed funds SRI International SRI Federal Credit Union	1,500.00 1,500.00	
TOTAL INCOME	\$11,361.37	\$11,361.37
EXPENSE Special event Spring Fling (Apple Park Visitor Center) Entry fee/lunch	\$1,260.00	
Other expenditures and costs Office supplies	\$193.59	
TOTAL EXPENSE	\$1,453.59	\$1,453.59
CASH BALANCE as of 12/31/18		\$29,199.84





The SRI Alumni Association welcomes new members:

Hannah Ahn Mark Budge Samuel French James C. Hodges Karl van Dyk

And welcomes back previous members:

Peter Gibb Karl Levitt Norman McEachron Charles L. Rino

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

We Need 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.

Directory Addendum

The enclosed directory addendum (covering the period December 1, 2018, to March 31, 2019) contains new members and corrections. Please add it to your 2019 Directory.

CREDIT UNION NEWS



Roy A. Long*



Roy Long, a research engineer with a 50-year SRI career, died January 12, 2019, at Stanford Hospital from congestive heart failure. He was 93 years old.

Born August 9, 1925, in Cutler, California, he grew up on a farm. At Sycamore High School in Modesto, he excelled in physics and math, played the French horn in the orchestra,

and had a part-time job as a radio repairman. After high school, he served in the Army Signal Corps during World War II. When he returned home, he enrolled in Modesto Junior College with an engineering major. In 1948, he was admitted to Stanford University, where he expanded his interests to include radio engineering and acoustic engineering. He received his B.S. in electrical engineering from Stanford in 1950.

Roy was still at Stanford when he joined SRI in December 1949. In 1957, he was part of the first U.S. team to track Sputnik with a dish antenna at Stanford. For more than a decade, he filled critical roles in outfitting and operation of the M/V Acania, SRI's only ship. (See the April 2017 newsletter for an article on the Acania.) Roy's other assignments at SRI included leading a project for development of scientific instruments for NASA spacecraft, including Pioneers 6 through 9, Mariner 5, and the Wideband satellite. He also led a project for ionospheric research connected with missile launch and reentry and for the operation of a shipborne ionospheric research facility. During his career, he was assistant and associate director of the Radio Physics lab; at retirement from SRI in 1990, he was assistant to the director of the Division of Geoscience and Engineering.

One of Roy's favorite hobbies was flying. He was one of the charter members of the SRI Flying Club, and he continued flying until age 80. He also liked classic Porsches; he had several during his life and spent a lot of time working on them to keep them in pristine condition.

His family and those who knew Roy will remember him for his cheerful disposition, his enjoyment of life, and his generous nature, always willing to help. After retirement, he organized an Engineering Friday lunch group that still meets the last Friday of every month. Roy is survived by his wife, Anna; nieces Janet, Kay, and Jean; nephews Bob, William, and Bruce; and by grand- and great-grandnieces and -nephews.

Based on information provided by Anna Long, Murray Baron, and Don Nielson.

Patricia Lubman*



Patricia Lubman died March 6, 2019, at Kaiser Hospital in Vacaville, California, at age 77.

Born in Ann Arbor, Michigan, Pat attended the University of Michigan for two years. Her father's employment moved the family to Columbia, South Carolina, and she finished her Bachelor of Education (B.Ed.) degree at the University of South Carolina. She moved to

California after graduation and obtained an Elementary Teaching Credential. A friend had recommended her to the superintendent of the Niles School District in Fremont, and she was hired over the phone. She spent two years at Niles and the remaining 18 years of her teaching career at Roosevelt Elementary School in Redwood City instructing sixth-grade students.

Having taught for 20 years, and looking for a change, Pat began taking math and computer classes and was fortunate to be employed at SRI for the next 20 years. As an assistant programmer in the Special Systems Office, she worked on the Electromagnetic Surveillance Project for George Carpenter from 1985 to 1988. Following that, she moved to the Envirotechnical Program, led by Patti Burns, and worked for a number of years on the NEXRAD (Next Generation Weather Radar) siting effort. Pat finished her career in the Procurement Group in 2005.

Retirement allowed Pat to spend more time observing nature (especially watching birds and squirrels in the backyard), take classes in cooking and needlework, and devote more time to reading, YMCA exercise classes, and camping. Pat and her husband, Dick, enjoyed camping destinations at Basalt (near San Luis Reservoir) and (their favorite) Kings Canyon National Park. They enjoyed traveling, and many

IN MEMORIAM (Concluded)

of their trips were taken with family members and friends to locations in Europe, China, Alaska, and Australia.

Pat is survived by Richard, her husband of 44 years. She also leaves behind her brother, David, and several nieces and nephews. She will be very much missed by her family and friends because of her warmth and caring, her love of nature, and her fascination with young children.

Based on an obituary provided by Richard Lubman.

Ronald Joseph Moore, Sr.*



Ronald Moore, a former SRI artist and graphic designer, died peacefully on January 8, 2019, at Kaiser Hospital in Santa Clara at age 88.

Born July 15, 1930, in Pawtucket, Rhode Island, Ron was a 1948 graduate of East High School, after which he continued his education at Rhode Island School of Design.

In 1955, he joined SRI, where he was a creative artist, art department manager, graphic designer, and similar positions for 37 years. His contributions and forward thinking as an illustrator and graphic designer helped consolidate SRI's position in the business and scientific communities as a professional research organization.

Beginning in the days of pen and ink drawings and film photography, Ron's SRI career extended well into the age of computer graphics. In addition to technical drawings, he created illustrations for a variety of media, ranging from SRI promotional pieces and periodicals to posters for special events and slide presentations. His work with several SRI publications won national awards for cover designs. Ron was inducted into the SRI Alumni Hall of Fame in 2015 for his contributions and forward thinking as an illustrator and graphic designer. He retired from SRI in 1992.

Throughout his life, Ron was an accomplished artist and cartoonist. In addition to cartooning, his activities included presiding over the Northern California Cartoon and Humor Association, with members including Bil Keane and Charles Schultz.

Ron lived a life of integrity, passion, and dedication, devoted to his faith and family. He is survived by Ruth, his wife

of 67 years; daughters Kathleen, Regina, and Karen; and 8 grandchildren and 19 great-grandchildren, whom he spoke of fondly with pride and adoration.

Based on information from Karen (Moore) Poulsen and an obituary published in the San Jose Mercury News.

Nancy Rae Teater



Nancy Rae Teater, a 42-year resident of Palo Alto, died at home on Thursday, March 7, 2019, at age 73.

Born in Madison, Wisconsin, in 1945, Nancy spent her early years in Wheeling, West Virginia, and then moved with her family to Salt Lake City during elementary school. She received a bachelor's degree in

English from the University of Utah, a master's in library science from the University of Pittsburgh, and an MBA from Golden Gate University in San Francisco. She worked at a number of Bay Area companies, including SRI, where she was an energy analyst until 1990, and at Stanford University, Hewlett-Packard, and Edelman Public Relations. Before her retirement in 2008, she ran her own public relations company, Hamilton Communications, which catered to Silicon Valley start-ups.

Always interested in nature and animals, Nancy studied wildflowers in the field and gardening at home. Later in life, she found her passion in birding and, by traveling to rather exotic and remote locations, compiled a life list of more than 1,700 species. She volunteered for International Bird Rescue and San Francisco Bay Bird Observatory and was a group leader in the annual Christmas Bird Count, as well as the Santa Clara Audubon summer bird count.

Nancy is survived by Richard Johnsson, her husband of 45 years, and Charlie, her cat of 7 years. Nancy will be profoundly missed by a great number of friends and many domestic and wild animals.

Based on an obituary published by the The Almanac Online.

^{*}Member of the SRI Alumni Association



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