CAREER PATHS IN COMPUTING

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Computing enabled me to . . . A Career Fueled by HPC

NAME

Dona Crawford

BACKGROUND

Born and raised in Indiana, the youngest of three girls, the first in my family to go to college.

CURRENT JOB TITLE/EMPLOYER

Board Chair, Livermore Lab Foundation

EDUCATION

**MS Operations Research, Stanford University, CA
MA German, Middlebury College, VT
and Johannes Gutenberg University of Mainz, Germany
BS Math, University of Redlands, CA**

I'VE BEEN STUMPING for why supercomputing or high-performance computing (HPC) matters most of my career.

I didn't start out loving HPC. It barely existed when I began as an undergraduate in 1969. But I loved math, the simple elegance of describing the world with equations and having the ability to be right or wrong. In a world of nuance and interpretation, the objectivity of math spoke to me (and still does). As the first in my family to go to college, I didn't know what career to pursue when I graduated. With a degree in German

and an interest in global affairs, I applied to the CIA, the FBI, the NSA, and the Department of Energy (DOE) national security labs. I was fortunate to receive an offer from DOE's Sandia, which saw fit to send me to Stanford for my MS in operations research—applied math, dealing with optimization. Once at work, I started writing code for big computers. My first assignment was to find an algorithm that would precisely evaluate the amount of sunlight hitting a parabolic trough. When it was complete, we ran it over and over again to understand how to set up solar farms for optimal capture of solar energy. This was in the late 1970s when solar farms were a new concept. Pioneering code for large, first-of-a-kind computers was thrilling and knowing that the results made a difference was exhilarating. I was hooked.

HPC has become indispensable to scientific research and discovery. It is different from what's done at Apple or Facebook or Google, among others. Those are cool jobs too, but for me, to be able to use my applied math to do science through the use of very large-scale computers was magic. We could “do hazardous, expensive, centuries-long experiments” via simulation on the computer. As a result, we, and the handful of other places (largely at national laboratories) that pioneered supercomputing fundamentally changed the scientific method from theory and experiment to theory, experiment and simulation.

While I was working at Sandia our models and large-scale computing had a big impact. For example, among other things, our knowledge of how parachutes work contributed to the development of air bags in cars. We also worked closely with Goodyear and helped them recover from financial ruin with a new way to design and produce tires using HPC.

After 25 years at Sandia, it was my privilege to lead one of the premier computing centers in the world. I did this for the last 15 years of my career at Lawrence Livermore National Laboratory (LLNL).

As HPC became more widely accepted, more data was collected and computers grew even larger, it led naturally to utilizing supercomputing for machine learning and what people think of as artificial intelligence (AI). It takes three things to be world-class in AI: the most advanced algorithms, fast computing hardware, and a good supply of data.

Recently, LLNL developed an AI-driven computational platform to simulate the molecular behavior of viruses and antibodies to create drugs for Covid.

What sets the national security labs apart from other excellent institutions is the multidisciplinary approach to solving very large, complex, long-term grand challenges. But the exciting thing about the labs is that their solutions for national security also offer great benefits for society in such domains as energy, environment and medicine.

When I retired in 2016, I had to stay involved in science and computing. That's why I co-founded the Livermore Lab Foundation (LLF). The foundation is leveraging the Lab's computing and data analytics capabilities to crunch through large amounts of data to help identify the cause of amyotrophic lateral sclerosis (ALS), or Lou Gehrig's disease. Our goal is to improve our understanding of ALS and accelerate the development of new therapies and treatments.

Also, in a world examining systemic racism, the LLF encourages black students and other historically underrepresented groups to pursue STEM by providing unique opportunities to engage with Lab facilities and mentors.

I have barely scratched the surface of how computing has changed our world for the better. Our planet faces daunting problems, and HPC is key to addressing many of them. **G**