Report on the NSF-sponsored *Human Language Technology Workshop on Industrial Centers*

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On May 3rd and 4th, 2007, the National Science Foundation (NSF) in Arlington, Virginia hosted the *Human Language Technology Workshop on Industrial Centers*. Twenty-nine representatives from academia, industry, and government (see attendee list in Appendix A) attended this workshop to discuss the feasibility of developing an NSF center-based partnership between industry and academia in the field of Human Language Technology (HLT).

Because the HLT field does not currently have an industrially-oriented center in the US, the purpose of the workshop was to determine whether the time is ripe to begin building such a center. Several factors justified convening the workshop:

- There have been considerable advances in this field, and there is great potential for continued advances in fundamental technologies ranging from speech recognition and synthesis to machine translation, text mining, and next-generation search engines.
- Planned coordination between academic, industrial, and government partners offers the potential to tackle research questions that are broader than the ones that could be addressed by any partner alone and whose solutions would be mutually beneficial.
- Such collaboration has a potential to stimulate research excellence at the university, to enhance the quality of the intellectual property of US HLT companies, and to foster university-to-industry technology transition.

The meeting participants developed strategic plans for building an HLT-related research center that would receive support from the NSF. This workshop's main focus was to evaluate the feasibility of building partnerships among academia, industry, and government with the intention of seeking funding from the following NSF programs, which require strong commitments from industry:

1. **The NSF Industry/University Cooperative Research Centers (IUCRCs) program:** This program seeks to develop partnerships among industry, university, and government members to stimulate cooperation for carrying out fundamental research recommended by an Industrial Advisory Board.

2. **The NSF-sponsored Engineering Research Center program:** This program seeks to develop engineering systems-focused, interdisciplinary centers at universities in close partnership with industry.

In preparation for the meeting, participants were asked to read the following materials which were related to each type of NSF center. They were asked to focus especially on university and industry collaboration.

1. Materials on the NSF Industry-University Cooperative Research Centers web sites:
    - The program web site at: http://www.nsf.gov/eng/iip/iucrc/

- The Industry-University Cooperative Research Centers Program Evaluation Project at: http://www.ncsu.edu/iucrc/index.htm
- "Managing the Industry/University Cooperative Research Center: A Guide for Directors and Other Stakeholders" at http://www.ncsu.edu/iucrc/PurpleBook. htm, in particular, chapters 1, 2, and 5.

2. Materials on the NSF Engineering Research Centers Web sites:

- The program web site at: http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5502&org=NSF&sel_org=NSF&from=fund
- The Engineering Research Centers Association web site at: http://www.erc-assoc.org/
- "ERC Best Practices Manual" was developed by staff of the ERCs to assist those involved in or planning involvement in the operation of an ERC. It can be found at http://www.erc-assoc.org/manual/bp_index.htm. Chapter 5 concerns building industrial relations.

Participants were also requested to consider the following issues prior to the meeting:

- Is a center a viable vehicle for collaboration between academia and industry in the area of Human Language Technology? If so, what type of center would be best?
- How can one optimize a mutually beneficial partnership among academia, industry, and government with respect to the following tasks?
  - Develop a long-term, strategic vision for an emerging engineered HLT system with the potential to transform a current industry or spawn something new.
  - Define a research agenda that optimizes shared research interests, needs, and opportunities.
  - Define partnership strategies between universities and industry and determine how to best collaborate and divide up rights and responsibilities.
  - Determine strategies for protecting/sharing intellectual property while enabling timely publication of intellectual output of the center.
  - Develop mechanisms for involving graduate students in industrially relevant research that also qualifies for Master's and Ph.D. level theses.
- What breadth of research should the center fund? Which areas of research are most viable for center collaboration?
- How should the center handle organizational issues?
  - Develop a strategic plan for integrating fundamental HLT-related science and engineering research. Is there a viable test bed that could be used to tie together the research threads and enable systems level evaluation?
  - Develop a strategic plan for constructing a multidisciplinary research agenda while developing a more diverse research population. Would a single site or multiple site centers be more effective?
  - What is the best structure for an advisory board (i.e., balance between academic, industrial, and government oversight)?

The agenda for the meeting was as follows:

Day 1:

8:00-8:30 am	Arrival and continental breakfast begins
8:30-9:00 am	Opening remarks and what we plan to accomplish / continental breakfast continues (see Appendix B for power point slides)
9:00-9:30 am	Introducing ourselves (see Appendix A for attendee list)
9:30-11:00am	Presentations about center programs at NSF (see Appendix B for power point slides)
9:30-10:15 am	Alex Schwartzkopf (NSF) on IUCRCs
10:15-11:00 am	Bruce Kramer (NSF) on ERCs
11:00-12:30 pm	Presentations by center directors: What does a successful center look like from the academic and industrial perspectives? (see Appendix B for power point slides)
11:00-11:45 am	Janis Terpenny (Virginia Tech) on IUCRCs
11:45-12:30 pm	Adam Powell (USC) on ERCs
12:00-1:00 pm	Working Lunch (discussion)
1:00-2:00 pm	Discussion Item 1: Would a center be a viable vehicle for collaboration between Industry and Academia in the area of Human Language Technology? What would the ideal collaboration look like? (Smaller Groups with Scribe)
2:00-3:00 pm	Reports from the groups and discussion
3:00-4:00 pm	Discussion Item 2: How can we best optimize the collaboration between Industry and Academia in a HLT center environment? (Smaller Groups with Scribe)
4:00-5:00 pm	Reports from the groups and discussion
5:00-5:30 pm	Homework assigned (questions to think about for day 2): What breadth of research should an HLT center carry out? Which areas of research are most viable for center collaboration?

Day 2:

8:30-10:00 am	Discussion of Homework / continental breakfast
10:00-11:30 am	Discussion Item 3: What are the next steps? (Small Groups with Scribe)
11:30- 12:30 pm	Report from the groups and discussion
12:30-2:00 pm	Wrap-up and general discussion

In the following subsections, we summarize some of the key issues raised by the focus groups for each breakout session.

Discussion Item 1: Would a center be a viable vehicle for collaboration between Industry and Academia in the area of Human Language Technology? What would the ideal collaboration look like?

As centers have a fairly high management and infrastructure overhead, the participants considered what the advantages of a University-Industry center would be compared to individual collaborations between one university laboratory and a single industrial partner. Some participants pointed out that an individual expert may be better suited to work on immediate well-defined problems, but a group with a diverse expertise would be needed to work on larger, less well-defined problems. A center could provide just the right environment to attract high quality students and faculty and engage industry involvement to tackle bigger problems than an individual or small group could handle. It could investigate broader efforts with multiple disciplines, while educating graduate students to work in the new emerging areas of science and technology. A center would also provide industry with more revolutionary science and engineering, produce better students for industrial partners to recruit, and produce more products and services than an individual laboratory.

Another advantage of a center is the availability of shared infrastructure, including various types of data, tools, and computational support (e.g., the MapReduce algorithm implemented over a grid-like computational substrate to support very large-scale computation). Large data collections are essential in the light of the data-driven methodology common in HLT, but they are often quite expensive to create, extend, document, maintain, and distribute. Some data collections require human subjects' approval, while others may require the center to deal with copyrights. In addition to coordinating the development of and providing access to the right data to set the challenges for the center, it is also necessary for the center to provide shared computing environments. Members should be able to work on parts of an end-to-end system without needing to build an entire system by themselves.

One of the breakout groups discussed other types of models for centers or collaborative efforts that support broad multidisciplinary research in addition to IUCRCs and ERCs. These models include:

- Centers of Excellence (CoE), e.g., NSA's new CoE at Johns Hopkins University
- Federally funded research and development Centers (FFRDCs), e.g., Institute for Defense Analyses (IDA), MIT Lincoln Labs, and MITRE
- University-affiliated Research Centers (UARCs), e.g., University of Maryland Center for the Advanced Study of Language (CASL), Johns Hopkins University Applied Physics Laboratory (APL), University of Southern California Institute for Creative Technologies (ICT))
- Patron-based funding (such as Bambergers), e.g., Institute for Advanced Studies (IAS) at Princeton
- University Centers, e.g., International Computer Science Institute (ICSI) at Berkeley
- DOE National Laboratories and Technology Centers, e.g., Argonne National Laboratory, Ames Laboratory
- The MOSIS Service (in VLSI)

- Supercomputing Centers
- NSF Science of Learning Centers (SLCs)
- Technology Alliances (CTAs, ITAs), e.g. Collaborative and International Technology Alliances at Army Research Labs (ARL)

These models involve different types of partnerships between industry, university, and government (see Figure 1). They vary in the extent to which partners are involved in the initial establishment of the collaborations, in the planning of projects, the reviewing and selection of projects, the financial funding decisions, and the legal commitments that come with project funding (grants vs. cooperative agreements vs. contracts). For example, ARL currently manages several CTAs and ITAs, each with joint planning and cooperative agreements among industry, university, and government partners. These are funded for five years, with three-year add-on options. They differ from UARCs and University CoEs that are university-led with industry partnerships, but have cycles of multi-year government funding, because UARCs and CoEs are intended to address their government stakeholders' interests over the long term. As there are a variety of organizational and funding options for tackling the grand challenge problems for human language technologies, the HLT-focused I/UCRC or ERC could partner with some of these other existing models for collaborations. This partnership would bring together researchers working within other arrangements in order to broaden the research portfolio of the partners and allow them to tackle potentially larger problems.

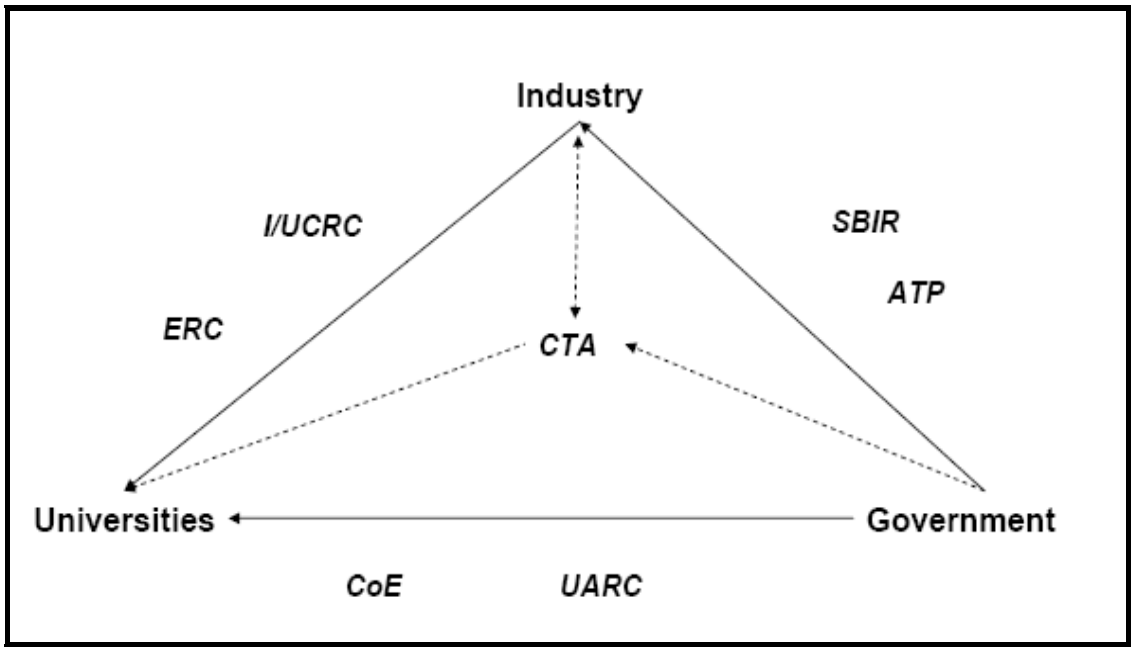

Figure 1. Center vehicles for collaboration between universities, industry, and government.

The advantages of a center were deemed to include the pooling of good people, ideas, and infrastructure to solve new problems, while providing a broad collection of opportunities for visiting investigators from other institutions and industry. A center would be an ideal locus for consolidating ideas and efforts from university, industry, and government researchers, each bringing different perspectives to the problems the center would tackle. The center would attract researchers that excel in their disciplines given the potential to work with other researchers with similar levels of excellence. Bringing these groups together can lead to qualitatively new research because it unifies groups that otherwise would be working from different less interdisciplinary perspectives. This consolidation of diverse, excellent researchers should also be a magnet for funding (both center-based and individual or small group awards).

The participants considered what industry would want out of an industrially-oriented HLT center. Many companies care about recruiting students who are well trained in emerging technologies that would be part of a successful center. Also, they would benefit from a center that produces solutions for difficult problems such as global communication aids, speech in real environments (e.g., sensor-based projects, cocktail party challenge), and better speech synthesis. A center would help the company partners to be more competitive (both domestically and internationally) by providing the critical mass to work on hard problems that matter to them but that they cannot afford to do themselves. The center also has potential to enable a number of new companies to be created that depend on HLT. Another potential impact of a center on research companies might be that it offers a vehicle that could potentially support broader than DARPA-focused research (DARPA has recently been engaging companies to manage research teams).

The participants also considered what the university researchers would want from an industrially-oriented HLT center. Academics like to work on hard problems (e.g., deep NLP) that are not near term. A center would provide the infrastructure and funding needed to support this type of research. Stability of funding is critical for attracting high quality students, post doctoral candidates, and faculty to the HLT center. Because obtaining center funding is challenging (especially an ERC award) and universities need steady funding to support good students (otherwise they move into other fields), broad industry buy-in could help to create a stable funding base to build upon. The center would also attract visiting scholars from academia, industry, and government to help with the research agenda.

Based on these discussions, the participants concluded that there is a good potential for a center to leverage the strengths of academic and industrial partners to tackle new human language technologies, such as virtual reality. A successful center would need to have a diversified portfolio of research problems; the research should be exciting, involve a multidisciplinary team, and result in innovations that can be used by industrial partners. If the center includes a sizable consortium of industry and government partners, it may be possible to build a massive infrastructure to support all of the partners. The center cannot simply produce core industrial products; it must also develop leading edge core technology, some of which may give rise to novel products given the guidance of the industrial partners. Some participants suggested that the center should avoid tackling the large data processing problems, which are currently too expensive and so should be left to industry. Instead it may be better to focus on how to tackle, for example, low density languages (e.g., translation to and from rare languages with minimal parallel text, speech understanding with sparse per-language training data).

Since the preponderance of the support for an IUCRC comes from company membership fees, NSF requires a center to have at least six members with total company membership fees equaling at least $300,000 yearly. Although an ERC does not rely as heavily as an IUCRC on industrial support, NSF expects substantial financial support from industry, again typically provided through annual membership fees (usually two or three levels of membership with corresponding fees and membership benefits). Participants at the meeting believed that the cost of participating in an IUCRC or an ERC could be prohibitive for some companies, especially for smaller companies. Although it may be a challenge to obtain funding from industry, if it is clear that the industrial partners have some control over how their membership fees will be spent (and can leverage other funding), they will have a greater interest in participating in the center. An effective IUCRC or ERC cannot take money without considering the needs of their industrial partners.

Some industrial participants expressed the concern that in a broad based center they would lose direct control. For example, some companies already have mechanisms for educating and recruiting students; they identify and directly support faculty who train students according to their specific needs. There was concern that being part of a center would mean that less of their funding would get to those researchers they would want to support (due to overhead and center priorities). There was also concern about losing control of intellectual property (IP). Some companies, especially small ones, keep things secret, worry about the potential risk of IP leaking, and usually do not patent.

Industrial partners would have a number of ways to influence the center. They would be able to negotiate with the universities involved in the center (with some limitations set by NSF programs), either when the center proposal is being developed or after the center is funded. Also by participating on the industrial advisory board, industrial partners can have a strong impact on the work conducted by the center (thus leveraging the full funding of the center) and recommend center affiliates that would enrich the center. In addition, industry partners who contribute more funding and effort to the center should receive greater benefit from the center than less engaged partners.

The participants stressed the importance of identifying a multi-disciplinary focus that has an actual or potential market, given that a center would require such a market focus. Currently there are few money-making products in speech processing or machine translation (though the opposite is true for web-search), so it is prudent not to define HLT technologies too narrowly. Additionally, projections about plausible markets are likely to need revision with potential impact on ideal partnerships. Formulating markets where language would play a role was thought to be a useful exercise even outside of the effort to define an HLT center. Several possible avenues for potential HLT products were identified:

- Social domain language-related products (e.g., dating)
- Commercial targeting of potential customers (advertising), although this could possibly be too sensitive for an open university research environment

- Automating the creation of call center systems. Note that building the application is currently done by hand; core recognition engines are good enough, but expensive to build.
- Information integration (e.g., Customer relationship management (CRM), business intelligence (internal and external), and brand marketing). A thought was that companies that are interested in the data may be less competitive about the core technologies.
- Construction industry language problems for foreign workers (5% of revenue now spent correcting mistakes, and there are also safety problems)
- Vertical high-accuracy translation markets, such as legal system translation
- Hospitals need to cope with providing medical help in a variety of languages.
- Assignment of insurance categories to medical reports
- Law enforcement applications
- Service to government goals or the government organization itself
- Reducing language barriers in information access (e.g., cross-lingual search engines)
- Question answering in any language
- Translingual information mining and access across media
- Reaching out to the speech impaired (text-to-speech), the manually impaired (speech-to-text), the visually impaired (speech again), or linguistic minorities (machine translation)

One thought was to look at 18-year olds to find where the markets will be in near future (e.g., instant messaging has moved into business, video gaming). Successful centers seem to involve many industrial partners, so it is not ideal to settle on just one market. Finally, it may be worth thinking about problems in two ways, e.g., what is holding back language technology AND which technologies is language technology holding back?

Participants raised a few additional issues that should be considered more thoroughly. One issue is the breadth of the center. If the center focus is too narrow, then it may be hard to find enough support. If the center focus is too wide, then the center will be less coherent and more difficult to manage. Another issue was that since the industry representatives at this initial meeting were by and large from larger companies, some of the other important industry voices were not heard. There is a need to get input from companies that are the language technology consumers but do not have their own investments in research. It would be beneficial to assemble a critical mass of industries that want the human language technology, but cannot pay for all of the cost of research and development themselves.

In summary, the participants in the meeting would expect the following elements from an ideal HLT center. It needs a big goal, the top people in the necessary disciplines, a shared vision with all partners, shared infrastructure, and ample funding. There needs to be sustained education of students that would ultimately feed into academia and industry. The center needs to be challenge-centric and attract partners from industry and government labs.

Discussion Item 2: How can we best optimize the collaboration between Industry and Academia in a HLT center environment?

All of the participants agreed that the ideal center would have a lifetime that is longer than a standard NSF proposal with a goal of becoming self-sustainable; it takes time to build sustainability. Participants estimated a time frame of five to ten years, although the industry partners tended to suggest shorter durations.

The makeup of the center was also discussed, and most agreed that it should be multi-disciplinary and that there should be multiple co-PIs per center-supported project (with a mixture of perspectives). Multiple universities, government labs, and industries of a variety of sizes and shapes seem useful for building a strong center that will have broad impact. The center needs to be heterogeneous and covering, even if one institution is named as the management hub for the center. Flexibility was seen as an advantage, but there must be critical mass in expertise to meet the requirements of the challenges set by the center. Small companies were considered critical for the vibrancy of the center since in many ways they will be the vehicles for getting ideas out into the world through product development.

Most participants felt that an ERC would be a more effective mechanism for building an HLT center than an IUCRC due to the higher levels of funding, and the consequent ability to build the right infrastructure at the outset. Much of the discussion centered on the need for major funding to support the research and research infrastructure. Many of the participants believed that it would be hard to sustain a center on membership fees alone, suggesting that the IUCRC should only be a first step.

Moving people bi-directionally between organizations was thought to be as important as the money for building a successful university-industry center. It has been more common for academics to visit different organizations for longer periods of time (e.g., sabbaticals) than researchers in industry. Industrial researchers will visit other organizations, but typically only for short periods of time. Location of the center is critical for supporting this culture.

Some of the other factors that were identified as critical for building a winning partnership include:

- An industrial liaison (master cajoler)
- An industry advisory board (with power)
- A director who reports to the board
- Chief Scientist position(s)
- Dedicated management (benign, not dictatorial, but with clear responsibilities)
- Empowerment of PIs
- Encouragement for companies to place people at center
- Student internships (from other institutions) and visiting faculty

To engage students, the center should be located at one or more universities. Also, the center should be focusing on evolving “cool” areas of research, technology, and/or suite of potential

applications. Robotics is cool for students. How about "Language/speech enabled agents," NLP–based web services, or a Universal Star Trek translator?

To engage industry, industrial partners should help define the challenges, while using the center leadership to select/filter/generalize/modify recommendations for moving forward. In some cases, industry may suggest specific applications that center efforts will generalize. It is also vital to involve industry in defining the center concept that will be proposed. Center retreats were suggested as one mechanism for obtaining industry input once the center is in place.

Although IP policies were discussed and some participants believed that they should be liberal and negotiable, much depends on the participating universities' policies. Additionally, the best practices for IUCRCs and ERCs (as defined in the center materials given at the beginning of this report) should play a role in working out IP policy. Another issue discussed is the need to develop mechanisms for pooling data resources while preserving ownership. Open versus non-open source code resources, as well as cross-licensing, should also be discussed with the industry partners.

One group drew a diagram representing one possible model of collaboration (see Figure 2). It details the flow of research prototypes and researchers, funding, special requirements, expertise for standards development, and products among government, universities, existing HLT industries, HLT consuming industries, and incubators and small companies.

Two possible types of centers (or some combination of the two) were identified as candidates for organizing the center:

1. An HLT infrastructure and education center: This center might be focused on developing a component repository for HLT (essentially a reusable software version of LDC) together with an architecture and APIs for assembling components (perhaps UIMA-based). Given this framework, members could develop demonstration prototypes for research, education, and industry. To support education of students, teaching materials could be developed that are based on the components and architectures. These products can be tested among participating institutions and then shared as open source (curricula, exercises, lectures, components, and data) or presented in an industry showcase for language technologies. The center needs computing and data infrastructure to build better HLT technological solutions. It is important to provide open access when possible and firewall access to proprietary data. For a multi-site distributed entity, infrastructure should be accessible to all participants, including industrial partners. The CISE Computing Research Infrastructure (CRI) (see http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=12810) and Global Environment for Networking Innovations" (GENI) (see http://www.cra.org/nsf.geni/march10) programs may have a role to play in supporting this type of center.
2. A grand-challenge centric center: In this center, the challenges come from consensus among researchers and/or directly from industry, with one to three grand challenges per center. There should be spinoff technologies along the way, free cross-licensing of any and all technology among center partners should be considered, and at least some technology should be open source. Such grand challenges for the center to address could be:

- Building a universal translator (any-language to any-language)
- Developing personalized learning "webbies" – i.e., agents that live in the web and communicate in natural language with users, read web pages, and perform a variety of useful tasks: recommendations, personalized search, negotiation with other webbies, perhaps there could be contests where people enter their trained webbies based on meta-webbie frameworks (basic functionalities, APIs, etc.) from the center.
- Creating question answering systems for any language
- Developing robust speech recognition with human-like capabilities to cope with cross-talk, noise, acoustic deformations (e.g., the speaker suffering from a cold, or whispering).

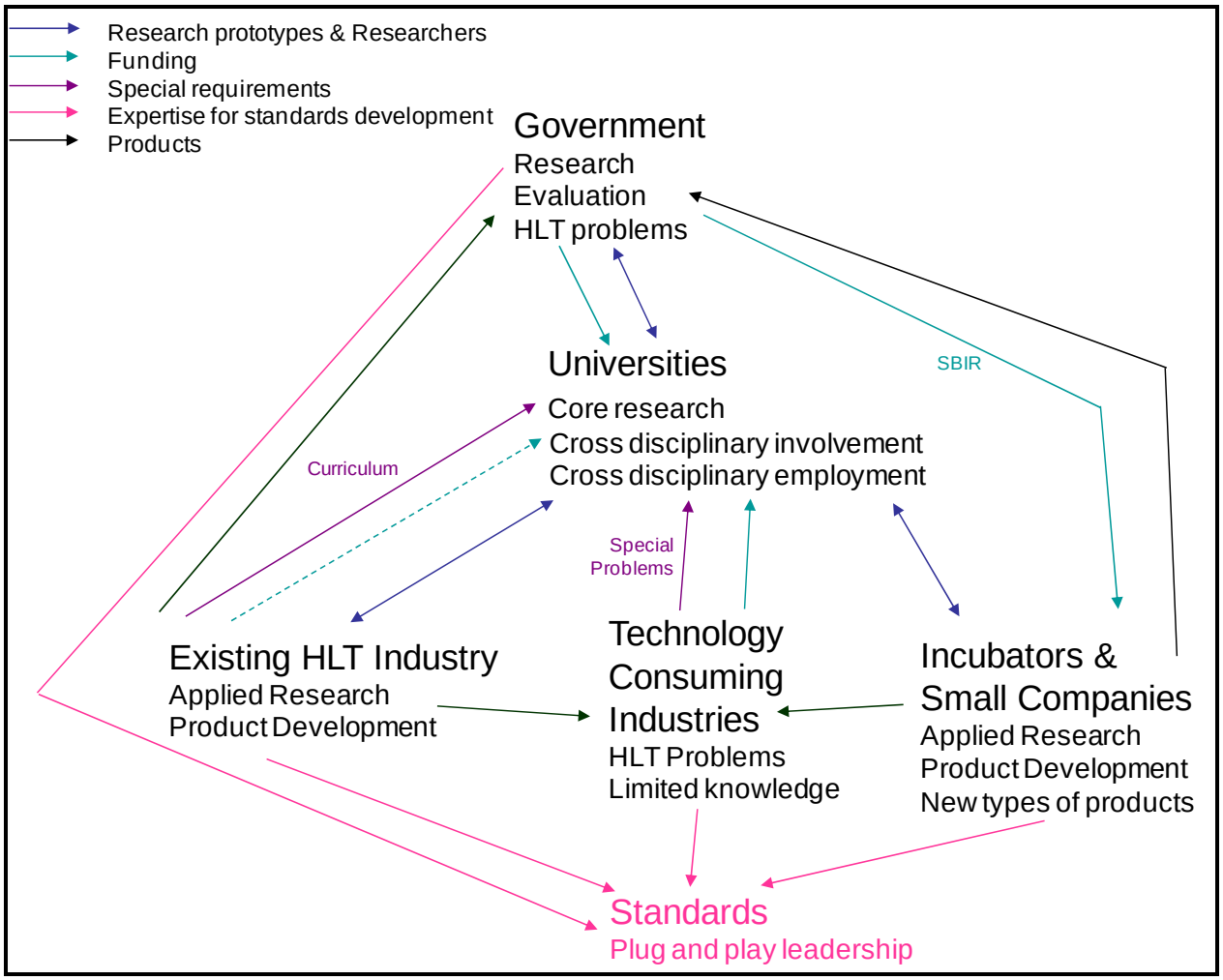

Figure 2. Possible linkages and funding options for collaboration among universities, industries, and government.

The participants were given homework after the first two discussion sessions.

Homework: What breadth of research should an HLT center cover? Which areas of research are most viable for center collaboration?

Some participants focused on the possible challenges for the grand challenge type of center:

- Robust speech recognition in cross-talk situations
- Cross-lingual (and perhaps cross-media) question answering, where answering the questions requires unifying information from more than one source (so it is not just answer retrieval), and perhaps more than one language or modality
- Rapid machine translation for resource-poor (minority or endangered) languages
- Learning from text, where the knowledge acquired is tested by performance on tasks (rather than having ornate but not necessarily useful knowledge representations)
- "Universal" help-desk dialog system, which can be rapidly configured and trained for specific applications
- Tough problems coming from industry with 3-5 year (or longer) timeframes, where the researchers get to vet or select from longer list, focusing on the most interesting and generalizable challenges

Others felt that finding good science is easier than finding good markets for a center, and so focused attention on possible markets:

- National security
- Health assistive technologies (gerontology, speech therapy, health monitoring, etc.)
- Education
- Cybertrust
- Geospatial applications (e.g., maps)
- Temporal applications
- Alignment across media

One comprehensive idea for a center involving both grand challenge problems and markets was proposed that resulted in much enthusiastic discussion: A center for cross-cultural communication /collaboration technologies (in cyberspace). This center must be multidisciplinary; the following disciplinary areas would be essential in such an endeavor:

- Human language technology (automatic speech recognition, machine translation, information extraction, etc.)
- Multimodal areas (human-computer interaction, engineering, human factors)
- Cultural anthropology
- Linguists (language experts, sociolinguistics, etc.)
- International dimension (bring in international programs)

Areas that seem to be emerging that could be addressed by the center include:

- Blogging and social network analysis
- Cultural specific aspects of language
- Mobile technologies
- Marketing across counties and cultures
- Coping with cross-language training (accent mitigation, language use, etc.)
- How language used by various groups changes over time
    - Discourse Analysis
    - Rhetoric
    - Media environment
    - Spin
    - Register
    - Data
    - Sciops (how organizations react)

Possible markets for such a center include:

- Cross-cultural collaboration technologies
- Multicultural language-based discourse
- Social networking
- Marketing
- Brand monitoring
- My Space
- Cross-border tutoring
- Call centers
- Expert finding (hiring)—e.g., email patterns
- Emerging market analysis
- State Department
- Tourism

Many factors affect the needs for the technology that the center would produce. For example, China and India would have different needs and commercial interests based not only on language but are also based on societal factors; after all, good interfaces to technology would be affected by all aspects of the user.

One participant pointed out the findings of a recent congressional committee hearing (see http://armed-services.senate.gov/scmembrs.htm#subet and http://armed-services.senate.gov/e_witnesslist.cfm?id=2715) that may affect the problems addressed by the center; they are summarized below:

- Technology is necessary, but we must evaluate its impact and invest wisely.
- Increasing the capabilities and efficiency of level one and two linguists using technology such as machine translation is critical because we will never have enough level three linguists.
- Increasing the pool of US citizens who know a second language, particularly languages of interest such as Chinese and Arabic, is a critical national priority. If technology can play a role in this, that is even better.

The needs identified by this congressional committee could help enhance the broader impact of a center's grand challenges.

Discussion Item 3: What are the next steps?

The participants agreed that the best way to move forward is to begin the process of building a center. They decided that a multifaceted approach would provide a staged, successful strategy.

- The first step would be to develop a plan for a multi-university IUCRC with a goal of leveraging this effort into a proposal for a multi-university ERC. Although the universities and their industrial partners will take over funding the center eventually, having NSF imprimatur at the start would help immensely with the development of the center. If the proposed center embraces one or more grand challenges, they should be identified and their importance and feasibility justified.
- In addition, in tandem, we should seek to develop a congressionally funded National Institute for Human Language Technology.

Developing a Multi-university IUCRC followed by an ERC:

The ERC program would provide an appropriate level of funding to create a vibrant center; however, such center funding is very challenging to win, so advanced planning is critical. Planning and coordination need to start well before the solicitation comes out, and people need time to develop the concept of the center. To begin planning for the staged HLT center, the participants suggested asking for support from deans, provosts, VPs of research, and departments at several universities (e.g., University of Texas at Dallas, Georgia Tech, University of Massachusetts, University of Maryland, Princeton, Ohio State, University of Southern California, and the International Computer Science Institute (ICSI) at University of California at Berkeley). Ideally, these institutions would provide some infrastructure for developing the center concept (e.g., release time, facilities, resources for fund-raising, and co-sponsorship). Having the weight of the community behind an ERC proposal would provide the necessary base for convincing potential funders of the necessity of a center.

Leveraging the IUCRC was thought to be a good first step in developing an ERC, especially for developing the industrial component. For planning the IUCRC, the participants thought it vital to immediately begin building ties with industry (along the lines of Figure 2). This requires assembling a working group of volunteers with the time to begin the planning process. As for deciding who will lead the effort going forward, one possibility is combining a visionary leader

with someone who has great planning and execution skills. A critical mass of working group members (not too many but not too few) would be beneficial, one from each university. When building a list of potential partners, it is important to select some partners who are capable of making ties with industry and helping to define who the consumers of the technology products of the center (i.e., third party customers) would be. There is an issue of group dynamics that may need to be addressed; one person might end up carrying the full load (everyone is happy to play, but none willing to step up and work), reducing the overall chance of success. Members should get buy-in from their universities, and they need to contribute concretely to the action items developed by the group. Identifying which institution will lead is a priority, as well as identifying which institutions will be partners in this multi-university HLT IUCRC. Agreements between these sites cannot begin too soon.

The IUCRC working group will need to:

- Discuss possible alternative approaches, develop a high-level vision, and collect evidence to convince companies to participate in the center.
- Build ties with industry, both large and small companies. The group should develop strategies for outreach to small companies. Assembling an industry working group and running a few focus groups may help to build an industrial strategy.
- Organize a series of planning meetings. These meetings (hopefully on both coasts) should involve industry, academia (US and international universities), and others (e.g., government labs, centers such as the Hopkins Center of Excellence, LDC, and possibly professional societies). Planning meetings should involve companies of all sizes. At these meetings, the working group will present the high-level vision of the center, as well as sub-visions targeted to industry cliques. The working group will need to identify the cliques based on which companies are interested. For small companies, it may be necessary to cover some expenses to come to the meeting or possibly some of their time (although this would be somewhat challenging to do with limited planning funds that NSF and universities might provide).

- Develop an international strategy. Several participants thought this was fundamental for establishing the credibility of the center and for supporting the follow-on ERC effort. The group needs to identify and court international partners in order to add new dimensions to the challenges being tackled by the center. When identifying international partners, it would be beneficial to consider value added (e.g., What expertise do they have to offer that we do not have? Do they have or are applying for parallel funding?). The NSF Office of International Science and Engineering (OISE) can potentially provide funding to help build ties (see http://www.nsf.gov/div/index.jsp?div=OISE).

- Begin proposal planning and preparation for the IUCRC (see http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5501&org=IIP&from=home) with the goal of a January 4, 2008 deadline for letter of intent and a March 28, 2008 deadline for a proposal. Planning meetings will be needed to write a successful proposal.

Developing a National Institute for Human Language Technology:

The establishment of a National Institute for Human Language Technology (HLT) would declare HLT as a national resource. This institute would need to involve a large number of universities and companies. Some companies already take an active role in congressional actions (e.g., SAIC and Lockheed), and so involving them will contribute to our success.

There are challenges in managing an effort with a large group of companies and universities. Definition of the role of the institute is critical. Does it host meetings at conferences, have an agenda, have a goal, share information, facilitate collaboration among PIs? Should it have an international aspect? Where should it be located? (Maybe there should be both an east and west coast arm.)

In support of the campaign for this institute, Joe Picone, Nelson Morgan, and Jordan Cohen have begun working on an executive summary describing the institute and its rationale. This summary will provide talking points for members to go to leadership of respective institutions in order to obtain support to work on the institute. Participants who have indicated an interest in helping to build the institute include: Alex Acero, Jordan Cohen, Carol Espy-Wilson, Christiane Fellbaum, Sanda Harabagiu, Mary Harper, Andrew McCallum, Nelson Morgan, Michael Picheney, and Joe Picone. Moreover, highlighting success stories in the evolution of human language technology will help increase the awareness of its importance in academic, governmental, and general audiences.

Some participants agreed to discuss the prospects of the center and institute at a number of upcoming conferences, including Interspeech, ACL, and ICML. It was also suggested that we put together a mailing list to send information out to potentially interested parties and plan a future one-day workshop related to the institute to plan for its evolution. A quarterly newsletter would be useful to update interested parties. With residual funds from the workshop, Mary Harper plans to set up a Wiki at University of Maryland to support both the center and the institute efforts.

Acknowledgments

We would like to thank Bruce Kramer and Adam Powell for their presentations on ERCs and Alex Schwartzkopf and Janis Terpenny for their presentations on IUCRCs. Also we would like to acknowledge Caitlin Christianson and Joe Olive for their helpful comments during this meeting. We thank Tanya Korelsky for her vision in funding the workshop and her enthusiastic support during all stages of planning and conducting the meeting. Finally, we thank Shaina Castle for her help in organizing the meeting and coordinating reimbursements and for her editorial input into this report.

Appendix A. Attendee List

Name	Email	Affiliation
Adam Powell	acpowell@usc.edu	University of Southern California
Alex Acero	alexac@microsoft.com	Microsoft
Alex Schwartzkopf	aschwarz@nsf.gov	NSF
Andrew McCallum	mccallum@cs.umass.edu	University of Massachusetts
Barbara Cuthill	barbara.cuthill@nist.gov	NIST
Bruce Kramer	bkramer@nsf.gov	NSF
Caitlin Christianson	Caitlin.Christianson.ctr@darpa.mil	DOD
Carol Espy-Wilson	espy@umd.edu	University of Maryland
Chin Lee	chl@ece.gatech.edu	Georgia Tech
Christiane Fellbaum	fellbaum@clarity.Princeton.EDU	Princeton
Clare Voss	voss@arl.army.mil	Army Research Labs
Hadar Shemtov	shemtov@yahoo-inc.com	Yahoo
Jaime Carbonell	jgc@cs.cmu.edu	Carnegie Mellon U.
Janis Terpenny	terpenny@vt.edu	Virginia Tech
Jeff Reynar	jreynar@google.com	Google
Jim Lester	lester@csc.ncsu.edu	North Carolina State University
Joe Olive	jolive@snap.org	DOD
Joe Picone	picone@ece.msstate.edu	Mississippi State
John Garofolo	john.garofolo@nist.gov	NIST
Jordan Cohen	jrc@speech.sri.com	SRI
Lance Ramshaw	lance.ramshaw@bbn.com	BBN
Mary Harper	mharper@casl.umd.edu	University of Maryland
Michael Picheney	picheny@us.ibm.com	IBM
Nelson Morgan	morgan@ICSI.Berkeley.EDU	Berkeley
Patrick Pantel	pantel@isi.edu	University of Southern California
Sanda Harabagiu	sanda@cs.utdallas.edu	UT Dallas
Shaina Castle	scastle@casl.umd.edu	University of Maryland
Srinivas Bangalore	srini@research.att.com	AT&T
Tanya Korelsky	tkorelsk@nsf.gov	NSF

Appendix B. Presentations

Human Language Technology Workshop on Industrial Centers

May 3rd and 4th, 2007
National Science Foundation

Welcome to NSF and the DC Area!!!

Day 1 Agenda

8:00–8:30 am

Arrival and continental breakfast begins

8:30–9:00 am

Opening remarks / continental breakfast continues

9:00–9:30 am

Introducing ourselves

9:30–10:30 am

Presentations about center programs at NSF

- 9:30–10:00 am
  - Alex Schwartzkopf (NSF) on I/UCRCs
- 10:00–10:30 am
  - Bruce Kramer (NSF) on ERCs

Day 1 Agenda (continued)

10:30–11:00 am

What we plan to accomplish

11:00–12:00 pm

Presentations by center directors: What does a successful center look like from the academic and industrial perspectives?

- 11:00–11:30 am
  - Jannis Terpenny (Virginia Tech) on I/UCRCs
- 11:30–12:00 pm
  - Adam Powell (USC) on ERCs

12:00–1:00 pm

Working Lunch

Day 1 Agenda (continued)

1:00–2:00 pm

Discussion Item 1: Would a center be a viable vehicle for collaboration between Industry and Academia in the area of Human Language Technology? What would the ideal collaboration look like? (Smaller Groups with Scribe)

2:00–3:00 pm

Reports from the groups and discussion

3:00–4:00 pm

Discussion Item 2: How can we best optimize the collaboration between Industry and Academia in a HLT center environment? (Smaller Groups with Scribe)

4:00–5:00 pm

Reports from the groups and discussion

5:00–5:30 pm

Homework (questions to think about for day 2): What breadth of research should an HLT center tackle? Which areas of research are most viable for center collaboration?

Workshop Purpose

- To discuss the feasibility of developing a center-based partnership between industry and academia in the area of human language technology (HLT) that
  - Is mutually beneficial
  - Supports work that simply could not be done by either partner alone
  - Stimulates research excellence at the university while enhancing the quality of the intellectual property of US HLT companies
- Each center works within its own industrial and university environment and must choose its path, not based on what works elsewhere, but on what may succeed for it." p. 5-52 (Strengths, Weaknesses, Opportunities, and Threats)

Strengths of HLT

- We have strong researchers who have been in industry (and are now in government or academia) and who are currently in industry.
- There is a need to develop common infrastructure (e.g., data).
- There are interesting large infrastructure problems that require more than one company or institution to solve. (However, it is vital to develop novel spinoff products to keep momentum for the field).

NSF Strategic Goals

National Science Foundation
By Strategic Outcome Goal*
(Dollars in Millions)

	FY 2006 Actuals	FY 2007 Request	FY 2008 Request	Change over FY 2007 Amount	Change over FY 2007 Percent
Discovery	$2,942.82	$3,086.93	$3,312.96	$226.03	7.3%
Learning	878.99	898.51	938.22	39.71	4.4%
Research Infrastructure	1,508.17	1,685.24	1,813.99	128.75	7.6%
Stewardship	315.82	349.53	363.83	14.30	4.1%
Total, NSF	$5,645.79	$6,020.21	$6,429.00	$408.79	6.8%

Totals may not add due to rounding.

*New Strategic Plan Outcome Goals presented here are roughly equivalent to Ideas, People, Tools, and Organizational Excellence in the FY 2003 - 2008 Strategic Plan.

ENG NSF-wide Investments

Dollars in Millions

	FY 2006 Actual	FY 2007 Request	FY 2008 Request	Change over FY 2006 Amount	Percen
Biocomplexity in the Environment	6.00	4.00	0.00	-4.00	-100.00%
Climate Change Science Program	1.00	1.00	1.00	0.00	0.00%
Cyber-enabled Discovery & Innovation	0.00	0.00	10.00	10.00	N/A
Cyberinfrastructure	52.00	54.00	58.00	4.00	7.41%
Human and Social Dynamics	2.00	2.00	1.50	-0.50	-25.00%
Mathematical Sciences	2.91	1.46	0.00	-1.46	-100.00%
National Nanotechnology Initiative	123.77	137.02	139.02	2.00	1.46%
Networking & Information Technology R&D	11.20	11.20	21.20	10.00	89.29%

Cyber-Enabled Discovery & Innovation (CDI)

"Broaden the Nation's capability for innovation by developing a new generation of computationally based discovery concepts and tools to deal with complex, data-rich, and interacting systems."

- ENG broadly supports research in advanced cyber-enabled engineering throughout all its divisions.
- CDI investments areas include:
  - Complex interactions
  - Computational experimentation
  - Knowledge extraction
  - Virtual environments
  - Education in computational discovery
- Budgets - 2008 $51.98m, 2009 $100m, 2010 $150m, 2011 $200m, 2012 $250m

Some Possible HLT Center Impacts

- Human-enabling HLT
- Better societal use of language artifacts in education, government, and business
- Multi-lingual systems
- HLT can impact business, labor, organizational processes
- HLT can impact the handling of ethical and value-sensitive information, enhance information privacy, and increase intellectual property protection
- HLT can spur changes in the conduct of science, engineering, and the humanities

Discussion Item 1 (4 Breakout groups)

- Would a center be a viable vehicle for collaboration between Industry and Academia in the area of Human Language Technology?
- What would the ideal collaboration look like?

Discussion Item 2 (4 Breakout groups)

- How can we best optimize the collaboration between Industry and Academia in a HLT center environment?
  - Develop a long-term, strategic vision for an emerging engineered HLT system with the potential to transform a current industry or spawn something new.
  - Define a research agenda that optimizes shared research interests, needs, and opportunities.
  - Define partnership strategies between universities and industry: how to divide up rights and responsibilities.
  - Determine strategies for protecting/sharing intellectual property while enabling timely publication of intellectual output of the center.
  - Develop mechanisms for involving graduate students in industrially relevant research that also qualifies for Master's and Ph.D. level theses.

Homework

- What breadth of research should an HLT center tackle?
- Which areas of research are most viable for center collaboration?

Day 2 Agenda

8:30–10:00 am

Discussion of Homework / continental breakfast

10:00–11:30 am

Discussion Item 3: Organizational Issues (Small Groups with Scribe)

11:30– 12:30 pm

Report from the groups and discussion

12:30–2:00 pm

Wrap-up, general discussion, and merging of notes for final report

Discussion Item 3 (4 Breakout groups)

- How should we handle center organizational issues?
  - Strategic plan for integrating fundamental HLT-related science and engineering research; is there a viable test bed that could be used to tie together the research threads and enable systems level evaluation?
  - Strategic plans for constructing a multidisciplinary research agenda while developing a more diverse research population. Would a single site or multiple site center be more effective?
  - How to best measure success of an HLT center?
  - What is the best structure for an advisory board (i.e., balance between academic, industrial, and government oversight)?

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Industrial Innovation Partnership (IIP) Division

Industry / University Cooperative Research Centers

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I/UCRC Research History in NSF

1972	Presidential Initiatives; e.g. Industrial Affiliates, Industrial R&D Incentive Program.
1976	NSF Small Business Innovation Research Program (SBIR) started.
1978	Industry/University Cooperative Research Centers program started. President's domestic policy review of industrial innovation.
1980	Stevenson-Wydler Innovation Act of 1980 Uniform Federal Patent Policy Act of 1980 Justice Department's Anti Trust Guide
1982	Small Business Innovation Development Act of 1982
1984	Engineering Research Centers program started.
1985	National Cooperative Research Act of 1985
1988	Science and Technology Centers program started.
2006	I/UCRC program has grown to about 40 centers and over 100 universities

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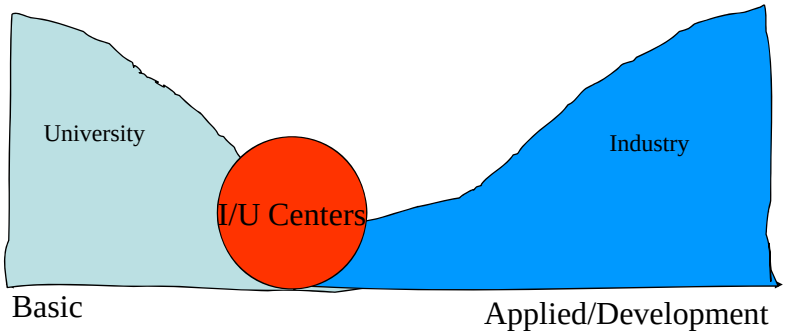
Research Interaction



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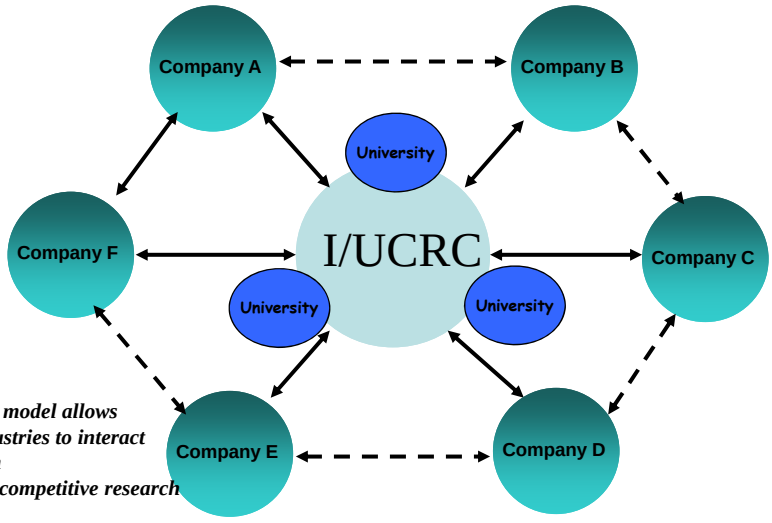
The I/UCRC Model



The model allows industries to interact with pre-competitive research

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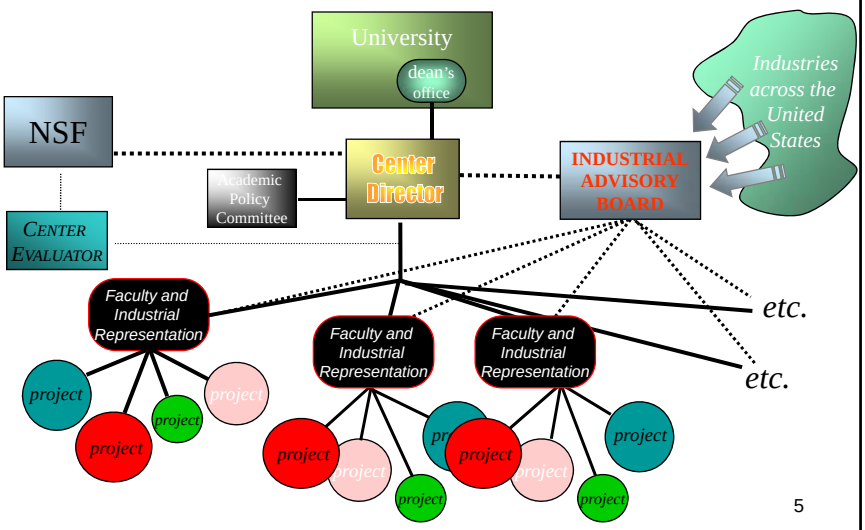
Typical Organizational Chart



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Evolution of Centers

Single discipline centers

Multi-discipline centers

Some researchers from other universities

Multi-university centers

Why? The expanding research base has become necessary to be able to respond to industries broad interests and to be more competitive on a national and international basis.

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I/UCRC CENTERS - 2007

SINGLE UNIVERSITY CENTERS:

1. Advanced Studies in Novel Surfactants
2. Nondestructive Evaluation
3. Precision Metrology
4. Advanced Vehicle Electronics
5. Bio-catalysis and Bio-processing of Macromolecules
6. Electronic Micro-Cooling
7. Child Injury Studies
8. Bio-instrumentation

Transitioning to Multi-University:

1. Biometrics/Identification
2. Fuel Cell Engineering
3. **Computer Systems****

MULTI-UNIVERSITY CENTERS:

1. Sensors and Actuators (MEMS)
2. Water Quality
3. **Intelligent Maintenance Systems****
4. Membrane Applied Science and Technology
5. Dielectrics
6. Engineering Logistics and Distribution
7. Tree Genetics
8. Telecommunication, Integrated Circuits Systems
9. Multi-phase Flow
10. **Wireless Internet****
11. Plasma Processing
12. **Search and Rescue Robotics****
13. **Cyber Protection****
14. Friction Stir Welding
15. **E-Design Manufacturing****
16. **Computational Material Design****
17. Precision Forming
18. Minimally invasive Diagnostics
19. **High Performance /Reconfigurable Computers****
20. Repair of Bridges & Buildings Composite
21. Ceramic and Composite Materials

**** CISE SUPPORTED**

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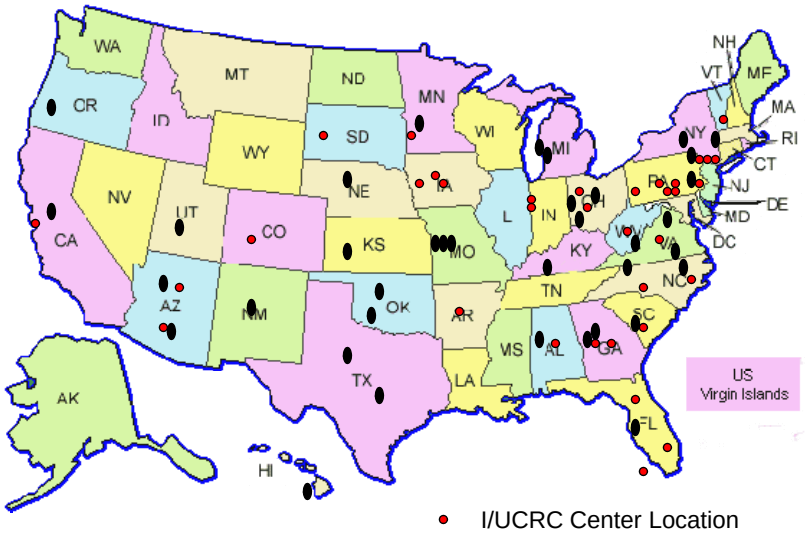
Locations of I/UCRCs – March 07



I/UCRC Center Location

I/UCRC Center Site Location

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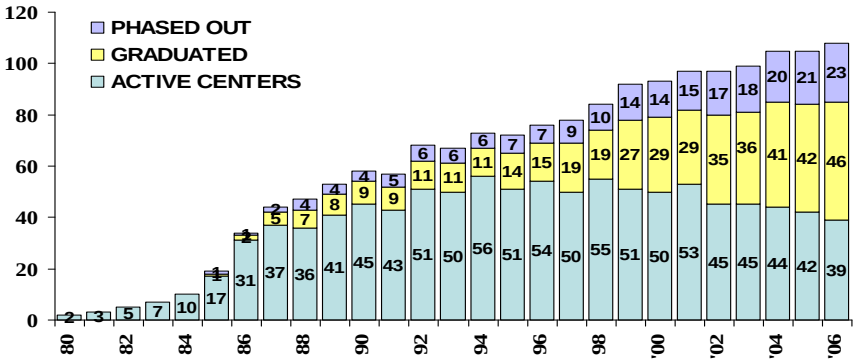
NUMBER OF CENTERS



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Funding Formula

First five years

- lead university receives $70K+$10K for each additional university
- partnering universities receive $50K-$70K[1] each

Second five years

- lead university receives $35K+$10K for each additional university +$8K for evaluator
- partnering universities receive $25K-$35K[3]+$5K[2] each

Notes:

1. Funding level depends upon industrial membership level (5 or 10 member companies)
2. For evaluator, $9K first site, $6K second site, $3K third site, $0K additional sites
3. Note: REU's, graduate fellowships, faculty fellowships, TIE awards, international, etc., are in addition to the base amounts above.

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Win-Win

For the academic community:

- stable funding source for research
- exposes the academic community to the 'real world'
- establishes a meaningful research focus -- industrially-relevant fundamental
- provides support for research and students

For industry, an **I/UCRC**:

- provides an avenue to investigate a topic which may otherwise not be done
- accomplishes research at a fraction of the cost
- allows an industry to utilize the talents and resources of a university
- vehicle for changing the university culture: multidisciplinary; strategic fundamental
- provides an excellent recruiting tool for building the future of the company

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Center Members are in Good Company

Partial List of I/UCRC Members as of 12/31/02

3M Corporation	Certain Teed Corporation	General Electric Company	Merck & Co.	Rolls Royce/Allison	U.S. Dept. State
Air Products & Chemicals, Inc.	Champion International	General Motors	Microsoft	Samsung	U.S. Federal Aviation Administration
Alcoa Inc.	Chevron PTC	Gerber Products Co.	Missouri Department of Transportation	Seagate Technologies	U.S. General Services Administration
Allegheny Power	Cisco Systems, Inc.	Gillette Company	MITRE Corporation	Sharp HealthCare	U.S. Jet Propulsion Lab
Amana Refrigeration	Coca-Cola	Gintic	Mitsubishi	Siemens	U.S. Los Alamos National Laboratory
AMD	Consolidated Edison	Goodyear Tire and Rubber Company	Monsanto	Westinghouse Power Corporation	NASA
American Concrete Institute	Corning Cable, Inc	Guardian Industries	Motorola, Inc.	Sperry Rail Service	U.S. National Security Agency
American Electric Power	Critchfield Mechanical	Hewlet-Packard	NAPP Systems	Sprint Corp	U.S. Naval Surface Warfare Center
Amway Corporation	Cummins Engine	Honda	National Semiconductor	Sun Chemicals	U.S. Navy
Analog Devices	Daimler Chrysler Corp.	Honeywell, Inc.	NEC USA, Inc.	TDK Corporation	U.S. Oak Ridge National Laboratory
Arizona Department of Environmental Quality	DePuy, Inc	IBM Corporation	Nokia Corporation	Tecumesh Products Company	U.S. Sandia National Laboratories
Armstrong World Industries	Dow Chemical	Intel Corporation	Nortel, Inc.	Tektronix	U.S. Veterans Administration
AT&T	Dow Corning	Intellisense Corporation	Northrup Grumman	Tennessee Valley Authority	Union Carbide Corporation
Bayer Corporation	Du Pont	International Concrete Repair Institute	Owens Corning	Teradyne	United Parcel Service
Bell South	Eastman Kodak Co.	International Facility Management Assn	Panasonic Technologies	Texas Instruments	United Technologies
Boeing	Electric Power Research Institute	International Paper Co	Payless Shoesource	Thermo King Corporation	US Borax Company
Bose Corporation	Eli Lilly & Co.	John Deere	Peak Communications	Toshiba Corp.	Verizon Wireless
BP	Estee Lauder Companies	Johnson Controls Inc.	Peerless of America	Turtle Wax Company	Westinghouse Corp.
Bristol-Myers Squibb	ExxonMobile Chemical Company	Kraft Foods	Pfizer	Tyco Electronics	Westvaco
British Telecom	Exempla Healthcare	Lennox International	Pharmacia & Upjohn	U.S. Air Force	Weyerhaeuser Company
California Department of General Services	Fisher Price/Mattel	Libbey Glass Company	Phillip Morris Company	U.S. Army	Whirlpool Corporation
Canon Information Systems	Florida Power & Light	Lockheed Martin Corp.	Phillips Petroleum	U.S. Bureau of Reclamation	Xerox Corporation
Carrier Corporation	Ford Foundation	Lucent Technologies	Pratt & Whitney	U.S. DARPA	
Caterpillar, Inc	Ford Motor Company	Manhattan Associates	Progress Group	U.S. Dept. of Agriculture	
	Frigidaire Company	Master Builders, Inc	Qualcomm, Inc	U.S. Dept. of Energy	
	General Dynamics	MEMS Technology Inc.	Raytheon/Texas		
			Reynolds Metal		
			Rockwell International		

National Science Foundation's Industry/University Cooperative Research (I/UCRC) Program

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New Announcement for the Program

NSF 01-116 Old Announcement		NSF 07-537 New Announcement
- $6 M Funding	→	- $6.8 to 9.8 M Funding
- CISE – collaborator	→	- CISE – Full Partner
- Cost sharing	→	- University Marketing Plan
- Full Proposal –Ad hoc review		- Full Proposal – Panel
- $150k per site	→	- Each site 5 memberships
- $300k for each Center/Site	→	- Each Center 10 members
- Evaluator Support 16K	→	- Increase Support –19K
- $50 k or $70 k NSF	→	- Same support to sites
- Alex	→	- "Ask ALEX"

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Memberships and Agreements

- Membership fee structure.
- Patent rights held by university, with royalty free, non-exclusive rights to center members.
- Publication delay policy.
- University cost share (25% of membership fees.)
- March-in rights for government via PL 98-620.
- Industrial Advisory Board Established.

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THE I/UCRC SYSTEM

A Research Management Franchise

Operations Protocol
Evaluation Tools
Experience Networking

CUSTOMER SATISFACTION

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Statistics

- Currently funding 32 centers
- Approximately 118 universities involved
- About 400 organizations participate with over 700 memberships
- NSF support approximately $9.8 million
- Industry support approximately $24 million
- Total support approximately $65 million

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EXECUTIVE SUMMARY
PROJECT OVERVIEW

PROJECT NAME: _____ **PROPOSAL:** _____

PROJECT MANAGER: _____

PROGRAM NAME: _____ **NEW** _____

PROGRAM MANAGER _____ **CONT.**_____

DESCRIPTION:	
EXPERIMENTAL PLAN:	
RELATED WORK ELSEWHERE:	HOW OURS IS DIFFERENT:
RELATED WORK WITHIN THE CENTER:	MILESTONES:
DELIVERABLES:	BUDGET:
POTENTIAL MEMBER COMPANY BENEFITS:	

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Input/Feedback

The Level of Interest/Feedback Evaluation (LIFE) process is an essential component of the I/UCRC that provides a simple, efficient method to assist with the selection, guidance, and direction of projects in the center.

The LIFE process ensures quality and stimulates continued interest in the program.

LIFE Forms are distributed and collected after each technical presentation during the semi annual meetings.

Level Of Interest Feedback Evaluation (LIFE)

To facilitate scientific and technical interaction between Center Faculty and Industrial Member Representative, each company represented is requested to rank their company's level of interest and the research relevancy of each presentation. Please mark an X below to reflect the opinion of your company.

Level of Interest:

	_____	**Very**
Interested	_____	**Interested**
	_____	**Interested**
with Change	_____	**Not Interested**
	_____	**Abstain**

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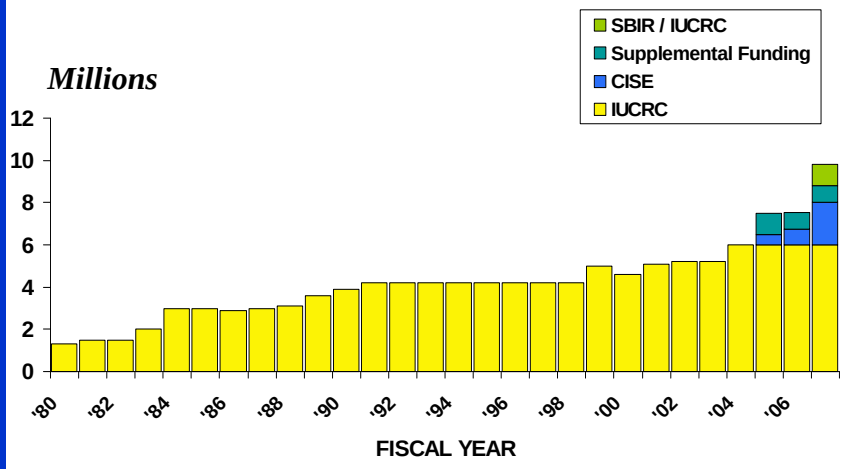
NSF BUDGET BY YEAR



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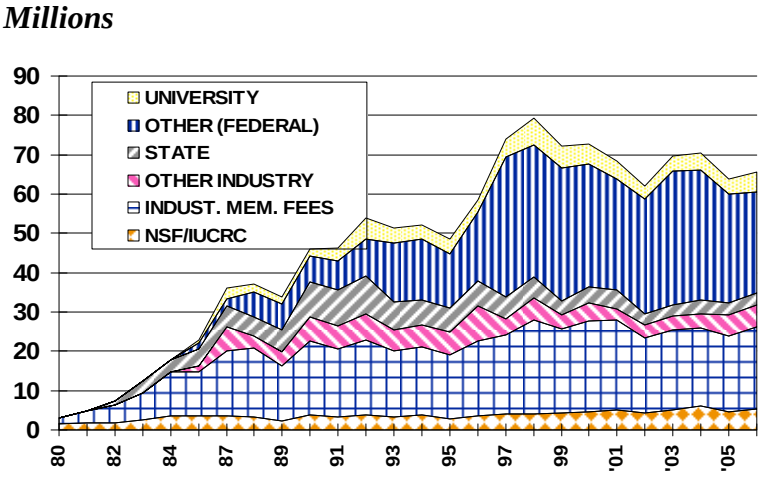
TOTAL FUNDING BY SOURCE BY YEAR IN DOLLARS



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New Announcement for the Program

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- $50 k or $70 k NSF	→	- Same support to sites
- Alex	→	- "Ask ALEX"

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New Supplement NSF 07018 SBIR-I/UCRC

- Supplemental Opportunity for SBIR/STTR Memberships in I/UCRCs
- Active NSF SBIR/STTR Phase II/IIB
- 20 to 35 awards a year
- Award supplement equal to membership fee for the I/UCRC center the company is planning to join less $5,000
- SBIR/STTR Grantees Need Letter from I/UCRC Director
- Glenn Larsen will make available the list of eligible SBIR/STTR Phase II/IIB awardees

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Fundamental Research Supplement

Dear Colleague Letter

Proposals Due February 7, 2007

12 + Awards – Up to $150,000 for up to 2 years

- 6 + awards CISE
- 6 +awards Non-CISE
- Preference given to collaborative proposals

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OTHER FUNDING

- **TIE** Projects –Between I/UCRC Centers
- Research Experience for Undergraduate Students **(REU)**
- Research Experience for Teachers **(RET)**
- Experimental Program to Stimulate Competitive Research **(EPSCoR)**
- Federal Government Interagency Exchange of Funds -**MIPRS**
- Other NSF Programs that Co-fund Centers
  - Chemical, Bioengineering, Environmental and Transport Systems **(CBET);** Civil, Mechanical and Manufacturing innovation **(CMMI**); Electrical, Communications and Cyber Systems (**ECCS**); and Computer Information Science and Engineering **(CISE**)
- **IREE** – International – 3 awards
- Other International Projects

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for more information: http://www.nsf.gov
and: http://www.nsf.gov/eng//iip/iucrc

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Engineering Research Centers:
Characteristics of an Effective Industrial Interaction

Workshop on Strategic Planning for Academic/Industry Centers for Language Technologies

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Orientation to the ERC Program

- The ERC Program Announcement: http://www.nsf.gov/pubs/2007/nsf07521/nsf07521.htm is quite explicit about requirements of the program
- The *ERC Best Practices Manual*: http://www.erc-assoc.org/manual/bp_index.htm provides detailed information about "what it takes" from the perspective of the key staff of the centers
- Each ERC is required to have compelling plans for Research, Education, Diversity, Industrial Collaboration and Outreach. These must be tailored to the strengths of the partner institutions.
- There is no formula for success – passion counts

Beyond Chapter 5 of the Best Practices Manual: Characteristics of Effective Industrial Interactions

Is Industry "Part of the Plan" or an Afterthought?

- Funding, supplies, equipment
- Unique facilities and fabrication capabilities
- Student and faculty internships
- Curricular input and part-time faculty support
- Technological ideas, context and direction
- Resident researchers/system integrators
- Systems integration and interdependencies
- Experience in strategic planning
- Market knowledge, including competitive technologies
- Knowledge of societal and regulatory context
- Knowledge and recruiting of other key industrial partners, both domestically and internationally

Telltale Signs

- Is the involvement of industry discussed in the proposal other than in the “industry involvement” section?
- Is the involvement of industry integral to the proposed work and discussed in terms other than funding level, board membership, and meeting attendance?
- Is there an Industrial Advisory Board (IAB) involved in proposal planning and advising on center direction?
- Do the letters of industrial support make clear the company’s involvement in and understanding of the center’s plans, the potential benefit of the center to the company, and the commitment of the company to obtaining full value for its contributions?
- Are obvious industry sectors unrepresented?
- Are companies with no clear connection included?

Example:

ERC for Compact, Efficient, Fluid Power

University of Minnesota
Georgia Institute of Technology
Purdue University
University of Illinois, Urbana-Champaign
Vanderbilt University

Goals and Key Features of an Engineering Research Center

Key Features of an ERC

- Strategic vision for transforming engineered systems and development of a globally competitive and diverse engineering workforce
- Strategic plans for research, education, and diversity to realize the vision:
- Integrated, interdisciplinary research program – spans from fundamental to systems research and proof-of-concept test beds;
- Integrating research and education from precollege to practitioners (courses, course modules, new degree programs)
- Partnership with industry/practitioners to formulate and evolve the strategic plan, strengthen research and education, speed technology transfer;
- Leadership, cohesive and diverse interdisciplinary team, effective management;
- Cross-institutional commitment to facilitate and foster the interdisciplinary culture and diversity of the ERC
- Substantial involvement from the academic, industrial, and other partners to support and sustain the ERCs

Annual Review Guidelines

- Vision and strategic plan drive and integrate the ERC to achieve systems goals
- Research program must be high quality, integrated, and effectively conducted to achieve the vision
- Industrial collaboration and education programs must be strong and support the vision
- Leadership, faculty, and students must be diverse and must embrace a interdisciplinary, team approach
- Judgments are made in the context of the age of the ERC and the degree of difficulty:
  - in integrating the disciplines
  - the readiness of industry to transform knowledge into practice
  - the relative need for educational innovations

Systems Vision and Value Added Review Criteria (years1-3)

- Strong systems vision motivates the ERC, early systems requirements understood;
- Vision has potential to transform or significantly impact industry/practitioners, the workforce, and society;
- Vision positions the ERC to lead in the field;
- Research output is high quality, some deriving from interdisciplinary collaboration, publications based on ERC research in process;
- Some research advances may be moving into use, most likely to be useful in a few years;
- Course and curriculum impacts derived from the ERC's research are planned or underway.

Strategic Research Plan Review Criteria (years 1-3)

- Systems concepts and technology goals drive and integrate all levels of research;
- Strategic plan focuses on significant barriers and challenges that position the research to lead the field and advance the state of the art;
- Research effectively organized into well integrated thrusts designed to achieve the vision;
- The team is appropriately cross-disciplinary;
- College-level outreach faculty and students becoming effectively involved in collaborative research that contributes to the vision;
- Test beds provide a significant opportunity to integrate the research to explore and prove enabling and systems level technologies.

Research Program (thrust level) Review Criteria (years 1-3)

- Thrust contributes to the ERC goals and vision;
- Projects appropriately cross-disciplinary and display growing interdependence within thrust and among thrusts;
- Significant research barriers/challenges being addressed through high quality research methods;
- Effective research management links doctoral dissertation research topics to achieve thrust/ERC deliverables;
- Beginning to deliver results that are unique in the field, high quality publications, some interdisciplinary;
- Results beginning to impact industry/practitioners;
- Thrust team is becoming cohesive; opportunities for cross-institutional collaboration being pursued;
- Appropriate allocation of funds at the project level to fulfill thrust and center goals.

Education and Educational Outreach Review Criteria, (years 1-3)

- Cross-disciplinary, cross-institutional, education culture is developing, where undergraduate and graduate students are starting to work in teams; significant commitment to involvement of undergraduates in research;
- High quality educational output based on research; some is impacting the curriculum for undergraduate and graduate students and practitioners;
- Strong plans in place to implement, evaluate and disseminate education programs and curricular materials;
- Students beginning to have formal training in systems integration with industry/practitioners involved in the training;
- Students have ample opportunities to work with industry/practitioners

Education and Educational Outreach Review Criteria (years 1-3) continued

- A Student Leadership Council (SLC) is in place and has been given sufficient resources to achieve its goals.
- College-level outreach programs are increasing diversity through connectivity with institutions serving under-represented groups, an NSF-sponsored Louis Stokes Alliance for Minority Participation (LSAMP), and one or more NSF-sponsored awardees focused on diversity, such as the Alliances for Graduate Education and the Professoriate (AGEP), NSF Tribal Colleges and Universities Program (TCUP), etc.
- Precollege outreach effectively involves K-12 students and teachers in the ERC's research and education programs, with an emphasis on increasing diversity;
- In a multi-university ERC, a partnership in education among the lead and core partner institutions impacts all.

FY 2004 ERC Diversity Policy (requirements for all ERCs)

- Execute a diversity strategic plan with goals, milestones, actions, and report on progress that exceeds national engineering-wide averages at a minimum;
- Form sustained partnerships with affiliated deans and department chairs to enable this performance;
- Develop outreach connections with predominantly female and underrepresented minority institutions as core or outreach partners
- Develop outreach connections with at least one LSAMP and one or more AGEP, TCUP, CREST, etc. through REU opportunities and graduate fellowships;
- Introduce a diverse cadre of precollege students to engineering;
- Operate diversity-oriented REU and RET programs.

Industrial/Practitioner Collaboration and Technology Transfer Review Criteria (years 1-3)

- Growing or stable group of members across sectors appropriate for the ERC's vision;
- Members are beginning to impact the ERC's planning, research, technology transfer, and education programs; Industrial Advisory Board (IAB) active and effective;
- Center-wide membership agreement structures the industry collaboration program with clear statements of fees, benefits, and intellectual property policies;
- Membership fees provide sound level of cash for generic support of the ERC, commensurate with typical investments in academic R&D for the sectors represented by the firms involved;
- Knowledge and technology transfer is beginning to impact industry/practitioners.

Infrastructure Review Criteria (years 1-3)

- Appropriate institutional configuration among lead, core partner, and outreach institutions, partnership beginning;
- Effective Center Director and Deputy Director, able to implement vision and provide leadership;
- Other members of the leadership team are becoming cohesive and effective in planning and implementing the research, education, industrial collaboration, and administrative aspects of the ERC;
- Effective management systems that include outside input on planning, project review, and assessment;
- High quality research team with appropriate mix of expertise beginning to share the vision;
- Diversity strategy in place and team leaders, faculty and students are diverse in gender, race, and ethnicity.

Infrastructure Review Criteria (years 1-3) continued

- High quality experimental and enabling equipment/facilities; test beds under development;
- Headquarters and communications network facilitate interaction among students, faculty, industry/users and participating institutions;
- University administration facilitates success of the Center through policies that encourage its cross-disciplinary configuration, its diversity, and its partnership with industry;
- Investment made by industry/users, university, and other non-NSF investors commensurate with their ability to contribute and benefit;
- Effective use of financial resources to achieve the ERC's goals. Thrust and institution-level budgets are appropriate to their roles in the ERC, timely allocation of funds.

Things to Think About

- Ask yourself why you want to be an ERC Director
- Get into the spirit of the solicitation
  - » Some, if not most, of what looks like bureaucratic nonsense will turn out to be good for you. It's more difficult than anyone imagines to manage a center…we've learned the hard way over 20 years.
- Volunteer for an ERC Review Panel (in a competition in which you are not proposing)
- Come to NSF and brief ERC program staff on your preproposal before you submit it

Center for e-Design

Real Time Collaboration and Sharing

IT-Enabled Design and Realization of Engineered Products and Systems

Key Strategies and Challenges for Starting and Running a Successful Multi-University I/UCRC

Janis Terpenny
Site Director, Virginia Tech

May 3, 2007

University of Pittsburgh · UMass Amherst · UCF · Virginia Tech · Carnegie Mellon

Outline

- Background and Description of Center
- Evolution of the Center
- Key to Getting Started
- Garnering Internal Support and with Industry
- Multi-Site Management Structure and Procedures
- Issues Unique to My Role in the Center
- Major Challenges and Opportunities

Real Time Collaboration and Sharing

Center Mission

- To serve as a national center of excellence in research on design and realization of discrete manufactured products in a collaborative, web-based environment
- To serve as a revolutionary integration environment with the goal to research, develop, and test technologies that enable the evolution of a collaborative service-oriented design paradigm
- To nurture and cultivate a new breed of engineers, scientists, and business leaders in e-Design systems through a closely dovetailed university/industry collaborative model

Real Time Collaboration and Sharing

GOAL: Efficient, Effective, Competitive

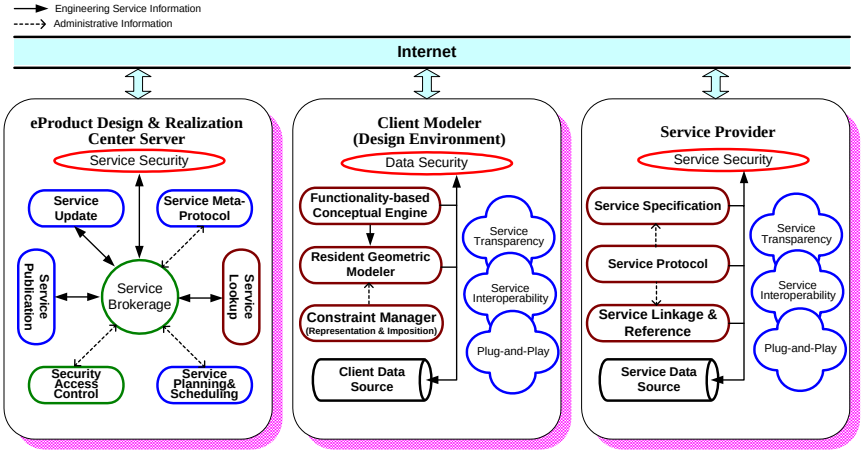
Distributed Collaborative Design and Realization of Products and Systems

- Design
- Suppliers
- Customers
- System Integrators
- Manufacturers
- and Other Stakeholders

Research Thrusts and Clusters

- **Information Infrastructure**
  - Information Management
    - Communication Protocols
    - Collaboration Methods
    - Information Representation
    - Information Repository
    - Security & Accessibility
    - Intellectual Property
  - Transition/Migration Strategy
- **New Design Processes and Paradigms**
  - New Design Process
    - Design Cycle
    - Product Decomposition
    - Uncertainty & Risk Management
    - Incentive Structures
    - Design Knowledge Modeling
  - Design Representation
    - Setting of Standards
    - Knowledge Representation & Retrieval
- **Design Optimization**
  - Economic and Supply Chain Models
  - Preferences
  - Constraints
  - Conflict Resolution & Negotiation
  - Optimization Methods and Tools
- **Visualizing and Virtual Prototyping**
  - Virtual Environment Models
  - Virtual Collaboration and Sharing
  - Virtual Test & Simulation
  - Real-Time Visualization

e-Design System Platform



Real Time Collaboration and Sharing

Application Areas

Aerospace

Nautical

Automotive

Medical Device

Real Time Collaboration and Sharing

Academic Partners

University of Pittsburgh	Bart Nnaji, Mike Lovell (Interim)
UMass Amherst	Ian Grosse
University of Central Florida	Lesia Crumpton-Young
VirginiaTech Invent the Future	Janis Terpenny
Carnegie Mellon	Jim Antaki

Real Time Collaboration and Sharing

Sample of Participating Companies & Organizations

Real Time Collaboration and Sharing

Evolution of the Center for *e*-Design

- Several Needs Gathering Meetings with Industry (2000-2002)
- UPitt and UMass, Planning Grants 4/2002, Full Center Grants 4/2003
- UCF Joined 8/2004
- Virginia Tech, Planning Grant 12/2004, Full Center Grant 8/2005
- CMU, Planning Grant 4/2006

Keys to Getting Started

- Recognize the most important element when starting or running a successful center …
- Heed the guidance from Mary Poppins " … a spoon full of sugar …"
  - Department, College and University Buy-In
  - Recruiting and Keeping Industry Members
- Attend January NSF Annual Director's Meeting
  - Network with others
  - Ask for examples and advice from other centers and NSF

Be Resourceful and Creative in Garnering Internal Support and with Industry

- Department, College, and University
  - Space
  - Staff Support
  - Release Time
  - Assistance from Development
  - Press Coverage
  - Presentations at Advisory Board Meetings
- Memberships
  - Flexibility in Wording of Letters of Commitment
  - Internships
  - Collaborative Proposals
  - In-Kind

Multi-Site Management Structure & Procedures

- UPitt is lead university
- Other university partners collaborate as equal partners
- Conference calls to discuss business at hand and upcoming opportunities
- Research planning occurs at IAB meetings and special meetings of directors
- Rotation of host university for semi-annual IAB meetings with admin assistance from UPitt

Issues Unique to My Role as Site Director

- The unexpected Will Happen
- Sharing Experience
- Special Circumstances
  - Transition to another university
  - Director on leave of absence
- Team Player at All Times
  - Ready to help with addition of new universities
  - Representation of entire center, not just site

Major Challenges and Opportunities

- Recruiting Members Without Competing
- Road Map Document
- Preparation and Processing of Documents Between Universities (MOU, By-Laws)
- Center Director on Leave
- Change of Center Evaluator
- Advice … Communicate, Communicate, Communicate

Questions ?

Janis Terpenny

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http://www.e-designcenter.info/

Integrated Media Systems Center

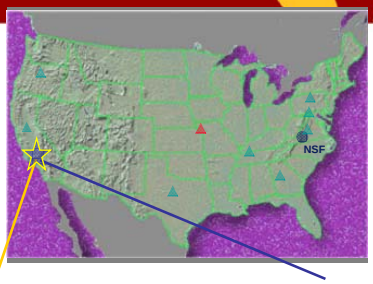
A partnership among:

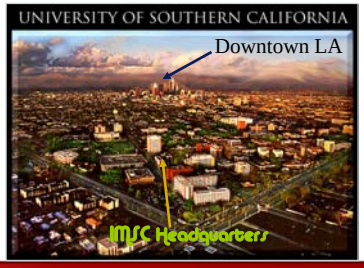
National Science Foundation

University of Southern California
- USC Viterbi School of Engineering
- Annenberg Center for Communication

Industry Partners:
- Computer Hardware and Software
- Entertainment
- Broadcasting
- Petroleum Industry
- Telecommunications
- Publishing
- Aircraft and Aerospace

Other Government Agencies:
DARPA, NASA, JPL, ONR, U.S. Army, NGA (NIMA), DHS





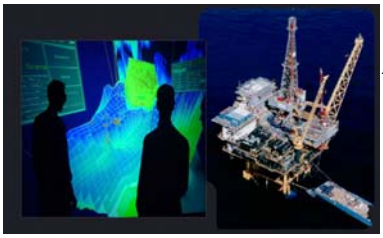
IMSC USC Partnerships

University of Southern California

School of Engineering EE, CS, BME, ISE, ISI	Cinema-Television	School of Education
School of Fine Arts	School of Music	Annenberg School for Communication

Large-Scale Sponsor Projects

- Defense/Security (2004)
  - DHS – USC CREATE
  - U.S. Army – USC ICT
  - Lockheed Martin
  - Northrop Grumman



▲ CiSOFT (2004 – with USC ISI)
- ■ Chevron

▲ PWICE (2003)
- ■ Pratt & Whitney, Korean Air, Inha Univ.

Scalable Immersive Environments

- Enable scalability to handle diverse communication scenarios
- Create technologies for facilitating increased awareness
- Develop application test beds for specific domains

SIE Research Objectives

- Scalable and distributed communication environments
  - Support symmetric and asymmetric communication: from fully immersive to constrained scenarios
  - Real-time systems for multimodal acquisition, transmission and rendition
- Enable truly aware collaborative environments
  - Accommodate and adapt to scenario, task, technology and human requirements
  - User centric approaches: multimodal sensing of users and groups during interactions: track, interpret and mediate
- Automatic summarization and indexing of interactions
  - Aid real time decision making
  - Enable simulations and after-action reviews
- SIE is the basic architecture that supports all IMSC applications

Technical Challenges

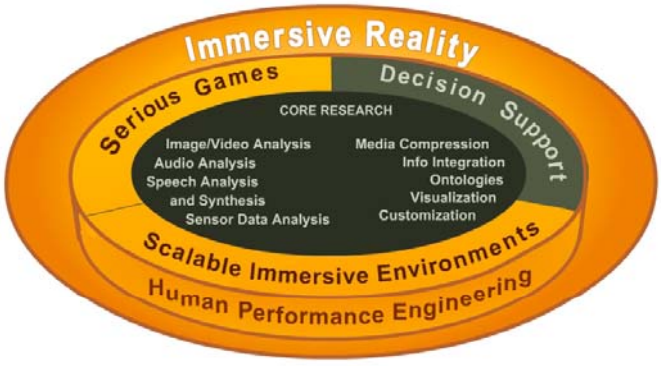
- Audio-visual localization
- Active speaker tracking and identification
- Two way meetings: optimization for asymmetric conditions
- Low latency transmission
- Multimodal recording
- Error correction and concealment

IMSC Immersive Reality: First Live Immersive Concert



- Miro quartet performs in one hall
- Capture with multiple microphones and 4 HD cameras
- Stream using HYDRA (RMI)
- Render in nearby hall using multiple projectors and 10.2 channel immersive audio
- Survey both audiences

Decision Support



National Science Foundation
Engineering Research Center
USC IMSC
Integrated Media Systems Center

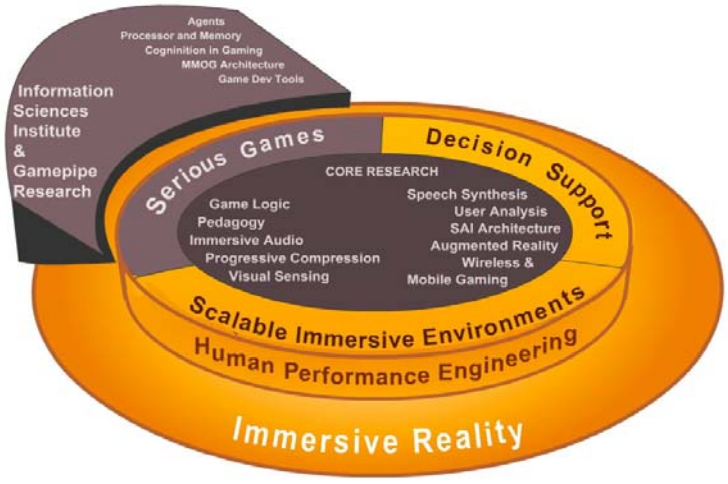
GeoDec

- *Rapidly* and *accurately* building an **information-rich** and **realistic** *immersive-reality* space (e.g., a city) with temporal dimension

- GeoDec Goals/Challenges:
  - **R**ealistic rendering
  - **A**ccurate information fusion
  - **I**nteractive query and access
  - **S**calable infrastructure
  - **E**fficient in time-to-build

- Example application
  - Disaster response

Serious Games



Human Performance Engineering

The qualitative and quantitative assessment of human performance in immersive environments

COLLABORATION (music)
Performer-Centered Experiments in the Distributed Immersive Performance Project

SCIENCE LEARNING (biology/education)
Serious Games to Promote Science Learning

COMMUNICATION (language)
Communication Across Cultures: Speech-to-speech Language Translation

REHABILITATION (medicine)
Virtual Environments for Stroke Recovery

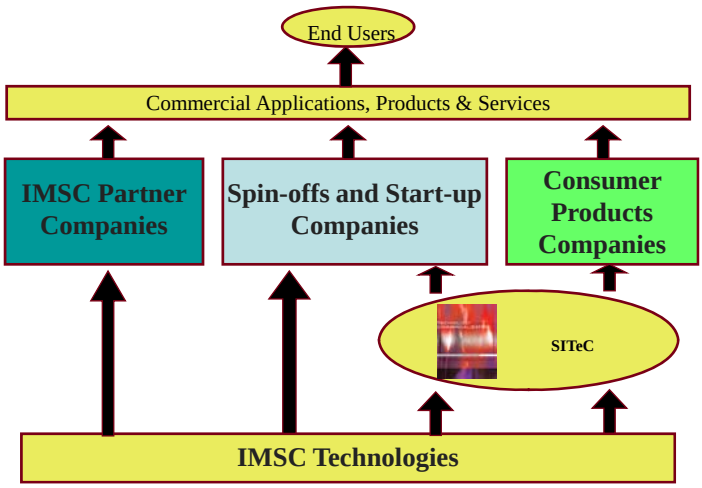
Human Performance Engineering: 2020Classroom

- Design, development, and assessment of Metalloman: a serious game for science learning
- Potentially broader impact
  - Rich context to explore human performance issues
  - Extends boundaries for advancing research algorithms and technologies for immersive applications in education
- Interdisciplinary effort from computer science, HCI, databases, biology, and the arts

Human Performance Engineering: Haptics for Virtual Rehabilitation

- Proper assessment requires reliable capture and analysis of raw and derived performance outcomes such as
  - Grip strength, pinch strength, lift strength
  - Thumb abduction, degree of wrist extension, joint extension, joint angles between fingers, etc
  - Endurance, velocity, reaction time, task completion time
  - Comparisons with same measures from less-impaired arm
  - Kinematic pattern
- Assessment of psychosocial variables
  - Sense of presence or immersion,
  - Co-presence with remote therapist
  - Patient progress self-report (interview, survey)

Technology Transfer Strategy



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