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College of Engineering

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TO: **Joint Committee on Semiconductors**
Senator Janeen Sollman, Co-Chair
Representative Janelle Bynum, Co-Chair

FROM: **Scott A. Ashford**, Kearney Dean of Engineering, Oregon State University

Chairs Sollman and Bynum,

My name is Scott A. Ashford, and I am the Kearney Dean of Engineering for Oregon State University. I am here today to underscore the urgency of your action and ask that you quickly advance legislation aligned with the Oregon Semiconductor Competitiveness Task Force.

The Oregon State University (OSU) College of Engineering is the 7th largest engineering college in the nation in terms of undergraduate enrollment. We award the most computer science degrees nationwide and rank third among public universities for the percentage of women faculty. This past year we awarded 2,247 degrees to graduates that are recruited (primarily) by regional companies and many of those companies are important to the semiconductor industry - including HP, Intel, Lam Research, and Tektronix.

As Sue Richards outlined, we are asking the legislature to invest in the research mission of Oregon's public universities. This session, the task force is seeking funds to help us recruit 25 faculty and invest in their start-up packages, and OSU is requesting $75M of XI-G Bonds to complete the Huang Collaborative Innovation Complex. This investment is critical to support education and research needs. My colleague Dr. Belinda Batten described this project to this committee last week and you can refer to her written testimony.

Recruiting the most impactful and promising faculty will be extraordinarily competitive in the coming years. You can imagine every other research university will be doing the same. With the investments recommended by the semiconductor task force, we can support programs critical to the regional semiconductor industry. For example, we want to grow our efforts in sustainable semiconductor manufacturing, an area where we do have expertise and where there is an increasing need. It's important to note, that the research mission fuels discovery and areas of need drive the specific faculty recruitment, but then those faculty drive the educational mission through developing curriculum and courses that then transfer their knowledge to graduate and undergraduate students.

Investment in new faculty start-up packages is an important tool in our recruiting efforts. The start-up packages provide support to build labs, purchase equipment and recruit top graduate students.

Providing support for faculty and facilities will grow the universities' capacity to produce a skilled workforce and create opportunities for Oregonians. The students graduating from Portland State University, Oregon Tech, University of Oregon and Oregon State's engineering, computer science, and related programs are in high demand; as an example, last year over 500 companies came to campus to recruit students from our college of engineering.

If the legislature invests as recommended by the task force, I want to assure you that Oregon State, Portland State, University of Oregon and OregonTech are experienced with strategic legislative investments and delivering a positive return on investment to the state.

Twenty-five years ago, industry impressed upon the legislature the need to build engineering programs within the state. The legislature gave Oregon's public engineering and computer science programs critical support through targeted funding. These funds transformed engineering programs in the state, supported innovation, and boosted the state's economy with a competitive workforce. This historical investment through the Engineering Technology Industry Council, and now through the Engineering Technology Sustaining Fund, has:

- Tripled the number of engineering graduates in the state.
- More than tripled research expenditures.
- Successfully enabled a focus on diversifying faculty and students.

Those investments, philanthropic support, and vital research programs have placed Oregon State in a competitive position to support our industry stakeholders as they prepare their CHIPS act proposals. In the past year, we've been working with many of them to understand how higher education in Oregon can partner with them and take advantage of this historic Federal investment in the semiconductor ecosystem and driving investment to Oregon.

At Oregon State, faculty have been submitting proposals to federal agencies such as the National Science Foundation, the Department of Defense, the Department of Energy, and others who are seeking to support advanced research, workforce development, and overall efforts to advance semiconductor competitiveness in Oregon and the nation. Attached you will find a summary of our strengths directly related to the semiconductor industry and below a list of recent proposals. I will emphasize that we are known for our collaborative approach and that our reputation, experience, faculty/staff and students have placed us in a position to respond to these early opportunities.

Underscoring the pace at which we're moving, just this past week we have advanced conversations with the University of California – Berkeley and Purdue University to partner with them on pending proposals and we plan to include others such as our community college partners in the ecosystems being developed. These particular efforts underscore Oregon State's reputation for collaboration and expertise in this critical area and these efforts must be

sustained. The pressure on engineering and science programs will only intensify in the coming years as the impact of the CHIPS funding is seen. Therefore, we need investment in our students, faculty, and staff who will further align our research enterprise to respond to the mission set by the federal government.

Finally, an engineering degree is highly adaptable. The state's investment in semiconductor-based engineering programs will benefit all manufacturers and industries.

I am happy to respond to any questions, and/or follow up with the committee or with individual members of the committee.

Background Information: Current Proposals

1. **Center for Innovation Excellence**: We are collaborating with the City of Hillsboro and several other partners on a planning grant from Business Oregon to establish a Center of Innovation Excellence focused on fostering public-private, and academic partnerships focused on semiconductor innovation in Oregon.
2. **National Science Foundation Regional Innovation Engine (submitted September 2022)** This proposal to the National Science Foundation aims to develop a regional innovation ecosystem that advances use-inspired semiconductors, invents scalable nanofabrication manufacturing processes, innovates in energy-efficient, memory-centric computing architectures, increases functionality via More than Moore, develops innovative computation tools, expands innovation and entrepreneurship, and creates training programs to enable a diverse workforce.

   Among our many partners in this effort are Intel, HP, Lam Research, the University of Oregon, Boise State University and the University of Washington. We are seeking a $1 million planning grant, and if our planning grant is successful, we could seek up to $160 million over a 10-year span to complete the work and build the engine.

3. **Intel Workforce Collaboration** In a competitive process, we recently earned an impactful gift from Intel, one of our largest ever from the company. The gift aims to develop a sustainable chemical processing curriculum and support research at OSU. It will also support recruiting, retaining, and advancing underrepresented students. The gift will support:
   - Developing a new curriculum in sustainable chemical processing includes learning modules shared in an open-source format.
   - A research experience for underrepresented minority undergraduates from community colleges transferring to OSU
   - Bridge-building visits for instructors from minority-serving community colleges instructors to learn about OSU and train in Sustainable (Chemical) Processing modules

4. **NSF-INTEL Scholarship Program (S-STEM)** – Next month, we will submit a proposal for science, technology, engineering, and math scholarships. The effort supports higher education institutions to fund scholarships for academically talented low-income students. The funding will allow us to study and implement programs and activities that support the recruitment, retention, and graduation of low-income students in STEM.

COLLEGE OF ENGINEERING

OREGON STATE UNIVERSITY - SEMICONDUCTOR LEADERSHIP

The Oregon State University College of Engineering (COE) has signature programs in areas of strategic importance to the nation's semiconductor ecosystem.

AREAS OF LEADERSHIP

Creating innovative electronic materials for use in consumer electronics and next-generation sensors

Advances in electronic materials include transparent thin-film transistors that revolutionized display technology. The college is pioneering research in magnetic, dielectric, and piezoelectric materials, tunneling electronics, sensors, advanced manufacturing methods, and supply chain logistics/life-cycle analysis to influence future semiconductor device design and fabrication.

Globally recognized efforts in integrated electronics that improve computing systems and wireless communications

Our integrated electronics faculty is among the best in the world, with leading experts in analog, digital, and mm-wave circuit design for applications in computing, low-power electronics, communications, and sensing.

Collaborative research to enable the future of nanotechnology

Groundbreaking advances in semiconductor research often hinge on multidisciplinary collaborations – a notable example is the college's collaborations in nanolithography with the College of Science, which led the development of high-sensitivity resists for extreme ultraviolet patterning.

Leading programs that produce highly trained engineers and scientists for industry and research laboratories

The OSU College of Engineering is the seventh-largest engineering college in the country and is a prominent contributor to semiconductor workforce development. Today, the CoE graduates over 2,000 engineers and computer scientists per year. Many of these graduates have become part of Oregon's semiconductor and circuit manufacturing workforce, which comprises over 20% of the nation's total workforce – the highest state percentage in the country. The demand for skilled graduates in the semiconductor industry is expected to grow in Oregon by 11% by 2027. The college is committed to creating innovative academic programs to expand and diversify the workforce.

COLLABORATIVE EXCELLENCE

The college's focus on a collaborative approach broadens and amplifies the impact of its research efforts.

The Materials Synthesis and Characterization Facility (MaSC) is a multi-disciplinary resource that serves as an open-user facility and an innovation center for materials science research. The Center for Design of Analog-Digital Integrated Circuits (CDADIC) is a multi-university center that has been advancing integrated electronics technology for over 30 years. The college also participates in federally funded national collaborative centers, including the National Nanotechnology Coordinated Infrastructure (NNCI), which leverages Oregon State's semiconductor and materials fabrication capabilities and world-class characterization methods.

Our many collaborations include partnerships with semiconductor industry leaders such as HP, NVIDIA, Intel, Tektronix, Lam Research, Semiconductor Research Corporation, ASM, Qualcomm, Analog Devices, Texas Instruments, ON Semiconductor and Microchip. These partnerships lead to advances in basic and applied research while preparing the next generation of engineers and scientists, which is critical for the nation's economic security.

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