

**APPROVED MINUTES<sup>1</sup>**  
**OPEN SESSION**  
**359<sup>th</sup> MEETING**  
**NATIONAL SCIENCE BOARD**

The National Science Foundation  
Arlington, Virginia  
August 3, 2000

Members Present:

Eamon M. Kelly, Chairman  
Anita K. Jones, Vice Chair  
John A. Armstrong  
Pamela A. Ferguson  
Mary K. Gaillard  
M.R.C. Greenwood  
Stanley V. Jaskolski  
George M. Langford  
Joseph A. Miller, Jr.  
Robert C. Richardson  
Michael G. Rossmann  
Vera Rubin  
Luis Sequeira  
Daniel Simberloff  
Bob H. Suzuki  
Richard Tapia  
Chang-Lin Tien

Rita R. Colwell, NSF Director

Member Absent:

Maxine Savitz

Consultants Present:

Nina V. Fedoroff  
Diana S. Natalicio  
Warren M. Washington

Consultants Absent:

Jane Lubchenco  
John A. White, Jr.  
Mark S. Wrighton

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<sup>1</sup> The minutes of the 359<sup>th</sup> meeting were approved by the Board at the October 19, 2000 meeting

The National Science Board (NSB) convened in Open Session at 12:55 p.m. on Thursday, August 3, 2000, with Dr. Eamon Kelly, Chairman of the Board, presiding (Agenda NSB-00-134). In accordance with the Government in the Sunshine Act, this portion of the meeting was open to the public.

AGENDA ITEM 5: Swearing in, NSB Nominees

Dr. Kelly welcomed two new Board members: Dr. Michael Rossmann, Hanley Professor of Biological Sciences at Purdue University, and Dr. Daniel Simberloff, Nancy Gore Hunger Professor of Ecology and Evolutionary Biology at the University of Tennessee at Knoxville. He also welcomed Board consultant Dr. Nina Fedoroff, Willaman Professor of Life Sciences and Director, Life Sciences Consortium and Biotechnology Institute of the Pennsylvania State University. Dr. Kelly noted that the Senate Health, Education, Labor and Pensions Committee has reported out five of the remaining nominees (Drs. Fedoroff, Jane Lubchenco, Diana Natalicio, Warren Washington, and John White) to the full Senate and that Dr. Mark Wrighton also awaits Senate confirmation.

He then welcomed Dr. Neal Lane, Director of the White House office of Science and Technology Policy, who administered the oath of office to Drs. Rossmann and Simberloff.

AGENDA ITEM 6: Open Session Minutes, May 2000

The Board APPROVED the Open Session minutes of the May 2000 meeting (NSB-00-123, Board Book Tab E).

AGENDA ITEM 7: Closed Session Items for October 2000

The Board APPROVED the Closed Session items for the October 2000 Board Meeting (NSB-00-132, Board Book Tab F).

AGENDA ITEM 8: Chairman's Report

**a. Committee membership**

Dr. Kelly reported the revised membership of the standing committees (see attachment #1, NSB-00-118).

**b. Discharge of the CPP Task Force on the Environment**

Dr. Kelly thanked task force chair, Dr. Lubchenco; committee members, Drs. John Armstrong, Mary K. Gaillard, and Washington; National Science Foundation (NSF) staff member, Dr. Mary Clutter, and executive secretary, Dr. Penelope Firth, for their important work. He then discharged the task force.

**c. Report on Executive Committee Elections**

Dr. Kelly reported that the Board had elected Drs. M.R.C. Greenwood and Robert Richardson to fill unexpired positions on the Executive Committee through May 2001.

**d. Inspector General's Semiannual Report to the Congress**

Dr. Kelly reminded the Board that the Audit and Oversight Committee had reviewed the Inspector General's Semiannual Report to the Congress at the May meeting and that management's response had been sent to the Board after the meeting. Because of the Congressional deadline for receiving the report, Dr. Kelly reported that he had transmitted the report and management's response for the Board.

The Board RATIFIED transmission of the NSB management's response to the Inspector General's Semiannual Report to the Congress.

**e. NSB Meeting and Retreat in February 2001**

Dr. Kelly reminded the Board that at the May meeting there appeared to be consensus that Head Start through grade 12 education would be the topic for the NSB policy meeting in February 2001, and that the meeting and NSB retreat would be held in the Washington, DC, area.

AGENDA ITEM 9: Director's Report

**a. Staff Introductions**

Dr. Rita Colwell introduced several recently appointed NSF staff members: Dr. Terry Yates, Director of the Division of Environmental Biology, Directorate for Biological Sciences; Dr. Louis Martin-Vega, Acting Assistant Director for Engineering; and Mr. John Wilkinson, Jr., Senior Staff Associate for Workforce Development, Office of the Director.

**b. Congressional Update**

Dr. Colwell noted that the House and Senate recessed on July 27 and will return after Labor Day to complete the current legislative session, scheduled for adjournment on October 6.

*Appropriations:* Dr. Colwell reported that support for NSF appropriations is strong in both the House and Senate, especially for the President's recommended budget number. Also, Senators Mikulski and Bond are circulating a "Dear Colleague" letter requesting support for doubling the NSF budget over the next five years. On June 22 the House passed H.R. 4635, the Veterans Affairs, Housing and Urban Development and Independent Agencies Appropriations bill, and the bill is now awaiting Senate

consideration. A markup in the Senate Subcommittee has not been rescheduled since the cancellation of all committee meetings on July 18th. An amendment to the House bill to transfer \$18 million from NSF polar research to a Housing and Urban Development program for housing opportunities for people living with AIDS will likely be restored in conference.

*Authorization:* Four bills to reauthorize NSF have been introduced in the House. H.R. 4901, which provides for a three-year authorization, is the focus of the committee's attention. No draft legislation is available from the Senate.

*Hearings and other actions:* On July 13 the Senate Health, Education, Labor and Pensions Committee held a hearing, and NSF's testimony was well received. On July 19 Dr. Judith Sunley, Interim Assistant Director of the Education and Human Resources (EHR) Directorate, testified before the House Science Committee on Representative Ehlers' National Science Education Act (H.R. 4271). The Science Committee marked up and passed the bill on July 26; it is now before the House Education and Workforce Committee. Dr. Colwell also noted that Congress had passed the Oceans Act of 2000, Senate bill 2327, establishing a Commission on Ocean Policy, to review Federal activities relating to the ocean, including science activities.

#### AGENDA ITEM 10: NSF Planning Issues

##### **a. Diversity**

Dr. Colwell described the ongoing challenge of attracting and retaining students in science and engineering to yield future scientists and engineers drawn from all segments of the Nation's population. NSF's strategic plan provides that NSF will use its activities to enhance diversity in the science and engineering workforce. Key in this effort is the participation of women, underrepresented minority group members, and persons with disabilities at all education levels, with special attention to the development of an interest in science and engineering careers. Dr. Colwell mentioned examples of programs through which NSF reaches a diverse student population through focused program goals, management, and oversight, such as the Urban Systemic Initiatives, Research Planning Grants for Minority Scientists and Engineers, Program for Persons with Disabilities, the Louis Stokes Alliances for Minority Participation, and Graduate Fellowships for Women in Engineering and Computer Science.

Dr. Colwell presented data on science and engineering degrees, showing that at all degree levels minority students are represented significantly below their representation in the U.S. population, but particularly at the graduate level. For women, attrition at the graduate level is a serious concern. Dr. Colwell suggested several implications of these data: (1) The most effective investments may be at the associate and bachelor's levels; (2) The transition points are critical—between academic levels, from high school to two- and four-year colleges, and from two-year to four-year colleges and to graduate school; and (3) Mentoring and career counseling are important, especially for minority students.

Dr. Colwell noted that most NSF programs focus on the graduate level and suggested that the Board think about stipends for NSF programs to assist students at two-year colleges and for summer support for students pursuing a bachelor's degree. She stated that on the graduate level NSF supports only a small fraction of students, but it can leverage that support through partnerships with other Federal agencies, colleges and universities, professional societies, and the private sector. She also presented data on disparities between women and minorities and other groups in advancement in careers in academe and industry after age 35, and noted that persons with disabilities were only five percent of the science and engineering workforce in 1995. She asked the Board to guide NSF strategies to increase workforce diversity with regard to how to invest, where to invest, and how best to influence institutional change and embed diversity within all NSF activities.

*Board discussion:* Drs. Richard Tapia and Bob Suzuki cautioned that data on diversity tend to be presented at a high level of aggregation that belies significant differences among the constituent groups of the larger categories, for example, Hispanics and Asian Americans. They also both commented on insufficient attention given to NSF's second review criterion, which, in its focus on broad social benefits, is important for promoting diversity. Dr. Joseph Bordogna, NSF Deputy Director, stated that more than a year ago the NSF Director notified the community leadership that NSF decisions would increasingly focus on the second criterion. NSF's Director's Review Board requires that large awards adequately address the criterion. When new division directors are appointed, approximately a third of the interview time spent with them deals with the second criterion and diversity issues.

Dr. Washington noted that programs that effectively support the transition between receipt of a bachelor's degree and graduate education tend to have focused traineeship summer programs structured around disciplinary cores. He further observed that NSF might want to seek ways to expose African-American students oriented toward medical degree programs to other opportunities in science and engineering.

Dr. Stanley Jaskolski remarked that strategies are needed to target students in grade school, high school, and college. He also suggested that industry be enlisted as an ally for diversity in the workforce, particularly in programs that would motivate people by exposing them to the value of science, engineering, mathematics, and information technology. Dr. Colwell responded that a matching program to provide scholarships for students interested in science, engineering, and mathematics at the community college level could make a significant difference because a large proportion of minority and women students are enrolled in community colleges.

Dr. Joseph Miller strongly supported Dr. Jaskolski's comments and, noting Dr. Colwell's remark, suggested that NSF and industry consider work-study programs or cooperative programs at community colleges. He further inquired about NSF's Centers for Learning and Teaching with regard to their involvement with tribal schools and historically black colleges and universities. Dr. Natalicio cautioned that the target group for work-study or other assistance needs to be carefully defined, and that the disaggregation of data is also

important for students enrolled in community colleges. She observed that community college students have widely divergent goals and many would not be appropriate for participation in programs to encourage pursuit of advanced science and engineering degrees.

Dr. Martin-Vega responded that engaging industry and community colleges would be a natural sequel to activities already occurring in the Engineering Research Centers and the Science and Technology Centers. Dr. Sunley, responding to Dr. Jaskolski, explained that Centers for Learning and Teaching programs focus on minority-serving institutions and on building diversity in the instructional workforce.

Responding to a question on NSF's Advance program targeted to assist women, Dr. Bordogna reported that a solicitation is being prepared that will integrate all NSF investments to advance women scientists and engineers. Strategies will include individual grants to women, components for handling issues such as re-entry, and grants to institutions that have a record of success in advancing women.

Members commented on the need to focus on strategies for retention, such as insuring that women and minorities get a strong math background early in their educational careers, that maternity leave is incorporated into graduate and postdoctoral programs, and that students from underrepresented populations become involved in research. Dr. George Langford suggested that NSF could greatly increase the number of minority graduate students by assuring diversity among its research assistantships.

## **b. Priority Setting**

Dr. Colwell described the process that NSF uses to establish budget priorities. The input to the budget planning comes from three general sources: (1) needs and opportunities, which is the scientific input, (2) strategic direction and policy, from the Board, Office of Management and Budget (OMB), the White House Office of Science and Technology Policy (OSTP) for the Administration's research and development priorities (through the annual memorandum from the heads of OMB and OSTP), and the Congress, and (3) performance evaluation. NSF management then develops budget options and scenarios, looks at major drivers and, with Board oversight, establishes priorities. Criteria or guideposts used in establishing priorities include opportunity, impact, readiness, timeliness, consensus, integration with NSF mission, and balance. Once the major budget decisions are made, the task becomes one of communicating information and building consensus and support. Dr. Colwell noted that the Board plays two major roles: (1) providing advice, input regarding needs and opportunities, strategic decisions, and performance assessment; and (2) reviewing and approving the budget request for submission to OMB.

Dr. Colwell stated that two integrative strategies define the NSF budget process: strengthening the core activities from which capabilities arise, and supporting major initiatives based on national and global priorities. Two other crosscutting strategies feed into the process: identifying unmet opportunities in the disciplines and diversifying the

portfolio. Dr. Colwell noted that although core activities and initiatives are distinguished in budget presentations, in fact they are synergistic and their boundaries are not well defined.

Dr. Colwell remarked that budgeting is continuous: one budget is being closed out, another is being implemented, a third is being prepared for submission, and a fourth is being planned. With regard to Board participation, in March, opportunities and issues are discussed. In May, priorities emerge. In June, the Executive Committee focuses on the principles and the constructs for preparing the budget. The May and June discussions are incorporated into the Budget Call to the Assistant Directors for detailed information. In early July, the Executive Committee discusses the preliminary budget estimates. Discussions in August and September are the basis of more detailed estimates. The budget is presented to the Executive Committee for approval in September and to the full Board at the October meeting.

Dr. Colwell described the process by which new initiatives are developed within NSF. Each new initiative is assigned to an Assistant Director as coordinator, who works with the Senior Management Integration Group (SMIG) to appoint an agency-wide initiative working group. This group develops scientific and education direction for the initiative and works closely with directorates and the budget office to develop integrated plans that are broadly understood and accepted throughout NSF. Dr. Colwell agreed to provide information to the Board on unmet opportunities considered but not included in the 2001 budget as context for the four initiatives that were included: biocomplexity in the environment, nanoscale science and engineering, information technology research, and the 21<sup>st</sup> century workforce.

#### AGENDA ITEM 11: National S&E Infrastructure

Dr. Bordogna reminded the Board that they had requested a presentation on the Nation's science and engineering (S&E) infrastructure to assist them in deciding whether to undertake a study of the subject. He noted that the presentation would focus on the changing nature of infrastructure. The definition of infrastructure is evolving, as computer and communications technologies—cyber infrastructure—and other developments change the nature of infrastructure. To make informed decisions about infrastructure, decision-makers need better measures to assess the current state and plan for future investment and stewardship. Disciplines have their own assessments and NSF collects data on research facilities, largely focused on buildings and equipment. There is a strong need to reexamine the criteria used to set priorities for infrastructure support and an opportunity to define infrastructure. It is more than buildings and tools; it also includes research space, protocols and standards, computation and networking capacity, and other things that enable future education and research capacity.

Dr. Bordogna noted issues involved include: What are the size and quality of national physical infrastructure for S&E? What new infrastructure is needed to ensure U.S. leadership in S&E? What portion of this infrastructure should be provided by the public and private sectors? How do Federal indirect costs and cost-sharing policies affect this

dynamic? What proportion produces knowledge that can be broadly used? To answer these questions requires national and international perspectives. A 1995 report of the National Science and Technology Council on infrastructure, facilities, and instrumentation made recommendations in three areas. (1) It recommended a major interagency effort to improve that infrastructure—that infrastructure be well used by sharing and by employing remote access, and that support of infrastructure be balanced with research support and training; (2) It suggested that seven percent of all Federal research and development be for infrastructure; and (3) It recommended that institutions should cost-share acquisitions and should support operations and maintenance.

Dr. Bordogna noted in conclusion that a significant decrease in the quality of S&E infrastructure would retard scientific and engineering progress and erode U.S. ability to attract and retain first-rate researchers and educators. Priorities must be set, but the changing nature of infrastructure requires reexamination of criteria used to set priorities.

Dr. Armstrong, as chairman of the Committee on Programs and Plans, led the Board's discussion, which focused on issues the Board might consider if a task force is formed. The Board discussion included questions of scope and definition, and availability of data for the proposed study. Currently available data on infrastructure focus on "bricks and mortar," availability of space, and counts of equipment, and do not address changing infrastructure needs, including the emergence of cyber infrastructure. Members generally agreed that general purpose bricks and mortar in the form of buildings should be excluded from such a study. However, unique specialized facilities required to house very large research instrumentation should be considered. Other needs noted included the people to operate and maintain major instruments, attention to animal facilities and specialized facilities for plants, and consideration of the trade-off between funding infrastructure and funding research.

Responding to a question from Dr. Pamela Ferguson as to how the findings of such a study would be used and who would be the audience, Dr. Colwell noted that the study findings would help demonstrate that investment in science and engineering is unacceptably low and that the Federal budget for NSF is severely below what it should be, given the size of the U.S. economy. Dr. Greenwood added that the study could also help direct well-targeted private sector investments for maximum impact.

Dr. Kelly stated that an NSB task force would make an important contribution by defining terms, which will take considerable thought and effort. The Board's study could educate the public on the nature of the gap between the accelerating rate of change in scientific knowledge and the lagging rate of change in infrastructure, and the consequences of that difference. Members agreed that the first step is to set up an internal group to focus on definitions and develop a workplan.

#### AGENDA ITEM 12: EHR Program Approvals

Dr. Suzuki reported that the EHR Committee had approved two programs to recommend to the Board. The first is the Federal Cyber Service: Scholarship for Service program, an



interagency program to build capacity for developing specialists in computer security systems (Board Book Tab G, NSB-00-143; see attachment #2).

The Board APPROVED the Federal Cyber Service program.

The second is the Centers for Learning and Teaching program, addressing the need for adequately prepared math and science teachers through collaborations involving a Ph.D.-granting institution and a school system, among others (Board Book Tab H, NSB-00-142; see attachment #3). A pilot program was conducted last year; the new program will be scaled up to 7-9 projects.

The Board APPROVED the Centers for Learning and Teaching program.

AGENDA ITEM 13: NSB Report—*Communicating Science and Technology in the Public Interest*

Dr. Greenwood, chair of the Committee on Communication and Outreach, thanked committee members and the Executive Secretary Ms. Mary Lou Higgs for their hard and efficient work on the document (Board Book Tab I, NSB-00-99). She summarized the committee's three recommendations and reported that during the public comment period all comments received were positive and none required changes to the document. During discussion, Dr. Marta Cehelsky, Board Executive Officer, clarified plans for distribution: the document will be posted on the website, announced by postcards sent to interested communities, and released as a printed report.

The Board ACCEPTED *Communicating Science and Technology in the Public Interest* as distributed.

Dr. Greenwood noted that NSF has been asked to help the Board play a more active role in communication and outreach by providing materials on key issues in science and engineering research and education. In response, the Director's proposal indicated that a collaborative effort among Budget and Finance Administration, the Office of Legislative and Public Affairs, and the Board Office will produce PowerPoint slides and related briefing materials conveying coordinated messages. The materials will be placed on the secure NSB website no later than Labor Day and will be updated quarterly. Board members will receive passwords to access the site. Dr. Bordogna stressed the importance of receiving feedback from Board members on what they really need and find useful. Adjustments will be made as needed.

Dr. Kelly thanked Dr. Greenwood, chair; committee members, Drs. Langford, Maxine Savitz, Suzuki, and Chang-Lin Tien; and Ms. Higgs, executive secretary, for their excellent work. He then discharged the committee.

## ADENDA ITEM 14: Committee Reports

### **a. Audit and Oversight Committee (A&O)**

Dr. Jaskolski, committee chair, reported that the committee welcomed three new members, Drs. Fedoroff, Simberloff, and Rossmann. Dr. Lorretta Hopkins, Staff Associate in the Office of Integrative Activities, provided information on the Government Performance and Results Act process at NSF and the challenges faced. NSF received comments from the General Accounting Office (GAO) on its 1999 performance report and needs to supply more background information to support its conclusions. The interaction with GAO in this first year of the formal process was constructive. Ms. Deborah Cureton from the Office of the Inspector General and Mr. Donald McCrory, Acting Chief Financial Officer, briefed the committee on the NSF audit process, underlying legislation, and preparation of the fiscal year 2001 statement. Mr. Wilkinson reported on the demographics of NSF's current workforce, including trends for the past 10 years. NSF's budget and workload have grown considerably during that time, but the workforce level has remained basically flat. The skill mix needed to support NSF functions requires more complex business and technology skills than were needed just five years ago.

### **b. Committee on Programs and Plans (CPP)**

Dr. Armstrong, committee chair, reported that the committee dealt with three action items: an amendment to the Cooperative Agreement for the Gemini 8-Meter International Telescope, an extension of the Cooperative Agreement for National Optical Astronomy Observatories, and the Terascale Computing System award. All three were recommended to the Board for approval. Dr. Bordogna and NSF staff led discussions on five high-priority items in the Major Research Equipment budget: (1) Ice Cube, a detector array at the South Pole for cosmic neutrinos, (2) Earth Scope, a U.S. plate boundary observatory of unprecedented scope and resolution, (3) a new network of high-technology ocean observatories, (4) Atacama Large Millimeter Array, now in its first prototype phase, and (5) Rare Symmetry Violation Processes, a set of experiments designed to answer fundamental questions about symmetry-breaking events. The committee received information on the National Ecological Observatory Network (NEON) and discussed it in the context of new ground rules for Major Research Equipment. Dr. Margaret Leinen, Assistant Director of the Geosciences Directorate, updated the committee on NSF's progress in implementing the Board's report on the environment. The committee also discussed the need to take a fresh look at NSF's long-term strategy for very high performance computing. In a continuation of this discussion, NSF management will make a presentation to the committee on this issue in October.

#### *Polar Issues Task Force*

Dr. Washington, chair of the Polar Issues Task Force, reported the finalization of the Cooperative Agreement between the University of Alaska and the International Arctic Research Consortium. The task force heard presentations on AMANDA, the Ice Cube,

and new findings on the early history of the glaciation of the Earth and received an update on the Arctic Climate Impact Assessment. The task force will provide oversight and advice for the Assessment. A representative of the new contractor for logistics at the South Pole, Raytheon, described procedures that are being put in place to improve safety and lower the accident rate.

**c. Committee on Education and Human Resources (EHR)**

Dr. Suzuki, committee chair, reported that Dr. Sunley and the committee continued discussing priority setting in the EHR Directorate and education programming across NSF. Among the issues raised were NSF's niche nationally in science and math education, the need for an annual presentation to set the context for current portfolio programs and planned initiatives, and a request for information on how other directorates support EHR priorities. Dr. Sunley also continued her presentation on diversity, emphasizing K-12 education. The committee discussed assembling a group of experts on NSF's niche in K-16 education. Participants will include five to seven specialists, such as a former school superintendent, a classroom teacher, a researcher in learning and cognition, and a bench scientist. The committee expects to present a proposed agenda and list of speakers for the Board's February policy meeting. The committee discussed and endorsed a proposal from Dr. Kelly for a task force on the future science and engineering workforce in the context of national workforce and global issues.

*Subcommittee on Science and Engineering Indicators (S&EI)*

Dr. Tapia, chair of the subcommittee, reported that *Science and Engineering Indicators*<sup>3/4</sup> 2000, released in June, has been well received and there has been strong press interest. Planning for *Indicators*<sup>3/4</sup> 2002 has begun, based on the recommendations provided in Dr. Claudia Mitchell-Kernan's End of Cycle Report. The subcommittee decided that the K-12 chapter was most in need of major revision and agreed to topics for the initial outline. It was decided to involve K-12 experts in the review process. Dr. Lynda Carlson, Director, Division of Science Resources Studies (SRS), proposed that the 2002 planning focus on improved accessibility and relevance, thematic organization of each chapter, effective integration of themes across chapters, early review and input from the Board, and delivery to the President on January 15, 2002. The subcommittee approved the proposed eight chapter topics, incorporation of environmental issues into the various chapters of the 2002 report, development of an outline for an environmental chapter in 2004, and the process and schedule to be followed. Dr. Tapia noted that the subcommittee will be involved with SRS staff from the initial outline through the final writing and that Board involvement in reviewing outlines and chapters will be essential throughout the process, not just in reading the final product.

**d. Task Force on the NSF's 50<sup>th</sup> Anniversary**

Dr. Vera Rubin, chair of the task force, reported on the external review of the 50<sup>th</sup> anniversary commemorative brochure and indicated that most comments suggested the need for more detail, especially for the 1980s and 1990s. Task force members will

review the document again, then submit it to the Board by mail in September and ask for Board approval at the October meeting. Dr. Kelly emphasized the need for quick review by the Board because of the tight timeline.

Dr. Rubin reminded the Board that the JumpStart 2000 competition ended in May. The six winning entries (two from grades K-4, two from grades 5-8, and two from grades 9-12) were published in *Parade* magazine on May 14, and the winners were brought to Washington, DC, May 16-18. Events included an awards banquet, a meeting on Capitol Hill, and a special tour of the White House. Dr. Rubin thanked Ms. Susan Mason and Ms. Janell Richardson from the Office of Legislative and Public Affairs for coordinating the activities of the contests and the awards events in Washington.

In planning for the Board's December 12 celebration, the task force concluded that the Carnegie Institution of Washington was too small for the invitation list the Board is proposing. Alternatives identified include the Willard Hotel and Loew's L'Enfant Plaza Hotel. Dr. Rubin reported that the task force has selected Burt and Jean Westwood for the evening entertainment. Their specialty is scientific sonnets, fitting lyrics to well-known popular songs. Dr. Rubin called the Board's attention to the proposed budget for the December 12 event, to be covered by the NSB subaccount of the NSF Trust Fund.

The Board APPROVED the budget for the December 12 event and the task force's selection of entertainment, Burt and Jean Westwood. The Board also ACCEPTED the task force's recommendation to change the location of the December 12 celebration.

#### **e. Task Force on International Issues in Science and Engineering**

Dr. Ferguson reported on behalf of the task force. The group is preparing a report and recommendations for the next Administration's transition team and expects to submit the report to the Board for approval at the October meeting. At the request of the NSF Director, the task force is also preparing guidance for NSF management to incorporate into discussions on the fiscal year 2002 budget. This document is in the early stages of development, but there is agreement that NSF needs to raise the profile of its international activities.

#### **f. Committee on Science and Engineering Policy Issues**

Dr. Kelly, committee chair, stated that the committee discussed draft recommendations based on its study of priority-setting methodologies to date. Issues raised included data sources used to monitor and track Federal funding for research, the complexity of allocation decisions in mission agencies, a centralized system for research and development budget allocations, the value of diversity in the U.S. system, the desirability of focusing on priority-setting methodologies, and the low level of support for investments in science and technology and their effect on the economy. The committee discussed plans for the August 4 meeting with agencies and agreed to hold a Stakeholders' Symposium on October 20-21. The intent is to bring a report to the Board at the December meeting and to issue a draft interim report following Board approval.

The committee met with the Chief of the OMB Science and Space Branch and three other staff members, summarized the rationale behind possible recommendations, and outlined a schedule for remaining activities. The OMB staff expressed great interest in the committee's effort and drew special attention to major cross-agency initiatives. While OMB wants to maintain the strength of core disciplines and balance in the Federal portfolio, it also sees exciting opportunities in multidisciplinary research. OMB shares the committee's concern over databases and tools available to support allocation decisions, especially in emerging areas of science and engineering.

Dr. Kelly reminded the Board of the meeting on August 4 with Federal agencies that support research, and of the reception for guests from Federal agencies immediately following this meeting.

**g. Executive Committee**

Dr. Colwell, committee chair, reported that the committee focused on budget matters related to fiscal years 2001 and 2002. In September, the committee will approve the NSF fiscal year 2002 budget and the Office of the Inspector General's fiscal year 2002 budget, consistent with the Board's delegation of authority to the committee.

AGENDA ITEM 15: Presentation: NSF Office of the Inspector General

Dr. Kelly introduced Dr. Tina Boesz, NSF Inspector General. He noted that the act establishing the office vested responsibility for supervision of the Inspector General in the Board.

In an abbreviated presentation, Dr. Boesz stated that NSF established its Inspector General (IG) in 1989, pursuant to Congressional statute. IGs are cabinet-level, appointed by the President and confirmed by the Senate, and charged with promoting economy, effectiveness, and efficiency. The Board has the responsibility to select, remove, and oversee the work of the NSF IG, and the IG works closely with NSF management. By statute, the office has an Associate IG for Audit and an Associate IG for Investigations. The IG prepares an annual audit plan for NSF, presented to the Board's Audit and Oversight Committee, covering financial and performance audits that focus on high-risk programs and projects (large dollar amounts or small institutions receiving NSF grants for the first time). Dr. Boesz stated that a Board member may request an audit of a program simply to learn more about how it operates. The IG performs civil and criminal investigations, which for NSF include misconduct in science (plagiarism, falsification of data)—the only time the Office of the IG intersects with the actual conduct of science. In misconduct cases, the Office of the IG monitors an institution's investigation or does the investigation itself, and the NSF Deputy Director adjudicates. Appeals go to the NSF Director. By law, the IG reports semiannually to Congress. The IG's mission is to support the NSF in its mission by promoting economy and safeguarding integrity. Other points in the IG's current strategic plan are to prevent problems, take appropriate actions, and focus on education and outreach.

AGENDA ITEM 16: Other Business

Dr. Kelly expressed appreciation to the many NSF staff members who provided support and helped with preparations for the meeting. He adjourned the Open Session at 4:47 p.m.

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Janice E. Baker  
Policy Writer/Editor

Attachments: #1 NSB-00-118  
                  #2 NSB-00-143  
                  #3 NSB-00-142

## NATIONAL SCIENCE BOARD COMMITTEES

### EXECUTIVE COMMITTEE

Dr. Colwell, Director, <i>Chair</i>	(Vacancy)
Dr. Jones, <i>NSB Vice Chair</i>	(Vacancy)
Dr. Kelly, <i>NSB Chair</i>	

### AUDIT AND OVERSIGHT

Dr. Jaskolski, <i>Chair</i>	Dr. Sequeira
Dr. Ferguson	Dr. Simberloff
Dr. Fedoroff**	Dr. Wrighton**
Dr. Rossmann	

### EDUCATION AND HUMAN RESOURCES

Dr. Suzuki, <i>Chair</i>	Dr. Rubin
Dr. Langford	Dr. Savitz
Dr. Miller	Dr. Tapia
Dr. Natalicio**	

### EHR Subcommittee on Science and Engineering Indicators

Dr. Tapia, <i>Chair</i>	Dr. Savitz
Dr. Miller	Dr. White**
Dr. Richardson	

### PROGRAMS AND PLANS

Dr. Armstrong, <i>Chair</i>	Dr. Richardson
Dr. Gaillard	Dr. Tien
Dr. Greenwood	Dr. Washington**
Dr. Lubchenco**	Dr. White**

### CPP Task Force on the Environment

Dr. Lubchenco**	Dr. Washington**
Dr. Armstrong	Dr. Clutter#
<u>Dr. Gaillard</u>	

Note: NSB Chairman and NSF Director are members *ex officio* of all committees

\*\* Nominee pending U.S. Senate confirmation

# NSF Staff

**CPP Subcommittee on Polar Issues**

Dr. Washington\*\*  
Dr. Rubin

Dr. White\*\*

**TASK FORCE ON NSB 50<sup>TH</sup> ANNIVERSARY**

Dr. Rubin, *Chair*  
Dr. Lubchenco\*\*

Dr. Tapia  
Dr. Washington\*\*

**TASK FORCE ON INTERNATIONAL ISSUES IN S&E**

Dr. Natalicio\*\*  
Dr. Armstrong  
Dr. Ferguson  
Dr. Gaillard

Dr. Jaskolski  
Dr. Lubchenco\*\*  
Dr. Sequeira  
Dr. Erb#

**COMMITTEE ON STRATEGIC S&E POLICY ISSUES**

Dr. Kelly, *Chair*  
Dr. Armstrong  
Dr. Greenwood

Dr. Jones  
Dr. Miller  
Dr. Richardson

**COMMITTEE ON COMMUNICATION AND OUTREACH**

Dr. Greenwood, *Chair*  
Dr. Langford  
Dr. Savitz

Dr. Suzuki  
Dr. Tien

**AD HOC COMMITTEE ON NSB NOMINATIONS FOR CLASS OF 2008**

Dr. Jones, *Chair*  
Dr. Greenwood  
Dr. Miller

Dr. Richardson  
Dr. Tapia  
Dr. Tien

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\*\* Nominee pending U.S. Senate confirmation  
# NSF Staff



July 11, 2000

## **MEMORANDUM TO MEMBERS OF THE NATIONAL SCIENCE BOARD**

**SUBJECT:** New Program - Federal Cyber Service: Scholarship for Service (SFS)

### PERSPECTIVE

The Federal Cyber Service: Scholarship for Service (SFS) program is an outgrowth of the Federal Cyber Services Training and Education Initiative. The Initiative and its SFS component were formulated in part as a response to the report "*Critical Foundations: Protecting America's Infrastructures*" prepared by the President's Commission on Critical Infrastructure Protection in October 1997.

Agency participants in the Federal Cyber Services Training and Education Initiative will include the Office of Personnel Management (OPM), the Critical Information Assurance Office (CIAO), the National Security Agency (NSA), the National Science Foundation (NSF), and the National Security Council (NSC).

In both the private and public sectors, the need for computer security and information assurance specialists is acute. The SFS program will address this need by increasing the number of qualified students entering the fields of information assurance and computer security, and by increasing the capacity of the United States higher education enterprise to produce professionals in these fields.

The SFS program will provide funding to colleges and universities for scholarships to individuals in information assurance who will commit to federal service on completion of their degree. Capacity building through faculty development and capacity building through institutional development in information assurance and computer security fields are also elements of the program.

The National Science Foundation anticipates the following outcomes:

- New entrants to the federal workforce with the education and training that will enhance the security of critical federal information infrastructure,
- An increased national capability for the education of information technology professionals in critical information infrastructure protection disciplines,
- Identification, development, recognition, and maintenance of leading edge programs at universities and colleges with information assurance curriculum,

- Increased national research and development capabilities in critical information infrastructure protection, and
- Strengthened partnerships between institutions of higher education and relevant employment sectors.

## **PROGRAM DESCRIPTION**

The program will consist of two elements—a scholarship track and a capacity building track:

- In the *scholarship track*, an award will provide four years of funding to enable institutions to cover as many as three cohorts of up to 10 two-year full scholarships (30 two-year scholarships total during the grant period) for study leading to baccalaureate and masters degrees providing technical competence in the area of information assurance and security. Upon graduation, the scholarship recipients will be required to work for a federal agency for two years as their Federal Cyber Service commitment.
- The *capacity building track* includes a faculty development component and an institutional development component to assist those higher education institutions that are not currently certified in information assurance education. The faculty development component would provide funding for institutions with the CAE/IAE certification or equivalent programs to conduct regional faculty development activities for teams from other institutions to develop faculty capacity in information assurance and computer security. The institutional development component for capacity building in information assurance and computer security will include outreach to Historically Black Colleges and Universities, Hispanic-Serving Institutions, and Tribal Colleges. There will be strong encouragement for the participation of underrepresented groups, including women.

## **PROJECT CHARACTERISTICS**

For the Scholarship track, support will be provided to students who compete successfully in a selection process developed by the grantee, who meet the SFS eligibility criteria, and who are selected as qualified for employment in the Federal Cyber Service by the OPM. It will be expected that scholarship participants will receive their degrees (undergraduate or masters) within two years of the beginning of their scholarships. Each proposing institution will provide a description of their selection criteria and process, and will explain and justify the proposed distribution of scholarship recipients. In particular, institutions must ensure that groups underrepresented in information technology have fair access to scholarships.

For the Capacity Building track, projects in the faculty development component will be expected to develop and implement activities that assist faculty in learning about recent advances in information assurance and computer security to improve their instructional capability in these areas. Such projects might include conferences, workshops, intensive seminars, distance learning opportunities, or a combination of such activities to bring about the desired professional development for faculty. Projects in the institutional development component will be expected to have a specific focus in one of the following

areas: (1) adaptation and implementation of exemplary education materials, courses and curricula that have been developed at institutions currently certified in information assurance education; (2) development of curricula and/or materials that affect the learning environment and increase the prominence and quality of information assurance and computer security education; (3) classroom and/or work environment technical experiences enabling students and faculty to interact with professionals in the field of information assurance and computer security; and (4) laboratory and/or field experiences to improve students' understanding of basic principles or support use by faculty of modern instrumentation and new technologies.

#### ELIGIBILITY

Scholarship Track: Accredited U.S. institutions of higher education and consortia with strong programs of activity in information assurance are eligible to apply. The proposing institution (lead institution in a consortium) must be able to demonstrate that its programs meet criteria relevant to those necessary for certification by the National Security Agency as a Center of Academic Excellence in Information Assurance Education (CAE/IAE).

Capacity Building Track: Institutions with CAE/IAE certification or equivalent are eligible for the Faculty Development component. Institutions that do not have CAE/IAE certification or equivalent are eligible for the Institutional Development component.

#### AWARD SIZE AND DURATION

The SFS Scholarship track will support a university or college based scholarship program that provides two years of tuition, room and board, and stipend for students in the general area of information assurance and security. The program will contain an internship component intended to provide for hands-on training in the Federal Government. A typical award might be approximately \$2.5 million for four years supporting three cohort classes of 10 first-year students (year 1), 10 first-year and 10 second-year students (year 2), 10 first-year and 10 second-year students (year 3), and 10 second-year students (year 4). The total award sizes will depend upon the tuition and room and board costs.

For the Capacity Building: Faculty Development component, awards will be made for up to \$100,000 per year for 2 years to CAE/IAE certified or equivalent institutions to conduct regional and national faculty development activities for faculty teams from non-CAE/IAE institutions. For the Capacity Building: Institutional Development component, awards will be made for up to \$100,000 per year for 2 years to institutions not currently eligible for the SFS Scholarship Track to develop institutional capacity in the information assurance and computer security area.

#### MERIT REVIEW

Merit review of formal proposals will be based upon standard NSF criteria interpreted in light of SFS program objectives and review criteria specific to the SFS program. Proposals will also be expected to include a management plan, budget justification, and partnership details, including institutional commitment if applicable.

## PROGRAM MANAGEMENT

The Assistant Director (AD) for Education and Human Resources (EHR) will oversee the SFS Program with regard to policy and budget matters within NSF. The Director of OPM will oversee SFS with regard to policy and budget matters within OPM. The management of the program will be assigned to the Division of Undergraduate Education.

An Interagency Coordinating Committee (ICC) will manage the review process and recommend proposals for funding. Its membership will include the Assistant Director for EHR, the NSF program officer designated as the lead officer for the SFS program, a representative from OPM, and a representative from NSA. Ex-officio members will include members from the National Security Council and the Critical Infrastructure Assurance Office. Additional members may be added by the ICC. It will be chaired by the lead SFS program director.

Each year, a single competition will be held with proposal review by expert panels. The panel members will be chosen by NSF with advice from the ICC, and panels will include members from federal agencies with information assurance needs. The review process will be consistent with merit review policies of NSF. Site visitations by NSF or the ICC may be conducted for proposal evaluation and assessment of progress.

For FY 2001, NSF has requested approximately \$11.2 million for this activity, supporting 5-8 institutional scholarship awards and 5-8 capacity building awards.

## MONITORING AND EVALUATION

Each year, the ICC will review the progress of the supported projects based on information provided in annual reports and possibly site visits. The ICC will develop a report for NSF, OPM, and NSA senior management that highlights accomplishments, as well as identifies strengths and weaknesses within specific projects and across the program as a whole.

As with all NSF education and training activities, the SFS program will receive a third-party evaluation after its third year of operation. Evaluation results will be used to assess effectiveness of the program in meeting its stated goals and objectives and to identify strengths and weaknesses that can inform new directions in program development and management.

## **RECOMMENDATION**

I recommend that the Board approve the following resolution:

**RESOLVED**, that the National Science Board approves a Federal Cyber Service: Scholarship for Service (SFS) Program subject to the availability of funds, and authorizes the Director to take final action on grants, contracts, and other arrangements except when such actions require Board approval under existing policy guidelines.

Rita R. Colwell  
Director

July 13, 2000

MEMORANDUM TO MEMBERS OF THE NATIONAL SCIENCE BOARD

**SUBJECT:** New Program - Centers for Learning and Teaching

PERSPECTIVE

The Centers for Learning and Teaching (CLT) program is a comprehensive, research-based effort that will address critical issues and national needs of the science, mathematics, engineering, and technology (SMET) instructional workforce. Centers will provide a rich environment that melds research, pre-service and in-service professional development, and education practice.

Individual Centers may have specific academic foci (e.g., K-6 science, large-scale assessments, curriculum development), but each will address the following two broad components:

- 1) enhancing the content knowledge and pedagogical skills of the current and future elementary and secondary teachers; and
- 2) rebuilding the infrastructure of higher education faculty who educate those teachers.

The CLT effort builds upon previous activities in the professional development of teachers and provides opportunities for graduate students and post-graduate students in the disciplines and in SMET education to acquire the knowledge and skills needed to educate the next generation of teachers. Combined with new approaches in assessment, curriculum and materials development, and research-based instructional methodologies, the CLT program will enable the Foundation to build the intellectual infrastructure needed to ensure high-quality, standards-based learning opportunities in SMET for all students.

A competition was held in FY 2000 that shortly will result in awards for two pilot Centers. Activities of the two pilot Centers, and lessons learned during the review process will inform future program management.

PROGRAM DESCRIPTION

The CLT program calls for a systemic approach to the development and enhancement of the SMET instructional workforce (kindergarten through graduate school) where professionals are educated in an environment of research and practice. For elementary and secondary teachers, a Center will provide opportunities to enhance content knowledge, develop teaching strategies that lead to improved student learning,

implement high quality instructional materials, develop skills in using various strategies for assessing student learning, and learn ways to effectively incorporate informational technology into instruction. For graduate students, postdoctoral students, and interns a Center will provide research opportunities that will improve learning, teaching, and assessment across the educational continuum.

Although Centers will develop different models to achieve their objectives, all will be expected to address the following three programmatic goals that are based upon documented national needs.

- 1) Centers will increase significantly the numbers of K-12 educators in both formal (schools) and informal (museums, zoos, botanical gardens, etc.) settings who have current content knowledge in their disciplinary area and who are prepared to implement standards-based instruction (for example, through problem-solving, small group work, and extended questioning) and new assessment strategies (performance-based, open-ended, and embedded in curricula). Further, these teachers will be able to use informational technology as an aid to student learning.
- 2) Centers will rebuild and diversify the human resource pool that forms the national infrastructure for SMET education. This component will provide basic and advanced education for graduate and post-graduate students who will specialize in K-16 education (either in disciplinary or education departments), provide the expertise for large-scale assessment and/or evaluation of educational reform, conduct research on teaching and learning, develop the next generation of curricular materials, and develop future directions in informal science education.
- 3) Centers will provide substantive opportunities for research into the nature of learning, strategies of teaching, policies of educational reform, and outcomes of standards-based reform.

#### ELIGIBILITY

Centers will involve partnerships of organizations with a scientific and/or educational mission. Among these are two- and four-year colleges and universities, state and local education agencies, professional societies, research laboratories, informal science centers, instructional materials development centers, private foundations, business and industry, and other public and private organizations whether for profit or nonprofit. Each Center must have one or more school district partners, as well as a partner that is authorized to award appropriate doctoral degrees. Where possible, Centers should have collaborative relationships with NSF systemic initiatives (i.e., state, urban, rural, local). Cost-sharing is mandatory at a level of 10% of the total budget requested from NSF. Submitting institutions must specify the sources and amounts of cost-sharing in support of the proposed Center.

#### PROJECT CHARACTERISTICS

Centers will address the continuum of teacher education and will increase the capacity of the SMET educational infrastructure by preparing professionals through doctoral programs or by providing postdoctoral and/or internship opportunities for individuals drawn from a discipline or from education. Each Center will provide a learning

laboratory for its participants, and all Centers are expected to incorporate features such as:

- involvement and commitment of scientists, engineers, and mathematicians, and of science, engineering, technology, and mathematics educators;
- research related to the focus of the Center and related to teacher professional development activities;
- a firm and committed collaboration among a variety of types of institutions that will work as equal partners;
- plans to increase diversity in the science, mathematics, and technology K-12 instructional workforce and in the higher education instructional workforce;
- teacher preparation and professionalization as part of the professional development continuum; and
- appropriate evaluation as well as participation in relevant evaluation activities as requested by NSF.

#### AWARD SIZE AND DURATION

It is anticipated that typical awards for Centers for Learning and Teaching projects will be \$10 million over five years. Awards will be made as continuing grants. All Centers will participate in reverse site visits during the second year of their awards, and evaluation of performance will form the basis for continued funding. Allowable costs will include support for teacher participants to attend graduate courses, and support for graduate and postdoctoral students and interns to develop specialized skills to support and sustain K-12 education and the instructional workforce. Cost-sharing is mandatory at a level of 10% of the total budget requested from NSF.

#### MERIT REVIEW

Merit review criteria established by the National Science Board will be used to evaluate Center proposals. As elaboration on the merit review criteria, the following concerns will be addressed in the review process:

- **Institutional Capacity.** There should be evidence of past participation in significant, high-quality SMET educational programs, and documentation that appropriate expertise is found among K-16 teachers and faculty who will be significantly involved with the Center. Further, there should be evidence of plans to institutionalize the Center's activities at one or more of the partnering institutions and/or agencies.
- **Program Design.** Project activities should reflect current understanding of high-quality professional development and allow for differences in background knowledge and experience that diverse participants may bring to the Center's programs.
- **Impact.** There should be evidence of recruitment plans that will strengthen the Nation's formal and informal SMET instructional workforce (K-16) and enhance its diversity.

- **Plan.** Planned efforts must improve the disciplinary content and instructional methods of potential and practicing teachers, as well as the ability of graduate and post-graduate students and interns to enhance the SMET educational enterprise.
- **Cooperative Relationships.** Existing collaborations must be strong and continue to strengthen as the Center evolves.
- **Evaluation.** Project goals must be clearly stated and measurable, and an evaluation plan that will provide data on the impact of the Center's activities on participants and on their students must be provided.

Depending on the availability of funds, competitions will be held annually or biennially. The proposal review process will consist of three stages: A preliminary review by program staff (this is advisory only for proposers); a two-stage panel review for full proposals; and a reverse site visit for the most competitive proposals identified during the panel reviews.

#### Program Management

The Centers for Learning and Teaching is a directorate-wide program, and the Assistant Director for Education and Human Resources (EHR) and the Director of the Division of Elementary, Secondary, and Informal Education (ESIE) will provide policy and budget oversight. Management and administration of the program will be coordinated by a Centers Coordinating Committee (CCC), chaired by ESIE's Division Director or by her/his appointee. The CCC will consist of a member from each of EHR's divisions with representation from other directorates that will benefit from awareness of Center activities.

An external review committee, appointed by NSF, will oversee activities and outcomes across Centers. This committee will conduct site visits for each Center at the end of its initial two years of funding. Continuation of a Center will depend on evidence that the Center is making satisfactory progress toward its goals and those of the program.

#### **EVALUATION**

In addition to each Center's evaluation activities that will be reviewed by a cognizant NSF program officer, all Centers will participate in an evaluation of the program's goals and outcomes.

As part of EHR's standing program evaluation activities, each Center also will be monitored by an external evaluator. Initially, background data will be collected in order to benchmark the current state of the instructional workforce so that progress may be accurately charted. Evaluation of the CLT program will be overseen by the CCC. In addition, the Center for Education of the National Research Council will review the external evaluation process.

#### PROGRAM BUDGET

The FY 2001 Budget Request for the Centers program totals \$20 million. Of that amount, \$2 million will be invested in small-scale planning efforts that, in the long run,



will broaden the diversity of institutional participation and of the geographic areas involved. In FY 2001, the budget will support seven to nine new Centers and maintain support of the two pilot efforts being funded in FY 2000. The program will continue as a high directorate priority in out-years, with the level of investment and number of Centers increasing as funds become available.

### **RECOMMENDATION**

I recommend that the Board approve the following resolution:

RESOLVED, that the National Science Board approves a Centers for Learning and Teaching (CLT) program subject to availability of funds, and authorizes the Director to take final action on grants, contracts, and other arrangements except when such actions require Board approval under existing policy guidelines.

Rita R. Colwell  
Director