SUNY College of Nanoscale Science and Engineering

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BACKGROUNDER

SUNY's College of Nanoscale Science and Engineering (CNSE) was created in response to the rapid changes in the national and international educational and research landscape resulting from the emergence of nanotechnology as the primary enabler for discovery, innovation, and education in science and engineering in the 21st century. The essence of nanotechnology is the ability to control the formation and assembly of individual building blocks of matter at the molecular level, atom by atom, to form macro-scale physical, biological, and chemical systems with customized properties and precise functionalities. As such, nanotechnology has literally transformed and reshaped traditional science and engineering disciplines: chemistry, physics, electrical engineering, mechanical engineering, materials science and engineering, molecular biology, and computer science.

The importance of nanoscale know-how to the U.S. research and pedagogical agendas is best captured in the multi-billion dollar National Nanotechnology Initiative (NNI), signed into law by the U.S. President in 2004, which proclaims nanotechnology as "leading to the next industrial revolution." The NNI also calls for the creation of the "laboratory and human resource infrastructure in universities and in the education of nanotechnology professionals" to prepare future generations of U.S. citizens to compete in the global economy of the 21st century.

These conclusions are echoed by the U.S. Commission on National Security/21st Century in its Report entitled "Roadmap for National Security: Imperative for Change." The report states that: "We also face an unprecedented opportunity. The world is entering an era of dramatic progress in bioscience and materials science as well as information technology and scientific instrumentation. Brought together and accelerated by nanoscience, these rapidly developing research fields will transform our understanding of the world and our capacity to manipulate it."

Investment in CNSE's revolutionary paradigm blending academic excellence, world-class research and transformational economic impact dates back to 1993, when Governor Mario M. Cuomo designated Professor Alain Kaloyeros' Materials Physics Program as a Center for Advanced Technology (CAT), providing $10 million in funding to enable leading-edge research on the next generation of computer chip technologies. In 2004, CNSE was created as "the first of its kind in the country – to provide our industry with the high quality workforce it needs to grow in New York State." Subsequently, the UAlbany President recommended and the SUNY Board of Trustees (BOD) unanimously approved in April 2004 the creation of the College of Nanoscale Science and Engineering (CNSE) as a UAlbany academic unit. As stated in the SUNY BOD resolution, the overarching mission of CNSE is to "enable the discovery and dissemination of fundamental knowledge in the emerging interdisciplinary fields of nanotechnology and provide the citizens of New York with a comprehensive education of the highest quality."

In May 2006, just two years after its formation, CNSE was named by leading industry trade publication Small Times magazine as the nation's number one college for nanotechnology, rated first overall among all colleges and universities in the United States, as well as number one in the

areas of education, facilities and industrial outreach. In May 2007, CNSE was ranked by Small Times as the world's number one college for nanotechnology, rated first overall among all colleges and universities in the world, as well as number one in the areas of education and facilities, receiving the highest five-star rankings in each category.

At the same time, CNSE has built the world's first "nano mall" known as CNSE's Albany NanoTech Complex. With more than $20 billion in high-tech investments, it serves as the hub of the world's most advanced university-driven research enterprise, offering students a one-of-a kind academic experience and providing over 300 corporate partners with access to an unmatched ecosystem for leading-edge R&D and commercialization of nanoelectronics and nanotechnology innovations. CNSE's footprint spans upstate New York, including its Albany NanoTech Complex, a 1.3 million-square-foot megaplex with the only fully-integrated, 300mm and 450mm wafer, computer chip pilot prototyping and demonstration line within 140,000 square feet of Class 1 capable cleanrooms. More than 3,100 scientists, researchers, engineers, students and faculty work here, from companies including IBM, Intel, GlobalFoundries, SEMATECH, Samsung, TSMC, Applied Materials, Tokyo Electron, ASML and Lam Research.

In September 2011, Governor Andrew M. Cuomo announced a $4.8 billion investment to develop a new era of computer chip technology in New York, highlighted by creation of the world's first Global 450 Consortium (G450C), headquartered at and managed by CNSE, through which Intel, IBM, Samsung, GlobalFoundries and TSMC will work collaboratively to lead the industry transition from 300mm wafer to 450mm wafer production.

In addition, CNSE's Solar Energy Development Center in Halfmoon provides a prototyping and demonstration line for next-generation CIGS thin-film solar cells and supports CNSE's leadership of the U.S. Photovoltaic Manufacturing Consortium (PVMC). CNSE's Smart System Technology and Commercialization Center of Excellence (STC) in Rochester offers state-of-the-art capabilities for MEMS fabrication and packaging. The CNSE Photovoltaic Manufacturing and Technology Development Facility (CNSE MDF), also in Rochester, is the solar industry's first full-service collaborative facility dedicated to crystalline silicon. CNSE also co-founded and manages operations at the Computer Chip Commercialization Center (QUAD-C) at SUNYIT and is lead developer of the Marcy Nanocenter site in Utica, and is partnering with AMRI and the Buffalo Niagara Medical Campus to develop the Medical Innovation and Commercialization Hub in Buffalo.

And, in partnership with SEMATECH, CNSE leads and serves as headquarters for the $400 million U.S. Photovoltaic Manufacturing Consortium (PVMC), an industry-led collaboration created through the U.S. Department of Energy's (DOE) SunShot initiative to accelerate next generation PV technologies, with a goal of reducing the total installed cost of solar energy systems by 75 percent over the next decade.

Timeline of Major Milestones – SUNY College of Nanoscale Science and Engineering

1988

- July: Governor Mario M. Cuomo recruits Alain Kaloyeros under the SUNY Graduate Research Initiative
- September: National Interconnect Focus Center in Interconnect Technologies is established in partnership with Stanford, Georgia Tech, MIT and RPI

1993

- May: Governor Mario M. Cuomo designates Alain Kaloyeros' Materials Physics Program as a Center for Advanced Technology

2001

- School of Nanosciences and Nanoengineering at UAlbany is established
- April: $150M Center of Excellence in Nanoelectronics and Nanotechnology (CENN) is announced

2002

- July: $405M International SEMATECH North center is announced
- November: $300M Tokyo Electron Ltd. Technology Center, America (TTCA) is announced
- November: Groundbreaking for $50M NanoFab South Building

2003

- April: Groundbreaking for $175M NanoFab North Building

2004

- January: Creation of the College of Nanoscale Science and Engineering (CNSE) of the University at Albany
- December: CNSE awards the world's first Ph.D. degrees in Nanoscience

2005

- January: CNSE chosen to lead national Center for Advanced Interconnect Science and Technology (CAIST) research program
- April: ASML establishes $400M International Multiphase Program for Lithography Science and Engineering (IMPLSE) research center at CNSE
- May: Announcement of $500M Center for Semiconductor Research

- July: Announcement of $600M International Venture for Nanolithography (INVENT) Program
- September: Announcement of $300M Applied Materials Research Center

2006

- January: Announcement of $435M Institute for Nanoelectronics Discovery and Exploration (INDEX) Program
- May: CNSE ranked nation's number one college for nanotechnology
- June: AMD announces plan to build computer chip fab in Luther Forest
- October: Vistec Lithography relocates headquarters from Cambridge, England to Watervliet Arsenal, R&D operations to CNSE

2007

- May: International SEMATECH agrees to locate its headquarters at CNSE
- May: CNSE ranked #1 college worldwide for micro- and nanotechnology for second straight year

2008

- February: Prestigious Global Nanoelectronics Research Consortium (NY-CAIST) awarded to CNSE
- April: CNSE and National Institute of Standards and Technology (NIST) announce partnership for the New York Center for National Competitiveness in Nanoscale Characterization (NC3)
- July: IBM and New York State announce $1.6B investment in packaging center at CNSE

2009

- March: Opening of $150M NanoFab East Building
- June: UAlbany NanoCollege launches the world's first comprehensive undergraduate degree program in Nanoscale Science
- July: $226M Computer Chip Hybrid Integration Partnership (CHIP) initiative in Utica, NY between SUNYIT, UAlbany NanoCollege and leading computer chip firms is announced

2010

- February: M+W Group announces relocation of U.S. Headquarters to Watervliet Arsenal from Dallas, Texas
- March: NYSERDA announces $1.5 million award to establish "iCLEAN" Clean Energy Incubator at CNSE
- September: CNSE leads creation of $250M Nanotechnology Innovation and Commercialization Excelerator (NICE) at Electronics Park in Syracuse, NY

- September: New York State announces $10M initiative to merge Infotonics Technology Center in Canandaigua with CNSE
- October: International SEMATECH Manufacturing Initiative (ISMI) to relocate its headquarters and operations to CNSE, completing move of SEMATECH from Austin, Texas to CNSE
- October: Moser Baer Technologies and CNSE's Smart System Technology & Commercialization Center in Canandaigua launch global partnership to establish pioneering clean energy facility
- October: Groundbreaking at SUNYIT to drive nanotechnology education, research and economic development in the Mohawk Valley

2011

- February: SEMATECH, ISMI and UAlbany NanoCollege partner to launch groundbreaking NanoHealth and Safety Center at CNSE
- March: UAlbany NanoCollege and SUNY Downstate Medical Center partner to launch the world's first M.D./Ph.D. program for research physicians in nanoscale medicine
- April: U.S. Department of Energy awards record $57.5M grant to CNSE to establish U.S. Photovoltaic Manufacturing Consortium (PVMC)
- September: Governor Andrew M. Cuomo announces $4.8B investment by international technology group led by Intel and IBM, and New York State, to develop next-generation computer chip technology in New York
- September: Construction begins on NanoFab Xtension (NFX), a $365 million, 280,000-square-foot expansion of CNSE's Albany NanoTech Complex
- October: UAlbany NanoCollege launches Solar Energy Development Center in Halfmoon, NY to accelerate commercialization of innovative photovoltaics technologies

2012

- April: NYSDOT begins highway improvements to ease congestion, support growth at UAlbany NanoCollege
- April: Governor Andrew M. Cuomo announces CNSE's STC Center in Canandaigua has been granted "Trusted Foundry" status by Department of Defense
- May: President Barack Obama visits CNSE, declares, "You have an outstanding university. Now I want what's happening in Albany to happen across the country."
- May: SEFCU, UAlbany NanoCollege and Girls Inc. announce launch of the nation's first nanotechnology-based Eureka!® program
- July: Spurring nanotechnology-driven economic growth in downtown Albany, CHA, Trinity Alliance and UAlbany NanoCollege Announce Partnerships to establish City of Albany as emerging hub for 'smart cities' technologies
- August: Governor Cuomo announces $20 million partnership between SUNY College of Nanoscale Science and Engineering and Ceres Technologies in Ulster County

- September: Three New York schools earn first-ever Innovation Awards as UAlbany NanoCollege & State School Boards Association partner for statewide technology competition
- December: UAlbany NanoCollege awarded $4M in funding through Governor Cuomo's Regional Economic Development Council Initiative to lead revitalization of Kiernan Plaza in downtown Albany as hub for 'smart cities' technologies
- December: UAlbany NanoCollege awarded $1M in funding through Governor Cuomo's Regional Economic Development Council initiative to launch design phase for the world's first zero energy nanotechnology building

2013

- February: SUNY NanoCollege and Children's Museum of Science and Technology announce agreement for CMOST to become part of CNSE
- February: Governor Cuomo announces Tech Valley High School® and SUNY NanoCollege form educational partnership, including co-location at CNSE, to prepare students for high-tech future
- March: Governor Cuomo Announces International Partnership Between New York State and the State of Israel to Grow the Nanotechnology Industry
- April: Governor Cuomo Announces New State-of-the-Art Data Center at SUNY's College of Nanoscale Science and Engineering
- July: SUNY to Establish Pioneering College of Nanoscale Science & Engineering As Separate Institution Within the SUNY System
- July: Governor Cuomo Announces SUNY's College of Nanoscale Science and Engineering Will Transform Former Kodak Building in Rochester into Solar Manufacturing and Technology Development Center
- July: U.S. Secretary of Commerce Penny Pritzker visits SUNY’s College of Nanoscale Science and Engineering to see firsthand the success of New York’s nanotechnology industry
- August: Governor Cuomo announces SUNY College of Nanoscale Science and Engineering acquires landmark Kiernan Plaza to establish hub for 'smart cities' technologies
- September: Governor Cuomo announces initial partners to locate at SUNY College of Nanoscale Science and Engineering's 'Smart Cities' hub at iconic Kiernan Plaza
- September: SUNY College of Nanoscale Science and Engineering and Mohawk Valley EDGE announces an expanded partnership through which CNSE will lead development of the Marcy Nanocenter site in Utica by serving as the site end user.
- September: Three schools honored with Innovation Awards in statewide competition presented by SUNY College of Nanoscale Science and Engineering & New York State School Boards Association

- September: Governor Cuomo announces NY HEALS initiative that brings together top researchers from public and private institutions to prevent, treat and cure a variety of diseases

- October: Governor Cuomo announces 'Nano Utica' $1.5 billion public-private investment that will make the Mohawk Valley New York's next major hub of nanotech research

- November: Governor Cuomo Announces New York State to Build High-Tech Manufacturing Complex in Buffalo

2014

- February: Governor Cuomo Announces First Construction Milestone for $1.5 Billion Nano Utica Initiative