The University of Iowa
2009 Annual Economic Development Report

The University of Iowa continues to make great progress in the area of economic development. Much of this success is as a result of the Battelle and Grow Iowa Values Funding (GIVF) which has proven critical to the development of a strong UI infrastructure to promote economic development consistent with our mission and the goals of the State of Iowa. This funding allowed us to reorganize and fully integrate our Technology Transfer and Economic Development programs through the formation of the IOWA Centers for Enterprise (ICE). This virtual organization now functions as integrated programs providing infrastructure and service to enhance technology transfer and commercialization of UI technologies, new company formation, support of Iowa companies and workforce development. ICE currently includes the following departments.

- The University of Iowa Research Park (formerly Oakdale Research Park) (UIRP)
- BioVentures Center (BVC) and The Technology Innovation Center (TIC)
- The University of Iowa Research Foundation (UIRF)
- The John Pappajohn Entrepreneurial Center (JPEC)
- The University of Iowa Small Business Development Center (SBDC)

FY09 proved to be an outstanding year for economic development activities at the University of Iowa. Our most notable accomplishments from FY09 are noted below.

- The BioVentures Center opened in November 2008. This 35,000 sq ft state-of-the-art biosciences incubator facility allows the University to provide laboratory facilities to support technology based companies emerging from the commercialization of faculty research. The occupancy to date is at approximately 50%.
- The UI Research Park companies and affiliated labs report 2,029 employees living in 107 communities in 31 Iowa counties, a regional labor shed covering almost one-third of the State. The annual payroll nears $100 million resulting in an estimated $5.7 million in State income taxes in 2009.
- Over the past four years, 27 companies were formed, resulting in 90 jobs being created. GIVF funds provided to the Center of Biocatalysis and Bioprocessing also created 6 new jobs and significantly increased revenues for this unit.
- UIRF has developed several support strategies for emerging commercialization of faculty research. In FY09, UIRF vetted approximately 16 company concepts, and of those, 6 are moving forward.
- In FY 09, the Small Business Development Center served nearly 300 clients, assisted in 29 business startups, and helped clients raise over $12,000,000 in financing.
- Trans Ova Genetics of Sioux Center and the IDED have collaborated to support Exemplar - a start-up company that will develop animal models of human disease. This resulted in a $1 million forgivable loan from IDED.
- The University of Iowa's John Pappajohn Entrepreneurial Center offers one of the top entrepreneurial educational programs in the country, according to a survey in the current issue of Entrepreneur Magazine. The UI's JPEC placed 23rd in the undergraduate ranking. It's the only school in Iowa to be ranked in the top 25, and one of only two Big 10 schools.

The following sections of this report will directly respond to specific areas as requested by the Board of Regents. These include 1) the impact of the University of Iowa activities on the economic growth in Iowa, 2) institutional activities and services that indirectly promote economic development, 3) quantitative information regarding economic development activities in FY09, 4) a summary of outreach and service activities, 5) direct economic development assistance to Iowa communities, 6) summary of GIVF and Battelle expenditures, and 7) emerging trends in the area of economic development.

Impact of UI Economic Development Activities on the Economic Growth in Iowa.

Job creation and wealth in Iowa.

University of Iowa Research Park (UIRP)

UIRP, formerly known as the Oakdale Research Park & Oakdale Research Campus, is a blended campus consisting of a multitude of commercial ventures and a variety of university academic programs and infrastructure assets. As of June 30, 2009, 10 established companies, 20 start up companies and 5 University anchor laboratories were located in the park. These companies have access to University research infrastructure including internet access and access to libraries and research facilities, core facilities to support chemistry, biology, computation, and instrumentation, and access to faculty collaborators and to students as interns or employees.

In FY09, the UIRP attracted one new tenant (Brighton Group), while TIC reported three new tenants (Pohaku, Santoshuman, Inc., Kepa Services). In FY 09, four existing companies relocated to the new BioVentures Center business incubator (ASL Analytical, Terpenoid Therapeutics, Vertex Pharmaceuticals, and Cellular Engineering Technologies). Two new companies located in the BioVentures Center (KemPharm and Exemplar Genetics). In addition the new 113,665 sq ft University Hygienic Laboratory facility is due to open in February, 2010.

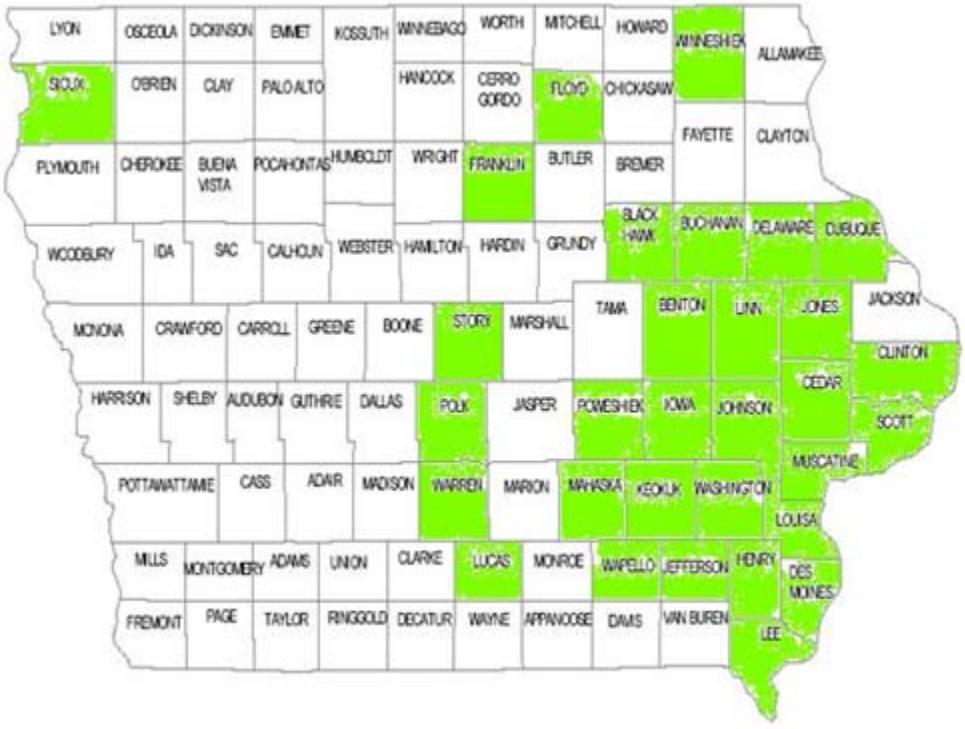
In FY 2009, the 50 active Iowa companies affiliated with UI Research Park and Technology Innovation Center[1], reported 1,673 employees earning an average salary of $52,000. The five UI anchor laboratories on the Research Park reported another 356 employees, for a total workforce of 2,029 employees. The 2,029 employees of companies and labs affiliated with the UI Research Park and business incubator reported living in 107 communities in 31 Iowa counties, a regional labor shed covering almost one-third of the State. The annual payroll nears $100 million resulting in an estimated $5.7 million in State income taxes in 2009. The affiliated companies and labs also reported employing 103 UI students, and 120 employees had earned doctoral degrees.

BioVentures Center (BVC)

A milestone was achieved in November 2008 with the completion of the UI BioVentures Center at the Research Park. This 35,000 sq ft state-of-the-art biosciences incubator facility allows the University to provide laboratory facilities to support technology based companies emerging from the commercialization of faculty research as well as other start-up companies drawn to the area by the substantial R&D assets of the University. We have already leased 9 of the 20 laboratories in this facility to start up companies, 3 of which were formed from technology created by UI faculty. GIVF funding was critical in enabling the design and construction of this facility, which now allows us to capitalize on University assets. BVC has 20 wet labs and 16 office/dry labs available for life sciences start-up companies. Six companies (Vertex Pharmaceuticals, Cellular Engineering Technologies, Terpenoid Therapeutics, ASL Analytical, KemPharm and Exemplar Genetics) occupy 9 wet labs and 9 dry labs/offices in BVC—almost 50% of leasable space

[1] This includes active companies at the Technology Innovation Center and/or at the UI Research Park, and graduate companies located in Iowa.

FY09 Labor Shed (in Green) for Affiliated Companies and Anchor Laboratories
UI Research Park, BioVentures Center and Technology Innovation Center



Since FY06, 19 companies were formed, resulting in 90 jobs created, some due to support from GIVF. The table below summarizes the number of new companies formed FY06-FY09 and jobs created as a result of increased emphasis on new company formation.

Company	**# of Employees**	**GIVF Gap Funded**
Optherion*	5	Y
Terpenoid Therapeutics*	1	Y
iOptics	0	Y
Repgenix	1	Y
Exemplar Genetics*	23	Y
OMR Sensors	3	Y
ASL Analytical*	2	Y
QI2*	0	Y
Voltesla	3 P/T	Y
Performex	1 P/T	Y
Santos Human*	1	Y
Behavioral Diagnostics	1 P/T	Y
View Point Molecular Targeting	3 P/T	Y
Quad CAD	1 P/T	Y
Advanced Infoneering	5	N
JL Meditech*	0	N

Componica*	6	N
Cellular Engineering Technologies*	4	N
Actual Safety, Inc.*	3	N
Soligence Corporation*	0	N
KemPharm*	5	N
The Thomas Group*	1	N
Bio::Neos*	4	N
NGI/Vivakor*	6	N
InnoMatix*	7	N
Kepa Services*	1	N
Pohaku*	3	N
TOTAL	90	

*****Indicates company is in the BVC, TIC and/or UIRP.
Note: Non-Gap funded companies received support from UIRP and/or TIC.
Note also that Optherion, Repgenix, and UIQI2 benefited from Battelle funds

Institutional activities and services which indirectly promote economic development

University of Iowa Research Park, BioVentures Center and Technology Innovation Center

A variety of educational and training programs are offered for UIRP/BVC/TIC tenants and faculty investigators including SBIR/STTR Phase I/Phase II grant writing workshops, UI Career Services and student internship programs, a seminar on working with the news media, and others.

The University of Iowa Research Foundation

The University of Iowa Research Foundation (UIRF) - a 501(c)3 corporation - commercializes University of Iowa developed technologies and inventions through licensing and new venture formation. UIRF collaborates with other economic development organizations and individuals, including the Iowa Department of Economic Development, the Iowa City Area Development Group, the Entrepreneurial Development Center, the Technology Association of Iowa, the Iowa Biotechnology Association, VentureNet Iowa, and local, regional and national investors and entrepreneurs.

The John Pappajohn Entrepreneurial Center (JPEC)

Formed in 1996, JPEC is an innovator in delivering interdisciplinary courses and specialized life-long learning programs to meet the unique needs of aspiring entrepreneurs and leaders. JPEC offers a wide variety of academic programs, continuing education and technology commercialization support that benefit Iowa companies. Included in indirect support are teacher training for youth entrepreneurship, conferences and speaker series, and programs, seminars and workshops. These are detailed in Appendix A of this report.

College of Engineering

The UI College of Engineering, in connection with Iowa State University has created a program entitled Project Lead the Way Iowa. Project Lead the Way is a program that seeks to make learning in the sciences, technology, engineering and mathematics (STEM) an attractive process for young people. The program has grown to 23 middle schools and 65 high schools in Iowa. The College hosted its second year of Summer Training Institutes for Project Lead the Way with 23 teachers participating in Principles of Engineering and 8 teachers participating in Biotechnical Engineering.

The College also provided joint scholarships with ISU College of Engineering to winning recipients in the regional Future City Competition, MATHCOUNTS state competition, the Eastern Iowa Science and Technology Fair, and the Invent Iowa Invention Convention.

IOWA Centers for Enterprise Senior Staff Board and Related Affiliations

IOWA Centers senior staff participated in economic development organizations in a variety of important ways in FY09.

STATEWIDE:

- Iowa Department of Economic Development (IDED)
  - Board, Bioscience Alliance of Iowa (BAI)
  - Board, Iowa Information Technology Council (ITC)
- Iowa Biotechnology Association, Board of Directors
- Technology Association of Iowa, Board of Directors
- Technology Association of Iowa, Panelist Reviewer for TAI annual awards
- Professional Developers of Iowa, Member
- Iowa Rural Development Council, Member
- Iowa Careers Consortium Advisory Board, Member
- Prolog Ventures, Iowa Deal Flow Committee
- Iowa Venture Capital and Entrepreneur Conference, Planning Committee
- Iowa First Capital Fund, Advisory Board
- Entrepreneurial Development Center Board, Member

LOCAL AND REGIONAL:

- Priority One, Board of Directors
- Iowa City Area Development Group, Board of Directors
- Iowa City Area Chamber of Commerce, Member

NATIONAL:

- AUTM- Association for University Technology Managers Board of Directors, Assistant VP of Finance
- AUTM Foundation Board of Directors, Member
- National Science Foundation (NSF) SBIR program, Mentor for Phase I-II awarded startups
- NSF SBIR program, Panelist for Proposal Reviews
- NBIA National Business Incubator Association
- AURP Association of University Research Park and Association of University Midwest Research Park Directors
- COGR – Council on Governmental Relations

Metrics describing UI economic development activity FY09

	FY09
a. Number of disclosures of intellectual property	70
b. Number of patent applications filed	
• U.S. Applications	69
• National Applications	40
• Patent Cooperation	19
• Total Applications	128
c. Number of patents issued	116
d. Number of license and option agreements executed on institutional intellectual property	18
• In Iowa	2
e. Number of license and option agreement yielding income	135
f. Revenue to Iowa companies as a result of licensed technology	$1.71 million
g. Number of startup companies formed	2
• In Iowa	2
h. Number of companies in research parks and incubators	50
i. Number of new companies in research parks and incubators	6
j. Number of employees in companies in research parks and incubators	2029
k. Royalties and license fee income	$42.9 million
l. Total sponsored funding	$429.5 million
m. Corporate sponsored funding for research and economic development	
• In total	$38.6 million
• In Iowa	$1.5 million
n. Iowa special appropriations for economic development in the following categories	
• Annual state appropriations for ongoing programs (TIC, ORP and CADD)	$264,325
• Grow Iowa Values Fund appropriations	$1,535,717
• Battelle appropriations (FY06; Spent in ensuing years)	$0
o. Estimated jobs created by SBDC clients	145

Direct and hands-on technical assistance to businesses and entrepreneurs

The University of Iowa Research Foundation

The UIRF aspires to maximize public benefit through commercial use of UI technologies, excellence in commercialization, and long term sustainability. In pursuit of this vision, UIRF's primary functions are:

- Licensing - finding suitable partners for commercializing UI technologies and inventions
- New Ventures - identifying and developing new high growth UI technology spinout companies suitable for venture capital financing
- Intellectual property services - which include protecting UI inventions through patents and copyrights, advising on intellectual property terms for Clinical Trials and Sponsored Research, and executing out-going material transfers

UIRF's economic development activities stem primarily from actions by the New Ventures Group. Working directly with UI faculty, entrepreneurs, and investors in selecting, evaluating and developing new companies, these actions include:

- IP analysis for viability of proposed company products
- IP protection strategies and execution; UIRF fronts the cost of IP protection
- Due diligence on the viability of UI spinout companies
- Business model development for UI spinout companies
- Provide *Entrepreneurs-in-Residence* for high new priority UI companies
- Provide gap funding for highest priority projects
- Facilitation of financial investment in the company
- Licensing to UI spinout companies
- Extensive mentoring and education of faculty in new company formation

As part of this work, UIRF vetted approximately 15 company concepts in 2009, and of those, 5 are moving forward. Potential companies are moving forward related to

- Through the use of an electronic wireless badge system
    - Tracking hand hygiene in hospitals and other environments to control the spread of infectious disease,
    - Modeling healthcare environment interactions to understand the spread of infectious disease, productivity, and other issues,
- Enhanced performance of power generation and environmental control through anticipatory control,
- Radio-labeled molecular imaging for diagnostic and therapeutic purposes,
- Diagnostics for behavioral conditions including addiction, and
- Low-cost retinal camera and diabetic retinopathy screening software.

FY09 projects that continue to move forward include

- Immunomodulation to influence and control the response to pathogens,
- Treatment of antibiotic resistant infections,
- Technology related to bone loss and injury prevention, and
- Magnetic materials to enhance the performance of batteries, fuel cells and photovoltaics.

John Pappajohn Entrepreneurial Center (JPEC)

JPEC provides one-on-one counseling to technology based entrepreneurial companies. JPEC also uses undergraduate and MBA student teams to conduct product assessments, strategic marketing assessments, and other components of an entrepreneurial business plan. Some 30 consulting projects were conducted in FY09. In addition, JPEC supports the efforts of the UIRF to vet and spin out companies based on faculty technology by providing strategic business advice and participating in business development assessments. Several programs related to hands-on technical assistance are described below. For a description of the JPEC programs aimed at supporting Iowa entrepreneurism, please see Appendix A.

- **Iowa Venture Capital and Entrepreneurship Conference** JPEC is a major sponsor and organizer of the Iowa Venture Capital and Entrepreneurship Conference, in partnership with IDED, the other Pappajohn Centers and Equity Dynamics.

- **FastTrac Entrepreneurial Training Program** JPEC has partnered with the Iowa Community College system and UNI to deliver statewide the nationally acclaimed FastTrac® entrepreneurial training programs of the Ewing Marion Kauffman Foundation of Kansas City. The initiative prepares aspiring entrepreneurs to launch new ventures and existing companies to grow their businesses. Since the inception of the partnership in fall 1997, over 3,000 Iowans have completed the entrepreneurial training programs. However, recently a change was made and this program is no longer Statewide.

- **Seminars/Workshops/Lecture Series** JPEC hosted over 60 different opportunities last year for students, faculty and persons from the community. In FY09 approximately 2100 attendees came to learn from experienced entrepreneurs on a variety of topics including: Building a Successful Business in Iowa, Raising Equity Capital for Your New and Growing Venture, and Entrepreneurial Boot Camp.

- **Entrepreneurial Ventures Group** JPEC conducts each year a seminars series, the Entrepreneurial Ventures Group, aimed at aspiring entrepreneurs that attracts students, faculty and members of the community at-large.

- **Wellmark Venture Capital Fund** JPEC is the regional administrator of the $5M Wellmark Venture Capital Fund that supports the creation and growth of new businesses throughout the state. JPEC screens applicants, performs due diligence, evaluates business concepts, and assists applicants with their business plans. JPEC partners with area angel investors, equity fund managers, lenders, the Iowa Department of Economic Development, and the Small Business Administration to help business owners secure additional venture funding.

- **Elevator Pitch Competition for UI Faculty and Staff**. An Elevator Pitch Competition was held with $10,000 in cash prizes awarded. The contest was open to any current University of Iowa Faculty, Staff, or Graduate Assistant and 28 contestants participated in the competition.

Small Business Development Center

The Small Business Development Center (SBDC) offers one-stop assistance to current and prospective small business owners by providing high quality, one-on-one counseling that is tailored to the needs of individual clients. The SBDC conducts research, counsels, and trains business owners in management, financing, and operating small businesses, and provides comprehensive information services and access to experts in a variety of fields. Education programs are offered on topics that include taxes, accounting systems, and business planning. It also offers a wide range of training seminars concerning business skills and issues, and assists small businesses in securing Small Business Administration backed loans. In FY 09, the SBDC served nearly 300 clients, assisted in 29 business startups, and helped clients raise over $12,000,000 in financing.

Direct economic development assistance to Iowa communities

John Pappajohn Entrepreneurial Center

- **Secondary Teacher Training** The Jacobson Institute for Youth Entrepreneurship and JPEC partner with educational agencies to offer entrepreneurship training to educators.

- **Be Your Own Boss Entrepreneurship Summit** – The Jacobson Institute for Youth Entrepreneurship, partners with Iowa community colleges and economic development organizations, sponsoring one-day entrepreneurial conferences open to Iowa high school students.

- **Distance Certificate in Entrepreneurial Management –** JPEC has designed a distance education program which will allow students of several community colleges (Iowa Western Community College, Western Iowa Tech Community College, Indian Hills Community College, and Iowa Lakes Community College) to earn a Certificate in Entrepreneurial Studies as part of their degree programs.

- **Okoboji Entrepreneurial Institute** – JPEC conducts an annual institute at UI's Lakeside Laboratories at Lake Okoboji that provides hands-on experiential learning for 40 undergraduates from UI, ISU, UNI, Buena Vista College and Iowa Lakes Community College about what it takes to launch an entrepreneurial enterprise.

University of Iowa Research Foundation

- **SIVF (Southeast Iowa Venture Fund)**: Public and private sector individuals in the southeast Iowa counties of Des Moines, Lee, Henry and Louisa are creating a joint economic development program. UIRF continued to talk with this group and provide feedback on plans and programs for the purposes of creating a new venture capital fund.

Economic development services provided by the research parks, incubators or similar service units

The University of Iowa Research Park, BioVentures Center and Technology Innovation Center

Corporate tenants of the Park benefit from sustained relationships with UI in the form of access to specialized research facilities, library access, faculty consultation, research collaboration and access to students as interns and employees. UI resources also provide smaller companies with assistance in business planning, identifying professional service providers, introductions to local and state government agencies and the regional business community, help in identifying potential sources of investment and other funding and communications. For a list of companies and developers associated with the Research Park, BioVentures Center and Technology Innovation Center please see Appendix B.

Research Park Magnet Laboratories

In addition to the core university facilities, four specialized UI laboratories reside within the Research Park that provide services on a fee-for-service basis to Park tenants, other Universities and private industry. These units provide Iowa with unique capabilities that IDED and local economic development entities have utilized in recruitment of outside companies to the Park, the region and the state. These facilities include:

Center for Advanced Drug Development (CADD)

The Center for Advanced Drug Development (CADD) is a division of the University of Iowa College of Pharmacy that offers contract analytical and quality assurance services to the pharmaceutical and biotechnology industry. CADD is U.S. Food and Drug Administration (FDA) registered and current Good Manufacturing Practices (cGMP) compliant and works closely with the University of Iowa Pharmaceuticals, housed on the central University campus. The focus of both CADD and UI Pharmaceuticals is the manufacture and control of clinical supplies of new drugs entering initial Phase I clinical trials. They are particularly attractive to smaller pharmaceutical/biotechnology companies that have new drugs moving into the clinic but have not developed their own manufacturing capabilities.

CADD and UI Pharmaceuticals have an extensive recurrent client base of mainly smaller biotechnology companies, manufacturers of pharmaceutical excipients, and a growing pool of U.S. and foreign pharmaceutical firms. CADD and UI Pharmaceuticals are particularly well positioned to work directly with discoveries from Iowa university research laboratories, thereby providing an opportunity to hasten technology transfer and shorten the time to market. The presence of these FDA registered facilities along with the Center for Biocatalysis and Bioprocessing makes UI unique among US universities in its ability to provide this type of infrastructure for pharmaceutical and biological products.

Center for Biocatalysis and Bioprocessing (CBB)

The Center for Biocatalysis and Bioprocessing is a research and education center reporting to the Vice President for Research that links university scientists from 6 different colleges who have focus on biocatalysis and bioprocessing. The Center also performs contract production for the fermentation and bioprocessing of products for the food, alternative energy, bio-pharmaceutical and biotechnology industries and is capable of working from small molecules to complex proteins, including such products as alcohols, vaccines, antibiotics, anticancer drugs, polymers, biochemicals, enzymes, pharmaceutical intermediates and derivatives of bioactive compounds. It can produce products under Good Laboratory Practices (GLP) conditions at a scale of up to a 1000 liter fermentor, and under U.S. Food and Drug Administration current Good Manufacturing Practices (cGMP) conditions (products produced under cGMP conditions can be used in Phase I human clinical trials) at a scale of up to 300 liters. The CBB is central to the University's efforts to attract industrial fermentation companies to Iowa; the IOWA Centers and CBB have worked in close concert with IDED and other Iowa economic development agencies to recruit companies to Iowa. The GIVF funded cGMP laboratories has already put CBB as the leading bioprocessing facility in a US university setting. Since 2006, 6 jobs have been created at CBB. At present, CBB is planning another expansion to build a state of the art fermentation and bioprocessing laboratory to attract Industrial Biotechnology companies involved in biomass-based production of chemicals and fuels. This new facility will position U of Iowa and to attract such companies to build pilot and manufacturing plants in Iowa.

National Advanced Driving Simulator (NADS)

Using the world's most advanced driving simulator, the NADS-1, researchers at the University of Iowa's National Advanced Driving Simulator (NADS) have defined the state-of-the-art in driving simulation, vehicle performance and cognitive systems engineering. This national shared-use facility has working collaborations with federal and state governments, industry and the military. It is available for use by any group interested in utilizing driving simulation as a tool to advance productivity, promote vehicle safety and foster innovation. Selected projects include studies of cell phone distraction in driving, younger driver risk, affect of pharmaceutical products on driver function, electronic stability control, crash avoidance, development of software for an agricultural equipment driving simulator, and customer satisfaction of ride quality during tractor driving tasks. Collaborators include the federal government, automotive companies and earth moving and agricultural equipment companies, including Deere.

University Hygienic Laboratory (UHL)

The University Hygienic Laboratory (UHL) has provided health and environmental laboratory services to the State of Iowa for more than 100 years. The UHL performs 175 different clinical laboratory tests in maternal screening, newborn screening, virology, serology, microbiology, molecular biology, blood lead screening and biological and chemical terrorism response. UHL uses state of art chemical, biologic and enzymatic analytical methods. These laboratories also serve as important training facilities and can perform fee for service analyses for companies at the UIRP and throughout Iowa. The new 113, 665 sq ft University Hygienic Laboratory facility is due to open in February, 2010.

Collaboration for economic development with Iowa entities

Start-up Company to Commercialize Animal Models of Human Disease

UI, Trans Ova Genetics of Sioux Center and the IDED have collaborated to support a start-up company that will develop animal models of human disease, an important tool for the research community in its effort to discover and develop new cures for diseases. The effort began with the work of UI's Michael Welsh, MD, and an investigator who has studied the development of cystic fibrosis (CF) for more than 15 years. Dr. Welsh developed an animal model for this disease as a part of his investigation. The collaboration with Trans Ova Genetics will allow a mechanism for translation for broader use as a research tool. A $400K Battelle award also supported a part of this development. A new company was formed, Exemplar Genetics, in which Trans Ova owns a minority, share and Dr. Welsh serves as a scientific advisor. The IDED is supporting further development of the business via a recent $1M forgivable loan awarded to UI to support three related projects: 1) development of a small pig facility to support the work, 2) development of a molecular biology laboratory to support the work, and 3) further R&D into the CF model and perhaps one additional animal model of human disease. Dr. Welsh developed intellectual property that is being licensed to Exemplar by the UIRF as a part of this overall effort.

Shovel Ready Site Initiative:

The Shovel Ready Site Program initiative which is being spear-headed by the Iowa City Area Development Group is an important economic development tool for communities and University Research Parks. The program is designed to give the UI Research Park a competitive edge in the site selection marketplace. The goal of the program is to have selected sites "shovel ready" -- connections to utilities and other physical infrastructure, clear swift procedures for permitting and incentive programs that can be quickly applied to a project. The UI Research Park, along with two other area sites, was recently chosen as a pilot project site. ICAD's goal is to work towards certification with of all sites by the end of the year. Gaining "shovel ready" certification should provide a very positive boost to recruitment of technology based companies to UIRP.

IAWind

The University of Iowa, and particularly the College of Engineering, took the lead in working with IDED to create the Iowa Alliance for Wind Innovation and Novel Development (IAWind), a virtual organization established to promote the wind energy industry in boost to Iowa. This collaboration includes:

- The Regents Universities
- Iowa Community Colleges
- State Agencies (IDED, DNR, Office of Energy Independence)
- Federal Agencies (NSF, DOE)
- Iowa Wind Industries
- Community Partners (Iowa Energy Center, Iowa Wind Energy Association)

The organization comprises components related to policy, research, training and education, and testing facilities. The impetus for this organization arose as the College of Engineering was assisting the Iowa Department of Economic Development in its efforts to recruit wind energy companies to the State, and the need to identify and integrate the state's wind energy assets became obvious. For more information: http://www.iawind.org.

Shared DNA Sequencing Instrumentation

UI and ISU biological scientists have recognized the need for partnering to facilitate the purchase of major scientific equipment that benefits both programs for human health and plant science. They worked jointly to acquire parallel DNA sequencers--instruments capable of deciphering DNA sequences at the rate of millions to billions of bases in a single run. These two instruments, one housed at UI and the other at ISU, have unique advantages and provide benefit for a large number of researchers engaged in biotechnology related science. Together, the two instruments place UI and ISU at the state-of-the-art in DNA sequencing technology, which will allow them to be more competitive in seeking federal funding and in supporting economic development efforts related to biotechnology.

Grow Iowa Values Fund projects for FY 2009

GIVF Program Summary	Description of Program	FY09 - Expenditures From FY08 GIVF and FY09 GIVF Match Funds Source	Progress through June 30, 2009 ROI DATA
VP for Research	These funds have been instrumental in enabling UI to expand the economic development infrastructure. Funding was used in the construction and completion of the BioVentures Center, completed in November 2008. Funds were used to support salaries for key administrative personnel, investing in facilities at the research park and providing critical start up funding for key faculty whose research is anchored in biotechnology.	**FY 2009 $850,493** **Ryan Companies – in-kind contribution $430,000**	Increased collaboration with IDED in support of IDED programs in recruitment of companies to Iowa. Increased outreach to state promoting UI engagement in economic development. UIRP staff moved to BVC to ensure active support for start up companies at both TIC and BVC
BioVentures Center and University of Iowa Research Park	$1,418,292 of these funds was used to finish construction on the 35,000 s/f BioVentures Center building. The building is owned by the developer and operated by the University as a life sciences business incubator. In addition the developer is constructing a three story 45,000 sq speculative wing $221,784 was used for operational start-up costs for the opening of the new BioVentures Center. $80,000 was used for marketing expenses to promote the Research Park. Costs included personnel costs and expense for redesigning the Research Park website. $1,910 was used to develop a signage program and revised the	**FY 2009 $1,721,986** **1. Ryan Companies – in-kind contribution $750,101** **2. UI BioVentures Center in-kind contribution $110,892**	BioVentures Center (BVC) construction is completed. BVC has 20 wet labs and 16 office/dry labs available for life sciences start-up companies. Six companies (Vertex, Cellular Engineering Technologies, Terpenoid Therapeutics, ASL Analytical, KemPharm and Exemplar Genetics) occupy 9 wet labs and 9 dry labs/offices in BVC.

	covenants and architectural guidelines for UIRP. Both projects were undertaken to reflect the new vision and master plan for future development of the Research Park.		Collaboration with Ryan Companies (the developer) provides 45K s/f of "accelerator" space.
John Pappajohn Entrepreneurial Center	These funds were used by the John Pappajohn Entrepreneurial Center to support the development, implementation, and expansion of entrepreneurship programs and support new venture formation and small firm growth.	**FY 2009 $220,693** **MATCH:** **JPEC in-kind contribution $111,045**	Conducted 31 consulting projects resulting in estimated 45 jobs created. 59 people participated in FastTrac® Entrepreneurial Training programs in Iowa City resulting in an estimated 10 business start-ups and 88 jobs created. 14 applications processed for Wellmark VC Funds resulting in 3 companies funded. 51 student teams enrolled in Bedell Learning Lab since 2004 (27 in FY09) resulting in 11 new business start-ups.
I-GROW – Subramanian	GIVF I-GROW funds provide start up funds that allowed the University to attract Dr. Mani Subramanian to serve as director of the UI Center for Biocatalysis and Bioprocessing (CBB). Prior to coming to UI, he was Global R&D Director of Biotechnology, Bioprocessing, and Bioinformatics for Dow Chemical Company. He brings 24 years of industrial experience and an entrepreneurial approach to the University. This start-up package was essential to attract this highly entrepreneurial faculty member.	**FY 2009 $150,000** **MATCH: Biosciences Initiative Fund $75,000**	CBB achieved $2.78M in revenues in FY09. CBB supported work of other GIVF/Battelle projects: Weiss lab, Optherion, ASL Analytical, O'Dorisio lab. CBB served 35 clients in FY09, including 4 in Iowa and 2 from the UI. CBB supported IOWA Centers and IDED in recruiting bioscience

			companies to Iowa; hosted at least 3 companies, and provided support for others.
University of Iowa Research Foundation (UIRF)	GIVF funds were used to engage Venture Advisors and Entrepreneurs-in-Residence (EIRs) to assist the UIRF in building viable spin-out companies and to evaluate UI technologies for company formation potential as well as overall commercial potential. UIRF matching funding was used to add extensive business development resources to these efforts develop new methods of quickly vetting people and opportunities, pay for crucial market intelligence resources, cover new related IP expenses, and to manage the overall effort. These activities are summarized below: 1. UIRF launched its Entrepreneur-in-Residence (EIR) and venture advisor program in FY07 and got major traction in FY08. 2. UIRF developed a rigorous, staged "go/no go" due diligence and decision process that is followed by presentation to industry experts and venture investors that ultimately and ideally culminates in financial investment in the company: 3. UIRF also developed substantial know-how and methods around determining the type of management resources needed for a given company stage of development. 4. UIRF launched an advanced technology marketing program that included preparing new marketing materials for ten of the top technologies and then marketing those technologies at BIO 2008. Feedback was invaluable in making plans for further development of these technologies. UIRF also launched a web-based marketing effort that will go substantially beyond the passive listing that most universities use, and this is in progress.	**FY 2009 $138,837** **MATCH: UIRF in-kind contribution $50,287**	With assistance of EIRs, reviewed more than 200 technologies for top business development candidates. Vetted 16 company concepts and identified top company candidates (6 emerged). EIR Bob Karr engaged as CEO for spin-out Terpenoid Therapeutics. EIR Dave Dorheim engaged to take lead in moving Leddy patent portfolio forward as a business. Evaluated over 300 UI technologies, patents or portfolios of patents for IP strength and commercial potential so that resources could easily be directed to top priorities, and new company concepts could be identified.
McKinley Research Collaboration	GIVF funding supported two year collaboration between the University of Iowa and Iowa State University. The collaboration was for the development of novel bioactive materials to treat acute	**FY 2009 $93,666**	Year one deliverables were focused on developing a viable material that meets structural and biologic criteria to be

	mechanical damage sustained by cartilage to prevent post-traumatic osteoarthritis. The funding was for salary support and fringe benefits and for materials, including the purchase of a UV light source, facilities charges, costos of peptide and consumables for sample preparation and cell culture.	**MATCH:** 1. UI Orthopedic Surgery in-kind Grant contribution $8,885 2. Ryan Companies –in-kind contribution $37,948	used to fill cartilage matrix cracking. Year two of testing was carried out mainly at the UI in a series of in vitro tests using bovine osteochondral specimens.
Abramoff Seed Grant	Developing software and hardware products for inexpensive, automated and remote screening of the human eye for prevalent diseases such as diabetic retinopathy.	**FY 2009 $44,875** **MATCH:** **UI Ophthalmo-logy Grant in-kind contribution $22,437**	Phase I SBIR award obtained. Business relationship established with VisionQuest. The software and camera have been optioned by highly experienced and well-funded individuals forming a startup to pursue commercialization. This group's evaluation continues, but they have recently begun negotiating for a full license. Technological development continues to advance for both the software and camera.

Please provide the following information about Battelle-funded projects for FY 2009: Identify and briefly describe each project or initiative which received Battelle funding in FY 2009, including information on outcomes or progress made. Identify metrics which were used to measure outcomes for each project and report progress on each metric for FY 2009.

University of Iowa - as of June 30, 2009					
Battelle Appropriation					
	FY 2007 Battelle Appropriation		**$8,410,000**	Board of Regents approved September 2006.	
Endowment/Salary Funding	$2,000,000				
Infrastructure (RIIF and VIF)	$2,720,000				
Platform	$3,690,000				
o Commercialization of Santos, A Human Simulation Environment		$370,000			
o Development of Ad5-TRAIL as a Cancer Therapeutic		$400,000			
o Designing Transgenic Cells for Biomedical Applications		$400,000			
o Porcine Models of Human Disease		$400,000			
o Development of Peptides for Diagnosis and Therapy of Cancer		$400,000			
o Iowa Neuro-Musculoskeletal Therapeutic Training System (TNMTS)		$130,000			
o Iowa Imaging-based Multicenter Trials Organization (I-IMTO)		$400,000			
o Design &Testing of Novel Toll-like Receptor (TLR) 4-directed Immunomodulators		$170,940			
o Build-out of Space in Myriad 2 Building in the UIRP Park		$1,019,060			

University of Iowa	Project	List of all Revenue Sources	Revenue Dollars	Board Approved for Programs /Projects	Amount of FY 2007 State Appropriations Expended as of 6/30/2009
	Endowment/Salary Funding	FY 2007 State Appropriations (Battelle)	$2,000,000	$2,000,000	$2,000,000
		FY 2008-2009 Endowed Professor-Hageman	$100,000		
		FY 2009 Endowed Professor-Fritzsch	$50,000		
		FY 2008-2009 Matching Funds (Other)	$150,000		
		FY 2007-2009 Unallocated Endowment Interest	$359,257		
Description of Project	Create an endowed professor and/or entrepreneur-in-residence program.				
Anticipated End Results	Attract world-class, entrepreneurial talent in the core Battelle platform areas.				

Results achieved to Date	In FY 07, the initial $2M was invested in the long term endowment pool. The interest income from the endowment provides funds for the endowed chairs. To date, two endowed chairs have been awarded. One endowed professor ($100,000/year for three years) allowed the University of Iowa to retain his expertise until his departure to the University of Utah in September 2009. During his tenure as an endowed chair, he obtained a $15,000,000 National Institutes of Health (NIH) grant and was affiliated with Optherion, which obtained a $37,000,000 venture capital investment. Importantly the University retains all of the patent rights to some very exciting technology related to treatment and diagnosis of serious eye disease and Optherion continues the development of these potential therapeutic products. A second endowed professor ($100K/yr for three years) position was filled allowing the UI to recruit a world class researcher. Dr. Bernd Fritsch was appointed Chair of the Department of Biological Sciences and Iowa Entrepreneurial Endowed Professor. He is internationally known for his research in neurology of the inner ear and joins a world class research group at the UI Cochlear Implant Clinical Research Center. He brings with him an SBIR award for development of neuronal tracers.				
Plans	Use the investment pool and matching funds to continue the program.				
University of Iowa	**Project**	**List of all Revenue Sources**	**Revenue Dollars**	**Board Approved for Programs/ Projects**	**Amount of FY 2007 State Appropriations Expended as of 6/30/2009**
	Infrastructure (RIIF and VIF)	FY 2007 State Appropriations (Battelle RIIF and VIF)	$2,720,000	$2,720,000	$2,720,000
Description of Project	Create a joint venture partnership between The University of Iowa, regional economic development leaders and the private sector aimed at supporting technology-based start-up companies.				
Anticipated End Results	Expand and develop a new Technology Incubation Center and enhanced UI Research Park.				

Results achieved to Date	Design and construction of a new University of Iowa life sciences business incubator (The University of Iowa BioVentures Center) is complete. Construction began in the Fall of 2007 and was substantially completed November 2008. This facility contains 20 laboratories and 16 offices for life science start-up companies as well as conference rooms, a shared equipment room, UI Research Park staff offices, and a multi-purpose room that supports conferences of up to 70 persons, receptions, and the like. The facility is being actively marketed to alumni, faculty, entrepreneurs, and national and international life science companies. Building at Myriad Plaza on the UI Research Park was purchased and renovated. This building allowed the University to provide space for a California based start-up company. A follow-on tenant is being sought.				
Plans	Aggressively market these assets for the support of start-up and early stage companies; continue to build collaborations among these companies and UI faculty, programs and facilities.				
University of Iowa	**Project**	**List of all Revenue Sources**	**Revenue Dollars for FY 2007**	**Board Approved for Programs/ Projects**	**Amount of FY 2007 State Appropriations Expended as of 6/30/2009**
	See platform allocations below	FY 2007 State Appropriations (Battelle)	$3,690,000	$3,690,000	$3,658,511
Description of Project	To provide financial assistance in the form of grants to accelerate the transformation of new and ongoing research and development initiatives in the core platform areas into commercial opportunities.				
University of Iowa	**Project**		**Allocated Dollars FY 2007**	**Allocation expended as of 6/30/2009**	
	Phase I funding of Core Platforms (see first 8 individual projects below	Phase I Platform allocation	$900,000	$900,000	
	Phase II funding of Core Platforms (see first 8 individual projects below)	Phase II Platform allocation	$1,770,940	$1,739,451	

Results achieved to Date/Plans	See first 8 individual projects below				
University of Iowa	**Project**		**Allocated DollarsFY 2007**	**Allocation expended as of 6/30/2009**	
Abdel-Malek Team	**Commercialization of Santos, A Human Simulation Environment**	Platform allocation	$370,000	$363,252	
Description of Project	Information Technology, Advanced Manufacturing				
Results achieved to Date/Plans	An entrepreneur-in-residence has assisted in evaluating the business opportunity. Formed SantosHuman, Inc. to commercialize the technology. Hired CEO to lead SantosHuman, Inc. SantosHuman, Inc. obtained a license from UIRF. SantosHuman, Inc. has obtained IDED Demonstration Funds to advance the technology. SantosHuman, Inc. is negotiating with two major companies that are evaluating the feasibility of incorporating Santos software into their own software; if successful, these will be major business relationships. SantosHuman, Inc. obtained an STTR award from the Office of Naval Research to advance the technology. Santos version 1.0 is complete; expect to ship 70 licenses by August 10, 2009. In active negotiations to install as many as 100 "seats" of software in Fortune 500 companies, governmental agencies and companies in Europe and Asia Anticipate applying for SBIR awards from NIH, NIST, NIOSH, and NSF to develop specific applications that advance the technology.				
University of Iowa	**Project**		**Allocated Dollars FY 2007**	**Allocation expended as of 6/30/2009**	
Griffith Team	**Development of Ad5-TRAIL as a Cancer Therapeutic**	Platform allocation	$400,000	$398,432	
Description of Project	Bio- genetics- cancer therapy				

Results achieved to Date/Plans	Completed human testing in 1st three dose levels (12 patients). Two grant applications have been submitted to the Department of Defense to support additional human clinical trials. Based on results of Phase I clinical trial, planning to extend to Phase II trial in prostate cancer patients and initiate a Phase I trial in renal cell carcinoma patients. Licensing discussions have been held with three companies, one continues its interest.				
University of Iowa	**Project**		**Allocated Dollars FY 2007**	**Allocation expended as of 6/30/2009**	
Leno Team	**Designing Transgenic Cells for Biomedical Applications**	Platform allocation	$400,000	$400,000	
Description of Project	Bio-genetics- transgenic cell lines				
Results achieved to Date/Plans	Established assays for TNFa and Luc reporter expression in virus-infected HeLa cells; established ten primary porcine fibroblasts with high cloning potential; conducted initial AAV transduction studies. Developing business model for an anticipated spin-out company, RepGenix, an ongoing process. Developed collaboration with NuPotential, LLC of Baton Rouge, LA, with the ultimate goal of establishing a business-to-business relationship between RepGenix and NuPotential. Applied for National Institutes of Health R21 grant to create *Oct-4*gene targeted cell lines. Submitted a STTR grant application in collaboration with NuPotential to produce a human *Oct-4* gene targeted reporter cell line that will be used to screen drug libraries for activators of *Oct-4* transcription. Established collaboration with Discovery BioMed, Inc. aimed at obtaining an SBIR award to advance the technology.				
University of Iowa	**Project**		**Allocated DollarsFY 2007**	**Allocation expended as of 6/30/2009**	
Welsh Team	**Porcine Models of Human Disease**	Platform allocation	$400,000	$400,000	
Description of Project	Bio-genetics- animal models				

Results achieved to Date/Plans	Produced cell line with appropriate Cystic Fibrosis (CF) genetic profile to use these cells to generate a "knock out" CF pig. Introduced the most common human CF mutation into pig cells that were then used to clone the first ever "knock in" pigs. First CF mutant pigs were born, and they have developed the intestinal, pancreatic, lung and liver disease that is often seen in human infants with CF. Early results also show development of the lung disease that is the cause of most mortality and morbidity in human CF. With Trans Ova Genetics (Sioux Center, IA) established spin-out company Exemplar Genetics, Inc. to commercialize the technology. UI awarded $1,000,000 grant from IDED to 1) further develop the CRF animal model and perhaps other models of human disease, 2) establish a pig facility in Johnson County that will support such R&D, and 3) establish a molecular biology at the UI BioVentures Center that will also support such R&D. The pig facility and molecular biology facility will be used by Exemplar. Exemplar obtained an NIH Phase I/Phase II SBIR award (approx. $725,000) to advance the CF pig model. Exemplar obtained license from UIRF. Exemplar has 23 (18FTE) full-time employees located in Iowa City and Sioux Center. Molecular biology lab established at UI BioVentures Center and procedures building and animal facility constructed and operational in Johnson County. Exemplar establishing contracts for additional porcine models of human disease. Exemplar selling CF pigs. Anticipate submitting an NIH SBIR Phase I and NIH SBIR Phase I/II Fast Track proposal to develop additional models (muscle disorder and cardiovascular disease).				
University of Iowa	**Project**		**Allocated Dollars FY 2007**	**Allocation expended as of 6/30/2009**	
O'Dorisio Team	**Development of Peptides for Diagnosis and Therapy of Cancer**	Platform allocation	$400,000	$399,801	
Description of Project	Bio-imaging & drug discovery				

Results achieved to Date/Plans	Identified four peptides to use as first candidate drugs; anticipate filing Investigational New Drug Applications to FDA for their use in PET imaging. Acquired team to conduct the R&D: peptide chemist expert in synthesis and purification of small peptides, new faculty member in the Carver College of Medicine with expertise in radiolabeling of peptides. Obtained grant from Carver Foundation to label a peptide for PET imaging; currently conducting preclinical animal imaging experiments and designing clinical protocol for PET imaging of neuroendocrine tumors in humans. Submitted two National Institutes of Health (NIH) grants to support the preclinical studies of meduloblastoma and neuroblastoma; both are pending. Purchased protein synthesizer that meets U.S. Food and Drug Administration current Good Manufacturing Practices requirements (cGMPs); a cGMP-compliant synthesizer is required if the product is to be used on humans. Obtained NIH grant to support a clinical trial of a product for solid tumors in children and young adults; this grant was funded at $500,000 per year for two years. Submitted an NIH grant proposal to support clinical trial of product for neuroblastoma and neuroendocrine tumors; funding for this grant is pending. Identified three additional receptors important for making peptides of interest. Expect to obtain Exploratory Investigational New Drug (IND) application approval for PET imaging using cGMP grade peptides synthesized and purified in the O'Dorisio laboratory. At least two patent applications are anticipated based on work conducted to date. Three NIH grants that depend on the peptide laboratory for support were funded ($1M), 5 are pending ($4.8M).				
University of Iowa	**Project**		**Allocated DollarsFY 2007**	**Allocation expended as of 6/30/2009**	
Shields Team	**Iowa Neuro-Musculoskeletal Therapeutic Training System (TNMTS)**	Platform allocation	$130,000	$122,724	
Description of Project	Bio-therapeutic/ medical device				

Results achieved to Date/Plans	Developed the computer drawings (CAD) of a hinged-type knee brace that will attach to the leg below and above the knee which has been manufactured and is operational. Designed a brake power controller in the inventor software; included in this design is a controller circuit that uses modern surface mount components. Designed all of the algorithms, and completed alpha version of the software code. Identified 2 Iowa companies interested in manufacturing the final product on a contract basis. Formed Performex, Inc. to commercialize the technology. A CEO has been identified and is currently assisting in developing a business plan. Submitted NIH Challenge Grant ($750,000) to further develop the technology. Major advances in design were completed in past year.				
University of Iowa	**Project**		**Allocated Dollars FY 2007**	**Allocation expended as of 6/30/2009**	
Van Beek Team	**Iowa Imaging-based Multicenter Trials Organization (I-IMTO)**	Platform allocation	$400,000	$400,000	
Description of Project	Information Technology; Bio-imaging				

Results achieved to Date/Plans	Collaborated with UI Institute for Clinical and Translational Science to build a web-based application to deal with image transportation, image importing and linking to software tools that allow Quality Assurance, visual analysis and quantitative analysis. Collaborated with Johns Hopkins University as subcontractors on two projects; provided quantitative analysis of lung CT scans in patients with rheumatoid arthritis and lung disease. Developed mechanism for importing imaging data and putting it into a database that allows analysis and reporting. Formed Quantitative Imaging of Iowa, Inc. (QI2) to commercialize the technology. QI2 has had two projects with Compleware, of North Liberty, IA, studying bone marrow density, including image analysis. With VIDA Diagnostics, a company located in the Technology Innovation Center in the UI Research Park, QI2 is examining the safety of inhaled drugs in monkeys for a major pharma company; involves protocol development, Quality Assurance (QA) analysis, and image analysis. With VIDA Diagnostics, QI2 obtained two contracts for multi-center studies with pharmaceutical companies. Beginning discussions with the UIRF about protection of intellectual property developed, and licensing the rights to QI2 and VIDA Diagnostics. Working to make the system capable of de-identifying patient data so that it will be HIPAA compliant.				
University of Iowa	**Project**		**Allocated DollarsFY 2007**	**Allocation expended as of 6/30/2009**	
Weiss Team	**Design and Testing of Novel Toll-like Receptor (TLR) 4-directed Immunomodulators**	Platform allocation	$170,940	$157,022	
Description of Project	Bio-genetics - immunology and infectious diseases				

Results achieved to Date/Plans	Produced and purified wild-type E:MD-2, an endotoxin-protein complex involved in the inflammatory response. Demonstrated that wild-type E:MD-2 is a potent agonist for airway TLR4, a receptor also involved in the airway immune response. Demonstrated that underacylated E:MD-2 is a weaker airway agonist. Obtained agreement with National Institutes of Health to test the ability of E:MD-2 to prime the airway host defense system against highly virulent airway pathogens. Concluded experiments showing that wild-type E:MD-2 protects mice from pneumonic plague. These protective effects are 100 times more potent than related endotoxin products without MD-2. Concluded experiments using an animal model of pneumonic tularemia, which showed a modest delay in killing the infective model. Currently examining whether a higher dose would be effective. Demonstrated prophylactic effects against pneumonic plague. Collaborating with the UI Center for Biocatalysis and Bioprocessing to increase the efficiency and capacity for production of MD-2, work resulted in 2-3 fold increase in yield. Obtained 5-year NIH award to advance the science and technology.				
University of Iowa	**Project**		**Allocated Dollars FY 2007**	**Allocation expended as of 6/30/2009**	
		Platform allocation	$1,019,060	$1,019,060	
Description of Project	Myriad Fit-out. The building was renovated to accommodate the California based start up company - National Genecular Institute (NGI), Inc.				
Results achieved to Date/Plans	Renovation of space in Myriad Building completed. NGI moved into this space in early 2007, and has since moved to alternative space. Space is now being actively marketed to potential follow-on tenants.				

Emerging trends in university economic development and technology transfer

Emerging Trends- There has been a clear focus among major research universities to enhance their infrastructure necessary to more effectively move important research findings towards commercialization for the benefit of society as well as to maximize economic value. More venture and angel investors are engaging with university tech transfer groups. National conferences held by early stage investors and conferences held by university tech transfer groups are merging. Experienced business and new venture development professionals are becoming common place in university tech transfer organizations, and university tech transfer conferences are presenting relevant business and new venture sessions. Successful university research parks have vibrant laboratory-based business incubators that provide both facilities and active business support programs for their start-up companies. Most successful university business incubators are constructed debt free, or very close to it. Graduate space for incubator companies – sometimes called accelerator space – is becoming a mainstream program to support companies as they graduate from life science and IT incubators.

Available Capital- The worldwide venture capital trend in past years has been a movement away from investing in early stage companies and with more focus on later stage companies. This is not a helpful trend for university borne startups, virtually all of which are early stage. However, more recently early stage investing is reemerging as a focus area for a growing number of regional and national venture funds. Furthermore, venture and angel groups within Iowa are recognizing that investing in Iowa technology companies typically means investing in early stage. As such, the sources of capital for university startup companies are on the rise.

New Programs- Most universities see only a few percent of technologies commercialized, typically because of lack of proof of concept for these innovations. As such, this is an area of growing focus for universities. New programs are focused on establishing the means for proof of concept that can lead to an interested commercial partner and the required capital to bring innovations to market. One example is to extend the concept of "Entrepreneur-in-Residence" which is applied to new startups, to "Commercialization Expert-in-Residence" which is applied more generally to technologies that are too early to garner the interest of an entrepreneur or industry partner. These individuals are being attracted to universities for their combined technology and business expertise to help faculty invent for specific market needs, versus the more historical serendipitous approach. University of Iowa started experimenting with this approach in FY09, and will begin a more formal program in FY10, modeled after an approach at the University of Minnesota that has produced a significant increase in the number of valuable invention disclosures.

Alignment with State and Regional Priorities and Cluster industries – working closely with the IDED as they develop their Innovation Council universities are strategically positioned to support the states three science and technology platforms of biosciences, advanced manufacturing and IT and are now also working across all 3 Regents institutions to develop strong infrastructure to support renewable energy. This alignment is crucial for Iowa's success in terms of science and technology infrastructure, workforce development and alignment with state and regional economic development assets need to create and recruit key companies in targeted areas. In the case of SUI our local targeted industry clusters include Wind Energy, Food Processing and Biotechnology and the university continues to align itself to support growth in these areas.

Appendix A

The John Pappajohn Entrepreneurial Center

Youth Outreach - Jacobson Institute for Youth Entrepreneurship

The Jacobson Institute for Youth Entrepreneurship is a comprehensive program that enriches K-12 students' lives through classroom and practical educational experiences. Created in 2007, the Institute is built on three key components – teacher education, development of innovation curricula, and outreach opportunities. The Jacobson Institute provides opportunities for both instruction and practice in entrepreneurship and gives educators the tools they need to teach the "entrepreneurial mindset" – that is, to encourage creativity, innovation, critical thinking, and problem solving, and to prepare students for success in the worlds of business and entrepreneurship.

Teacher Training

The Jacobson Institute for Youth Entrepreneurship and JPEC work directly with secondary teachers by training them to incorporate entrepreneurship into their classrooms and providing them with ongoing support and curriculum resources throughout the school year. Designed to simulate an entrepreneurial-based classroom, the training provides educators with hands-on learning experiences enabling them to leave the training fully equipped to implement entrepreneurial education in their respective classrooms.

YouthBizCentral Online Curriculum

Educators incorporating entrepreneurship into their classrooms have access to a customized, innovative, internet-based entrepreneurship curriculum. In addition to downloading PowerPoint presentations, lesson plans, and activities on key entrepreneurial topics, teachers develop a fully customized business planning template geared to meet the specific needs of their classroom. Through completion of the business planning process, students using the YouthBizCentral curriculum learn firsthand the skills necessary for starting and running a successful business.

Through support from the Carver Trust of Muscatine, IA, the Jacobson Institute is currently developing discipline-based modules for math, science and agriculture to better meet the entrepreneurship education needs of these classrooms. Furthermore, teachers nationwide will have the opportunity to enroll in graduate level online entrepreneurship courses offered by the Jacobson Institute in partnership with JPEC.

Outreach

JPEC is committed to providing entrepreneurial education, consulting services, and lectures to the community at large in order to contribute to the growth of existing and emerging businesses. Through the following programs, JPEC impacts the economic development of the region and the state of Iowa.

Conferences & Speaker Series

The John R. Hughes Lecture Series, sponsored by Hills Bank & Trust, Inc., the Sandage Entrepreneurial Speaker Series, sponsored by the Sandage Charitable Trust, and the Community Lectures, a component of the Entrepreneur-in-Residence program, sponsored by the Iowa State Bank & Trust Company, bring successful entrepreneurs to campus to share their experiences with UI students and community members. The Iowa Venture Capital and Entrepreneur Conference and Collegiate Entrepreneurs Iowa Conference provide seminars and networking opportunities for aspiring entrepreneurs, business owners, investors, and students.

JPEC's Distance Certificate in Entrepreneurial Management

A unique partnership with The University of Iowa and Iowa Western Community College (IWCC) offers western Iowa students and citizens a distinctive opportunity to earn a Certificate in Entrepreneurial Management from the John Pappajohn Entrepreneurial Center (JPEC) at the University of Iowa. Participants must complete 18 – 20 semester hours in entrepreneurship coursework offered by the UI JPEC and IWCC. Participants may choose from a variety of delivery

options, including introductory courses taught by IWCC faculty, online coursework that includes regular interactive sessions with JPEC faculty and students from across the country, and local experiential learning opportunities.

Academic Program

- **Enrollment**
  -Summer 2008: 17 Classes/Sections, 172 Undergraduates, 83 Graduate Students
  -Fall 2008: 32 Classes/Sections, 1547 Undergraduates, 10 Graduate Students
  -Spring 2009: 42 Classes/Sections, 1595 Undergraduates, 40 Graduate Students

- **I-Envision Student Organization**
  - Number of members 75
  - National / Regional Conferences Attended 3

Client Consulting Services

- **Wellmark Venture Capital Fund**
  - Applications processed 14
  - Companies funded 3
  - Applications in process 5

- **Consulting Projects**
  - Number of projects 31
  - Industries include:
    Biotech, manufacturing, medical, information technology, Ag services, retail
  - Estimated Job Creation 45
  - Number of hours contributed 4,960

FastTrac® Entrepreneurial Training Program

Statewide (including Iowa City):
- Classes 10
- Total participants 202

Iowa City area class:
- Classes 2
- Total participants 59
- Estimated Job Creation 88
- Estimated New Business Starts 10

Assorted Other Clients

Various consulting projects and clients not directly involved in the programs above.
- Estimated New Business Starts 30
- Total Clients 50
- Estimated Job Creation 5
- Hours dedicated to one-on-one consulting 500+

Bedell Entrepreneurship Learning Lab

Enrollment Since Inception in May 2004
- Number of student teams 51
  (including 27 in the past year)

- Number of student participants 43

Business Plan and Elevator Pitch Competitions

- **Pappajohn New Venture Business Plan Competition (11 Entrants)**

SmarteRx (Erin Thatcher)	*Regional Finalist*
The Paper Nest (Liz Munger, Liz Crooks, Erin Maurelli)	*Regional Finalist*
Mania Spot (Museyilnen Goshit)	*Regional Finalist*

- **Student Elevator Pitch Competition (42 Entrants)**

SmarteRx (Erin Thatcher)	*$2,500*
Knotty Sisters (Brittany Burggraaf)	*$2,500*
Point of Sale Solutions (Ross Peterson)	*$1,500*
CorNroc (Mokotsi Rukundo)	*$1,500*
GoGreen Coupons (Jacob Rigert)	*$1,000*
The Paper Nest (Liz Crooks, Liz Munger)	*$1,000*
Universiticks (Dustin Waner)	*$ 500*
A Warm Walk Home (Wanda Raiford)	*$ 500*

- **Faculty & Staff Elevator Pitch Competition (28 Entrants)**

SmarteRx (Erin Thatcher)	*$2,500*
Celadon Applications, LLC (Karen Pease)	*$2,000*
Sports Analytics Group (Jeffrey Ohlmann)	*$1,500*
Wonder Bath (Michelle Altmaier)	*$1,000*
Bonny Olson	*$1,000*
Immunology Science Editors	*$1,000*
Abiogenix (Chandan Reddy)	*$1,000*

- **Volding Business Plan Competition (23 Entrants)**

Green Transitions (Brandon Yoder)	*$3,500*
FuzeTrade (Cody Seeley and Jason Willcox)	*$2,500*
CollegeCrasher.net (Adam Stillman)	*$2,500*
SmarteRx (Erin Thatcher)	*$2,500*
Mood Consignment Furnishings (Christopher Williams)	*$2,500*
Knotty Sisters (Brittany Burggraaf)	*$1,000*
CorNroc (Mokotsi Rukundo)	*$1,000*

- **Bedell Entrepreneurship Learning laboratory Year-End Competition (17 Entrants)**

CollegeCrasher.net (Adam Stillman)	*$5,000*
Knotty Sisters (Brittany Burggraaf)	*$2,500*
Art of the Vine (Kami Ricklefs)	*$2,500*

- **Pappajohn Iowa Business Plan Competition (64 Entrants)**

Reference LLC/Sensor	*$15,000*
J&J Solutions	*$ 1,000*

- **Storer Competition (4 Entrants)**

National Business Plan Competitions

J&J Solutions (Jared Garfield)

- Evansville Business Plan Competition, University of Evansville
  - 1st Place, $10,000
- Nebraska Business Plan Competition, University of Nebraska
  - 2nd Place, $2,000
- Technology Association of Iowa and LWBJ Financial, 2009 Prometheus Award
  - Student Start-Up of the Year
- NASCENT 500 Business Plan Challenge, Ball State University
  - 1st Place, $10,000
- Advanced E-Team Grants: NCIIA Grants for Funding
  - $18,000

Programs, Seminars and Workshops *Fall 2008*

FastTrac Information Meeting	46
Sandage: Don DeWaay	111
BELL Roundtable Lunch	12
E-in-R: Keith Chiavetta	15
FastTrac (Washington)	9
FastTrac (Iowa City)	30
BELL Roundtable Lunch: Merle Volding	15
E-in-R: Merle Volding	15
Tax Workshop	6
BELL Roundtable Lunch: Networking	15
Franchise Business Ownership Workshop	4
Business Expenses and Deductions Tax Workshop	10
Iowa Venture Capital Conference (DSM)	2
Reporting Sole Proprietor Income Tax Workshop	6
Tax Workshop	2
SBIR/STTR	22
Sandage Nick Rhodes	210
BELL Roundtable Lunch: John Hall, Goose Island	15
Hughes Lecture Series: Building a Successful Business in Iowa, Rodney Anderson, Bob Gillispie, Nathan Sams	313
BELL Roundtable Luncheon	15
JPEC Board Meeting	21
Entrepreneurship Boot Camp	38
Quick Books I	12
Spring 2009	
Quick Books II	12
EVG "U of I Resources" for Technology Commercialization	117

BELL Roundtable: Networking	18
Pappajohn New Venture	11
BELL Roundtable IP Attorneys: Kate Cox, April Marshall	23
E-in-R Janice Baldes	15
Succession Planning/Train the Marketer	22
EVG "Exemplar Genetics: Challenges and Solutions in an Early Stage Start-up"	42
FastTrac (IC)	15
E-in-R: Keith Chiavetta	15
BELL Roundtable: Carl Hirschman	15
Elevator Pitch Workshop: Students	30
OEI Informational Meeting	28
IRS Disaster Tax Seminar	43
Elevator Pitch Competition	42
EntreFest Conference (IC)	251
Collegiate Entrepreneurs Iowa Conference (UNI)	55
Sales, Use & Local Option Tax Workshop	6
EVG: "Raising Equity Capital for Your New and Growing Venture"	68
Business Expenses and Deductions Tax Workshop	7
Reporting Sole Proprietor Income Tax Workshop	7
BELL Roundtable: Tom Martin	16
Payroll and Employment Taxes Workshop	8
BELL Roundtable: Bob Squires	19
SIFE Regional Competition	7
EVG "Raising Equity Capital for Your New and Growing Venture"	57
Small Business Disaster Recovery Grant Workshop	4
Elevator Pitch Workshop: Faculty, Staff, Graduate Assistants	29
BELL E-in-R: Sheldon Ohringer	6
BELL E-in-R: Kathleen Ameche	6
Alumni Association Spring Reunion	27
OEI Meeting	21
BELL End of Year Contest	17
MidwestOne Lecture: Joe Crookham	400
Faculty, Staff, Graduate Assistants Elevator Pitch	28
Volding Business Plan Competition	23
SIFE National Competition	7
Entrepreneurial Boot Camp	39
TOTAL	2,500

Appendix B

Name of Business or Other Entity Served	City and County where this Project is in Place		University Unit that interacted with business or other entity
	City	County	
BUSINESS INCUBATOR TENANTS			
ASL Analytical	Coralville	Johnson	BioVentures Center
Bio::Neos, Inc.	Coralville	Johnson	Technology Innovation Center
Cellular Engineering Tech.	Coralville	Johnson	BioVentures Center
Componica, LLC	Coralville	Johnson	Technology Innovation Center
Digital Artefacts, LLC	Coralville	Johnson	Technology Innovation Center
Exemplar	Coralville	Johnson	BioVentures Center
Innomatix, LLC	Coralville	Johnson	Technology Innovation Center
J. L. MediTech	Coralville	Johnson	Technology Innovation Center
KemPharm, Inc.	Coralville	Johnson	BioVentures Center
K2 Technologies	Coralville	Johnson	Technology Innovation Center
Pharmacom Corporation	Coralville	Johnson	Technology Innovation Center
Ramaanchar Technologies, Inc.	Coralville	Johnson	Technology Innovation Center
Terpenoid Therapeutics, Inc.	Coralville	Johnson	BioVentures Center
The Thomas Group	Coralville	Johnson	Technology Innovation Center
UIQI2	Coralville	Johnson	Technology Innovation Center
Vertex Pharmaceuticals	Coralville	Johnson	BioVentures Center
VIDA Diagnostics	Coralville	Johnson	Technology Innovation Center
Kepa Services	Coralville	Johnson	Technology Innovation Center
SantosHuman, Inc.	Coralville	Johnson	Technology Innovation Center

Pohaku	Coralville	Johnson	Technology Innovation Center
RESEARCH PARK TENANTS			
Innovative Software Engineering	Coralville	Johnson	UI Research Park/TIC Graduate
LMS North America	Coralville	Johnson	UI Research Park/TIC Graduate
Stanley Environmental, Inc.	Coralville	Johnson	UI Research Park
Vangent, Inc.	Coralville	Johnson	UI Research Park
Integrated DNA Technologies, Inc.	Coralville	Johnson	UI Research Park/TIC Graduate
Pearson Educational Measurement	Coralville/Iowa City	Johnson	UI Research Park
Noel-Levitz	Coralville	Johnson	UI Research Park
Cargill International	Coralville/Cedar Rapids	Johnson	UI Research Park
Optherion, Inc.	Coralville	Johnson	UI Research Park
Brighton Group	Coralville/Des Moines	Johnson/Polk	UI Research Park
OTHER BUSINESS INCUBATOR GRADUATES ACTIVE IN IOWA			
Garvin Consulting Services	North Liberty	Johnson	Technology Innovation Center
Ecolotree, Inc.	Lowden, North Liberty	Cedar, Johnson	Technology Innovation Center
Accredo Therapeutics	Iowa City	Johnson	Technology Innovation Center
Corcoran Communications, Inc.	Iowa City	Johnson	Technology Innovation Center
Buckle Down Publishing, Inc.	Iowa City	Johnson	Technology Innovation Center
Bio-Research Products, Inc.	North Liberty	Johnson	Technology Innovation Center
aJile Systems, Inc.	Cedar Rapids	Linn	Technology Innovation Center
CompuTerra, Inc.	Cedar Rapids	Linn	Technology Innovation Center
Entrepreneurial Learning Systems	Iowa City	Johnson	Technology Innovation Center
Caviforce Technologies, Inc.	Des Moines	Polk	Technology Innovation Center
Sebesta Blomberg & Assoc., Inc.	Coralville	Johnson	Technology Innovation Center

HomeSafe	Coralville	Johnson	Technology Innovation Center
Integrated DNA Technologies, Inc.	Coralville	Johnson	UI Research Park/TIC
The Patient Education Institute	Coralville/Iowa City	Johnson	UI Research Park/TIC
Police Law Institute	Coralville/North Liberty	Johnson	UI Research Park/TIC
Actual Safety, INC.	Coralville	Johnson	Technology Innovation Center
Applied Fullerene	Coralville	Johnson	Technology Innovation Center
Corridor Business Journal	Coralville	Johnson	Technology Innovation Center
DEVELOPERS			
Myriad Developers, Inc.	Cedar Rapids	Linn	UI Research Park
TMD, L.L.C.	Solon	Johnson	UI Research Park
Midwest Development & Invest.Corp.	Fairfield	Jefferson	UI Research Park
Liberty Growth	Iowa City	Johnson	UI Research Park
Hunter Companies	Cedar Rapids	Linn	UI Research Park
S & S Developers	Iowa City	Johnson	UI Research Park
Andersen Construction	North Liberty	Johnson	UI Research Park
Kevin Hanick	Iowa City	Johnson	UI Research Park
Ryan Companies, US	Cedar Rapids	Linn	UI Research Park
NAI Iowa Realty	Des Moines/Cedar Rapids	Polk/Linn	UI Research Park
Weitz Companies	Des Moines	Polk	UI Research Park
Southgate Development	Iowa City	Johnson	UI Research Park
PROSPECTIVE TENANTS			
Modular Genetics	Boston	MA	UI Research Park
Cambrex	Charles City	Floyd	BioVentures Center
Precision Analytics	Dallas	TX	Technology Innovation Center

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FY 2009 Board of Regents, State of Iowa, Annual Economic Development and Technology Transfer Report

PRESENTED BY SHARRON QUISENBERRY, VICE PRESIDENT FOR RESEARCH AND ECONOMIC DEVELOPMENT

September 24, 2009

FY 2009 Board of Regents, State of Iowa, Annual Economic Development and Technology Transfer Report

1. Please briefly describe the relationship of your institution's economic development activities to the enhancement of economic growth in the state. The description should cover, but not necessarily be limited to the following:
A. the relationship between institutional activities and creation of jobs and wealth in Iowa
B. Institutional activities and services which indirectly promote economic development, such as training provided to staff of local economic development agencies

1A. Enhancement of Economic Growth through Job Creation and Retention, Investments, Sales, and Cost Savings

Iowa State University engages in several activities that have direct impact on both the creation as well as the retention of jobs in Iowa. The ISU Research Park is a technology community that encourages commercialization of university research. Likewise, the Innovations Development Facility, part of the Plant Sciences Institute, incubates new companies. In addition, the IPRT (Institute for Physical Research and Technology) Company Assistance Program, ISU Extension's Center for Industrial Research and Service (CIRAS), the Small Business Development Center (SBDC) and the ISU Pappajohn Center for Entrepreneurship interact with companies across Iowa to solve production and management problems. These interactions lead to the resolution of problems related to product development and business management. As a consequence of the improved production resulting from these interactions, businesses have been able to retain and often expand their work force. Some examples of the direct impact that these ISU units have had this past year are as follows:

- The ISU Research Park has been very successful in initiating as well as nurturing numerous **new businesses**. Fourteen new companies and affiliates have joined the Park in FY09, bringing the historical total to 191 companies, research centers, and affiliates. Currently, there are 58 companies, research centers, and affiliates located in the Park, employing 839 people.

- Two new faculty start-up companies have located in the Innovations Development Facility, which is an on-campus business incubator in the Roy J. Carver Co-Laboratory, under direction of the Plant Sciences Institute. A total of 15 companies have used business incubator space since the facility opened in September 2003.

- A summary of project evaluation data clearly shows that Iowa companies with technical problems and research and development needs continue to find important technical help through the services of IPRT Company Assistance. Companies report positive impacts affecting their sales, investments, and operating costs. Of the IPRT clients responding to the survey, the estimated annual impact over the last 5 years is $12.8 million per year, while the impact in FY09 alone was $14.5 million. Companies also estimated that 20 jobs are created or retained each year. The satisfaction rating given by clients during this five year period is 4.4 (1-5 scale, with "1" being "is not satisfied" and "5" being "very satisfied).

- ISU proprietary biodiesel catalysts technologies (developed by Victor S.-Y. Lin, director of IPRT's Center for Catalysis and a professor of chemistry at Iowa State University) have been successfully transferred to an Iowa-based startup company, Catilin, Inc. These unique recyclable solid catalysts have enabled Catilin to attract $6.7 million in venture capital. The company, founded in 2007, now employs 20 full-time staff members.

- Visualization software for medical applications (developed by Eliot Winer, associate director of IPRT's Virtual Reality Applications Center (VRAC) and professor of mechanical engineering at Iowa State University, James Oliver, VRAC director and Dr. Thom Lobe, a pediatric surgeon based at Blank Children's Hospital in Des Moines) have been transferred to an Iowa-based company. Visual Medical Solutions, founded in 2007, is offering BodyViz, software that creates 3D MRI, CT scan visualizations, unlocking medical imaging for the practicing surgeon, diagnostics and treatment. The company is located in the Iowa State University Research Park and employs four people.

- Extension's Center for Industrial Research and Service (CIRAS) has a mission to improve the quality of life in Iowa by enhancing the performance of business and industry through research, education, and technical assistance. Cumulatively, over the past four fiscal years, CIRAS and its partners have reported impact from companies totaling more than $753 million dollars (new investments $270 million, costs saved or avoided $52 million, sales gained or retained $431 million) with 7,919 jobs added or retained as a result of the technical assistance, education, or research they received.

- In FY09, businesses from 96 counties in the state received assistance on projects or attended educational workshops from CIRAS staff or partners; 775 companies reported $58 million in new investments, $24 million in costs saved or avoided, and $184 million in sales gained or retained ($266 million total). Company executives stated that 3,079 jobs were added or retained as a result of the research, technical assistance, or education they received from CIRAS and its partners. In addition to direct project and workshop assistance to companies, CIRAS staff also provided educational information to more than 10,000 individuals in FY09.

- In response to the floods and tornados of 2008, CIRAS reached out to Iowa industry in an effort to identify and assist in overcoming the resulting challenges for Iowa industries. CIRAS staff surveyed companies to identify industry obstacles to exceeding pre-disaster production levels. The information learned was conveyed to local, state, and federal economic development agencies, organizations, and people providing support and resources, establishing CIRAS as the "voice of industry" in a time of need. In addition, CIRAS provided direct assistance to 17 manufacturers across the state, including emergency tooling analysis, facility layouts, and productivity improvements to help manufacturers recover as effectively as possible. During the recovery period, CIRAS identified a need for assistance in business continuity planning for small- to medium-sized manufacturers. In response, CIRAS developed a business continuity planning service for manufacturers, which is tailored to meet the needs of Iowa manufacturers.

- During the Business Continuity Planning Process, CIRAS works with companies to identify risks, and then to develop and implement mitigation plans to ensure critical business operations recover in the minimum amount of time after a disruption. To date, CIRAS has held seven business continuity planning workshops. The service will be offered on an ongoing basis to manufacturers throughout Iowa.

- More than 800 participants were trained in FY09 by attending conferences and workshops offered through a partnership of CIRAS; Civil, Construction, and Environmental Engineering; Electrical and Computer Engineering; Alliant Energy; CIPCO; MidAmerican Energy; Muscatine Power and Water; and the Iowa Energy Center. Energy efficiency workshops, held across Iowa, provided education on process heating, pumps, motors, compressed air systems, natural gas efficiency, and industrial steam systems. Energy short courses educated participants on the production, transmission, and distribution of electricity. Arc flash sessions provided safety training on procedures to prevent arcing of electrical currents and safety processes for employees. Engineers, geologists, technicians, and safety personnel attended structural engineering, transportation, and environmental and water resources design conferences. Attendees were able to obtain professional development hours towards retention of their Iowa engineering licenses.

- During FY09, the Small Business Development Center (SBDC) provided business assistance to companies, involving 2,544 clients and 11,519 counseling hours in 99 counties. They also conducted 345 training workshops in which 4,289 individuals participated.

- The ISU SBDC, along with the ISU Pappajohn Center for Entrepreneurship, provided 6,387 hours of counseling assistance to start-up and existing companies; served 214 clients with one-on-one counseling; educated 418 attendees through workshops; provided advice to several hundred clients via telephone and email; and advised 41 technology companies in the areas of licensing, equity based financing, market entry, and numerous operational areas.

- In a report published by James J. Chrisman, *Economic Impact of Small Business Development Centers (SBDC's)*, it was shown that for every $1.00 in SBDC funding in FY07, the amount of tax dollars returned to the State of Iowa and the federal government by SBDC clients was $2.19. There were also 631 jobs retained, 644 jobs created, $42.5 million in sales retained and $43.1 million in sales increased.

- Technologies originating at ISU and licensed to Iowa companies have resulted in over $103 million in sales by those companies in calendar year 2008. Total sales of ISURF-licensed technologies were $559 million, not including germplasm.

- The Office of Intellectual Property and Technology Transfer began supporting SBIR (Small Business Innovation Research) and STTR (Small Business Technology Transfer) outreach efforts in FY06. Since then, SBIR and STTR funding in Iowa has rebounded following a decrease in FY05 after federal support for an earlier assistance program at ISU ended. An emphasis has been placed on outreach and training activities. This includes a monthly newsletter

and workshops presented by Federal program managers. In addition, comprehensive proposal preparation support has contributed to an increasing number of companies applying for funding. Twenty-three Iowa companies were assisted in the preparation of 28 proposals or administration of awards during FY09, including eight Iowa State faculty or staff-related companies. In FY09, 21 Iowa companies won 27 new or continuing SBIR and STTR awards worth nearly $6.4 million, an increase over the $6.2 million awarded in FY08. The Departments of Agriculture, Defense and Energy, as well as the National Institutes of Health, the National Aeronautics and Space Administration and the National Science Foundation, are funding this year's Iowa SBIR/STTR award winners. The funded projects reflect Iowa's strengths in biotechnology, information systems, materials development and agriculture. Over $3.7 million in support was awarded for Navy and Air Force projects to enhance machining technologies, develop innovative sensors, and improve components with applications in electronics. An additional $1.8 million was received from the National Institutes of Health for diverse projects that range from the development of novel neuroprotective agents to improved influenza vaccines to medical monitoring devices.

- The ISU Grow Iowa Values Fund program has a competitive research component that pairs ISU faculty members with Iowa industries to create economic benefit for the companies. A survey of nine companies (surveyed one year after project completion) that participated in projects that were completed in June 2007 documented 71 jobs created or retained and a $9.1M sales impact due to the research projects conducted in partnership between ISU and the companies. Surveys for the round of projects competed in June 2008 are occurring this fall.

1B. Training Opportunities for Staff of Local Economic Development Agencies and Other Activities that Indirectly Promote Economic Development

- In preparation for the Bio World Congress trade show, several IDED staff members spent a day at Iowa State learning about the Bioeconomy Institute, Center for Biorenewable Chemicals, Biobased Industry Center, BioCentury Research Farm, and the Harvest, Storage and Transportation Consortium. This allowed them to be better prepared to speak with companies while attending the trade show and generate interest in Iowa State and the State of Iowa.

- The College of Engineering and ISU Extension's Center for Industrial Research and Service (CIRAS) partnered to hold the "1st ISU Wind Energy Symposium: Challenges and Opportunities" to begin the work of drawing a road map that will better define Iowa State's role in this rapidly evolving energy sector. Participants included the Department of Energy, the American Wind Energy Association, John Deere, Siemens, Mid-American Energy, Clipper Windpower, and Iowa State faculty and staff. Faculty led discussion panels on wind turbine systems, manufacturing and deployment, and infrastructure and delivery—all areas with developing or active research projects at Iowa State. College of Engineering faculty and staff are continuing with their development of the wind energy road map. CIRAS staff members are providing links between the ongoing research at ISU and the needs of manufacturers in the wind industry in Iowa. Staff members have worked with nine companies in the wind industry over the past two years.

- In 2007 CIRAS initiated the first annual Veterans Procurement Conference because of the struggle disabled veterans have with navigating the federal procurement system. The event was designed to connect veterans and businesses of Iowa with knowledge, resources, and opportunities to be successful in government contracting. Each year the Veterans Conference has grown and now includes large businesses and government agencies eager to contract with well qualified veteran business owners. CIRAS received awards from the Department of Veterans Affairs Center for Veterans Enterprise in both 2007 and 2008 for the creation and delivery of these conferences. In 2009, CIRAS is leading the curriculum development for the Federal Contractor Certification training program intended to help veteran business owners understand Federal contracting, respond competently to solicitations, and perform them successfully once they have won the contract. This is a joint project of the Center for Veterans Enterprise and the Association of Procurement Technical Assistance Centers, with the assistance of the Defense Acquisition University.

2. Please provide the following information for FY 2009: (If your institution utilizes additional metrics specific to your institution's specialized areas of research or service, please include them here)

Note: Unless noted, the data provided below are FY09 data.

a. Number of disclosures of intellectual property: 95
b. Number of patent applications filed: 40
a. Number of patents awarded: 23
b. Number of license and option agreements executed on institutional intellectual property, in total and in Iowa: 84 total, 32 in Iowa
c. Number of license and option agreements yielding income: 121
d. Revenue to Iowa companies as a result of licensed technology: $103 million (CY08)
e. Number of startup companies formed, in total and in Iowa (through licensing activities): 1 total, 1 in Iowa
f. Number of companies in research parks and incubators: ISU Research Park: 42 private and 16 university-related; Plant Sciences Institute Innovations Development Facility (IDF): 4 (all university-related)
g. Number of new companies in research parks and incubators: ISU Research Park: 14 private and 0 university-related; Plant Sciences Institute IDF: 2 (both university-related)
h. Number of employees in companies in research parks and incubators: ISU Research Park: 533 private and 306 university-related; Plant Sciences Institute IDF: 15 (all university-related)
i. Royalties and license fee income: $9.3 million
j. Total sponsored funding received: $305.2 million of which $170 million is for research
k. Corporate sponsored funding received for research and economic development, in total and in Iowa: $22.4 million total, $12 million in Iowa

l. Iowa special appropriations for economic development in the following categories:
    i. Annual state appropriations for ongoing programs (such as research parks, SBDC, IPRT, IDM, Metal Casting Center): $2.8 million—includes $1,074,990 SBDC (includes state-wide programs), $154,539 ISU Research Park & $1,600,000 IPRT
    ii. Grow Iowa Values Fund appropriations: $1,540,000
    iii. Battelle appropriations No new funding in FY09
m. Research expenditures (including state appropriations and external funding) $224.4 million—Note that this is an FY08 number, most recent number available
n. Licenses and options executed per $10 million research expenditures: 3.3 (est.)—Note that this is an FY07 figure, most recent number available
o. Sales of licensed products by Iowa-based companies: $103 million--Note that this is a CY08 figure, most recent number available.
p. Number of employees for current Research Park tenants and incubator, as well as former tenants that are still in existence in basic form world-wide 2,843
q. Number of interactions ISU had in FY09 with communities and businesses across the State of Iowa: 6,836 (in all 99 counties)

3. Please describe the ways in which your institution is engaged in the following activities (For example, what is the nature of the outreach and service activities? Which units provide it? What kinds of people and organizations benefit?)
A. Direct and hands-on technical assistance to businesses and entrepreneurs
B. Direct economic development assistance to Iowa communities
C. Economic development services provided by research parks, incubators or similar service units

3A. Direct and Hands-on Technical Assistance to Businesses and Entrepreneurs: ISU System for Innovation

Iowa State University is charged with advancing economic development and technology transfer activities that promote growth and benefit all citizens. While creation of knowledge remains the basic responsibility of a research university, the way we share knowledge determines our success. ISU shares knowledge and expertise with students (learning and teaching), communities (engagement), and business and industry (technology transfer and economic development). ISU ranks as one of the most successful universities nationwide in several categories of technology transfer and economic development. The activities of the colleges, institutes and centers are coordinated through the Economic Development Council that advises the Vice President for Research and Economic Development. The Vice President and this Council continuously communicate with economic development entities within the State such as the Iowa Department of Economic Development, the Iowa Business Council, the Greater Des Moines Partnership and other local and regional agencies.

The Iowa State University “System for Innovation” was developed to focus on the transfer of university technologies into commercial applications in start-up or existing companies. Functions of the ISU System for Innovation include:

- **Business Development & Assistance and Entrepreneurial Activities**: Efforts related to start-up companies, including business assistance services & SBIR/STTR applications.
- **Technical Assistance & Technology Development**: Solving technical problems, assisting in product development and process improvement projects for existing businesses. This includes the current efforts of no-cost technical assistance and cost-sharing projects.
- **Industry Relations**: Facilitation of a multitude of interactions between ISU and its industry partners, including the management of research relationships and interactions with economic development groups, legislative groups, and other third parties.
- **Community Development**: To disseminate and develop programming, facilitating community organizations, fostering community planning, and coordinating with community and regional economic development networks and organizations.
- **Technology Transfer and Licensing:** The transfer of patented intellectual property to business and industry through license agreements.
- **Physical Space:** Physical space for business incubation is available in the ISU Research Park, Plant Sciences Institute, and Center for Crops Utilization Research.
- **Research and Instrumentation Facilities:** Iowa State University maintains more than 20 central research facilities that also serve communities and businesses on a fee-for-service basis.

3B. Direct Economic Development Assistance to Iowa Communities

- Since 2005, ISU Extension's Center for Industrial Research and Service (CIRAS) has partnered with the ISU Department of Economics to conduct six regional economic studies throughout Iowa. The studies provide economic developers with an overview of their regional economy and the forces affecting it, assess the regional industrial structure, identify key regional industries, and promote the use of research-based criteria for justifying public economic development spending. The regional studies help to enhance the link between local economic development needs and Iowa State University research, extension, and continuing education professionals. The studies have been funded in part from a grant to CIRAS from the Economic Development Administration.

  The sixth study, "Establishing a Baseline for the Siouxland Tri-State Regional Innovation Project: Key Industries and Occupational Characteristics," was completed in June 2009. Through this study, CIRAS assisted the Siouxland Region (ten counties in three states) in identifying their regional economy by defining the occupational characteristics and key industries in the region. This data assisted the region in the development of a strategic plan driven by a Regional Innovation Grant (RIG). The RIG's are funded by the Employment and Training Administration within the Department of Labor to assist state workforce agencies and local Workforce Investment boards in the development of a comprehensive, integrated, strategic regional plan, with a focus on current or future unanticipated economic events. CIRAS continues to work with the greater

Siouxland region to assist with data driven decision-making in addressing economic development and workforce development issues in the region.

3C. ISU's Key Units Engaged in Economic Development

Iowa State University, as part of the higher education system in the State, is charged with advancing technology transfer and economic development activities that promote growth and benefit all citizens. The University evolves these goals by contributing to workforce development, creating intellectual property, advancing ideas to the stage of market readiness, supporting creation of new companies, offering assistance to existing companies, and attracting new companies to the State. The University's economic development/technology transfer support system includes the following units that are coordinated through the Research and Economic Development Council:

- **Pappajohn Center for Entrepreneurship and the Small Business Development Center (SBDC)**. These units work with researchers to define the technologists' role in the company, evaluate markets, assist in the creation of a business plan and help the company develop connections with a network of business resources including consultants, accountants, attorneys, prospective employees and investors. In a typical year, the Pappajohn Center, working with IPRT, the Plant Sciences Institute, ISURF/OIPTT and other research centers, identifies approximately 25 prospective new technologies. These technologies can take six to 26 months to develop sufficiently to justify the formation of businesses. During this time the researcher receives assistance in moving the technology from the researcher's bench to the marketplace. The Pappajohn Center helps the researcher develop the model for the business and establish the network of resources necessary to implement the plan. These resources can include business assistance, students or capital. The Pappajohn Center/SBDC also continues to provide a referral network and facilitates the recruitment of students including access to internships.
- **Institute for Physical Research and Technology (IPRT).** Through IPRT's Company Assistance Program, Iowa companies can leverage the expertise of the IPRT research centers and other ISU capabilities in order to solve technical problems, create new products and processes, and increase productivity and quality. IPRT Company Assistance provides help through both its Research and Development cost-sharing program and through short-term, no-cost technical assistance. IPRT assists early-stage technology commercialization and actively collaborates with Iowa companies on technology development projects. IPRT plays an integral role in the process of technology transfer targeted at new business creation. Many successful businesses have emerged from IPRT technologies, including Mechdyne of Marshalltown and PowerFilm, Inc. of Ames. The staff members of the Materials Group and the Nondestructive Evaluation Group within Company Assistance provide significant and broad expertise to help Iowa manufacturers address material and inspection issues. These programs offer state of the art knowledge made available to business, and both groups have expanded their capabilities and facilities to keep pace with research advances and modern industrial needs. This direction allows them to reach ever more clients and tackle an increasingly wide range of challenges.

IPRT has also been a major supporter of Iowa State University's Solar Decathlon team, which has built an innovative 800-sq. ft. solar house as its entry into the U.S. Department of Energy's 2009 Solar Decathlon competition. Ulrike Passe, director of IPRT's Center for Building Energy Research and a professor of architecture at Iowa State University, is the project's lead investigator. The team has worked with over 25 Iowa companies, either to help construct the house or as a supplier of materials and components. Some of the innovations created for the house may lead to new products for Iowa manufacturers.

- **Iowa State Innovation System (ISIS).** Near the time a venture is launched, facilities become an issue. ISIS, ISU's technology incubator, provides an ideal first home for companies. ISIS offers connections to the University, affordable space with reception services, office equipment (copiers, fax machines, and computers), conference rooms, and other amenities at a very reasonable rate. The Pappajohn Center, described above, provides mentoring to the companies as well as the opportunity for companies to utilize students as interns and researchers. ISIS will generally attract five new companies each year. Companies typically spend one to three years in the Incubator moving from product development to product sales. Once sales are established, companies grow out of the Incubator. Some companies remain within the Research Park and continue to receive development assistance, while others move on to commercial space elsewhere but can still receive business development services from the ISU Pappajohn Center and ISU SBDC. As companies mature, the University provides opportunities for collaboration between researchers at the University and in the companies. Students provide cost-effective labor and are potential employees. The Research Park provides expansion space, often financing the space and improvements.

- **Iowa State University Research Park.** The Iowa State University Research Park is a 230-acre development with over 325,000 square feet of building space and is located south of the Iowa State University campus. The ISU Research Park is more than just land and buildings; it is a technology community that encourages commercialization of University research.

- **Extension's Center for Industrial Research and Service (CIRAS).** CIRAS provides research, education, and technical assistance to Iowa industry through partnerships with Iowa's universities and community colleges, government agencies, and business associations. Account managers throughout the state meet with clients to assess needs and provide links to resources that companies can use to increase their competitiveness. Solutions are offered through a combination of direct assistance from center staff, university faculty, partner organizations, and outside consultants. CIRAS staff has expertise in engineering, biobased products and biorenewables, management practices, government procurement, productivity, growth services, quality systems, and community-business economic development. The center is supported in part by the DoC/NIST Manufacturing Extension Partnership, the DoD/DLA Procurement Technical Assistance Program, the DoC/EDA University Center Program, and the USDA BioPreferred program.

- **ISU Research Foundation (ISURF) and the Office of Intellectual Property and Technology Transfer (OIPTT).** ISURF owns and ISURF and OIPTT jointly

manage, market and license the intellectual property for Iowa State University. ISURF/OIPTT works with faculty members in regard to the reporting and protection of innovations, including patenting inventions. It markets the innovations to find commercial partners interested in licensing. It also funds projects within the University that have potential for broadening the intellectual property protection or providing value for its commercial potential. ISURF also provides assistance to Iowa companies, including ISU faculty start-ups with SBIR and STTR applications.

- **Innovations Development Facility (IDF).** This is a business incubator operated by the Plant Sciences Institute to promote the commercialization of plant biotechnology. IDF encourages ISU faculty, staff, and students to commercialize their research in the plant sciences and promotes the development of start-up companies among aspiring entrepreneurs. IDF is housed in the Roy J. Carver Co-Laboratory and consists of six well-equipped laboratory modules. The facility offers an environment to transition research from a university to a business setting. The IDF facility is a productive research location where scientists from academe and industry can work together to advance the mission of the Plant Sciences Institute and to promote economic development in Iowa.

- **ISU Extension Community and Economic Development** provides assistance in land use and community planning, community economic analysis, nonprofit management, community design, local government management, and leadership development. Major partners in the provision of these services and educational programs have included the Iowa Department of Economic Development; the University of Iowa Nonprofit Resource Center; the Iowa Department of Transportation; the U.S. Department of Housing and Urban Development; the Iowa Finance Authority; Hometown Perry, Iowa; and the U. S. Department of Agriculture.

  For example, the Iowa's Living Roadways Community Visioning Program was awarded $951,360 from the Iowa DOT to assist 12 communities in transportation enhancement planning. At the request of the DOT, the Visioning Program has refocused some of its planning assistance efforts on five communities affected by recent natural disasters. The program is conducting a two-year, long-term planning process in New Hartford, Parkersburg, Clermont, Elgin, and Elkader. These disaster communities are following a process similar to typical visioning communities, but with additional dimensions related to their specific circumstances. Elgin, Elkader, and Clermont, all located in the Turkey River corridor, also are interested in articulating a regional identity for the river corridor and associated communities, in part to develop community value as a recreational destination and also as a great place to live. At the same time, seven other Iowa communities are participating in the "traditional" visioning process: Garner, Glenwood, Lansing, Laurens, Lohrville, Robins, and Riverside.

- **ISU Extension to Families** provides leadership to the Horizons program, which helps communities take charge and build stronger leaders to address poverty, economic decline, and the exodus of young people. Fourteen new rural communities joined 22 alumni communities that recently completed the 18-month Horizons program. Some 409 trained, community volunteers engaged more than 2,547 citizens in study circles, leadership training, and visioning. Communities

implemented poverty reduction efforts such as expanding child care, providing food (including weekly weekend backpacks to children in need), improving housing, and offering youth mentoring and tutoring. At an Expanding Horizons workshop 45 representatives from 19 Horizons communities — alumni and current — learned about public policy, forming nonprofits, SHARE and VITA sites, and how to grow and expand their community volunteer base. Thirty-six people from nine alumni communities explored how to advance Rural Family Economic Success and help people Earn it! Keep it! Grow it! during a three-day institute. The program is funded in part by the Northwest Area Foundation and the Annie E. Casey Foundation.

ISU Extension to Agriculture and Natural Resources (ANR) provides educational leadership to integrate Iowa's rich natural resources, productive people, and viable communities with its strong agricultural industry to grow the economic base of Iowa agriculture. The ANR program plans and delivers extension education activities through seven teams of faculty, field specialists, and staff with expertise in crop production and protection, farm business management, horticulture, beef production management, pork production management, dairy production management, and natural resources and stewardship. For example, the ISU Extension Value Added Agriculture Program conducted 12 feasibility audits during FY09. These audits helped businesses access more than $70.2 million in loans and financing for economic development in rural Iowa. More than 150 new jobs are projected to be created from these 12 businesses' development projects.

- The Office of the Vice President for Research and Economic Development (OVPR/ED) works closely with all of the above units, including the Office of the Vice President for Extension and Outreach, in promoting the University's mission related to technology transfer and economic development.

    - The Research and Economic Development Council (chaired by the VPR/ED) coordinates ISU research, technology transfer and economic development activities. Members meet monthly 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 and economic development activities at ISU. This council, formed in 1993, is comprised of representatives from all units on campus that have a primary role in economic development and technology transfer as well as representatives from each of the seven colleges.

    - A new initiative was started to implement a comprehensive management strategy for key industrial partners. This effort is co-led by the Director of Industry Relations and the Corporate and Foundations Relations group in the ISU Foundation. This is a collaborative effort that involves the Associate Deans for Research in the colleges, CIRAS, IPRT, ISURP, and key research faculty.

    - An Opportunity Response Team (ORT) was formed 3 years ago to focus on the bioeconomy initiative and fostering relationships with industry in this area. Members include the Director of the Office of Biorenewables

Programs; the Deputy Director of the Office of Biorenewables Programs; the Director of Industry Relations; and the Director of Development, ISU Foundation. This group continues to function effectively and this model is currently being extended to other research areas on campus.

The above units are the key units that focus attention on economic development and technology transfer at ISU; however, significant additional related activity also occurs across campus in individual academic departments, centers and institutes, and colleges.

4. Please briefly describe two or three examples of major economic development collaborative projects with such other entities as Regent universities, Iowa community colleges, the Iowa Department of Economic Development, Iowa Workforce Development, or other state agencies.

Major Economic Development Collaborative Projects

NSF EPSCoR. ISU is collaborating with UNI and the U of I on an NSF EPSCoR proposal that is being submitted in October 2009. If funded and successful, this would develop a statewide energy plan for the State of Iowa, covering three renewable energy platforms—solar, wind and bioenergy and a fourth platform dealing with energy efficiency. The ultimate outcome would be an energy plan leading to energy efficiency and sustainability for the State. Other partners include the Iowa Office of Energy Independence, the Iowa Energy Center, community colleges and other four-year institutions in Iowa and industry.

Grow Iowa Values Fund. This legislation is providing the universities and private colleges financial resources to expand technology transfer and commercialization efforts. We are in the fourth year of GIVF funding, in addition to providing core support for infrastructure in the Research Park, Pappajohn Center, IPRT Company Assistance, and the VPR/ED office. Each year projects are funded that pair ISU researchers and Iowa companies. More information appears later in this report.

Battelle Initiative. ISU, the University of Iowa, and the University of Northern Iowa have worked closely with the Iowa Department of Economic Development, the Board of Regents, State of Iowa; legislators, and business leaders through the Biosciences Alliance of Iowa organization to implement the Battelle initiative. Proposed projects that focus on the biosciences, information technology and advanced manufacturing have been funded. More information appears later in this report.

Iowa Power Fund. In fall 2007, the State of Iowa established the Office of Energy Independence (OEI) "to help create an economically viable and environmentally sound energy future". The goal was to fund $100 million over 4 years through the Power Fund program to support research and development, knowledge transfer, technology innovation and educate the public about technologies and different approaches, in an effort to improve the state of Iowa's competitiveness and help it achieve its goal of energy independence.

Investigators have to submit a 5-page pre-proposal with a full budget to the Due Diligence Committee, which screens and reviews all proposals, to seek funds from the Power Fund. If invited, investigators then submit a full proposal and make a brief 15 minute presentation to the Due Diligence Committee and the Board. The Due Diligence Committee then forwards all recommendations to the Power Fund Board for its final review and decision. If selected for funding, the Board recommends a technical and/or market impact review if they feel it is necessary. Awardees negotiate the final details of the contract and budget with the Board.

ISU has completed the negotiation process for three awards from the Iowa Power fund and has more several projects in various stages of negotiation.

State-wide committees – Many people from ISU serve on committees that promote economic development programs such as the Biosciences Alliance of Iowa, the Iowa Power Fund, the Advanced Manufacturing Research and Collaboration Cluster, Professional Developers of Iowa, the Iowa Business Council, etc.

5. Please provide the following information about Grow Iowa Values Fund projects for FY 2009:
A. Identify and briefly describe each project or initiative which received GIVF funding in FY 2009 including information on outcomes or progress made
B. Identify metrics which were used to measure outcomes for each project and report progress on each metric for FY 2009
C. Provide a description of the sources of the matching institutional dollars for each GIVF-funded project

The ISU Grow Iowa Values Fund (GIVF) program has a competitive research component that pairs ISU faculty members with Iowa industries to create economic benefit for the companies. A survey of seven companies that participated in projects that were completed in June 2007 documented 42 jobs created or retained and a $5.3M sales impact due to the research projects conducted in partnership between ISU and the companies.

Attached is an additional report that provides information on projects funded through the GIVF (see Appendix 1).

In addition, the following projects were identified this past spring for FY10 funding.

FY10 Projects Approved for Funding

PI	Title	**Amount Requested**
Byron Brehm-Stecher	Rapid Sequence-Based Detection of Human Pathogens: From Farm to Fork to Physician	$ 106,690
Jesse Goff	Use of Beta-Glucuronides of Vitamin D To Treat Inflammatory Bowel Disease	$ 89,657

Brad Bosworth	Prevention of Swine Influenza: Commercialization of Replicon Particle and Replicon Subunit Vaccines	$ 146,610
David Grewell	Naturally Controlled Gelatinization of Corn Starch	$31,426
Bryony Bonning	Transgenic Plant Resistance to Invertebrate Pests	$ 107,680
Patrick Halbur	Development of a Novel Genetic Test for Inherited Bovine Diseases and its application to tissues and embryos	$ 69,500
Anumantha Kanthasamy	Testing of lead PK compounds in preclinical animal models of Parkinson's disease	$128,100
*Atul Kelkar	Waste Plastics, Crude Oil Sludge, and Tar Sand to Diesel – Capturing Energy from Waste	$ 9,337
*Victor Lin	Catalytic Production of 1,6-Hexanediol	$ 10,538
*Mike Kessler	Pultruded Window Frames from Agricultural Oils	$ 28,275
*Mike Olsen	Development of the Next Generation of Vortex Flow Meters for Engine Applications	$ 55,340
**TOTAL		$ 783,153

*In FY09, the projects had already been selected before the 20% budget reversion. A 20% cut to these projects would have jeopardized their commercialization potential. We elected to cut the project budgets 7% and to partially fund some of the FY09 projects during FY10.

** The unallocated projects funds will be allocated to projects at the Vice President for Research and Economic Developments discretion, throughout FY10, on projects consistent with the mission of these funds.

6. Please provide the following information about Battelle-funded projects for FY 2009:
A. Identify and briefly describe each project or initiative which received Battelle funding in FY 2009 including information on outcomes or progress made
B. Identify metrics which were used to measure outcomes for each project and report progress on each metric for FY 2009

- The following executive summary (prepared in July 2009) provides an overview of the Battelle funding awarded to ISU. For more detailed information on specific projects, including some updates, see the attached report (Appendix 2).

IOWA STATE UNIVERSITY
BATTELLE UPDATE: July 01, 2007 – December 31, 2007

EXECUTIVE SUMMARY

Platform	Expenditures	Total Allocation	Project Allocation	Project Obligated	Infrastructure Allocation	Infrastructure Obligation
Advanced Food	$ 166,830.88	$ 856,334	$ 507,572	$ 348,762	$ -	$ -

& Feed						
Advanced Manufacturing	$ -	$ 100,000	$100,000	$ -	$ -	$ -
Animal Systems	$ 589,852.60	$ 626,000	$ 579,000	$ -	$ 47,000	$ -
Bioeconomy	$1,734,027.38	$ 2,328,196	$ 1,054,666	$ -	$ 1,273,530	$ -
Biosecurity	$ 609,195.34	$ 793,470	$ 450,000	$ -	$ 343,470	$ -
Information Technology	$ 771,903.69	$ 1,718,800	$ 650,000	$ -	$ 1,068,800	$ -
Total	**$**	**$ 6,410,000**	**$ 3,690,000**	**$ 348,762**	**$ 2,720,000**	**$ -**

Infrastructure note:
Within the College of Agriculture and Life Sciences, some of the infrastructure funds have been reallocated from BioSecurity to Bioeconomy.

- Extension's Center for Industrial Research and Service (CIRAS) is in the process of developing and deploying a new supply chain management program aimed at small- to medium-sized manufacturers in the state of Iowa. The ASPIRE (Advancing Supply chain Performance and Innovation for Reliable Excellence) program will apply a disciplined approach to analyze supply chain operations, identify areas for improvement, and provide manufacturers with the tools and knowledge to sustain long-term competitive advantages through proactive supply chain management. The existing Battelle funds are being used to support the early development of this program, and CIRAS is anticipating funding from the Iowa Department of Economic Development (IDED) to execute the first full year of the program. At this time, two OEMs, one each from the targeted industries of Advanced Manufacturing and Information Technology, have committed to participate in the ASPIRE program in 2009.

  In addition to the new ASPIRE program, CIRAS is involved in several other activities in the supply chain field. CIRAS continues to support activities such as supplier development projects for large OEMs in Iowa, and plans to expend the remaining Battelle funds during the current fiscal year working on supply chain research efforts with large OEMs. CIRAS also has participated in an event through the Green Supplier Network, in which OEMs work with suppliers to develop "Lean and Green" assessments of value streams with a goal of increasing productivity and reducing waste. Finally, through the Economic Development Administration (EDA) University Center program, CIRAS is in the process of identifying the structure, performance, and barriers in supply chains for biobased products in the state of Iowa.

7. Optional: If desired, please include observations regarding:
A. Availability of startup and venture capital for technology entrepreneurs
B. Suggestions for new programs or activities that could further enhance the impact of university technology transfer and service on creation of jobs and wealth in Iowa.

7A. Iowa continues to suffer from a lack of investment capital for start up and rapidly growing technology/innovation based firms.

- The Values Funds to the universities have provided a valuable source of funding for proof of concept/early stage development funding for the innovations that will become the next generation of businesses.

- There has been an increase in the number of Angel/Seed funds throughout the state. Available capital and experience varies widely and there is little coordination between the funds. The seed funds have typically brought more individual investors into play.

- The funding provided by Wellmark through the Pappajohn Center's has been a very valuable tool for early stage investment.

- There are very few true venture capital firms located in the state of Iowa actively investing funds at this point in time.

- Each fund has a particular focus, the investment profile further limiting choices and resulting in very little competition.

- Most venture firms invest with other venture firms, one as lead with the others in secondary positions to spread risk and assure the ability to continue to fund the needs of the company--this is a major problem in Iowa.

- Firms must look outside the state for significant investments of $5 million plus.

- Really good businesses with really good management teams will attract money; a major problem is the development of an experienced/skilled management team.

- Microenterprise--businesses with less than 5 employees--account for 86 percent of business firms in Iowa, according to the Association for Enterprise Opportunity. A 2007 survey conducted by the Iowa Bankers Association in collaboration with the Community Vitality Center and Leopold Center identified a gap in capital for small entrepreneurial firms seeking less than $50,000 in Capital. In 2008, the Community Vitality Center (CVC)--which is administered by ISU Extension--received part of a $1 million grant by Northwest Area Foundation and the Greater Des Moines Community Foundation to implement a business plan for organizing a statewide tax exempt nonprofit microloan intermediary as part of a 3-year Iowa Microenterprise Assistance Project (IMAP). The SBA has also approved a $750,000 revolving microloan fund for the new entity, called the "Iowa Foundation for Microenterprise and Community Vitality," In addition, $475,000 was appropriated for IDED to implement a Community Microenterprise Development Grant program and statewide microenterprise advisory committee to encourage collaboration and coordinate statewide efforts.

7B. Restoration of funds for economic development and technology transfer activities due to budget cuts in the past several years would greatly enhance the University's

efforts in this area. The following is a summary of what benefits would occur if funds were restored in the units affected by budget cuts.

- **Small Business Development Centers.** The legislature cut a total of $15,900 from the SBDC budget for FY09 and another $67,866 for FY10. In FY10 the state appropriation is $976,234, down from a high of $1,211,869 in FY01.

  An independent study of the program shows that for every Iowa tax dollar spent on the Small Business Development Center program, over $2.13 is generated in increased tax collections the following year, with respect to SBDC counseling services alone,. An investment of one Iowa tax dollar yields over $7.09 to the state treasury in increased tax collections the following year. Because the program's infrastructure is fully built, the majority of restored and new funds would be directed toward client counseling, resulting in a substantial increase in tax revenues over tax expenditures. Conversely, a reduction in funding could well result in an adverse impact on the state treasury of between 2 and 7 times the amount of the reduction.

  A concurrent increase in federal funding remedied the reduction in state funds for FY09, leaving the net program budget relatively equal to the preceding year. Additional funding from a congressional appropriation for Midwest disaster relief – the use of which is strictly limited to disaster recovery – will permit the SBDC to meet most of the demands from its client base for continued disaster recovery efforts in FY10. However, any future decreases in funding risk the ability of the program to retain experienced talent and to deliver the services needed by one of the largest component's of Iowa's economy, namely small business.

- **Iowa State University Research Park.** The restoration of approximately $230,000 in funding to the Iowa State University Research Park would provide direct benefit to Iowa State University efforts to establish and support new technology ventures. New funds would be utilized to support the costs of providing incubator space and the support services required by new and early stage companies. The additional funds will increase the capacity for business incubation resulting in more new companies created and higher quality support for the young companies.

- **Institute for Physical Research and Technology (IPRT).** The IPRT economic development programs suffered a loss of over $2,500,000 in budget cuts in 2003 and $265,000 in 2009. Ironically, these cuts came at times when the need for IPRT's expertise by Iowa industries was rapidly growing. Although much of the program has survived the cuts, it now serves only a fraction of the Iowa companies it once served and the current personnel are overextended. Each year since the budget cuts, both the technology commercialization unit and the technical assistance units have had many unmet requests for assistance to Iowa companies. Over 75% of the Iowa manufacturers that IPRT serves have less than 100 employees.

  The materials assistance unit of the IPRT economic development program provides short-term no cost technical assistance to Iowa manufacturers and is often the first interaction that manufacturers have with the University. Restoration of funding would allow for growth of materials assistance, enhancing

their delivery of services. They seek to offer a wider scope of services directly meeting the needs of Iowa manufacturers. Results of recent surveys of Iowa manufacturers by IPRT and CIRAS indicate that materials and quality issues associated with metallurgical processing, material selection, fabrication, and especially coatings for wear and corrosion protection are top priorities. If funding becomes available, they will hire staff with coating expertise.

The technology commercialization unit has administered cost-sharing, contract research projects and since 1993 has leveraged tax dollars slightly better than 4 to 1. The staff is working with Iowa's small to medium-sized manufacturers and identifying research and development needs that can be addressed by university teams of faculty scientists and engineers. These small companies have very limited Research and Development dollars and facilities, and now, this unit does not have the funds needed to leverage Iowa companies' limited resources. These are projects with obvious economic impact—introduction of new products, addressing manufacturing processes, and improving quality—all areas that impact Iowa's global competitiveness in the manufacturing sector.

A unique feature of the economic development program in IPRT is the active participation of scientists from internationally renowned ISU centers such as the Center for Nondestructive Evaluation, the Virtual Reality Applications Center and the Center for Catalysis. These centers have excellent track records of spinning off new Iowa start-up companies in the areas in which they excel. Restoring the budget cuts to IPRT units would have a rapid and quantifiable impact on Iowa's manufacturing sector. An investment now will result in continuing benefits to Iowa's companies, important opportunities to retain our brightest students, and new industries based on technology transfer from IPRT centers.

- **Center for Industrial Research and Service.** CIRAS has successfully leveraged its state budget to bring in additional federal grants and fees to expand technical assistance and education programs and economic development studies to support Iowa businesses. In FY09, CIRAS generated an additional $2.45 for each $1 of state funds provided. Of the approximately $4 million of additional funding generated, CIRAS distributed more than $700,000 to other business outreach units on campus to help them expand their work with businesses.

  CIRAS has lost about $500,000 of state funds from their annual budget this past decade. These funds were used as match on the Department of Commerce/NIST Manufacturing Extension Partnership award and the Department of Defense Procurement Technical Assistance Program award. This loss of state funds reduces the extent of CIRAS assistance to companies and communities and limits the amount of additional funds that might be brought to Iowa via new business assistance grants.

  The loss of annual state appropriations equates to the loss of approximately five full time staff. This causes a further reduction of about six staff due to the loss of federal awards requiring matching funds from the state. Based on an analysis of data provided by Iowa companies, these eleven staff might have generated more than $20 million of impact and more than 200 jobs in Iowa companies — each year.

Using this same data, for every $100,000 of additional state funds that are made available, CIRAS would be able to leverage the funds and hire two new business professionals to provide services in the areas of engineering, biobased products and biorenewables, supply chain management, import/export services, government procurement, productivity, growth services, quality systems, or community-business economic development. These two staff would help create a minimum of 40 new jobs and $4,000,000 of new sales, cost savings, and investment impact in Iowa companies.

(Appendix 1)
EXECUTIVE SUMMARY – JULY 2009
IOWA STATE UNIVERSITY GROW IOWA VALUES FUND UPDATE

To date, 56 projects have been funded through the *Commercialization Program*, and seven (7) additional projects are recommended for funding in FY2010. Forty-one of these projects are complete and many show excellent progress in improving the competitiveness and profitability of the Iowa companies involved.

Surveys are being conducted by the Center for Industrial Research and Service (CIRAS) on year after project completion. The data below represents projects that were funded in FY2006, completed in FY2007, and surveyed during the summer/fall of 2009:

Companies surveyed:	9 (all start-up companies)
Jobs created or retained:	71
Total sales increase:	$9.1 M
Total investment/cost savings:	$23.5M
Average impact per company:	$3.6M

The company surveys for projects funded in FY2007 will be completed this summer/fall.

In FY2008, 16 projects were initiated. Eleven of these projects are complete and five projects have been given no-cost extensions. In addition, four of the projects initiated inFY2007 were given no cost extensions and have been completed. Therefore, a total of 15 projects were completed in FY2009. For projects completed in FY2009, the following metrics have been collected (Company surveys will be done in FY2010).

Number of projects completed:	15
Publications and Presentations:	53
Awards:	9
New invention disclosure:	4
Research Centers/Institutes inv.	12
External funding applications:	48
Applications awarded:	20
External funding received:	$3.5M reported (not all awards reported dollar amounts)

In FY2009, 10 projects were initiated and five FY2008 projects received no cost extensions. The following metrics have been collected for these on-going projects.

	Funded in FY2008	Funded in 2009
Number of projects:	5	10
Publications and Presentations:	23	16
Awards:	3	2
New invention disclosure:	3	1
Research Centers/Institutes inv.	5	5
External funding applications:	15	14
Applications awarded:	2	1 (most applications are pending)

External funding received: $1.42M reported

FULL REPORT
IOWA STATE UNIVERSITY GROW IOWA VALUES FUND UPDATE
JULY 2009

FY08 FUNDED PROJECTS
INTERIM REPORT: Update period July 01, 2008 – December 31, 2008

Principal Investigator	Project Title	FY08 Total Award	FY08 Allocation	FY09 Allocation	ISU Cost Share reported	Industry Cost Share reported
Arun Somani*	Differential Testing for Control Systems Software	$ 95,001	$ 61,534.50	n/a	69,276.39	55,000
Johnny Wong	Evaluation of Quality Assessment Tools for Colonoscopy	$ 100,592	$ 100,592	n/a	109,715	---
Brad Bosworth	Replicon particles: a novel approach for more effective porcine reproductive and respiratory syndrome virus (PRRSV) vaccines	$ 82,708	$ 82,708	n/a	52,364.79	54,461.31
Jay-Lin Jane	Resistant and slowly digestible starch from cornstarch through ingredient processing.	$ 66,960	$ 66,960	n/a	62,391.25	5,265.48
Jay-Lin Jane*	Enzyme Hydrolysis of Uncooked Dry-grind Corn for Ethanol Production	$ 149,233	$ 75,120.34	n/a	93,703.28.12	---
Halil Ceylan	Ethanol Plant By-Product Uses for Pavement Geo-Materials Stabilization	$ 93,775	$ 93,775	n/a	97,090.13.	40,891.66
Eliot Winer*	Commercialization of 3D Interactive Digital Medical Software for Surgical Planning and Training	$ 109,533	$ 50,133	n/a	11,625	109,533
Terry Meyer	Laser-Based Diagnostics of Next Generation Combustion Systems	$ 86,972	$ 86,972	n/a	33,890.81	2,570.54
Stephen Gilbert	Multi-touch Technology: Applications to Homeland Security and ISU Research	$ 100,000	$ 100,000	n/a	57,603.96	50,000
Lie Tang	Automated phenotyping of biomass crops – part 2	$ 52,180	$ 52,180	n/a	15,790.93	---
Manjit Misra#	Commercialization of a Continuous In-Line Flow Meter	FY07 award	25,000	n/a	11,625	---
Robert Brown#	Gasification Technologies in Support of Biorefineries	FY07 award	29,227.91	7,701.35	67,762.37	110,000
Pamela White#	Designing corn lines with dietary fiber to produce ethnic foods with enhanced health benefits	FY07 award	6,051.25	n/a	4,462.61	---
Ruth MacDonald#	Role of complex carbohydrates from soybeans in inflammatory bowel	FY07 award	21,000	n/a	63,580.31	---

	disease					
Suzanne Hendrich	Flaxseed Lignins for Health	FY07 award	21,453	n/a	30,768.40	
Marian Kohut**	Effectiveness of EpiCor in improving immune function, inflammation, and performance after intense exercise	$ 92,777	$ 84,277	8,500	47,812.75	87,704.77
Charlie Hurburgh**	Automated phenotyping of biomass crops – part 1	$ 51,450	$ 30,450	21,000	12,609.85	---
Guru Rao**	Development of Novel Digestion-Resistant Starches from Corn to Combat Human Disease	$ 70,000	$ 55,000	15,000	95,109.36	
Toni Wang* **	Oil Recovery from Corn Fermentation By-Products	$ 113,500	$ 71,100	36,000	85,207.41	86,748.09
Mike Wannemuehler**	Generation X Vaccines: Combining Novel Antigens and Single Dose Delivery Technologies	$ 151,966	$ 121,966	30,000	52,577.81	116,396.88 – fed. match
Infrastructure						
Research Park		$ 200,000	$ 200,000		93,000	200,000
Pappajohn Ctr		$ 200,000	$ 200,000		93,000	57,000
IPRT		$ 100,000	$ 100,000		111,193.17	45,000
VPRED		$ 100,000	$ 100,000		101,955.03	

*These projects were initiated in FY08 but partially funded using FY07 funds.
**These projects were funded in FY08 and given a no-cost extension. They will be completed in FY10
#These projects were funded in FY07 and given a no-cost extension. They will be completed in FY09.

FINAL REPORT
Title: Differential Testing for Control Systems Software
PI: Arun Somani
Companies: EnSoft Corp.
Project Goal: The overarching goal of our research is to achieve significant cost reduction and more reliable production of highly reliable control systems software by empowering manufacturing companies with automation tools for analyzing and transforming control systems software.

Publications/presentations based on project:

- Two conference papers were published in 2008
- Two journal papers submitted in 2009
- A third journal paper will be submitted in the next three months

Awards received: Dr. Kothari received two Prometheus awards from the Iowa Technology Association of Iowa for:

- Innovation in Teaching
- Innovator Company of the Year

Invention disclosures: None

External funding applied for (indicate received/denied/pending):
Three proposals were submitted to the National Science Foundation, two are denied and one is pending. A pre-proposal was submitted to Lockheed Martin Company - one among the top three proposals selected from ISU.

Centers/Institutes involved in this project: ICUBE

Progress report (300 word maximum, please focus on results in non-technical terms and especially commercialization progress):
This research has resulted in a new algorithm for computing the difference between graphs and its application to difference graph models of software. EnSoft built a new tool called SimMerge and released it for beta testing on March 1, 2009. More than 30 major automobile and avionics companies in US, Europe, and Japan did testing. EnSoft released the SimDiff product for sale on June 1, 2009 and since then the following companies bought SimMerge: Moog Aircraft – US, Aisin-Aw, Transtron – Japan, Williams F1 – France, Brembo – Italy, GMV – Spain.

FINAL REPORT
Title: Evaluation of Quality Assessment Tools for Colonoscopy
PI: Johnny Wong and Wallapak Tavanapong
Company Partners (company names only): EndoMetric, LLC.
Project Goal:

1. To improve the automated objective quality measurement algorithms and software.
2. To evaluate the effectiveness of our invention at Mayo Clinic Rochester, Iowa Digestive Disease Center (IDDC) in West Des Moines, and University of Iowa Medical School (UI).

Publications/presentations based on project:

- Presentation at the eighth annual Iowa Venture Capital & Entrepreneur Conference held on Wednesday, Oct. 11, in Des Moines.
- S. Stanek, W. Tavanapong, J. Wong, J. Oh, and P. C. de Groen. Automatic Real-Time Capture and Segmentation of Endoscopy Video. PACS and Imaging Informatics. SPIE Medical Imaging. February, 2008.
- Y. Wang, W. Tavanapong, J. Wong, J. Oh, and P. C. de Groen. Edge Cross-Section Features for Detection of Appendiceal Orifice Appearance in Colonoscopy Videos. Accepted to appear in Proc. of International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), Vancouver, British Columbia, Canada, August, 2008.
- J. Oh, S. Hwang, Y. Cao, W. Tavanapong, D. Liu, J. Wong, and P. C. de Groen. Measuring Objective Quality of Colonoscopy. Accepted to appear in IEEE Transactions on Biomedical Engineering.
- Y. Wang, W. Tavanapong, J. Wong, J. Oh, and P. C. de Groen. Detection of Videos Showing Appendiceal Orifices using Local Edge Cross-Section Profile Features and Near Pause Detection. In preparation for submission to IEEE Transactions on Biomedical Engineering.
- P. C. De Groen, W. Tavanapong, J. Oh, J. Wong. Computer-aided Quality Control for Colonoscopy: Automatic Documentation of Cecal Intubation. Digestive Disease Week 2007. ASGE Poster Session Endoscopic Technology Endoscopy: New Image Technology, May 15-24, 2007, Washington DC, USA.
- D. Liu, Y. Cao. W. Tavanapong, J. Wong, J. Oh, and P. C. de Groen. Mining Colonoscopy Videos to Measure Quality of Colonoscopic Procedures. In Proc. of IASTED Int'l Conf. on Biomedical Engineering (BioMed), pages 409-414, Innsbruck, Austria, February 2007. (Oral presentation)
- Y. Cao, D. Liu, W. Tavanapong, J. Wong, J. Oh, and P. C. de Groen. Automatic Classification of Images with Appendiceal Orifice in Colonoscopy Videos. In Proc. of IEEE Engineering in Medicine and Biology Conference, pages 2349-2352, New York City, New York, August 2006. (Oral presentation).
- - Danyu Liu, Yu Cao, Ki-Hwan Kim, Sean Stanek, Bancha Doungratanaex-chai, Kungen Lin, Wallapak Tavanapong, Johnny Wong, JungHwan Oh, and Piet C. de Groen. Arthemis: Annotation Software in an

Integrated Capturing and Analysis System for Colonoscopy. In preparation for 2nd round review of Computer Methods and Programs in Biomedicine.

Awards received:

- Second prize winner for the annual statewide John Pappajohn Business Plan Competition
- Objective Quality Control for Colonoscopy: Automated Extraction of Endoscopic Metrics from Video Files. 2006 American College of Gastroenterology Governors Award for Excellence in Clinical Research for "The Best Scientific Paper," Oct. 21, 2006.

Articles written by others discussing our work

- New Technology Aims to Improve Colonoscopy by Automatically & Objectively Analyzing Efficacy, Oncology Times, Volume 1, Jan 10, pages 24-25.
- Danna Voth. Toward More Intelligent Healthcare, IEEE Intelligent Systems, March/April 2007, pages 5-7.
- Best of ACG. Gastroenterology & Hepatology Volume 3, issue 1, Jan 2007, pages 41-48.
- - Steve Frandzel. New Digital Recording System Measures Colonoscopy Performance Metrics. Gastroenterology & Endoscopy News. Volume 58, issue 3, March 2007.

Invention disclosures:

- The technology was previously patented. ISURF #03305: Intelligent Multimedia Processing and Analysis for Colorectal Tumors (IMPACT)
- An additional invention disclosure is planned for new algorithms

External funding applied for (indicate received/denied/pending):

- STTR Phase I: Video Analysis Techniques for Computer-Aided Quality Control for Colonoscopy. National Science Foundation. Award No. 0740596. Tavanapong (PI) with Johnny Wong (Co-PI). 01/01/2008-12/31/2008, $149,882. Status: Received
- Improving Colonoscopy Quality through Automated Monitoring. Subcontract to Mayo Clinic Rochester. NIH NIDDK PA-07-070. 4/1/09-3/31/2012. $317,169. Status: Pending
- The proposal submitted for Iowa Demonstration fund from Iowa Department of Economic Development was denied. We have been improving the proposal and will resubmit it again by this July 14.
- NSF STTR Phase IB proposal. EndoMetric, LLC Wallapak Tavanapong (PI). Johnny Wong (Co-PI) and JungHwan Oh (Co-PI, University of North Texas) 01/2009-06/30/2009. $49,997 (entire budget). This grant is a supplement of our NSF STTR Phase I grant. We are waiting for the grant money.
- Improving Colonoscopy Quality through Automated Monitoring. Subcontractor of Mayo Clinic Rochester. NIH NIDDK PA-07-070. 4/1/09-3/31/2012. $317,169 (ISU budget). The proposal was recommended for funding. However, the lead investigator at Mayo Clinic is still working with the funding agency on budget revision.
- Real-time feedback to improve colonoscopy quality. NIH/NIDDK. PI Piet C. de Groen (Mayo Clinic Rochester), Wallapak Tavanapong and Johnny Wong (Iowa State University), and JungHwan Oh (University of North Texas). 7/1/2009 – 6/30/2014. $763,013 (ISU budget).
- III: Medium: Collaborative Research: Computer Guided Quality Control System for Colonoscopy. US National Science Foundation. Wallapak Tavanapong and Johnny Wong (PI and Co-PI for Iowa State University), JungHwan Oh (Lead PI and PI for University of North Texas), and Piet C. de Groen (PI for Mayo Clinic Rochester) 6/1/2009-5/31/2012. $279,656 (ISU budget).
- Automated Reporting System for Colonoscopy. Mayo Clinic Rochester. 01/15/2007 – 12/31/2007. $50,000. Status: Awarded.
- Enhancement of a Quality Control System for Colonoscopy. Iowa State University Research Foundation. 03/01/07 – 02/28/08. $25,000. Status: Awarded.
- Evaluation of a Quality Assessment System for Colonoscopy at Iowa Digestive Disease Center (IDDC). Iowa State University Technology Commercialization Acceleration Program. 01/01/2007-06/30/2007. $10,000. Status: Awarded.
- Evaluation of Quality Assessment Tools for Colonoscopy. Grow Iowa Values Fund. Iowa State University. 07/01/2007-06/30/2008. $100,397. Status: Pending.

- Computer-Aided Quality Control for Colonoscopy, National Institutes of Health, STTR. 01/01/2008-06/30/2008. $100,000. Status: Pending.
- III-CXT: Objective Quality Control System for Colonoscopy. National Science Foundation. 06/01/07-05/31/10. $861,546. Status: Rejected; reason: regarded as an application of techniques developed as part of our current NSF grant.

Progress report (300 word maximum):
We have met and exceeded the milestones outlined in the original proposal.

Progress on Software Development
•Arthemis 3.0 (or EndoMetric-Manual---Software for annotating colonoscopy videos): We completed the implementation of the software. Dr. de Groen (domain expert) has used the software to annotate colonoscopy videos.
•Avidense version 2.0 (software that analyzes quality measurements from captured videos generated during colonoscopy): We completed the development of the proof-of-concept analysis software that produces a total of six quality metrics (one extra metric in addition to what we originally proposed) for videos captured from Olympus endoscopes. These metrics are (1) location of maximal intubation; (2) duration of informative frame video segment during withdrawal excluding both biopsy and therapeutic operations; (3) duration of operational episodes; (4) direction of movement and speed estimate of the endoscope during withdrawal; (5) an estimated score of quality of colon mucosa inspection; and (6) number of images with the appendiceal orifice clearly seen. The software has been installed at Mayo Clinic Rochester in September of 2006 and show promising results.
II. Progress on Commercialization
•Increased Visibility. We have demonstrated EndoMetric-Manual at Digestive Disease Week 2006 in May in Los Angeles. Our invention on the automatic quality measurement system also received the 2006 American College of Gastroenterology (ACG) Governors Award for Excellence in Clinical Research. News articles on the award appeared locally and nationally. Oncology Times, IEEE Intelligent Systems, and Gastroenterology & Endoscopy News have articles on our work. Our work has created a significant visibility for the university and the state of Iowa.
•Protection of Key Intellectual Property. Mayo Medical Venture (MMV) has filed patent applications to cover related inventions on behalf of ISU, Mayo, and UTA. The application includes 13 inventions.
•Formation of EndoMetric, LLC, an Iowa-based startup company to commercialize our technology. We have incorporated the company and developed the business plan with the help of the ISU Papajohn Business center. Our business plan was one of the thirty plans selected to compete in the next stage of the 2007 Pappajohn Iowa Business Plan Competition.
•External collaboration. We conducted feedback sessions with endoscopy staffs at UI and IDDC and received verbal agreements to have the two places as test sites.

FINAL REPORT
Title: Replicon particles: a novel approach for more effective porcine reproductive and respiratory syndrome virus (PRRSV) vaccines
PI: Brad Bosworth
Companies: Sirrah
Project Goal: To determine if replicon particles are an effective vaccine for preventing of PRRSV

Publications/presentations based on project: Replicaon particle PRRSV vaccine provides partial protection from challenge. Mark Mogler. PRRS Symposium. Chicago, IL Dec 2008.

External funding applied for (indicate received/denied/pending): Phase II SBIR USDA Grant (received)

Progress report (300 word maximum, please focus on results in non-technical terms and commercialization progress):
Commercialization progress: Harrisvaccines, Inc d/b/a Sirrah Bios began selling a recombinant protein vaccine for the prevention of PRRSV in November, 2007 via veterinary prescription. The protein is prepared using

similar technology as used to prepare replicon particles (RP). To date, sales have totaled over $3.9M. The company will introduce a recombinant protein vaccine for prevention of the novel H1N1 influenza virus in swine in August 2009. The Iowa Farm Bureau has taken a 25% ownership position in Harrisvaccines. The company will achieve USDA licenses for RP vaccines for PRRS and swine influenza by late 2011.

Experimental progress: One study was conducted utilizing replicon particles expressing a single antigen. Post-vaccination immune responses were weak, suggesting inadequate antigen exposure. Following challenge with virulent virus, there were no differences between vaccinated and non-vaccinated animals. The dose of replicon particle vaccine used in this study was lower than in previous work, which may have contributed to the lack of immune response.

A second study was conducted using the same replicon particle vaccine as the first study, but at three different doses. Pigs receiving higher doses had increased rates of specific immune response, when measured by Western blot. In addition, all replicon particle vaccinated pigs developed significant cell-mediated immune responses, as measured by an interferon-gamma ELISPOT assay. Between pigs receiving different doses of vaccine, there was a positively correlated, significant increase in cell-mediated immune response by the same assay. Following challenge, vaccinated pigs receiving higher doses had a trend toward lower viremia, but the differences were not statistically significant.

These results indicate that replicon particles expressing PRRSV proteins can induce specific antibody and cell-mediated immune responses in an dose-dependent manner. Future work is needed to refine the choice of antigens to improve protection post-challenge.

FINAL REPORT
Title: Resistant and slowly digestible starch from cornstarch through ingredient processing
PI: Jay-lin Jane
Company Partners (company names only): Grain Processing Company
Project Goal: To produce resistant and slowly digestible starch

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Publications/presentations based on project:

J. Hasjim and J. Jane, "Production of resistant starch by extrusion cooking of acid-modified normal-maize starch." Journal of Food Science, Accepted.

H. Jiang, M. Campbell, and J. Jane, "Crystalline structure of enzyme-resistant maize *ae*-mutant starches" American Association of Cereal Chemist International Annual Meeting, Honolulu, Hawaii, September 21 – 24, 2008.

Awards received: 1. Outstanding Poster Award.

External funding applied for (indicate received/denied/pending): USDA, AFRI, Title: Effects of lipid-starch interaction on physical properties, digestibility, and nutritional benefits of starchy foods. Pending.

Centers/Institutes involved in this project: Center for Crop Utilization Research and Nutrition and Wellness Research Center.

Description of major laboratory equipment used for this project including an estimate of the number of hours used, number of samples processed, or dollar amount for services provided:
Gel-permeation chromatography, 320 hours, 30 samples. High-performance size-exclusion chromatography, 120 hours, 40 samples. Differential scanning calorimeter, 200 hours, 60 samples. Spectrophotometer, 100 hours, 150 samples. Twin-screw extruder, 40 hours, 30 samples. X-Ray, service fee, $1000 (20 samples)

Progress report (300 words maximum):
Resistant starch and slowly digestible starch were produced from normal cornstarch and high-amylose cornstarch using different processing techniques. Normal cornstarch with or without partial acid-hydrolysis were subjected to batch cooking and drying to produce resistant and slowly digestible starch. The cooked acid-modified starch consisted of a larger resistant-starch content (32.7%) than that without acid hydrolysis (26.2%)

but less slowly digestible starch (8.2%) than the normal cornstarch counter part (11.4%). A high-temperature (110°C) treatment of the cooked starches for three days increased the resistant starch content of the cooked normal cornstarch to 32.9%, but did not change the resistant starch content of the cooked acid-modified cornstarch. The results showed that partial hydrolysis of starch reduced the molecular weight and facilitated retrogradation of the starch to form resistant starch. Extrusion cooking was used as an economical alternative for the batch cooking process. Extrusion of acid-modified cornstarch using low and high-sheer screw configurations produced 19% and 20% resistant starch and 8.7% and 7.9% slowly digestible starch, respectively. After heating at 110ºC for three days, the resistant starch increased to 29.8% and 25.9%, respectively, and the slowly digestible starch increased to 12.1% for the high-sheer extruded starch but did not change that of the low-sheer extruded starch. Normal cornstarch was modified with octenyl succinic anhydride (OSA) to increase the content of slowly digestible starch. Two techniques were studied, one was to pretreat the starch before reacting with the OSA and the other was to develop a bi-phase reaction. Results showed that after the pretreatment of the starch, the degree of derivatization increased. The octenyl succinic derivatives of the starch were more evenly distributed through the starch granule as revealed using confocal laser-light microscopy. Resistant starch contents of high-amylose maize starches varied between 11.5% and 43.2%. After extracting lipids using methanol, the resistant starch contents decreased to between 9.0% and 28.9%.

FINAL REPORT
Title: Enzyme hydrolysis of uncooked dry-grind corn for ethanol production
PI: Jay-lin Jane
Company Partners (company names only): POET Company
Project Goal: To improve the production yield of ethanol from dry-grind corn grain.

Publications/presentations based on project: J. Gutesa, S. Harjadi, A. Burgers, C. R. Hurburgh and J. Jane, Effects of drying conditions on endogenous enzyme activity and starch properties of corn. A poster presentation at the American Assoc. of Cereal Chemists, International. Baltimore, MD. September, 2009.

External funding applied for (indicate received/denied/pending): POET, Pending.

Centers/Institutes involved in this project: Center for Crops Utilization Research, Grain Quality Lab

Description of major laboratory equipment used for this project including an estimate of the number of hours used, number of samples processed, or dollar amount for services provided:

High-performance liquid chromatography was used for 1200 hours, 600 samples. Gel-permeation chromatography, 300 hours, 60 samples. Incubators, 1200 hours, 300 samples. Spectrophotometers, 180 hours, 180 samples. Light microscope, 40 hours, 80 samples. Scanning electron microscope (Bessi Microscopy Center), service fee $1000, 20 samples.

Progress report (300 word maximum, please focus on results in non-technical terms and especially commercialization progress):

Ethanol fermentation using uncooked dry-grind corn as the substrate is a novel technology, which produces greater ethanol yields than the conventional process using cooked corn. The uncooked fermentation process requires different standard methods for quantitative analyses of components in the fermentation mixture and novel approaches to control contamination. During the period of this study, the research team conducted a broad spectrum of studies to unveil the reaction mechanism, tested a wide selection of corn varieties for ethanol fermentation, and analyzed the structures of the starch and corm composition to understand the impacts of starch structures and corn compositions on the yield of ethanol. The results showed that starch of certain corn varieties, which had desirable structures, gave significantly greater conversion rates to ethanol production. Other corn varieties could have large starch contents but had average or below average in conversion rates. Results obtained from these studies showed that some corn varieties produced more than 3 gallons ethanol per bushel corn, comparing with the current average yield at 2.7 gal/bushel corn in the industry. The team also investigated different milling techniques to improve the yield of ethanol. Results showed that shapes and sizes of the ground corn particles affected the yield of ethanol. Because weather conditions controlled the planting date of corn, we also studied the impacts of planting dates, maturity, and post-harvesting drying temperature and storage conditions of corn on its fermentation and ethanol yield. These

results provided critical information on proper conditions for corn processing and handling to improve the corn quality and ethanol yield. The team developed a modified near-infrared (NIR) calibration curve using an accurate starch quantification method and uncooked corn fermentation process, which is suitable for accurate predictions of ethanol yield from uncooked corn fermentation process. The researchers also developed ozone-treatment techniques as an alternative for bacterial control to reduce contamination and improve ethanol yield.

INTERIM REPORT
Title: Oil Recovery from Corn Fermentation By-Products
PI: Tong Wang, Lawrence Johnson, and Anthony Pometto
Project Goal: Obtaining oil from corn ethanol fermentation co-products

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Publications/presentations based on project:

- May, 2008, AOCS annual mtg (Abs submitted and accepted)
- Wang, H., T. Wang, L.A. Johnson, and A.L.Pometto III. 2008. Effect of corn breaking method on oil distribution between stillage phases of dry-grind corn ethanol production. *Journal of Agricultural and Food Chemistry* 56 (21) 9975–9980.
- Numerous presentations (5, oral and poster, national and local mtgs) were made.
- Wang, H., T. Wang, L.A. Johnson, and A.L. Pometto. 2009. Low-shear extrusion on corn fermentation and oil partition, *Journal of Agriculture and Food Chemistry, 57*:2302-2307.
- Wang, H., T. Wang, A.L. Pometto III, and L.A. Johnson. 2009. Establishing a laboratory decanting procedure to simulate whole stillage separation during industrial corn dry-grind fuel ethanol process, JAOCS, in press.
- Wang, H., L.A. Johnson, and T. Wang. Effect of corn breaking and fermentation on germ integrity and oil quality. Submitted to *Journal of Agricultural and Food Chemistry*.
- Majoni, S., and T. Wang. 2009 presentation. Characterization of the corn oil deposit extracted from condensed corn distillers grain with solubles (CCDS). The 100th AOCS Annual Meeting and Expo, May 3-6. Orlando, Florida. Abstract pp 89.
- Wang, H., T. Wang, and L.A. Johnson. 2009 presentation. Effect of corn breaking method on oil distribution in the thin stillage of dry-grind corn ethanol production. The 100th AOCS Annual Meeting and Expo, May 3-6. Orlando, Florida. Abstract pp 124.

Awards received: AOCS Processing Division Best Graduate Student Research Award

Invention disclosures: Two ISURF disclosures: (1) Wang, H., T. Wang, and L.A. Johnson. Novel corn degerming ethanol fermentation processes Corn degerm. ISURF docket number 03649. (2) Wang, T. and H. Wang. A Slurry separation process and device. ISURF docket number 03645.

External funding applied for (indicate received/denied/pending): 09 GIVF, not approved. Parts of the new proposal to be submitted to Iowa and National Corn Growers' Associations, and certain selected ethanol fermentation companies.

Centers/Institutes involved in this project: CCUR

Progress report (300 word maximum):
Oil recovery from corn fermentation by-products provides an alternative source for biodiesel production. The objectives of this study were to determine the effect of enzyme hydrolysis of various corn components, and the effect of physical and chemical processes on oil extraction yield from condensed corn distillers solubles (CCDS). The effect of enzyme and enzyme concentration on oil recovery from CCDS showed that hydrolysis with a commercial acid protease preparation significantly increased oil recovery as the enzyme concentration was increased, with greatest oil recovery of 70% achieved at 10% v/w (dry weight basis) of enzyme (commercial preparation). For CCDS particle sizes reduced by grinding, oil recovery was increased to 83% when enzyme was used. Protein-lipid interaction may be one of the factors affecting oil recovery. It shows in a model system that zein (a storage protein in corn endosperm)-lipid interaction was very strong, with only 10% of the oil being freed by centrifugation alone. However, following enzyme hydrolysis of the zein-oil complex with a protease, oil recovery was increased to 97%. Heating provided energy to disrupt physical interactions in

the CCDS and increasing oil recovery by 2.5 fold when temperature was increased from 25 °C to 59 °C. Oil recovery at acidic pH was significantly greater than at alkaline pHs. Oil recoveries at alkaline pH were increased by heating and addition of reducing agent, sodium metabisulfite. Oil extraction using polar solvents isopropanol and butanol gave total oil recoveries greater than 80%. When oil was co-extracted with zein using hexane as a co-solvent, the greatest total oil recovery of 89% was achieved. It was observed that by just churning CCDS for 3 hours at 50°C, pH 3.5 up to 75% oil could be recovered. Therefore, several different strategies are identified to recover oil from corn fermentation by-products.

INTERIM REPORT
Title: Generation X Vaccines: Combining Novel Antigens and Single Dose Delivery Technologies
PI: Michael Wannemuehler, Balaji Narasimhan, Chris Minion
Company Partners (company names only): BioProtection Systems

Project Goal: This project proposes to develop a single dose vaccine product that will induce humoral (i.e., antibody) and cell-mediated immunity to protect against infectious agents. The specific focus of this project will be the development of a protective vaccine against pneumonic plague caused by *Yersinia pestis*.

Publications/presentations based on project:

- Ulery, B., K. Pustulka, Y. Phanse, B. Bellaire, and B. Narasimhan. 2008. Amphiphilic Polyanhydride Chemistry Affects Monocytic Association of Nanospheres. Ann. Biochem. Eng. Proceed., Vol. 37, 2008
- Ulery, B. D., Y. Phanse, A. Sinha, M. J. Wannemuehler, B. Narasimhan and B. H. Bellaire. 2008. Polymer Chemistry Influences Monocytic Uptake of Polyanhydride Nanospheres. Pharmaceutical Research (in press, available on-line)
- Wilson-Welder, J, Torres MP, Kipper MJ, Mallapragada SK, Wannemuehler MJ, Narasimhan B. 2008. Vaccine Adjuvants: Current Challenges and Future Approaches. Journal of Pharmaceutical Science (in press, available on-line).
- Schiltz, E., B. Carrillo-Conde, Y. Phanse, M. Wannemuehler, and B. Narasimhan. IgG and F1-V Stability in the Presence of Polyanhydride Degradation Products. AIChE Annual Meeting, November 2008, Philadelphia, PA.
- Carrillo-Conde, B., A. Garza, J. Anderegg, and B. Narasimhan. Protein Adsorption on Biodegradable Polyanhydride Microspheres. AIChE Annual Meeting, November 2008, Philadelphia, PA.
- Ulery, B. D., S. A. Sarkar, M. Torres, Y. Phanse, J. Wilson, B. Bellaire, M. J. Wannemuehler, and B. Narasimhan. Biodegradable Polyanhydride Nanosphere Interactions with Antigen Presenting Cells. AIChE Annual Meeting, November 2008, Philadelphia, PA.
- Ulery, B., S. Sarkar, Y. Phanse, B. Bellaire, M. Wannemuehler and B. Narasimhan,. Antigen Presenting Cell Uptake of Biodegradable Polyanhydride Nanospheres. Annual Meeting of the Biomedical Engineering Society, October, 2008
- Ulery, B. D., J. Wilson-Welder, M. J. Wannemuehler, D. Kumar, D. W. Metzger, and B. Narasimhan. 2009. Novel vaccine strategies against *Y. pestis*. Annual Meeting of the Society for Biomaterials, San Antonio, TX.
- Ulery, B. D., Y. Phanse, S. A. Sarkar, M. Torres, B. Bellaire, M. J. Wannemuehler, J. Yu, F. C. Minion, D. Kumar, D. W. Metzger, and B Narasimhan. 2009. Intracellular trafficking of polyanhydride nanospheres within antigen presenting cells. Annual Meeting of the Society for Biomaterials, San Antonio, TX.
- Phanse, Y., J. Wilson-Welder, M. J. Wannemuehler, B. Narasimhan, and B. Bellaire. 2009. Polymer chemistry influences uptake and intracellular and intracellular integrity of polyanhydride microspheres in dendritic cells. Annual Meeting of the Society for Biomaterials, San Antonio, TX.
- B. R. Carrillo-Conde, M. P. Torres, E. Schiltz, M. J. Wannemuehler, B. Narasimhan. 2009. Amphiphilic polyanhydrides for stabilization of therapeutic proteins. Annual Meeting of the Society for Biomaterials, San Antonio, TX.
- L. K. Petersen, L. Xue, M. J. Wannemuehler, K. Rajan, and B. Narasimhan. 2009. The simultaneous effect of polymer chemistry and device geometry on the *in vitro* activation of murine dendritic cells. Biomaterials, (available on-line, ahead of publication)

- B. Carrillo-Conde, M. P. Torres, E. Schiltz, J. Yu, F. C. Minion, G. J. Phillips, M. J. Wannemuehler, Balaji Narasimhan. 2009. Amphiphilic Polyanhydrides for the Stabilization of Protein Antigens. Biomaterials (Submitted).

Centers/Institutes involved in this project: Institute for Combinatorial Discovery

Awards received:
- B. Narasimhan was elected a Fellow of the American Institute for Medical and Biological Engineering.
- B. Narasimhan also received the ISU award for Mid-Career Achievement for Research.

External funding applied for (indicate received/denied/pending):
- Protective Nanosphere Vaccine Platforms for Emerging Infectious Diseases, Midwest Regional Center of Excellence for Biodefense, Washington University, St. Louis. [Denied]
- W. M. Keck Laboratory for PathoBioinformatic Imaging, W.M. Keck Foundation's Science & Engineering and Medical Research Program Proposal. [Denied]
- Impact of polymer adjuvant chemistry on adaptive immune mechanisms, NIH-NIAID. [pending]
- Novel polymer-based single dose vaccine: Use of rPA for anthrax immunity. M.J. Wannemuehler, B. Narasimhan, and T. Merkel (FDA), submitted to NIAID (National Institutes of Health), November, 2007. $142,000 (FUNDED)
- Nanoparticle vaccines exploiting diverse polymer chemistry for pneumonic plague. B. Narasimhan, M. J. Wannemuehler, R. Mandel, and R. Flick, submitted to Midwest Research Center for Excellence (MRCE) at Washington University, St. Louis, January, 2008. $142,625 (NOT FUNDED).
- Impact of Polymer Adjuvant Chemistry on Adaptive Immune Mechanisms. B. Narasimhan, M. J. Wannemuehler, B. Bellaire, submitted to NIAID – NIH, July, 2008. $2,764,345 (PENDING).
- Ability of carbohydrate modification to enhance vaccine efficacy. B. Narasimhan, M. J. Wannemuehler, N. Pohl, submitted to the Gates Foundation, May, 2008, $100,000 (PENDING).
- R03 grant from NIAID NIH.
- Synthetic Nanovaccines Against Respiratory Pathogens. S. Mallapragada, B. Narasimhan, C. Miller, M. J. Wannemuehler. In collaboration with the University of Nebraska Medical Center in Omaha, DoD, $4,000,000 total ($1,000,000 to ISU) (received)
- Imaging System for Highly Infectious Host-Pathogen Studies. F. C. Minion, b. Narasimhan, M. J. Wannemuehler, P. Nara. DoD-DURIP (ONR), $737,626 (pending)
- Polyanhydride Nanospheres as a Vaccine Delivery System for *Yersinia pestis*. M. J. Wannemuehler, B. Narasimhan, F. C. Minion**.** Submitted to DoD-BAA, $3,211,000 (denied)
- Impact of Polymer Adjuvant Chemistry on Adaptive Immune Mechanisms. B. Narasimhan, M. J. Wannemuehler, B. Bellaire, submitted to NIAID – NIH, July, 2008. $2,764,345 (pending).

Progress report (300 word maximum):

The goals of this project are to develop a novel vaccination strategy using bioerodible polyanhydride nanospheres and modification of the vaccine candidate with the sugar alpha-galactose (□Gal). This will lead to the design of a vaccine regimen that will induce protective immunity following immunization with a single dose and improve patient compliance. The project focuses on the use of a recombinant protein (rF1-V) derived from *Yersinia pestis,* the causative agent of plague. During the past six months we have been able to successfully conjugate the sugar □Gal to the rF1-V protein. This was confirmed by performing immunoblot analysis using an antibody reagent and a lectin that recognized □Gal bound to the protein. Mice deficient in the alpha galactosyl transferase (□GT) were used to evaluate the benefits of the □Gal-modification. Following immunization of these mice with graded doses of either the unmodified rF1-V or the □Gal-modified rF1-V, we evaluated the serum antibody response and the antigen-specific lymphocyte proliferation. With respect to lymphocyte proliferation, the □Gal-modified rF1-V induced greater proliferation than did the unmodified F1-V. Similarly, the mice immunized with the □Gal-modified F1-V presented higher anti-rF1-V serum antibody titers. In addition, these antibodies had a greater avidity (i.e., bound more tightly) to the rF1-V than did antibodies induced by the unmodified rF1-V. There was as much as a five-fold reduction in the amount of total

protein required to induce a significant immune response when the Gal-modified rF1-V was used to immunize the mice. The significance of the higher avidity antibody response is that it requires less antibody to effectively neutralize a toxin. Current studies are underway to evaluate the nature of the immune response induced following immunization of mice using polyanhydride nanospheres containing Gal-modified rF1-V.

FINAL REPORT - NO REPORT RECEIVED – PREVIOUS REPORT
Title: Ethanol Plant By-Product Uses for Pavement Geo-Materials Stabilization
PIs: Halil Ceylan and Kasthurirangan Gopalakrishnan
Company Partners (company names only): Grain Processing Corporation (GPC) of Muscatine, Iowa; Dynamotive Energy Systems, Inc.
Project Goal: The goal of this research is to investigate the utilization of processed or unprocessed by-products from lignocellulosic ethanol/bio-fuel plants for stabilizing underlying pavement layers composed of geo-materials. Specifically, the proposed research will (1) demonstrate the ability of lignin as an effective soil stabilizing agent for lignins that are currently available or are anticipated to become available in the future in abundant supply, and (2) evaluate the effect of lignin on the engineering properties soil-lignin mixtures for Iowa conditions.

Publications/presentations based on project:
Several articles appeared regarding this research project on the ethanol production, biomass and bioenergy related magazines, journals, radio interviews, etc. Some of these articles published online are listed below:

- http://www.biobasednews.com/list2.php?storyid=15194
- http://www.sciencedaily.com/releases/2007/10/071016101452.htm
- http://www.innovations-report.com/html/reports/materials_science/report-93049.html
- http://www.radioiowa.com/gestalt/go.cfm?objectid=C7FF5469-A0A9-38C3-5ECD3AF26E777854
- http://www.treehugger.com/files/2007/10/building_better.php
- (INVITED BOOK CHAPTER) K. Gopalakrishnan, S. Kim, and H. Ceylan. "Lignin Recovery and Utilization". In *Biofuel and Bioenergy from Biowastes and Residues*, S. Khanal (ed.), American Society of Civil Engineers (ASCE) – to be released in March 2009.

External funding applied for utilizing project results (indicate received/denied/pending):

- A joint proposal submitted to the Iowa Power Fund program by Dr. Robert C. Brown and others on the utilization of ethanol by products (lignin) for soil stabilization and dust control purposes (Status: *Pending*).
- Another joint proposal was submitted to the 2008 NRI Biobased Products and Bioenergy Production Research Program with Dr. Hans van Leeuwen and others (Status: *Denied*).
- Centers/Institutes involved in this project: Iowa Bioeconomy Institute, Center for Transportation Research and Education (Institute for Transportation and Sustainability)

Description of major laboratory equipment used for this project including an estimate of the number of hours used, number of samples processed, or dollar amount for services provided:
The Gerald and Audrey Olson Soil Mechanics Lab: equipment for low-stress, conventional, and stress-path controlled triaxial testing, direct/residual shear testing, conventional and automated consolidation testing, soil index tests and engineering classification. To date, numerous tests have been carried out using a variety of additive types, concentrations, moisture content, etc.

Progress report (300 words maximum):
During this period, the research efforts mainly focused on obtaining the bio-oil/lignin test materials and studying the engineering property of these materials. Potential lignin samples have been obtained by contacting industry (Dynamotive Energy Systems, Inc. and Grain Processing Corporation of Muscatine, Iowa, Inc.) and Iowa State University's biofuel research labs. The research team consulted the Iowa Department of Transportation engineers to identify potential soil types which will benefit from lignin treatment both from structural and economic perspectives. The research team collected the identified potential soil materials from new construction site near US 20 in Calhoun County, Iowa. The research team has characterized the engineering properties of obtained soil materials trough national standard laboratory specifications including Grain size distribution (AASHTO T 27), Atterberg's limit test (AASHTO T 89/90) and the Moisture/density

relationship (AASHTO T 99). Preliminary test factorials have been completed to study the lignin-soil/aggregate mixtures and to examine the effect of lignin addition on the strength and overall engineering characteristics of the lignin-soil mixtures. Preliminary test results gave very encouraging results in terms of using the bio-oil/lignin samples for soil geomaterial stabilization purposes. Future research will focus on optimizing the test parameters (additive concentration level, moisture content, curing time, etc.) for achieving maximal performance in terms of lignin/bio-oil - soil stabilization.

FINAL REPORT
Title: Commercialization of 3D Interactive Digital Medical Software for Surgical Planning and Training
PI: Eliot Winer
Company Partners (company names only): Visual Medical Solutions, LLC.
Project Goal: The proposed effort seeks to commercialize a preliminary research prototype software package that enables automated model generation, 3D visualization, and interactive manipulation to facilitate surgical planning and training.

Publications/presentations based on project:

- Foo J.L., Lobe T., and Winer E., "A Virtual Reality Environment for Patient Data Visualization and Endoscopic Surgical Planning", *Journal of Laparoendoscopic & Advanced Surgical Procedures*, accepted for publication, June 2008.
- Koehring, A., Foo, J.L., Miyano, G., Lobe, T., and Winer, E.H., "A Framework for Interactive Visualization of Digital Medical Images", *Journal of Laparoendoscopic & Advanced Surgical Procedures*, Accepted for publication, March 2008.
- Foo, J.L., Miyano, G., Lobe, T., and Winer, E., "A Framework for Interactive Examination of Automatic Segmented Tumors in a Virtual Environment," Proceedings of the 16th Medicine Meets Virtual Reality (MMVR) Conference, January 29, 2008, Long Beach, CA, vol. 132, pp. 120-122.
- Grow Iowa Values Fund 2008 (denied)
- Foo, J.L., and Winer, E., "Interactive Multi-Modal Visualization Environment for Complex System Decision Making," ASME 2008 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference, IDETC/CIE 2008, Brooklyn, NY, August 3–6, 2008, Paper No. DETC2008-49805

Awards received: Visual Medical Solutions, LLC. received the 2008 Outstanding Startup Company of the Year award from the Technology Association of Iowa

External funding applied for (indicate received/denied/pending):
Grow Iowa Values Fund 2008 (denied)
Iowa Economic Development Demonstration Fund (received)
Grow Iowa Values Fund 2009 (pending)

Please list all Centers/Institutes involved in this project
Virtual Reality Applications Center (VRAC), Institute for Physical Research and Technology (IPRT), & CyberInnovation Institute (CII)

Progress report (300 word maximum):
All of the objectives for the project have been completed. These are listed below:

- Completed tech transfer of research topics into BodyViz to make it a full featured medical visualization and surgical planning software package
- Hired Curt Carlson as President/CEO of company. Also hired 3 part-time employees (one in Iowa) and a student intern for Marketing from Iowa State University
- Awarded Wellmark venture funding
- Awarded Iowa Economic Development Demonstration funding
- Beta-tested BodyViz software at several partner sites including, Stryker Medical, Des Moines University Medical School, and Texas Methodist Hospital System (TMHS)

- BodyViz chosen as platform for earmark research project for Marshalltown Medical Center. Proposal facilitated by Mechdyne Corporation. Sale to be complete by July 2009
- Received FDA 510K certification for BodyViz in March 2009
- Sold BodyViz to first major reference client, TMHS. TMHS is the largest non-profit hospital system in the world
- Had display booths at three high profile surgical conferences: 1) 2007 American College of General Surgeons Meeting and conference, 2) the 2008 American Association of Colorectal Surgeons Annual Meeting, and 3) the 2009 Society of American Gastrointestinal and Endoscopic Surgeons Meeting

FINAL REPORT
Title: Multi-touch Technology: Applications to homeland security and ISU Research
PI: Stephen Gilbert
Company Partners: Priority 5 (P5)
Project Goal: Extend P5's multitouch technology using research-based systems

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Publications/presentations based on project:

- Ramanahally, P., Gilbert, S., Niedzielski, T., Velazquez, D., Anagnost, C. (2009, in press) Sparsh UI: A Multi-Touch Framework for Collaboration and Modular Gesture Recognition. *Proceedings of the World Conference on Innovative VR 2009*.
- KCCI TV News feature of multitouch lab ; http://www.kcci.com/video/18428264/index.html

Please list all Centers/Institutes involved in this project

- VRAC (under IPRT)
- CyberInnovation Institute

Progress report (300 word maximum):
Growth and Commercialization at P5
Since this project started, engineering staff at P5 has more than doubled in size (from 4 to 9).
The P5 software using the interface that resulted from this work is deployed and currently in use at several federal agencies for disaster and relief management.

Launch of Sparsh-UI 1.0 Software
With guidance from Priority 5, the ISU team developed Sparsh-UI, and open source platform that supports multitouch software development across systems, e.g. Windows, Mac, Linux. It can also accommodate different languages, e.g. C++ or Java. Sparsh-UI 1.0 was placed in Google Code in October 2008, and as of June 2009 there have been over 1400 downloads worldwide.
This fact illustrates that Sparsh is a worthwhile platform, and discussions continue with P5 about how to tweak it so that it would be fully usable out of the box by P5 in their commercial products. The target for this advance is Spring 09.

Usability Analysis and Interface Prototyping
We also worked with P5 to help them design a new interface for their TACCS software. The usability analysis at ISU was helpful to P5 so that it could continue focusing on implementation.
The multitouch hardware market continues to be problematic, e.g. it's hard to be good multitouch hardware off the shelf. P5 and ISU assist each other by comparing notes on what they can find.

FINAL REPORT
Title: Laser-Based Diagnostics of Next Generation Combustion Systems
PI: Terry Meyer
Company Partners (company names only): Goodrich Turbine Fuel Technologies
Project Goal: The goal of this project is to study how laser-based sensors can be used to analyze combustion systems that burn alternative fuels.

Please list all Centers/Institutes involved in this project

- Bioeconomy Institute
- Center for Sustainable Environmental Technologies
- Biorenewable Resources and Technology Graduate Program

Publications/presentations based on project:

- Mechanical Engineering Magazine, Too Hot to Handle, March 1, 2008
- ScienceDaily, Engineer Develops Laser Technologies to Analyze Combustion, Biofuels, December 14, 2007
- Laser Focus World, Laser Technology Used to Analyze Combustion in Biofuels, December 6, 2007
- EnergyDaily, Laser Technologies Used to Analyze Combustion of Biofuels, December 6, 2007
- N. Jiang, W.R. Lempert, M.N. Slipchekno, J.D. Miller, T.R. Meyer, and J.R. Gord, "A Tunable High Energy Ultra-Violet Burst Mode Laser System," *Laser Focus World*, Vol. 44, No. 8, 79-83, Aug. 2008.
- D. Wissmiller, T.R. Meyer, and R.C. Brown, "Characterization of Bio-Crude Oil Combustion Emissions," *BioBased Industry Outlook Conference*, Ames, IA, Sept. 10-11, 2008.
- J.D. Miller, M.N. Slipchenko, T.R. Meyer, N. Jiang, W.R. Lempert, and J.R. Gord, "Planar LIF of the OH Radical Using a Tunable MHz-Rate UV Source," AIAA Paper 2009-0523, *47th AIAA Aerospace Sciences Meeting and Exhibit*, Orlando, FL, Jan. 5-8, 2009.

Awards received:

- Elected General Co-Chair, Optical Society of America's Conference on Laser Applications to Chemical, Security, and Environmental Analysis, March 2008
- Elected Chair, Optical Society of America's Conference on Lasers and Electro-Optics, Subcommittee on Active Optical Sensing, February 2009.

Invention disclosures:

- Pending, "A System for Utilizing Pyrolysis Oil in Domestic Scale Burners Designed for Fuel Oil No. 2"
- Pending, "A Wavelength-Agile Burst-Mode Optical Parametric Oscillator"

External funding applied for (indicate received/denied/pending):

- Pending, Combustion of Bio-Oil in Packaged Boilers for Heating Applications, Iowa Capitol Complex, $123,317, 2009-2010
- Pending, Wood-to-Wheels (W2W): Center for Sustainable Forest-Based Biofuels Transportation Systems, NSF, $725,000 (ISU Portion) proposed in collaboration with Michigan Technological University, 2010-2014
- Received, A Systems Approach to Bio-Oil Stabilization: Laser diagnostics for Vapor Filtration and Bio-Oil Recovery, Department of Energy, $249560 of $1.5M, 2009-2010
- Received, Major Research Instrumentation: Terahertz Ray Experimental Facility, National Science Foundation, $42,000 of $280,000 granted in collaboration with IPRT, 2008-2010
- Received, Spray and Combustion of Gelled Hypergolic Propellants, Army Research Office $475,000 of $6.25M granted in collaboration with Purdue and the University of Massachusetts Amherst, 2008-2013.
- Received, Studies of Injection and Ignition for Gas-Turbine Afterburners, Air Force Research Laboratory, $65000, 2008
- Denied, Combustion of Emulsified Pyrolysis Oil with Petroleum-Based Fuels, Conoco-Phillips, $268792, 2 years
- Denied, Technologies for Heating and Power Generation Using Pyrolysis Oil Derived from Cellulosic Biomass, Iowa Energy Center, $100,000, 1 year
- Denied, Characterizing the Effects of Unsteadiness on Turbulent Flame Chemistry and Pollutant Formation, National Science Foundation, $400,000, 5 years

Progress report (300 word maximum):

Overview. During the program, we have built up the facilities and instrumentation that allow us to develop advanced laser-based sensors for analyzing combustion systems that burn alternative fuels. The end products

of this effort are (1) improved combustion sensors and (2) improved combustor designs given detailed knowledge of alternative fuel sprays, fuel-air mixing, and energy release.

Results. We have developed a number of laser-based combustion sensors that allow us to characterize differences in the performance and emissions of alternative and conventional fuels. By characterizing the droplet field, detecting carbon cenospheres (prevalent in bio-oil flames), mapping the flame zone, and pinpointing soot formation, we have optimized the combustion of bio-oil derived from corn fiber and waste pine wood to burn as cleanly as conventional fuel oil. In this work, we have utilized injector technology developed by Goodrich Turbine Fuel Technologies in Des Moines and, with follow-on funding, we hope to demonstrate this commercially within boilers at Iowa's Capitol Complex. Success in this program (and some follow-on funding) has allowed us to begin renovations of a laboratory in the Department of Mechanical Engineering dedicated to studying advanced combustors. We hope this facility will help bring additional funding from government and industry sources. In addition to bio-oil combustion in furnaces and biolers, we have developed high-speed imaging methods for studying diesel sprays in a $50k diesel simulator donated by John Deere in Waterloo, Iowa. While funding from John Deere to develop injector technologies for alternative fuels is currently on hold, we have acquired funding to use these techniques for studying safe alternative fuels for the Army Research Office, and we have submitted a joint proposal for an NSF Science and Technology Center in collaboration with Michigan Technological University. Patent disclosures on both the combustor technology and laser diagnostics are currently being prepared.

INTERIM REPORT
Title: Development of Novel Digestion-Resistant Starches from Corn to Combat Human Disease
PIs: Guru Rao
Company: Starch Design
Project Goal: The project goal is to develop maize lines that produce novel starches that when fed in human diets result in more gradual of glucose to the blood stream than normal starch.

Publications/presentations based on project:

- *Manuscript in preparation*. C. Moallic, A. M. Myers, and M. G. James. Modification of amylopectin chain length in transgenic maize plants results in novel starches with altered hydrolysis properties. *To be submitted to Journal of Agricultural and Food Chemistry*.
- *Invited oral presentation*: M. James. New insights into the regulation of starch synthesis in maize endosperm. International Sweet Corn Development Association Meeting, December 8-9 2008, Chicago, IL.

Invention disclosures: Methods and Transgenic Plants for Increasing Starch Yield, U.S. Patent Application filed March 4, 2009 by ISURF; Martha G. James and Alan M. Myers, inventors.

Centers/Institutes involved in this project: Nutrition and Wellness Research Center, Center for Crops Utilization Research, Plant Sciences Institute Nutrition Research Initiative

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Progress report (300 word maximum, please focus on results in non-technical terms and commercialization progress):

Previous analyses of genetically modified (GM) corn plants identified a line producing long-chain amylopectin starch (LCAPS) that is enzymatically converted to glucose more slowly than normal cornstarch (60% of the normal rate), and another line accumulating a higher than normal percentage of starch (~5% increase, termed HS). Objectives for the current period were: *1)* to analyze the properties of a new LCAPS-based starch, LCAPS3, and *2)* to design a means to further increase the starch amount in the HS line, toward the long-term goal of producing high yield, slowly digestible starch for incorporation into health-promoting foods.

Approaches: 1) LCAPS3, produced by breeding the LCAPS line with the genetic mutant line *dull1*, was further analyzed to evaluate its starch properties. *2)* Additional engineering of the maize *dull1* gene was accomplished in preparation for further increasing starch in kernels of the HS and LCAPS lines.

Accomplishments: 1) Analyses showed that GM LCAPS3 starch has more long chains compared to LCAPS, and is less viscous than normal starch. LCAPS3 also is digested to glucose more slowly than either LCAPS or normal starch; thus, LCAPS3 shows promise as a slow energy release food ingredient. LCAPS3 granules are smaller and smoother than normal starch granules, which may be of interest for certain commercial food applications. *2)* Site-directed mutagenesis was employed to alter a specific protein-protein interaction site within the maize *dull1* gene. Disruption of this interaction is predicted to ease a "braking mechanism" that normally would limit starch accumulation. Introduction of this newly engineered plasmid into a HS background is predicted to further increase the amount of starch in the kernel. This new line, which could have commercial potential for all cornstarch-based food, feed, and fuel products, will be combined with LCAPS and LCAPS3 traits to produce new healthful HS lines of corn.

INTERIM REPORT
Title: Effectiveness of EpiCor in improving immune function, inflammation, & performance after intense exercise
PI: Marian Kohut ; Rick Sharp
Company: Embria Health
Project Goal: Determine whether a dietary supplement alters immune, oxidative, or metabolic response to exercise stress.

Progress report (300 word maximum, please focus on results in non-technical terms and commercialization progress):

In the present study, college aged males performed 2 weeks of intense aerobic and anaerobic cycle ergometer training that is known to place a substantial amount of physiological and metabolic stress on the individual, and is known to trigger a variety of adaptations to reduce the stress. Although this study was not specifically designed to test a hypothesis of improved inflammatory response with EpiCor, the observed responses of the anti-inflammatory markers measured in this study are consistent with a possible protective effect against inflammation. Despite this finding, however, the subjects did not perform the exercise tests better during the training or at the end of training while consuming EpiCor. Because the exercise testing and training were not specifically designed to cause inflammation or to be limited by inflammation, the effect of EpiCor on the inflammation process and whether it can improve performance by enhancing the inflammatory response should be studied with an exercise protocol known to be affected by the inflammatory process. Such an exercise stimulus should include unaccustomed eccentric exercise which is well known to lead to muscle damage, inflammation and delayed onset muscle soreness.

FINAL REPORT
Title: Commercialization of a Continuous In-Line Flow Meter
PI: Manjit K. Misra Co-PIs: Yuh-Yuan Shyy
Company Partners (company names only): Remington Seeds Company and Almaco Company
Project Goal: The project objective is to fabricate, test, and demonstrate a prototype under real dynamic flow conditions thus making the patent attractive for commercialization.

Invention disclosures: ISURF patent pending prior to the start of the project

Centers/Institutes involved in this project: Seed Science Center

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Progress report (300 words maximum):
We are working with Remington seed plant in Williams, Iowa for field testing of the ISU flowmeter.
Drs. Misra and Shyy visited the plant and discussed the testing details with the manager. Presently, seed corn is conditioned and operated 10 hours/day at the facility. They have modified and added a 2-way valve from the

discharge end of an elevator from the "Large Flat" sizer bin so the seed corn can be diverted to either flowmeter or a seed-ladder. Another 2-way valve was also added at the end of the flowmeter so that the sample can be collected for flow rate determination. On the bottom of the pipe, a receiving boot was installed so the samples can be dumped back to the flow for recirculation. The flow rate at the point is between 150 to 200 Bushels per hour. We have installed an all-steel, high capacity flowmeter with a data logger to collect the data on site.

The preliminary data shows that both mechanical and electrical noise is interfering with the signal from the flowmeter during data acquisition for measurement of flow rate. This is due to the fact that the flowmeter is located on the fourth floor of the tower which houses a dust system with two large fans and cyclones running continuously and four sizers and one air-screen cleaner is running simultaneously on third and second floor. The load cell used in the flowmeter is sensitive enough to pick up vibration from building as well as equipments. To solve this problem, a soft layer will be installed on the load cell surface. To solve the electrical noise from the adjacent motors will need some additional research. A noise reducing circuit will be investigated. We will also separate the flowmeter power line from the high voltage AC source.

FINAL REPORT
Title: Gasification Technologies in Support of Biorefineries
PI: Robert C. Brown, Francine Battaglia, Theodore J. Heindel
Companies: Frontline Bioenergy; Chippewa Valley Ethanol Company
Project Goal: This project has three goals: (i) validate computational fluid dynamics models that are used to simulate biomass gasification in fluidized bed gasifiers; (ii) use CFD to predict pressure fluctuations and then analyze these fluctuations to determine hydrodynamic conditions within the fluidized bed; and (iii) evaluate producer gas contaminant impacts on emissions.

Publications/presentations based on project:

- Battaglia, F., Deza, M., Franka, N.P., and Heindel, T.J., "Computational and Experimental Studies of Fluidized Beds for Biomass Gasification", 2007 American Physical Society, Division of Fluid Dynamics, November 18-20, Salt Lake City, UT, 2007.
- Deza, M., Battaglia, F., and Heindel, T.J., "Computational Modeling of Biomass in a Fluidized Bed Gasifier," Proceedings of the 2007 ASME International Mechanical Engineering Congress and Exposition, November 10-16, Seattle, WA, ASME Press, Paper IMECE2007-43097, 2007.
- Franka, N.P., Heindel, T.J., and Battaglia, F., "Visualizing Cold-Flow Fluidized Beds with X-rays," Proceedings of the 2007 ASME International Mechanical Engineering Congress and Exposition, November 10-16, Seattle, WA, ASME Press, Paper IMECE2007-43073, 2007.
- Franka, N.P., "Visualizing Fluidized Beds with X-rays," M.S. Thesis, Iowa State University, Ames, IA, May 2008.
- Heindel, T.J., and Battaglia, F., "Gasification Technologies in Support of Biorefineries – Progress Report," Submitted to John Reardon, Frontline BioEnergy, June 18, 2008.
- Franka, N.P., and Heindel, T.J., "Local Time-Averaged Gas Holdup in a Fluidized Bed with Side Air Injection using X-ray Computed Tomography," *Powder Technology*, In Review, 2008.
- Deza, M., Battaglia, F., and Heindel, T.J., "A Validation Study for the Hydrodynamics of Biomass in a Fluidized Bed," To be presented at the 2008 ASME Fluids Engineering Division Summer Meeting, August 10-14, 2008, Jacksonville, FL, Paper FEDSM2008-55158, ASME Press, New York, 2008.
- Franka, N.P., Drake, J.B., and Heindel, T.J., "Minimum Fluidization Velocity and Gas Holdup in Fluidized Beds with Side Port Air Injection," To be presented at the 2008 ASME Fluids Engineering Division Summer Meeting, August 10-14, 2008, Jacksonville, FL, Paper FEDSM2008-55100, ASME Press, New York, 2008.
- Deza, M., Franka, N.P., Battaglia, F., and Heindel, T.J., "CFD Modeling and X-ray Imaging of Biomass in a Fluidized Bed," *Chemical Engineering Science*, In Review, revision submitted Dec. 20, 2008.
- Franka, N.P., and Heindel, T.J., "Jetting Observations in a Cold-Flow Fluidized Bed," AIChE 2008 Annual Meeting, November 16-21, 2008 Philadelphia, PA, Abstract #125416.
- Battaglia, F., Deza, M., and Heindel, T.J., "Numerical Simulations of a Biomass Fluidizing Bed with Side Port Air Injection," APS Fluids Division Meeting, San Antonio, TX, Nov. 23-26, 2008.

- Deza, M., Battaglia, F., and Heindel, T.J., "Approximating a Three-Dimensional Fluidized Bed with Two-Dimensional Simulations," *Proceedings of the 2008 ASME International Mechanical Engineering Congress and Exposition*, October 31 – November 6, 2008, Boston, MA, Paper IMECE2008-66378, ASME Press, New York, 2008.
- Drake, J.B., Franka, N.P., and Heindel, T.J., "X-ray Particle Tracking Velocimetry for Applications in Fluidized Beds," *Proceedings of the 2008 ASME International Mechanical Engineering Congress and Exposition*, October 31 – November 6, 2008, Boston, MA, Paper IMECE2008-66224, ASME Press, New York, 2008.

Centers/Institutes involved in this project: Center for Sustainable Environmental Technologies

External funding applied for utilizing project results (indicate received/denied/pending):
- "Collaborative Research: GOALI: Biomass Particle Hydrodynamics in Fluidized Bed Gasifiers," Theodore J. Heindel and John P. Reardon (ISU) and Francine Battaglia (Virginia Tech), Submitted to the National Science Foundation. Pending.
- "Characterizing Biomass Fluidization to Improve Biomass Gasification," Theodore J. Heindel, Submitted to the Iowa Energy Center. Denied
- "Biomass Gasification to Improve Producer Gas Quality for Power Production," Theodore J. Heindel (ISU) and Francine Battaglia (Virginia Tech), Submitted to USDA (RD-RBP-BIOMASS-2007: Biomass Research and Development Initiative. Pending
- "Advanced Diagnostics Using High-Resolution 3D X-ray Imaging to Characterize Fluidized Bed Hydrodynamics," Theodore J. Heindel, Submitted to DOE, June 10, 2008. Declined
- "Fluidized Bed Modeling and Validation for Gasification and Pyrolysis: Phase 2," Theodore J. Heindel and Rodney Fox, Submitted to ConocoPhillips, Funded – to begin January 1, 2009.

Description of major laboratory equipment used for this project including an estimate of the number of hours used, number of samples processed, or dollar amount for services provided:
- All of the X-ray imaging work that was used for CFD model validation was completed in the ISU Experimental Multiphase Flow Laboratory using our one-of-a-kind X-ray flow visualization facility.

Progress report (300 word maximum):
A Pfeiffer Mass Spectrometer (MS) was calibrated and installed to analytically measure Hydrogen Sulfide, Hydrogen Chloride, Ammonia, Sulfur Dioxide, Methane, Carbon Dioxide, Carbon Monoxide, Hydrogen, Nitrogen, Oxygen, Acetylene, Ethylene, and Ethane gases on-line. Approximately 14 initial trials to quantify these gases were completed in Black Engineering on a 5 kg/hr atmospheric gasifier to establish a baseline for future gasification tests. The MS was relocated to the BECON facility to analyze the producer gas stream from a 200kg/hr pressurized biomass gasifier. The installation and calibration was reproduced following parameters established on the initial tests at Black Engineering. Data was collected on May 7, 2009 and gas compounds were analytically quantified using on-line Mass Spectroscopy.

FINAL REPORT
Title: Designing corn lines with dietary fiber to produce ethnic foods with enhanced health benefits.
PIs: Pam White
Companies: Genetic Enterprises International.
Project Goal: To develop corn lines having high dietary fiber (RS): 1) with agronomic characteristics suitable for production in the Corn Belt, and 2) with enhanced nutritional properties and quality characteristics appropriate for traditional Hispanic foods. Production of these value-added corn varieties will create economic benefits for farmers who serve these niche markets.

External funding applied for utilizing project results(indicate received/denied/pending):
- Hendrich, S., P.J. White, and L.M. Pollak, Screening System for Digestion-Resistant Starch. USDA Special Grants Program. Center for Designing Foods to Improve Nutrition, ISU. $30,000 funded through 2008.

- Hendrich, S., P.J. White, and L.M. Pollak, Screening System for Digestion-Resistant Starch: Effects on Human Fecal Microbes and Short-chain Fatty Acid Production, ISU Plant Sciences Institute. $50,000 for two years.
- White, P.J. and L.M. Pollak, Improving the Nutritional Quality of Corn Starch, ISU Plant Sciences Institute. $45,026 through 2008.
- White, P.J., T. Boylston and N. Yao. 2008. Yogurt nutritionally enhanced with *Bifidobacteria* and □-glucan. Midwest Dairy Association. $36,955 for one year.
- Pollak, L.M., S. Duvick, and P.J. White. Corn Cream from Altered Fatty Acids. USDA-Cooperative Research and Development Project with private industry. $100,000 for one year. Received.
- Pollak, L.M., S. Duvick, and P.J. White. Corn Cream from Altered Fatty Acids. USDA-Cooperative Research and Development Project with private industry. $48,913 for one year. Received.
- White, P.J. and L.M. Pollak, Improving the Nutritional Quality of Corn Starch, ISU Plant Sciences Institute. $35,272 through 2010. Received.

Publications/presentations based on project:

- Rohlfing*, K., and P.J. White. 2008. Resistant Starch Levels in Exotic Corn Crosses and Impact on Starch Gelatinization Characteristics. Proceedings of the Corn Utilization and Technology Conference XIII.
- 2008 Yao*, N., A. V. Paez, L. Pollak, and P. J. White. Physical and molecular properties of total and resistant starches from corn with different doses of mutant amylose-extender and floury-1 alleles. Honolulu, HI. September, 2008.
- 2008 Rohlfing*, K., and P.J. White. Resistant Starch Levels in Exotic Corn Crosses and Impact on Starch Gelatinization Characteristics. Honolulu, HI. September, 2008.
- Yao, N., A. Paez, and P.J. White. Structure and function of starch and resistant starch from corn with different doses of mutant amylose-extender and flour-1 alleles. Journal of Agricultural and Food Chemistry. 57 (5):2040–2048; On-line, Feb. 12, 2009.

- Pollak, L.M., S. Duvick, and P.J. White. The Road to Commercialization: Altered fatty acids in corn. Crop Science Society Association. Invited presentation to be presented Nov. 2009.

- Pollak, Linda. 2009. Corn flavor. *In* Y.H. Hui et al. (eds.). Handbook of flavors from fruits and vegetables. Wiley-Blackwell, Inc., Hoboken, N.J. In press.
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Awards received:

Pamela J. White; Institute of Food Technologists' Stephen S. Chang award for Excellence in Lipid and Flavor Research. June 2009.

Centers/Institutes involved in this project: Center for Crops Utilization Research, Plant Sciences Institute, Nutrition and Wellness Research Center

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Progress report (300 word maximum):

Aim #1. Develop specialty corn lines with high resistant starch (RS) that can thrive in the U.S. Corn Belt.

Corn lines with properties ideal for use in native Hispanic foods were previously planted and crossed with corn lines containing high amounts of resistant starch (RS) as a dietary fiber. These lines include corn types with different numbers of mutant *amylose-extender* (high-RS) and *floury-1* (low-RS) alleles. Our commercial partner, Dr. Alix Paez, **Genetic Enterprises International (GEI),** developd these lines, and increased corn yields. The lines were self pollinated during summer 2008 to create lines with more fixed starch properties, and harvested in fall 2008, with enough material for evaluation as described in aim #3.

Aim #2. Characterize the new lines for basic composition and potential RS

These data were previously reported.

Aim #3. Evaluate the functional and sensory properties of flours from the new corn lines.

The new corn lines were dry milled in the Center for Crops Utilization Research (CCUR) pilot plant, the resulting flours made into three tortilla types (100% *floury*, 50% *floury*-50% *amylose-extender*, and 100% *amylose-extender*) and the tortillas evaluated. The *floury* tortillas were chewier, more rollable, and grittier than the *amylose-extender* tortillas. The blend tortillas were intermediate in most parameters. The cutting force of the *amylose-extender* tortillas was very low, whereas the blend and *floury* tortillas required more force. Chewiness was related to rollability, and the RS % related to rollability and cutting force. The *floury* and blend tortillas had a firm texture that would be expected when eating a tortilla with a filling. The *amylose-extender* tortillas fell apart with very little force, and would not roll around a filling, making them unsuitable for this use. The blend tortillas, retained enough of the textural properties of the *floury* tortilla to make it a suitable product.

FINAL REPORT - NO REPORT RECEIVED – PREVIOUS REPORT
Title: Role of complex carbohydrates in inflammatory bowel disease
PI: Ruth MacDonald
Report Type: Interim
Company Partners (company names only): Proliant
Project Goal: To determine the role of dietary carbohydrates in reducing the symptoms of inflammatory bowel disease.

External funding applied for (indicate received/denied/pending): USDA-NWRC grant in collaboration with Proliant Inc. received.

Progress report (300 word maximum):

To date we have established a protocol for inflammatory bowel disease (IBD) in mice that provides a suitable model for the human disease. We have used the model to study dietary interventions to reduce the severity of inflammation. In addition, we are developing techniques to quantify cellular events associated with the model. This includes several cytokines to be measured using the Luminex system, Western immunoblotting and ELISA. In addition, we plan to screen for global protein expression changes using 2-D electrophoresis. Through these studies we will identify potential mechanisms through which dietary factors may reduce the symptoms of inflammatory bowel disease. Our goal is to complete these studies by May 2010.

FINAL REPORT
Title: Flaxseed lignans for heart health
PI: Suzanne Hendrich
Company Partners: Grain Processing Corp.
Project Goal: Test a novel dietary fiber for its human health effects

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External funding applied for utilizing project results(indicate received/denied/pending): grant application to NIH in process for Mar 2009

Please list all Centers/Institutes involved in this project
Nutrition and Wellness Research Center

Description of major laboratory equipment used for this project including an estimate of the number of hours used, number of samples processed, or dollar amount for services provided
LC/MS/MS, 200 samples, 150 hours @ $126/h = $18,900

Progress report (300 word maximum):
The human feeding study of a novel dietary fiber was completed Dec. 16, 2007. The trial consisted of 3 feeding periods of 14 days each, with a randomized crossover design, 12 subjects, 4 on each treatment (control,

wheat bran, test fiber) during each feeding interval. All subjects completed the trial. Mean daily fecal weights, gut transit time, gastrointestinal symptoms, blood glucose response, 3-day food records and fecal calcium compared with dietary calcium are under study. Breakfast bars containing 15 g of dietary fiber were formulated and prepared, as well as a low fiber control. One bar of each type was consumed daily during each feeding period. When g wet fecal weight change/g dietary fiber added compared with the control breakfast bar was contrasted between corn and wheat bran, the two treatments did not differ significantly in their effect. Dietary fiber intakes of subjects were significantly increased by the addition of high fiber breakfast bars to their daily diets, with no adverse effects on gastrointestinal function. The lack of effects of either dietary fiber source on blood glucose after a 50 g glucose challenge is consistent with the literature, but such fibers may exert other diabetes preventive effects that deserve further study. This trial supports the ability of corn bran to function as a dietary fiber similar to wheat bran. The study data was accepted by Health Canada, and the product has been successfully introduced into that market.

FINAL REPORT
Title: Automated Phenotyping of Biomass Crops
PI: Lie Tang
Company Partners (company names only): EnaGen LLC
Project Goal: To develop a computer vision-based plant screening station that can reconstruct 3D plant images for plant structure and growth rate analysis.

External funding applied for (indicate received/denied/pending): I joined EnaGen LLC. to apply for SBIR funds from both NSF and DoE, but both proposals were denied. I also wrote a proposal to Plant Science Institute (PSI) at ISU on collaboratively developing the system, but due to budget issues at PSI, the project did not move forward. We are still discussing the potential of collaboration.

Centers/Institutes involved in this project: PSI was partly involved into some discussions

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Progress report (300 word maximum, please focus on results in non-technical terms and especially commercialization progress):
As the first stage of the project we have completed the design part of the screening station. The current design has a 3D camera mounted at a side on a lead screw. The camera captures images of a rotating plant while moving along the lead screw. We decided to rotate the plant instead of the camera due to some difficulties we encountered while selecting a motor that could be stopped without causing considerable amount of vibration to the rotating arm. We have purchased all the components required and are assembling the screening station. At the same time we are developing a software component to capture plant images.
In the second stage we performed some crucial experiments with the camera. First, we tested how fast we can rotate the plant without causing significant motion blurring effect. We came up with the result that it is suitable to rotate the plant at up to RPMs. Second, we tested for the minimum distance requirement. We came up with the result that the camera to object distance should be at least 18 inches.
Once the screening station and the software component for image acquisition are ready we will start collecting images of the plants we are growing in our lab. We will be spending some time doing research on possible ways to reconstruct 3D model from multiple images collected from plants. We will be focusing on corn plants of v3-v4 stages for the moment.

INTERIM REPORT - NO REPORT RECIEVED
Title: Automated Phenotyping of Biomass Crops
PI: Charlie Hurburgh
Company Partners (company names only): EnaGen LLC
Project Goal: To develop a computer vision-based plant screening station that can reconstruct 3D plant images for plant structure and growth rate analysis.

FY09 FUNDED PROJECTS*

Principal Investigator	Project Title	FY09 Award Amount	FY09 Allocation	FY08 Allocation	FY10 Allocation	ISU Cost Share	Industry Cost Share
Michael Kessler	Pultruded Window Frames from Agricultural Oils	$ 40,000	11,725	n/a	28,275	816.60	---
Jesse Goff	Test glycosides of 1,25-dihydroxyvitamin D for anti-cancer activity in vitro and in vivo	$ 125,550	125,550	n/a	n/a	15,620.45	50,209.60
Michael Olsen	Development of the Next Generation of Vortex Flow Meters for Engine Applications	$ 104,690	49,350	n/a	55,340	13,261.03	---
Gary Munkvold	Low-Temperature Plasma Treatments for Improving Seed Performance	$ 25,121	25,121	n/a	n/a	2,397.70	---
Nicola Pohl	Automated synthesis of custom-order carbohydrates for biologists and pharmaceutical scientists	$ 66,477	$66,477	n/a	n/a	6,971.53	---
Iver Anderson	Iowa Powder Atomization Technologies (IPAT): Titanium Atomizer Prototype	$ 171,499	171,499	n/a	n/a	23,264.84	---
Tim Ellis	Novel, Cost-Effective H2S Absorption Technology Using Scrap Tire Rubber Particles	$ 33,443	9,942	23,500	n/a	30,210.99	$ 35,000
Atul Kelkar	Waste Plastics, Crude Oil Sludge, and Tar Sand to Diesel – Capturing Energy from Waste	$ 143,816	134,477	n/a	9,337	15,978.72	62,846
Victor Lin	Catalytic Production of 1,6-Hexanediol	$117,150	39,612	66,000	11,538	35,671.02	100,000
David Grewell	Protein Polymer Product Development	$ 78,452	78,452	n/a	n/a	5,810.91	46,062.40
Infrastructure							
Research Park		$ 186,000	$ 186,000			89,280	186,000
Pappajohn Center		$ 186,000	$ 186,000			1,547.17	---
Post-doc Entrepreneurial Program		$ 139,500	$ 139,500			51,849.69	139,500
IPRT		$ 80,000	$ 80,000			59,736.93	n/a
VPRED		$ 93,000	$ 93,000			69,477.59	n/a

*Due to funding delays, these projects were only started approximately 6 months ago. We received a 20+% budget reduction. The original proposed project budgets were reduced by 7%. An additional 7% of project budgets will not be allocated until FY10. The remaining budget cut was accounted for by utilizing unallocated funds (these funds are normally used to fund projects that arise during mid-year).

** The ISU Cost share does not include unrecovered indirects (48% of direct project costs). The unrecovered indirects will be included in the detailed financial information.

INTERIM REPORT
Title: Pultruded Window Frames from Agricultural Oils
PI: Michael R. Kessler
Company Partners (company names only): Pella Corp.
Project Goal: To develop resins and composites for pultrusion manufacturing to produce fiberglass reinforced biorenewable composite window frames.

Publications/presentations based on project:

- P. Badrinarayanan, Y. Lu, R. C. Larock, M. R. Kessler: *Cure Characterization of Soybean Oil-Styrene-Divinylbenzene Thermosetting Copolymers*, **Journal of Applied Polymer Science**; 2009; 113, 1042-1049.

External funding applied for (indicate received/denied/pending):

- Michael Kessler & Richard Larock, "Fiberglass Reinforced Polymers from Agricultural Oils", The Consortium for Plant Biotechnology Research, 2009-2010, $240,000 plus $240,000 matching contribution from Iowa State and Ashland Performance Materials, denied.
- Richard Larock & Michael Kessler, "Replacing Petroleum in Plastics by Renewable Oil / Biofuel By-product Composites", Iowa Energy Center, July 2009-June 2012, $279,640, selected for a full proposal, but ultimately denied.
- Michael Kessler & Richard Larock, "Bio-based Hybrid Composite Materials for Wind Power Turbine Blades", Iowa Energy Center, July 2009-June 2012, $268,709, submitted preproposal but not funded.

Centers/Institutes involved in this project:

- Center for Crops Utilization Research, Iowa State University

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Progress report (300 word maximum, please focus on results in non-technical terms and commercialization progress):

We have made good progress in developing a resin formulation for the pultrusion processing of fiberglass/bio-resin composite window frames. Our efforts have focused primarily on two areas. The first effort has been directed at decreasing the cure times and characterizing the cure kinetics of the resins made by the cationic polymerization of soybean oil, styrene, and divinylbenzene. The second effort has been directed at increasing the interfacial shear strength (IFSS) between the glass fiber and ring-opening metathesis polymerization (ROMP)-based matrix using a silane coupling agent.

Our research team travelled to Pella Corp. in early May to present our progress in these areas and to plan for the next few months of the project. At the meeting, we updated the engineers at Pella on the results of our cure kinetics modeling and received positive feedback. The next step will be to develop, with Pella Corp.'s help, a method for producing fiberglass composite specimens using a hot press, which is simulative of the pultrusion process, and will allow us to compare more directly the properties of composites from our bio-based resins and composites made from the unsaturated polyester resins currently used in Pella's window frames.

The process for increasing the fiber/matrix interfacial shear strength (IFSS) in the ROMP system has been less successful so far. We have tried quantifying the IFSS using a single-fiber fragmentation test (SFFT) approach and a direct fiber pull-out method. However, obtaining reliable IFSS values or quantifying an improvement in the silane-treated glass fiber compared to the untreated glass fiber has not been possible. A new piece of equipment is being purchased to improve our ability to make the SFFT measurements and alternative techniques for improving IFSS in the ROMP system are also being investigated.

INTERIM REPORT
Title: Test glycosides of 1,25-dihydroxyvitamin D for anti-cancer activity in vitro and in vivo.
PI: Jesse Goff (with James Bloedel, Chair, BMS)
Company Partners (company names only): GlycoMyr, Inc.; Heartland Assays, Inc
Project Goal:

Develop products based on vitamin D to treat and prevent a number of human and animal diseases. The basis for these products is a plant of the *Solanaceae* family that contains a number of vitamin D-related compounds that have been shown to have unique activities affecting both calcium metabolism and cell growth. An immediate goal is to purify/ synthesize the active compounds for testing in cell culture and in mouse /rat models.

External funding applied for (indicate received/denied/pending): NIH Challenge grant – pending

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Progress report (300 word maximum, please focus on results in non-technical terms and commercialization progress):
We embarked first on synthesis and purification of the various glycosides of vitamin D. This was done thru Heartland Assays at a cost of $95,000 for precursors, and time and reagents needed to conjugate carbohydrate structures to the vitamin D backbone at distinct locations. We quickly learned that some of the glycosides were inherently unstable and abandoned them and that glucuronides of the vitamin D compounds were relatively stable in solution.

1,25-Vitamin D glucuronides have been administered to rats to determine maximal tolerable levels as compared to the native hormone, 1,25-dihydroxyvitamin D. As hoped, we can deliver at least 10 fold (varies with study between 12 and 25 times) the amount of 1,25-vitamin D in the glucuronide form as the native hormone without causing significant hypercalcemia. We have only recently gotten our tissue culture studies underway. We are currently validating our methods for measuring cell proliferation and apoptosis in tissue culture. No preliminary data on the compounds effects on cell proliferation are available. We also conducted tests of vitamin D delivery to the colon and have data suggesting very little free drug will be released in the upper gastrointestinal tract of rats but nearly 100% of the drug becomes available to cells in the lower GI tract. This data caused us to focus on cancer of the colon and also opened up the possibility of treating inflammatory bowel disease. An NIH grant was submitted to fund further work in this area.

In summary we know we can target vitamin D to hit cells of the lower GI tract, while having little effect on the rest of the body. We also know we have at least a ten fold level of safety over the native hormone, which is too toxic for use. We are still on track!

INTERIM REPORT
Title: Development of the Next Generation of Vortex Flow Meters for Engine Applications
PI: Michael Olsen, Mechanical Engineering, 3025 Black, e-mail:mgolsen@iastate.edu
Company Partners (company names only): J-TEC, Inc.
Project Goal: To assist J-TEC in developing their next generation of vortex flowmeters, the proposed research seeks to: 1) experimentally study the basic physics of vortex flows generated by struts in automotive applications, 2) develop computational fluid dynamics tools to assist in the design of strut geometries for these applications, and 3) investigate alternative methods for accurate vortex detection

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External funding applied for (indicate received/denied/pending): None yet, although a proposal to the NSF SBIR under the topic Energy Supply and Use from the latest NSF-RFP is being considered. This RFP is requesting proposals in developing technologies that assist in the reduction of engine emissions, the reduction of greenhouse gasses, vehicle weight reduction, and improved efficiency, all of which can be affected by the technology being developed in this project.

Progress report (300 word maximum, please focus on results in non-technical terms and commercialization progress):

Since the project began in January, the major accomplishments have been the construction of two wind tunnel facilities in which the experimental study of vortex shedding will take place. The two wind tunnels are meant to mimic the two different types of ducting geometries in which J-TEC's vortex flowmeters are placed, i.e., one of the wind tunnels has a circular cross-section, and the other has a rectangular cross-section. Both wind tunnels are fan driven, and can achieved air flow velocities covering the entire range of vortex flowmeter operation. The last phase of wind tunnel construction is now ongoing, and that involves fitting each of the wind tunnels with a preheating section. In diesel engine operations, the vortex flowmeters measure the flowrates of heated exhaust gases. Because vortex shedding is dependent on air temperature, the preheating sections are necessary to mimic the flow conditions that exist in diesel engine applications. The preheating sections contain electrical heaters that can accurately be controlled to provide a wide range of inlet air flow temperatures. The other accomplishment has been designing the computational grids for the computational fluid dynamics study. With this completed, computer simulations of the flows can now begin.

Progress during the first year was hampered by the delay in the investigators receiving GIVF funding due to the catastrophic floods in Cedar Rapids. The research proposal called for three graduate students to begin working on the project in January, but because of delays in funding, only one student was hired to work on the project at that time. This student focused on building the facilities, and thus, that is where the greatest progress has been made. The delay also resulted in approximately $17,000 in funding for the first fiscal year being unspent and carrying over to the second year. In mid May, two additional graduate students were hired onto the project, and with the project now fully staffed, it is anticipated that the project can progress in a more rapid manner.

INTERIM REPORT
Title: Low-Temperature Plasma Treatments for Improving Seed Performance
PI: Gary Munkvold & Alan Gaul
Company Partners (company names only): Plasmer Seed, LLC
Project Goal: To determine whether low temperature plasma treatment of high value seeds can improve seed performance by reducing contamination from economically important pathogens and/or by enhancing the efficacy of seed treatment fungicides

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Centers/Institutes involved in this project: Seed Science Center, Plant Sciences Institute

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Progress report (300 word maximum, please focus on results in non-technical terms and commercialization progress):
Initial testing with low-temperature plasma treatments with varying treatment parameters did not indicate any reductions in fungal contamination. Seed germination was unaffected or, under some treatment parameters, was affected negatively. Initial results on the interactions between low-temperature plasma treatment and fungicidal seed treatment also did not indicate an enhancement of seed treatment efficacy when the plasma treatment was applied. Current testing relates to duration of fungicidal seed treatment efficacy and effect of plasma treatment on this duration. We are working with plasma instrument providers to adjust treatment parameters in an attempt to optimize potential plasma treatment benefits. No commercialization activity has been initiated, and this will not occur until we can establish the value of the low-temperature plasma treatment.

INTERIM
Title: Automated synthesis of custom-order carbohydrates for biologists and pharmaceutical scientists
PI: Nicola L. Pohl, Professor and Caldwell Chair of Chemistry
Company Partners (company names only): LuCella Biosciences, Inc.
Project Goal: To advance carbohydrate synthesis technology developed at ISU to assist LuCella Biosciences, Inc., an Ames startup company, in achieving the success of IDT (Integrated DNA Technologies). The specific goal of the first quarter is to develop larger scale routes to common building blocks necessary to carry out commercial carbohydrate synthesis.

Publications/presentations based on project:

- 19th Winter Fluorine Conference, St. Petersburg Beach, FL, 12 January.
- University of British Columbia, Lectures in Modern Chemistry series speaker, Vancouver, BC (Canada), 20 January.
- NIH-Sponsored Consortium for Functional Glycomics Workshop, La Jolla, CA, 15 March.

External funding applied for (indicate received/denied/pending):

- Revised NIH Phase I STTR application that builds upon the work proposed with this GIVF grant was submitted with LuCella Biosciences, Inc. (Title: Solution-Phase Automated Synthesis of Oligosaccharides) on April 5, 2009. Study section meeting June 24, 2009. Score: 27 (on new 10-90 scale, 10 = perfect). Pending Council Review in October 2009.

Centers/Institutes involved in this project: Plant Sciences Institute

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Progress report (300 word maximum, please focus on results in non-technical terms and commercialization progress):

Work is in progress to scale up the building block syntheses for 30 different building blocks that serve as the basis for the automated synthesis platform. The recent price escalation of certain organic solvents has required some reworking of chemistry; however, initial studies with modified routes look promising. Apart from this grant, web site design is also in progress and graphic blocks depicting each of the building blocks being made have been created.

INTERIM REPORT

Title: Iowa Powder Atomization Technologies (IPAT): Titanium Atomizer Prototype Design
PI: Iver E. Anderson
Company Partners (company names only): Iowa Powder Atomization Technologies (IPAT)
Project Goal: The primary goal of this project is to design and fabricate a novel prototype atomizer for the production of fine spherical titanium metal powder. Upon completion, this prototype will be used to demonstrate the feasibility of an innovative titanium melt pouring concept that can be coupled to a high pressure gas atomization nozzle to produce high quality Ti powder. If successful, commercialization of this atomization technique could result in the start of a new business called Iowa Powder Atomization Technologies (IPAT).

Publications/presentations based on project:

- I.E. Anderson, J. Sears, D. Byrd, J.R. Rieken, A. Heidloff, M. Glynn, and M. Ward, "Development of Advanced Gas Atomization Process for Ti and Ti Alloy Powders," **to be submitted** for the proceedings of the 2009 International Conference on Powder Metallurgy & Particulate Materials, MPIF/APMI, Princeton, NJ.
- J.R. Rieken, I.E. Anderson, A. Heidloff, and D. Byrd, "Development and Commercialization of a New Titanium Gas Atomization Process," presented at the Integrated Titanium Factory Vision and Roadmap Conference, held at Rock Island Arsenal (US Army) on May 12, 2009.
- I.E. Anderson, J. Sears, D. Byrd, J.R. Rieken, A. Heidloff, M. Glynn, and M. Ward, "Development of Advanced Gas Atomization Process for Ti and Ti Alloy Powders," **to be presented** at 2009 International Conference on Powder Metallurgy & Particulate Materials on July 1, 2009 at the Mirage Hotel, Las Vegas, Nevada.

Awards received: IPAT was invited to participate in the John Pappajohn Iowa Business Plan Competition for 2009 (currently included in the top 30 at this stage of the competition)

Invention disclosures: Rieken, J.R. and Heidloff, A.J., "Rare Earth Sub-Stoichiometric Pour Tube for Reactive Materials," submitted as an ROI (ISURF no. 3695) on March 17, 2009.

External funding applied for (indicate received/denied/pending): Submitted subcontract proposal entitled: "Generation of Fine Spherical Ti Alloy Powder for Net-Shape Powder Injection Molding of High Performance Fastners," for $240,000 as part of the full proposal, "Innovative Net Shape Manufacturing of Small Parts Using Titanium Powder," for $963,015 to the Industrial Base Innovation Fund II of the Defense Logistics Agency (pending).

Centers/Institutes involved in this project: Ames Laboratory (Materials Preparation Center, Facilities Machine Shop)

Progress report (300 word maximum, please focus on results in non-technical terms and commercialization progress):

Task 1: A prototype CC-HPGA system with copper skull melting crucible and composite refractory superheat tundish will be designed and fabricated. Following an extended period of detailed system design, a complete set of engineering drawings was completed. An initial design decision was made to construct the system as a module that attaches to the lower spray chamber and powder collection system of the existing industrial prototype gas atomization system that is located in rm. 141, Applied Science Center II. Also, the enhanced power level of the new induction melting power supply in 141 ASCII will be utilized to supply the cold wall melting crucible. Moreover, the prototype Ti melting chamber and atomization module has been built on the base of three existing chamber components that were sequestered for the use from Ames Lab equipment. At this time, all new ports and fittings have been completed, an additional chamber adapter section was finished, and the vacuum capability of the full shell of the module is ready to be tested, after fabrication and assembly of the hanging structure. Several vendors for the copper cold wall crucible melt system were identified and have been contacted and the purchasing process has been initiated. It should be noted that the lead time for delivery of this special melting capability averages about 6 months after the order is placed. Also, the current funds in our project probably need to be supplemented by more than $75,000 to complete this purchase. As you can see, at least one major additional proposal has been filed for this purpose and one smaller supplemental funding proposal is planned (in June) for ISURF support. The Advanced Plasma Spray Laboratory on site at Ames Laboratory will fabricate the composite superheat crucibles and pour tubes that are required. These patented composite superheat crucibles were tested successfully at the University of Birmingham, UK, in July 2008 under an IPRT (ISURF funded) project.

Task 2: The completed prototype CC-HPGA system will be tested for its ability to produce metal injection molding (MIM) quality powder from a Ti alloy. Completion of this task awaits the first trial of the full Ti prototype CC-HPGA system, estimated for January 2010.

Task 3: The yield of the prototype CC-HPGA system for high quality titanium alloy powders will be compared to other commercial powders (derived from samples, available data, and informed estimates) in terms of purity and the portion (wt.%) of each batch that is suitable for powder injection molding (dia.<45μm). Several samples of commercial Ti powders have been obtained, as well as chemical analysis data and some information for estimating yield of PIM grade powder for these sources.

INTERIM REPORT
Title: A Novel and Cost-Effective H_2S Absorption Technology Using Tire Derived Rubber Particles
PI: Timothy Ellis
Company Partners (company names only): Envirotech Systems, Inc.
Project Goal: Development of a new hydrogen sulfide absorption process to clean biogas using tire derived rubber particles.

Invention disclosures: TDRP is patented by Envirotech Systems Incorporated (EnviroESI)

External funding applied for (indicate received/denied/pending): Funding received from EnviroESI (Project Acct. No. 400-20-59)

Progress report (300 word maximum, please focus on results in non-technical terms and commercialization progress):

Research is progressing successfully towards understanding and applying tire derived rubber particles (TDRP) as a hydrogen sulfide scrubbing medium. Major objectives of the study include demonstrating successful and efficient removal of hydrogen sulfide from biogas using TDRP, optimizing operating conditions for TDRP performance, gaining a better understanding of the mechanism for TDRP function, and performing a comparison of the effectiveness and marketability of TDRP versus competitive technologies; iron sponge and/or activated carbon.

An experimental apparatus was designed and constructed that allows for safe and detailed study of the scrubbing efficiency of TDRP (Figure 1). The system consists of a scrubber housing with appropriate valving and monitoring sensors. This system was installed at the Ames Water Pollution Control Facility (WPC), and the effectiveness of TDRP is tested using digester biogas generated at the facility.

As of May 31, 2009, 15 trial runs at the Ames WPC were completed providing a wealth of critical information necessary to application of TDRP as a hydrogen sulfide scrubber media. Tests have shown that hydrogen sulfide can be reduced from 400 ppm to below 10 ppm (>95% removal) consistently when using TDRP. Important observations include:

- Gas contact time with the media was varied between 30 and 90 seconds
- The biogas temperature varied between 70 and 82°F
- The scrubber adsorbed between 1.0 and 2.5 mg-H_2S per gram TDRP media
- Pressure drop across the media was within reasonable limits for a potential scrubber application

Knowledge about the removal mechanism is needed to improve TDRP effectiveness. The removal mechanism is being tested, and a number of tests have been completed. Results show, a smaller TDRP grain size is desirable, and the smaller grain size is not prohibitive to practical scrubber operation. Second, no specific surface groups have been identified on TDRP suggesting no limitations to use of specific waste tires or rubber products.

INTERIM REPORT
Title: Waste Plastics, Crude Oil Sludge, and Tar Sand to Diesel – Capturing Energy from Waste
PI: Atul G. Kelkar
Company Partners (company names only): Innovative Energy Solutions, Inc., Ames, IA 50014
Project Goal: To conduct research related to thermo-catalytic conversion of Waste Hydrocarbons to useful fuels. Specific goal of this GIVF project is to enhance and fine-tune the proof-of-concept technology developed by IES for converting waste hydrocarbons to high grade fuel by investigating various catalyst and process parameters.

Publications/presentations based on project:

- Presentation to Iowa Business Plan Competition, Sept 2008.
- Presentation to AGAS International, Bahrain, March 2009.
- Presentation to Hyvee Corporate Office, West Des Moines, IA, Oct 2008.
- Presentation at Iowa Cleantech Venture Capital and Entrepreneur Event, August 2008.

Awards received: IES has been selected to be semi-finalist in 2009 Iowa Business Plan Competition.

External funding applied for (indicate received/denied/pending):

- Agency: EPA, Title: Waste Hydrocarbons to Fuel Technology – Capturing Energy from Waste – Denied
- Agency – Iowa Power Fund, Title: Harnessing energy from waste hydrocarbons, in preparation.
- Preparing proposal for Iowa Power Fund as well as DOE

Progress report (300 word maximum, please focus on results in non-technical terms and commercialization progress):
The accomplishment to date on the project are:
1. The state-of-the-art in the field was examined to determine issues associated with conversion of various types of plastic feedstocks and possible remedy to overcome those problems. These issues primarily included high temperatures needed in cracking of various plastics and generation of wax in handling of the PET.

2. Based on the data given by IES from their proof-of-concept trials a new set of catalyst compositions and trial matrix has been developed for various feedstocks.

3. Several trials were conducted on two types of feedstocks – refinery residue and different types of plastics. The trials were largely successful. In most of the cases, the yield of 70-75% of diesel was obtained. The flash point of diesel needs to be improved and proper catalyst combination needs to be determined for different composition of plastic waste.

4. For conducting further trials according to the designed testing procedure a modification is needed to the front end of the equipment. ISU provided list of their needs to IES. IES engineers have designed the modification needed to the front end. IES will build and install the new components into the pilot facility by the end of Summer 09.

INTERIM REPORT
Title: Catalytic Production of 1,6-Hexanediol
PIs: Dr. Victor Lin
Company Partners (company names only): Grain Processing Corporation
Project Goal: The proposed technology involves conversion of either sorbitol or fructose-derived hydroxymethyl furfural to 1,6-hexanediol (HDO), a chemical precursor to a polymer commonly used by industry. This work represents an opportunity to develop new, lower cost processes that utilize renewable carbohydrate-based feedstocks while lessening reliance on fossil fuels and environmentally hazardous chemicals such as benzene. The proposed reduction is a moderate temperature, *catalytic* process that has low overall fuel and power demands for the production of HDO relative to traditional routes involving the reduction of adipic acid and its esters.

Centers/Institutes involved in this project: IPRT Center for Catalysis

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Progress report (300 word maximum, please focus on results in non-technical terms and commercialization progress):

We have successfully synthesized a rhodium nanoparticle-encapsulated mesoporous silica (Rh-MS) material. This material exhibits a MCM-41 type of mesoporous structure with Rh nanoparticles (average particle diameter of 5 nm) embedded inside the pores. We have evaluated the feasibility of using this novel nanocomposite material as a heterogeneous catalyst for the hydrogenation of both sorbitol and fructose-derived hydroxymethyl furfural.

This Rh-MS catalyst is a substantial improvement over those other conventional catalysts because this technology enables the use of five-carbon sugars for production of the value-added HDO compound. This technology will be valuable in processing the mixed stream of five-carbon sugars derived from the breakdown of hemicellulose.

While we are making good progress in developing the proposed solid catalyst technology, our industrial partner, Grain Processing Corporation (GPC), has decided to change their original commitment. The entire R&D budget of GPC has been terminated because of the bad economy. This unfortunate decision of GPC has changed the nature of our partnership in this project. The progress of commercializing is consequently affected. As we proceed to the next period of investigation, we would need to develop alternative strategy for the potential scale-up and commercialization of this technology.

INTERIM REPORT
Title: Protein Polymer Product Development
PI: David Grewell,
Company Partners (company names only): Creative Composites**,** Pella Corporation**,** Soy Works Corporation**,** Vermeer Corporation
Project Goal: The main thrust of the proposed work is to cooperate with several industrial partners to develop and commercialize novel biobased products that impact Iowa's economy. These products will include hay bale wrapping, pots for plants, dry wall application, construction panels, lubrication sticks and temporary cards.

Publications/presentations based on project:

- G. Srinivashan, D. Grewell, Investigation of Processability of Zein Based Plastics and Composites, *67th Annual Technical Conference for the Society of Plastic Engineers Proceedings* (2009), Society of Plastic Engineers, Brookfield, CT
- D. Grewell, The Technology of Bioplastics, Bioplastic Container Cropping Systems Conference, Iowa State University, January 2009
- D. Grewell, M. Vlad, G. Srinivasan, Investigation of Processability of Protein Based Plastics and Composites, Presentation at 25th Annual Meeting of The Polymer Processing Society, Goa, India 2009, Invited Lecture
- D. Grewell, The Technology of Bioplastics and Applications, Engineers for a Sustainable World meeting, ISU, January, 2009

External funding applied for (indicate received/denied/pending):

- $60,000 Grant to United Soy Bean Board (Pending)
- $980,000 Grant to ARI-R² - NSF ISU Internal Pre-proposal, ISU
- $1,508,998 Grant to USDA, Bioplastic Container Cropping Systems: Green Technology for the Green Industry (Pending)

Centers/Institutes involved in this project:
Center for Crops Utilization Research (CCUR)
Institute for Combinatorial Discovery
NSF International Materials Institute: Combinatorial Sciences and Materials Informatics Collaboratory (CoSMIC-IMI)

Progress report (300 word maximum, please focus on results in non-technical terms and commercialization progress):

Two products are currently being tested by the industrial sponsors; soy protein plastic pellets by SoyWorks and soy based lubrication sticks by Creative Composites. In more detail, we have worked with SoyWorks to develop a soy plastic formulation and pellet geometry to match their product specifications. This involved indentifying proper mixing sequence, material ratio and design, and fabrication of an extrusion die. To date, nearly 500 pounds of soy protein based plastic were supplied to SoyWorks.

In addition, we have worked with Creative Composites in developing a soy reinforced lubrication stick that is soy based grease. In more detail, we have worked with Creative Composites to develop a soy oil and flour based formulation stick that had the mechanical strength meeting and exceeding the product based strength

requirements. Soy flour was selected as the resin feed stock, in order to assure that costs specifications were not exceeded. Secondly, we developed alternative formulations and mixing procedure to produce a product that met water stability specifications. Lastly, we developed and fabricated a combined friction and wear rate test cell for product testing and performance estimation. Initially the test showed excessive wear rates and low coefficient of friction. Based on these results, the formulations were modified and the current product meets or excides the specification of a low wear rate and coefficient of friction besides other product specifications. Recently, Creative Composites tested full sized lubrication sticks based on one of the above mentioned soy oil formulations on rail systems. These tests were reported as "had a positive field test".

(Appendix 2)
FULL REPORT

IOWA STATE UNIVERSITY

BATTELLE UPDATE: JANUARY 01, 2009 – JUNE 30, 2009

Platform	Expenditures	Total Allocation	Project Allocation	Project Obligated	Infrastructure Allocation	Infrastructure Obligation
Advanced Food & Feed	$ 166,830.88	$ 856,334	$ 507,572	$ 348,762	$ -	$ -
Advanced Manufacturing	$ -	$ 100,000	$100,000	$ -	$ -	$ -
Animal Systems	$ 589,852.60	$ 626,000	$ 579,000	$ -	$ 47,000	$ -
Bioeconomy	$1,734,027.38	$ 2,328,196	$ 1,054,666	$ -	$ 1,273,530	$ -
Biosecurity	$ 609,195.34	$ 793,470	$ 450,000	$ -	$ 343,470	$ -
Information Technology	$ 771,903.69	$ 1,718,800	$ 650,000	$ -	$ 1,068,800	$ -
Total	**$**	**$ 6,410,000**	**$ 3,690,000**	**$ 348,762**	**$ 2,720,000**	**$ -**

BATTELLE FUNDING: PROGRESS REPORT

Update Period: January 01, 2008 – June 30, 2008
Purpose: Endowed Chairs
Purpose Funding: $2,000,000
Purpose Expenditures: $2,000,000

Progress Report:
The fund raising for the four endowed chairs is complete. All chairs have been established/named. The status of each chair follows:

1) The previously reported W. Eugene Lloyd Chair in Toxicology in the College of Veterinary Medicine has been awarded to Dr. Peter Nara. Dr. Peter Nara is currently co-founder, president and CEO of Biological Mimetics, Inc., a Maryland-based company that commercializes pharmaceutical products. Nara is also a former section chief of the Vaccine Resistant Diseases section at the National Cancer Institute, U.S. National Institutes of Health, in Washington, D.C.

2) In July 2008, the College of Veterinary Medicine received a $1 million pledge from a donor who has requested anonymity to establish the Anderson Chair in Veterinary Medicine. Dr. Jesse Goff has been hired for this position. Dr. Goff is an entrepreneur with involvement in two Ames start-up companies.

3) In December 2007, $500,000 was committed to match a $1 million gift from the estate of Charles Schafer to establish the Charles Schafer Chair in Biorenewable Energy Science and Technology in the College of Engineering. Unfortunately, the negotiations were not successful with the identified candidate and we are pursuing other options.

4) The fourth Battelle chair has been established as the Kriby Gray Chair in Engineering. The first identified candidate did not accept the position and we are pursuing other options.

BATTELLE FUNDING: PROGRESS REPORT

Update Period:	January 01, 2009 – June 30, 2009
Title:	Large Animal Genomics Models for Animal and Human Health
Platform:	Animal Systems
Platform Chair:	Max F. Rothschild
Platform Expenditures:	$589,852.60
Platform Funding:	$626,000
Project Allocated:	$579,000
Project Obligated:	$ -
Inf. Allocated:	$47,000
Inf. Obligated:	$ -

PROJECT 1 (Rothschild)

Publications/presentations based on project:

- Onteru, S.K., B. Fan, B. Mote, T. Serenius, M. Nikkilae, K. J. Stalder , M.F. Rothschild. SNP discovery in genes affecting leg health traits in pigs. 2007. Proc. International Symposium on Animal genomics for Animal Health, Paris, France, Oct. 23-25.
- B. Fan., Onteru, S. K., B. Mote, T. Serenius, M. Nikkilae, K. J. Stalder, M. F. Rothschild. 2008. Association Of Genes Affecting Skeletal Design And Feet And Leg Soundness In Pigs. Plant and Animal Genome XVI Conference, San Diego, California, Jan. 12-16. (accepted)
- Onteru, S. K., B. Fan, B. Mote, T. Serenius, M. Nikkilae, K. J. Stalder, M. F. Rothschild. 2008. Association of candidate genes to leg and body conformation traits in pigs. ASAS/ADSA Midwest Meeting, Des Moines, IA, Mar. 17-19. (submitted)
- Onteru, S. K., B. Fan, B. Mote, T. Serenius, M. Nikkilae, K. J. Stalder, M. F. Rothschild. 2008. Determination of genes associated with leg and body conformation traits in pigs. Animal Industry Reports (submitted)
- Onteru, S.K., B. Fan, M.F. Rothschild. 2008. SNP detection and comparative linkage mapping of 66 bone-related genes in the pig. Cytogenetic and Genome Research (accepted).
- Fan, B., S. K. Onteru, B. Mote, T. Serenius, M. Nikkilae, K. J. Stalder, M. F. Rothschild. 2008. Association of gene markers affecting the principal components of skeletal design and feet and leg soundness in pigs. Proceedings Joint ADSA-ASAS annual meeting, Indianapolis, Indiana, July 7-11.
- Onteru, S. K., B. Fan, B. Mote, T. Serenius, M. Nikkilae, K. J. Stalder, M. F. Rothschild. 2008. Association of candidate genes to leg and body conformation traits in pigs. Proceedings ASAS/ADSA Midwest Meeting, Des Moines, IA, Mar. 17-19.
- Fan, B., S. K. Onteru, B. Mote, T. Serenius, M. Nikkilae, K. J. Stalder, M. F. Rothschild. 2008. Association of genes affecting skeletal design and feet and leg soundness in pigs. Proceedings Plant and Animal Genome XVI Conference, San Diego, California, Jan. 12-16.
- Onteru, S.K., B. Mote, T. Serenius, M. Nikkilae, K. J. Stalder, M.F. Rothschild. SNP discovery in genes affecting leg health traits in pigs. 2007. Proceedings, International Symposium on Animal genomics for Animal Health, Paris, France, Oct. 23-25.
- Guo,Y.M., H.S. Ai, J. Ren, G.J. Wang, Y. Wen, H.R. Mao, L.T. Lan, J.W. Ma, B. Brenig, M.F. Rothschild, C.S. Haley, and L.S. Huang. 2009. A whole genome scan for quantitative trait loci for leg weakness and its related traits in a large F2 intercross population between White Duroc and Erhualian. J. Anim. Sci. 87:1569-1575.
- Onteru, S.K., B. Fan, M.F. Rothschild. 2008. SNP detection and comparative linkage mapping of 66 bone-related genes in the pig. Cytogenet. Genome Res. 122:122-131.

- Fan, B., S. K. Onteru, B. Mote, T. Serenius, K. J. Stalder, M. F. Rothschild. 2008. Large-scale association study for structural soundness and leg locomotion traits in the pig. Genetic Selection and Evolution 41:14.

External funding applied for (indicate received/denied/pending):

Association of genetic markers with structural soundness and sow longevity (M Rothschild, K Stalder)	National Pork Board	$86,000
Association of genetic markers with structural soundness and sow longevity year 2 (M Rothschild, K Stalder)	National Pork Board	$118,669

$100,000 received National Pork Board Large scale SNP association analyses of feed efficiency and longevity

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Progress Report (300 word maximum):

This grant uses the pig as an animal model to predict bone disorder predisposition in pigs and humans. In this work, 214 genes affecting skeletal development and mineral metabolism were chosen and a total 435 SNPs were detected in 146 genes and these SNPs were deposited to dbSNP of NCBI (Accession numbers: ss86352080-ss86352515). Five Sequenom's genotyping multiplexes were developed involving 172 SNPs. We excluded SNPs with no calls, monomorphism, mistaken inheritance, MAF less than 5% and a call rate less than 85%, 119 SNPs from 95 genes were successfully genotyped for 2066 commercial pigs which were scored for 17 traits describing various leg and feet and conformation conditions. Association analyses between SNPs and individual scoring traits, and principal components (PCs) were completed using SAS package. A number of genes were found to be significantly associated with the various leg traits. Planning of *in vitro* functional studies on bone marrow culture system is being conducted for important genes.

A second grant was received from the National Pork Board to do much larger scale association work, called whole genome association analyses. To do this, the Illumina Porcine Bead Chip with over 50,000 SNPs is being used. Genotypes were taken on a total of 800 animals and the analyses of these are now underway. SNP quality appears to be good and we are reviewing genotypes. It is hoped this will help point to gene pathways affecting bone health in pigs and humans. Analyses will be conducted to examine associations. Funding for the project has now been completed.

Platform leader Rothschild has met with new groups concerning expanded commercial activities in Iowa and two companies are starting up.

PROJECT 2 (Ellinwood)

Publications/presentations based on use of infrastructure:

- Presented at the 10th International Symposium on Mucopolysaccharide and Related Diseases: Intrathecal and Intravenous rhIDU treatment of MPS I dogs from birth
- A recombinant N-acetyl-alpha-D-glucosaminidase (Naglu)-Apolipoprotein E ligand domain fusion: Paradoxically similar cellular internalization proplerties to native Naglu
- Delivery of a recombinant Naglu fusion enzyme to the central nervous system after a systemic AAV2-8 vector injection in the MPS I IIIB mouse model
- Presented at the 4th International Conference: Advances in canine and feline genomics and inherited diseases
- Canine Facto VII deficiency: Propagation of inadvertent inherited genetic diseases within canine research breeding colonies.
- Atypical transitory congenital hypothyroidism in a feline colony

- Rothschild MF, Van Cleave PS, Glenn KL, Carlstrom LP, Ellinwood NM. Association of MITF with white spotting in Beagle crosses and Newfoundland dogs. Anim Genet. 2006. 37: 606-607.
- Ellinwood NM, Colle MA, Weil MA, Casal ML, Vite CH, Wiemelt S, Hasson CW, O'Malley TM, He XX, Prociuk U, Verot L, Melniczek JR, Lannon A, Aguirre GD, Knox VW, Evans SM, Vanier MT, Schuchman EH, Walkley SU, Haskins ME. Bone marrow transplantation for feline mucopolysaccharidosis. Mol Genet Metab. 2007. 91: 239-250.
- Lhériteau E, Libeau L, Stieger K, Deschamps JY, Mendes-Madeira A, Provost N, Lemoine F, Mellersh C, Ellinwood NM, Cherel Y, Moullier P, Rolling F. The RPGRIP1-deficient dog, a promising canine model for gene therapy. Mol Vis. 2009. 15. 349-361.
- Ellinwood NM, Clay CM. Large Animal Models of Genetic Disease: Pertinent IACUC Issues. ILAR Journal. 2009. 2: 225-228.
- Carlstrom LP, Jens JK, Dobyns ME, Passage M, Dickson PI, Ellinwood NM. Inadvertent Propagation of Factor VII Deficiency in a Canine Mucopolysaccharidosis Type I Research Breeding Colony. Comp Med. In Press.
- NM Ellinwood. Preclinical Evaluation of CNS- Directed AAV Using the MPS III B Canine Model. NIH hosted workshop: Towards Clinical Progress in the Mucopolysaccharidoses Washington, D.C., March 7–8, 2007
- N. Matthew Ellinwood, Karen L. Kline, Marie-Anne Colle, Elizabeth M. Snella, Jackie K. Jens, Song Lui, Yan Cherel, Jean Michel Heard. Intracerebral Delivery of AAV-2/5 Vectors To Treat Canine MPS IIIB. American Society of Gene Therapy. 10th Annual Meeting. May 30th – June 3rd, 2007
- Rafi Awedikian, E.M. Snella, B.J. Spencer, I.M. Verma, and N.M. Ellinwood. Active Enzyme Fusions For Therapeutic Targeting Of The Central Nervous System Via The Peripheral Circulation In Mucopolysaccharidosis Type IIIB. MPS IIIB. American Society of Gene Therapy. 10th Annual Meeting. May 30th – June 3rd, 2007
- Karen L. Kline. Preliminary Clinical Neurologic, Cardiac, Ophthalmologic and MRI Findings in Mucopolysaccharidosis Type IIIB (MPS IIIB) Dogs. American College of Veterinary Internal Medice, 25th Annual Meeting, Seattle Washington, June 6-10.

Invention disclosures utilizing infrastructure purchases:A provisional patent application filed April 23, 2008, with the US Patent and Trademark Office (PHOSPHORYLATED RECOMBINANT N-ACETYL-alpha-D-GLUCOSAMINIDASE (NaGlu) AND USES THEREOF)

External funding applied for utilizing infrastructure purchases (indicate received/denied/pending):

Short-term Investigation Of Gene Therapy For MPS IIIB Using The Canine Model Institut Pasteur, Paris, France	N. Matthew Ellinwood	PI	2006-2008	$66,420
Intrathecal Enzyme Therapy For Mucopolysaccharidosis I NIH, National Institute of Neurology and Stroke, as a subcontract (R01 HL085107)	P. I. Dickson	PI of Subcontract from Harbor-UCLA Medical School	2006-20011	$621,139 (Total Sub)
Treatment of Leukocyte Adhesion Deficiency By Foamy Virus Vectors NIH, National Institute Heart Lung and Blood, as a subcontract (R01 HL085107)	D. Russell	PI of Subcontract from University of Washington Medical School	2006-2008	$50,000 (Total Sub)
Evaluation of Multiple Intrathecal Administrations of rhIDUA to MPS I Affected Cats	N. Matthew Ellinwood	PI	2006-2008	$21,680

BioMarin Pharmaceuticals				
Support For Research On MPS IIIB and IIIC Sanfilippo Children's Research Foundation	N. Matthew Ellinwood	PI	2006-2007	140,000
Pathogenesis of Murine MPS IIIB Lysosomal Storage Disorder Research Consortium	N. Matthew Ellinwood	PI	2007-2008	$25,000

Progress Report (350 word maximum):
Work supported aims to develop biomedical research in 1) neurologic and 2) ophthalmologic diseases which capitalize on ISU strengths in large animal biomedical models. Substantial progress was made at the research or grantsmanship level. A review of specific goals follows:
Neurologic Conditions Achievements
1. Develop an enzyme fusion capable of crossing the blood brain barrier. Work continues on this project which has yeiled a patent application for the recombinant fusion protein which will likely generate interest from specific biopharmaceutical company for the production of a therapeutic product to treat MPS IIIB.
2. Further characterize and maintain a feline congenital glaucoma model. This model continues to be maintained and used to characterize this spontaneous and unique model for one of the worlds leading causes of blindness. This model is the subject of an awarded grant to Dr Gill McLellan, Univ of WI.

In conclusion, this award has helped in the securing of ~$1,00,000 in direct competitive external grant funds. Additionally over 10 abstracts, invited presentations, and peer reviewed publications were generated. Finally one patent disclosure is proceeding, associated with work done as part of this platform grant.

PROJECT 3 (Greenlee)

Progress Report (350 word maximum):
Dr. Molly Murphy, the post-doc supported by these funds is continuing to collect data as the majority of animals that are intended for this study are at the National Animal Disease Center (a collaborator on this project) have been and are still at pre-clinical stages of disease.

We have begun to analyze some of the data gathered in the preclinical period. In addition, the first animals have begun to show some signs of disease, and we have begun tissue collection.

Data collected by Dr. Murphy will be used as preliminary data in a proposal to be submitted to NIH (Characterizing retinal pathology associated with transmissible spongiform encephalopathies). Target submission date has gain been delayed (now target is February 2010), as will need to include some data from clinically affected animals.

PROJECT 4 (Spurlock)
NO REPORT RECEIVED

INFRASTRUCTURE (Ellinwood)

Publications/presentations based on use of infrastructure:

- Presented at the 10th International Symposium on Mucopolysaccharide and Related Diseases:Intrathecal and Intravenous rhIDU treatment of MPS I dogs from birth
- A recombinant N-acetyl-alpha-D-glucosaminidase (Naglu)-Apolipoprotein E ligand domain fusion: **Paradoxically similar cellular internalization proplerties to native Naglu**
- **Delivery of a recombinant Naglu fusion enzyme to the central nervous system after a systemic AAV2-8 vector injection in the MPS I IIIB mouse model**
- **Presented at the 4th International Conference: Advances in canine and feline genomics and inherited diseases**
- **Canine Facto VII deficiency: Propagation of inadvertent inherited genetic diseases within canine research breeding colonies.**
- **Atypical transitory congenital hypothyroidism in a feline colony**
- **Lhériteau E, Libeau L, Stieger K, Deschamps JY, Mendes-Madeira A, Provost N, Lemoine F, Mellersh C, Ellinwood NM, Cherel Y, Moullier P, Rolling F. The RPGRIP1-deficient dog, a promising canine model for gene therapy. Mol Vis. 2009. 15. 349-361.**
- **Ellinwood NM, Clay CM. Large Animal Models of Genetic Disease: Pertinent IACUC Issues. ILAR Journal. 2009. 2: 225-228.**
- **Carlstrom LP, Jens JK, Dobyns ME, Passage M, Dickson PI, Ellinwood NM. Inadvertent Propagation of Factor VII Deficiency in a Canine Mucopolysaccharidosis Type I Research Breeding Colony. Comp Med. In Press.**

Invention disclosures utilizing infrastructure purchases:
A provisional patent application filed April 23, 2008, with the US Patent and Trademark Office (PHOSPHORYLATED RECOMBINANT N-ACETYL-alpha-D-GLUCOSAMINIDASE (NaGlu) AND USES THEREOF)

External funding applied for utilizing infrastructure purchases (indicate received/denied/pending):
The National MPS Society, "Development of Pharmacoperon Based Therapy fro the Treatment of MPS IIIIB", Letter of intent invited for full application. $60,000. Application denied.

CIAG - $8000

Progress Report (300 word maximum):
This infrastructure award was used to renovate large animals research/housing facilities in Kildee Hall. These facilities and the animals housed therein have been instrumental in securing over ~1,000,000 in extramural funding, one patent application, and over 10 publications, abstracts, or presentations since this award was made.

STARTUP FUNDS

Title: Genetics of Dairy Cattle – Start-up Funds
Principal Investigator(s): Diane Moody Spurlock

Publications/presentations based on use of infrastructure:

- Elkins, D., and Spurlock, D. M. 2009 Phosphorylation of perilipin is associated with indicators of lipolysis in Holstein cows. Hormone and Metabolic Research. In press.
- Elkins, D. and D. M. Spurlock. 2008. Adipose triglyceride lipase is a novel lipase in dairy cattle. Abstract, presented at American Dairy Science Association National Meeting, Indianapolis, IN. July, 2008.
- Elkins, H. Park, and D. M. Spurlock. 2008. Phosphorylation of perilipin is associated with lipolytic activity in dairy cows. Abstr. #90. Midwest ASAS/ADSA Annual Meeting. Des Moines, IA March, 2008.

- Elkins, D. and D. M. Spurlock. Phosphorylation of Perilipin is Associated with Indicators of Lipolysis in Holstein Cows. Journal of Dairy Science. Submitted.
- McDaneld, T.G. and D.M. Spurlock. Ankyrin repeat and SOCS box-containing protein (ASB) 15 alters differentiation of mouse C_2C_{12} myoblasts and phosphorylation of MAPK and Akt. Journal of Animal Science. In press.

Awards received related to infrastructure purchases:
Grad student competitive research paper presentation, 3rd place awarded to Ms. Dawn Elkins, M.S. student division

External funding applied for utilizing infrastructure purchases (indicate received/denied/pending):

- Genetic regulation and genomic selection of energy balance traits in dairy cattle. Received. USDA-NRI, March 1, 2008 – February 28, 2011. $446,972
- Integrated regulation of lipolysis by perilipin, adipose triglyceride lipase, and CGI-58 in dairy cows. Received. USDA-NRI, March 1, 2009-February 28, 2012. $334,926
- Data collection at the ISU Dairy. Submitted to Merial. Pending, $135,000

Progress Report (350 word maximum):
Funds have been used to establish a research program studying the genetic and physiological regulation of energy balance in dairy cattle. This program currently has two primary focus areas. (1) Genetic regulation and genomic selection of energy balance traits in dairy cattle. USDA-NRI funding has been awarded to evaluate genotypes from a panel of 50,000 of bovine single nucleotide polymorphisms (SNP) and determine associations with multiple traits relating to energy balance in lactating dairy cows. This is a collaborative project with the Scottish Agricultural Center (SAC). To date, genotypes have been determined for 300 animals representing the SAC population, and phenotypic data are currently being collected cows at the ISU Dairy. This project will evaluate genotypes and phenotypes from a total of 800 cows. (2) Integrated regulation of lipolysis by perilipin, adipose triglyceride lipase, and CGI-58 in dairy cows. We are studying the physiological regulation of energy balance by investigating novel proteins involved in regulating the mobilization of energy substrates from adipose tissue in lactating dairy cows. We have determined that the abundance of phosphorylated perilipin is correlated with indicators of lipolysis, and that the abundance of adipose triglyceride lipase is greater in cows in mid lactation compared to early lactation. Our continued investigation of these proteins will expand our understanding of the regulation of energy mobilization in response to negative energy balance in dairy cows. To date, this research has resulted in the presentation of two abstracts and a manuscript (in press), and is supported by funding from USDA-NRI.

BATTELLE FUNDING: PROGRESS REPORT

Update Period:	January 01, 2009 – June 30, 2009
Title:	Advanced Food & Feed: Advanced Carbohydrates for Health
Platform:	Advanced Food and Feed
Platform Expenditures:	$166,830.88
Platform Co-Chairs:	Ruth MacDonald
Platform Funding:	$856,334*
Project Allocated:	$507,572
Project Obligated:	$348,762**
Inf. Allocated:	$ -
Inf. Obligated:	$ -

*****In addition to the Battelle funds, $330,000 from ISU's FY07GIVF funding was used to support research projects associated with this platform.

****** This funding is reserved as a start-up package for the Director of the Nutrition & Wellness Research Center (to be hired)

PROJECT 1 – NWRC

Progress Report:
These funds were provided for salary support for staff of the Nutrition and Wellness Research Center. The funds have been used for that purpose. The NWRC is now staffed with a research project coordinator, an accountant, an office coordinator and a communications manager. In addition student workers are employed to assist with research projects. The search for a Director has begun and there is expectation that the Director will be in place within the next year.

PROJECT 2 (MacDonald)

Project Goal: To determine the role of dietary carbohydrates in reducing the symptoms of inflammatory bowel disease.

Progress report (300 word maximum):
Completed work includes three animal studies to examine the effects of dietary components on colon inflammatory responses. In this work, we have used a chemical induction model to mimic human inflammatory bowel disease in mice. Several dietary interventions were performed to characterize a protective response. We have analyzed colon samples from these experiments for cytokine expression using the Luminex system which provides 23 cytokine quantifications. From these data, we observed many were increased by the induction of inflammation and dietary intervention prevented the increase in a few. In the colon samples we have also quantified histological changes and COX-2 and B-catenin using Western immunoblot. The analysis of these parameters is ongoing. In current work, we are preparing to analyze the samples for TLR-4 and NFkB which are mediators of the inflammatory response. We have met with Dr. Eric Weaver from Proliant on several occasions throughout the work and sought his advice and input on the studies. In addition, a graduate student Huyani Jiang, hasa joined the project and her work is to develop the TLR-4 assay. From these studies we are gaining a better understanding of how dietary factors can impact the inflammatory response associated with inflammatory bowel disease with the goal of finding ways to reduce the systems of this disease in the human population.

STARTUP FUNDS (Spurlock)

NO REPORT RECEIVED

BATTELLE FUNDING: PROGRESS REPORT

Update Period:	January 01, 2009 – June 30, 2009
Title:	Thermochemical Technologies for the Bioeconomy
Platform:	BioEconomy
Platform Chair):	Robert Brown
Platform Expenditures:	$ 1,734,027.38
Platform Funding:	$ 2,164,666
Project Allocated:	$ 1,054,666
Project Obligated:	**$ -**
Inf. Allocated:	**$** 1,273,530
Inf. Obligated:	$ -

NOTE: The following report is a combined platform/infrastructure report.

Publications/presentations based on use of infrastructure:

- David C. Chipman, Young S. Do, Dong-Won Choi, Samuel T. Jones, Alan DiSpirito and Robert C. Brown. 2007. Syngas Fermentation Research Facility at Iowa State University. Biobased Industry Outlook Conference. Poster presentation.

- Zhu, H., Shanks, B.H., and Heindel, T.J., "Enhancing CO-Water Mass Transfer with MCM41 Nanoparticles and Electrolytes," To be presented at the AIChE 2008 Annual Meeting, November 16-21, 2008 Philadelphia, PA, Abstract #124029.
- Zhu, H., Shanks, B.H., and Heindel, T.J., "Enhancing CO-Water Mass Transfer by Functionalized MCM41 Nanoparticles," *Industrial & Engineering Chemistry Research*, In Review, 2008
- David C. Chipman, DongWon Choi, Samuel T. Jones, and Robert C. Brown., Optimization of PHA Production in *Rhodospirillum rubrum* Cultured on Carbon Monoxide from Synthesis Gas, 30th Symposium on Biotechnology for Fuels and Chemicals, *May 4-7, 2008, Astor Crown Plaza Hotel, New Orleans, LA* (Poster)
- Zhu, H., Shanks, B.H., and Heindel, T.J., "Enhancing CO-Water Mass Transfer by Functionalized MCM41 Nanoparticles," *Industrial & Engineering Chemistry Research*, 47(20) 7881-7887, 2008.
- Zhu, H., Shanks, B.H., and Heindel, T.J., "Enhancing CO-Water Mass Transfer with MCM41 Nanoparticles and Electrolytes," Poster presented at the AIChE 2008 Annual Meeting, November 16-21, 2008 Philadelphia, PA, Abstract #124029.
- Zhu, H., Shanks, B.H., and Heindel, T.J., "Effect of Electrolytes on CO-Water Mass Transfer," *Industrial & Engineering Chemistry Research*, 48(6) 3206-3210, 2009.
- Zhu, H., Shanks, B.H., Choi, W., and Heindel, T.J., "Effect of Functionalized MCM41 Nanoparticles on Syngas Fermentation," *Industrial & Engineering Chemistry Research*, In Review, Submitted for review on March 20, 2009.
- Chipman, D.C., D.-W. Choi, A.A. DiSpirito and R.C. Brown. 2009. Growth media optimization for polyhydroxyalkanoate and hydrogen coproduction from Rhodospirillum rubrum cultured on synthesis gas. 31st Sumposium on Biotechology for Fuels and Chemicals. San Francisco, CA.
- Choi, D., Chipman, D., Bents, S., Brown, R. (2008) A techno-economic analysis of polyhydroxyalkanoates and hydrogen production from syngas fermentation of gasified biomass, Applied Biochemistry and Biotechnology, published on-line: DOI10.1007/s12010-009-8560-9, February 7, 2009.
- Chipman, D., Choi, D., Jones, S., DiSpirito, A., Brown, R. (2008) Optimization Strategies for Fermentative PHA Production from Synthesis Gas, 2008 Biobased Industry Outlook Conference, Ames, IA, September 8-9.
- Chipman, D., Choi, D., Jones, S., Brown, R., DiSpirito, A. (2008) Hydrogen and Polyhydroxyalkanoate Production in Rhodospirillum rubrum Cultured on Carbon Monoxide from Synthesis Gas, 2008 Biobased Industry Outlook Conference, Ames, IA, September 8-9.
- Chipman, D., Choi, D., Jones, S., Brown, R. (2008) Optimization of PHA Production in Rhodospirillum rubrum Cultured on Carbon Monoxide from Synthesis Gas, 30th Symposium on Biotechnology for Fuels and Chemicals, New Orleans, LA, May 3-7, 2008.
- Williams, R. C., Satrio, J., Brown, R. C., McCready, N., and Shropshire, R. (2008) Utilization of Bio-Oil Fractions as an Anti-Oxidant Asphalt Additive, China I-Bio Conference.
- Patwardhan P. R.; Satrio J. A.; Shanks B. H.; Brown R. C. (2008) Product Distribution from Fast Pyrolysis of Biomass, Iowa Academy of Science 120th Annual Meeting, Kirkwood College, Cedar Rapids, Iowa, April 12.
- Rover, M., Brown, R.C., (2008) Characterization of Pyrolytic Oil Collected in Fractions, Iowa Academy of Science, Cedar Rapids, Iowa, April 12.
- P. Ortiz-Toral, J. A.Satrio, R. C. Brown, B. H. Shanks. Steam reforming of bio-oil: Effect of bio-oil composition and stability, AIChE Annual Meeting, Philadelphia, PA, November, 2008.
- Patwardhan P. R.; Satrio J. A.; Shanks B. H.; Brown R. C.; Product Distribution from Fast Pyrolysis of Polysaccharides, AIChE Annual Meeting, Philadelphia, PA, November, 2008.
- P. Ortiz-Toral, J. A.Satrio, R. C. Brown, B. H. Shanks (2008) Hydrogen by Steam Reforming of Bio-oil, ISU GMAP Research Symposium, Ames, IA.
- Hernández-Cintrón, J., Patwardhan, P., Satrio, J., Shanks, B., Brown, R. (2008) Effect of Biomass Composition on Products Yield Speciation in Fast Pyrolysis, American Institute of Chemical Engineers Conference, Philadelphia, Pennsylvania, November 17-21.
- Brewer, C., Treviño, H., Satrio, J., Brown, R. (2008) Engineering Biochar: Characterization of Chars from Three Thermochemical Processes, 2008 Growing the Bioeconomy Conference, Ames, IA, September 8-9, 2008.

- Kasparbauer, R., Brown, R., Jones, S., Satrio, J. (2008) Bench Scale Fast Pyrolysis. Biobased Industry Outlook Conference, Ames, Iowa, USA. September 8-9, 2008.
- Brown, J.N., Brown, R.C., Jones, S.T.; Satrio, J.A.B. (2008) Development and Demonstration of a Lab-Scale Auger Reactor for Bio-Oil Production, 2008 Biobased Industry Outlook Conference, Ames, Iowa, September 8-9, 2008.
- D. Wissmiller, T. Meyer, and R. C. Brown (2008) Characterization of Bio-Crude Oil Combustion Emissions, Biobased Industry Outlook Conference, Ames, IA, September 8-9.
- Patwardhan P. R.; Satrio J. A.; Shanks B. H.; Brown R. C.(2008) Product Distribution from Fast Pyrolysis of Carbohydrates, Biobased Industry Outlook conference Ames, IA, September 8-9.
- Brown, R. C., Ellens, C., Jones, S., Satrio., J. (2008) Fast Pyrolysis of Cornstover Biomass in a Free-fall Reactor, 2008 Biobased Industry Outlook Conference, Ames, Iowa, September 8-9.
- Rover, M., Brown, R.C., Satrio, J., (2008), Comparison of Biomass and Pyrolytic Oils, Biobased Industry Outlook Conference, Ames, Iowa, September 8-9.
- Two presentations at the American Oil Chemists' Society. One on the separation of saturated esters from high-oleic soybean oil converted to butyl or *iso*-propyl esters. One on the products of the surface oxidation of methyl linoleate spread as a monolayer on silica gel.
- Miao, S. and Shanks, B.H., "Esterification of Biomass Pyrolysis Model Acids over Sulfonic Acid-Functionalized Mesoporous Silicas," *Appl. Catal. A: Gen.,* **359**, 113-120 (2009).
- B.H. Shanks, "Thermochemical Conversion of Biomass to Fuels via a Fast Pyrolysis-Based Route" Unversity of Puerto Rico - Mayaguez, Mayaguez, PR, February, 2009.
- N. Lohitharn, S. Miao and B.H. Shanks (presenter), "Upgrading of Bio-oil via Acid Removal: Effect of Various Alcohols and Aldehydes on Esterification of Acetic Acid," 21st North American Catalysis Society Meeting, San Francisco, CA, June, 2009.

Invention disclosures utilizing infrastructure purchases:
IPDR entitled "Ethanol production by combined fermentation and chemical synthesis." was filed with ISURF.

External funding applied for utilizing infrastructure purchases (indicate received/denied/pending):
- Funding received: Conoco-Philips. $150,000 (3/07-12/07)
- Funding received: Conoco-Phillips and ADM $200,000 (1/08-12/08)
- Funding received: Annotation of novel enzymatic functions in methanogens : Amount: $1.25M
  Funding Agency: DOE-GTL : Dates: October, 2007-October, 2010
- Funding pending: CPBR
- Funding Received: Department of Energy under award number: DE-FG36-07Go87003.
- Funding Received: Project Title: Fast Pyrolysis Process Development Unit for Validating Bench Scale Data
  Duration: October 2007- September 30, 2008)
  Amount of funds awarded by DOE: $500,000
  Cost share from ISU: $125, 132
- Funding received: Catalytic Upgrading of Bio-Oil, ConocoPhillips, $162,974 (5/07-12/08)
- Funding Received: Condensed Phase Catalysis with Bio-Oil Species, ConocoPhillips, $70,000 (1/08-12/08)
- Title of project: Engineering Research Center on Biorenewable Chemicals
  Funding Agency: National Science Foundation
  Date submitted: December, 2007
  Status: Pending
- Department of Energy under award number: DE-FG36-07Go87003.
  Project Title: Fast Pyrolysis Process Development Unit for Validating Bench Scale Data
  PI: Robert C. Brown
  Status: received
  Duration: October 2007- September 30, 2008)
  Amount of funds awarded by DOE: $500,000
  Cost share from ISU: $125, 132

- "A Systems Approach to Bio-Oil Stabilization," Department of Energy, $1,500,000 (10/08-9/10) - pending
- Equipment Donation, Parr Instruments, $29,000
- ConocoPhillips Company, Project Title: Extractive Dilution and Gas Analysis of Gasification, PI: Robert Brown, Status: Completed, Duration: January 2008 – December 2008, Amount of funds awarded by ConocoPhillips Company: $200,000
- ConocoPhillips Company, Project Title: Mass Spectrometry Analysis of Gasification Streams for Syngas to Synfuels Projects, PI: Robert Brown, Status: Received, Duration: January 2009 – December 2010, Amount of funds awarded by ConocoPhillips Company: $148,000
- COP & ADM - $200,000 (2009)
- Project Title: Fast Pyrolysis Process Development Unit for Validating Bench Scale Data, PI: Robert C. Brown, Status: received , Duration: October 2007- September 30, 2009, Amount of funds awarded by DOE: $500,000, Cost share from ISU: $125, 132
- Project Title: Systems Approach to Bio-oil Stability, PI: Robert C. Brown, Status: received, Duration: January 2009 – December 2010, Amount of funds awarded by DOE: $1,500,000, Cost share from ConocoPhillips Company: $600,000
- Project Title: Controlling Biomass Properties for Optimizing Fast Pyrolysis Products, PI: Robert Brown, Status: received, Duration: October 2008 – December 2009, Amount of funds awarded by ConocoPhillips Company: $250,000
- "A Systems Approach to Bio-Oil Stabilization," Department of Energy, $1,500,000 (10/08-9/10) – received.
- "Catalytic Upgrading of Bio-Oil, ConocoPhillips/ADM, $98,000 (1/09-12/09) – received
- "Condensed Phase Catalysis with Bio-Oil Species, ConocoPhillips, $145,000 (1/08-12/09) - received
- "EFRI-HyBi Preliminary Proposal: Consolidated thermal pathway to advanced biofuels," National Science Foundation, $2,000,000 (5/09-4/13) - pending

Infrastructure Purchased During this Reporting Period:

- Multiple Reactor System

Infrastructure Purchases made previously:

- Pyrolyzer Fabrication (partially complete)
- Mercury Porosimeter
- MicroGC
- Plumbing & Flow Control System
- Spectrophotometer
- Fermentation System
- Room Modification
- Electrical Modification
- High Pressure Pumps, Filtration System, and HPLC

RESEARCH PROJECTS

Task 1: Thermochemical Products: Syngas production and clean-up

Task Objective:

The objective of this task is to produce syngas with properties suitable for catalytic or biocatalytic upgrading to fuels and bioproducts.

Summary of Progress to Date:

A ThermoStar mass spectrometer was purchased from Pfeiffer Vacuum and installed to analyze producer/syngas contamination levels. The mass spectrometer instrument was calibrated with the following matrix of gases for quantitative analysis: Hydrogen Sulfide, Hydrogen Chloride, Ammonia, Sulfur Dioxide, Methane, Carbon Dioxide, Carbon Monoxide, Hydrogen, Nitrogen, Ethylene, and Ethane. This matrix

contains the primary constituents of the producer/syngas gas stream after the water and organic tars were removed.

Equipment purchases and upgrades to the gasifier using Battelle funding allowed for work to be completed during the last reporting period to understand the relationship between biomass alkali concentrations and carbon conversion during the gasification process. Results of said work will be published in a graduate student thesis later this summer and submitted to a peer reviewed journal.

Task 2. Thermochemical Products: Enhancing gas-liquid mass transfer

Progress Report (300 word maximum):
The biologically mediated water-gas shift reaction using *R.rubrum* was enhanced by the introduction of MCM41 nanoparticles with or without functional mercaptopropyl groups. These results complement previous studies and suggest that the increased H_2 yield was due to enhanced CO-water mass transfer.

Task 3: Syngas fermentation pilot facility

Progress Report (300 word maximum):
Experiments this year have completed our studies to optimize growth and fermentation condition for *Rhotospirllum rubrum* for hydrogen and polyhydroxyalkanoate (PHA) during growth on syngas. Limiting nitrogen concentrations in the growth media was shown to increase the yield of PHA by approximately 400% with no effect on hydrogen production.

Task 4: Thermochemical Products: Ethanol production by combined fermentation and chemical synthesis

Progress Report (350 word maximum):

The goal of this task is to examine an alternative route to ethanol production that avoids the high energy and water costs of distillation. We previously engineered *E. coli* to produce acetaldehyde plus hydrogen. These compounds can be converted to ethanol bypassing distillation. During this reporting period we continued work on increasing the yield of acetaldehyde and hydrogen which are currently produced at about 500 μM and 84 μM, respectively.

Task 5 - Thermochemical Products: Establish functional genomics of *Rhodospirillum rubrum* metabolism

Progress Report (300 word maximum):
This task has focused on understanding and manipulating the metabolism of *Rhodospirillum rubrum* so as to make this organism more suitable as a platform for the fermentation-based conversion of syn-gas to biorenewable chemicals and biofuels.

Since the last report, we have completed the characterization of the negative gene effectors that modulate the ability of this organism to produce biorenewable bioplastics. To address this question we created *R. rubrum* strains that lack functional negative genes individually or in combination. Genes that have been evaluated include: *phaC*, *phaC-like1*, *phaC-like2*, and *phaJ*, the double mutant combinations of *phaC* and *phaC-like1*, *phaC and phaC-like2, phaC-like1* and *phaC-like2*, and the triple mutant in which all three genes *phaC*, *phaC-like1*, *phaC-like2*. These characterizations led to the discovery of specific genes and gene combinations that can be manipulated to enhance bioplastics production.

Task 6 -Thermochemical Products: Developing stable bio-oils from fast pyrolysis

Summary of Progress to Date:
Work on task 6 focuses on generating bio-oil under well characterized operating conditions in conjunction with the characterization of the physicochemical properties which influence bio-oil stability.

The original goal of building a new pyrolysis unit has been expanded with the receipt of $500,000 from the U.S. DOE which allowed us to purchase new feedstock preparation equipment as well as design and build more sophisticated bio-oil collection equipment. The new fast pyrolysis reactor, char removal system, and bio-oil collection equipment have been designed, built, and installed. The system is being used to support newly sponsored research with the Department of Energy and the ConocoPhillips Company to explore methods to improve bio-oil stability.

In an ongoing effort to improve our ability to characterize biomass and bio-oil, instrumentation capabilities continue to be added to the analytical laboratory. Two recently purchased instruments include a HPLC (from Dionex) for quantifying the bio-oil major chemical compositions and a TGA/DSC (from Mettler) for determining biomass, bio-oil and biochar proximate analysis.

Task 7: Oleochemicals: Identifying physical and chemical attributes for improved biobased lubricants and fuels

Progress Report (300 word maximum):
Silica gel was treated with trivalent vanadium, and a monolayer of methyl linoleate was spread on the silica and oxidized. The vanadium produced an induction period because it converted the hydroperoxides to epoxides. Vanddium increased the percentage of epoxides obtained significantly and may be useful as a lipid antioxidant.

Task 8: Bio-Oil Upgrading

Progress Report (350 word maximum):
In addition to ongoing work on bio-oil upgrading through esterification, C-C coupling, and steam reforming, which is now funded by ConocoPhillips and the Department of Energy, we are performing scouting experiments on bio-oil model compounds using aqueous-phase reforming. This work is the basis for the National Science Foundation proposal.

STARTUP FUNDS

Title: Raman Startup Funds
Publications/presentations based on use of infrastructure:

- Mathematical Models of Batch SSF Processes: Dimensionless Groups for Characterizing Process Regime. D Raj Raman & Robert P Anex, presented at the Institute of Biological Engineering 2008 Annual Conference in Raleigh NC.
- Himmelsbach, J. N., D. R. Raman, R. P. Anex, and R. T. Burns. (Submitted May 2009) Aqueous Ammonia Soaking Followed by Anaerobic Digestion: Energy Yield from a Bench-Scale Biochemical Methane Potential Study, Transactions of the ASABE. (In review)
- Himmelsbach, J. N., A. Isci, D. R. Raman, and R. P. Anex. (Submitted January 2009) Design and Testing of a Pilot-Scale Aqueous Ammonia Soaking Biomass Pretreatment System, Applied Engineering in Agriculture. (Revision in review on June 24, 2009)
- Raman, D. R., and R. P. Anex. (Submitted August 2008). Conceptual and Mathematical Models of Batch Simultaneous Saccharification and Fermentation: The Predictive Value of Dimensionless Groups for Characterizing Process Regime. Bioresource Technology. (Under Revision)

Progress Report:

Battelle Funds provided to Associate Professor D Raj Raman as startup funds were used to support the following activities:

- Summer salary to allow working on multiple biorenewable related projects, including low-cost pretreatment reactors using aqueous ammonia steeping method, and organizing Intensive Program in Biorenewables using Cargill Gift funds to bring over 40 students from across the country and around the world to ISU campus to learn about biorenewables.
- Summer salary allowed authoring a paper entitled Mathematical Models of Batch SSF Processes: Dimensionless Groups for Characterizing Process Regime, which defines a novel method of characterizing SSF (simultaneous saccharification and fermentation) that can be used by scientists developing high-throughput fermentation screening methods for lignocellulosic biomass.
- Funds were used to develop a conceptual framework for comparing various biomass feedstocks. This framework was expanded as part of the A E 480/580 course that Dr Raman taught, and led to a $50k award from the Biorenewable Industry Consortium this past May. This work is being prepared for publication.

Title: Grewell Startup Funds

Publications/presentations based on use of infrastructure:

- D. Grewell,G. Harmon, S. Vengasandra, Zero Zero Flash Ultrasonic Micro Embossing on
- Foamed Polymer Substrates A Proof of Concept, Polymer Engineering and Science, in print.
- S. Vengasandra, Y. Cai, D. Grewell, J. Shinar, R. Shinar, Design and Analysis of OLED-Based Lab on CD for Multianalyte Biosensing, SPIE Conference, 2009, Invited Lecture.

Progress Report (350 word maximum):
This work has a patent pending application and focuses on embossing features designed to act as reservoirs, valves, and reaction chambers to allow glucose and lactate levels to be measured in solution using a standard PC-CD player and thus termed 'Glucose/lactate Bio-CD'. Once embossed, the surface energy of the plastic substrate was chemically modified to make it hydrophilic by increasing the surface energy by approximately 135%. Flash-free micro patterns were embossed on thermoplastic substrates. The embossing technique relies on a micro-cellular foamed substrate to absorb the displaced material during the embossing process so that flash is not produced (zero mass transfer in near fields). It was demonstrated that a CD utilizing a photoluminescence (PL) could characterize glucose and lactate levels, using an organic light-emitting diode (OLED) as the excitation source. Enzyme samples were placed in reservoirs and directed through burst valves, by rotation of the CD, toward a reaction chamber, where the analytes were oxidized in the presence of oxygen and their specific oxidase enzymes. The analytes' concentrations were determined by monitoring the PL decay time of an oxygen-sensitive dye following a pulsed OLED excitation. The results demonstrate the viability of the PP CD for sensing applications in conjunction with an OLED-based sensing platform. The potential of integrating OLED arrays as excitation sources in PL-based sensors with the microfluidic CD-based platform, including for simultaneous multiple analyses is discussed.

Title: Koziel Startup funds
NO REPORT RECEIVED

INFRASTRUCTURE FUNDS PROVIDED TO COLLEGES

College of Engineering
NO REPORT RECEIVED – PREVIOUS REPORT
Dr. Chris Williams has upgraded a servo-pneumatic testing machine for testing materials associated with bio-energy research. Research will be under contract within the next 6-12 months. A substantial amount of exposure is being received by the research team associated with utilizing bio-energy co-products in asphalt materials and this equipment will further expand their research capabilities and thus research exposure.

Dr. Terry Meyer purchased components for building a quadruple pulse laser system that will help develop technologies for alternative fuel processing and utilization.

Dr. Santosh Pandey has purchased a Leica Microscope with High-resolution Digital Camera & Vibration Isolation Table. This equipment will be used for testing characteristics of living cells and microorganisms under various stimuli. The electrically-active bio-nanoelectronic platform combines the versatility of nanoscale circuits with the flexibility of polymeric substrates to study biological processes. Our portable assay would allow label-free detection of a specific biological specimen and nanoscale probing of its characteristics. The electronic detection scheme would provide real-time information over a long time interval, which is not possible with optical or fluorescence-based assays. Combined with high-performance computing features and embedded systems, the microscope system can provide real-time monitoring of biological processes..
He also purchased a two-section glove box from MBraun Inc. for research in organic and bio-electronics of material which are sensitive to air and humidity.

Dr. Jaeyoun Kim purchased an optical table, its support, and a pneumatic controller. The heavy, very flat optical table stabilized by pneumatic floating will serve as the platform in various high-precision optical experiments. He will purchase lasers, optomechanical stages, and detectors. The equipment will be essential for the development of high-performance optical sensing, communication, and computing systems including surface plasmon resonance sensors and nanoscale optical waveguides.

College of Liberal Arts and Sciences

Emily Smith (Startup package)

Publications/presentations based on use of infrastructure:

- "General Fluorescence Resonance Energy Transfer Assay for the Study of Cell Membrane Protein Clustering" Pittsburgh Conference, New Orleans, LA, March 2008.
- "Fluorescence Studies of Cell Membrane Organization" American Chemical Society National Meeting, New Orleans, LA, April 2008.
- "General Fluorescence Resonance Energy Transfer Assay for the Study of Cell Membrane Protein Clustering" University of St. Thomas, St. Paul, MN, November 30, 2007.
- "General Fluorescence Resonance Energy Transfer Assay for the Study of Cell Membrane Protein Clustering" Emily A. Smith, Deepak Dibya, Suzanne Sander, Nuha Salem. Midwestern Universities Analytical Chemistry Conference, Urbana, IL, November 1-3, 2007.
- "General Fluorescence Resonance Energy Transfer Assay for the Study of Cell Membrane Protein Clustering" 34th Federation of Analytical Chemistry and Spectroscopy Societies, Memphis, TN, October 2007.

Awards received related to infrastructure purchases:

Society of Analytical Chemists of Pittsburgh Starter Award (2007)

External funding applied for utilizing infrastructure purchases (indicate received/denied/pending):

- I.S.U. Plant Sciences Institute and U.S. Department of Energy, Ames Laboratory, "High-Throughput Raman Imaging Studies of Plant Tissue Arrays for Measuring Cell Wall Content and Degradation" 7/1/2007-6/30/09, $60,000
- Roy J. Carver Charitable Trust, "Novel Fluorescence Resonance Energy Transfer Studies of Cell Membrane Dynamics: Unraveling Integrin Cluster Mediated Signaling Pathways" 11/1/2007-10/30/1009, $239,000
- Society of Analytical Chemists of Pittsburgh 2007 Starter Grant Award, "Development of Raman and Fluorescence Imaging Methods for the Study of Cellular Processes and Biological Materials in Diverse Applications" 5/1/07-4/30/08, $20,000

Pending Support

- NSF CAREER, "Development of Novel Methods to Measure Cell Membrane Protein Clustering *in vivo*: Unraveling the Relationship between Clustering, Ligand Binding and Cell Signaling" 2009-2014, $798,068

- U.S. Department of Energy, "Chemical Analysis of Nanodomains" 2008-2011, $2,005,000, (PI: E. Smith; co-PIs: J. Petrich, N. Fang, E. S. Yeung)
- USDA, U.S. Department of Energy, "Diagnostic DNA Markers for High Ethanol and Biomass Yield in Maize and Other Energy Grasses" 2008-2011, $250,000, (PI: T. Lubberstedt; co-PI: E. Smith)
- Midwest Forensic Resources Center "Detection of Exogenous Compounds in Latent Prints Using Raman Spectroscopy: A Practical Tool to Assist Forensic Investigators" 8/2008-4/2009, $53,208
- U.S. Department of Energy Midscale Instrumentation "Development of a Sub-Diffraction Limited Microscope with Molecular Resolution and Time-Resolved Capabilities" 2009-2012, $1,950,369, (PI: E.Smith, Co-PIs: J. Petrich, V. Lin)
- U.S. Department of Energy, "Nanostructure of Plant Cell Walls" 2009-2014, $21,581,962 (PI: R. Jernigan, co-PIs: N. Fang, M. Hargrove, V. Honavar, M. Hong, H. Horner, B. Nikolau, J. Petrich, N. Pohl, K. Rajan, S. Sivasankar, E. Smith, D. Vaknin, J. Verkade, E. Yu, O. Zabotina)

Denied Support

- Petroleum Research Fund Type G Grant "Raman Spectroscopy Studies of Bifunctionalized Mesoporous Silica Nanosphere Catalytic Systems"**,** $50,000
- National Institutes of Health 2007 Director's New Innovator Award "Unraveling and Inhibiting Advanced Glycation End Products (AGE) *in vivo*" Program (DP2), $1,500,000
- Midwest Forensics Resource Center Competitive Research Program "Raman Imaging for the Detection of Latent Fingerprints on Traditionally Hard to Visualize Surfaces and the Measurement of Endogenous Compounds in Fingerprint Residue", $57,106
- Arnold and Mabel Beckman Foundation "A Novel Method for Studying Cell Membrane Proteins: Combining Surface Chemistry, Model Lipid Bilayers and Raman Microscopy" 2007-2010, $300,000
- Searle Scholars Program "Elucidating Cell Membrane Protein Dynamics with Fluorescence and Raman Imaging", 2008-2011, $240,000
- Camille Dreyfus Teacher Scholar Award "Development of Raman and Fluorescence Imaging Methods for the Study of Cellular Processes, Catalysis, and Lignocellulosic Materials", 2008-2013, $75,000

Equipment Purchased/Rennoations Made:

- ISU # 446552 Microscope Inverted w/Epifluor Kit $42,317.25
- ISU # 446605 Cabinet Safety Biolagical Cabinet $6,171
- ISU # 446642 Sorvall Primo Centrifuge Benchtop $6,584.95
- ISU # 447012 Camera Pixis Digital CCD System $32,063
- ISU # 447031 High Power NIR Laser $16,486
- ISU # 447032 Holospec Imaging Spectrograph $16,645
- ISU # 447042 Microscope Inverted 4-Position $19,383.80
- ISU # 447270 Photon Max CD Camera Detector $22,998.70

Progress Report (300 word maximum):

We are developing imaging instrumentation and methods, and subsequently applying these techniques in a diverse set of applications, including the study of cellular processes that are initiated at the cell membrane, lignocellulosic biomass, and catalytic systems. Two goals of this work are elucidating how properties of the cell membrane influence cell signaling events across the membrane, and developing methods to study reactions utilizing chemical and biological catalysts. The analysis techniques that we use include fluorescence and Raman scattering. Raman imaging is a particularly attractive imaging mode since it provides spatially-correlated chemical content data without the need to destroy or modify the sample under study. Fluorescence imaging can provide kinetic and thermodynamic information concerning biological interactions, and can also provide spatial data below the diffraction limit. The lab has built two imaging instruments, one capable of Raman scattering measurements and one suitable for several fluorescence techniques. The Raman instrument has been used to measure the efficiency of converting a variety of plant materials to ethanol, and to measure chemical catalysis in nanoporous materials. This work serves as a foundation for developing biofuels and improving the efficiency of catalytic reactions. The fluorescence instrument has been used to study cell membrane receptor signaling

events, receptor clustering, receptor conformational changes in two diverse classes of cell membrane proteins: integrins and receptor for advanced glycation end products.

College of Agriculture
Construction of the biomass processing facility at the New BioCentury Research Farm is nearing completion and the initial equipment installations will be made in the coming months. The grand opening scheduled for September, 2009.

BATTELLE FUNDING: PROGRESS REPORT

Update Period:	July 01, 2006 – December 31, 2006
Platform:	BioSecurity
Platform Chair):	Manjit Misra
Platform Expenditures:	$609,195.34
Platform Funding:	$793,470
Project Allocated:	$450,000
Project Obligated:	$ -
Inf. Allocated:	**$** 343,470
Inf. Obligated:	$ -

PROJECT FUNDS:

Publications/presentations based on use of infrastructure:

- Lantz, A., Brehm-Stecher, B.F., and D.W. Armstrong. Combined Capillary Electrophoresis and DNA-FISH for Rapid Molecular Identification of *Salmonella* Typhimurium in Mixed Culture. Invited manuscript for special issue of Electrophoresis (under review).
- B.F. Brehm-Stecher. 2007. "New Technologies for Imaging Individual Microbial Cells". *In Imaging Cellular & Molecular Biological Function*, F. Frischknecht and S. Shorte, (eds.) Springer-Verlag, Berlin.
- B.F. Brehm-Stecher "Methods for Whole Cell Detection of Microorganisms" *in Structure, Interaction and Reactivity at Microbial Surfaces*, T. Camesano and C. Mello (eds.), American Chemical Society, Washington, D.C. (*in press*).
- Manjit Misra (PI): Food and Fuel Initiative: Iowa, USDA. $261,040. Funded.
- H. Scott Hurd (PI): Electronic Veterinary Prescription Pilot Study for a Tool Demonstrating Judicious Antibiotic Use. National Pork Board. $49,980. Pending.
- H. Scott Hurd (PI): Impact of Pig Health on Human Foodborne Risk. USDA. $699,844. Pending.
- Aubrey Mendonca (Co-PI): Functional Food Ingredients and Related Compounds as Antimicrobial Enhancers for Improving the Safety of Fresh Produce. USDA. $370,058. Pending.
- Manjit Misra (Co-PI): STC: Multifunctional Sensor Platforms for Food Safety and Security. NSF. $24,768,996. Pending.

External funding applied for utilizing infrastructure purchases (indicate received/denied/pending):
Funded

- Ahn, D. U., E. J. Lee, and A. L. Pometto III. 2007-08. Production of Ovotransferrin from Egg White for Antimicrobial Applications. Midwest Poultry Research Program. $44,421
- Brehm-Stecher. 2007-2008. Antimicrobial Activities of Essential Oils Part II: Formulation Testing, Blend Optimization, Expanded Pathogen Testing, Activity Enhancement and Alternative Delivery Strategies. Industry/IPRT. $36,893.
- Brehm-Stecher. 2007-2008. Testing the Antimicrobial Effects of QSI-Nano Metal Nanoparticles: Basic Research and Applications. Industry. $50,944.
- Brehm-Stecher. 2007-2008. Simultaneous Concentration and Visual Identification of *Salmonella* and *Listeria* in Mexican-Style Soft Cheeses. Midwest Dairy Association. $31,068.
- Brehm-Stecher. 2007-2008. Rapid Cytometric Detection of *Salmonella*, *Campylobacter*, *Yersinia* and *Listeria monocytogenes* in Pork Products – Assay Refinement, Extension and Technology Transfer. Food Safety Consortium. $17,794.

- Brehm-Stecher. 2007-2010. Biomimetic Polymer-Based Antimicrobial Systems: Development and Applications. Industry. $117,300.
- Mendonca, A, and A. L. Pometto III. 2007. Antimicrobial Efficacy of a Novel Antimicrobial Skin Cleanser against Foodborne Enteric Pathogens on a Model Skin Surface. IPRT ($12,057) and Northern Filtration Media ($12,065)

Pending

- Brehm-Stecher. 2007-2008. Midwest Regional Center of Excellence for Biodefense and Emerging Infectious Diseases Research. Biomimetic Antimicrobial Systems for Biothreat and Emerging Pathogen Mitigation. $97,289.
- Brehm-Stecher. 2008-2011. USDA-NRI. Rapid Separation, Concentration & Visual Molecular Identification of Foodborne Pathogens on Fresh Produce. $328,343.
- Narasimhan, B., A. L. Pometto III, S. Mallapragada, and M. Misra. 2008-2013. NSF Engineering Research Center for Food Safety and Security. NSF $18.5 Million.
- Munkvold, G., A.L. Pometto III, Kim, T., and Shetty, K. 2008-2011. Corn biomass quality for biofuel production; impacts of fungal pathogens and approaches for quality enhancement. Department of Energy. RD-RBP-BIOMASS-2007. $1,101,301.

Progress Report (350 word maximum):
DDGS (Distiller Dried Grains with Solubles) and CDS (Condensed Distiller's Solubles or "Syrup") were obtained from Lincoln Way Energy, Nevada, IA. Extracts (25% w/v) of DDGS were prepared by steaming for 2 hrs @88^{o}C in water or 20% (v/v) ethanol. The liquid portions of the extracts were recovered by vacuum filtration through Whatman #1 filter paper, concentrated to syrups by rotary evaporation at 60^{o}C, then adjusted to pH 7. Ethanol lost during the evaporation step was replaced to a final concentration of 20% (v/v). Extracts were filter sterilized through 0.2 μm filters, then tested for anti-microbial activity against *Esherichia coli O157:H7, Listeria monocytogenes, Salmonella, sp., and Staphylococcus aureus.* Tests were done on the Bioscreen Growth Curve instrument in replicates of five.

S. aureus and L. monocytogenes were not inhibited by the extracts. It is likely that nutrients in the extracts stimulate these bacteria, resulting in improved growth. With *E. coli O157:H7,* slight inhibition was observed with aqueous extracts; inhibition was greater in ethanolic extracts. *Salmonella*, *sp.* was moderately inhibited by aqueous- and ethanolic extracts. Viability tests showed that the DDGS extracts did not kill the cells, so their effects are bacteriostatic, not bacteriocidal. CDS (syrup) was also tested with similar results. With *E. coli*, only slight inhibition was observed, and then only with the highest doses of CDS. With *S. aureus* and *L. monocytogenes*, low doses of CDS produced slight inhibition; however, when the dose was doubled, growth was stimulated. Like DDGS extracts, CDS may contain nutrients that improve the growth of these organisms. *Salmonella*, *sp.* was more sensitive to CDS than the other bacteria.

Dr. Scott Hurd continues to work with GlobalVetLink on the on-line traceability of food animals. Prior work has focused on beef cattle. While that work continues, the project is now expanding to include swine.

INFRASTRUCTURE FUNDS

Equipment Purchased/Rennovations Made:
All equipment has been purchased and installed. Final inspections are being done and we anticipate everything will work fine. Installed equipment includes two bioguard hoods, a solvent hood and an anaerobic chamber equipped with a BioScreen C MBR reader to study anaerobes and microaerophiles.

Progress Report (300 word maximum):
William Colonna continues to supervise the work of the Discovery Lab. Recent work has included testing of extracts of DDGS (Distiller Dried Grains with Solubles) and CDS (Condensed Distiller's Solubles or "Syrup") obtained from Lincoln Way Energy, Nevada, IA in September 2008. It was observed that *Salmonella*, *sp.* was inhibited by extracts. Therefore, the mechanism of inhibition of *Salmonella, sp.* by CDS was examined in greater detail. Although the inhibition was potentiated at acidic pH's, it was observed at neutral pH, demonstrating that the inhibition was not a simple effect

of pH. Moreover, the extent of inhibition was not affected by inoculum size. Instead, the degree of inhibition and inhibition profile were identical if the inoculum size (i.e., CFU/mL) was reduced by 10- to 100-fold.

Viability tests showed that exposure to CDS does not kill the bacteria, demonstrating that the inhibition is bacteriostatic, not bacteriocidal. Also, with all bacteria, there was essentially no difference in the extent of inhibition by CDS that was sterilized by filtration or by autoclaving. The heat-stability suggests that the inhibitory substance in CDS is of low molecular weight.

STARTUP FUNDS

Title: Munkvold startup funds

Publications/presentations:

- Colonization of maize roots by *Fusarium* spp. in relation to transgenic corn rootworm resistance *G. Munkvold, L. Meinke, L. Lewis and A. Fessehaie*
- Internation Plant Pathology Congress, Torino, Italy, Aug 25-29, 2008

Progress Report (350 word maximum):

Larvae of the corn rootworm (CRW) (*Diabrotica* spp.) injure maize roots through their feeding activity, completely destroying some roots and leaving others with extensive epidermal and cortical damage. We hypothesized that the roots of plants with CRW injury will be more intensively colonized by soilborne fungi, including root and stalk rot pathogens. In 2007 and 2008, we planted maize hybrids in fields where high populations of CRW had been encouraged through the use of trap crops. Hybrids genetically engineered with different genes for CRW resistance were compared to their near-isogenic CRW-susceptible counterparts in replicated plots in each of three locations (Mead, NE; Ames, IA; Crawfordsville, IA, USA) in 2007 and two locations (Mead and Crawfordsville) in 2008. We measured CRW injury (0-3 nodal injury scale) and *Fusarium* colonization (by dilution plating and quantitative PCR) in mid to late July and again in mid September, and recorded the incidence of stalk rot symptoms in plants collected randomly from each plot. CRW injury was severe on susceptible hybrids, especially at the Mead location in 2007 and Crawfordsville in 2008, with scores averaging ~2.0. Transgenic hybrids showed moderate to high levels of resistance, with average scores <1.0. Several *Fusarium* species were isolated from roots, including *F. verticillioides*, *F. proliferatum*, *F. semitectum*, and *F. graminearum*. Dilution plating showed that colonization by all *Fusarium* species was higher in CRW-susceptible hybrids exceeded that of their CRW-resistance counterparts for locations with severe CRW feeding injury, although results for individual plants were highly variable. Several of the observed *Fusarium* species are stalk rot pathogens and CRW-susceptible hybrids also had more severe symptoms of stalk rot than resistant hybrids. However, quantitative PCR results from roots and stalks did not demonstrate consistent differences in colonization by *F. verticillioides* and *F. graminearum* between CRW-susceptible and CRW-resistant hybrids. These results indicate that root colonization by *Fusarium* species in the presence of CRW is suppressed by CRW resistance, but the effect is dependent on the species of Fusarium; furthermore, stalk quality is improved in CRW-resistant hybrids under these conditions, but the difference could not consistently be attributed to *F. graminearum* or *F. verticillioides*.

INFRASTRUCTURE ALLOCATED TO COLLEGES

College of Agriculture
Funding was approved for construction of a field building erected in FY07. The building is being used primarily by a new tenure-track faculty member for field research on soybean pathogens.

College of Vet Med
A small allocation has been made to the College of Vet Med to assist in building the BL3 facility. Construction should occur within the next year.

BATTELLE FUNDING: PROGRESS REPORT

Update Period: July 01, 2006 – December 31, 2006
Title:
Platform: Information Solutions
Platform Chair): Jim Oliver
Platform Expenditures: $ 771,903.69
Platform Funding: $1,718,000
Project Allocated: $650,000
Project Obligated: $ -
Inf. Allocated: **$**1,068,800
Inf. Obligated: $ -

PROJECT FUNDS

External funding applied for (indicate received/denied/pending):

- "Multi-Touch Technology: Applications to Homeland Security and ISU Research," Grow Iowa Values Fund, $100,000, Jan 1, 2008, December 31, 2008. Partners: Priority5 (Allen Bierbaum), ISU (Stephen Gilbert) awarded
- "Center for Information Protection: NSF IU/CRC Industry Memberships," Doug Jacobson, PI, $150,000. awarded
- "Bio-inspired Fault-tolerant, Adaptive, Decentralized, and Stable Decision-making and Control for Dynamic and Concurrent Coalitions of Vehicle-Human Teams," James Oliver, PI, with ISU Co-PI's Soon-Jo Chung, Arun Somani, Stephen Gilbert, and MIT Co-PIs Jean-Jacques Slotine and David W. Miller. $6,891,646, Office of Naval Research, pending.
- "An Interdisciplinary Methodology to Measure the Social and Emotional Aspects of Communication in Health Care," Debra Satterfield, PI, with Co-PI's Sung Kang and Nora Ladajahasen, $108,498, National Institutes of Health, pending.
- "EFRI: Development, Validation, and Use of Sense of "Self" in Robots," Alex Stoytchev, PI, with Co-PI's Nicola Elia, Akhilesh Tyagi, Umesh Vaidya, James Bloedel, and Srikanta Tirthapura, $1,948,294, National Science Foundation, pending.
- "A Distributed Peer to Peer Investigation Tool Kit," Doug Jacobson, PI, $558,110, National Institute of Justice, pending.
- "Combinatorial and High Throughput Discovery of High Temperature Piezoelectro Ceramics," Air Force Office of Scientific Research, $82,431, June 15, 2008 to October 30, 2008, Krishna Rajan
- "Center for Information Protection: NSF IU/CRC Industry Memberships," National Science Foundation, $60,000, Doug Jacobson
- CyberInnovation Institute Industry Memberships, Deere & Company, $50,000.00, January 1, 2008 to December 31, 2008, James Oliver
- "NETS-NBD: Network Coding-Based Protection," National Science Foundation, $103,700, Ahmed Kamal, PI, with Co-PI Aditya Ramamoorthy, pending
- "CPA-ACR: Parallel Algorithms and Software for Large Scale Microarry Data Analysis and Gene Network Interference," National Science Foundation, $494,853, Srinivas Aluru, pending
- "Theoretical Foundations and Design of Self-Healing and Fast-Recovery Strategies for Network Infrastructure Protection," US Department of Defense, $429,587, Lei Ying, pending

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Progress Report (350 word maximum):

To help foster the cross-disciplinary research needed to address today's complex chalenges, CII announced openings for five postdoctoral positions. These full-time, two-year post-docs will work with faculty teams to address research in one or more of the following areas:

- High-performance computing
- Data Mining, information integration, semantic web

- Visualization
- Information assurance/network modeling
- Information infrastructure and sensor network applications

The post-docs will work closely with faculty and students on cross-disciplinary research projects to develop the advanced cyberinfrastructure and new research opportunities in bioinformatics, materials informatics, security informatics, and computational fluid dynamics (among others). The CII post-docs are expected to begin as early as August 15, 2008.

Last reporting period, CII announced a joint industry/university project funded by the Grow Iowa Values Fund entitled: "Multi-Touch Technology: Applications to Homeland Security and ISU Research." This spring, the CII helped the PI's negotiate an agreement with ISU's Office of Intellectual Property and Technology Transfer to enable the results of the project to be distributed via open source. The resulting library "Sparsh" facilitates the creation of multi-touch applications on a variety of hardware and software platforms. Details can be found at: http://code.google.com/p/sparsh-ui/

On April 3-4, the CII co-sponsored the second annual "Emerging Technologies Conference" (ETC 2008) in Ames. This conference features the research progress of CII member centers, with particular emphasis on the Virtual Reality Applications Center and its graduate program in Human Computer Interaction. ETC2008 kicked off on the evening of April 3 with "IgniteIT" a networking opportunity for Iowa's information technology community to spark imaginations, connect people, create new technology opportunities in Iowa and have fun in the process. More than 200 regional IT professionals attended IgniteIT, which was hosted at the CII Technical Collaboration Facility in ISU's Research Park. On Friday April 4th, ETC2008's was anchored by a keynote address entitled "HCI: Help Create Ideas—Exploring Innovation Leadership" presented by Michael Schrage, an affiliate of MIT's Sloan School, widely published columnist, consultant for the United States government, and author of two critically acclaimed books focused on the social implications of technology. ETC2008 was open to the public and its technology demonstrations attracted over 300 attendees.

INFRASTRUCTURE FUNDS

Awards received related to infrastructure purchases:

- "NSF I/UCRC Center for Information Protection-Deere," Doug Jacobson, DEERE AND COMPANY, $15,000, Information Assurance Center - CII, 1/13/2009
- "IT Adventures Program," Doug Jacobson, IOWA DEPARTMENT OF ECONOMIC DEVELOPMENT, $50,000, Information Assurance Center – CII, 2/202009
- "Cyber Attack Impact Analysis for SCADA Systems," Manimaran Govindarasu, SANDIA NATIONAL LABORATORY, $6,000, Information Infrastructure Institute - CII 4/1/2009
- "CAREER: Practical Scheme Design for Supporting Secure and Resilient Resource-Constrained Wireless Networks" Yong Guan, NATIONAL SCIENCE FOUNDATION, $12,000 Information Infrastructure Institute – CII, 4/16/2009
- "Developing Tools for the Design of Multiphase Flows," Kenneth Bryden, DEERE AND COMPANY, $60,920, Virtual Reality Applications Center, 3/31/2009
- "Extensible VE Tools for Improved Product Design," Kenneth Bryden, DEERE AND COMPANY, $35,176, Virtual Reality Applications Center, 3/31/2009
- "Improved Reliability Through Linked Information Gathering," Kenneth Bryden, DEERE AND COMPANY, $36,578, Virtual Reality Applications Center, 3/31/2009-03-31
- "Integrated Robust Optimal Design for Quality Improvement and Cost Reduction in Product Development," Atul Kelkar, DEERE AND COMPANY, $33,740, Virtual Reality Applications Center, 4/1/2009
- "Enhancing Realism and Flexibility of VR-Based Real-Time Dynamic Simulation Framework with Operator and Hardware in-the-Loop," Atul Kelkar, DEERE AND COMPANY, $65,519, Virtual Reality Applications Center, 4/1/2009
- "Development of VR Simulation for 3D Painter Training," Eliot Winer, DEERE AND COMPANY, $48,615, Virtual Reality Applications Center, 3/30 2009

- "Development of the Advanced Systems Design Suite," Eliot Winer, DEERE AND COMPANY, $77,272, Virtual Reality Applications Center, 4/1/2009
- "Tool Tracking," Alexander Stoytchev, DEERE AND COMPANY, $61,683, Virtual Reality Applications Center, 4/1/2009
- "Virtual Training, Assembly, and Maintenance Methods," Judy Vance, DEERE AND COMPANY, $57,629, Virtual Reality Applications Center, 4/1/2009
- "Ignite IT Event," Stephen Gilbert, IOWA DEPARTMENT OF ECONOMIC DEVELOPMENT, $5,000, Virtual Reality Applications Center, 2/4/2009
- "Creating an Information Dashboard to Explore Market Data for Enhanced Portfolio Creation and Management," Kenneth Bryden, DEERE AND COMPANY, $80,000, Virtual Reality Applications Center, 2/4/2009
- "Conceptual Design of a Eucalyptus Machine Form," Eliot Winer, DEERE AND COMPANY, $77,936, Virtual Reality Applications Center, 5/1/2009
- "Experimental Command and Control Project," Brian Mennecke, ROCKWELL COLLINS, INC, $23,000, Virtual Reality Applications Center, 5/18/2009
- "Integrated Robust Optimal Design for Quality Improvement and Cost Reduction in Product Development," Atul Kelkar, DEERE AND COMPANY, $37,087, Virtual Reality Applications Center, 6/09/2009
- "Improved Quality on Complex Manufacturing Processes Through Tool Tracking and Validation," Alexander Stoytchev, DEERE AND COMPANY, $2,474, Virtual Reality Applications Center, 6/8/2009
- "A Virtual Reality Interface for Product/Analysis Data Visualization, James Oliver, ROCKWELL COLLINES, INC. $140,000, VRAC 6/24/09
- "Virtual Reality Implementation Study," James Oliver, BOEING COMPANY, $50,000, Virtual Reality Applications Center, 4/25/2009

External funding applied for utilizing infrastructure purchases (indicate received/denied/pending):

- "Sequence and Structural Correlates of Protein-RNA Interactions," Drena Dobbs, NATIONAL INSTITUTES OF HEALTH, $1,459,331,Center for Computational Intelligence, Learning, and Discovery – CII, 2/4/2009, pending
- "REU Supplement: Collaborative Research: Learning Classifiers from Autonomous, Semantically Heterogeneous, Distributed Data," Vasant Honavar, NATIONAL SCIENCE FOUNDATION, $16,000 Center for Computational Intelligence, Learning, and Discovery – CII, 4/30/2009, pending
- "Gene Networks as Biomarkers for Stem Cells Useful to Treat Retinal Degeneration," Mary Greenlee, NATIONAL INSTITUTES OF HEALTH, $999,997, Center for Computational Intelligence, Learning, and Discovery – CII, 4/24/2009, pending
- "Computational Methods for B-Cell Epitope Identification ," Vasant Honavar, NATIONAL INSTITUTES OF -HEALTH, $669,190, Center for Computational Intelligence, Learning, and Discovery – CII, 4/22/2009, pending

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- "A Unified Framework for Complex Critical Infrastructure Predictive Modeling in Disaster Preparedness and Response: The Critical Infrastructure Modeling and Response Environment Project," Doug Jacobson, NATIONAL SCIENCE FOUNDATION, $558,603, Information Assurance Center – CII, 2/25/2009, pending
- "NSDL Pathways: RAVEN: Remotely Accessible Virtual Education Networks," Thomas Daniels, NATIONAL SCIENCE FOUNDATION, $858,777, Information Assurance Center – CII 4/13/2009, pending
- "Expanding Technological Literacy Through Engineering Minors," Mani Mina, NATIONAL SCIENCE FOUNDATION, $500,000, Information Infrastructure Institute – CII, 1/12/2009, pending
- "CPS: Small: Run-Time Platform Support for Software Adaptation in Changing Environments," Jien Chang, NATIONAL SCIENCE FOUNDATION, $468,861, Information Infrastructure Institute – CII, 2/25/2009, pending
- "ARO Workshop on Digital Forensics," Yong Guan, ARMY RESEARCH OFFICE, $30,000, Information Infrastructure Institute – CII, 2/23/2009, pending

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- "GAANN: Preparing Students for R and D Careers in Cyber-Physical Critical Infrastructure Systems," Manimaran Govindarasu, DEPARTMENT OF EDUCATION, $1,043,376, Information Infrastructure Institute – CII, 3/19/2009, pending
- "CPS: Medium: Collaborative Research: Seamless Integration of Conjoined Cyber-Physical Systems Properties," Phillip Jones , NATIONAL SCIENCE FOUNDATION, $644,224, Information Infrastructure Institute – CII, 2/25/2009, pending
- "CPS:Medium: Collaborative Research: Embedded Sensor Network and Algorithms for Robust Electric Power Infrastructure," Manimaran Govindarasu, NATIONAL SCIENCE FOUNDATION, $840,000, Information Infrastructure Institute – CII, 2/26/2009, pending
- "Magneto-Optic Devices for Future Transparent Optical Networks," Mani Mina, NATIONAL SCIENCE FOUNDATION, $348,256, Information Infrastructure Institute – CII, 2/10/2009, pending
- "UFit: A Ubiquitous Fitness Promotion System Based on Innovative Wireless and Social Networking," Daji Qiao, UNIVERSITY OF MEMPHIS, $250,000, Information Infrastructure Institute – CII, 4/14/2009, pending
- "Collaborative Research: CSR-PSCE, SM: Memory Thermal Management for Multi-Core Systems," Zhao Zhang, NATIONAL SCIENCE FOUNDATION, $12,000, Information Infrastructure Institute – CII, 4/29/2009, pending
- "CT-ER: Detecting Click Fraud in Pay-Per-Click Streams of Online Advertising Network," Yong Guan, NATIONAL SCIENCE FOUNDATION, $12,000, Information Infrastructure Institute – CII, 4/16/2009, pending
- "NETS-NOSS: Secure and Resilient Network Coding and Cooperative Relaying Schemes for Wireless Sensor Networks," Yong Guan, NATIONAL SCIENCE FOUNDATION, $12,000, Information Infrastructure Institute - CII 4/29/2009, pending
- "Applied Design of Practical Technology ADEPT in the Computer Engineering Curriculum Stepping Stones to Capstone," Akhilesh Tyagi, NATIONAL SCIENCE FOUNDATION, $622,776, Information Infrastructure Institute - CII 4/28/2009, pending
- "Collaborative Research: CSR-PSCE, TM: Effective Resource Sharing and Coordination Inside Multicore Processors for High Throughput Computing," Zhao Zhang, NATIONAL SCIENCE FOUNDATION, $12,000, Information Infrastructure Institute – CII, 4/29/2009, pending
- "CSR-DMSS, SM: Design and Evaluation of a Scalable Meta-Event Dissemination System, Arun, Somani, NATIONAL SCIENCE FOUNDATION, $12,000, Information Infrastructure Institute – CII, 5/1/2009, pending
- "CDI-TypeII: Collaborative Research: Sensor-Network Enabled Innovation for a Secure National Energy Infrastructure," Manimaran Govindarasu, NATIONAL SCIENCE FOUNDATION, $460,233, Information Infrastructure Institute – CII, 5/19/2009, pending
- "CCLI: Teaching Multicore Programming," Jien Chang, NATIONAL SCIENCE FOUNDATION $199,996, Information Infrastructure Institute – CII, 5/19/2009, pending
- "MNP: Overlay Network Design and Evaluation," Manimaran Govindarasu, ARCHITECTURE TECHNOLOGY CORPORATION, $250,000, Information Infrastructure Institute – CII, 2/11/2009, pending
- "Charge Density Engineering: A Feasibility Study," Krishn Rajan, UNITED STATES ARMY RESEARCH OFFICE, $170,546, Institute for Combinatorial Discovery – CII 2/20/2009, pending
- "Electrochemical Reduction of Carbon Dioxide to Ethylene and other Hydrocarbons," Lee Woo, DEPARTMENT OF ENERGY, $832,795, Institute for Combinatorial Discovery – CII, 4/24/2009, pending
- "Center on Interfacial Engineering for Microelectromechanical Systems," Krishna Rajan, STANFORD UNIVERSITY, $1,012,500, Institute for Combinatorial Discovery – CII, 6/19/2009, pending
- "ARI: Informatics Aided Design of Inorganic Scintillator Materials," Krishna Rajan, NATIONAL SCIENCE FOUNDATION, $1,999,999, Institute for Combinatorial Discovery – CII, 4/24/2009, pending
- "Discovery and Design of Radiation Detection Materials," Krishna Rajan, DEPARTMENT OF ENERGY, $599,999, Institute for Combinatorial Discovery – CII, 6/4/2009, pending
- "Integrated Robust Optimal Design for Quality Improvement and Cost Reduction," Atul Kelkar, DEERE AND COMPANY, $54,920, Virtual Reality Applications Center, 3/23/2009, pending
- "Evaluating Stress and Quality of Firefighters' Decision Making in a Virtual Environment: Simulations to Reduce Deaths and Injuries," Nir Keren, DEPARTMENT OF HOMELAND SECURITY, $768,139, Virtual Reality Applications Center, 3/6/2009, pending
- "Combining 3D Scanning and Imaging," Song Zhang, WASHINGTON UNIVERSITY, $132,529, Virtual Reality Applications Center, 3/10/2009, pending
- "Learning Sustainability Through Social Networking: Building Footprints, Patterns, and Signs," Kenneth Bryden, NATIONAL SCIENCE FOUNDATION, $1,178,301, Virtual Reality Applications Center, 2/19/2009, pending

- "Graphics User Interface Development for Digital White Light Projection System," Song Zhang, FARO, $25,000, Virtual Reality Applications Center, 2/18/2009, pending
- "Graduate Student Research Program," Eliot Winer, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, $30,000, Virtual Reality Applications Center, 1/29/2009, pending
- "Collaborative Research: Statistical Inference for Graphical Displays," Heike Hofmann, NATIONAL SCIENCE FOUNDATION, $389,135, Virtual Reality Applications Center, 3/30/2009, pending
- "Diabetic Ecamp: Technology to Enhance Self-Care for Adolescents with Type 1 Diabetes," Stephen Gilbert, NATIONAL INSTITUTES OF HEALTH, $999,290, Virtual Reality Applications Center, 4/23/2009, pending
- "Understanding Decision Processes in Emergency Responders: Using Immersive Virtual Reality to Improve Preparedness and Response," Nir Keren, NATIONAL SCIENCE FOUNDATION, $419,377, Virtual Reality Applications Center, 2/10/2009, pending
- "GOALI: A Hybrid Method to Support Natural Interaction of Parts in a Virtual Environment," Judy Vance, NATIONAL SCIENCE FOUNDATION, $446,086, Virtual Reality Applications Center, 2/11/2009, pending
- "IARPA Reynard BAA," Brian Mennecke, ROCKWELL COLLINS, $720,116, Virtual Reality Applications Center, 6/10/2009, pending
- "Collaborative Research: Constraint-Based Compliant Mechanism Design Using Virtual Reality as a Design Interface," Judy Vance, NATIONAL SCIENCE FOUNDATION, $12,000, Virtual Reality Applications Center, 5/12/2009, pending

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Progress Report (300 word maximum, include how the infrastructure has been utilized):

By encouraging partnerships, CII nurtures new synergies among faculty, students, industry leaders, and entrepreneurs to create an entrepreneurial culture that fosters connections and opportunities. This vision motivated the creation of a space that encourages collaboration and community. To date, five companies have located at the CyberInnovation Technical Collaboration Facility, building on CII's commitment to economic development in the state of Iowa. Our industry partners now include:

- Entrepreneurial teams:
    - New entrepreneurial clients since January include:
        - Measure Inc., a design company focused on new media communications.
        - 3Fueled, an Iowa start-up focused on storage and transportation logistics for bio-fuels.
    - Complimenting our existing entrepreneurial clients:
        - Adapt Data Solutions, online issues tracking software (http://www.adaptds.com/)
        - ProPlanner, a developer of web-based simulation tools for manufacturing automation
        - Intuition Games, a new computer game company
        - Mack Enterprises, a video and sound editing company
        - Visual Medical Solutions LLC, a company that is developing technology for medical personnel to easily visualize and interact with 3-dimensional images of patients' complex internal systems, helping them plan and prepare for specific operations.
    - Start-ups terminating their agreements with CII (both due to closure of business)
        - Clearsighted, which designs and develops intelligent tutoring systems software to change the ways that future computer-based learning is done.
        - Kung Pow Studios, a custom animation company.

- Members:
    - Unfortunately, our only industry member, Deere and Company elected to not renew its CII membership in January 2009, citing the difficult economic climate. However, since Fall 2008 we have formalized CII's *Industry Research Membership Program* (IRMP) with official By-Laws and streamlined the contracting processes. In addition we have commitment from ISU's Industry Relations team to help re-market the membership program during 2009-2010, and are confident that, with the improving economic outlook, it will be successful.

These partnerships build on CII's commitment to economic development in the state of Iowa. Start-up companies share resources (from the copy machine to student interns) and network access with other startups as well as bigger IT companies. Overall these resources ease the start-up process by providing a space to collaborate on the challenges in commercializing new technologies.

As an educational, training, and research resource, the CII Technical Collaboration Facility also houses the Information Assurance Center's (IAC) *Internet Scale Event and Attack Generation Environment* (ISEAGE). IAC personnel work with regional high schools and local industry leaders to sponsor programs to engage high school and undergraduate students in IT. IAC also sponsors training short courses for industry, both at CII, and remotely, with a mobile system.

Current ISEAGE projects include:

- MapIowa, a graphical simulation of the Iowa Communications Network that can be dynamically attacked, crippled, or modified to research the effects of a catastrophic failure of the network;
- ISECUBE, a portable ISEAGE that can be used to create a virtual copy of a network for testing. The first remote information security industry workshop was held in Omaha in June using an ISECUBE;
- National and local Cyber Defense Competitions; and
- IT Adventures, a program to motivate high school students to pursue a career in IT.

For more information about the new and ongoing activity at CII, visit our web site: www.cyberi.iastate.edu.

INFRASTRUCTURE PROVIDED TO COLLEGES

College of Liberal Arts and Sciences
Publications/presentations based on use of infrastructure:
Publications:

- "Components for Integral Evaluation in Quantum Chemistry", J.P. Kenny, C.L. Janssen, E.F. Valeev, and T.L. Windus, *J. Comp. Chem.*, **2008**, 29, 562-577
- "Implementation of Dynamical Nucleation Theory with Quantum Potentials", L.D. Crosby, S.M. Kathmann, T.L. Windus, *J. Comp. Chem.*, **2008**, 29, 562-577
- "High performance computations using dynamical nucleation theory", T.L. Windus, S.M. Kathmann, L.D. Crosby, *J. Phys.: Conf. Ser.*, **2008**, 125, 012017
- "A Component Approach to Collaborative Scientific Software Development: Tools and Techniques Utilized by the Quantum Chemistry Science Application Partnership" Joseph P. Kenny, Curtis L. Janssen, Mark S. Gordon, Masha Sosonkina, and Theresa L. Windus, *Scientific Programming*, **2008**, 16, 287
- "Implementation of Dynamical Nucleation Theory with Quantum Potentials", L.D. Crosby, S.M. Kathmann, T.L. Windus, *J. Comp. Chem.*, **2009**, 30, 743
- "A Temperature Scaling Method for Markov Chains", L.D. Crosby, T.L. Windus, *J. Phys. Chem. A*, **2009**, 113, 607
- "Nanoscale computations with NWChem", Theresa L. Windus, Eric J. Bylaska, Jan Andzelm, Niranjan Govind, *J. Comp.and Theor. Nano.*, **2009**, 6, 1297. Invited
- "Development of High Performance Scientific Components for Interoperability of Computing Packages", Teena P. Gulabani, Masha Sosonkina, Mark S. Gordon, Curtis L. Janssen, Joseph P. Kenny, Heather Netzloff, Theresa L. Windus, *Proc. of High Perf Comp. 2009*, accepted
- "Steric buttressing in the selective metalation of 4,6-dibromoresorcinol dimethyl ether", George A. Kraus, Insik Jeon, John Mengwasswer, Aaron C. West and Theresa L. Windus, *J. Org. Chem.*, in preparation
- "Non-ancillary achiral tris(oxazolinyl)borate scorpionates Supporting Iridium(I) Complexes", A.V. Pawlikowski, T. Gray, G. Schoendorff, B. Baird, A. Ellern, T. L. Windus, and A.D. Sadow, *Inorg. Chim. Acta*, accepted
- "Density Functional Studies on the Complexation and Spectroscopy of Uranyl Ligated with Acetonitrile and Acetone Derivatives", G. Schoendorff, T.L. Windus, W.A. de Jong, *J. Phys. Chem. A*, accepted

Presentations: (new for this period)

- "Monte Carlo Simulations of Cluster Nucleation Using Quantum Mechanical Potentials", T.L. Windus, Invited, Differential Equations & Computational Simulations, May 2009
- "Use of components in high performance chemistry", T.L. Windus, J.P. Kenny, M.S. Gordon and C.L. Janssen, Invited, University of Alabama at Birmingham, May 2009
- "Quantum Chemistry for Heavy Elements", T.L. Windus, G. Schoendorf, W. DeJong, M.S. Gordon, Invited, Air Force Institute of Technology, Dayton, OH, April 2009

- "New Advances in NWChem: Dynamical Nucleation Theory", T.L. Windus, Invited, Wright-Patterson Air Force Base, Dayton, OH, April 2009
- "High performance computational chemistry", T.L. Windus, Invited, American Chemical Society, Salt Lake City, UT, March 2009
- "Monte Carlo Simulations of Cluster Nucleation Using Quantum Mechanical Potentials", T.L. Windus, Invited, Texas Tech University, February 2009

External funding applied for utilizing infrastructure purchases (indicate received/denied/pending): Only new projects or updated information within the update period are listed here.

Received:

- Co-PI on "A Multi-scale Approach to Addressing Bio-Remediation", DOE ($1,500,000)

Pending:

- Co-PI on "Computational Evolution of Aptamer Specificity", NIH ($1,761,745)
- Co-PI on "CDI-Type II: Dynamics and Kinetics for the Rational Design of Protected Functional Nanoparticles", NSF ($1,838,243)
- Co-PI on "DUE CCLI Phase II: Vertical Integration of Chemical Bonding in the Undergraduate Curriculum", NSF ($499,987)
- Co-PI on "PRAC: Computational Chemistry at the Petascale", NSF, ($31,800)
- Co-PI on "Improving Developer Productivity for HPC through Cyberinfrastructure: Applications, Languages, Tools and Services", NSF ($1,950,000)
- Co-PI on "An Accelerator-based HPC System driven by High Productivity Programming Models", NSF ($11,997,780)

Denied:

- Co-PI on "PRAC: Computational Chemistry at the Petascale", NSF ($31,800 + 620 Million CPU hours)

Equipment Purchased/Renovations Made:

Purchase of 105 4GBx2 memory upgrades.

Progress Report (300 word maximum):

In one major research effort, we have been using dynamic nucleation theory Monte Carlo to examine small water clusters, small nitric acid clusters and small sulfuric acid clusters using ab initio methods – their reaction rates, energy distributions and properties. In our quest to reduce the number of quantum mechanical evaluations, we have continued developed of a method to scale configurational probability distributions obtained at high temperatures to lower temperatures without any additional evaluations. These results are currently being reviewed for an article in the Journal of Physical Chemistry A. In addition, we have had two papers accepted on the overall methodology and parallel algorithms used in the research.

In addition, we have continued to make significant inroads into the computational science of component development. On the component front, we have been tackling the complex issue of developing components for interoperability of integral codes between three computational chemistry codes, NWChem, GAMESS and MPQC. While the final testing is still in progress, the interfaces have been defined and the interfaces have been implemented. We have also continued to develop new components for combined quantum and molecular mechanics computations. These components have been tested with the NWChem framework and a paper has been submitted.

In collaboration with George Kraus, an experimentalist at ISU, we have been performing calculations on the selective metalation of 4,6-dibromoresorcinol dimethyl ether. The calculations are successful in predicting the products produced from the several reactions of interest and in explaining the steric buttressing effect of the methyl groups. This work is in the final preparation stages for submission to the Journal of Organic Chemistry.

Finally, we have started extremely accurate computations of oxygen atom with ethylene to study the dynamics of the nonadiabatic crossings on the reactive surfaces. These calculations will represent the most accurate computations of these surfaces and will lead to new insights on the actual mechanisms of the crossings.

College of Engineering:
Previously reported

- **Principle Investigator : Aaron Clapp**

Publications/presentations based on project:

- A.R. Clapp, E.R. Goldman, H.T. Uyeda, E.L. Chang, J.L. Whitley, I.L. Medintz, "Monitoring of Enzymatic Proteolysis Using Self-Assembled Quantum Dot-Protein Substrate Sensors," *J. Sensors*, in press.

- I.L. Medintz, H. Mattoussi, and A.R. Clapp, "Potential Clinical Applications of Quantum Dots," *Int. J. Nanomed.*, **3**, 1-17 (2008)

External funding applied for (indicate received/denied/pending):

- $31,000 for Equipment for Aaron Clapp, CBE Department
- Denied: Ames Lab seed grant, NIH R01
- Pending/future: NIH R21, NSF CAREER

Equipment Purchased/Renovations Made: On PO I7-50307-00, purchased Fluoromax-4; Research spectrofluorometer with 150w ozone free Xe source and power supply. Also, on PO I7-49358-00, used $6,653 of the Battelle funding towards the purchase of a unilab antechamber.

Progress Report (300 word maximum):

These funds were used as part of a startup package where the equipment has been in place for approximately 1.5 years.

The Fluoromax-4 is a highly sensitive fluorescence fluorometer which we use to formally characterize fluorescent nanoparticles synthesized in our laboratory. It is a workhorse piece of equipment and invaluable to our research. Recently, it has been used to study protein-protein interactions using fluorescence resonance energy transfer (FRET) where quantum dots donate energy to nearby fluorescent dyes. The emission spectrum provides quantitative distance and orientation information about the associating biomolecules. This is a capability that is greatly enhanced through the use of this instrument.

The mini antechamber is an integral part of the Unilab glovebox system which allows us to safely handle air-sensitive precursor materials such as diethyl zinc. The antechamber is absolutely necessary for transferring materials into and out of the glovebox system. We use the glovebox daily in our work.

- **Principal Investigator(s): JimAlleman**

External funding applied for utilizing infrastructure purchases (indicate received/denied/pending):

This equipment has provided all faculty the opportunity to benefit from this donation. In FY08, 128 proposals were submitted and 82 funded for a total of $9,056,980 for CCEE/CTRE staff.

Equipment Purchased/Renovations Made:

Dual Core Intel Xeon 5050 Server for the CCEE Department. New server provides the capability of larger memory storage and real-time computer access for an entire research group.

Progress Report (300 word maximum):

1) Five professors within the department (more than 20% of our total faculty) are using the system for archival and backup data storage as well as for routine IT applications tied to individual research and departmental operations. In addition, our department's staff communications specialist also uses the system primarily for large-scale photo and video archiving and retrieval (i.e., see item #4 below).
2) One of these professors (i.e., Charles Jahren) is in charge of the CCEE department's 'distance education' (DE) initiative, and according uses the server as the department's DE-related course file storage repository. A related highlight point on this account is that our department's DE activities represent one of the most rapidly evolving college-level DE operations, with rapidly expanding course offering and enrollment changes, and the use of this server plays a strategically critical role with local hosting of course materials.
3) Yet another professor using this system (i.e., David White), uses the server for high-level storage of data tied to his world-class initiative in geo-construction engineering. In this case, Dr. White is also studying the parallel use of this server as a repository for real-time data acquisition via on-site sensors tied to intelligent compaction technologies coupled with in-field geotechnical equipment.
4) This server is also used as the primary storage site for all departmental photographs and videos taken during routine student, faculty, and staff events. This information is then used for both developing both print and web-based materials.

- **Principal Investigator(s): Jaeyoun Kim**

Publications/presentations based on use of infrastructure:

- Jiwon Lee and Jaeyoun Kim, "Numerical Investigation of Quasi-Coplanar Plasmonic Waveguide-based Photonic Components," Optics Express, v. 16, pp.9691-9700, 2008.
- Jaeyoun Kim, "Surface plasmon-polariton waveguiding characteristics of metal/dielectric quasi-coplanar structures," Optics Letters, v. 32, pp.3405-3407, 2007.
- Yu Liu and Jaeyoun Kim, "Ultracompact Plasmonic Waveguide Bend Based on Nanoscale Cavity Resonance," Integrated Photonics and Nanophotonics Research and Applications, IWD2, Boston, MA, 2008
- Jiwon Lee and Jaeyoun Kim, "A Quasi-Coplanar Plasmonic Waveguide for Ultracompact Photonic Integrated Circuits," Conference on Lasers and Electro-Optics, QTuD6, San Jose, CA, 2008

External funding applied for utilizing infrastructure purchases (indicate received/denied/pending):

An Implantable Optical Glucose Sensor (to NSF, pending)

Equipment Purchased/Renovations Made:

- WS-400B_6NPP-Lite Processor Singer Wafer Spin with vacuum pump and SPIN2000-PC interface software from Laurel Technologies ($5,390)
- FEMTO 40KHZ Plasma System including Leybold D1.5B Vacuum Pump, Food Grade Vacuum hose from Diener Electronic ($11,185)
- ST-UT2-46_8 Table Assy, Support System, and ACMP-02 Compressor Assy from Newport Corp ($8,45672)
- Leica Microscope with Camera and Vibration Isolation Table from north Central Instruments (Paid $4,071.75, $20,267.85, and $4,243.50)
- GB-08 Labmaster 130 (2500/1000) with single purification and analyzer from M Braun Inc ($31,416.90)

- 4DOF WAM Basic Turn-Key System with modular 3 DOF Wrist and Barrethand Robot from Barrett Technology ($54,968.28)

Progress Report (300 word maximum):
The research focuses on a novel plasmonic waveguide structure for future applications in photonic integrated systems. Plasmon waveguides are attractive for their ability to confine electromagnetic waves on subwavelength scale, which is not possible in purely optical waveguides. Numerous plasmonic waveguiding structures have been demonstrated. Many of them require, however, extremely small feature size or high aspect ratio which makes their implementation prohibitively difficult. We invented a new plasmonic waveguiding structure called "quasi-coplanar plasmon waveguide (QCPW)."

The results of 2D numerical studies reveal that QCPW has many desirable characteristics: (1) The fabrication QCPW involves only standard lithographic and deposition processes. (2) It supports a wide range of wavelength, especially the important "telecommunication bandwidth". (3) The size of propagating modes is far below wavelength scale. (4) The tolerance of the modal characteristics to the fabrication imperfection is good. These 2D results are published and presented [2,4].

Since the QCPW structure is partially open in lateral directions, its performance in "perturbed 3D operations", such as propagation through waveguide bends or couplers, needs to be confirmed with 3D simulations. The results show that: (1) 2D mode analysis and 3D propagation simulation results match well each other. (2) The coupling between QCPW becomes negligible when the waveguides are separated by more than 500 nm, (3) The bending loss becomes negligible when the bend radius becomes greater than 8 microns. (4) The QCPW supports a new type of mode called the half-mode. It is useful for implementing plasmonic interferometers. (5) By covering part of the QCPW structure with metal films, we can increase the transmission through an ultracompact waveguide bends by a factor of 2. These results are published and presented in 2008 [1,3].

In the 2nd half of 2008, we will seek the mechanism for bending efficiency improvement.

A two-section glove box from MBraun Inc. for research in organic and bioelectronics of material, have also been purchased, which are sensitive to air and humidity.

The Barrett WAM is a state of the art robot arm with 7 degrees of freedom in the arm and an additional 7 degrees of freedom in the hand. It is highly dexterous and has human-like grace and dexterity. Two WAM arms were purchased and they will be used to construct an upper-torso humanoid robot. The robot will be used to conduct cutting edge research in autonomous and developmental robotics.

Previous information:

- Andrew Hillier. $120,000 is currently encumbered on this fund. It is match support for the Keck Grant. Dr. Andy Hillier has placed a purchase order to AJA International, Inc. for an ATC Series Combinatorial/Conventional Sputtering System. The W. M. Keck Foundation established the W. M. Keck Laboratory for High Throughput Atom-Scale Analysis to drive the frontiers of combinatorial science and atom-scale materials research. This lab provides sample preparation and characterization facilities in support of the research activities performed by members of the Institute for Combinatorial Discovery as well as researchers throughout Iowa State University and the public. The laboratory provides unique materials preparation and characterization facilities that support a range of research and educational projects.
- Dr. James Alleman purchased a Dual Core Intel Xeon 5050 Server for the Civil Construction and Environmental Engineering Department. The new server provides the capability of larger memory storage and real-time computer access for the entire research group.
- Dr. Song-Charng Kong purchased time on the Lighting Cluster (high performance computing). This computer time will allow him to perform combustion process modeling which is vital to his effort to find better ways to burn bio-renewable fuels in engines cleanly, efficiently and effectively. If we want to increase use of bio-renewable fuels to lessen our dependence on petroleum based engine fuels, this kind of research must occur.
- Dr. Krishna Rajan spent $81,000 of the Battelle funds to purchase a Nano Test Platform and NTX Controller with High Temperature option and High temperature extension. The equipment was purchased from Micro Materials Limited. The total cost of the equipment was $188,905. The benefits of the equipment are various

including the ability to collaborate with several other faculty members at ISU and support industrial sponsored projects in the areas of mechanics of materials and high temperature behavior of materials.

- Dr. Richard LeSar spent $80,000 of the Battelle funds to purchase a portion of the large computer system. This equipment is essential for Dr. LeSar's work on computational materials science, providing the ability to model a wide range of materials behavior. Results of this work enable the ability to collaborate with other ISU researchers and to develop strong and active ties with industry and governmental research efforts.

BATTELLE FUNDING: PROGRESS REPORT

Update Period: July 01, 2006 – December 31, 2006
Title:
Platform: Advanced Manufacturing
Platform Chair): Ron Cox
Platform Expenditures: $ -
Platform Funding: $100,000
Project Allocated: $100,000
Project Obligated: $ -
Inf. Allocated: **$** -
Inf. Obligated: $ -

Progress Report:
The work is scheduled to be completed in FY10.

University of Northern Iowa
Annual Economic Development and Technology Transfer Report
FY 2009

Section 1. UNI's Economic Development Activities to Enhance Economic Growth in Iowa

By excelling in several specific areas, UNI's economic development efforts have become a renowned resource. The University continues to realize considerable growth and accomplishment in these areas, helping to better serve clients statewide. Specific focus areas for UNI include: community and economic development; market research; environmental research and service; metal casting; biobased lubricants; executive development; new Iowans; and entrepreneurship. The Business and Community Services (BCS) division houses a host of programs that emphasize hands-on assistance to advance business, community and entrepreneurial development. Serving clients in each of Iowa's 99 counties, BCS is able to capitalize on the intellectual resources of the University to better meet Iowa's economic development needs. We are also able to bring these needs back to our university community – the faculty, staff and students – all of which play critical roles in providing practical assistance. Outcomes realized by key economic development/tech transfer programs during FY 2009 include:

- Provided service in all 99 counties to more than 4,250 business and community clients.
- Involved 220 faculty members and 2,100 students in delivery of these services.
- Leveraged each $1 invested by the state with $6 in federal funding, or private grants.

Entrepreneurship and Business Incubation

- UNI's 3 incubator/accelerator programs and MyEntreNet helped start or expand 160 ventures, creating 277 jobs.
- MyEntreNet now boasts more than 3,000 actively engaged users.
- More than 900 entrepreneurs attended 64 webinars.
- 24 student businesses were tenants in the John Pappajohn Entrepreneurial Center's Student Business Incubator and 31 additional student entrepreneurs were virtual tenants.
- One of the UNI John Pappajohn Center's student incubator tenants has been selected as a winner of the John Pappajohn Collegiate Business Plan Competition and another tenant placed 3rd, nationally in the Collegiate Elevator Pitch Competition.
- MyEntre.Net received the Award of Excellence from the University Economic Development Association (UEDA) for Innovative Entrepreneurship Assistance.

Technology Transfer

- UNI faculty and staff submitted 12 new intellectual property disclosures.
- A total of 4 patents were received and 6 new patents were filed.
- 3 new license agreements were approved and 2 more are in negotiations.
- Support from GIVF and Battelle funds enabled 19 research projects, with substantial commercial potential, to either be launched or completed.
- All but one of the GIVF research projects have submitted disclosures and are moving toward commercialization.

Waste Reduction and Environmental Assistance

- Environmental technical assistance and on-site reviews were provided to 253 small businesses.
- 195 military personnel were provided with painting / coating training to improve transfer efficiency.
- Worked in conjunction with state agencies to study geospatial mapping data related natural disasters in Iowa.
- Recycling and reuse project funding was provided to 47 companies and organizations.
- Energy efficiency and environmental education assistance was provided to 316 educational institutions, farmers, and food vendors in 168 different communities and 38 counties.

Local Economic Development

- Community clients report creating approximately 1,500 jobs as a result of local economic development technical assistance from the Institute for Decision Making (IDM).
- Extensive technical assistance was provided to 46 community partners and 6 regional groups.
- IDM created a base set of regional metrics for the Iowa Department of Economic Development, to measure the progress of regional development groups.
- Partnered with the Center for Regional Economic Competitiveness (CREC) to conduct workforce assessments for two regions.
- A methodology for estimating job vacancies in Iowa industrial sectors was developed.
- Developed a new community-wide plan for sustainability in Fairfield; the first such plan of its kind in the Midwest.

Bioeconomy

- More than 15,000 acres of roadway right-of-way have been restored to native prairie vegetation.
- Testing labs for biobased lubricants and biofuels were augmented; testing services were provided to the State of Iowa, university partners and biodiesel producers.
- New research involving continuous oil recycling for diesel engines and microwave heating systems for blending biobased oils and greases, commenced.

Metal Casting – Advanced Manufacturing

- New biobased binder systems have been developed; patent applications were prepared and license agreements are being finalized.
- Technical assistance, research and training were provided to 30 foundries.

Market Research

- 27 diverse market research projects were conducted for16 different companies.
- Market research clients report an average employment increase of 16%, due in part to the information provided by UNI.
- 9 Grow Iowa Values-funded market research projects were conducted for small, rural Iowa companies.
- 3 technology transfer projects at UNI were provided with market research assistance.

Section 2. Technology Transfer and Intellectual Property

FY 2009

	UNI
a. Number of disclosures of intellectual property	12
b. Number of patent applications filed	6
c. Number of patents awarded	4
d. Number of license and option agreements executed on institutional intellectual property (all Iowa)	3
e. Number of license and option agreements yielding income	13
f. Revenue to Iowa companies as a result of licensed technologies	$3,200,000
g. Number of start up companies formed, in total and in Iowa	74/74
h. Number of companies in research parks and incubators	34
i. Number of new companies in research parks and incubators	23
j. Number of employees in companies in research parks and incubators	65
k. Royalties/license fee income	$117,750
l. Total sponsored funding	$39,750,000
m. Corporate-sponsored funding for research and economic development and revenue generation (excludes corporate philanthropy all in Iowa)	$1,353,850
n. i. Annual appropriations for economic development ii. Grow Iowa values appropriation	$578,608 $760,000

Section 3. Overview of UNI's Economic Development Programs

UNI outreach services for community and economic development activities are outlined in a table format on the following six pages. The format provides a brief overview of each program, its purpose, who is served and outcomes. Together, the programs served approximately 4,250 communities and/or businesses in the past year.

Section 3. Overview of UNI's Economic Development Programs (continued)

Programs	Services	Those Typically Served	FY 2009 Results	Cumulative Results
Institute for Decision Making (IDM)	Hands-on community and economic development guidance and research	Economic development organizations, chambers, city councils, communities and others	✓ Developed first community-wide sustainability plan for Fairfield, IA. ✓ Assistance and research provided to 46 community partners and 6 regional development groups. ✓ Partnered with C2ER of Virginia, for workforce assessment and development planning for two regions in the state.	✓ Served 635 communities, counties and groups in nearly all of Iowa's counties to date. ✓ Community clients report 1,500 – 2,000 new jobs annually as a result of IDM assistance. ✓ Trained over 700 economic development professionals.
Iowa Waste Reduction Center (IWRC)	Free, confidential, non-regulatory environmental assistance for small businesses	Small businesses throughout Iowa	✓ Environmental technical assistance and on-site reviews were provided to 253 small businesses. ✓ 195 military personnel received painting / coating training.	✓ 896 military personnel received training at the STAR4D facility. ✓ Provided 4,316 on-site reviews to Iowa small businesses.
National Ag-Based Lubricants (NABL) Center	Biobased lubricants research, testing services, development of performance standards and biobased lubricant product certification	Companies and individuals developing biobased lubricants, traditional lubricant companies, and lubricant consumers	✓ Added additional engine testing resources and completed over 500 hours of diesel engine tests using soy-based engine oils. ✓ Provided fee-based testing services to industry clients. ✓ New laboratory capabilities and staff members were added.	✓ Over 40 soy lubricants, greases, metalworking fluids and specialty lubricants developed to date. ✓ Leads the U.S. biobased lubricants' industry as a national testing center.
Strategic Marketing Services (SMS)	Market research and analysis	Businesses, entrepreneurs and non-profit organizations	✓ Market research and analysis services were provided to 16 Iowa companies and 3 technology transfer projects.	✓ Since 1990, market research and analysis services have been provided to 256 Iowa companies.

Section 3. Overview of UNI's Economic Development Programs (continued)

Programs	Services	Those Typically Served	FY 2009 Results	Cumulative Results
Executive Development Center (EDC)	Management and professional training workshops and certificate programs	Iowa businesses and organizations	✓ Specialized business management training provided in 41 workshops to 323 business professionals in 50 businesses during the past year	✓ Since 1998, has provided training in 1,020 workshops to 17,578 business professionals.
John Pappajohn Entrepreneurial Center (JPEC)	Research, entrepreneurship education, technology transfer, and capital investment programs	Students interested in entrepreneurship, UNI faculty and staff entrepreneurs, new ventures and rapidly growing small companies	✓ One student entrepreneur won 3rd place at a national elevator pitch competition. ✓ 1532 businesses and individuals were assisted through all JPEC programs. ✓ 17 student business owners were provided space and services in the student business incubator. ✓ 31 student business owners were provided services as part of the student business (virtual) incubator program.	✓ The JPEC saw a 29% increase during FY2009 in clients and services provided ✓ The JPEC Student Business Incubator has provided space to more than 20 business owners since the BCS building opened. ✓ The Cedar Valley Venture Fund, managed by JPEC, has invested in 6 new ventures.
Iowa Center for Immigrant Leadership and Integration (ICILI)	Helping Iowa communities and businesses accommodate the needs of newcomers	Communities, faith-based organizations and businesses	✓ Created a new handbook entitled *New Americans, New Iowans.* ✓ Created a manual for effectively using interpreters in health care settings. ✓ Worked with 30 companies, health care providers, social service providers and communities to better meet the needs of newcomers.	✓ Assistance in accommodating the needs of newcomers has been provided to more than 200 Iowa companies and organization. ✓ More than 25,000 copies of four different guides/manuals (and untold electronic copies) have been distributed throughout Iowa.

Section 3. Overview of UNI's Economic Development Programs (continued)

Programs	Services	Those Typically Served	FY 2009 Results	Cumulative Results
UNI Regional Business Center/ Small Business Development Center (RBC/SBDC)	Rural/ Urban Entrepreneurship development, online entrepreneurship resources, business consulting, business training, business incubation	Small and medium sized businesses, entrepreneurs, entrepreneurial service providers, community leaders	✓ New online community launched in May. ✓ 911 entrepreneurs participated in one of 64 free interactive Webinars online. ✓ Second annual statewide conference hosted 251 participants in Coralville. ✓ MyEntre.Net entrepreneurs reported 94 new or expanded businesses, creating 177 jobs and $18,449,000 in new commercial equity investment. ✓ The 4th Street Incubator served many disaster-affected business owners. ✓ Innovation Incubator served six early stage firms; graduated first tenant. ✓ 872 Iowans attended a regional EntreBash! ✓ 274 clients served by UNI SBDC with technical assistance or training.	✓ 3,024 registered in new online community at www.myentre.net ✓ 46 companies have graduated from the UNI RBC incubation programs to date. They have collectively created 88 new FTE jobs and leveraged $4,027,000 in new commercial/equity investment in the Cedar Valley.

Section 3. Overview of UNI's Economic Development Programs (continued)

Programs	Services	Those Typically Served	FY 2009 Results	Cumulative Results
Tallgrass Prairie Center (TPC)	Research, techniques, education and source-identified seed for restoration and preservation of native vegetation	Iowa counties, state and federal agencies, commercial native seed producers, the community, educators, students and others	✓ Roadside vegetation research for restoring right-of-ways was provided to the Iowa Department of Transportation and native seeds distributed to 50 counties in Iowa. ✓ Replanted prairie after 2008 flood to determine prairie species mix for optimal biomass electrical generation. ✓ Manuscript to U of I press: Tallgrass Prairie Center's Guide to Prairie Restoration in the Upper Midwest ✓ Completed roadside research projects.	✓ More than 15,000 acres of roadway right-of-way have been restored to native vegetation. ✓ Increased public knowledge regarding prairie ✓ Provided information for Iowa DOT to change seeding regulations.
Center for Energy and Environmental Education (CEEE)	Innovative educational and technical advice related to energy, environment and community-based agriculture	Iowa classrooms, teachers, farmers, businesses, state agencies and citizens	✓ Energy efficiency, environmental education assistance, and local economic development assistance was provided to 316 educational institutions, farmers, and food vendors in 168 different communities and 38 counties. ✓ Education programs reached roughly 9,800 K-12 students, and over 1,100 K-12 teachers. ✓ But Fresh, Buy Local participating restaurants and institutional buyers in the Black Hawk County area spent $2.2 million on locally grown foods, a growth of 250%.	✓ Since 1998, energy and environmental education programs in 72 counties have reached over 80,000 K-12 students, and 4,580 K-12 teachers. ✓ Since 1998, Buy Fresh/Buy Local program has facilitated purchase of $5.8 million worth of meat and produce from hundreds of area farmers by food vending institutions.

Section 3. Overview of UNI's Economic Development Programs (continued)

Programs	Services	Those Typically Served	FY 2009 Results	Cumulative Results
Recycling and Reuse Technology Transfer Center (RRTTC)	Recycling and by-products research, education and outreach	Serving Iowa businesses the recycling industry and Iowa citizens.	✓ Research project funding and outreach services related to recycling and reuse were provided to 47 companies and organizations.	✓ 42 RRTTC-funded research projects and over 170 reports and publications available. ✓ Outreach and services provided to more than 8,185 individuals this year, including business/industry, K-12 students and teachers, and Iowa citizens.
Metal Castings Center (MCC) and Center for Advanced Biobased Foundry Binders (CABB)	Metal casting technologies, applied research, testing and training	Iowa casting users, foundries and foundry suppliers	✓ Maintained active contracts with 24 companies, provided outreach projects to 2 Iowa foundries and technical assistance to 30 additional foundries. ✓ Conducted DOE-sponsored research into bio-based foundry binders – 2 patents submitted. ✓ Sponsored commercialization of bio-based foundry binders ✓ Collaborated with University of Iowa and Iowa State University on Department of Defense-sponsored research.	✓ More than 50 industry-funded research projects have been completed to date.
Sustainable Tourism and Environment Program (STEP) and Recreation Research and Service (R2S)	Sustainable tourism planning and policy assistance and recreation research and programs	Businesses, government and non-government organizations, special interest and community groups	✓ Technical assistance was provided to 1 county resource agency and 1 multi-county regional sustainable tourism project. Provided training for 1 state association. Provided youth programs in rural areas.	✓ Market research feasibility and economic impact studies have been provided to more than 40 counties or communities.

Section 3. Overview of UNI's Economic Development Programs (continued)

Programs	Services	Those Typically Served	FY 2009 Results	Cumulative Results
Materials Innovation Service (MIS)	Mechanical, physical and chemical tests of metals, polymers and cementitious materials	Serving Iowa manufacturers and suppliers	✓ Technical assistance provided to more than 160 individuals and testing contracts from five companies.	✓ Over 1,870 hours of testing provided since the beginning of the program.
Geoinformatics Training, Research, Education and Extension Center GeoTREE)	Geospatial technologies, education, research, and outreach activities for federal, state, local and tribal agencies	Federal, state, local and tribal (FSLT) government agencies (NASA)	✓ 7 educational workshops held with 251 attendees. ✓ Worked with DNR and Public Health to apply geospatial data to solve problems. ✓ Working with Dubuque River Museum for science education. ✓ Working with Cedar Falls Utilities on identifying areas most in need of energy conservation and efficiency assistance. ✓ Provided training on agent-based modeling for flooding.	✓ GeoTREE has provided 19 training and educational workshops for approximately 560 federal, state, local and tribal government staff members.

Section 4: Grow Iowa Values Funding Project

See attached spreadsheet highlighting outcomes from UNI's Grow Iowa Values Fund projects in 2009 (presented at the August 2009 Board of Regents meeting).

Section 5: Battelle Projects

See attached spreadsheet highlighting outcomes from UNI's Battelle projects in 2009 (presented at the August 2009 Board of Regents meeting).

Section 6: Collaboration for Economic Development

Examples of UNI's collaboration with state government, federal agencies and other Regent institutions are outlined by category below, by subject area:

Energy and Environment

Recycling & Reuse Technology Transfer Center (RRTTC) and Educational Partners
The RRTTC worked with Lincoln Elementary school in Cedar Falls to bring the Environmental Education program, Get Your Green On, to more than 460 K-6 students through the course of the school year. This program also included members from UNI Tallgrass Prairie, Cedar Falls Utilities, Waste Trac, and City Carton Recycling. The RRTTC also worked with the CEEE, CFU, St. Vincent de Paul, Goodwill, University Book & Supply, Duee's Pawn Shop and the UNI Physical Plant to help bring about the fist annual "Panther Pick-Up" to help reduce useable items and recyclable metal materials from going into the landfill.

Iowa Waste Reduction Center (IWRC), Iowa Dept. of Natural Resources and the Iowa Dept. of Economic Development
The Iowa Air Emissions Assistance Program (IAEAP, a program of the IWRC), the Iowa Department of Natural Resources (DNR) and the Iowa Department of Economic Development (IDED) have formed a working group to evaluate and determine the best ways to assist Iowa businesses with the new Area Source Rules. The group determined that the Surface Coating rule (a specific Area Source Rule) posed a significant potential impact on Iowa small businesses. In conjunction with the DNR, the IWRC delivered 18 presentations to 597 individuals across the state regarding this new rule.

Strategic Marketing Services (SMS) and the Iowa Office of Energy Independence
SMS worked with the Iowa Power Fund and Office of Energy Independence to conduct a comprehensive statewide residential energy survey, gathering data on Iowans' knowledge, beliefs, attitudes, and levels of concern, use, affordability, and behaviors as they relate to energy issues. A comprehensive report was issued detailing the findings of this research.

GeoInformatics Training, Research, Education, and Extension (GeoTREE) Center, the Iowa Dept. of Natural Resources and the Iowa Dept. of Transportation
GeoTREE continues its collaboration with the Iowa Department of Natural Resources and the Iowa Department of Transportation, and have developed a web portal to disseminate optical remote sensing data for the entire state. This team is also working with other federal, state, local and tribal agencies in Iowa on a variety of other research, education and outreach activities utilizing remote sensing data.

Public Health

GeoTREE and the National Geospatial-Intelligence Agency (NGA)
Mosquito-borne diseases such as the West Nile virus (WNV), malaria, dengue fever, and Rift Valley, fever cause tremendous suffering throughout the world. All of these diseases are intrinsically linked to environmental, climatic, demographic, and hydrological conditions. Considerable research into each of these diseases has been carried out and disease/location specific warning systems have been developed and applied. The purpose of this collaboration is the development of an adaptive multi-scale predictive framework for mosquito-borne diseases (termed FPModeler) that will provide functionality for near real-time forecasting of conditions likely to lead to the proliferation of mosquito-borne diseases.

The Iowa Center for Immigrant Leadership and Integration, Iowa Dept. of Public Health and the Iowa Center on Health Disparities
The Iowa Center for Immigrant Leadership and Integration (ICILI) worked with the Iowa Center on Health Disparities and the Iowa Department of Public Health to develop advertising materials to encourage more African Americans to be tested for colorectal cancer. This marketing research involved focus groups with African American adults in Waterloo, Iowa.

Entrepreneurship and Local Development

Institute for Decision Making (IDM), Iowa Area Development Group and Delta Dental
IDM and the Iowa Area Development Group (IADG) established a partnership with Delta Dental focusing on the establishment of a new initiative to help locate dentists in rural Iowa. The program is called the Iowa Rural Dental Health initiative and it is underway to "FIND" new dentists for rural Iowa communities. FIND stands for "Fulfilling Iowa's Need for Dentists." Other "FIND" partners included Iowa Department of Public Health Oral Health and the Office of Iowa Practice Opportunities at the University of Iowa, College of Dentistry.

Regional Business Center and Iowa State University
In 2009, the RBC partnered with the Iowa Microloan Program, a project of Iowa State University Extension to provide small Iowa firms access to a new microloan fund. Through MyEntre.Net's online community, applicants from anywhere in the state can now access the technical assistance and funding available through this innovative new loan program.

Regional Business Center (RBC) and Statewide Service Providers
The UNI RBC collaborates with 12 statewide partners to plan and implement an annual conference for Iowa small business owners called EntreFest! This two day conference is tailored

to the unique needs of Iowa's smallest ventures. Collaborators included multiple private sector companies and the following public entities: Iowa State University, University of Iowa, Iowa Area Development Group, Community Vitality Center, Farm Bureau, Iowa Small Business Development Centers, Alliant Energy, Black Hills Energy and the Iowa Bankers Association.

Bioeconomy

Tallgrass Prairie Center, Cedar Falls Utilities and the Iowa Crop Improvement Association
The Tallgrass Prairie Center (TPC) has developed a relationship with Cedar Falls Utilities (CFU) to determine the maximum energy production potential from prairie biomass. CFU will burn the biomass in their stoker furnace to evaluate the materials. Unfortunately, the June 2008 flood has set the project back one year. TPC is also working with the Iowa Crop Improvement Association to develop a consortium of native seed producers, native plant growers, nurseries, Iowa DNR, Iowa DOT, Iowa NRCS and private individuals to market native plants.

National Ag-Based Lubricants (NABL) Center and Iowa State University
UNI's NABL Center is collaborating with faculty and graduate research assistants at Iowa State University (ISU) to identify and evaluate the correlation between various free fatty acids in vegetable oil and resulting properties of those vegetable oils in lubricant applications. This ongoing research will provide targets for ISU plant researchers and improved functionality the NABL Center's lubricant formulations.

Advanced Manufacturing

Metal Casting Center (MCC), Northern Illinois University, Quad Cities Manufacturing Laboratory and Rock Island Arsenal
The MCC is currently collaborating with these partners to develop a center for excellence in titanium casting technologies. Projects include the development of advanced technology to replace heavy conventional castings with high-performance titanium castings. The resulting technology will be available to Rock Island Arsenal and also licensable by commercial companies throughout the Midwest.

Metal Casting Center (MCC), Iowa State University, University of Iowa and the Steel Founders Society of America
The MCC has an ongoing research partnership with professors at Iowa State University, the University of Iowa and the Steel Founders Society of America. This group is investigating advanced manufacturing methods for high-performance steel castings, in support of several key defense systems for the United States Military Service.

Metal Casting Center (MCC) and Iowa State University
The MCC has also been working with Iowa State University in an effort to develop lightweight steels for use in the wind generation industry. This project is part of the Iowa Wind Energy Alliance, a major partnership that includes roughly 13 institutional partners (including UNI).

Section 7: Client and Project Summary

See attached spreadsheet of UNI's clients served in 2009

7. Client and Project Summary

University of Northern Iowa

Service to Iowa

Fiscal Year 2009

Key to Acronyms

CEEE - Center for Energy and Environemtnal Education

EDC - Executive Development Center

GeoTREE - GeoInformatics Training, Research, Education, and Extension

ICILI - Iowa Center for Immigrant Leadership and Integration

IDM - Institute for Decision Making

IWRC - Iowa Waste Reduction Center

JPEC - John Pappajohn Entrepreneurial Center

MCC - Metal Casting Center

NABL - National Ag-Based Industrial Lubricants

RBC/SBDC - Regional Business Center/Small Business Development

RRTTC - Recycling and Reuse Technology Transfer Center

MIS - Materials Innovation Services

SMS - Strategic Marketing Services

STEP - Sustainable Tourism and the Environment Program

R2S - Recreation Research and Service

TPC - Tallgrass Prairie Center

Community or Business	County	State	Industry	Counseling Provided	Program
Winter Solstice Conference	Appanoose	IA	Educational association	EE Training	CEEE
Audubon Elementary School	Audubon	IA	K-12 School	Energy Poster Contest	CEEE
Campus Reuse mtg	Black Hawk	IA	University Group	Waste Outreach	CEEE
Campus Reuse mtg	Black Hawk	IA	Solid waste	Waste Outreach	CEEE
Cedar Falls	Black Hawk	IA	School	Energy Education	CEEE
Cedar Falls	Black Hawk	IA	School	Energy Education	CEEE
Cedar Falls	Black Hawk	IA	School	Energy Education	CEEE
Cedar Falls	Black Hawk	IA	School	Energy Education	CEEE
Cedar Falls	Black Hawk	IA	School	Energy Education	CEEE
Cedar Falls	Black Hawk	IA	School	Energy Education	CEEE
Cedar Falls	Black Hawk	IA	School	Energy Education	CEEE
Cedar Falls	Black Hawk	IA	School	Energy Education	CEEE
Cedar Falls	Black Hawk	IA	School	Energy Education	CEEE
Community Reading	Black Hawk	IA	Community Group	EE Outreach	CEEE
Community Reading	Black Hawk	IA	Community Group	EE Outreach	CEEE
Community Reading	Black Hawk	IA	Community Group	EE Outreach	CEEE
Community Reading	Black Hawk	IA	Community Group	EE Outreach	CEEE
Community Reading	Black Hawk	IA	Community Group	EE Outreach	CEEE
Community Reading	Black Hawk	IA	Community Group	EE Outreach	CEEE
Community Reading	Black Hawk	IA	Community Group	EE Outreach	CEEE
Community Reading	Black Hawk	IA	Community Group	EE Outreach	CEEE
Community Reading	Black Hawk	IA	Community Group	EE Outreach	CEEE
Community Reading	Black Hawk	IA	Community Group	EE Outreach	CEEE
IAN Workshop	Black Hawk	IA	County Conservation	EE Training	CEEE
IAN Workshop	Black Hawk	IA	County Conservation	Outcomes Evaluation Training	CEEE
Waterloo Schools Local Comp-Bunger	Black Hawk	IA	K-12 School	Energy Poster Contest	CEEE
Irving Elementary	Bremer	IA	K-12 School	Energy Poster Contest	CEEE
Waverly Light & Power	Bremer	IA	Utility	Energy Poster Contest	CEEE
Independence	Buchanan	IA	School	Energy Education	CEEE

7. Client and Project Summary

University of Northern Iowa

Service to Iowa

Fiscal Year 2009

Community or Business	County	State	Industry	Counseling Provided	Program
St. John School	Buchanan	IA	K-12 School	Energy Poster Contest	CEEE
Manson	Calhoun	IA	School	Electric Vehicle Education	CEEE
Pomeroy	Calhoun	IA	School	Electric Vehicle Education	CEEE
Anita Elementary School	Cass	IA	K-12 School	Energy Poster Contest	CEEE
Cherokee Middle School	Cherokee	IA	K-12 School	Energy Poster Contest	CEEE
Zion Lutheran	Crawford	IA	K-12 School	Energy Poster Contest	CEEE
Melcher-Dallas School	Dallas	IA	K-12 School	Energy Poster Contest	CEEE
Davis County Middle School	Davis	IA	K-12 School	Energy Poster Contest	CEEE
Noter Dame Elementar	Des Moines	IA	K-12 School	Energy Poster Contest	CEEE
Community Reading	Dubuque	IA	Community Group	EE Outreach	CEEE
Sageville School	Dubuque	IA	K-12 School	Energy Poster Contest	CEEE
Armstrong	Emmet	IA	School	Electric Vehicle Education	CEEE
Alden Elementary School	Hardin	IA	K-12 School	Energy Poster Contest	CEEE
Mt. Pleasant Christian School	Henry	IA	K-12 School	Energy Poster Contest	CEEE
Salem	Henry	IA	K-12 School	Energy Poster Contest	CEEE
Van Allen Elementary	Henry	IA	K-12 School	Energy Poster Contest	CEEE
Waco Elementary School	Henry	IA	K-12 School	Energy Poster Contest	CEEE
Winfield-Mt. Union School	Henry	IA	K-12 School	Energy Poster Contest	CEEE
Pekin Community School	Jefferson	IA	K-12 School	Energy Poster Contest	CEEE
Pence School	Jefferson	IA	K-12 School	Energy Poster Contest	CEEE
Washington Elementary School	Jefferson	IA	K-12 School	Energy Poster Contest	CEEE
Iowa City	Johnson	IA	School	Electric Vehicle Education	CEEE
ITAG Conference	Johnson	IA	Educational association	EE Training	CEEE
Lakeview Elementary	Johnson	IA	K-12 School	Energy Poster Contest	CEEE
REAP CEP Bd. Mtg.	Johnson	IA	Government	EE Grant Ass't	CEEE
Olin Consolidated Schools	Jones	IA	K-12 School	Energy Poster Contest	CEEE
St. John School	Kossuth	IA	K-12 School	Energy Poster Contest	CEEE
Holy Trinity Catholic	Lee	IA	K-12 School	Energy Poster Contest	CEEE
All Saints Elem	Linn	IA	K-12 School	Energy Poster Contest	CEEE
Bowman Woods Elem	Linn	IA	K-12 School	Energy Poster Contest	CEEE
Cedar Rapids	Linn	IA	School	Electric Vehicle Education	CEEE
Cedar Rapids	Linn	IA	School	Electric Vehicle Education	CEEE
Cedar Rapids	Linn	IA	School	Energy Education	CEEE
Cedar Rapids	Linn	IA	School	Energy Education	CEEE
Cedar Rapids	Linn	IA	School	Energy Education	CEEE
Cedar Rapids	Linn	IA	School	Energy Education	CEEE
Cedar Rapids	Linn	IA	School	Energy Education	CEEE
Cedar Rapids	Linn	IA	School	Energy Education	CEEE
Cedar Rapids	Linn	IA	School	Energy Education	CEEE

7. Client and Project Summary
University of Northern Iowa
Service to Iowa
Fiscal Year 2009

Community or Business	County	State	Industry	Counseling Provided	Program
Cedar Rapids	Linn	IA	School	Energy Education	CEEE
Cedar Rapids	Linn	IA	School	Energy Education	CEEE
Cedar Rapids	Linn	IA	School	Energy Education	CEEE
Cedar Rapids	Linn	IA	School	Energy Education	CEEE
Cedar Rapids	Linn	IA	School	Energy Education	CEEE
Cedar Rapids	Linn	IA	School	Energy Education	CEEE
Cedar Rapids	Linn	IA	School	Energy Education	CEEE
Cedar Rapids	Linn	IA	School	Energy Education	CEEE
Cedar Rapids	Linn	IA	School	Energy Education	CEEE
Cedar Rapids	Linn	IA	School	Energy Education	CEEE
Cedar Rapids	Linn	IA	School	Energy Education	CEEE
Cedar Rapids	Linn	IA	School	Energy Education	CEEE
Cedar Rapids	Linn	IA	School	Energy Education	CEEE
Cedar Rapids	Linn	IA	School	Energy Education	CEEE
Cedar Rapids	Linn	IA	School	Energy Education	CEEE
Cedar Rapids	Linn	IA	School	Energy Education	CEEE
Cedar Rapids	Linn	IA	School	Energy Education	CEEE
Cedar Rapids	Linn	IA	School	Energy Education	CEEE
Cedar Rapids	Linn	IA	School	Energy Education	CEEE
Cedar Rapids	Linn	IA	School	Energy Education	CEEE
Cedar Rapids	Linn	IA	School	Energy Education	CEEE
Cedar Rapids	Linn	IA	School	Energy Education	CEEE
Cedar Rapids	Linn	IA	School	Energy Education	CEEE
Cedar Rapids	Linn	IA	School	Energy Education	CEEE
Cedar Rapids	Linn	IA	School	Energy Education	CEEE
Cedar Rapids	Linn	IA	School	Energy Education	CEEE
Central City Comm Sch	Linn	IA	K-12 School	Energy Poster Contest	CEEE
IRA Solid Waste Educator	Linn	IA	Solid waste	Waste Outreach	CEEE
Lakeview Elementary	Linn	IA	K-12 School	Energy Poster Contest	CEEE
Knoxville	Marion	IA	School	Energy Education	CEEE
Pella Christian Grade School	Marion	IA	K-12 School	Energy Poster Contest	CEEE
Riceville Community School	Mitchell	IA	K-12 School	Energy Poster Contest	CEEE
Community Reading	Muscatine	IA	Community Group	EE Outreach	CEEE
Community Reading	Muscatine	IA	Community Group	EE Outreach	CEEE
Community Reading	Muscatine	IA	Community Group	EE Outreach	CEEE
Community Reading	Muscatine	IA	Community Group	EE Outreach	CEEE
Community Reading	Muscatine	IA	Community Group	EE Outreach	CEEE
Community Reading	Muscatine	IA	Community Group	EE Outreach	CEEE
Muscatine	Muscatine	IA	School	Electric Vehicle Education	CEEE

7. Client and Project Summary

University of Northern Iowa

Service to Iowa

Fiscal Year 2009

Community or Business	County	State	Industry	Counseling Provided	Program
Muscatine Community	Muscatine	IA	Community Group	EE Outreach	CEEE
Muscatine Power and Water	Muscatine	IA	K-12 School	Energy Poster Contest	CEEE
South O'Brien Schools	O'Brien	IA	K-12 School	Energy Poster Contest	CEEE
Ankeny	Polk	IA	School	Energy Education	CEEE
Ankeny	Polk	IA	School	Energy Education	CEEE
Ankeny	Polk	IA	School	Energy Education	CEEE
Ankeny	Polk	IA	School	Energy Education	CEEE
Ankeny	Polk	IA	School	Energy Education	CEEE
Ankeny	Polk	IA	School	Energy Education	CEEE
Ankeny	Polk	IA	School	Energy Education	CEEE
Ankeny	Polk	IA	School	Energy Education	CEEE
Ankeny	Polk	IA	School	Energy Education	CEEE
Centennial Elementary	Polk	IA	K-12 School	Energy Poster Contest	CEEE
IAEYC Conference	Polk	IA	Educational association	EE Training	CEEE
IAEYC Conference	Polk	IA	Educational association	EE Training	CEEE
Iowa Public Television	Polk	IA	Educators	EE Training	CEEE
Iowa Public Television	Polk	IA	Educators	EE Training	CEEE
ITAG Conference	Polk	IA	Educational association	EE Training	CEEE
ITAG Conference	Polk	IA	Educational association	EE Training	CEEE
REAP CEP Bd Teleconf	Polk	IA	Government	EE Grant Ass't	CEEE
Science Conference	Polk	IA	Educational association	EE Training	CEEE
Social Studies Confer	Polk	IA	Educational association	EE Training	CEEE
Social Studies Confer	Polk	IA	Educational association	EE Training	CEEE
The Academy	Polk	IA	K-12 School	Energy Poster Contest	CEEE
Urbandale	Polk	IA	School	Energy Education	CEEE
Urbandale	Polk	IA	School	Energy Education	CEEE
Urbandale	Polk	IA	School	Energy Education	CEEE
Urbandale	Polk	IA	School	Energy Education	CEEE
Urbandale	Polk	IA	School	Energy Education	CEEE
Urbandale	Polk	IA	School	Energy Education	CEEE
Urbandale	Polk	IA	School	Energy Education	CEEE
Urbandale	Polk	IA	School	Energy Education	CEEE
Davenport	Scott	IA	School	Electric Vehicle Education	CEEE
Davenport	Scott	IA	School	Energy Education	CEEE
Davenport and 100-ml rad	Scott	IA	Educators	EE Training	CEEE
Netherlands Reformed Christian School	Sioux	IA	K-12 School	Energy Poster Contest	CEEE
Netherlands Reformed Christian School	Sioux	IA	K-12 School	Energy Poster Contest	CEEE
Rock Valley Community Schools	Sioux	IA	K-12 School	Energy Poster Contest	CEEE

7. Client and Project Summary
University of Northern Iowa
Service to Iowa
Fiscal Year 2009

Community or Business	County	State	Industry	Counseling Provided	Program
East Elementary School	Story	IA	K-12 School	Energy Poster Contest	CEEE
Fellows Elementary	Story	IA	K-12 School	Energy Poster Contest	CEEE
REAP CEP Bd Mtg.	Story	IA	Government	EE Grant Ass't	CEEE
REAP CEP Bd. Mtg.	Story	IA	Government	EE Grant Ass't	CEEE
Indianola Middle School	Warren	IA	K-12 School	Energy Poster Contest	CEEE
Lineville-Clio Community	Wayne	IA	K-12 School	Energy Poster Contest	CEEE
Butler Elementary	Webster	IA	K-12 School	Energy Poster Contest	CEEE
Fort Dodge	Webster	IA	School	Energy Education	CEEE
Fort Dodge	Webster	IA	School	Energy Education	CEEE
Fort Dodge	Webster	IA	School	Energy Education	CEEE
Fort Dodge	Webster	IA	School	Energy Education	CEEE
Fort Dodge	Webster	IA	School	Energy Education	CEEE
Fort Dodge	Webster	IA	School	Energy Education	CEEE
Fort Dodge	Webster	IA	School	Energy Education	CEEE
Fort Dodge	Webster	IA	School	Energy Education	CEEE
Fort Dodge	Webster	IA	School	Energy Education	CEEE
Fort Dodge	Webster	IA	School	Energy Education	CEEE
Manson NW Webster Community Schools	Webster	IA	K-12 School	Energy Poster Contest	CEEE
Forest City Elementary School	Winnebago	IA	K-12 School	Energy Poster Contest	CEEE
Decorah	Winneshiek	IA	School	Energy Education	CEEE
Danbury Catholic	Woodbury	IA	K-12 School	Energy Poster Contest	CEEE
Northwood-Kensett	Worth	IA	K-12 School	Energy Poster Contest	CEEE
Advanced Heat Treat - Waterloo	Black Hawk	IA	Manufacturing	Training	EDC
Allen Health System - Waterloo	Black Hawk	IA	Health Care	Training	EDC
Bossard - Cedar Falls	Black Hawk	IA	Manufacturing	Training	EDC
Cedar Falls Jaycees - Cedar Falls	Black Hawk	IA	Service	Training	EDC
Cedar Falls Utilities - Cedar Falls	Black Hawk	IA	Service	Training	EDC
ConAgra Grocery Products - Waterloo	Black Hawk	IA	Manufacturing	Training	EDC
CUCCC - Cedar Falls	Black Hawk	IA	Service	Training	EDC
Engineered Products - Waterloo	Black Hawk	IA	Manufacturing	Training	EDC
Exceptional Persons, Inc. - Waterloo	Black Hawk	IA	Service	Training	EDC
GMAC - Waterloo	Black Hawk	IA	Service	Training	EDC
Grainger Parts - Waterloo	Black Hawk	IA	Service	Training	EDC
InVision	Black Hawk	IA	Service	Training	EDC
Iowa Laser Technology	Black Hawk	IA	Manufacturing	Training	EDC
John Deere Waterloo Works - Waterloo	Black Hawk	IA	Manufacturing	Training	EDC
Kay Park Industries - Janesville	Black Hawk	IA	Manufacturing	Training	EDC
Martin Bros. - Cedar Falls	Black Hawk	IA	Retail	Training	EDC
Mudd Group - Cedar Falls	Black Hawk	IA	Service	Training	EDC

7. Client and Project Summary

University of Northern Iowa

Service to Iowa

Fiscal Year 2009

Community or Business	County	State	Industry	Counseling Provided	Program
North Star Community Services - Waterloo	Black Hawk	IA	Service	Training	EDC
PIPAC - Cedar Falls	Black Hawk	IA	Insurance	Training	EDC
Rabo AgriFinance - Cedar Falls	Black Hawk	IA	Financial	Training	EDC
Trinity Consultants - Cedar Falls	Black Hawk	IA	Service	Training	EDC
UNI - Business & CommSvcs - Cedar Falls	Black Hawk	IA	Education	Training	EDC
UNI - GBPAC - Cedar Falls	Black Hawk	IA	Education	Training	EDC
UNI Physics Dept. - Cedar Falls	Black Hawk	IA	Education	Training	EDC
UNI-JPEC - Cedar Falls	Black Hawk	IA	Education	Training	EDC
VGM Financial	Black Hawk	IA	Financial	Training	EDC
Viking Pump, Inc - Cedar Falls	Black Hawk	IA	Manufacturing	Training	EDC
Western Home - Cedar Falls	Black Hawk	IA	Service	Training	EDC
Wheaton Franciscan Healthcare-Waterloo	Black Hawk	IA	Service	Training	EDC
Centennial Oaks	Bremer	IA	Country Club	Training	EDC
Nestle USA Beverage Div. - Waverly	Bremer	IA	Manufacturing	Training	EDC
Richway Industries - Janesville	Bremer	IA	Manufacturing	Training	EDC
TDS Automation - Waverly	Bremer	IA	Manufacturing	Training	EDC
United Equipment - Waverly	Bremer	IA	Manufacturing	Training	EDC
Waverly Health Center - Waverly	Bremer	IA	Health care	Training	EDC
Sperian Protection - Dubuqe	Dubuqe	IA	Manufacturing	Training	EDC
DuTrac Community Credit Union - Dubuque	Dubuque	IA	Financial	Training	EDC
City Laundering - Oelwein	Fayette	IA	Service	Training	EDC
Cambrex Charles City - Charles City	Floyd	IA	Manufacturing	Training	EDC
Lincoln Savings Bank - Reinbeck	Grundy	IA	Financial	Training	EDC
Edith Lenehan - Elma	Howard	IA	Individual	Training	EDC
ACT - Iowa City	Johnson	IA	Service	Training	EDC
Vangent - Coralville	Johnson	IA	Service	Training	EDC
Duane Arnold Energy Center - Palo	Linn	IA	Energy	Training	EDC
ESP International -Cedar Rapids	Linn	IA	Manufacturing	Training	EDC
Gazette Communications - Cedar Rapids	Linn	IA	Publishing	Training	EDC
Linn Area Credit Union - Cedar Rapids	Linn	IA	Financial	Training	EDC
United Fire & Casualty Co - Cedar Rapids	Linn	IA	Service	Training	EDC
Worley Warehousing - Cedar Rapids	Linn	IA	Service	Training	EDC
Emerson Process Mgmt - Marshalltown	Marshall	IA	Manufacturing	Training	EDC
Lennox Industries - Marshalltown	Marshall	IA	Manufacturing	Training	EDC
Black Hawk County	Black Hawk	IA	County Government	Education & Research activities in Geospatial technologies	GeoTREE
Cedar Falls Utilities - Cedar Falls	Black Hawk	IA	Utilities	Education & Research activities in Geospatial technologies	GeoTREE

7. Client and Project Summary

University of Northern Iowa
Service to Iowa
Fiscal Year 2009

Community or Business	County	State	Industry	Counseling Provided	Program
City of Cedar Falls	Black Hawk	IA	City Government	Education & Research activities in Geospatial technologies	GeoTREE
City of Evansdale	Black Hawk	IA	City Government	Education & Research activities in Geospatial technologies	GeoTREE
City of Waterloo	Black Hawk	IA	City Government	Education & Research activities in Geospatial technologies	GeoTREE
Hawkeye Community College	Black Hawk	IA	College and Universities	Education & Research activities in Geospatial technologies	GeoTREE
Natural Resources Conservation Services	Black Hawk	IA	US Government Agency	Education & Research activities in Geospatial technologies	GeoTREE
Dubuque River Museum	Dubuque	IA	City	Education & Research activities in Geospatial technologies	GeoTREE
ITREES	Linn	IA	City Government	Education & Research activities in Geospatial technologies	GeoTREE
Kirkwood Community College	Linn	IA	College and Universities	Education & Research activities in Geospatial technologies	GeoTREE
Iowa Department of Public Health	Polk	IA	State	Education & Research activities in Geospatial technologies	GeoTREE
Homeland Security	Statewide	IA	US Government Agency	Education & Research activities in Geospatial technologies	GeoTREE
Iowa Department of Natural Resources	Statewide	IA	State Government	Education & Research activities in Geospatial technologies	GeoTREE
Iowa Department of Natural Resources	Statewide	IA	State Government	Education & Research activities in Geospatial technologies	GeoTREE
Iowa Department of Transportation	Statewide	IA	State Government	Education & Research activities in Geospatial technologies	GeoTREE
US Fish and Wildlife Service and NASA	Statewide	IA	US Government Agency	Education & Research activities in Geospatial technologies	GeoTREE
Iowa State University	Story	IA	College and Universities	Education & Research activities in Geospatial technologies	GeoTREE
Black Hawk County Health Department	Black Hawk	IA	Public Health	Consulting	ICILI
Career Connections	Black Hawk	IA	Workforce Development	Immigration Traning	ICILI
Upper Des Moines Opportunity (UDMO)	Buena Vista	IA	Social Services	Consulting and Training	ICILI
Mercy Medical Center	Cerro Gordo	IA	Health Care	Consulting and Training	ICILI
Upper Des Moines Opportunity (UDMO)	Clay	IA	Social Services	Consulting and Training	ICILI
Upper Des Moines Opportunity (UDMO)	Dickinson	IA	Social Services	Consulting and Training	ICILI
Upper Des Moines Opportunity (UDMO)	Emmet	IA	Social Services	Consulting and Training	ICILI
Upper Des Moines Opportunity (UDMO)	Hamilton	IA	Social Services	Consulting and Training	ICILI
Upper Des Moines Opportunity (UDMO)	Humboldt	IA	Social Services	Consulting and Training	ICILI

7. Client and Project Summary

University of Northern Iowa
Service to Iowa
Fiscal Year 2009

Community or Business	County	State	Industry	Counseling Provided	Program
Upper Des Moines Opportunity (UDMO)	Lyon	IA	Social Services	Consulting and Training	ICILI
Upper Des Moines Opportunity (UDMO)	O'Brien	IA	Social Services	Consulting and Training	ICILI
Upper Des Moines Opportunity (UDMO)	Osceola	IA	Social Services	Consulting and Training	ICILI
Upper Des Moines Opportunity (UDMO)	Palo Alto	IA	Social Services	Consulting and Training	ICILI
Upper Des Moines Opportunity (UDMO)	Plymouth	IA	Social Services	Consulting and Training	ICILI
Upper Des Moines Opportunity (UDMO)	Pochahontas	IA	Social Services	Consulting and Training	ICILI
Des Moines University	Polk	IA	Education	Consulting and Training	ICILI
Iowa Department of Public Health	Polk	IA	Public Health	Consulting and Training	ICILI
Iowa Department of Public Safety	Polk	IA	Iowa State Patrol	Cultural Competency Training	ICILI
Upper Des Moines Opportunity (UDMO)	Sioux	IA	Social Services	Consulting and Training	ICILI
Upper Des Moines Opportunity (UDMO)	Webster	IA	Social Services	Consulting and Training	ICILI
Upper Des Moines Opportunity (UDMO)	Wright	IA	Social Services	Consulting and Training	ICILI
Mid West Partnership	Adair	IA	Regional Economic Development	Economic Development Planning	IDM
Western Iowa Advantage	Adair	IA	Regional Economic Development	Planning	IDM
Northeast Iowa Business Network	Allamakee	IA	Regional Economic Development	Economic Development Assistance	IDM
Western Iowa Advantage	Auduboon	IA	Regional Economic Development	Planning	IDM
Black Hawk County Board of Supervisors	Black Hawk	IA	County Government	Strategic Planning	IDM
Black Hawk County Dept of Public Health	Black Hawk	IA	Public Health	Organizational Management & Planning	IDM
Cedar Falls, City of	Black Hawk	IA	City Government	Economic Development Assistance	IDM
Cedar Valley Regional Partnership	Black Hawk	IA	Regional Economic Development	Economic Development Planning & Research	IDM
College Hill Partnership	Black Hawk	IA	Economic Development	Organizational Management & Planning	IDM
Goodwill Industries	Black Hawk	IA	Non-Profit Organization	Economic Development Planning	IDM
Greater Cedar Valley Alliance	Black Hawk	IA	Economic Development	Economic Development Assistance	IDM
UNI - Iowa Waste Reduction Center	Black Hawk	IA	University	Planning	IDM
Waterloo Center for the Arts	Black Hawk	IA	City Government	Economic Strategic Planning	IDM
Waterloo Nieghborhood Economic Dev Corp	Black Hawk	IA	Economic Development	Organizational Management & Planning	IDM
Cedar Valley Regional Partnership	Bremer	IA	Regional Economic Development	Economic Development Planning & Research	IDM
Waverly/Bremer County Economic Development	Bremer	IA	City Government	Economic Development Planning	IDM
Buchanan County Economic Development Commission	Buchanan	IA	Economic Development	Economic Development Assistance	IDM

7. Client and Project Summary

University of Northern Iowa
Service to Iowa
Fiscal Year 2009

Community or Business	County	State	Industry	Counseling Provided	Program
Cedar Valley Regional Partnership	Buchanan	IA	Regional Economic Development	Economic Development Planning & Research	IDM
Cedar Valley Regional Partnership	Butler	IA	Regional Economic Development	Economic Development Planning & Research	IDM
Parkersburg Economic Development Corp	Butler	IA	Economic Development	Economic Development Assistance & Research	IDM
Parkersburg, City of	Butler	IA	City Government	Visioning, Strategic Planning	IDM
Carroll Area Development Corporation	Carroll	IA	Economic Development	Economic Development Assistance	IDM
Western Iowa Advantage	Carroll	IA	Regional Economic Development	Planning	IDM
Eastern Iowa Economic Development Alliance	Cedar	IA	Regional Economic Development	Marketing, Planning	IDM
North Central Marketing Alliance	Cerro Gordo		Regional Economic Development	Research	IDM
Clarke County Development Corporation	Clarke	IA	Economic Development	Marketing Assistance	IDM
Off-Shore Iowa	Clarke	IA	Economic Development	Marketing Assistance	IDM
South Central Area Partnership	Clarke	IA	Regional Economic Development	Economic Development Planning	IDM
Spencer, City of/Iowa Lakes Corridor	Clay	IA	Economic Development	Strategic Planning	IDM
Monona, City of	Clayton	IA	City Government	Organizational Management, Planning	IDM
Northeast Iowa Business Network	Clayton	IA	Regional Economic Development	Economic Development Assistance	IDM
Strawberry Point	Clayton	IA	City Government	Visioning, Strategic Planning	IDM
Clinton Reginal Development Corporation	Clinton	IA	Economic Development	Economic Development Assistance	IDM
Eastern Iowa Economic Development Alliance	Clinton	IA	Regional Economic Development	Marketing, Planning	IDM
Western Iowa Advantage	Crawford	IA	Regional Economic Development	Planning	IDM
Greater Dallas County Economic Development	Dallas	IA	Economic Development	Economic Development Planning	IDM
Decatur County Development Alliance	Decatur	IA	Economic Development	Economic Development Fundraising, Targeting, Planning	IDM
South Central Area Partnership	Decatur	IA	Regional Economic Development	Economic Development Planning	IDM
Delaware County EDC	Delaware	IA	Economic Development	Economic Development Assistance	IDM
Northeast Iowa Business Network	Delaware	IA	Regional Economic Development	Economic Development Assistance	IDM
Grow Greater Burlington, Inc	Des Moines	IA	Economic Development	Economic Development Assistance	IDM
Fayette County Economic Development	Fayette	IA	Economic Development	Economic Development Assistance	IDM
Northeast Iowa Business Network	Fayette	IA	Regional Economic Development	Economic Development Assistance	IDM

7. Client and Project Summary

University of Northern Iowa
Service to Iowa
Fiscal Year 2009

Community or Business	County	State	Industry	Counseling Provided	Program
Oelwein Chamber & Area Development	Fayette	IA	Economic Development	Economic Development Assistance	IDM
Off-Shore Iowa	Fayette	IA	Economic Development	Marketing Assistance	IDM
Charles City Chamber of Commerce	Floyd	IA	City Government	Economic Developmetn Planning	IDM
North Central Marketing Alliance	Franklin		Regional Economic Development	Research	IDM
Mid West Partnership	Greene	IA	Regional Economic Development	Economic Development Planning	IDM
Western Iowa Advantage	Greene	IA	Regional Economic Development	Planning	IDM
Cedar Valley Regional Partnership	Grundy	IA	Regional Economic Development	Economic Development Planning & Research	IDM
Grundy Center Economic Development	Grundy	IA	Economic Development	Research/Survey	IDM
Mid West Partnership	Guthrie	IA	Regional Economic Development	Economic Development Planning	IDM
Western Iowa Advantage	Guthrie	IA	Regional Economic Development	Planning	IDM
Webster City Area Development	Hamilton	IA	Economic Development	Organizational Management	IDM
North Central Marketing Alliance	Hancock		Regional Economic Development	Research	IDM
Eldora, City of	Hardin	IA	City Government	Planning	IDM
Iowa Falls Area Development Group, Inc.	Hardin	IA	Economic Development	Economic Development Assistance	IDM
Greater Council Bluffs Area Partnership	Harrison	IA	Regional Economic Development	Research	IDM
Mt. Pleasant Area Development Commission	Henry	IA	Economic Development	Economic Development Planning	IDM
Off-Shore Iowa	Henry	IA	Regional Economic Development	Marketing Assistance	IDM
Western Iowa Advantage	Ida	Sac	Regional Economic Development	Planning	IDM
Williamsburg, City of	Iowa	IA	City Government	Economic Development Planning	IDM
Eastern Iowa Economic Development Alliance	Jackson	IA	Regional Economic Development	Marketing, Planning	IDM
Fairfield, City of	Jefferson	IA	City Government	Sustainability Planning	IDM
Iowa City Area Development Group	Johnson	IA	Economic Development	Economic Development Assistance	IDM
Kossuth/Palo Alto County Economic Development Corp	Kossuth	IA	Economic Development	Economic Development Planning	IDM
Lee County Economic Develoment Group, Inc.	Lee	IA	Economic Development	Economic Development Assistance	IDM
South Central Area Partnership	Lucas	IA	Regional Economic Development	Economic Development Planning	IDM
Madison County Economic Development	Madison	IA	Economic Development	Organizational Management, Planning	IDM
South Central Area Partnership	Madison	IA	Regional Economic Development	Economic Development Planning	IDM
Greater Council Bluffs Area Partnership	Mills	IA	Regional Economic Development	Research	IDM
North Central Marketing Alliance	Mitchell		Regional Economic Development	Research	IDM
Eastern Iowa Economic Development Alliance	Muscatine	IA	Regional Economic Development	Marketing, Planning	IDM
Kossuth/Palo Alto County Economic Development Corp	Palo Alto	IA	Economic Development	Economic Development Planning	IDM

7. Client and Project Summary

University of Northern Iowa
Service to Iowa
Fiscal Year 2009

Community or Business	County	State	Industry	Counseling Provided	Program
Iowa Area Development Group	Polk	IA	Economic Development	Research/Survey	IDM
Professional Developers of Iowa	Polk	IA	Economic Development	Planning	IDM
South Central Area Partnership	Polk	IA	Regional Economic Development	Economic Development Planning	IDM
Council Bluffs Chamber of Commerce	Pottawattamie	IA	Economic Development	Economic Development Assistance & Research	IDM
Greater Council Bluffs Area Partnership	Pottawattamie	IA	Regional Economic Development	Research	IDM
Montezuman 2020	Poweshiek	IA	Economic Development	Visioning, Strategic Planning	IDM
Western Iowa Advantage	Sac	IA	Regional Economic Development	Planning	IDM
Eastern Iowa Economic Development Alliance	Scott	IA	Regional Economic Development	Marketing, Planning	IDM
Off-Shore Iowa	Shelby	IA	Economic Development	Marketing Assistance	IDM
Shelby County DevelopSource	Shelby	IA	Economic Development	Marketing Assistance	IDM
Orange City Development Corporation	Sioux	IA	Economic Development	Economic Development Assistance	IDM
Nevada, City of	Story	IA	City Government	Economic Development Planning	IDM
Bedford Economic Development	Taylor	IA	Economic Development	Economic Development Assistance	IDM
South Central Area Partnership	Union	IA	Regional Economic Development	Economic Development Planning	IDM
South Central Area Partnership	Wayne	IA	Regional Economic Development	Economic Development Planning	IDM
North Central Marketing Alliance	Winnebago	IA	Regional Economic Development	Research	IDM
Northeast Iowa Business Network	Winneshiek	IA	Regional Economic Development	Economic Development Assistance	IDM
North Central Marketing Alliance	Worth	IA	Regional Economic Development	Research	IDM
Adair	Adair	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Adair	Adair	IA	Manufacturing (20-39)	Air Assistance	IWRC
Adair	Adair	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Postville	Allamakee	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Audubon	Audubon	IA	Services (70-89)	Air Assistance	IWRC
Vinton	Benton	IA	Construction (15-17)	Air Assistance	IWRC
Cedar Falls	Black Hawk	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Cedar Falls	Black Hawk	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Cedar Falls	Black Hawk	IA	Services (70-89)	Air Assistance	IWRC
Cedar Falls	Black Hawk	IA	Manufacturing (20-39)	Air Assistance	IWRC
Cedar Falls	Black Hawk	IA	Services (70-89)	On-Site Assistance	IWRC
Waterloo	Black Hawk	IA	Public Administration (91-97)	Air Assistance	IWRC
Waterloo	Black Hawk	IA	Retail Trade (52-59)	Air Assistance	IWRC
Waterloo	Black Hawk	IA	Manufacturing (20-39)	Air Assistance	IWRC
Waterloo	Black Hawk	IA	Services (70-89)	Air Assistance	IWRC

7. Client and Project Summary

University of Northern Iowa
Service to Iowa
Fiscal Year 2009

Community or Business	County	State	Industry	Counseling Provided	Program
Waterloo	Black Hawk	IA	Wholesale Trade (50-51)	On-Site Assistance	IWRC
Waterloo	Black Hawk	IA	Retail Trade (52-59)	On-Site Assistance	IWRC
Waterloo	Black Hawk	IA	Services (70-89)	On-Site Assistance	IWRC
Waterloo	Black Hawk	IA	Services (70-89)	On-Site Assistance	IWRC
Waterloo	Black Hawk	IA	Services (70-89)	On-Site Assistance	IWRC
Waterloo	Black Hawk	IA	Public Administration (91-97)	On-Site Assistance	IWRC
Boone	Boone	IA	Manufacturing (20-39)	Air Assistance	IWRC
Boone	Boone	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Independence	Buchanan	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Newell	Buena Vista	IA	(01-09)	Air Assistance	IWRC
Storm Lake	Buena Vista	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Storm Lake	Buena Vista	IA	Manufacturing (20-39)	Air Assistance	IWRC
Allison	Butler	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Allison	Butler	IA	Construction (15-17)	Air Assistance	IWRC
Allison	Butler	IA	Manufacturing (20-39)	Air Assistance	IWRC
Clarksville	Butler	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Parkersburg	Butler	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Lake City	Calhoun	IA	Manufacturing (20-39)	Air Assistance	IWRC
Rockwell City	Calhoun	IA	Public Administration (91-97)	Air Assistance	IWRC
Carroll	Carroll	IA	Manufacturing (20-39)	Air Assistance	IWRC
Carroll	Carroll	IA	Retail Trade (52-59)	Air Assistance	IWRC
Carroll	Carroll	IA	Services (70-89)	Air Assistance	IWRC
Carroll	Carroll	IA	Services (70-89)	On-Site Assistance	IWRC
Carroll	Carroll	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Carroll	Carroll	IA	Wholesale Trade (50-51)	On-Site Assistance	IWRC
Anita	Cass	IA	(40-49)	Air Assistance	IWRC
Atlantic	Cass	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Atlantic	Cass	IA	Construction (15-17)	Air Assistance	IWRC
Atlantic	Cass	IA	Manufacturing (20-39)	Air Assistance	IWRC
Atlantic	Cass	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Atlantic	Cass	IA	Construction (15-17)	On-Site Assistance	IWRC
Lowden	Cedar	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
West Branch	Cedar	IA	(40-49)	On-Site Assistance	IWRC
Clear Lake	Cerro Gordo	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Mason City	Cerro Gordo	IA	Manufacturing (20-39)	On-Site Assistance	IWRC

7. Client and Project Summary

University of Northern Iowa
Service to Iowa
Fiscal Year 2009

Community or Business	County	State	Industry	Counseling Provided	Program
Mason City	Cerro Gordo	IA	Services (70-89)	On-Site Assistance	IWRC
Mason City	Cerro Gordo	IA	Wholesale Trade (50-51)	On-Site Assistance	IWRC
Mason City	Cerro Gordo	IA	(40-49)	Air Assistance	IWRC
Mason City	Cerro Gordo	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Mason City	Cerro Gordo	IA	Services (70-89)	Air Assistance	IWRC
Thornton	Cerro Gordo	IA	Manufacturing (20-39)	Air Assistance	IWRC
Cherokee	Cherokee	IA	Manufacturing (20-39)	Air Assistance	IWRC
Cherokee	Cherokee	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Marcus	Cherokee	IA	Services (70-89)	Air Assistance	IWRC
Quimby	Cherokee	IA	Manufacturing (20-39)	Air Assistance	IWRC
New Hampton	Chickasaw	IA	Manufacturing (20-39)	Air Assistance	IWRC
Osceola	Clarke	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Dickens	Clay	IA	Manufacturing (20-39)	Air Assistance	IWRC
Spencer	Clay	IA	Retail Trade (52-59)	On-Site Assistance	IWRC
Spencer	Clay	IA	Manufacturing (20-39)	Air Assistance	IWRC
Spencer	Clay	IA	Retail Trade (52-59)	Air Assistance	IWRC
Edgewood	Clayton	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Elkader	Clayton	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Garnavillo	Clayton	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Strawberry Point	Clayton	IA	Wholesale Trade (50-51)	On-Site Assistance	IWRC
Strawberry Point	Clayton	IA	Manufacturing (20-39)	Air Assistance	IWRC
Strawberry Point	Clayton	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Camanche	Clinton	IA	Construction (15-17)	On-Site Assistance	IWRC
Camanche	Clinton	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Camanche	Clinton	IA	Construction (15-17)	Air Assistance	IWRC
Camanche	Clinton	IA	Manufacturing (20-39)	Air Assistance	IWRC
Camanche	Clinton	IA	(40-49)	Air Assistance	IWRC
Denison	Crawford	IA	Manufacturing (20-39)	Air Assistance	IWRC
Denison	Crawford	IA	(40-49)	On-Site Assistance	IWRC
Denison	Crawford	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Perry	Dallas	IA	Wholesale Trade (50-51)	On-Site Assistance	IWRC
Perry	Dallas	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Leon	Decatur	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Manchester	Delaware	IA	(01-09)	Air Assistance	IWRC
Burlington	Des Moines	IA	Services (70-89)	On-Site Assistance	IWRC

7. Client and Project Summary

University of Northern Iowa
Service to Iowa
Fiscal Year 2009

Community or Business	County	State	Industry	Counseling Provided	Program
Burlington	Des Moines	IA	Retail Trade (52-59)	Air Assistance	IWRC
Lake Park	Dickinson	IA	(40-49)	Air Assistance	IWRC
Lake Park	Dickinson	IA	Manufacturing (20-39)	Air Assistance	IWRC
Milford	Dickinson	IA	Manufacturing (20-39)	Air Assistance	IWRC
Milford	Dickinson	IA	(40-49)	Air Assistance	IWRC
Spirit Lake	Dickinson	IA	Manufacturing (20-39)	Air Assistance	IWRC
Cascade	Dubuque	IA	Public Administration (91-97)	Air Assistance	IWRC
Dubuque	Dubuque	IA	Services (70-89)	On-Site Assistance	IWRC
Dubuque	Dubuque	IA	Manufacturing (20-39)	Air Assistance	IWRC
Dubuque	Dubuque	IA	99)	Air Assistance	IWRC
Dyersville	Dubuque	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Dyersville	Dubuque	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Peosta	Dubuque	IA	Manufacturing (20-39)	Air Assistance	IWRC
Peosta	Dubuque	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Armstrong	Emmet	IA	Construction (15-17)	Air Assistance	IWRC
Estherville	Emmet	IA	(40-49)	Air Assistance	IWRC
Estherville	Emmet	IA	Manufacturing (20-39)	Air Assistance	IWRC
Hawkeye	Fayette	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Hampton	Franklin	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Jefferson	Greene	IA	Services (70-89)	Air Assistance	IWRC
Scranton	Greene	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Dike	Grundy	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Dike	Grundy	IA	Manufacturing (20-39)	Air Assistance	IWRC
Dike	Grundy	IA	Services (70-89)	On-Site Assistance	IWRC
Reinbeck	Grundy	IA	Manufacturing (20-39)	Air Assistance	IWRC
Reinbeck	Grundy	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Reinbeck	Grundy	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Bagley	Guthrie	IA	Manufacturing (20-39)	Air Assistance	IWRC
Bayard	Guthrie	IA	Mining (10-14)	Air Assistance	IWRC
Bayard	Guthrie	IA	Services (70-89)	Air Assistance	IWRC
Bayard	Guthrie	IA	Services (70-89)	On-Site Assistance	IWRC
Stuart	Guthrie	IA	(40-49)	Air Assistance	IWRC
Webster City	Hamilton	IA	Manufacturing (20-39)	Air Assistance	IWRC
Britt	Hancock	IA	Manufacturing (20-39)	Air Assistance	IWRC
Woden	Hancock	IA	Wholesale Trade (50-51)	Air Assistance	IWRC

7. Client and Project Summary

University of Northern Iowa
Service to Iowa
Fiscal Year 2009

Community or Business	County	State	Industry	Counseling Provided	Program
Dunlap	Harrison	IA	Manufacturing (20-39)	Air Assistance	IWRC
Logan	Harrison	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Woodbine	Harrison	IA	Manufacturing (20-39)	Air Assistance	IWRC
Woodbine	Harrison	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Mount Pleasant	Henry	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Winfield	Henry	IA	Services (70-89)	Air Assistance	IWRC
Winfield	Henry	IA	Services (70-89)	On-Site Assistance	IWRC
Cresco	Howard	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Gilmore City	Humboldt	IA	Manufacturing (20-39)	Air Assistance	IWRC
Humboldt	Humboldt	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Humboldt	Humboldt	IA	Manufacturing (20-39)	Air Assistance	IWRC
Maquoketa	Jackson	IA	(01-09)	Air Assistance	IWRC
Maquoketa	Jackson	IA	Services (70-89)	On-Site Assistance	IWRC
Preston	Jackson	IA	(01-09)	Air Assistance	IWRC
Newton	Jasper	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Newton	Jasper	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Sully	Jasper	IA	Services (70-89)	On-Site Assistance	IWRC
Fairfield	Jefferson	IA	Manufacturing (20-39)	Air Assistance	IWRC
Iowa City	Johnson	IA	Services (70-89)	On-Site Assistance	IWRC
Iowa City	Johnson	IA	Services (70-89)	Air Assistance	IWRC
Tiffin	Johnson	IA	Services (70-89)	On-Site Assistance	IWRC
Tiffin	Johnson	IA	Services (70-89)	Air Assistance	IWRC
Monticello	Jones	IA	Services (70-89)	On-Site Assistance	IWRC
Gibson	Keokuk	IA	(01-09)	Air Assistance	IWRC
Keota	Keokuk	IA	Wholesale Trade (50-51)	On-Site Assistance	IWRC
What Cheer	Keokuk	IA	(01-09)	Air Assistance	IWRC
Houghton	Lee	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Coggon	Linn	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Hiawatha	Linn	IA	Manufacturing (20-39)	Air Assistance	IWRC
Hiawatha	Linn	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Wapello	Louisa	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Wapello	Louisa	IA	Manufacturing (20-39)	Air Assistance	IWRC
Doon	Lyon	IA	Wholesale Trade (50-51)	On-Site Assistance	IWRC
George	Lyon	IA	Manufacturing (20-39)	Air Assistance	IWRC
Rock Rapids	Lyon	IA	Manufacturing (20-39)	Air Assistance	IWRC

7. Client and Project Summary

University of Northern Iowa
Service to Iowa
Fiscal Year 2009

Community or Business	County	State	Industry	Counseling Provided	Program
Saint Charles	Madison	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Winterset	Madison	IA	(01-09)	Air Assistance	IWRC
Winterset	Madison	IA	Manufacturing (20-39)	Air Assistance	IWRC
Oskaloosa	Mahaska	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Pella	Marion	IA	Manufacturing (20-39)	Air Assistance	IWRC
Pacific Junction	Mills	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Saint Ansgar	Mitchell	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Mapleton	Monona	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Onawa	Monona	IA	Wholesale Trade (50-51)	On-Site Assistance	IWRC
Albia	Monroe	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Albia	Monroe	IA	Wholesale Trade (50-51)	On-Site Assistance	IWRC
Red Oak	Montgomery	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Muscatine	Muscatine	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Muscatine	Muscatine	IA	Manufacturing (20-39)	Air Assistance	IWRC
Muscatine	Muscatine	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Muscatine	Muscatine	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Muscatine	Muscatine	IA	Wholesale Trade (50-51)	On-Site Assistance	IWRC
Archer	O'Brien	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Paullina	O'Brien	IA	Wholesale Trade (50-51)	On-Site Assistance	IWRC
Sanborn	O'Brien	IA	Manufacturing (20-39)	Air Assistance	IWRC
Ocheyedan	Osceola	IA	Manufacturing (20-39)	Air Assistance	IWRC
Sibley	Osceola	IA	(40-49)	Air Assistance	IWRC
Sibley	Osceola	IA	Manufacturing (20-39)	Air Assistance	IWRC
Braddyville	Page	IA	Manufacturing (20-39)	Air Assistance	IWRC
Clarinda	Page	IA	Manufacturing (20-39)	Air Assistance	IWRC
Clarinda	Page	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Emmetsburg	Palo Alto	IA	Manufacturing (20-39)	Air Assistance	IWRC
Akron	Plymouth	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Akron	Plymouth	IA	Manufacturing (20-39)	Air Assistance	IWRC
Hinton	Plymouth	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Le Mars	Plymouth	IA	Wholesale Trade (50-51)	On-Site Assistance	IWRC
Le Mars	Plymouth	IA	Manufacturing (20-39)	Air Assistance	IWRC
Le Mars	Plymouth	IA	(40-49)	Air Assistance	IWRC
Laurens	Pocahontas	IA	Manufacturing (20-39)	Air Assistance	IWRC
Ankeny	Polk	IA	Retail Trade (52-59)	Air Assistance	IWRC

7. Client and Project Summary

University of Northern Iowa
Service to Iowa
Fiscal Year 2009

Community or Business	County	State	Industry	Counseling Provided	Program
Ankeny	Polk	IA	Retail Trade (52-59)	On-Site Assistance	IWRC
Urbandale	Polk	IA	Retail Trade (52-59)	Air Assistance	IWRC
Urbandale	Polk	IA	Retail Trade (52-59)	On-Site Assistance	IWRC
Urbandale	Polk	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Council Bluffs	Pottawattamie	IA	Manufacturing (20-39)	Air Assistance	IWRC
Council Bluffs	Pottawattamie	IA	Services (70-89)	Air Assistance	IWRC
Council Bluffs	Pottawattamie	IA	Retail Trade (52-59)	On-Site Assistance	IWRC
Early	Sac	IA	Manufacturing (20-39)	Air Assistance	IWRC
Bettendorf	Scott	IA	Manufacturing (20-39)	Air Assistance	IWRC
Blue Grass	Scott	IA	Manufacturing (20-39)	Air Assistance	IWRC
Blue Grass	Scott	IA	Services (70-89)	Air Assistance	IWRC
Blue Grass	Scott	IA	Services (70-89)	On-Site Assistance	IWRC
Davenport	Scott	IA	Retail Trade (52-59)	Air Assistance	IWRC
Davenport	Scott	IA	Services (70-89)	On-Site Assistance	IWRC
Davenport	Scott	IA	Retail Trade (52-59)	On-Site Assistance	IWRC
Davenport	Scott	IA	Services (70-89)	On-Site Assistance	IWRC
Davenport	Scott	IA	Services (70-89)	Air Assistance	IWRC
Davenport	Scott	IA	Wholesale Trade (50-51)	On-Site Assistance	IWRC
Davenport	Scott	IA	Manufacturing (20-39)	Air Assistance	IWRC
Eldridge	Scott	IA	Manufacturing (20-39)	Air Assistance	IWRC
Harlan	Shelby	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Panama	Shelby	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Hawarden	Sioux	IA	Manufacturing (20-39)	Air Assistance	IWRC
Ireton	Sioux	IA	Wholesale Trade (50-51)	On-Site Assistance	IWRC
Orange City	Sioux	IA	Services (70-89)	On-Site Assistance	IWRC
Orange City	Sioux	IA	Manufacturing (20-39)	Air Assistance	IWRC
Orange City	Sioux	IA	Services (70-89)	Air Assistance	IWRC
Rock Valley	Sioux	IA	Manufacturing (20-39)	Air Assistance	IWRC
Sioux Center	Sioux	IA	(01-09)	Air Assistance	IWRC
Sioux Center	Sioux	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Sioux Center	Sioux	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Sioux Center	Sioux	IA	Manufacturing (20-39)	Air Assistance	IWRC
Ames	Story	IA	Manufacturing (20-39)	Air Assistance	IWRC
Ames	Story	IA	Construction (15-17)	Air Assistance	IWRC
Ames	Story	IA	Manufacturing (20-39)	On-Site Assistance	IWRC

7. Client and Project Summary

University of Northern Iowa
Service to Iowa
Fiscal Year 2009

Community or Business	County	State	Industry	Counseling Provided	Program
Nevada	Story	IA	Manufacturing (20-39)	Air Assistance	IWRC
Tama	Tama	IA	99)	Air Assistance	IWRC
Lenox	Taylor	IA	Manufacturing (20-39)	Air Assistance	IWRC
Carlisle	Warren	IA	Manufacturing (20-39)	Air Assistance	IWRC
New Virginia	Warren	IA	Manufacturing (20-39)	Air Assistance	IWRC
Kalona	Washington	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Washington	Washington	IA	Manufacturing (20-39)	Air Assistance	IWRC
Washington	Washington	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Allerton	Wayne	IA	Manufacturing (20-39)	Air Assistance	IWRC
Fort Dodge	Webster	IA	Services (70-89)	On-Site Assistance	IWRC
Fort Dodge	Webster	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Fort Dodge	Webster	IA	Retail Trade (52-59)	Air Assistance	IWRC
Lake Mills	Winnebago	IA	Manufacturing (20-39)	Air Assistance	IWRC
Calmar	Winneshiek	IA	Manufacturing (20-39)	Air Assistance	IWRC
Decorah	Winneshiek	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Spillville	Winneshiek	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Anthon	Woodbury	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Lawton	Woodbury	IA	Construction (15-17)	On-Site Assistance	IWRC
Lawton	Woodbury	IA	Wholesale Trade (50-51)	On-Site Assistance	IWRC
Sergeant Bluff	Woodbury	IA	Manufacturing (20-39)	Air Assistance	IWRC
Sioux City	Woodbury	IA	Construction (15-17)	Air Assistance	IWRC
Sioux City	Woodbury	IA	Manufacturing (20-39)	Air Assistance	IWRC
Sioux City	Woodbury	IA	Wholesale Trade (50-51)	On-Site Assistance	IWRC
Sioux City	Woodbury	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Sioux City	Woodbury	IA	Wholesale Trade (50-51)	On-Site Assistance	IWRC
Clarion	Wright	IA	Manufacturing (20-39)	On-Site Assistance	IWRC
Clarion	Wright	IA	Manufacturing (20-39)	Air Assistance	IWRC
Clarion	Wright	IA	Wholesale Trade (50-51)	Air Assistance	IWRC
Cedar Falls	Black Hawk	IA	Interior design	Start-up	JPEC
Cedar Falls	Black Hawk	IA	Web consultiung	Start-up	JPEC
Cedar Falls	Black Hawk	IA	educational software	Start-up	JPEC
Cedar Falls	Black Hawk	IA	financial services	Start-up	JPEC
Cedar Falls	Black Hawk	IA	entertainment venue and bar	Start-up	JPEC
Cedar Falls	Black Hawk	IA	photography studio	Start-up	JPEC
Cedar Falls	Black Hawk	IA	construction management	Start-up	JPEC
Cedar Falls	Black Hawk	IA	import/export	Start-up	JPEC

7. Client and Project Summary

University of Northern Iowa
Service to Iowa
Fiscal Year 2009

Community or Business	County	State	Industry	Counseling Provided	Program
Cedar Falls	Black Hawk	IA	sporting goods retail	Start-up	JPEC
Cedar Falls	Black Hawk	IA	restaurant	Start-up	JPEC
Cedar Falls	Black Hawk	IA	photography studio	Existing	JPEC
Cedar Falls	Black Hawk	IA	export	Start-up	JPEC
Cedar Falls	Black Hawk	IA	music school	Start-up	JPEC
Cedar Falls	Black Hawk	IA	import/export	Start-up	JPEC
Cedar Falls	Black Hawk	IA	restaurant	Start-up	JPEC
Cedar Falls	Black Hawk	IA	financial services	Start-up	JPEC
Cedar Falls	Black Hawk	IA	restaurant	Start-up	JPEC
Cedar Falls	Black Hawk	IA	photography studio	Start-up	JPEC
Cedar Falls	Black Hawk	IA	Bookstore and café	Start-up	JPEC
Cedar Falls	Black Hawk	IA	personal trainer	Start-up	JPEC
Cedar Falls	Black Hawk	IA	rollerskating	Start-up	JPEC
Cedar Falls	Black Hawk	IA	music performance	Start-up	JPEC
Cedar Falls	Black Hawk	IA	moviemaking	Start-up	JPEC
Cedar Falls	Black Hawk	IA	internet reseller	Start-up	JPEC
Cedar Falls	Black Hawk	IA	import	Start-up	JPEC
Cedar Falls	Black Hawk	IA	manufacturing	Start-up	JPEC
Cedar Falls	Black Hawk	IA	translation	Start-up	JPEC
Cedar Falls	Black Hawk	IA	Sandwich shop	Start-up	JPEC
Cedar Falls	Black Hawk	IA	manufacturing	Start-up	JPEC
Cedar Falls	Black Hawk	IA	online networking	Start-up	JPEC
Cedar Falls	Black Hawk	IA	recording studio	Start-up	JPEC
Cedar Falls	Black Hawk	IA	local foods growing	Start-up	JPEC
Cedar Falls	Black Hawk	IA	video and graphic production	Start-up	JPEC
Cedar Falls	Black Hawk	IA	mediation and negotiation services	Start-up	JPEC
Cedar Falls	Black Hawk	IA	construction	Start-up	JPEC
Cedar Falls	Black Hawk	IA	clothing retail	Start-up	JPEC
Cedar Falls	Black Hawk	IA	online business	Start-up	JPEC
Cedar Falls	Black Hawk	IA	landscaping	Start-up	JPEC
Cedar Falls	Black Hawk	IA	real estate brokerage	Start-up	JPEC
Cedar Falls	Black Hawk	IA	senior services	Start-up	JPEC
Cedar Falls	Black Hawk	IA	restaurant	Start-up	JPEC
Cedar Falls	Black Hawk	IA	e-commerce clothing	Start-up	JPEC
Cedar Falls	Black Hawk	IA	bar and restaurant	Start-up	JPEC
Cedar Falls	Black Hawk	IA	chemical supplies distribution	Start-up	JPEC
Cedar Falls	Black Hawk	IA	coffee shop/bookstore/gallery	Start-up	JPEC
Cedar Falls	Black Hawk	IA	consulting	Start-up	JPEC
Cedar Falls	Black Hawk	IA	furniture refinishing	Start-up	JPEC

7. Client and Project Summary

University of Northern Iowa
Service to Iowa
Fiscal Year 2009

Community or Business	County	State	Industry	Counseling Provided	Program
Cedar Falls	Black Hawk	IA	crafts	Start-up	JPEC
Cedar Falls	Black Hawk	IA	B2B information systems	Start-up	JPEC
Cedar Falls	Black Hawk	IA	events planning	Start-up	JPEC
Cedar Falls	Black Hawk	IA	sports supplements ecommerce	Start-up	JPEC
Cedar Falls	Black Hawk	IA	hooka bar	Start-up	JPEC
Cedar Falls	Black Hawk	IA	wind turbines	Start-up	JPEC
Cedar Falls	Black Hawk	IA	computer sales	Start-up	JPEC
Cedar Falls	Black Hawk	IA	real estate apartment management	Start-up	JPEC
Cedar Falls	Black Hawk	IA	public speaking	Start-up	JPEC
Cedar Falls	Black Hawk	IA	non-profit	Start-up	JPEC
Cedar Falls	Black Hawk	IA	car coating	Start-up	JPEC
Cedar Falls	Black Hawk	IA	non-profit	Start-up	JPEC
Cedar Falls	Black Hawk	IA	non-profit	Start-up	JPEC
Cedar Falls	Black Hawk	IA	Graphic production	Start-up	JPEC
Cedar Falls	Black Hawk	IA	cleaning service	Start-up	JPEC
Cedar Falls	Black Hawk	IA	photography studio	Start-up	JPEC
Cedar Falls	Black Hawk	IA	ecommerce sports motorbiking	Start-up	JPEC
Cedar Falls	Black Hawk	IA	computer application	Start-up	JPEC
Cedar Falls	Black Hawk	IA	coffee shop	Start-up	JPEC
Cedar Falls	Black Hawk	IA	accounting services	Start-up	JPEC
Cedar Falls	Black Hawk	IA	virtual mall	Start-up	JPEC
Cedar Falls	Black Hawk	IA	alternative energy	Start-up	JPEC
Cedar Falls	Black Hawk	IA	texting service	Start-up	JPEC
Cedar Falls	Black Hawk	IA	fitness and nutrition	Start-up	JPEC
Cedar Falls	Black Hawk	IA	yoga studio	Start-up	JPEC
Cedar Falls	Black Hawk	IA	coffee and gelato	Start-up	JPEC
Cedar Falls	Black Hawk	IA	grocery store	Start-up	JPEC
Cedar Falls	Black Hawk	IA	turkey production	Start-up	JPEC
Cedar Falls	Black Hawk	IA	oil wholesale	Start-up	JPEC
Cedar Falls	Black Hawk	IA	wedding consulting	Start-up	JPEC
Cedar Falls	Black Hawk	IA	organic pork production	Start-up	JPEC
Cedar Falls	Black Hawk	IA	marketing	Start-up	JPEC
Cedar Falls	Black Hawk	IA	internet retailer	Existing	JPEC
Cedar Falls	Black Hawk	IA	construction trucking	Existing	JPEC
Cedar Falls	Black Hawk	IA	personal trainer	Existing	JPEC
Cedar Falls	Black Hawk	IA	ecommerce clothing retail	Existing	JPEC
Cedar Falls	Black Hawk	IA	educational software	Existing	JPEC
Cedar Falls	Black Hawk	IA	computer software	Start-up	JPEC
Cedar Falls	Black Hawk	IA	recruiting company	Start-up	JPEC

7. Client and Project Summary

University of Northern Iowa
Service to Iowa
Fiscal Year 2009

Community or Business	County	State	Industry	Counseling Provided	Program
Cedar Falls	Black Hawk	IA	landscaping	Start-up	JPEC
Cedar Falls	Black Hawk	IA	public art business	Start-up	JPEC
Cedar Falls	Black Hawk	IA	gambling website	Start-up	JPEC
Cedar Falls	Black Hawk	IA	Educational performance tour company	Start-up	JPEC
Waterloo	Black Hawk	IA	alternative energy and monorail	Start-up	JPEC
Dubuque	Dubuque	IA	tire disposal	Start-up	JPEC
Oelwein	Fayette	IA	patent	Start-up	JPEC
Eldora	Hardin	IA	manufacturing	Start-up	JPEC
Urbana	Johnson	IA	ecommerce	Existing	JPEC
Cedar Rapids	Linn	IA	cosmetology	Start-up	JPEC
Benton Castings	Benton	IA	Foundry, Metal Casting	Technical Assistance	MCC
John Deere Waterloo Works	Black Hawk	IA	Foundry, Metal Casting	Technical Assistance	MCC
Roskamp	Black Hawk	IA	Foundry, Metal Casting	Consulting	MCC
Viking Pump, Inc - Cedar Falls	Black Hawk	IA	Foundry, Metal Casting	Technical Assistance	MCC
American Colloid Co	Blackhawk	IA	Foundry, Metal Casting	Technical Assistance	MCC
Bentonite Performance Materials	Blackhawk	IA	Foundry, Metal Casting	Technical Assistance	MCC
GMT	Bremer	IA	Foundry, Metal Casting	Technical Assistance	MCC
Plastic Professionals	Cass	IA	Foundry, Metal Casting	Consulting	MCC
Progress Foundry	Chickasaw	IA	Foundry, Metal Casting	Technical Assistance	MCC
AY McDonald	Dubuque	IA	Foundry, Metal Casting	Technical Assistance	MCC
University of Iowa	Johnson	IA	Foundry, Metal Casting	Technical Assistance	MCC
Bender Foundry Service	Keokuk	IA	Foundry, Metal Casting	Technical Assistance	MCC
Clow Valve	Mahaska	IA	Foundry, Metal Casting	Technical Assistance	MCC
Sivier Steel Casting	Scott	IA	Foundry, Metal Casting	Technical Assistance	MCC
Iowa State University	Story	IA	Foundry, Metal Casting	Technical Assistance	MCC
Wellman Dynamics / Fansteel	Union	IA	Foundry, Metal Casting	Technical Assistance	MCC
ELM	Black Hawk	IA	Manufacturing	Testing/Research	NABL
Creative Composites	Butler	IA	Research/Manufacturing	Testing/Research	NABL
Golden Grains Energy, LLC	Cerro Gordo	IA	Ethanol	Testing/Research	NABL
Little Sioux Corn Processing	Cherokee	IA	Manufacturing/Ethanol	Testing/Research	NABL
AMTek	Linn	IA	Manufacturing/Microwave	Testing/Research	NABL
Benefuel	Polk	IA	Research/Manufacturing/Biofuels	Testing/Research	NABL
Iowa State University Center for Sustainable	Story	IA	Research	Testing/Research	NABL
Renewable Energy Group	Story	IA	Manufacturing/Biodiesel	Testing/Research	NABL
Adams County Economic Development Corp	Adams	IA	Economic Development	Entrepreneurship Support System	RBC
Allamakee County Economic Development Corp.	Allamakee	IA	Economic Development	Entrepreneurship Support System	RBC
Greater Cedar Valley Alliance	Black Hawk	IA	Economic Development	Entrepreneurship Support System	RBC
Clayton County Economic Development Corp.	Clayton	IA	Economic Development	Entrepreneurship Support System	RBC

7. Client and Project Summary

University of Northern Iowa

Service to Iowa

Fiscal Year 2009

Community or Business	County	State	Industry	Counseling Provided	Program
Decatur County Economic Development	Decatur	IA	Economic Development	Entrepreneurship Support System	RBC
Delaware County Economic Development Corp.	Delaware	IA	Economic Development	Entrepreneurship Support System	RBC
Fayette County Economic Development	Fayette	IA	Economic Development	Entrepreneurship Support System	RBC
Howard County Economic Development Corp.	Howard	IA	Economic Development	Entrepreneurship Support System	RBC
Jasper County Economic Development	Jasper	IA	Economic Development	Entrepreneurship Support System	RBC
City of Iowa City	Johnson	IA	Economic Develoment	EDA Grant proposal assistance	RBC
Marion County Economic Development	Marion	IA	Economic Development	Entrepreneurship Support System	RBC
O'Brien County Economic Development Corp.	O'Brien	IA	Economic Development	Entrepreneurship Support System	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Smart Start	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	QuickBook Revisited	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	search Engine Optimization	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	A City Rebuilding: Greensburg,	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Insurance Adjusters and Claims	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Grand Forks Flood of 1997	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Rebuild, Reposition, Recover!	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Smart Start	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Branding Your Business	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	search Engine Optimization	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Organizational Marketing- Marketing	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Creating Extraordinary Customer	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Angel Investors and Venture	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Time Management	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	How to FastTrac Your Business	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Going Green	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Surviving an Economic Downturn	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Managing Your Company Like a	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Free Market Research Tools on the	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Web Design for Small Business	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	The Law and Small Business	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Economic Conditions	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Controlling Those Costs!	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Using Financial Tools	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	The Nitty-Gritty of Business Taxes	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Insurance: Protecting Your Business	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Credit and the Current Status of the	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Implementing Marketing: An	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Where's the Money"	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Savvy Marketing for 2009	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Making Sense of Your Life in	RBC

7. Client and Project Summary

University of Northern Iowa
Service to Iowa
Fiscal Year 2009

Community or Business	County	State	Industry	Counseling Provided	Program
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Managing Cash Flow During an	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Post-Distaster Update: Parkersburg,	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	IowaBizNet- a Healthcare Solution	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Brand Building in a Down Economy	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Exploring Entrepreneurship	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	EntreFest! Conference	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Exploring Entrepreneurship	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Free Market Research Tools on the	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Iowa Micro-Loan Program	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Bookkeeping and Financial Tools	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Tax Filings and the 2008 disaster	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	The Law and Business	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Workforce Development During	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Marketing During an Economic	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Banking and Small business	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	JPEC Business Plan Competition!	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Business Finance Package	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	The Importance of Showing Profit	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Alternative Financing and COG's	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Is There a Market for Your Product?	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Tech	Radio and the Future of Mass Media	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Technology	MyEntrre.Net's New Features	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Technology	Technology and Small Business	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Technology	Leading an Organization	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Technology	Transition Your Business	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Technology	Marketing on the Web	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Technology	The Culinary Art of Restaurant Marketing	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Technology	You Are What You Eat: Staying Healthy While Running Your Business	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Technology	Post Legislative Update	RBC

7. Client and Project Summary

University of Northern Iowa
Service to Iowa
Fiscal Year 2009

Community or Business	County	State	Industry	Counseling Provided	Program
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Technology	Contracts, Leases, Sales Agreements and the Statutory Process	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Technology	The Secrets of Government Procurement	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Technology	Iowa Inventors and Innovators	RBC
Webinar	Online-Statewide	IA	Retail.Manufacturing/Service/Technology	SOS on SEO	RBC
Pow I-80	Poweshiek	IA	Economic Development	Entrepreneurship Support System Dlvp.	RBC
Iowa Entrepreneurs	Statewide	IA	All Industries	EntreFest! Conference	RBC
Union County Ecoomic Development Corp	Union	IA	Economic Development	Entrepreneurship Support System Dlvp.	RBC
Winneshiek County Economic Development Corp	Winneshiek	IA	Economic Development	Entrepreneurship Support System Dlvp.	RBC
John Deere, PEC facility	Black Hawk	IA	Engineering/Manufacturing	Recycling education presented at Health Fair to over 775 employees.	RRTTC
Lincoln Elementary School	Black Hawk	IA	Education	Environmental Education presented to all 464 students, 54 steachers and staff members and over 900 parents over the school year	RRTTC
University of Northern Iowa	Black Hawk	IA	Education	Coordination of Panther Pick Up with other organizations.	RRTTC
University of Northern Iowa	Black Hawk	IA	Education	Coordination and participation in campus "Earth Day" celebration	RRTTC
Iowa Citizens, Businesses and Industries	Multi-county	IA	Multiple	Technical Assistance, & Env. Education	RRTTC
Iowa Chamber of Commerce Executives	Allamakee	IA	Economic Development	Disaster Recovery Planning	SBDC
Entrepreneurs	Black Hawk	IA	All Industries	Marketing During an Economic Downturn	SBDC
Entrepreneurs	Black Hawk	IA	All Industries	Smart Start	SBDC
Entrepreneurs	Black Hawk	IA	All Industries	Smart Start	SBDC
Entrepreneurs	Black Hawk	IA	All Industries	Smart Start	SBDC
Entrepreneurs	Black Hawk	IA	All Industries	Smart Start	SBDC
Entrepreneurs	Black Hawk	IA	All Industries	Smart Start	SBDC
Entrepreneurs	Black Hawk	IA	All Industries	Smart Start	SBDC
Entrepreneurs	Black Hawk	IA	All Industries	Smart Start	SBDC

7. Client and Project Summary
University of Northern Iowa
Service to Iowa
Fiscal Year 2009

Community or Business	County	State	Industry	Counseling Provided	Program
Entrepreneurs	Black Hawk	IA	All Industries	Smart Start	SBDC
Entrepreneurs	Black Hawk	IA	All Industries	Smart Start	SBDC
Entrepreneurs	Black Hawk	IA	All Industries	Smart Start	SBDC
Entrepreneurs	Black Hawk	IA	All Industries	Smart Start	SBDC
Entrepreneurs	Black Hawk	IA	All Industries	Smart Start	SBDC
Entrepreneurs	Black Hawk	IA	All Industries	Smart Start	SBDC
Entrepreneurs	Black Hawk	IA	All Industries	Smart Start	SBDC
Entrepreneurs	Black Hawk	IA	All Industries	Smart Start	SBDC
Entrepreneurs	Black Hawk	IA	All Industries	Smart Start	SBDC
Entrepreneurs	Black Hawk	IA	All Industries	Smart Start	SBDC
Entrepreneurs	Black Hawk	IA	All Industries	Smart Start	SBDC
Entrepreneurs	Black Hawk	IA	All Industries	Smart Start	SBDC
Entrepreneurs	Black Hawk	IA	All Industries	Smart Start	SBDC
Entrepreneurs	Black Hawk	IA	All Industries	Smart Start	SBDC
Entrepreneurs	Black Hawk	IA	All Industries	Smart Start	SBDC
Entrepreneurs	Black Hawk	IA	All Industries	Smart Start	SBDC
Entrepreneurs	Black Hawk	IA	All Industries	Smart Start	SBDC
Entrepreneurs	Black Hawk	IA	All Industries	Smart Start	SBDC
Entrepreneurs	Black Hawk	IA	All Industries	QuickBooks Pro	SBDC
Entrepreneurs	Black Hawk	IA	All Industries	QuickBooks Pro	SBDC
Entrepreneurs	Black Hawk	IA	Service/Technology	Fast Trac - Growth Venture	SBDC
Entrepreneurs	Black Hawk	IA	All Industries	Fast Trac - Growth Venture	SBDC
Entrepreneurs	Bremer	IA	All Industries	Marketing During an Economic Downturn	SBDC
Entrepreneurs	Bremer	IA	Construction	Disaster Recovery - Existing	SBDC
Entrepreneurs	Bremer	IA	Service/Technology	Disaster Recoery - Existing	SBDC
Entrepreneurs	Buchanan	IA	All Industries	Smart Start	SBDC
Entrepreneurs	Buchanan	IA	All Industries	Surviving an Economic Downturn	SBDC
Entrepreneurs	Clarke	IA	All Industries	Surviving an Economic Downturn	SBDC
Entrepreneurs	Fayette	IA	All Industries	Fast Trac - New Venture - Financial Packaging	SBDC
Entrepreneurs	Floyd	IA	Retail/Service/Technology	Business Succession	SBDC
Regional Economic Developers	Floyd	IA	Economic Development	Business Succession	SBDC
Entrepreneurs	Jasper	IA	All Industries	FastTrac - New Venture	SBDC
Anti-Leukemic - Waterloo	Black Hawk	IA	Medical Research	Market Research	SMS
Cedar Falls Utilities - Cedar Falls	Black Hawk	IA	Utility	Market Research	SMS
Retirement Resource Center - Cedar Falls	Black Hawk	IA	Service	Market Research	SMS
Waterloo Municipal Utility - Waterloo	Black Hawk	IA	Utility	Market Research	SMS
Hub City - Stanley	Buchanan	IA	Food Manufacturing	Market Research	SMS

7. Client and Project Summary

University of Northern Iowa
Service to Iowa
Fiscal Year 2009

Community or Business	County	State	Industry	Counseling Provided	Program
Butler County Cheese Factory	Butler	IA	Food Manufacturing	Market Research	SMS
Heavy Equipment Mfg. - Grundy Center	Grundy	IA	Manufacturing	Market Research	SMS
Lincoln Savings Bank - Reinbeck	Grundy	IA	Financial	Market Research	SMS
Metal Tech - Iowa Falls	Hardin	IA	Manufacturing	Market Research	SMS
Collis, Inc. - Muscatine	Muscatine	IA	Manufacturing	Market Research	SMS
Northern Filter Media - Muscatine	Muscatine	IA	Manufacturing	Market Research	SMS
Maintainer Corp. - Sheldon	O'Brien	IA	Manufacturing	Market Research	SMS
Building Inspectors - Huxley	Story	IA	Service	Market Research	SMS
Iowa Energy Center - Ames	Story	IA	Service	Market Research	SMS
Parkersburg Community Day Camp	Butler	IA	Recreation Services	Youth Services	STEP/R2S
Calhoun County RC&D	Multi-county	IA	Tourism/Education/Cultural	Cultural Center Feasibility Study	STEP/R2S
Cedar Valley	Multi-county	IA	Recreation Services	Youth Services	STEP/R2S
Iowa Park and Recreation Assocation	Multi-county	IA	Recreation Services	Training	STEP/R2S
RAGBRAI - Des Moines Register	Multi-county	IA	Tourism	Evalution/Economic Impacts	STEP/R2S
County Roadside Managers	Adair	IA	Roadside Vegetation Management	Soils Training	TPC
County Roadside Managers	Adair	IA	Roadside Vegetation Management	GPS Training	TPC
County Board of Supervisors	Adams	IA	Roadside Vegetation Management	IRVM Education	TPC
General Public	Allamakee	IA	Education	Native Plant Propagation Workshop	TPC
Natural Resources and Conservation Service	Allamakee	IA	Education	2-Day Prescribed Fire Workshop	TPC
County Roadside Managers	Appanoose	IA	Roadside Vegetation Management	GPS Training	TPC
County Roadside Managers	Audubon	IA	Roadside Vegetation Management	Soils Training	TPC
County Board of Supervisors	Benton	IA	Roadside Vegetation Management	IRVM Education	TPC
Natural Resources and Conservation Service	Benton	IA	Education	2-Day Prescribed Fire Workshop	TPC
Cedar Falls Garden Club	Black Hawk	IA	Leisure	Tour & Talk	TPC
Cedar Falls School Children	Black Hawk	IA	Education	Upward Bound Summer Camps	TPC
Cedar Falls School Children	Black Hawk	IA	Education	Wetland Demonstration Planting	TPC
Cedar Falls School Children	Black Hawk	IA	Education	Fall Prairie Walks with 1st Graders	TPC
County Roadside Managers	Black Hawk	IA	Roadside Vegetation Management	GPS Training	TPC
General Public	Black Hawk	IA	Education	Fall Natural Resource Research and Manegment Seminars	TPC
General Public	Black Hawk	IA	Education	Spring Natural Resource Research and Manegment Seminars	TPC
General Public	Black Hawk	IA	Education	Seed Harvesting Workshop	TPC

7. Client and Project Summary

University of Northern Iowa
Service to Iowa
Fiscal Year 2009

Community or Business	County	State	Industry	Counseling Provided	Program
General Public	Black Hawk	IA	Education	Native Plant Propagation Workshop	TPC
General Public	Black Hawk	IA	Education	1-Day Plant Propagation Workshop	TPC
Hawkeye Environmental Science Class	Black Hawk	IA	Education	TPC Facility Tour	TPC
Iowa Power Fund Board	Black Hawk	IA	Education	Prairie Power Project Presentation	TPC
Natural Resources and Conservation Service	Black Hawk	IA	Education	2-Day Prescribed Fire Workshop	TPC
Prairie Rapids Audubon Society	Black Hawk	IA	Education	Upland Forest Preserves orientation	TPC
Prairie Resource Unit, Iowa DNR	Black Hawk	IA	Education	Operations, Seed Production and Cleaning	TPC
County Board of Supervisors	Boone	IA	Roadside Vegetation Management	IRVM Education	TPC
General Public	Bremer	IA	Education	Seed Harvesting Workshop	TPC
General Public	Bremer	IA	Education	Native Plant Propagation Workshop	TPC
Isaac Walton League	Bremer	IA	Education	Prairie as Habitat presentation	TPC
Natural Resources and Conservation Service	Bremer	IA	Education	2-Day Prescribed Fire Workshop	TPC
Wartburg Environmental Science Class	Bremer	IA	Education	TPC Facility Tour	TPC
General Public	Buchanan	IA	Education	Bently Prairie Recognition	TPC
Natural Resources and Conservation Service	Buchanan	IA	Education	2-Day Prescribed Fire Workshop	TPC
Natural Resources and Conservation Service	Buena Vista	IA	Education	2-Day Prescribed Fire Workshop	TPC
Allison School Children	Butler	IA	Education	Prairie Tours	TPC
Clarksville School Children	Butler	IA	Education	Prairie Tours	TPC
General Public	Butler	IA	Education	Seed Harvesting Workshop	TPC
General Public	Butler	IA	Education	Native Plant Propagation Workshop	TPC
Natural Resources and Conservation Service	Butler	IA	Education	2-Day Prescribed Fire Workshop	TPC
Parkersburg School Children	Butler	IA	Education	Prairie Tours	TPC
General Public	Carrol	IA	Education	Seed Harvesting Workshop	TPC
Natural Resources and Conservation Service	Carrol	IA	Education	2-Day Prescribed Fire Workshop	TPC
County Roadside Managers	Cerro Gordo	IA	Roadside Vegetation Management	Soils Training	TPC
General Public	Cerro Gordo	IA	Education	Native Plant Propagation Workshop	TPC
General Public	Cerro Gordo	IA	Education	Seed Harvesting Workshop	TPC
Natural Resources and Conservation Service	Cherokee	IA	Education	2-Day Prescribed Fire Workshop	TPC
County Roadside Managers	Chickasaw	IA	Roadside Vegetation Management	Soils Training	TPC
Natural Resources and Conservation Service	Chickasaw	IA	Education	2-Day Prescribed Fire Workshop	TPC
New Hampton School Children	Chickasaw	IA	Education	Campus Prairie Walk	TPC
Natural Resources and Conservation Service	Clay	IA	Education	2-Day Prescribed Fire Workshop	TPC

7. Client and Project Summary

University of Northern Iowa

Service to Iowa

Fiscal Year 2009

Community or Business	County	State	Industry	Counseling Provided	Program
County Roadside Managers	Clinton	IA	Roadside Vegetation Management	Soils Training	TPC
General Public	Clinton	IA	Education	Horticulture in the Heartland Presentation	TPC
County Roadside Managers	Dallas	IA	Roadside Vegetation Management	GPS Training	TPC
County Roadside Managers	Dallas	IA	Roadside Vegetation Management	Soils Training	TPC
County Roadside Managers	Dallas	IA	Roadside Vegetation Management	Wetland Plant ID Workshop	TPC
Natural Resources and Conservation Service	Delaware	IA	Education	2-Day Prescribed Fire Workshop	TPC
County Roadside Managers	Des Moines	IA	Roadside Vegetation Management	GPS Training	TPC
County Roadside Managers	Des Moines	IA	Roadside Vegetation Management	Soils Training	TPC
Natural Resources and Conservation Service	Dickinson	IA	Education	2-Day Prescribed Fire Workshop	TPC
General Public	Dubuque	IA	Education	Native Plant Propagation Workshop	TPC
Natural Resources and Conservation Service	Dubuque	IA	Education	2-Day Prescribed Fire Workshop	TPC
Natural Resources and Conservation Service	Emmet	IA	Education	2-Day Prescribed Fire Workshop	TPC
County Roadside Managers	Fayette	IA	Roadside Vegetation Management	Soils Training	TPC
County Roadside Managers	Floyd	IA	Roadside Vegetation Management	GPS Training	TPC
General Public	Floyd	IA	Education	Native Plant Propagation Workshop	TPC
Natural Resources and Conservation Service	Floyd	IA	Education	2-Day Prescribed Fire Workshop	TPC
County Board of Supervisors	Hancock	IA	Roadside Vegetation Management	IRVM Education	TPC
County Roadside Managers	Hardin	IA	Roadside Vegetation Management	Soils Training	TPC
General Public	Hardin	IA	Education	Native Plant Propagation Workshop	TPC
County Roadside Managers	Henry	IA	Roadside Vegetation Management	Soils Training	TPC
Natural Resources and Conservation Service	Howard	IA	Education	2-Day Prescribed Fire Workshop	TPC
County Board of Supervisors	Humboldt	IA	Roadside Vegetation Management	IRVM Education	TPC
County Board of Supervisors	Ida	IA	Roadside Vegetation Management	IRVM Education	TPC
County Roadside Managers	Iowa	IA	Roadside Vegetation Management	Soils Training	TPC
General Public	Jackson	IA	Education	Native Plant Propagation Workshop	TPC
Natural Resources and Conservation Service	Jackson	IA	Education	2-Day Prescribed Fire Workshop	TPC
County Roadside Managers	Jefferson	IA	Roadside Vegetation Management	Soils Training	TPC
County Roadside Managers	Johnson	IA	Roadside Vegetation Management	Soils Training	TPC
County Roadside Managers	Johnson	IA	Roadside Vegetation Management	GPS Training	TPC
General Public	Johnson	IA	Education	Seed Harvesting Workshop	TPC
General Public	Johnson	IA	Education	Native Plant Propagation Workshop	TPC
County Roadside Managers	Jones	IA	Roadside Vegetation Management	GPS Training	TPC
County Roadside Managers	Jones	IA	Roadside Vegetation Management	Soils Training	TPC

7. Client and Project Summary

University of Northern Iowa

Service to Iowa

Fiscal Year 2009

Community or Business	County	State	Industry	Counseling Provided	Program
General Public	Jones	IA	Education	Seed Harvesting Workshop	TPC
Natural Resources and Conservation Service	Jones	IA	Education	2-Day Prescribed Fire Workshop	TPC
County Conservation Board	Linn	IA	Educaton	Prairie Harvest field day	TPC
County Roadside Managers	Linn	IA	Roadside Vegetation Management	Soils Training	TPC
General Public	Linn	IA	Education	1-Day Weed Identification Workshop	TPC
General Public	Linn	IA	Education	Seed Harvesting Workshop	TPC
Kirkwood Plants of the Wild Class	Linn	IA	Education	TPC Facility Tour	TPC
Natural Resources and Conservation Service	Linn	IA	Education	2-Day Prescribed Fire Workshop	TPC
County Roadside Managers	Lyon	IA	Roadside Vegetation Management	Soils Training	TPC
Natural Resources and Conservation Service	Lyon	IA	Education	2-Day Prescribed Fire Workshop	TPC
County Roadside Managers	Mahaska	IA	Roadside Vegetation Management	Soils Training	TPC
County Roadside Managers	Mahaska	IA	Roadside Vegetation Management	GPS Training	TPC
County Roadside Managers	Marion	IA	Roadside Vegetation Management	Soils Training	TPC
County Roadside Managers	Marion	IA	Roadside Vegetation Management	GPS Training	TPC
County Board of Supervisors	Marshall	IA	Roadside Vegetation Management	IRVM Education	TPC
County Engineer	Mills	IA	Roadside Vegetation Management	Funded to North American Prairie Conference	TPC
Natural Resources and Conservation Service	Mitchell	IA	Education	2-Day Prescribed Fire Workshop	TPC
County Roadside Managers	Montgomery	IA	Roadside Vegetation Management	GPS Training	TPC
County Roadside Managers	Muscatine	IA	Roadside Vegetation Management	Soils Training	TPC
Natural Resources and Conservation Service	O'Brien	IA	Education	2-Day Prescribed Fire Workshop	TPC
Natural Resources and Conservation Service	Osceola	IA	Education	2-Day Prescribed Fire Workshop	TPC
County Roadside Managers	Page	IA	Roadside Vegetation Management	Soils Training	TPC
County Roadside Managers	Palo Alto	IA	Roadside Vegetation Management	Wetland Plant ID Workshop	TPC
Natural Resources and Conservation Service	Palo Alto	IA	Education	2-Day Prescribed Fire Workshop	TPC
Natural Resources and Conservation Service	Plymouth	IA	Education	2-Day Prescribed Fire Workshop	TPC
County Roadside Managers	Pocahontas	IA	Roadside Vegetation Management	Wetland Plant ID Workshop	TPC
Natural Resources and Conservation Service	Pocahontas	IA	Education	2-Day Prescribed Fire Workshop	TPC
County Roadside Managers	Polk	IA	Roadside Vegetation Management	Soils Training	TPC
County Roadside Managers	Polk	IA	Roadside Vegetation Management	Wetland Plant ID Workshop	TPC
General Public	Polk	IA	Education	Native Plant Propagation Workshop	TPC
General Public	Polk	IA	Education	Seed Harvesting Workshop	TPC
Iowa Prairie Network Winter Meeting	Polk	IA	Education	Presentation	TPC
Pheasants Forever	Polk	IA	Education	State Convention Exhibit	TPC
County Roadside Managers	Pottawattamie	IA	Roadside Vegetation Management	Soils Training	TPC
County Board of Supervisors	Poweshiek	IA	Roadside Vegetation Management	IRVM Education	TPC
County Roadside Managers	Poweshiek	IA	Roadside Vegetation Management	Soils Training	TPC

7. Client and Project Summary

University of Northern Iowa
Service to Iowa
Fiscal Year 2009

Community or Business	County	State	Industry	Counseling Provided	Program
County Roadside Managers	Sac	IA	Roadside Vegetation Management	Soils Training	TPC
General Public	Scott	IA	Education	Native Plant Propagation Workshop	TPC
Natural Resources and Conservation Service	Sioux	IA	Education	2-Day Prescribed Fire Workshop	TPC
County Conservation Employee Conference	Statewide	IA	Roadside Vegetation Management	Information Booth	TPC
County Engineer's Conference	Statewide	IA	Roadside Vegetation Management	Distribute Materials and Information	TPC
County Weed Commissioner's Convention	Statewide	IA	Roadside Vegetation Management	Technical Presentation	TPC
IRVM Calendar/Poster	Statewide	IA	Roadside Vegetation Management	Education/Promotion Material	TPC
Living Roadway Trust Fund	Statewide	IA	Roadside Vegetation Management	Grant writing instruction mailing	TPC
Living Roadway Trust Fund Summer Meeting	Statewide	IA	Roadside Vegetation Management	County Program Support	TPC
Native Seed Distribution for Roadsides	Statewide	IA	Roadside Vegetation Management	Write grant, buy and distribute seed	TPC
Recreational Impact	Statewide	IA	Education	Upland Forest Preserves trail project	TPC
Resource Managers, General public	Statewide	IA	Education	Seed Harvest and Cleaning Workshop	TPC
Roader's Digest Newsletter	Statewide	IA	Roadside Vegetation Management	Informational Networking	TPC
Roadside Conference	Statewide	IA	Roadside Vegetation Management	2-Day Technical Training	TPC
State Capitol Rotunda Natural Resources	Statewide	IA	Roadside Vegetation Management	Information Booth	TPC
State Preserves Managers Semina	Statewide	IA	Education		TPC
TPC Newsletter	Statewide	IA	Programmatic	Informational	TPC
Trees Forever Annual Celebration	Statewide	IA	Roadside Vegetation Management	Information Booth	TPC
County Roadside Managers	Story	IA	Roadside Vegetation Management	GPS Training	TPC
County Roadside Managers	Story	IA	Roadside Vegetation Management	Soils Training	TPC
County Roadside Managers	Story	IA	Roadside Vegetation Management	Wetland Plant ID Workshop	TPC
County Roadside Managers	Story	IA	Roadside Vegetation Management	Funded to North American Prairie Conference	TPC
Native Species Committee, Iowa Crop Improve As	Story	IA	Services	Policy, Native Species Certification	TPC
County Board of Supervisors	Tama	IA	Roadside Vegetation Management	IRVM Education	TPC
Natural Resources and Conservation Service	Tama	IA	Education	2-Day Prescribed Fire Workshop	TPC
Toledo School Children	Tama	IA	Education	Trees Forever Afterschool Program	TPC
County Roadside Managers	Warren	IA	Roadside Vegetation Management	Soils Training	TPC
County Roadside Managers	Washington	IA	Roadside Vegetation Management	Soils Training	TPC
County Roadside Managers	Webster	IA	Roadside Vegetation Management	Soils Training	TPC
General Public	Webster	IA	Education	Native Plant Propagation Workshop	TPC

7. Client and Project Summary

University of Northern Iowa

Service to Iowa

Fiscal Year 2009

Community or Business	County	State	Industry	Counseling Provided	Program
County Roadside Managers	Winneshiek	IA	Roadside Vegetation Management	Funded to North American Prairie Conference	TPC
County Roadside Managers	Winneshiek	IA	Roadside Vegetation Management	GPS Training	TPC
Natural Resources and Conservation Service	Winneshiek	IA	Education	2-Day Prescribed Fire Workshop	TPC
Natural Resources and Conservation Service	Woodbury	IA	Education	2-Day Prescribed Fire Workshop	TPC
Field Day, USDA Natural Resource Conservation	Worth	IA	Education	Resource Management	TPC

University of Northern Iowa - as of June 30, 2009
Grow Iowa Values Fund Appropriations

	FY 2006 GIVF Appropriation	**$950,000**	Board of Regents approved September 2005
1	Technology Transfer and Business Incubation	$310,000	
2	Rural Entrepreneurship	$155,000	
3	Market Research	$120,000	
4	Capacity building and Implementation for Regional Development	$140,000	
5	National Ag-Based Lubricants (NABL) Center	$225,000	

	FY 2007 GIVF Appropriation	**$950,000**	Board of Regents approved August 2005
1	Technology Transfer and Business Incubation	$310,000	
2	Rural Entrepreneurship	$200,000	
3	Market Research	$110,000	
4	Helping Regions Succeed	$130,000	
5	National Ag-Based Lubricants (NABL) Center	$200,000	

University of Northern Iowa	**Project**	**List of all FY 2006 Revenue Sources**	**Revenue Dollars for FY 2006**	**Amount of FY 2006 State Appropriations Expended as of 6/30/2009**	**List of all FY 2007 Revenue Sources**	**Revenue Dollars for FY 2007**	**Amount of FY 2007 State Appropriations Expended as of 6/30/2009**
1	**Technology Transfer and Business Incubation**	FY 2006 State Appropriations (GIVF)	$310,000	$310,000	FY 2007 State Appropriations (GIVF)	$310,000	$310,000
		FY 2006 Matching Funds (Federal Support)	$1,158,299		FY 2007 Matching Funds (Federal Support)	$700,000	
Description of Project	FY 2007 has been a productive year for both technology transfer and business incubation efforts. The Technology Transfer team is creating a supportive community culture for entrepreneurial development on campus through a planned schedule of events and educational opportunities for students, faculty and staff in the coming year. The Student Business Incubator continues to be a popular resource for UNI students, and the Innovation Incubator is nearing full completion with two entrepreneurs taking early tenancy in the new facility. Additional late-stage researchers and spin-off companies from the Cedar Valley are scheduled to enroll in the incubator this fall, as construction is completed.						
Anticipated End Results	Create a supportive community culture for entrepreneurial development on campus through a planned schedule of events and educational opportunities.						
Results achieved to Date/Plans	18 new disclosures from a variety of colleges across campus were accepted, from among the 26 that were submitted. Four of the five GIVF-funded, applied research projects submitted disclosures. Four US patent applications were filed during the fiscal year, with three US patents and multiple foreign patents awarded to innovators across campus. Three patents were licensed.						

University of Northern Iowa	**Project**	**List of all FY 2006 Revenue Sources**	**Revenue Dollars for FY 2006**	**Amount of FY 2006 State Appropriations Expended as of 6/30/2009**	**List of all FY 2007 Revenue Sources**	**Revenue Dollars for FY 2007**	**Amount of FY 2007 State Appropriations Expended as of 6/30/2009**
2	**Rural Entrepreneurship**	FY 2006 State Appropriations (GIVF)	$155,000	$155,000	FY 2007 State Appropriations (GIVF)	$200,000	$200,000
		FY 2006 Federal Support	$155,118		FY 2007 Matching Funds (Federal Support)	$175,662	
					FY 2007 Matching funds (State Approp)	$9,616	
					FY 2007 Matching Funds (Other)	$16,728	
Description of Project	As of fiscal year end, twelve rural Iowa counties have launched MyEntreNet Rural Entrepreneurship Development Systems across the state. It was anticipated that MyEntreNet would serve 50 community leaders and 450 entrepreneurs (150 of them with advanced technical assistance or training) for a total of 500 rural participants during FY 2007. Those goals were exceeded across all segments, with over 900 community leaders and entrepreneurs receiving some kind of on-site technical assistance, training, mentoring or networking support during the past fiscal year, and a record 235 of these entrepreneurs receiving advanced technical assistance or training.						
Anticipated End Results	Provide advanced technical assistance or training to rural entrepreneurs. MyEntreNet staff continues to fill gaps in service delivery areas and provide training in entrepreneurial development strategies for community and professional leaders.						
Results achieved to Date	To date, more than 1,300 Iowa entrepreneurs have registered at www.myentre.net; 326 in the past six months alone. This represents nearly double the number of rural entrepreneurs registered online a year ago. Across all MyEntreNet regions, 167 new full time jobs were created by 45 new or expanding rural companies. An additional 32 jobs were saved by technical assistance provided to struggling companies in these regions. Of those entrepreneurs receiving advanced services, nearly 20% have opened or expanded a rural company in the past twelve months.						
Plans	As reported in January, a unique partnership was developed this past year with the statewide system of Small Business Development Centers (SBDCs), in order to merge their online presence with MyEntreNet's online community. However, the statewide marketing campaign has been moved back to FY 2008 in order to include the SBDC system. Thus, GIVF resources have primarily been spent to augment the array of online learning, networking and technical assistance tools available to entrepreneurs via MyEntreNet.						

University of Northern Iowa	Project	List of all FY 2006 Revenue Sources	Revenue Dollars for FY 2006	Amount of FY 2006 State Appropriations Expended as of 6/30/2009	List of all FY 2007 Revenue Sources	Revenue Dollars for FY 2007	Amount of FY 2007 State Appropriations Expended as of 6/30/2009
3	**Market Research**	FY 2006 State Appropriations (GIVF)	$120,000	$120,000	FY 2007 State Appropriations (GIVF)	$110,000	$110,000
		FY 2006 Matching Funds (General Funds)	$8,632		FY 2007 Matching Funds (General Fund)	$59,094	
		FY 2006 Matching Funds (Other)	$112,601		FY 2007 Matching Funds (Other)	$53,260	
Description of Project	Quality market intelligence can significantly increase a business's opportunity for success. The purpose of devoting GIVF funds to market research projects for start-up businesses, existing businesses and tourism/quality-of-life ventures, is to help expand and stimulate economic growth across Iowa by providing businesses with invaluable insight on their target markets. Strategic Marketing Services (SMS) has allocated GIVF support towards three primary areas: 1) Assistance to UNI's technology transfer program, 2) Market Research Projects, and 3) Market Research Plans and Assessments.						
Anticipated End Results	Improve competitive intelligence for Iowa companies. Provide initial market screening and identify potential competitors for UNI faculty and staff research.						
Results achieved to Date	Area 1: Assistance to UNI's Technology Transfer Program – SMS conducted six Phase One research projects for UNI Technology Transfer opportunities during FY 2007. GIVF funding supported 50% of these Phase One projects, with the UNI Research Foundation (UNIRF) contributing the other 50%. Area 2: Market Research Projects – SMS has successfully completed five market research projects for Iowa-based businesses in FY 2007 with one still underway. Additionally, four other entities have expressed a sincere interest in utilizing SMS for market research, and are still under consideration. Costs for market research projects are split between the client and GIVF investment, with maximum GIVF support of $10,000 per project.						
Plans	Projects currently under consideration as of June 30, 2007: ASI Modulex, Grinnell Northern Filter Media, Muscatine Heavy Equipment, Bellevue City of West Des Moines						

University of Northern Iowa	Project	List of all FY 2006 Revenue Sources	Revenue Dollars for FY 2006	Amount of FY 2006 State Appropriations Expended as of 6/30/2009	List of all FY 2007 Revenue Sources	Revenue Dollars for FY 2007	Amount of FY 2007 State Appropriations Expended as of 6/30/2009
4	**Capacity Building and Implementation for Regional Development/Helping Regions Succeed**	FY 2006 State Appropriations (GIVF)	$140,000	$140,000	FY 2007 State Appropriations (GIVF)	$130,000	$130,000
		FY 2006 Matching Funds (Federal Support)	$122,816		FY 2007 Matching Funds (General Fund)	$7,982	
		FY 2006 Matching Funds (Other)	$17,615		FY 2007 Matching Funds (Federal Support)	$88,755	
					FY 2007 Matching Funds (Other)	$35,435	
Description of Project	During FY 2007, the Institute for Decision Making (IDM) and local/regional economic development leaders built upon growing levels of trust and collaboration in order to strengthen partnerships and build capacity at the local level, thus enhancing the regional product. Specifically, IDM has focused its efforts in six regions and across multiple development initiatives. Steps have also been taken to prepare these regions for operating independent of state marketing money.						
Anticipated End Results	Assisting regional organizations and agencies in job creation and adding businesses.						
Results achieved to Date	IDM solicited reports from a cross section of economic development organizations (collaborative partners) involved in regions. Over the last year, each partner averaged three business leads attributable to regional activity, with each lead having a one in six chance of a follow-up business visit. In a typical region, the average investment by each collaborative partner organization was roughly $16,000 (53% monetary; 47% in-kind). Additionally, IDM has reviewed its partners' identification of regional metrics noting that *job creation* and *businesses added* were most often mentioned. Other highlights include two regions that developed concerted marketing and operating protocols and the receipt of testimonial letters from each region praising IDM's contributions.						
Plans	Continue economic development partnerships and assistance.						

University of Northern Iowa	Project	List of all FY 2006 Revenue Sources	Revenue Dollars for FY 2006	Amount of FY 2006 State Appropriations Expended as of 6/30/2009	List of all FY 2007 Revenue Sources	Revenue Dollars for FY 2007	Amount of FY 2007 State Appropriations Expended as of 6/30/2009
5	**National Ag-Based Lubricants (NABL) Center**	FY 2006 State Appropriations (GIVF)	$225,000	$225,000	FY 2007 State Appropriations (GIVF)	$200,000	$200,000
		FY 2006 Matching Funds (Federal Support)	$248,492		FY 2007 State Appropriations	$40,032	
					FY 2007 Matching Funds (Federal Support)	$226,358	
Description of Project	The NABL Center has been a leader in the development of Iowa's biobased products industry for over 15 years. As the price of gasoline continues to surpass three dollars per gallon and the cost of petroleum-based lubricant products increases proportionately, the significance of developing a profitable, diverse, and well-accepted biobased industry within the state of Iowa has become paramount to Iowa's economic growth.						
Anticipated End Results	Provide support for the growth of the state's biobased products industry.						
Results achieved to Date	To provide support for the growth of the state's biobased products industry, the NABL Center has worked to expand its scope by: Offering fee-based biobased lubricant testing services to entrepreneurs and biobased lubricant manufacturers. Adding fee-based biofuels testing capabilities to serve the State's biodiesel and ethanol producers, and to provide quality assurance for biofuels consumers. Leveraging NABL scientists' 17 years of vegetable oil-based expertise to provide biodiesel and ethanol troubleshooting services for producers. Consulting with various biobased industry partners, in order to assist in product development projects.						
Plans	In the last year, NABL has continued to provide fee-based testing to various private entities. Roughly, 169 tests were performed at the request of outside firms. Staff anticipates that this volume will increase significantly in the upcoming months due to the finalization of NABL's ISO certification and concerted marketing efforts.						

University of Northern Iowa
Grow Iowa Values Fund Appropriations
June 30, 2009

	FY 2008 GIVF Appropriation	**$950,000**	
1	Technology Transfer and Business Incubation	$320,000	
2	Rural Entrepreneurship	$200,000	
3	Market Research	$100,000	
4	Capacity building and Implementation for Regional Development	$130,000	
5	National Ag-Based Lubricants (NABL) Center	$200,000	
	FY 2009 GIVF Appropriation	**$760,000**	**Reflects 20% reduction due to state disaster reallocation**
1	Technology Transfer and Business Incubation	$256,000	
2	Rural Entrepreneurship	$160,000	
3	Market Research	$80,000	
4	Capacity building and Implementation for Regional Development	$104,000	
5	National Ag-Based Lubricants (NABL) Center	$160,000	

University of Northern Iowa	**Project**	**List of all FY 2008 Revenue Sources**	**Revenue Dollars for FY 2008**	**Amount of FY 2008 State Appropriations Expended as of 6/30/2009**	**List of all FY 2009 Revenue Sources**	**Revenue Dollars for FY 2009**	**Amount of FY 2009 State Appropriations Expended as of 6/30/2009**
1	**Technology Transfer and Business Incubation**	FY 2008 State Appropriations (GIVF)	$320,000	$320,000	FY 2009 State Appropriations (GIVF)	$256,000	$218,000
		FY 2008 Federal Support	$267,618		FY 2009 Federal Funding	$172,117	
		FY 2008 Other	$74,501		FY 2009 Other	$64,779	
Description of Project	UNI continues to advance intellectual property disclosures, protection and commercialization across campus. Strategies for commercialization include licensing, strategic partnerships and new business development. The Innovation Incubator offers a hub facility to coalesce the existing strength of Intellectual Property disclosures and University research with quality business services to support commercialization and licensing. With construction now complete, the fourteen dedicated suites in the incubator offer a physical link between Iowa's business community, campus innovators and faculty researchers. Central to this approach is a multitude of programs in BCS where education and innovation come together- some new and some successfully established-working in tandem to create a rich spectrum of services and a unique physical environment to support technology transfer and entrepreneurship.						
Anticipated End Results	As technology transfer and intellectual property development continues to mature at UNI, we expect to generate 12-15 disclosures per year, file 5 patents, enter 2-3 license agreements and graduate 3-4 new companies into the greater Cedar Valley business community annually; 50% of those served are anticipated to be directly tied to commercialization resulting from university research or campus innovation at UNI. These expected outcomes will result in UNI ranking in the upper percentiles of technology transfer activity for master comprehensive undergraduate institutions..						
Results achieved to Date	2009 saw UNI researchers further concentrating applied research efforts into (1) support for utility patent applications and (2) collaboration with businesses to prepare technologies for full market-readiness and licensure. As expected, this resulted in fewer new intellectual property disclosures (12) than the previous year (16), but more utility patent filings (4) and provisional filings (4). Three of the four technologies represented by the new utility patent applications are in early stage negotiations for licensure, and two technologies submitted for provisional patents are under consideration for licensure. UNI also partnered with 3 Iowa companies (two major manufacturers and a smaller high-tech company) in advanced-stage research and industrial-scale trials to bring new technologies to market readiness. Business incubation also increased substantially. The Innovation Incubator celebrated its first graduate (a 7-employee technology firm) and has just completed an expansion project to add 5 additional suites. The Student Business Incubator was full with a waiting list of student ventures for the entire year. 17 student businesses were tenants in the Student Business Incubator and 38 student businesses were assisted virtually. The recently renamed 4th Street Incubator in downtown Waterloo continues to have full tenancy and a positive impact upon downtown economic development. To date, the Innovation Incubator and 4th Street Incubator have served 46 early stage firms, created 88 FTE jobs in technology, service and related sectors and have leveraged more than $4,000,000 in new commercial/equity investment in local business development.						
Plans	UNI will continue to focus on commercialization initiatives, including license negotiations and business start ups. Tenancy at the new Innovation Incubator will increase to 100% occupancy by the end of the fiscal year. At least 15 intellectual property disclosures will be received with 2-3 licensing agreements executed under patent or trade-secret provisions and 4-5 new late-stage research projects awarded to UNI faculty. In addition, the Student Business Incubator will remain full and generate spin-off companies for the Iowa economy. Expansion of the Innovation Incubator has been completed and the facility now offers 14 business suites of varying size and flexible student and employee work areas. With the final phase of the Innovation Incubator complete, marketing efforts to engage campus innovators, faculty researchers and targeted entrepreneurs in the region will become a primary focus.						

University of Northern Iowa
Grow Iowa Values Fund Appropriations
June 30, 2009

University of Northern Iowa	Project	List of all FY 2008 Revenue Sources	Revenue Dollars for FY 2008	Amount of FY 2008 State Appropriations Expended as of 6/30/2009	List of all FY 2009 Revenue Sources	Revenue Dollars for FY 2009	Amount of FY 2009 State Appropriations Expended as of 6/30/2009
2	**Rural Entrepreneurship**	FY 2008 State Appropriations (GIVF)	$200,000	$200,000	FY 2009 State Appropriations (GIVF)	$160,000	$154,628
		FY 2008 Federal Support	$160,481		FY 2009 Federal Funding	$84,836	
		FY 2008 State Appropriations	$0		FY 2009 State Appropriations	$0	
		FY 2008 Other	$39,702		FY 2009 Other	$68,183	
Description of Project	MyEntreNet is an entrepreneurship development system that identifies, recruits, networks and serves Iowa small business owners with information, services and access to capital. Through a comprehensive, technology-supported approach of building community capacity, customized technical assistance, networking and enhanced access to capital, MyEntreNet fills a much-needed gap in rural economic development.						
Anticipated End Results	On an annual basis more than 1,200 entrepreneurs will attend a regional *EntreBash!* event in the state of Iowa, with 400 of these individuals attending multiple events supported by a service provider partner participating in the MyEntreNet master calendar. These entrepreneurs will generate 100 new or expanded businesses and create 200-250 new full time jobs. At least 250 entrepreneurs representing 50 Iowa counties will attend the 3nd annual EntreFest! statewide conference for small business. With the statewide rollout of the MyEntre.Net online community, the number of registered users is expected to continue increasing at a rapid rate.						
Results achieved to Date	2008-09 will be remembered as a difficult year for small business. Between natural disasters and the national economic downturn, Iowa small business owners slowed job creation greatly in FY 2009. Small business owners invested heavily into their existing business operations this past year; particularly among those affected by the disasters. Business start-up activity remained steady; many job seekers turned to 'necessity entrepreneurship' in light of the economic downturn. In FY2009 the users of the MyEntre.Net community were responsible for 94 business start ups or expansions, created 177 new jobs and leveraged $18,449,350 in commercial investment. Iowa entrepreneurs continue to seek assistance from service providers at all levels. The second statewide EntreFest! conference for small business owners drew 251 attendees to Coralville for two days in March and more than 800 pre-venture and existing small business owners attended smaller, regional EntreBash events or disaster recovery events throughout the year. Webinar attendance also jumped by 50% this past year. Iowa's online community for entrepreneurs at www.myentre.net was re-launched in mid May with many new, interactive features including small business profiles. 538 new small business owners joined the online community in the first six weeks of re-launch, bringing the total number of users to more than 3,000 representing every county in the state.						
Plans	In fiscal year 2010, MyEntreNet's online community will grow by 33% to 4,000 Iowa small business owners engaged online. 500 small business owners will attend a regional EntreBash! in the state of Iowa and 400 will go on to attend one or more events supported by a service provider partner who participates in the MyEntreNet master calendar. Those served through this systems approach will generate 125 new or expanded businesses and create 300 new full time jobs. 250 entrepreneurs representing 50 Iowa counties will attend the 3nd annual EntreFest! statewide conference for small business in March of 2010.						

University of Northern Iowa
Grow Iowa Values Fund Appropriations
June 30, 2009

University of Northern Iowa	Project	List of all FY 2008 Revenue Sources	Revenue Dollars for FY 2008	Amount of FY 2008 State Appropriations Expended as of 6/30/2009	List of all FY 2009 Revenue Sources	Revenue Dollars for FY 2009	Amount of FY 2009 State Appropriations Expended as of 6/30/2009
3	**Market Research**	FY 2008 State Appropriations (GIVF)	$100,000	$100,000	FY 2009 State Appropriations (GIVF)	$80,000	$80,000
		FY 2008 General Fund			FY 2009 General Fund		
		FY 2008 Other	$107,382		FY 2009 Other	$80,084	
Description of Project	The purpose of devoting GIVF investment towards market research projects for start-up businesses, existing businesses and tourism/quality-of-life ventures, is to help expand and stimulate economic growth across Iowa. Quality market intelligence significantly increases the opportunity for success. Strategic Marketing Services (SMS) allocated FY 2009 GIVF support towards three primary areas: 1) Market Research Projects, 2) Market Research Plans and Assessments, and 3) Marketing and Education.						
Anticipated End Results	Improve competitive intelligence for Iowa companies by offering quality market intelligence. SMS will also provide initial market screening and identify potential competitors for Iowa businesses and UNI faculty and staff tech transfer projects. Iowa companies will also b better educated about what market research is, what its benefits are, and the important role that it plays in successful business operations.						
Results achieved to Date	Area 1: Market Research Projects – Market research projects were split equally between the Iowa-based client and GIVF investment, with maximum GIVF support of $10,000 per project. As of June 30, 9 projects were complete or fully committed.Area 2: Market Research Plans and Assessments – SMS staff conducts consultations with potential clients (Iowa companies and entrepreneurs) about their businesses and proposes a Market Research Plan / Strategic Plan, which assesses their situation and a plan to address it, along with associated costs. GIVF investment for these projects leverages a one-to-one match; 7 market research plans were complete as of June 30. Area 3: Marketing and Education – In order to ensure that the best possible candidates for GIVF-supported projects are recruited, efforts were targeted towards educating Iowa businesses about the benefits of market research and marketing these services statewide. During 2009, activities in Area 3 included direct mail campaigns, trade show displays, presentations and participation in statewide conferences. Overall 16 Iowa companies benefitted from market research assistance and three technology transfer projects were provided market feasibility assessments.						
Plans	SMS will complete 6-10 market research projects; measurement of success for these will be based on new/increased sales, new sales leads, new product introductions, product modifications, customer satisfaction measurements, new jobs created, workforce development, physical plant expansions, new market penetration, market expansion, job retention, and focused marketing/operations initiatives. 25 consultations, assessments, and market research plans, economic gardening projects or secondary research projects will be conducted. SMS staff will participate in at least 8 targeted public relations/marketing activities across the state to include a direct mail campaign consisting of postcards and promotional letters. SMS will be conducting follow-up calls with GIVF recipients to track outcomes from market research projects.						

University of Northern Iowa	Project	List of all FY 2008 Revenue Sources	Revenue Dollars for FY 2008	Amount of FY 2008 State Appropriations Expended as of 6/30/2009	List of all FY 2009 Revenue Sources	Revenue Dollars for FY 2009	Amount of FY 2009 State Appropriations Expended as of 6/30/2009
4	**Capacity Building and Implementation for Regional Development/Helping Regions Succeed**	FY 2008 State Appropriations (GIVF)	$130,000	$130,000	FY 2009 State Appropriations (GIVF)	$104,000	$104,000
		FY 2008 Federal Support	$82,251		FY 2009 General Fund	$15,749	
		FY 2008 Other	$39,817		FY 2009 Federal Support	$16,873	
		FY 2008 General Fund	$8,518		FY 2009 Other	$79,901	
Description of Project	With the shared purpose of expanding and stimulating economic growth across the state of Iowa, the Institute for Decision Making continues to implement regional development assistance programs that build capacity regionally and locally to sustain Iowa's regional economies over the long term.						
Anticipated End Results	Improvements are expected in 4 key areas related to regional development: 1) sustainability of regional work and strengthening collaborative partnerships, 2) layoff aversion and regional response to mass layoffs, 3) linkages across regions in the state, 4) incorporating Regional Innovation Grants and regional development to address workforce issues.						
Results achieved to Date	In FY2009, IDM solicited reports from a cross-section of local economic development organizations active in their regions. All responding organizations reported that their regional operating protocols were working well with one wanting more effective communications. Organizations' volunteer hours committed to the region have increased according to one-half of the reporting organizations. The number of business leads also increased, ranging from 3 to 65. Regions' marketing activities generally increased, while their budgets remained about the same as previous years. Regions have tended to expand their work beyond marketing; some of the areas are: entrepreneurship, employer/educator linkages, social media technology, a virtual speculative building program, hospitality training, and business retention/ expansion. 5 regional development organizations joined IDM's new Regional Partner Program; one of the benefits of this program is benchmarking assistance, with 30 measurable sources and a demographic report. IDM also devoted considerable resources to disaster assistance, particularly to the efforts in Parkersburg and Butler County. Progress towards a regional response manual for mass layoffs resulted in a draft product and initial design for an online guide geared towards economic developers. IDM also received testimonial letters from active developers in regions where staff worked during FY 2009.						
Plans	The Institute for Decision Making (IDM) will continue to implement regional development assistance programs that build capacity regionally and locally to sustain Iowa's regional economies over the long term. Efforts will be focused in six areas: Area 1 - Sustainability o Regional Work and Strengthening the Collaborating Member Groups, Area 2 – Regional Metrics Pilot Project, Area 3 – Social Media as Potential Marketing Tools, Area 4 – Economic Adjustments and Shifts to Economic Base, Area 5 – Linkages across Regions in Iowa and Area 6 – Regional Workforce Assessments - Skillsheds. IDM will solicit and report testimonials and the number of leads generated through the region, based on reports from local developers. IDM will also document progress in Areas 1 – 6.						

University of Northern Iowa
Grow Iowa Values Fund Appropriations
June 30, 2009

University of Northern Iowa	Project	List of all FY 2008 Revenue Sources	Revenue Dollars for FY 2008	Amount of FY 2008 State Appropriations Expended as of 6/30/2009	List of all FY 2009 Revenue Sources	Revenue Dollars for FY 2009	Amount of FY 2009 State Appropriations Expended as of 6/30/2009
5	**Bioeconomy - National Ag-Based Lubricants (NABL) Center**	FY 2008 State Appropriations (GIVF)	$200,000	$200,000	FY 2009 State Appropriations (GIVF)	$160,000	$29,684*
		FY 2008 Federal Support	$200,000		FY 2009 State Appropriations		
					FY 2009 Federal Support*	$160,000*	
					*NABL has only spent a small amount of 2009 GIVF funding due to a delay in the release of matching funds from the US Dept of Energy. DOE funding was approved for '09, but has not been drawn on due to ongoing negotiations to reduce match percentages. Preliminary DOE approval has been received and NABL expects to have '09 GIVF funding spent in the next few months. NABL's projects have proceeded as outlined.		
Description of Project	The NABL Center brings national leadership in the biobased products industry to the State of Iowa. As a globally recognized research center, NABL contributes to the growth of Iowa's bioeconomy with cutting-edge research involving biobased industrial lubricants and greases, metalworking and functional fluids, and recently, engine oil technologies. As the biofuels industry comes under scrutiny as a scapegoat for increased prices and economic pressures, the continued support of credible resources such as NABL will be critical to maintaining the state's bioeconomy.						
Anticipated End Results	Provide support for the continued profitability and growth of the state's biobased products industry with credible performance testing resources and successful new product development.						
Results achieved to Date	The National Ag-Based Lubricants (NABL) Center has begun building on its foundation of almost two decades of research and development to provide much-needed resources and advocacy for the State's bio-product industries. With recent attacks on biofuels rippling through Iowa's growing industry, and currently unprofitable ag commodity prices relative to finished fuel values, this support could not come at a more critical time for the State. In FY2009, the NABL Center expanded its focus to include: 1) Comprehensive biolubricant product research, development, testing, and fee-based client services; 2) Biodiesel testing services, covering nearly the full spectrum of ASTM's D-6751 biodiesel series; 3) Support for the creation and widespread acceptance of appropriate standardized testing methodologies, which truly capture the benefits and monitor the risk factors inherent in biobased products, as opposed to traditional petroleum methodologies, through organizations such as ASTM International, SAE (Society of Automotive Engineers), AOCS (American Oil Chemists' Society), and NLGI (National Lubricating Greases Institute). As of June 30, 2009 NABL laboratories has provided testing services for 31 fee-based tests to industry clients, including two Iowa biolubricant companies, one U.S. lubricant company, two chemical/bio-science companies and one ethanol producer. NABL also provided biodiesel testing services to a University institution, an Iowa biodiesel producer and the State of Iowa. NABL's director presented at five major industry organization conferences and NABL scientists participated in 4 ASTM inter-laboratory cross checks. Two new research projects were also launched in FY2009; the first is the development of a Continuous Oil Recycling System (CORS) for off-road diesel engines and the second investigates the potential use of microwave technology for process heating of vegetable-based lubricants.						
Plans	As the State's biobased industry faces challenges from political and economic competitors, NABL will continue to support Iowa's economic growth by supporting appropriate performance measurements and classifications for biobased products, credible third-party testing services with a biobased product emphasis, and research involving new ways to incorporate materials sourced within the State in products used throughout the world. The presence of the NABL Center adds credibility to the biobased lubricants industry, while the Center's resources and expertise encourage major agri-industrial companies to pursue biobased lubricant alternatives. NABL will provide fee-based testing services to at least 15 biofuels and/or biolubricant industry clients during FY09-10. NABL will complete at least three ASTM Crosscheck programs. NABL will participate in at least two scientific or industry organizations during 2009-10. NABL will formulate at least 2 different engine oils, using biobased base oils. NABL laboratories will complete at least 100 hours of diesel engine testing, operating a diesel engine lubricated by biobased crankcase lubricants.						

University of Northern Iowa - as of May 31, 2009
Battelle Appropriation

	FY 2007 Battelle Appropriation		
Endowment/Salary Funding	$1,000,000		
Infrastructure (RIIF and VIF)	$1,360,000		
Platform	$820,000		
Ethanol and Biodiesel Byproducts as Base Oils for Biobased Industrial Lubricants		$120,247	
Development and Commercialization of a Foundry Binder System from Biobased Feedstock		$71,512	
Robotics-deployed Detection of Biological Agents		$136,875	
Commercialization of Protein Structure Prediction Technology		$58,767	
Identifying Drought Tolerance Genes in the Reproductive Structure of Barley		$169,997	
Commercial Computing Grids		$64,933	
Commercialization of Leading Edge Paint Removal technologies		$119,837	
Faculty/Student Collaboration on Commercializable Research		$77,832	

$3,180,000 Board of Regents approved September 2006.

University of Northern Iowa	**Project**	**List of all Revenue Sources**	**Revenue Dollars**	**Board Approved for Programs/Projects**	**Amount of FY 2007 State Appropriations Expended as of 5/31/2009**
	Endowment/Salary Funding	FY 2007 State Appropriations (Battelle)	$1,000,000	$1,000,000	$983,732
Description of Project	Provide salary support for faculty members engaged in research projects with the potential for commercialization. Faculty members received support to work on 12 projects.				
Anticipated End Results	Undertake key recruitment, capacity building, and required investments to ensure rapid progress in the Battelle platforms.				
Results achieved to Date/Plans	Since 2006, faculty members received support to work on 12 projects. Seven of these projects were in the Biosciences. These funds supported 6 new faculty members whose primary research focused on creating new products related to the bioeconomy and advanced manufacturing. These funds were used to accelerate the establishment of their research programs of these key contributors to technology transfer. Funds were used to support new faculty on some of the research grants identified in Section 3, as well as for the following research: • A "phase 2" orthotic insert for lower leg amputees. • A patentable neural network-based and other data-mining algorithms for mining Enterprise Resource Planning (ERP) databases. • The integration of UNI grapevine identification data with the international plant germplasm database. • Nanoscience basic and applied research				

University of Northern Iowa	**Project**	**List of all Revenue Sources**	**Revenue Dollars**	**Board Approved for Programs/Projects**	**Amount of FY 2007 State Appropriations Expended as of 5/31/2009**
	Infrastructure (RIIF and VIF)	FY 2007 State Appropriations (Battelle RIIF and VIF)	$1,360,000	$1,360,000	$1,246,352
Description of Project	Renovation and equipping research laboratories used in Battelle projects.				
Anticipated End Results	Infrastructure to support research to discover genes for drought resistant crops and test bio-based foundry binders.				
Results achieved to Date/Plans	The status of the work for renovation and equipping research laboratories associated with the Battelle funds is complete. We are still holding some money pending the total completion of the contracts.				

University of Northern Iowa	**Project**	**List of all FY 2007 Revenue Sources**	**Revenue Dollars for FY 2007**	**Board Approved for Programs/Projects**	**Amount of FY 2007 State Appropriations Expended as of 05/31/09**
	Battelle Platform (see 8 projects that follow)	FY 2007 State Appropriations (Battelle)	$820,000	$820,000	$718,144
		FY 2007 Matching Funds (Other)	$283,637		
		FY 2007 Matching Funds (Federal, Industry)	$427,000		
Description of Project	UNI held an internal competition to select applied research projects with the greatest potential technology transfer and commercialization. With input from the Technology and Commercialization Resources Organization, 8 projects were funded. Thirty-two UNI undergraduate and thirteen graduate students have participated in these research projects thus far.				

	Project		**Allocated Dollars FY 2007**		
University of Northern Iowa	**Ethanol and Biodiesel Byproducts as Base Oils for Biobased Industrial Lubricants**	Platform allocation	$120,247		$120,247
Description of Project	Bioeconomy				
Anticipated End Results	The intent of this research is to determine whether corn oil and glycerin, byproducts of ethanol and biodiesel production, respectively, have potential for use in the development of biolubricants.				
Results achieved to Date	Tribological and performance testing were conducted to evaluate each of the samples collected within each category of byproduct, including byproduct corn oil, glycerin, and methyl esters. NABL scientists found that glycerin byproducts, in particular, have potential for biolubricant formulation. A new commercial product, drilling mud, was developed. A market issue exists of price feasibility, as the cost of the incumbent petroleum product dropped, due to the economic slowdown.				
Plans	This project is complete. Transfer to the marketplace remains as the final step, but remains difficult due to petroleum pricing.				
	Project		**Allocated Dollars FY 2007**	**Allocation expended as of 5/31/2009**	
University of Northern Iowa	**Development and commercialization of a Foundry Binder system from Biobased Feedstock**	Platform allocation	$71,512	$66,375	
Description of Project	Bioeconomy				
Anticipated End Results	The overarching goal of the UNI Metal Casting Center's research in foundry binder systems is to find bio-based substitutes for the current petroleum based binder systems that hold sand in the shape of a mold in which to cast molten metal. The new polymers would be much more environmentally friendly than their petroleum based counterparts.				
Results achieved to Date	In November of 2008 the University of Northern Iowa applied for patents for two revolutionary new polymer adhesives developed at the university's Metal Casting Center and Center for advanced Bio-based Binders (MCC/CABB). The new polymers are based on a byproduct of Iowa grown corn and a naturally occurring organic material.				
Plans	The university is in late-stage negotiation on both of the bio-based foundry binders and expects to have a license agreement soon.				
University of Northern Iowa	**Project**		**Allocated Dollars FY 2007**	**Allocation expended as of 5/31/2009**	
	Robotics-deployed Detection of Biological Agents	Platform allocation	$136,875	$102,088	
Description of Project	Biodefense and Biosecurity				
Anticipated End Results	This project targets development of a universally deployable bio-agent sensor unit.				
Results achieved to Date	In collaboration with partners from Doerfer Corporation and Advanced Automation, prototype design has been completed for the air-spore sampler. The prototype was tested for integrity and control by the industry partners, followed by additional tests using 'safe-strain' spores at UNI, under BSL-2 conditions. The prototype-sampler and QCM-detector system was then tested for performance with Ames strain spores, under BSL-3 conditions. The spore-detector prototype worked pretty well against the real anthrax spores in preliminary, 'range-finding' tests.				
Plans	We will have the sub-contractor conduct final work with the detector that will improve upon the preliminary data recently obtained.				
University of Northern Iowa	**Project**		**Allocated Dollars FY 2007**	**Allocation expended as of 5/31/2009**	
	Commercialization of Protein Structure Prediction Technology	Platform allocation	$58,767	$57,634	
Description of Project	Post Genomic Medicine				
Anticipated End Results	Develop novel and improved methods for computational protein structure determination from the sequence of amino acids, and commercialize a software package based on discovered innovations.				
Results achieved to Date/Plans	The research part of the project is now completed. The method for protein fold recognition (called UNI-FOLD), outlined in the Battelle grant proposal, has been implemented in Java programming language and extensively tested and benchmarked. A provisional patent application for UNI-FOLD was filed in July, 2008. A perfected patent application was recently filed.				
University of Northern Iowa	**Project**		**Allocated Dollars FY 2007**	**Allocation expended as of 5/31/2009**	
	Identifying Drought Tolerance Genes in the Reproductive Structure of Barley	Platform allocation	$169,997	$125,688	
Description of Project	Advanced Food and Feed				
Anticipated End Results	Discover genes for drought tolerance in barley flowers that can be used to develop new Iowa crops resistant to drought in the sensitive reproductive stage.				
Results achieved to Date	Research on the response of the reproductive structures of barley to drought stress using the Barley1 GeneChip microarray has identified many drought-inducible genes. This includes genes for late embryogenesis abundant (LEA) proteins, dehydrins, heat-shock proteins, transcription factors, antioxidant genes, disease resistance genes, and genes involved in metabolism and maintenance of tissue water level. In addition, the data showed that the reproductive structures of barley (awn, husk, and developing grain) express different genes in response to drought. To verify whether the microarray data is accurate, researchers performed real-time polymerase chain reaction (real-time PCR) analysis using a few randomly selected genes. Real-time PCR confirmed results of the microarray study: genes that showed changes in expression in the microarray analysis also showed similar expression patterns in the real-time PCR analysis.				
Plans	Project researchers plan to use Genome Sequencer FLX system (454 Life Sciences/Roche) or Genome Analyzer (Illumina) to identify new transcripts that were not represented on the Barley1 GeneChip. This was delayed due to technical issues this past semester, but the researchers are confident this can be accomplished this next year.				

University of Northern Iowa	Project		Allocated Dollars FY 2007	Allocation expended as of 5/31/2009
	Commercial Computing Grids	Platform allocation	$64,933	$52,049
Description of Project	Information Solutions			
Anticipated End Results	Create a High Performance Computing grid to provide academia and industry with accessible, secure, and scalable computing infrastructure. This statewide resource will provide a computing fabric needed to support new economic development in financial services, engineering and biotechnology in Iowa.			
Results achieved to Date	During the last few months, researchers completed the addition of general purpose graphics processing units (GPGPUs). Adding this low-cost, high-performance computing environment to the high performance computing grid has an impact on accounting and pricing possibilities for the project. It also greatly improves the ability to mine large databases.			
Plans	The current focus is on mining and compressing Iowa's LIDAR data housed at http://www.geotree.uni.edu/lidarProject.aspx. New mining, compression, and rendering capabilities have the potential for bringing about a new business model and uses for this data-intensive geographical endeavor.			
University of Northern Iowa	**Project**		**Allocated Dollars FY 2007**	**Allocation expended as of 5/31/2009**
	Commercialization of Leading Edge Paint Removal technologies	Platform allocation	$119,837	$119,837
Description of Project	Advanced Manufacturing			
Anticipated End Results	The Iowa Waste Reduction Center (IWRC) staff have developed a VirtualBlast system based on their existing VirtualPaint™ virtual reality training tool.			
Results achieved to Date	Development and testing of the Abrasive Blasting Simulator is complete. The VirtualPaint Blasting patent has been filed but has not yet been published			
Plans	An agreement has been reached with Clemco in which they will provide expertise and financial resources to further develop the simulator.			
University of Northern Iowa	**Project**		**Allocated Dollars FY 2007**	**Allocation expended as of 5/31/2009**
	Faculty/Student Collaboration on Commercializable Research	Platform allocation	$77,832	$58,391
Description of Project	Five teams of UNI faculty and students collaborated on research related to plant genetics, wireless mesh networks, nanotechnologies, and biobased cutting fluids.			
Anticipated End Results	Two UNI faculty proposed to work with students to discover plant genes that would be used to develop plant-made pharmaceuticals and fungus resistant crops. Two UNI faculty proposed to work with students to develop a novel system for automatically reading utilities meters using wireless mesh networks. Three faculty teams will work with students to enhance the properties of materials used for novel nanoscale devices and miniaturization of components; to prove the utility of a novel laser interferometer for non-contact measurement of nanoscale surface vibrations; and to compare the performance of bio-based with petroleum-based cutting fluids during machining.			
Results achieved to Date	Fungus Resistant Crops: To study possible resistance to Fusarium verticillioides native prairie plants were exposed to the fungus and observed for resistance. These experiments resulted in identification of a single gene sequence thought to be involved in the resistance. The isolated gene shares similarity with an uncharacterized gene involved in drought stress in poplar trees. Wireless Networks for Automated Meter Reading (AMR): Multiple AMR prototype nodes have been implemented and are under final integration and testing. Each AMR node consists of an AMR communication controller module, a kilowatt hour meter and several loads. Plant-made Pharmaceuticals: After establishing a new and more efficient in vitro regeneration system for hops (accepted for publication in Acta Horticulturae 2009), we worked over the past year on transforming hops with four genes to improve Xanthohumol content. Among those genes are two genes encoding pathway enzymes leading to Xanthohumol precursors and two genes encoding for transcription factor genes putatively involved in regulating pathway enzymes. All four genes have been customized and cloned in Agrobacterium binary vectors, licenced to us from VIB (Gent, Belgium). They harbor the GFP reporter gene for easy screening of transformants. Unfortunately Initial plant transformations carried out in 2008/2009 (about 3000 explants transformed) have shown limited success for the following three reasons. First, workers were inexperienced and an unexpected high number of losses occured due to tissue contamination. Furthermore, antibiotic selection had to be optimized to prevent overgrowth of Agrobacteria. Third, the vessels used regeneration of transformants were worn out (after three years of use and many rounds of autoclaving) and became insterile. Replacements have been ordered through our collaborator, Hospteiner, Inc., but have not arrived yet (they have been ordered from France). Over the past couple of months, the first two problems have been resolved and new transformations utilizing the new antibiotic selection scheme have been carried out with one of the transgenes. Results are promising but numbers of regenerants are still too low. Further transformations will be necessary for this gene construct, as well as for the other three.			
Plans	Fungus Resistant Crops: While this research began to help us understand the complex virulence of and plant resistance to Fusarium verticillioides there are many issues that need to be resolved beyond the scope of the funding provided by this award. Isolating and understanding genes that could confer resistance to crop plants will lead to increased productivity in new resistance cultivars. Wireless Networks for Automated Meter Reading: We are in the process of collecting measurement data to validate the system operation. We are planning to meet with local energy-related industry companies, such as Waverly Light and Power Co, to seek funding support and further project collaboration opportunities for long term development. Plant-made Pharmaceuticals: We were working diligently to increase sterile hop plants for use in the transformation experiments in order to make up for the losses occured during the past year (due to contamination, antibiotic issues, and unsterility of tissue culture vessels). We have resolved the issues and as soon as the new vessels arrive from France we will be continuing our transformations.			