NATIONAL SCIENCE FOUNDATION
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ARLINGTON, VIRGINIA 22230

OFFICE OF THE
ASSISTANT DIRECTOR
FOR COMPUTER AND INFORMATION
SCIENCE AND ENGINEERING

DATE: January 12, 2006

TO: Arden L. Bement, Jr., Director

FROM: Peter A. Freeman, Assistant Director, Directorate for Computer and Information Science and Engineering (CISE)
Deborah L. Crawford, Acting Director, Office of Cyberinfrastructure (OCI)

SUBJECT: Report of the Committee of Visitors for the CISE Division of Shared Cyberinfrastructure, now the Office of Cyberinfrastructure

Please find attached the report of the Committee of Visitors (COV) for the CISE Division of Shared Cyberinfrastructure*. The COV met June 20-21, 2005. The COV report was discussed and accepted on October 20, 2005 at the fall 2005 meeting of the CISE Advisory Committee. Together with the COV report, we also attach a list of the COV members, and the CISE/OCI response to the COV recommendations.

The COV consisted of 10 members selected to span the technical areas represented within OCI. It was composed of 2 women and 8 men from a variety of academic institutions and different regions of the country. It also included one under-represented minority.

3 Attachments

cc:
Kathie Olsen, OD
Thomas Cooley, BFA
Anthony Arnolie, OIRM
Christine Boesz, OIG
Nathanial Pitts, OIA
Fae Korsmo, OD
Susanne Bolton, OIRM

* The CISE Division of Shared Cyberinfrastructure became the Office of Cyberinfrastructure in an organizational realignment, effective July 22, 2005.

# Committee of Visitors
# Division of Shared Cyberinfrastructure
# June 20-21, 2005

**ATKINS, Daniel (Chair)**
School of Information
University of Michigan

**CIMENT, Melvyn**
Consultant

**COLLINS, Lance R.**
Cornell University - Endowed
Dept. of Mechanical and Aerospace Engineering

**CORBATO, Steven C.**
Internet2 c/o Center for High Perf Computing
University of Utah

**FELDMAN, Stuart**
IBM T. J. Watson Research Center

**HUTCHINS, Ron**
Georgia Institute of Technology
Office of Information Technology

**JESSUP, Elizabeth**
University of Colorado-Boulder
Dept. of Computer Science

**JOHNSTON, William**
Lawrence Berkeley National Laboratory
Energy Sciences Network

**SCOTT, MaryAnne H.**
Department of Energy
Office of Science,

**WOOLEY, John**
UCSD

# CORE QUESTIONS and REPORT TEMPLATE
# for
# FY 2005 NSF COMMITTEE OF VISITOR (COV) REVIEWS

NSF relies on the judgment of external experts to maintain high standards of program management, to provide advice for continuous improvement of NSF performance, and to ensure openness to the research and education community served by the Foundation. Committee of Visitor (COV) reviews provide NSF with external expert judgments in two areas: (1) assessments of the quality and integrity of program operations and program-level technical and managerial matters pertaining to proposal decisions; and (2) comments on how the outputs and outcomes generated by awardees have contributed to the attainment of NSF's mission and strategic outcome goals.

Many of the Core Questions are derived from NSF performance goals and apply to the portfolio of activities represented in the program(s) under review. The program(s) under review may include several subactivities as well as NSF-wide activities. The directorate or division may instruct the COV to provide answers addressing a cluster or group of programs – a portfolio of activities integrated as a whole – or to provide answers specific to the subactivities of the program, with the latter requiring more time but providing more detailed information.

The Division or Directorate may choose to add questions relevant to the activities under review. NSF staff should work with the COV members in advance of the meeting to provide them with the report template, organized background materials, and to identify questions/goals that apply to the program(s) under review.

**Guidance to the COV:** The COV report should provide a balanced assessment of NSF's performance in two primary areas: (A) the integrity and efficiency of the ***processes*** related to proposal review; and (B) the quality of the ***results*** of NSF's investments in the form of outputs and outcomes that appear over time. The COV also explores the relationships between award decisions and program/NSF-wide goals in order to determine the likelihood that the portfolio will lead to the desired results in the future. Discussions leading to answers for Part A of the Core Questions will require study of confidential material such as declined proposals and reviewer comments. *COV reports should not contain confidential material or specific information about declined proposals.* Discussions leading to answers for Part B of the Core Questions will involve study of non-confidential material such as results of NSF-funded projects. It is important to recognize that the reports generated by COVs are used in assessing agency progress in order to meet government-wide performance reporting requirements, and are made available to the public. Since material from COV reports is used in NSF performance reports, the COV report may be subject to an audit.

*We encourage COV members to provide comments to NSF on how to improve in all areas, as well as suggestions for the COV process, format, and questions.*

**FY 2005 REPORT TEMPLATE FOR**
**NSF COMMITTEES OF VISITORS (COVs)**

| |
|---|
| **Date of COV June 20-22, 2005** |
| **Program/Cluster: All** |
| **Division: SCI** |
| **Directorate: CISE** |
| **Number of actions reviewed by COV[1]: Awards: 27 Declinations: 21 Other:** |
| **Total number of actions within Program/Cluster/Division during period being reviewed by COV[2]: 303 Awards: 103 Declinations: 200 Other:** |
| **Manner in which reviewed actions were selected: Random and by specific request from CoV members.** |

## PART A. INTEGRITY AND EFFICIENCY OF THE PROGRAM'S PROCESSES AND MANAGEMENT

Briefly discuss and provide comments for *each* relevant aspect of the program's review process and management. Comments should be based on a review of proposal actions (awards, declinations, and withdrawals) that were *completed within the past three fiscal years*. Provide comments for *each* program being reviewed and for those questions that are relevant to the program under review. Quantitative information may be required for some questions. Constructive comments noting areas in need of improvement are encouraged.

### A.1 Questions about the quality and effectiveness of the program's use of merit review procedures.

Provide comments in the space below the question. Discuss areas of concern in the space provided.

| QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCEDURES | YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE[3] |
|---|---|
| 1. Is the review mechanism appropriate? (panels, ad hoc reviews, site visits)<br>Comments:<br>Appropriate mechanisms were used: most done by panel with some mail review; large projects examined with ad hoc reviews; fully appropriate to optimizing peer review of the proposals. | YES |

[1] To be provided by NSF staff.
[2] To be provided by NSF staff.
[3] If "Not Applicable" please explain why in the "Comments" section.

| | |
|---|---|
| 2. Is the review process efficient and effective?<br>Comments:<br>We cannot judge efficiency, other than number of reviewers (3-6) is sensible.<br>The process is effective and it reflects community views and produces crisp results based on excellent input and judgment.<br><br>We note that the staff workload appears to be growing, both because of the new electronic jackets and specific responsibilities, as well as increased numbers of proposals and expectations. The time before proposal results are reported is rising. | YES |
| 3. Are reviews consistent with priorities and criteria stated in the program's solicitations, announcements, and guidelines?<br>Comments:<br>The reviews present analyses of merit criteria, impact and relevance, and usefulness that are consistent with the program solicitations, announcements, and guidelines. | YES |
| 4. Do the individual reviews (either mail or panel) provide sufficient information for the principal investigator(s) to understand the basis for the reviewer's recommendation?<br>Comments:<br>Typically the reviews are specific about the general strengths and particular concerns, and support the ratings. The reviews for the larger projects were typically more extensive than for small ones. In some cases, additional prescriptive feedback from the reviewers would have been helpful, but we understand the need to balance desires of submitters and time of the reviewers. | YES |
| 5. Do the panel summaries provide sufficient information for the principal investigator(s) to understand the basis for the panel recommendation?<br>Comments:<br>Panel summaries are well done, summarizing the range of views and the basis for decision. In some cases (especially for the larger projects), the summaries appear to be based on the panel discussion and PI responses as well as the written reviews. | YES |
| 6. Is the documentation for recommendations complete, and does the program officer provide sufficient information and justification for her/his recommendation?<br>Comments:<br>The boilerplate is correct and well written, and the explanation of funding decisions based on overall recommendation is very clear. We were impressed by the thoroughness of the process documentation provided by the program officers.<br><br>We noted one case in which a program officer overrode a negative vote from a panel, | YES |

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| and although it was a legitimate action, there was insufficient documentation.<br><br>There were some problems with the documentation provided to the COV. Some paper jackets were incomplete since site review reports and similar documents are not always included in the paper trail, even though they are important and should influence future funding decisions.<br><br>The brand new electronic jackets were imperfect (some electronic jackets were not found, various elements such as panel summaries were missing from others). Since we were the first COV to use the EJ system, we sympathize with problems that we are sure will be addressed. | |
| 7. Is the time to decision appropriate?<br>Comments:<br>The data show a typical four month cycle time, well within NSF guidelines of six months. We note that the average review process took longer in FY04 than in earlier years, so care must be taken to avoid growth in time and decision due to staff workload or process changes. | YES |
| 8. Discuss any issues identified by the COV concerning the quality and effectiveness of the program's use of merit review procedures:<br><br>The merit review is run with high integrity, with appropriate care on criteria, consideration, and judgment. We were overall quite impressed by the process and the outcomes.<br><br>Conventional peer review may not be fully adequate to evaluate the merit of very large equipment purchases, especially in complex consortia and other organizational structures. Perhaps some mixed internal/external review process that builds on external expertise should be considered, since the implications of inappropriately denying an award may have far-reaching impacts. | |

## A.2 Questions concerning the implementation of the NSF Merit Review Criteria (intellectual merit and broader impacts) by reviewers and program officers.

Provide comments in the space below the question. Discuss issues or concerns in the space provided.

| IMPLEMENTATION OF NSF MERIT REVIEW CRITERIA | YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE[4] |
|---|---|
| 1. Have the individual reviews (either mail or panel) addressed both merit review criteria?<br>Comments:<br>In almost all cases reviewed, each review addressed both quality and impact intelligently (sometimes by implication rather than in separate paragraph). Most reviewers filled in comments along both dimensions; in a few cases these were conflated into a single block (and miscounted in the summary data). | YES |
| 2. Have the panel summaries addressed both merit review criteria?<br>Comments:<br>Panel summaries were uniformly complete. | YES |
| 3. Have the *review analyses* (Form 7s) addressed both merit review criteria?<br>Comments:<br>Review analyses similarly address both criteria uniformly. (There were some cases in which analyses or summaries were missing from the electronic jacket system). | YES |
| 4. Discuss any issues the COV has identified with respect to implementation of NSF's merit review criteria.<br>The reviews and summaries did an excellent job of addressing both quality and impact criteria, commenting separately and balancing them in the rating. | |

[4] In "Not Applicable" please explain why in the "Comments" section.

**A.3 Questions concerning the selection of reviewers.** Provide comments in the space below the question. Discuss areas of concern in the space provided.

| SELECTION OF REVIEWERS | YES , NO, DATA NOT AVAILABLE, or NOT APPLICABLE[5] |
|---|---|
| 1. Did the program make use of an adequate number of reviewers?<br>Comments:<br>There were at least 3 reviewers in each case, sometimes as many as 6 (especially when there was contention or a very multidisciplinary case). Panels generally had 6-8 members. The average number of reviews per proposal declined by about 10% in FY04, though still in the acceptable range. In specialized areas there is a risk of saturating the population of potential reviewers. | YES |
| 2. Did the program make use of reviewers having appropriate expertise and/or qualifications?<br>Comments:<br>We were impressed in our sampling by the excellent choice of reviewers (overall group for papers), and the specific reviewers actually used had relevant background and expertise for accurate ratings. Leaders in relevant disciplines appeared on panels. | YES |
| 3. Did the program make appropriate use of reviewers to reflect balance among characteristics such as geography, type of institution, and underrepresented groups?<br>Comments:<br>There was an excellent job of reaching out to a diverse set of institutions and from many states.<br><br>The data on submissions and awards by state should have been graphically presented weighted by population. It is hardly surprising that Montana has fewer submissions than Texas, for example.<br><br>The data on underrepresented groups are weak (2/3 of people did not self-identify by race or gender), but there appeared to be reasonable balance. | YES |
| 4. Did the program recognize and resolve conflicts of interest when appropriate?<br>Comments:<br>Overall, the program did a good job of managing potential conflicts by choice of reviewer and then self-certification. The processes are clear and well tuned. | YES |

[5] If "Not Applicable" please explain why in the "Comments" section.

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| There was one apparent (but justified) exception in the review of a major facilities proposal. In some cases the people who are most qualified to consider a proposal are already active in related projects. It is appropriate for the project officer to convene a discussion among those people, but should very carefully document the reason and acquire independent complementary judgment. In the situation here, the right actions were taken, but the paper trail should have been stronger. | |

5. Discuss any issues the COV has identified relevant to selection of reviewers.

The program managed reviewers very well, and the COV was impressed in most cases by the size and quality of the pool as well as the selection.

**A.4 Questions concerning the resulting portfolio of awards under review**. Provide comments in the space below the question. Discuss areas of concern in the space provided.

| RESULTING PORTFOLIO OF AWARDS | APPROPRIATE, NOT APPROPRIATE[6], OR DATA NOT AVAILABLE |
|---|---|
| 1. Overall quality of the research and/or education projects supported by the program.<br>Comments:<br>The projects that were funded are of very good quality and high likelihood of impact. We noted that there were some discrepancies between scores, written text, panel summaries and final funding decisions. In most cases the COV members agreed with the outcomes, but stronger documentation would have been helpful. | APPROPRIATE |
| 2. Are awards appropriate in size and duration for the scope of the projects?<br>Comments:<br>The projects are mostly for 3 years (necessary to produce useful software and sufficient to begin to measure impact). The program officers took appropriate actions after the reviews to manage budgets: There was evidence of thoughtful negotiation on scope and funding in response to reviewer concerns, and some large projects were reduced in scope and cost in order to support more awards with the available resources.<br><br>For awards made to support the provisioning of cyberinfrastructure services to the research community, great attention must be paid to long term availability and evolution. | APPROPRIATE |
| 3. Does the program portfolio have an appropriate balance of:<br>• High risk projects?<br>Comments:<br>We feel NSF is tackling infrastructure projects that as systems present high risk while some individual components may be lower risk. Integration into global systems presents appropriate high risk and is a necessary path for the US to maintain global R&D competitiveness. For example, the DTF/ETF is viewed as high risk, but this is a very worthwhile and managed risk for potentially large payoff to the cyberinfrastructure.<br><br>In the Networking area, there were several awards to appropriately risky projects, but each had a reasonable balance of success and risk based on expertise and track records of the PIs. | APPROPRIATE |
| 4. Does the program portfolio have an appropriate balance of:<br>Multidisciplinary projects? | APPROPRIATE |

[6] If "Not Appropriate" please explain why in the "Comments" section.

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| Comments:<br>Two of the NMI projects for FY04 projects are for domain-specific persistent infrastructure (in astronomy and chemistry) with computational science experts. Other NMI projects mix skills within the mathematical, computational, and cognitive subdisciplines. Very few were narrowly restricted to a single computer science area.<br><br>PACI projects are generally multidisciplinary and also include researchers in the humanities and social sciences. | |
| 5. Does the program portfolio have an appropriate balance of:<br>• Innovative projects?<br>Comments:<br>The level of innovation is appropriate to the program focus. Projects are addressing hard problems that require innovation, not just hard work. There is technical/research risk in most of them, and good signs that the investigators have new ideas. There has been clear progress in some areas of CS, especially grid computing, as a result of SCI grants. | APPROPRIATE |
| 6. Does the program portfolio have an appropriate balance of:<br>• Funding for centers, groups and awards to individuals?<br>Comments:<br>Because of the nature of infrastructure programs, it is appropriate that most of the projects be performed by groups or centers. For example, in NMI, because of the need to produce software of considerable scope and difficulty, there is an appropriate tilt toward groups and centers. An even larger fraction of groups might be appropriate in the future. | APPROPRIATE |
| 7. Does the program portfolio have an appropriate balance of:<br>• Awards to new investigators?<br>Comments:<br>Although prior investigators have a clear statistical advantage (success rate around 1.5 times higher), it is not unreasonably large. The program is clearly attracting new participants.<br><br>In the PACI programs, new participants rarely start as Principal Investigators, but rather as participants in other projects. This is an excellent way to bring new people into the activity and quickly give them appropriate experience. | APPROPRIATE |
| 8. Does the program portfolio have an appropriate balance of:<br>• Geographical distribution of Principal Investigators?<br>Comments:<br>Data are too sparse to judge clearly, but there does not appear to be any regional bias. | APPROPRIATE |
| 9. Does the program portfolio have an appropriate balance of:<br>• Institutional types?<br>Comments: | APPROPRIATE |

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| The awarded projects come predominantly from the Top 100 PhD-granting universities, as is to be expected in a research-driven program. There is however good representation from other PhD granting institutions and from state and 4-year institutions. This demonstates excellent outreach and honest reviewing, especially in an emerging area for NSF | |
| 10. Does the program portfolio have an appropriate balance of:<br>• Projects that integrate research and education?<br>Comments:<br>There are several explicit REUs, as well as many that make appropriate use of students in the implementation and research activities. In addition, the PACIs have had very large scale education and outreach activities (touching over 50,000 people). | APPROPRIATE |
| 11. Does the program portfolio have an appropriate balance:<br>▲ Across disciplines and subdisciplines of the activity and of emerging opportunities?<br>Comments:<br>Specific application sciences as well as a range of computing disciplines (security, distributed processing, distributed management, data, etc.) are included in infrastructure projects. We hope even more non-CISE scientific disciplines will be willing to participate in the future.<br><br>The PACI partnerships included a wide variety of sciences, and contributed to significant research results in a number of them.<br><br>The focus on grid technologies will naturally improve collaboration among disparate disciplines and institutions. | APPROPRIATE |
| 12. Does the program portfolio have appropriate participation of underrepresented groups?<br>Comments:<br>Minority status had no visible impact on acceptance, though the data are sparse. | APPROPRIATE |
| 13. Is the program relevant to national priorities, agency mission, relevant fields and other customer needs? Include citations of relevant external reports.<br>Comments:<br>The efforts in SCI are designed to support a very significant agency mission, Shared Cyberinfrastructure, as outlined in the Blue Ribbon Advisory Committee report on "Revolutionizing Science and Engineering through Cyber Infrastructure". These activities are designed specifically to improve American leadership in many sciences and to improve the efficiency as well as likelihood of breakthroughs in scientific research. Priorities on advanced cyberinfrastructure and bold application to science are also emphasized in the recent June 2005 report from the Presidents Information Technology Advisory Committee (PITAC). Numerous recent reports from specific disciplinary communities have also documented the importance of this program.<br><br>The NMI effort is directly supportive of the goals of a recent workshop on | YES |

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| middleware strategy. This is a high priority project, and its success is critical to Shared Cyberinfrastructure. The PACI and Terascale projects directly provide computational and networking infrastructure as well as application efforts. | |

14. Discuss any concerns relevant to the quality of the projects or the balance of the portfolio.
The overall quality of accepted projects seems gratifyingly high. The projects represent a good balance between shorter term implementation and engineering concerns and longer-term research to maintain the pipeline. On the other hand, we were concerned that areas of potential long term importance (e.g., the Experimental Infrastructure Networks) had relatively short lives. Some areas deserve more attention (e.g., data and especially metadata management, shared ontologies, shared web services) in the future. There were insufficient criteria and validation for software engineering processes and experience by the executing teams.

## A.5 Management of the program under review. Please comment on:

1. Management of the program.
Comments:
The management of SCI has done a good job of addressing past problems and in running excellent review and award processes. They have worked to energize the community and to shift focus. For example, the management of the NMI element is appropriate for the scope identified for the two solicitations.

There does not appear to be sufficient staff to support the needs of a growing and unique program. The overload may have prevented staff from taking a sufficiently strong role in shaping and managing strategic visions in addition to everyday requirements. In NMI, the inclusion of separate category for "system integrator" and component developer is a step forward, though the full scope of limited number of SI's needs to be developed over time.

An effective, thoughtful, and multi-level management process is required for the largest cooperative projects. With the information available to us, it was not possible for us to ascertain how the levels of management were implemented.

There was evidence during the period reviewed of the need for an overarching strategic framework for SCI to inform management decisions. There should be greater strategic clarity in choosing the components and integrating frameworks that are needed, and ensuring that the results are meeting true needs of the scientific users.

2. Responsiveness of the program to emerging research and education opportunities.
Comments:
The focus on distributed grid-based computing is laudable, and is important to supporting both collaborative research and future educational needs. There has been good use of co-investment with other agencies as well as industry to pursue these goals.

PACI/ETF is supporting cutting edge research in developing cyberinfrastructure. The facilities they support enable research in a broad range of disciplines.

We encourage NSF to devote the critically needed financial and human investments to enable the US cyberinfrastructure community to gain a position of international leadership that will provide significant benefit to US science and engineering as well as workforce competitiveness.

3. Program planning and prioritization process (internal and external) that guided the development of the portfolio.

Comments:

It is not clear to us how well the cooperative agreement mechanisms worked with the PACI programs. Over the 2002-2004 period, it appears that most management decisions were made by individual center directors. Although weekly videoconferences and numerous site visits provided some coordination, the global direction of the centers was not tightly coordinated. The prioritization process was not presented explicitly to the COV, nor was a clear master plan (with content and timeline) described.

The NMI solicitations for the consecutive years under consideration show a logical progression in shaping the portfolio to address elements that were needed for the desired program content as articulated in a general way at the time the program was initiated. Planning has taken advantage of the usual NSF mechanisms such as external workshops and project reviews.

4. Additional concerns relevant to the management of the program.

A stronger, explicit, agreed upon, and overarching strategy would increase the value of the contributions to overall SCI.

Even better measures and metrics of the use and value gathered from infrastructure programs would help guide future investments.

# PART B. RESULTS : OUTPUTS AND OUTCOMES OF NSF INVESTMENTS

NSF investments produce results that appear over time. The answers to the first three (People, Ideas and Tools) questions in this section are to be based on the COV's study of award results, which are direct and indirect accomplishments of projects supported by the program. These projects may be currently active or closed out during the previous three fiscal years. The COV review may also include consideration of significant impacts and advances that have developed since the previous COV review and are demonstrably linked to NSF investments, regardless of when the investments were made. Incremental progress made on results reported in prior fiscal years may also be considered.

The following questions are developed using the NSF outcome goals in the NSF Strategic Plan. The COV should look carefully at and comment on (1) noteworthy achievements of the year based on NSF awards; (2) the ways in which funded projects have collectively affected progress toward NSF's mission and strategic outcomes; and (3) expectations for future performance based on the current set of awards. NSF asks the COV to provide comments on the degree to which past investments in research and education have contributed to NSF's progress towards its annual strategic outcome goals and to its mission:

- To promote the progress of science.
- To advance national health, prosperity, and welfare.
- To secure the national defense.
- And for other purposes.

Excellence in managing NSF underpins all of the agency's activities. For the response to the Outcome Goal for Organizational Excellence, the COV should comment, where appropriate, on NSF providing an agile, innovative organization. Critical indicators in this area include (1) operation of a credible, efficient merit review system; (2) utilizing and sustaining broad access to new and emerging technologies for business application; (3) developing a diverse, capable, motivated staff that operates with efficiency and integrity; and (4) developing and using performance assessment tools and measures to provide an environment of continuous improvement in NSF's intellectual investments as well as its management effectiveness.

## B. Please provide comments on the activity as it relates to NSF's Strategic Outcome Goals. Provide examples of outcomes (nuggets) as appropriate. Examples should reference the NSF award number, the Principal Investigator(s) names, and their institutions.

**B.1 OUTCOME GOAL for PEOPLE: Developing "a diverse, competitive and globally engaged workforce of scientists, engineers, technologists and well-prepared citizens."**

Comments:
The programs will produce people experienced in both creating specialized infrastructure to promote technical computing and a more knowledgeable set of researchers. There is good representation in the reviewing and project communities from new participants and institutions. A considerably enlarged program would valuably increase the national knowledge base in this area.

The PACI/ETF awards supported a broad range of outreach programs directed towards teachers and K-12 students (with special attention for underrepresented groups). Undergraduate and graduate students are supported primarily through training to use the national facilities through workshops. Successful students are

further encouraged by being given additional computer time.

**B.2 OUTCOME GOAL for IDEAS: Enabling "discovery across the frontier of science and engineering, connected to learning, innovation, and service to society."**

Comments:
The PACI/ETF facilities have enabled world-class investigations across a broad range of disciplines. In addition, excellent computer science has come out of the middleware and networking initiatives. There is much to be said both for "Learning By Doing" and "Doing While Learning".

The stated vision is to facilitate scientists and engineers in transparently using and sharing distributed resources, computing, data, and unique facilities. Having this capability opens up new avenues of discovery that would be not be accessible otherwise whether coupling experiment with simulation in a regime that requires large computer power, gather data streams from instruments around the world, or extracting knowledge from huge databases.

**B.3 OUTCOME GOAL for TOOLS: Providing "broadly accessible, state-of-the-art S&E facilities, tools and other infrastructure that enable discovery, learning and innovation."**

Comments:
The focus of SCI is fully directed to this goal. The mission of SCI is the creation of tools, frameworks, reusable components, and facilities that will support work in the sciences, enhance productivity, and facilitate research collaborations. Broad accessibility is promoted by using open standards and open source methods. For example, the "Grids Center" effort, one of the first NMI awards, has successfully engaged a number of communities in the use of its tools, from EGEE in the European Union to LEAD in the U.S. looking at mesoscale weather.

Some PACI/ETF facilities are at the leading edge and all are available to the entire scientific computing community. The hardware complement has evolved along with technological developments.

**B.4 OUTCOME GOAL for ORGANIZATIONAL EXCELLENCE: Providing "an agile, innovative organization that fulfills its mission through leadership in state-of-the-art business practices."**

Comments:
The merit review system is very well run, ensuring fairness and openness. The e-jacket system is a valuable addition to the NSF process.

The staff appear capable and diverse. The professionals are too stretched, with too many responsibilities, to do the optimal job of driving, shaping, measuring, and adapting the program.

Business practices for tracking details and results of investments of the large cooperative programs could be tighter.

# PART C. OTHER TOPICS

## C.1 Please comment on any program areas in need of improvement or gaps (if any) within program areas.

The strategic plan for the future should fundamentally link all elements of complementary activities beginning with basic research and extending through applications development and operations. A particular concern is the separation of computing and computational sciences from cyberinfrastructure, which can slow progress on grand challenge problems, which demand tight integration of models, algorithms, software, and hardware.

There is also a need for more focus on several areas. These include:

- Providing support for data intensive applications in the infrastructure, including handling of massive streams, management of process and data location.
- Supporting management of metadata and higher-level knowledge derived from data. Ontologies and semantic technologies have moved into the mainstream (OWL and RDF standards for example) and are crucial for interoperability and cross-disciplinary activities.
- Exploiting web services for designing new systems and improving interoperability and access to information. Web Services and service-oriented architectures are a major thrust in commercial and Grid computing, and are likely to be very helpful for supporting scientific research.
- Inclusion and use of active computational/storage elements in the widely distributed network environment to optimize network performance and data management.
- Bridging the gap in security, to move productive research results from the cybertrust focus to real implementations in production environments. In particular, it is necessary to secure the running cyberinfrastructure against attackers using, e.g., pragmatic approaches and observation-based responses to detected threats.
- Innovative implementation of optical networking technologies and advanced wireless networks (e.g., sensors)
- Widely distributed high performance storage over advanced networks

The NMI System Integrator focus is a good one for providing long-term support of software. There could be enhanced focus on a limited number of large and dedicated groups to provide these services (and be rewarded for excellence).

We are concerned by the discontinuation of relevant solicitations (e.g.,STI) and the falloff in awards related to advanced Internet technologies.

## C.2 Please provide comments as appropriate on the program's performance in meeting program-specific goals and objectives that are not covered by the above questions.

Nothing further on SCI program performance. Primary issues are now agency-wide (see C.3)

## C.3 Please identify agency-wide issues that should be addressed by NSF to help improve the program's performance.

To maximize the creation of leading edge science, a long term strategic vision for the integration of the complementary activities across the NSF is essential. We urge the creation of appropriately balanced external advisory committees to examine where science is going at the agency level, and then make recommendations on the program elements that should be integrated to facilitate both current investments and future programs.

People and groups that provide support and well-engineered technology require different management and

incentives than those who want to explore frontiers of computing and other sciences. It is therefore important to create the right organizational structures to bridge research components from other divisions of NSF, the applications that support the sciences, with the capabilities and operation of the infrastructure elements in the SCI program.

In order to meet these goals, there will need to be sufficient high-quality staff to provide both leadership and coordination, and fundamental agreement across the agency about the need to balance multiple goals, including supporting research that needs facilties (computational, storage, networking) of maximum scale as well as increasing effectiveness of collaborations that cross institutions, information sources, and disciplines.

NSF should work to ensure integration of computer science and cyberinfrastructure. As the organization of the cyberinfrastructure activity shifts from CISE to the Director's office, it is essential to maintain and even strengthen the link between progress in computer science and its exploitation for the benefit of all the sciences.

For example, NMI should be more widely supported and driven across the agency. We are pleased to see one component (lightweight replication from LIGO through GriPhyN and the Grid Physics Network) being added to the core infrastructure set. There should be a greater emphasis on ensuring that the software being produced is being used by scientists in the various disciplines, and that their highest priority needs will be met by the available middleware.

## C.4 Please provide comments on any other issues the COV feels are relevant.

Moving forward, the shared cyberinfrastructure program needs to be far more execution oriented, driving to agreed upon and highly important goals that NSF as a whole supports, in a strategically managed and organized fashion. There must be high value to improving the sharing of knowledge across disciplines, more reusable applications and middleware, use of modern software approaches, and excellent provision of service to the community.

## C.5 NSF would appreciate your comments on how to improve the COV review process, format and report template.

We applaud the electronic jacket system. Although there are some minor startup problems, this represents significant progress and greatly improves the efficiency of the review process.

A few observations on this template and process:

Question A.1.2 is impossible for a COV to address properly since there is no measure for an “efficient” review process, nor data to support such an analysis. We suggest changing it to “Is the review process effective?” The data on underrepresented populations is very incomplete. At least for this review, about 2/3 of the respondents did not give gender or race. A COV is not in a position to apply sophisticated statistical techniques for dealing with this. If the data are usually this bad, please rephrase the question or delete it.

When providing randomized sets of proposals to a COV, they should be weighted by size of proposal, and all very large proposals should be included for review. (This is particularly important for divisions that have a very lumpy distribution of projects, rather than a stream of single-investigator grants.)

Some further improvements of the electronic jacket system are needed to ensure completeness of data and ease of use.

When presenting data by state, information and graphics should be weighted by population (total or academic) to avoid visual biases.

**SIGNATURE BLOCK:**

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For the CISE Division of Shared Cyberinfrastructure
Daniel E. Atkins
Chair