

**Building Long-Term Capacity  
In Ohio's  
Instrument, Control, and Electronics Industry**

*“Ohio has the critical mass, research expertise, and educational focus to become an international industrial powerhouse in instruments, controls, and electronics (ICE). Harnessing that power – creating new products, new approaches, and high-tech jobs - is what Ohio ICE is all about.”*

- Joseph P. Keithley, President and CEO, Keithley Instruments

### *The Vision*

Ohio ICE will position Ohio as the international destination for the emerging high-tech measurement and control industry thus providing tremendous statewide economic development opportunity. Ultimately, the world will look to Ohio as the leader for expertise in measurements and controls, and an educated workforce will grow in support of this cluster of strength. The leadership, workforce, and resulting economic activity will spawn new companies and further spur other development throughout the state.

The role of Ohio ICE is to initiate and support industry-university partnerships that respond to the technological opportunities and infrastructure challenges of the test, measurement, and control industry, and thus provide leadership in the enabling technologies needed by manufacturers, including those in industries such as aerospace and biomedicine. This means developing a technology hotbed that attracts and empowers those industries that need and will support advances in networked distributed control systems, advanced sensors and measurement products, as well as appeals to and develops an educated workforce skilled in electrical engineering, computer science, and related disciplines.

### *Ohio's ICE Legacy*

Ohio is uniquely positioned to realize this vision of global leadership. First, the State can build upon its historic foundation of expertise in instruments, controls, and electronics, which contributed to the significant manufacturing productivity and growth seen over the last two decades. This advantage in advanced manufacturing led to real improvements in the manufacturing process, creating true economic value. That success also helped to establish a core group of Ohio companies viewed as world leaders in the test, measurement, and control industry.

Second, there is the relative lack of competition from other regions in the U.S. vying to position themselves as centers of excellence in measurement and controls. As the nation sprints toward the emerging fields of IT, biotechnology, and nanotechnology, the vast majority of states (including Ohio), are competing to be viewed as centers for these emerging areas. Few, if any, states are investing resources in the technological advancements of measurements and controls (nor do they have the pre-requisites to become the nation's center for measurement and controls).

Throughout the country, the race is on to determine the next area of innovation to jumpstart a state or region's economy. In Ohio, we have a clear opportunity to lead the nation in the test, measurement, and control industry, the cluster that is quietly, yet dramatically and immediately, altering technology. We can become the premier global destination for expertise and commercial development in measurement and control solutions. The foundation is already set for such a vision; now is the time to catapult the vision to reality.

## ***The Global Challenge:***

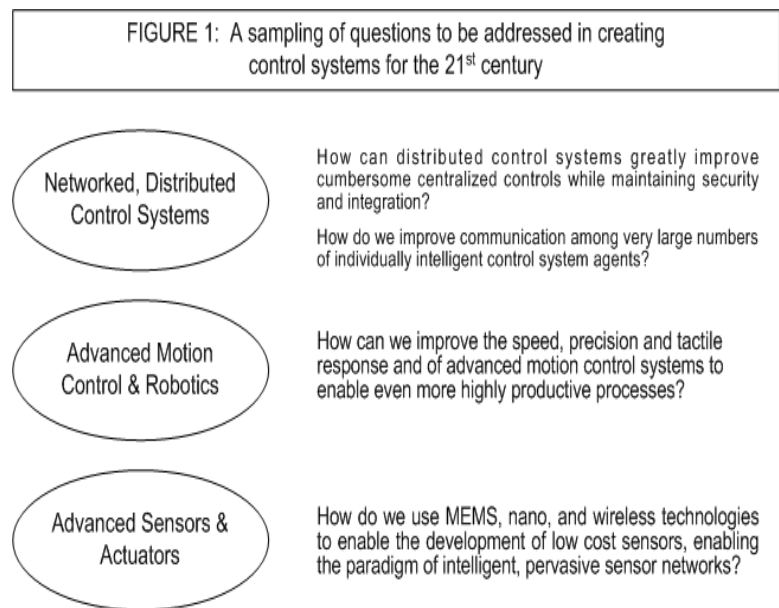
### ***Continued Innovation Necessary To Drive Greater Productivity Gains***

Technological development has changed the world of manufacturing. Advances in technology, particularly through streamlined production processes, automation, and controls, have driven companies to record levels of productivity. Many companies today are seeing productivity gains that are comparable to those gains made during manufacturing's peak between 1948-51.

As manufacturing processes advance, global economic competitiveness and growth factors are critical to the survival of the U.S. manufacturing industry. Alongside the seismic shift in the use of technology in manufacturing is the transformation of its workforce. Replacing high school educated factory workers are well-paid college graduates with highly technical backgrounds.

On the technological horizon, the world's large and small manufacturers are looking at the "brains" of the manufacturing process - measurement and control systems and sensors - as a key place for continued innovation.

The next generation of control systems will be networked and distributed, using technologies such as wireless sensing, advanced local motion control, robotic systems, and smart sensors. To arrive at this point, however, requires significant intellectual and capital investments to address questions in all levels of these systems, from the sensor to the distributed network (Figure 1).



### ***Advancements Will Require Highly Technical & Skilled Workforce***

Concurrent with investment in technological advances is the need to invest in the development of a highly technical, highly skilled workforce. Gone are the days when a high school graduate enters a job at the local manufacturing plant and is guaranteed a living wage and the chance to provide for a family. In fact, over the last 30 years, the

percentage of people employed in manufacturing has declined from about 25 percent in 1960 to less than 12.5 percent today.

The workers of tomorrow will require a higher level of education in a high-tech discipline such as electrical engineering or computer science. Further, a keen sense of the business and economic impact of technical decisions will be integral to their day-to-day work. The evolving manufacturing plants of today are highly advanced and will house not thousands of average wage employees, but hundreds of highly-paid, highly-skilled individuals.

### ***Ohio's Challenge***

At the height of Ohio's success as a manufacturing state (the 1950's), over 1.4 million people were employed in manufacturing, representing half of all non-farm employment. Since the 1950's, as manufacturing has declined, Ohio has focused more on perfecting and streamlining its existing business rather than innovating, changing, and growing. The resulting job and economic outlook has been devastating. In 1960, Ohio ranked sixth highest in the nation in income levels; today, Ohio ranks 24<sup>th</sup>. Since 2000, Ohio has lost more jobs than any other state - a quarter-million jobs or 37 percent of all jobs lost nationwide. Unfortunately, Ohio's transition to the "new economy" has been very slow. While one of every 24 American jobs is in Ohio, you can find only one of every 34 computer and data processing jobs in the state; only one of every 34 research and development jobs; and only one in every 29 engineering services jobs. Moreover, Ohio is ranked 39<sup>th</sup> in the nation for the percentage of its citizens who have a four-year college degree, a fact that does not bode well for the preparation of a workforce that is ready to tackle the technological challenges of the new economy.

### ***Ohio's Solution: Instruments, Controls and Electronics***

But hope is on the horizon. Government, industry, and academic leaders are seeing innovation take hold, and seeing dramatic improvements in precision, quality and efficiency thanks to the significant advancements in the "brains" of manufacturing systems. Moreover, they are now embracing the next step: taking those groundbreaking innovations and applying them to the challenges and needs of new fields. In 2001, leaders from Northeast Ohio's instruments, controls, and electronics (ICE) industry decided that pockets of innovation were occurring in many corners of the state that had the potential to make a global impact and change the course of manufacturing history in Ohio by focusing on innovation and technological advancements. Through informal networking among colleagues in industry as well as those in the higher education community, the ICE leaders recognized innovations in fields such as sensors, controls, and distributed networking.

- One group of academic researchers was working to transition the cumbersome, centralized control systems into highly secure and integrated distributed control systems.
- Researchers were focused on improving the speed, precision, and tactile response of advanced motion control systems available during the production process.

- Small sensor companies were being built to develop improved communication within the distributed environment.
- Larger control companies were investing significant dollars and resources to transition the traditional control systems into highly functional, highly integrated systems.

These same ICE leaders began to realize that these efforts were occurring in isolation without a focus on how Ohio could become the international destination for ICE innovations. With the support of the Governor's Science Advisor, a network of industry, higher education, and economic development experts were brought together in 2002 under the name "Ohio ICE". This proposed membership-based network provided a focal point for the ICE industry and helped capture the expertise and resources throughout the state in order to become a significant economic force for Ohio, with national and international implications.

### ***Momentum for Growth***

Over the last three years, significant traction has occurred in the formation of Ohio ICE, resulting in tangible results:

- Ohio universities (primarily Cleveland State University, Case Western Reserve University, and the University of Akron) have begun investing significant dollars in support of ICE-related faculty and research;
- A governing structure for Ohio ICE has been agreed upon; technology transfer and licensing templates have been developed; two industry memberships have been secured; a research/industry sub-committee has funded its first joint pilot research project; and two conferences have drawn together over 150 ICE industry, academic, and economic development leaders;
- Volunteer efforts of industrial, academic, and economic development leadership have coalesced to support these efforts.

### ***Ohio ICE Project Objectives and Outcomes***

- ***Objective 1:*** Increase the amount of academic research focused on the current and future needs of the ICE industry, including research sponsored specifically by Ohio ICE.
- ***Objective 2:*** Enhance the ability of new and existing ICE companies to use innovations in sensors and actuators; advanced controls and robotics; and networked distributed controls that are being developed within Ohio's higher education laboratories for the purposes of new processes and products.
- ***Objective 3:*** Increase the availability of a skilled workforce - from the technician to the PhD - able to continue moving ICE companies toward innovation.

### ***Sustainability***

In seeking to move Ohio forward, an organized and disciplined coalition has been developed of industry executives and researchers from public and private academic sectors who are providing committed, passionate leadership and focus for Ohio ICE. Major companies like Rockwell Automation, ABB, and Keithley who formed the original ICE cluster in Northeast Ohio, have continued their commitment to the success of Ohio ICE. The composition of the board of directors (51% from industry) and the three advisory committees reflects the importance of the business sector's involvement. The structure helps to facilitate broadening the participation of other companies throughout the State as Ohio ICE is launched and becomes more operational.

Attracting new industrial players to Ohio ICE is a key priority over the next year. While much of the industrial focus has been on Northeast Ohio, Ohio ICE and its leaders have a clear intent to broaden the geographical focus of industry participation, reaching into all corners of the State to target the nearly 1,300 ICE-related firms.

### ***Broader Impacts and Significance***

Ohio has reached a critical juncture in its movement into the "new economy". With the identification of the instruments, controls, and electronics sector in Ohio as a force to invigorate the economy, leaders throughout the state have come together to help focus resources to this cluster. The ICE-related technological advancements associated with manufacturing will not produce automated jobs that can be fulfilled by a high school graduate or low-wage employees. Rather one will see industries emerging that are staffed by significant numbers of highly technical, highly educated individuals who can manipulate sensor technology to manufacture products the size of a human hair or control systems that can build rocket components while in space.

This future can happen only if we make strong connections between our educational and research institutions (from K-12 to graduate school), our governmental and economic development agencies (such as the Ohio Department of Development and NorTech), and the strong industry base that resides in Ohio. Small steps have been made in solidifying this future, and with additional support, significant advancements will occur in building the long-term capacity of the ICE industry and the jobs that support it.