

**Report of the Committee of Visitors
Upper Atmosphere Research Section
National Science Foundation**

September 7-9 2005

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1.0 PROCESS:

COV members were appointed by NSF to examine the performance of the UARS section in the period 2002 to 2004. Roger W. Smith was appointed as Chair. The committee was provided with a set of prescribed questions on proposal processing and program management. Answering these questions through investigations of proposal jackets and the compilation of statistics constituted the main activity of the visit. In the weeks before the meeting, committee members made selections from a list of proposals processed by UARS in the period 2002 to 2004. The jackets for those proposals were loaded into the Electronic COV module and were immediately available for committee use upon arrival. Statistical data and a copy of the previous COV report on UARS were also provided ahead of meeting for panel perusal. There is no doubt that being able to become familiar with this material helped the committee to get started quickly on the first day.

On the morning of the first day, the committee was welcomed by Margaret Cavanaugh and Jarvis Moyers. Then followed presentations by Section Leader Richard Behnke, and program officers Paul Bellaire, Kile Baker, Robert Kerr and Robert Robinson. These presentations provided important data and context bringing all committee members up to date on achievements and issues relating the section and its programs.

The preselected set of jackets for investigation was chosen with the major component being borderline between acceptance and declination based on their grading profiles. Additional selections were made during the meeting to help answer questions as they arose. The committee process called for most time to be spent in breakout groups of two

or three members representing the four individual programs. Breakout groups found answers to the prescribed sets of questions. Short plenary sessions were held once or twice a day to compare notes and intercalibrate findings.

Each breakout group provided a complete set of answers to the questions for the Chair to use in compiling this report. The whole committee contributed to the formulation of the list of collective findings and assisted the Chair in writing the overall conclusions in this report. The final report was delivered to NSF on September 15, 2005.

The COV was uniformly pleased with the support provided by UARS staff for its work prior to and during the meeting. Requests for information were processed promptly, speeding the committee's work. The COV benefited greatly from the ease of access to data and materials through the Electronic COV software and database. The committee carried out most of its work in a 3-day period on-site at NSF headquarters from September 7-9, 2005. A preliminary verbal report was provided to Margaret Cavanaugh, Jarvis Moyers and the UARS staff at 10am on September 9.

The COV has one complaint about the software support provided. The committee did not have any electronic means to exchange information between themselves. The isolation designed into the software system did not permit file sharing or email between committee members. We were forced to share information by copying files on physical media. This was an inconvenience that the committee recommends be removed to facilitate future COV panels.

2.0 OVERVIEW OF FINDINGS:

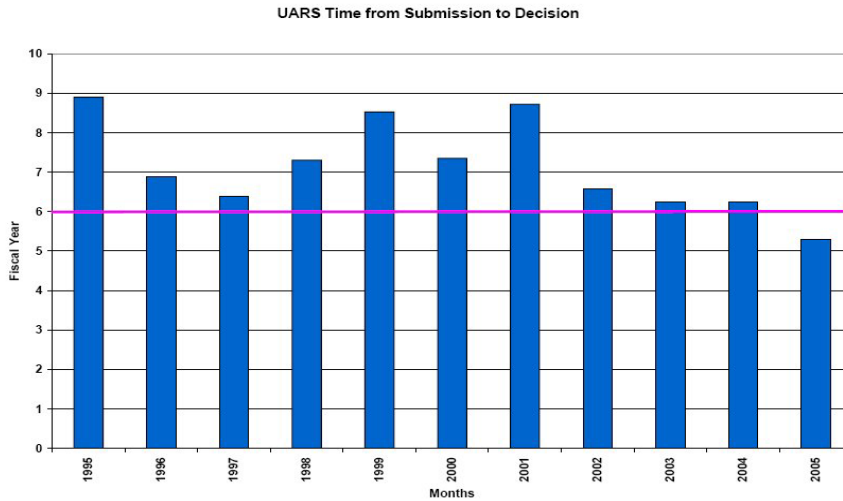
This section contains summaries of findings reported in sections 3 and 4 of this report. 2.1 reports comments on improvements made following on the 2002 COV report. 2.2 summarizes responses to the prescribed questions on processing of proposals. 2.3 reports on major findings on management of the section. 2.4 discusses some selected issues in greater detail and contains some recommendations. 2.5 gathers some additional comments selected from the responses to the prescribed questions.

2.1 IMPLEMENTATION OF RESPONSES TO PREVIOUS COV

The committee was pleased to note that there had been several very positive outcomes to comments and suggestions made by the 2002 COV report. The following examples of responses have been selected to illustrate the positive evaluation of the UARS section for their achievements.

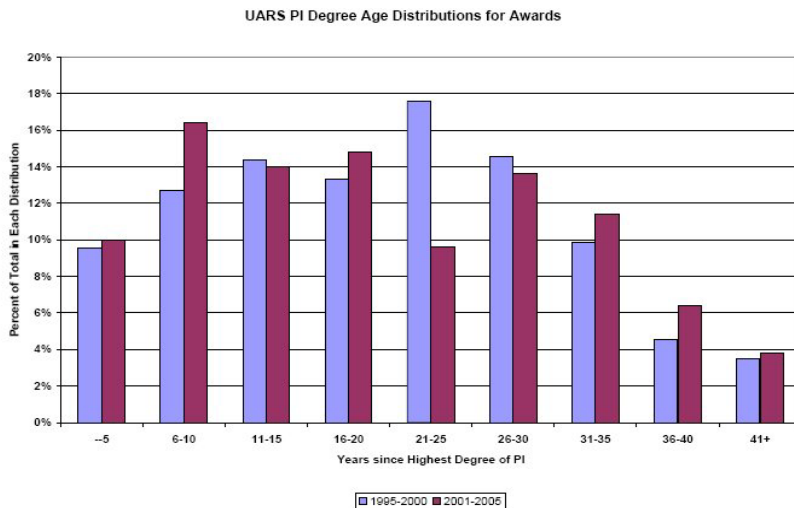
a. Proposal processing

The COV was generally pleased that the average processing times from submission to decision have dipped well below six months in 2004. The UARS staff has performed well in doing this since in this same year, the number of proposals has risen noticeably.



b. Awards to young researchers

A good proportion of awards are being made to young researchers and the diversity of award recipients is representative of the community. The figure below shows the distribution of UARS awards according to professional experience of the PI. The purple bars represent results from the last four years. The blue bars are for the five years prior. It is clear that an increasing percentage of awards are going to those within ten years of graduation. The COV believes that this result is due to a combination of proactive consideration by program officers and part due to the encouragement given to young scientists through the CEDAR, GEM and SHINE programs.



c. The Faculty Development in Space Science (FDSS) program

Originating in the STR program prior to 2002, UARS was encouraged in the previous COV report to develop the FDSS program to reverse the trend of decreasing numbers of faculty positions in space science in US universities.

About 10% of UARS funding, contributed from across the section, was dedicated to this important program. The first opportunity was announced in 2004 and the results are summarized in the table below. A total of eight awards were made and at the time of this report, five appointments were reported by the successful universities.

PI	Ph.D. Year	no.	Institution	FY-05	Total	period	Research Title
Core Awards For 1st Faculty Yr.							
Joshua Semeter	1997	0323941	Boston Univ.	139,909	385,255	5 yr.	Ground-based investigation of Upflowing ions in The Discrete Aurora
Xinzhao Chu	1996	0334357	??	119,946	324,788	3 yr.	Characterizing mid-Atmos. Thermal Structure, PMCs, and Gravity Waves at Rothera, Antarctica (67.5 S)
Qihou Zhao	1991	0337245	Univ. of Miami (Ohio)	63,611	210,448	3 yr.	Dual-Beam Incoherent Scatter Radar Study of the Mesosphere at Ascibo
Tai-Yen Huang	1997	0406585	Penn St. Burkes-Lehigh (RYI)	35,307	115,938	3 yr.	RUI: Wave-induced Nonlinear Response of Chemically Active Species & Associated Airglow Emissions in Shear Flow
John Emmert	2001	0407823	George Mason Univ.	53,890	162,050	3 yr.	Global Empirical Studies of Geospace Storm-induced Disturbance Neutral Winds in the F-region
Carer Awards							
Syed Azeem	1999	0449864	Embry-Riddle Aeronautical Univ.	87,561	446,646	5 yr.	CAREER: Mesospheric Dynamics during Stratospheric Warming Events
Scott Palo	1994	0449965	University of Colorado Boulder	99,998	499,397	5 yr.	CAREER: Development Of A Distributed, Multistatic Meteor Radar System
FDSS							
unknown		0457156	Penn State University	190,000	900,000	5 yr.	FDSS: Space Science Faculty Development at Penn State University
unknown		0457441	Virginia Polytechnical Inst.	10,000	204,000	5 yr.	FDSS: Virginia Tech Space Science Initiative
unknown		0457561	Dartmouth College	193,263	985,914	5 yr.	
Other New Faculty							
Jonathan Makela			University of Illinois				
Julio Urbina	2002		University of Arkansas Little Rock				
Jeff Thayer			University of Colorado				

Table showing awards in the first round of the faculty development program

d. The Second Criterion.

Recognizing the recent NSF innovation in reviewing proposals through two primary criteria, the 2002 COV report made reference to their findings on the implementation of the new way to evaluate broader impacts of proposed investigations. Better performance from the UARS section was requested, The results of the past three years are summarized in the table below. It is clear that in 2004, 98% of reviews received addressed both review criteria, an increase of 13% compared to 2002.

FY	Pct Of Props Processed w/in 6 Mos. of Receipt	Pct of Reviews Addressing Both Review Criteria	Proposals With No Returned Review	Pct of Reviewers from UnderRepresente d Groups	Reviewers Providing Demographic Information	Reviewers With Returned Reviews
2005	100%	93%	0	21%	28	185
2004	49%	98%	4	42%	19	160
2003	55%	92%	3	15%	20	259
2002	62%	85%	1	41%	17	153

e. Returning to full staffing

Staffing shortages highlighted in 2002 have been overcome and program management stresses have been relieved. Program directors for MAG and STR are now permanent NSF employees. Also a science assistant has been hired. Although this COV is very satisfied with the performance of program directors in the UARS section in the period under review, there is some concern that the rapidly increasing numbers of proposals received in recent years might lead to further stress down the line. The COV urges careful monitoring of the evolving situation and action to avoid a return to the difficulties of four years ago.

f. Winning funds from cross-cutting programs

A very welcome improvement of section participation in Foundation-wide cross-cutting programs has occurred. The CISM STC proposal was successful at the second attempt resulting in a new grant that brings \$4M per year to the section. The COV commends the section for its resourcefulness in obtaining bridging support for the CISM team enabling the second attempt to be developed and submitted. Other new cross-cutting funds has come from the GEO medium research equipment fund for AMISR (\$44M), from CISE and from the NSF/DOE Partnership in Basic Plasma Science. The figure in 2.3c, below, shows how these new additions have increased section spending.

g. Visiting Panel to Major Facilities

The COV welcomed the creation of a visitor panel for the major facilities and generation of the report prepared by the Upper Atmosphere Facility review panel chaired by Susan Avery. Implementation of the recommendations of this panel is ongoing and the results are even more critical as AMISR comes on-line with its own set of budgetary, management, scientific, and infrastructure issues. It is critical to the future of our community that these facilities remain healthy and able to enable/address cutting-edge science and engineering outcomes and to integrate with global science issues such as space weather and IPY. The COV finds that oversight of the UAF requires the use of site visits, technical advisory committees in addition to the standard review process that occurs with each five year renewal

proposal. We also note that in addition to AMISR, the UAF portfolio now includes SUPERDARN

2.2. *EFFICIENCY AND INTEGRITY OF PROCESSES.*

a. Proposal Processing

The COV findings on proposal processing are found in section 3 of this report. They show an overall consistent approval from committee members for the work being done in all programs of UARS. Proposal processing is done efficiently and with good judgment.

Two concerns arose that are more related to NSF policy and procedures than to performance local to the UARS section. The first relates to the broader impacts criterion for evaluation of proposals and its implementation. The second concerns the way review panels work and a perception that mail-in reviews may sometimes be ignored in favor of a panel evaluation. Both of these concerns are discussed further in section 2.4.

The committee comments that a small minority of mail-in reviews that show signs of over grading in an attempt to support a proposal and yet criticize it at the same time. This is also discussed further in section 2.4

b. Program Management

Overall performance in program management receives high praise for the committee. This extends to all members of the section. The high standard of management has important positive results in terms of the confidence and respect of the UARS scientific community in the integrity and skill of their program managers.

One aspect of program management raised a minor concern. This related to the way in which high risk programs are chosen and implement within UARS, This is discussed further in section 2.4

The committee comments that it would be beneficial to extend the scope of the STR program to include the heliosphere in a more comprehensive manner. A discussion of this is found in section 2.5.

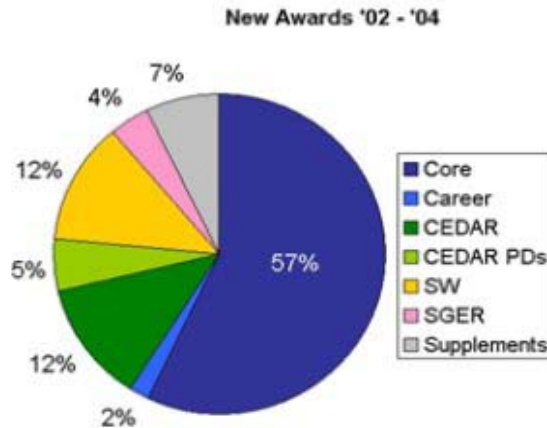
2.3. *OUTPUTS AND OUTCOMES*

Reports on the Ideas, People and Tools evaluations requested in the prescribed questions are found in section 4. The COV comments in this section are summarized here as an introduction to some specific highlights that the committee has selected for comment in the itemized list below. Examples of creditable performance nuggets in section 4 are given for each of the categories. This COV believes that these examples substantiate our evaluation that the section performance is excellent.

a. Healthy Base Programs

There is a good mix of base program and special program activities such as CEDAR/GEM/SHINE , NSWP, etc.. In addition, the base is enhanced with NSF/DOE Plasma Partnership for MAG. In all cases, the base is the largest

component in the budget. Base program is appropriately managed as a continuing opportunity and mail-in reviews only



The pie chart shows the distribution of funds in AER with Core funding predominant. The charts for other programs are similar.

b. New Medium Facility Funded

Beginning some ten years ago as a proposal to install a permanent Polar Cap Radar at Resolute, Canada, the section has been striving to establish a new incoherent scatter radar to make observations in the critical high latitude regions near the geomagnetic pole. Rebounding from a politically-based rebuff, radar leaders responded with a portable version of the concept called the Relocatable Atmospheric Observatory. This fell at the same political hurdle again, but the concept advanced once again, leading to the Advanced Modular Incoherent Scatter Radar (AMISR) which has now been funded. The COV is delighted with this eventual success and generally pleased that construction of the modular components is under way. In addition, small test versions of AMISR are in operation as this report is being written. The COV is convinced that the consistent effort of the UARS section, and particularly the skill and dedication of Richard Behnke and Robert Robinson have led to this success.

c. Spending Pattern shows healthy increase

Following on recent success in attracting funds from cross-cutting programs within the Foundation and other monies, expenditures in UARS for the report period, shown in the figure below, illustrate the positive effect this has brought. In 2004, available funds for the section were enhanced about 30% through the addition of AMISR and CISM.

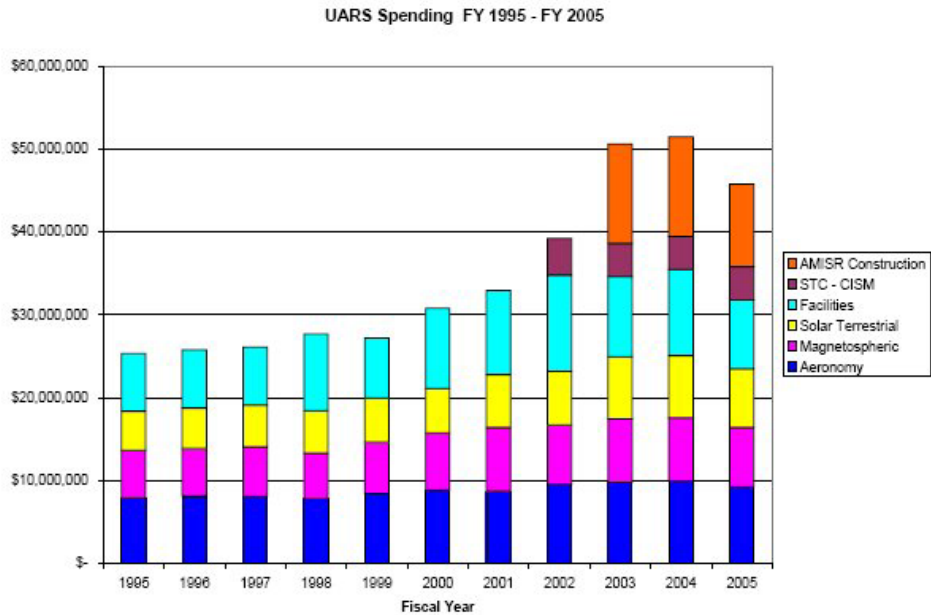


Figure showing the profile of UARS spending in total and by major components. The influence of the CISM and AMISR funds from 2002 to 2005 is dramatic.

It is also important to note that both CISM and AMISR bring broad-based benefits to scientists working in UARS.

2.4. CONCERNS AND ISSUES

a. Use of Criterion 2.

The COV is pleased to note that the balance of grant-funded projects in UARS appears acceptable in terms of mainly intellectual and mainly outreach types. It notes that many awards have been made for proposals that have their greatest strengths in criterion 2. These would include the eight FDSS awards, the award funding the new Space Weather Journal and the REU sites and supplements. Correspondingly, many awards have been made for mainly intellectual reasons reported in the Form 7 Reviews.

The selection of proposal jackets was designed so show up how program officers are implementing the considerations of review criterion #2. As expected, in the borderline cases chosen, there were some cases where the influence of criterion 2 evaluation becomes evident. These cases were in the minority, however. It seems evident that for research proposals, the intellectual criterion #1 is predominant in the judgment. The COV does not find fault with this, but feels obliged to point out that proposal actions do not show equal attention to arguments based on the two criteria. Despite the clear instructions found in the Grant Proposal Guide and in the Announcements of Opportunity issued by UARS, there is still some uncertainty about the importance of criterion #2.

The COV finds that, in practice, the treatment of the criteria in research proposals amounts to a strong emphasis on intellectual merit with the broader impacts having the role of tie breaker when the case in consideration is on the dividing line between acceptance and declination. The second criterion appears to be evaluated in a pass/fail mode and has most influence the proposal actions in borderline cases. The COV is not opposed to this use of the second criterion but points out the apparent inconsistency with the NSF assertion that the two criteria are to be used with equal importance in deciding proposal actions.

The UARS community is concerned that there is, in practice, uncertainty as to how the second criterion is used in proposal processing. If committee experience in examination of the use of the second criterion is consistent with what NSF thinks is appropriate, then the COV recommends that announcements concerning opportunities for research funding make it clear, in terms similar to our findings, how evaluations of the second criterion will be used.

b. Differences of Panel and Mail-in Reviews.

The COV was concerned that it found occasions when panel grading of a proposal differed considerably from that obtained from mail-in reviews. This occurred in a minority of cases. When it did occur, we expected to find a panel argument for the adoption of the panel view in preference to that of the mail-in reviewers. Some impressions of the arguments leading to the difference of grading were found in the Form 7 Review by the Program Officer. However, the lack of explanation in the panel report suggests that panel procedure lacked the level of deliberation we expect.

Having been panel members ourselves, we are aware of the “herd instinct” that sometimes afflicts a panel when a review, led by a senior scientist well known in the relevant field, takes a commanding role in the committee process. Not knowing if this had, in fact, occurred in the cases encountered, the committee merely supposes that such behavior could have been involved. Our concern is that it is expected that panel chairs insist on a recorded step-by-step argument be provided for the rejection of the mail-in review and the adoption of the panel grading. The panel has some suggestions toward that end.

- i. Assign proposals to panel members without an initial appointment of the presenter. That will encourage at least two people to read the proposal thoroughly.
- ii. Use more virtual panels where appropriate or keep number of panelists above 4 or 5. It has been noted that the “herd instinct” is less prevalent when the panel members are on a teleconference and when there is a minimum of 4 or 5 panelists participating on a single proposal.
- iii. Be sure that the panel objection to the proposal is not limited to a narrow aspect of the proposal. If so, the chair should encourage the panel to review the broader picture of the proposed work.

- iv. A caveat recognized by the committee is that these remedies might have the disadvantage of overburdening the panel members resulting in more declinations to serve. Hence we are make these suggestions with some caution.
- c. High Risk Projects

The 2002 COV report commented that UARS was not making a clear and consistent approach to awards for high-risk projects. This COV noted similar findings. Each program in the section seemed to be making so-called high-risk awards and no cases were found where the committee thought it necessary to challenge the decision. However, it does seem that what happens is more pragmatic than designed through policy. For example, some projects with the prospect of a high scientific return but with a wide range of mail-in grades have been funded because the program officer's judgment is that they are worthwhile. In other cases, the proposer had been advised to submit an SGER proposal for an initial proof of concept. Like any venture capital activity, a few great successes are achieved but a higher failure rate is experienced compared to normal awards. There were too few cases for the COV to reach any reliable conclusion, but it is recommended that a deliberate percentage of funds be assigned as an upper limit for high-risk projects.

2.5 OTHER RECOMMENDATIONS to NSF.

- a. Accomplishment-based Renewals

Although "Accomplishment Based Renewal (ABR)" proposals are an option in the Grant Proposal Guide, none of the STR proposals reviewed were of this type. As recommended by the 2002 COV, encouraging this kind of submission from established scientists would reduce the time commitment required both of proposers and reviewers. It seems to be the case that ABR proposals are not submitted for fear of being down-graded compared to full proposals. This negative view might be countered by educating reviewers on the advantages of ABRs and requesting that they be given equal consideration compared to standard proposals.
- b. Preservation of CEDAR, GEM and SHINE

Normally sub-programs such as CEDAR, GEM and SHINE would be expected to have a lifetime of 5 to 10 years and an eventual sunset as intellectual and broader impacts decline and priorities change. However, these special programs appear to have the seeds of vitality and renewal planted in them from the outset. The COV believes that with careful management, they will be good investments for NSF for many years to come.

Part of their strength is the grass-roots management through steering committees and their openness to new ideas through their workshop structure. Another part is through the strong support provided by UARS program directors. Emphasis on the importance of workshop participation by students and young scientists with oversight by more senior colleagues has led to self-selection of important

scientific objectives. CEDAR, GEM and SHINE are healthy and vital organizations.

Nevertheless, occasionally there are signs of a clouding vision that needs to be refocused. CEDAR and GEM are energized by the prospect of new achievements to come with the AMISR and CISM projects. These hopes are mainly focused on tools. The COV recommends a return to a clear vision based on science as described in the CEDAR Phase 1,2 and 3 program documents. GEM achieves steady renewal through new campaigns and the development of campaign concept through planning meetings and document describing objectives prepared by the community that are available to proposers.

c. Expand STR to include heliospheric physics

The STR program should consider expanding its purview to cover all of solar-heliospheric physics, out to the heliopause, which can rightly be considered the New Frontier. In so doing, UARS would reflect the complete field of space physics and aeronomy as reflected, for example, in the structure of AGU, where we present our results. It would no longer systematically exclude this relatively small community. This proposed change is radical in the sense that the name “Solar-Terrestrial” would need to be changed to “Solar-Heliosphere,” but it is forward-looking because it reflects the new direction our field is taking to establish what we do as a universal science (see arguments made in NRC report, “Plasma Physics of the Local Cosmos”). To do that, we need to perform comparative studies (e.g., of shocks in the inner and outer heliosphere or of planetary atmospheres and magnetospheres) that focus on physical processes under various conditions in order to find the universal physical laws that govern them.

This change, of course, would increase the number of applicants for funds, with the resulting negative impact on the budget; but because it is forward-looking, it could serve as a selling point for new funds. As UARS embraced and nurtured the applied side of our field, space weather, in its infancy, so, too, it could embrace and nurture this new basic science thrust.

d. Use of virtual panels

Through necessity after the 9/11 events and subsequent travel problems, many panels were held in virtual mode. NSF Fastlane has a virtual panel module that permits audio-conferencing with online support enabling all panel members to discuss and evolve a current document and exchange documents in real time.

Another factor of these virtual panels is that members find them easier to schedule since they do not have to compromise teaching schedules in order to participate. Furthermore, the phenomenon of “herd instinct” (see previous discussion) distorting the proper panel process is effectively minimized. On the negative side

is the fact that member participation for those less familiar with the process can be retarded by the distancing effect of the teleconference.

Given this successful experience, the COV recommends continued use of virtual panels in cases where the participants are known to each other and are familiar with the process. The COV also recognizes that some activities are better done face-to-face because of the nature of the decision-making process and necessary security of information, for example this particular committee event.

e. Admission of Proposals from other Federal Agencies

The committee observed that there is significant synergy between the activities of NSF and other federal agencies such as NOAA, NASA, DOD. The collaborative efforts that have resulted from this synergism are noteworthy and have enabled significant advancements in science (e.g. modeling results from the space weather program) and will continue to do so in the foreseeable future. However, we note that there are cases where research efforts that are well aligned with the goals of NSF have significant participation of scientists who happen to be civil servants employed by another federal agency. Some of this research is in fact better aligned with NSF goals than with their own agency goals. Unfortunately, these civil servant scientists do not have ready access to the NSF program funding. The result is that the advancement of science suffers because these civil servants are not able to participate to the level needed since they are unfunded to do so. The committee understands that exceptions are occasionally made to this policy, but that these are rare. The general NSF policy of not allowing civil servants to be funded by their programs should perhaps be revisited to enable a broader participation. For example, this exemption could be invoked for cases where significant contributions would be made that enabled NSF to achieve its goals.

3.0 INTEGRITY AND EFFICIENCY OF THE INDIVIDUAL PROGRAM'S PROCESSES AND MANAGEMENT

3.1 AERONOMY PROGRAM

Number of actions reviewed by COV¹: Awards: 22 Declinations: 12 Other:0
Total number of actions within Program during period being reviewed by COV²: 184
Awards: 120 Declinations: 64 Other:26
Manner in which reviewed actions were selected:
Apparent borderline cases based on grading profile

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

The COV found overall management of the Aeronomy program to be outstanding, and identified no significant areas of concern. In particular, we were impressed by Program Director Robert Kerr, both for his insightful review analyses and his ability to reconcile occasional discrepancies found between proposal scores and the supporting discussions. His analyses always contained relevant statements from both the proposal and mail-in reviews to support his recommendation, and specifically addressed both merit review criteria. In fact, the Program Director's effectiveness in objectively analyzing the external reviews was significantly superior to some panel recommendations.

The COV recommends several areas of potential improvement that might be helpful to the AER program director, particularly with regard to the panel review process. These recommendations are discussed below.

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

QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCEDURES	Response
<p>1. Is the review mechanism appropriate? (panels, ad hoc reviews, site visits) Comments: The panel review process may be improved by some modifications to the process, including changes to the current lead/scribe roles. In some cases, it appears that the lead panelist may have too much influence on the overall success or failure of the proposal, especially when there are few mail-in reviews for reference. This may be remedied by assigning the proposal to at least two panelists for review, but removing the lead/scribe designation in favor of a "presenter", to be determined at the time of the panel meeting. This will require that more than two people read and be involved in the ensuing panel discussion. A forum for discussion of the proposal among the reviewing panelists prior to the formal presentation would also be preferred.</p>	<p>Yes</p>

<p>2. Is the review process efficient and effective? Comments: The committee was impressed by the thoroughness of the reviews undertaken by the Program Director, and feels that the process is both efficient and effective. The committee was able to discern in the Program Director’s review analyses the precise reasoning for each recommendation, even in cases when the Director faced wide discrepancies in the external reviews. For example, he noted the case of one seemingly anomalous grade by a reviewer whose highest rating ever was VG out of roughly 15 proposal evaluations, and was able to normalize that evaluation to the appropriate average.</p>	<p>Yes</p>
<p>3. Are reviews consistent with priorities and criteria stated in the program’s solicitations, announcements, and guidelines? Comments: The committee feels that there is still some difficulty in how well external reviewers consider criteria two (Broader Impact), and an uneven emphasis among the reviews concerning its relative weight. Although the Program does explicitly describe both review criteria in the Grant Proposal Guide and Instructions to Reviewers, further explanation (as well as some cajoling) seems to be required to allow the community to adjust to this requirement. It may be helpful to publicize exactly how the criteria is considered in various funding categories: i.e., is it simply pass/fail, to be considered in borderline cases, or is a significant portion of the proposal grade related to the proposal Broader Impacts?</p>	<p>Yes</p>
<p>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? Comments: The individual and/or the panel reviews generally provide sufficient information to support the recommendation, although there are occasionally unresolved discrepancies between the panel recommendation and the external reviews. We believe that this may be addressed by modifications to the panel review process described above.</p>	<p>yes</p>
<p>5. Do the panel summaries provide sufficient information for the principal investigator(s) to understand the basis for the panel recommendation? Comments: Ensuring that at least two or three panelists have sufficient expertise to evaluate a proposal allows for most informative summary for the principal investigator.</p>	<p>yes</p>
<p>6. Is the documentation for recommendations complete, and does the program officer provide sufficient information and justification for her/his recommendation? Comments: The committee feels that the Program Director has done an exceptional job of</p>	<p>yes</p>

providing detailed justification in the review analyses.	
7. Is the time to decision appropriate? Comments: None	yes
<p>8. Discuss any issues identified by the COV concerning the quality and effectiveness of the program's use of merit review procedures:</p> <p>Suggestions regarding the panel review process are described above, but in spite of these, the committee feels that the overall quality of the review program is excellent, thanks to the efforts of the Program Director.</p>	

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

IMPLEMENTATION OF NSF MERIT REVIEW CRITERIA	Response
<p>1. Have the individual reviews (either mail or panel) addressed both merit review criteria? Comments: There has been much improvement in this area over the three years of consideration.</p>	yes
<p>2. Have the panel summaries addressed both merit review criteria? Comments: Again, there has been much improvement in this area over the three years of consideration, but there is still significant variation in the coverage of the second review criteria, both from proposal to proposal and panel to panel.</p>	yes
<p>3. Have the <i>review analyses</i> (Form 7s) addressed both merit review criteria? Comments: This is perhaps the strongest element of the review process identified by the committee. The review analyses have been consistently thorough, addressing both merit criteria and citing supporting statements.</p>	yes
<p>4. Discuss any issues the COV has identified with respect to implementation of NSF's merit review criteria. The clarity of instructions regarding the relative weight of the two merit criteria in arriving at the final recommendation can be improved to ensure consistency and objectiveness among reviewers and panel members. Until the community is comfortable addressing both criteria, considerable guidance from the Program Directors may be required.</p>	

A.3 Questions concerning the selection of reviewers..

SELECTION OF REVIEWERS	Response
<p>1. Did the program make use of an adequate number of reviewers? Comments: In the majority of cases there were at least three reviewers, averaging between 4 and 5, which the committee found sufficient.</p>	yes
<p>2. Did the program make use of reviewers having appropriate expertise and/or qualifications? Comments: The COV recognizes that due to the broad and multi-disciplinary nature of Aeronomy, encompassing both theoretical and experimental research, ensuring good match of qualifications can be challenging. We find that the Program Director has adequately addressed this issue, without inviting conflict of interest.</p>	yes
<p>3. Did the program make appropriate use of reviewers to reflect balance among characteristics such as geography, type of institution, and underrepresented groups? Comments: The committee did not have complete statistics for reference in answering this question, but a cursory review of available proposals shows a satisfactory balance of reviewers.</p>	yes
<p>4. Did the program recognize and resolve conflicts of interest when appropriate? Comments: None.</p>	yes
<p>5. Discuss any issues the COV has identified relevant to selection of reviewers. None.</p>	

A.4 Questions concerning the resulting portfolio of awards under review.

RESULTING PORTFOLIO OF AWARDS	Response
<p>1. Overall quality of the research and/or education projects supported by the program. Comments: The filter provided by the selection process is effective in ensuring that the funded research/education is of the highest quality.</p>	Appropriate
<p>2. Are awards appropriate in size and duration for the scope of the projects? Comments: The observed trend toward longer duration awards is encouraged, when appropriate.</p>	Appropriate

<p>3. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • High risk projects? <p>Comments: There are several examples of clearly high-risk projects, e.g., the link between global circuit variations to cloud cover [0242827]. Also, SGER provides an avenue for supporting high-risk concepts.</p>	Appropriate
<p>4. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • Multidisciplinary projects? <p>Comments: GEO-ATM-AER by its very nature is a multi-disciplinary program and as such it encompasses cross-directorate projects and initiatives. We encourage continued involvement of AER in projects such as ITR and CMG.</p>	Appropriate
<p>5. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • Innovative projects? <p>Comments: There appears to exist sufficient presence of innovative projects supported in AER [0323941; 0310233]. The multi-disciplinary projects discussed above also contribute to the innovative nature of portfolio.</p>	Appropriate
<p>6. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • Funding for centers, groups and awards to individuals? <p>Comments: The program portfolio seems to contain a good balance of centers (e.g., CISM), and facilities (e.g., AMISR), as well as individual projects.</p>	Appropriate
<p>7. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • Awards to new investigators? <p>Comments: The Program director has been very proactive in fostering involvement of new investigators, as the percentage of awarded proposals with new PI's indicates.</p>	Appropriate
<p>8. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • Geographical distribution of Principal Investigators? <p>Comments: None</p>	Appropriate
<p>9. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • Institutional types? <p>Comments: The overall impression of the committee is that the institutional balance is appropriate, but data on the fraction of funded projects by educational (degree granting)/industry/government should be compiled for future reference.</p>	Appropriate
<p>10. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • Projects that integrate research and education? <p>Comments:</p>	Appropriate

<p>AER seems to have a balanced portfolio consisting of a number of initiatives that address this topic. Examples are CAREER awards, which explicitly emphasize this component, and the upcoming FDSS awards.</p>	
<p>11. Does the program portfolio have an appropriate balance:</p> <ul style="list-style-type: none"> • Across disciplines and subdisciplines of the activity and of emerging opportunities? <p>Comments: None.</p>	<p>Appropriate</p>
<p>12. Does the program portfolio have appropriate participation of underrepresented groups?</p> <p>Comments: None.</p>	<p>Appropriate</p>
<p>13. Is the program relevant to national priorities, agency mission, relevant fields and other customer needs? Include citations of relevant external reports.</p> <p>Comments: Aeronomy-funded research figures prominently in the Decadal Survey of the National Academies, which outlines goals set out by the space science community over the coming decade. Subjects include CEDAR initiatives, studies of M-I coupling, and newer Space Weather initiatives, which have intrinsic relevance to national priorities.</p>	<p>Appropriate</p>
<p>14. Discuss any concerns relevant to the quality of the projects or the balance of the portfolio. The COV found no concerns in this section.</p>	

A.5 Management of the program under review.

<p>1. Management of the program. Comments: The COV finds the management of the AER to be excellent.</p>
<p>2. Responsiveness of the program to emerging research and education opportunities. Comments: The program responds efficiently to emerging opportunities, both in research and education. In research, this is mostly in the form of special joint programs and opportunities with other agencies, SGER program, the upcoming FDSS initiative, and in education examples include special summer school programs.</p>
<p>3. Program planning and prioritization process (internal and external) that guided the development of the portfolio. Comments: The balance among various programs, e.g., core, CEDAR, SW, seems appropriate. Also, the recent</p>

activities toward soliciting and producing community-generated self assessment reports such as the LIDAR and Passive Optics reports seem valuable in providing guidance for effective portfolio development.

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

The observed increase in the amount of proposal activity in AER raised a question as to the sufficiency of human resources to effectively cope with the significant increase in management demands. If the number of proposals have increased by a factor of 2 to 3 in the previous years, is there an elevated pressure on the program director or staff? Is there a need to increase the human resources, e.g., support staff, etc.?

3.2. THE MAGNETOSPHERIC PHYSICS PROGRAM

Number of actions reviewed by COV³: Awards: 11 Declinations: 13 Other:0
Total number of actions within Program during period being reviewed by COV⁴: 223 Awards:105 Declinations: 118 Other:27
Manner in which reviewed actions were selected: Apparent borderline cases based on grading profile

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

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

QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCEDURES	Response
<p>1. Is the review mechanism appropriate? (panels, ad hoc reviews, site visits) Comments: Yes, the appropriate range of review mechanisms is used: both in-person and virtual panels for solicitations, supplemented by mail-in reviews, site visits for larger programs like UAF and STC and at least three mail-in reviews are required for base grant proposals. Typically 4-6 reviews were available for jackets examined.</p>	Yes
<p>2. Is the review process efficient and effective? Comments: Yes, proposals were handled in a timely manner, with few exceptions associated with changing staff at UARS. The arrival of a permanent staff member for magnetospheric physics has expedited efficiency.</p>	Yes

<p>3. Are reviews consistent with priorities and criteria stated in the program's solicitations, announcements, and guidelines? Comments: Yes. As a specific example, when an excellent and so-rated proposal is submitted which does not address the particular campaign objectives within the GEM program, the PI is encouraged to re-submit to the appropriate solicitation or base program. The program manager is careful to stick with the guidelines of the solicitation.</p>	<p>Yes</p>
<p>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? Comments: Yes. Individual reviews can be mixed, however the program manager has identified mail-in reviews, which may be too brief and cursory, and given more weight to thoughtful and complete reviews. *Is the PI made aware of the distinction between mail-in and panel reviews?</p>	<p>Yes</p>
<p>5. Do the panel summaries provide sufficient information for the principal investigator(s) to understand the basis for the panel recommendation? Comments: Yes. The panel summaries are thorough in explaining the recommendation, although more insight into panel dynamics can be gleaned from the program officer's summary.</p>	<p>Yes</p>
<p>6. Is the documentation for recommendations complete, and does the program officer provide sufficient information and justification for her/his recommendation? Comments: The program officer's documentation is thorough, for example in panel reviews the real-time appreciation of potential conflict of interest is noted and action taken to exclude any panel member who may not have noted the potential conflict. Relative weight given to reviews which lack supporting detail is noted. The COV specifically examined jackets where there might appear to be a disparity between review scores and action taken, and noted that there was always a clearly stated explanation, for example leveraging of funds from another program such as OPP or ITR when parallel proposals were submitted by the same PI. Proposed work that falls under the purview of another agency such as NASA was noted. Pro-action in supporting the development of a larger pool of women in the field was noted along with additional justification, for example in selection from comparably qualified applicants for the GEM post-doc.</p>	<p>Yes</p>

<p>7. Is the time to decision appropriate? Comments: There was a significant decrease in processing time as the magnetospheric section was the first to go to electronic processing of declines. The notification of action to PIs within 6 months went from 60% in 2002 to over 80% in subsequent years, which is excellent. This includes action on panel reviews, which were convened in a timely manner and action taken.</p>	<p>Yes</p>
<p>8. Discuss any issues identified by the COV concerning the quality and effectiveness of the program's use of merit review procedures: The program manager was very effective at leveraging additional resources, for example from ITR and OPP. This occasionally involved declining a proposal with strong reviews that was submitted in parallel with proposals to one of these other programs by the same PI. This was done in order to contribute funds from the magnetospheric section and leverage additional funding from these programs. This is an effective approach to acquiring additional support and working with other program managers.</p>	

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

IMPLEMENTATION OF NSF MERIT REVIEW CRITERIA	Response
<p>1. Have the individual reviews (either mail or panel) addressed both merit review criteria? Comments: The reviews addressed the "intellectual merit" of the proposals adequately. A few reviewers did not address the "broader impact" criterion even though they were asked to. We note that in the MAG program, the number of reviewers addressing both criteria increased each year beginning in 2002 and was at 96% in 2004. Often the "broader impact" criterion lacked any justification or explanation.</p>	<p>Not always</p>
<p>2. Have the panel summaries addressed both merit review criteria? Comments: The panel summaries always included statements regarding both merit review criteria.</p>	<p>Yes</p>
<p>3. Have the <i>review analyses</i> (Form 7s) addressed both merit review criteria? Comments: The review analyses always mentioned both merit review criteria. However, the same disparity in emphasis between the two criteria is also evident in the analyses.</p>	<p>Yes</p>

4. Discuss any issues the COV has identified with respect to implementation of NSF's merit review criteria.

Issue: Unclear relative weight of the two merit review criteria. It is evident that the two merit review criteria are not given equal weight in the proposal review process. The first review criterion "intellectual merit" is always given much more emphasis and weight than the second review criterion "broader impact". The COV panel believes that the first criteria should usually be given greater weight. However, it is not evident that the NSF UARS has established a consistent policy regarding the relative weight of the two criteria merits. Furthermore, it appears that the proposal reviewers and the PI's are not provided specific guidance by the NSF UARS regarding the relative weight of the criteria merits except in cases such as the FDSSP where the "broad impact" criterion is primary. In some cases, the second criterion is apparently invoked to discriminate between proposals in without any clear justification or elaboration (e.g. ATM-0208507: " The panel noted Broader Impacts in the fact that the PI is a woman and she uses the material for a course she teaches in general science."). In other reviews, the second criterion is only mentioned in passing. In all cases, the first criterion is weighted significantly more than the second criterion.

Recommendation: (a) The NSF UARS should clarify the relative weight of the two merit criteria for each proposal opportunity. This information should be disseminated to the community in an easily accessible manner so that each PI and reviewer is clearly aware of what is expected by the NSF UARS. (b) The COV recommends that the "intellectual merit" criterion generally be given greater weight than "broader impact". The COV also recognizes that there may be opportunities where the relative weight of the "broader impact" criterion should be given greater weight, such as for the FDSSP.

A.3 Questions concerning the selection of reviewers.

SELECTION OF REVIEWERS	Response
<p>1. Did the program make use of an adequate number of reviewers? Comments: For the jackets that we examined, an adequate number of reviewers were used. There was an adequate balance of mail-in and panel reviewers with one exception (ATM-0318629; only one mail-in review and 3 panel reviews)</p>	Yes
<p>2. Did the program make use of reviewers having appropriate expertise and/or qualifications? Comments: Yes - all of the jackets we examined appeared to have appropriate expertise, even if there were disparate reviews provided.</p>	Yes
<p>3. Did the program make appropriate use of reviewers to reflect balance among characteristics such as geography, type of institution, and underrepresented groups?</p>	Geographic balance - Yes

<p>Comments: Geographic balance of reviewers is difficult to access since appropriate reviewers are located where institutions exist that are primarily involved in upper atmospheric and space science. Over the years 2002-2004 we note that over 2100 reviewers were used from 43 states, with over 42% of the total reviewers originating from 4 states (California, Colorado, Maryland and Massachusetts). Considering that each of the four states have very large programs in the areas of expertise needed for reviews, this seems reasonable. It is impressive that reviewers were used from 43 states and NSF UARS is to be commended for looking far and wide for reviewers.</p> <p>Institutional origin of reviewers was dominated by "PhD institutions" (35.5%) and "Foreign, Business, State & Local Other" (25.8%). However, we note that a percentage decline from 2002 to 2004 in reviewers from Research Intensive PhD Institutions (22.3% to 18.9) and an increase from "Foreign, Business, State & Local Other" (23.1% to 26.6%). It is not clear whether these numbers indicate a significant trend since the number of reviewers has increased over this period from 511 to 836 and the percentage of blank responses for institutional type is large and increasing as well (37%, 188 to 302).</p> <p>Reviewers from Under Represented Groups is difficult to access because 89% of the reviewers did not identify themselves one way or another. This is also true of disabled and gender data (89% for each). Therefore, the statistics are not reliable and no conclusion can be made.</p>	<p>Institutional Balance - Yes</p> <p>Underrepresented Groups - Not Available</p>
<p>4. Did the program recognize and resolve conflicts of interest when appropriate? Comments: It appears that conflicts of interest were properly handled. Individual reviewers are given the opportunity to identify and address particular circumstances that might be viewed as being in conflict. The program officer has exercised the right to exclude conflicted reviews (ATM-0318629). For virtual panels, conflicted persons are excused from the telecom during the discussion of associated proposals.</p>	<p>Yes</p>
<p>5. Discuss any issues the COV has identified relevant to selection of reviewers.</p> <p>It is recognized that assembling appropriate panels and securing mail-in reviewers is a difficult task. We believe that appropriate reviewers have been selected to review the MAG proposals.</p> <p>NSF UARS should monitor the apparent trend of increasing fraction of non-academic reviewers.</p> <p>It is not obvious from the data that the number and/or fraction of qualified reviewers from underrepresented groups are increasing. However, based on discussion with NSF UARS officers, it is clear to us that a commitment is being made to do increase the participation of qualified underrepresented groups in the review process.</p>	

A.4 Questions concerning the resulting portfolio of awards under review.

RESULTING PORTFOLIO OF AWARDS	Response
<p>1. Overall quality of the research and/or education projects supported by the program. Comments: Overall the UARS program and magnetospheric program in particular is doing an outstanding job over a broad range of research opportunities, several of which UARS has been instrumental in initiating. The CEDAR, GEM, SHINE opportunities have been highly successful at bringing the respective communities together. They are far more than simply funding opportunities. The crown jewel of UARS in leveraging resources from other agencies has been the NSWP, with annual support from AFOSR and ONR, collaborative opportunities pursued with NASA and strong organizational support at the annual Space Weather Week in Boulder from the user communities of NOAA SEC and the Air Force Weather Service. On the education side, UARS is to be highly commended for the FDSSP which was developed as a concept initiated within UARS during the review period and executed beginning with 05 funding to establish eight new faculty lines in solar and space physics. This directly addresses concerns called out in the NAS/NRC Decadal Survey in Solar and Space Science.</p>	<p>Excellent</p>
<p>2. Are awards appropriate in size and duration for the scope of the projects? Comments: Award size has declined in real dollars over the past twenty years when adjusted for inflation, however award size has increased ahead of inflation over the three year period under review. An effort is being made by the program manager to extend the award period when his annual budget does not accommodate a larger award request in order to accomplish the research goals of specific proposals. This seems like a reasonable first approach, but will result in the further partitioning of time between projects for students and postdoctoral candidates.</p>	<p>Could improve</p>
<p>3. Does the program portfolio have an appropriate balance of: <ul style="list-style-type: none"> • High risk projects? Comments: Examples have been provided of high risk projects, because of either reviewer skepticism or novelty of approach or both, which have been successful (0225772, 0233370, 0330756) and others for which the outcome is still uncertain (0136032, 0230995). The program manager has shown a willingness to encourage research in new directions by established investigators as well as young investigators not yet well known to the reviewers.</p>	<p>Yes</p>
<p>4. Does the program portfolio have an appropriate balance of: <ul style="list-style-type: none"> • Multidisciplinary projects? </p>	<p>Yes</p>

<p>Comments: Support has been provided to multidisciplinary programs including the joint NSF-DOE Basic Plasma Science initiative during the review period as well as upcoming joint initiative with the NASA LWS TR&T program that leverages funds from the NSWP. The NSWP leverages funds from AFOSR and ONR in its annual competition. Within NSF the program manager has worked to support proposals jointly with the ITR and OPP that leverage funds for the magnetospheric program from these additional sources. Within UARS there is close interaction between the Aeronomy, MAG, STP and UAF to support programs which bridge the disciplines, the CISM STC being a prime example with \$4M/yr in funding brought into UARS research areas from STC. Support to establish the new AGU journal Space Weather is another example of support to a multidisciplinary effort that will bridge communities within UARS. Support to the CCMC has provided the community with computing and code access resources that spans the UARS disciplines.</p>	
<p>5. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • Innovative projects? <p>Comments: An example is the UCSD computational project which received joint funding from the ITR program to develop new tools to bridge timescale issues in global simulations which attempt to incorporate more physics than contained in ideal MHD. The program manager has a good grasp of where new tools are needed and responds to proposals that are innovative in their approach to ‘tall pole’ problems.</p>	Yes
<p>6. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • Funding for centers, groups and awards to individuals? <p>Comments: Funding for the CISM STC, ITR programs at MI and UCSD and to individuals through the base program and GEM have provided a good balance.</p>	Yes
<p>7. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • Awards to new investigators? <p>Comments: Funding of two CAREER awards during the review period within the magnetospheric section is excellent, given the number of new tenure track faculty in the field prior to the FDSSP opportunity. The annual GEM postdoctoral award opportunity is another example of supporting new investigators as PIs that has worked out well for the community.</p>	Yes
<p>8. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • Geographical distribution of Principal Investigators? <p>Comments: There is good representation from the broad geographical distribution of institutions in magnetospheric physics, from the Northeast to Midwest, South and Southwest, West Coast and Alaska.</p>	Yes
<p>9. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • Institutional types? <p>Comments: About 80% of funding goes to academic institutions when research labs affiliated</p>	Yes

<p>with universities are included (APL). National laboratories like LANL and PPPL are represented in the balance, along with The Aerospace Corporation, which does the technical management of the Air Force Space Program. We note that a more proactive effort should be undertaken by NSF UARS to identify opportunities to fund relevant proposals that include civil servant from other agencies, and these should be evaluated on a case-by-case basis.</p>	
<p>10. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • Projects that integrate research and education? <p>Comments: The FDSSP initiative is an outstanding example of proactivity in education by the UARS section. The program manager for the CISM STC has provided ongoing feedback in the area of education, which is 20% of the STC effort. Awards have been made to PIs whose prime focus is education and outreach (Dusenbery, U Colorado). Funding for faculty and researchers at labs who provide research opportunities to undergraduate and graduate students should continue to receive high priority.</p>	Yes
<p>11. Does the program portfolio have an appropriate balance:</p> <ul style="list-style-type: none"> • Across disciplines and subdisciplines of the activity and of emerging opportunities? <p>Comments: It appears that more resources are available within UARS for the Aeronomy sub-discipline when judged on the bases of budget, certainly when combined with UAF. This counterbalances the current trend at NASA within LWS, which has put more resources initially in the solar-heliospheric discipline. Certainly when there has been a UARS-wide competition such as the recent FDSSP there has been no imbalance towards Aeronomy. Having a permanent program manager in the magnetospheric physics section should strengthen the position of that program relative to the use of rotators in the past.</p>	Qualified Yes
<p>12. Does the program portfolio have appropriate participation of underrepresented groups?</p> <p>Comments: The program manager has been proactive in selecting a woman PI when there are equally ranked proposals at the junior level (GEM postdoc) and sustaining funding to at least one senior researcher by creatively reducing the funding level but extending the period of the award. Attention has been paid to supporting historically black institutions (AAMU) and those with a large minority enrollment (UTEP) through the CISM STC program and selection of a minority PI on one of the FDSSP awards. Attention was paid to a high risk opportunity with a handicapped PI at the University of Iowa.</p>	Yes
<p>13. Is the program relevant to national priorities, agency mission, relevant fields and other customer needs? Include citations of relevant external reports.</p> <p>Comments: UARS has been responsive to multi-agency national priorities, through the National Space Weather Program in which UARS has taken the lead from the start; support of multi-institutional projects (e.g. the CISM STC) which ties university and NCAR research to NOAA SEC and Air Force users of space weather produces; programs</p>	Yes

which have high international visibility through the distribution of ground based measurement facilities as well as data products like SuperDARN, all cut across UARS subdisciplines. Co-support of the MI-Coupling campaign within GEM has been brokered between the magnetospheric and aeronomy programs within UARS and opened to both communities.

UARS has been responsive to the NASA LWS opportunity, arguably helped to create interest at NASA in the NSWP early on and is stepping up to the opportunity to combine resources in the current LWS TR&T program. UARS has contributed resources to the CCMC which is managed by NASA but provides a community resource for both computing and models developed by the community which spans all sections of UARS.

UARS has been responsive to the National Academy report on Basic Plasma Science infrastructure and the need to find a home for this key area of research that bridges what is otherwise a gap at both NSF and DOE. UARS supported and has been responsive to the recent NAS/NRC Decadal Study in Solar and Space Physics. It is responsive to recommendations from other advisory committees for NSF programs, for example the GEM Steering Committee, which suggested the GEM postdoc opportunity for recent PhDs in magnetospheric physics, which parallels a similar opportunity in CEDAR.

14. Discuss any concerns relevant to the quality of the projects or the balance of the portfolio.

It is always important to go back to the primary objectives of UARS and ask what the benefit is likely to be within the UARS research community of supporting projects on the periphery. A key test is the level of publication in AGU journals and participation in AGU, SHINE, GEM and CEDAR meetings. For example, in basic plasma science there have been substantial contributions in experiments like the UCLA large plasma device designed with scaling to magnetospheric and solar plasma environments for the study of reconnection in the laboratory, while others may be more appropriate to astrophysical applications. Contributions have been important on the modeling side from the basic plasma science community in leading the GEM reconnection challenge. An important test of relevance to UARS objectives in research areas like nonlinear dynamics should be the degree to which models use or are compared with space or ground based measurements.

A.5 Management of the program under review.

1. Management of the program.

Comments:

The NSF UARS MAG program is managed very well. The MAG program officer is capable, knowledgeable and his attention to detail is evident by the completeness of the jackets and thoroughness of the review analysis.

2. Responsiveness of the program to emerging research and education opportunities.

Comments:

The MAG program and the NSF UARS in general appears to be responsive to research and education opportunities. The development of cross-discipline proposal opportunities with CEDAR and GEM

emphasizing multiscale phenomena and the Space Weather program are excellent examples of responsiveness to research opportunities. The FDSSP new faculty program was developed in response to education needs and subsequently realized. The ability of the NSF UARS to respond in a timely fashion is vital to its relevance to research and education opportunities.

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

Comments:

The NSF UARS MAG program has responded to internal and external pressures to implement a program with appropriate prioritization. The ability to leverage funds from non-MAG sources is to be commended (23%). The division of funds between the various sub-programs within MAG is reasonable and appropriate. The large fraction of the base program (53% of the funds) should be maintained, if not increased, since this is the core program that maintains the vitality and flexibility of the MAG efforts. The 6% supplemental budget is important to maintain, but not grow, in order to provide the MAG program officer flexibility in managing the program. The 15% spending on students (undergraduate, graduate and post-doctoral) is noteworthy. This level of financial commitment demonstrates the impact and dedication of the MAG program to the future of the community. The informal dialog and formal relations that are maintained between NSF UARS and other federal agencies (e.g. DoE, NASA, DoD, NOAA) have been productive and are a means to avoid duplication. These activities have provided valuable planning and prioritization input to the MAG program and should be continued.

The MAG program is to be commended on the planning and priority it adopted over this time period.

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

Keep up the good work

3.3 SOLAR TERRESTRIAL RESEARCH PROGRAM

Number of actions reviewed by COV ⁵ : Awards:16 Declinations: 15 Other:0
Total number of actions within Program during period being reviewed by COV ⁶ : 182 Awards: 82 Declinations: 100 Other: 0
Manner in which reviewed actions were selected: Apparent borderline cases based on grading profile

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

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

QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCEDURES	Response
<p>1. Is the review mechanism appropriate? (panels, ad hoc reviews, site visits) Comments: Generally the process is very good. The panel leaders/program officers have been of high quality over the past three years..</p>	Yes.
<p>2. Is the review process efficient and effective? Comments:</p> <ul style="list-style-type: none"> a. Decisions can be strongly skewed by single outspoken panel member (e.g., 0327702, 0318631). This is a perennial problem that requires strong leadership from the panel leader and program officer. b. Panelists who override mail-in reviews should be required to provide written justification. c. In some cases (e.g., 0327715, funding young female), the program officer overrode the panel for well-justified reasons. d. For non-panel reviews, in some cases (e.g., 0416340, anomalous opinion), the program officer overrode a mail-in reviewer for well-justified reasons. <p>This is related to A.1.2a and A.1.1. There are cases where one person on the panel forms a strong opinion about a proposal because of one particular point (e.g. their research disagrees with one aspect of the proposal, or the proposal does not cite a paper which that panelist thinks is important). It is common for that panelist to be an "expert" on the topic of the proposal (perhaps the most experienced person on that topic on the panel), and therefore their opinions carry unbalanced weight. We are not saying that these panelists are necessarily wrong, but it is something that the NSF team should be alert to.</p> <ul style="list-style-type: none"> e. Recommendation: If the panel leader detects that a panelist "has an issue" with a narrow aspect of a proposal, (s)he can ask that panelist to consider the broader picture of the proposed work also. For example, the leader could ask the 	For the most part

<p>panelist whether the proposed work would lead to useful results despite the single “flaw” in the proposal. (This situation occurs with write-in reviews sometimes also, but these tend to have weaker consequences than when the reviewer is a panel member.)</p>	
<p>3. Are reviews consistent with priorities and criteria stated in the program’s solicitations, announcements, and guidelines? Comments: None.</p>	Yes.
<p>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? Comments: Often mail-in reviews are too brief and not sufficiently specific. In some cases this may be because reviewers are not sufficiently familiar with the field. The most appropriate potential reviewers may have been removed (sometime gratuitously) from consideration because of the “conflict of interest” regulations (see A.3.2).</p>	For the most part
<p>5. Do the panel summaries provide sufficient information for the principal investigator(s) to understand the basis for the panel recommendation? Comments: The panel summaries plus the individual reviews together cover this.</p>	Yes.
<p>6. Is the documentation for recommendations complete, and does the program officer provide sufficient information and justification for her/his recommendation? Comments: The examples we have seen are excellent.</p>	Yes.
<p>7. Is the time to decision appropriate? Comments: The program manager is to be commended on keeping the time to decision under the six-month standard.</p>	yes
<p>8. Discuss any issues identified by the COV concerning the quality and effectiveness of the program’s use of merit review procedures: Although “Accomplishment Based Renewal (ABR)” proposals are an option in the Grant Proposal Guide, none of the STR proposals reviewed were of this type. As recommended by the 2002 COV, encouraging this kind of submission from established scientists would reduce the time commitment required both of proposers and reviewers. It seems to be the case that ABR proposals are not submitted for fear of being down-graded compared to full proposals.</p>	

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

IMPLEMENTATION OF NSF MERIT REVIEW CRITERIA	Response
<p>1. Have the individual reviews (either mail or panel) addressed both merit review criteria? Comments: Virtually all reviews address both criteria.</p>	Yes
<p>2. Have the panel summaries addressed both merit review criteria? Comments: Virtually all individual reviews plus their summaries together address both of these.</p>	Yes
<p>1. Have the <i>review analyses</i> (Form 7s) addressed both merit review criteria? Comments: None.</p>	Yes.
<p>4. Discuss any issues the COV has identified with respect to implementation of NSF's merit review criteria.</p> <p>We believe that NFS' policy in being open in its interpretation of the broader impacts criterion is fully adequate. As a minimum, it assures that the proposers will focus attention on this very important concern, which they might not have done if the criterion was not explicitly stated. This policy also gives the proposers room to be innovative in their suggestions for fulfilling this criterion; this has the prospect to lead to truly revolutionary methods to have quality scientific results reach a larger audience.</p> <p>In practice, we have found the broader impacts criterion to be used as a pass/fail requirement for most proposals, but in some cases it has been used as a tie-breaker for proposals that are close calls for being funded or not funded (or in helping to sway a reviewer's opinion one way or the other, cf. comment by one referee in ATM-0321895).</p>	

A.3 Questions concerning the selection of reviewers.

SELECTION OF REVIEWERS	Response
<p>1. Did the program make use of an adequate number of reviewers? Comments: The program directors should be commended for their tenacity in obtaining a sufficient number of reviewers for each proposal.</p>	Yes
<p>2. Did the program make use of reviewers having appropriate expertise and/or qualifications? Comments: a. The requirement to list all co-authors on papers for the last four years as collaborators often eliminates as reviewers those who would understand best the content of a proposal. This restriction should be modified to include only those involved in substantial working</p>	Yes but

<p>collaborations.</p> <p>b. Some proposals are victims of too little detail in the write-in reviews. For example, for 0327536 the two write-ins gave excellents, but the panel dismissed those reviews as lacking in content (which one definitely did).</p> <p>c. To compound the problem in b, the lowest grade (G) in the cited proposal was given by the panelist who knew least about the field, and his written review did not have enough content to justify a grade so low (see a).</p>	
<p>3. Did the program make appropriate use of reviewers to reflect balance among characteristics such as geography, type of institution, and underrepresented groups?</p> <p>Comments: The program officer appears to be well aware of these requirements and does well at meeting them within the constraints of the available pool.</p>	Yes
<p>4. Did the program recognize and resolve conflicts of interest when appropriate?</p> <p>Comments: We did not see any examples of conflicts.</p>	N/A
<p>5. Discuss any issues the COV has identified relevant to selection of reviewers. No further discussion required.</p>	

A.4 Questions concerning the resulting portfolio of awards under review.

RESULTING PORTFOLIO OF AWARDS	Response
<p>1. Overall quality of the research and/or education projects supported by the program.</p> <p>Comments:</p>	High
<p>2. Are awards appropriate in size and duration for the scope of the projects?</p> <p>Comments: Although the idea of extending durations to five years has been publicized as a good one, few proposals request more than three years, possibly for fear of not being funded. In particular, the SHINE program effectively discourages durations longer than three years by what can be considered the program announcement's intimidating statement that a request for more than three years requires extra justification.</p>	Adequate
<p>3. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • High risk projects? <p>Comments: One young researcher was funded, despite her relatively low scores (see A.1.2c); we find this type of action to be justified and positive (as long as the number of cases is not too large) Another example of a high-risk proposal is described in B.2.</p>	Adequate

<p>4. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • Multidisciplinary projects? <p>Comments: At least one funded proposal (PHY-0408226) crossed disciplinary lines with the physics and magnetosphere programs, and another proposal series (ATM-0086999, ATM-0342560, and AST-0244679) was jointly funded with the astronomy program. Although most proposals were not significantly multidisciplinary in themselves, many SHINE proposals are intrinsically multidisciplinary.</p>	Adequate
<p>5. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • Innovative projects? <p>Comments: Two examples of innovative research are the proposal series ATM-0208443 and ATM-0331513 (the Solar Mass Ejection Imager), and proposal ATM-0219581 (helioseismic probing).</p> <p>Although in general there were few outstandingly innovative proposals, the quality of the funded proposals was high overall and they covered a wide variety of techniques and subjects.</p>	Adequate
<p>6. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • Funding for centers, groups and awards to individuals? <p>Comments: The proposals we covered were for individuals only, except for one collaborative effort between a university and a national laboratory (0327607 & 0327723).</p>	N/A
<p>7. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • Awards to new investigators? <p>Comments: Yes, statistics show that there are about 20% – 30% new investigators.</p>	Adequate
<p>8. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • Geographical distribution of Principal Investigators? <p>Comments: It reflects the geographical distribution of space physicists.</p>	Adequate
<p>9. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • Institutional types? <p>Comments: Yes.</p>	Adequate
<p>10. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • Projects that integrate research and education? <p>Comments: Yes.</p>	Adequate
<p>11. Does the program portfolio have an appropriate balance:</p> <ul style="list-style-type: none"> • Across disciplines and subdisciplines of the activity and of emerging opportunities? 	Adequate

<p>Comments: See A.4.4.</p>	
<p>12. Does the program portfolio have appropriate participation of underrepresented groups? Comments: The program manager works hard to include underrepresented groups, but unfortunately the pool is small. More generally however, CISM recently held a program introducing underrepresented undergraduates to space weather (held at Alabama A&M University). This type of program is very positive and proactive.</p>	<p>Adequate</p>
<p>13. Is the program relevant to national priorities, agency mission, relevant fields and other customer needs? Include citations of relevant external reports. Comments: a. The program is highly relevant to national priorities in that it provides the negatively impact space travelers, and increasingly abundant technological systems in that it provides the background knowledge needed to understand Space Weather; Space Weather can negatively impact space travelers, and is a threat to increasingly-abundant technological systems. b. If UARS adopts the suggestion in A.4.14, it will be responding to the president's vision for space exploration on other planets.</p>	<p>Adequate</p>
<p>14. Discuss any concerns relevant to the quality of the projects or the balance of the portfolio. The STR program should consider expanding its purview to cover all of solar-heliospheric physics, out to the heliopause, which can rightly be considered the New Frontier. In so doing, UARS would reflect the complete field of space physics and aeronomy as reflected, for example, in the structure of the AGU, where we present our results. It would no longer systematically exclude this relatively small community. This proposed change is radical in the sense that the name "Solar-Terrestrial" would need to be changed to "Solar-Heliosphere," but it is forward-looking because it reflects the new direction our field is taking to establish what we do as a universal science (see arguments made in NRC report, "Plasma Physics of the Local Cosmos"). To do that, we need to perform comparative studies (e.g., of planetary atmospheres, aurora) and study physical processes under various conditions in order to find the universal physical laws that govern them. This change, of course, would increase the number of applicants for funds, with the resulting negative impact on the budget; but because it is forward-looking, it could serve as a selling point for new funds. To do that, we need to perform comparative studies (e.g., of shocks in the inner and outer heliosphere or of planetary atmospheres and magnetospheres) that focus on physical processes under various conditions in order to find the universal physical laws that govern them</p>	

A.5 Management of the program under review.

<p>1. Management of the program. Comments: Although historically UARS has its roots in aeronomy, the higher proposal pressure (at least during 2002-2004) in the now-competing magnetosphere and solar-terrestrial programs suggests that the distribution of funds should be reviewed.</p>
<p>2. Responsiveness of the program to emerging research and education opportunities. Comments: The response of the program to the call for more faculty positions in space physics is to be highly commended.</p>
<p>3. Program planning and prioritization process (internal and external) that guided the development of the portfolio. Comments: The new emphasis on SHINE and the NSWP is commendable.</p>
<p>4. Additional concerns relevant to the management of the program. None.</p>

3.4. THE UPPER ATMOSPHERE FACILITIES PROGRAM

Number of actions reviewed by COV⁷: Awards: 13 Declinations: 1 Other:39
Total number of actions within Program during period being reviewed by COV⁸: 24 Awards:18 Declinations: 6 Other:32
Manner in which reviewed actions were selected: Apparent borderline cases based on grading profile

Introduction

The COV finds that the Upper Atmospheric Facilities (UAF) Program Director, Bob Robinson, continues his exceptional job of managing the program. This is a difficult task given the wide range of science and engineering objectives and complexities among the facilities. Bob has the “pulse” of all the facilities and their staff and guides them with a fine hand. While the 2002-2004 period was in some ways dominated by AMISR, the existing facilities received considerable attention with proposals for continued funding, resulting in Cooperative Agreements, for both Sondrestrom (SRI) and Millstone (MIT). As before, an overarching issue that appears in facility reports and reviewer comments concerned the aging infrastructure of these sites with the need for modern transmitters and repair/replacement of the antenna structures of concern. These and related issues were addressed by the Upper Atmosphere Facility review panel chaired by Susan Avery. Implementation of the recommendations of this panel is ongoing and the results are even more critical as AMISR comes on-line with its own set of budgetary, management, scientific, and infrastructure issues. It is critical to the future of our community that these facilities remain

healthy and able to enable/address cutting-edge science and engineering outcomes and to integrate with global science issues such as space weather and IPY. The use of site visits (e.g., the Upper Atmosphere Facility Review Panel) is necessary to deal with the scope of these facilities. Given the potential for management/budgetary impact on the other facilities and the 21st century science potential of AMISR, this panel's scope should be increased to include AMISR while also visiting other relevant facilities such as EISCAT in order to gain the additional perspective. While maintaining and improving the existing Upper Atmosphere Facilities, in AMISR, the NSF Upper Atmosphere Program and the community it serves is exhibiting (high-risk) leadership in stimulating the development of next-generation radars and attendant instrumentation. The COV notes the evolution/oversight of AMISR through the series of proposals culminating in the AMISR proposal (ATM 0121483) that, after 11 mail-in reviews and a panel review resulted in funding with ongoing oversight via a Technical Advisory Committee (TAC). As already noted, the Avery Panel did not directly address AMISR.

The COV finds that oversight of the UAF requires the use of site-visits, TACs, etc. in addition to the standard review process that occurs with each five year renewal proposal. We also note that in addition to AMISR, the UAF portfolio now includes SUPERDARN.

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

The UAF program appears to apply the merit review system efficiently and effectively. Summaries appear to capture the overall level and character of the reviews. Each panel and major proposal has a significant number of high quality reviews (6 or more) and there appeared to be a strong consensus among the reviewers for the major UAF actions we reviewed. The *Diary Notes* entries were consistent with overall panel and mail in reviews and reflected a thorough and effective application of the review procedures. The notes contain additional information (e.g. outside leveraged funding and other programmatic concerns) providing a more complete explanation of the overall decision process and provides historical information for later analysis. Panel summaries were often very detailed and complete covering all the major aspects of the proposal including science, engineering, education, outreach, etc. The summaries appeared balanced and effectively brought out both the positive and negative aspects revealed in the reviews. The two sets of reviews (mail & panel) consistently provided enough information to support the overall ratings provided and provide adequate feedback to the PI.

The 2003/2004 UAF Review Panel provided a recent and valuable evaluation of all the UAF facilities and resulted in several important recommendations which the UAF PO had begun to investigate and implement. This Panel was recommended by the previous COV.

QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCEDURES	Response
<p>1. Is the review mechanism appropriate? (panels, ad hoc reviews, site visits) Comments: Mechanisms seem appropriate and effective – site visit to UAF was an excellent addition. As the reviews point to issues, NSF response increases with for example, the Upper Atmosphere Facility Review Panel and the Technical Advisory Committee for AMISR construction were/are used to address a wide range of issues.</p>	Yes
<p>2. Is the review process efficient and effective?</p>	Yes

<p>Comments: In all, the process is very efficient and effective—innovations such as virtual panel has made an important impact on the overall efficiency.</p>	
<p>3. Are reviews consistent with priorities and criteria stated in the program’s solicitations, announcements, and guidelines? Comments: Announcements and reviews appear to be highly consistent although there seems to be more confusion and effort in “finding” broader impact than in intellectual merit.</p>	Yes
<p>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? Comments: The review opinions are well documented. While constructive “broader impact” comments are sometimes very abbreviated, the overall flavor of the reviewer comments are quite useful.</p>	Yes
<p>5. Do the panel summaries provide sufficient information for the principal investigator(s) to understand the basis for the panel recommendation? Comments: Panel summaries in the UAF proposals are fairly complete and serve their purpose.</p>	Yes
<p>6. Is the documentation for recommendations complete, and does the program officer provide sufficient information and justification for her/his recommendation? Comments: Internal memoranda generated by the PO make it easy to understand the basis for the decision—the recommendation details outlined in the Cooperative Agreement and additional response such as forming the Avery Panel and an independent Technical Advisory Committee with the attendant reports form a well balanced and justified response to issues raised by reviewers.</p>	Yes
<p>7. Is the time to decision appropriate? Comments: Process seems timely and consistent with the need for panel meetings, etc.</p>	Yes
<p>8. Discuss any issues identified by the COV concerning the quality and effectiveness of the program’s use of merit review procedures:</p>	

Introduction to A2.

We note that the community views the facilities in a generally very positive light. This results in almost uniformly excellent ratings from the mail-in reviewers. This is seen most clearly in the proposal for continued funding of the Sondrestrom facility (ATM-0334122). This proposal was sent to 12 reviewers with 8 responses all of which rated the proposal “excellent.” In general the responses were short and supportive indicating considerable satisfaction with the facility and the PI. The proposal for continued funding

of the Millstone facility (ATM 0233230) was sent to 12 reviewers and resulted in 9 responses with 6 excellents, an excellent/very good, a very good, and a fair. Here even the reviewers giving an excellent rating expressed concerns that largely centered on infrastructure and on diverging scientific goals. The Upper Atmosphere Facility Review Panel was created to address these and additional issues surrounding the current set of UA Facilities. The proposal for funding construction of AMISR (ATM 0121483) was sent to 13 reviewers resulting in 11 responses with 8 excellents, 2 very goods, and a good. There was uniform support for building AMISR with one reviewer noting that the proposal was “maybe the best proposal reviewed in my 50 plus years” in the field. However there were some deep concerns with the management, design, and manufacturing issues surrounding construction of a facility of this scale. Due to the scale of the proposed effort and additionally because of the concerns expressed in the review process, this proposal received considerable scrutiny from a review panel, review/approval by the National Science Board, and creation of Technical Advisory Committee. The COV finds that the level of NSF response to the initial reviews was appropriate to the issues revealed in the reviews. That is, Bob Robinson’s response to the issues raised in reviews appears to be quite successful.

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

Both panel and mail reviews consistently addressed both merit criteria. This seems to be an improvement over prior years. There was clearly a bias towards the intellectual merit aspects of the proposal and often only a cursory discussion of the broader impacts. In some cases, the reviewers noted a weakness in the impacts aspect of a proposal and took it upon themselves to articulate what the broader impacts of the proposal really should have been. Weaknesses in the later criteria were often glossed over and it did not appear that weakness in the latter criteria was often a reason for a low rating of a proposal.

IMPLEMENTATION OF NSF MERIT REVIEW CRITERIA	Response
1. Have the individual reviews (either mail or panel) addressed both merit review criteria? Comments: Heavy emphasis on intellectual merit – broader impacts were not usually discussed in nearly as much detail by the reviews.	Yes
2. Have the panel summaries addressed both merit review criteria? Comments: Summaries addressed both criteria consistently.	Yes
3. Have the <i>review analyses</i> (Form 7s) addressed both merit review criteria? Comments: None.	Yes
4. Discuss any issues the COV has identified with respect to implementation of NSF’s merit review criteria.	

It is clear that the reviewers are comfortable with “intellectual merit” but are much less comfortable with “broader impacts.”
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A.3 Questions concerning the selection of reviewers.

Each proposal and panel appeared to have a diverse and well balanced set of reviewers covering all the scientific and engineering disciplines relevant to the proposal. Overall, the experience level of the reviewers was very high and provided a series of high quality reviews.

SELECTION OF REVIEWERS	Response
1. Did the program make use of an adequate number of reviewers? Comments: Excellent use of reviews – typically 6 or more for major UAF proposals	Yes
2. Did the program make use of reviewers having appropriate expertise and/or qualifications? Comments: Expertise of reviewers was diverse and more than adequate to address each proposal.	Yes
3. Did the program make appropriate use of reviewers to reflect balance among characteristics such as geography, type of institution, and underrepresented groups? Comments: There were no noticeable underrepresentations.	Yes
4. Did the program recognize and resolve conflicts of interest when appropriate? Comments: There appears to be strong and successful interest in eliminating COI at all levels.	N/A
2. Discuss any issues the COV has identified relevant to selection of reviewers. No further discussion of issues required.	

A.4 Questions concerning the resulting portfolio of awards under review.

RESULTING PORTFOLIO OF AWARDS	Response
1. Overall quality of the research and/or education projects supported by the program. Comments: Quality of research is consistently high over most program awards.	Appropriate
2. Are awards appropriate in size and duration for the scope of the projects? Comments: The award size seems adequate to meet the requirements of the UAF program.	Appropriate

<p>3. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • High risk projects? <p>Comments: Good balance – aided SGR and Supplementals.</p>	<p>Appropriate</p>
<p>4. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • Multidisciplinary projects? <p>Comments: The UAF portfolio, by its nature, is highly multidisciplinary.</p>	<p>Appropriate</p>
<p>5. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • Innovative projects? <p>Comments: There appear to be several new innovative projects annually.</p>	<p>Appropriate</p>
<p>6. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • Funding for centers, groups and awards to individuals? <p>Comments: None.</p>	<p>Appropriate</p>
<p>7. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • Awards to new investigators? <p>Comments: All the facilities except Millstone have moved to younger PIs. This was found to be most positive by the Avery Panel.</p>	<p>Appropriate</p>
<p>8. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • Geographical distribution of Principal Investigators? <p>Comments: No bias noted.</p>	<p>Appropriate</p>
<p>9. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • Institutional types? <p>Comments: Several types from academic to organizations such as SRI International.</p>	<p>Appropriate</p>
<p>10. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • Projects that integrate research and education? <p>Comments: Strong evidence of integration of research and education across UAF. The Avery Panel strongly recommended even greater integration of research, education, and outreach at the facilities.</p>	<p>Appropriate</p>
<p>11. Does the program portfolio have an appropriate balance:</p> <ul style="list-style-type: none"> • Across disciplines and sub-disciplines of the activity and of emerging opportunities? <p>Comments: The range of technologies and science goals across the UA Facilities is very large.</p>	<p>Appropriate</p>

Thus we have the science emerging from the “mature” facilities along with expectations and planning for the emerging opportunities represented in AMISR.	
12. Does the program portfolio have appropriate participation of underrepresented groups? Comments: Yes, e.g several HBCU initiatives.	Appropriate
13. Is the program relevant to national priorities, agency mission, relevant fields and other customer needs? Include citations of relevant external reports. Comments: e.g. Space weather program strongly coupled to DoD, NOAA and NASA with clear evidence of funding contributions from each.	Appropriate
14. Discuss any concerns relevant to the quality of the projects or the balance of the portfolio. No concerns were identified.	

A.5 Management of the program under review.

The UAF program is very ably managed by Dr. Robert Robinson and continues to sustain high quality research facilities which continue to evolve in response to new technologies and emerging science requirements. In particular, Dr. Robinson appears to use Supplemental Funding effectively for a number of applications including: maintaining continuous operations of facilities; respond to emerging scientific needs and short term campaign needs; responding to emergency or safety requirements and providing assistance with workshops, graduate student or short term postdoc investigations. Supplementals appear to be especially important to the efficient operation of the UAF program and increase the overall scientific output of the facilities in a significant way.

There appear to be several new initiatives in the area of education and human resources interactions with the UAF including Space Weather Summer Schools and Polar Aeronomy and Radio Science Summer School (PARS) at Arecibo and Gakona. The need for improvement was highlighted by the previous COV and there seem to be a concerted effort in this area. The CISM program has been an important enabler in this area.

1. Management of the program. Comments: The UAF program appears to be well managed by Dr. Robinson and has resulted in high quality research facilities which are widely used by the scientific community and which appear to be highly responsive to the needs of that community.
2. Responsiveness of the program to emerging research and education opportunities. Comments: Program is highly responsive to emerging research and educational opportunities and the PO makes effective use of Supplementals to respond quickly to emerging needs and opportunities in a variety of ways including

supporting short term projects of post-docs and graduate students and helping support workshops.

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

Comments:

There appears to be a well thought out planning and prioritization process applied throughout the UAF program. The success of the AMISR facility is a tribute to the long term planning and persistence of the PO. There is clear evidence that the UAF PO has been highly successful in leveraging funding from other agencies (Air Force, NASA) and putting together scientific collaborations in a timely fashion. In addition, SUPERDARN has been added to the portfolio bringing with it a new paradigm for management of extended facilities.

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

None.

4.0 OUTPUTS AND OUTCOMES OF THE UARS PROGRAM

4.1 AERONOMY PROGRAM

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 Aeronomy program supports a wide range of activities designed to educate new scientists, including the annual CEDAR/GEM combined meeting, the Polar Aeronomy and Radio Science (PARS) summer school, and Research Opportunities for Undergraduates (REU). The CEDAR program also supports a large number of postdocs in the space sciences. Such programs have been successful at producing future scientists/engineers, and the model looks promising for delivering similar success for future.



Attendees at the 2004 Polar Aeronomy and Radio Science Summer School held at the Arecibo Radar site in Puerto Rico. This school was designed for theoretical and practical training with graduate students and advisors working together.

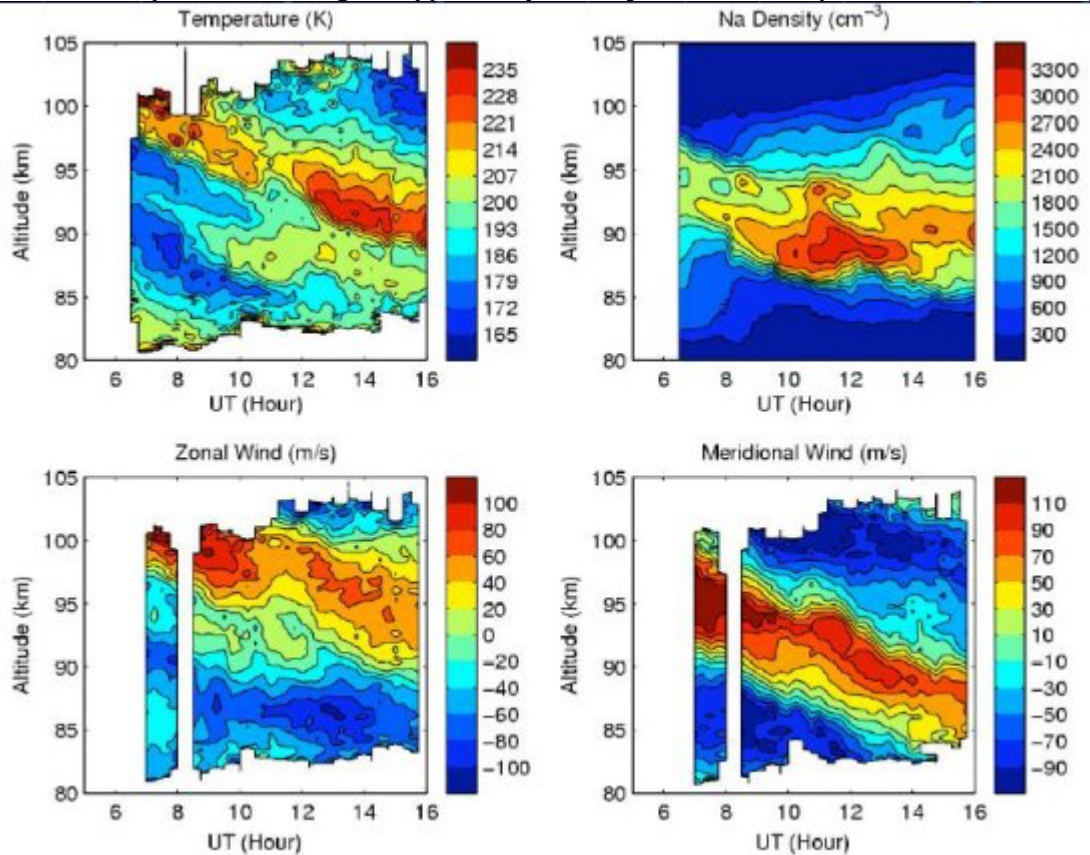
B.2 OUTCOME GOAL for IDEAS: Enabling “discovery across the frontier of science and engineering, connected to learning, innovation, and service to society.”

Comments:

The Aeronomy program is proud of its accomplishments connected to learning, innovation, and service to society. Highlights of the program are listed below:

- *High-Speed auroral imaging captures M-I coupling manifestation [Semeter, 0323941, SRI International]* has successfully developed a multi-spectral all-sky imager for use at the Sondrestrom Radar Facility. Using an innovative optical system, the imager simultaneously measures auroral emissions at four wavelengths. The images are used to determine quantitative information about the intensity and mean energy of the precipitating electrons that produce the aurora. These data have been compared with simultaneous measurements of electron density from the Sondrestrom Radar, and with space-based images of auroral luminosity from NASA’s Polar satellite.
- *FM radio broadcasts used for passive ionospheric monitoring [Sahr, 0310233, University of Washington]* is developing a technique to study Earth’s ionosphere using a new concept referred to as “bistatic passive radar”. The radar is passive because it does not use a dedicated transmitter, but instead relies on commercial FM radio broadcasts. The technique requires two receiving antennas about 150 km apart. When a target scatters the radio signal toward one antenna, it modulates the illuminating signal such that the original signal's amplitude and frequency are changed according to the properties of the target. The second receiver picks up the reference signal directly from the FM radio station. The scattered signal and reference signal are digitally compared to deduce properties of the target. The primary purpose of the radar is to study the ionosphere, particularly E-region irregularities caused mostly by plasma interactions with earth's electromagnetic fields and the solar wind. However, once perfected the technique may have many practical applications as well.
- *The highly successful Maui/MALT campaign, fostering cooperation between many research groups:*

nested instruments revealing mesosphere and lower thermosphere coupling dynamics (MALT). The Aeronomy community has understood, probably since the seminal theoretical work of Colin Hines in the early 1960's, that energy deposition into the upper atmosphere is primarily by solar UV and auroral particle precipitation from above, and momentum transfer through gravity wave interactions from below. While the former energy source has been quantified with good accuracy on local and global scales, the latter has proven very difficult to quantify, primarily because the MALT region is so difficult to observe. A group of researchers has established a collection of nested instrumentation at Maui, Hawaii that shatters that traditional observation barrier from the ground. The centerpiece of the effort has been the 3.6m AEOS telescope operated by the USAF, which serves as a steerable receiver for a sodium resonance lidar operated by the University of Illinois [Gardner, 0003198; Swenson, 0338425]. In addition a high speed imager with NIR capability is operated at Maui under the auspices of Hecht, [0122772 and 0436516, The Aerospace Corporation], as are more traditional imagers providing altitude information by samples of Na, OH, and O, and O₂ [Taylor, 0228914, 0003218, Utah State University; Kelley, 0000196, Cornell University]. A meteor radar providing lower precision MALT winds but with a broader spatial context is operated with support from Franke, [0003182, University of Illinois], while wind shear driven energetics and electrodynamics in the E-region are studied by Tsunoda, [0333138, SRI International] using bistatic MF radars. A Rayleigh lidar was also operated at the sight, supported by Kane, [0202293, Pennsylvania State University].



Na Wind/Temperature Lidar, Maui, HI

April 11, 2002

These panels show results from observations made by the Sodium wind/temperature Lidar during the Maui-Malt Campaign in April 2002. The height resolution and speed of measurement was considerably enhanced through the coordinated use of the USAF telescope on Haleakala. University of Illinois [Gardner, 0003198; Swenson, 0338425]

The program also supports several cross-cutting and multidisciplinary projects, for example, the study of

how the global electric circuit research links thunderstorms to the ionosphere. The phenomena of optical flashes above thunderstorms, extending to approximately 95 km above the cumulonimbus cloud top, was first documented independently from orbital images by William Boeck and Otha Vaughan of NASA in 1990, and by serendipitous ground-based imaging by R.C. Franz, R.J. Nemzek and J.R. Winckler, at the University of Minnesota in 1989. Since discovery, these optical flashes, collectively dubbed “Transient Luminous Events” (TLEs) have been roughly categorized into three subdivisions, based originally on color, shape, and spatial extent. They are Red Sprites, Blue Dwarfs, and Elves. Not just interesting optical events, these events are being used to learn about a recently appreciated “global electrical circuit”, which connects the ionosphere to mesoscale tropospheric events, and to auroral zone electric field generation and structure. This research is certainly multidisciplinary, but it is also innovative. Since this discovery just over a decade ago, there have been multiple research groups investigating the basic morphology, triggering mechanisms, and ionospheric ramifications for these large but fleeting transient optical events. NSF supports these groups through a joint effort within GEO/ATM, including the Aeronomy, Physical Meteorology, and Climate Dynamics Programs. A partial list of NSF awarded PIs includes:
Dr. Umran Inan, Stanford University, 0233955, 9910532
Dr. Victor Pasko, Pennsylvania State University, 0134838 (*Career Award*), 0118271 (*SGER*)
Dr. Stephen Cummer, Duke University, 0221968
Dr. Robert Holzworth, University of Washington, 9987684, 0091825, 0355190
Dr. Walter Lyons FMA Research Inc., 0221512, 0000569
Dr. Earle Williams, Massachusetts Institute of Technology 0003346, 0337298

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 development of broadly accessible, state-of-the-art tools is a vital component of the program. The introduction of the new Space Weather Journal is one success story.

Several of the projects which support the NSF outcome goals for Ideas (B2 above) also require the development of new tools. Examples include the high-speed auroral imaging developed by Semeter [0323941, *SRI International*], and the passive radar techniques being developed by Sahr [0310233, *University of Washington*].

Other tools include Web-based empirical models of the ionosphere assimilating data from multiple ISRs [Holt, 0207748]. This work involves development of an empirical model of the earth’s ionosphere using ISR data from UAF facilities and from international ISR sights. The results reveal a longitudinal and latitudinal asymmetries in electron densities across the globe, poorly understood and scarcely recognized until this work, and are likely related to global circulation patterns and to climatological neutral composition variations. The identification of the asymmetries identifies new challenges for analytical ionospheric modeling.

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 AER program effectively uses resources provided by the UARS and other higher levels of the NSF organization. The AER performance in delivering top quality research projects to the community with adequate funding levels and minimal intervention on PI operations reflects the effectiveness of their leadership and business practices. The examples given above are testimony to this.

The organization is effective and fair in the proposal evaluation process, with Program Director recommendations fully supported by external reviews. The Program Director initiated discussion with the PI in several difficult cases, resulting in partial funding for promising research.

As a measure of the efficiency of the Aeronomy staff, proposal dwell time is on the order of 6-7 months, which we consider to be excellent, considering the amount of work involved for timely external review of proposals.

The organization also promotes new opportunities for students and PI's through workshops and new programs (CAREER, REU, FDSS), and development of new facilities, instrumentation, and software tools to enable cutting-edge research in Aeronomy.

The organization has been successful in establishing effective partnering cross-cutting activities to leverage use of its own funds with other parts of the NSF and other agencies to support research with direct effects on society; the Space Weather program has direct application to many space-based, commonly used resources, including ionospheric propagation effects on GPS and WAAS networks.

4.2 MAGNETOSPHERIC PHYSICS PROGRAM

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:

There has been 1 institutional REU funded by UARS for MAG during 02-04.

In MAG, Roger Smith at the University of Alaska runs ATM-0097871 that funds a summer REU research program for undergraduates with interests in atmospheric science. Research Experiences for Teachers is a new program funded by MAG to support outreach activities at two institutions: George Morales at UCLA (ATM-0138187) involved a Los Angeles high school math teacher Ms. Anna Fox with plasma simulation experience as an example to take back to her students of math applications, while Mark Koepke at WVU (ATM-0201112) involved teachers and students in laboratory space plasma experiments.

Suggestion: Individual REU supplements (only three in UARS over the three year period) should be

augmented with additional funding from outside of UARS in order to encourage individual investigators to go beyond simple inclusion of undergraduates in their core budgets as research assistants, with the benefit of project descriptions focused on student participation.

GEM has a large student contingent each year for the summer workshop. Senior students run a tutorial day on Sunday before the workshop where tutorials are given by students finishing their PhD research that provide background and context for students attending the workshop for the first time. There is a student representative to the GEM Steering Committee and a tutorial during the main part of the workshop which is by invitation from the students. The GEM postdoc, which came as a suggestion from the Steering Committee, was promptly implemented by the MAG program director and has been highly competitive and successful as measured by GEM postdocs going on to regular NSF support, as well as alumni from the GEM ‘student body’ who now hold tenure track positions.

The **FDSSP** was conceived in response to the need to replace retirements in solar and space physics with a new generation of faculty who will train tomorrow’s scientists in the UARS area. The fact that hiring was not gradual during the 60’s response to Sputnik and the discoveries of the IGY has created a potential vacuum in the wake of retirements underway. UARS effectively argued for a program to address this situation before a crisis develops and received an overwhelming response of 36 proposals from which 8 have been selected for funding beginning in 05. While the program itself postdates the current review period, the advance planning by UARS staff in coordination with the community is to be applauded.

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

Comments:

Space Weather Program - NSF UARS should continue its leadership in bringing together other agencies to work synergistically in addressing large-scale system modeling constrained by observations of the connected Sun-Earth system. This continues to be a challenge given the interfaces between and distinct missions of other agencies, but NSF should be applauded and encouraged by the success of the NSWP to date. It is an activity that provides an enormous service to society. Because the space weather program is intellectually stimulating, impacts the nation's communication assets (thus affecting business, health, entertainment, safety, etc.), and supports the nations military activities, it helps NSF to achieve its mission to promote the progress of science, to advance national health, prosperity and welfare and to secure the national defense.

GEM reconnection challenge - The idea of bringing together the community to compare results of models is innovative and has lead to significant advancement in our understanding of the mechanisms that are modeled and various model limitations and strengths - in particular the importance of the Hall term in Ohm's Law that is captured by 2-fluid, hybrid and particle simulation codes was elucidated in this exercise. This example supports the goal of promoting progress in basic science which is of critical importance to understanding the rapid energy conversion process which occurs in the range of UARS phenomena from solar flares to magnetospheric substorms.

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:

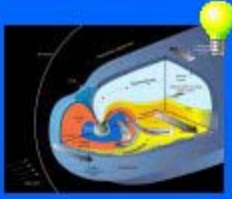
Hardware example:

The UCLA BAPSF (PI, W. Gekelman), jointly funded by UARS and DOE through the Basic Plasma Science Initiative, provides an opportunity for controlled experiments, for example on reconnection, in a scalable laboratory plasma system. It is a facility class experiment wherein proposals are solicited from researchers at other institutions, for example C. Kletzing, U. Iowa.

**Computational Modeling examples:**

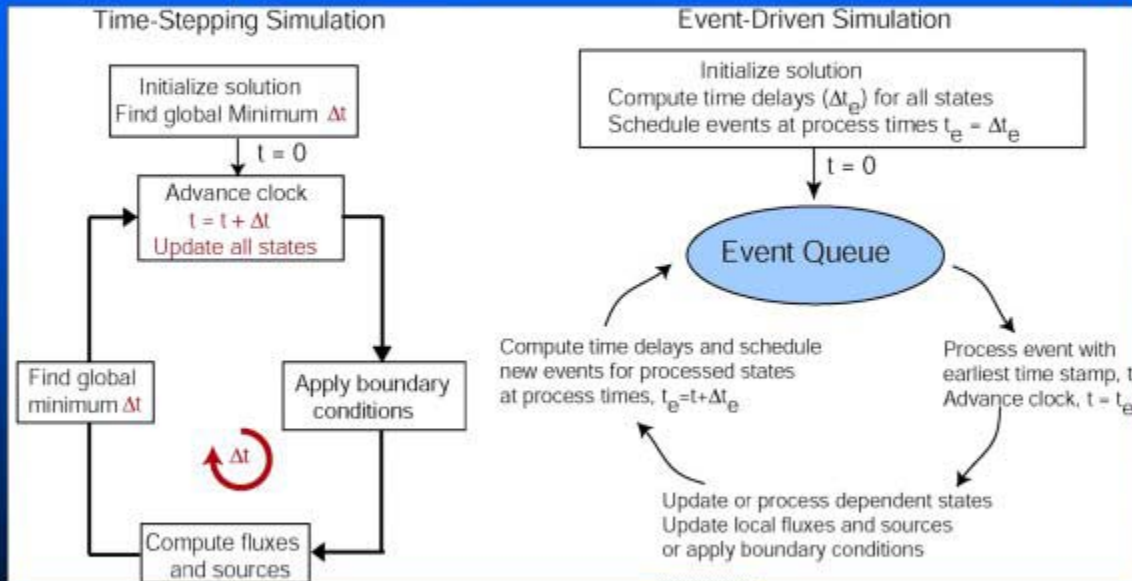
Support for the CCMC provides the community with a primary code repository where model runs can be specified on-demand, broadening community access in much the same way as the Assimilative Mapping of Ionospheric Electrodynamics (AMIE) technique has been used to provide a context for data interpretation. Conversely the CCMC code repository allows for novel runs that test the limits and validity of models independently from code development. The need exists for additional staff to support the CCMC. Providing additional NSF staff for the CCMC would further demonstrate NSF's commitment to achieving this outcome goal for "Tools".

Support for model development through the CISM STC and novel computational approaches such as the time-stepping algorithm under development by H. Karimabadi of UCSD, under joint ITR funding supplemented by MAG, provide tools which can have a broader utility than their immediate application to UARS research areas. Support for the annual CISM summer school ensures that a new generation of students is exposed to the full extent of UARS science in the context of space weather.



Innovative Research

ITR, PI: H. Karimabadi



Sept. 2005

UARS/MAG, COV 2005

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:

There are two examples that we identify that demonstrate the UARS commitment to achieving the goal of "Organizational Excellence":

Permanent Program Officer for MAG - the establishment of a permanent program officer for the MAG program has proven to be a significant factor in the success of managing the program over the review period. This success is reflected, for example, in the innovative way that activities are being leveraged within and outside of NSF.

Interdisciplinary Science Assistant - In the recent past, the UARS program has experienced work-overload conditions due to understaffing. In response to this situation, NSF UARS has filled their full compliment of program officers for each of the four programs (STR, MAG, AER, and UAF), and an interdisciplinary science assistant position has been established to support all of the programs. This action has demonstrably lead to better integration of UARS since one person is able to help coordinate proposal data and results between the four programs, with a broad view of the UARS activities. During the 2005 COV review, having someone specifically responsible for this integration effort has been a tremendous help.

4.3 SOLAR TERRESTRIAL RESEARCH PROGRAM

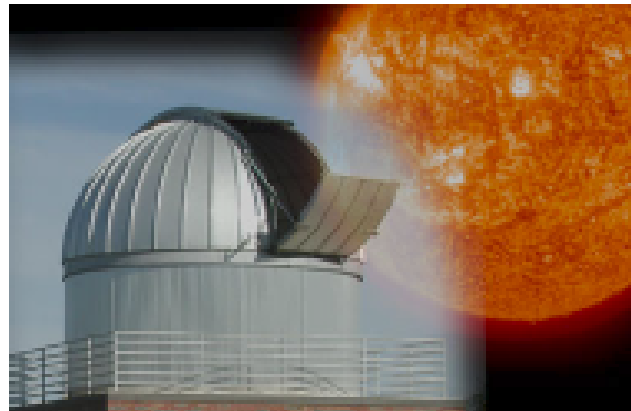
B.1 OUTCOME GOAL for PEOPLE: Developing “a diverse, competitive and globally engaged B. Please provide comments on the activity as it relates to NSF’s Strategic Outcome workforce of scientists, engineers, technologists and well-prepared citizens.”

Comments:

ATM-0453519, PI: Tian-Sen Huang, Prairie View A&M University (PVAMU)

The Prairie View Solar Observatory (PVSO) provides opportunities for students to investigate space physics problems within the NSF’s Research Experience for Undergraduates (REU) program. It should be noted that PVAMU is a Historically Black College/University (HBCU).

Student projects encompass two main science areas: (1) the study of solar activity based on observations performed at PVSO and (2) computer modeling to ascertain the response of Earth’s magnetosphere and ionosphere to solar activity. PVSO faculty and research staff members act as mentors for students during their research experience. AFOSR agreed to co-fund this five-year REU program at PVAMU; currently, AFOSR provides three years of funding and STR provides two. Encouraged by the STR Program Director, PVSO is negotiating observatory access for Rice University graduate students in nearby Houston, now studying under Dr. David Alexander, a member of the SHINE Steering Committee.



Co-Investigator Dr. Sorin Pojoga assists a PVSO student in a solar physics project.

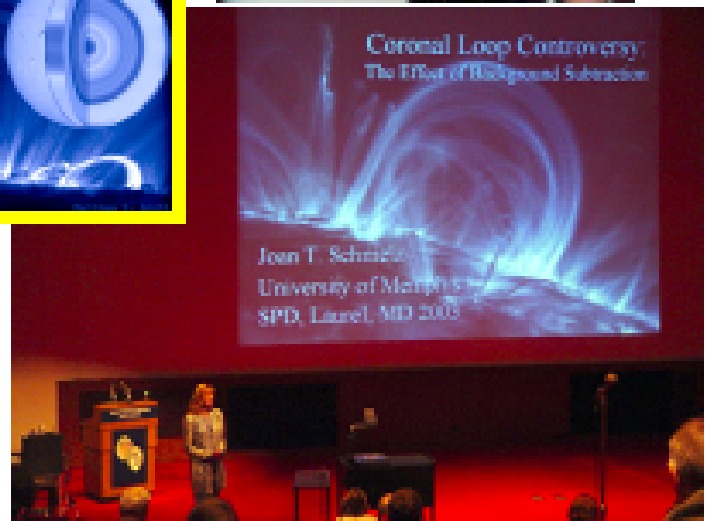
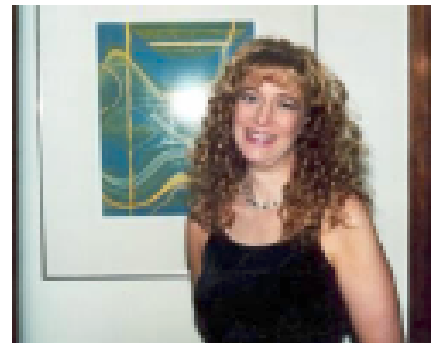
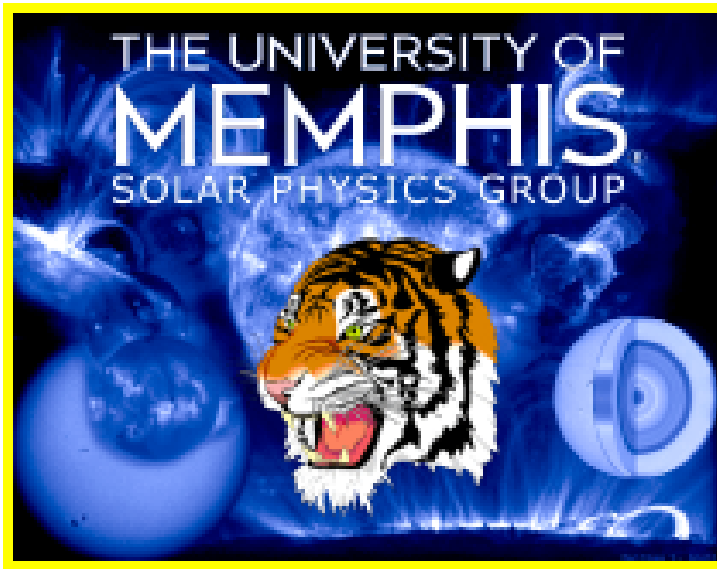
ATM-0402729, PI: Joan Schmelz, University of Memphis

Dr. Joan Schmelz is an active officer of the Solar Physics Division of the American Astronomical Society, and is well-known to the US solar physics community. She works as a spectroscopist in the Solar Physics Laboratory at the University of Memphis. Her laboratory group studies the solar corona using state-of-the-art

imagers and spectrometers in an effort to understand coronal energetics and loop dynamics.

Dr. Schmelz received NSF EPSCoR funds in 2004 for this project. The Experimental Program to Stimulate Competitive Research (EPSCoR) is a program designed to fulfill the National Science Foundation's (NSF) mandate to promote scientific progress nationwide. The EPSCoR program is directed at those jurisdictions that have historically received lesser amounts of NSF funding.

Dr. Schmelz employs graduate and undergraduate research assistants as integral components of her lab workforce. Dr. Schmelz created a large public outreach effort to share scientific discoveries with the Memphis community. Her outreach program, *Breaking the Secret Code of Starlight*, introduces 5th graders from the Memphis inner-city school system to the basics of spectroscopy by answering the age old question, “*What are stars made of?*”



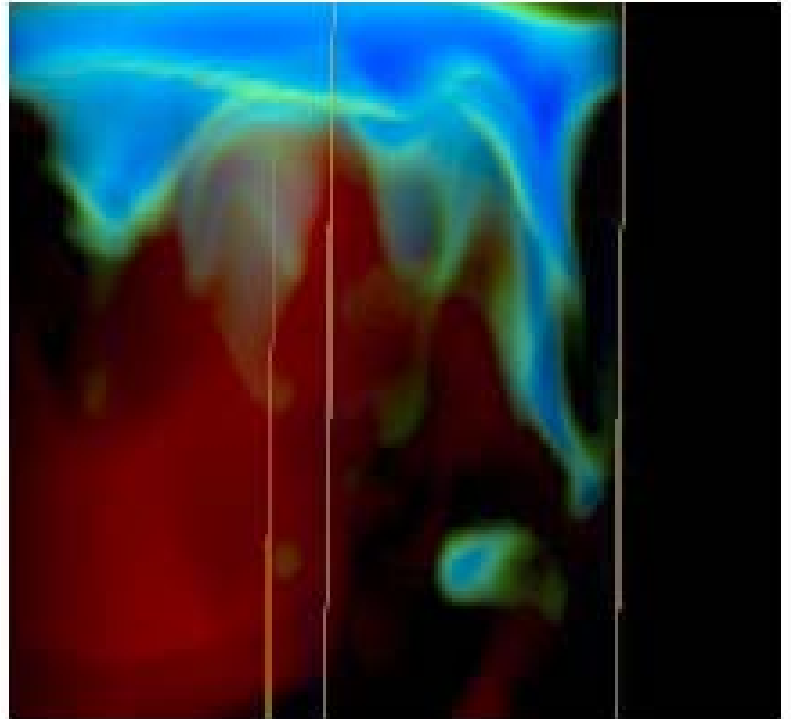
B.2 OUTCOME GOAL for IDEAS: Enabling “discovery across the frontier of science and engineering, connected to learning, innovation, and service to society.”

Comments:

ATM-9988111, PI: Robert Stein, Michigan State University

Dr. Robert Stein and his colleague, Dr. Åke Nordlund of the Neils Bohr Institute for Astronomy, Physics, and Geophysics in Denmark, have constructed state-of-the-art simulations of solar magneto-convection. Like Earth-based and satellite-based instruments, computer simulation is an important tool for studying solar behavior. Direct observations must eventually be explained by consistent theories that stand the test of time.

Discoveries made with theoretical modeling lead scientists to look for supporting physical evidence and can define the performance and characteristics of next-generation instruments. The simulation graphics of Stein and Nordlund were featured in a cover story summarizing current efforts in solar physics research in the July 2004 issue of National Geographic magazine.

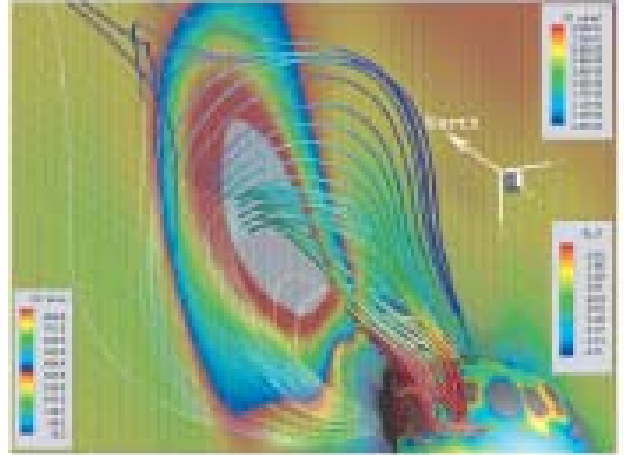
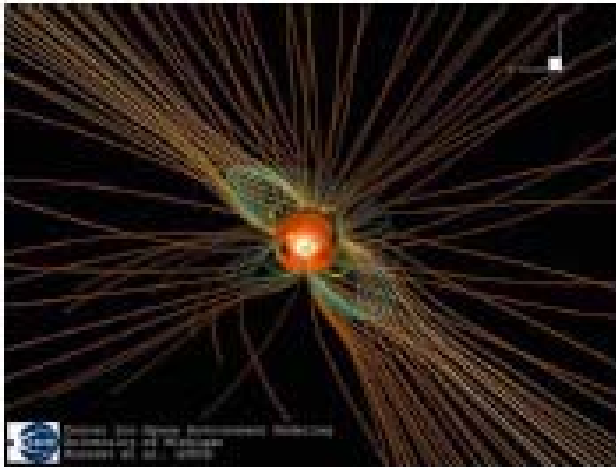


This simulation image shows rising and falling plasma convection currents below the Sun's surface (red depicts the hottest solar plasma, blue the coolest) and shows a volume of about one million cubic kilometers. (Vertical lines are superimposed measurement axes.)

ATM-0454469, PI: Ilia Roussev, University of Michigan

Dr. Ilia Roussev and his colleague Dr. Igor Sokolov received a SHINE award in the 2004 competition, and they are now working to improve our understanding of solar eruptions and related solar energetic particles (SEPs). Their main focus has been the SHINE Campaign Events, which they study by means of three-dimensional coupled MHD-SEP numerical simulations. Roussev and Sokolov are investigating the 1998 Apr-May events and 2002 Apr-Aug events in order to address the following fundamental questions of importance for the SHINE community: (1) how are solar eruptions initiated and how do they evolve? and (2) how are solar particles accelerated and transported?

Typically, a winning STR proposal earns a majority of rankings in the "Excellent" category. ***This effort is high risk because three out of the four reviewers in this case only rated the proposal as "Good."*** The main reviewer complaints emphasized what were believed to be significant weaknesses in the proposed numerical technique. However, the STR Program Director (and several SHINE panelists) believed these criticisms were overblown and that the scientific promise of this work overcame the identified weaknesses. The SHINE community has since embraced Dr. Roussev's efforts, and his productivity has been impressive to date, but only time will tell if the proposers will fulfill expectations and justify overruling the negative reviews.



Above left: Three-dimensional depiction of solar magnetic fields; **Above right:** Three-dimensional view of the modeled CME from May 2, 1998, at 1.1 hrs after the initiation (from Roussev et al., 2004). The solid lines are magnetic field lines and the false color shows the magnitude of the current density in units of microamps per square meter (see color legend at top right). The magnitude of flow velocity, in units of km per second, is shown on a translucent plane (see color legend to the left). Values in excess of 1,000 km per second are blanked and shown in light grey. The grid-structure on this plane is also shown as the black frame. The inner sphere corresponds to the Sun's surface. The color shows the distribution of radial magnetic field in Gauss (see color legend at bottom right). Regions with field strength greater than 3 Gauss are blanked and appear in grey.

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:

ATM-0114545, PI: Paul Bellan, CalTech

Dr. Paul Bellan and his colleagues at Caltech constructed a “magnetized plasma gun” that produces arched, transient, twisted flux tubes similar to erupting solar prominences. Their research program is dedicated to investigating the topological evolution of these simulated prominences. Topological evolution involves the breaking and reconnection of magnetic field lines and is believed to be a critical process in actual solar prominence eruptions. Dr. Bellan received NSF funds in 2001 to purchase an advanced high-speed digital framing camera, capable of framing rates between 8 million and 200 million frames per second, depending on the operating mode. He uses the camera to make still images and movies of his simulated solar prominences in the plasma chamber. Dr. Bellan’s research results were featured on the cover of the 22 July 2005 issue of Physical Research Letters.

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:
CISM, CCMC

4.4 UPPER ATMOSPHERE FACILITIES PROGRAM

The UAF program contributes very effectively to NSF’s Strategic Outcome Goals. The maintained facilities are unique, world class and attract scientists from all over the world. The facilities are scientifically multidisciplinary and distributed strategically across the globe to provide important diagnostics of ionospheric and space weather phenomena. These facilities are used collaboratively by a number of NASA, NOAA and DoD programs to validate space-based data and coordinate with space and ground experimental campaigns.

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

Comments:

Through coordination with the CEDAR and summer/visitor programs at the facilities, the UAF program provides numerous opportunities for hands-on experience to train undergraduates, graduate students, and postdocs in several space science fields. This is especially important since involvement with space hardware can often take a prohibitively long time. The facilities are well organized to allow visiting scientists to arrive at the facility, take data and make quick-look evaluations. In many cases, the World Days operations allow scientific collaborations without the need for scientists to travel to the facility.

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 UAF program has been key in providing key observations of discoveries in a number of areas. Observations at Millstone Hill demonstrated fundamental new phenomena showing storm enhanced density plumes transiting the polar cap on the nightside of the earth. Simultaneous observations of electron density from radars and sodium densities from lidars provide important insights into the creation and maintenance of the earth’s sodium layer. Additionally, several UAF-leveraged ITR grants have been made that impact facility issues incorporating “discovery across the frontier of science” while leading to “learning, innovation, and service to society.”

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 UAF facilities provide a unique global database of atmospheric and ionospheric observations not available anywhere else in the world. The facilities are routinely part of World Day global observations that are often used in coordination with space-based observations (e.g. NASA TIMED mission, C/NOFS). The facilities aid in the design and validation of new ground-based and space-based observational instruments. The facilities provide easily accessible hands-on experiences for undergraduate and graduate education. New “tools” such as AMISR and the planned for Arecibo Heating Facility provide additional excitement and leverage the current portfolio of UA tools.

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:

In addition to maintaining a premier set of radar and optical atmospheric and ionospheric facilities, the UAF program through its AMISR initiative is redefining the state of the art in atmospheric research facilities and providing a highly agile and sensitive diagnostic system that will provide fundamental new insights into atmospheric and ionospheric science for years to come. The use of specialized visiting committees such as the Avery panel provide a method of better integrating the portfolio of “tools” to achieve organizational excellence. This process is succeeding and should



continue.

The left view shows the 16 panel installation of AMISR units at Gakona, Alaska. The right view shows the frame for the installation of a complete AMISR face at Poker Flat that will be completed during Fall 2005 and Spring 2006.

5.0 SIGNATURE BLOCK:

For the UARS COV 2005
Roger W. Smith (Chair)