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ASSESSMENT OF THE ENGINEERING RESEARCH CENTERS' SELECTION PROCESS

Cross-Disciplinary Engineering Research Committee
Commission on Engineering and Technical Systems
National Research Council (U.S.).

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Summary

The Engineering Research Centers (ERC) program is 3 years old. It has grown rapidly, with 13 centers now established, and the program is at the halfway mark in terms of its planned size. This is the report of an assessment, conducted by the Cross-Disciplinary Engineering Research Committee, of the policies and procedures used by the National Science Foundation (NSF) to review ERC proposals and to select ERCs.

The basic selection process has not changed substantially since the program was founded in 1985. It consists of eight separate review steps and four levels of selection. The key steps are:

- prereview by topic area experts (members of review panels);
- review and sorting by review panels into three categories on the basis of merit;
- review and further selection by a "blue-ribbon" ERC panel;
- site visits;
- oral presentations by principal investigators at institutions selected for site visits; and
- final selection for award.

The committee finds that this basic process is sound, and that it has thus far functioned well. However, the committee makes

several recommendations and suggestions on ways to strengthen specific aspects of the ERC selection process. A number of these are aimed at strengthening the contribution of the ERCs to the nation's economic competitiveness.

To help keep the program focused on cross-disciplinary research and education (a key component of the competitiveness aspect), review panels should be briefed specifically on the nature and purposes of the cross-disciplinary thrust before they begin their reviews. The committee also recommends that proposals be required to describe the *problem* being attacked and to work backward from there to the research approach and team composition.

The excellence of research must be a primary factor in evaluating the ultimate success of an ERC. The quality of the research problem is therefore an important factor in selecting proposals. However, judging the quality of a research problem is different from judging the quality of research to be done on that problem. There should be a way to incorporate within the review process assessments of the economic importance of different areas of research. Admittedly, such assessments are far from infallible, but couched in broad terms they can be useful as input. Accordingly, the NSF should devise a procedure (e.g., an annual workshop) for eliciting from the engineering community assessments of technological growth areas and their corresponding technical barriers, and for providing reviewers with this information.

The committee believes that any research topics identified in the ERC Program Announcement must be clear and specific. The ERCs must be selected on the basis of excellence in research and education with the long-term goal of meeting anticipated national needs. In accomplishing this, the NSF should make sure that its expressed willingness to award more than one ERC per topic area, and more than one ERC per university, is a firm policy. The committee is concerned about indications that pressure is developing to award ERCs on a "pork barrel" basis. The committee recognizes the frustration inherent in making repeated unsuccessful proposals, but urges the academic and political communities to resist the temptation to subvert the selection process in this way. Universities not obtaining an ERC award can use the relationships and momentum gained in preparing the ERC proposal to seek funding from various other sources that are now amenable to cross-disciplinary research. The committee urges the NSF to

resist the external pressure, and to continue emphasizing the research and educational excellence and potential economic impact of proposed centers.

To help reduce the cost of proposal preparation—and thus the number of disappointed applicants—the committee recommends that the NSF consider introducing a brief "preproposal" for making the first cut of ERC proposals. These preproposals should be uniform in format and subjected to a formal review process.

Because institutional and managerial factors have enormous influence in determining the success of an ERC, the committee believes that the ERC panel should focus much more strongly on these aspects of the proposal—not changing their relative weight in the selection, but giving them more specific attention. First, it is essential that there be a critical mass of faculty and students dedicated to advancing the research and education goals of the center. The committee recommends that the proposal evaluation criteria include a requirement for a core of people who are heavily funded through the center and strongly committed to its goals. The ERC panel should be advised to be wary of long lists of lightly funded participants. In addition, the reviewers should scrutinize the proposed mechanism for the allocation of funds and equipment to ensure that the center can function as a cohesive entity, and not simply as a mechanism for distributing funds to the disciplinary departments.

Introduction

BACKGROUND ON THE ERCs

The ERC program was initiated by the NSF in 1985 to provide a focal point in American universities for research and education directed at the needs of technology-intensive U.S. industries. Explicitly cross-disciplinary and systems-oriented, these centers were conceived to be a powerful tool in the battle those industries are waging to regain or maintain their competitiveness in world markets.

Although the ERCs are expected by the NSF to bring about significant change in the "culture" of academic engineering, they certainly are not intended to replace the existing engineering disciplines. Instead, they are expected to link the traditional departments and build on the evolving knowledge bases in the disciplines, yielding rapid growth of knowledge at the interdisciplinary boundaries. Today, it is at these boundaries that many important opportunities for industrial growth are to be found.

PURPOSE OF THE REPORT

The ERC program is 3 years old. Three rounds of awards have been made, and 13 centers are spread across the nation. Dr. Nam Suh, assistant director for engineering at the NSF, has set a

goal of establishing 20 to 25 ERCs in all, with an annual budget approaching $100 million by 1992 (NSF, 1986, p. 4). (Requested fiscal year [FY] 1988 funding for the ERC program is $48 million, or 23 percentage of the overall NSF engineering budget.) Thus the program, although still quite new, is already at the halfway point in terms of its projected size.

Given this rate of growth, the NSF deems it important to ensure that the process for selecting new ERCs is sound, one that will result in centers of the highest quality and representing the optimal distribution of investment across technological areas. Accordingly, the Division of Cross-Disciplinary Research (CDR), which manages the ERC program, asked the Cross-Disciplinary Engineering Research Committee of the National Research Council (NRC) to (a) review the evolution of the ERC selection process and (b) assess the policies and procedures for proposal review and ERC selection. The committee met with the staff of the CDR in March 1987 to discuss these issues.

This is the report of the committee's review and assessment. The next chapter describes the selection process, highlighting modifications that have occurred over time. A subsequent chapter discusses aspects of the process, focusing on points of concern to the committee and presenting recommendations regarding ways to strengthen the selection process and, through it, the centers themselves.

The Selection Process for ERCs

CURRENT PROCESS

Each year a program announcement is prepared and distributed by the NSF. This document provides prospective applicants with a basic description of the ERC program, the evaluation criteria, and the required format for a proposal. Proposals are then prepared by applicant institutions and submitted for review. Interest in the program has been such that a large number of proposals have been submitted each year, of which only 3 to 5 percent can be funded. Because so many of the proposals are excellent, the selection process is both difficult and extensive.

The basic selection process (as used in the FY 1987 selections) involves a considerable number of people. It is a stepwise process, with eight separate reviews and four successive levels of selection, as listed below. ("R" and "S" indicate review and selection steps, respectively.)

1. (R) Each proposal is read by a CDR program director and categorized as to the subject area of the research. The proposals are then sorted into groups.

2. Topic area experts are chosen to review and critique the proposals. These reviewers are then formed into panels that will be responsible for one or more groups of proposals. In 1987 there

were 68 proposals and 60 reviewers, who made up five panels with 8 to 18 proposals per panel.

3. (R) Each proposal is examined in depth by at least three reviewers prior to the panel meeting.

4. (R) The panels convene in Washington, D.C. Panel members first review the other proposals assigned to their group, focusing on the research content and plan.

5. (S) Members of each panel then discuss all the proposals assigned to their group and divide them into three categories: "highly recommended," "recommended," and "not recommended." One of the prereviewers of each proposal is assigned to draft a report on that proposal, which is read to the entire panel for discussion and concurrence.

6. A separate blue-ribbon ERC panel of about 10 members, consisting of people with high-level organizational research responsibilities and covering a wide range of disciplines, is convened in Washington, D.C.

7. (R/S) The reviews and rankings of all proposals are considered by the ERC panel. Each of the highly recommended proposals is read by at least three panel members and discussed in depth. A subset of the institutions making these proposals is then selected to receive a site visit.

8. (R) Site visits are conducted by teams consisting of at least two members of the ERC panel and three to four subject-matter experts. A report is written for submission to the ERC panel.

9. (R) The principal investigator on each proposal from institutions receiving a site visit makes a half-hour oral presentation to the ERC panel and answers questions about the proposed center.

10. (R/S) After further reconsideration of each proposal and the results of each stage of review, the ERC panel recommends a subset of the proposals for award.

11. (R/S) These recommendations are reviewed by top officials of the NSF and, if approved, the final selections are presented to the National Science Board for its approval.

12. Each principal investigator is sent copies of all the reviews for that particular proposal.

EVOLUTIONARY DIFFERENCES

The current (i.e., 1987) selection process just described differs

little from that used for the first round of ERC selections in 1985, as described by ERC Panel Chairman Eric Walker (NRC, 1986a) and summarized in Table 1.

There are two changes in the process itself. First, item 3 in the preceding list is a new feature. This prereview was introduced to permit a more in-depth examination and to allow the review panels to spend more of their meeting time in group discussions of the proposals. Second, as of 1987 there is no limit placed on funds for the site visits. The ERC panel can designate as many proposals as it wishes for this level of review. (The number of site visits has typically been three to four times the number of ERCs ultimately awarded.)

A number of changes have also been made to the program announcement for ERCs, with a view to helping institutions prepare proposals that highlight more clearly the key features of interest to the NSF. Changes in *format* are one type of change. Beginning with the second announcement (FY 1986), a 3-page executive summary was required; the research plan was limited to 25 pages (now 20); and out-year budgets were required to show increments above the preceding year.

A second type of change in the announcement relates to the specification of potential *topics* for ERCs. This has been a somewhat sensitive matter, as the NSF has not wanted, by suggesting topics, to discourage novel ideas. As it happened, responses to the first-year announcement were grouped exactly in accordance with the topics listed there, so the listing did not appear in the second and third announcements. Yet now, with roughly half the expected number of ERCs in place, the NSF wants to ensure that the final configuration of centers covers an appropriate range of research areas relevant to industrial competitiveness (see NRC, 1985). Therefore, the FY 1988 program announcement suggests a number of potential topics that complement the established centers.

Finally, some wording changes have been made to the program announcement. One set of these changes was intended to clarify for those writing proposals the nature of the *systems aspects* of cross-disciplinary engineering research (NRC, 1985, 1986b). The addition in FY 1987 of a requirement to specify the importance of the proposed center to *international competitiveness* highlighted the increased weight this factor is being given in the evaluation of proposals. A new requirement that the proposal describe *key*

TABLE 1 Summary of the First-Year ERC Selection Process

Step 1: Preliminary Peer Review

Several panels of topic-area experts reviewed the 142 proposals, focusing on research content and plan. They divided the proposals into "highly recommended," "recommended," and "not recommended" categories (40 were "highly recommended").

Step 2: Select Candidates for Site Visits

Conducted by a blue-ribbon ERC panel with 14 members (10 from industry).

The ERC panel applied the NSF's criteria: (a) true cross-disciplinary research and team composition, (b) provisions for undergraduate/graduate education involvement, (c) pursuit of fundamental knowledge in areas critical to U.S. industrial competitiveness, (d) provision for participation in research by industry and government researchers. The panel also emphasised the likely quality of the research, the likelihood of meeting stated objectives, and the relevance of the goals and objectives of the ERC program.

The panel assigned "yes," "no," or "maybe" to the 40 highly recommended proposals. Fourteen "yes" proposals were selected for site visits.

Step 3: Conduct Site Visits

Teams of five to seven people (NSF staff, ERC panel members, and subject-matter expert consultants) visited the schools. They focused mainly on organisational/management and educational aspects of the center, university commitment, and budget.

Step 4: Presentations by Principal Investigators

The 14 principal investigators were invited to meet with the panel to give an oral presentation on their proposed center and to answer questions from the panel.

Step 5: Select Awardees

At this stage, the panel attempted to judge overall excellence, and to ask the following questions: Will the center make a difference? and How strong is the commitment by the university and by industry?

Six finalists were selected, along with three runners-up in ranked order.

SOURCE: NRC (1986a).

technical issues **blocking advances in the area and the proposed research plan for dealing with those issues was intended to elicit a more focused research plan. Finally, a requirement that proposals include *information on promotion and tenure practices* with regard to faculty pursuing cross-disciplinary research is intended to make this issue more visible.**

Assessment of the Process

In its assessment of the proposal review and selection process for ERCs, the committee was impressed by the excellent job that the NSF's Cross-Disciplinary Research Division has done in establishing and rapidly expanding this program during a short period of time. Many features of the ERC program are virtually unique in academic research and education. In addition, with its bold thrust in support of the nation's industrial competitiveness, the program has sparked considerable controversy within the engineering community. Yet the ERC program shows every sign of living up to its promise and succeeding, not only as a program, but also as an idea. The strength of the program is a tribute to the vision, effort, and organizational skill of those within the NSF who have devoted themselves to the success of this very important and inherently risky initiative.

From a procedural standpoint, the ERC selection process has thus far functioned well. As described previously, it is a multilayered process with a number of checks and balances, focusing the judgment of several groups of highly qualified reviewers on the proposals received. The basic process is sound. However, at this midpoint in the growth of the program it is appropriate to see whether suggestions can be made to fine-tune and strengthen the

selection process. That is the purpose of this chapter of the report and the following sections.

COMPETITIVE IMPACT OF ERCS

Keeping the Focus on Competitiveness

The desired impact of the ERCs is improved U.S. industrial competitiveness. This was a major driver for the program at its inception, and it remains so today. Each ERC must offer the potential to contribute strongly to knowledge in an area of technology likely to have strong future economic implications. This explicit focus on competitiveness appears to be missing from the deliberations of some review panels. It is, to be sure, difficult to predict what areas will have the greatest competitive implications 5 to 15 years hence; yet the committee believes that there are ways to sharpen this focus.

One way to do this is to ensure that reviewers understand the requirement for cross-disciplinary research at ERCs. A determination has been made at the highest levels of technology management within the U.S. government that cross-disciplinary approaches to engineering research offer the best way to generate the kind of technological advancement that strengthens industrial competitiveness*. Furthermore, a growing number of the engineering community's leaders believe that the intellectual frontiers of engineering demand a focus on cross- or interdisciplinary research and teaching. The ERC program, then, reflects both a societal need and an increasingly dominant idea in the research community.

In selecting reviewers, the NSF has had difficulty finding technically qualified individuals who understand this mandate—many qualified senior people are, by the nature of their experience, not strongly oriented to cross-disciplinary research. Furthermore, with more than 3,000 faculty members represented in ERC proposals in some years, many of those who do have a cross-disciplinary orientation are not eligible to be reviewers.

In the first year of the program, review teams were organized along disciplinary lines; now the teams are cross-disciplinary in

*See NSF budget submission to U.S Congress, approved as part of FY 1985 appropriations process.

makeup, but it is nevertheless difficult for them to judge the cross-disciplinary aspects of proposals. The committee believes that, from a procedural standpoint, one improvement would be to provide additional instruction to reviewers regarding the cross-disciplinary focus of the program.

> RECOMMENDATION: Review panels should be briefed specifically on the nature and purposes of cross-disciplinary research and the reasons why it is emphasized. If this briefing cannot take place before the prereview stage, then printed materials with the same aim should accompany the mailings to prereviewers.

Presentations by Erich Bloch, Roland Schmitt, Nam Suh, and Don Kash in the proceedings of the two ERC symposia hosted by the National Research Council would be excellent choices in this regard (NRC, 1986a, 1987), as would some of the publications produced by existing ERCs.

Another way to reinforce this program goal would be to require a proposal's authors to demonstrate that they are working on a problem that can be best attacked through a cross-disciplinary approach. This would require some reordering of the technical portion of the proposal.

> RECOMMENDATION: In the section of the Program Announcement dealing with proposal format, under "Description of the Research," authors should be required to (a) describe the broad problem they are attacking, then work backward to (b) their proposed research approach and (c) the team composition. The *problem* (defined in broad terms) should drive the center and its work.

Having different academic departments involved in the center necessarily produces some organizational problems for interaction among the units. It is likely that a problem-driven focus will help to alleviate those difficulties. Beyond such practical concerns, the committee believes ensuring that the ERCs are truly cross-disciplinary and problem-driven can be one way to ensure they make major contributions to our industrial competitiveness. However, that aim can be achieved only if the problems chosen afford an opportunity for high-quality research with intellectual depth appropriate for Ph.D. theses and the education of graduates who are capable of creative insights and pathbreaking engineering.

Ensuring Competitive Excellence

Judging the quality of a *problem* is different from judging the quality of the research to be done on a problem. There is often an inevitable trade-off between the overall quality of a proposal and the quality of the proposed topic. A balance must be struck between these two, and hard decisions must be made. If investment in the ERCs is geared ultimately to show a payoff in exports, then an effort should be made to try to divine where the future hot areas in technology-based trade will be.

It would be highly useful to have a framework or a set of agreed-upon criteria for establishing desirable areas of focus and judging proposals in terms of their economic potential—that is, for judging the "quality of the problem." Such a framework will not be easy to develop; indeed, it may be impossible. However, the committee believes that this is an important issue. Thus, as an interim substitute, the committee makes the following recommendation.

> RECOMMENDATION: The NSF should deliberately focus on developing a procedure or process that will permit its annual selection of ERCs to be influenced by predictions of what the key technological growth areas (defined in fairly broad terms) are likely to be. To this end, the Division of Cross-Disciplinary Research could sponsor an annual workshop to identify areas of emerging technological opportunity and the corresponding technical barriers. This annual assessment would provide a firmer basis for specifying topic areas in the Program Announcement. The resulting assessments and forecasts could then be summarized and sent to reviewers in the initial mailing, for use in selecting proposals. Such information might also be useful to CDR in shaping the overall direction of its various programs.

It was mentioned previously that in FY 1988 the NSF resumed listing suggested topics for research. The committee believes that it is reasonable—indeed, useful—to do so. Knowing the NSF's areas of interest simplifies a university's decision about whether to apply. The committee only cautions that the topics listed must be clearly stated and relatively specific. For example, "emerging technologies" and "design and manufacturing" are so broad that

they may attract a number of proposals whose topics have little chance of receiving funding. If selection is to be made partly on the basis of topic area, and if areas are suggested, then fairness demands that proposing groups not be lured into spending time unnecessarily on an extensive proposal effort.

Uncertainties also persist within the academic community about whether the NSF will actually award more than one ERC grant on a given topic, or will permit more than one ERC at a given university. The results of the FY 1988 competition may well allay those concerns. In the meantime, however, some definitive assurance is warranted on both those questions.

> RECOMMENDATION: The NSF should make certain that its expressed willingness to award more than one ERC per topic area, and more than one ERC per university, is a firm policy. Assurances should be issued at symposia and other meetings, and strongly emphasized in the Program Announcement, that this is the case.

On the subject of distribution of ERCs, the committee is highly concerned about indications that pressure is developing for allocating centers on a "pork barrel" basis. A number of universities have now made two or more proposals, and in some cases have received site visits, but have not been granted an ERC. They have become frustrated and disillusioned. One result is that some pressure has developed for distributing the ERCs on a geographic basis.

To the committee's knowledge, no awards to date have been influenced by this political pressure. However, the pressure appears to be building. The NSF is clearly committed to a merit-based allocation process. The committee's concern here, then, is addressed not to the Foundation but to the academic engineering community. To turn the ERC program into a political pork barrel would subvert and degrade the high goals of the program. The committee recognizes the frustration inherent in making repeated unsuccessful proposals, but it urges the academic and political communities to maintain their faith in the system and not to turn the selection process into a political free-for-all.

> RECOMMENDATION TO UNIVERSITIES: Funding for new ERCs is increasingly limited. However, other agencies (e.g., the U.S. Department of Defense, the U.S. Army, and the National Aeronautics and Space Administration) are

now operating center programs that are similar in many ways to the ERC program. Industry has also been stimulated to a greater interest in supporting problem-oriented university research. As of March 1987 there were at least 14 other centers nationwide that began as unsuccessful ERC proposal efforts. The committee recommends that universities put to use the relationships and momentum gained in preparing an unsuccessful ERC proposal to seek funding for cross-disciplinary research from sources other than the NSF.

SUGGESTION TO THE NSF: Continued emphasis must be placed on ensuring that only proposals of high technical excellence focusing on cross-disciplinary issues of potential economic value receive funding. The tendency for disappointed university scientists and engineers to seek funding through congressional intervention must be resisted. An explicit statement could be made in the Program Announcement to the effect that ERC awards will not be determined on the basis of geographic location. To the extent that additional clarity can be established concerning topical research areas of interest, the ERC program will benefit—specifically, there will be fewer disappointed proposers. Every effort should be made to ensure that those who serve as proposal reviewers represent not only the highest technical competence but also diversity in terms of academic discipline and geographic location.The Cross-Disciplinary Engineering Research Committee views these pressures toward pork-barrel allocations as a very serious matter. To date this pressure has been minor, but the research community needs to guard against this trend.

There have been repeated suggestions that the NSF should solicit preproposals for the first-round selection. Many universities have argued that preparing a short abstract of a proposal would not exact the same high cost in resources that an unsuccessful, full-blown ERC proposal does. That cost makes a university reluctant to make repeated proposals, and it is a major factor in the pork-barrel pressure described previously. As it stands, a university has three choices when its proposal is unsuccessful: it can (a) make another costly and time-consuming effort on a new proposal the

following year; (b) submit a slightly revised version of the previous year's proposal; or (c) drop out of the competition.

From the NSF's standpoint, requiring full proposals had two advantages in the first years of the program. First, it permitted the NSF to compare a large number of proposals in detail, and thus to calibrate the selection process for this novel program. Second, it stimulated universities to explore the needs of the nation's industries and to investigate cross-disciplinary approaches to meeting those needs. Given the smaller number of proposals now being submitted each year, the first point is no longer relevant. In addition, given the almost universal interest in the program, the second advantage has already been gained. Thus, the committee makes the following

> SUGGESTION: The NSF should consider new options, such as a preproposal, for making the first cut of ERC proposals. Such a document should be quite brief and should follow a set format. Review at this stage must be rapid to permit those surviving the first cut to prepare a full-blown proposal. However, preproposals ought still to be reviewed comparatively in some formal way, to ensure that worthy applicants are not arbitrarily rejected.

INSTITUTIONAL AND MANAGERIAL FACTORS

The ERC selection process has tended to focus most heavily on the research plan, with perhaps the second level of emphasis being placed on the plan for interacting with industry. There has been relatively little emphasis on the elements of the management plan that govern the relationship of the center to the engineering disciplines, including the distribution of ERC funds. In FY 1987 a requirement was added for information on promotion and tenure practices with regard to faculty involved in cross-disciplinary research. Yet, as was pointed out in an earlier section, NSF cannot readily or realistically include this information in its basis for decision making.

The committee believes that the ERC panel should focus much more strongly on institutional arrangements between the center and the university as a whole. The nature and quality of the research program should, of course, continue to be the most important elements. Yet institutional and managerial factors should draw specific, focused attention.

The ERC Vis-á-Vis the Departments

It has been noted that many ERC proposals are essentially a number of single-investigator-style disciplinary projects grouped together in a cross-disciplinary package (NRC, 1986a, p.53). The review panels may be gaining experience in recognizing this approach. (The fact that the main ERC panel has about a two-thirds retention rate from year to year is a strong point here.) Yet universities may also be getting better at devising the packaging. It can still be difficult to distinguish a truly cross-disciplinary proposal from a "simulated" one. Additional instruction to reviewers, as recommended earlier, should help in this regard.

Typically, the center director and codirectors are spending a substantial percentage of their time on center activities. It is they who coordinate the cross-disciplinary effort, and they are truly involved in the center. The faculty, on the other hand—who might number 30 or more in some centers, and might be supported with an average of only $15,000 per year in ERC funds—are still basically *department* faculty members in the typical center. Fundamentally, many neither identify nor are identified with the center.

The ideal situation would be for a center to have a large fraction of faculty and students who are heavily involved in its cross-disciplinary research and teaching functions. The most significant and long-lasting impact will come when faculty and students have a major portion of their effort, energy, and attention focused on center activities. However, that is not always likely or even possible. Whenever compromises are necessary, the committee believes the emphasis should be on attracting individual faculty and students from a variety of disciplines and involving them in a very major way in the center's activities. Strong participation by a smaller number of faculty and students is more likely to contribute to the center's goals than less participation by a much larger number of individuals.

> RECOMMENDATION: The peer reviewers, and especially the ERC panel, should be advised to be wary of long lists of lightly funded participants in a proposed center. The proposal evaluation criteria should include a requirement that there be a core of people who are heavily funded through the center and who are positioned to drive the ERC strongly. These key individuals should be identified

in the main body of the proposal and their biographical information and qualifications should be highlighted in the appendix describing "center participants."

In this connection it is important to point out the high priority that must be accorded to the educational mission of the ERCs. Most graduate students, and nearly all undergraduates, associated with the centers are pursuing degrees within the traditional departments. But the involvement with ERC research should represent a crucial component of their educational experience that may well set patterns of thought, discipline, and methodology that will determine their effectiveness throughout their careers. For this reason the educational plan of the proposed center is key. In particular, the research to be conducted at the center must show promise of being of a quality and depth that could not be attained through single-investigator research.

It has been said that some ERCs resemble "little NSFs" in that they exist largely as a mechanism to parcel out funds to the traditional disciplinary departments. The committee hopes that this is overstating the case for any existing ERC; yet any tendency in that direction must be avoided. The essence of an ERC is its cross-disciplinary nature, and the use of funds is a powerful indicator and determinant of that quality.

RECOMMENDATION: ERC proposal reviewers should be alert to the "little NSF" syndrome. The mechanism for allocation of funds and equipment, as called for in the Program Announcement, must be clear and detailed and should be carefully scrutinized by the panels. The ERC panel should be prepared to question the center director and others closely on this matter during site visits and oral presentations.

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