August 2019 Newsletter

SRI International

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MESSAGE FROM ARCHIVES CHAIRMAN DON NIELSON

Don Nielson

As you pick up, or "screen up," this newsletter, get comfortable and be prepared for a full issue. First the easy stuff. The Spring Fling was pretty well attended, and the atmosphere was fun and engaging. We were at the Hiller Aviation Museum and got the personal tour from an SRI alum, John Ciboci. He's a good example of the transition of our alumni into important volunteer roles to help the community. As an old Navy pilot, John showed his qualifications regarding all these remarkable craft that once flew.

Speaking of Flings, reliable international reporter David Gibby really paints a picture you'd love to be in. So many interesting things to see in London, and I craved to be there for this jaunt. Who would have guessed that Henry Wellcome was an American!

Our Caren Rickhoff has drawn a few very interesting examples of SRI's current projects. For example, every one of us has wondered about the veracity of the digital media with which we are now deluged. Every time I diddle with Photoshop, I can't decide if I'm fish or fowl. It seems okay to improve our own not quite remarkable images, but when we see media that are so critical to understanding the world fall under the hidden manipulating power of artificial intelligence, it is simply scary. Hopefully, there will be digital signatures on all media to tell whenever they are modified. Otherwise, maybe there will be "truth squad" filters for all important digital material, and SRI will have an early hand in developing that technology.

Now fetch the stamina for some history lessons, first about the Poulter Lab's long and distinguished life. Don Shockey knows its history well, and though we may not know the subject matter well, we can see how the Lab made its way in all the variants of an "explosive field." Dave Harvey spent some time in Denver working on SIME/DIME, and the topic is worth your time because of its current relevance. If there is to be some type of guaranteed income in our future, through whatever means, what is the likely impact of that on our society? Politicians probably can't stand the details, but this was one of the few research efforts looking into the matter. Finally, you may see arising in October the media's attention to the 50th anniversary of computer networking. I try to illuminate SRI's important role in how that now critical world began. This year's observance is about the 50th anniversary of the homogeneous ARPANET, the first wide-area, general-purpose network that linked and gave access to a variety of different computers. It was a decade or so later when the heterogeneous Internet gave similar accommodation to widely different networks.

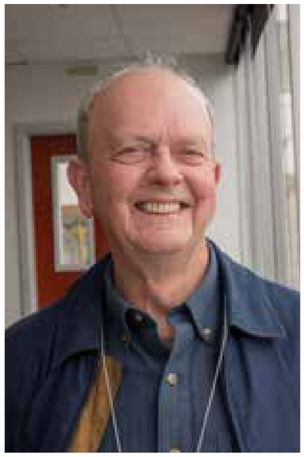
Finally, please put our annual reunion on your calendar for October 10. We'll again get to greet each other and be honored to hear from SRI's chief executive. It won't be the same without YOU!

The Annual Reunion is on October 10, 2019. Please see the announcement on page 17. The invitation flyer for the event is enclosed with this mailing.

Spring Fling at Hiller Aviation Museum

On May 16 the Alumni Association had its spring outing at the Hiller Aviation Museum in San Carlos. The turnout at around 45 was good; only the weather got in the road a bit, literally. The Bayshore Freeway imposed its toll, so to speak, with weather-caused delays, the result being about a 45-minute delay in the start of the docent-led walkaround. We were fortunate in that two of the docents were Association members, John Ciboci and Dave Harvey. John led the extended tour, which lasted until around noon. The Museum has an amazing assortment of the earliest flying machines, with an emphasis on the aspects of those rooted in the San Francisco Bay Area. For those of you who couldn't make it and either live within reach or are passing through, a visit is highly recommended. Several in attendance had come a long way, even from out of state.

The box lunches from Whole Foods were delicious. Fortunately, the Museum has a large indoor room where we could meet out of the elements and have some spirited interactions. Our thanks go to Dave Harvey for getting the event set up and greeting us; to Augustina Biosic and Joyce Berry for assembling the attendee list, making the gorgeous name tags, and checking everyone in; to Dave, Gary Bridges, and Don Shockey for the food; to Gary for taking the pictures; to Linda Hawke-Gerrans for the enticing flyer; and finally to John Ciboci, who shared his considerable background knowledge about what we saw. All in all, a good day, and we wish more of you could have been there!

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A Wellcome Visit for the "Incurably Curious"

By David Gibby

In 1880, when Henry Solomon Wellcome left the United States and went to England with his business partner, Silas Burroughs, he could have had no idea of the fortune they would make.

They had the bright idea of selling medicines in tablet form instead of as powders or liquids and in 1884 patented their invention of "tabloids." With direct marketing to family doctors in England, they soon built up a highly profitable business, which can be considered as the beginning of the modern pharmaceutical industry. When Burroughs died in 1895, Wellcome became the sole owner of Burroughs Wellcome & Company, and he became very rich—the equivalent of a present-day billionaire. Upon Wellcome's death in 1936, his will specified that his fortune was to be held in trust and used to "further human and animal health." The Wellcome Trust is now one of the world's largest private biomedical charities.

Wellcome also had a passion for collecting things—initially medically related artifacts, but later anything that interested him. Most of the "medical" items are now in the Wellcome Collection in London, near Euston Station; others have been given to the Science Museum in London or to other institutions. There is also a library of books, painting, drawings, and photographs. Many of the million or so other items he collected are still held, but most have been disposed of.

On Sunday, June 2, we visited the Wellcome Collection (advertised as being for the "incurably curious"!) to see for ourselves. There is a permanent exhibition ("Medicine Man") that has more than 125,000 "medical" artifacts, ranging from surgeons' saws, scalpels, and other instruments to Napoleon's toothbrush, Darwin's walking stick, Nelson's razor, Florence Nightingale's moccasins, death masks, an Ecuadorean tribe's shrunken heads, and a collection of bedpans! There were also a number of models of bodies that could be taken apart to show the various internal organs—not all of which were anatomically correct. This permanent collection also includes many paintings of famous doctors and scenes depicting consultations and operations.

When we visited, there were also two special exhibitions for us to see. "Smoke and Mirrors: The Psychology of Magic"

An antique chamber pot.

was a fascinating array of magician's tricks and illusions, as well as a short history of the paranormal. "Misbehaving Bodies" included many photos of some rather gruesome ailments. On weekdays there are lectures and discussions on a range of topics; for example, on June 12 there was one titled "How does the world feel about vaccines?"—a rather topical subject, given the recent outbreaks of measles.

After our visit, we all went to a nearby restaurant for lunch and caught up with everyone's news and plans for the summer. In the photo are (clockwise, from the front) Gillian Collin, Gia Campari, Anne Saunders, Peter Weisshuhn, Sonia Shaw, Andy Shaw, Bob Morgen, Maurizio Petitbon, Nick Collin, and Jeanette and David Gibby.

Spotting Audio-Visual Inconsistencies (SAVI): Deepfakes Begone

Videos with audio are a dominant means of documenting events and communicating messages around the world. However, modifying or replacing the audio, or replacing the video, can be easy to do, and such manipulations are so common they now have a name: deepfakes. Fortunately, these modifications often leave discrepancies between the visual and audio channels that can be exposed by physical and semantic analysis.

With funding from the Defense Advanced Research Projects Agency (DARPA), SRI researchers are working with the University of Amsterdam and Idiap Research Institute to develop new techniques for detecting tampered videos by identifying discrepancies between the audio and visual tracks. The discrepancies are identified through lip sync analysis, speaker inconsistency detection, scene inconsistency detection (for example, room size and acoustics), and identification of frame drops or content insertions. The aim of the SAVI project is to detect and characterize multiple types of inconsistencies involving different aspects of a video, and fuse these detections into a combined media integrity score.

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Sources:

Spotting Audio-Visual Inconsistencies (SAVI): SRI is finding new ways to detect altered and tampered video, https://www.sri.com/work/projects/spotting-audio-visual-inconsistencies-savi

Spotting Audio-Visual Inconsistencies, https://www.idiap.ch/en/scientific-research/projects/SAVI

A compilation of CNN online presentations, including videos by SRI researchers Robert Bolles and Aaron Lawson, is available at https://www.cnn.com/interactive/2019/01/business/pentagons-race-against-deepfakes/

SRI Leads Consortium to Advance Quantum Information Science

Quantum information science (QIS) applies the best understanding of the subatomic world—quantum theory and quantum physics—to generate new knowledge and technologies. The U.S. Department of Commerce's National Institute of Standards and Technology (NIST) has signed a cooperative research and development agreement with SRI to lead a consortium focused on quantum science and engineering. Joseph S. Broz, VP for Strategy and Applied Sciences at SRI, outlined the work of the Quantum Economic Development Consortium (QED-C), of which he is the Executive Director and Governing Board Chairman. The new consortium will effectively align resources and quantum research and development efforts between federal, academic, and industry partners to ensure America's position at the forefront of scientific discovery and development.

SRI was asked to develop the consortium with a focus on how the new industry will emerge. "We are not about qubits," Broz said. "We are about all the enabling tech that creates qubits, stable qubits that behave. That means creating all the enabling equipment and technology for a mature industry. The purpose is to look at those gaps and find solutions to fill them."

The QED-C, Broz said, is "ahead of schedule, moving two times the expected pace of development." The consortium's members include Amazon, Boeing, FLIR, and Raytheon, and more companies are joining each week. QED-C goals include seeking out "killer quantum apps" and setting quantum standards, as well as defining markets. By 2021, it will make its first proposal awards and issue consortium licenses. The QED-C will address technology gaps like superconducting qubit cabling, high-density interconnects, cryogenically compatible components, and customized magnetic shielding.

Sources:

NIST Launches Consortium to Support Development of Quantum Industry, https://www.nist.gov/news-events/news/2018/09/nist-launches-consortium-support-development-quantum-industry

National Strategic Overview for Quantum Information Science, https://www.whitehouse.gov/wp-content/uploads/2018/09/National-Strategic-Overview-for-Quantum-Information-Science.pdf

DCS 2019: Spotlight on emerging quantum sector, http://optics.org/news/10/4/26

Quantum Economic Development Consortium (QED-C), Meeting Presentation, https://www.nist.gov/sites/default/files/documents/2018/10/11/4._joseph_broz_plans_for_the_quantum_economic_development_consortium_qed-c.pdf

Passio: A "Food–Artificial Intelligence" Platform That Needs Your Input

Passio is an SRI spin-off company that is developing a game-changing food-AI platform and is asking for help with testing and improving its food-recognition technology. The Passio app lets you track your nutrition and view detailed food logs with simple finger taps—no typing required. You can help the Passio team improve the app by collecting short videos of foods that are not well recognized. Instructions are provided below.

After spending a year at SRI in dual roles of a director at the Advanced Technology and Systems Division and an Entrepreneur in Residence at SRI Ventures, Dmitriy Starson developed Passio, Inc., a company specializing in on-device machine learning and real-time user insights. Passio's first product is a platform enabling companies to provide nutrition tracking and real-time insights to their users.

The goal at Passio is to use cutting-edge machine learning and computer vision tools to address a major gap in healthcare and wellness: lack of adequate tools for collection, analysis, and activation of nutrition data. The company is developing real-time ingredient recognition technology to create easy-to-use software that provides detailed information, such as number and type of calories and amount estimations, to ultimately provide an aggregate summation of the meal contents—all with just a touch of your fingertips.

Passio's website is at https://www.passiolife.com/.

How to Provide Your Input

Here is a quick demo:
https://youtu.be/K2ntlyVvB74.

You can see how you can log foods with video, select alternatives, adjust the amounts, and add foods via voice. Using the app you can track nutrition and see detailed food logs. You can also help us improve by collecting short videos of foods that are not recognized well. Here are instructions:

1. Download and install TestFlight on your iPhone (iPhone 6 or newer). [Android version is coming.]
2. Open this link from your phone after TestFlight is installed on your phone: https://testflight.apple.com/join/VVKusdCq.
3. Register and start logging meals with real-time video and voice.
4. When foods are not recognized to your satisfaction, please capture short videos using the "add" button next to the microphone.
5. If you know someone who would enjoy testing and using the app, please share!

After you register and use the app for a few days, Passio will send you a brief questionnaire. For more information, contact Passio at support@passiolife.com if you have any questions.

Poulter Lab "Retires" at Age 65

By Don Shockey

Poulter Laboratory, SRI's longest-lived laboratory, closed its doors on May 3 after 65 years of continuous operation. Researchers in the Lab worked in a world where events are over in a flash—in thousandths and even millionths of a second—and experiments often wind up in pieces. The Lab's core mission was to determine how materials and structures fail under the shock of high-rate loads, such as those produced by impact, explosions, earthquakes, and intense X-ray and laser radiation. By developing experimental and computational capabilities to address counterterrorism, mine neutralization, target breaching, and directed-energy effects, the Lab achieved novel solutions that enhanced the safety of America.

The Lab was founded by the late Dr. Thomas C. Poulter, an expert in explosives and biosonar, who gained initial fame as an Antarctic explorer before joining SRI in 1948, 2 years after SRI's founding. Originally known as the Extreme Pressure and Explosives Research Laboratory, the name was changed to Poulter Laboratory in 1954 in recognition of Dr. Poulter's contributions and leadership. Offices were initially in the "tar paper shacks" of the temporary Dibble Hospital built by the Army during World War II to care for patients with head and eye trauma. In those early days, explosive experiments were conducted in an outdoor firing pit just outside the offices. The initial staff of six grew rapidly, and the Lab moved to its present site in Building A in 1958.

In the 1950s, the remote Calaveras test site, where larger explosive experiments could be performed, was developed in the hills above Milpitas. In these early years, the site had essentially no instrumentation; charges were detonated with a detonator plunge box typically used in the mining industry, and the only data were posttest damage observations. Over the next 5 years, the Lab acquired high-speed optical and electronic instrumentation, established test areas for specialized explosive experiments, and generated data to support theoretical investigations.

In the first decade after World War II, projects were sponsored mainly by the Army, Navy, and Welex, a company wishing to stimulate oil wells via down-hole explosive detonation. But the scope of the Lab's activities expanded considerably in the 1960s as military concerns intensified and commercial clients became more aware of the potential benefits of explosive applications. The Defense Nuclear Agency (DNA) sponsored large programs to study nuclear weapon effects. Missile systems and reentry vehicle shells were fielded in underground nuclear tests in Nevada to determine their response to intense X-ray loads. The Lab developed and fielded gauges at the Department of Energy's Nevada Test Site to measure close-in nuclear ground shock. Gauges close to the nuclear device often measured pressures of 1 Mbar! During this time, the Pressure-Impulse method for dynamic structural characterization was formulated, and Poulter Lab's longest-running program started—a 40-year effort that addressed material hardening and survivability in a high-pressure load environment.

But underground tests were expensive, so the Lab pioneered the development of above-ground explosive techniques to simulate X-ray loading on reentry vehicle shells, as shown in Figure 1, and to study nuclear airblast and ground shock effects. The High Explosive Simulation Technique (HEST) used planar explosive charges to produce the desired shock wave profiles. The appropriate explosive properties and dimensions were achieved via Lab-generated computational models of the expansion of the detonation products and the resulting ground shock loads. In the 1980s, the Lab designed every significant HEST simulator of large DNA field tests.

Figure 1. Impulsive loading with sheet explosive on a Kevlar/epoxy bottle to simulate X-ray loading.

As the Lab continued to grow—at one point, the staff numbered 120—a new and larger site near Livermore was acquired in 1970 to accommodate the Lab's remote testing needs. Today, the 480-acre Corral Hollow Experimental Site (CHES) contains specialized facilities, such as an 8-foot diameter, 259-foot-long explosive shock tube for nuclear airblast simulation, a gas-propelled-projectile launch facility for impact response studies, and a large 20-foot-deep water pool for underwater-shock-simulating experiments that test submarine models, lethality of submerged mines, and underwater launches of Navy missile systems. The results and data are used to develop computational models of weapon effects, which are then used to predict the vulnerability of structures and systems to attack. SRI's CHES was one of the most complete privately held explosive test sites in the world.

The 1980s brought the Strategic Defense Initiative (SDI)—a proposed missile defense system intended to protect the United States from attack by nuclear weapons delivered by intercontinental and submarine-launched ballistic missiles—and Poulter Lab played a large role in understanding material damage and structural failure of solid- and liquid-fueled boosters under X-ray loads. During this time, Poulter lab developed and patented Dilute Explosive Tile (DET). Initially, the main use of DET was to simulate nuclear ground shock, but DET became a major technology platform for the Lab that would continue to be used and implemented into many different types of products for explosive simulation and target neutralization.

Concurrently, crack nucleation and growth (NAG) models describing the physics of material failure under shock loads were being developed. More than 1,000 precise plate-on-plate, one-dimensional-strain impact experiments were performed on metals, polymers, ceramics, composites, and geologic materials using our two gas guns in the basement of Building A to generate the necessary understanding and data. The NAG theory for material failure has been implemented into an advanced computer model called BFRACT and applied to propellants, body and vehicle armor, and fragmentation of deeply buried rock for ore recovery. And today the models are applied to predict failure behavior under quasi-static as well as dynamic loads.

With the end of the Cold War in 1991, the support of nuclear-weapons-related work dropped off dramatically, and interest shifted to effects of conventional weapons. The Lab was asked to determine critical loads to defeat terrorist bombs and mitigate damage from buried mines, and to devise ways to clear obstacles from the beach and surf zone. The 1990s also saw the start of a 20-year program to perform high-fidelity scale model testing aimed at determining the vulnerability of deeply buried structures to conventional weapons.

During this period, FRASTA—a technology for reconstructing a failure event from the topographies of the fracture surfaces—was being developed in the Lab and applied to understand in microstructural detail how materials and structures failed. The Lab began to address failure under slowly applied loads, dealing with such challenges as life prediction of aging aircraft and buried pipelines. A summary of such projects conducted in Poulter's Center for Fracture Physics is available in the April 2019 newsletter.

In the 2000s, the 9/11 atrocity brought another high-priority challenge to the United States, and the Lab focused on antiterrorism. Products were developed to neutralize mines, stop large maritime vessels, breach doors, and safely contain small improvised explosive devices (IEDs). A major program was aimed at neutralizing IEDs of all sizes. It was found that DET, at a low enough density to prevent it from initiating the terrorist explosive in a vehicle bomb, can neutralize the largest of IEDs without collateral damage. A DET charge is placed either underneath (Figure 2) or next to the side of the vehicle to break the vehicle apart, but without causing the internal explosive to detonate.

Figure 2. Neutralization of a vehicle bomb IED using SRI's DET.

After 2000, more emphasis was placed on safety studies, and the Lab expanded from having a few clients that funded large programs to many diverse clients. Projects were performed for commercial companies and many government agencies. Large contracts were granted by Japanese and European companies to investigate the damage to nuclear reactors from aircraft impact and the pressure and thermal radiation loads from a full-scale natural gas pipeline rupture (Figure 3).

Figure 3. 1,000-foot-high flammable gas plume from a full-scale natural gas pipeline rupture experiment (performed in Canada).

The capability to design and test scale model structures, initially aimed at investigating weapon effects, was later applied to investigate the crashworthiness of cars and trains. Scale models were also used to investigate the response of nuclear reactors to core disruptions, as well as of buildings to earthquake loads. Many of these tests relied on the explosive expertise in the Lab to shape the loads required for these investigations. For example, multiple buried explosive charges were used to produce the cyclic loads typical of earthquakes, and this technique was validated through testing performed at DoE's Nevada Test Site.

Impact studies were carried out throughout Poulter Lab's history because many of the effects are closely related to those of explosions. A series of gas guns were built to characterize the response, including failure, of materials to high-pressure loads. A gas-propelled launcher that can accelerate a 100-lb aircraft model up to 300 mph was built at CHES and used to study the response of reinforced concrete walls of various constructions to aircraft impact.

Following the two oil crises of the 1970s, the need for energy diversification increased, and against this backdrop, Japan established the New Energy and Industrial Technology Development Organization (NEDO) to promote the development and introduction of new energy technologies. In the 2000s, the Lab conducted a 7-year NEDO program for the Japanese to understand the safety of hydrogen for cars and filling stations. Figure 4 shows the largest hydrogen detonation test performed, which illustrated the rapid transition from deflagration to detonation.

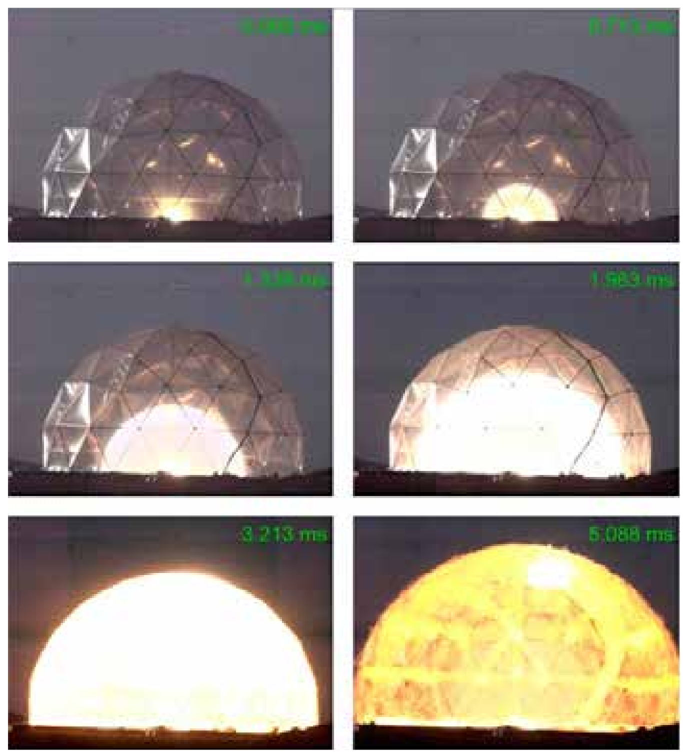

Figure 4. High-speed video frames from a 300-m^3 30% hydrogen detonation test for the NEDO program.

During the decade from 2010 to 2019, the Lab continued large antiterrorism programs, performed a critical program for NASA to help design frangible joints for high-probability rocket stage separation, and initiated a large Flammable Gas Safety program as a result of the BP Horizon offshore platform disaster. Under this latter program, the Lab performed some of the largest flammable-gas tests in the world, which have dramatically changed the understanding of the transition from deflagration to detonation of flammable gases (Figure 5). Finally, history always seems to repeat itself, and in the last 5 years we saw the need to once again use our large shock tube to understand nuclear blast effects on building components (Figures 6 and 7).

Figure 5. Large-scale flammable-gas deflagration to detonation transition.

Figure 6. Aerial view of the 259-foot-long shock tube at CHES.

Figure 7. One of many tests conducted in the large shock tube.

Throughout the past 65 years, Poulter Lab was instrumental in developing theory and experimental techniques to advance the understanding of shock physics and material/structural failure. The results from this work are currently widely used throughout the world and have made people inherently safer.

Two reasons for Poulter Lab's success are the early leadership of Dr. Poulter and the culture established by George Abrahamson, the Lab Director from 1969 to 1988—a culture of delivering more than the client expects, identifying and fixing problems early before they become weaknesses, and treating people with fairness and honor.

This history of Poulter Lab activities is based on articles written by George Abrahamson, Lab Director from 1969 to 1988; Jim Colton, Director from 1988 to 2011; Paul Gefken, Director from 2011 to 2019; and an SRI Journal *article by James Kloss in 1986. Don Shockey founded the Poulter Lab's Center for Fracture Physics in 1998 and led the Center until his retirement in 2018.*

SRI's Role (or Not) in the Origins of the ARPANET

By Don Nielson

In October 2019, you will be seeing some stories in the press about the beginnings of computer networking and perhaps what will erroneously be labeled the 50th anniversary of the founding of the Internet. What actually happened around October 1969 and what role, if any, SRI played in the events of the day will be the subject of this note. I'll try to be objective and fair, but there swirls around any momentous event a clamor for self-attribution and exaggeration that makes such goals difficult.

The ARPANET certainly was a watershed development in the course of computer networking and the opportunities that technology provides. It was the first instance of a wide-area computer network capable of offering the services of a host computer to anyone who had network access, whether through a network-connected host to which a terminal was attached or by means of a terminal connected to a specially equipped switching node (router) of the network. In fact, a major reason the network was created was to offer "cross-net" access to remote computers, each configured with a major specialized application, such as graphics. Computers of the day were so expensive in both hardware and software and so limited in computational power that specialized applications couldn't be replicated in each host.

This network first emerged from the efforts of enlightened leaders and program managers at the Advanced Research Projects Agency (ARPA) around the mid-1960s. Although motivations flowed from ARPA office managers J. C. R. Licklider and Robert Taylor, the implementation fell to program manager Larry Roberts. After a series of meetings with an interested contracting R&D community (mostly ARPA principal investigators) in the spring of 1967, network concepts started to emerge. Because Doug Engelbart was already engaged with ARPA in the creation of interactive computing, SRI was a member of that network-authoring community. Other innovations extant in computer networking, such as packet switching, were occurring elsewhere, and many of those ideas were incorporated in the early formulations.

But out of these early deliberations two events important to SRI occurred in early 1967. The first contract let under an ARPA Order with ARPANET in its title came to SRI; its task was to define and document the emerging network concepts. The final report, titled "A Study of Computer Network Design Parameters," was delivered to Roberts in late 1968. Authored by Elmer Shapiro, it played an important role in enabling ARPA to write a specification and an invitation-to-bid for the network's switching node, called an Interface Message Processor (IMP) but in today's parlance, simply a router.

The second event derived specifically from Engelbart's interest in computer-based collaboration. He could see the new network as the platform for such interaction and group collaboration. Perhaps because others didn't have that insight or may even have considered the subject mundane, he applied for and got the role for SRI as the ARPANET Network Information Center (NIC). This Center became the source of information and network addresses for all who would come to join the ARPANET. The NIC, under the leadership of Jake Feinler, would be the gateway to user participation in the new network for more than two decades (the later part of that time relating to the Internet).

Now to the realizations. Roberts next tasked Shapiro to "make something happen." So, in the summer of 1968 Shapiro formed the Network Working Group (NWG), a small assemblage of mostly university and SRI researchers, to consider a development plan. This shy group saw themselves as amateurs in the field of communications networks, and that view was reflected in what they came to call their design literature, the very passive "Request for Comments" (RFC). Little did they know that there would be no experts where they would take themselves and where their "clean slate" enabled them to go. The experts never came calling, and the world is the better for it. Thus began, on a deliberate scale, the birth of packet-switched computer networking. Today, RFCs are still the design "specifications" of the Internet. Shapiro, after leading that first meeting and not wishing to continue in that endeavor or that field, left the NWG and, with the exception of the NIC, SRI's contributions to the ARPANET left with him.

By late 1969, Bolt Beranek & Newman (BBN), who had won the IMP contract, began to deliver the IMPs. The first went to UCLA, site of the Network Measurement Center, in late August and the second to SRI, the location of the NIC, in early October. Both sites engaged themselves quickly under Roberts' pressure to interface their existing (and different) time-share computers to the new switches, guided by a BBN protocol. Over the previous months, the NWG had been struggling mightily with the role of the hosts versus that of the IMPs and just how this undefined network would take shape. Shapiro's 1968 report revealed much of the resulting progress. In addition, a few of the earliest RFCs hatched would come from SRI. RFC 2 was by Bill Duvall on host-to-host interaction (protocol); RFC 4 by Shapiro laid out a schedule for network growth over the first four nodes; and Jeff Rulifson's RFC 5 created a network interchange language called DEL.

The first connection of two ARPANET hosts probably took place in late October 1969. The two researchers engaged in that connection were Charley Kline at UCLA and Bill Duvall. A note by Charley Kline on his log stating "talked to SRI host-to-host" was written on October 29, and that has been scooped up as the date of origin. The connection was more formally recognized on an ARPA visit in late November. Importantly, it was Duvall's RFC 2 that was modified to enable that first connection.

One more aspect of SRI's involvement in the ARPANET needs mention: the key role of the NIC. It became more than the repository of design procedures, protocols, and the requisite software for entry onto the network. All new users had to enter via the NIC, not just for the necessary documentation and software but also for the unique network names and addresses that would make use of the network possible. Also, one of the first net locators for people and hosts on the network was built by Ken Harrenstien of the NIC. It was, naturally, called "Whois." Finally, as the network grew rapidly, addressing had to take on symbolically memorable names. Thus arose the domain naming system and the seven original names: .com, .edu, .mil, .org, .gov, .net, and .int. Although the naming system was designed elsewhere, the NIC was the major contributor in the choice of those first names. That nonprofit SRI, which received the eighth such name assigned, got a commercial .com name instead of .org was the erroneous choice by a member of the NIC, and it was never corrected.

Beyond the critical and continuing over-two-decade run of the NIC and Engelbart's use of the ARPANET to illustrate its resources and collaborative powers, SRI had no other ongoing role in its evolution. But when Larry Roberts returned in the early 1970s to offer an opportunity for a radio adjunct, SRI would again enter into what would become known as internetworking. It is perhaps a small distinction to some, but the ARPANET as designed was capable of scaling up only via hosts running its one intrinsic transport protocol. As such, the ARPANET was hugely successful in accommodating very different host computers. But the accommodation of dissimilar networks required a new protocol that also recognized a system of network gateways. I choose to think that is a very notable, even critical, difference—one that was needed to enable the Internet we see today. But that's another story.

The 1970 SIME/DIME Experiment

By Dave Harvey

In the mid-1960s, policy analysts in the United States were concerned with potential problems of the existing welfare transfer payments. A variety of proposals were being put forth, such as the Heineman Commission's 1969 proposal for a federal negative income tax[1*] with universal eligibility. The objective of such proposals was to extend coverage to the working poor. It was important to determine whether the benefits of increased income would be offset by reductions in work participation.

The Seattle-Denver Income Maintenance Experiment (SIME/DIME) was the last in a series of four large-scale income maintenance experiments undertaken in the late 1960s and early 1970s. The objective of its negative income tax (NIT) was to measure the extent that a guaranteed income source reduced the amount of work people would engage in and to test countermeasures selected to neutralize that effect. One type of countermeasure was to place various levels of "tax" on the grant; as earned income increased, payment from the grant would be reduced by a percentage of that income. A second countermeasure was to increase expected earnings by providing counseling and training. The underlying assumption was that if one could raise the recipients' expected incomes, they would choose more work over leisure.

The Seattle Income Maintenance Experiment (SIME) was launched in 1970, but with the cancellation of the Boeing Supersonic Transport program and laid-off workers entering the unemployment rolls, it became apparent that Seattle was not going to be representative of the working poor. In 1971, Denver was chosen as an alternative site

*Numbered footnotes are at the end of the article.

to complete the experimental sample (DIME). The prime contractors for SIME/DIME were the states of Washington and Colorado, which in turn subcontracted with SRI. SRI then subcontracted the counseling/training treatment to community colleges in Seattle and Denver. SRI subcontracted Mathematica Policy Research to interview participants and manage financial payments.

My role in the SIME/DIME experiment was setting up the Denver office and overseeing the field implementation of the experiment. I was not involved in the design of the experiment or the analysis or evaluation of the experimental results. Therefore, as a precaution, please note that any comments I make here about the design, analysis, and findings are not based on my experience with the experiment, but only gleaned from published material.

Design and Implementation of SIME/DIME

The experiment was designed to have 5,000 families—2,000 in Seattle and 3,000 in Denver—enrolled for a period of three years. The initial task in Denver was to survey 30,000 households in the metropolitan area. The survey, conducted by face-to-face interviews with families, was designed to identify for each household the family structure according to race and the number of parents (one or two) in the home, and to determine what would be a normal income for that family.[2]

From the 30,000 households surveyed, a subset of families with characteristics that fell within the parameters of the experimental design became the pool of possible participants. The family units in the pool were then classified by race (White, Black, or Chicano[3]), a single- or two-parent-headed family, and normal income. The permutations of six levels of normal income and six classifications of family structure resulted in a six-by-six matrix of 36 unique classifications of family structure and normal income. Those became the experimental cells. Families in the pool of possible participants were grouped according to the 36 classifications and then were selected randomly for assignment to the cell representing their classification until that cell contained the number of participants it needed to satisfy the experimental design.

The remaining task before embarking on the experiment was to determine which experimental treatment to assign to members of a cell. There were four experimental treatments: NIT (the financial grant) only, counseling/training only, NIT and counseling/training, and a fourth group with neither of the experimental treatments, which served as the null control.

The guaranteed grant level payments in the NIT treatment were based on 95%, 120%, and 140% of the official poverty line. In 1971, the grant levels were $3,800, $4,500, and $5,600, respectively, for a family of four. In addition to the grant dollar amount, an NIT treatment was subjected to a tax—that is, a reduction of the participant's grant—based on other income earned.[4] Two NIT tax rates were fixed at 50% and 70% of earned income; two other rates started at 80% and 70% but declined after the first $1,000 of earned income. The three grant levels combined with the four tax rates resulted in 11 specific NIT treatments (one combination was not used) plus controls. As an example, the most generous of the NIT treatments would be for a family assigned to the $5,600 NIT and 50% fixed tax rate on their grant. This meant that they would still receive grant payments until their earned income reached $11,200.

The counseling/training treatment consisted of three levels: counseling only, counseling plus 50% subsidies for school or training programs, and counseling plus 100% subsidies for school or training programs.

Null control families enrolled into the experiment continued to receive eligible AFDC (Aid to Families with Dependent Children) income, whereas the experimental families waived their AFDC financial payments in favor of the SIME/DIME financial support.[5]

Once the experiment was launched, staff from Mathematica visited each family unit three or four times a year and conducted an interview at each visit. Those interviews were designed to sample attitudes on a large variety of subjects. Each interview included groups of questions called "modules." Some modules were included in every interview, some at the beginning of the experiment, some at the end of the experiment, and others at strategic points throughout the three-year period.[6]

The modules addressed experimental objectives other than the effects of NIT or counseling treatments on work behavior; rather, they were designed to record the sociological impacts of SIME/DIME. One important set of modules was designed to capture and record any effects the SIME/DIME treatments had on marital formation[7] or dissolution. Other important modules were designed to determine whether the experimental results in fact were representative of the participants' long-term behavior.

Those were modules to ascertain the participants' "time horizon." If participants viewed the experimental treatments as temporary, and consequently did not make permanent changes to their lifestyles, then the experimental results could not be extrapolated as expected results of a national program.

Conclusions Suggested by SIME/DIME

I was unable to find any final reports of findings by the SRI and Stanford staff involved. I did, however, find many subsequent reports, studies, and analyses of the SIME/DIME results, particularly with respect to the effects of NIT on marital stability. Perhaps the most authoritative report was the overview of the final report issued by the Office of the Assistant Secretary for Planning and Evaluation (ASPE).[8] This overview listed results for three issues examined by SIME/DIME: (1) the effect of NIT on labor supply, (2) the effect of labor market counseling/training subsidies in addition to an NIT program, and (3) the effect of NIT on marital stability.

The overview report noted that the results of SIME/DIME provide the ability to predict more precisely how much more or less people would work as the result of NIT initiatives and to determine the effect of various tax levels on grant payments. The question studied was whether a recipient would have greater incentive to undertake work if that work income did not significantly reduce the recipient's NIT benefit. The results of the SIME/DIME experiment showed that imposition of higher marginal tax rates on the grant had smaller effects on labor participation than formerly thought.

For the effects of the counseling/training subsidy treatment, the analysts (SRI) found that participation in both the counseling and training-education programs was strongly related to the subsidy. Both the 50% and 100% subsidy plans led to significant increases in formal schooling. However, contrary to the assumption that increased skills would lead to increased work, the analysts found that hours worked during or after completing the period of training were reduced. They found that the negative effect of reduced work was not compensated for by any job-related skills acquired during the subsidy program.

Although the experiment did not specifically test the effects of NIT on marital stability, the ASPE overview noted that the design was well suited to determine the extent that those effects depended on the grant and the tax rate and the extent that they were expected to differ according to income, ethnicity, and family type. However, the SRI analysts stressed that the sample was not representative of the national population and, therefore, cautioned against any attempt to uncritically extrapolate from SIME/DIME effects on marriage dissolution to any other NIT program.[9]

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1. A tax on income below a given level would be negative—instead of paying a tax, one receives a tax payment.

2. This was also the process used for the Seattle sample.

3. Chicano families of Mexican origin were identified for the Denver sample only.

4. Participants reported their earned income monthly. The monthly grant payment then would be adjusted based on the annualized level of that amount.

5. Experimental families were assured that they could return to AFDC payments after the end of the experiment.

6. To validate that the three-year period captured the participants' long-term behavior, a small portion of the sample continued for an extended two years.

7. For example, "marrying" into the experiment.

8. Report by ASPE, Office of the Assistant Secretary for Planning and Evaluation, U.S. Department of Health and Human Services (https://aspe.hhs.gov/report/overview-final-report-seattle-denver-income-maintenance-experiment).

9. This topic generated many governmental hearings and subsequent studies of the SIME/DIME results. A comprehensive listing of this activity was reported in *Focus*, a publication of the University of Wisconsin-Madison Institute for Research on Poverty, Volume 10:4, Winter 1987-1988 (https://www.irp.wisc.edu/publications/focus/pdfs/foc104.pdf).


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2019 Annual SRI Alumni Reunion in Menlo Park

SRI Alumni Association members who will be in the Bay Area on October 10 are encouraged to come to the annual reunion. It will be held in the International Building from 4:00 until 7:00 p.m. The program will include a report from Bill Jeffrey, SRI CEO, on the status of the Institute, and we'll hear from Dr. Phil Vahey, Director of Strategic Research and Innovation, about how SRI Education is making an impact in the lives of learners. A special feature of the reunion will be the induction of one or more SRI alumni into the Alumni Hall of Fame. You can count on sumptuous hors d'oeuvres, excellent drinks, delightful conversation, and plenty of door prizes.

The charge is $25 for each attendee. An invitation to the reunion with sign-up form is included with this mailing; members receiving electronic distribution will need to print the sign-up form from their email attachment. Please complete the form and return it with your check by October 4.

Alumni Association Membership Renewals Due by November 30

It's almost time to renew your SRI Alumni Association membership for 2020. Membership renewal forms will be mailed to association members on **October 15**. The fee is $25 per member, due by **November 30, 2019**. All members who renew on time will be included in the 2020 Alumni Directory, which will be issued in January.

The SRI Alumni Association welcomes new members:

Marie Bienkowski
Walter Bogaerts
Michael Daley
Magnus Kennedy
Lorenza Moro
Dan O'Hara
Jay Prakash
Luis R. Quezada
Heyward Robinson
Donna Smith
Robert E. Tokheim
Julien van Hout

And welcomes back previous member:

Andrew (Andy) Shaw

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 April 1, 2019, to July 31, 2019) contains new members and corrections. Please add it to your 2019 Directory.

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.

Scott Bramwell

Scott Bramwell, a former SRI staff member, died at his home in Ogden, Utah, on April 1, 2019, two days before his 62nd birthday.

Scott received his education in Ogden, graduating from Ben Lomond High School in 1975 and then earning a B.A. degree in graphic design from Weber State University. Beginning in 1998, Scott had a 16-year career at SRI as a highly regarded graphic designer and staff photographer. According to Kathy Wright, his manager in SRI's design team, he "was thoughtful, curious, creative, versatile, and empathic. Always the first to start the day. Always fearless with a sense of humor. I think he secretly enjoyed being the only 'man' in the department, as well as the confidant of the CEO."

Scott's love of the outdoors is demonstrated by his marvelous photos of the ocean, sky, landscapes, and sunrises. He had a gentle and caring soul, and a great sense of humor; he was the life of the party and a friend to everyone; and he loved his family dearly.

Scott is survived by his wife, Susan; siblings Kathy, Karen, Kim, Stacey, Teresa, Sabrina, KC, Corey, Cody, Beau, Bryan, and Ladonna; daughter Tiffiny; grandsons Giovanni and Mateo; and his dog, Cody.

Based on an obituary and guest book messages posted online by Lindquist Mortuaries and Cemeteries, Ogden, Utah.

Maurice Deatrick*

Maurice ("Maury") Deatrick, a former SRI operations analyst and business manager, died in Honolulu, Hawaii, on April 22, 2019, eight days before his 98th birthday.

Born and raised in Fort Wayne, Indiana, Maury graduated from high school in 1939. Unable to afford a university education, he went to work as a busboy and then a bartender. On December 8, 1941, the day after the attack on Pearl Harbor, he joined the U.S. Navy and served as a communications specialist on several ships in the Pacific. After his discharge from the Navy, he worked for several years in Indiana before moving to Santa Barbara, California, with his wife and young son. While working full-time, he attended the University of California at Santa Barbara, graduating with a degree in mathematics/economics in 1955.

Before joining SRI as an operations analyst in 1958, Maury worked as a mathematician and programmer at UC's Livermore Radiation Laboratory and at Technical Operations, Inc., in Monterey. Still in the Monterey area, he worked in an SRI research office on a major support contract for the U.S. Army, including such topics as the vulnerability of aircraft to enemy ground fire and a comparison of the effect of several types of rifles on the performance of combat rifle squads. In recognition of his work, Maury was promoted to Assistant Director for Administration and Finance, with responsibility for research office personnel matters, budgets, proposal preparation, contract negotiations, and a host of other interfaces with the Army client.

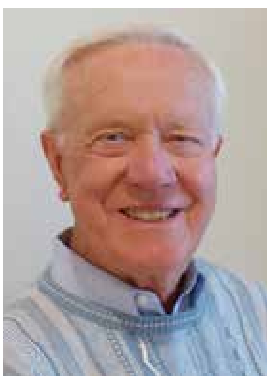
In 1964, Maury moved to Menlo Park to take the position of Research Administrator/Business Manager of the System Sciences Division. Among the division's new contracts was one for the Advanced Research Projects Agency (ARPA) in support of the war effort in Vietnam, which he was assigned to administer in Menlo Park. The assignment soon changed, taking Maury (and his family!) to Thailand for three years to solve various organizational and operational problems, coordinate activities with several agencies and other Southeast Asian countries, and test various hardware systems. After returning to Menlo Park in 1969, he continued coordinating activities related to the ARPA contract until it ended two years later. He then took a position as Senior Research Administrator for Charlie Cook in the Physical Sciences Division, followed by similar positions as business manager for Paul Jorgensen and George Abrahamson, who both persuaded Maury to put off retirement because they considered him necessary to their success as vice presidents. He finally retired in 1989, after 31 "mostly good years at SRI."

In retirement, Maury and his wife, Beverly, traveled extensively, visiting notable tourist destinations from Alaska to the Panama Canal and from California to Illinois. Searching for a calmer environment than the Bay Area, they selected the Hawaiian island of Maui and moved there in 1991. They enjoyed the relaxed lifestyle, including painting, golf, and volunteering with local agencies, as well as regular trips to the mainland to visit relatives and friends. After she was diagnosed with terminal cancer, Beverly decided she wanted to move back to the Menlo Park area in 1994. Maury was in Maui making arrangements for the move when their son Scott called with the news that Beverly had died. Maury decided to go through with the move, but he missed Maui and eventually moved back there in 1997. He continued taking trips to the mainland, and in September 1998 he attended the SRI Alumni Reunion dinner, reconnecting with former colleagues and catching up with work being done at SRI.

Maury is survived by sons Maury Jr. and Scott and by six grandchildren and four great-grandchildren.

Based on a 1999 autobiography by Maury and information provided by Scott Deatrick.

Nils Nilsson*



Nils Nilsson, a pioneer in the field of artificial intelligence (AI) and former lab director of SRI's AI Center, died at his home in Medford, Oregon, on April 23, 2019. He was 86 years old.

Born in Saginaw, Michigan, in 1933, Nils was 11 when the family moved to Glendale, California. After graduation from high school, where he was valedictorian, he enrolled at Stanford University, earning a master's degree in 1956 and a doctorate in 1958, both in electrical engineering. He then joined the Air Force and served for three years at the Rome Air Development Center, a research laboratory in New York.

Nils came to SRI in 1961 and worked in the AI Center for 23 years, including serving as lab director from 1980 to 1984. During his career, he became known worldwide for his foundational work in robotics, artificial intelligence, and machine learning.

His best-known work at SRI was his contributions to the capabilities of SHAKEY, the first mobile robot. As the first robot to embody AI, SHAKEY could perceive its surroundings, navigate from place to place, make a plan to achieve a goal, monitor the execution of a plan in the real world, recover from errors in plan execution, improve its planning abilities through learning, and communicate in simple English. Nils was instrumental in developing the algorithms that helped SHAKEY make decisions and plan the most efficient course to a specified destination. These algorithms are still used extensively today.

Some of Nils's earliest work was on neural network approaches to pattern recognition and problem solving. Although neural networks went out of fashion for a number of years, many successes in AI today are based on the next-generation version of neural networks: deep learning. With the availability of vast amounts of data, neural networks are beginning to rival human capabilities, particularly in speech understanding and vision. SRI continues to work on many of the areas Nils pioneered, including reasoning, robotics, machine learning, and explainability.

After leaving SRI, Nils joined the Stanford faculty in 1985 as chair of the Department of Computer Science, a position he held until 1990. There, he taught courses on AI and machine learning, and he conducted research on flexible robots able to react to dynamic worlds, plan courses of action, and learn from experience. His time at Stanford was marked by his continued leadership in the field and a growing international profile.

In addition to his many technical accomplishments, Nils was a charismatic leader who was greatly loved and respected by his staff and students. He was known for taking a deep interest in his graduate students and worked to establish a pipeline for them to come from Stanford to SRI.

Nils authored or coauthored at least nine books, contributed chapters to many other books, and published often in the scientific press. He served on editorial boards or as editor of several AI journals and was a president of the Association for the Advancement of Artificial Intelligence (AAAI). He was elected for membership in prestigious professional associations and was honored with a number of industry awards, such as a Neural-Network Pioneer Award from the IEEE and the Distinguished Service Award for lifetime achievement from the AAAI.

Nils is survived by Grace Abbott, his wife of 27 years; daughter Kristen and son Lars (from a first marriage); four stepsons; four grandchildren; and eight step-grandchildren.

Based on obituaries published by SRI Insider, Stanford News, *and the* New York Times.

Bernard Wood*

Bernard ("Bernie") Wood, a longtime staff member at SRI, died of cancer at his home in Santa Clara on January 22, 2019. He was 99 years old.

Born in Denver, Colorado, Bernie graduated from the University of Notre Dame with a B.S. degree in chemistry in 1952. He also took graduate-level courses in chemistry at Stanford University from 1957 to 1960. After graduating from Notre Dame, he took a position as a chemist at the Caltech Jet Propulsion Laboratory in Pasadena, California, followed by service at the U.S. Army Chemical R&D Labs in Edgewood, Maryland.

Bernie joined SRI in Menlo Park in 1958 as a research chemist in the Inorganic Materials and Surfaces Program of the Materials and Chemical Engineering Laboratory. His research focused on catalytic reactions, such as catalytic gasification of coal char. Other areas involved reactions such as the diffusion of sulfur on metallic surfaces and the development of coatings for protecting steel from corrosion. Bernie retired officially as a senior scientist in 1996, but he worked at SRI part-time for several more years.

Bernie's hobby was making movies and videos of his family and their travels. He was a longtime member of the San Jose Movie Video Club and the Cupertino Viewfinders Club. He was also active in various service programs at several churches in the South Bay area.

Bernie is survived by Nancy, his wife of 65 years; by sons Christopher, Thomas, and Timothy, and daughters Teresa, Mary Beth, and Jane; by 10 grandchildren and 7 great-grandchildren; and by his sister-in-law Sr. Pieta, O.P., and numerous cousins.

Based on an obituary published by the San Jose Mercury News, *on a LinkedIn profile, and on information from Nancy Wood.*

*Member of the SRI Alumni Association

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