

The Coordinating Council on Technology Transfer (CCOTT) was formed in January 1993 and coordinates all ISU technology transfer activities. Representatives from technology transfer units and each of the colleges meet regularly to discuss problems, update each other on activities, assess the state and national environment for technology transfer and propose policy and procedures to encourage technology transfer. Current membership includes:

**Steve Andrie**  
*Center for Transportation Research and Education  
(CTRE)*

**Roger Baer/Tim Borich**  
*College of Design*

**Willem Bakker**  
*Iowa Manufacturing Extension Partnership (IMEP)*

**Floyd Barwig**  
*Iowa Energy Center*

**James Bloedel (Chair)**  
*Vice Provost for Research*

**Steven Carter**  
*Pappajohn Center for Entrepreneurship/  
ISU Research Park*

**Walter Fehr**  
*Biotechnology*

**Joseph Gilbert**  
*Institute for Physical Research and Technology  
(IPRT)*

**Richard Grieve**  
*Center for Industrial Research and Service (CIRAS)*

**Robert Harris**  
*Center for Advanced Technology Development  
(CATD) & Ames Laboratory*

**Severin Johnson**  
*Utilization Center for Agricultural Products (UCAP)*

**Kenneth Kirkland**  
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Transfer (OIPTT) & Iowa State University Research  
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**Wolfgang Kliemann**  
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(CATD)*

**Lisa Lorenzen**  
*Biotechnology Industrial Liaison*

**Ronald Manning**  
*Small Business Development Center (SBDC) &  
College of Business*

**Theodore Okiishi**  
*College of Engineering*

**Prem Paul**  
*Research Administration*

**Donald Reynolds**  
*College of Veterinary Medicine*

**Roger Smith**  
*College of Education*

**Joel Snow**  
*International Institute of Theoretical and Applied  
Physics (IITAP)*

**Mary Winter**  
*College of Family and Consumer Sciences*

**Wendy Wintersteen**  
*Agriculture and Home Economics Experiment  
Station*

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## **Iowa State University Technology Transfer Accomplishments: Highlights of Economic Development Activities October, 2000**

*Iowa State University's Coordinating Council on Technology Transfer* is pleased to provide the following report of accomplishments in technology transfer that have contributed to economic development in the past year. These accomplishments represent the continued growth of the university's departments, centers and institutes devoted to the implementation of technology developed both inside and outside the laboratories of Iowa State's scientists and engineers.

It should be emphasized that a major contribution of Iowa State to Iowa's economic development and technology transfer is the generation of technology-literate graduates for Iowa's work force and the technical courses offered for professionals throughout the state and elsewhere. The many programs from which students graduate and the ways in which students acquire technology literacy are reported to the Board of Regents, State of Iowa through summaries of program reviews and accreditation reviews. To avoid duplicate reporting, those efforts are not described here.

The report is organized on the basis of Iowa State University's current strategic plan, which includes three goals that relate to technology transfer and economic development. The first is its research mission, the second is its mission related to extension and outreach, and the third directly addresses the university's role in economic development. The strategies indicated in the university's plan are identified as "objectives" in this report, and several accomplishments illustrating progress toward those objectives are listed as "actions" under each objective. The actions are not exhaustive, but they provide concrete examples of the year's work toward that objective. In addition, the report provides summary data on patenting and licensing activities as well as start-up companies.

In recognition of the current university theme, "Strengthening Families," this year's report emphasizes ways that ISU's faculty and staff are contributing to economic development activities in Iowa relating to this theme. By drawing on the knowledge base and technologies at ISU, many quality-of-life issues are addressed that benefit not only individual families but also communities that are trying to strengthen their economic base. Examples range from nutrition and daycare issues to helping disabled farmers and making communities more desirable places to live and work.

The executive summary includes highlights from this report with an emphasis on the following five core elements of the "new economy": fiscal discipline to sustain the long-term strength of our economy; invest in people; expand markets to increase efficiency and reduce costs; support the production, dissemination and application of knowledge; and make the new economy work for everyone.

## **Iowa State University Technology Transfer Accomplishments: Highlights of Economic Development Activities**

### ***Executive Summary for 2000 Annual Report***

- ISU researchers disclosed 114 new inventions to the Iowa State University Research Foundation (ISURF), and 41 new patents were issued to ISU inventors.
- ISURF signed 229 new licenses and options for ISU technology, including 198 for plant germplasm. Thirty-five technologies were licensed for the first time in FY00.
- Technologies licensed to Iowa companies (not including plant germplasm) resulted in over twelve million dollars of sales by those companies in 1999. This represents over 50% of all sales of products licensed by ISURF.
- Businesses (including commodity groups) funded 556 research projects at ISU totaling \$15.2 million in FY00.
- ISU and USDA researchers received another R&D 100 award, bringing the total R&D 100 awards received by ISU since 1984 to 22, second among all universities.
- Thirteen new companies and affiliates began operations in the ISU Research Park, bringing the total to 109 companies and research centers that have located in or been affiliates of the Research Park.
- The ISU Pappajohn Center for Entrepreneurship and the Small Business Development Center (SBDC) provided business counseling to 26 technology-based companies during FY00; they also assisted 15 of those companies that are in the early stages of development to raise over \$1 million in capital.
- Construction of an addition to Multi-tenant Building III in the ISU Research Park was commenced in September of 1999 bringing the total multi-tenant space available in the Park to 125,000 square feet.
- The Iowa Demonstration Laboratory (IDL) completed 40 projects with 23 Iowa companies using nondestructive methods to evaluate materials for industrial clients.
- The Iowa Companies Assistance Program (ICAP) had 76 projects with 63 Iowa companies this past year. In one case, ICAP confirmed the quality of sawdust used for facility heating, heading off a potential \$80 K/yr. heating bill for the company. In another case, a company experienced a 25% increase in output due to ICAP's assistance in solving a manufacturing problem.
- In FY00, the Iowa Manufacturing Extension Partnership (IMEP) helped Iowa businesses and manufacturers create 40 new jobs and retain 50 jobs. IMEP's efforts also led to sales being increased by \$3.2M, cost savings totaling \$1.2M and reduction in inventories totaling \$350K. They also assisted companies in obtaining \$6.7M in capital investments and another \$1.4M in other investments.
- During FY00, the Center for Advanced Technology Development worked with more than 60 Iowa companies and initiated 36 industrial product and process development and improvement projects

with Iowa industry. One project led to improved workplace safety and a more efficient production process for a northeast Iowa firm.

- 27,347 bushels of specialty soybean germplasm developed at ISU were planted in Iowa, generating \$66,834 in royalties.
- About 70 students participated in ISU's Business Lab, an experiential learning opportunity where students solve real-world business problems for corporate sponsors.
- The Center for Transportation Research and Education (CTRE) adds value to the graduate experience and talent to Iowa's workforce by employing graduate students as research assistants to work on transportation-related projects. A recent follow-up on the 220 master's level students who worked at CTRE since 1993 showed that 25% of them took their first post-college job in Iowa.
- The Iowa Energy Center and the Center for Building Energy Research conducted a Total Assessment Audit for a small, family-owned commercial printer, leading to a 3.4% increase in company profit. Specifically, sales per employee increased 10.1%, spoilage decreased 38%, waste removal costs decreased 5.7%, and energy costs fell 4.8%.
- Two maize genes were licensed by ISURF to two different firms, contributing to the goal of creating novel products and expanded markets.
- The Center for Industrial Research and Service (CIRAS) provided a variety of productive interactions with Iowa companies, including the consultation required to help a company develop a more effective and efficient inspection process that now saves the company \$600,000 annually.
- The Research Institute for Studies in Education collaborated with a number of university, state and national groups to evaluate the effectiveness of economic development programs. One example of this joint participation was the evaluation of the Quality Jobs for Quality Communities program in which communities explore their values related to the fit between workforce development and economic growth opportunities. Another example was the evaluation of the community-based Precision Agriculture Education Network which prepares students to use technology more effectively in agriculture and to fill jobs in the New Economy.

### ISU Acronyms In This Report

**CARD** - Center for Agricultural and Rural Development

**CATD** - Center for Advanced Technology Development

**CIRAS** - Center for Industrial Research and Service

**CNDE** - Center for Nondestructive Evaluation

**CTRE** - Center for Transportation Research and Education

**ICAP** - Iowa Companies Assistance Program

**IDL** - Iowa Demonstration Laboratory

**IDRO** - Institute for Design Research and Outreach

**IEC** - Iowa Energy Center

**IICAB** - Institute for International Cooperation in Animal Biologics

**IMEP** - Iowa Manufacturing Extension Partnership

**IPRT** - Institute for Physical Research and Technology

**ISBR** - Institute for Social and Behavioral Research

**ISIS** - Iowa State Innovation System

**ISUE** - Iowa State University Extension

**ISURF** - Iowa State University Research Foundation

**ISURP** - Iowa State University Research Park

**MIC** - Microanalytical Instrumentation Center

**MRC** - Microelectronics Research Center

**SBDC** - Small Business Development Center

# **IOWA STATE UNIVERSITY**

## **OUTLINE FOR 2000 TECHNOLOGY TRANSFER ANNUAL REPORT**

**I. GOAL:** As part of the goal of strengthening its overall research efforts, ISU will strengthen research programs related to technology development and economic development (*see Goal 2 of the ISU Strategic Plan for 1995-2000*)

- A. Strengthen research giving rise to new technology
- B. Strengthen research focused on economic development

**II. GOAL:** Strengthen outreach and extension efforts related to technical assistance, community and economic development (*see Goal 3 of the ISU Strategic Plan for 1995-2000*)

- A. Provide technical assistance to companies
- B. Support efforts to diversify the economic base of Iowa
- C. Support efforts to strengthen the economic base of Iowa by helping already strong companies develop new products and remain competitive
- D. Provide management assistance to companies
- E. Support community resource development
- F. Provide assistance to government, community groups, businesses and individuals in using research results

**III. GOAL:** Strengthen initiatives to stimulate economic development (*see Goal 6 of the ISU Strategic Plan for 1995-2000*)

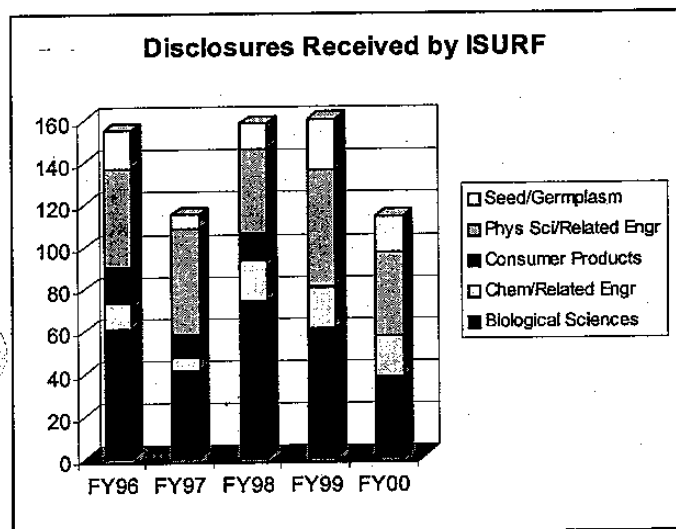
- A. Undertake new initiatives to assist in diversifying Iowa's economy
- B. Emphasize new initiatives for developing Iowa agriculture
- C. Provide technical assistance to existing Iowa industry to maintain current strengths
- D. Assure that results of ISU research and technology are used for public benefit
- E. Develop advanced manufacturing methods leading to products/processes designed to be market-competitive
- F. Cooperate with others to increase local and regional economic competitiveness and assess needs
- G. Participate in partnerships with local, state, regional, national, and international organizations

**I. GOAL: As part of the goal of strengthening its overall research efforts, ISU will strengthen research programs related to technology development and economic development**

**Objective A: Strengthen research giving rise to new technology**

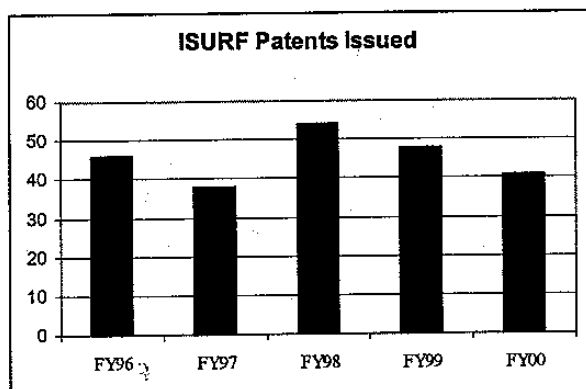
**Action 1: New Technologies Arising from Research**

New technologies are being disclosed on a regular basis from ISU programs as indicated in Figure 1 below. These disclosures provide the initial step towards licensing of new technological developments to Iowa companies and elsewhere.



**Action 2: Patents Issued to ISU Inventors**

About one third of new disclosures finally result in a patent. Iowa State is typically among the top fifteen universities nationally in the number of patents issued each year. See Figure 2 below.



**Action 3: R&D Magazine Award**

This year, the technology selected for submission received the prestigious R&D 100 Award, awarded to the 100 best applicants across the country. This award brings Iowa State's total to 22 since 1984, placing ISU second among all universities. The winning technology, which is based on laser-induced fluorescent spectroscopy, was invented through a collaboration of ISU and USDA researchers and has been licensed to eMerge Interactive, Inc. The invention is useful for the detection and imaging of bacterial contamination on animal carcasses during and after slaughter. It is a more effective method than those currently available and can be packaged in small, portable, low-cost units or in large, automated, high-capacity instruments.

**Action 4: Virtual Reality Grows Up at ISU**

Filling Howe Hall's atrium from the ground to second floor is the C6—the world's state-of-the-art, next generation virtual reality (VR) interface. Through the vision, research, and technical leadership of the Virtual Reality Applications Center—and the financial vision of many, including the University, NSF, and several national industrial partners—C6 has become a reality. The C6, a three-dimensional, full-immersion, synthetic environment, includes a room where all four walls, the floor, and the ceiling are projection screens capable of displaying back-projected stereoscopic images which totally immerse a subject in the projected image. The result is a seamless, animated scene that will allow C6 researchers to walk inside buildings that no longer exist, get close-up views of severe weather phenomena like tornadoes, and inspect the interior of operating industrial furnaces to make them more efficient. This is new technology, and its development represents an ongoing collaborative research effort between ISU and the Iowa companies of MechDyne Corporation, Brooks Borg Skiles Architecture Engineering, and Neumann Brothers.

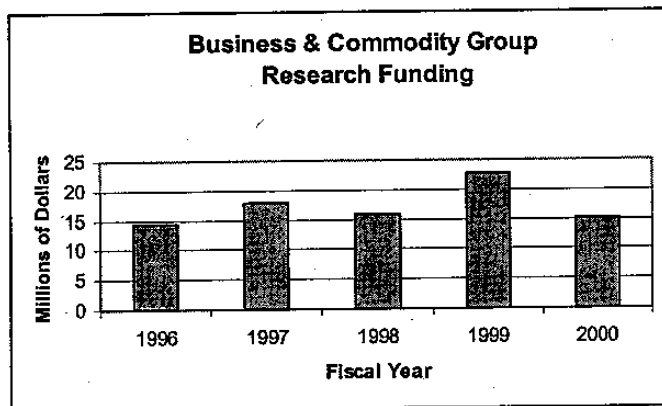
**Action 5: Pig Gene Mutation Affects Feed Intake**

Using a mouse gene knock-out model, researchers in the animal science department discovered a mutation in the pig MC4R gene that reduces or increases feed intake in a pig depending on whether they have one form of the gene or the other. This significantly affects

growth (6% difference) or fat levels (8% difference). Economically speaking, this technology could result in a \$20,000 increase per year for a producer with a 1,000 pig finishing facility.

#### Action 6: Funding from Business

In FY00 businesses (including commodity groups) funded 556 research projects at ISU totaling \$15.2 million. See Figure 3 below. In addition, businesses funded 79 non-research projects totaling \$9.7 million.



#### Objective B: Strengthen research focused on economic development

##### Action 1: Seeding Economic Development

In the second round of its Research Seed Funding Program, the Institute for Physical Research and Technology (IPRT) provided over \$260,000 for five new research projects headed by ISU and Ames Laboratory researchers. Seed funding helps researchers initiate challenging new projects, thereby giving them an edge in obtaining external funding. The projects selected are chosen for their potential to positively impact Iowa's economy. In a recent report from one group of researchers funded in the first round of seed funding in 1998, the team reported that their initial funding already has resulted in an award for \$100K/year from a national laboratory, and the same group signed a two-year contract with an Iowa power company in June. This research team designed tools in immersive virtual environments and investigated the application of these tools to power plants.

##### Action 2: Potential Outcomes from Research Investments

Two major ISU studies focus on the economic benefit of various genetic or processing modifications in corn products that have the potential to reduce feed or

starch costs, or to increase the value of feed or its ingredients. These efforts are blueprints for grant submissions to funding agencies and research initiatives focused on increasing value-added revenue for grain producers, feed producers, feeders, ingredient suppliers and manufacturers.

#### II. GOAL: Strengthen outreach and extension efforts related to technical assistance, community, and economic development

##### Objective A: Provide technical assistance to companies

##### Action 1: 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 (ICN), 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.

## **Action 2: ICAP Technical Assistance Results in Iowa Manufacturing Cost Containment**

For seven years the Iowa Companies Assistance Program (ICAP) has provided Iowa manufacturers with short-term technical assistance on various manufacturing topics. With information gained from working with ICAP, companies are able to develop new products, resolve product concerns, improve production processes, and more. In FY00, ICAP had 76 projects with 63 Iowa companies. Recent surveys returned from ICAP-assisted companies indicate "cost containment" issues as the primary benefit of their ICAP assistance. The following projects illustrate ICAP's impact:

### *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. ICAP 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 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.

### *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 ICAP provided the company with the information required to correct the problem, reduce returns, and maintain customer confidence in their product.

### *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 ICAP by a Center for Industrial Research and Service (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.

## **Action 3: IDL Advocates NDE Best Practices**

The Iowa Demonstration Laboratory (IDL) for Nondestructive Evaluation not only provides Iowa companies with nonroutine technical assistance—40 projects with 23 Iowa companies last year—but their efforts to incorporate NDE best practices into Iowa industry is best described as "teaching someone to fish." To accomplish this, three workshops were held across the state. 60 Iowans took basic NDE methods back to their workplace—ready to apply the six primary NDE methods to their companies' quality and waste reduction issues. The following projects illustrate IDL's impact:

### *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 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 IDL. 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.

**Action 4: Companies Seek MRC's Niche Expertise**  
The Microelectronics Research Center's (MRC's) 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 county company resulted in the company exploring full-scale production and sales of the prototype device.

**Action 5: Tire Changing Made Safer**

An 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 ICAP 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.

**Action 6: Soft Landings Assured**

An Iowa Manufacturing Extension Partnership (IMEP) agent contacted CIRAS on behalf of a manufacturer who was looking for a method to test an air pillow for stability, safety and weight capacity. This inflatable is used as part of a safety device for an amusement park game. To meet this challenge, CIRAS designed a load ram using controlled weights to simulate a human knee – the part of the body most likely to strike the inflatable upon falling. The company will use this test apparatus to measure capacity and wear; maintain and improve quality control; and confirm design configurations.

**Action 7: Outreach Gets Attention**

A faculty member in Chemical Engineering provided nine training seminars during the past year to a major manufacturer with multiple Iowa sites. The presentations represented work in statistical process control, a critical component to the industry, and covered new ways to approach efforts in production and quality measurement. In addition, the faculty member also worked with Iowa State graduates and interns on specific related problems.

**Action 8: New Connection Aids Unique Construction Process**

Working with the Civil and Construction Engineering department, an Iowa building products company has proven that its new design for a connector is feasible and may well provide a competitive advantage. New connectors are made of fiber-reinforced polymer material and are used as a tie between layers of concrete that sandwich a layer of insulation. Research involving CATD, Iowa Incentive Development Funds, and the company showed that the new connector offers advantages over current connectors and could improve the composite of this wall system.

**Action 9: Meat Processors Learn About New Food Safety Processes/Technologies**

Meat scientists conducted 20 short courses and workshops dealing with meat and poultry irradiation, processed meat production and food safety. One processed meat short course was taught in Spanish. People from 30 states, including Iowa, and 25 countries attended.

**Action 10: New Categorizing System Aids Plant Breeders**

ISU's Seed Science Center and the USDA-ARS developed a system to scan corn ears, cross sections and kernels and wed the images with a USDA-ARS germplasm database. The USDA uses the system to manage 13,000 accessions of corn germplasm. The information is available worldwide. The Center also was selected to administer the new national seed health system.

**Action 11: Growing Soy Foods Industry**

Supporting Iowa's rapidly growing soy foods industry is the focus of ISU faculty and staff who provide a range of expertise including market research, training of equipment operators, and international market development workshops. Recent participating businesses include Mycal Corporation, Jefferson; Midwest Harvest, Grinnell; and Devonsoy, Creston.

**Action 12: Statistical Methods for Industrial Processes**

A major component of the Department of Statistic's technology transfer efforts is its consulting activities on statistical methods for industrial processes. The largest project of this kind is the collaboration of a group of seven faculty with two major companies, supported by an NSF "Grant Opportunities for

Academic Liaison with Industry" award. A project with one of these companies was to isolate the cause of high variability they had experienced for years. Previously, it was not known whether the dominant source of variability was process equipment or process variables. Through experimentation and data analysis, the ISU statisticians showed that no one variable was dominant and isolated the specific piece of equipment contributing to the problem and aided company researchers in redesigning this equipment.

### **Action 13: Helping Create or Maintain Jobs in Iowa**

IMEP links Iowa businesses and manufacturers with ISU specialists and research, community resources, training, assessment and technical assistance in order to increase productivity and competitiveness. As a result of IMEP's efforts in FY00, 40 new jobs were created and 50 jobs were retained. Sales were increased by \$3,200,000 and cost savings reached \$1,200,000. Inventories were reduced by \$350,000. Additional capital investments reached \$6,680,000 and other investments amounted to \$1,400,000.

### **Objective B: Support efforts to diversify the economic base of Iowa**

#### **Action 1: Expand Markets**

The Small Business Development Center/Pappajohn Center employs and provides opportunities for international students through the Internship Program, the Business Lab and client services and market research – a mutually beneficial arrangement. The Center also meets with foreign visitors who are interested in technology transfer/business incubators and entrepreneurship. There were six such groups in FY2000 from Australia, Zimbabwe, South Africa, Ukraine and Poland. These efforts help diversify the economic base of Iowa through expanded markets.

#### **Action 2: CTRE Adds Talent to Iowa Workforce**

One of the greatest contributions made by the Center for Transportation Research and Education (CTRE) is the training of students in a business environment. This year, 30 graduate students work at CTRE as research assistants, working on transportation projects of interest to the Iowa DOT, the Iowa Highway Research Board, other state DOTs, or the Federal Highway Administration. Students work with faculty and professional staff at CTRE in a professional, company-like environment. CTRE provides students

state-of-the art computing hardware and software so that they will graduate with knowledge of the tools of the trade. In addition to working on real-world projects, students learn how to deal with budgets, deliverables, and schedules. CTRE students are well-prepared to enter the transportation engineering and planning workforce, equipped with technical knowledge and attitudes that lead to success. Since 1993, 315 students have worked at CTRE. Of the 220 master's level students who have worked at CTRE in the same time frame, 25% took their first post-college job in Iowa.

#### **Action 3: Plant Sciences Institute**

The Plant Sciences Institute was established in 1999 to lead Iowa to be recognized globally as the home of the premier plant sciences program. The Institute will have the world's leading concentration of scientific talent and resources working for the public good on the fundamental and applied plant sciences. This intellectual center will build on new fundamental knowledge to develop innovative solutions to issues in plant agriculture for the benefit of producers, the environment, and the economy of the state, nation and the world. The Roy J. Carver Co-Laboratory will provide a business incubator to facilitate university and industry plant scientists working in a collaborative manner. To assist in funding the business incubator, the Iowa Department of Economic Development approved a forgivable loan of \$500,000 (managed through ISURF) for this 15,000 to 19,200 nsaf building. Completion of the Roy J. Carver Co-Laboratory is planned for 2002.

### **Objective C: Support efforts to strengthen the economic base of Iowa by helping already strong companies develop new products and remain competitive**

#### **Action 1: Company's Waste Converted to Useable Energy**

Several years ago, an Iowa-based, international seed company contacted the 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.

#### **Action 2: CATD Leads Contract Research**

In FY00, CATD worked with more than 60 Iowa companies and initiated 36 industrial product and process development and improvement projects with Iowa industry. These contract research projects used \$318.3K in State of Iowa Industrial Incentive Program funds and \$110.5K in IPRT applied research funding, which leveraged \$887,800 in direct industry funding. Interns from the Reiman Scholars in Entrepreneurship recently surveyed more than 200 contract research projects managed by CATD since 1993. They found that Iowa manufacturers are satisfied with their contracts because of the technical results and turnaround time.

#### **Action 3: New Design Process Saves Time and Money**

When a northern Iowa manufacturer of recreational vehicles began new product designs, the company came to CATD seeking expanded computer modeling tools to conduct structural analyses as a means to shorten the design process of each new vehicle. After reviewing the company's needs and goals, CATD matched the company with the expertise and facilities in the Aerospace Engineering and Engineering Mechanics department. Under a university contract research project and using the company's designs and test data, the faculty customized finite element analysis (FEA) applications for the new designs. During a three-month time, the FEA iterations illustrated structural weak spots within the computer designs and assisted the company in making design decisions without the high costs in time and money of fabricating and testing full prototype models.

#### **Action 4: University/Industry Team Develops New, Improved Monitoring System**

An Iowa-based 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, ISU's Microanalytical Instrumentation Center (MIC) 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.

#### **Action 5: Making Waves Proves Design**

Destructive testing was used to simulate long-term testing of a new innovative dock manufactured by a company from Adair that also builds fishing boats. A team of engineers and engineering student interns from CIRAS designed and built test equipment that would simulate wave action on the company's modular, plastic floating dock. The equipment was set up in an acoustic tank and filled with water to simulate the desired wave action. This equipment will enable the company to perform long-term testing for further design modifications.

#### **Action 6: Students Seek Jobs with Iowa Biotech Companies**

The ISU Office of Biotechnology and the Iowa Biotechnology Association co-hosted the first Biotechnology Career Day on October 20, 1999, in the Molecular Biology Building atrium. The event drew more than 400 ISU students who talked to representatives from 12 Iowa-based biotechnology companies about job and internship opportunities. Company feedback from the event was universally positive; as a result of this success, Biotechnology Career Day will become an annual event.

#### **Action 7: Bringing Industry and ISU Research Together**

The biotechnology industrial liaison hosted more than 20 campus visits for industry, including four major plant sciences companies; assisted 15 faculty members in drafting agreements with industry; and initiated, negotiated, or reviewed 38 agreements with industry.

#### **Action 8: Electronic Commerce**

The Department of Logistics, Operations and Management Information Systems determined how to improve a major railroad's web-based e-commerce to further the mission and strategic goals of the company and to benchmark the company against other leading transportation companies.

## **Objective D: Provide management assistance to companies**

### **Action 1: TAA Cuts Printer's Bills**

Through IMEP, a small, family-owned commercial printer was selected as one of five Total Assessment Audit (TAA) demonstration projects by the Iowa Energy Center and the Center for Building Energy Research at ISU. A CIRAS field specialist was selected as project manager for the audit team. Teams were established to look at productivity, energy consumption, waste reduction, marketing, estimating, training, and various other tasks. Constraint management philosophy was used to develop a system to improve the flow of work through the plant. Company profit increased by 3.4%, sales per employee increased 10.1%, spoilage decreased 38%, waste removal costs decreased 5.7% and energy costs fell 4.8%.

### **Action 2: Internships Provide Experience-Based Learning**

The Reiman Internship Program provided experience-based learning opportunities to nine students in FY 2000. Students receive instruction in business plan writing and market analysis before spending time with a start-up company to help solve real business problems.

### **Action 3: Information Systems (IS) Certificate Program**

The IS Certificate Program in the Department of Logistics, Operations and Management Information Systems was started to educate and train IS and non-IS professionals in contemporary information technologies and thereby help them exploit the potential of information technology in their organizations. The program consists of five seminars, each lasting 30 hours and covering an eight-week period. Fourteen students from Deere and Company are enrolled.

### **Action 4: Transportation Trends Publication**

The Department of Logistics, Operations and Management Information Systems prepares a quarterly publication that addresses key management and public policy issues for transportation companies. Department faculty compose articles based on their research but targeted for an audience of 1800 professionals.

### **Action 5: Production Increases Over 20%**

A company located in Sioux Center with over 100 employees is expanding its core business of cab air suspension systems and tire pressure visual gauges to include axles. To increase sales of the dual truck tire visual pressure gauge, the company needed to decide how to increase productivity. Increasing staff and shop space was not a viable solution, since the state's unemployment rate was 2% and the cost of manufacturing space was at a premium. The company contacted IMEP for help in devising a plan that would meet the projected increased demand while maintaining existing space and the number of employees. IMEP immediately recommended that the company involve its existing staff in the improvement process and suggested that the company look at another larger firm in the area as an example of what types of efficiencies can be gained by process improvement.

IMEP contracted two employees from the larger firm to analyze the Sioux Center company's production process and make recommendations. By incorporating the techniques of the larger firm, the employees developed new approaches to producing the new product. The company expects to improve production and save up to 3 minutes per unit on a total previous production time of 15 minutes per unit. This is a labor savings of more than \$50,000 per year which reflects a savings of more than \$1.35 per unit. In addition, space requirements were reduced.

## **Objective E: Support community resource development**

### **Action 1: ISUE Financial Counseling Certification Program**

Working with ISU Extension (ISUE), a faculty member in Human Development and Families Studies has developed a web-based certification program to train individuals interested in helping people manage resources. The program, the first of its kind offered by a university, provides interactive web-based subject matter combined with a practicum field experience.

### **Action 2: Family Development Workers Help Families Reach Goals**

To assist Iowa families transitioning off public assistance become economically self-reliant and independent, a team of facilitators has modeled a 60-

hour strengths-based empowerment training for partnering with families. The team of facilitators consists of marriage and family therapists within the Human Development and Families Studies Department, family development workers practicing in the field and Extension families specialists who understand adult learning. Social workers, Head Start professionals and public health professionals are among those certified; 123 family development workers from Iowa have been trained to date.

### **Action 3: Child Care Center Needs**

Families Extension staff worked with several communities to provide consultation and technical assistance to ascertain child care needs. ISUE also worked on sustainability issues with a child care center in Forest City that was experiencing serious financial difficulties; recommendations were made for restructuring financial management practices.

### **Action 4: Retail Design Assistance**

During fall semester 1999, faculty-supervised teams of senior interior design students implemented a joint project with 12 retail and service-oriented businesses in Cherokee, Iowa. *The Cherokee Project – Retail Design* focused on preserving or restoring the historic character of the building façades while updating the interiors and fulfilling accessibility requirements. The students met with Cherokee clients in person and via the ICN to produce useful recommendations and to design guidelines for each business. A final report containing full-color design exemplars was published in May 2000. The community provided funding toward the studio's transportation and materials and Cherokee businesses are now reviewing project results for implementation.

### **Action 5: Urban Design and Planning Assistance**

During the 1999 fall semester, students in the Community and Regional Planning Department's Urban Design and Planning Practice class focused on the Taylor County town of Lenox, Iowa. The studio's first phase covered image and visual analysis of the community. Students assessed the town's appearance and developed preliminary drawings and maps, which they presented to the community to give residents and leaders a fuller sense of Lenox's existing conditions.

The second phase involved a thorough review of the community and county using Internet and other sources. The ISU Department of Economics provided

consulting services to the class as a part of the Iowa Department of Economic Development's contract with the College of Design. The college's diversity consultant spent time with the students discussing aspects of Latino relations within the community. The third phase involved citizens in a nominal group method with an ISU community development field specialist, who guided community members through the SWOT analysis technique, focusing on community strengths, weaknesses, opportunities, and threats. This resulted in a list of prioritized projects for the students to pursue with design concepts. The field specialist will help put the results on the Lenox home page on the Internet.

The fourth phase involved the students in the design of a market-rate subdivision, Main Street refurbishment, façade renovation, and open-space development for the downtown area. This outreach studio effort provided Lenox community leaders with valuable information to use in pursuing future projects.

### **Action 6: Community Outreach Partnership Center**

The Community Outreach Partnership Center (COPC) project is a joint endeavor of the Department of Community and Regional Planning, ISU Extension, the City of Des Moines, and the Des Moines Enterprise Community. The three-year project aims to establish a COPC in the Des Moines Enterprise Community (EC). The EC's five neighborhoods together make up one of the most diverse communities in Iowa.

Over the project period, the COPC program will focus on issues of local empowerment and planning, community leadership, affordable and fair housing, and neighborhood revitalization in the EC. The intent is to empower residents of the five EC neighborhoods to make and influence decisions about the future of their community. The project's format centers on a set of studios in which ISU faculty, graduate and undergraduate students work with EC residents on specific issues facing the community and its neighborhoods. Three studios were completed in the past academic year: the Community Development Planning studio, the Intermediate Landscape Architecture Design I studio, and the spring 2000 studio which involved the Department of Landscape Architecture's Comprehensive Landscape Planning class that researched the EC and proposed a wide

range of suggestions for improvement and redevelopment of areas within the EC area.

**Action 7: Citizens Join Animal Ecologists in Improving Communities**

The Animal Ecology Department established a "NatureMapping" program that involves citizen volunteers in environmental monitoring and reporting to aid natural resources managers. This is one of four such state programs in the country. In addition, the "Master Conservationist" program expanded into three additional counties after a pilot test in Story County. The program provides training for people who then complete 32 hours of volunteer service.

**Objective F: Provide assistance to government, community groups, businesses and individuals in using research results**

**Action 1: Tip Sheets Bring Legal Issues to Light**

A new series of mailings called Tip Sheets that help ISU faculty become more informed about various aspects of working with industry was developed by the biotechnology industrial liaison. Topics in the monthly series have included information on confidentiality agreements, material transfer agreements, research funding, and patent applications. The Tip Sheets are sent to faculty with biotechnology-related research interests and others involved in technology transfer on and off campus.

**Action 2: ISU 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 needs 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.

**Action 3: CTRE Aids in Managing Iowa's Roads**

Iowa has 39,000 miles of paved roads, and the Iowa DOT estimates repaving needs in the next 20 years to exceed \$19 billion. To assist in making cost-effective maintenance and construction decisions, the Iowa DOT implemented the Iowa Pavement Management Program (IPMP), which is partially based on research conducted by CTRE. Data on pavement distress are collected using vehicle-mounted video and laser equipment. CTRE manages the IPMP, controls data quality, delivers data to participating agencies, provides training, and conducts on-going research. 35 local agencies have requested the service.

CTRE's Center for Portland Cement Concrete Pavement Technology (PCC Center) is conducting research and developing outreach courses targeted at industry practitioners. It is funded by \$1 million from the Iowa Concrete Paving Association program and supported by the Iowa DOT and ISU engineering faculty. Even though this center is new, a materials supplier has contracted for research that will help extend the life of PCC pavements.

**Action 4: Smoothing the Process To Better Roads**

Civil and Construction Engineering researchers working with state and industry partners have developed new methods for reducing road closings and building smoother roads. Iowa State engineers helped evaluate the concept of estimating concrete strength very early and found that estimates of pavement strength could be made in the lab or on the first day of construction. This testing allows contractors to reduce closing time in most cases to two days, and reduce the need for using high early-strength concrete in intersections.

In addition, new concrete pavement vibration technology was evaluated. The evaluation resulted in an Iowa DOT requirement that all mainline pavers be equipped with monitoring devices, and established a range of frequencies that must be met to achieve high performance concrete pavements.

**Action 5: Mapping Crashes to Save Lives**

In order to increase the use of crash data in the planning of roadway modifications, the Iowa DOT contracted with CTRE to develop a mapping enhancement to the Accident Location and Analysis

**System (ALAS) called GIS ALAS.** The enhanced system ties roadway information to crash data. Crashes at a location can be plotted by time of day, year, age of driver, or any other variable in the database, providing the analytical basis for improving safety at high crash locations. Since the inception of the project in January of 1998, accuracy and error checking has improved from around 70% locatable crashes to 95%. CTRE is now focusing on developing an intersection database management system, adding system enhancements, and strengthening program support. A transportation official comments that the value of this research is enormous: It makes it much more likely that a poorly functioning location will be corrected prior to the occurrence of a headline-generating crash.

#### **Action 6: Computerized Incident Location Tool Serves Officers**

Another enhancement to the crash reporting system developed by CTRE is the Incident Location Tool software, which links Geographic Information System (GIS) and Global Positioning Satellite (GPS) technology in the patrol car at the scene of a crash. This software provides Iowa law enforcement officers a tool to locate crashes on a digital map of their region. The location and accompanying text report from the officer are transmitted electronically to the DOT for reporting purposes. The DOT is optimistic about the productivity and efficiency increases, reporting that time has been reduced by up to 18 months and that advanced types of analysis linking data about the roadway (i.e. pavement type, shoulder width) to the crash scene can be undertaken.

#### **Action 7: Biotech Education Center Opens**

On April 14, 2000, the Biotechnology Outreach Education Center was dedicated. The center, located in the Molecular Biology Building, offers hands-on training in various aspects of biotechnology to K-12 educators and students, ISU Extension professionals, adult educators in public and corporate sectors, and the general public. The center has trained various industry, scholastic, and public groups. In FY2000, the center provided supplies for biotechnology laboratory experiments to 152 teachers in 114 school systems in Iowa, affecting more than 11,000 students. By the end of July, 30 events had been held in the Biotechnology Outreach Education Center for more than 650 participants.

#### **Action 8: Course to Explain the Basics of Biotech to a Non-Scientific Audience**

The Office of Biotechnology worked with the Iowa Biotechnology Association (IBA) to create a three-hour, hands-on seminar to explain the basics of biotechnology to industry professionals without a scientific background. Participants learn about DNA, genetically modified organisms, and the future of biotechnology.

#### **Action 9: Direct Digital Controls Online**

The complexity and proprietary nature of Direct Digital Control (DDC) systems for automation and management of building environmental systems makes it difficult for building owners, managers and engineers to stay current with technology developments. To address this problem the Iowa Energy Center developed a Web site ([www.energy.iastate.edu/DDC\\_online/](http://www.energy.iastate.edu/DDC_online/)) that provides generic and specific information on DDC systems. Prior to debut of DDC-Online, head-to-head comparison of systems from different vendors was difficult. The Center's Web site provides introductory information such as terminology and a manual covering input/output processes. However, the heart of DDC-Online is a detailed listing of DDC system architectures, hardware components and software associated from nearly 20 national and international vendors.

#### **Action 10: Outreach to Iowa Communities in Fiscal, Development, and Planning Issues**

Faculty members in the Department of Political Science have been extensively involved with providing their expertise to Iowa communities on such issues as local development, budgeting and finance, and land use planning and offering training programs for municipal clerks, county officials, and operators of public water and waste water disposal plants. These activities reach officials across the state of Iowa—including some 950 incorporated communities and all 99 counties.

#### **Action 11: Public Acceptance of Agricultural Products**

A professor in the Greenlee School of Journalism has been studying the communication issues surrounding public acceptance of GMOs and has given six presentations to regional and national meetings involving government agencies, businesses, and educators.



**Action 12: E-mail Newsletter and Web Site Solves Transportation Problems for AgrAbility Families**

Transportation is a difficult challenge for farm families affected by disabilities. Wheelchair users and others with severe health problems are reluctant to travel long distances to educational meetings, especially on icy gravel roads during Iowa's cold winters. Staff for the Iowa AgrAbility Project (a collaborative effort between ISU Extension and Easter Seals Iowa that is partially-funded by a grant from USDA) saw an e-mail newsletter as a convenient, low-cost way to reach this at-risk audience. Easter Seals staff obtained donated computers to distribute to selected AgrAbility participants who did not already have access to a computer; ISUE staff wrote a monthly e-mail newsletter on farm and family issues. Started in July, 1999, the "AgrAbility Chit Chat" now reaches more than 70 AgrAbility households and more are being added each month. An AgrAbility Listserv and Web site ([www.extension.iastate.edu/agrability](http://www.extension.iastate.edu/agrability)) also have been created to meet the needs of this special audience. AgrAbility families are using the new technology to develop a strong network of interest and support for each other across rural Iowa.

**Action 13: Building Resourceful Families**

A viable source of potential employees for Iowa business and industry is available within families currently receiving welfare assistance. Several years ago, Iowa's Promise Jobs initiative identified lack of basic life skills as an impediment for many participants' progress toward economic self-sufficiency. ISU Extension to Families developed a curriculum, and trained staff in seven Workforce Development regions to facilitate Building Resourceful Families classes.

**Action 14: Rural Welfare-to-Work Strategies: Transportation for Rural Family Investment Program Recipients**

Affordable, reliable transportation is a key to moving Iowa's rural welfare recipients into the workforce. Iowa received one of ten Rural Welfare-to-Work Strategies planning grants from the U.S. Department of Health and Human Services to design pilot programs that would remove barriers to work in rural locales. The Iowa Department of Human Services (IDHS) contracted with ISU to conduct applied research on transportation needs of welfare recipients in Lee County. Focus group findings clearly demonstrated

that welfare recipients preferred improved access to private vehicles rather than the development or expansion of public transit. Local Extension and Lee County DHS staff members created a steering committee that designed a subsidized loan program for the purchase or repair of cars. IDHS plans to replicate the loan program in other rural counties.

**Action 15: Food Safety Web Site**

The Food Safety Web Site, maintained by the Department of Hotel, Restaurant, and Institution Management, provides research-based, up-to-date food safety information to institutions, businesses, and individuals. The Web site has had almost three million hits from visitors from 77 countries.

**Action 16: Land-Use Planning Survey and Report**

More counties and cities in Iowa are establishing land-use plans, but local governments' planning practices are still risky business, according to a new study by the Institute for Design Research and Outreach (IDRO). IDRO recently completed the first statewide land-use planning inventory since 1976. While the report does cite some improved conditions in the status of local planning, especially among Iowa's counties, it also notes the appearance of increased risk among local governments due to their planning practices. Many areas in Iowa are not basing zoning ordinances on land-use plans, as required by state law. Others are not updating plans and ordinances.

**Action 17: U.S. Highway 20 Environmental Corridor Project**

ISU Landscape Architecture Extension, the nonprofit organization Trees Forever, and the Iowa Department of Transportation have teamed for several years to bring the Iowa's Living Roadways Community Visioning Program to smaller Iowa communities. These three groups recently joined again in the U.S. Highway 20 Environmental Corridor Project.

The IDOT plans to expand Highway 20 to four lanes between Dubuque and Sioux City. The goal of the environmental corridor project is to help the communities linked by Highway 20 to work together to envision more beautiful, environmentally friendly roadsides, and to incorporate residents' ideas into the IDOT's design work.

A series of six three-part workshops was conducted in May and June 2000 in six communities located along



the Highway 20 corridor. IDRO was in charge of creating, distributing, tabulating, and analyzing the results of this survey. Issues of importance that were identified by the survey will be considered in the planning of the Highway 20 expansion.

**Action 18: Behavioral Research Translated into Community Human Services**

Based on recent research on the prevention of mental health and substance abuse problems in rural and urban communities, the Institute for Social and Behavioral Research (ISBR) developed programs to reduce risks for these difficulties. In the past year, these programs have been adopted in communities in Iowa and the nation.

**Action 19: Stronger Families Goal of Research-Based Interventions**

Studies conducted by researchers at ISBR have identified several avenues whereby economic hardship and community disadvantage disrupt family processes and child development. Based on these findings, they have developed prevention/intervention programs designed to strengthen families at risk for problems. Results indicate that these programs make families more effective and significantly reduce the probability that children will display conduct problems, use illegal substances, or suffer from anxiety or depression.

**Action 20: Cooperation Extends Impact of Soy Research**

The Soybean Yields Project developed new information regarding the effect of interactive stresses on soybean production and provided management recommendations to reduce impacts of stress on yield. The results were summarized in a publication sent to approximately 70,000 soybean producers in Iowa and Illinois. Over 1000 additional copies have been distributed by request to crop consultants, state extension services, and industry.

**Action 21: Better Water is Focus of Research-Education Team in Maquoketa Watershed**

An ISU team led a water-quality monitoring project in the Upper Maquoketa River Basin above Backbone State Park near Strawberry Point and Arlington. Cooperators in the project include the Texas Institute for Applied Environmental Research, IDNR, National Resources Conservation Service and several Maquoketa River organizations. Results are being

shared with the Maquoketa Headwaters Watershed Council and have been used to calibrate models to project the impact of various practices on water quality in the 40,000-acre watershed. Local citizens are using this study to help them decide where they would like to utilize their resources best to make needed water quality improvements.

**Action 22: Discussing the Impact of Technology**

The director of the History of Technology and Science program gave thirty-five interviews to various media sources, including Investors' Business Daily, The New York Times, the New York Daily News, the Fort Worth Star, the San Francisco Chronicle, the Atlanta Journal-Constitution, and the Kansas City Star on topics that included: technology trends in the 20th Century, the impact of technology on people's lives, significant changes in the dot.com decade, the public reaction to biotechnology, the growing technology gap between engineering and people, and technology in the 21st Century.

**Action 23: ICN and Latino Cultural Communication**

The Department of Foreign Languages and Literatures (FLL) periodically offers the ICN Latino Cultural Communication course to professionals across the state. WOI funds have also been provided to develop a Spanish for Health Care course for a similar market. In addition, FLL maintains a list of persons willing to interpret or translate for companies or others.

**Action 24: Evaluating Quality Jobs**

The Research Institute for Studies in Education collaborated with a number of university, state, and national groups to evaluate the effectiveness of economic development programs. One example of this joint participation is the evaluation of the Quality Jobs for Quality Communities program, in which communities explore their values related to the fit between workforce development and economic growth opportunities. Another is the evaluation of the community-based Precision Agriculture Education network, which prepares students to use technology more effectively in agriculture and to fill jobs in the New Economy.

### III. GOAL: Strengthen initiatives to stimulate economic development

#### Objective A: Undertake new initiatives to assist in diversifying Iowa's economy

##### Action 1: Companies Arising from ISU Technology

Companies whose formation was based in part on technologies and/or technical expertise arising at Iowa State University are listed in Table 1. The nature of their business is also indicated.

#### COMPANIES THAT HAVE FORMED DUE TO ISU TECHNOLOGIES AND/OR TECHNICAL EXPERTISE

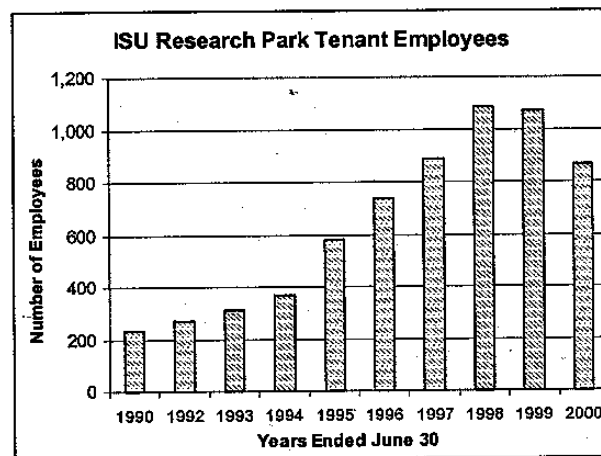
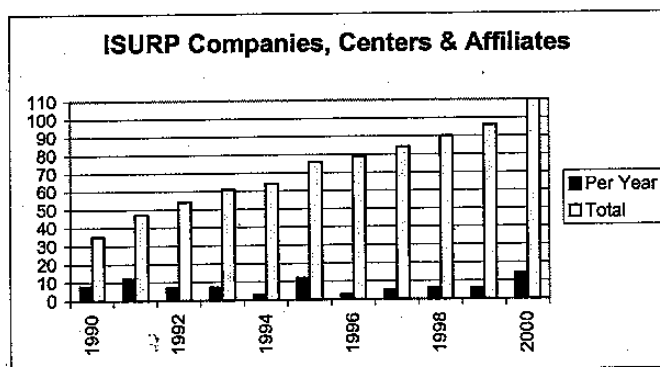
<u>Name of Company</u>	<u>Date</u>	<u>Specialization</u>
MultiSep, Inc.	2000	Electrophoretic instrumentation technology
Nitro Cream, Inc.	2000	Ice cream processing system
Novascan, Inc.	2000	Instrumentation for atomic force microscopy
Phytodyne Incorporated	1999	Plant transformation technologies
Technology Labs, Inc.	1999	Assessing computer performance
MASIM, Inc.	1999	Process for joining ceramics
IA-TEK	1999	Process for analyzing seeds
Biotronics	1999	Ultrasound techniques for food animals
Innovative Materials Testing Technologies	1999	Advanced nondestruction evaluation techniques
Modelspace Corporation	1998	CAD System for turbomachinery
MSTRS Technologies	1998	Metered semiochemical timed-release systems
NDE Technologies, Inc.	1998	X-ray simulation code
epmt, inc.	1998	auction market simulators
Carbon Energy Technology (CETECH)	1997	Biomass gasification technology
MechDyne Corporation	1997	Haptic feedback devices
Advanced Analytical Technology, Inc.	1997	Applications of microanalytical instrumentation
Engineering Analysis, Inc.	1997	Computational fluid dynamics
Applied Academics	1997	Interactive veterinary training
Delta Tie	1997	Engineered structures
Accumen	1997	Data storage
Engineering Manufacturing, Inc.	1997	Powdered metals
Vista R & D	1997	Video hardware, software
X-L Space Systems	1997	Rocket fuel processing
Anaerobic Biosystems Corporation	1996	Anaerobic technologies
ESGA, Inc.	1996	Computer-based patient medical records system (closed in 1997)
Palisade Systems, Inc. (formerly MidAmerica Networking, Inc.)	1996	Computer network products
NewMonics, Inc.	1996	Real-time Java software & computer memory management systems
Amtak, Inc.	1995	Nondestructive evaluation instrumentation
Pefftronics	1995	Audio processing
Intellignostics, Inc.	1995	Biomedical sensors (closed in 1997)
Bioforce Laboratory	1994	Atomic force microscopy (probes)
8VA Corporation	1994	Thermal management components
Intellitech Inc.	1994	Software for nondestructive evaluation (closed)
Molecular Express Incorporated	1994	Research and testing of laboratory products
RESIFT, Inc.	1994	Ultra-high sensitivity in microsequencing small proteins and peptides (closed)
Arete Software Company	1993	Software for manufacturing processes (closed in 1995)
Pioneer Precision Coatings Inc.	1993	Hard coating surfaces (closed in 1994)

Potter Solar Services	1993	Electric Motors
Veterinary Resources, Inc.	1993	Testing new animal health products
Calyscale Company	1993	Livestock specialties
Adaptivation, Inc.	1992	Adaptive medical devices
Larock Organics	1992	Organic forms of palladium
Prototype Engineering	1992	Sensors for pilots (closed in 1995)
CETAC Technologies	1991	Analytical instruments
Full Spectrum	1991	Laser fiber optics
Ames Specialty Metals	1990	Permanent magnet materials (closed in 1993)
Edge Materials, Inc.	1990	Nondestructive evaluation (closed in 1991)
Engineering Animation, Inc.	1990	Scientific computer visualization
Metabolic Technologies, Inc.	1990	Natural biological compounds

## Action 2: Research Park and Innovation System Launch New Businesses

The Iowa State University Research Park and the Iowa State Innovation System (ISIS) continue to launch new businesses based upon technologies developed at ISU. With the assistance of the SBDC and the Pappajohn Center, ISIS and the Research Park nurture new start-up companies at a critical point of technology commercialization. By providing financial assistance and a supportive environment for new start-up companies, based on ISU technologies, the Research Park is a vital link in the transfer process.

As of June 30, 109 companies and research centers have located in or been affiliates of the Research Park and ISIS. Of these, 29 companies employing over 348 people have left the Park to expand or locate elsewhere. Twenty-three of those stayed in Iowa. Currently, forty-six companies and centers are located in or affiliated with the Research Park. These companies employ nearly 900 people, including hundreds of ISU graduates and more than 200 current students. During FY00, 13 new companies and affiliates joined the Park.



- Construction of an addition to Multi-tenant Building III commenced in September of 1999 bringing the total multi-tenant space available in the Park to 125,000 square feet. This has increased the space available for lease in the Research Park by 67% since 1997. The addition is already 60% leased and should be completed by October.
- The Iowa State University Research Park has assisted two start-up companies by financing improvements critical to their early growth phase and by funding business-consulting assistance through the Pappajohn Center.

## Action 3: ISU Composite Research Important to Start-up Company in Northeast Iowa

The continuing 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 CATD now has firm plans to manufacture soy-based adhesives. The start-up company has received a \$250,000 IDIED 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.

#### **Action 4: High-Tech Central Iowa Company from ISU Technology**

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, 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.

#### **Action 5: Seed and Starch Advisory Board**

In conjunction with research funds obtained from the Iowa Corn Promotion Board, faculty members in the Department of Food Science and Human Nutrition formed an industry advisory board, comprised of members from the seed and starch industries and one Iowa farmer, to help guide them in their development of new corn genotypes with value-added properties.

#### **Action 6: Business Assistance**

The ISU Small Business Development Center provides business assistance to all for-profit companies, and the ISU Pappajohn Center focuses on developing businesses based on ISU technologies. The Center provided business counseling to 26 technology-based companies in fiscal year 2000. The Center assisted 15 of these companies that are in the early stages of development to raise over \$1 million in capital. In addition, the Center has 17 prospective companies in the start-up stage.

#### **Action 7: Youth Entrepreneurship**

The Pappajohn Center leads conference sessions on youth entrepreneurship exposing on average 300 – 500 youth per year to small business, and the Youth Marketplace, an entrepreneur program for elementary/middle school students, continues to impact large numbers of elementary/middle school

students. The results of last year's pilot program led to the creation of a formal curriculum for use in elementary schools that includes a teacher's, student's, and coordinator's manual.

#### **Action 8: E-commerce Potential for Agriculture Explored**

The Center for Agricultural and Rural Development (CARD) and the Midwest Agribusiness Trade Research and Information Center sponsored the 2000 Agricultural Forum, which focused on the impacts of e-commerce on agriculture. This was one of the first conferences to address the policy implications of e-commerce. More than 700 people attended. A Web site was developed to extend the educational benefits of the conference speakers to a broad audience.

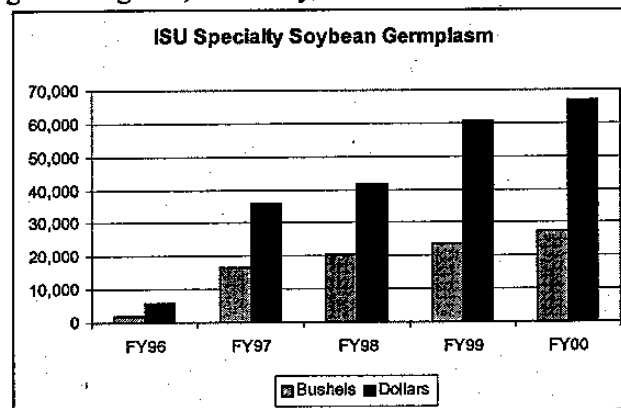
#### **Action 9: Fish Farms Receive Technical Support**

The Animal Ecology Department helped several Iowa fish farmers obtain economic development grants and then assisted with start-up activities.

### **Objective B: Emphasize new initiatives for developing Iowa agriculture**

#### **Action 1: Making New Plant Germplasm Available**

The next graph shows the number of bushels of soybean on which royalties were collected and the dollar amount of those royalties. Example: In FY2000, 27,347 bushels were planted in Iowa generating \$66,834 in royalties.



**Action 2: Weighty Manual Aids Pork Industry**  
Agriculture and food processing are changing due to demands from the consumer market and global standards that are changing standards of quality and safety. Many pork producer groups are creating their own value-added businesses with an eye toward

processing and marketing. The motivation is to capture the margins that processors and retailers now enjoy. A challenge was issued by the USDA Rural Development Program to create a "how to" manual for value-added pork production. A team from CIRAS responded. Business and marketing worked with other specific disciplines to create a comprehensive self-help manual that is generic enough to garner wide use, but specific enough to be of high value. This type of tool can eliminate weeks or months from the normal formation time of a value-added ag business.

### **Action 3: Two Maize Genes Licensed for Expanded Usage of Corn**

The ISU Research Foundation has granted to a major agricultural research firm with a presence in Iowa an exclusive license that provides genetic technology related to the maize gene *Du1*. This technology, developed by faculty members in Biochemistry, Biophysics and Molecular Biology, is being applied to alter the structure of starch in corn kernels towards the goal of providing novel products and thus expanding the market. Another genetic technology developed by this team related to the maize gene *Su1* has been optioned for license to a second major biotechnology firm with Iowa ties.

### **Action 4: Adding Value: Linking Growers with Food Service and Restaurant Managers**

ISU studies have indicated a need to develop new efforts in research/extension to expand Iowa markets. A strategic plan was developed to integrate the work of the Department of Hotel, Restaurant, and Institution Management, the Field-to-Family Project of Practical Farmers of Iowa, Leopold Center, and school food service managers. A Central Iowa Food System Leadership Retreat to link growers and food service operations was held. All-Iowa meals, one tangible result, are on the increase. A report, *Local Food Connections: From Farms to Schools*, documents procedures to guide producers and value-adding entrepreneurs seeking new markets in local grocery stores and the food industry.

### **Action 5: Electron-Beam Pasteurization Tested and Adopted**

ISU's Linear Accelerator Facility has conducted research for the military, Electrical Power Research Institute, private companies and commodity groups. It has the nation's only program for training,

demonstration and education in food irradiation and has conducted tests for more than 175 groups and companies. A private food irradiation facility opened this spring in Sioux City based on work conducted at the ISU facility. Using the electronic beam pasteurization process, pathogen threats from beef and poultry can be eliminated for a few pennies a pound.

## **Objective C: Provide technical assistance to existing Iowa industry to maintain current strengths**

### **Action 1: ".com" Research Delivers Groceries**

ISU faculty and researchers from several engineering disciplines and the Ames Laboratory assisted a northern 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, CIRAS engineers, working with university faculty and researchers, 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.

### **Action 2: 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 a CATD 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.

### **Action 3: New Process Plugs Trough Leaks**

A company in central Iowa 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 a CIRAS field specialist to look for a solution to this testing dilemma. The IDL 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.

### **Action 4: Heavy Loads Get Lift**

An Iowa company that designs, manufactures and integrates material handling devices turned to the Mechanical Engineering Department for assistance in developing a new product. Researchers developed methods that use computer-controlled sensing and actuation to amplify push and pull forces from an operator, minimizing the effort required to position heavy or bulky objects during the manufacturing operations. The new technology helps protect workers from lift-related injuries, increases productivity, and improves the capacity of the operator and machine. Iowa State has applied for the patent to the control scheme used in this new device and has negotiated a licensing agreement with the company. Machines utilizing the technology have been installed in industries, and the company is exploring other heavy lift assist applications.

### **Action 5: Optimization Effort Has Big Impact**

A major Iowa electronics manufacturer was looking for ways to optimize the configuration of its assembly line and facility and turned to an Industrial Manufacturing Systems Engineering professor for help. The researcher developed a robust and quantitative method that fit the manufacturer's need and increased its production efficiency. The method also gave them a tool for use in future applications and benchmarking. This advance enabled the

manufacturer to gain competitive advantages in cost, speed and flexibility.

### **Action 6: Apple Cider**

Fresh fruit juices, especially unpasteurized apple cider, have been the sources of significant food poisoning outbreaks recently. The FDA has mandated that apple cider that has not been treated by a method that reduces the significant microbial population by 100,000-fold must carry a warning label. Pasteurization will achieve this reduction in organisms but can alter the flavor and appearance of the cider, and it is expensive for small cider producers to implement.

Faculty members in Food Science and Human Nutrition have been working with Iowa cider producers to improve the safety and quality of apple cider produced in Iowa. They gave presentations at Iowa Fruit and Vegetable Growers meetings on good manufacturing practices (GMPs) and Hazard Analysis Critical Control Points (HACCP) programs, and conducted Cider Schools to certify cider producers. The effect of electron beam irradiation on the microbial population in apple cider and on the cider's quality is being studied actively.

The goals of this work are to increase the safety and quality of Iowa cider, to help cider producers stay in business, to provide cider producers with training to improve their manufacturing practices, to provide information about the manufacturing practices of cider producers, and to determine if irradiation would be a viable alternative to pasteurization as an effective and economic way to reduce microorganisms in cider.

### **Action 7: Web Site One of Nation's Top Sources of Weed-Management Information**

The Extension Weed Science group has one of the top-rated Extension Web sites in the country devoted to weed management. The site is "linked" by many other Web sites worldwide, and receives an average of 1,600 "hits" per day (more than 500,000 per year). The site provides the kinds of general weed science information, graphics and up-to-date news items and articles that computer-oriented outreach clientele require.

**Action 8: Way to Identify GMO Crops Developed**

A method to use near infrared technology to differentiate Round-up Ready soybeans from non-genetically modified beans was developed. Work continues on a way to distinguish between GMO and non-GMO corn.

**Action 9: Research and Education on Pork Leads to Higher-Value Pork**

The National Pork Producers and others, including Iowa State Extension, have developed a formula for evaluating economic traits of swine. Swine specialists work with county swine committees to weigh pigs going on and off the test. Carcasses are evaluated for percent lean, usually by ultrasound. Observed improvements include 18.4% less backfat in just five years, which should increase the value of a 250-pound pig by \$4.75 per head. Such improvements are based not only on the carcass evaluation program but they are evidence of the impact extension has on producers and 4-Hers adapting to changes in modern pork production.

**Action 10: ISU Executive Seminars Focus on Corn and Soy Processing**

ISU hosted executive training seminars for government officials, industry leaders and university administrators interested in commercial corn and soy processing for food- and non-food products. The seminars focused on the demands on and needs of Iowa grain processors, and food, ingredient, and industrial product manufacturers.

**Action 11: CARD Web Site Helps Farmers Assess Risk**

CARD has an interactive web-based resource that provides farmers with the information they need to determine the riskiness of crop marketing decisions associated with the government loan deficiency payment (LDP) program. Since September 1999, more than 125,000 hits have been recorded. Many leading agribusiness Web sites have linked to the CARD Web site because of this interactive tool on LDPs.

**Action 12: Study of Earthen Waste Storage Structures Widely Used**

An ISU research team completed a legislatively-mandated report on earthen waste storage structures. The report was distributed widely to decision-makers, and the entire report was made available to

many around the country through a Web site. The study has had impact on the IDNR permit requirements for earthen waste storage structures as well as those in other states. It remains the most comprehensive study to date to indicate how well earthen structures can be expected to perform in various geological settings. The report consisted of information on the geology of the construction sites, the past management of the structures, as well as the measured seepage rates and soil samples surrounding the structures to determine potential migration of pollutants off-site.

**Action 13: SBDC/Pappajohn Programs**

The Small Business Development Center/Pappajohn Center Intern Program provides experience-based learning to students in start-up technology-based companies and provides student assistance to the companies.

The ISU Business Lab utilizes corporate sponsor support to provide up to 70 students with hands-on experience in solving business problems presented by the sponsor. In addition to experiential learning, some students receive academic credit for their work on projects and others are paid an hourly wage. Faculty from the College of Business, Industrial Education, and Engineering oversee the projects. The sponsoring company receives the benefit of quality results at a lower cost.

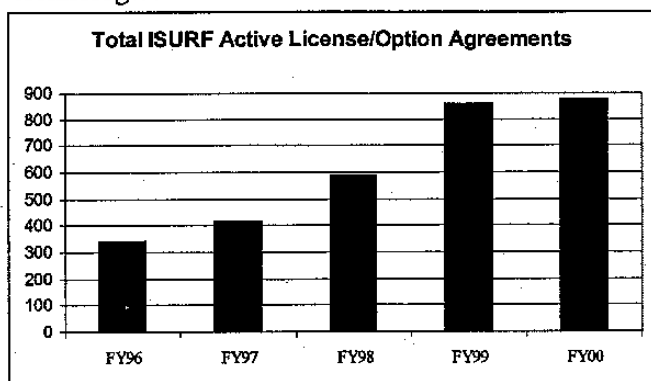
The Small Business Development Center/Pappajohn Center employed five undergraduate students and one graduate student to assist with client services and programming. In FY2000, at least 27 of these companies were high tech in nature. Students in the client services area learn to write business plans and perform secondary market research, market planning and cash flow analysis.

**Objective D: Assure that results of ISU research and technology are used for public benefit**

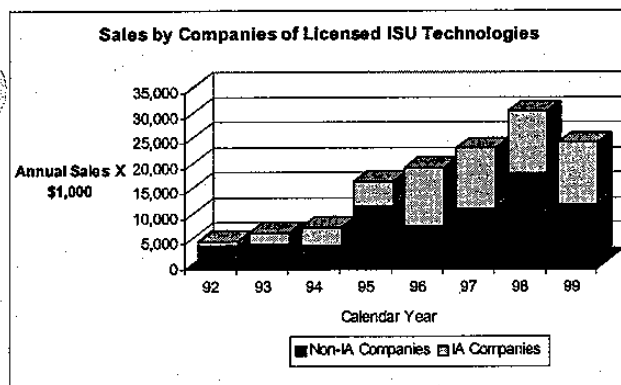
**Action 1: Iowa State's Research Foundation Signs New Licenses**

Iowa State University contributes to the diversity of Iowa's economy through the invention and licensing of new technologies, many to Iowa companies. In FY2000, 229 new licenses and options were signed including 198 for plant germplasm. Thirty-five

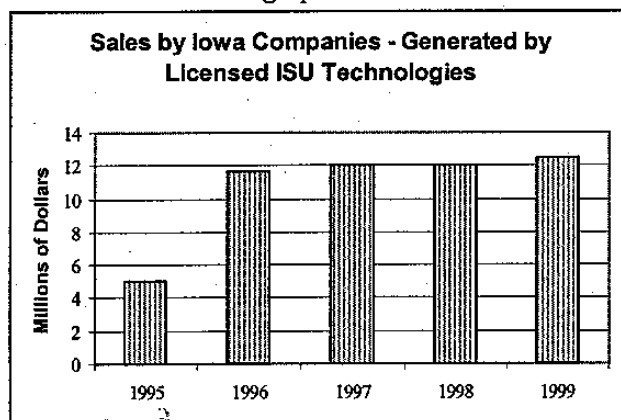
inventions were licensed for the first time in FY2000. Of these, 11 are plant varieties and 24 are other technologies.



**Action 2: ISU Technology Generates Iowa Sales**  
New technologies originating at ISU contribute directly to the Iowa economy. Technologies licensed to Iowa companies (not including plant germplasm) resulted in twelve and a half million dollars of sales by those companies in 1999.



Note: FAX and non-patented plant germplasm not included in these two graphs.



### Action 3: 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.

### Action 4: Tapping ISU Industrial Outreach Resources

Two recent initiatives emphasize how Iowa businesses and industries learn to access university research and technical services. That topic was the focus of a two-day conference, Technology Outreach 2000. ISU hosted more than 50 Iowa business and industry leaders, representing companies such as Amana Refrigeration, Vermeer, Fisher Controls, Maytag, and Ritchie Industries. Businesses that have benefited from ISU's resources shared their experiences during the event. In addition, conferees visited with researchers and toured facilities that conduct research and provide outreach services. CATD reports that as a result of the conference their organization has had several discussions with companies about university contract research.

In a training initiative, IPRT and CIRAS joined forces and held a conference entitled *Nuts & Bolts—ISU Industrial Outreach*. This two-day workshop introduced the IMEP community college account managers to the university's industrial outreach programs. Located throughout the state, the IMEP agents offer ISU outreach programs to Iowa manufacturers. At the end of the workshop, 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 the IMEP quarterly meetings, where field agents discuss the delivery of ISU services. Another workshop this fall will provide a hands-on introduction to manufacturing



areas such as nondestructive evaluation and rapid prototyping.

#### **Action 5: Let The Plants Do It**

The ability to recover and purify materials, industrial enzymes and pharmaceuticals from plant material is a critical factor for industries that use plant biotechnology. Costs of purification strongly influence the economics of production, and a challenging goal is to have all or as much of finished products as possible "manufactured" in the plants themselves, rather than in a chemical plant.

Chemical Engineering researchers have been working with two Iowa biotechnology firms on several projects to produce proteins either directly from plants or agricultural crops by way of fermentation rather than producing them via more costly methods. The completed research has provided methods that hold the potential for greatly improving production costs, and improving competitiveness. One company is in the process of pursuing the approach indicated by the research findings.

#### **Action 6: CTRE Information System Aids Travelers**

Twenty automated weather stations around the state monitor conditions such as precipitation, air temperature, wind velocity, wind direction, and pavement temperature. The system also incorporates data from 33 aviation weather stations located at airports. The CTRE-developed "Weatherview" system collects this information and presents it in real-time map form on the Iowa DOT's Web site, providing Iowa travelers weather information to aid in making travel decisions. This information supplements traditional weather reports because it is site-specific. Iowa DOT maintenance staff use this information to plan winter roadway maintenance activities. The Web site began operation in the spring of 2000 and can be viewed at this address: <http://www.weatherview.dot.state.ia.us>. Over 26,000 visits were recorded in the first six months, indicating travelers are making good use of the information.

The Iowa DOT Road Work Report provides current construction status for projects throughout the state. CTRE developed the report for the Iowa DOT, using an electronic map to visually present project locations and pertinent project details, such as

duration and impact on motorists. The Road Work Report in combination with Weatherview provides valuable information for the motoring public to make better, more informed travel decisions.

#### **Action 7: Software Gets Positive Reviews**

*Science Magazine* reviewed an educational computer-graphics software package called "Phase" that was developed by a Chemical Engineering faculty member. The software uses high-performance visualization methods to produce user-movable 3-D images of vapor/liquid phase diagrams. While single, static drawings have been used for many years in teaching and learning thermodynamics, "Phase" gets the learner to interact with the images, developing a greater understanding of the physical/chemical relationships involved. This is a major step in the use of visualization techniques for high-level chemical engineering courses that is now being used by over 100 schools and institutions.

#### **Action 8: Computerized Nutrient Analysis of School Foodservice Menus**

Iowa school foodservice managers are required to complete a nutrient analysis of meals served in Iowa schools for the purpose of balancing the fats, carbohydrates, and proteins in school meals. One method to measure the food composition and complete the nutrient analysis is to use software developed for this purpose. In cooperation with the Iowa Department of Education, faculty members in Hotel, Restaurant and Institution Management give a series of one-day short courses in which school foodservice managers and lead employees work with the software and ascertain nutrient analysis of school meals. The course content and program development was based on ISU HRIM research. Eighty Iowa school foodservice managers attended 3 one-day short courses to learn the process. The participants are responsible for planning and serving 45,000 Iowa meals daily (8 million meals annually).

#### **Action 9: Starting a Food-Related Small Business and Adding Value to Iowa Agriculture**

Iowans interested in starting a food-related small business need support and information at all levels, from applicable government regulations to project feasibility, business planning, manufacturing support/advice, food safety concerns, producer contacts, and determining profitability. Twenty campus and Families Extension field specialists

developed resources to assist clients; they are posted on the web at [www.extension.iastate.edu/pages/families/incubator.html](http://www.extension.iastate.edu/pages/families/incubator.html). The market/audience for this site is highly targeted and growing rapidly: June-July page views were 190; August average was close to 400 page views.

#### **Action 10: Impact of New Corn Genetics Technology Examined**

Researchers in plant pathology and entomology showed that corn that has been genetically modified for resistance to the European corn borer has a lower incidence of fungal ear rot and reduced mycotoxin levels in grain. The ISU researchers were the first to document consistently reduced levels of infection and mycotoxin contamination in Bt corn.

#### **Action 11: Policy Research Widely Used by Local and National Leaders**

The Rural Policy Research Institute (RUPRI) (ISU, Missouri and Nebraska) conducts research and analyses on rural policy. In the last three years, RUPRI has provided 20 analyses in congressional hearings or briefings and published more than 75 reports. During the last decade, the Food and Agricultural Policy Research Institute (FAPRI), recognized as the nation's premier agricultural policy analysis unit, has published more than 100 studies, the results of which also have been presented to Congress, USDA briefings and public meetings across the United States and in many foreign countries. FAPRI at Missouri has a similar record of productivity, with its focus on domestic policy. ISU's work includes international agriculture, policy and markets.

#### **Action 12: ISU-Developed Uses for Soy Adopted by Industry**

The Biocomposites Research Group conducts research on the use of agriculturally derived adhesives and underutilized fiber sources. Their efforts have resulted in several new technologies undergoing patent protection and licensing and have progressed to technology transfer initiatives that involve several private partners. One soy-based wood adhesive, for example, has won the approval of the Western Wood Products Association for vertical and horizontal use in finger-jointed lumber. Previously, the soy adhesive product had been approved only for vertical use. Soybean check-off investments helped develop the soy-based wood

adhesive, which now can be used for a wide variety of products, such as windows, fences, and I-joists. One of the many environmental benefits of this technology is reduced emissions of volatile organic compounds in the home and wood product manufacturing environments.

#### **Objective E: Develop advanced manufacturing methods leading to products/processes designed to be market competitive**

##### **Action 1: One Problem Defined, Dual Results Achieved**

A Postville manufacturer of laminate sheets came to CATD concerned about worker safety and process efficiency. The varied weights and dimensions of the company's laminate sheets requires workers to frequently place and remove sheet trays from an industrial oven as part of the curing process. CATD set up a university research contract and matched the company's Quality Manager with Ames Laboratory engineers to design and fabricate a specialized handling device to assist workers to manipulate the trays. The device was sophisticated and required special calibrations for exact positioning and handling of the varying sheet weights and sizes. The project addressed one problem that gave the company dual results, improved workplace safety and a more efficient production process.

##### **Action 2: Kaizen Produces Big Savings**

After reading about the benefits of Kaizen (continuous improvement) in a CIRAS publication, the manager of a plastics company contacted a CIRAS specialist. With the help of the CIRAS specialist, a Kaizen team was started in the routing department of the manufacturer. The team learned the principles and concepts of Kaizen and developed a plan of action to implement its ideas. The primary benefits obtained by using this strategy were in the areas of reduced scrap, improved set up times, and reduced programming expense. Over \$103,000 in savings was documented. According to the general manager of the firm, the CIRAS specialist motivated the employees to do training and problem solving well beyond the actual project – and this motivation is still continuing.

### **Action 3: ISU-developed Soy Processing Technologies Used by Industry**

Researchers who work on soy-protein-based biodegradable plastics have developed protocols for processing protein isolates, concentrates and flours using conventional processing methodologies that include extrusion and compression and injection molding. Iowa State University recently granted an exclusive right of commercialization license for this technology to Soy Works in Goodrich, Illinois.

### **Action 4: Private Sectors License ISU Technology to Improve Soy Digestibility**

A soybean processing patent recently was awarded to an ISU scientist who developed an economical method for production of soy concentrate from soybeans modified to reduce or eliminate raffinose and stachyose which cause intestinal gas. Reduced processing costs associated with this technology offer a superior alternative for many processors. ISU licensed the patent to Protein Technologies Corporation, a joint venture of DuPont and Pioneer Hi-Bred, Int., Inc.

### **Objective F: Cooperate with others to increase local and regional economic competitiveness and assess needs**

#### **Action 1: New Center Reaches Out to Industry**

The ISU Industry Outreach Center was established for one basic purpose—to support and encourage the growth of industry in northeast Iowa. The center provides the information, technology transfer assistance, research capabilities, and technical support that companies need to remain competitive and be successful. To make this center a valuable resource for northeast Iowa, CIRAS has created partnerships with the many industry-related components of ISU such as Extension and CATD, as well as external agencies. Through its affiliation with the College of Engineering, the Industry Outreach Center offers current research on and solutions to industries' greatest challenges.

#### **Action 2: Promoting Biotech Opportunities**

The biotechnology industrial liaison worked with the Ames Chamber of Commerce to create an eight-page brochure about resources available at ISU and in Ames to biotechnology companies interested in locating or relocating to Iowa. The brochure

provides information on the ISU Research Park, ISURF, Pappajohn Center for Entrepreneurship, the Plant Sciences Institute, CATD, USDA, and other ISU industry resources.

### **Action 3: ISU Helps Lead 35-member Consortium to Beat Soybean Cyst Nematode**

ISU played a leadership role in the development of the SCN (soybean cyst nematode) Coalition, a partnership among 12 universities, 15 state and national soybean commodity boards, and eight seed companies. The coalition has undertaken a major effort to educate soybean producers about the SCN and how to manage it in order to reduce losses. After the first year of the program, requests for SCN soil tests in Iowa increased 178%.

### **Action 4: Nation's Only Source of Swine Ultrasound Training and Certification**

ISU offers the only swine ultrasound training and certification conference in the nation. Producers and other pork industry professionals from nine states attended last year's program, organized by the Iowa Pork Industry Center at ISU. Those who successfully complete a two-part scanning practicum and written exam are certified for two years by the National Swine Improvement Federation. For more than a decade, undergraduate and graduate ISU students who are certified as ultrasound technicians through this program have offered an ultrasound scanning service to Iowa county fair livestock shows. In 2000, they scanned more than 1,300 hogs in 12 counties.

### **Objective G: Participate in partnerships with local, state, regional, national and international organizations**

#### **Action 1: NDE Education to the World**

Two major nondestructive evaluation conferences were hosted by ISU this summer. The World Federation of Nondestructive Evaluation (NDE) Centers met from July 12 through July 16, 2000 to develop a common curriculum in NDE science and technology that can be taught in educational institutions worldwide. Over 20 representatives from sixteen leading research centers located in Africa, Asia, Europe, and South America participated in the meeting. This was an important step for the Federation as it was formed in 1998 to improve NDE technology and promote its uniform utilization on a worldwide scale through cooperative educational and

research programs. The work of the Federation this past year has concentrated on outlining curriculums, developing preliminary coursework, and seeking funding. Those efforts were reviewed and studied at this year's meeting. The next goal is in sight – a week long summer school in 2001 to train about 45 participants who will then be able to teach others in their own countries.

#### **Action 2: University Delivers IC Short Course to Cedar Rapids Company**

An international Cedar Rapids-based company wanted their engineers to know more about integrated circuit fabrication—not because that is what the engineers do but rather because the engineers regularly interact with the integrated circuit industry. The department of Electrical and Computer Engineering called on the College of Engineering's distance education unit to deliver a one-week short course at ISU's Microelectronics Research Center. At the end of the week, the nine attendees had a stronger knowledge base about the processes of integrated circuit fabrication and that base will be strengthened more throughout the semester when the lecture component is delivered to the company.

#### **Action 3: International Animal Disease Assistance**

The Institute for International Cooperation in Animal Biologics (IICAB) continued in its role as an Office International des Epizootics (OIE) Collaborating Centre for the Diagnosis of Animal Diseases and Vaccine Evaluation in the Americas. The OIE Collaborating Centre includes Iowa State University and the USDA Animal and Plant Health Inspection Service in Ames. The OIE Collaborating Centre for the Diagnosis of Animal Disease and Vaccine Evaluation in the Americas is the only OIE Collaborating Centre affiliated with a university in this hemisphere. OIE Collaborating Centres provide the 153 OIE member countries with scientific and technical assistance and expert advice on topics related to animal disease surveillance and control. Collaborating Centres also develop training courses and workshops and organize scientific meetings on topics related to the OIE mission. As a part of its mission, the IICAB organized the 5th Annual Veterinary Biologics Training Program. A total of 21 international participants from 13 countries

attended the program, along with 63 U.S. participants from government, industry and academia.

The IICAB also organized the Plant-Derived Biologics Meeting for 200 representatives of academia, government and industry in April 2000 and the Virulence Mechanisms of Bacterial Pathogens International Meeting in September 1999 with 176 participants.

College of Veterinary Medicine faculty organized the "Mobilizing the Veterinary Profession to Recognize and Appropriately Respond to Exotic Animal Diseases" meeting in February 1999. As a follow-up to the meeting, CVM faculty received a grant from the USDA to develop a web-based course for veterinary students on foreign animal diseases. The University of California and the University of Georgia are project participants and the USDA APHIS is a collaborator on the project.

#### **Action 4: Transportation Center Builds Partnerships**

In 1999, CTRE was successful in winning a competition to become the federally funded University Transportation Center in federal Region 7—Iowa, Missouri, Nebraska, and Kansas. CTRE's partners in this Midwest Transportation Consortium (MTC) include the University of Northern Iowa; the University of Missouri at Columbia; the University of Missouri at St. Louis; the University of Missouri at Kansas City; and Lincoln University in Jefferson City, Missouri, a historically Black College. For FY1999 through FY 2005, the program generates \$900,000 per year for ISU and its partners, which must be matched by local sources. The funding is used for research in the area of "sustainable transportation asset management" and for student scholarships. This year, 14 students are benefiting from the MTC Scholars program.

#### **Action 5: Promoting Tech Transfer Resources at BIO**

The director of the Office of Biotechnology, the executive director of ISURF and the Office of Intellectual Property and Technology Transfer, the interim director of the Plant Sciences Institute, and the biotechnology industrial liaison attended the national biotechnology association's BIO conference in Boston and exhibited a new display of research and industrial resources available at Iowa State.

Literature was provided from CATD, Plant Sciences Institute, Ames Lab, IPRT, ISU Research Park, and other centers at ISU. ISU was a sponsor for the Iowa Department of Economic Development's efforts to promote the state's biotechnology development opportunities, with a theme entitled Biotechnopoly, based on the Monopoly board game. BIO drew a record 10,280 scientists, industry professionals, and government participants.

#### **Action 6: Midwest Textile and Apparel Industry Directory**

In 1999, the Midwest Textile and Apparel Industry Directory was published with the cooperation of Iowa, Minnesota, Oklahoma, Arkansas, and North Dakota and the Midwest Textile and Apparel Industry Association. Its purpose is to strengthen the industry and communication among its members. 425 firms are listed that produce items from bridal veils to luggage and truck tarps. Information was collected by surveys conducted in each state. In 1998, over \$962 million of textiles and apparel products were produced and over 40,000 people employed in these five states according to the American Textile Manufacturers Institute. The Midwest Textile and Apparel Association, based in Iowa, helped fund the printing of the Directory.

The Iowa Textile and Apparel Industry News was published and distributed quarterly to 181 Iowa firms, county and area Extension offices and CIRAS offices, and the Textiles and Clothing Advisory Board. The purpose of the newsletter is to support a strong linkage between Iowa State University and the textile and apparel industry in the state. Printing and distribution costs were partially funded by the Midwest Textile and Apparel Association.

#### **Action 7: National Network for Child Care Web site**

ISU Extension hosts the National Network for Child Care Web site, supported by USDA- CSREES and over 36 landgrant universities. The Web site has 4 million hits per year with over 100,000 user sessions per month. It is accessed by all 50 states and over 127 international countries. The Web site supports the national "Extension Cares for America's Child and Youth Initiative," of which a goal is to increase quality, affordability, accessibility, and sustainability of child care, school-age care and youth development programs. Four outcomes include: increasing

knowledge of child and youth care policy options among decision makers and the general public; increasing community resources to support child care, school-age care and youth development programs; increasing options, capacity, and sustainability of programs within local communities; and increasing employer-assisted program options.

#### **Action 8: ISU Research Leads to National Watershed Restoration Project**

In 1999, the Bear Creek Watershed Project was one of 12 projects nationwide selected as a "National Restoration Demonstration Watershed" under the federal Clean Water Action Plan, a program sponsored by nine federal agencies to revitalize the nation's commitment for clean, safe water. The research by the ISU Agroecology Issue Team has provided much of the science now guiding the National Resource Conservation Service's National Buffer Initiative. Iowa now has more than 50 demonstration sites linked to this project.

#### **Action 9: Education and Cooperation Smooths Way for International Seed Trade**

The Seed Science Center, in collaboration with the International Regional Organization for Plant and Animal Health (OIRSA), coordinated 12 workshops in Central America on seed policies and regulations that should open new markets for Iowa and U.S. seed companies. The workshops resulted in harmonization of seed policies and regulations in the areas of seed certification, variety evaluation and release, plant variety protection, and phytosanitary requirements. The scientific base of information used in the phytosanitary discussions was an international seed disease database assembled by the Seed Science Center and distributed by CAB International in England.

#### **Action 10: ISU and IDNR Teach and Certify Manure Applicators**

ISU faculty developed educational materials to help IDNR certify manure applicators. Some 3500 confinement operators have been trained in the past year. A newsletter is distributed three times annually to all certified manure applicators, certified crop consultants, veterinarians, and consulting engineers to provide results of new research and to update users regarding proper manure application practices. Manure application field days have been conducted around the state.

**Action 11: Consortium Will Advance Biobased Industry in the Midwest**

Scientists from six institutions, including Iowa State University and the Ames Laboratory, have formed the Midwest Biobased Materials Consortium that will conduct research and technology transfer on biobased products and energy. The Consortium also includes Argonne National Laboratory, the University of Illinois, Michigan State University, and Purdue University. At ISU, scientists from the Plant Sciences Institute and the Agriculture Experiment Station will participate in the Consortium's research projects and technology transfer activities. The ultimate goal is to develop a new chemical industry in the Midwest based on agricultural feedstocks and biotechnology. The combined expertise of the Consortium members establishes an exceptional technical base for innovation in this arena. The Consortium is ready to pursue funding sources that will facilitate the transfer of developed technologies to private industries.