

## **BACKGROUND**

The College of Nanoscale Science and Engineering (CNSE) of the University at Albany-SUNY (UAlbany) 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 21<sup>st</sup> 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 21<sup>st</sup> century.

These conclusions are echoed by the U.S. Commission on National Security/21<sup>st</sup> 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.

In response to these strategic needs, Governor George E. Pataki called on SUNY in his 2004 State of the State Address to create CNSE 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, as well as second in commercialization and sixth in research, up from eighth last year.

At the same time, CNSE has built the world's first "nano-mall" known as CNSE's Albany NanoTech Complex. CNSE's Albany NanoTech Complex is the most advanced research and development complex of any university in the world, with a current net asset base of \$5 billion located within 800,000 square feet of state-of-the-art facilities, including 80,000 square feet of Class 1 capable 300mm wafer cleanrooms. CNSE's Albany NanoTech Complex is also home to more than 2,500 scientists, researchers, engineers, and technicians – a sharp increase from 72 technical personnel employed on-site in 2001 – from many of the world's leading nanoelectronics companies, such as IBM, AMD, GLOBALFOUNDRIES, SEMATECH, Toshiba, Applied Materials, Tokyo Electron, ASML, Novellus Systems, Vistec Lithography and Atotech, among many others. CNSE works with over 250 corporate partners from around the world.

### **Timeline of Milestones**

Below is a chronological timeline of the milestones, and events, and actions that led to the creation of CNSE, including pertinent initiatives of CNSE and its Center of Excellence in Nanoelectronics and Nanotechnology (CENN) at the University at Albany-SUNY.

#### **January 2001: Announcement of NYS Center of Excellence Program**

Governor Pataki unveils the Center of Excellence program in his 2001 State of the State address, highlighting the nanotechnology CoE in Albany, the bioinformatics CoE in Buffalo and the infotonics CoE in Rochester.

#### **April 2001: Announcement of \$150M Center of Excellence in Nanoelectronics and Nanotechnology at UAlbany**

Governor Pataki, Speaker Silver, Majority Leader Bruno and IBM launch the Center of Excellence in Nanoelectronics and Nanotechnology at UAlbany with \$150 million in funding, \$100 million from IBM and \$50 million from New York State.

#### **July 2002: Announcement of \$405M International SEMATECH North program**

Governor Pataki, Speaker Silver, Majority Leader Bruno and SEMATECH announce the creation of the \$405 million International SEMATECH North Center at the Albany CoE. SEMATECH, a global semiconductor technology development consortium, is the leading and most powerful consortium for the international nanoelectronics industry. It has effectively represented the nanoelectronics manufacturing industry on innovation issues since its creation in Austin, Texas in 1987.

SEMATECH conducts and sponsors state-of-the-art research, and has extensive experience collaborating with equipment and materials suppliers, as well as government and academic research centers, to refine the manufacturing tools and technology necessary to produce future generations of computer chips. SEMATECH's member companies are IBM, Intel, Freescale, Hewlett-Packard, Texas Instruments, Advanced Micro Devices, Philips (Netherlands), Infineon Technologies (Germany), Panasonic (Japan), Renesas (Japan), Samsung (Korea), Spansion, and TSMC (Taiwan). ISMTN was created as a joint SEMATECH-CENN partnership to pursue four principal objectives:

- Maximize leverage of nanoelectronics industry and New York investments to pursue cooperative programs, which significantly benefit the global nanoelectronics industry by contributing to the realization of the International Technology Roadmap for Semiconductors;
- Engage in nanoelectronics R&D and manufacturing infrastructure programs that enhance efficiency through a joint cooperative program and through alignment of separate, individual efforts to the strategic alliance;
- Bring world-class private consortium nanoelectronics R&D activities to New York, where essential resources and cutting-edge facilities are readily available, with the goal of drawing critical nanoelectronics and high technology industry to the state; and,
- Work in technical areas of this strategic alliance jointly and individually with other entities in the United States, Europe and Asia, which may include universities, semiconductor producers, equipment and material suppliers, national laboratories, research institutes, government agencies, associations and other consortia, with the specific objective to maximize the utilization New York State contractors where technically feasible.

### **November 2002: Announcement of Groundbreaking for \$50M NanoFab 300 South**

Governor Pataki, Speaker Silver, Majority Leader Bruno announce the groundbreaking for NanoFab 300S (NFN 300S) at the Albany CoE. NFN 300S is a three-story, 150,000-square-foot building that was completed in October 2004 at a brick and mortar cost of \$50M, including 32,000 square feet of Class 1 capable 300mm wafer cleanroom space. NFN 300S is dedicated to providing state-of-the-art office, virtual classroom, conferencing, laboratory, cleanroom space, and business incubation space to support the R&D, education, and technology development and deployment for the CENN and its corporate partners. Pertinent infrastructure includes a sloped/tiered floor 250-seat auditorium with "virtual classroom" capabilities throughout for internet-based distributed learning programs, in addition to six fully electronic classrooms also equipped for long distance educational delivery capabilities. Currently, NFN 300S houses the strategically selected mix of small, medium, and large nanoelectronics corporate partners of CNSE – including IBM, TEL, Applied Materials, Infineon, Advanced Micro Devices, SONY, Toshiba, Micron, and International SEMATECH. NFN 300S also houses the management, administrative, operational, and outreach operations of the CENN.

### **November 2002: Announcement of \$300M Tokyo Electron Ltd. R&D Center**

Governor Pataki, Speaker Silver, Majority Leader Bruno and Tokyo Electron (TEL) announce the \$300M TEL Technology Center America at the Albany CoE. The establishment of the TTCA represents TEL's only R&D facility located outside of Japan and involves the installation of the complete spectrum of alpha- and beta-type TEL manufacturing tools, placement of TEL researchers and engineers from Japan, Europe, and the U.S., and joint R&D activities on a variety of advanced computer chip programs - with emphasis on future generations of computer chip wiring technologies. As such, the TTCA represents a showcase for "in-sourcing" of high-tech jobs, wherein high-tech, high-paying jobs are moving into the U.S. (New York) from overseas.

### **April 2003: Groundbreaking for \$175M NanoFab 300 North**

Groundbreaking takes place for NanoFab 300 North (NFN 300N) at the Albany CoE. NFN 300 is a three-story, 250,000 square feet building that was completed in December 2005 at a brick and mortar cost of \$175M, including 35,000 square feet of Class 1 capable, ballroom style, 300mm wafer cleanroom space and 35,000 square feet of clean sub-cleanroom space. NFN 300N was configured to primarily house the CoE's Center for Semiconductor Research (CSR). The CSR (see below) is the only center of its kind at any university in the world to be equipped with the complete spectrum of 300mm wafer equipment and capabilities to support the design, modeling, fabrication, testing, prototyping, rapid turn-around and workforce training resources of a fully integrated, 300mm wafer processing line targeting the 45nm computer chip device node and beyond. To that end, the CSR has capacity for experimenting with multiple processes and integration of hybrid nanomaterials, nanoscale architectures, nanodevices and emerging system-on-a-chip (SOC) applications. The CSR is also equipped with instructional tools dedicated to meet the needs of the educational and workforce training programs of the SNN. NFN 300N also houses a cutting edge IBM RS-6000 Supercomputer Cluster, equipped with the latest commercially available software packages for the design and performance simulation of monolithic and hybrid optoelectronic, electro-optic, and photonic computer chips.

### **August 2003: Infineon launches research partnership**

One of world's largest computer memory corporations, Infineon (now Qimonda), partners with the Albany CoE and locates operations and researchers in NFN 300S. The Infineon decision represents yet another showcase for "in-sourcing" of high-tech jobs, wherein high-tech, high-paying jobs are moving into the U.S. (New York) from overseas.

### **January 2004: Announcement of College of Nanoscale Science and Engineering**

Governor Pataki announces the creation of UAlbany's College of Nanoscale Science and Engineering (CNSE) in his 2004 State of the State Address. CNSE is the first college in the world that is fully dedicated 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."

### **June 2004: Honeywell launches research partnership**

One of world's largest chemical, material and sensor corporations, Honeywell, partners with the Albany CoE and locates operations and researchers in NanoFab 200. The Honeywell-CoE partnership is designed to support the retention and expansion of Honeywell's Buffalo operations. The latter include R&D and pilot production, and employ over 120 high tech scientists and researchers.

### **January 2005: Announcement of \$400M IMPLSE Center/IBM-led Fishkill Chip Fab**

Governor Pataki announces in his 2005 State of the State address that ASML has located a \$400 million R&D center at the Albany CoE to develop nanoscale lithography technologies for future generations of nanochips - the International Multiphase Partnership for Lithography Science and Engineering (IMPLSE). The establishment of the ASML R&D Center represents ASML's only 300mm wafer R&D facility located outside of its main headquarters in the Netherlands, and involves the installation of the complete spectrum of alpha- and beta-type ASML lithography tools, placement of ASML researchers and engineers from Europe and the U.S., and joint R&D activities on a variety of advanced computer chip programs - with emphasis on future generations of lithography technologies. As such, the ASML R&D Center represents another showcase for "in-sourcing" of high-tech jobs, wherein high-tech, high-paying jobs are moving into the U.S. (New York) from overseas.

At the same time, the Governor announces that an IBM-led venture including SONY, AMD, and Infineon have pledged \$1.9 billion toward construction of a new 380,000-square-foot chip manufacturing facility in Fishkill that will partner with the Albany CoE on the development and manufacturing of future generations of nanochips.

### **January 2005: CNSE chosen to lead CAIST national research effort**

Semiconductor Research Corporation, the premier funding agency that supports basic nanoelectronics research on behalf of the entire U.S. semiconductor industry, designates CNSE as the headquarters and lead of its Center for Advanced Interconnect Science and Technology (CAIST). The CAIST 18 university participants include, in addition to the UAlbany CNSE, Binghamton University, Columbia University, Cornell University, Georgia Institute of Technology, Harvard University, Purdue University, Rensselaer Polytechnic Institute (RPI), SUNY Stony Brook, University of Arizona, University of California at Berkeley, University of Central Florida, University of Maryland, University of Rochester, and the University of Texas at Austin. The mission of CAIST is to bring together a critical mass of intellectual capital and state-of-the-art infrastructure to implement a multi-phased basic science strategy to address medium range computer chip challenges.

### **May 2005: Announcement of \$500M Center for Semiconductor Research**

The Albany CoE is selected as home of the \$500 million Center for Semiconductor Research (CSR). The CSR is a long-term, multi-phase, joint R&D cooperative program on future computer chip technology nodes beginning with the 32nm computer chip device node. Industry partners

within the CSR include IBM, Advanced Micro Devices, SONY, Toshiba, Tokyo Electron, and Applied Materials. The CSR is truly unique in the academic world in two respects: (a) it is the only center within a university setting that provides full vertical integration of the design, modeling, fabrication, testing, and pilot-prototyping capabilities required to produce the nanochips of the future, beginning with a blanket silicon wafer and ending with workable nanochip demonstration vehicles, and (b) it represents the first time in history that a university "has been placed in the critical path of technology development and deployment" of a high tech corporation.

### **July 2005: Announcement of \$500M+ INVENT Program**

Speaker Silver, Governor Pataki and Senator Bruno announce the creation of the International Venture for Nanolithography (INVENT) initiative at the Albany CoE. INVENT is a global, \$500 million+ industry-university consortium for R&D, education and technology deployment for future nanolithography applications. Industry partners include IBM, Infineon, Micron, Advanced Micro Devices, Corning, Honeywell, and many others.

### **September 2005: Announcement of \$300M Applied Materials Research Center**

The Applied Materials (AMAT) \$300 million research center is established at the Albany CoE. The establishment of the AMAT R&D Center represents AMAT's only R&D facility located outside of its main headquarters in San Jose, California and involves the installation of the complete spectrum of alpha- and beta-type AMAT tools, placement of AMAT researchers and engineers from Europe, Israel, and the U.S., and joint R&D activities on a variety of advanced computer chip programs -with emphasis on future generations of computer chip device technologies. As such, the AMAT R&D Center represents another showcase for "in-sourcing" of high-tech jobs, wherein high-tech, high-paying jobs are moving into the U.S. (New York) from overseas.

### **January 2006: Announcement of \$435M INDEX Program**

Governor Pataki, Speaker Silver, Majority Leader Bruno announce the location of the \$435 million Institute for Nanoelectronics Discovery and Exploration (INDEX) at the UAlbany CNSE. Funded jointly by the U.S. semiconductor industry and federal funding agencies, the INDEX university participants include, in addition to the UAlbany CNSE, Harvard, Yale, MIT, Purdue, Georgia Tech, and RPI. The mission of INDEX – funding for which has now grown to about \$500 million – is to design and demonstrate new computer chip transistor paradigms that will replace the current conventional transistor architecture as the technological and business driver of the nanoelectronics industry in the 21<sup>st</sup> century.

### **January 2006: Announcement of NanoFab 300 East/NanoFab 300 North expansion**

Governor Pataki, Speaker Silver, Majority Leader Bruno announce the selection of Keenan Development, LLC as the developer of a new 350,000 sq. ft. facility at the Albany CoE. The new facility, NanoFab 300 East (NFN 300E), will be completed in early 2009 at a brick and mortar cost of \$150M, and will be entirely funded through private financing. NFN 300E will be

dedicated to providing additional state-of-the-art office, virtual classroom, conferencing, laboratory, and business incubation space to support the R&D, education, and technology development and deployment of CNSE and its corporate partners. In addition, it will include 15,000 square feet of Class 1 capable, ballroom style, 300mm wafer cleanroom space and 15,000 square feet of clean sub-cleanroom space to support the expansion of the R&D operations of the Albany CoE.

Once NFN 300E is completed, the CNSE complex will reach more than 800,000 square feet with over 80,000 square feet of Class 1 capable cleanroom, and will support over 2,500 researchers and scientists by mid-2009.

### **January 2006: SEMATECH opens \$50M EUV Resist Test Center**

SEMATECH expands its Albany CoE commitments with a \$50 million research center within the International SEMATECH North consortium to focus on extreme-ultraviolet lithography. At the same time, SEMATECH announces a downsizing in its operations, including reducing its workforce by 15%, in Austin Texas.

### **May 2006: CNSE ranked nation's number one college for nanotechnology**

CNSE is selected as the premier college in the country in nanotechnology and microtechnology, according to the annual University Rankings released by *Small Times* magazine, the world's leading trade publication covering the nanotechnology and microtechnology industries. CNSE was ranked first overall among all US colleges and universities, as well as number one in the areas of education, facilities and industrial outreach, receiving the highest five-star rankings in each category from *Small Times*. CNSE was also ranked eighth in the nation in research, ahead of most of the major U.S. universities. This recognition is especially noteworthy given that CNSE was formed just over two years ago.

### **June 2006: AMD announces plan to build computer chip fab in Luther Forest**

AMD announces plans to build a \$3.2 billion computer chip fabrication plant in Saratoga County using 300mm technology, projected to employ 1,200. This major step toward attracting even further investment represents the largest public-private investment in New York State history. The Albany CoE is credited by AMD as a critical enabling component in its decision. AMD also announces that its research activities at the Albany CoE will feed the new plant with technological breakthroughs that will drive its competitive manufacturing protocols.

### **October 2006: Vistec Lithography to relocate from England to Watervliet, establish R&D operations at CNSE**

Speaker Silver and Assemblyman Ron Canestrari announce the NYS Assembly will provide \$30 million toward the relocation of Vistec Lithography Inc.'s global headquarters, R&D, manufacturing and business operations from Cambridge in the United Kingdom to the Arsenal Campus in Watervliet. Vistec will also establish joint R&D operations at CNSE under a newly created Center for Nanolithography Development.

### **January 2007: CNSE, Einhorn Yaffee Prescott partner to create National Institute for Sustainable Energy**

CNSE and EYP announce the creation of a world-class center for zero energy and sustainability to serve as both a catalyst for energy technology innovations and as a magnet for the attraction of clean energy businesses and industries to the Capital Region and New York State. EYP will locate its new business group, EYP/energy – including 15 EYP executives, managers, architects, designers and engineers – at CNSE's Albany NanoTech complex as part of the \$3.5 million National Institute for Sustainable Energy (NISE).

### **February 2007: CNSE reports world's first exposed images using ASML EUV R&D lithography tool**

Less than six months after taking delivery of the world's first full-field extreme ultraviolet (EUV) research and development tool, CNSE announced that it produced the world's first exposed images while using the tool in a development environment. The production of images from the EUV tool supports the R&D programs of the \$600M International Venture for Nanolithography (INVENT), a global industry-university consortium for R&D, education and technology deployment for future generations of nanolithography applications.

### **May 2007: International SEMATECH agrees to locate its headquarters at CNSE**

Governor Eliot Spitzer, Assembly Speaker Sheldon Silver and Senate Majority Leader Joseph Bruno announced that International SEMATECH, the global consortium of leading nanoelectronics manufacturers, has agreed to a major expansion of its existing research and development program at the Center of Excellence in Nanoelectronics and Nanotechnology at the University at Albany's CNSE. As part of its partnership with CNSE, International SEMATECH agreed to locate its headquarters in Albany, increase its workforce by 450 jobs over three years, and provide \$25 million to fund research at colleges and universities at five centers around the state. To facilitate this expansion, legislative leaders agreed to introduce and pass a bill providing \$300 million in funding which will be made available over five years to help SEMATECH purchase advanced semiconductor process equipment. SEMATECH has made a financial commitment of \$300 million in cash and in-kind contributions.

### **May 2007: CNSE ranked #1 college for micro- and nanotechnology for second straight year**

In its May/June 2007 issue, *Small Times* magazine, the world's leading publication covering micro- and nanotechnology, ranked CNSE the world's number one college for nanotechnology and microtechnology in the publication's annual University Rankings. This year's survey for the first time included colleges and universities from across the globe, rather than just in the United States. The #1 world ranking comes one year after CNSE was ranked by *Small Times* as the nation's top college for nanotechnology and microtechnology.

**June 2007: U.S. Senate Appropriations Committee approves funding to create national research center at CNSE**

Senator Charles Schumer, in partnership with Senator Hillary Clinton, secured \$1 million in funding in the Senate Appropriations Committee to create the New York Center for National Competitiveness in Nanoscale Characterization (NC<sup>3</sup>), a new national nanotechnology research center. NC<sup>3</sup>, a partnership between the National Institute of Standards and Technology (NIST) and CNSE, will leverage the intellectual assets and physical resources of CNSE and NIST to act as a “next-generation Bell Labs” model, advancing nanoscale metrology innovations and strengthening the resulting R&D-manufacturing-commercialization ecosystem in the U.S.

**August 2007: Congressman McNulty secures funding for nanoscale research effort at CNSE in support of Watervliet Arsenal**

Congressman Michael R. McNulty secured \$2 million in funding in the U.S. House of Representatives to create the NanoSensor StageGate Accelerator (NSSA), a new nanotechnology-driven research and commercialization program designed to play a critical role in the U.S. Army's transformation into a 21<sup>st</sup>-century fighting force. NSSA will combine the technological, intellectual and infrastructural assets of CNSE, the Arsenal Business and Technology Partnership and the U.S. Army's Benet Laboratories with leading defense, aerospace and nanoelectronics companies across New York State to accelerate research, development and deployment of nanoscale-enabled products that support the Army's transition to a lighter, more agile and more effective force, as well as applications in the aerospace, energy and transportation sectors.

**January 2008: UAlbany NanoCollege and IMEC Collaborate on EUV Lithography; First Experiments Performed at CNSE's Albany NanoTech**

The world's two leading centers for next-generation nanoelectronics research and development (“R&D”) – CNSE and IMEC in Leuven, Belgium – begin jointly performing extreme ultraviolet lithography (“EUVL”) experiments in order to accelerate the introduction of EUVL into manufacturing. The first set of collaborative experiments is carried out at CNSE's Albany NanoTech Complex, with future joint studies to be conducted at CNSE and IMEC, depending on throughput and/or availability of the tools. This groundbreaking collaboration between CNSE and IMEC also involves scientists from IBM and ASML, which has built the world's first full-field EUVL R&D tool, the Alpha Demo Tool (“ADT”). The majority of activities focus on the advanced imaging capabilities of the EUVL system, with additional effort devoted to the understanding of new materials and various aspects of equipment technology.

**February 2008: Prestigious Global Nanoelectronics Research Consortium Awarded to UAlbany NanoCollege**

The Semiconductor Research Corporation (SRC), the world's leading university-research consortium for semiconductors and related technologies, announces that CNSE will serve as headquarters for a comprehensive research effort aimed at enabling nanoelectronics advances that are critical for the development of smaller, faster and cheaper computer nanochips amid the

approaching limits of interconnect scaling. The \$7.5 million, three-year program, which is funded jointly by SRC and New York State, began February 1, with the UAlbany NanoCollege serving as headquarters for the New York Center for Advanced Interconnect Science and Technology (NY CAIST), with participation from the following colleges and universities: Columbia University, Cornell University, Lehigh University, Massachusetts Institute of Technology (MIT), Penn State, Rensselaer Polytechnic Institute (RPI), Stanford, SUNY Binghamton, University of Florida, University of Maryland, University of North Texas, University of Texas at Arlington, and the University of Texas at Austin.

#### **April 2008: UAlbany NanoCollege Chosen for Prestigious International Consortium Focused on Renewable Energy Technologies**

The International Renewable Energy Technology Institute (“IRETI”) announced that CNSE has been selected to participate on behalf of the State of New York as part of a global consortium designed to accelerate the adaptation and implementation of renewable energy technologies around the world. CNSE was selected based on the strength and depth of its renewable energy research and education programs, as well as its location in a region having unique alternative energy resources, economies, and climates. CNSE’s Energy and Environmental Technology Applications Center (“E<sup>2</sup>TAC”) leads participation in IRETI, in partnership with the New York State Energy Research and Development Authority (“NYSERDA”), the New York State Foundation for Science, Technology and Innovation (“NYSTAR”), and Einhorn Yaffee Prescott Architecture and Engineering (“EYP”). CNSE will also leverage the involvement of more than 50 industrial, university and government partners through its leadership in New Energy New York (“NENY”).

#### **April 2008: U.S. Senator Schumer Announces Landmark Partnership Between CNSE and National Institute of Standards and Technology**

U.S. Senator Charles Schumer announced the first-ever partnership between the federal government and University at Albany’s College of Nanoscale Science and Engineering (CNSE) that will bring federal research expertise and resources to the nanoscale campus. In the wake of securing nearly \$900,000 for the Center for National Competitiveness in Nanoscale Characterization (NC3), which triggered an additional investment of nearly \$15 million, the agreement brokered by Schumer between CNSE and the National Institute of Standards and Technology (NIST) will provide the framework for both organizations to share research, equipment, staff and other key resources. The collaboration will help both organizations tackle some of the most critical challenges facing the nanotechnology industry, including obtaining precise measurements in the atomic and sub-atomic levels.

#### **May 2008: U.S. Army and UAlbany NanoCollege Sign Agreement to Establish Unique Research Partnership**

The U.S. Army Research Laboratory (“ARL”) and the College of Nanoscale Science and Engineering (“CNSE”) signed an agreement to create a new research partnership that is designed to accelerate the development and commercialization of nanotechnology-enabled sensors and electronic devices that will play a critical role in the U.S. Army’s transition into a 21<sup>st</sup>-century

fighting force. The Center for National Nanotechnology Innovation & Commercialization (“NNICC”), to be headquartered at CNSE’s Albany NanoTech Complex, will combine the capabilities and resources of ARL, through its Sensors and Electron Devices Directorate, and CNSE to develop and demonstrate nanotechnology-driven products and applications that will provide the Army with technological and manufacturing advantages to support combat operations and enhance protection of its troops. Through NNICC, scientists from ARL and CNSE will conduct joint research targeting development of a variety of next-generation devices, structures and systems enabled by nanotechnology: “sensor-on-a-chip” systems for anti-terrorism and “soldier-in-the-field” remote sensing; lighter but stronger nanomaterial coatings that offer protection against chemical, thermal and environmental conditions; and, sensor networks and power electronic devices that provide multi-functionality while operating at low power.

### **July 2008: Governor Paterson and Legislative Leaders Announce IBM Will Make Major Investment in New York**

Governor David A. Paterson, Assembly Speaker Sheldon Silver and Senate Majority Leader Dean G. Skelos announced significant new investments by IBM and New York State, accelerating New York’s international leadership in nanotechnology research and development and creating up to 1,000 new high-tech jobs Upstate. The State will provide a total of \$140 million in economic development grants, leveraging more than ten-to-one the private investment of \$1.5 billion from IBM. The investment will go toward three separate and complementary components of a comprehensive project, supporting the nanotechnology computer chip activities of IBM, including: the expansion of IBM's operations at the College of Nanoscale Science and Engineering’s Albany NanoTech Complex, which will result in the creation of 325 new R&D jobs; the creation of a new, advanced 120,000-square-foot semiconductor packaging research and development center at a to-be-determined location in Upstate New York that will be established, managed and owned by CNSE, with IBM conducting operations at that site; and, the upgrading of IBM's East Fishkill facility in Dutchess County. The three projects will collectively advance nanochip technologies, including cutting-edge chip design, demonstration, and testing, all of which takes place at CNSE’s Albany NanoTech.

### **November 2008: Vistec Lithography Completes Relocation from United Kingdom to Become First International High-Tech Equipment Supplier to Move Entire Operation to New York’s Capital Region**

New York State Assembly Majority Leader Ron Canestrari, United States Senator Charles E. Schumer, and Congressman Mike McNulty were joined today by officials from Vistec Lithography Inc. (Vistec), the Arsenal Business & Technology Partnership (Partnership), the College of Nanoscale Science & Engineering (CNSE) of the University at Albany, and the Watervliet Arsenal to officially open Vistec's new global headquarters and state-of-the-art manufacturing facility in Watervliet. Combined with its world-class research and development center located at the UAlbany NanoCollege, Vistec becomes the first high-tech equipment supplier to move its entire operation to New York's Capital Region. As part of the move announced in October 2006, Vistec is expected to invest \$125 million at the Arsenal Campus and UAlbany NanoCollege, with more than 130 high-technology jobs projected to be created over five years involving Vistec and its supplier network. The joint Vistec-CNSE Center for

NanoScale Lithography, located at CNSE's Albany NanoTech, allows Vistec to conduct its most advanced research and development for electron beam lithography equipment in the interdisciplinary fields of nanotechnology in partnership with the faculty and students at the NanoCollege. This Center also provides a critical education and workforce training capability for the newly-created high-technology jobs located at the Arsenal.

### **March 2009: Speaker Silver, Governor Paterson, Assembly Members, Global Technology Leaders Hold Ribbon-Cutting Ceremony At UAlbany NanoCollege**

Assembly Speaker Sheldon Silver, Governor David A. Paterson and Capital Region Assembly members joined Dr. Alain E. Kaloyeros, Senior Vice President and Chief Executive Officer of the College of Nanoscale Science and Engineering (CNSE) of the University at Albany, IBM Senior Vice President and Director of Research Dr. John E. Kelly III, UAlbany Interim President George Philip and global technology leaders at a ribbon-cutting ceremony to mark the official opening of a \$150 million expansion at CNSE's Albany NanoTech Complex that will support more than \$1 billion in new investments and 600 new high-tech jobs by 2013, while further establishing New York State as a global leader in nanotechnology education, research, development and commercialization.

The opening of the NanoFab East (NFE) Office and Laboratory Building and NanoFab Central (NFC) Cleanroom Building adds more than 350,000 square feet of prime office, laboratory, and class 1 cleanroom space to CNSE's Albany NanoTech. With the expansion, the UAlbany NanoCollege now covers more than 800,000 square feet, including 80,000 square feet of Class 1 capable cleanroom space - by far the largest and most state-of-the-art high-tech complex at any university in the world.

The new buildings are host to cutting-edge nanoelectronics research and development (R&D) programs, business deployment and commercialization outreach initiatives for a host of leading international companies, such as IBM, International SEMATECH, Vistec Lithography, M+W Zander, and Einhorn Yaffee Prescott (EYP) Architecture and Engineering; a number of their high-tech suppliers, contractors and service providers; and students, faculty, scientists and researchers at CNSE.

In addition, IBM announced that it will extend its R&D partnership with CNSE through 2013, by which time the company will have invested in excess of \$1 billion into CNSE's Albany NanoTech Complex, helping CNSE to create and retain thousands of high-tech jobs across Upstate New York.

### **June 2009: UAlbany NanoCollege Launches the World's First Comprehensive Undergraduate Degree Program in Nanoscale Science**

State University of New York (SUNY) Chancellor Dr. Nancy L. Zimpher joined with SUNY Board of Trustees Chairman Carl Hayden, Assembly Majority Leader Ron Canestrari, Assemblyman John J. McEneny, University at Albany Interim President George Philip, College of Nanoscale Science and Engineering (CNSE) Senior Vice President and Chief Executive Officer Dr. Alain E. Kaloyeros and a host of state and local elected officials, technology

executives and business leaders in announcing that CNSE will become the world's first college to offer a comprehensive baccalaureate program in Nanoscale Science - launching a groundbreaking educational and research curriculum that will uniquely prepare students for growing scientific opportunities in the nanotechnology-enabled careers of the 21<sup>st</sup> century.

The UAlbany NanoCollege also announced a significant donation by G. Thomas Selfridge, Owner and President of Albany Valve & Fitting Company and a longstanding supporter of CNSE, as part of \$10 million in private funding and endowments that have already been secured to support undergraduate student fellowships, scholarships, and awards under the degree program.

### **July 2009: Silver, Paterson, Destito Announce Major Nanotechnology Partnership Between SUNYIT, UAlbany NanoCollege and Leading Computer Chip Firms**

Assembly Speaker Sheldon Silver, joined by Gov. David A. Paterson and Assemblywoman RoAnn M. Destito, announced the creation of a high-tech venture between SUNY Institute of Technology SUNYIT and the University at CNSE, establishing the Computer Chip Hybrid Integration Partnership (CHIP).

This cross-regional partnership will develop the region's physical and intellectual ability and result in a state-of-the-art high tech business incubator/technology accelerator at SUNYIT. This joint partnership will support the attraction and retention of small and medium size nanotechnology companies in the Utica-Rome area and provide the necessary infrastructure to enable innovation, education and commercialization of computer chip solutions in upstate New York. The CHIP venture also establishes the Computer Chip R&D Integration Center (CCIC) at CNSE.

The project is funded with \$92.5 million in capital funds from the NYS budget, as well as a combined capital investment of \$133.5 million from the internationally renowned firms IBM, SEMATECH and Intel. The partnership also creates a joint educational and training curriculum between the SUNYIT School of Information Systems and Engineering Technology and CNSE that would prepare workers for careers in computer chip integration and deployment. The CHIP establishes an inter-regional, cross-university structure for promoting the nanoelectronics industry.