CENTER OF EXCELLENCE

INSTITUTE OF MATERIALS RESEARCH (IMR)

> CENTER FOR ADVANCED SENSORS AND ENVIRONMENTAL SYSTEMS (CASE)

CENTER FOR ADVANCED MICROELECTRONICS MANUFACTURING (CAMM)

THE INTEGRATED ELECTRONICS ENGINEERING CENTER (IEEC)

Taproot of excellence

BINGHAMTON PLUGS INTO INTERNATIONAL RESEARCH GRID AS SMALL-SCALE ELECTRONICS POWERHOUSE

Excellence.

With origins dating back to 1350 and its Latin root *cellere*, meaning to rise high, excellence is defined as the fact or state of excelling; superiority; eminence.

It's lofty language. But with the official naming of Binghamton University's Small Scale Systems Integration and Packaging program as a New York state Center of Excellence (COE), the region can expect to see a lot more than idle talk, according to several of the COE's industry partners.

From its impact on research and development in next-generation electronics, which is likely to lead to totally new products and processes, to its role as a magnet for student and faculty recruitment, creating a significant brain trust in the region, the COE won't just be a nice addition, they said, but will help to make Binghamton a vital nerve center in the technology race.

Endicott Interconnect Technologies played a key supporting role in the founding of the Small Scale Systems and Integration Packaging Center, and the technology-based company is confident it will see a significant return on the investment of time, manpower and space that has gone into its partnership with the University, said Mark D. Poliks, senior advisory technologist and director of research, development and intellectual property for the company.

"EI's relationship with the Center of Excellence brings new capability and plans for developing new technologies that may be used to unlock new markets and business opportunities. It gives us the ability to attract a talented workforce because it offers highly technical, leading-edge work that translates into good paying jobs,"Poliks said.

"Developing essential process technologies and manufacturing know-how so that components can be produced more efficiently, at higher yields and at a lower cost, makes us more competitive in the marketplace."

The COE is dedicated to the creation and development of new electronic applications that will enhance the way people live and interact with their surroundings, said its director, Bahgat Sammakia. As such, it will also serve as a center of economic acceleration, speeding the translation of technology into commercial applications, he said.

"Infrastructure is half the battle in terms of both federal and industrial funding, so having unique capabilities that complement your research is extremely important," Sammakia said. "There's nothing I can think of that's more important.

"You can have the most talented faculty in the world but if they can't build anything, it would be very hard for them to compete. Research today requires big labs and multidisciplinary teams working in these big labs and doing very challenging things that are really at the cutting edge. You can't do the same thing in an office using a computer." Located in the biotechnology research building at Binghamton's 21-acre Innovative Technologies Complex, the center brings together partners from government, industry and academia, providing unique opportunities for collaborative projects. Those projects will advance the frontiers of microelectronics research and development by addressing challenges in small-scale systems design, development, prototyping, process development and manufacturing for the microelectronics industry, Sammakia said.

That means work at the COE will likely find its way into applications in medical diagnostics and treatment, defense and homeland security, flexible displays and electronics, computers and telecommunications and a broad range of new or improved consumer products.

"This lab is really exciting because it serves our research, it serves our companies, it will enhance economic development and activity in the region, it provides expanded educational opportunities for the student, especially for graduate students, and again, it's a one-of-a kind lab. There's nothing like it in this area," Sammakia explained.

In about 8,000 square feet of laboratory space, filled with \$21 million in state-of-the-art analysis equipment, the COE coalesces and builds upon the intellectual resources of several of Binghamton University's organized research centers, including

Bahgat Sammakia

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— Bahgat Sammakia

the Integrated Electronics Engineering Center (IEEC). Internationally renowned for its research in electronics packaging, the IEEC, a New York state Center of Advanced Technology, has a history of advancing basic research and working with companies to respond to trends within the electronics industry.

Binghamton's newly developed Center for Advanced Microelectronics Manufacturing (CAMM), a national roll-to-roll (R2R) manufacturing research and development center, will also be engaged with and embraced by the COE. The CAMM is dedicated to demonstrating the feasibility of R2R electronics manufacturing by acquiring prototype tools and establishing processes capable of producing low-volume, testbed products. That augments the analytical lab of the COE by providing manufacturing capability.

"The COE demands that we excel at different levels," Sammakia said. "It's not enough anymore to just be a very strong advocate of industry, working very closely with them in solving their problems and even doing the research for them. We will, of course, continue to do that, but I really think we have to be 'the best' at research in this field, moving from responding to industry trends to leading the trends, defining the trends.

"I would anticipate that by the middle or end of this year the lab will be a hub of activity. There should be all kinds of scientists and engineers from higher education and industry working side by side."

Sandeep Tonapi, advanced process engineering manager at GE, another of the center's partnering industries, agrees with Sammakia's assessment.

"We expect the COE to significantly add to the physical and intellectual infrastructure at Binghamton, which in turn will enable a broad spectrum of industrial partnerships," Tonapi said. "This will be at the heart of New York state growth in high technology and emerging technology areas."

First-rate facilities and equipment and a critical mass of researchers all combine to position the COE to begin changing the face of the electronics industry within the next decade. And closer to home, the existence of such resources promises to enhance the vitality of the regional economy by positioning companies to be more competitive in a keenly contested international marketplace.

"Without these things you really can't get anywhere in today's technology, especially in small-scale systems," Sammakia said. "You really need very difficult analysis done to understand why things are working or not working and how to correct or optimize the design.

"When you think about what we're building, it will really enable the existence of small and mid-sized companies in this region, companies that are unable to afford this type of infrastructure and would otherwise either run into trouble

Roll-to-roll material

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or have to relocate or go and do all their work out of the region."

The COE laboratory was established under a business model so that its operations would be to a large degree self-supporting. All the costs in the lab will be driven and covered by the research conducted there, and industries and sponsored researchers will pay set fees for access to the lab. Primarily, the lab affords University and industry researchers unprecedented access to analytical equipment, including two transmission electron microscopes that permit investigation and examination at near atomic-scale, down to a few nanometers.

"Binghamton was uniquely positioned with a foundation upon which something like this could be built," Sammakia said. "We had a lot of it, and we were missing some additional, very expensive and very difficult tools to get. By getting them, we're really completing our analytical capability."

The impact of the COE is already being felt as it brings together companies that were previously affiliated only with the IEEC or the CAMM. These new business-to-business relationships are likely to create the kind of dynamic energy that readily translates into local prosperity, Sammakia said.

"And we're absolutely hoping that because of the COE, we'll establish the kind of relationships that result in our local companies suddenly getting national attention," he added.

Cynthia Giroux, technology director in thin films and surfaces research at

Corning, said establishing the Center of Excellence at Binghamton will add to the prestige of the University, attracting even higher-quality students and faculty.

"Competitive edge in industry is built upon a good college and/or graduate education," Giroux said. "Without a solid foundation in fundamental physical and chemical principles, it's just impossible to win any technology race."

Recruiting faculty to the COE research team is critical to the center's success, Sammakia agreed. Some of that can and will be done among existing faculty, he said.

"People like faculty in materials science, sensors, engineering, computer science, all of those are a natural fit," he said. "And if we really think carefully, we should be able to find ties to people in psychology, and even ties to people in art and history. If you think, for instance, about work on abating terrorism, it's not just about hardwired sensors. There are all sorts of psychological, historical and cultural considerations to factor into that kind of project."

Especially in regard to external faculty recruitment efforts, the COE improves the odds that Binghamton will attract top-notch candidates, Sammakia said.

"This puts us in a position that, when we are hiring faculty, they look at us and say, 'This University has the same kind **Innovative Technologies Complex**

of equipment that I would get access to in a major university like Stanford or Cornell," Sammakia said. "And so we're already able to attract very talented world-class faculty who are joining us because they know they'll not only have access to these tools, but actually more ready access, because on a campus of our size, they'll experience less competition for lab time."

Ultimately, the most likely effects of the COE will be accelerating the move of technology from the lab to the marketplace and then also supporting technology in the marketplace in a way that makes it more commercially viable.

"It's wonderful to ship things quickly," Sammakia said, "but when they fail, you can't get around the fact that you have to understand why, and that understanding will be enabled by the ITC lab.

"People who have ideas and want to build prototypes can come and build them. And, if they want to understand and analyze them, people who have prototypes or products, no matter where they're building them, can come to us."■

Key Center of Excellence Partners	
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	BAE Systems
	IBM
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	Philips
	Corning
	Universal Instruments
3,14,15,16,19,18,19,00	Endicott Interconnect Technologies
	Lockheed Martin
	Texas Instruments
	United States Display Consortium
	Cornell University
	Army Research Laboratory
	National Aeronautics and Space Administration
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