

**IOWA STATE UNIVERSITY**  
Institute for Physical Research and Technology

***Business Assistance Summary***

***November 2000***

**Dr. Prem Paul**  
**Office of the Vice Provost for Research and Advanced Studies**

**Presentation to Legislative Fiscal Committee**  
**November 16, 2000**

## ***Institute for Physical Research and Technology (IPRT) Business Assistance Summary November 2000***

The Institute for Physical Research and Technology (IPRT) is a network of ten research and technology development, technology transfer, and technical assistance centers and is a critical component in the university's efforts to strengthen the economic vitality of the State of Iowa. The network includes a federal research laboratory, the Department of Energy's Ames Laboratory.

- IPRT promotes basic and applied interdisciplinary research in the engineering and physical sciences that fosters the development of new technologies and the transfer of those technologies into the marketplace.
- IPRT works to strengthen the viability of Iowa industry through technical assistance to Iowa manufacturers.
- IPRT's emphasis in interdisciplinary research results in new technologies and processes that can be transferred to industry and important technical assistance and real-world educational opportunities.
- Areas of expertise include advanced semiconductors, aircraft safety, analytical instrumentation, biorenewable energy, cluster and parallel computing, high-purity metals, materials and chemical sciences, noninvasive characterization, rare earths and magnetics, and real-time computer visualization.
- In FY00, the IPRT Centers had more than 40 research projects and interactions with Iowa companies; the Center for Advanced Technology Development worked with 70 Iowa companies in research and technology transfer initiatives, the two industrial outreach programs (Iowa Companies Assistance Program and Iowa Demonstration Laboratory) conducted 116 technical assistance projects, the Iowa Industrial Incentive Program opened and managed 36 university/industry research contracts, and SBIR/STTR staff consulted with 240 Iowa companies.

### ***Representative Interactions and Activities of IPRT Centers and Programs***

**Start-up company will be a player in Iowa's New Economy**—Making large-scale visualization systems a tool routinely used by industry is the goal of a young, high-tech Marshalltown company. Formed in 1997—by ISU graduates and based on ISU technology from IPRT's cutting edge Virtual Reality Applications Center—the company designs, installs, and services virtual reality systems ranging from desk-sized systems to theater-sized facilities. In 1999, the company employed 15 full-time people with an annual payroll of nearly \$500,000 and has five-year projected revenues of \$25 million and employment of 100. The company has built visualization systems for several Fortune 500 companies and has clients on four continents. The company is also impacting career prospects in Iowa, as their employees are individuals recruited by the high-tech, out-of-state companies.

**Companies Seek MRC's Niche Expertise**—The Microelectronics Research Center's (MRC) niche expertise in plasma deposition techniques and thin film semiconductor materials and devices has been sought by local and national companies that develop unique device structures. The findings from a recent plasma deposition research project with a Boone company resulted in the company exploring full-scale production and sales of the prototype device.

**ISU Composite Research Important to Start-up Company in Northeast Iowa**—A soy-based construction adhesive project illustrates that ISU's R&D efforts impact economic development in the state. The Oelwein start-up company that worked with the university's biocomposite research group and Center for Advanced Technology Development now has firm plans to manufacture soy-based adhesives. The start-up company has received a \$250,000 IDED Community Economic Betterment Account royalty agreement that will assist in the \$7.4 million investment project, which will initially create sixteen new jobs. The company is working with Iowa investors to raise capital and targets plant completion and full operation in 2002.

**University/Industry Team Develops New, Improved Monitoring System**—An central Iowa company manufactures process-control valves for several markets including companies in the pharmaceutical, petroleum refining, and pulp and paper industries, which are all regulated by the EPA. An area of concern is unexpected emissions of volatile organic compounds from valves, pumps, and flanges. In a long-term project, IPRT's Microanalytical Instrumentation Center teamed with the company to create a Fugitive Emission Sensor System that monitors emissions at leak points and provides early warning of preventive maintenance needs much more economically than its current EPA-approved system. The university/industry team developed a low-cost, low-power, automated sensor system to detect low levels of emissions in harsh industrial environments. The company plans to commercialize the system within the next year.

**Company's Waste Converted to Useable Energy**—Several years ago, an Iowa-based, international seed company contacted IPRT's Center for Sustainable Environmental Technologies to recommend cost-effective disposal alternatives for dealing with plant waste streams, particularly corn seed waste. The company was interested in using fluidized bed gasification to convert this waste seed to usable energy in direct-fired seed dryer applications. This initial inquiry broadened into an on-going research project to develop and demonstrate a 15-ton per day gasifier at the company's Toledo plant, a project completed earlier this fall. The seed company, working with a small, central Iowa company that was formed from ISU technology, successfully completed gasification trials this spring, and the program will continue into the next harvest season.

**ISU Research Improves Safety for the Flying Public**—The Center for Nondestructive Evaluation and the Airworthiness Assurance Center of Excellence support the industrial research needs of the aviation industry and thus the safety of the flying public. These Centers and their scientists are internationally recognized by the industry as leaders in materials research and development. Recently, scientists utilized model-based calculations of inspection geometries to predict maximum flaw response in a critical aerospace component. During this research, an inspection process was changed and, as a consequence of that change, flaws were detected that previously had gone undetected—flaws that could have caused fatalities.

**“.com” Research Delivers Groceries**—The Center for Advanced Technology Development brought together a team of ISU faculty and researchers from several engineering disciplines, CIRAS, and the Ames Laboratory to assist a north central Iowa dot-com start-up company to improve its product development process. The company is developing computer hardware and software to support Web-based grocery shopping. The technology will allow customers to order groceries from their local grocery store via a Web site, and customers can choose grocery delivery or pickup. The company had a proof-of-concept design but needed to redesign the device to improve ergonomics and component integration. In a 6-month project, the team analyzed signal processing, power usage, and frequency emissions of the components to help reduce noise and improve overall signal processing. The company has incorporated the design and component recommendations into its current system and is conducting internal tests. The project used \$20.5K Iowa Industrial Incentive Program funds and the company invested \$23K in the project.

**IPRT Partners with ICL to Apply Forensic Research**—Months of discussions with the Iowa Criminalistics Laboratory (ICL) convinced IPRT and Ames Laboratory administrators that the forensics community has many needs that are not being met. These range from needing faster, more reliable ways of examining crime-scene evidence to hiring employees trained in laboratory and investigative techniques. Several collaborative initiatives are underway. One project is a sophisticated fingerprint system that was designed and fabricated by a scientist from the Microanalytical Instrumentation Center (MIC) for the ICL. This system allows investigators to develop fingerprints faster and control the conditions under which they are obtained. Investigators place evidence in the fingerprinting system and then are able to control humidity, temperature, and other factors while analyzing the sample. Local law enforcement officials are discussing a second-generation system with MIC scientists.

**Research Influences New Product Production and Validates Product Effectiveness**—An Allamakee county company that manufactures commercial feed and veterinary products had developed a whey product for the treatment of mastitis in cattle. The company sought ISU assistance to determine proper production methods and product evaluation testing. Through an Iowa Industrial Incentive Program contract research project, a Veterinary Microbiology and Preventive Medicine professor worked with the company to analyze the ultrafiltration procedure used to prepare the whey product and tested the final product to determine if it was capable of reversing the suppression of neutrophil function, which triggers mastitis shortly after calves are born. Results of the project provided the R&D information to proceed with manufacture of the product.

**IPRT and CIRAS initiate IMEP community college training workshops**—In a training initiative, IPRT and CIRAS joined forces and held two workshops, in the Fall of 1999 and 2000, entitled Nuts & Bolts—ISU Industrial Outreach. These workshops introduced the IMEP community college account managers to the university’s industrial outreach programs, including hands on introductions to manufacturing areas such as nondestructive evaluation and rapid prototyping. Located throughout the state, the IMEP agents offer ISU outreach programs to Iowa manufacturers. At the end of the workshops, the agents were ready to match the services of ISU with the needs of Iowa industry. The training is ongoing with follow-up sessions at IMEP quarterly meetings

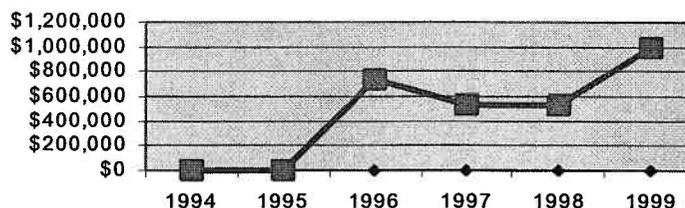
**Tire Changing Made Safer**—A north Iowa company manufactures tools that aid tire changing on large equipment (i.e., dump trucks, end loaders, etc.). The load capacity of these tools needed to be tested. CIRAS and the Iowa Companies Assistance Program were contacted to perform the testing procedure. As a result of these tests, an assembly problem was corrected and a part redesigned, thus improving the factor of safety for the equipment. The company benefited economically by detecting this problem prior to production.

**Product Quality Maintained**—A Des Moines firm that guaranteed their brass handle sets found they were incurring substantial costs from returns of worn and tarnished handles. To determine the basis for the problem, the company sought specific information about the composition of the surface coating and brass alloy percentage of each handle set. The characterization of the materials by Iowa Companies Assistance Program provided the company with the information required to correct the problem, reduce returns, and maintain customer confidence in their product.

**CATD brings SBIR/STTR to Iowa Industry**—The Center for Advanced Technology Development (CATD) has become the resource recommended by the Iowa SBA and the Iowa Department of Economic Development when Iowa businesses need assistance in seeking federal research funding through programs such as the Small Business Innovation Research (SBIR) or Small Business Technology Transfer Research (STTR). Since 1996, when CATD added SBIR/STTR Outreach Assistance to its industrial service portfolio, SBIR Phase I research funding to Iowa companies has nearly doubled, and seven Iowa businesses have received SBIR Phase II awards totaling \$2.8M. In the previous four years, no Iowa company had received SBIR Phase II funding.

Using the Iowa Communications Network, CATD reaches across Iowa to more than 60 attendees at each of its workshops. At these workshops, industry leaders learn about proposal preparation and meet with federal SBIR program managers from USDA, NIH, NSF, and the Departments of Defense, Education, and Transportation. This year two awards, each just under \$100K, were made to Iowa companies. One went to a start-up firm in Iowa City that is developing software for a low-cost screening tool to identify one of the earliest indicators of cardiovascular disease. The second went to a Polk County start-up company that is working with genetically modified crops to develop efficient methods for plant transformation using ISU-developed technology.

**SBIR Phase II Awards to Iowa Companies  
Through CATD Assistance**



*SBIR/STTR funding is one measure of a state's economic strength and the above chart indicates how CATD's SBIR/STTR program, which began in 1996, is impacting Iowa's competitiveness in the New Economy.*

**Manufacturing output increased**—An east central Iowa company with approximately 200 employees had one of their customers identify a possible microstructural problem in a die casting. The company was referred to Iowa Companies Assistance Program (ICAP) by CIRAS field staff who recognized that this problem needed the expertise of ICAP metallurgists. The company reported that the ICAP work benefited their operations—a problem was identified, the cause was understood, and when the manufacturing process was improved to correct the cause, the company experienced a 25% increase in output.

**Confirmed Quality of Sawdust Used for Facility Heating**—A west central Iowa company manufactures architectural doors of which a small percent have an inner lead plate. The company believed it was possible that the lead plates could inadvertently become nicked during their milling and finishing processes. If this occurred, some solid lead could be picked up by their dust collection system, making the sawdust useless for heating the plant and providing bedding for livestock. Iowa Companies Assistance Program analyzed the sawdust and found it contained extremely low to zero levels of lead contamination, indicating that the company could avoid over \$80K in heating costs/year.

**New Processing Methods Evaluated**—A Webster City pork producer needed to improve its animal feed system by developing a more accurate method to measure feed volume contained within feed bins. Working with Iowa Companies Assistance Program (ICAP), the company sought to evaluate an acoustic method using off-the-shelf technologies for measuring volume. ICAP's assistance with field tests, data acquisition, and analysis provided the company the information needed to make this assessment.

**Recommendation to Fix a Problem and Suggestion to Reclaim Waste Stock**—A family-owned and operated manufacturer of power-driven hand tools was concerned about the performance of steel laminations in an electric motor and brought their questions to the Iowa Demonstration Laboratory (IDL). The company needed to both understand the cause and learn how to prevent the problem. IDL scientists developed a method to characterize and distinguish between two types of laminations, each with different properties. The analysis ended with two recommendations: modify purchasing specifications of the steel laminations and perform a heat treatment to possibly "reclaim" materials that were already stocked.

**Business Decisions Based on IDL Information**—When an east central Iowa company was considering the addition of nondestructive inspection to their aircraft maintenance services, the company principals sought advice from Iowa Demonstration Laboratory. Its staff provided information on the training and experience requirements for FAA certification of inspectors and included information on training. This information enabled the company to determine whether this new service could be offered at a reasonable profit.

**New Process Plugs Trough Leaks and saves company \$600K/year**—A central Iowa company produces watering troughs for animals. The need was for a more effective and efficient inspection process to detect leaks. The current process of filling the troughs with water and running an air hose along the welded seams was effective, though time-consuming and lacking in accuracy. The company asked CIRAS to look for a solution to this testing dilemma. The Iowa Demonstration Laboratory was contacted to cooperate in the solution process. A new method was found for applying fluorescent dye penetrant to the weld seams of the water troughs. Through capillary action, cracks or holes at the welded joints instantly attracted the dye, which could be detected using ultraviolet light. At present, the inspection process is applied to over 90% of the troughs manufactured, at a savings of \$600,000 annually.

**IPRT FY00 Funds**

**State of Iowa Special Purpose Funds**

**4.6 M**

Center and Commercialization Project Support

3,817,200

Faculty and Graduate Assistant Salaries	783,700
Professional & Scientific Salaries	1,383,000
General Services Salaries	395,100
Hourly Wages	84,200
Materials, Supplies, & Services	762,400
Equipment	408,800

Industrial Outreach Program Support

754,300

*Iowa Industrial Incentive Program (IIP)*  
*Iowa Demonstration Laboratory for NDE Applications (IDL)*  
*Iowa Companies Assistance Program (ICAP)*

	<u>IIP</u>	<u>IDL</u>	<u>ICAP</u>
Faculty and Graduate Assistant Salaries	69,000		
Professional & Scientific Salaries	81,600	149,200	106,500
General Services Salaries	4,500		2,000
Hourly Wages	29,100	17,400	
Materials, Supplies, & Services	110,600	57,600	88,800
Equipment	23,600	14,400	
Subtotal	<u>318,400</u>	<u>238,600</u>	<u>197,300</u>

**Iowa State University Allocation**

**2.1 M**

(Salaries, Materials and Supplies, Equipment)

**Private Industry Project Funds**

**2.4 M**

**Federal Project Funds**

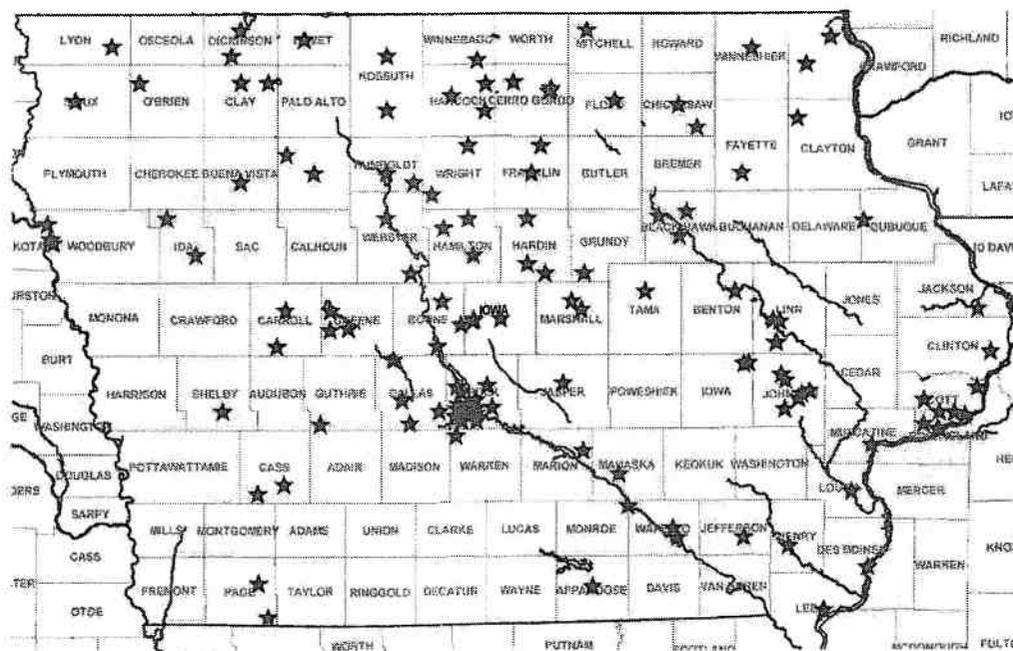
**39.0 M**

Department of Commerce	217,200
Department of Defense	297,100
Department of Energy	27,474,000
Department of Transportation	6,713,100
HHS	575,100
NASA	402,900
National Science Foundation	1,515,200
USDA	875,800
Various Federal Agencies	895,600

**TOTAL**

**48.1 M**

**FY1999 and FY2000**  
**Areas of the State served by IPRT Industrial Outreach Programs**  
**ICAP, IDL, and IIP**



**Iowa Industrial Incentive Program Leverages State Investment**—During IIP’s eight years, IPRT has leveraged every State of Iowa dollar in this program to an average research value of \$3.35. The following table summarizes all program investments.

Year	Number of Projects <sup>1</sup>	IIP Funds* <sup>2</sup>	Industry Funds*	University & Other Funds*	IMEP* <sup>3</sup>	Totals*
2000	36	323.2	454.0	110.5	N/A	887.2
1999	29	350.2	603.7	382.2	N/A	1336.1
1993	10	282.5	500.6	136.8	N/A	920.0
<b>1993-2000 Totals</b>	<b>221</b>	<b>2,567.9</b>	<b>3,739.6</b>	<b>2,746.6</b>	<b>683.0</b>	<b>9,737.3</b>
<b>Average</b>	<b>26</b>	<b>321.0</b>	<b>467.5</b>	<b>343.3</b>	<b>N/A</b>	<b>1,217.16</b>

*\*Dollars in thousands*

1. At any given point during a year, staff from IPRT’s Center for Advanced Technology Development (CATD) will have 25-30 projects under development. CATD’s tech transfer associates work with Iowa industry to define research needs and match those needs with university resources. The reported number reflects the number of discussions that ended in contract research agreements with Iowa industry and businesses. Discussions that do not end in research contracts are often referred to IPRT’s other industrial outreach programs—Iowa Companies Assistance Program and the Iowa Demonstration Laboratory for Nondestructive Evaluation—for short-term, no-cost technical assistance.
2. The figure in this column reflects the allowance of carryover funds for one fiscal year.
3. The Iowa Manufacturing Extension Program (IMEP), formerly called the Iowa Manufacturing Technology Center, is an U.S. Department of Commerce NIST program with more than 70 programs across the nation. From 1994 through 1996, IMEP directed funds into IIP industrial research projects, but since 1998, IMEP has not funded these projects.

## Summary of Centers and Programs

**IPRT—Institute for Physical Research and Technology:** IPRT is a network of 10 research and technology development, technology transfer, and technical assistance centers.

*Airworthiness Assurance Center of Excellence (AACE)*—Identifies and provides solutions for national aircraft safety problems

*Center for Advanced Technology Development (CATD)*—See below

*Center for Nondestructive Evaluation (CNDE)*—Develops noninvasive methods and instruments for assessing the integrity of structures and materials

*Center for Physical & Computational Mathematics (CPCM)*—Researches high-performance computing via cluster-computing and parallel-computing strategies

*Center for Sustainable Environmental Technologies (CSET)*—Develops and demonstrates renewable energy and chemical technologies, and environmental technologies related to fossil fuels

*Materials Preparation Center (MPC)*—Prepares specialized high-purity metal compounds for research and engineering uses

*Microanalytical Instrumentation Center (MIC)*—Develops innovative, small-scale analytical and bioanalytical instruments for emerging analyses

*Microelectronics Research Center (MRC)*—Characterizes advanced semiconductor materials devices and processing technology

*Virtual Reality Applications Center (VRAC)*—Applies virtual reality technology to the challenges of science and engineering

*Ames Laboratory of the U.S. Department of Energy*—Conducts fundamental research in energy, materials, and chemical sciences.

**CATD—Center for Advanced Technology Development:** IPRT's Center for Advanced Technology Development assists in technology transfer and industrial problem solving. CATD is a statewide resource that moves university-developed technology into industry. Since 1984, 54 companies have formed from ISU technology and/or technical expertise. CATD has worked with 33 of those companies to commercialize new technologies and to assist in addressing the challenges of product development and process improvement.

**IIP—Iowa Industrial Incentive Program:** In 1993 the State of Iowa established, within the state economic development appropriation for IPRT, the Iowa Industrial Incentive Program. This program matches Iowa companies that have research and development needs with a combination of university resources (faculty expertise, facilities, and equipment) in cost-shared research contracts. State IIP funds are available to reduce up to 50% of the project costs with the remaining research costs funded by the company. During the eight years of IIP, CATD has initiated, developed, and managed more than 220 research contracts, leveraging the State's \$2.57M investment in the Industrial Incentive Program to \$9.74M in research value.

**SBIR/STTR—Small Business Innovation Research/Small Business Technology Transfer:** In 1996, Center for Advanced Technology Development (CATD) added SBIR/STTR Outreach Assistance to its industrial service portfolio. These programs are competitive, three-phase federal funding sources that provide qualified small businesses with opportunities to propose innovative research and development projects that meet specific federal needs in agencies such as DOE, DOD, DOT, USDA, NIH, and NSF. Since CATD began working this program, SBIR Phase I research funding to Iowa companies has nearly doubled, and seven businesses have received SBIR Phase II awards totaling \$2.8M. CATD uses the Iowa Communications Network to present workshops where industry leaders learn about proposal preparation and meet with SBIR program managers from the various federal agencies.

**ICAP—The Iowa Companies Assistance Program:** The Iowa Companies Assistance Program, started in 1993, provides Iowa manufacturers with short-term (less than 40 hours), no-cost technical assistance. The program specifically addresses materials-related problems such as microstructure characterization, chemical composition analysis, preparation and fabrication of advanced materials, mechanical testing and characterization, and optical and electron microscopy. By working with ICAP, companies are able to develop new products, resolve product concerns, and improve production processes. During the eight years of the program, ICAP has conducted about 700 projects with Iowa companies and entrepreneurs.

**IDL—The Iowa Demonstration Laboratory for Nondestructive Evaluation:** Iowa Demonstration Laboratory is a fully equipped nondestructive evaluation (NDE) facility. NDE includes a wide range of techniques for assessing the integrity and fitness for service of materials, components, and structures. The Laboratory provides Iowa manufacturers up to 40 hours of no-cost technical assistance by addressing nonroutine quality, liability, and waste reduction questions and issues. IDL advocates NDE best practices and since 1997 has been working with companies across the state through on-site workshops that introduce the six primary NDE methods to employees. Participants leave these workshops ready to apply NDE best practices in their company's manufacturing processes. Since this program started in 1993, IDL has had about 250 projects with Iowa companies and since 1997 has conducted more than 12 NDE workshops.