

New Campus Set to Transform Two National Laboratories

FOR more than half a century, Lawrence Livermore and Sandia national laboratories have thrived as neighbors on the eastern edge of the Livermore Valley in California. Much of the research conducted by the two laboratories addresses national security issues. Although classified aspects of that work must be performed in strictly controlled environments, the underlying science and technology is not classified. In addition, both laboratories have a broad range of unclassified programs that focus on complex problems of national importance. Throughout the years, these programs have benefited from participation by colleagues in academia and industry.

To promote even greater collaboration between researchers at the two laboratories and their counterparts outside the Department of Energy (DOE) complex, Livermore and Sandia are planning to create an open research and development campus. The Livermore Valley Open Campus (LVOC), a partnership involving Livermore, Sandia, DOE, and the National Nuclear Security Administration (NNSA), creates a shared space between the two adjacent sites.

According to James “Buck” Koonce, senior adviser to Livermore Director George Miller, the new campus is in keeping with DOE’s vision for increased scientific interaction and collaboration. “LVOC will position the two laboratories to more fully address their broad national security mission,” says Koonce, who leads Livermore’s effort to develop the open campus. “DOE and NNSA recognize that many national security issues are too important and complex to leave out broader participation by the talented scientists and engineers in universities and industries. We need their contributions to expand and deepen basic research related to national security in areas such as transportation, energy, cybersecurity, high-performance computing, and nonproliferation. We’re confident the open campus will attract new partnerships and innovative teams to take on these issues.”

LVOC will capitalize on the intellectual and industrial resources of the San Francisco Bay Area, including University of California campuses, Stanford University, the California State University system, and other academic institutions currently working with the two laboratories as well as businesses in the surrounding community and Silicon Valley. In addition, nearby federal laboratories, such as Lawrence Berkeley National Laboratory, SLAC National Accelerator Laboratory, and NASA Ames Research Center, are expected to play important roles in the new campus.

Campus to Cover 110 Acres

The campus is being built on 110 acres (less than 0.5 square kilometers) of contiguous land adjoining the southeast corner of Lawrence Livermore’s main site and the northeast corner of the Sandia site. The campus extends from an area adjacent to the National Ignition Facility (NIF) at Livermore to the Combustion Research Facility (CRF) at Sandia. Over the next several years, the exact boundaries will be adjusted as necessary to accommodate mission and program needs.

NNSA Administrator Tom D’Agostino and DOE Under Secretary for Science Steve Koonin formally authorized development of LVOC in 2009, following several years of discussion centered on ways to more fully exploit the resources and talents of Livermore and Sandia. “A Livermore Valley Open Campus will maximize the return on our nation’s investment in nuclear security,” said

An artist's concept of the future Livermore Valley Open Campus (LVOC) depicts a bustling center of collaborative research. (Courtesy of Flad Architects.)



Secretary of Energy Steven Chu in announcing the new campus. “By leveraging the groundbreaking research of our nuclear security labs through private sector collaborations, we will bring breakthroughs to the market faster and find new solutions to the energy problem.”

Camille Bibeau, who leads program development for LVOC, says the campus will enhance Livermore’s and Sandia’s abilities to execute their missions. It also will help both laboratories remain at the forefront of science, technology, and engineering and ensure that they have the talented workforce they need for the future. “Having an open campus will expand opportunities to engage with the broader international research and academic community in a modern high-tech environment,” says Bibeau. “Those kinds of partnerships will help the laboratories recruit and retain talented scientists and engineers and keep our staffs at the leading edge of their fields.”

In 2010, Livermore and Sandia engaged Flad Architects, a Madison, Wisconsin, firm with extensive DOE experience, to study development options and create a master plan with different scenarios. For example, one scenario offers a design for expanding the campus over 30 years until it eventually provides 2.5 million square feet (over 230,000 square meters) of laboratory and office space and accommodates up to 4,000 people. Another Flad option features a “village center,” which could offer amenities such as conference space, a visitor’s center, and food services, while ensuring compliance with security requirements and maximizing the available acreage. In the first phase of LVOC construction, from late 2009 through 2011, the two laboratories created a general access area, a new entrance to CRF with more convenient visitor access, and an interim High-Performance Computing Center.



This artist's rendering shows one vision of a completed LVOC circa 2040. Several design plans are being considered for expanding the campus over the next 30 years. (Courtesy of Flad Architects.)

Reducing Partnership Barriers

To fully implement the LVOC concept, Livermore and Sandia must maintain the appropriate level of security and access controls in areas that perform sensitive work while maximizing access to the open campus for research partners and visitors. A critical aspect to LVOC success will be to streamline existing business and operating procedures to enhance scientific collaboration. Toward that end, the laboratories are studying ways to accelerate and accommodate new research.

Koonce points to the Hyperion project as a model for LVOC collaborations. In this pioneering cooperative venture, which began in 2008, Livermore has teamed with 15 companies to develop a realistic high-performance computing environment that industrial partners can use to test new products. Hyperion allows developers to improve technologies and decrease the time required to bring new products to market. The financial benefits offered by this collaboration are also proving to far outweigh the partners' initial investments. (See *S&TR*, December 2009, pp. 15–17.)

LVOC planners have identified two classes of programs to attract collaborations: anchors and candidates. Anchor programs

draw on core institutional competencies, well-established expertise, and renowned facilities.

According to Koonce, the LVOC team has initially established three anchor programs. The Transportation Energy Center will engage CRF and associated resources, expanding on Sandia's current efforts with hundreds of industrial collaborators researching combustion science. The International High-Energy-Density Science and Inertial Fusion Energy Center will capitalize on the capabilities offered by NIF, the world's most energetic laser, and Livermore's expertise in high-energy-density science.

Ed Moses, principal associate director for NIF and Photon Science, sees a bright future for the open campus. "LVOC is encouraging leading researchers from around the world to collaborate on NIF experiments that explore matter under extreme temperatures and pressures," he says. "Those studies will lead to important new discoveries. We expect the field to change dramatically in the years ahead."

The third anchor program will be the High-Performance Computing Center, designed to provide significant computational resources to LVOC collaborations. According to Bibeau, the



The Combustion Research Computation and Visualization building was completed in 2010. This facility complements the existing Combustion Research Facility at Sandia, one of the key anchors for LVOC. Both buildings are located within a newly designated general access area.

permanent facility, when constructed, will provide researchers with supercomputing power equivalent to the resources already available for Livermore's classified nuclear weapons program.

Candidate programs are smaller research efforts that can start up more quickly in an open environment compared with the current configuration of the laboratories. These efforts offer a wide range of opportunities for collaborations with academia and industry. Potential programs include the Hydrogen Materials in Extreme Conditions Institute, Applied Antineutrino Physics Program, Joint Microscopy Center, Cyber Science and Security Institute, Bay Area Biosecurity Center, and Climate and Energy Center.

Large Role for High-Performance Computing

Mark Seager, assistant department head for Advanced Technology in Livermore's Computation Directorate, has been meeting with California business executives to discuss how working with LVOC's computational resources could significantly reduce the time required to advance from concept to manufacturing prototype. "We want to bring high-performance computing to California businesses, especially small and medium-size companies, so they can test new products in simulations—a process called virtual prototyping," says Seager, who spearheaded the Hyperion project. With virtual prototyping, manufacturers can design, build, test, and

"break" new technologies before they devote time and money to manufacturing and testing a physical prototype. Seager adds, "Virtual prototyping helps them bring products to market far sooner than they can with traditional methods."

Koonce reports enthusiastic response from local, state, and federal officials and strong support from DOE and NNSA. Alice Williams, manager of NNSA's Livermore Site Office, says, "The new campus is an exciting concept with enormous potential, and we're working hard to expedite its realization."

"LVOC represents a new way of doing business with the national labs," says Koonce. "Everyone we have spoken to is very excited, especially because of the potential to expand our partnerships both locally and internationally."

—Arnie Heller

Key Words: Combustion Research Facility (CRF), high-energy-density science, Hyperion, Livermore Valley Open Campus (LVOC), National Ignition Facility (NIF).

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