

# IMPLEMENTING THE COOPERATIVE RESEARCH PROGRAM

C H A P T E R

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## INTRODUCTION

A plan is merely words. In order to have any impact, words must be translated into deeds. This involves implementation. Implementing a center's research involves project development project review, evaluation and selection; and project management. In contrast to planning activities described in Chapter 5, many of the implementation activities described in this chapter occur regularly, in a relatively set order and by established procedures.

In many industrial settings implementation means assigning people and resources to carry out projects defined and prioritized in a highly detailed strategic plan. Centers can't work that way. Implementation in an I/UCRC involves identifying, informing, and motivating talented, unobligated researchers to develop and submit high-quality research proposals. It also requires decision-making processes that allow marketplace competitors to reach consensus on a research program. We discuss these and related issues in this chapter. Since planning and implementing the research program are so closely intertwined, readers are encouraged to also read Chapter 5.

## Recruiting Colleagues: Soliciting Proposals

The first step in implementing a center's research plan is soliciting from faculty a manageable number of high quality, member-relevant proposals to review. Strategies to solicit proposals vary (see Figure 6-1).

Solicitation can be targeted at specific individuals, usually based on their reputation, previous track record, or prior working relationships with the individual, or it can be open, in which case anyone from a defined population (e.g., all Electrical Engineering and Computer Science faculty) will be offered an opportunity to develop a proposal.

Second, the approach itself can be a personal phone call or a formal letter and request for proposal (RFP). The personal approach

**Figure 6-1** Advantages and disadvantages of proposal solicitation strategies

Dimension	Option	Advantage	Disadvantage
<b>Focus</b>	<i>Targeted solicitation</i>	<ul style="list-style-type: none"> <li>■ Concentrate on proven reputations</li> <li>■ High percentage positive contact</li> </ul>	<ul style="list-style-type: none"> <li>■ Miss people outside network</li> <li>■ Center perceived as closed club</li> </ul>
	<i>Open</i>	<ul style="list-style-type: none"> <li>■ Efficient</li> <li>■ Keeps door open</li> <li>■ Encourages new blood</li> </ul>	<ul style="list-style-type: none"> <li>■ Shotgun approach</li> <li>■ Quality can vary</li> <li>■ Must screen</li> </ul>
<b>Approach</b>	<i>Personal</i>	<ul style="list-style-type: none"> <li>■ Interactive</li> <li>■ Allows persuasion</li> </ul>	<ul style="list-style-type: none"> <li>■ Time-consuming</li> <li>■ Message can get garbled</li> </ul>
	<i>Formal RFP</i>	<ul style="list-style-type: none"> <li>■ Information communicated accurately</li> </ul>	<ul style="list-style-type: none"> <li>■ May be ignored</li> </ul>
<b>Scope</b>	<i>Narrowed to one faculty community</i>	<ul style="list-style-type: none"> <li>■ Reinforces local commitment</li> <li>■ Money stays close to home</li> </ul>	<ul style="list-style-type: none"> <li>■ May not meet IAB member needs</li> </ul>
	<i>Broaden to outside</i>	<ul style="list-style-type: none"> <li>■ Diverse perspectives</li> <li>■ Enhanced ability to meet IAB member needs</li> <li>■ Creates opportunities for multi-university center</li> </ul>	<ul style="list-style-type: none"> <li>■ Money goes off campus</li> <li>■ Local faculty may get discouraged</li> </ul>

allows some preliminary discussion of research ideas, while formal written RFPs may be ignored.

Since talented and creative faculty and graduate students are the life blood of a center, and since all of these options have their advantages and disadvantages (see Figure 6-1), we advocate an eclectic approach. Center Directors and IAB members need to personally solicit proposals from the best and the brightest. This is best accomplished by targeting and directly contacting, and sometimes working with, faculty who possess specific interests or expertise. On the other hand, centers also need to send a message that they welcome new ideas and researchers. This is most easily accomplished by posting and circulating formal announcements and RFPs to relevant departments and individuals.

Directors should solicit proposals from all relevant departments on their campus. As a center matures it should consider targeted and even open solicitation at other institutions. This becomes a practical necessity if a center is unable to meet its members' needs on its own campus. While such arrangements sometimes raise the ire of local administrators, they often have led to multi-university arrangements which have produced a bigger pie. At least one I/UCRC has taken this approach and become a virtual center which accepts proposals from around the country (see Figure 6-2).

**Figure 6-2** Center for Innovation Management Studies (CIMS)—A Center Without Walls.

CIMS is an I/UCRC located at Lehigh University. It is devoted to the study of the management of technological innovation and its focus is on management disciplines rather than science or engineering disciplines. Like other I/UCRCs, CIMS is supported by a consortium of members. However, since its inception, CIMS has operated as a 'virtual center' soliciting and supporting proposals from investigators

(faculty and graduate students) from across the country. Over the past 12 years, CIMS has funded 75 projects at 40 different universities and 12 institutes. Most projects are relatively small (under \$20,000 per year) and require investigators to make a presentation of results at semi-annual research reviews. Investigators and their home institutions must agree to abide by all CIMS policies.

### The Request For Proposal (RFP)

A formal written RFP is a very efficient way to communicate information. An RFP can be a letter or a flyer, and should include center name, contact person, deadline, where to send proposals, the type of proposals being requested, budget guidelines or restric-

tions, timeline and mechanism for review, and expectations of personal presentations to a review group. The RFP package should detail I/UCRC needs and priorities.

### Needs/Priorities

Your ability to enlighten prospective researchers about center needs and priorities depends upon the center's investment in its planning process (see Figure 6-3). A center that has produced planning products that accurately reflect IAB members needs will be in a better position to inform.

### Proposal Format

The RFP in a center should call for three to four pages written in clear language following a specified format (Appendix 6-1). Respondents should follow a standard executive summary form, organized into sections with white space for a brief response (see Appendix 2-2). These guidelines can be modified for a preliminary concept paper or pre-proposal.

RFP selection criteria should be specified. For example, relative amounts can be assigned to proposal themes:

- Relevance to industrial needs and priorities—40 percent.
- Clear and workable methodology and work plan—20 percent.
- Potential deliverables and products—10 percent.
- Contribution to scientific understanding—20 percent.
- Qualifications of the research team—10 percent.

**Figure 6-3** Information provided by planning products.

<b>Product</b>	<b>Information</b>
Center Name	Research related to center name
Vision and Mission Statement	Research mission boundaries
Themes or Programs Defined	All of above, plus high and low-priority themes
Goals and Objectives	All of above, plus topics and goals
Roadmap	All of above, plus specific technical obstacles to be overcome or requirements to be met

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## DEVELOPING VIRTUAL RESEARCH TEAMS

Formal planning and its by-products (e.g., mission statements) can and should be used to inform would-be proposers. However, centers should not rely completely on formal planning because needs and priorities change rapidly. Members sometimes are reluctant to disclose them in public, and a consensus-based planning process may suppress unpopular views. Further, it would be a mistake to assume that a two-year old statement of goals and objectives, no matter how well conceived, necessarily reflects current needs and priorities of IAB members.

Thus, the Center Director can and should compensate for the shortcomings inherent in formal planning products by constantly updating these products or informally briefing faculty based on real-time reconnaissance. Comments and feedback disclosed during the proposal review process provide a rich source of current needs and priorities. However, directors cannot fulfill this role on their own. Faculty also must shoulder the responsibility.

Center proposals and projects should represent the work of virtual industry-university teams. One strategy for achieving this goal involves encouraging and facilitating direct one-on-one interaction between proposers and IAB members perhaps as early as the idea generation phase of new proposals. Unfortunately, because of past experiences many faculty believe they are supposed to develop a research proposal in a hermetically-sealed room with no feedback. Such an approach is anathema in a cooperative research center. Directors can use a number of techniques to avoid this.

- **Consultation.** Faculty can be encouraged or required to consult with at least one IAB member before submitting a proposal. Some centers designate IAB mentors for certain themes or topics. Other centers schedule informal pre-proposal meetings to encourage a collaborative process.
- **Pre-Proposals.** Short informal pre-proposals are an efficient way to test, circulate, and get feedback on ideas. A center may request, usually in the form of a letter, a one-page concept paper or pre-proposal. This is a good way to quickly surface new ideas from investigators. A pre-proposal that doesn't garner at least one champion is a poor bet. Conversely, pre-proposals may spark interest among a few industrial participants and lead to full-fledged proposals. Poster sessions can also be used for this purpose.

- **Industry Initiated Proposals.** Centers should allow and even encourage industry to submit proposals for projects they would like faculty to pursue.

## Motivation

How can a center motivate faculty to follow through and develop proposals? Personal solicitation, opportunities for quick and early feedback on ideas, and minimal proposal documentation should all help motivate proposers. The strongest motivation must be the center concept itself.

It has been suggested that closer university-industry ties may result in faculty being coerced into doing research they would otherwise shun (e.g., Brooks, 1993), but the truth is that faculty are diverse and are not easily coerced. Some faculty are totally curiosity-driven. They get a great deal of satisfaction out of solving theoretical puzzles, enjoy following a question wherever it leads, and typically like to work solo. Other faculty like solving or contributing to the solution of real problems. They respond to a larger mission, are willing to reshape their personal interests in pursuit of a challenging problem, and relish the idea that their work will be put to use. Many enjoy the give and take involved in team research. Thus, some faculty will gravitate toward or away from your center.

The most important thing you can do to motivate appropriate faculty is to create a setting that is ripe with interesting and challenging problems that reinforce problem-driven but theoretical informed research, possesses ample resources, and encourages collaboration and teamwork. Experience shows, if you build it, they will come.

## Summary

Good, high quality proposals are the life blood of a center. Centers lacking them must re-evaluate information provided by their formal and informal planning products, ability to communicate this information, nature of solicitation efforts, and organizational culture regarding teamwork.

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## REVIEW, EVALUATION, AND SELECTION

The overarching goal of the review, evaluation, and selection stage should be to reach an agreement, hopefully a consensus, about

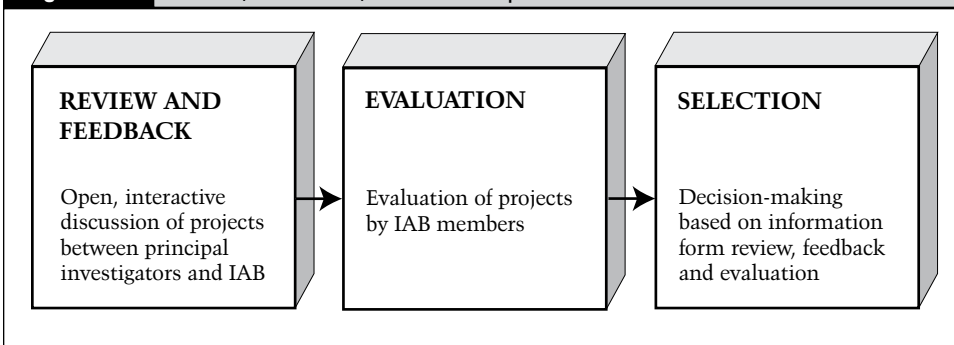
allocating resources to research projects. This is undoubtedly the most critical and organizationally challenging stage of the implementation process.

This stage is critical for several reasons. First, this is the point at which members find out if they are in a workable partnership. Review, evaluation, and selection transactions help answer questions like: Will my advice and counsel be heeded by the university? Do the interests of other members converge enough with mine that I will realize the benefits of financial leveraging and technical synergy?

Review, evaluation and selection, if managed correctly, provides a wealth of information about current and future needs and priorities. Information obtained can help keep a center's research relevant. Most important, a center's plans or intentions become reality. Dollars are allocated to projects. The value and success of projects selected during these steps will ultimately determine the success of the center.

Unfortunately, for review, evaluation, and selection to be effective, it is necessary to meet the needs of a diverse group of stakeholders and to conduct constant communication, feedback, and decision-making within a one or two-day time frames. The semi-annual meeting is discussed in more detail in Chapter 7. Because the stakes are so high and the social and interpersonal dynamics so complex, a relatively structured decision-making process is advised. Review, evaluation, and selection are discrete steps (see Figure 6-4) in what should be a sequential decision-making process. Specifically, review provides an opportunity for interactive feedback between proposers and members; evaluation provides an opportunity for members to share their observations with each

**Figure 6-4** Review, evaluation, and selection process.



other (and hopefully begin to achieve a consensus); and selection involves making decisions about allocating limited resources to projects. Since each step in this process serves a different purpose and requires different conditions, we will discuss each separately.

## **Project Review and Feedback**

The review process should promote candid interactive communication and feedback between individual investigators, IAB members, and other stakeholders. Most of the exchanges will tend to be along paired opposite groupings—between individual faculty and IAB members. Faculty will want an opportunity to communicate ideas and plans, and respond to questions and concerns. Industry, to ensure industrial relevance, will want an opportunity to seek clarification and resolve questions and concerns. The following format has been used extensively within the I/UCRC program and have proven very successful:

- Distribute written proposals in a timely fashion. Nothing irritates IAB members more than to be asked to review and prioritize proposals they haven't had sufficient time to read. Centers should distribute new proposals two to three weeks prior to the semi-annual meeting.
- Schedule oral presentations at semi-annual meetings. Oral presentations are an effective way to promote two-way communication between investigators and IAB members. Faculty and especially graduate students should be encouraged to practice presentations.
- Communicate and enforce time allotments. Since members have already read the written proposals, these sessions should be short, 15- to 20-minute overviews and audience questions. Directors or their designate should monitor sessions to ensure they keep to the time allotted.
- Reinforce planning products. Center-developed planning products (e.g., thrust areas, objectives) are reinforced by the way you group presentations or by investigators referencing them in presentations.
- Get written feedback. Use the LIFE Form. As we discussed earlier, many people are uncomfortable in groups. As a consequence, it's critical that each IAB member is asked to complete a rating form on each project. Members should be told that the purpose of these ratings is to provide feedback (not for

selection). Many I/UCRCs use a LIFE form (Level of Interest and Feedback) for this purpose. It is a relatively simple form which includes a single rating scale (interested, interested with change, not interested) and two or three open-ended questions. Setting aside time to complete this form after each presentation (and prompting same) is an effective way of ensuring a high response rate and timely feedback. Instructions and sample forms are presented in Appendices 2-3 and 2-4.

- Share copies of LIFE forms immediately with researchers so they can respond to IAB concerns. Some I/UCRCs facilitate feedback by using multi-copy carbon forms.
- Provide ample opportunity for informal interactions between researchers and IAB members. It's important that sufficient breaks, poster sessions, cocktail hours, and dinners be included on the meeting agenda to permit informal discussions and mutual lobbying activities.

## Evaluation

The evaluation process should facilitate consensus within the IAB about the quality and relevance of individual projects. In order to achieve this goal, one must promote candid, interactive (multi-party) exchange of information and opinions. Sometimes the ratings provided during review are so clear-cut, Center Directors are tempted to skip formal evaluation. This is a mistake! If handled correctly, the processes that occur during this stage should allow members to gain a sense of where each other is coming from and also provide the Center Director with a veritable gold mine of information about current and future member needs, desires and priorities. These inputs constitute high-quality, real-time reconnaissance. As we have discussed elsewhere, they can and should be used to shape the center's emergent plan.

This kind of evaluation requires a group format and facilitator. The following procedures have proven very successful in the I/UCRC program.

Procedures for evaluating proposals:

- Summarize and share LIFE feedback. Someone, often the evaluator, should take responsibility for producing a hard copy summary (newsprint or handouts), aggregating ratings (simple frequency counts) and transcribing open-ended comments on each project. The process has also been automated

(see Figure 6-5). The summary should list the total budget requested for each project. IAB members should be given an opportunity to review the ratings and comments for each project.

- Reinforce the center's plan. There's no reason to have a plan if it isn't used when you're preparing for project prioritization and resource allocation decisions. This is particularly true if you've invested time and energy in soliciting proposals and PIs based on your plan! As a consequence, this is as good a time as any to refer the members back to your center's mission, goals, thrust areas, etc.
- Select a discussion leader. Someone must act as the discussion leader during the project evaluations, probably the Center Director. However, evaluators and IAB chair people have also filled this role. The Center Director should leave the room when his or her own project is evaluated to avoid conflict of interest.
- Promote a thorough discussion of each project. The facilitator ensures evaluation not selection takes place and encourages discussion of the merits and shortcoming of each project. One tactic is to recite comments, questions, and concerns from the transcribed LIFE forms and invite clarification and discussion from the IAB. Another tactic is to ask: "What makes this project so 'hot'?" "Why isn't anyone interested in this one?" "How could we improve this project?" The director can comment and provide relevant background information.
- Encourage real-time project revision. Be particularly attentive to IAB requests for project changes. An IAB member vote may

**Figure 6-5**

The Graphic Program for LIFE, and meeting effectiveness data.

The Graphic Program (GP), developed by the evaluation team at Texas A&M University, provides evaluators with pre-formatted data entry spreadsheets which are auto-linked to chart templates. Using the GP evaluators are able to quickly and easily format spreadsheets and graphics, adapting them to their individual center's needs. With the GP, at IAB meetings evaluators can quickly com-

pile LIFE and meeting effectiveness data, and graphically present this data (either on a paper handout, computer projection screen, or transparency-overhead projector), along with previous meeting data, immediately following entry of data. Also included in the GP are MSWord® files containing LIFE and meeting effectiveness survey questionnaire form templates.

be influenced positively if the facilitator declares immediately that the investigator will accommodate them. Obviously, some changes (a merger of two related projects) may require active consultation, extensive revision, or re-submission that cannot be settled immediately.

- Make sure someone takes copious notes. Comments about needs or priorities which don't relate to current projects probably have implications for future projects!

## Selection

Project selection methods discussed in standard textbooks (Martino, 1995) are complex, and highly quantitative and inappropriate for the more informal I/UCRC planning and implementation process.

A center's selection process should meet two fundamental criteria. First, it should provide a process for allocating resources to thrusts and projects in a way that is consistent with the center's formal plan (e.g., goals, objectives) and at the same time is responsive to the center's emergent plan. The foundation for achieving this goal should have been laid in the discussions held during this review and evaluation stage.

In addition, the selection process must meet the strategic and psychological needs of IAB members. For most members, the ability to prioritize research projects and to shape the center's research portfolio is the single most important privilege they get from their annual membership fee. Because it can help create a sense of participation in the center and ownership of the research program, it can have great personal and psychological significance for the IAB member. Experience indicates that an IAB member who doesn't get the opportunity to participate actively and personally in the selection process, will soon lose interest in attending semi-annual meetings, resulting in an inevitable loss of commitment to the center.

### Preliminaries

A few preliminaries to selection must be handled.

**Review financial, staff, and capital resources.** Before the IAB allocates resources to projects, they need budget and resource information. At a minimum, the total amount of funding available for projects, approximately how many projects can be supported, need

for specialized equipment, current project commitments within each research area, and any external factors against committing support should be provided.

**Decide on format.** Some IAB members prefer that no staff is present during selection. This allows them to discuss projects and personnel candidly. On the other hand, experience shows that IABs often need to clarify certain points while they are making their decisions. The IAB should be asked if the Center Director is to sit in on their deliberations or be available. Most I/UCRC centers that go into a closed executive session allow the NSF representative and the evaluator to sit in as observers.

### **Informal Approach: Reaching a Consensus**

When an IAB is small, homogeneous, and cohesive, and project evaluation is relatively clear cut, discussion held during the evaluation stage can approximate the selection discussion. In these cases, often the selection moderator, usually the IAB chairperson, can achieve a consensus by following the steps described below. This approach has the advantage of avoiding conflict within your board.

- Review and revisit LIFE project ratings. Since ratings may have changed because of the evaluation discussion, it's wise to ask if there is interest in revising the LIFE forms.
- Reach decisions on the tail ends of the rating distribution. Generally, there is little debate about the highest rated and the lowest rated projects. The goal of this step is to approve a few of the highest rated projects and to eliminate a few of the lowest rated projects.
- Select among remaining projects. The IAB selects from remaining projects after a brief review of the strengths and weaknesses of each project, including how they fit into the center's plan or complement other projects, and how they meet the needs of specific members. This usually leads to a real-time revision of ratings. Members are asked if the failure to fund a particular project would affect negatively their ability to maintain their membership. One benefit of this approach is it sometimes results in one or several members agreeing to provide enhancement support for projects that fall below the funding threshold. (See section titled *Research Enhancements* in Chapter 11.)

## Structured Approach: Allocating 1,000 Points of Light

If your IAB is large, diverse, not particularly cohesive, or demonstrates significant disagreement during evaluation of various projects, a formal voting or rating procedure to select projects is advised. Projects can be rated, ranked, and approved until there is no more money. However, with most rating systems minority interests are put at a severe disadvantage. Members with interests or needs out of synch with the majority won't have the votes to get funded. In fact, this is one reason for reluctance to join a center<sup>7</sup>. The following weighted voting scheme mitigates this concern.

- Provide voting points. Each member is given the same number of points. The number of points is arbitrary. Some centers give members 1,000 points. Other centers have found that members like the symbolism of getting one point for every \$1,000 of membership support.
- Members allocate points across projects. Members express their priorities by dividing points among top projects. A member may allocate points equally among top projects (e.g., 250 points each). A member who is only interested in two projects might allocate points to two projects (e.g., 500 points each).
- Tally points and select projects. Similar to the procedure described above, support is allocated to the projects with the most points.

This approach is effective in producing a research portfolio everyone can support, but it is only a temporary solution to a board with divergent interests. A center made up of nothing but outliers will not survive very long. A lack of leveraging and a mishmash of projects with little synergy will seal its fate. When using this approach the goal should be to bring outliers into the mainstream or add more members who share similar interest.

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## PROJECT MANAGEMENT: BACK TO THE FUTURE

While it is inappropriate in a chapter on implementation to delve into issues that are strictly management, there are some aspects

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<sup>7</sup>At least one center has avoided this problem by letting new members assign their first year's membership fee to a specific project.

of project management that have implications for planning. As a project unfolds and is implemented, does it remain “true” to the original project proposal and, by extension, to its place in the overall plan of the center? Project management in the context of a university-industry cooperative research center does not have the same meaning that it has in an industrial setting. Teams of faculty and graduate students tend to be autonomous, and at best a Center Director can provide some informal oversight and guidance. This is, of course, supplemented by the project reviews that take place at the periodic IAB meetings, and by special committees that the IAB may establish. Whatever the processes of project management that are in place, the following are the important issues and questions from a planning perspective.

### **Projects and Critical Paths on the Roadmap**

Some projects may be more critical than others. A project addressing a key question may force redrawing the road map and revising planning goals. By the same token, a project yielding positive or revolutionary results may also demand revising the roadmap and plan. As each project moves along to completion the center leadership needs to assess its effect on other projects.

### **Projects, Structure, and Partnerships**

One of the planning issues that often becomes acute during project execution is the need for additional or complementary research capacities. A project or research area outcome may be more satisfactory if the team has access to special equipment or experts. These observations should not be ignored. They have implications for planning strategic partnerships or personnel that the center should develop. A center which is launched from one university may need to evolve into a multi-institutional structure, with greatly enhanced research capacities and industrial participation.

### **Termination of Projects**

One result of project management LIFE evaluations and oversight may be a decision to terminate a project. This is always painful, but should be done when it appears that continuation of an effort will not benefit the program. Sometimes a project is terminated when a key principal investigator or graduate student leaves the university. This has implications for planning to disband this line

of work or to acquire, directly or through partnership, new human resources. A project may be terminated when preliminary results or findings indicate that a line of inquiry is an unpromising blind alley or effort has been lacking<sup>8</sup>. In all cases of project terminations, there will be decisions about how to reinvest resources.

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## SUMMARY AND CONCLUSIONS

In some respects, implementation in an I/UCRC resembles conventional R&D implementation. Decisions should be guided by the by-products (e.g., goals, thrusts) of the planning process. Implementation is approached sequentially: project development; project review, evaluation, and selection; and project management. However, the process deviates from industrial R&D implementation in a number of respects. First, it depends heavily on a Center Director's ability to identify, recruit, and motivate talented researchers. Second, the selection process must produce a viable research portfolio balanced on the needs of market-place competitors. Finally and most important, because soft planning requires short feedback cycles, directors must capitalize on the information gathering opportunities inherent in the implementation process and use this information to make appropriate adjustments in the center's research plan.

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## REFERENCES

- Brooks, H. Research Universities and The Social Contract for Science. In Branscomb, L.M. (Ed.) *Empowering Technology*. Cambridge, MA, MIT Press, 1993, pp.202- 234.
- Martino, J.P. *Research and Development Project Selection*. New York: Wiley 1995.

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<sup>8</sup>NSF/I/UCRCs always ensure graduate student thesis plans are not affected by termination decisions.

## APPENDIX 6-1

### Sample Standard RFP Format

- Investigators name, departmental and institutional affiliation.
- Industry need, problem or theoretical issues.  
Length: half-page maximum.
- Review of Relevant Existing Research. Should be clear and draw from non-academic sources as well as patent literature and member company reports.  
Length: one-page maximum.
- One or two goals and a few attainable objectives should be stated in behavioral, operational terms.  
Length: half-page.
- Work plan organized into research tasks specifying approach and methodology, level-of-effort and expected products and deliverables.  
Length: one to two pages.
- Budget for the project by major categories.
- Relevance to center plan research themes, goals and objectives, and specific IAB member company interests.  
Length: half-page to one page.
- (Specify font size, margins, number of words, an overall page limit, and *curriculum vitae* to be attached.)