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A career driven by engines: Bob Carling reflects on four decades at Sandia

Much better than I ever expected – how Bob Carling describes his long career at Sandia in six words. Bob, the director of the Transportation Energy Center (8300) at Sandia/California, will retire in February after 38 years of service.

“I never expected to have a job like this, with these responsibilities and the privilege of working with such quality people,” he says. “That might sound trite, but it’s true. Without question, the Combustion Research Facility is the premier combustion lab in the world. Running the CRF and Center 8300 was my dream job.”

It’s a job he has done well. “The CRF has a long and proud history characterized by exceptional science and visionary leadership. Bob exemplifies these CRF features,” says President and Laboratories Director Paul Hommert. “He effectively increased the already significant profile of the CRF with industry and within the DOE science community. He leaves having positioned the CRF for continued unique contributions to a field that will remain important to the U.S. energy landscape for decades to come.”

Back in 1975, after finishing a PhD in physical chemistry at the University of Michigan, Sandia was Bob’s “plan B.” He was laid off after six weeks at his first job in a Chicago company’s research department. With a 16-month-old son and another baby on the way, he needed another job, fast. He reached out to colleagues from graduate school and, on the day after his second son was born, received a job offer from Sandia.

Bob first worked on solar energy and later was part of the Excalibur special project for the Strategic Defense Initiative. He joined the Combustion Research Facility in 1983, first as a supervisor (the equivalent to today’s level 1 manager) of the Exploratory Chemistry Division and then of the Combustion of Energetic Materials Division.

As part of a team to develop remote sensing programs, Bob helped start the first Atmospheric Radiation Measurement program at Sandia. “We created a program that is the foundation of much of the remote sensing work that continues today,” he says. “That program applied diagnostic techniques that the CRF had developed over the years to a new problem, the daytime measurement of water vapor in the atmosphere.”

Engines, engines, engines

In 1991, Bob became manager of the Engines & Furnaces Department and moved into a realm that would define the rest of his career – engine work. “At that time, our work was much broader than just engines,” he recalls. “We had projects on furnace combustion and pulse combustion for water heaters. We had just one functional engine lab.”

He took over that position from Dennis Siebers (8362), who wanted to return to research. “Right after Bob became manager, there was a reorganization at DOE and suddenly our group was in a lot of trouble,” recalls Dennis.

“I had to start over, essentially, and build a whole new set of relationships in a completely different department at the DOE,” says Bob. “That turned out to be vehicle technologies, which still provides a big chunk of our funding today.”

One of Bob's critical decisions during this time was to aggressively push for funding for a new optical engine lab. "We had optical engines at the time but they were very unrealistic," says Dennis. "Under Bob's leadership, we built a new set of optical engines, multimillion dollar labs that are much closer to the physical geometry of a real engine on the road. That allowed us to work closely with industry and really propelled our research. It's the basis of our program now. There were many people involved in making this happen, but Bob's foresight and courage was really the driver."

With the increase in engine work in the department, research into other forms of combustion dwindled. But it was the ideal time for the CRF to become a leader in automotive engine research. With the formation of United States Council for Automotive Research LLC (USCAR) in 1992 and the Partnership for a New Generation of Vehicles (PNGV) the following year, increasing fuel efficiency became a national priority.

"This was an opportunity for the national laboratories to work with the Big Three automakers in a different way," says Bob. Under his leadership, Sandia created its first Cooperative Research and Development Agreement (CRADA) with USCAR.

In 1994, Bob spent 10 months at Ford's Scientific Research Lab in Dearborn, Michigan as a visiting researcher. "I'm not sure I can point to any particular project that came out of my time there, but it did allow me to develop relationships with many people at Ford and participate rather substantially with the four stroke direct injection technology team, which included researchers from the Big Three, the EPA, universities, and other national laboratories."

As an added bonus, Bob's second son – the one who was born the day before he got his job offer at Sandia – started college at the University of Michigan during his time at Ford. "It worked out really nicely for both of us," he says. "I'd see him on the weekends, he had a place to do laundry – it was a special time."

Plenty of reasons to be proud

Bob became a senior manager in 2000 and in 2005 became director of Center 8700, Physical and Engineering Sciences. In 2008, he landed his dream job of Center 8300 director. The last five years, he says, have been the best of his career.

"I'm especially proud of how the research coming out of the CRF has repeatedly changed the thinking on a particular topic," says Bob. "The first time was John Dec's [8300] research into what goes on inside a diesel engine and how fuel burns. It was a new picture of diesel combustion that completely changed how everyone in the industry thought about this process."

He also points to Craig Taatjes' (8353) identification of enols as a combustion product, Craig and David Osborn's (8353) first direct kinetics measurements of reactions of Criegee species, and the work of Paul Miles, Mark Musculus, and Lyle Pickett (all 8362) on low-temperature combustion.

"CRF researchers continue to change the face of science in a number of areas by proving long-predicted concepts or countering the way of accepted way of thinking," says Bob. "It's very easy to be proud of these people."

That groundbreaking research has been well-recognized in the industry through awards, high-profile publications, and invitations. In 1998, John, Dennis, and Pete Witze (retired) were nominated for Fellowship in the Society of Automotive Engineers (SAE). All three became Fellows, which spurred Bob and other managers to continue positioning their researchers for prestigious national and international awards.

Since that time, Paul, Chuck, and Lyle have also become SAE Fellows; Dennis has become a Fellow of the American Society of Mechanical Engineers; and CRF researchers have won numerous awards for outstanding papers and presentations at conferences and have frequently been published in prestigious journals such as *Science*.

Bob attributes this success to three things: good people, resources, and a standard of excellence. “The staff know we have very high standards, but we also provide the support they need to excel, whether that is allowing our people to try new things, like taking experiments to the Advanced Light Source in Berkeley, or pushing for capital equipment investments or even new buildings,” he says.

John Dec recalls receiving that kind of support when he wanted to work on homogeneous charge compression ignition (HCCI). “As the most fundamental low-temperature combustion process, HCCI emerged as a way to meet low emission standards without aftertreatment while still giving the high efficiency of a diesel engine,” he says. “I felt like we had to be working in HCCI if our engine program was to continue to lead the research needed by engine community.”

Bob championed John’s proposal to DOE and secured the funding to build the lab that John still works in today. “Bob helped me make that vision a reality,” he says. “This made a big difference for me as a researcher and helped our program stay in the forefront.”

The Livermore Valley Open Campus (LVOC) falls under that broad umbrella of resources to enable success. “When the CRF began in 1980, DOE expected collaborative work and publications. Whether it is with students, postdocs, visiting faculty, or industrial scientists, the expectation was that you as an individual PI were not going to publish work with only your name on it,” Bob explains. “It’s an important part of the culture within the CRF. The LVOC really enables that collaborative work.”

Leaving all of this will be hard for Bob. The decision to retire now, he says, was difficult. “It’s time,” he says. “Two of my three sons live out of state and I have six grandchildren with one on the way. I want to spend more time with them.”

He will be greatly missed at the CRF, the California site, and across Sandia as a whole. “From his advocacy for science and engineering excellence to his leadership in advancing Sandia’s national security mission and improving the quality of our work environment, Bob is a role model for us all. I know I speak for everyone in offering Bob our congratulations on this occasion of his retirement and in expressing our heartfelt gratitude for his nearly 40 years of service to the nation and Sandia National Laboratories,” says Division 8000 vice president Steve Rottler.

“On a more personal note, I will miss my daily interactions with Bob and the opportunity to continue learning from him. He is blessed with many things, not the least of which is a terrific family, including numerous grandchildren, all of whom are looking forward to spending more time with him, and vice versa. I wish for Bob and his family good health, happiness, and good fortune as he enters this ‘second’ career.”

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CRF 25th anniversary



20 year anniversary



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CRCV opening, 1/2011



Royalty 2010



Lipinski visit, 8/2011

