

California's Federal Laboratories: A State Resource

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CALIFORNIA COUNCIL ON SCIENCE AND TECHNOLOGY

EXECUTIVE SUMMARY

Federal laboratories are an important part of California's science and technology capabilities and infrastructure. California is home to over 40 federal laboratories, the largest concentration of federal laboratories in the nation, ranging from small facilities to two laboratories with annual budgets over \$1.5 billion each. The six largest of these provide a wide range of direct benefits to the state, including:

- *\$5 billion in annual spending.*
- *More than 23,000 jobs.*
- *Partnerships with local industry.*
- *Collaboration with research universities in the state.*
- *Research opportunities for young university graduates as well as seasoned scientists.*
- *Science education for thousands of school students.*
- *Expert assistance to state and local governments — from environmental clean up, to port security, combating wildfires, detecting agricultural diseases, and beyond.*

At a time when California's economic future increasingly relies on scientific and engineering expertise, the federal labs provide critically important know-how and highly specialized facilities. Their presence spurs innovation in California's high-tech industries; collectively, they serve as a magnet for some of the best scientific minds in the nation. And today, going beyond their federal missions, the labs are working with California state and local agencies, industry, and universities to collaboratively solve local problems and pursue new research initiatives.

Even so, these laboratories remain a largely untapped resource by the state. Most of them are regularly called upon by the federal government to assist in disaster response; for example a team from Sandia National Laboratories/California helped analyze Hurricane Katrina's long-range effects on physical infrastructure, including the levee system, and industry in Louisiana. NASA used satellite imaging from NASA's Jet Propulsion Laboratory to characterize the extent of flooding and damage to homes. However, while the federal government regularly calls upon these facilities, laboratory officials often find themselves struggling to determine how to best inform the state government of these same resources.

THE LABORATORIES IN BRIEF

Given their many contributions, remarkable potential, and the intense competition for resources today, it is to California's advantage to ensure that federal laboratories housed here flourish. This report focuses on the six largest in the state, each of which offers a multitude of benefits and tremendous potential:

Lawrence Berkeley National Lab — a Department of Energy facility run by the University of California, Berkeley Lab conducts unclassified research in physics, energy, advanced computing, materials science, biology, and nanotechnology. Berkeley Lab has an active technology transfer program, working closely with many California companies, both large and small. The lab also helps create new jobs by licensing technologies that become the basis for startup companies. Technologies developed there have led to the creation of more than 18 start-up companies with a combined market capitalization of more than \$2 billion. Symyx Technologies, Inc., for example, is the result of a Berkeley Lab license. Begun as a start-up, it is now a publicly traded company with a market capitalization of more than \$900 million and more than 275

employees, many of whom hold well-paid, highly skilled positions. Joint research projects and other research endeavors with major California companies are numerous, and include activities with Chiron, General Atomics, Hewlett-Packard, Kaiser Foundation Hospital, and Genentech, to name a few.

Lawrence Livermore National Lab — concentrates on national security, particularly the reliability and safety of nuclear weapons, nonproliferation, and homeland security. The Department of Energy (DOE) owns LLNL; the University of California operates it. Livermore helped state farmers successfully battle Newcastle poultry disease and soybean disease. In addition, the Lab pioneered summer programs for California science and math teachers; has assisted state and local governments with groundwater clean up, air quality assessment and monitoring; and assists with assessing the state's homeland security needs, including port, border, and airport concerns.

Sandia National Laboratories (California branch) — with responsibilities in national security, homeland security, and energy. The Sandia Corp., part of Lockheed Martin, operates Sandia/California. Sandia/California has a robust technology licensing program that in 2004 had 1,090 active licenses, many with California companies. In energy research, the Lab is at the forefront of work being done on hydrogen fuel systems, in partnership with California firms. A vigorous set of educational programs supports some 200-300 students each year; the Lab also runs a number of institutes for students and faculty in cybersecurity, explosive detection technology, advanced sensors, computational science and mathematics, and three-dimensional modeling and simulation, among others. Moreover, as with Lawrence Livermore, Sandia/California works directly with the state to tackle security issues. It evaluated the preparedness of Southern California Edison's grid management system and helped officials in Riverside and Alameda counties learn how to use a patented technology for disabling unexploded bombs. In a long-term partnership, Sandia and San Francisco International Airport have jointly developed models, introduced detection technologies, performed exercises, and developed response procedures to mitigate the risk and consequences of possible chemical and biological attacks.

Stanford Linear Accelerator Center — conducting fundamental research in physics as well as research in imaging for advanced materials and biology. SLAC is owned by DOE and run by Stanford University. Using SLAC's powerful imaging tools, researchers are able to look deeply into materials and analyze their composition. In medicine, scientists are investigating parasite proteins associated with breast cancer. They're using SLAC equipment to learn more about protease inhibitors — to combat HIV, and they're finding out about how the structure of the bone is affected by osteoporosis. In environmental science, researchers are learning how certain types of plants clean up the environment by removing toxic substances. Researchers from the semiconductor industry use the facility to detect and remove microscopic specks of metals from silicone wafers that can impair computer memory.

Ames Research Center — involved in robotics, spacecraft re-entry systems, advanced computing, aviation safety, astronomy, astrobiology, and nanotechnology. Ames is run by NASA with an affiliated research center managed in partnership with the University of California. In the 1990s, Ames used its remote-sensing technology to help California's multi-billion-dollar wine industry detect and manage phylloxera, a root louse that destroys grape vines. Ames also runs a host of education programs — robotics camp for students; summer research experiences in industry for teachers; and opportunities for high school seniors to work at Ames, to name a few. At the college level, the Lab runs a variety of programs, among them, a summer program for minority students, competitively awarded graduate fellowships, and summer research opportunities for college faculty.

Jet Propulsion Laboratory — designs and manages many of the nation's robotic missions in space, along with orbiting telescopes and a deep-space communications network. Caltech operates JPL for NASA. From 2000-2003, JPL obtained nearly 140 patent licenses — more than any other NASA center — contributing to the state's economy through the commercialization of high-tech inventions. Over the past 10 years JPL has licensed, among other inventions, a methanol fuel cell to a Los Angeles-based company, a high-performance gyroscope to the Hughes Space and Communications Co. in El Segundo, and a new radar mapping technology to EarthData International in Fresno. Educational opportunities abound and include robotics competitions, summer employment, materials seminars, tours for teachers, and research awards and fellowships for college and university faculty.

ISSUES AND LIMITATIONS

Despite the benefits the federal laboratory facilities offer the state, they remain a largely untapped resource for California. State agencies of course have their own technical capabilities, but the laboratories could also contribute more to the state. For example, the labs could provide additional expertise in such areas as homeland security, water management, energy efficiency, and science and math education.

There are, however, significant issues to address before the gaps between the state and the federal laboratories can be bridged. The principal challenges fall into five main categories:

Challenges facing state government. State agencies that want assistance from federal laboratories face several changes. The state's contracting rules run counter to the federal government's: state law generally prohibits agencies from paying in advance for research services; federal law requires advance payments. The difference makes the negotiation of cooperative projects exceedingly difficult. Moreover, different ways of managing indemnification, audits, and intellectual property also hinder the process. And because state agencies appear to have different procurement policies, each agreement must be individually crafted, leading to inevitable delays that impede prompt action on important issues.

Challenges facing local government. At the local level, officials do not routinely have access to the level of expertise they might need to help determine which research trends to follow and which new technologies to adopt. In other words, they may not know what they don't know, and so would have no way of assessing where to go for assistance, and even what questions to ask. The potential for local governments to benefit from what the federal labs are doing in the area of homeland security, for instance, is great, but a mechanism is needed to help facilitate the transfer of that knowledge down to the local level.

Challenges facing industry. While some of California's large corporations enjoy steady, ongoing relationships with the federal laboratories, smaller companies are not likely to know about the technical opportunities the labs offer. Intel, for example, works closely with several of California's federal facilities. But an examination of the list of collaborations among the labs and private firms reveals that few small companies are so engaged. And even large firms may not have the know-how to deal with the rules and procedures of the federal bureaucracy.

Competition from other states. The federal laboratories in California compete vigorously with labs in other states to win new projects and facilities. The fact is, other states are becoming increasingly sophisticated in the way they attract federal projects — providing their own money to attract or supplement new federal facilities — ultimately making the competition extremely difficult. California must become more cognizant of that fact, and more connected to its federal labs if they are to compete effectively against other states.

Internal laboratory issues. The laboratories themselves face limitations that sometimes affect their ability to conduct new kinds of research or work with California companies, universities, and governments. The labs must of course give priority to their prime federal missions. Taking on other missions and activities requires careful planning and cooperation among the laboratories and industrial and government officials. But there are many areas of activity where the needs of state based entities are entirely consistent with the laboratories overall missions and hence offer excellent opportunity for federal-state and industry partnerships.

Given the tremendous value already demonstrated by these facilities, and the enormous potential they possess to assist California's government, academic, and industry communities even further, it is in California's long-term interest to keep them in the state and work to overcome challenges inhibiting more successful leveraging of these important resources that contribute jobs, procurement dollars, and technology to California.

RECOMMENDATIONS

Given the reality of increased competition, bureaucratic snags, and other structural challenges, what can be done to help remedy the situation? There are some practical, achievable steps that state officials in the Governor's office, the Legislature, and state agencies could take, possibly in partnership with CCST, that would help reduce these barriers and enable California to take better advantage of what the laboratories have to offer.

1. Streamline the contracting process with the state.

Administrative barriers could be reduced by standardizing rules and procedures. To accomplish this:

- The California Department of General Services should assemble a small working group of representatives from state and federal agencies to propose a set of standardized rules and policies that would facilitate — rather than hinder — collaboration.
- The California legislature should enact a new law that would permit state agencies to pay for technical services in advance, once the contract has been signed.
- A standardized model contract for working with the laboratories, approved by the state attorney general and the Department of Finance, should be made available to all state agencies.
- The major state agencies with technical missions — such as the California Energy Commission, Environmental Protection Agency, and the Office of Homeland Security — should appoint specific individuals with principal responsibility for working with the federal laboratories — making contact, brokering agreements, and creating partnerships. Reciprocally, the laboratories should designate individuals who would provide liaison back to the state.

2. Create bridges between laboratory and state officials.

For the state to benefit more fruitfully from the federal labs in California, a richer exchange of information first must occur. In keeping with its mission of providing science and technology assistance to the state, CCST could organize special workshops for agency officials, legislators, and laboratory officials — so that they have the opportunity to better understand the missions, roles, and research areas of each, and brainstorm possible collaborative opportunities. Follow-up activities should then occur, including site visits and temporary personnel exchanges.

3. Use the laboratories to enhance state research on key issues such as homeland security.

The federal labs can provide vital expertise and direction for a range of state interests including energy research, water, and other key infrastructure issues. In addition, several of the laboratories, including LLNL, Sandia, and Ames, have important technologies that could help state disaster response at a variety of levels. For emergency response and security related issues, the Governor's Office of Homeland Security should build on recent visits to LLNL and Sandia and establish state-facilitated mechanisms that will help transfer laboratory technology and know-how to California first responders. The laboratories also can provide further training for local agencies. It is possible that new federal funding might become available for these activities, either from the U.S. Department of Homeland Security or through assistance from the California Congressional Delegation.

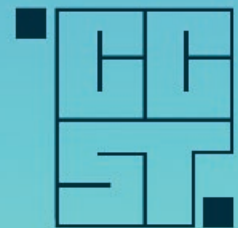
4. Assess the state's competitive edge.

To ensure California's competitiveness, a study should be commissioned that surveys private industry and universities throughout the state about the research capabilities and facilities that will be needed for the future — particularly in the key fields of information technology, aerospace, energy, biotech, agriculture, and nanotechnology. The survey should ultimately be directed to answer the question: What facilities should the federal laboratories located in the state have in place to ensure competitiveness in these areas?

A related point is that opportunities exist for the state and the laboratories to partner in proposals to 'win' important facility construction programs from the federal government, e.g., in the near term, in proteomics and in energy efficiency from the Department of Energy (DOE). There also could be opportunities to enlist the support of the California Congressional Delegation for user facilities at the laboratories that would intentionally build in mechanisms for university and industry access to these facilities, based on models such as access to the Combustion Research Facility at Sandia or the Advanced Light Source at Berkeley Lab.

CONCLUSION

Along with the state's universities and high-tech companies, the six major federal labs provide the raw talent and research muscle that helps make California a world leader in science and technology. But more — much more — could be done to make the connections among the labs to industry, universities, and state agencies more seamless and more productive. And time is of the essence — particularly in this era of increased competitiveness and a multitude of other challenges including natural disasters and terrorism. We offer these practical, achievable steps in the hopes of spurring fresh thinking, new partnerships, and a heightened sense of urgency and potential.



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