NSF Committee of Visitors
Civil, Mechanical, and Manufacturing Innovation Division

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Background

- Review period: 6/30/2008-6/30/2011
- Jackets randomly selected to achieve diverse representation for:
  - Advanced Manufacturing
  - Mechanics and Engineering Materials
  - Resilient and Sustainable Infrastructure
  - Systems Engineering and Design
- Charge:
  - Integrity and efficiency of the processes related to proposal review; and
  - The portfolio and other key issues

Integrity and efficiency of the processes related to proposal review

The report addresses:

- Quality and Effectiveness of the Merit Review Process;
- Selection of Reviewers;
- Questions Regarding Management of the Program.

Summary findings:

- *The Committee found no substantive operational procedures or processes that would have a substantive negative impact upon integrity and efficiency.*

Integrity and efficiency of the *processes* related to proposal review (cont.)

- CMMI deserves high praise for the integrity and efficiency for the work product of the entire organization and its processes.
- The program directors (PDs) often work under stressful conditions -- reviewing large numbers of proposals, setting up numerous review panels, and reading and assessing all award recommendations under very limited time constraints.
- Reviewers are representative of the technical community.
- PDs are diligent and rational in making their assessments and recommendations for both award and rejection, and
- PDs often take the time to “teach” grantees -- thus increasing the quality of future proposals and improving chances for future awards.

Portfolio and Key Issues

The report addresses:

- Support for potentially transformative research
- Areas of emphasis within the portfolio
  - The role of crosscutting topics in division activities
  - Areas of emerging opportunity where CMMI could play a leadership role
- Collaborations and platforms that could enhance CMMI's role in catalyzing frontier research and advancing the CMMI community
- Strategies for enhanced translation of knowledge/technology transfer to spur innovation
- Participation by the engineering community

Summary findings:

- *The Committee felt that sufficient travel funds for both face to face panel reviews and program director management and operational practices are critical to future effectiveness.*

Portfolio and Key Issues (1)

- **Support for potentially transformative research**
  - CMMI is pursuing several mechanisms – EAGER, CREATIV
  - "High Risk/High Impact" typically means that a high rate of failures is expected and the true impact may not be known for decades.
  - Recommendation:
    - NSF needs to own that process and be proud of the successes.
    - Documentation of what is learned is critical, whether failure or success in achieving the anticipated result is the outcome

- **Areas of emphasis within the portfolio (including cross-cutting topics and leadership opportunities)**
  - PD's have done a very good job of identifying emerging areas and gaps where CMMI can have a significant impact (e.g., computational – new materials design, chemical/mechanical interface for biological and battery applications).
  - CMMI is well-suited to lead many of these interdisciplinary programs because of its engineering background coupled with social sciences.
  - Recommendation: CMMI should continue to make its researchers aware of the targeted solicitations at an early stage, to encourage strong proposals.

Portfolio and Key Issues (2)

- **Collaborations and platforms that could enhance CMMI's role in catalyzing frontier research and advancing the CMMI community**
  - CMMI already collaborates with several other funding agencies – e.g., DOD, NIH.
  - The CMMI grantees conference has led to many new collaborations, but often amongst existing CMMI PIs.
  - CMMI currently participates in PIRE and sponsors international workshops.
  - Recommendation: CMMI can play a leadership role in helping researchers connect
    - **Cross-agency collaborations** should be further encouraged as they lead to better leveraging of the funding, while reducing undesired overlaps in funding across agencies.
    - CMMI should continue to expand its efforts with other divisions, directorates, and agencies to bring researchers from **multiple fields** together
      - e.g., medical and mechanical (biomechanics and mechanobiology collaboration with NIH), chemistry and manufacturing, social sciences and civil infrastructure
      - Not only solicitations that encourage multi-disciplinary research, but activities (e.g., regional) that help researchers from disparate fields meet each other.
    - **International partnerships** and continued understanding of the global efforts in various research areas should be encouraged.

Portfolio and Key Issues (3)

- **Strategies for enhanced translation of knowledge/technology transfer to spur innovation**
  - Graduating students are often the most effective vehicle to transfer knowledge from the research lab to industrial innovation.
  - GOALI, PFI, SBIR, etc. are all programs that require industry collaboration.
  - Recommendation: increase supplements and internships to
    - enable students to spend time in industry and national labs
    - encourage PIs to identify representatives from industry and national labs to serve as advisors on projects

Portfolio and Key Issues (4)

- **Participation by the engineering community (new investigators, demographics, different institution types)**
  - CMMI does a good job of having a percentage of its panel reviewers from the new investigator ranks.
  - Mentoring programs (e.g., in earthquake engineering) or explicit mentoring activities within a broader workshop or conference, can help to bring junior and senior researchers together.
  - CMMI's outreach to young faculty through proposal writing workshops, targeted funding for the REU supplement program and the Graduate Research Diversity Fellowship program are very worthwhile.
  - <u>Recommendation:</u>
    - CMMI could explore best practices for mentoring, with CMMI in the role of creating an environment where more mentees may find appropriate mentors.
    - Continued communication is critical to make the broader community aware of the various programs.

Key Issues - Travel

- **Face to Face Panel Reviews are believed by the COV to be key to NSF's success in supporting frontier research.**
  - Face to face panels provide strong discussion necessary for both quality reviews and for community building.
  - A blended model can be explored, but there is no substitute for "face to face", where not only words, but facial expressions and vibrant face-to-face discussion aids good communication and thus good decision making.
  - The committee recommends *pilot programs* to avoid unintended consequences, while seeking to identify the most effective structure for **limited use** of virtual meetings.

Key Issues - Travel

- **Travel is Necessary for Best Management and Operational Practices, and Program Director Recruitment**:
  - As part of their management role, PDs must travel to manage and oversee critical or problem ridden programs.
  - PDs must understand the forefront in a field to make good proposal selections and focus on solicitations in areas of greatest impact
    - The necessary conceptualization and idea generation happens in national and international conferences and in collaborative group meetings where experts in the field are assembled.
    - It happens at national laboratories, universities, businesses, and at other governmental agencies.
  - Limiting travel budgets for permanent PDs does not allow them to fully stay abreast of their field and uphold the intellectual and creative challenges of their job.
  - Recruitment of high-quality PD candidates requires such challenges and sufficient resources to achieve a high standard of excellence.

Summary

- CMMI is doing an excellent job in a challenging environment
  - Program Directors and professional staff demonstrate a laudable dedication to their roles and responsibilities
- However, several threats beyond the division's influence loom in the horizon
  - Proposal pressure
  - Continued restrictions on travel budgets
  - Agency budget uncertainty