The Regents of the University of California

NATIONAL LABORATORIES SUBCOMMITTEE
January 16, 2019

The National Laboratories Subcommittee met on the above date at UCSF–Mission Bay Conference Center, San Francisco.

Members present: Regents Estolano, Morimoto, Napolitano, Ortiz Oakley, Tauscher, and Zettel; Ex officio member Pérez; Chancellors Block, Christ, and Yang

In attendance: Staff Advisor Klimow, Assistant Secretary Lyall, General Counsel Robinson, Provost Brown, Vice Presidents Brown and Budil, Chancellor Hawgood, and Recording Secretary Li

The meeting convened at 4:05 p.m. with Subcommittee Chair Tauscher presiding.

1. **APPROVAL OF MINUTES OF PREVIOUS MEETING**

Upon motion duly made and seconded, the minutes of the meeting of November 14, 2018 were approved.

2. **ANNUAL REPORT ON FISCAL YEAR 2018 NATIONAL LABORATORY PERFORMANCE RATINGS**

[Background material was provided to Regents in advance of the meeting, and a copy is on file in the Office of the Secretary and Chief of Staff.]

Vice President Budil presented performance ratings given to each of the National Laboratories by the Department of Energy (DOE) and National Nuclear Security Administration (NNSA), which assessed the science, technology, and mission accomplishments of each Laboratory, as well as operational performance. The DOE Office of Science also grades the Laboratory, as the contractor, on stewardship.

Ms. Budil reported that Lawrence Berkeley National Laboratory (LBNL) received 94 percent of earned award fee and an A grade, and it has consistently been the top-rated Laboratory for science and technology accomplishment across the DOE Office of Science. LBNL Director Michael Witherell was noted for his leadership in the stewardship of scientific capability and in building operational infrastructure. LBNL has also taken a leading role in cybersecurity, which was a significant issue for the DOE. LBNL's major scientific projects include: an upgrade to the Advanced Light Source (ALS) synchrotron; a new computer coming to the National Energy Research Scientific Computing Center (NERSC); an upgrade to the Energy Science Network (ESnet), the high-speed internet network for the DOE; and the Gamma-Ray Energy Tracking Array (GRETA) project.

LBNL is executing many capital projects; there is a great deal of construction on site as well as several major environmental remediation projects, where progress has been made but there is much work to be done. The Laboratory is also revamping its site access and Foreign Visitors and Assignments program, which is challenging at an open site. On the whole, this Laboratory received exceptionally good ratings.

Ms Budil then reported on Lawrence Livermore National Laboratory (LLNL), whose performance rating last year was the Laboratory's best, only to be surpassed this year with a 94 percent earned award fee. LLNL also received a new award term, with a contract that extends to 2023. LLNL boasts only successes in fiscal year 2018 and had no issues noted.

The rating for Los Alamos National Laboratory (LANL) represents the last such rating under the Los Alamos National Security, LLC (LANS) partnership. The Laboratory was again given an excellent performance rating and was particularly recognized for science and mission accomplishment as well as for very substantial improvement in capital project management and safety culture. These are good harbingers for Triad National Security, LLC (Triad), which has taken over LANL management. The first evaluation for the new team will be given at the end of next year. One issue noted was material control and accountability, the highly structured and regulated process by which nuclear materials are accounted for. Inventories were not being reconciled in a timely manner, but the issue has been addressed and the facility is working through it.

With regard to fee income, Ms. Budil explained that the National Laboratories were projected to earn $26 million, and the actual net fee income earned was $23.2 million, with possible additional fee from an outstanding capital project at LANS that would bring the total to over $24 million. The first income from Triad would not be earned until the end of the next calendar year.

Regent Tauscher remarked that this was an excellent report and congratulated Ms. Budil and her team, as well as the three Laboratories, their management, technicians, and scientists.

Regent Morimoto also congratulated Ms. Budil and her team on the excellent performance ratings. Regent Morimoto asked whether the additional year award terms had a direct correlation to the percentage of the earned fee or whether there was a more complicated algorithm. Ms. Budil clarified that there was a direct relation. She added that the NNSA Laboratories are evaluated across six performance objectives, and a Laboratory must receive very good ratings across all six. LLNL received a rating of "excellent" for five of the six objectives and "very good" for the remaining objective, and a performance such as that allowed the Laboratory to earn an additional award term. In order to receive an "excellent" rating, a Laboratory must receive a rating of above 91 percent, and the percentage determines the exact dollar amount of the award.

Regent Tauscher asked Ms. Budil where the University of California's National Laboratories rank overall while acknowledging that it would not be an apples-to-apples comparison given the uniqueness of the Laboratories.

Ms. Budil noted that Fiscal Year 2018 was an exceptionally good year for the Laboratories that saw the LANS team commended for the quality of the transition and handover to Triad. LANL received increasingly good reviews in the run-up to that transition and handover. Even at times of operational challenges, the Laboratories have been viewed as exceptional performers in science, technology, and mission—providing excellent quality but also being leaders and innovators in these areas. At the DOE Office of Science, regularly giving an A rating is rare, but LBNL has received such a rating on a routine basis. LBNL stands out in a community of excellent laboratories pursuing world-class science, and one of the Laboratory's defining features is its relationship with the University of California broadly and with the UC Berkeley campus in particular. The DOE is very mindful of what that relationship brings to the scientific excellence seen at the Laboratory.

3. **PRESENTATION ON THE STATE OF LAWRENCE LIVERMORE NATIONAL LABORATORY**

[Background material was provided to Regents in advance of the meeting, and a copy is on file in the Office of the Secretary and Chief of Staff.]

Vice President Budil introduced William Goldstein, the 12th director of Lawrence Livermore National Laboratory (LLNL) and president of Lawrence Livermore National Security, LLC (LLNS). Director Goldstein has a workforce of about 6,600 and an operating budget of approximately $2 billion. Director Goldstein is the senior leader of longest tenure at LLNL, was previously deputy director for LLNL Science and Technology, and led the Physical and Life Sciences Directorate for many years prior to that. A fellow of the American Physical Society, Director Goldstein has a Ph.D in theoretical physics from Columbia University and a bachelor's degree in physics from Swarthmore College.

Director Goldstein thanked Regent Tauscher and Ms. Budil, and he noted that LLNL had a $1.8 billion budget and employed 6,500 people when he last spoke at the November 2016 Regents meeting. This fiscal year, he anticipated $2.1 billion in new work with over 7,000 employees. This growth largely reflected increases in mission scope, driven by the plan for nuclear stockpiling life extension and increased investment by the nation in infrastructure across the nuclear weapons enterprise. LLNL has received work from the Department of Defense, Department of Energy (DOE) Office of Science and Energy and Technology Offices, as well as work with industrial partners under cooperative research and development agreements. Director Goldstein believed that, as evidenced by receiving its highest rating since entering into its management and operating (M&O) contract, the Laboratory was successful in meeting the challenges of this growth in delivering on its commitment to the National Nuclear Security Administration (NNSA) and other stakeholders.

Director Goldstein then discussed the foundations of LLNL's success and began with the Laboratory's values, which were revised this past year and embody "the Livermore difference." These values reflect LLNL as a "new ideas" Laboratory and also represented the Laboratory's mission focus, highlighting impact, public service, and accountability.

LLNL valued diversity of teamwork, talent, and perspectives, as well as zeal—employees' "fire in the belly" to excel or their enjoyment of working at LLNL. As one of 17 National Laboratories and one of two nuclear design laboratories, LLNL's values, combined with its unique mission to strengthen national security through world-class science, technology, and engineering, has truly set it apart from other laboratories.

The Laboratory's primary mission is to underwrite nuclear deterrence by helping ensure the safety, security, and reliability of systems in the United States nuclear weapons stockpile. LLNL also provides the technology and expertise to implement arms control, non-proliferation, and other threat reduction methods for weapons of mass destruction. LLNL has also evolved its threat reduction approach by addressing threats in space, cyberspace, and missile defense, and the Laboratory develops solutions for energy and climate security.

Currently, LLNL is responsible for annually assessing the status of the W87 warhead and B83 gravity bomb, as well as actively life-extending the W88 air-launched cruise missile warhead and the W78 Minuteman warhead system, each of which are over 30 years old and full of specialty parts that were made using now-obsolete processes and need replacing. These parts and processes must be tested to last longer and under conditions such as extreme cold and extreme heat; they must be guaranteed to work in a system that cannot be tested and hopefully will never be used.

The Laboratory also looks beyond immediate deliverables to anticipate future developments and technological surprise. Director Goldstein acknowledged the changing security environment and the new problems it presents. LLNL is part of the national hedge against the possibility of a rapid erosion in nuclear security, and it plays a fundamental role in ensuring that the nation has a competitive advantage in advanced technologies with potential military applications.

The Laboratory's robust science and technology base is a national asset and itself a crucial element of deterrence. The University plays a critical and contractual role in ensuring the excellence and credibility of this science and technology base. Director Goldstein provided a Herbert F. York reference about "pushing at the technological extremes" and noted that this philosophy has made LLNL unique and has served the nation very well.

In order to carry out this work, the Laboratory hosts tools found nowhere else in the National Laboratory complex and nowhere else in the world. These include an accelerated mass spectrometer facility that has led the use of accelerated mass spectrometry to biomedical research. LLNL is the national user facility for the National Institutes of Health research community. Also included is a one-of-a-kind nano secondary ion mass spectrometry (NanoSIMS) laboratory that is supported entirely by the DOE Office of Science.

LLNL's billion dollar flagship facilities, on the other hand, truly set it apart. They could not exist anywhere else and are the tools needed to carry out the Laboratory's stockpile stewardship mission while opening new frontiers of scientific research. LLNL's high-

performance computers allow it to simulate full-scale nuclear testing, and the high energy density experimental facilities like the National Ignition Facility (NIF) laser can measure the physics needed by these simulations and validate these scaled experiments.

At the end of fiscal year 2018, the Laboratory took delivery and completed commissioning of the Sierra supercomputer and has begun classified calculations of its stockpile deliverables. Sierra is the second most powerful computer in the world, with a peak performance of 95 petaFLOP. A supercomputer with exaFLOP capability is scheduled for delivery to LLNL in late 2022.

Director Goldstein then discussed what the Laboratory refers to as "cognitive simulation," which is the convergence of computer modeling and simulation with machine learning. This step that goes beyond Moore's law is already being explored on Sierra, and LLNL believes that it will have profound impacts on stockpile stewardship and a host of scientific problems. The Laboratory is already working in collaboration with UCSF, the pharmaceutical industry, and the National Cancer Institute to apply this new paradigm in computing to accelerate drug discovery.

The Laboratory is also employing Sierra's raw computing power at UCSF to improve detection, characterization, and eventual treatment of traumatic brain injury. This project, which is personally championed by United States Secretary of Energy Rick Perry, has shown enhanced research applications and clinical use of the most advanced and complex magnetic resonance imaging techniques for rapid assessment and prognosis of patients.

NIF holds the world record for laser energy and power. No other facility can create the interiors of giant planets, simulate the physics of cosmic accelerators, or explore stellar nucleogenesis under realistic conditions. Recently, UC faculty led a campaign to demonstrate the precision measurement of equations of state at pressures well above previous limits.

LLNL has also worked with UC campuses and the Office of the President to establish an NNSA-sponsored high-neutral density center for matter under extreme conditions. Funding of $10.5 million will flow to UC San Diego, UCLA, UC Davis, UC Berkeley, UC Santa Cruz, and UC Irvine, as well as several other universities, to work with LLNL to understand extreme conditions achievable at NIF.

Not only is the Laboratory's mission unique due to the world-class tools needed to carry it out, but it is also unique due to its dependence on a world-class workforce of scientists and engineers, who contribute their talents behind the scenes and are sometimes isolated from the rest of their professional communities in order to work on classified projects. The quality of LLNL's workforce not only underwrites its ability to execute its mission; it also serves as guarantor of the nation's nuclear deterrent posture.

Director Goldstein acknowledged challenges in rewarding the workforce when typical metrics for measuring and validating quality and success do not necessarily fit the unique work at LLNL. In addition, stiffening competition and limits in compensation are barriers

to recruiting and retaining such world-class talent, especially in the Bay Area job market. The Laboratory's primary responsibility—ensuring the effectiveness of things that will never be used—can be a difficult selling point.

LLNL also prioritizes the opportunity for staff to participate in entrepreneurial opportunities, technology transfer activities, scientific and engineering grand challenges, and smaller-scale exploratory work that enable staff to perform high risk, high reward research and development at the cutting edge of their disciplines. This work is the seed corn for solving future problems and is a significant magnet for talent. The Laboratory espouses such values as intellectual freedom, the ability to explore new ideas, and maintaining a culture that encourages taking risks and even failing.

The University of California is a significant contributor to LLNL's success. Twenty-one percent of LLNL staff have their highest degrees from UC campuses, 55 percent of graduate students come from UC, and 21 percent of the Laboratory postdoctoral researchers earned their Ph.D. degrees at a UC campus. Furthermore, 62 percent of LLNL publications are co-authored with UC faculty and staff, and more than one-third of LLNL's university collaborations are with UC faculty.

LLNL plans to increase the presence of Laboratory scientists at UC campuses through the Livermore Ambassador Lecture Series, a new program that began this year. Laboratory scientists will be visiting campuses regularly to speak about their work on NIF, using big computers, 3D printing and new materials, searching for dark matter, measuring climate change, and other topics. Director Goldstein highlighted several of the scientists participating in the lecture series.

Tammy Ma, who grew up in Fremont, leads LLNL's X-ray analysis group in NIF. Ms. Ma received her bachelor's degree at California Institute of Technology and her master's degree and Ph.D. at UC San Diego. She was a postdoctoral researcher at LLNL and became a scientist in 2012. Already a winner of multiple awards, Ms. Ma won a DOE Office of Science Early Career Award this year.

Ben Santer joined the Laboratory in 1992 in its program for climate model diagnostics and comparison and is a pioneer in climate fingerprinting. Mr. Santer was the lead author of the climate change detection attribution chapter of the 1995 Intergovermental Panel on Climate Change Report. His accolades include receiving the MacArthur Fellowship and membership at the National Academy of sciences.

Director Goldstein also highlighted the work of Donna Strickland, who worked at LLNL in 1992 and 1993 and won the 2018 Nobel Prize in Physics. She is only the third woman Nobel Laureate in Physics. Ms. Strickland and her graduate thesis mentor, Gérard Mourou, invented chirp pulse amplification, which amplifies highest intensity, shortest laser pulses. Ms. Strickland's work at LLNL contributed to the Laboratory's first demonstration at the petawatt level, the highest level demonstrated, in 1996. This year, LLNL delivered the L3-HAPLS, the highest possible petawatt laser system, to the ELI Beamlines project in the Czech Republic.

LLNL also sends its scientists around the world in order to further threat reduction and security. Some of these locations can be dangerous. At the time of this presentation, LLNL scientists were in Adana, Turkey, training Syrian white helmet first responders sponsored by the Syrian American Medical Association to collect and preserve samples that may prove the use of chemical weapons.

Director Goldstein concluded his remarks by emphasizing the Laboratory's commitment to being an enjoyable place to work. LLNL is currently one of Glassdoor's 2019 Best Places to Work, is the number one government or government contractor employer in the nation as well as the number one laboratory employer. LLNL is the number six among U.S. large employers in the Bay Area, and, out of 100 top corporations, Glassdoor ranked LLNL the 24th best place to work.

Regent Tauscher expressed her pride in representing Livermore in her congressional district for her seven terms in Congress and noted how wonderful it was to be affiliated again through the Board of Regents. Regent Tauscher also congratulated LLNL on its accomplishments in national security, science, and being a great place to work, and she thanked Director Goldstein for his leadership.

Regent Morimoto noted that he, Regent Zettel, Regent Anderson, and Student Adviser Huang visited LLNL and were amazed by the work being done there. He commended Director Goldstein and his team for their community outreach in order to engage and inspire the next generation of science and technology leaders.

Regent Tauscher thanked Director Goldstein and looked forward to his updates in one year, and she invited him to return to speak to the Regents at any time. Regent Tauscher planned to bring more Regents to visit the Laboratory operations and to see the great work done in the Bay Area.

The meeting adjourned at 4:45 p.m.

Attest:

Secretary and Chief of Staff