CHAPTER 2

GETTING STARTED:
Planning and Initiating a New Center

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INTRODUCTION

"The growth of university-industry and university-industry-government collaborative R&D programs is the single most important development in the character of university technology transfer endeavors since the early 1980s. University-industry research centers (UIRCs) are the primary vehicle through which industry supports academic R&D." (Feller, p. 31, 1997)

Since there is growing uncertainty surrounding future federal and industrial support for R&D, we may need to rely even more heavily on the highly leveraged, yet mutually beneficial, partnerships described by Feller.

Centers are created in a variety of different ways: as a response to a government-sponsored centers initiative, based on the instigation of a number of firms or a whole industry, as a survival strategy when a large federal grant expires, or as a gradual evolution of an informal small partnership. In spite of this diversity, evidence suggests a number of common features associated with the "birthing" of new cooperative research center involving industry and university.

First, while industry can and has been the driving force behind the creation of cooperative research centers, an entrepreneurial faculty member or team of faculty is typically the catalyst for creating a new center. This should come as no surprise. Faculty

need to support their research programs, and centers have become a viable way of expanding the market for faculty and graduate student research.

Second, while the title of this volume stresses the partnership between industry and university, the overwhelming majority of cooperative research centers receive funding from federal or state government sources (Coburn, 1995). As a consequence, the growth and success of cooperative research centers in the U.S. is really a product of industry-university-government partnerships. Thus, most individuals interested in creating a new center will typically find themselves involved in meeting the requirements of a federal or state sponsor.

Finally, creating a center tends to be action-oriented. It involves much more than writing a successful grant proposal (although this is usually involved). As we will point out, the process is closer to planning and implementing a new business start-up. As a consequence, creating a new center is best understood as a **process** which is articulated over time, involves a series of steps, feedback loops, and periodic follow through.

Given these common features, the material presented in this chapter will emphasize the central role of the faculty entrepreneur and attempts to secure sponsorship and funding from a government agency (illustrated by the NSF IUCRC program). However, in doing so we will emphasize a generic action-oriented process which can and has been used profitably by faculty and non-faculty with a variety of federal or state agencies, and by individuals trying to start a center without government support.

The Center Development Process

New centers usually evolve during a three-stage process.

Exploratory Stage

Individuals collect preliminary information about the feasibility of establishing a center and begin to formulate their center vision. This stage involves a great deal of self-assessment and reality testing, which culminates in the development and submission of a concept paper to an agency for internal review. Proposed centers which meet program criteria and are considered potentially viable are encouraged to submit a formal proposal.

Pre-Planning Stage

Collaborators develop a full-blown plan for evaluating the feasibil-

ity of establishing a center and developing the industry and university interaction necessary to support an operational center. This may involve the development and submission of a planning grant proposal to a government agency.

Planning Stage

Collaborators test the feasibility of establishing a center, gain industrial commitments, and refine the center operating plan. A proposal to establish a new center is submitted to industrial sponsors and eventually to a government agency.

Government Funding

As we described above, the vast majority of cooperative research centers involve sponsorship and/or co-funding by a government agency. The NSF I/UCRC program has figured prominently in the growth of cooperative research centers in the U.S. It was the first major government initiative to attempt to systematically create cooperative research centers, it served as a model for other programs, and it remains one of the largest (at least in terms of number of participants). As a consequence, we will use the NSF I/UCRC and its application process to illustrate how the center development process can dovetail with government granting procedures.

However, it's important to remember that the NSF I/UCRC program's fifty plus centers account for less than five percent of the centers identified by Cohen, Florida and Goe (1994). Therefore, individuals interested in starting new centers should consider a broad spectrum of federal and state funding options.

THE NSF I/UCRC PROGRAM AND MODEL

Currently over 50 I/UCRCs exist at universities around the nation (see Appendix 2-8). According to NSF, I/UCRCs pursue three objectives:

- To pursue fundamental engineering and scientific research having industrial relevance.
- To produce graduates who have a broad, industrially oriented perspective in their research and practice.
- To accelerate and promote the transfer of knowledge and technology between university and industry.

Since NSF does not provide financial support for an indefinite period of time, centers must pursue a fourth objective: *"to achieve self-sufficiency from NSF support within ten years."* I/UCRCs may also re-invent themselves with innovative research themes and compete for funding beyond ten years (see Chapter 11).

In order to achieve these objectives, the I/UCRC program framework has the following characteristics:

- develops a partnership among academe, industry and other organizations participating in the center;
- consults with center members to set a research agenda focused on shared research interests and opportunities;
- shares the intellectual property developed by the center equally among center members;
- has center members monitor and advise on the progress of the research, which speeds two-way transfer of knowledge between universities and industry;
- has industrial and other partners that are the primary financial resource for the center;
- has a formal structure and policies for center members outlined in an I/UCRC membership agreement;
- relies primarily on graduate student involvement in the research projects, thus developing students who are knowledgeable in industrially relevant research;
- has a center director, based at a university or college, who is responsible for all center activities, and
- has formal evaluation of the partnership conducted by an independent evaluator.

Universities and colleges with sufficient research and graduate education capabilities are eligible as lead institutions for I/UCRC program support. Since organizations of this type are difficult to create, the NSF I/UCRC program provides two kinds of assistance: a screening process designed to provide feedback on the viability of proposed centers, and modest financial support for the planning and operation of centers.

Criteria for supporting a new I/UCRC are very straightforward (see Figure 2-1). Proposed centers must demonstrate $300,000 of industrial support from at least six firms in order to be eligible for up to $100,000 a year in NSF support. Additional details on NSF

Figure 2-1 I/UCRC program funding criteria.

New Centers

- Minimum of $300,000 annually from at least six firms.
- In first five years, are eligible for up to $100,000 per year from NSF, renewable annually.

Multi-University Centers

- Partner universities must have a minimum of $150,000 per year industry support from at least three firms, and are eligible for up to $50,000 funding per year from NSF, renewable annually.
- Affiliate universities must have a minimum of $75,000 industrial support annually, and are eligible for up to $25,000 per year from NSF.

funding guidelines and options are described in the "NSF I/UCRC Program Announcement" and at the NSF website: *http://www.eng.nsf.gov/eec/i-ucrc.htm*

A Program Metaphor—Developing a Small Business

Establishing an I/UCRC is like starting a small business (Lauer, 1994). The prospective Center Director must be an entrepreneur with vision and ambition to realize a thriving academic team of investigators who produce high-quality research ideas, new knowledge, and graduates. Research results are disseminated to a diverse market of industry, federal, and state government agencies.

Consistent with this metaphor, the process involved in developing a new I/UCRC is similar to developing and refining a business plan, and submitting a concept paper and planning and operations proposals to a government agency are similar to seeking seed and venture capital for a new start-up.

In the case of the NSF I/UCRC program, the business venture represented by an I/UCRC is like a unique franchise. The NSF application process is designed to screen potential franchisees for qualifications and strengths critical for long-term technical and educational success. Successful applicants receive start-up funding; a proven model for center development, structure, operation, management, and evaluation; and a valuable NSF seal of approval in the form of a peer-reviewed NSF award.

The I/UCRC application process screens potential cooperative research franchisees for a variety of qualities (see Figure 2-2).

Local Capabilities

Successful centers require junior and senior faculty researchers who **understand the I/UCRC model** and demonstrate capabilities which coincide with industrial needs. Since industry values **multidisciplinary work**, faculty should represent a variety of relevant disciplines.

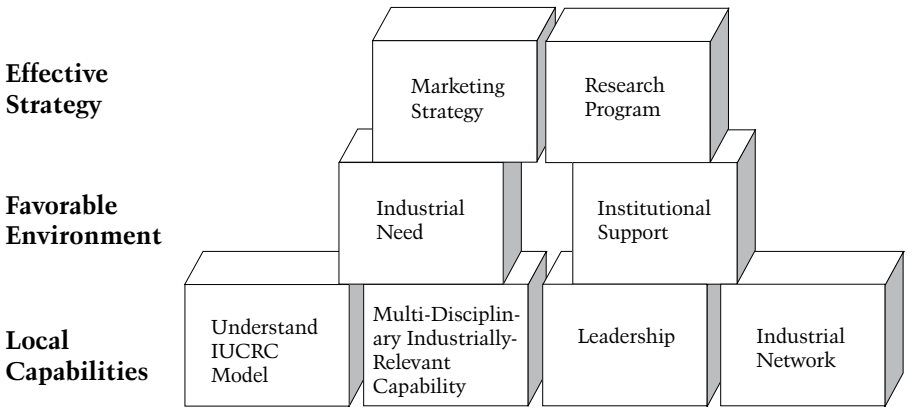
Center **leadership** should reflect entrepreneurship, technical vision, commitment to boundary spanning, commitment to team work, administrative capability, and self-knowledge (see Chapter 10).

Successful centers are usually built on a pre-existing **network of industrial contacts**. This is essential for recruiting industrial members and for targeting research in an area of strong industrial needs. Healthy revenue from consulting and industrial collaborative research in a sponsoring department demonstrates the university's and the department's ability to address industry research needs.

Favorable Environment

Centers must address a research **need** of industry. An industry-relevant research program is a prerequisite because industry's financial support is mandatory. Though most firms involved in

Figure 2-2 Building blocks for successful I/UCRC start-up.



I/UCRCs perform and support a great deal of R&D, firms which are not R&D intensive may also be candidates for recruitment. The important point is that centers must be able to identify industry members who will recognize the value of their proposed research agenda and who can apply the center's research outputs.

Strong **institutional support** from academic administrators, the university president, deans, and department chairs is vital in attracting cross-disciplinary research teams of quality faculty members and students. Issues of tenure, funding allocation, overhead reimbursement or waiver, space assignment, access to equipment, and course development and credit may hamper an I/UCRC if key administrators are not supportive.

Effective Strategy

While a pre-existing industrial network is essential when a center is getting started, few if any centers have sustained themselves on one. Center leadership must reach outside and develop an I/UCRC **marketing plan** that continues throughout the life of the center. Strategic alliances between industry and university are not permanent and need constant renewal and upgrading. Marketing is a center way of life. While the Center Director shoulders most of these responsibilities, faculty and industrial members should also be involved in recruiting new members.

An I/UCRC proposal must match a university's research strengths to an industry's research needs and funding capability. Sharpening this focus is a major activity throughout the NSF three-phased process. This process does not end when a new center is established. Ongoing development of a **relevant research agenda** is critical to a center's continued success and is discussed in detail in Chapter 5.

Venture capitalists look for certain qualities before investing in a new enterprise. The I/UCRC screening process does the same thing. All of these qualities are not expected to be in place at once, but are developed throughout the evolution of the center from idea to operation. This chapter provides guidance on this developmental process and describes early warning signs of problems, or dimensions one must strengthen (e.g., research agenda).

EXPLORATORY STAGE: DO YOU HAVE WHAT IT TAKES?

Creation of a cooperative center does not begin with writing a proposal. In fact it begins by deciding *whether* a proposal should be

written at all! Often the enthusiasm among faculty for creating a center may be out of touch with the actual probability of success. As a consequence, we recommend that the process of developing a center begin with an exploratory stage. A thorough self-assessment and informal external assessment may be reflected in a concept paper.

Beginning Self Assessment

Do Your Homework

First, carefully review the relevant funding announcements. At this stage, it is also recommended to identify by name a number of potential member firms in a given industry and their characteristics. The next step is to review Chapters 1 through 5 in this handbook.

Do a Feasibility Scan

It is more effective to involve at least one or two other faculty and close industrial supporters in this task. Conduct a day-long mini-retreat to brief the group on the I/UCRC model and requirements. Every participant is asked to answer the following questions prior to the retreat:

- Do available faculty have the multidisciplinary technical capability that is relevant to industrial need in the prospective research area, research themes and specific projects?
- Is the center leadership strong (especially the director) in terms of technical, administrative, and entrepreneurial skills and commitment?
- Does the leadership have much experience and a network of contacts in the relevant industry?
- Will the research focus be in an area in which there is a critical mass of firms which need it?
- Will university administrators support a cross-disciplinary research center?
- Is the necessary supporting university infrastructure of labs, equipment, instrumentation, students in place?

Through candid discussion and straw votes during the retreat participants examine several key questions:

- *Scientific and organizational **strengths** of the university and the likely team members*? For example, what is their experience with companies? In what research areas does the institution have national acclaim? Does the administration have a mission to promote university-industry relations?
- *Scientific and organizational **weaknesses** of the university and the likely team members?* For example, are there administrative practices that inhibit faculty from participating in cooperative research with industry? Are there research competencies missing at the institution? Are there personality conflicts?
- ***Opportunities** in the external environment relevant to the proposed center?* For example, what are the acute technology needs of key industries that fit the scientific capacities of the university? Has a foundation recently established an endowed chair in the research area? Have new government regulations imposed on the target industries accelerated the need for research?
- *The **threats** in the external environment relevant to the proposed center?* For example, is there a competing center established at another university? Has the state legislature recently passed a faculty conflict-of-interest law which makes it difficult to work with industry?

Results of these discussions will decide: (1) do not go any further; (2) wait until certain internal weaknesses or external threats are resolved; or (3) yes, full speed ahead. A memorandum or similar document detailing the decision is useful. The same problems tend to turn up later.

Concept Paper

Preparation

When the decision is to go forward, the next step is a concept paper which should be submitted to the NSF-I/UCRC program office (see Figure 2-3) or other government agency. Since NSF's suggested outline for this is described in considerable detail in the NSF I/UCRC Program Announcement, we emphasize the process of developing a successful proposal rather than the content.

Most of the information collected during the self-assessment process will be useful for the concept paper, but there is need for

Figure 2-3 Concept paper outline.

Proposed Center: Description of the research focus;

Industrial Need: Description of the industry and its research needs;

University Capabilities: Summary of the university's capability to address those research needs, including center leadership and university commitment;

Financial Potential: Brief analysis of anticipated industry, university, state, or other funding commitments;

Proposed Model: Summary of center structure, policies, management research focus, and planned budget;

Endorsements: At least five potential industry supporters.

more formal data collection. For instance, an objective catalogue of university research resources, faculty, students, and facilities matched to industrial needs would be extremely helpful. It is necessary to contact key researchers to ascertain their interest. This includes faculty researchers as well as industry colleagues who may become corporate members. It is important to list the grants, contracts and consulting experience of the center research team. This indicates the potential for the center to become self-sustaining.

University administration support, especially from relevant department chairs and deans, is essential. Similar cross-disciplinary, industry-oriented research support is the most concrete indication. Consultation with these individuals is advisable. In particular, the office of the president of the university should be consulted. It is this office that reviews patent policy, center structure, and overheads, and gives permission to plan new centers.

Feedback

It is important to remember that a concept paper is *not* a formal proposal. It is an *informal* way to gauge potential for the center before you make a huge investment in planning, recruiting, and proposal writing. Concept papers should be limited to 4 to 8 pages, no more. NSF staff will review and comment on the concept paper within two months.

After the concept paper has been endorsed and the potential center can respond favorably to comments, the decision to proceed can be made by the proposer.

PRE-PLANNING STAGE: DEVELOPING A PRELIMINARY BUSINESS PLAN

Consistent with our franchise metaphor, to make a proposed center a reality it is necessary to develop a business plan, operating proposal, or a prospectus, including a marketing plan for prospective members. Since this process can be time consuming and costly, NSF provides seed funding in a (up to $10,000) pre-planning grant/meeting award.

Pre-planning proposals address in greater detail the same concept paper issues: local capabilities, model understanding, multidisciplinary industry-relevant capabilities, leadership, local network, environment, industrial need, and institutional support. In addition, a coherent research agenda and proposed marketing strategy should be articulated.

Who's Involved in Developing a Pre-Planning Grant/Meeting Proposal

As in the concept paper, it is advisable for the potential Center Director to draw together a small team of faculty who share the vision of the center. Collaboration is one of the hallmarks of a co-operative research center and this team will put the pre-planning proposal together and later, if approved, implement it. The team may include a representative from the university research office or an associate dean for research. Then add three or four industrial allies with whom the core group have had long professional relationships and who are supportive of the effort.

University support is needed in regard to patent policy, delays in publication, center structure, membership fees, and cost sharing. These must be documented in the pre-planning proposal. Someone should be added to the team to address these issues with appropriate university officials. Industrial allies serve as team members and a sounding board during these critical pre-planning and implementation phases.

Center Directors should be able to remind influencers and collaborators of the significance of basic, pre-competitive research merit and the ability of I/UCRCs to deliver such research. Close to half of all the productivity gains may be the result of innovation —the application by managers/innovators of knowledge generated

by talented scientists and engineers. This leads to higher standards of living and global pre-eminence. I/UCRC leveraging is 10 to 15 times and R&D dollar multipliers of 1.5 to 7 are the profile of the I/UCRC centers. (Barker, 1991; Clinton and Gore, 1994; Crawford, 1994; Illman, 1994; Walters, 1987.) This documentation helps position basic research and its linkage to productivity alongside of such other issues as monetary and fiscal policy, inflation, employment, and balancing the budget. I/UCRCs are part of the solution to maintaining and enhancing U.S. vitality.

Chapter 6 details a number of strategies for soliciting team input. The Center Director may flesh out a draft of the proposal and ask team members to critique it; team members can be convened as a group to brainstorm; individuals can be given responsibility for authoring specific sections which are then passed around for comment, revision and integration; or some combination of these approaches. Obviously, the more interaction and participation one solicits, the better.

Preparing the Pre-Planning Proposal

Figure 2-4 summarizes the format for preparing a proposal. A formal analysis of industrial needs and capabilities should be provided, including national, regional, or local statistics on the size and importance of the target industry, literature or expert opinion on needs or gaps in that industry's research, or on emerging scientific or technological trends, etc. A general description of the center's proposed research program research areas, thrusts, topics, and projects should also be provided.

Proposals also address how the I/UCRC organizational model may need to be customized to meet particular university circumstances. For centers which involve a number of departments and other colleges or even other universities, it may be desirable to consider the addition of a new layer of management to supervise activities in their respective discipline or respective school.

In addition to NSF funding and the industrial membership fees, state sources, federal agencies, and special program grants which might be included in center funding should be identified. Centers which show funding leverage along with world-class research have a greater probability of attracting industrial firms and obtaining NSF and other government approval.

The plan for developing an industrial-relevant research program and marketing the center to industrial sponsors should be spelled out in a time line or other scheduling device. These are the objec-

Figure 2-4 Preparing the pre-planning proposal.

Introduction

- Analysis of the industry on which the proposed center plans to focus, its importance to the nation's economic health and its research interests and needs, especially in those areas of research that could be considered appropriate for a university.
- Description of the center research focus.
- University capabilities to address the industrial research interests and needs noted above, including faculty and infrastructure.

Model of the Envisioned Center

- Proposed center structure, organization, policies, and operational procedures.
- Management and staffing plan.
- One- or two-page description of each anticipated research project including a discussion of its industrial relevance and appropriateness for the center.
- Budget and sources of funding, noting potential for obtaining a minimum of $300,000 from industry in each year of operation.
- Evaluation plan.

Project Description

- Detail how the pre-planning research objectives will be achieved.
- Outline for a meeting which will determine the research agenda and its viability with possible industrial sponsors.
- Roles the proposed Center Director and other researchers will have in performing this pre-planning study.
- Managerial experience of the proposed Center Director.

Budget

- Complete Form 1030 found in NSF Publication 95-27 for travel, an industry pre-planning meeting, publications and faculty time.
- Note any other sources of funds to be used in this study.

Industry Endorsements

- Letters from at least 5 potential participant companies noting the center's concept and proposed research agenda and that the firm would consider joining if the center were formed.

tives of the pre-planning grant/meeting, and the most important elements of the proposal.

The budget should be specified for travel, expenses of pre-planning meetings, faculty time evaluation, and reference other sources of funds which might be used in the pre-planning study; not infrequently, some industrial funding may be available along with funding and support from the university itself[2].

Letters of interest from potential industrial participants should be included. They should endorse the proposed center's concept, policies and the proposed research agenda and indicate that the center's research has the potential to have a positive impact on the industry. They should state that the company is interested in becoming a center member. These letters should be signed by someone within the company who has the responsibility and authority to authorize later the flow of funds to the center.

Review Criteria

While the venture capitalist evaluates proposals based on their probability of producing a financial return, NSF and other government agencies will invest in those proposals which appear to have the highest probability of becoming technically and educationally successful and financially stable (see Figure 2-5).

Figure 2-5 NSF I/UCRC pre-planning grant/meeting criteria.

- Center is consistent with characteristics and operations of an I/UCRC.
- There is enough potential university support, faculty and facilities involved to build a viable center.
- Research interests focus on an industry that is in a position to support the center.
- Center has potential for sufficient industrial and other financial commitments.
- The center proposes to develop a research program that does not duplicate that of an existing I/UCRC.

[2]NSF budget forms are posted on the NSF website at www.nsf.gov/bfa/cpo/forms.

PLANNING STAGE: REFINING AND IMPLEMENTING THE BUSINESS AND MARKETING PLAN

The final stage focuses on the refinement and implementation of the pre-planning proposal. In the NSF program, the goal is to attract members totaling $300,000 or more in annual support. This process usually reaches closure during a two-day recruiting meeting attended by potential industrial sponsors.

Getting Ready: Developing Materials

It is advisable to prepare a brochure/prospectus describing the proposed center venture, policies, research, projects, proposed budgets, and faculty. Most of this information is obtained in the pre-planning proposal.

Preliminary Marketing

It is at this stage that the Center Director tries to identify potential members from the wider industrial environment in the chosen area of research (see Figure 2-6). It is wise to use the center's industry members to initiate such contacts. The entire industrial network of the prospective director and other core faculty should be contacted. The Center Director and core faculty must be prepared to make cold calls, individually or in groups. Contacts may

Figure 2-6 Targeting industry prospects.

Allies: Identify and get feedback from a small group of firms or individuals that you consider your allies. This group is contacted for advice early and often. They must commit to the creation of the center and become its advocates.

Top Prospects: Identify twenty highest-quality firms that you think should join the center, based on strong technical or industrial convergence with center, proximity, or personal network. Have extensive one-on-one phone calls or visits with this group during the pre-planning stage about the research program. Identify likely allies or decision-makers to optimize outcome.

Relevant Prospects: Identify firms that might join based on technical overlap. Communicate with this group via letters or announcements, providing them opportunity to become top prospects.

involve visits to the university or company to detail the research mission, the operations, and the potential benefits of participation. Center Directors must devote considerable effort to preparing solid, professional presentations for they are a continuous aspect of center life.

Presentations should inform the prospective member about the proposed center, solicit input on the proposed research program, convince the prospect to attend an already-scheduled pre-planning conference, and ultimately get a commitment to join the center.

The Pre-planning and Recruiting Meetings

An organizational pre-planning conference or series of such meetings should be the capstone of the pre-planning process and a bridge to the operations proposal. Shumacher (1992) has provided a checklist for organizing such a meeting (see Appendix 2-1). These conferences provide an opportunity to draw together faculty, students, and potential industrial members in one room to focus on the establishment of a center, agreement on research thrusts and specific research proposals, obtain letters of commitment from each industrial company; and so on.

Figure 2-7 shows a typical agenda for such a meeting. Pre-planning meetings may be opened by the president of the university who welcomes the industrial participants. A representative of the NSF, or other government agency describes the program and what can be expected in the way of support. The meeting is chaired by the potential Center Director. One purpose of the meeting is to convey a vision of the center, its organizational structure, its policies, and its proposed research agenda. Another purpose is to confirm that there is a need for the specific research projects being proposed by faculty members. Every effort should be made to be sensitive and responsive to industry suggestions for changes in research mission, thrusts, and individual projects.

Every effort must be made during and following this meeting to obtain formal letters of intent committing the industrial participants to recommending to appropriate authorities in their company the budgeting of the membership fee and the conditions upon which those funds would be released for center use. These letters accompany the center operations proposal or requests for funding from any other funding agency.

The entire meeting should be structured to elicit fullest participation of industry, and include opportunities for informal social interactions between faculty and industrial members. Feedback

Figure 2-7 Typical agenda for a pre-planning conference.

Center for _____

Sunday–Month, Day	
6:00–7:30 p.m.	Meeting Registration
7:30–9:30 p.m.	Informal Cocktail Reception and Discussion
Monday–Month, Day	
7:00–8:30 a.m.	Breakfast
8:45–9:00 a.m.	Welcome—President of the University
	Introduction to the University
9:00–9:10 a.m.	Introduction of Participants
9:10–9:30 a.m.	Introduction to Department(s) in which center will be based.
9:30–10:10 a.m.	Center Structure: presentation by Center Director assisted by a key industrial supporter outlining the need for the proposed research of the new I/UCRC, and describing the organization including major policies and procedures, cost and funding options.
10:10–10:50 a.m.	Research Program: presentation by director or faculty–perhaps double teamed, a high-level overview of the proposed research of the center.
10:50–11:20 a.m.	Coffee Break
11:20–11:40 a.m.	Introduction to NSF I/UCRC Program
11:40–11:55 a.m.	Presentation by the evaluator regarding evaluation procedures and feedback during the meeting, what is envisioned for semi annual meetings, and the administration of the NSF research instruments to gauge measures of intervening center success.
11:55–12:00 a.m.	Outline of the afternoon session.
	A break for lunch with devices available for industry members to make contact with their business location.
1:00–1:45 p.m.	Research Area 1: Overview of research followed by 15 minute project presentations; use proposal and LIFE forms (Appendices 2-2, 2-4).
1:45–2:30 p.m.	Research Area 2: (repeat as above)
2:30–3:15 p.m.	Research Area 3: (repeat as above)
3:15–3:45 p.m.	Coffee Break
3:45–4:15 p.m.	Breakout Sessions by Research Area (optional).
	Guided discussion and feedback on the proposed projects—use Discussion Guide (Appendix 2-5).
4:15–5:00 p.m.	Repeat Breakout Session
5:00–5:30 p.m.	Discussion of the organization of the evening and morning session. Use Organization Feedback Form (Appendix 2-7).
6:00–8:00 p.m.	Cocktail Hour and Dinner
8:00 p.m	Industry-only Workshop on the Day's Topics (optional).
Tuesday—Month, Day	
7:00–8:30 a.m.	Breakfast
8:30–10:00 a.m.	Discussion of Project Feedback (Director)
	Review and discussion of feedback obtained via LIFE forms and during breakout sessions. Focus on kinds of changes and refinements for which there is a consensus.
10:00–10:30 a.m.	Break
10:30–11:15 a.m.	Discussion of Organizational and Policy Feedback (Director). Define Organization Feedback Forms.
11:15–12:00	Closing Remarks, Action Items.

obtained during the meeting will help in planning the research agenda and formulating specific research projects which meet industry's needs for the first year of the center's operation.

Developing the Research Plan

During the meeting, the research areas and projects are presented by individual faculty members. Copies of research proposals and other materials should be distributed to potential members before the meeting. Survey instruments such as the Level of Interest and Feedback Evaluation (LIFE) form are distributed which provide industrial participants with an opportunity to indicate their level of interest and to make comments regarding suggested changes (see Chapter 5 and Appendix 2-4).

Early on in this process, proposers should begin to use several I/UCRC devices, the project proposal form and the LIFE form. The project form provides a uniform basis for proposing research projects, and the LIFE form provides a uniform basis for capturing industrial feedback. (See Appendices 2-2 to 2-5 and Chapters 5, 6, and 7 for operating details.) Every effort should be made to encourage industrial participants to suggest research ideas that, if appropriate, are then transformed into research proposals either to be included in the start-up stage or added as the center evolves.

The purpose of the meeting and these procedures is: (1) to present the research proposals and have open discussion and an exchange of ideas, (2) to formalize the opinions of the potential industrial members on feedback forms, (3) to quickly tabulate and place those opinions in the hands of the Center Director and core faculty, (4) to brainstorm and have feedback sessions, (5) while the meeting is still in progress change research areas and specifics of a research proposal as needed, and (6) to obtain industrial approval.

Although the greatest interest usually is shown in the research themes and the individual projects, discussion will also touch upon policies on patents, royalties, publication of the research, and levels of funding that would be necessary to initiate a research program of the type that is being proposed and to sustain it over a number of years. Appendix 2-6 illustrates an organizational feedback form that could be used to solicit this input.

A typical pre-planning conference provides a great deal of feedback, which must be digested. Sometimes this feedback may necessitate a rethinking of the center's research program. Appendix 2-7 includes a set of questions proposers may want to address before submitting their operations proposal.

The Operations Proposal

The operations proposal is an expanded version of the pre-planning proposal (see Figures 2-8 and 2-9) that demonstrates that the objectives of the pre-planning study have been achieved and that the center is ready to function. It documents the appropriateness of the research agenda and the willingness of industry to fund it through letters of commitment or cash in hand. Since the proposal

Figure 2-8 Center proposal format.

Introduction

Describe need for the center and its technical focus. Describe the research, the industry, and the center expertise and resources to address this need.

Center Structure and Operations

Discuss evidence of university involvement and participation, and available facilities and infrastructure. Describe director management capability and research experience. Explain intellectual property policies (permit non-exclusive, royalty-free licenses for industrial center members and the possibility of exclusive, royalty-bearing license), publication delay policies; public law 98-620 "march in rights;" membership fee structure of the center, role of members; specific benefits of membership categories; and list the proposed evaluator and members of the university policy committee.

Research Plan

For each research project proposed for the center, describe (in no more than three pages per project): the goals, experimental plan, industrial relevance and time scale of the project, the names and capabilities of faculty involved, the involvement of students and industrial advisory personnel in planning and executing the project, if applicable, and the project budget.

Financial Management of the Center

The proposal should include financial operating plans for five succeeding years, and projected allocation of funds by source and function. A separate budget detailing all costs for the initial year should be included. Provide details on the support to the center from the participating universities. Include a proposed budget for NSF funds for each of the first five years of center operation and a five year summary budget as well. Use NSF Form 1030 from the Proposal Forms Kit, Grant Proposal Guide (NSF 95-27/28).

Appendices

Copy of the industrial agreement document, letters of financial commitment from participating companies; a full list of each individual who participates in any center activity. The list should identify institutional and departmental affiliation or discipline and should include biographical information (NSF Form 1362) on the director, faculty members, or other individuals from participating institutions who will be directly involved in the development, operation, and evaluation of the center. The publications list for these individuals is limited to the ten most relevant. Current and Pending Support (NSF Form 1239) for key academic personnel who are requesting salary support from NSF.

Figure 2-9 Evaluation criteria for operations proposal.

A proposal is evaluated according to the technical and management quality of the proposed center, the qualifications of the personnel, the level of industrial involvement and the likelihood of achieving the goals of the I/UCRC program, as follows:

- Aggregate industrial membership fee support of at least $300,000 per year from a minimum of six firms and potential for more memberships;
- High-quality, industry-relevant research;
- Student involvement with industry and the research;
- Clear technical focus, research need, and defined research agenda;
- Strong industry and university collaboration;
- Adherence to the center structure and policies recommended by the I/UCRC Program;
- Center Director and research team capable of developing and operating a center;
- University administration's commitment.

is subjected to an external peer-review, it must also include summaries of the center's proposed research. The proposal should reaffirm the university administration's support. In the case of the NSF I/UCRC program, the proposal will have to address these issues.

Funding

Strong leveraging of NSF funds is a very positive point in evaluation. I/UCRC operational support from NSF is renewable each year and phased out completely at the end of five years. Renewal for a second five-year period (up to $50,000 per year) is possible. A strategic plan for increasing membership over the term of the award is required. Anticipated funding from the state and other federal agencies should also be identified, as appropriate. The proposal must also budget salary, travel, equipment, and support for the evaluation function.

Center Evaluation

NSF requires each center be observed independently and evaluated during its planning and operational phases. The evaluation normally is conducted by an evaluation expert, usually from within the university but not from the department receiving center funding. Funds are provided by NSF to help cover operational support of evaluation.

The evaluator collects data that provides feedback to the center and NSF on the center's performance. The information gathered also provides a basis for NSF presentations to congressional committees and other policy makers such as officials in the Office of the President's Science Advisor. This function is described in detail in Chapter 3 and 8.

SUMMARY

The development process used by NSF's I/UCRC program offers a proven model for setting up and operating a successful industry and university collaborative research center. Organizational structure, policies, management and evaluation protocols, as well as techniques for recruiting members, planning a research program, and transferring technology to industry are all well-established and available to new centers. Thus, much of the entrepreneurial burden and risk of starting an academic research center are minimized. The challenge to a prospective Center Director instead is focused on winning initial NSF approval of his or her concept and successfully advancing all the way through the three-stage approval process.

Although the center model and its many established elements provide substantial assistance, the effort involved in establishing a new center is considerable and the commitment required is great. This does not entail mere grantsmanship. It may be useful to reiterate the steps for proposers to follow.

Exploratory Stage

Self-Assessment and Concept Paper, 2 months and 2 months for NSF review.

- Determine whether there is a critical mass of potential dues-paying members in an R&D-intensive industry in the prospective focus area.
- Look inward to determine objectively whether there is strong leadership (especially the director) in terms of technical, administrative, and boundary-spanning and commitment.
- Ask whether the leadership is experienced, has a network of contacts in the relevant industry, is respected and trusted by colleagues.

- Find faculty and industry colleagues who are willing to help.
- Determine faculty multidisciplinary technical capability relevant to industrial needs in the prospective research area.
- Match university infrastructure, labs, equipment, staff, commitment to industry needs.
- Be sure that all university and industry participants understand the I/UCRC model.
- Obtain university administration support. (Make the Office of the President of the university aware of the undertaking.)
- Proceed with concept paper and developing a center only if self-assessment is positive.
- Submit concept paper to the NSF-I/UCRC program office or other government agency for comment.

Pre-planning Stage

Concept Paper to Planning Grant, 6-12 months and 3 months for NSF review.

- Upon approval of the concept paper, proceed with pre-planning proposal if commitment from university, industry, and researchers is still strong.
- Convene a group of two to three faculty plus the prospective Center Director to prepare and implement the pre-planning proposal.
- Form a larger group to plan the center and advise the proposal-writing team. This group should include representatives from the university research office, the department or college administration, and several industry members.
- Circulate draft copies of the pre-planning proposal to university administrators.
- Obtain university documentation relating to patent policy, delays in publication, center structure, membership fees, and cost sharing.
- Conduct a formal analysis of industry capabilities and needs in the proposed area.
- Meet with potential industry members individually and collectively regarding their research needs. Look for opportuni-

ties to match and build upon these with faculty research expertise.

- Consider alternatives to the generic I/UCRC organizational structure.
- Identify other funding including state, federal, private, and other sources.
- Formulate a marketing plan to recruit industrial members.
- Prepare budget for NSF or other government agency pre-planning grant/meeting award.
- Formulate tentative research areas and specific projects.
- Obtain letters of interest from potential industrial participants.
- Rewrite the pre-planning proposal.

Planning Stage

Planning Grant/Meeting to Operations Proposal, 3-6 months and 3 months for NSF review.

- Upon notification of a planning grant/meeting award, implement the marketing plan.
- Contact the industrial network of the prospective Center Director and other core faculty.
- Ask industry network to contact colleagues in other companies.
- Conduct university or industry site visits to present the research mission, operating protocols, and potential benefits of a company's participation.
- Publish a prospectus describing the proposed center, company members, center policies, research areas specific projects, budgets, and include faculty and prospective Center Director CVs.
- Convene one or more organizational planning conferences for industry to recruit members and flesh out the strategic research plan.
- Recruit nine-to-ten members at $300,000 or more in annual fees.

- At this meeting obtain formal letters of intent from the industrial participants.
- Finalize the proposed research plan.
- Identify a center evaluator within the university.
- Submit an operations proposal to NSF or other government agency.

NEXT STEPS

By the time an operations proposal is submitted, there should be enough momentum built during preparations and development to sustain energy for the center during the proposal review period. A positive prudence in scheduling meetings and making center commitments in advance of an award is advised.

Following notification of a center operating grant award, final preparations for the center should be made. The Industrial Advisory Board (IAB) should convene at an initial meeting to get the research program underway. The Center Director should finalize administrative arrangements, contracts, official bylaws, membership agreements, etc., with the university and the member companies. An evaluator should begin to carry out his/her duties.

The Center Director and colleagues must now lead and manage an I/UCRC successfully. The remainder of this book covers this and more.

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APPENDIX 2-1

Checklist for Organizing an On-Campus Symposium for Industry (from Shumacher, 1992, pp. 192)

- Decide who is going to be responsible for organizing and hosting the symposium
- Decide on program objectives; rough out program
- Select convenient (for both academics and corporate people) date that is far enough in advance (preferably at least 6 months)
- Obtain commitments from presenters and introducers
- Reserve meeting rooms and audiovisual equipment
- Write program brochure and registration form; order printing
- Identify corporate representatives to be invited
- Send preliminary, individual letter of invitation (including program date) to corporate invitees
- Send preliminary notice to invited faculty
- Identify academic administrators to be invited; get dates on their calendars; send them confirming memos
- Send program brochure and registration form to corporate representatives
- Arrange meals, reception
- Order name tags, handouts, folders and such
- Follow up with corporate invitees by means of phone calls
- Conduct dress rehearsal

APPENDIX 2-2

Project Proposal or Progress Report Form

Program Name: New:_____

Program Manager: Continuation:_____

Description:	
Experimental Plan:	
Related Work Elsewhere:	How Ours Is Different:
Related Work In:	Milestones:
Deliverables:	Budget:
Potential Member Company Benefits:	
Economics:	
Progress to Date:	
Knowledge Transfer Target Date:	

APPENDIX 2-3

Directions and Sample LIFE Form

Level of Interest Feedback Evaluation (LIFE)

An important objective of an NSF/I/UCRC semi-annual Industrial Advisory Board meeting is to facilitate scientific discussion about center research projects among faculty, students and industrial members.

LIFE forms hold the potential for stimulating project relevant discussion.

- One of these forms is filled out by each IAB voting member during the five to ten minute period set aside for this purpose following each project progress report or new project proposal.
- The form, which includes instructions, can be produced by any commercial printer. It is usually printed on no carbon required (NCR) paper. The white sheet is for the Director, the yellow sheet is for the researcher, and the pink for the IAB member to retain. (See Appendix 2-4.)
- The Evaluator and the NSF Program Officer collect the forms and make the yellow copy available immediately to the faculty in time for them to discuss comments with members during coffee breaks, lunch, and poster sessions.
- Following the poster sessions and any discussions with the researchers, IAB members may modify their forms and give the revised copy to the Evaluator.
- Based on the final comments, faculty prepare a single flip chart size page or view graph with brief, highlighted statements of the comments they wish to respond to and the responses.
- These sheets or a view graph showing the Level of Interest and Comments for each project are then used as a basis for discussion during the Executive Session of the Industrial Advisory Board.
- They also provide a basis for further IAB faculty discussions during the IAB/Faculty debriefing session. This procedure can help foster scientific discussion and exchange of expertise among Center participants.

With some analysis by the Evaluator, LIFE forms also hold the potential of contributing to the Director's project management

system and of alerting the Director to those members whose rankings of Level of Interest and Comments signal possible dissatisfaction with Center activities.

When presenting the results for discussion, list project titles and researcher names along the X axis and VHI, I, IWC, NI and ABS Levels of Interest along the Y axis. Post the LIFE Level of Interest data from each LIFE form. Projects and researchers with a third or more votes in the combined IWC, NI, ABS score should be looked at very carefully. They could be entering the "endangered species" area. Director and researchers need to be informed so that discussions can take place and, if appropriate, corrective action taken.

Some Centers also prepare a second matrix listing the company member names along the X axis and the Levels of Interest along the Y axis. This information is prepared for the Director especially. Once again the rule of thumb, to be adjusted by your Center experience, is that a company with a third or more of its votes as IWC, NI, and ABS could become a candidate for withdrawal from the Center and thus should receive special attention.

The use of the LIFE form and process enables the IAB and the Director to gain a sense of the priorities of the research which is being proposed and thus assists the Center in making final selections of research for funding. This process has a great deal of power. Use it carefully.

Oral and/or Written Instructions for use of the LIFE form:

To facilitate scientific and technical interaction between center faculty and Industrial Member Representatives, each company represented is requested to rank each presentation on the LIFE form as follows: Very Interested, Interested, Interested with Changes, No Interest and Abstain (i.e., not qualified to comment). The level of interest checked should reflect the opinion of the company and not a personal interest).

Comments should include: suggested changes, quality of research, scientific merit, innovative nature of the research, industrial relevance, level of effort, (progress since last report for previously funded projects), offers of help, (relevance to Center long range plans, technology road maps, Center research thrusts/objectives, etc.) and other suggestions that might relate in a timely way.

Your completed LIFE forms will be picked up immediately after each research presentation. Please keep the pink sheets for your records.

APPENDIX 2-4

Level of Interest Feedback Evaluation Form (LIFE Form)

(Courtesy Emission Reduction Research Center, NJIT)

Project Title:

Research Leader:

To facilitate scientific and technical interaction between Center Faculty and Industrial Member Representatives, 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

Relevance to Company:

|_____|_____|_____|
High Moderate Some None

Comments: (include precompetitive suggestions/ applications/ Industry benefits, suggested changes, quality of research, scientific merit, innovations of research, industrial relevance, level of effort, progress since last report, offers of help, etc.)

_____
_____
_____
_____

Your completed LIFE forms will be picked up immediately after each research presentation. Please keep the pink sheets for your records.

Name: _____ Company: _____
(Please print) (Please print)

Date: _____

APPENDIX 2-5

Guide for Research Discussion Sessions

Instructions to Discussion Leader:

These questions may help stimulate and structure the discussion in your workshop. Please add or subtract to this list as you see fit. Someone in your area should be responsible for taking notes.

SUGGESTED QUESTIONS:

1. Are there any general observations about the nature and direction of the research proposed in presentations in this area?
2. Does anyone have any suggestions for ways in which the projects might be improved, accelerated or made more relevant to industrial needs?
3. Does anyone see any major obstacles or barriers to conducting these studies that we may not have anticipated?
4. Are there information, people or new technology relevant to these projects that you think we should tap?
5. Are there important problems, questions, or issues for your firm or for the industry in this area that we should be tackling but aren't? What are they? How many other participants are interested in these issues?

APPENDIX 2-6

I/UCRC Organization Feedback Form

NAME: _____

COMPANY_____

In order to finalize the structure, policies and scientific program for X university's I/UCRC, we need your input. In the space provided below, please indicate any questions or concerns you have about the following issues.

A. The organizational structure, general policies and bylaws, patent policies, publication policies, membership fee and scientific program.

B. Any other information that will be needed by your firm before it can arrive at a decision on membership.

C. It would be helpful to know your personal evaluation of the proposed center. What recommendation will you make to your firm about joining center? (Please check one.)

_____ JOIN CENTER

_____ MEMBERSHIP DECISION NEEDS FURTHER INVESTIGATION

_____ DON'T JOIN CENTER

APPENDIX 2-7

Debriefing an I/UCRC Research Planning Meeting for a New Center

1. Are all of the projects presented consistent with the center's stated technical mission and boundaries?
2. *If not*, which ones are not consistent?
    a. Can the mission statement be broadened to accommodate these projects?
    b. *If yes*, is the mission statement still coherent?
    c. What are the pros and cons of making this change? (e.g., what industries/ firms would be interested in this broadened mission?)
3. Are there any obvious holes or redundancies in the technical "menu" reflected by the proposed projects when compared to the center's mission?
    a. *If yes*, what are they?
    b. Can investigators and projects be found to fill these holes?
    c. Can and should some projects be merged to avoid redundancies?
    d. Where and how? (both b and c.)
4. Can the center's research menu be logically grouped into major research areas or thrusts?
    a. *If yes*, what are they? (name and provide statements of goals and objectives.)
    b. Are all of the areas well represented?
    c. Do these areas/thrusts seem for form a coherent whole and are they complementary (show how areas might provide synergy or intersect)?
    d. *If not*, what areas should or could be dropped?
5. Is the center's mission and research program too broad given the available resources?
    a. *If yes*, can it be narrowed to provide a tighter and more focused program?
    b. *If no*, can resources (people) be added to provide better coverage?
6. Were project presentations (and hard copy) consistent with the format and detail needed for a formal presentation to industry representatives?
    a. *If not*, how and when will this be accomplished?
7. Can presentations and mission statements be translated into statements of industrially-relevant needs, problems and concerns?

APPENDIX 2-8
List of I/UCRCs 1996-1997

Status	Year Funded	Center	Academic Affiliation
6 Years or Older	1981	Center for Applied Polymer Research	Case Western Reserve University
	1982	Center for Advanced Computing and Communication	North Carolina State Univ./Duke Univ.
		Center for Ceramic Research	Rutgers University
		Center for Materials Handling/Logistics	Georgia Institute of Technology/ Univ. of Arkansas
		Center for Dielectric Studies	The Pennsylvania State University
		Center for Advanced Steel Processing and Products Research	Colorado School of Mines
	1984	Center for Process Analytical Chemistry	University of Washington
		Hazardous Substance Management Research Center	NJ Inst. of Technology/Princeton U./ Rutgers U./Stevens Inst. Of Tech./ Tufts U./ Univ. Of Medicine and Dentistry of NJ
		Center for Optoelectronic Devices, Interconnects, and Packaging	University of Arizona/University of Maryland
		Surface Engineering and Tribology	Northwestern Univ./Georgia Inst. of Technology
		Center for Microcontamination Control	University of Arizona
		Center for Electromagnetics Research	Northeastern University
		Center for Chemical Process Modeling and Control	Lehigh University
	1985	Center for Iron and Steelmaking Research	Carnegie Mellon University
		Center for Innovation Management Studies	Lehigh University
		Center for Advanced Electronic Materials, Devices and Systems	University of Texas at Arlington/ Texas A&M
		Center for Measurement and Control Engineering	University of Tennessee
		Center for Nondestructive Evaluation	Iowa State University
	1986	Center for Web Handling	Oklahoma State University
		Center for Glass Research	Alfred University/University of Missouri Rolla
		Center for Energetic Materials	New Mexico Institute of Mining and Technology
		Center for Software Engineering	Univ. of Florida/Purdue Univ./Univ. of Oregon
		Center for Sensors and Actuators	University of California, Berkeley

Status	Year Funded	Center	Academic Affiliation
6 Years or Older (cont.)	1987	Center for Virtual Simulation Proving Ground: Mechanical and Electromechanical Systems	University of Iowa/Univ. of Texas at Austin
		Center for Aseptic Processing and Packing Studies	North Carolina State U./Univ. of California at Davis
	1988	Center for Biological Surface Science	SUNY at Buffalo/Univ. of Memphis/NY State College of Ceramics
	1989	Center for Micro-Engineered Materials	University of New Mexico
		Center for Ultra-High Speed Integrated Circuits and Systems	Univ. of California at San Diego
		Center for Analog/Digital Integrated Circuits	Washington State U./Univ. of Washington/Oregon State Univ./SUNY at Stony Brook
	1990	Center for Advanced Air Conditioning and Refrigeration	University of Illinois, Urbana
		Center for Grinding Research	University of Connecticut
		Center for Dimensional Measurement and Control in Manufacturing	University of Michigan, Ann Arbor
3 to 6 Year-Olds	1991	Center for Coatings Research	Eastern Michigan/North Dakota State Univ.
		Center for Nanostructural Materials Research	University of North Texas
	1992	Center for Separations Using Thin Films	University of Colorado at Boulder
		Center for Polymer Interfaces	Lehigh University
		Center for Integrated Pest Management	North Carolina State University
		Center for Wireless Information Networks	Rutgers University
		Center for Advanced Communications	Villanova University
		Center for Building Performance and Diagnostics	Carnegie-Mellon University
		Center for Health Management	Arizona State University
	1993	Center for Corrosion in Multiphase Systems	The Ohio State University
	1994	Center for Machine-Tool Systems	University of Illinois
		Center for Polymer Biodegradation	University of Massachusetts
		Center for Emission Reduction Research	NJ Institute of Technology/Penn State Univ./Massachusetts Inst. Of Technology/ Ohio State Univ.
		Center for Ocean Technology	University of Rhode Island
		Center for Composite Design	Stanford University
		Center for Advanced Control of Energy and Power Systems	Arizona State Univ./Colorado School of Mines/Purdue Univ.

Status	Year Funded	Center	Academic Affiliation
2 Years or Less	1995	Center for Advanced Manufacturing and Packaging of Microwave, Optical and Digital Electronics	Univ. of Colorado
		Center in Ergonomics	Texas A&M
		Center for Pharmaceutical Processing Research	Purdue University
		Center for Particulate Matters	The Pennsylvania State University
	1996	Center for Power System Engineering	Cornell University/Univ. of California at Berkeley/Univ. of Illinois/Univ. of Wisconsin at Madison
		Center for Management of Information	University of Arizona
New	1997	Center for Quality and Reliability Engineering	Rutgers University/Arizona State University
		Center for Advanced Polymer and Composite Engineering	Ohio State
		Center for the Built Environment	University of California, Berkeley
		Center for Wireless Electromagnetic Compact Compatibility	University of Oklahoma
		Center for Management of Information	University of Arizona

APPENDIX 2-9

Information Flow for New Research Missions, Themes, Projects

(Courtesy Center for Wireless Information Networks, Rutgers University)