

**Directorate for Mathematical and Physical Sciences
Advisory Committee Meeting Minutes (DRAFT)
November 8-9, 2007**

Thursday, November 8, 2007
Morning Session

Welcome and Introductions

Dr. Michael Witherell, Chair, called the meeting of the Directorate for Mathematics and Physical Sciences Advisory Committee (MPSAC) to order at 8:30 AM. He described the MPSAC subcommittees that had been formed in order to enable members of the MPSAC to interact amongst themselves and MPS staff between meetings.

Remarks by MPS Assistant Director

Dr. Tony Chan, the MPS Assistant Director, thanked the MPSAC members for devoting time to serving on the Advisory Committee and gave special mention members who had just completed their terms on the Committee. He noted that each member had received a copy of the just issued MPS brochure, which introduces MPS to the public and provides information MPS and statistics associated with each of the Division within MPS and the Office of Multidisciplinary Activities (OMA). that just rotated off; and he introduced the MPS brochure, which gives basic purpose and statistics about the five divisions and OMA. After describing the organizational structure of MPS and how it fits within the structure of NSF, he noted the NSF had received a 7.7% increase from FY 2007 in its FY 2008 budget request. MPS had received an 8.9% increase from FY 2007 in the FY 2008 budget request.

Chan then provided an update on activities that had occurred since the April 2007 meeting of the MPSAC. The FY 2008 budget was in conference, NSF's FY 2009 budget request had been submitted to the President's Office of Management and Budget (OMB). The America Competes Act had been signed into law. Within MPS an award for the Deep Underground Science and Engineering Laboratory (DUSEL) had been made in July. The University of California-Berkeley had been selected to produce a technical design for a Deep Underground Science and Engineering Laboratory (DUSEL) at the former Homestake gold mine near Lead, S.D. The Homestake team, headed by Kevin Lesko, would receive up to \$5 million per year for up to three years. A gender equity workshop had been held by the Divisions of Physics (PHY), Astronomical Sciences (AST), and Materials Research (DMR). Committee of Visitor (COV) reviews for the AST and DMR were scheduled for February 2008.

New MPS staff were introduced. Dr. John (Jack) Lightbody was now the Deputy Assistant Director of MPS, Dr. Zakya Kafafi had been selected as the Director of DMR, Dr. Lance Haworth was now the Acting Director of OMA, and Dr. Susan Hamm was the new MPS Budget Officer.

MPS Division Updates

Following Chan's presentation, the Directorate Division Directors (Dr. G. Wayne van Citters, AST; Dr. Luis Echegoyan, CHE; Dr. Zakya Kafafi, DMR; Dr. Peter March, DMS; and Dr. Joseph Dehmer, PHY) provided an update and overview of their Divisions. These presentations were associated with the viewgraphs that are provided below.



AST



CHE



DMR



DMS



PHY

Strategic Issues for FY 2010 and Beyond (MPS Retreat, International)

Chan briefly reviewed the President's American Competitiveness Initiative (ACI) and its relationship to the National Academy of Sciences document *Rising Above the Gathering Storm*. He then led a discussion of planning for FY 2010 and beyond, touching on the importance of follow-through on the MPSAC activities, exploiting partnerships with other directorates, agencies, countries, identification of emerging frontiers like the MPS-BIO interface, the

challenge of MPS and taking the lead in NSF-wide initiatives. He then described the existing portfolio of MPS facilities and the role they had in advancing the frontiers of science, the MPS Horizon projects and MPS facilities under construction [IceCube, the Atacama Large Millimeter Array (ALMA), and Advanced Laser Interferometer Gravitational Wave Observatory (AdvLIGO)]. Facilities that were in the design and development phase were the Advanced Technology Solar Telescope (ATST), DUSEL, the Giant Segmented Mirror Telescope (GSMT), and the Large Synoptic Survey Telescope (LSST). Other facilities under consideration are a coherent light source and the International Linear Collider (ILC).

He summarized the progress made since the AST Senior Review and gave a brief overview of MPS centers and institute. He noted that (6 varieties) and discussed the new NRC report on the MRSEC program.

With respect to diversity, Chan stated that a great deal had happened over the last couple of years to increase diversity in MPS portfolios. The Division of Chemistry (CHE) led with a gender diversity workshop in FY 2006, which was subsequently followed by a workshop involving department chairs of AST, PHY, and DMR departments in the summer of 2007. CHE has gone on to plan similar workshops for minorities and disabled individuals. There have also been good results from the ongoing Partnerships for Research and Education in Materials (PREM) program in DMR, and a similar program in AST is starting up. In addition, MPS is asking its facilities and centers to have explicit diversity plans and actions that will be reviewed at their annual reviews.

Chan reported on the internal activities within NSF on ‘transformational’ research taking place in the last couple of years. The NSF has completed a report and recommended an NSF initiative in this area. The MPS working group report on transformational research played a major role in NSF deliberations. Actions have included including transformational research as an element of merit in the first of the two merit review criteria.

Chan then turned to a discussion of the challenges that face MPS. He noted that the cost of new projects was approaching O(\$1B) and that such projects required very accurate cost estimates as well as cost control. There was the problem of balance between support of the core programs versus management and operation costs for facilities. With respect to international challenges, it was a strategic goal that the US maintain leadership in basic science. The old model was one where the US would have complete dominance in science with top science talent coming to the US. Now, in the era of “The World is Flat” there was the question of global competition versus collaboration and there was competition to attract the top international talents to the US.

Chan concluded his presentation by describing recent visits to Japan and China by MPS staff. Staff had received considerable help in arranging these visits from the NSF Beijing & Tokyo Offices. Institutes and universities that visited in China included Xinglong Observatory, the Purple Mountain Observatory, Nanjing Institute for Astronomical Optics and Technology, Tsinghua University, the Shanghai Synchrotron Radiation Laboratory, Fudan University, Zhejiang University, the Kavli Physics Institute, the Institute for High Energy Physics, and the Institute for Modern Physics (Lanzhou). Staff from the Division of Materials Research had also visited universities in Japan.

In the discussion that followed Chan’s presentation Chan noted that Europe was actively recruiting and paying Chinese students and scientists. Onuchic commented that every program at NSF in the past 10 years has made it harder to bring foreign students and postdocs to US. Soboyejo commented that there is a rapid decline in students coming from China and India to US. Working conditions, funding, life quality are getting better in home countries. US universities are merely reactive, looking at short term financial interests. It was necessary for the US to engage with the world, not just let the world come to exploit past US success. Witherell commented that the NSF has a more international outlook than other US agencies that fund science.

Report from the MPS Major Facilities Subcommittee

Witherell described the recent activities of the MPSAC Subcommittee on Major Facilities. Three teleconference meetings had been held and the topic of the discussions was the Deep Underground Science and Engineering Laboratory (DUSEL). This project was still in its early design stages, and the role of the subcommittee was to examine that status of the project and determine whether it would bring a recommendation to the full MPSAC to recommend to MPS and to the NSF that the project was at a point where it could enter the “Readiness Stage.” This is one of the steps outlined by NSF through which a project is considered and possibly recommended for inclusion

in a future NSF budget request. NSF is viewed externally as a very good agency with good reputation, but major facility construction is seen as needing improvement.

Lunch Adjournment Followed by Divisional Breakout Sessions

MPSAC members had lunch with the MPS Divisions in the divisional breakout sessions. Topics discussed during these sessions included key long-range planning issues and FY 2010 budget ideas.

Thursday, November 8, 2007

Afternoon Session

The MPSAC reconvened in plenary session at 4:00 PM.

Reports from Divisional Breakout Groups

Membership within each breakout group can be found in Appendix II.

Division of Physics

The committee discussed how PHY can interface with multiple areas such as bioinformatics, materials, etc. and was pleased with the PHY workshop on diversity and the positive feedback it had received regarding the workshop. A significant amount of time was spent on international collaborations. It was felt that NSF should work with countries that have been historically protective of their science. Collaborations like this would greatly benefit our country. Also, scientists/agencies should move on both sides of the front (U.S. and other countries) and incorporate the best of the world. The cost was minimal compared to the benefit to society.

With respect to the DUSEL project it was important to remember that when DUSEL is being discussed the costs associated with the project are dependent upon the agreements and that more interactions are needed between NSF and the physics community.

Division of Mathematical Sciences (DMS)

The meeting was productive with excellent divisional staff attendance. Peter March, Division Director, was not at the meeting but Deborah Lockhart, Executive Officer, very capably chaired the meeting. While the DMS Committee of Visitors (COV) met in February 2007, the COV report was revisited at the breakout discussion today. The breakout group had a lengthy discussion on the workforce program and training of future researchers. The group agreed that the program is impressive and tuned-in to the issues. The Vertical Integration of Graduate Research and Education (VIGRE) program was now being assessed by the National Academy of Sciences and DMS is also studying the ten years of VIGRE to established best practices.

The subcommittee discussed underrepresented groups support and it was noted that in the past year the DMS success rates for men and women were the same. However, this area still needs work. As for international collaborations, DMS has established a collaboration with China. Both sides will review and fund proposals.

With respect to interdisciplinary activities, DMS's contribution to Cyber-enabled Discovery and Innovation (CDI) is equal to the total of other divisional contributions. DMS is also utilizing their Mathematics Institutes to spread the message about CDI to the community at large. The older Scientific Computing Research Environments for the Mathematical Sciences (SCREMS) program is being reviewed.

The subcommittee also discussed ideas and budget drivers, including large data sets, multi-scale issues and data fusion (a new area that could be developed), predicting credit defaults, imaging and rare events such as Katrina and the collapse of the I-35 bridge.

Division of Materials Research (DMR)

The group noted that funding for DMR was flat with respect to previous years that and the number of proposals DMR was receiving was increasing. The group discussed the balance between single investigator grants and center grants. Materials Research Science and Engineering Centers (MRSEC) are very large, and a possibility for the future is to have smaller precursor grants so that teams can build up to compete at the MRSEC level. Other issues discussed by the group included complexity, energy and sustainability, biomaterials and photonics. The group noted that DMR is developing a strategic plan that includes working more with other divisions, establishing fellowships with mentoring, and how to participate in the American Competes Act (ACI). Another item that was discussed was the manner in which DMR could inform the community about CDI, and the role of DMR with large facilities that cost \$60 - \$100 million per year.

Division of Chemistry (CHE)

The group noted that the 2008 budget was encouraging but increased funding needed to be sustained for many more years. It was encouraging that the ratio of permanent rotators to off-site rotators had been increased and this should provide more stability. Priority areas for the CHE included the Beyond Moore's Law activity and emergent behavior. CHE has worked very hard to create CHE 2012 Strategic Directions (CSD) in response to a recommendation of the 2007 COV report. The group applauded the effort CHE was taking the time to step back and reflect on where they want to be in five years.

The CSD focuses on six critical issues.

- CHE division structure. Are the traditional subdivisions the right boxes or should there be something different? CHE will establish a new taxonomy for proposals being submitted and track submissions with the new taxonomy. This information will inform a possible shift in structure. The group feels it is good to be asking this question and that it is very important to the community.
- From the ACS Town Hall meeting, there were concerns submitted about mid career faculty, which CHE interpreted as concern for PIs across various career stages – junior, mid and senior. CHE is considering opportunities for chemists – especially midcareer - that want to pursue a new area but lack the funds and equipment. The group was happy with the direction of this issue.
- Broader impacts have been here for ten years but with little assessment. CHE will assess broader impacts. CHE already asks for broader impacts separately in their highlights. It was suggested that CHE include both criteria in one highlight.
- The group discussed how ACI impacts CHE. CHE recently sponsored a workshop titled Enhancing Innovation and Competitiveness through Investments in Fundamental Research. Through the workshop, attendees learned how difficult it is to bring together industry and universities because of intellectual property (IP) issues. CHE plans to provide leadership for the community in this area.
- CHE and the community needs to better communicate the value of chemistry to the public and the impact that chemistry has on our lives. This is viewed as important for attracting students to the field and public support for chemistry.
- The committee discussed broadening participation. The new departmental instrumentation solicitation has a new criterion that departments must submit with their proposal. They must describe a broadening participation plan for their department. It was noted that the new requirement would require universities to integrate from the department level to the university level, which will make better use of resources and change the staffing to better reflect the face of America.

The committee was briefly informed of the upcoming CHE sponsored workshop about persons with disabilities.

Division of Astronomical Sciences (AST)

The group reported that AST was doing a good job communicating to their community and political and economic communities their activities concerning the assessment of facilities and priorities of the AST budget. An outside contractor has been hired in an effort to understand more clearly the cost of operating facilities. AST is preparing for the next decadal survey in which the Department of Energy (DOE) and NASA will participate. The Virtual Observatory activity, being done in collaboration with NASA, is moving forward.

The breakout group discussed the AST budget. In FY 2008 AST requested a 10% increase in funding for the grants program. The committee discussed but did not agree with what the appropriate level of funding for instrumentation needed for astronomy should be. The group felt that strategic thinking/planning needs to be established regarding budgets and expectations.

International collaborations could be considerably expanded, and it will be risky for AST and MPS if NSF takes too narrow of an interpretation of ACI. Furthermore, the distribution of ACI funding is not transparent to the outside community. The comment was made that the overall budget and that related to ACI depend on OMB and that AST suffers in this respect as it needs to make sure that marketable technology resulting from AST investments is made known to the public and to legislators.

Cyber-enable Discovery and Innovation (CDI) Program Update:

Dr. Thomas Russell of the Division of Mathematical Sciences gave a report on this activity. Russell is cochair of the NSF-wide working group on this initiative. This is a five-year initiative, with all directorates, programmatic offices involved, and with investments monitored by the Office of the Director, the National Science Board, and the Office of Management and Budget. The Initiative aims to create bold, revolutionary, radical, paradigm-changing, transformative science and engineering research outcomes and will involve multidisciplinary activities that significantly advance more than one field of science or engineering through innovations in, or innovative use of, computational thinking

There are three CDI themes: from data to knowledge; understanding complexity in natural, built, and social systems; and building virtual organizations. Long term funding includes:

- a. FY 2008 \$52 million (50% pooled)
- b. FY 2009 \$100 million (7% pooled)
- c. FY 2010 \$150 million
- d. FY 2011 \$200 million
- e. FY 2012 \$250 million

The types of products include new concepts of research modalities as defined by CDI and project size is not just measured by cost.

Russell reviewed the dates when proposals are due and awards are expected to be made no later than October 2008.

The America Competes Act (ACA)

Ms. Theresa Davies of the Office of Legislative and Public Affairs gave a brief description of the recently passed America Competes Act (ACA). She noted that Congress is concerned that the U.S. keep its competitive edge economically. This is an authorization act (not an appropriation act) that calls for the doubling of the NSF budget in the next seven years. Some of the key points within the Act include:

- All grant applications that include funding for postdocs should include a mentoring program for postdocs that is evaluated under the broader impacts criterion;
- Minimum and maximum levels are established for funding Major Research Instrumentation and a 30% cost share is instituted; and
- Students supported by Integrative Graduate Education and Research Traineeship (IGERT) grants should be taught to communicate about their research with the public.

The NSF will have to carry out the requirements contained in this legislation even if the funding is not approved.

Adjournment

The meeting was adjourned at 6:00 P.M.

Friday, November 9, 2007

Morning Session

The MPSAC convened at 8:30 A.M.

NSF Working Group on Diversity by Celeste Rohlfiing

Dr. Celeste Rohlfiing of the Division of Chemistry and co-chair of the NSF Working Group described the composition of the current activities of this working group. The group is made up of large number of staff from across the NSF and began its work in April 2007. There are six major recommendations in the report, and for each recommendation there are specific ideas as to how those recommendations would be implemented. The recommendations are the following:

- 1) Portfolio:
 - a. Maintain and update regularly the NSF portfolio of broadening participation programs to facilitate coordination.
 - b. Inform the portfolio through the incorporation of strong scholarship that takes into account differences among populations, fields and levels of education.
- 2) Diversifying the Reviewer Pool:
 - a. Increase the diversity of scientists and other STEM experts who review NSF proposals by:
 - i. providing a searchable reviewer database with accurate demographic data,
 - ii. encouraging reviewers to provide demographic data,
 - iii. cultivating additional reviewer sources, and
 - iv. encouraging NSF staff to use a more diverse reviewer pool.
- 3) Training
 - a. Provide training to staff on:
 - b. NSF priorities and mechanisms for broadening participation and workforce development, effective community outreach, and mitigation of implicit bias in the review process.
- 4) Dissemination
 - a. Communicate clearly broadening participation and workforce development guidance and promising practices within NSF and throughout the STEM community.
 - b. Establish two websites: one for the general public, and one internal to NSF, to facilitate broad dissemination and consultation.
- 5) Accountability
 - a. Require PIs to report outcomes of broadening participation activities.
 - b. Establish NSF-wide reference codes for all broadening participation funded activities.
 - c. Incorporate broadening participation efforts as a performance indicator for program staff and management.
- 6) Effectiveness
 - a. Promote effectiveness and relevance of the NSF broadening participation portfolio via periodic evaluations.

Next steps in the working group's activities included internal posting of the report for comments, a public comment period, implementation of the report with allocation of personnel and funding, and ongoing assessment. She noted that a workshop entitled "Excellence Empowered by a Diverse Academic Workforce: Achieving Racial and Ethnic Equity in Chemistry" had been held in September 2007 and had been co-sponsored by NIH, NSF, and DOE.

Rohlfiing commented that NSF data on minorities and under-represented groups is based on self-identifying information volunteered by the PIs and the panelists. It is estimated that while the PIs' response is around 70%, the panelists' response at around 25% is much lower. One committee member suggested that the reason for gathering

data was insufficiently advertised, and that if the individuals only knew that the information was being collected for the purpose of broadening participation, they would be more forthcoming. Another member countered that certain groups (the Native Americans in particular) were reluctant in divulging their ethnic identities for fear of inviting discrimination. Still another wondered whether members of under-represented groups were wary of self-identifying for concern that they might be called upon far too often to render public service on committees etc. It was also pointed out that some individuals find ethnic identity simply irrelevant and would not provide the information on principle. The suggestion that a panel could be photographed to acquire data was discounted on the grounds of informed consent, with the committee generally favoring the voluntary approach. It was generally conceded that the lack of data seriously hampered efforts aimed at, and impeded performance evaluation of those within NSF charged with the task of, broadening participation.

Committee on equal Opportunities in Science and Engineering (CEOSE) Meeting

Dr. Theresa Maldonado, the CEOSE liaison to MPS described recent CEOSE activities. She began by describing the origins of CEOSE and noted that findings in the 1994-2003 Decennial and 2004 Biennial Reports to Congress entitled "Broadening Participation in America's Science and Engineering Workforce" were that there were modest, but not significant increases in STEM degrees awarded to underrepresented groups and that the pipeline was still very leaky. Several mini-symposia were held in the period 2006-2007. She stated that MPS had been the most visible Directorate making presentation to CEOSE, with 7 presentations during the period 2006 – 2007 and then described issues including broadening participation (how does one achieve this objective, and how is evaluated, measured, and can best practices be documented), the NSF broader impacts review criterion, and, how should one proceed given the minimal changes that have taken place over the years.

In the discussion period following the presentation a member noted that 40% of the undergraduates in the country enroll in community colleges; it would therefore appear that these institutions should provide a natural pipeline to universities for students in the STEM disciplines. Witherell pointed out that while the community college system in California is large and growing, it does not view as its mandate the streaming of its graduates into the University of California system. In particular, the community colleges do not necessarily have the mathematics and science courses that would prepare the students for entry into the STEM curricula of the universities of California. A committee member pointed out that there do exist models of cooperation between community colleges and universities elsewhere in the country. The Pennsylvania State University, for example, has a program in which community college students participate in a Nanomaterial experimental activity. Several members pointed out that in universities, faculty involvement is the key, and that too often faculty members are unwilling to make the requisite time commitments. Another member wondered whether the concern of the CEOSE extended to individuals with disabilities. Maldonado responded that the committee had indeed begun discussions on both physical and mental disabilities. Dr. Luis Echegoyen, Division Director for Chemistry stated that the Chemistry division is in the planning stages of a program in this area, but he emphasized that it is a sensitive topic, especially when the disabilities are hidden. NSF in general, and MPS in particular, was congratulated by Maldonado for its initiatives in these directions.

The Advisory Committee for GPRA Performance Assessment (ACGPA) Meeting by Larry Dalton

Dr. Larry Dalton presented the report of the most recent meeting of the Advisory Committee for the Government Performance Results Act (GPRA). He stated that the committee consists of 18 members, with 12 of these members from current NSF advisory committees, and with members representing the engineering, science, and education communities, including both the public and private sectors. He discussed the charge to the committee, which is to provide a report the NSF Director that included an assessment of whether NSF had demonstrated "significant Achievement" for overall performance for each of the three 2006-2011 NSF strategic outcome goals of Discovery, Learning, and Research Infrastructure. In addition, in the committee was asked to provide comments to the NSF regarding "transformative research" and general comments about the entire ACGPA process. The ACGPA concluded that NSF had demonstrated significant achievement in each of the strategic outcome goals. The committee had several recommendations to NSF, including the selection of highlights, criteria for goal assessment, materials for review and data on portfolio balance.

With respect to transformative research, the ACGPA felt there was a need for a formal definition that encourages high potential proposals in a risk-taking environment. An agile review process should also be developed.

Impact of Proposal and Award Management Mechanisms (IPAMM) Report

Dr. Jacqueline Meszaros of the Social, Behavioral and Economic Sciences (SBE) Directorate gave a presentation on the IPAMM (Impact of Proposal and Award Management Mechanisms) Report. She began by describing the context within which the report was prepared. Between FY 2000 and FY 2005 the NSF budget had increase by 44%, the average size of research awards had increased by 41%, and research proposal submissions had increased by nearly 50%. NSF budget increases were absorbed by the growth in the average award size. As a result, the research proposal funding rate decreased by 29%, from 30% to 21%. Directorate level trends show significant variability in rate of change, degree of change, and starting and end points of change. The increase in proposal submissions was due to an increased applicant pool and to an increased number of proposals per applicant, increased size and capacity of the research community, loss of funding from other sources, increased use by NSF of targeted solicitations in new areas, and external institutional pressures.

The result has been that the funding rate of highly-rated proposals has decreased but the decrease in funding rate has not had a disproportionate effect on women, minorities, beginning PIs, or PIs at particular types of institutions. The surveys done by IPAMM give anecdotal and attitudinal information about trends. Even though the timeliness of proposal decisions did not decline, however principal investigators are increasingly dissatisfied with turnaround time.

The report describes how funding rates might be improved by limiting proposal submissions, and the report makes a number of recommendations to NSF. The recommendations are the following:

- Focus on developing strategies that are appropriate within the context of each unit, that balance long-term planning with the ability to respond to changing needs, and that help break the decline-revise-resubmit cycle for highly fundable proposals
- Improve communications with internal and external communities when implementing new management practices
- Update the IPAMM trends analyses annually, and periodically reassess the practices and policies of the directorates/research offices.

In the discussion that followed this presentation Maldonado asked about data on Small Grants for Exploratory Research (SGERS) but these were not available. Arnold felt that the concept of transformative research has not been productive, and that statistics such as those in the IPAMM Report should be put online, easily accessible, and updated regularly with new data. Witherell said transformative research may be defined personally by individuals and hard to made consistent but nonetheless is being incorporated into the Intellectual Merit review criteria and so will have to be dealt with in the future. Jorgensen saw no change in pressures on MPS PIs with respect to seeking funding but thinks that faculty in medical schools are seeing increased pressure because of dependence on extramural funding and the expansion of the medical schools. Meszaros noted that some think the increase in numbers of proposal could be due to news about an increase (doubling) of the NSF budget in the future. Witherell said that limited submissions are perceived, and in fact are, damaging to morale of individuals in academics. Meszaros said that transformative research is understood differently by different stake holders (e.g. members of Congress vs. scientists).

Comments on Strategic Issues – Office of Science and Technology Planning(OSTP)

Dr. Kate Beers of the Office of Science and Technology Planning described some strategic issues as viewed from OSTP. She noted that it was important for the Directorate to determine the priority it would give to how increased funds would be spent – would it be for people or would it be for research? Diverse skill sets are needed for success in academic or private sector careers. It is not clear how NSF funds deal with this issue in the training and education. There may be a need to further separate funds for research and for outreach and/or education. There are currently problems with supporting large facilities as there are a number already in existence and a need for new ones. It will be important to leverage funding via partnerships, both nationally and internationally in an environment where there may not be significant new funds.

In the discussion period Witherell noted that it has been well known for a long time that graduate students (e.g. new PhDs) are seeking diverse types of careers and not just going to academia. Dalton felt that there has been a change in the last couple of decades over where graduate students are choosing to go after completing degrees and this affects what additional education they need during their graduate years to fit these variations in career paths. Robertson noted that a survey on graduate students at his institution concluded that graduate students do not want to pursue academic careers because academic positions are perceived as relatively unattractive today. Onuchic felt that diverse choices in career paths is natural and appropriate since peoples' skills, interests, and personal goals make them better suited for one thing versus another. Soboyejo felt that US academia is not attractive to new PhDs at this time due to a number of factors including the lack of mentoring and personal support, and the lack of funding with the junior faculty member in mind. Also, there is not enough support for mid-career professionals seeking to change their focus or fields. Hughes noted that there are serious deficits in the job quality at many colleges and universities (e.g. large teaching loads, lack of support for junior faculty, poor balance in the representation of women and minorities), and that this is a serious problem that has been a problem for many years and is not getting better.

Strategic Planning for FY 2010 and Beyond

Chan introduced the topic by presenting strategic planning issues that had been discussed at an MPS retreat in October. The areas covered included scientific frontiers and how to stay in the lead, issues with major facilities, people, interagency activities, and international activities. The question was how MPS could be a leader with respect to new initiatives within NSF and with external agencies.

He noted that Dr. Beers had commented, during her presentation, that NSF could learn from other agencies. Chan commented that other agencies have more specific missions, while NSF is discipline-based. We can, however, learn from their management techniques.

Arnold commented that there was a need to articulate interdisciplinary initiatives and avoid duplication. His own institute is running a program for math and chemistry next year, spending \$1M on visitors, roughly half primarily mathematicians and half primarily chemists. Witherell commented that centers are important to the life of MPS. It was noted that international aspects are important to everything that MPS does. Monica Olvera de la Crz commented that NSF needed to think how it can help emerging countries when it collaborates scientifically with them. A question was raised as to how NSF policies change in response to external changes. Another aspect concerns intellectual property rights with respect to individuals who come from foreign countries. A comment was made that with respect to students from China, such intellectual property agreements can become extremely complex. In Japan and China, agencies that support applied science are very concerned about this issue, but this is less so for those funding basic research.

It was noted that the Division of Chemistry, at the recommendation of their Committee of Visitors, has put forward a Strategic Directions document within the context of NSF's overall Strategic Plan. Other divisions are presumably doing the same on different timescales.

Chan said that MPS would like general principles to guide the Directorate and that the Directorate should have a strategic plan for two reasons:

- Many issues are common across divisions, and by addressing them on the MPS level we can develop best practices;
- If MPS and its Advisory Committee can agree on and endorse such a plan, it gives MPS more weight in carrying such initiatives forward, putting MPS in a leadership position.

It was noted that although various committee members have pointed out that US academia is a discouraging place for young faculty. If the NSF budget increases, should those dollars go to making it easier for new faculty to get started, and training them to handle the interpersonal issues involved in, for example, running a lab? The comment was made that universities have an important responsibility here.

It was noted that while the job of strategic planning process is to recognize the problems it is the implementation of those plans that requires specific tactics and at all times accommodating discipline-specific cultures.

The MPSAC discussion then turned to preparing for the meeting with NSF Deputy Director Dr. Kathie Olsen. It was agreed that two questions that would be addressed would be

- How does the Director's office think about the lifecycle and operations cost of facilities?
- How does the Director's Office and the NSB decide which facilities should be built?

Meeting with Dr. Kathie Olsen, Deputy Director, NSF

Witherell thanked Dr. Olsen for taking the time to meeting with the Advisory Committee. Olsen responded that both she and the Director consider meeting with the Advisory Committees very important. In response to Witherell's invitation to speak to issues that were of concern to her Olsen responded that one of the principal concerns was the budget. The Senate and the House each passed separate budgets for FY08 but it was necessary for them to meet in conference and resolve differences.

Witherell brought up the topic of major facilities. He said that it is very important to plan for the life-cycle costs. There is an MPSAC subcommittee on major facilities and is currently discussing the proposed Deep Underground Science and Engineering Laboratory (DUSEL). Some proposed forefront facilities are now so large that the agency has to figure out how to share maintenance and operations costs between division, directorate and the agency as a whole. Dr Olsen responded that she had reviewed the current facilities plan for NSF and feels that some aspects of the plan have underestimated costs. s. I will forward you the presentation I gave to the NSB: this is important to the MPSAC. There are questions:

- First, at what stage does NSF prioritize a project and determines when it will go in the budget, so that the agency can work on getting interagency or international partners? Waiting till readiness delays projects too long and it is very difficult to bring in partners when there is no commitment to the project. NSF is considering asking the National Science Board (NSB) to make an early commitment *e.g.* a statement that "if the costs are under control and XYZ conditions are met, then we will put this in our budget request".
- Second, after a project is built and enters into operation, NSF proceeds to compete the management of the facility, which means that the management might change. NSF has asked NSB to change this – why pretend to re-compete on day one? NSF should approve the partnership that builds the facility, if all goes well, agree to let that partnership to operate it for the first few years and only then have a competition for future operations. At present, the operations contract must be competed as soon as the facility is built and before it starts to operate.
- Third, NSF is supposed to integrate research and education, so we need to do this with MREFC projects. Would it be easier to get education set up at the same time the facility is being built? Dr. Barry Barish is looking at this for the NSB.

Olsen then commented on cost over-runs. OMB and Congress have not understood why the budget must include contingency. NSF must convince them that project budgets must have 35% (or at least 25%) contingency, that this contingency be included in the initial budget, and that the agency then commit to descope if necessary to remain within that budget. There would be no tolerance for over-runs. With respect to this, NSF was asking the NSB and all of the advisory committees for guidance.

Olsen commented that the Office of Management and Budget (OMB) was considering whether NSF should have a separate MREFC account at all. With respect to operations and maintenance costs (O&M) the concept that such costs should come from a central source ("off the top"), would probably never happen, so communities will have to weigh the costs and benefits of maintaining and operating facilities against other research activities.

Witherell commented that the MPSAC had discussed this matter. The AC felt that O&M should not be disconnected, but on some scale a division cannot handle it. The NSF and Directorate must take part or nothing above a certain scale will ever get done. Is there an allotment to take some out of the agency as a whole?

Olsen commented that this is a concern. One directorate had already thought about taking M&O "off the top" at the directorate level, but had not yet talked to their advisory committee yet, and many communities would be very unhappy about that. NSF needs to talk to the advisory committees and the NSB about these concepts. Witherell commented that NSF needs to plan for a realistic budget in the long term, even if it makes the initial barrier to

constructing a new facility higher.

Olsen commented that NSF Science and Technology Centers are supported for a maximum of 10 years. After that, they must find other forms of support. She asked the AC about the concept that such a concept that NSF support facilities for 10 years and then they would also have to seek other forms of support. She noted that the United Kingdom is starting to close facilities unless others pick up the funding costs. Their criterion is the “half life of the science return.” Government funding could ramp down rather than vanish.

Williams commented that there there is a disconnect and some misperceptions about project management. Kate Beers (OSTP) had commented that there’s a feeling (which he shared) that program management is carried out more effectively at NASA and DOE than at NSF. That perception is really an important problem for NSF. Olsen responded that NSF has good program management but many projects do not take into account a need for adequate contingency. Williams then noted NASA has program management as a priority and puts in much more effort than NSF. Olsen then remarked that NASA has a program manager and a program scientist for each facility and does a lot of independent oversight.

The discussion then turned to international science. Witherell commented that the US is no longer the choice of all the best students. Olsen responded that she would appreciate advice in this area. NSF has to understand what has to be done in this area.

With respect to the Cyber-Enabled Discovery Initiative, Arnold commented that there was considerable activity with MPS to mobilize the community with respect to this initiative.

Dalton drew attention to the issue of broadening participation, which the MPSAC feels is very important for NSF. He noted that it was critically important to start academia thinking about this. The gender equity workshops in PHY and CHE, the underrepresented minorities workshop in CHE, the future workshop in DMR, and the upcoming disability workshop, are wonderful. CHE plans to require departments proposing for instrumentation to produce a plan for broadening participation within the institution will really stimulate this. This sort of departmental diversity requirement is very important, and it reaches to the top of the university. It is a very difficult problem to tackle the attitudes and culture in academia, but it’s important to start the activity to change the life view.

Olvera de la Cruz and Maldonado noted that the Partnerships for Research and Education in Materials program in DMR was very successful, and that undergraduates are doing high-level research. It is a good model that shows the need to think differently. It empowers minority serving institutions (MSI) to be leaders. Olsen commented on her recent visit to the Maui Community College in Hawaii. In Hawaii they have had effective exposure to science through the CfAO program.

Witherell thanking Olsen for taking the time to meet with the MPSAC.

Other Business

Witherell noted that work remained to be done on forming additional MPSAC subcommittees. In particular one needed form a subcommittee on centers and institutes. A subcommittee on international activities could also be formed later. Chan commented that at the next MPSAC meeting there would be need for comment and input from the MPSAC on possible areas for consideration in the FY 2010 budget.

Adjournment

The meeting was adjourned at 1:30 PM.

APPENDIX I

ATTENDEES

MPSAC Members Present at NSF

Douglas Arnold, University of Minnesota
Cynthia Burrows, University of Utah
Claude R. Canizares, Massachusetts Institute of Technology
Eric A. Cornell, University of Colorado
Larry R. Dalton, University of Washington
Rhonda Hughes, Bryn Mawr College
Iain M. Johnstone, Stanford University
William L. Jorgensen, Yale University
David E. Keyes, Columbia University
Theresa A. Maldonado, Texas A&M University
Dusa M. McDuff, SUNY-Stony Brook
Monica Olvera de la Cruz, Northwestern University
Jose N. Onuchic, University of California, San Diego
Ian M. Robertson, University of Illinois at Urbana-Champaign
Winston Soboyejo, Princeton University
Joel E. Tohline, Louisiana State University
Robert Williams, Space Telescope Science Institute
Michael Witherell, University of California, Santa Barbara

MPSAC Members Present via Telephone

Hector D. Abruna, Cornell University

MPSAC Members Absent

Dennis L. Matthews, University of California, Davis

MPS Staff

Morris Aizenman, Senior Science Associate, MPS
Tony Chan, Assistant Director, MPS
Adriaan de Graaf, Senior Advisor, MPS
Joseph Dehmer, Director Division of Physics
Luis Echegoyen, Director, Division of Chemistry
Eileen Friel, Executive Officer, Division of Astronomical Sciences (present via phone)
Lance Haworth, Acting Division Director, Division of Materials Research
Janice Hicks, Executive Officer, Division of Chemistry
Zakia Kafafi, Director, Division of Materials Research
Jack W. Lightbody, Executive Officer, MPS
Deborah Lockhart, Executive Officer, Division of Mathematical Sciences
Ulrich Strom, Acting Executive Officer, Division of Materials Research
G. Wayne van Citters, Jr., Director, Division of Astronomical Sciences (present via phone)

Visitors

Kate Beers, Director, Division of Mathematical and Engineering Sciences, OSTP
Elizabeth Grossman, Burke-White Associates
Kathie Olsen, Deputy Director, NSF

Appendix II

BREAKOUT SESSION ROOMS
MPS Advisory Committee Meeting
November 8, 2007

		DIVISIONAL ASSIGNMENTS FOR MPSAC MEMBERS						
		AST	PHY	CHE	DMR	DMS		
		Room	Room	Room	Room	Room		
		320	330	1020	1060	370		
Term Ends 09/30/08								
	ARNOLD					R		
	BURROWS			R				
	CANIZARES	R						
	DALTON			X				
	HUGHES					X		
	OLVERA				R			
	ONUCHIC		X					
	WITHERELL		R					
Term Ends 09/30/09								
	JOHNSTONE					X		
	JORGENSEN			X				
	KEYES					X		
	MALDONADO		X					
	MCDUFF					X		
	ROBERTSON				X			
	SOBOYEJO				X			
	WILLIAMS	X						
Term Ends 09/30/10								
	ABRUNA			X				
	CORNELL		X					
A	MATTHEWS							
	TOHLINE	X						
A	Absent							
R	Breakout CHAIR, MPSAC member who will summarize Divisional meetings activities to MPSAC							

Appendix III

BREAKOUT REPORTS

Division of Astronomical Sciences Breakout Session Report

C. Canizares (rapporteur), J. Tohline, R. Williams

The AST subcommittee thanks Wayne Van Citters and his colleagues for a very open and broad-ranging discussion of AST issues, challenges and plans.

Implementing the Senior Review

AST has spent considerable effort on implementing the recommendations of last year's Senior Review (Nov 2006), which was charged with looking at balance within AST budget and recommending adjustments. This is viewed generally as both a necessary and a courageous activity, one that is getting considerable visibility both inside and outside the Foundation.

AST appears to be making good progress on implementing the Senior Review. The Senior Review identified several major facilities for budget reductions and possible shut-downs. AST has taken pro-active steps to work with the affected research and non-research communities and to manage the understandable morale issues raised by the recommendations. There are promising signs that at least some of the facilities may secure sufficient alternative sources of supplementary funding that will permit continued viable levels of operation. As an appropriate contingency, however, AST is developing decommissioning plans in order to make rational decisions if necessary.

AST is also working to understand the true cost of operating facilities, in order to better manage those facilities, look for opportunities to economize further, and accurately plan for new facility budgets. They will be using an appropriate outside contractor to conduct this review.

As a related issue, we discussed the advisability of looking at the cost/benefit of various services connected with the operations of present and future facilities. The goal would be to find an appropriate balance and to make sure that community expectations match what can be provided with a reasonable level of resources.

We also discussed how to institutionalize the Senior Review process. This was first time such a review was conducted for AST facilities, and it was very time consuming and labor intensive for both the AST staff and the community. Yet such exercises will be essential if we are to make optimal use of limited federal dollars and make room for new initiatives. Some agencies, such as NASA, have such a process tailored to their specific circumstances, and which benefit from standing committees. This is not an easy issue but one that deserves discussion within AST and at the Directorate and Foundation levels as well.

Decadal Survey for Astronomy and Astrophysics

AST is participating in the establishment of the next decadal survey, working with NASA and DOE. It is anticipated that this major effort will begin this spring.

Interagency Issues

There has been good interaction with sister agencies in several areas, including the planning for the decadal survey noted above. NSF has signed an MOU with NASA for the Virtual Observatory; that collaboration is a good one at the working level. Prior to full implementation, both NSF and NASA have made some funding available to advance the VO. The coordinated Astronomy and Astrophysics Advisory Committee, established to advise jointly the NSF, NASA and DOE, appears to be helping enhance effective cooperation between these three agencies.

Nevertheless, differences in funding models, planning timescales and even cultures always challenge those trying to forge cooperative programs. There is no real roadmap for how to effect such cooperation.

AST Committee of Visitors

The AST COV will meet this winter/spring and should be reporting at the next MPSAC meeting.

Balance in AST Budget Allocations

AST reported that approximately 17% of budget goes directly to individual grants, but this does not include other support of individual research groups through instrumentation grants, support of postdocs etc. The 24% success rate is low, mostly because of increased demand, not a decline in the number of awards. Anecdotal reports suggest that some of this may be due in part to the attractiveness of new areas of astronomy and to an influx of physicists, who are increasingly interested in astrophysical problems. AST seeks to fund the full, proposed budget level, if appropriate, consistent with NSB policy.

Importantly, the AST FY2008 budget request included a 10% increase for the grants program. We discussed possible modalities to support observers who are awarded time at national observatories but lack funds to analyze and publish the data. AST is considering if appropriate mechanisms can be found. We also discussed what the appropriate level should be for the grants program. The Senior Review recommended enhancement of the grants program, but it is not clear that success rate should be the sole or even the primary metric for establishing the appropriate balance (certainly it cannot be the primary metric in the long term, since feed-back makes this an unstable solution!).

Future Program

The AST program is heavily dependent on major facilities. We had considerable discussion about, for example, ATST, LSST, GSMT, SKA. More generally, the issue is that the operating rule set for MREFC is of keen importance to AST; It does not appear that the current mechanisms for “appetite control” (i.e., loading the Design/Development and Operations/Maintenance cost on the division base budget) is either effective or commensurate with current funding levels and future needs. This is something that affects an increasing number of divisions and needs to be addressed at the MPS level, maybe at the Foundation level through a strategic planning effort for MREFC. The goal would be a more transparent roadmapping and planning exercise that addresses D&D and O&M. This effort might pick up by revisiting the Brinkman report.

We discussed special opportunities for 2010 and beyond. AST has a draft plan for funding allocations for the out years, based on some current assumptions, which, of course, we could not review in detail. AST has and can be particularly effective in the areas of Education/outreach and in the international sphere, and should emphasize these connections. While AST may be a less obvious contributor to more applied research with obvious commercial applications, there are many examples of practical and commercially important instrumentation/algorithms that emerged from astrophysical research. AST and the community needs to continue to emphasize this. Finally we discussed ways that AST could play a larger role in cross-cutting initiatives in which it has a naturally large interest, such as CDI.

However, there was serious concern in our group that NSF appears to be taking an overly narrow or even myopic (i.e. near term) interpretation of ACI. We believe that the true intent of the Augustine Report, Rising Above the Gathering Storm, is to provide *broad support for research* (and education), not only applied research. In fact the first research recommendation in the report, Recommendation A1, is to “Increase federal investment in long-term basic research [emphasis added] by 10%/yr over next 7 years.” We believe it is in the interest of MPS overall (and of the nation!) to continue to stress this point.

Other

Finally, the subcommittee perceived that the AST staff appear overstressed in terms of workload and hampered by limited travel funds (which, for example, makes it difficult for AST staff to visit the facilities they are trying to oversee).

Division of Chemistry Breakout Session Report

November 8, 2007

Division Director Luis Echegoyan elaborated on his update earlier in the day concerning the recent activities of the division. The projected increase in the CHE budget for FY 2008 is encouraging, although the critical need for this increase to be sustained over the next several years was also discussed. The budget plan for the next 5 years includes standard increases in all areas of the budget (single investigator, collaboratives, instrumentation, REU, etc.) but a more major increase in the budget is slated for Centers for Chemical Innovation (CCI), since these programs more directly reflect the ACI and America COMPETES Act goals. There was a short discussion of some key topics that might constitute grand challenges; a number of topics were suggested from the community as potential focal points for CCIs.

The division staff have increased the permanent:rotator ratio which is a positive step toward providing more experience and continuity. Other recent activities in the division include a number of workshops—for example, the Diversity Workshop in September 2007, that was patterned after the Gender Equity Workshop of January 2006; a chemistry workshop on persons with disabilities is planned. The report on the Enhancing Innovation Workshop was recently completed. There was discussion about planning a high level workshop on a key topic in chemical research, such as photochemical energy conversion or sustainability.

Following a recommendation of the February 2007 COV report, the CHE division undertook a major project to assess their current and future directions. A draft of the plan, entitled “CHE 2012: Strategic Directions” constituted the bulk of our discussion. Ten “Critical Issues” were identified by input from various sources including a Town Hall meeting at the August 2007 American Chemical Society meeting. The discussion with AC members was focused on the 6 critical issues that constituted new rather than ongoing ones that had been previously identified. These were:

1. Structure of the Division of Chemistry: how can the Division best structure its working groups to be agile and responsive to new trends in chemical research? The discussion focused on whether CHE could take a leadership role in moving out of the traditional boxes (analytical, physical, inorganic, etc.). By comparison, chemistry departments are encumbered by undergraduate teaching, journal publishing, etc. that keep faculty compartmentalized in traditional areas. CHE proposes to develop a new taxonomy with which to classify the work supported in order to guide the staff in the evolving discipline. In addition, efforts will be made to improve co-review and co-funding with other divisions and directorates.
2. Funding Needs of Investigators at Various Career Stages: how can CHE ensure that the portfolio represents the appropriate balance of junior, mid-career, and senior investigators? In particular, what mechanisms are in place to assist seasoned investigators who wish to change directions or move into new fields? Some of the ideas include: studying the impact of the CAREER program on the chemistry community, evaluating the over portfolio, and engaging mid-career faculty in a high-risk/high-impact workshop. The AC members expressed some cautionary notes about the idea of programs specifically targeting re-entry to research since this population does not have a high success rate.
3. Broader Impacts: evaluating the impact of the broader impacts criterion on activities including broadening participation. The division will continue its efforts to educate PIs about best practices related to broader impacts, and it was recommended that the Highlights submitted by PIs address both the intellectual merit and the broader impacts of the work rather than only one or the other.
4. CHE and American Competitiveness: closing the gap between academia and industry. A December 2006 workshop on Enhancing Innovation and Competitiveness through Investments in Fundamental Research identified several issues impeding relationships between universities and industry, notably problems in sharing IP. CHE has outlined several objectives to help spur conversations between the various groups and programs in education that introduce students to industry and entrepreneurship.
5. Communicating the Value of Chemistry to the Public. Ideas were discussed for forwarding potential chemistry topics to Nova (or other PBS programs), and other methods of improving the human face of chemistry.

6. **Articulating the Impact and Importance of Chemical Research.** This area is particularly oriented toward strategic planning of future investments including an increase in centers aligned with ACI and with emerging topics of high impact. The idea of convening one or more high level workshops on topics in chemistry related to societal issues was met with enthusiasm by the AC members, and several topics were discussed.

The last part of our session was devoted to early feedback from the newly implemented requirement that CRIF-MU (shared instrumentation) proposals be accompanied by a departmental policy on broadening participation. Analysis conducted by SRI showed a high level of compliance with the guidelines of the solicitation. Common ideas as well as innovative ideas were tallied, and it will be interesting to see how these plans play out in funded proposals.

Finally, the AC members wanted to express their gratitude to the CHE division for continued excellence and particularly for the major efforts that have gone into the Strategic Directions discussions and resulting document.

Division of Materials Research Breakout Report

The DMR budget is flat while the number of proposals is growing. As such the division needs to make a strategic plan of how to make better use of resources. In particular, the balance between individual PI grants, centers and instrumentation/facilities needs to be carefully evaluated.

The MRSEC report from the NRC proposes funding for fewer centers at the expense of increasing the number of smaller group proposals. These used to be called MRG (Materials Research Groups), which were the precursors of MRSECs. The committee suggests funding smaller groups but in areas of the American Competitive Initiative (ACI groups). Since the MRSEC program has been successful, a possible new direction needs to be carefully considered.

The areas of research that are growing, judging by the topics of the 102 MRSEC pre-proposals received, are biomaterials, photonics and energy. These topics are very important to our society and offer great opportunities to DMR. These topics are included in the list of research opportunities identified by DMR, among others, such as complexity and research at the intersection between life and physical sciences. The division did a superb job identifying the 2010 Research Opportunities. Interactions with other divisions in these areas should optimize the output, and plans in this direction are in place.

The committee proposed a fellowship program to provide mentoring to gifted potential scientists and/or engineers. Broadening participation is a high priority in the division. The funding success rate for female scientists has increased, and is well above the overall success rate of PI proposals. However, the success rate of ethnic and racial minorities is flat. The fellowship mentoring program suggested above may help to identify interested students in these groups.

The role of DMR in the support of large scale facilities needs to be reviewed. Facilities operated by NSF support have been shown to provide education to the next generation of scientists but on the other hand, they have the potential of taking a large percent of DMR budget. A substantial proposal is expected to be submitted soon to support the operation of a large instrumentation facility, the operation of which may cost about 1/3 of the DMR budget. A strategic plan is required to decide the overall role the division should play. Perhaps a proportional user cost should be made, given that biologists use these large light source facilities extensively. A shared stewardship with other agencies might be a solution.

Many workshops are planned and some have recently taken place to find new directions in education, to broaden participation, and on research opportunities. One recent workshop was in polymers, an area of growth in this division and overall in the world. DMR has a large percent of research in nanoscience. It has a large potential for growth in related nano subjects such as biomaterials.

The division is planning to advertise the Cyber Discovery and Innovation (CDI) program given the need for materials research, simulations and for collection of data.

Division of Mathematical Sciences Breakout Session Report

Five members of the MPSAC (Douglas Arnold, Rhonda Hughes, Ian Johnstone, David Keyes, and Dusa McDuff) met with members of the Division of Mathematical Sciences. Approximately 20 DMS members participated. With Division director Peter March on travel, deputy director Deborah Lockhart began with a brief summary of the state of the division. We then discussed the February 2007 report of the divisional Committee of Visitors, the Division's response, and progress towards implementation.

Deborah pointed out increases of about 10% in the number of graduate students and postdocs supported by the Division.

She also noted that a gap in the success rate for proposals of men and women had essentially disappeared in 2007, when the rates were 35% and 34% respectively.

Hank Warchall reviewed the Division's extensive workforce program consisting of the EMSW21 (Enhancing Mathematical Sciences Workforce in the 21st Century) program with three different subprograms aimed primarily at graduate education and early career, the Mathematical Sciences Postdoctoral Research Fellows (MSPRF), REU programs, and programs to support undergraduate education in at the math/biology interface and in computational science. The MPSAC members were impressed by this extensive, layered, nuanced program. They were also pleased to learn that the VIGRE component of EMSW21, which is now about ten years old, is being assessed by a high-level panel of the National Research Council. Another positive activity related to VIGRE is a report being developed on best practices which have arisen at VIGRE grantee sites. We heard about several adjustments to the workforce programs. The selection panels will henceforth be run directly by the Division, rather than outsourced to the American Mathematical Society. A new component will be added to allow for unsolicited proposals that approach the Division's workforce aims in other ways than the exiting programs. Continuing with workforce issues, there was discussion of possible programs to target lower division students who are not already directed to mathematics (related to the notion of ACI fellows).

We also heard reports on two recent workshops. Ian Johnstone played a leading role in the first one, entitled "Discovery in massive datasets, common statistical themes". Ian is overseeing the production of a report from this workshop.

The second workshop was held to discuss the roughly 30 year old SCREMS program (Scientific Computing Research Environments in the Mathematical Sciences), which, these days, typically makes awards of roughly \$60,000 to departments and groups building computing clusters. The panel considered possible changes in view of the current modes of sharing and providing computer supports.

Junping Wang reported on a recent trip with Peter March and others from the Foundation to China, in which they met with the National Science Foundation of China, the Chinese Academy of Sciences, the Ministry of Science and Technology, Microsoft Asia, and various universities. DMS already has a start in international collaboration with China through a jointly administered, jointly funded bilateral grants program with NSFC.

The CDI initiative was another major point of discussion.

The DMS involvement in CDI is budgeted at \$5.2M in the first year, half of the total MPS budgeted involvement. DMS commitment is also exercised through the involvement of Tom Russell as one of the three cochairs of the effort.

Six of the mathematical sciences institutes have cooperated over the last two months to help inform the community about CDI possibilities through workshops and support for group meetings.

Besides their role in CDI, the math sciences institute portfolio, which accounts for about 10% of the DMS budget, arose in several other contexts: their contributions to workforce efforts, international science, and, of course, their primary scientific missions. The two original institutes are coming up for their second recompetition in a couple of years. The Division now manages the portfolio through an institute management teams, which appears to be working well.

Chris Stark, a member of the team reported on a preliminary assessment of institute coverage and overlap, which indicated that the portfolio is functioning well, without any major problems in these areas. The Division intends to study this in more detail.

There was a substantial discussion of the possibility of a report surveying the state of mathematical research and areas of particular opportunity. This would come roughly a decade after the 1998 report of the Senior Assessment Panel for the International Assessment of the U.S. Mathematical Sciences (Odom report) commissioned by the NSF, which was highly influential. Discussion topics included the need and uses for such a report, the impact of past reports, intended audience, possible audiences, etc.

Finally, there was a brief discussion of particularly exciting ideas for potential future initiatives. There remains a high level of interest and opportunity areas related to knowledge extraction from data, large datasets, etc. This includes dealing with multiscale data sets and data from sensor networks, and brings in new approaches to data assimilation, modeling, inverse problems, and data fusion. Another interesting area is related to risk quantification for rare events, ranging from natural disasters to infrastructure failures to credit default.

Another area which was brought up as very timely was imaging science, ranging from the collection of data from sensors, through image processing, to knowledge extraction.

Division of Physics Breakout Session Report

Participants: Michael Witherell, Theresa Maldonado, Eric Cornell and Jose Onuchic

We were well impressed with Joe Dehmer's presentation, which was clear and informative about the current state of the division and its strategic plans.

The committee and the NSF staff agree that physics is going through a time where the possibilities for great discoveries in many non-conventional fields are enormous. Just to cite a few: biological physics, physics of informatics, the physics of the universe, gravity (LIGO). It is a great time for physics! The division has taken strong action to address these multifaceted fronts (described by Joe as the Physics Frontiers, at 21st Century).

We were pleased to see that the Physics division has held a workshop on diversity and Joe has reported to us that very useful information was generated during this meeting. The meeting had the participation of more than 50 chairs and deans, which have shared their success and frustrations in dealing with this major challenge. We all see this initial effort as a positive development and we are looking forward to hearing from actions implemented as a consequence of this workshop.

The notion of international collaboration resonated in our discussion. The current situation of protecting American science from foreign participation has the potential of being damaging. Actually, the USA became the world's leader in science when opened its efforts to a large foreign participation during the last century. Currently, most of the federal agencies have difficulty in dealing with foreigners because of security issues. Therefore the NSF should be the agency that makes sure that international science is part of its mission. Actions in this direction should bring large benefits to our country.

We further expanded this discussion to conclude that it is of vital importance for our nation to act forcefully in two complementary directions: first by finding mechanisms for incorporating the larger segments of society that are not yet actively participating in science, but there is also a need to aggressively recruit the best people of the world to join the American effort. The country should make strong efforts in both directions and never choose one over the other. It is our belief that the cost for the nation to aggressively moving in both of these directions is minimal considering the possible benefits for society.

A long and informative discussion about the budget and priorities took place. Joe highlighted that physics has worked very hard in balancing the budget. His current plan is projected over 23 years. Following the commitments that the division has made to the community, they have balanced their program among single/few investigator awards, centers and facilities with the following percentages: 55%/10%/35%.

One concern, however, was raised about the actions of the last year. Although we view very positively the NSF efforts in keeping operational costs to a minimum, we strongly encourage more interaction between NSF staff and the scientific community. Last year actions of enormously reducing staff traveling and canceling panels such as our MPSAC meeting were viewed as problematic.

Three important highlights about the division budget:

1. DUSEL is such an important part for future planning that everybody in the MPSAC should understand the difficulties. Management and Operational costs for this laboratory will depend on agreements across the NSF to decide how costs and risks will be shared. Without these agreements it will be almost impossible to implement this major scientific effort.
2. The new much needed program on Midscale instrumentation, which was largely discussed in our previous meeting, appears to be moving appropriately. It has become a priority and we believe it is ramping up significantly.
3. Compared to most of other divisions, physics has to spend a substantial fraction of its budget on tools, i.e., facilities and equipments. For the intellectual health of the field, however, it needs to keep a basis of at least 1000 principal investigators. It is important therefore to keep the entire agency aware of this special pressure in our division.

APPENDIX IV

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March 28, 2008
Dr. Tony F. Chan,
Assistant Director
Directorate for Mathematical and Physical Sciences
National Science Foundation
4201 Wilson Boulevard
Arlington, VA 22230

Dear Dr. Chan:

I have reviewed the final version of the minutes of the Directorate for Mathematical and Physical Sciences Advisory Committee meeting that was held November 8-9, 2007 (attached), and am pleased to certify the accuracy of these minutes. Morris Aizenman has done an excellent job in recording the most significant parts of the discussion.

Sincerely,

A handwritten signature in cursive script that reads "Michael Witherell".

Michael Witherell
Chair, Mathematical and Physical Sciences Advisory Committee