

The American Semiconductor Academy Initiative

Supplying talent and innovation for the U.S. semiconductor industry

A White Paper by the Executive Committee of the ASA Planning Team

February 1, 2022

Leadership in semiconductor "chip" design and manufacturing requires a well-trained workforce and continuous innovation. A 2017 survey conducted by Deloitte and SEMI found that 82% of semiconductor industry executives reported a shortage of qualified job candidates.¹ The challenge of finding qualified workers exists at all skill and education levels, from technicians to doctoral-level engineers. In order to sustain and grow domestic invention and production of chip technologies, the U.S. needs to make substantial investments in both **soft** infrastructure (human and digital resources) and **hard** infrastructure (equipment and facilities) for a resilient domestic semiconductor ecosystem. Modernization of educational curricula and research & training facilities is needed to complement industry investments in advanced development and manufacturing. Therefore we propose the establishment of a nationwide semiconductor education & training network of universities and colleges - hereinafter referred to as the American Semiconductor Academy (ASA) - geographically distributed across the U.S. and organized into Western, Central, and Eastern Regions, to

- increase and broaden access to education and training leading to technical careers in the semiconductor industry, filling the pipeline of talent for U.S. semiconductor companies, and
- facilitate the commercialization of innovations that originate in university research labs, to ensure that leading-edge chip products will always be manufactured first in the U.S.

Specifically, to achieve these goals:

1. An up-to-date and comprehensive curriculum in integrated circuits and systems, semiconductor materials and devices, and microfabrication technology will be developed in **partnership with the semiconductor industry** and shared across the ASA network, to facilitate education of a broad diversity of undergraduate and graduate students, to prepare them to enter the U.S. semiconductor workforce;
2. Hands-on training (**tech apprenticeships**) in semiconductors and integrated circuits, microfabrication, and wafer processing tools will occur at "hub" universities in each of the U.S. Regions, that are equipped and staffed to support this training. These facilities will be accessible to all students who have completed prerequisite ASA courses. Students who complete necessary ASA courses and training will be well prepared for industrial internship opportunities.
3. Wafer-scale prototyping of both new and technologically important materials, processes and devices will occur at "hub" universities to demonstrate their system-level benefits and suitability for high-volume manufacturing, to **speed the translation of innovations "from lab to fab."**

¹ Chris Richard, Karthik Ramachandran, and Ivan Pandoy. Deloitte and SEMI. [2017 SEMI-Deloitte Workforce Study](#). (2017).

To tap into the “missing millions” of talented individuals in the U.S., the ASA will be diverse and inclusive by design:

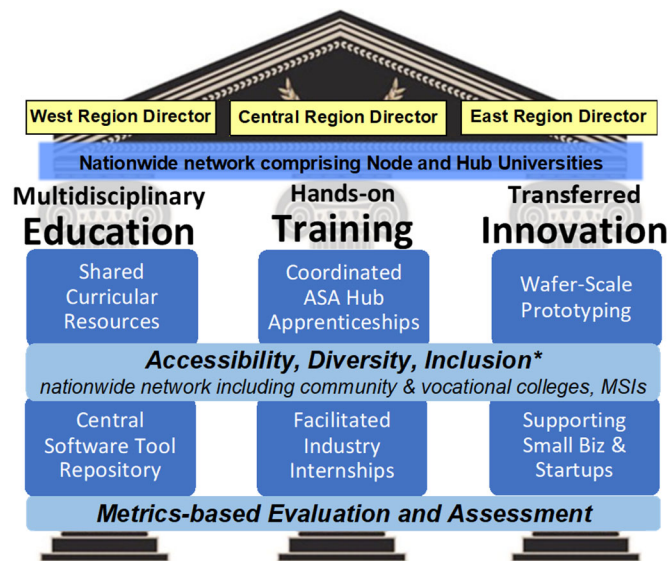
*At least 20% of the participating universities should be minority-serving or R2 institutions, and each university should have at least one community or trade-college partner to facilitate student transfer to the university or directly to the semiconductor industry.

Also, to ensure a robust semiconductor workforce in the coming decades, it is critical to build a pipeline of students interested in STEM – and in semiconductors in particular – at the primary and secondary level. (High-profile scientific and technical challenges like the Space Race and the Human Genome Project inspired generations of young students to learn about space and biology and ultimately to pursue careers in aerospace and biotechnology.) Therefore the ASA also will develop K-12 lessons about the importance of semiconductors for society, grade level-appropriate hands-on activities, teacher programs, and invited speaker programs to inspire future generations of talent for the semiconductor industry.

The ASA should have appropriated funding to support curriculum development and dissemination, new faculty hiring, student scholarships and fellowships, industry internships, as well as equipment and facilities upgrades and all operational costs of hands-on workforce training at ASA universities and colleges. We estimate that for each \$100M per year invested, up to 2000 additional trained graduates (AA, BS, MS and PhD degrees) will be produced for the semiconductor industry annually.

The Semiconductor Industry Association estimates that \$50B invested by the federal government will result in 42,000 new jobs in semiconductor manufacturing over 5 years, leading to a total of 280,000 new jobs in the U.S. economy.² Only a neutral, broad and inclusive network of universities and colleges – the ASA – can sustainably meet this growing workforce development need with **speed and scale**.

Measures of success for the ASA include (i) increase in the number and diversity of students enrolled in microelectronics courses at participating universities, and (ii) increase in the number and diversity of graduates hired into the semiconductor industry.



² https://www.semiconductors.org/wp-content/uploads/2021/05/SIA-Impact_May2021-FINAL-May-19-2021_2.pdf

Appendix

Executive Committee of the ASA Planning Team

- Prof. Tsu-Jae King Liu (Chair), University of California, Berkeley
- Prof. John Dallesasse, University of Illinois at Urbana-Champaign
- Prof. Stephen Goodnick, Arizona State University
- Prof. Quanxi Jia, State University of New York at Buffalo
- Prof. Mark Lundstrom, Purdue University
- Prof. Kang Wang, University of California, Los Angeles

Universities and Colleges Represented on the ASA Planning Team

as of February 1, 2022

WEST REGION		CENTRAL REGION		EAST REGION	
Arizona State Univ.		Alabama A & M University (HBCU)		Brown Univ.	
Boise State Univ. (R2)		Ohio State University		Columbia Univ.	
Cal Poly San Luis Obispo		Purdue Univ.		Cornell Univ.	
California State Univ. Fullerton (HSI)		Saint Mary's College (Women's)		Dartmouth College	
Colorado School of Mines (R2)		Southern Methodist Univ. (R2)		Florida International Univ. (HSI/R2)	
Idaho State Univ. (R2)		Univ. of Arkansas		Harvard Univ.	
New Mexico State Univ. (HSI/R2)		Univ. of Illinois at Chicago (HSI)		Howard Univ (HBCU/R2)	
Northern Arizona Univ. (R2)		Univ. of Illinois at Urbana-Champaign		Massachusetts Institute of Technology	
Northwest Nazarene Univ.		Univ. of Michigan, Ann Arbor		Morgan State Univ. (HBCU/R2)	
Oregon State Univ.		Univ. of Missouri, Columbia		Norfolk State Univ. (HBCU)	
San Jose State Univ. (HSI)		Univ. of Notre Dame		North Carolina State Univ.	
Stanford Univ.		Univ. of Texas at Austin		Pennsylvania State Univ.	
Univ. of California, Berkeley		Univ. of Texas at Dallas		Rochester Institute of Technology (R2)	
Univ. of California, Davis (AANAPISI)		Univ. of Texas at El Paso (HSI)		State Univ. of New York at Buffalo	
Univ. of California, Irvine (HSI)		Univ. of Wisconsin - Madison		Univ. of District Columbia (HBCU)	
Univ. of California, Los Angeles				Univ. of Maine (R2)	
Univ. of California, Riverside (HSI)				Univ. of Massachusetts Boston (AANAPISI)	
Univ. of California, San Diego					
Univ. of California, Santa Barbara (HSI)					
Univ. of Southern California					
Univ. of Washington					
Community Colleges		Community Colleges		Community Colleges	
Bellevue College, WA		El Paso Community College, TX		Bristol Community College, MA	
Chabot College, CA		Parkland College in Champaign, IL		Bunker Hill Community College, MA	
Chemeketa Community College, OR		Collin County Community College		Carolina Central community college, NC	
College of Eastern Idaho, OR		College of DuPage, IL		Corning Community College, NY	
College of Marin, CA		Columbus State Community College		Durham Technical community college, NC	
College of Western Idaho, ID		Austin Community College, TX		Erie Community College, NY	
DeAnza College, CA		Ivy Tech Community College (Lafayette), IN		Harrisburg Area Community College, PA	
Dofia Ana Community College, NM		Ivy Tech Community College South Bend/Elkhart), IN		UDC community college, DC	
Estrella Mountain Community College, AZ		Madison College, WI		Hudson Valley community college, NY	
Foothill College, CA		Moberly Area Community College, MO		Miami Date College, FL	
Irvine Valley College, CA		NorthWest Arkansas Community College, AK		Middlesex Community College, MA	
Lewis and Clark State College, ID		Richard J. Daley College, IL		Monroe Community College, NY	
Linn-Benton Community College, OR		Washtenaw Community College, MI		New York City College of Technology, NY	
Los Angeles Trade-Technical College, CA				Northern Virginia Community College, VA	
Mesa Community College, AZ				Prince George's Community College, DC	
Ohlone College, CA				Roxbury Community College, MA	
Red Rocks Community College, CO				Southern Maine Community College, ME	
Riverside Community College, CA				Tidewater Comm College, VA	
Santa Barbara Community College, CA				Tompkins Cortland Community College, NY	
Santa Monica City College, CA					