

A Tradition of **EXCELLENCE** in Technology Innovation

Cutting-edge Livermore technologies have garnered prestigious R&D 100 awards for more than 40 years.

NEARLY 60 years ago, *R&D Magazine*, now called *R&D World*, began recognizing the top 100 technological advances from industry, government, research institutes, and academia that revolutionize the state of the art in a specific field, or have potential to usher in a new one. Before the digital wristwatch, antilock brakes, and high-definition television became household names, they were recognized as R&D 100 winners. Today, the program remains the only industry-wide, international competition that rewards the practical application of science.

Over the years, Lawrence Livermore's track record in the R&D 100 competition has been exceptional, enjoying a 60 percent success rate since 1978, when it earned its first award for diamond machining—a process used to fabricate precision optics. "R&D 100 awards recognize the impact that Livermore

innovation, in collaboration with industry partners, can have on the U.S. economy as well as globally," says Hannah Farquar, a business development executive in the Laboratory's Innovation and Partnerships Office (IPO).

In 2021, the Laboratory added three winners to its roll call. First, Livermore's Multiplicity Counter for Thermal and Fast Neutrons (MC-TF) detects both types of neutrons to help first responders discriminate between special nuclear material and non-special nuclear material in the field—data that informs the emergency response strategy to potential nuclear threats. Next, Flux, a scalable workload management software framework, maximizes the utilization of computing resources through workflow optimization so applications run faster and more efficiently. Finally, the Optical Transconductance Varistor (OTV) is a light-activated, electricity-delivery

control device, which if deployed for the U.S. electrical grid, could save 1 billion kilowatt-hours of electricity and reduce carbon emissions by more than 10 percent. Articles beginning on p. 6 discuss each of these winners in detail.

A Winning Legacy

In the 1980s, Livermore engineered award-winning innovations such as coated diffraction gratings (1989) and a highly dispersive x-ray mirror (1987), among others. A few years later, DYNA3D (1994)—a sophisticated finite element code for analyzing the transient dynamic response of 3D solids and structures—revolutionized crash simulation in the auto industry by accurately predicting vehicle behavior in a collision. In the next decade, Livermore's laser peening system for strengthening metal parts (1998)—marketed as the Lasershot Peening System—made its debut, and the technology continues to be used extensively in the aviation industry for extending the useful life of critical parts, such as airplane fuselages and turbines.

More recently, the Lawrence Livermore Microbial Detection Array (LLMDA, 2017) offered a high-throughput, pan-microbial mechanism for

detecting pathogens. In its commercialized form, the device is used in clinical settings to assess co-infection with other diseases, allowing health care providers to plan more specialized patient treatment options. In 2020, Livermore scientists adapted LLMDA technology to detect COVID-19 during the evolving pandemic.

The Laboratory's technological innovation also extends to software development. Spack (2019), an open-source software package management tool, simplifies and accelerates building, installing, and customizing complex software stacks, and unifies software deployment. Thanks to Spack, thousands of users can share and leverage more than 3,200 scientific software packages.

Livermore's depth and breadth of expertise in wide-ranging disciplines make it a hub for innovative thinking. From the beginning, the Laboratory has stressed the benefit of a multidisciplinary approach to research that has led to many scientific and technological advances. In many cases, Lawrence Livermore also partners with collaborators to enhance exploration and development of new ideas, concepts, and technologies. Indeed, all three R&D 100 winners in 2021 resulted from collaborations with external partners, including another national laboratory, a university, a federal agency, and private companies. These awards also show how products developed in support of the Laboratory's mission have relevance in the marketplace for societal benefit.

Technical Competitiveness

To be eligible for consideration of an R&D 100 Award, the nominated products must have been made commercially available to the marketplace within the previous year. Entry categories include analytical/test, information/electrical, mechanical/materials, process/prototyping, software/services, and other (for technologies falling outside the other groups). Nominees can also submit their entries into five Special Recognition categories—corporate social responsibility; green technology; market disruptor for products; market disruptor for services; and a new category last year, battling COVID-19. A judging panel that includes international technical experts in a range of disciplines reviews and rates each submission. Awards are based on the entry's technical significance, uniqueness, and usefulness compared to competing technologies.

R&D 100 awards captured by Livermore are a testament to the innovative quality of the work done by Livermore's talented and dedicated staff and illustrate how a team approach to research yields significant dividends. Notably, including three recently announced

winners for 2022, Livermore has garnered 176 of these prestigious awards. The Laboratory's success also demonstrates the importance of IPO, which works with Livermore staff and external partners to describe the principal applications and benefits of a new product or technology and transition it successfully to the marketplace. "Lawrence Livermore is a technologically exciting place to work," says Farquar. "In IPO, we get to see the wide breadth of technological diversity and watch innovation move from the lab bench toward industrial and market impact with the support and validation of industry partners." The Laboratory looks forward to the many scientific and technological breakthroughs yet to come as it continues its tradition of excellence in technology innovation.

—Caryn Meissner

