

Contact: Diana Gonzalez

**REQUEST TO CREATE NEW CENTER AT IOWA STATE UNIVERSITY:
CENTER FOR e-DESIGN**

Action Requested: Consider approval of the request by Iowa State University to establish a Center for e-Design in the Department of Industrial and Manufacturing Systems Engineering in the College of Engineering.

Executive Summary: The purpose of the proposed Center for e-Design is to integrate fundamental principles of science, mathematics, and engineering in the development, testing, and implementation of new methods and technologies for the design of products. This proposal was reviewed by the Board Office and the Council of Provosts and is recommended for approval. Board of Regents Policy Manual §6.08 requires that all centers and institutes be approved by the Board. This request addresses the Board of Regents Strategic Plan priorities to provide “educational excellence and impact” and “economic development and vitality” and Goal #7 “Iowa’s public universities shall contribute to the expansion and diversification of the Iowa economy” and Goal #8 “Iowa’s public universities and special schools shall be increasingly efficient and productive.”

Background:

- ◆ **Description of Center.** The Center for e-Design is an existing multi-university National Science Foundation (NSF) Industry/University Cooperative Research Center (I/UCRC) which was founded in 2003. Dr. Janis Terpenney, who joined Iowa State University in August 2011 from Virginia Tech, is one of the founders of the Center and has served as the director for several years. ISU has now completed the steps required by NSF to join and relocate the Center’s home from Virginia Tech to ISU. Dr. Terpenney will serve as the ISU site director and director of the national multi-university Center, and ISU will become the lead institution. The Center currently includes seven universities (including ISU)¹ and 38 industry members. Three additional universities¹ have NSF planning grants and are in the process of joining (dates indicated below). Each of the three universities will bring at least five industry members to the consortium, bringing the number of industrial members to 53.

As an NSF I/UCRC, the Center for e-Design is a true public-private partnership. The I/UCRC program at NSF has been in place for more than 35 years and is often cited as one of its most successful programs. Its main purpose is to foster industry/university collaborations in research and education that are critical to the productivity of the nation. Currently, there are more than 50 NSF I/UCRC centers nationally (see <http://174.143.170.127/iucrc/publicCenterListServlet>).

In the consortium model of the I/UCRC program, industry and government agencies pay a membership fee to join. For the Center for e-Design, the membership fee is \$30,000 annually. This represents a true commitment by member companies, and, in turn, universities provide real value to the members by bridging research, education, technology development, and practice.

¹ ISU, Brigham Young University, Carnegie Mellon University, Oregon State University (Summer 2013), University at Buffalo, University of Central Florida, University of Massachusetts Amherst, University of Puerto Rico (TBD), Wayne State University (Fall 2012), and Virginia Tech.

The Center for e-Design has three major focus areas to deliver value to its industry/government partners: (1) Fundamental Research focuses on creating methods, tools, and technologies to address industry relevant needs in e-tools-enabled product development and realization, including enabling information infrastructure; new design paradigms and processes; design optimization; and visualizing and virtual prototyping; (2) Research Testbed focuses on integration of interdisciplinary research activities to validate developed tools, methods, and technologies; and (3) Engineering Education and Technology Transfer, which focuses on educating a new generation of engineers and scientists proficient in e-design and rapidly transferring results into usable applications for industry and government.

- ◇ Need for Center. Product development has become a very complicated process. Discrete product manufacturers are under pressure from customers (and the market) to move away from the traditional *make-to-stock* production model to a *build-to-demand* model. Many customers are no longer satisfied with mass-produced goods. They are demanding customization and rapid delivery of innovative products. These market pressures are impacting three key elements of competitiveness: time to market, cost, and quality. More than 70% of a product's life-cycle costs are committed at design, particularly the conceptual design phase. However, today's design approaches do not allow for incorporation of life cycle considerations at this phase. Industries now realize that the best way to reduce life cycle costs is to evolve a more effective product development paradigm using the Internet and web based technologies. Yet there remains a gap between these current market demands and current product development paradigms. Current computer-aided design systems neither allow direct imposition of multi-disciplinary constraints nor collaborations by stakeholders at remote locations. They also lack a mechanism for creating form from specifications. The emergence of the Internet provides the opportunity to fill this gap and leapfrog product development with a design approach that confers a competitive advantage to U.S. manufacturers.

The Center for e-Design has a track record of providing value to its industry and agency members. This has been exhibited with growth and sustained memberships for almost 10 years as well as growth in the number of university sites. The Center has been featured and showcased nationally with news features of research breakthroughs, significant savings to industry members, students graduated and employed by member companies (undergraduate and graduate), numerous publications, patent applications and disclosures, and additional funding obtained through university-industry partnerships. The benefits to companies include the following:

- ⇒ **Access and ability to drive cutting-edge research**
 - Directly influence the research priorities of the Center
 - Lower in-house R&D costs through utilization of R&D efforts of the Center
 - Provide a competitive advantage through achieving shorter cycle-time development for product development and design
 - Access research conducted by multiple state-of-the-art universities
- ⇒ **Tools and IP**
 - Access to information and technology on rapid advances occurring in product/system production
 - First rights and access to developments, including patents, licenses, publications
 - Tools for customers to communicate product specifications and preferences to manufacturing vendors and original equipment manufacturers

⇒ **Education & Training**

- Integrated state-of-the-art web-based product design and realization training
- Organizational means through which the private and public sectors can identify and support pertinent research challenges
- Short courses for industry representatives

⇒ **Recruitment/Outreach**

- Visitation program between university researchers and industry partners
- Access to a pool of talented students trained with the Center

◇ Center activities and objectives. The Center functions according to the guidelines established by the NSF I/UCRC program. Faculty and students work on research projects of shared value to industry members and the universities. Every six months, all university sites and Center members participate in an Industry Advisory Board (IAB) meeting where projects are presented/demonstrated, feedback and evaluation is obtained, new projects are selected, and workshops with industry that capture on-going and new challenges occur. Between IAB meetings, in addition to project work, universities and members provide educational and research experiences and pursue a variety of funding sources for added resources to support the work of the Center.

◇ Center structure and organization. The organizational structure of the Center complies with NSF requirements and includes an Industrial Advisory Board, a Center Director, Research Site Directors, and a University Policy Committee (see Figure 1).

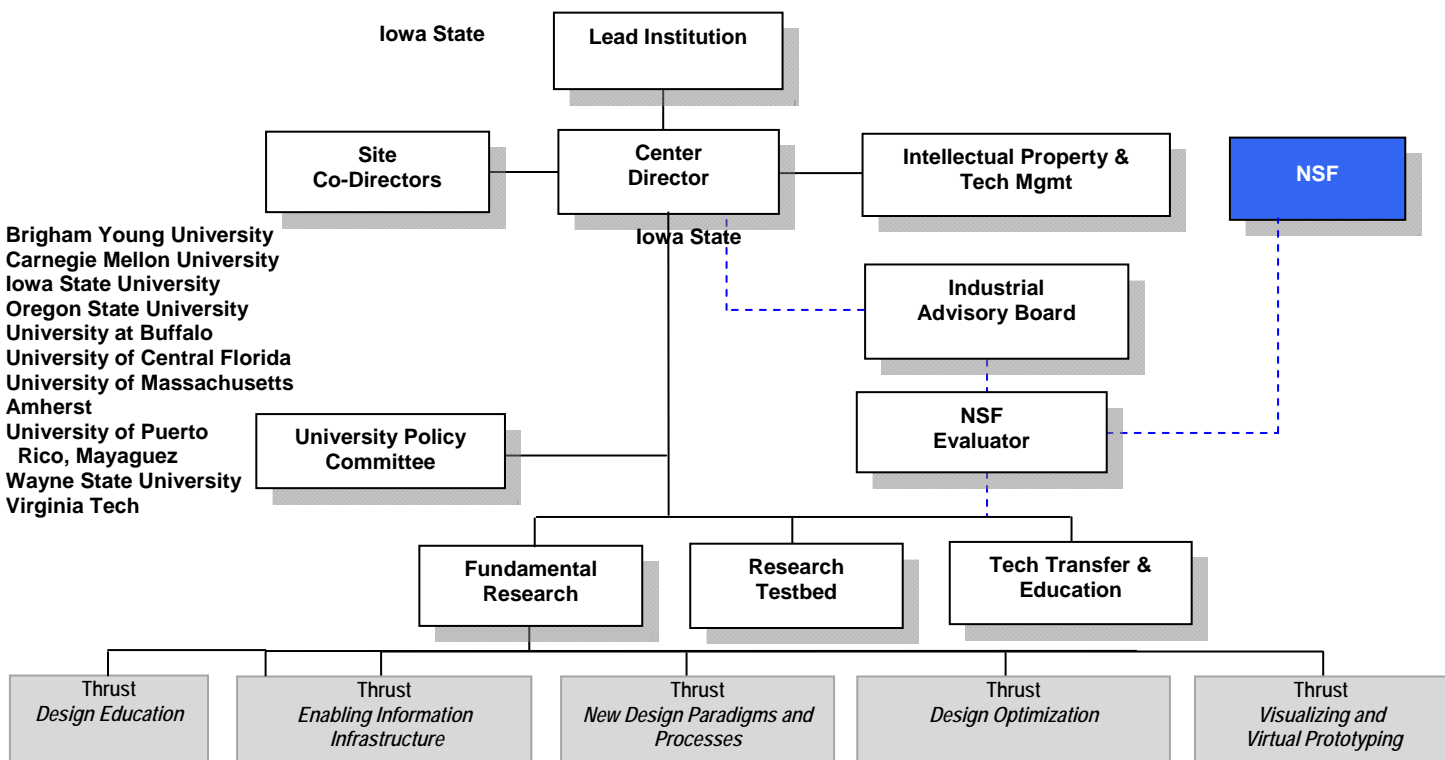


Figure 1. Organizational Diagram of NSF I/UCRC Center for e-Design

The director of the overall Center for e-Design will be Dr. Terpenny when ISU becomes the lead institution. There are site co-directors at each member institution. The Industrial Advisory Board (IAB), which includes one voting member from each company, provides advice on research priorities and makes recommendations on project funding. The IAB meets twice each year. All members from the various universities are part of a single industry advisory board (IAB) and vote as a larger group. IAB members have privileges and rights to all projects in the Center across university sites. Each of the university sites recruits and maintains a minimum of five members. All funds do not flow through the lead institution. Each university collects and retains the membership fees associated with their member companies. Each university receives base funding from NSF.

The site co-directors, in collaboration with the IAB, set goals and future directions of research, manage the day-to-day operation of the Center, and act as a liaison with member companies for tech-transfer and with the university administration. Leadership meetings are held every other week, via conference call, and include the director, site directors, IAB chair, evaluator, and administrative assistant. Activities that are discussed may include planning (date and location) and format of IAB meetings; the development or update to marketing materials, such as the center web page, printed materials, and marketing presentations; discussion and planning collaborative projects for presentation to the IAB or other funding opportunities, such as fundamental research grants, etc. Depending on the depth of the activities discussed among the site directors, a committee may be formed to take on the tasks at hand. These committees report back and get input/review in subsequent meetings from the entire leadership team.

The IAB chair participates in the regular leadership meetings and communicates with the IAB when input, guidance, or assessment is needed outside of the IAB meetings. For example, the IAB provided critical review of the Strategic Plan and has provided resources (technologies and tools) to the overall Center to aid in achieving the mission.

The University Policy Committee, which consists of senior leaders from all of the universities, has the responsibility to ensure that the Center's activities are consistent with academic policies and procedures of the universities. In addition, the Center has an external NSF evaluator (Dr. Donald Price) to monitor and evaluate research interaction between Center researchers and company members, as stipulated in the NSF I/UCRC protocol.

The Center's patent policy complies with the standard policies of partner university sites and is well suited to the goals of cooperative research with industry. The Center's inventions are promptly reported to the University, and to the sponsors. Title to inventions made in the course of research funded by the Center for e-Design normally vests in the university or its designee. The companies that are sponsors on the date of the invention disclosure receive an option to license any patents on the invention. Participating companies electing to exercise their license option must agree to share the patent costs in exchange for a royalty-free, non-exclusive license to use such an invention for the life of the patent protection obtained and must sign the standard non-exclusive license agreement with the university. Royalties from companies that license the invention are distributed in accordance with the university's patent policy, which is in effect on the date of disclosure. Research results publications are distributed to the Center for e-Design sponsors who must keep such reports in confidence. After six months, they become available to the general public at the discretion of the Center co-directors and the advice of the IAB.

An administrative assistant coordinates and supports center operations (correspondence with members, collection and tracking of membership dues, updates to the center web site, coordination of meetings, preparation and coordination of reports required each year by NSF, industry, and universities). The administrative assistant also supports membership recruitment and the preparation of marketing materials. The administrative assistant duties will transfer to ISU with the transfer of the lead.

Five primary thrust areas help to organize the research activities of the center.

- ⇒ **Design Education** - Focuses on the preparation of students capable of taking on current and future challenges of engineering design. Research in this area is focused on methods and tools that improve design pedagogy and tools to support students' skills and knowledge in design methods locally as well as in distant and distributed design educational environments.
- ⇒ **Design Optimization** - Addresses the challenges associated with customer constraints and preparedness, automatic accommodation of scalability, flexibility, efficient collaboration (concurrency), and multidisciplinary product design evolution.
- ⇒ **Enabling Information Infrastructure** - Focuses on the development of an e-design platform that will seamlessly and dynamically integrate distributed design objects and engineering tools over the Internet.
- ⇒ **New Design Paradigms and Processes** - Focuses on advancing a design paradigm to support functionality-based design and reasoning in the conceptual design phase (early design) of product development. It also supports research to capture and model the designer's intent at product conceptualization.
- ⇒ **Visualizing and Virtual Prototyping** - Supports cost-effective product design. Advanced tools for viewing design at the system level are needed so that interrelated effects of behavior on the complete product are known. Expanding on current computer aided design (CAD) software, virtual prototyping allows engineers, early in the development cycle, to visualize their full-system design ideas on the computer with realistic 3D models, and models that behave dynamically, just as they would in the real world, under any operating condition.

Research activities of the ISU team will strengthen the Center's efforts in the area of visualization and virtual prototyping research, an area where the Center has had less activity and contribution historically.

- ◇ Relationship of proposed Center to University's strategic plan. The proposed Center is aligned with the mission, vision and strategic plans of the university and the college in advancing research in critical areas of national need and transferring this knowledge to industry to support economic development of the state and the nation. One goal of the Center is to prepare the next generation of students, capable of multi-disciplinary design research and thinking, to develop new technologies and methods, and to engage in collaborative research in a global economy. The NSF I/UCRC program provides a proven framework for the success of the Center's public-private partnership. Students working on research supported through the funding of the Center receive practical education as they work in collaboration with industry members to solve important industrial problems. The operation of the Center for e-Design requires active participation of industry members in advising the projects that are completed and selecting new projects for funding support. The success of the Center rests on the ability of the faculty, staff and students to provide

value to the industrial partners while educating the next generation of leaders who understand the fundamentals of early stage design. The I/UCRC provides a unique environment in which academic researchers and industry partners can work together on technology issues that affect a broad spectrum of issues impacting our ability as a nation to be competitive in the marketplace with innovative and value-added products and systems.

- ◇ Relationship of proposed Center to existing centers. Improving products for better quality at reduced costs are areas where the Center for e-Design can add value to other initiatives and centers at ISU. For example, visualization and simulation are core to decision making in the design of products. Faculty and students working in the Virtual Reality Applications Center (VRAC) at ISU perform cutting-edge research in visualization and simulation. Center projects in this area will bring more attention to existing strengths at ISU and expand the opportunities for new research. Design decisions and consideration of trade-offs from a variety of perspectives over time are important to the evaluation and design of alternatives to power needs of the nation and products and systems that are sustainable. These are important focus areas for the university and Iowa as a whole. The Center for e-Design is aligned with the Center for Industrial Research and Service (CIRAS), whose mission is to support Iowa manufacturers. CIRAS has been instrumental in recruiting members for the Center for e-Design.

There are three other NSF I/UCRC centers in Iowa, all at Iowa State University:

- ⇒ Center for Nondestructive Evaluation (CNDE) is a single university center with a long history of success. CNDE has already reached out to the Center for e-Design to initiate collaborative projects between the centers.
- ⇒ Power Systems Engineering Research Center (PSERC) is a multi-university center with 13 sites. Arizona State University is the lead institution and ISU is one of the sites.
- ⇒ Security and Software Engineering Research Center (SSERC) is a 13 university center which conducts applied and basic research on software security, system security and software technology problems of interest to its members. Ball State University is the lead institution and ISU is one of the sites. The ISU site has a robust corporate presence with nationally recognized leaders in data protection and intrusion detection and also operates a robust pre-collegiate outreach program.

NSF fosters collaboration between I/UCRC centers with opportunities for added funding. The Center for e-Design plans to pursue relationships with the three other I/UCRC centers at Iowa State University.

- ◇ Existence of proposed Center at other Iowa institutions. The National Science Foundation does not create competition between I/UCRC centers. The NSF requires that a university interested in forming a center with a similar mission and objectives join an existing center. In fact, through NSF's referral, ISU has continued to expand the Center, having started with just two universities. No other centers or institutes focused on research and educational training in e-Design exist at other universities in Iowa. However, there are faculty at the University of Iowa and the University of Northern Iowa who are working in research areas that are aligned with some of the research thrusts of the Center for e-Design which could lead to possible collaborations.

◇ Unique features of Iowa State University to support the proposed Center.

- ⇒ Dr. Terpenny is one of the founders of the Center and has served as the Center Director for many years. NSF is in full support of establishing ISU as the lead institution.
- ⇒ All required steps related to receiving the funding for the Center from NSF have been completed successfully (multi-disciplinary team formation, project proposals, planning meetings and workshops with industry and NSF, and receipt of commitments from industry to membership).
- ⇒ The strength of the team of faculty and students has been proven with a history of successful partnerships with industry, leading edge research and facilities in topical areas that are at the heart of innovation, invention, and product development.

◇ Resources. ISU has assembled a multidisciplinary team of 34 faculty from the following departments who will work within the proposed center: Aerospace Engineering; Agronomy; Art and Design; Civil Construction and Environmental Engineering; Industrial and Manufacturing Systems Engineering; Mechanical Engineering; Marketing; Materials Science Engineering; Psychology and Human Computer Interaction; and Supply Chain and Information Systems. Related centers and institutes partnering in the ISU research site include: Virtual Reality Applications Center (VRAC); Wind Energy Initiative; and Center for Industrial Research and Service (CIRAS). Appendix A (page 11) describes the staff team and responsibilities.

High quality space to support the multi-disciplinary projects and collaborative environment for faculty and graduate students is available. The proposed center's facility needs will be accommodated through existing space that is either repurposed or integrated with existing initiatives/programs at ISU. In addition to the core space, ISU has centralized facilities to perform the research projects of the Center for e-Design. ISU has an academic and research presence in Virtual Reality, Non-Destructive Evaluation, Advanced Manufacturing, and the Center for Industry Research and Service. The wide variety of participants at ISU includes facilities and personnel in the Colleges of Business, Design, and Agriculture and Life Sciences. The resources and capabilities of the existing multi-university Center for e-Design will also be utilized in collaboration with colleagues at other participating universities and facilities/equipment of industry members. Appendix B (page 12) provides a detailed description of facilities available to support the Center for e-Design.

The primary equipment needs of projects are currently in place.

◇ Expected need. The proposed Center has an initial grant from NSF for five years and is renewable for two additional 5-year cycles for a total of 15 years. The long-term existence of the Center is based upon memberships from industry and government agencies. The Center is expected to be self-sustaining and remain in existence well beyond the NSF funding period.

❖ Costs and funding sources.

Table 1. Center for e-Design funding for the ISU site in Years 1-7

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
NSF funds - base	\$ 60,000	\$ 80,000	\$ 80,000	\$ 80,000	\$ 80,000	\$ 60,000	\$ 60,000
NSF funds - lead institution	\$ 60,000	\$ 80,000	\$ 80,000	\$ 80,000	\$ 80,000	\$ 80,000	\$ 80,000
NSF funds - evaluator	\$ 21,000	\$ 21,000	\$ 21,000	\$ 21,000	\$ 21,000	\$ 21,000	\$ 21,000
NSF funds - deputy director	\$ 33,000	\$ 45,000	\$ 45,000	\$ 45,000	\$ 45,000	\$ 35,000	\$ 35,000
Industry funds - memberships	\$ 240,000	\$ 300,000	\$ 300,000	\$ 360,000	\$ 390,000	\$ 420,000	\$ 450,000
ISU Funds administrative assistant*	\$ 54,360	\$ 55,991	\$ 57,671	\$ 59,401	\$ 61,183	\$ 63,018	\$ 64,909
Additional Research Funding	\$ 800,000	\$ 1,000,000	\$ 1,000,000	\$ 1,200,000	\$ 1,300,000	\$ 1,400,000	\$ 1,500,000
TOTAL	\$ 1,268,360	\$ 1,581,991	\$ 1,583,671	\$ 1,845,401	\$ 1,977,183	\$ 2,079,018	\$ 2,210,909

Primary (base) Funds as a Center Site
<ul style="list-style-type: none"> NSF support is intended to augment the support that a center receives from industry and other sources. The NSF base grant covers expenses for travel, IAB meetings, 1 month salary for PI/co-PI, and materials. The I/UCRC program uses the following funding formulas. Multi-institutional center sites with an annual industry membership participation between \$150,000 to \$300,000 can receive up to \$60,000 annually. (Note: the center must obtain a total of \$300,000 in membership participation to receive an award.) Multi-university research sites with \$300,000 or more in annual memberships can receive up to \$80,000 annually. We anticipate reaching the \$300,000 in memberships by year 2. All costs for conducting research projects are covered by membership fees and additional research funding (see below).
Multi-University Center Coordination
<ul style="list-style-type: none"> Additional Supplemental Funding and Support for the Lead Administrative Institution The lead administrative institution is defined by the I/UCRC program as the institution that assumes primary coordination, general management and operations responsibilities including marketing, communications, dissemination, and evaluation of a multi-university center. Additional funds are used by the lead institution to support these functions. Active centers with changes in their number of sites request support via a supplement. The lead administrative institution makes an annual request for supplemental funding consistent with the center's award phase and the current number of sites within the center. The lead administrative institution for a Phase I and Phase II center receives an additional \$10,000 per year for each added institution in the center to offset the added administrative functions. The lead administrative institution of a Phase III center receives a fixed amount of \$25,000 independent of the number of sites. The Center for e-Design budget is based on 6 additional sites in year 1 and 8 additional sites thereafter.
Evaluator Support
<ul style="list-style-type: none"> In addition, NSF will provide the lead administrative institution with annual funds for an evaluator for Phase I and II awards as outlined below. The lead institution receives the following each year, all of which must be paid to the evaluator and be reflected in the budget: <ul style="list-style-type: none"> ⇒ A one site center receives \$9,000 for the evaluator. ⇒ A two site center receives \$15,000 for the evaluator. ⇒ A three site center receives \$18,000 for the evaluator. ⇒ A four or more site center receives \$21,000 for the evaluator.
Deputy Director Support
<ul style="list-style-type: none"> At NSF's discretion, a center with eight or more sites may submit a request for supplemental funding to help support a deputy director. The "Deputy Director" request for supplemental funding must outline specific responsibilities that are measurable and which will benefit all sites within the center. The funding level of these requests are based on the center phase and annual award for the lead institution as shown below:

⇒ Phase I center with a \$55,000 annual award may receive \$33,000.
⇒ Phase I center with a \$80,000 annual award may receive \$45,000.
⇒ Phase II center with a \$40,000 annual award may receive \$25,000.
⇒ Phase II center with a \$60,000 annual award may receive \$35,000.
⇒ Phase III center with a \$15,000 annual award may receive \$12,000.
⇒ Phase III center with a \$25,000 annual award may receive \$18,000.
Memberships
<ul style="list-style-type: none"> • 8 initial memberships are committed. Each membership is \$30,000. Modest growth in memberships is projected. • Center projects are funded with memberships and additional research funding.
Administrative Assistant
<ul style="list-style-type: none"> • \$40,000 salary + benefits with a 3% increase each year. • All other expenses (project costs, evaluator, deputy director, travel, meeting costs, etc.) are covered by sources of income.
Additional Research Funding
<ul style="list-style-type: none"> • Additional research funding related to the Center will be obtained from member companies, agencies, and the NSF. • Additional funding is estimated at \$100,000 additional per membership.

- ◇ Marketing plan for additional funding. ISU will use several mechanisms and strategies to promote the multi-university Center as a whole, its role as the lead institution, and the ISU site in particular. The list of marketing mechanisms and strategies that will be used includes:
1. Presentations to advisory boards whose membership includes representatives from industry and/or agencies (e.g., College of Engineering, Departments of Mechanical Engineering, Aerospace Engineering, Industrial and Manufacturing Systems Engineering, and Business, and a variety of multidisciplinary institutes);
 2. Presentations to and meetings with visitors from industry identified by the College and University development offices;
 3. Attractive and engaging web site and materials;
 4. Printed promotional materials (brochures, handouts, presentations, etc.);
 5. Targeting the distribution of marketing materials (industry groups) through mass mailings and e-mails;
 6. Using current industry contacts to recruit new members;
 7. Approaching a variety of government agencies (not limiting membership efforts to industry);
 8. Soliciting interest from NSF small business innovation research (SBIR) Phase II companies;
 9. Utilizing national and local events (workshops, conferences, etc.) to make personal contacts and promote the benefits of the Center;
 10. Actively promoting and marketing students who have worked in the Center.

New marketing strategies will be considered continuously based on suggestions at the NSF I/UCRC Annual Directors meetings, from other centers, from the research team or administration, or members of the IAB. The primary industries of focus for ISU include automotive, aerospace, medical device companies, defense agencies and contractors, farm equipment, wind energy, bioenergy and renewable, and companies whose products include information technology solutions for design, collaboration, knowledge engineering, analysis, and visualization. Researchers in the proposed Center will also participate in recruiting members and prepare and submit directed research proposals, aligned with their work in the Center, to a variety of funding sources for additional funding.

Table 2. Costs and Sources of Funds for the Center (see Table 1 for detail)

	Total Costs	Sources of Funds¹	*Total New Costs²
Year 1	\$1,268,360	\$1,214,000	\$54,360
Year 2	\$1,581,991	\$1,526,000	\$55,991
Year 3	\$1,583,671	\$1,526,000	\$57,671
Year 4	\$1,845,401	\$1,786,000	\$59,401
Year 5	\$1,977,183	\$1,916,000	\$61,183
Year 6	\$2,079,018	\$2,016,000	\$63,018
Year 7	\$2,210,909	\$2,146,000	\$64,909

¹ Sources of funds include: NSF; industry memberships; additional industry funding of projects; other federal agencies; and private donations.

² New costs are limited to the cost of the administrative assistant. All other costs are covered by sources of income outside of ISU.

- ◆ Value of proposed center. The proposed center will contribute to the development and preparation of graduate and undergraduate students in 11 departments. The results of this research effort will be integrated into the educational curriculum to enrich the student learning experiences in design, modeling and simulation, decision analysis, rapid prototyping, manufacturing, and simulation-based acquisition courses. Students associated with the Center for e-Design will receive career development opportunities, including laboratory and field studies, attendance and presentations at interdisciplinary conferences and workshops, design colloquium series, participation in interdisciplinary activities and journal publications, as well as training in the ethical conduct of research. The addition of Iowa State University to the Center contributes to the diversity of the Center. Both the PI and co-PI, as well as 25% of participating faculty are women, typically underrepresented in engineering. The PI and other ISU faculty will continue their history of recruiting women and minority graduate and undergraduate students. Research and educational findings will be disseminated nationally and have significant broader impact through industrial collaboration and technology transfer.
- ◆ Implementation. After obtaining Board approval, the College of Engineering is prepared to implement the Center of e-Design in Fall 2012.

APPENDIX A
STAFFING PLAN AND RESPONSIBILITY MATRIX

Leadership Team	Janis Terpenney, Director	<ul style="list-style-type: none"> ⇒ Leadership ⇒ Coordination of ISU research team and other sites ⇒ Membership recruitment and primary interface ⇒ Record keeping ⇒ Supervision of staff
Research Team	<ul style="list-style-type: none"> ⇒ 34 Faculty ⇒ Graduate and Undergraduate Students ⇒ Post Doctoral Researchers 	<ul style="list-style-type: none"> ⇒ Membership recruitment ⇒ Interface/collaboration with members on projects ⇒ Project presentations and project reports ⇒ Supervision of students and post-docs
Administration	Administrative Assistant	<ul style="list-style-type: none"> ⇒ Recruitment of members ⇒ Development of PR materials and ISU web pages ⇒ Invoicing and record keeping of membership fees ⇒ Preparation of annual reports ⇒ Assistance with IAB materials preparations and meetings ⇒ Communications with other sites, evaluator, IAB chair, members, etc.
Development	<ul style="list-style-type: none"> ⇒ Leadership team ⇒ Research team ⇒ Administrative assistant ⇒ CIRAS ⇒ VRAC ⇒ College of Engineering 	<ul style="list-style-type: none"> ⇒ Leveraging existing industry contacts ⇒ Presentations at advisory board meetings (university, college, department) ⇒ Representation at national meetings ⇒ National workshops ⇒ Distribution of PR materials
Intellectual Property and Legal Matters	<ul style="list-style-type: none"> ⇒ University Sponsored Programs Office ⇒ Legal Counsel 	<ul style="list-style-type: none"> ⇒ Documents processing with contracts and grants ⇒ Interface with industry counsel and other university sites as needed

Faculty Research Team

Thirty-four faculty have joined the team at the Iowa State University Center for e-Design site. This team provides a diverse and talented base, drawing from the following departments: Aerospace Engineering, Agronomy, Art and Design, Civil Construction and Environmental Engineering, Industrial and Manufacturing Systems Engineering, Mechanical Engineering, Marketing, Materials Science Engineering, Psychology and Human Computer Interaction, and Supply Chain and Information Systems.

APPENDIX B
IOWA STATE UNIVERSITY FACILITIES

Iowa State University (ISU) has a full scale set of centralized facilities under the umbrella of the College of Engineering to perform the research projects of the Center for e-Design. Iowa State has an accomplished academic and research presence in Virtual Reality, Non-Destructive Evaluation, Advanced Manufacturing, and the Center for Industry Research and Service. The wide variety of available participants at ISU includes facilities and personnel in the Colleges of Business, Design, and Agriculture and Life Sciences. The resources and capabilities of the existing multi-university Center for e-Design will be greatly enhanced and strengthened by the addition of Iowa State University facilities, resources, and expertise. We look forward to collaborating and leveraging resources with our colleagues at other participating universities and Center membership in a synergistic and strategic manner.

1. Research Centers

a) Virtual Reality and Visualization

The Virtual Reality Applications Center (VRAC) is a research center administered by the Iowa State University Institute for Physical Research and Technology. The VRAC was founded in 1990 and has grown to encompass a broad interdisciplinary research scope focused at the intersection of humans, their rapidly evolving interface technologies, and the computational infrastructure powering them. The VRAC's more than \$20 million of active grant funding provides research support for more than 60 faculty, 100 graduate students, and 80 undergraduate students. The center is housed in the Engineering Teaching and Research Complex (ETRC), a \$60 million facility that includes a unique 3D projection system for teaching visualization methods in large classroom environments. The VRAC is well equipped with computer hardware, software and specialized equipment, and it is committed to providing access to, and technical support for, its diverse research infrastructure for our partners in the Alliance.

b) Center for Non Destructive Evaluation (CNDE)

CNDE is an interdisciplinary group of scientists, students, and support staff working in close cooperation with industry to advance the field of nondestructive evaluation. CNDE employs over 50 faculty and staff, including investigators drawn from nearly all departments of the College of Engineering and selected departments in other colleges, as well as approximately 65 undergraduate and graduate students. The core of CNDE is the Industry/University Cooperative Research Center (IUCRC) in NDE, established by the National Science Foundation in 1985. This program focuses on generic, industrially relevant research and includes the transfer of those results to industry and the education of the future workforce as central elements of its mission. The IUCRC provides a unique environment in which academic researchers and industry partners can work together on technology issues that affect the broad spectrum of NDE practitioners. Whether it is application of existing NDE methods or development of new approaches, a strong bond has been built between the CNDE research staff and industry partners. CNDE seeks to serve as a shared, corporate research laboratory in NDE and has developed many supplemental programs focused on the needs of specific clients. The center has already begun to discuss collaborative projects between CNDE and the Center for e-Design. Further, CNDE has already been providing support and guidance with lessons learned with IUCRC and university administration and policies.

c) Center for Industrial Research and Service (CIRAS)

The Center for Industrial Research and Service is the industrial extension arm of Iowa State University. The CIRAS mission - to enhance the performance of Iowa industry - is an integral part of the history of Iowa State and the ISU Extension Service. The Center for Industrial Research and Service improves the quality of life in Iowa by enhancing the performance of industry through applied research, education, and technology-based services. Assistance to companies is provided in partnership with Iowa's universities, community colleges, and government agencies. CIRAS has already taken an active role in the recruitment of members for the ISU site of the Center for e-Design.

2. Research Laboratories and Facilities

a) Rapid Manufacturing and Prototyping Lab (RMPL)

The Rapid Manufacturing and Prototyping Laboratory is developing new methods for rapid prototyping and more importantly, rapid manufacturing. The term rapid manufacturing implies the need to make functional components, not just models. The major goal of our work is to eliminate the pre-process engineering time and skill required to create a custom component. Therefore, the term rapid means fast and easy process planning, fixture planning and setup planning for making one, or a few functional parts. CNC machining facilities and Prototyping equipment outfit this laboratory with state of the art capabilities.

b) Boyd Lab

The Boyd Lab is the focal point of hands-on student design projects in the College of Engineering. Some of the most successful student design projects in the country call the Boyd Lab home. Facilities include classroom and conference rooms, project showroom, computer-aided design lab, welding shop, machine shop, and work stations for student groups to build and demonstrate projects.

c) C-6 Lab

The C-6 is a full immersion virtual reality environment illuminated by 100 million pixels, VRAC's C6 displays over 16.7 million pixels per wall (4096x4096). Forty-eight dual-cpu workstations send images to 24 digital cinema projectors, providing an intensely detailed, high-resolution, immersive experience for researchers and other participants.

The C6 is a three-dimensional, fully-immersive synthetic environment residing in the center atrium of Iowa State University's Howe Hall. This unique facility consists of a 10ft x 10ft x 10ft room where all four walls, the floor and the ceiling are projection screens capable of displaying back-projected stereoscopic images, providing total immersion for the participants. The C6 incorporates a three-dimensional eight-channel surround sound system for audio immersion. Originally opened in 2000, the C6 was the first six-sided synthetic immersive environment in the world, and the only known system of its kind to support wireless tracking. With the recent upgrade, the C6 is the highest resolution immersive environment of its kind in the world.

3. Research Classrooms

Iowa State has a strong reputation for innovative leadership in engineering research and education. The College of Engineering has multiple open use computer labs available to students 24 hours a day. With hardware and software available full time, students have access to all the capabilities needed to program and design innovation. The Black Engineering building has 128 computers available to students through open labs with multiple printers available for use.

4. Office Space

Faculty and graduate students at Iowa State have sufficient office space as well as access and support from a wide range of computing hardware and software, experimental, and educational facilities and equipment. State of the art computing and networking facilities and software to support research in design decision making, forecasting, optimization, data base development, distributed interactive collaborative design environments, and web-based environments for educational and research use are available. Department staff is available to handle the receipt and distribution of hardcopy materials with collaborators and other organizations related to the project. Fax facilities are also available. Computer technician support staff is also readily available to assist with network and hardware issues. Video and teleconferencing facilities are also available to facilitate collaborative exchange between universities, industries, and for education delivery.