

Report to the UCAR Members on the

NSF Review of the National Center for Atmospheric Research

by the

UCAR Scientific Programs Evaluation Committee (SPEC) and Observers

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I. Introduction

The UCAR Scientific Programs Evaluation Committee (SPEC) is responsible for determining if the research conducted and services provided at the National Center for Atmospheric Research (NCAR) are of high quality and if the scientific objectives of the Center are being accomplished. In the current cooperative agreement between the National Science Foundation (NSF) and the University Corporation for Atmospheric Research (UCAR), the responsibility for conducting the scientific reviews of NCAR rests with NSF. However, the cooperative agreement also provides for UCAR to appoint up to two observers to each of the NSF on-site review panels, including the review of the management of NCAR and UCAR. The responsibility of SPEC is to provide a report to UCAR members on whether, in the opinion of SPEC, the NSF reviews satisfy UCAR's requirement for periodic reviews of NCAR. Furthermore, the SPEC observers are expected to provide any additional findings to UCAR. In this current review cycle two SPEC observers (either members of SPEC or other experts identified by SPEC to work with them) have participated in each of the NSF reviews of eight divisions at NCAR as well as the review of NCAR/UCAR management. Thus, nine separate reviews were undertaken.

In their reviews the SPEC observers were particularly asked to look at cross-divisional activities and to highlight issues that might be common to all of the division and program reviews. This would provide a useful integrating approach that would give a valuable additional perspective for NSF and would satisfy the responsibilities of SPEC to UCAR and its members. The individual division SPEC review reports which contained more specific recommendations were made available to the Division Director and the NCAR Director.

The dates of the nine reviews were as follows:

Environmental and Societal Impacts Group (ESIG)	11-13 September 2001
Advanced Study Program (ASP)	25-26 September 2001
High Altitude Observatory (HAO)	10-12 October 2001
Climate and Global Dynamics Division (CGD)	23-25 October 2001
Atmospheric Chemistry Division (ACD)	24-26 October 2001
Atmospheric Technology Division (ATD)	29 October – 1 November 2001
Scientific Computing Division (SCD)	16-18 October 2001
Mesoscale and Microscale Meteorology Division (MMM)	17-19 October 2001
NCAR/UCAR Management	13-15 November 2001

The SPEC observers were well integrated into the overall review process for all nine reviews. Before the reviews the NSF panels and SPEC observers were provided with considerable background information and material, including strategic plans, reports of accomplishments, and copies of outside reviews of the divisions obtained by NSF. During each of the individual reviews the Director of NCAR, the individual division director, and selected scientists and staff of the division being reviewed made detailed presentations. There was opportunity for extensive general discussions and also for individual one-on-one discussions between panel members and divisional personnel. SPEC observers were involved fully in the NSF review process and participated in all of the discussions and considerations of recommendations. They were not involved in the final writing of the NSF reports.

The SPEC observers wrote their own report for each review they participated in. We note that the ESIG review took place during the September 11 terrorist attack. The review, nevertheless, went on as scheduled, and we want to particularly thank the NCAR and UCAR personnel as well as the individual reviewers for carrying out their responsibilities in such an exemplary manner under such very difficult and trying circumstances. We note that the NSF observers were excellent scientists who were technically versed in the subject areas of each division. However, some of them were unfamiliar with the specific role that a particular division plays with regard to its interaction with the university community in the atmospheric and related sciences. An important role of the SPEC observers was to facilitate the information gathering process of the NSF panel from their own perspectives as individuals with extensive experience with NCAR and its programs. After the completion of the nine reviews SPEC and its observers met in a conference call to discuss the overall review process and SPEC's conclusions and to consider a draft of this final integrated report.

II. Results of the Review

The SPEC observers agreed unanimously that the NSF divisional review process and reports were thorough, fair, provided constructive guidance, and accurately reflected the conclusions of the reviewers. SPEC observers were very impressed with the high quality of the personnel and the excellent research and other programs being undertaken at NCAR. Furthermore, SPEC observers were impressed by the management of NCAR/UCAR and, as pointed out in their review of the overall NCAR/UCAR management, by "NCAR, UCAR and NSF having

developed a mutually supportive relationship. All three organizations are to be congratulated for the development of such a positive and nurturing relationship. This is a major factor in the success of NCAR and its programs.” The SPEC observers also agreed that the NSF review completely satisfies the UCAR requirement for an independent review.

The first section below provides a very brief set of quotes from the NSF panel reports on each division, indicating the general high quality of the science undertaken by the divisional programs. This is followed by two sections that outline the views of the SPEC observers in the two areas that NSF specifically requested SPEC to address – cross-divisional interactions and broadly-based management issues. The fourth section provides several additional specific management-related recommendations for several of the divisions.

A. General Impressions of NCAR Science

The NSF panels agreed that the scientific research at NCAR is of high quality and the service provided by NCAR is of good value to the community. The overall management of NCAR and UCAR also get high marks for effective and innovative leadership. Specific quotes from the NSF reviews about individual divisions and programs as well as the overall management are given below to support this:

Overall Management “NCAR is a unique institution which plays a critical role in the nation's atmospheric science program. The Panel found compelling evidence that UCAR and NCAR are well managed, have a clear vision of the future, and are poised to bring new contributions to the understanding and application of atmospheric sciences to national needs. We found that UCAR and NCAR have an excellent leadership team.”

ACD “The performance of the Division has been strong during the past three years. The Division maintains an active research program directed at major issues in atmospheric chemistry, involving field measurements, modeling, laboratory kinetics, and remote sensing. All of these components are viewed as strong.”

ASP “The ASP Postdoctoral Program is an ambitious and highly successful means of giving recent PhD graduates an early career opportunity to guide their own research... The overall program is excellent.” “...ASP has a unique position that provides opportunities to initiate and foster cross-institutional activities and programs. The Panel compliments ASP on their creative use of this position in supporting institution-wide goals...”

ATD “ATD is doing an excellent job in support projects and instrumentation that cuts across several thematic areas.” “The overall quality of ATD instrumentation, platforms, deployment services, and science is high. ATD management and staff appear committed to a properly balanced program of serving the community, advancing technology, and conducting scientific enquiry.”

CGD “CGD has a group of excellent scientists who are doing high quality research and making important contributions of national and international prominence.” “Both the Panel and the mail reviewers found evidence of high quality research in all sections of CGD.”

ESIG "...the Panel found the people of ESIG to be creative, intellectually active people who are involved in many important national and international activities. The Panel was particularly impressed with the tremendous potential of the vibrant new hires, which represent the future of ESIG. The Panel also found evidence of persistent high-caliber interdisciplinary research in critically important areas."

HAO "The panel was extremely impressed with the vitality of the HAO research program, the very high scientific standards, and the quality of service to the community. The panel was also pleased to see that a large number of energetic young scientists have been hired since the previous review."

MMM "Based on all available input, the Panel unanimously concludes that the overall scientific research in MMM is of the highest quality, leading to advances in the understanding of weather and climate and important applications of this knowledge (e.g., weather prediction) to benefit society."

SCD "The panel developed a clear sense ... that NCAR's Scientific Computing Division had undergone a successful management transition ... producing a world class service organization". They found "a high level of (user) satisfaction", "superlative ... mass storage services", "world-class ... stewardship of... data", "outstanding ... analysis and visualization", high-quality computational science research, and "the best possible (computing) solution for the atmospheric science modeling community".

B. Cross-divisional Interactions

There has been a strong effort to improve cross-divisional cooperation and collaboration at NCAR during the past several years, and this is applauded. With the increasing recognition of the value and necessity of interdisciplinary efforts in the atmospheric and related sciences, this is particularly important. However, there was some concern that cross-divisional interactions remain somewhat of a problem within the NCAR structure and that improvements may take further deliberate action by the NCAR leadership. Additional cross-divisional efforts are strongly encouraged.

Specific comments and recommendations made by SPEC observers in this area included the following:

- NCAR should integrate ESIG priorities and staff into activities of the other NCAR divisions to help solve interdisciplinary problems that are central to the goals of NCAR and the nation.
- While MMM has good interactions with most divisions, it could profitably increase collaborations with the modeling group in CGD.
- CGD has a good potential to interact with ESIG, ACD, and MMM, but there has not been much interaction to date.

- ATD has made good progress in strengthening interactions with other divisions, including ACD and SCD, and continues to enjoy a strong relationship with MMM. Planned improvements in data management connections with JOSS (Joint Office for Science Support) in UOP (UCAR Office of Programs) and SCD are very important.
- ASP is fulfilling its role in providing opportunities to initiate and foster creative interdisciplinary programs within NCAR.

C. Broadly-based Management Issues and Recommendations

A number of common management-related issues arose in several of the individual reviews. These issues are outlined below.

Strategic Planning While many of the divisional strategic plans were well conceived and well written, there were several divisions that were still in the process of developing and completing their strategic plans. The individual plans should define the priorities of the divisions clearly and include steps for implementation of the plans. The SPEC observers believe that the individual strategic plans should be developed in a manner that tracks with the NCAR strategic plan. ACD, CGD, ATD, and ESIG were mentioned specifically as divisions that need continued work on their strategic plans and their priority setting. Involvement of the ATD Advisory Committee was specifically mentioned as a means to improve ATD's planning, and each division's advisory committee should be actively involved in their division's strategic planning process as well. SPEC supports NCAR management's use of strategic initiatives to target resources into particularly exciting new areas. However, focusing these resources into considerably fewer and more ambitious efforts might have more long-term impact. In developing strategic plans, the expertise of the university community should be considered as one way to attract high quality additional breadth without having comprehensive expertise in-house.

Staffing The SPEC observers noted that in general morale at NCAR is high – people are happy to be working at NCAR and appreciate the leadership and planning process there. The increase in the percentage of women scientists is applauded, as are the programs that encourage an increase in the percentage of underrepresented groups. However, several staff issues did arise, and NCAR management needs to continue to address them. For example, while some divisions include all levels of scientific staff in their planning process, this is apparently not a universally accepted process. SPEC believes that this should be institutionalized in all divisions at NCAR. SPEC applauds the recent efforts to hire new, junior scientists at NCAR, although the loss of expertise of retiring senior scientists is of concern. This will continue to be an issue that must be carefully addressed across the Center in view of limited funding and low scientist turnover expectations. In addition, all divisions should have clearly defined criteria for performance evaluation, advancement and career development. These criteria are important in general, but they are particularly important for those scientists with non-traditional backgrounds.

Interactions with the University Community It is important to recall that scientists in every division also have a community service obligation. Close and mutually profitable interactions between NCAR and its divisions and the university community are among the most important hallmarks of a successful NCAR. While these interactions are strong and growing, discussions

about possible new ways to enhance the quality of NCAR division/university interactions should be considered. NCAR scientists should be encouraged to spend sabbatical leaves at universities. The number of visitors, joint proposals and co-authored papers, while very valuable, are not the only way to have and evaluate interactions. One additional possibility might involve including university and other community scientists earlier in the planning of divisional activities, including the development of community products. The support staff who will be involved in the delivery and service of the product to the community should be included in such efforts. Another approach would be to include more university scientists in NCAR projects as a means to increase scientific breadth rather than having to increase staff at NCAR.

Funding Over the last decade NCAR core funding has been stable or sub-inflationary, while there has been a modest growth in external “soft” dollars related to grants and contracts. This mode of growth has introduced some concerns, with a differential impact on the divisions within NCAR. In some cases, the age distribution of NCAR scientists, and the slow turnover of senior scientists, has reduced the flexibility of using the base funding for hiring new scientists and supporting junior scientists. Base funding is also utilized to support and attract external research dollars, introducing stress in funding new initiatives and supporting staff. This point was cited in several divisional reviews. For example, within ATD the delicate balance among the deployment, development, and science activities could be compromised without additional base funds and increased deployment pool resources. HIAPER was cited as a specific example where management must be particularly vigilant. In ACD, use of base funding as subsidies to gain important externally funded programs is apparently substantially reducing division flexibility. Within MMM, stable base support has resulted in a stronger tendency to support more junior scientists on soft money. The lack of equity among the ranks has evidently created significant stress. These examples reveal an issue of general importance to the institution. Finally, the transference of one division’s costing onto another segment of the NSF base funding must be considered carefully. For example, the HAO review committee’s recommendation that the solar coronal observatory at Mauna Loa be supported by the NCAR-wide facility budget will necessarily come at the expense of something already supported by that pool.

Space Laboratory facilities and office space once again are becoming an important issue at UCAR/NCAR. NCAR staff are now housed at several different locations, and discussions about the construction of a new building on the Foothills Campus are now underway. SPEC believes that the development of a comprehensive long-range strategic plan for space for both NCAR and UCAR that would cover the next several decades is necessary before any short term decisions are made about space.

Computing UCAR/NCAR should take a national leadership role in the development of computational capabilities in the atmospheric and related sciences in the United States. In particular, SCD must lead the other divisions in transition and adaptation to new technologies with the strong encouragement of NCAR management; and CGD and SCD should lead the university community in the adoption of new and effective modeling and analysis techniques. The NSF Panel and the SPEC observers were very impressed with the thoroughness of the procurement process for an Advanced Research Computing System and the prospects for advanced analysis and visualization tools within SCD. NCAR’s role in the development of a

common infrastructure that will facilitate interactions among various research groups and the operational community will also be important.

Education and Outreach The outreach and education programs of UCAR/NCAR are outstanding. The SOARS Program is viewed as a very successful program that has long-term benefits for the atmospheric sciences as well as the individuals involved. Continued strong education efforts as well as programs to increase diversity both at UCAR/NCAR and across the atmospheric and related sciences are strongly encouraged. NCAR should attempt to expand the involvement of UCAR members and affiliates in its education and outreach programs. UCAR/NCAR were congratulated on their strong diversity efforts.

D. Other Specific Management-related Recommendations

There were several other specific recommendations made for certain divisions, and those are as follows:

ACD

- The division should be organized by the division's three thematic foci, rather than by "technique".

ASP

- Any further growth in the Graduate Fellowship Program should be carefully planned by forming an NCAR community committee to define the scope of an expanded program and program details.

SCD

- The Computational Sciences Section should be doubled in size "to help the atmospheric sciences modeling community make better use of current parallel supercomputers and ease migration to the supercomputers of the future".

ESIG

- Development of a strategic plan focused around a single theme such as a weather and climate initiative is needed.
- Key hiring of social and interdisciplinary scientists and greater internal collaboration will be required.
- The division's vitality depends on integrating its work with the rest of NCAR "to help solve interdisciplinary problems central to NCAR and the nation."
- Clear career paths and incentives are needed for the social scientists and others who bridge the gap between the physical and societal aspects of NCAR's research.

MMM

- There is a need to ensure adequate staffing to support current and future community model efforts.

III. Possible Improvements to the Review Process

While the review process was generally perceived to be very good, there were several suggestions by SPEC observers about ways that it might be improved in the future. For example, there was a general feeling that there were too many presentations and not enough discussion time. It was also felt that the NCAR Strategic Plan should have been part of the materials provided to the reviewers so divisional plans could be tracked with it. It might be useful to have a closed session of junior scientists with the review panel to hear their views and to ensure that their career paths are being adequately mentored. There was also some significant sentiment that more opportunity for community wide input to the entire review process would be very valuable.

Finally it was believed that the format of the "accomplishments" documents in the future could be made more useful by:

- a) articulating the highlights and payoff of the research accomplishments;
- b) including plans and questions to be addressed during the next five year cycle;
- c) articulating the aspects of the program that are unique to a National Center; and
- d) self-identifying issues for the panel to consider.