United States General Accounting Office

GAO

Report to Congressional Requesters

LM133370

June 1987

NATIONAL SCIENCE FOUNDATION

Problems Found in Decision Process for Awarding Earthquake Center

RESTRICTED — Not to be released outside the General Accounting Office except on the basis of specific approval by the Office of Congressional Relations,

539259 / 133370

GAO/RCED-87-146

GAO

United States
General Accounting Office
Washington, D.C. 20548

Resources, Community, and
Economic Development Division

B-227247

June 24, 1987

The Honorable Pete Wilson
United States Senate

The Honorable Alan Cranston
United States Senate

This report responds to your September 23, 1986, letter in which you request that we assess the National Science Foundation's procedures for awarding a cooperative agreement for an earthquake engineering center. The award was made on September 12, 1986, to the State University of New York at Buffalo in the amount of $5 million a year for a period of up to 5 years, with matching nonfederal funds secured by the awardee.

As arranged with your offices, unless you publicly announce its contents earlier, we plan no further distribution of the report until 30 days from the date of this letter. At that time, we will send copies of the report to the Director, National Science Foundation, and other interested parties. We will also make copies available to others upon request.

The review was performed under the direction of Sarah P. Frazier, Associate Director. Major contributors are listed in appendix IV.

J. Dexter Peach
Assistant Comptroller General

Executive Summary

Purpose

In September 1986 the National Science Foundation (NSF) awarded a $25-million cooperative agreement for an Earthquake Engineering Research Center to the State University of New York at Buffalo over the University of California-Berkeley, after eliminating four other applicants. Senators Pete Wilson and Alan Cranston, believing that there were irregularities and possibly bias in NSF's award decision process, asked GAO to investigate. As agreed with the Senators, GAO examined NSF's evaluation and approval procedures for this particular award decision to determine whether

- the panelists chosen by NSF exhibited favoritism for any proposal,
- the panelists met NSF's selection criteria for reviewers, and
- problems existed with NSF's management of the award process.

Background

Earthquake engineering is the study of the effects of earthquakes and emphasizes engineering and social strategies to prevent or mitigate their damaging effects. Traditionally, NSF has supported research in this area through grants for individual research projects, usually managed by a single university investigator. In fiscal year 1986 NSF used a portion of its earthquake engineering budget to create a research center, which is a larger, more interdisciplinary approach whereby numerous research activities are coordinated and conducted under the aegis of the center.

NSF makes its awards through a competitive process in which proposals are evaluated by an expert panel of external reviewers. The reviewers judge the proposals against stated criteria known to the applicants in advance through a program announcement. On the basis of their evaluations of the proposals, the reviewers recommend an award to that proposal which, in their estimation, best meets the criteria. However, NSF is responsible for oversight of the award process and for making the final award decision.

Results in Brief

Only limited information exists on the panel's evaluation process—GAO interviews with the panelists themselves. This limited information does not indicate that the panel showed favoritism towards a particular proposal. All the panelists gave consistent accounts of the evaluation process. They stated that their deliberations were thorough and the proposals were evaluated on their merits. In addition, panel members' qualifications met NSF's selection criteria for reviewers and seemed appropriate for evaluating proposals for such a center.

GAO did find, however, serious problems in NSF's management of the award process. Although NSF officials followed their internal guidelines in making this award, GAO found that their lack of firm direction over the process as well as their preparation of inadequate and unbalanced documentation made the NSF decision appear suspect. For example, NSF's documentation did not demonstrate how the award decision relates to the criteria in the announcement, and NSF staff did not set firm and clear criteria for receipt of proposers' matching funds—an important requirement of the announcement. Further, reports of the panel's meetings prepared by NSF staff present decidedly positive comments for the New York proposal but almost entirely negative ones for California.

GAO's Analysis

No Evidence of Favoritism by Panel

On the basis of limited information consisting of panel members' testimony, GAO found no evidence that the panel showed favoritism for one proposal over another during its evaluation deliberations. Because no documentation exists describing the panel's evaluation process, GAO's findings are based on interviews with each panelist separately about their meeting. All stated that the panel thoroughly discussed the proposals, used the stated criteria to judge them, and applied those criteria consistently to all proposals.

GAO also found that the panel members' qualifications met NSF's selection criteria and seemed appropriate for evaluating the proposals for this award. GAO found that all seven panelists had management expertise in running large research efforts through experience in heading engineering departments at various universities or research divisions in private companies. GAO found that in addition to the one recognized earthquake engineering expert on the panel, three other panel members have had earthquake engineering experience. Finally, because of the requesters' concern regarding the panel's earthquake engineering expertise, GAO had the technical sections of the California and New York proposals examined by four independent reviewers who are nationally recognized earthquake engineering experts. The reviewers did not uncover any major strengths or weaknesses in either proposal not described to GAO by the panelists.

Serious Problems With NSF's Management

Although GAO did not find evidence of preselection for a particular proposal, it did find serious problems with NSF's management of the award process.

Lack of adequate documentation: NSF staff did not compile documentation of the award process that justifies the reasons that the award went to one school over the other and provides assurance that the criteria were consistently and fairly applied. GAO found that the statements in the existing documentation are not linked to the stated criteria in the program announcement, are misleading in places, and are unbalanced in tone and coverage of topics. As a result, this has led to the appearance that the criteria were not consistently and fairly applied and that additional criteria could have been added during the evaluation process.

Matching funds requirement not clear: NSF staff did not make clear the due date for the award's $5-million matching funds requirement. Although the announcement states that proposals were due to NSF on January 15, 1986, it did not clearly state whether the matching funds were also due at that time. GAO found that this lack of clarity caused confusion for all contenders and raised questions of unfair treatment, especially for California and New York. Additionally, GAO raises questions about the appropriateness of a large matching funds requirement under tight time frames when the only probable source of funds is the state government, and asks the Director, NSF, to examine this issue. GAO found that three of the six proposers stated that even given a full year, they could not have obtained that much money from their legislatures.

NSF's use of a "conditional" recommendation: Because of time constraints, GAO found that NSF staff permitted the panelists to make a preliminary recommendation to award to New York before they made their site visit to California. This "conditional" recommendation was forwarded through NSF's review process at the time the California site visit was made. These actions created an appearance of prejudgment on the part of NSF and suggested to California that a decision had been made before all substantive evidence about its proposal had been evaluated.

Recommendations

GAO recommends that the Director, NSF, take the following actions to improve the agency's management of its award process:

- require documentation in NSF's large award packages that clearly links reviewer comments to the stated criteria in the program announcement;

- require that the program announcement specify the requirements for matching funds commitments, especially concerning due dates; and
- not consider conditional recommendations in situations where the evaluation of the substantive merits of all proposals has not been completed.

Agency Comments

GAO discussed the factual information in this report with NSF officials, who generally agreed that it was accurate. However, as requested by Senators Wilson and Cranston, GAO did not obtain official agency comments on the report.

Contents

Executive Summary		2
Chapter 1 Introduction		8
	Background	8
	The National Science Foundation	8
	The Merit Review Process	9
	NSF's Earthquake Research Center: Part of a Coordinated, Federal Program	10
	Chronology of the Earthquake Engineering Research Center Award	10
	Objectives, Scope, and Methodology	12
Chapter 2 The Panel and Its Deliberations		14
	Evaluation Process Appears to Have Been Based on Merits of the Proposals	14
	Panel Members' Qualifications Met NSF's Selection Criteria	17
	Reasons for Panelists' Recommendation That the Award Go to New York	20
	Conclusions	22
Chapter 3 Serious Problems Existed With NSF's Management of the EERC Award		24
	Existing Documentation Does Not Adequately Justify the EERC Award	25
	Matching Funds Requirements Not Clear, Raising Questions of Fairness by Contenders	29
	NSF's Use of Conditional Recommendation Led to Appearance of Prejudgment	32
	Conclusions	34
	Recommendations to the Director, NSF	36
	Issue for Further Consideration	37
Appendixes		
	Appendix I: Request Letter From Senator Pete Wilson and Senator Alan Cranston	39
	Appendix II: Additional Information Regarding Requesters' Specific Concerns	41
	Appendix III: Independent Technical Reviewers	64
	Appendix IV: Major Contributors to This Report	65

Abbreviations

CPP	Committee on Programs and Plans
CSSC	California Seismic Safety Commission
DARB	Director's Action Review Board
EERC	Earthquake Engineering Research Center
ERC	Engineering Research Center
NISEE	National Information Service for Earthquake Engineering
NSB	National Science Board
NSF	National Science Foundation

Introduction

Background

On September 12, 1986, the National Science Foundation (NSF) formally awarded a 5-year, $25-million cooperative agreement to establish an Earthquake Engineering Research Center (EERC) at the State University of New York at Buffalo. On September 23, 1986, Senators Pete Wilson and Alan Cranston of California requested that GAO examine NSF's merit review process as it was applied to this award and determine whether NSF adhered to its own policies and procedures in making this award.

The California Senators were concerned that serious improprieties may have occurred in the award process leading to NSF's decision to award the cooperative agreement to a group of schools led by the State University of New York at Buffalo rather than to a consortium of California schools under the aegis of the University of California at Berkeley.[1] Specifically, the Senators raised questions regarding the impartiality of the award decision, the qualifications of the external peer reviewers who evaluated the proposals, and other irregularities in NSF's review and approval process.

The National Science Foundation

The National Science Foundation is an independent federal agency created by the National Science Foundation Act of 1950 (Public Law 81-507), as amended (42 U.S.C. 1861 et seq [1970]). Its primary mission is to "promote and advance scientific progress in the United States." This is accomplished mainly by supporting fundamental research in all fields of science and engineering, primarily at academic institutions.

NSF is composed of grant-making units called directorates, each headed by an assistant director and organized by scientific discipline. The directorates in turn are subdivided into divisions, sections, and programs representing specific areas of science and engineering.

At the top of the NSF hierarchy is a director and deputy director, and a policy-making body known as the National Science Board (NSB). The Board consists of 25 members and includes the Foundation's director. Among NSB's responsibilities is the requirement to approve new NSF programs and all grants or contracts involving a total commitment of $6 million or more, or a yearly commitment of more than $1.5 million (a $2-million total commitment, or a $500,000 annual commitment at the time the EERC was awarded).

[1]The State University of New York at Buffalo consortium consists of City College of New York, Columbia University, Cornell University, Lamont Doherty Geological Observatory, Lehigh University, and Princeton University. The Berkeley consortium consists of the California Institute of Technology, the University of Southern California, and Stanford University.

If an award requires NSB consideration, it first must be screened by a panel called the Director's Action Review Board (DARB), which is composed of senior NSF officials. The DARB validates the merit of proposed actions, ensures that reviews were adequate, and makes certain that NSF policies and procedures were followed.

The Merit Review Process

NSF provides grants to awardees selected in a competitive process.[2] The key individual in the award selection process is the program officer. He or she manages proposal evaluations and makes funding recommendations. In so doing, the program officer relies on the advice of external reviewers who study proposals and determine those with the greatest merit. The program officer selects reviewers according to these criteria: scientific expertise; the degree to which they represent the regions, organizations, or segments of the public directly affected by the proposals under consideration; and the extent to which they provide institutional, geographic, and demographic balance.

When reviewing proposals, NSF either uses an ad hoc mail review or review by an assembled panel of experts. When panels are used, as was the case for the EERC award, groups of experts meet at NSF and discuss the proposals. Where pertinent, site visits, additional reviews, and other activities can supplement the evaluation process.

Reviewers evaluate all proposals according to four general criteria approved by the NSB and stated in the program announcement: (1) research performance competence, (2) intrinsic merit of the research, (3) utility or relevance of the research, and (4) the effect of the research on the infrastructure of science and engineering. The relative importance of the criteria varies with the type of project or program. Additional criteria relevant to specific programs may be applied if they are so stated in the announcement or solicitation. No criteria may be included that have not been described to the applicant.

[2]For a detailed description of NSF's merit review process, see our report, University Funding: Information on the Role of Peer Review at NSF and NIH (GAO/RCED-87-87FS, Mar. 26, 1987).

NSF's Earthquake Research Center: Part of a Coordinated, Federal Program

The Earthquake Engineering Research Center is part of a large federal approach toward the problem of earthquake hazard mitigation. This effort, known as the National Earthquake Hazards Reduction Program, resulted from the Earthquake Hazards Reduction Act of 1977 (Public Law 95-124) and coordinated the earthquake hazard-related research activities of four federal agencies: the Federal Emergency Management Agency, the U.S. Geological Survey, the National Bureau of Standards, and NSF. The legislation authorized NSF to support activities in the earth sciences, engineering, architecture, and the social sciences.

About 10 percent of NSF's university funds go toward the establishment and support of research centers. NSF support for an academic research center typically provides "core" funding for interdisciplinary research performed at special university research centers. The general purpose of these centers is to focus research and faculty systematically on topics key to advancing U.S. research and technological capabilities. This contrasts with individual project support in which awards are generally smaller and are used to fund research projects in discrete areas managed by a single university investigator. Previously, nearly all the NSF activities in pursuit of the National Earthquake Program had been in the form of individual project grants. Thus, shifting funds to EERC support was a departure from its traditional program. In fiscal year 1987 the EERC will account for approximately 33 percent of the engineering directorate's Earthquake Hazard Mitigation Program budget.

Chronology of the Earthquake Engineering Research Center Award

On November 18, 1985, NSF's engineering directorate, working through its Earthquake Hazard Mitigation Program in the critical engineering systems section, issued an announcement inviting proposals for the establishment of an Earthquake Engineering Research Center. This was done in the belief that certain aspects of earthquake engineering could be better studied "through a more systematic research approach dealing with the totality of mitigation of earthquake hazards." The announcement stated that NSF would provide funding "up to a total of $5 million per year for a period of up to 5 years for the establishment and operation of [the] Earthquake Engineering Research Center. Each dollar provided by NSF must be matched by state, industry, or other non-Federal funds."

Although the NSB approved the program announcement in June 1985, it was not formally issued until 5 months later. The delay was caused by the budget process, which prevented NSF from issuing the announcement

until its appropriations bill was enacted by the Congress. Since the deadline for receipt of proposals was January 15, 1986, proposers technically had just under 2 months to respond to the announcement, although NSF had announced plans for the EERC to members of the earthquake community almost a year before. (The concept of an earthquake research center was first announced at a congressional hearing in March 1985 and later discussed at NSF-sponsored planning workshops and meetings.)

The deadline for receipt of proposals was in mid-January 1986, recruitment of the review panel began in early April, and the panel first met on June 17, 1986. The delay between the proposal receipt date and the panel's first meeting was caused in part by the receipt of a large number of proposals concerning the Mexico City earthquake, which occurred in September 1985, and the subsequent increase in program officer work load. At the June panel meeting, four of the six proposals received were eliminated,[3] leaving the California and New York proposals as the remaining contenders.

After reviewing the two proposals, the panel members decided to make a site visit to the Buffalo campus on July 9, 1986. No site visit was recommended for California at that time since it had not obtained its matching funds commitment (a requirement of the program announcement) from the state legislature. Because California had not yet received its match from the state, the panel also gave California a deadline of July 17, 1986, for receipt of its funds. Following the New York site visit, the review panel recommended that the EERC award go to New York, with the stipulation that a site visit to California would be considered if California could document the availability of matching funds by midnight July 17. On July 16 California delivered a letter to NSF indicating the availability of matching funds. The review panel then held a meeting by conference call on July 21, and decided to make a site visit to Berkeley on August 9. Meanwhile, on July 18, 1986, the preliminary award package with the conditional recommendation for New York (with the stipulation regarding the California site visit) had been forwarded by the NSF staff to the DARB. According to NSF officials, this was done to save time in obtaining the DARB's approval of the recommendation before the full NSB meeting on August 14, 1986.

[3]The schools eliminated were University of Missouri-Rolla, The Citadel, University of Michigan, and University of Illinois.

On July 24 the DARB reviewed and approved the package conditionally recommending the award to New York. Members of NSF's Earthquake Hazard Mitigation Program informed the DARB that they had planned a site visit to California and that they would submit a final recommendation to the DARB after August 9.

Following the site visit to California, the panel convened and made its final recommendation to NSF that the award go to New York. On August 15, 1986, the NSB approved the award, and on September 12 signed the formal cooperative agreement with New York.

Objectives, Scope, and Methodology

In their request letter of September 23, 1986, Senators Alan Cranston and Pete Wilson asked that GAO investigate the review process for the EERC award. (See app. I.) Of particular concern to the Senators was the apparent lack of earthquake engineering expertise on the part of the peer reviewers; imbalances in the review panel's reports on the proposals and site visits; and NSF's deviation from customary procedures at critical points in the decision-making process. (A complete list of specific concerns can be found in app. II.)

As agreed with the Senators, we limited our review to examining NSF's compliance with its own award processes and procedures. We did not judge the scientific or technical merits of the proposals. Instead, we examined whether

- the panelists NSF chose showed favoritism for any proposal,
- the panelists met NSF's selection criteria for choosing reviewers, and
- problems existed with NSF's management of the award process.

In addressing these objectives, we interviewed relevant NSF program staff, NSB members, and pertinent officials from NSF's Division of Grants and Contracts; Office of the General Counsel; Office of Budget, Audit, and Control; and the DARB. They detailed their responsibilities for us and outlined the procedures they followed in the award process.

We also interviewed all panel members individually regarding their evaluation of the proposals and the comments they made in proposal and site visit reports. Additionally, we spoke with the principal investigators of the six proposing schools as well as with other relevant university and state officials associated with the New York and California proposals.

Lastly, we reviewed relevant documents such as panel and site visit reports, transcripts of NSB meetings, NSF's Proposal and Award Manual, and correspondence between proposers, NSF, and Members of Congress.

Because of the concern over the technical expertise of the panel, we had the New York and California proposals reviewed by independent earthquake engineering experts. We selected four earthquake engineering experts who were not associated with either proposal. We selected three of these experts from the National Academy of Sciences' National Research Council, Committee on Earthquake Engineering. The fourth, also a recognized expert in this field, was suggested to us by the committee's director. The purpose of this expert review was to determine whether the panel overlooked any technical weaknesses in the proposals. Our independent experts confined their reviews to the technical aspects of each proposal. They did not compare one proposal with the other, but identified the technical strengths and weaknesses of each. In consulting the independent experts, we did not attempt to recompete the proposals or "second guess" the judgments of the NSF panelists. We intended only to supplement and validate other evidence regarding the panelists' expertise.

Our audit work was conducted from September 1986 to May 1987, primarily in the Washington, D.C., area. Interviews with the seven review panel members were conducted at their places of employment. We discussed the factual information in this report with NSF officials, who generally agreed that it was accurate. However, as requested by Senators Wilson and Cranston, we did not obtain official agency comments from NSF. We performed our work in accordance with generally accepted government auditing standards.

The Panel and Its Deliberations

In our review of NSF's EERC award decision, we found no evidence of favoritism on the part of the review panelists in making their award decision. However, our evidence is limited to testimony only—albeit extensive—by the panelists because of the lack of adequate documentation of the award process.

In separate interviews, the panelists gave us consistent accounts of the process they followed in evaluating the EERC proposals. From these accounts, the process they followed seems reasonable and thorough in that all members stated that they used the criteria in the program announcement and applied these criteria consistently to all the proposals. Additionally, all gave the same reasons as to why they judged New York's proposal to best meet the criteria.

As described later, we found that the panelists were qualified to make this decision. They were selected in accordance with NSF guidelines and possessed the additional qualifications NSF staff stated were needed to properly evaluate this particular award. All the panelists have experience in managing large research efforts either in private industry or at a large university. Additionally, although only one panel member has recognized earthquake engineering expertise, we found that three other panel members also had earthquake engineering experience.

Evaluation Process Appears to Have Been Based on Merits of the Proposals

NSF's program announcement for the EERC award stated that proposals will be evaluated according to four criteria: (1) research performance competence, (2) intrinsic merit of the research, (3) utility or relevance of the research, and (4) effect of the research on the infrastructure of science and engineering. In addition to these criteria, the announcement specified other factors that the proposals would be evaluated on:

- a demonstrated capability to manage, direct, and focus the research center activities;
- a management plan and methodology for the direction of the center's activities;
- a plan and methodology for integrating the education of engineers into the research center; and
- a plan and methodology for the center's effective and accelerated technology transfer.

Although NSF's Proposal and Award Manual provides general policy regarding panel review procedures, there are no requirements governing the process by which an external panel should conduct its meeting.

From our interviews with the panelists, it appears that the panel's discussion of the proposals was judicious and extensive, and that the panelists judged the proposals on their perceived merits with regard to the above mentioned criteria. During these extensive interviews, we obtained information on the panel's process for evaluating the proposals both individually before the meeting and with the group as a whole.[4] The seven panel members gave consistent descriptions of the process and of the reasons and analysis that led to the judgments expressed in their reports and ultimately to their recommendation that New York get the award.

The Panel's Deliberation Process

In separate interviews lasting from 3 to 4 hours each, we asked each panelist a standard set of questions that covered all aspects of their deliberations: what process did they use to evaluate the proposals; what criteria did they use; how were they applied; what, if any, weighting was established; and was a scoring sheet used? In addition, we asked them the basis for specific comments written in the proposal review and site visit reports as well as the differences, in their opinion, between the New York and California proposals that resulted in the award going to New York. We also asked them questions about financial ties or conflicts of interests in regard to any of the institutions that submitted proposals.

The panelists generally used the same process to individually evaluate the proposals before their June 17 meeting. All stated that they read the proposals at least once and examined the program announcement and the criteria stated in it. They then went back through each of the proposals again, comparing them to the stated criteria. Two panelists stated that they devised their own score sheets for this purpose, and a third stated that he made notes in the proposals' margins.

Each panelist also gave generally the same description of the evaluation process employed by the group as a whole. Each panelist presented his opinion about all the proposals and then, as one panelist stated, through "an iterative process" the panel discussed and evaluated the proposals against the criteria. Most panelists agreed that the application of the criteria was not "systematic." In some cases, for example, because a proposal was technically weak or seriously underscoped, it was eliminated

[4]No written record exists detailing the process by which the panelists reviewed and evaluated the proposals. The limited documentation that is available consists of panel comments assessing each of the proposals and reports of the panel's site visits to New York and California. Problems with NSF's documentation of this award are discussed in detail in chapter 3.

very quickly before being evaluated against all of the criteria. One panelist stated that although the process was not a rigidly systematic one, the panel reached a consensus regarding each proposal. Another panelist added that the panel referred to the program announcement many times during their discussions. A third member stated that the discussions were extensive and exhaustive to the point of being over-cautious because the panelists anticipated that their decision would receive a great amount of scrutiny.

The program announcement did not quantitatively or qualitatively weight the criteria. The four standard NSF criteria (see p. 11) were set forth together with additional considerations with no indication that any should be more important than another. NSF's Proposal and Award Manual states that standard criteria 1, 2, and 3 (research performance competence, intrinsic merit of research, and utility or relevance of the research) constitute an integral set that are to be applied in a balanced way to all research proposals in accordance with the objectives and content of each proposal. Criterion 4 (effect of the research on the infrastructure of science and engineering) permits the evaluation of proposals in terms of their potential for improving the scientific and engineering enterprise and its educational activities in ways other than those encompassed by the other three criteria.

Although the panel members said that they carefully reviewed the proposals, they did not use a formal scoring sheet or assign explicit weights to the criteria. NSF program officials provided the panel with a scoring sheet with suggested criteria weights but, because of the small number of proposals, the panelists felt that they did not need to use what they regarded as a rigid format. NSF officials present during the panel meeting confirmed this and noted that the panelists are not required to use scoring sheets. While the panelists discussed the proposals in relation to the criteria, they apparently did not decide for each criterion separately which proposal was superior; neither did they explicitly decide which of the criteria, if any, was the most important.

Finally, we asked each panelist if they were pressured in any way to make a particular recommendation, if they had financial ties to any of the proposing schools, and if they had received remuneration for any services from any of the schools submitting proposals. Each panelist answered no to these questions.

Panel Members' Qualifications Met NSF's Selection Criteria

Earthquake engineering is the study of the causes and effects of earthquakes as they relate to the response of the natural and man-made environment. It involves several disciplines and specialties such as structural engineering, mechanical engineering, engineering seismology, and applied mechanics.

We found that the seven panel members selected to review the EERC proposals possessed the necessary qualifications to make such evaluations, meeting the NSF criteria outlined in its Proposal Award Manual and the additional qualifications the NSF staff thought were needed in this particular case. In addition, all the panelists stated that they had no current affiliations or financial ties with any of the proposing schools.

NSF Selection Criteria for Reviewers

NSF's Proposal and Award Manual provides NSF staff with criteria for selecting external reviewers. It states that, ideally, reviewers should have

- special knowledge of the science and engineering subfields involved;
- broader or more generalized knowledge of the science and engineering subfields involved;
- broad knowledge of the infrastructure of the science and engineering enterprise and its educational activities; and
- to the extent possible, balance within the group of various characteristics such a geography, type of institution, and underrepresented groups.

The proposal manual also provides a list of "should nots" for selecting reviewers stating that they should not be

- directly involved in the project,
- from the same institution as the applicants, and
- related to the applicants.

In addition to the criteria stated in the proposal manual, NSF program staff stated that they also wanted people who had management capability and broad experience in designing and managing large technical activities of this kind. Since the EERC's research was intended to represent an approach different from the usual single-focused research proposal, the NSF staff wanted panelists with broad engineering research, management, and practice perspective. NSF did not want any panelists from the states or schools submitting proposals.

Officials in the Earthquake Hazard Mitigation Program do not maintain a standard or comprehensive list from which to select reviewers. In developing a pool of panelists from which to choose, NSF earthquake program officials stated that they themselves identified names of potential candidates and also solicited names from other NSF program people and from the head of the engineering directorate. From this list, they eliminated those with known conflicts of interest (i.e., from schools submitting proposals) and started calling the remaining individuals. Although they no longer had the original list in their files, they told us that about 10 to 12 people they called from the list were not available because of schedule conflicts.

Panel Members' Qualifications

From information stated in their resumes and obtained in our interviews with them, we determined that six of the seven panel members are engineers with degrees in either civil or mechanical engineering, and the seventh is a physicist. One of the panelists, Dr. Beavers, is an active specialist in the earthquake engineering field. Furthermore, we found in our discussions with the panelists that three other members have had experience specifically in earthquake engineering, although they are not currently active in this field. Mr. Rydz, as Vice President of Research for Diebold, was involved in the design of earthquake-proof banks and security products. Dr. Papadakis was at one time the Director of Earthquake Engineering at Bechtel. He specialized in earthquake engineering research as part of his graduate studies, particularly in the area of soil dynamics, and has published a number of papers in professional journals on this topic. Lastly, Dr. Stelson stated that he has personally designed several earthquake-resistant structures in his career and has participated in earthquake engineering forums, including a joint U.S./U.S.S.R. earthquake engineering panel.

The following synopsis of the panel members' background and their present positions and affiliations shows that the panel members met NSF's requirement that reviewers have both special knowledge as well as general knowledge of the scientific subfields involved in the research proposals.

Dr. Thomas E. Stelson

Dr. Stelson is the Vice President for Research and a professor of Civil Engineering at the Georgia Institute of Technology, which has the third largest engineering research program in the country. Prior to this position, he was the Dean of Engineering and served as the Science and Technology Advisor to Governor George Busbee of Georgia. Dr. Stelson

is a civil engineer with degrees from Carnegie-Mellon. He also was the panel's chairman.

Mr. John Rydz

Mr. Rydz is Vice President of Technology for Emhart Corporation, a multi-national corporation that makes rivets and construction adhesives. Prior to his joining Emhart, Mr. Rydz was Vice President and Chief Technical Officer for the Singer Company and Vice President for Research at Diebold. Mr. Rydz has a B.S. in physics from Massachusetts Institute of Technology and a M.S. in physics from the University of Pennsylvania. Mr. Rydz has also served on NSF review panels for its Engineering Research Centers (ERC).

Dr. Constantine Papadakis

Dr. Papadakis is the Dean of the College of Engineering and a professor of Engineering Education at the University of Cincinnati. Prior to this, he served as Director of Earthquake Engineering for Bechtel. He is a civil engineer, specializing in hydraulics and water resources, with degrees from the University of Cincinnati and the University of Michigan. Dr. Papadakis is also a member of the American Society of Civil Engineers and the American Society of Mechanical Engineers.

Dr. Ernst W. Kiesling

Dr. Kiesling is a professor and Chairman of the Civil Engineering Department of Texas Tech University. He has degrees in mechanical engineering and applied mechanics. His particular expertise is in hazard mitigation. Dr. Kiesling is a member of the American Society of Civil Engineers and the American Society for Engineering Education.

Dr. Mounir M. Kamal

Dr. Kamal is a mechanical engineer who is the Technical Director, Mechanical and Electrical Engineering Directorate, for the General Motors Research Laboratories. Dr. Kamal is also a member of the American Society of Mechanical Engineers and has authored a book on structural mechanics.

Dr. Russel C. Jones

Dr. Jones is a civil engineer who is the Vice President for Academic Affairs and Academic Development at Boston University. Formerly, he was the Dean of the School of Engineering at the University of Massachusetts and a professor and Chairman of the Department of Civil Engineering at Ohio State University. He was Chairman of the National

Society of Engineers' Technical Council on Research and is also a member of the American Society of Civil Engineers and the American Society for Engineering Education.

Dr. James E. Beavers

Dr. Beavers is the Manager of Civil and Architectural Engineering for Martin Marietta Energy Systems, Inc. He is a civil engineer with an expertise in earthquake engineering who has authored books and technical papers in the area. He is an active member of the Earthquake Engineering Research Institute as well as the American Society of Civil Engineers and the Seismological Society of America.

Technical Expertise of the Panel Is Validated

Specific concerns were raised regarding the technical expertise of the review panelists. The major concern was that more reviewers with specific earthquake engineering expertise should have been on the panel and that those panel members without this expertise could not adequately evaluate the parts of the proposal that explain and describe the technical nature of the research to be done by the proposed EERC. To address this concern, we asked four independent reviewers to look at the technical areas of each proposal in order to determine whether or not the panelists had overlooked any major technical weaknesses or strengths in either the New York or California proposals. Our intent was not to recompete the proposals or to second guess the judgments of the panelists but rather to validate information the panelists had provided to us.

The technical assessments of our independent reviewers concurred with those of the panelists. (We summarize the panelists' opinions regarding the responsiveness of the proposals in this area as well as others in the next section.) Although the comments provided to us by our independent reviewers were more numerous and detailed, the panelists mentioned the same general points regarding each proposal's technical strengths and weaknesses when we interviewed them.

Reasons for Panelists' Recommendation That the Award Go to New York

The focus of our review was to determine whether NSF followed its award procedures for this award and to examine the credibility of that decision. However, as stated earlier, we discussed with each panel member the reasons for their recommendation that the EERC be awarded to New York. In doing this, we did not intend to question or second guess the expert judgments of the panelists but simply to give their rationale for their decision.

The panelists consistently responded that the differences between the two proposals were in three areas: technical competence, management plan, and national focus. (These are areas of consideration in evaluating the proposals that can be directly linked or could be inferred from the announcement's criteria on p. 11.) The panelists stated that, except for technical competence, the New York proposal better met the program announcement's criteria for management plan and national focus.

Technical competence: Six of seven panelists stated that the California team was technically more experienced, had quality people and facilities, and a long track record in the earthquake engineering area. As one panelist stated, California had assembled a "glamorous" group of researchers.

Management plan: Four of the seven panelists viewed New York's management plan as excellent. Three panelists tied this specifically to the leadership of the EERC's designated director whom they saw as a very experienced manager in running a large center of this type and who would be able to direct and focus the numerous research activities. Two panelists stated that the New York researchers have had experience working well together as a team, which is needed to make the center successful. Again, this was in part due to the strong leadership ability of the designated center director.

National focus: Four of the seven panelists were impressed with New York's plan to address the national aspects of the earthquake problem by bringing in outside researchers from different parts of the country as well as in related hazards. Included in this approach was an effort to start work on earthquake research in the East, an area of the country for which little earthquake data exist, and then expand further West.

Other aspects of the New York proposal that were viewed favorably by some panelists included New York's ability to secure its matching funds commitment quickly and its plan for technology transfer. For example, three panelists stated that they were impressed with New York's swiftness in securing its $5-million matching funds commitment from the state, viewing it as strong state support, and the fact that they exceeded the required $5 million if the school's contribution was counted. Regarding New York's approach to technology transfer, one panelist liked the fact that New York would not rely solely on the traditional method of publishing papers and educating students to disseminate research results but would also actively combine with other schools to hold workshops with industry. Another stated that New York's high priority to

technology transfer was seen in its organization structure where the position to manage this area was on par with its managers of the research areas.

Conclusions

One of the NSF's most critical and important steps in making the EERC award, as with any award, was the evaluation by the expert peer reviewers. We examined two aspects of the panel's evaluation: the process itself as we could best obtain from the panelists' testimony and the qualifications of the panel. In doing so, we found no evidence that showed that one proposal was intentionally favored over another for reasons other than it better met the stated criteria.

Since no detailed account of the panel's meetings exists, we could only reconstruct the evaluation process through the testimony of the panel members themselves. Although such evidence is limited, the consistency of the panelists' accounts of their deliberations and of the reasons why New York was selected indicates that they made their decision based on the perceived merits of the proposals. Our interviews with the panelists gave no indications that any of them entered these meetings with the intent of favoring one proposal over another. On the contrary, our interviews with them suggest that the panelists were thorough and judicious in their consideration of the proposals. Further, we found no evidence showing that panel members were pressured to vote for or against any particular proposal.

The panel's qualifications are an important consideration to judging the credibility of its decision. We found that the qualifications of the panel both met NSF's selection criteria and seemed appropriate for the task of evaluating proposals for such a large research undertaking. As described earlier in this chapter, all the panelists brought considerable research management expertise to the panel, an important criterion on which the proposals themselves were evaluated. Four of the seven panelists are involved in engineering research in the academic setting and thus are familiar with the educational component to research, another selection criterion in the program announcement for the proposed center. The one panel member who was not an engineer but a physicist had been involved in large-scale corporate research, specifically in bringing that research to the development stage. One NSF official described him as particularly qualified in understanding what is needed for innovation, which is yet another specific criterion against which the proposals were to be evaluated.

Regarding the panelists' technical qualifications, we believe two pieces of information confirm that the earthquake engineering expertise present on the panel was adequate. First, in addition to the one panel member who was acknowledged as an earthquake engineering expert, three other panel members had earthquake engineering experience in their backgrounds. Although these members are not presently active in the earthquake engineering field, we believe that such experience supplements the technical knowledge of the one recognized expert and results in a reasonable technical base for the panel as a whole. Second, we note that the conclusions reached by our independent experts in reviewing the technical sections of each proposal are similar to those reached by the panel members. The independent reviewers did not uncover substantive technical points that the panelists had overlooked.

Serious Problems Existed With NSF's Management of the EERC Award

Although we found no evidence that this award decision was predetermined for a particular proposer, NSF's weak management of the award process as well as the inadequacy of the written record resulted in a series of events leading to the questioning of the award decision and NSF's credibility. We have identified three specific areas in which NSF did not act to ensure the integrity of the award process: in compiling adequate documentation of the award process, in making clear the specifics of the matching funds requirement, and in using and approving a conditional recommendation.

NSF management did not ensure that documentation of the award process was adequate to justify the reasons the award was given to one proposal over another or to provide assurance that the criteria were applied consistently. Although testimonial evidence provides a rationale for the final decision, in some cases the documentation has led to the appearance that the proposals were evaluated against criteria other than those in the program announcement. The available evidence makes it impossible to determine with any certainty if additional considerations were introduced during the evaluation process.

NSF staff did not make clear the due date of a $25-million ($5 million per year over a 5-year period) matching funds requirement. This lack of clarity caused confusion among all universities sending in proposals as to the actual due date. It also was cause for California and New York, the major contenders for the final award, to question the fairness of NSF's decision process.

The panel meeting and subsequent site visits to the California and New York schools occurred much later than NSF's original schedule for these events, leaving little time for normal NSF review procedures. As a result, NSF made a conditional recommendation in favor of New York before all evidence was obtained regarding California's proposal. Then, in an effort to save time, NSF staff forwarded this conditional recommendation through its normal channels of approval. These actions suggested to California that a decision had been made by NSF before all of the substantive evidence regarding its proposal had been evaluated.

Existing Documentation Does Not Adequately Justify the EERC Award

Good internal control practices dictate that documentation of significant events and expenditures of resources be accurate, complete, and facilitate the tracing of the action after it has occurred. In this regard, NSF's documentation of the EERC decision process does not adequately explain why the award was made to New York. Specifically, we found that the existing documentation was imbalanced in that it did not cover the same criteria in the same manner for the two contenders nor did it link the comments of the peer review panel to the stated criteria in the program announcement. The California researchers have asserted that a criterion not stated in the program announcement—national focus—was used to evaluate the proposals. From the available evidence, we could not determine with any reasonable certainty whether or not this actually occurred.

Documentation Does Not Link Panel Comments and Criteria

The program announcement for the EERC contained the criteria to be considered in making the award decision. NSF's policy stipulates that proposals for research awards cannot be evaluated against any criteria not made known to the applicant. However, the existing documentation of the EERC award is not sufficient to determine how the proposed centers met the criteria in the program announcement. Documentation consists of the reports of the panel's reviews of the proposals on June 17, 1986, and the reports of the panel's site visits to New York on July 9, 1986, and to California on August 9, 1986. The NSF staff, who were also present at these meetings, prepared these reports on the basis of the notes supplied to them by the panel.

As explained in chapter 2, all panel members stated that they used the evaluation criteria stated in the program announcement to evaluate the proposals and that they applied these criteria consistently to all proposals. However, the reports prepared by NSF staff from the panel members' deliberations do not relate the panel comments directly to the selection criteria contained in the program announcement, and in some cases, it is unclear exactly to which criteria certain statements relate. For example, the panel report comments positively in the case of New York and negatively in the case of California regarding the addition of new faculty at the center. Adding new faculty is not an explicit criterion in the program announcement, but panel members explained in our interviews that they saw additional faculty as indicative of the proposed center's ability to meet its objectives. New York's plan to hire additional faculty was seen as recognizing certain needs of a new multi-disciplinary, systems approach. Open positions would allow the center director the flexibility to fill expertise gaps as they arose, change orientation as needed in the

center, and scale-up to the total $10 million annual funding level. However, the reports alone do not make these links or provide this rationale.

National Focus: "Indicator" of Stated Criteria or Additional Criterion?

The emphasis in the panel's evaluation on having a center with a national focus was one area where the documentation is particularly weak in making a direct link to the published selection criteria. This has raised the concern among California researchers that their proposal was evaluated against a criterion not stated in the program announcement. Although during our interviews with the panel members, they were able to link the national focus with explicit criteria in the program announcement, we found other evidence that suggests that this evaluation factor may have been added after the program announcement was issued. However, the available evidence is not sufficient for us to determine with any certainty whether or not national focus was an additional criterion added during the evaluation process.

California contends that the program announcement did not call the EERC a national center and that national focus was not a criterion. Panel reports show that the California proposal was viewed negatively for being focused on California while New York's proposal was viewed positively for having a more national focus. Although the evidence does not suggest that national focus was the deciding factor in the decision, all of the panel members agreed that national focus was an important element in the proposed center.

Some Evidence Suggests That the National Focus Criterion Can Be Tied to Stated Criteria

Although not an explicit criterion in the announcement, the panel reports, as well as one panel member in our interviews, tied national focus to technology transfer, which is a specific criterion in the program announcement. Also, in our original interviews and in follow-up telephone interviews with the panelists, all members defined national focus as meeting earthquake hazard mitigation research needs in other parts of the country and including researchers from other parts of the country in the center's work. These views of national focus can be linked to criteria stated in the program announcement such as "relevance to national technological problems," and "distribution of resources with respect to institutions and geographical areas." In addition, a September 9, 1986, letter from an NSF official responding to a letter sent by California's principal investigator on its proposal, stated that the panel took into account the potential of national scope and impact of proposed center activities in evaluating which proposed centers could best meet the congressional mandate for mitigation of earthquake hazards from a systems

point of view. The program announcement does state that the EERC should emphasize the systems aspects of earthquake hazard mitigation.

Other Evidence Suggests That the Criterion Was Added Later

Nevertheless, we also found evidence to suggest that the need for a national focus in the EERC may have been added after the program announcement was issued. When panel members were asked specifically how national focus related to the criteria in the program announcement, they told us that they assumed that the EERC was to be a national center, therefore needing a national focus, and that this was stated in the program announcement. However, the program announcement does not explicitly state in either the criteria or introduction sections that the proposed center will be a national center and that it should have a national focus. As stated earlier, the announcement does contain a criterion referring to national technological problems, and California researchers contend that research done in California will have "national applicability." In any case, there is no explicit criterion stating that a broader approach is required. In fact, California's principal investigator stated that his understanding from discussions with NSF officials and from the program announcement is that they wanted a center that was problem-focused without a "business as usual" approach. He contends that giving money to individual research projects across the country is creating a "mini-NSF," which is exactly the "business as usual" approach California was trying to avoid.

Second, the September letter mentioned earlier regarding NSF's response to California's principal investigator also states that the panel was "instructed to evaluate each of the six proposals from a national point of view." Since national focus is not explicitly mentioned in the program announcement, NSF's instruction to the panel as they started their evaluations, we think, could suggest that national focus was a criterion added during the panel's deliberations.

Third, we asked the principal investigators of the other four proposing universities if they thought the EERC was supposed to be a national center, and if so, where they got that information. Three of the four principal investigators told us that they assumed the EERC was to be a national center with a national focus. The fourth did not have a clear answer to this question. None of them was sure if he had gotten this perception from the program announcement.

NSF Documentation Is Imbalanced in Tone and Coverage

In addition to the lack of linkage between comments made in panel and site visit reports and the stated criteria in the program announcement, these reports do not present a balanced evaluation of the proposals. In several places the reports do not discuss similar factors in the New York and California proposals in the same way. For example, the New York site visit report states that "corporate representatives were present at the site visit." The California site visit report does not refer to corporate representatives, although on the basis of evidence we found, such representatives were also present at the California site visit. In addition, the New York site visit report states that state and university officials made it clear that they were committed to establishing a first-rate center. Again, the California site visit report does not mention the state or university officials' commitment, although a California state official who was present at the site visit told us that they expressed the same sentiments at their site visit. Overall, the reports present no negative evaluation comments regarding the New York proposal but, conversely, present almost no positive ones for the California proposal. Last, the tone of the reports in several cases was strongly positive for the New York proposal and as strongly negative for the California one. (More examples are provided in app. II.)

As stated earlier, the NSF staff prepared both sets of reports based on the panel members' notes as well as their own. They then sent the reports to the panel's chairperson who approved them. In discussing the reports' tone and balance problems with the panelists, some stated that the reports were not meant to be a comprehensive explanation of the strengths and weaknesses of the proposals but to reflect the impressions of the panel. Other members also stated that specifically in regard to the California site visit report, the panel (after their site visit to California and after making final their recommendation to New York) was trying to justify what they knew would be a controversial decision and that this could account for the negative tone. Last, two members told us that the reports do not reflect the thoroughness of their discussions and that, in hindsight, their deliberations should have been better documented.

The result of this problem with the documentation is the same as that with the problems noted with lack of linkage to the criteria: California school officials questioned whether the assessment of their proposal had been a fair one based on the criteria. From only reading the reports, it did not appear so to California or to us.

Matching Funds Requirements Not Clear, Raising Questions of Fairness by Contenders

NSF's program announcement for the EERC, issued on November 18, 1985, required a nonfederal, dollar-for-dollar match of up to $5 million a year for 5 years. Although the program announcement established a due date of January 15, 1986, for the proposals, we do not believe that the program announcement was clear as to whether or not the matching funds commitment also was due by this date.

We also found that there was not a consistent understanding among the universities responding to the EERC program announcement as to when their matching funds commitment was due to NSF. Four of the universities sending in proposals, including New York, interpreted the program announcement to mean that the matching funds commitment was due on January 15 with the proposals. The other two universities, including California, assumed that NSF was flexible regarding when the matching funds commitment was due.

The NSF official who managed this award told us that he did not expect the commitment on January 15 because he wanted to give the universities more flexibility and time. He stated that NSF did send a letter out on May 21, 1986, to all universities sending in proposals asking for additional information by June 10.[5] The letter specifically mentioned the matching funds commitment.

Panel Sets Deadline for Matching Funds Commitment

When the panel met on June 17 to review and evaluate the EERC proposals, the New York and California proposals became the main contenders for the award. New York had submitted its matching funds commitment with its proposal. Although California had not submitted its matching funds commitment at the time of the panel's meeting, NSF had informed the panel that California legislation to obtain the funds was soon to be approved.

NSF staff explained to the panel members that NSF wanted to make the award in fiscal year 1986, which meant that NSF would have to have a final recommendation ready for review and approval in time for NSB's last scheduled meeting for the fiscal year in mid-August 1986. From discussions with NSF staff, the panel members also decided that because a matching funds commitment was a requirement for the final award, it therefore should be a requirement for the site visit, which was to be

[5]We interviewed the principal investigators of the six proposing schools. Five of the six stated that they did receive a letter from NSF in May 1986 asking for additional information. The sixth stated that he had not received such a letter.

made to help decide among the best contenders. Consequently, the panel members established a July 17, 1986, deadline for California to submit its matching funds commitment. Three panel members explained that they thought this date would allow time for completion of the California legislative process as well as meet NSF's needs not to significantly delay the award process.

Both California and New York Contend That They Were Not Treated Fairly

The fact that NSF did not have a clear matching funds due date resulted in New York and California operating under different assumptions as to when the matching funds were actually due. New York assumed that January 15 was a firm deadline for the proposal as well as the matching funds commitment. A university official in New York told us that because he thought everything was due on January 15, New York did not even begin to write the proposal until they first had the required $5 million.

On the other hand, California officials stated that they had informed NSF in early 1985 (when NSF was first discussing the idea of the EERC with the earthquake engineering community) that they would not be able to get a matching funds commitment from the state legislature until sometime in July 1986 or, as stated in the California proposal, possibly as late as August. California researchers and state officials connected with preparing the proposal stated that the NSF program officials told them that the EERC schedule would accommodate this date. Additionally, California officials stated that they kept NSF periodically apprised of the status of the bill.

When the panel set the July 17 deadline, California school officials thought that NSF was going back on their understanding regarding the receipt of the matching funds commitment even though California had informed NSF about the time required by its legislative process and had been assured by NSF that it was acceptable. Conversely, New York thought that NSF had extended its deadline for California, thereby affording California special treatment.

Other Matching Fund Issues

We found that other questions had been raised regarding the matching funds commitment: whether in-kind contributions were allowable, whether the commitment was meant to be for 1 year or 5 years, and whether the required amount was reasonable.

In-Kind Payments

The program announcement did not specifically discuss whether the matching funds commitment could include in-kind payments or whether it must be in cash.[6] NSF did allow in-kind funds as part of California's match. However, California school officials stated that NSF questioned them about the acceptability of their in-kind contributions. This led California school officials to think that questions existed about the eligibility of their proposal, and that their proposal was viewed negatively for having in-kind funds.

Duration of the Matching Funds Commitment

Matching funds were required for 5 years; however, the program announcement did not clearly state whether proposers must have a firm commitment for only the first year or for all 5 years to be eligible. NSF officials told us they expected only the first year's commitment, but this was not clear to all competitors for the award. One university official told us that he thought the commitment must be firm for 5 years, and if he had known the first year would suffice, his strategy in developing the proposal might have been different.

Reasonableness of the Matching Funds Requirement

On the basis of our discussions with representatives of all six universities, we question the reasonableness of the matching funds requirement given the timing, amount, and probable source of funds. An NSF official told us that NSF anticipated that state or local support would be the only realistic source for schools to obtain the money for the matching funds requirement.

The principal investigators of three of the six universities sending in proposals said that even given a full year they could not have gotten this much money. They also told us that, given the amount of money needed, they could not expect to get state support of this size since they were not from states that experience frequent earthquakes. In addition, two university officials pointed out that the timing of the program announcement was important because of the fact that state legislatures meet at different times of the year, and it takes time to get legislation passed. A third university official said that his state legislature had thought it too much trouble to enact legislation for the funds when there were no assurances of getting the award.

[6]In-kind funds refer to the value placed on items other than cash, such as faculty salaries, already contained in a school's operating budget or the use of a piece of equipment to which a school has access.

NSF's Use of Conditional Recommendation Led to Appearance of Prejudgment

Large awards, like the EERC, require review by the Director's Action Review Board (DARB), then final approval by the National Science Board. The DARB reviews all recommendations sent to the NSB to make sure they are adequately justified and to prepare the NSF staff for any questions which they think NSB might ask. NSF staff sent a conditional recommendation to the DARB favoring New York—conditional on the site visit to California possibly changing that recommendation. This action led California to believe that the panel and NSF had made a decision before all evidence had been evaluated.

Peer Review Panel Made a Conditional Recommendation

The peer review panel made a site visit to New York on July 9, 1986, and were pleased with the results of that visit. Because there was uncertainty as to whether California would obtain its matching funds commitment in time from the state legislature (the commitment was due to NSF within 8 days, although the California legislature had not yet approved the bill for the money), and in light of NSF's time constraints to make this award by the end of the fiscal year, the panelists did not want to delay the process further by reconvening to make an award recommendation if California did not obtain its money. Consequently, after the New York site visit, they made a preliminary recommendation that NSF award the EERC to New York. The NSF staff overseeing the award process went along with this decision. The recommendation, however, was written with a provision stating that if California got a commitment to NSF by midnight of July 17, 1986, the panel would consider a site visit to Berkeley prior to finalizing an award recommendation.

Panelists Make Site Visit to California

California delivered a letter to NSF on July 16, 1986, indicating that it had its matching funds commitment. On July 17, NSF sent a letter to panel members telling them of California's commitment and arranging to set up a conference call to discuss the California site visit. On July 21, 1986, the conference call was made and the panel decided to make a site visit to California on August 9, 1986. After the California site visit, the panel finalized its preliminary recommendation that the award go to New York.

In interviews with the panelists and the California school officials, both groups agreed that the site visit did not go well. California participants contend that it appeared that the panelists did not come to the site visit with an open mind. Two of the California participants told us that they were concerned with the questions the panelists asked; some of the

questions did not seem relevant to the criteria in the program announcement, others were "adversarial," and few centered on the technical aspects of California's research. California scientists were further convinced of the panelists' prejudgment after later finding out that the panel had made a conditional recommendation to New York prior to the California visit.

Although the panelists agreed that the California site visit did not go well, four of the seven also stated that, in their minds, the "coin was on the edge" regarding the merits of both proposals until that visit. These panelists agreed that it was here the differences between the proposals became delineated. The panel did not establish a set of questions beforehand; each panel member asked questions about the areas that he felt were important or needed more clarification after reading the proposal. Although one panelist told us he thought California would "seal the award" at the site visit, all panelists agreed that California did not answer their questions as well as they had expected.

We cannot conclude whether or not the panelists and the NSF staff approached the California site visit with an open mind. However, given that the site visit occurred after a conditional recommendation had already been made and that the visit concluded with an unbalanced report, it is understandable that there were doubts about the fairness of the decision.

NSF Staff Forwarded the Conditional Recommendation to the DARB

At the time of this award, NSF awards involving a total commitment of $2 million or more, or an annual commitment of $500,000 or more, required final approval by the NSB. NSF guidance stipulates that a recommendation to be approved by the NSB is to be sent for review to the chairperson of the DARB 30 calendar days prior to being sent to the NSB. Because the EERC award was for $5 million per year for 5 years, and the NSB's final meeting of fiscal year 1986 was August 14-15, NSF staff had to have the recommendation to the NSB at this meeting in order to make the award in fiscal year 1986.

Because of this time constraint, NSF staff decided to send the panel's initial conditional recommendation to the DARB. NSF officials told us that this was the first time a conditional recommendation has been considered by the DARB and that no internal guidelines exist on the use of conditional recommendations. The conditional recommendation, reviewed by the DARB on July 24, 1986, noted that the site visit to California was planned and that the final recommendation was subject to that site visit.

According to NSF staff, the rationale for sending a conditional recommendation to the DARB was to save time. However, the same NSF staff assured us that had the California site visit changed the final recommendation, they would have been able to get a new package with a new recommendation through the DARB in time for the NSB meeting. One NSF official told us that much of the material in the recommendation package would have been the same for recommending either California or New York. In discussing the problem of prejudgment with the head of NSF's Engineering Directorate, he stated that the DARB process was an internal process and not known to the competitors anyway. However, according to the DARB's executive secretary, the DARB had also been concerned that a conditional recommendation might give the appearance of prejudgment. She added, though, that the DARB was convinced by the staff's rationale and decided to process the conditional recommendation anyway.

Conclusions

The series of events we have described caused at least one of the major contenders of the award to question the impartiality of the evaluation process and the final decision. Accusations of lack of impartiality, we believe, are a serious matter that can damage the credibility of the NSF, especially in a case such as this that involves a large sum of money and has received considerable press coverage. Although the evidence is limited, as discussed in chapter 2, it does not indicate that the final award decision was predetermined in favor of a particular proposal. However, the events surrounding NSF's decision process fueled speculation about the impartiality of NSF's peer review process, which is the primary mechanism NSF uses in deciding how to spend its federal dollars.

We believe that the problems outlined earlier in the report are a direct result of the responsible NSF staff's poor judgment in managing the EERC award process. We believe their lack of firm direction and control led to a "snowball" effect on events which, taken cumulatively, raised legitimate concerns about the impartiality of the decision. Specific events of poor judgment included not ensuring sufficient systematic documentation of the evaluation process to explain how the proposals met the criteria in the program announcement; not clarifying in advance the requirements for the matching funds agreement, which was an important eligibility requirement for the award; and processing a conditional recommendation to the DARB, which they permitted the panelists to make, before all evaluations were complete. All of these events led to understandable questions about the fairness of the award process at NSF.

NSF's documentation does not support a conclusion that a fair and balanced evaluation of the proposals took place based on the criteria in the program announcement for the EERC. Adequate documentation is a standard internal controls practice to allow just such a conclusion to be reached. Because the documentation of the EERC award process does not provide a clear link between panel comments and criteria in the program announcement, it does not adequately justify the final award and cannot provide assurance that the criteria were consistently applied. After extensive interviews with the panelists and correlation of their testimonial evidence, we were able to find links between the factors in the panel reports and the criteria in the program announcement. Not all of these links, however, are clear. For example, we cannot determine with any certainty whether national focus was a reasonable, a priori assumption based on the program announcement or whether it was a new criterion. Allegations of adding criteria not previously stated in the program announcement strikes at the fairness of the entire award process. We believe that our inability to conclusively determine this because of the inadequacy of NSF's documentation only underscores the serious nature of the documentation problem.

NSF staff did not make clear the specifics regarding the important matching funds requirement. Clarity in the eligibility requirements for an award competition is crucial to a fair process, particularly when the process is one of direct competition such as the EERC award. Our extensive interviews with the panelists and NSF staff surfaced no evidence that the matching funds issue was crucial to the final decision, or that it was intentionally used to give either side an unfair advantage. Rather, it appears to have been an effort on NSF's part to allow contenders greater flexibility by giving them more time. However, this flexibility was not apparent to all competitors, caused confusion about the requirements, and started a chain of events that created the appearance of an unfair process. While we recognize the value of flexibility in the support of research, we nevertheless believe that requirements for competitive research awards, particularly requirements of this magnitude, be thoroughly thought out in advance and clearly established in the public announcement of the proposed award.

Although the use of a conditional recommendation is not prohibited by NSF guidance, we believe that it is a questionable practice. Although it was the panel's idea to write a conditional recommendation in the first place, panel recommendations are strictly advisory to the NSF staff, who are the ones responsible for the evaluation process. NSF did not have to accept such a recommendation and could have instructed the panelists

not to make one. Furthermore, we believe that the staff's lack of intervention at this critical decision point was made more serious by NSF's actions to process the conditional recommendation. NSF's assumption that sending forward a conditional recommendation would save time must be, in turn, based on the assumption that the recommendation would not change. Further, if the staff was certain that, after the California site visit, they could have gotten a new package through the DARB review prior to the NSB meeting, we question the need for sending forward a conditional recommendation at all. In our opinion, it would have served NSF's need to respond in a tight time frame, without giving the appearance of prejudgment, to have sent two separate packages to the DARB, one for New York and one, albeit incomplete, for California. Alternatively, NSF could have sent forward the material common to both recommendations without making a specific recommendation.

The panel members told us that they had not made up their minds prior to the California site visit, and that the decision to award the EERC to New York was not a matter of prejudgment. However, the processing of a conditional recommendation did give the appearance of prejudgment on the part of NSF. California believed that the conditional recommendation demonstrated that a decision had been made in the minds of the panel members and the NSF prior to the California site visit. In discussing the conditional recommendation matter, NSF officials stressed the need for flexibility to deal with unusual situations or tight time schedules, as was the case with the EERC. We believe the appearance of prejudgment is a serious matter, particularly for NSF which relies so much on the reputation of its peer review process, and one that could have implications for NSF's overall credibility. Although a conditional recommendation may be acceptable in situations where the completion of administrative matters or minor eligibility requirements (such as budget negotiations) are pending, we believe such recommendations should not be made before the substantive evaluation process for all proposers has been completed.

Recommendations to the Director, NSF

We recommend that the Director, NSF, take the following actions to help ensure that the problems that occurred in the EERC award do not occur in the future:

- Require documentation in large award packages that clearly link reviewers' comments for each proposal to the stated criteria in the program announcement in order to better show and defend the reasons an award went to one proposal over another.

- Require that the program announcement clearly specify the requirements for matching funds commitments. This should include such items as the due date for the commitment, the duration of the commitment, and the types of funding that are acceptable (in-kind or cash). Adhering to these requirements would ensure that all applicants compete by the same rules.
- In order to avoid the appearance of preselecting a particular proposer, NSF staff should not consider conditional recommendations in situations in which the evaluation of the substantive merits of all proposals has not been completed.

With regard to the first recommendation, NSF should develop criteria (such as the size or sensitivity of the award) indicating which awards would require this documentation since it would not be practical for all. For example, small, individual research awards may not need detailed documentation in order to justify them. We believe that such documentation would force a more systematic accounting of the criteria during the panelists' deliberations, which would lessen the likelihood of criteria not known by the proposers from entering the evaluation process. Further, given the visibility and importance of NSF's large awards, such as the engineering research centers, this documentation would protect and ensure the impartiality and credibility of NSF's decision.

Issue for Further Consideration

We believe the issue of matching funds required from the proposing schools for this award and other awards merits further attention by the Director of NSF. They should examine (1) the conditions under which a matching funds requirement of this size is appropriate and (2) the procedural implications for obtaining matching funds commitments from state legislatures.

An NSF official explained that NSF's rationale for requiring such a large matching funds commitment is that it will help ensure that technology transfer takes place and that the results of the research will be used. Nevertheless, a state agency, whose mission may be totally unrelated to earthquake hazard mitigation but which is providing the funds for the match, may not be likely to "use" the results of the research itself or to induce other agencies to use it as well. In fact, a New York school official stated that the school received the money from the Urban Development Corporation because of the agency's strong commitment to encouraging economic development in the state. One of the panelists also stated he had reservations about matching funds requirements because it has not been proven as a good criterion.

We question the appropriateness of NSF's decision to require a matching funds requirement of the magnitude of this award ($5 million) given the probable source of these funds (states) in the allowable time frame. State legislative schedules vary across the country; some meet only every other year. While for some states it might have been impossible to obtain passage of legislation in the November-to-January time frame (from the official release of the announcement to the proposal due date), it is conceivable that even EERC's 9-month time line (November to August—the actual award date) could be a tight schedule for others for passage of a $5 million appropriation. Representatives from the other four proposing schools all stated that the amount of time permitted them to obtain funds from their legislatures was not enough; three of them stated that it would have taken at least a year to get such legislation passed.

In raising these issues, we are not questioning the use of matching funds per se. We recognize that matching funds is a standard tool by which NSF can leverage its money. However, we believe that more careful consideration needs to be given to both the amount of money NSF is asking for in matching funds and the likely source of that money. If such care is not taken, the result may be to greatly restrict the competition for an award. This may exclude schools in states that cannot provide a large amount of up-front cash, especially within a short amount of time, and give an advantage to schools in those states that can.

Request Letter From Senator Pete Wilson and Senator Alan Cranston

United States Senate
WASHINGTON, DC 20510

September 23, 1986

The Honorable Charles A. Bowsher
Comptroller General of the United States
General Accounting Office
441 G Street, N.W.
Washington, D.C. 20548

Dear Mr. Bowsher:

On August 15, 1986, the State University of New York was awarded a five-year grant by the National Science Foundation to establish an Earthquake Engineering Research Center. We have reason to suspect that in the process of awarding this grant certain parties may have violated the research community's long-standing tradition of objectivity, impartiality and honesty and substituted them with bias, pressure tactics and misinformation.

We realize that the system of professional merit review is not perfect, but it has worked well in the past and is still the preferred method, among researchers, of awarding research grants. Since the research community places a high degree of trust and confidence in the peer review process and those individuals responsible for making evaluations, it is necessary to hold that process to a high standard of accountability. After carefully reviewing the issues raised by researchers, consultants, and others in sensitive positions, we believe there is sufficient evidence to suggest that there was a major breakdown in the overall peer review process.

Therefore, we are requesting that the GAO immediately proceed with an investigation to determine whether irregularities occurred in processes leading to the award by the National Science Foundation for the Earthquake Engineering Research Center.

The Honorable Charles A. Bowsher
September 23, 1986
Page Two

We look forward to working with you on this investigation to ensure that the NSF strictly adhere to their own policies and procedures of the grant review process. Enclosed is a list of some concerns which we feel need to be addressed in a GAO investigation. If you have any questions, please have your staff contact Bruce Millis at 224-5423 or Gary Aldridge at 224-3553.

Sincerely,

Pete Wilson

Alan Cranston

Enclosure

Additional Information Regarding Requesters' Specific Concerns

The letter from Senators Wilson and Cranston requesting GAO to review the EERC award included an attachment detailing a number of specific concerns. As agreed with the Senators, we concentrated our review on determining whether NSF adhered to its policies and procedures and did not attempt to investigate each of these concerns. However, in the course of our work, we developed information relevant to most of them.

This appendix presents the specific concerns (underlined), followed by the additional relevant information, if any, that we obtained. In most instances, the information is in the form of further clarification or rationale that the external review panelists, the NSF staff, or NSB members provided to us. We present this information to more clearly explain the positions of those making the decision, not to defend their decision or to rebut the Senators' concerns. We do, however, note instances in which we have different interpretations of the documentation than those of the requesters.

We have numbered each concern and modified the captions for easier reference. In several instances, we either reordered or made minor editorial changes to the original text for clarity.

Comparison of the New York and California Proposals

1. The management structure described in the two proposals is basically similar. Both have an oversight committee or board, a center director, a technical director, and various research teams. Both use a matrix approach to project organization and management.

Our discussions with the review panelists indicated that they perceived differences in management plans and abilities rather than in management structures. When we asked the seven panelists what they considered to be the major differences that led to New York getting the award, four included management in their responses. None of them, however, specifically referred to the structure of management. Rather, the individual panelists perceived the New York researchers as having stronger experience and competence in managing a large organization or in working together effectively as a team. In contrast, individual panelists perceived the California researchers as being inexperienced in working as a team, unsure as to the specifics of their management plan, or generally unconvincing as to their management abilities. We also noted that these distinctions were based more on the site visits than on the proposals themselves.

2. The emphasis of the New York proposal is strongly regional while the California proposal does not stress regionalism. This would suggest the need for a review panel that was regionally unbiased.

Information on regionalism is provided in response to concern number 25. Regarding geographic distribution of the review panelists, NSF's Proposal and Award Manual notes that while it is seldom possible to meet every desired criterion in a small group, it is nevertheless important that review panels be structured to provide broad representation and many views on matters under the group's purview. Geographic balance is one of seven considerations the manual prescribes to help achieve a reasonable balance in such groups. In this regard, the manual states that "members should be drawn from as broad a set of geographic areas as is feasible."

The seven-member panel NSF selected was predominately from states east of the Mississippi River, with fairly even distribution between northern and southern states. No members were from the Far West. The panelists were from Connecticut, Texas, Ohio, Georgia, Massachusetts, Michigan, and Tennessee.

The NSF official responsible for selecting the EERC review panel told us that he did attempt to get panelists from the west. He said that 2 of about 10 individuals (he could not recall the exact number) who were unable to serve on the review panel were from the state of Washington.

3. The technical activities described in the two proposals are very similar. The New York proposal claims to emphasize problems with "breakthrough" potential, but no technical basis is provided for assessing this assertion.

We noted that in the New York site visit report, the review panel did cite a basis for breakthrough potential in one area of New York's proposed center. The report states that "[t]he second major thrust of the Center's research program is directed at structural system(s) (e.g., low- and high-rise structures, dams, and bridges) and lifeline system (e.g., power and communication, gas, water, and sewage, and transportation). It is believed that such systems have not been given adequate attention in a coordinated and integrated fashion and if approached in such a manner major breakthroughs will result." No further discussion of the technical basis for this assertion is noted in the report.

4. The California proposal has a sharper problem focus than the New York proposal. The California focus is on the national problem of existing hazardous structures. The New York proposal covers nearly all of the topics included in earthquake engineering research.

The review panelist who is an acknowledged earthquake engineering expert told us that the scope of the proposed research was the only technical difficulty he saw in either proposal. He deemed New York's scope to be very broad, encompassing the entire spectrum of earthquake engineering, but he viewed California's scope as very narrow, focusing almost entirely on existing structures.

The four independent technical reviewers we asked to review the two proposals identified concentration on existing structures among the positive features of California's proposal. However, two of these reviewers also criticized California's proposal for not recognizing differing earthquake hazards outside of California. These same two independent reviewers also viewed New York's focus on hazards east of the Rocky Mountains as appropriate, while the other two reviewers criticized the New York proposal for being too broad or for lacking depth.

5. The New York center would require much greater startup funding than would a California center. Adequate facilities and personnel for a center currently do not exist at the New York schools. The proposed expenditures for library facilities, experimental facilities, and faculty represent a very large portion of the budget. Less funds are therefore available for research.

Our analysis of the budgets submitted with the New York and California proposals indicated that New York did have higher estimated first-year facility and equipment costs than California, but also had slightly more budgeted for actual research than did California. Both groups budgeted a total of $10 million for the first year. New York budgeted $2,550,000 for first-year facility and capital equipment costs, while California budgeted $1,400,000 for first-year equipment and space/capital improvements. First-year funds identified in the budgets as available for research were $5,609,800 for New York and $5,300,000 for California.

6. On the basis of biographical information supplied, the earthquake engineering experience and expertise of the New York researchers is not at all comparable to that of the California researchers.

We found that the review panel recognized California's superior earthquake engineering experience and expertise. The panel's written comments on California's proposal stated that "[a]lso the team is strong and experienced in earthquake engineering research." Further, six of the seven panelists included references to the superior qualifications of the California researchers when we asked them what they perceived to be the major differences in the two proposed centers. However, the panel viewed the New York team to be strong also, as noted in their written comments on New York's proposal: "The quality of researchers is high and includes new aspiring researchers and well-known investigators."

7. Even after the New York center is fully operational, its experimental facilities will be significantly inferior to those that exist at the universities involved in the California proposal. For example, the "shake table" at the University of California-Berkeley has nearly three times the usable area of the shake table at the State University of New York at Buffalo (SUNY-Buffalo) and much greater force capacity. The same comparison holds for static testing facilities, centrifuge facilities, and other experimental facilities.

We did not obtain information relevant to this concern.

8. The educational component of the New York proposal is significantly weaker than that of the California proposal. The California universities involved in the proposed center are rated by the American Council on Education as among the very best of all civil engineering schools in the nation. In the same rating, SUNY-Buffalo is rated well below the California schools. University of California-Berkeley is rated number one in the nation.

The review panelists had various reasons for judging New York's educational component to be superior to California's. One panelist said New York had more of an applications approach and engineering focus, and thus would be more likely to turn out practical engineers grounded in new technology than would California, which had a more academic approach. The panelist added that this difference came through at the site visit rather than in the written proposals.

Another panelist acknowledged that California had been good at educating students, but believed that New York would be better from an "value-added" perspective. In other words, this panelist saw little evidence that California's educational component would improve because

of the center, but believed that a center at New York would spawn several centers of excellence among the consortium that did not previously exist.

A third panelist saw the educational component closely tied to the addition of new faculty and to the technology transfer component of the center. This panelist believed that because California did not plan to hire new faculty, it would be less likely to teach new courses and transmit new technology. To this panelist, New York was using a more proven approach—i.e., training new graduate students in the latest technology as compared with California's proposed process of professional engineers working at the center. Another panelist believed that New York more overtly addressed the educational aspects of the center, while yet another discerned little difference between the two proposals in this area and did not see it as a critical factor in the decision to give New York the award.

9. The implementation goals of the proposed New York center are very high, but it is questionable whether they are achievable as New York has no established infrastructure for the implementation of earthquake engineering research. New York does not have an aggressive structural engineering community, there are few, if any, earthquake code committees, and little record of public or government interest in or support for seismic safety. By contrast, the California proposal outlines a very strong implementation strategy, which is built upon a record of success.

We did not obtain information on New York's infrastructure. Differences the panel perceived regarding the technology transfer process of implementing research results are provided in response to concern number 28.

Qualifications of the Review Panel

10. Since many of the technical and management aspects of the two proposals are quite similar, the most important issue in evaluation of these two proposals is the likelihood of success in achieving the stated goals and objectives. A background in and demonstrated understanding of the field of earthquake engineering would seem to be essential to a fair and accurate assessment of the assertions made in the proposals. The NSF-appointed review panel did not possess these qualifications.

The qualifications of the review panelists are discussed in chapter 2.

Panel Reviews

11. On July 8 and 9,[1986,] the panel members and six representatives from NSF made a 2-day site visit to the State University of New York at Buffalo. On August 9 the review panel and three NSF staff members made a 1-day site visit to California.

According to the review panelists and the NSF official in charge of the EERC award, each site visit lasted 1 day. The itinerary New York prepared also indicates that the actual site visit lasted only 1 day. In New York, however, the site visit team attended a dinner hosted by the President of SUNY-Buffalo on the evening preceding the actual site visit. According to the NSF official in charge of the award, a similar invitation for dinner on the evening before the California site visit was declined because there was little time to schedule events and because some panelists were arriving late and the panel felt it necessary to meet before the actual site visit began.

12. At the conclusion of the New York site visit on July 9, the panel submitted a glowing review of the proposed New York center using numerous superlatives. Again, the panel's review was decidedly positive, stressing only the strengths of the New York proposal. The same day, the panel wrote a resolution favoring award of the center to New York. Immediately following the California site visit, the panel submitted a review of the California proposal. The tone of this review is in stark contrast to that of the New York proposal. It is decidedly negative, stressing only perceived weaknesses.

We agree that the site visit reports are unbalanced. This is discussed in more detail in chapter 3.

13. On July 16 the principal investigator for the California proposal was told that no California site visit would be necessary. The assistance of the California Congressional Delegation was solicited at this time, and shortly thereafter, NSF agreed to a site visit.

The NSF official in charge of the EERC award told us that California was not denied a site visit on July 16, 1986 (the date on which California obtained its matching funds commitment). The NSF official said he told California's principal investigator in a telephone conversation that he would have to discuss the matter of a site visit with the review panel. Documents provided to us by one of the review panelists support the NSF official's account. These documents are (1) a letter dated July 17, 1986, from the NSF official to the review panelists, which described California's matching funds commitment and said that NSF would arrange a

conference call to get the panel's recommendation on what should be done and (2) a panelist's handwritten notes of a July 21, 1986, conference call, which state that the panel decided to make the site visit. In addition, all seven review panelists told us that they would have recommended a site visit to California after reviewing its proposal in June 1986 if California's matching funds commitment had been made at that time.

14. The SUNY-Buffalo proposal was considered by the DARB at a meeting on July 24, prior to the California site visit. The function of the DARB is to review recommended actions requiring the Director's approval including actions recommended to the NSB. Normally, actions considered by the DARB must have prior approval of the Assistant Director, Division Director, and Section Head. This would suggest that the recommendation considered by the DARB was prepared shortly after the July 9 site visit to SUNY-Buffalo.

The review panel did draft a recommendation that New York get the award on July 9, 1986, immediately following the New York site visit. However, this recommendation was contingent on California not submitting its matching funds commitment by July 17, 1986. The DARB reviewed and approved that conditional recommendation on July 24, 1986, even though California had obtained a matching funds commitment and a site visit had been decided on by that time. We discuss the reasons given to us for this course of action and how it created the appearance of a predetermined decision in chapter 3.

Inconsistent Treatment of Similar Information

15. Even a casual reading of the panel reviews of the California and New York proposals shows these reviews to be clearly biased against the California proposal. In the case of New York, only strengths are discussed, while in the case of California, perceived weaknesses are emphasized. In point of fact, both proposals must have had strengths and weaknesses and a fair evaluation would have discussed both aspects of each proposal. The matter could not have been as black-and-white as represented by the panel. The reviews are definitely unbalanced and selective in their discussion of the two proposed centers and appear to be more designed to support a predetermined conclusion than to present a fair evaluation. Often the same set of facts are portrayed in an opposite light depending on which proposal is being discussed. Some examples of the biased nature of the reviews follow: [Numbers 16 through 36 below are the examples referred to here.]

We believe that the panel's written comments on the proposals and site visit reports are inconsistent in coverage of topics and do not present a balanced evaluation of the proposed centers. This issue is discussed in chapter 3.

16. Regarding the fact that both California and New York presently have only 1-year funding, the report states that New York "expects" that funds will continue, while for California, "future year funding is not assured." The facts are the same but the interpretation clearly biased.

We agree that this statement appears biased. Both site visit reports state that the respective groups had matching funds committed for the first year only. Although we did not obtain information relevant to this specific concern, it is unclear to us why one school's commitment seemed more assured to the panelists than the other's.

17. The New York site visit report stated that the University at Buffalo will provide the use of its $1.5 million Seismic Research Laboratory. No mention is made in the California site visit report of the much larger and fully equipped California research laboratories except to say that the testing facilities and support equipment "would support a national earthquake engineering center."

We agree that the California site visit report does not specifically mention California's research laboratories, and that this serves as another example of imbalance of coverage in the reports. The California report, however, makes the following general comment on California's facilities: "The current facilities that were reviewed on the August 9, 1986, site visit to the University of California at Berkeley were viewed as good by the Panel."

18. The New York site visit report points out that the University at Buffalo will provide $150,000 per year toward salaries and provide administrative space. In referring to the contribution pledged by the California group, the site visit report merely states that "in-kind contributions . . . do not represent any new sources of support." No mention is made of the fact that the California schools pledged over $1,000,000 toward faculty salaries and facility support.

The California site visit report notes the following: "In-kind contributions of $1,464,000 for the first year represented existing support of the four institutions and do not represent any new sources of support." This

statement was made in the context of in-kind funds being used to satisfy the desired level of $5 million per year. The quoted statement from the New York site visit report was made in the context of enumerating commitments over and above the desired $5 million in matching funds.

19. The New York site visit report states that "corporate interest is very high" and that several corporate representatives were present during the site visit, and financial contributions were expected in the future from corporate sources. No mention was made of similar representation and pledges by California's much larger and more active private earthquake engineering sector in the California site visit report even though a number of nationally prominent representatives participated in the presentation.

We agree that the California site visit report does not mention corporate representatives being present. Although we did not ask California school officials about this, California's prepared program for the site visit states that they were to be present.

20. In the New York site visit report it is stated that "during the site visit, New York State and University of Buffalo officials made it clear that they are committed to establishing a first-rate earthquake engineering research center." No mention is made in the California site visit report of the same commitment expressed by high-level California State and university officials. Nor was it pointed out that the California facilities are already considered "world-class."

The California site visit report included a section entitled "University and State Commitment," which was a discussion of California's matching funds commitment, but which did not address the commitment of state and university officials. Six of the seven panelists, however, indicated to us that they perceived New York's commitment to be much stronger than California's. Their reasons for this perception centered around the matching funds commitment and impressions made at the site visit.

Four panelists perceived that California had difficulty getting the matching funds legislation passed because of the time involved or because of statements made at the site visit. One panelist recalled a member of the California legislature saying that it is always difficult to get the legislature to commit funds. Another panelist recalled one of the California researchers saying he was "amazed" that the matching funds legislation passed. Another panelist viewed California getting a lesser

amount than requested from the legislature as a sign of weak commitment. Other panelists perceived New York's commitment to be stronger because higher-level university officials, such as SUNY-Buffalo's President and the Dean of the School of Engineering, were personally involved in the site visit.

21. In the New York site visit report it is stated that the proposed Center Director, Robert Ketter, has an outstanding record as a researcher and administrator. In the California site visit report the proposed Center Director, Joseph Penzien, who has a much more distinguished record as a researcher and an equally outstanding record as an administrator of technical and research activities, was not even mentioned. Professor Penzien was elected to the National Academy of Engineering on the basis of his earthquake engineering contributions and was the founding director of the Earthquake Engineering Research Center at Berkeley. In the evaluation of the California proposal, it was stated that the "director was not even named." This is totally false and misleading. The lack of experience of the proposed New York center's director in earthquake engineering was never mentioned.

The panelists told us that they were particularly impressed with Dr. Ketter's management abilities. Dr. Ketter's experience as a former President of SUNY-Buffalo and the impression he gave of being firmly in control at the site visit were key factors leading to several panelists' perceptions of Ketter as a stronger manager. Several panelists had reservations about Dr. Penzien's management experience, and two were concerned that other university duties or outside business interests might take time away from his duties as center director.

The panel's report on the California proposal states that "[t]he leadership is not firm in this proposal: a director has not even been named by the Chancellor." We agree that this statement is misleading on the basis of the following statement from California's proposal: "The first Director is Professor Joseph Penzien of the Department of Civil Engineering, subject to confirmation by the Chancellor." However, none of the panelists recalled the naming of California's director as being an issue in the decision since Dr. Penzien had been officially confirmed by the time the California site visit was made.

22. The New York site visit report states that the Center Oversight Committee "will have representatives from industry, government and the research and educational community, and will set policies and provide oversight for the center." No mention was made of a similar oversight

committee and functions in the report on the California site visit except to say that the governing board "lacked national broad representation." The strong background of experience in earthquake engineering-related matters of the California oversight committee and its national stature was never mentioned. Likewise, the specifics of the national representation on the New York board was not discussed.

We agree that this was not mentioned in California's site visit report and point out that this is another example of the imbalance of coverage in NSF's documentation, which we discuss in chapter 3. However, we did not obtain further information relevant to this concern.

23. The California site visit report states that the California team is excellent technically and well recognized "but is aging." Isn't the New York team also aging? The factual basis for this assertion is never discussed and it is not clear that this point is really pertinent anyway. However, it conveys a negative impression.

We believe that it is not appropriate to mention age, and that on the basis of the data provided to us by both schools, this statement is misleading. According to data supplied to us by California's principal investigator, the actual age distribution of the California researchers was as follows: one under 30 years old; 17 between 30 and 39 years old; 12 between 40 and 49 years old; 18 between 50 and 59 years old; and 15 between 60 and 76 years old. New York's principal investigator provided us with the ages of the key management personnel for his center. One individual was 48 years old and the other seven personnel were between 50 and 58 years old.

However, the review panelists told us that their concern was not the age of California's researchers per se, but rather the continued operation of the center and the likelihood of the center's generating new ideas. Several panelists believed that California had not adequately addressed the need to bring in new and younger people to take over the center in the future, whereas New York had addressed this point. Two panelists believed that the likelihood of new and different research would be diminished by not bringing in new, younger staff. One panelist was concerned that some of the California researchers were no longer active technically.

The age of the California researchers also came up when the NSB was considering the award recommendation. Here again, the concern appears to have been the continued operation of the center. The transcript of

that NSB meeting shows that NSF's assistant director for engineering told the Board that NSF was concerned that many of the key people in the California group were over 60 years old, which raised the question of who was going to carry on the research burden 5 years hence—a question for which the Assistant Director said California had no answer. However, most of the NSB members present at the time told us that the age of California's researchers did not influence the NSB decision to approve the award to New York.

24. The New York site visit report states that the New York center will emphasize structural systems including low- and high-rise buildings, dams, and bridges as well as lifeline systems using a matrix organization. This is cast in a very positive light. On the other hand, the California site visit report states that what is proposed is a structure based on a "complicated matrix arrangement," which covers buildings, dams, and "virtually all topics in earthquake engineering." The emphasis was clearly negative. The overall coverage of the New York proposal does not appear to be substantially different from that of the California proposal (structures and lifelines covers most of earthquake engineering), but this is expressed very differently in the two reviews.

We interpreted the California site visit report as critical of the lack of coordination between the components of California's proposed matrix organization rather than critical of its matrix organization per se.

The California site visit report states:

"The structure, based on a complicated matrix arrangement which covered buildings, dams, and virtually all topics in earthquake engineering, was more of a classification scheme rather than a management plan. The plan did not include how the different activities would be coordinated and linked together, and failed to indicate how the management of the Center would accomplish anything different than would be accomplished by an unsolicited proposal system."

On the other hand, the New York site visit report states:

"The second major thrust of the Center's research program is directed at structural systems (e.g., low- and high-rise structures, dams and bridges) and lifeline systems (e.g., power and communication, gas, water and sewage, and transportation). It is believed that such systems have not been given adequate attention in a coordinated and integrated fashion and if approached in such a manner major breakthroughs will result . . . The Center's research activity, which will emphasize structural systems and lifeline systems, will use a matrix organization. Eight program areas will

receive attention and the activities within each area will be coordinated by specialists from the consortium institutions who will serve as program directors or co-chairmen of a particular area."

25. More importantly, no mention was made of the very significant fact that the California proposal has a single strong focus that pulls everything together: the national problem of existing hazardous structures. The focus of the New York proposal is decidedly regional.

[Chapter 3 discusses the issue of national focus as an evaluation factor.]

The review panel recognized that California was "strongly focused on a national need" (presumably existing hazardous structures), but the panel also had the strong perception that California intended to concentrate exclusively on problems in California and to use only California researchers. The California site visit report states:

"Although the research plan was focused on a national need, it was very narrow and was directed only at the state of California. The plan did not allow for research interaction with other universities outside the State of California. . . The proposal was almost entirely focused on California's needs with the assumption that improvements in California's conditions will ultimately benefit the rest of the country."

The panel also recognized the regionalism of New York's proposed center. The New York site visit report states:

"The earthquake problem is usually identified with the Western U.S., especially California. However, earthquakes are a national problem and areas east of the Rocky Mountains are also at risk. Less is known about earthquakes east of the Rocky Mountains and for this reason, and because of the strengths and interests of the cooperating institutions, the Center will initially concentrate its attention on that region."

The panelists expressed to us a unanimous belief that New York did a better job of addressing earthquake hazards mitigation on a national basis. The panel members perceived a difference in earthquake problems in different parts of the country and were critical of California's perceived approach of applying changes to California's building codes in other areas of the country. Several of the panelists also believed that California should have planned to actively involve researchers from other parts of the country, as New York did. One panelists noted that although New York intended to concentrate initially on problems east of the Rocky Mountains, it planned to later expand to problems in the West.

26. The New York site visit report states that "many of the principals uncovered in its research program will have implications for earthquake hazard reduction in California and other Western states." On the other hand, the California site visit report states that "although the research plan was focused on a national need it was very narrow and was directed only at the State of California." This interpretation is highly opinionated and totally unwarranted. The California research team has a demonstrated record of accomplishment in the application of earthquake engineering research nationwide.

The review panel's basis for labeling California's plan as narrow is discussed above in response to concern number 25. We have no information as to why the panel believed that principles uncovered in New York's initial efforts would have implications for hazard reduction in western states even though it perceived regional differences in earthquake problems.

27. The New York site visit report contains brief, upbeat summaries of the proposed research. No such summaries of proposed research are contained in the report on the California site visit as supplied by NSF.

We agree that the California site visit report does not contain similar information and is another example of the lack of balanced coverage in the reports. Again, however, we did not obtain information relevant to this specific concern.

28. The New York site visit report states that "the investigators were also impressive in terms of their sensitivity to education and technology transfer matters." No mention was made in the California site visit report of the fact that the California schools are the recognized national leaders in earthquake engineering education and technology transfer. On the contrary, it is stated that California proposed "no new mechanisms for technology transfer" and that "technology transfer was weak and left to the individual investigators and was not part of the overall management plan." This is totally false. One of the major strengths of the proposed California center, which was stressed during the site visit, was that the center would be an integral part of an innovative, multifaceted, and comprehensive implementation program. The center would have been a key element in a major new state program of seismic safety. This program would have set an example for the rest of the nation and saved many lives.

Information regarding perceived differences in the educational components of the proposed centers is provided in response to concern number 8. Regarding technology transfer, the review panelists told us that California did not convey to them plans for anything new. Several panelists said that the California group appeared to rely on published literature and papers or that it planned to do nothing more than it was already doing. They said that New York, on the other hand, had a more explicit and hands-on approach, including seminars, conferences, and workshops to bring people together, and involvement of outside researchers and universities. Other differences the individual panelists cited were that New York gave technology transfer a higher priority in its proposed organizational structure (a separate component on a par with the research component) and that New York budgeted money specifically for technology transfer. One panelist was of the opinion that California had historically been a poor disseminator of information outside of California.

29. The New York site visit report states that "a library collection of documents, graphic materials and computer programs related to earthquake hazard reduction will be developed." The report on the California site visit makes no mention of the fact that a unique collection of such materials currently exists at the California universities and that this material has been made readily available to all researchers nationwide through the NSF-supported National Information Service for Earthquake Engineering (NISEE).

We agree but did not obtain any further information relevant to this concern.

30. In fact, in the proposal review, the NISEE operation, which is managed by the University of California-Berkeley and Caltech, was treated in a negative light rather than as a positive asset of the proposed California center and the nation. To imply that important earthquake engineering materials are not currently available to the eastern United States is simply untrue.

We interpret the proposal review not to treat NISEE in a negative light but to criticize the proposal for not explaining how NISEE would be incorporated into the proposed center. Specifically, the proposal review states: "Another weakness is [that] the educational thrusts and information dissemination elements, such as the existing National Information Service for Earthquake Engineering, are not discussed as to how they would interface or integrate into the organization."

31. The report on the New York site visit is filled with references to the beliefs and hopes of the proposers regarding the proposed center: the belief that major breakthroughs will result, the belief that efforts can be integrated to handle the infrastructure problem, the hope that cost-effective seismic design and rehabilitation techniques will result, and the hope that other hazards can also be addressed. No such statements of positive feelings are included in the report on the California site visit, even though the California researchers strongly expressed similar positive feelings. Furthermore, New York hopes are never compared with the California record of accomplishment.

We agree but did not obtain further information relevant to this concern.

32. A great deal is made of the fact that the New York center will add a number of new faculty members. The report on the California site visit states that no new faculty members are projected. The latter conclusion is dubious since the question of new faculty members was never raised during the site visit. Futhermore, the reason that so many faculty members are needed in New York is that the New York schools are now inadequately staffed to conduct the activities of a research center. The total number of faculty members who will be active would have been a more appropriate measure of the strength. Even with an increase of 12 faculty members, the New York center will have fewer faculty active in earthquake engineering than the more than 50 faculty presently involved in earthquake engineering education and research at the California universities participating in the California proposal.

Our discussions with the panelists indicated that their primary concern was not how many researchers would be needed to staff the center but rather other benefits attendant to adding new faculty. Most of the panelists saw the bringing in of new faculty as important to implementing the "systems approach," making the center something better than the individual research projects that proceeded it, or filling in talent gaps. As one panelist put it, new faculty helps overcome the problem of existing staff being reluctant to change from the goals and objectives of their individual projects to the broader goals and objectives of the center. Several panelists saw not adding faculty as an indication of California's intent to merely maintain the status quo and not to take advantage of an opportunity to expand its existing effort. Two panelists also wondered what California would do with the additional funds the center would bring if it did not hire more people. Another panelist said that,

assuming the current faculty was productively employed, he was concerned about whether they would be able to dedicate sufficient time to the center.

33. In the report on the California site visit, the panel expressed "disappointment" that California projected "only a 50-percent increase in students." Why was this disappointing? It was not mentioned that this 50-percent increase would represent a very substantial increase in the total number of well-trained earthquake engineers nationwide.

Three of the review panelists said that they could not recall the basis for this statement. One of these stated that, in retrospect, he would deem a 50-percent increase to be substantial. Three other panelists (two of whom were not sure of the exact basis for this statement) told us the panel believed that California should have been able to train more students given the significant increase in funding that the center would bring or given that California's initial capital investment in the center would have been lower than that of New York. A seventh panelist said he recalled that California proposed to increase the number of interns rather than the number of full-time graduate students.

34. The California site visit report states that "it was expected that code development in California would presumably become a model which would dictate national codes, as it has in the past, without taking into account differing conditions in different parts of the country." This statement is clearly biased and fails to recognize the leadership position that California has played and will continue to play in the development of earthquake codes and other forms of implementation. It also makes it appear that the California researchers are insensitive to what are thought to be differing conditions in other parts of the country. This is also an unfair implication as a very large number of California researchers have been heavily involved in the implementation of earthquake engineering research nationwide. Only a very small number of New York researchers have been involved in implementation.

The statement in question was made in the context of critiquing California's technology transfer plan, as follows:

"The California consortium relegated technology transfer to the individual investigator, as one of several responsibilities. No new mechanisms were proposed and this was viewed as a serious weakness. It was expected that code development in California would presumably become a model which would dictate national codes, as it

has in the past, without taking into account differing conditions in other parts of the country."

Additional information on California's technology transfer plan is presented in response to concern number 28. We did not obtain other information relevant to this concern.

35. The report on the California site visit states that "it is evident that there was significant difficulty in getting the [California] legislation passed." Such a comment is completely inappropriate and out of order in a review. There is, in fact, no basis for this statement and one wonders where the review panel obtained this information.

As noted previously in response to concern number 20, four panelists told us they perceived that California had difficulty in getting its matching funds legislation passed. They got this impression either from the time it took for passage or from statements they said were made at the site visit. One panelist recalled a member of the state legislature saying that it is always difficult to get the legislature to commit funds. Another panelist recalled a California researcher saying he was "amazed" that the legislation passed.

Passage of California's matching funds legislation actually took about 5-1/2 months. The bill was introduced on February 3, 1986, and signed into law by the governor on July 16, 1986. There was an approximate 1-month delay in initial hearings on the bill (from March 19, 1986, to April 16, 1986) because its author twice cancelled the hearings to amend the bill. Consideration and further amendments of the bill by four different committees accounted for the bulk of the remaining processing time. There apparently was little or no opposition to the bill because it passed the four committees and both houses of the legislature with only one opposing vote.

We also noted that the then-Chairman of the California Seismic Safety Commission (CSSC) wrote to Senator Wilson on June 11, 1986, seeking his assistance in getting the governor to support the legislation. According to the letter, the governor had given no indication of support, even though CSSC had worked with his office on this matter. The current CSSC chairman, however, told us that this probably was a routine letter encouraging the governor's endorsement of a pending bill, and not necessarily an indication that the legislation had difficulty passing.