NSB-04-191
January 10, 2005

MEMORANDUM TO MEMBERS OF THE NATIONAL SCIENCE BOARD

SUBJECT: Summary Report of December 15-16, 2004 Meeting

The major actions of the National Science Board (NSB, the Board) at its 383rd meeting on December 15-16, 2004 and a preliminary summary of the proceedings are provided below. This memorandum will be publicly available for any interested parties to review. A more comprehensive set of NSB meeting minutes will be posted on the Board's public Web site (http://www.nsf.gov/nsb/) following Board approval at the February 2005 meeting.

1. Major Actions of the Board (not in rank order of importance)

a. At the Open Plenary Session, Dr. John Marburger, Senior Advisor to the President and Director of the White House Office of Science and Technology Policy, administered the Oath of Office to seven newly appointed Board Members: Dr. Dan E. Arvizu, CH2M Hill; Dr. Steven Beering, Purdue University; Dr. G. Wayne Clough, Georgia Institute of Technology; Dr. Kelvin K. Droegemeier, University of Oklahoma; Dr. Louis J. Lanzerotti, New Jersey Institute of Technology; Dr. Alan I. Leshner, American Association for the Advancement of Science; and Dr. Jon C. Straus, Harvey Mudd College.

b. The Board approved the minutes for the Open Plenary, Executive Closed Plenary, and Closed Plenary Sessions of the October 2004 meeting of the NSB (http://www.nsf.gov/nsb/meetings/2004/1004/open_minutes_oct_2004.pdf).

c. The Board approved a slate of candidates for the NSB class of 2006-2012 for transmittal to the White House in February 2005.

d. The Board approved a resolution to close portions of the upcoming February 7-8, 2005 NSB meeting dealing with staff appointments, future budgets, pending proposals/awards for specific grants, contracts, or other arrangements, and those portions dealing with specific Office of the Inspector General investigations and enforcement actions, or agency audit guidelines (NSB-04-176) (Attachment 1).

e. The Board authorized the Director, at his discretion, to make an award to Dartmouth College for the Center for Cognitive and Educational Neuroscience (C-CEN).

f. The Board approved NSB responses to the four specific IPA-related questions that the Board's Executive Officer received from staff of the House Appropriations Subcommittee for VA, HUD and Independent Agencies (Attachment 2).

g. The Board approved the establishment of the Committee on Programs and Plans Task Force on Transformative Research (NSB/CPP/TR-04-1) (Attachment 3).

2. NSB Chairman's Report

Dr. Warren Washington, NSB Chairman, congratulated Dr. Arden Bement, Jr., on his recent confirmation by the Senate as the National Science Foundation's Director. Further, the Chairman congratulated Dr. Bement on the honorary Doctorate of Engineering degree that will be conferred by his alma mater, the Colorado School of Mines, on December 16.

The Chairman noted that Congressman Vernon Ehler, Chairman of the Subcommittee on Environment, Standards, and Technology of the House Science Committee, expressed his 'concern and astonishment' that Congress cut funding for the NSF in the FY 2005 Omnibus Appropriations Bill. This marks only the third time in the past 20 years that NSF funding has been cut.

The Chairman reminded Members to respond to Dr. Beering's request for reviewers for the 2006 Science & Engineering Indicators. Several chapters still need reviewers for this important biennial publication.

The Chairman announced that he would be establishing the 2005 Vannevar Bush Award Committee in the near future and asked for individuals interested in serving on the committee to contact Dr. Michael P. Crosby, NSB Executive Officer.

3. NSF Director's Report

Dr. Joseph Bordogna, Deputy Director, National Science Foundation (NSF), reported in the absence of the Director.

Dr. Bordogna announced new NSF staff positions: Dr. Sherry Farwell, Head, Office of Experimental Program to Stimulate Competitive Research (EPSCOR), Education and Human Resources Directorate; and Mr. Ronald D. Branch, Director, Office of Equal Opportunity Programs (OEOP).

The Deputy Director reported that since the October NSB meeting there had been only one congressional hearing involving NSF. On November 16, the Senate Commerce, Science and Transportation Committee held a hearing in conjunction with the release of the Arctic Climate and Impact Assessment Report. Congress completed work on the FY 2005 appropriations by passing an Omnibus Appropriation Bill, which was signed into law by the President on December 8. In addition to the NSF funding, Congress enacted legislation that will continue the H1-B visas to temporary professional workers. The NSF will receive 40 percent of the application fees to continue support for the Computer Science, Engineering, and Mathematics Scholarships Program and the Information Technology Experiences for Students and Teachers (ITEST) program.

Finally, Senator Bond introduced a bill that would establish a Division of Food and Agricultural Science at NSF that would coordinate a research agenda with the Department of Agriculture. This bill is likely to be reintroduced in the 109th Congress.

4. NSB Committee Reports

a. Committee on Audit and Oversight (A&O)

A&O Open Session

Dr. Mark Wrighton, A&O chairman, noted that NSB responses to Hill staff questions about NSF rotators via the Intergovernmental Personnel Act (IPA) were approved by the committee in a November teleconference, and the committee recommended that the Board approve the responses. *[The full Board subsequently approved the NSB responses to IPA-related questions in Plenary Open Session, and asked the NSB Executive Officer to notify the appropriate Hill staff.]*

The committee had agreed to request that the NSB Chairman include time at the upcoming NSB retreat for further discussion of the Board positions on two of the National Academy of Public Administration (NAPA) study recommendations that dealt with the role of the Board and the appointment and reporting process for the Inspector General. The Board Office was requested to develop and provide background papers on these issues, with any input that the Office of the NSF Director and Inspector General are able to provide them.

Mr. Dan Kovlak, KPMG, reported on the 2004 Financial Statement Audit. He noted NSF was given a clean audit opinion and met the accelerated deadline. He noted that there were two "reportable conditions." Mr. Thomas Cooley, the NSF's Chief Financial Office, also discussed the audit report, with particular attention to the reportable condition on grant monitoring and the steps NSF has taken and continues to take to resolve the auditors' concerns. KPMG and NSF have agreed to an intensive series of meetings to work together to resolve these differences. The NSF Chief Information Officer, Dr. Strawn, provided an update on information technology issues, achievements and plans at NSF.

Dr. Peggy Fischer, Office of the Inspector General (OIG), discussed the investigative process at OIG and how they handle over 300 allegations annually. Mr. Bruce Carpel, OIG, sought out the committee's views on the policy regarding identification of audit subjects in the OIG semiannual report. Ms. Jill Schamberger, OIG, described a recent audit on compliance with project reporting requirements on NSF awards and noted that NSF was in general agreement with the recommendations for improvement.

A&O Closed Session

In Closed Session, OIG staff discussed several pending investigations.

b. Committee on Programs and Plans (CPP)

CPP Open Session

Dr. Daniel Simberloff, CPP chairman, reported that the committee approved the minutes from the October 13 meeting. He then reported on behalf of Dr. Michael Rossmann, who is serving as the CPP lead for finalizing the Long-lived Data Collections (LLDC) report, that CPP had asked for NSF comments on the draft LLDC report at its last meeting. Dr. Bordogna had subsequently informed Dr. Simberloff that NSF comments were forthcoming and would be substantive. Following a discussion, CPP and Dr. Bordogna agreed that NSF comments will be received by CPP in January 2005. These comments would be reviewed and incorporated into a revised report by CPP. The revised LLDC report will be discussed by CPP at the March 2005 NSB meeting and, if provisionally approved, then made available for public comment. CPP envisions that public comments will be reviewed and incorporated into the report for discussion and final approval by the NSB in May. A final Board report on LLDC would be released shortly afterwards.

A draft charge for the creation of a CPP Task Force on Transformative Research (TR) was presented by Dr. Nina Fedoroff on behalf of the *ad hoc* Task Group on High Risk Research, and discussed and approved by the committee for transmittal to the Board for approval. *[The full Board subsequently approved the charge creating a formal Task Force on Transformative Research under the auspices of CPP in Plenary Open Session.]*

CPP heard several reports on developing a new large facility planning (LFP) process. Dr. Washington reported on a meeting that he, Dr. Bement, Dr. Crosby and Dr. Bordogna had with congressional staff regarding the joint NSB/NSF management document, "Setting Priorities for Large Research Facility Projects." Dr. Washington reported that Hill staff were positive and supportive of steps taken so far. Dr. Simberloff reported on a meeting that he, Dr. Bement and Dr. Crosby had with the National Academies' Committee on Science, Engineering, and Public Policy (COSEPUP) to update them on joint efforts of NSF and NSB to develop the new LFP process. Dr. Simberloff reported that COSEPUP was also very positive on how the new process was developing. He also stated that two key COSEPUP recommendations, which will be included by CPP in the implementation language, were to have a formal and explicit role for the various NSF advisory committees in the new LFP process, and for there to be a full public comment on the entire process. CPP has requested the Board Office to solicit public review and comment on the provisionally approved LFP report; this solicitation will include highlighting the report on the Board's Web site, sending it to the various NSF Advisory Committees, and through distribution to various stakeholders and interested parties that normally receive Board reports.

CPP also discussed the NSF response to the proposed timeline for integrating the new LFP process with the NSB schedule, and decided that the appropriate time for the Board's annual reprioritization of MREFC projects would be during the May NSB meetings, with the presentation of the NSF facility plan annually at the March NSB meetings and NSF proposals for new starts considered by the Board during its February, March and May meetings. The Board will reserve the prerogative to be flexible with this timeline as circumstances warrant.

CPP Closed Session

CPP considered award actions and recommendations for transmittal to the Board for approval, and heard status reports on other large facilities and future MREFC projects.

c. Committee on Strategy and Budget (CSB)

CSB Open Session

Dr. Douglas Randall chaired the CSB session on behalf of Dr. Ray Bowen, CSB chairman, and called on Dr. Bement to provide an update on the FY 2005 budget, which was approved by the President on December 8, as part of the Omnibus Appropriations Bill. The NSF is now preparing the FY 2005 operating plan for Congress, with details of how the budget is proposed to be allocated. NSF is funded at $5.473 billion, or $105 million (2%) less than in FY 2004. Of the total, the Research and Related Activities (R&RA) account is funded at $4.22 billion, a reduction of $30 million from the previous year. The appropriations report language provides broad NSF discretion in allocating these funds. The EHR account received $841 million, which includes $79.36 million for Math and Science Partnerships (MSPs). Significant reductions occurred in the Division for Elementary, Secondary, and Informal Science Education and the Division for Research, Evaluation and Communication.

The MREFC account is funded at $173.65 million, nearly $40 million less than the requested level. Both the Atacama Large Millimeter Array (ALMA) and EarthScope are funded at the requested level (less .8 percent recession) and the IceCube project ($47.62 million) is funded at $14.2 million above the request. The Scientific Ocean Drilling project is funded at $14.8 million ($26.9 million less than requested) and the Rare Symmetry Violating Processes (RSVP) is provided $14.8 million -- half the requested funding ($30 million). Congress addressed funding for National Ecological Observation Network (NEON) within the R&RA account, where it received half of the $12 million request.

NSF's salaries and expenses account is funded at $223 million, a $4.5 million increase over the FY 2004 appropriated level. Funding for NSF staff employed under the IPA was maintained in the R&RA and EHR accounts. The Board and the OIG were funded at the requested levels; minus the .8 percent across the board rescission applied to all appropriation accounts.

The committee discussed some of the potential impacts of the FY 2005 budget allocation and whether there was value in the Board developing a report similar to its previous report to Congress that was mandated in Section 22 of the NSF Authorization Act of 2002. Such a report could address suggestions by Hill staff for making the Section 22 Report more useful to them, and highlight potential impacts of constraints on future NSF appropriations levels. CSB decided to continue this discussion at the February Board retreat and meeting.

CSB Closed Session

The NSF Director provided a status of the FY 2006 budget submission, and details from the recent passback from the Office of Management and Budget (OMB) and the subsequent NSF appeal.

d. Executive Committee (EC)

EC Open Session

Dr. Barry Barish reported to the NSB Plenary Session on behalf of Dr. Bement, Executive Committee chairman. Dr. Washington had reminded the Executive Committee that it is important for private corporations, universities, and Federal agencies to have explicit policies regarding various forms of harassment in the workplace. He requested that NSF prepare a report that will provide the Board with an overview of existing NSF formal policies on harassment in the workplace and the training required of NSF supervisors and managers to deal with this issue. This report will be provided to the Board Office for distribution to the Board in advance of the February meeting.

Additionally, Dr. Crosby briefed the committee on issues and topics that Congress, through their recent Appropriations Report Language, has raised to the Board for its attention and action. The Executive Committee also heard an update on the February 2005 Board meeting and retreat site from Dr. Crosby.

EC Closed Session

The NSF Director provided updates of specific senior NSF personnel actions, and comments on future NSF budgets.

e. Committee on Education and Human Resources (EHR)

Dr. Elizabeth Hoffman, EHR chair, opened the meeting with a welcome to committee members and guests. She also acknowledged and thanked Dr. Judith Ramaley, Assistant Director to the Education and Human Resources Directorate, for her many outstanding contributions to the EHR committee and the Board. Those comments were warmly endorsed by the other Board Members.

The committee heard a summary report from Dr. Ramaley describing changes in NSF/EHR that have taken place since her arrival at NSF, including furthering the integration of research and education across NSF, implementation of the portfolio concept for EHR programs, and broadening diversity. The committee again thanked her for her contributions to the work of the Board, and for her dedicated service to NSF, and wished her well as she moves on from NSF to new endeavors.

The committee heard a presentation by Dr. James J. Duderstadt, former Board Chairman and President Emeritus of the University of Michigan, on the topic of "Human Capital in a Global Knowledge Society: A Challenge for NSF in the 21st Century." Dr. Duderstadt stimulated a

lively discussion and challenged NSF to take a leadership role in developing human capital with bold actions that would lead to significant change, recognizing new ways of learning that today's students bring to our campuses, and to further utilize linkages between education and research to broaden NSF to reshape future education.

The committee heard a series of reports including an update from the Subcommittee on Science and Engineering Indicators and an update on the status of the NSB report *Broadening Participation in Science and Engineering Faculty* (NSB-04-41), which is now under final review by the NSB Chairman and the EHR chair.

Dr. Jo Anne Vasquez led a short discussion of the Math and Science Partnership (MSP) program implementation at NSF, focusing on the balance between mathematics and science education. NSF stated that although it is not budgeted to continue the MSP competition, it will honor its commitments to all existing MSP sites.

The committee discussed a potential future EHR committee activity that would engage industry leaders in a panel discussion to understand what skills are needed for the 21st century workforce. Committee members showed significant interest in the activity, and several Board Members volunteered to participate in developing a charge and to help plan for it. A teleconference will be scheduled to further craft a charge and discuss details of the activity and to understand what value would be gained by such an activity.

f. Subcommittee on Science & Engineering Indicators (SEI), Committee on Education and Human Resources

Dr. Steven Beering, SEI chairman, reminded members to fill out the matrix in the Board Book indicating which chapter or chapters they would like to review of *Science and Engineering Indicators 2006*. Drs. Jo Anne Vasquez and John White agreed to be the lead reviewers for the K-12 and state chapters, which are expected to be discussed at the March 2005 Board meeting. Additional lead reviewers are expected to be identified when the Subcommittee is expanded. Staff was asked to e-mail names of potential external expert reviewers for the K-12 and state chapters to subcommittee members so they had more time to offer further suggestions and to e-mail external reviewer lists for the remaining chapters when they were ready.

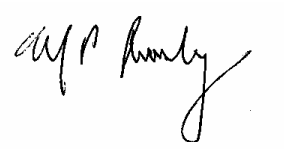
The purpose, content, and possible topic for the companion piece to the SEI publication were discussed. The consensus was, considering its short length, the number of topics covered should be limited. The topic or topics are expected to be finalized during the March meeting. Staff was asked to send subcommittee members the topics covered in previous companion pieces and to indicate when the companion piece must be completed to be packaged with Science and Engineering Indicators 2006 for mailing.

There was some discussion about preferences for possible covers or themes for a cover for the Indicators 2006 report. The Science Resources Studies (SRS) staff will review color options for the cover and tables in the 2006 report.

Dr. Washington asked staff to investigate the possibilities of making Indicators more prominent in Internet search engines, such as Google.

g. *ad hoc* Committee on Nominations for NSB Class of 2006-2012

In Closed Session, the committee finalized the list of candidates for the NSB Class of 2006-2012 to recommend to the Board for approval. *[The full Board subsequently approved the list of candidates for the NSB Class in Plenary Executive Closed Session.]*



Michael P. Crosby
Executive Officer

Attachment 1: NSB-04-176
Attachment 2: NSB Approved Responses to IPA Questions
Attachment 3: NSB/CPP/TR-04-1

Attachment 1 to NSB-04-191
NSB-04-176
November 29, 2004

MEMORANDUM TO MEMBERS AND CONSULTANTS OF THE NATIONAL SCIENCE BOARD

Subject: Closed Session Agenda Items for February 7-8, 2005 Meeting

The Government in the Sunshine Act requires formal action on closing portions of each Board meeting. The following are the Closed Session agenda items anticipated for the February 7-8, 2005 meeting.

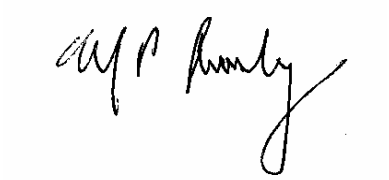
1. Staff appointments

2. Future budgets

3. Grants and contracts

4. Specific Office of Inspector General investigations and enforcement actions

A proposed resolution and the General Counsel's certification for closing these portions of the meetings are attached for your consideration.



Michael P. Crosby
Executive Officer

Attachments

PROPOSED
RESOLUTION
TO CLOSE PORTIONS OF
384th MEETING
NATIONAL SCIENCE BOARD

RESOLVED: That the following portions of the meeting of the National Science Board (NSB) scheduled for February 7-8, 2005 shall be closed to the public.

1. Those portions having to do with discussions regarding nominees for appointments as National Science Board members and National Science Foundation (NSF) staff appointments, or with specific staffing or personnel issues involving identifiable individuals. An open meeting on these subjects would be likely to constitute a clearly unwarranted invasion of personal privacy.

2. Those portions having to do with future budgets not yet submitted by the President to the Congress.

3. Those portions having to do with proposals and awards for specific grants, contracts, or other arrangements. An open meeting on those portions would be likely to disclose personal information and constitute a clearly unwarranted invasion of privacy. It would also be likely to disclose research plans and other related information that are trade secrets, and commercial or financial information obtained from a person that are privileged or confidential. An open meeting would also prematurely disclose the position of the NSF on the proposals in question before final negotiations and any determination by the Director to make the awards and so would be likely to frustrate significantly the implementation of the proposed Foundation action.

4. Those portions having to do with specific Office of the Inspector General investigations and enforcement actions, or agency audit guidelines.

The Board finds that any public interest in an open discussion of these items is outweighed by protection of the interests asserted for closing the items.

CERTIFICATE

It is my opinion that portions of the meeting of the National Science Board (NSB) or its subdivisions scheduled for February 7-8, 2005 having to do with nominees for appointments as NSB members and National Science Foundation (NSF) staff, or with specific staffing or personnel issues or actions, may properly be closed to the public under 5 U.S.C. § 552b(c) (2) and (6); those portions having to do with future budgets may properly be closed to the public under 5 U.S.C. § 552b(c) (3) and 42 U.S.C. 1863(k); those portions having to do with proposals and awards for specific grants, contracts, or other arrangements may properly be closed to the public under 5 U.S.C. § 552b(c) (4), (6), and (9) (B); those portions disclosure of which would risk the circumvention of a statute or agency regulation under 5 U.S.C. § 552b(c) (2); and those portions having to do with specific Office of the Inspector General investigations and enforcement actions may properly be closed to the public under 5 U.S.C. § 552b(c) (5), (7) and (10).

Lawrence Rudolph
General Counsel
National Science Foundation

RESPONSES TO IPA-RELATED QUESTIONS FROM STAFF OF HOUSE APPROPRIATIONS SUBCOMMITTEE FOR VA, HUD AND INDEPENDENT AGENCIES

1. ***Does the heavy use of IPA's and other temporary employees compromises the quality of the organization in the long run? This really has to do with a basic public administration and organizational management question of the effect of half your professional workforce and almost all of your Directorate heads being temporary employees.***

The National Science Board has concluded that the use of IPAs and other outside rotators constitutes an important contribution to the National Science Foundation and to the community that the Foundation serves. This contribution is valuable on many levels as a bridge to the science and engineering community supported by the Foundation. It is our opinion that the long term quality of the organization is enhanced by the current practice. The Board has reviewed recent reports on IPAs by the U.S. Office of Personnel Management (OPM), the National Academy of Public Administration (NAPA), and the NSF Office of Inspector General, and has heard relevant staff presentations on NSF's workforce and IPAs/rotators in particular. We are confident that the Foundation's use of IPA's and other temporary employees provides a valuable source for science and technology leadership that enhances the quality of the organization in both the long- and short-term.

The Board also concurs with the conclusion of the recent OPM report that found NSF to have appropriate succession planning strategies in place for the overall workforce. We recognize the importance of NSF to produce a leadership cadre that ensures continuity in addition to motivating staff and maintaining high ethical standards. NSF has a Human Capital Management (HCM) Plan aligned to the agency strategic plan and has selected a workforce planning model that meets strategic requirements and incorporates findings from human capital pilot programs.

In response to a recommendation in the OPM report, the Foundation has agreed to review and revise its workforce planning system beginning in FY 2005. As part of this effort, the Board's Audit and Oversight (A&O) Committee has requested NSF Management to annually report to A&O on the filling of its senior management positions at the Assistant Director, Deputy Assistant Director, and Division Director levels.

2. ***Are some of these staffing and pay tools being used so far beyond what was originally intended that they constitute an inappropriate use of a legitimate tool?***

The Board believes that the use of IPAs and other non-federal rotators by the Foundation is consistent with the IPA Act and other hiring authorities; reflects the essential mission of NSF; enhances NSF's ability to attract senior scientists and engineers; and preserves NSF's flexibility to use IPAs to the extent that NSF program staff find most beneficial and meaningful.

The Intergovernmental Personnel Agreement (IPA) Act was intended for the mutual benefit of the loaning and receiving institutions. It enables the exchange of employees between an institution of higher education (or State or local government or other organization) and a Federal agency when the agency

head determines the exchange to be of benefit to the receiving and loaning institutions. While IPAs are detailed to NSF, they are performing work of benefit to the Foundation. When they return to their home institutions, they share information and knowledge with their home institutions that is of benefit to the home institutions.

In response to a recommendation in the OPM report, the Foundation has agreed to submit an annual report to OPM on the filling of its senior management positions. As OPM suggests, the report will also reflect NSF's human capital strategy in support of mission accomplishment, in general, and how NSF will make better use of available civil service compensation flexibilities to fill its senior management positions. The Board will request that copies of this annual report be made available to the Board each year for its review.

3. Does compensation significantly exceed what the marketplace requires for the sorts of people NSF needs?

The Board's A&O Committee reviewed data on the costs of IPA salaries, consulting fees and benefits, and has concluded that the annual incremental costs associated with using IPAs are rather modest in comparison to the overall expenditures for research and associated activities; and that these investments do provide commensurate return on that investment. The Board generally agrees with the OPM finding that compensation of IPA assignees for non-managerial positions does not raise concerns. However, OPM findings on the issue of compensation for senior management level IPAs may need further examination by the Director of NSF, working in concert with the Board's A&O Committee.

4. Should anyone in government service be paid above the levels that would be paid to a permanent employee in the same job?

The Board feels that IPA (or other temporary rotator positions) compensation packages in excess of the maximum authorized levels for career SES civil servants must be justified by NSF Management. Justification may include, but not be limited to, the ability for the candidate to bring to NSF, for a specified period of time, experience and expertise simply not available in a pool of career SES applicants, a unique ability to maximize exchange between the scientific community and the Foundation, and/or effectuate NSF outreach in a way that would not otherwise be possible. The Board's own experience in academia, industry, and government indicates that there are many instances where salaries must accommodate the talent being sought and the value assigned by the marketplace. There will be instances where IPAs are paid above the levels that would be paid to a permanent employee in the same job.

The Board is confident that NSF use of IPAs is critical for meeting the mission and goals of the agency. Implementing the combination of Board oversight actions described in the previous responses will also better enable NSF Management to more clearly and convincingly justify occasional IPA compensation packages above the maximum SES level.

Attachment 3 to NSB-04-191
NSB/CPP/TR-04-1
December 16, 2004

Committee on Programs and Plans
Charge to the Task Force on Transformative Research

Statutory basis
"...the Board shall establish the policies of the Foundation, within the framework of applicable national policies as set forth by the President and the Congress." (SEC. 4.(a))

Action Recommended
The National Science Board (NSB, the Board) should consider new policies that would enhance the ability of the National Science Foundation (NSF, the Foundation) to identify, evaluate, and fund innovative, "transformative" research, defined as research that has the potential to revolutionize an existing discipline through a paradigm shift or create a new one.

Background
In July 1999, the NSB noted a need to revitalize a commitment to innovative research (NSB-00-39). In October 2000, the former NSB Chair, stated to the Committee on Science's Subcommittee on Basic Research, "industry is increasingly dependent on the Federal government to support long term and high risk research at the same time that the Federal share of the U.S. R&D enterprise is declining." At the February 2003 retreat, the Board itself discussed ways in which it could help NSF develop new and more effective approaches to reviewing and funding both multidisciplinary and innovative research that has the potential to transform disciplines.

The August 2004 report of the NSF Advisory Committee for Government Performance and Results Act Performance Assessment (AC/GPA) concluded that no obvious formula exists to guide NSF as to the fraction of the portfolio that should be "high risk" (or "bold"). However, the Advisory Committee also stated "… without hesitation that it is vital that the overall portfolio contain an appropriate amount of "bold" research and that the definition of such research must be clear and widely understood by NSF's key stakeholders". They recognized that there is always a tension between funding such research and funding other priorities, and where possible, they suggested that NSF should do more. The Committee concluded by stating that it "…believes that this issue is important enough to warrant attention by the National Science Board".

The Board's *ad hoc* Task Group on High-Risk Research (now referred to as transformative research) has conducted an initial review of current practices that NSF and other funding organizations use to identify and support potentially transformative research. The NSB Office developed a white paper that provided an overview of the variety of current approaches to identify and fund such research. The Task Group also convened a workshop at the Santa Fe Institute in Santa Fe, New Mexico (22-23 September 2004) to solicit the individual views of members of the scientific community on NSF's approaches to funding transformative research and their suggestions for improvements. Several major issues were identified during the course of the workshop that affect NSF's ability to identify, evaluate, and fund potentially transformative research:

- There is a lack of common definitions of "high-risk" or "transformative" research.
- There is a need to develop criteria within NSF for flagging potentially transformative proposals.
- There is a need to establish appropriately higher failure rates, as well as extended time-frames, for potentially transformative research.
- There is a need to establish a different and possibly higher target funding rate for potentially transformative research than for research with a more certain outcome.

- There is a need to develop ways of tracking potentially transformative research through the NSF system and of evaluating outcomes over an extended period.

Workshop participants also discussed aspects of the peer review process that militate against selection of potentially transformative research and identified key variables in the review and funding processes that could enhance NSF's ability to identify and support truly pioneering researchers at an early stage in the development of transformative concepts:

- A markedly greater emphasis on selection of individuals, rather than projects.
- A different view of panels, including the possible constitution of separate and different panels for evaluating potentially transformative research and researchers.
- Developing mechanisms that would permit applicants to respond to questions during the review process in written form, in real-time electronic form, and in person.
- Expanding funding specifically for the support of transformative research irrespective of discipline to encourage the influx of new ideas.
- Increasing the ability of program officers to identify and champion such research through better training, greater autonomy, and rewards.
- Increasing awareness and confidence in the scientific community that NSF welcomes transformative concepts, research and researchers.
- Establishing ways of measuring and tracking both the success of potentially transformative proposals within the NSF system and the long-term outcome of funding them.

Policy Objectives

The *ad hoc* Task Group recommends that the Board approve the creation of a formal Task Force on Transformative Research under the Committee on Programs and Plans (CPP). The following issues will be analyzed and discussed before constructive policy recommendations are brought to CPP and the full Board.

- Definition of "transformative/high risk" research
- An acceptable "failure" rate for transformative research
- Review process modifications to improve identification of potentially transformative research
- Appropriate funding mechanism amount and duration
- Mechanisms for assessing success in identifying and supporting transformative/high risk research

Logistics

The Task Force will bring together NSF staff, NSB members, and members of the scientific community. The NSB Office will serve as the focal point for coordination and implementation of all Task Force activities, including liaison with NSF staff, Task Force members, and external contractors.

A series of workshops will be held during 2005, some internal and some external, to address the issues identified above. In addition, the Task Force will convene such working groups as it deems necessary to obtain relevant information about the success rate and fate of "transformative" proposals within the current NSF system, using external contractors as appropriate.

It is anticipated that the Task Force will produce a final report that synthesizes the contributions from its own deliberations, workshops and working groups and presents recommendations for the NSB to consider in formulating policy on soliciting, identifying, supporting and tracking potentially transformative research within the NSF framework. Printed copies of an NSB report will be widely distributed and available on the NSB Web site for the public, universities, the Congress, various special interest groups, and the broad scientific community. The Task Force expects to conclude its activities with 2 years from the date that formation of the Task Force is approved.