2010

ACADEMIC REVIEW AND
PLANNING ADVISORY COMMITTEE

FINAL REPORT FOR THE
DEPARTMENT OF ATMOSPHERIC AND OCEANIC SCIENCES

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Provost and Executive Vice Chancellor for Academic Affairs : Date
I. REVIEW PROCESS

The review of the Department of Atmospheric and Oceanic Sciences (ATOC) was conducted in accordance with the procedures set forth in the document guiding the 2010 Review Cycle (http://www.colorado.edu/facultyaffairs/2010_ReviewPROCEDURES.pdf). A self-study was prepared by the unit and reviewed by an internal review committee (IRC), which found that the report was complete and certified that the unit had adequately responded to the mandatory questions on diversity, assessment, and mentoring and had supplied a copy of the unit’s bylaws. An external review committee (ERC) visited the unit in April 2010 and, having reviewed the relevant documents, met with faculty, students, and university administrators. The internal and external reviewers' comments and recommendations are cited at the appropriate points. This public document reflects the assessment of and recommendations for the Department of Atmospheric and Oceanic Sciences as approved by the members of the Academic Review and Planning Advisory Committee (ARPAC).

II. OVERVIEW OF THE UNIT

The campus’s standardized description of ATOC can be found at http://www.colorado.edu/pba/depts/arp/0910/Profile_ATOC.pdf

The Department of Atmospheric and Oceanic Sciences (ATOC) was founded in the fall of 2005, and in 2008 the Ph.D. and M.S. degrees in Atmospheric and Oceanic Sciences were created. The department also offers an undergraduate minor and is evaluating the feasibility of offering an undergraduate major. On average, ATOC awards eight masters degrees per year, mainly to students who are pursuing Ph.D. degrees, and six Ph.D. degrees. ATOC currently has about 70 graduate students and produces about three percent of Ph.D.s in atmospheric and oceanic sciences in the United States. Graduate students typically serve as TAs in their first year and then become associated with research projects on which they serve as RAs. ATOC employs 12 TAs each semester, one third of whom are paid from leaves and replacement funds.

The department has thirteen tenured and tenure-track (TTT) faculty, most of whom are also associated with a research institute or laboratory. ATOC faculty are affiliated with LASP, CIRES, and INSTAAR as well as the non-university laboratories NCAR and NREL. Only four TTT faculty are rostered entirely within the College of Arts and Sciences.

Although atmospheric and oceanic sciences is not a commonly ranked discipline, in 2006 and 2007 the Chronicle of Higher Education produced rankings of Ph.D.-granting institutions according to various fields, relying on data such as book and journal publications, journal citation rates, federal grant dollars, and honors and awards. CU was ranked in the top ten in both atmospheric and oceanic sciences. Only two other AAU public universities, the University of Washington and Rutgers University, were ranked in the top ten in both sub-disciplines. In a comparative ranking published in 2005 by the Bulletin of the American Meteorological Society, ATOC was ranked 5th out of 29 departments for faculty funding. An NCAR study of citation rates over the past ten years in the geosciences ranked CU sixth in the world, with ATOC being a major contributor. ATOC faculty also have won many prestigious university, national, and
international awards, including the NSF young investigator award in 2009. Another ATOC faculty member was recognized by the UN’s Environmental Program for contributing to the 2007 Nobel Peace Prize won by the IPCC and Albert Gore, Jr.

The predecessor of ATOC was the Program for Atmospheric and Oceanic Sciences (PAOS), which was established in 1992. At that time, PAOS began offering a graduate certificate in Atmospheric and Oceanic Sciences within the framework of the Department of Astrophysical, Planetary and Atmospheric Sciences (APAS). PAOS became an autonomous academic unit in 1997 when APAS split into two independent programs, PAOS and the Department of Astrophysical and Planetary Sciences (APS) The two programs shared common M.S. and Ph.D. degrees. Each unit tenured its own faculty and administered its own teaching and research program. In 1998, an undergraduate minor in atmospheric and oceanic sciences was implemented. PAOS became ATOC in 2005.

III. HISTORY OF PROGRAM REVIEW

The last program review was in 2001, prior to the establishment of ATOC as a department. At that time, key stated goals were for the program (PAOS) to be transformed into a department and for the unit to have contiguous space, including laboratory space. Although now a department, ATOC still faces the same space problems. ATOC has participated in building planning exercises since that time, but it has not made significant progress towards having contiguous space. ATOC faculty are dispersed across nine different locations. The recent self-study advocates that the geosciences building project move forward more quickly, as that building is intended to provide space for ATOC.

Another issue cited in the 2001 review that seems to remain problematic is the source of funding for administrative staff. The 2001 review notes that Indirect Cost Recovery (ICR) funds were used to pay for staff costs, which remains a concern in the current self-study.

IV. ATOC IN A CAMPUS CONTEXT

Faculty

ATOC’s thirteen faculty members have close ties to several campus institutes and national laboratories located in Boulder. The department has relied on a strategy of hiring in conjunction with campus institutes, a strategy it considers beneficial for both the institutes and the department because it gives the department access to campus initiatives while strengthening the institutes by adding faculty and the graduate students who assist them. The self-study indicates that ATOC plans to continue with this strategy for hiring faculty.

The department also embraces a strategy of hiring for broad interdisciplinary coverage rather than for building depth in particular areas of specialization. Areas currently investigated by ATOC faculty include hurricanes and tornadoes; climate change in the upper atmosphere; oceans and climate change; chemistry of the changing atmosphere; wind energy; clouds, aerosols and
climate; sun and climate; fundamental fluid dynamics; climate and the water cycle; and changing polar climate.

**Undergraduate education**

ATOC offers an undergraduate minor but no undergraduate major. The department also offers several undergraduate courses in atmospheric and oceanic sciences that are a part of the university’s core curriculum.

**Graduate education**

ATOC offers M.S. and Ph.D. degrees in atmospheric and oceanic sciences.

**Assessment**

Since the last review period, ATOC has established a curriculum committee that provides departmental outcomes assessments and recommendations. Metrics include student fellowships and awards and student placement.

**Space and Facilities**

The thirteen ATOC faculty are located in nine separate locations, the majority being on four separate floors and in two wings in Duane Physics. The administrative staff are located in Folsom Stadium, where the teaching offices of two faculty members (who have laboratories that are not on the main campus) are located. First-year graduate students and TAs are also located in the stadium.

The self-study identifies current and potential future problems with laboratory space. Although currently available laboratory space is considered adequate, concerns have been raised about future needs in light of funding proposals for new research. Also, ATOC needs and currently lacks access to a laboratory on the main campus with a fume hood to handle chemical fumes, without which it will be difficult to hire faculty who do experimental work in atmospheric chemistry.

**Diversity**

Although ATOC has only 13 faculty members, the department has been successful in building a diverse faculty. As of January 2010, 46% of ATOC’s TTT faculty were women while NSF data indicate that women comprise only 24% of the atmospheric science Ph.D.s nationally. Two ATOC faculty are members of minority populations (one Native American and one Asian).

Of the 104 graduate students who have enrolled in ATOC M.S. and Ph.D. programs since 2001, 46% have been female and 9.6% minorities. Since 2001, 39% of the 155 undergraduate minors have been female; 10% have been from minority populations.

Twenty ATOC students have completed the Ph.D. since 2001, 40% of whom were female and 10% minorities. Currently, 49% of the students enrolled in the Ph.D. program are female and 11% minorities. According to the self-study, all of these figures are above the national averages. ATOC boasts success in retaining and graduating female and minority students. CU’s undergraduate population is about 14% students of color, 60% of whom graduate by their 6th summer after matriculation. ATOC minors are approximately 10% minority students, with 88% completing their minor after declaring it. Although a smaller percentage of ATOC minors are
female than is the case in Arts and Sciences generally, women students in ATOC complete the minor at a higher rate than male students (58% versus 55%).

Overall, the department demonstrates a clear commitment to diversifying its faculty and student body, availing itself of the many campus and national resources used for this purpose (e.g., National Science Foundation) and actively promoting diversity through collaborative efforts beyond CU.

V. ATOC IN A DISCIPLINARY CONTEXT

As its name suggests, the Department of Atmospheric and Oceanic Sciences is conceived as an interdisciplinary unit. As the self-study notes, although the department only awards one degree title, student projects range widely across atmospheric science, oceanography, glaciology, paeloclimate, and climate studies, involving observation of and theorizing about and/or modeling chemical, physical, and biological processes.

The range of faculty research interests listed above is indicative of a clear commitment by the department to maintaining a broad interdisciplinary approach rather than depth in specific areas. This commitment has driven its past hiring strategy, and it also explains the reasoning behind the broad range of specializations identified in the self-study’s stated plans for future hiring.

VI. ANALYSIS

By all accounts and without question, ATOC is a major asset among CU’s science departments. Its small size should not be viewed as the measure of its value, its influence, or the rich intellectual and public policy ferment to which it is recognized widely as a major contributor. The scientists of ATOC contribute to a very wide range of influential research journals. They also have a significant presence at some of CU’s world-class research institutes and at Boulder’s prestigious national laboratories. As one of the top-ranked atmospheric and oceanic sciences departments in the country, ATOC is a leader in its field, and it is well-positioned, both intellectually and geographically, to continue to build on its record of national distinction.

Surprisingly, despite the unqualified praise and recognition ATOC deservedly receives, ATOC’s identity and, by extension, its continued viability as an academic department, seem precarious. The IRC and the ERC both indicate concerns about the absence of a clear identity for the department on the campus. The major reasons given for this problem seem to be the lack of contiguous space and the absence of a clearly articulated vision and mission for the department. These apparent problems are summarized briefly below.

Space issues: The fact that ATOC faculty represent a very diverse range of interdisciplinary interests and are affiliated with several different institutes and laboratories only compounds the problem of a lack of contiguous space for forging and maintaining a cohesive intellectual community. As an example, the self-study notes that graduate students have some difficulty
learning about the research opportunities at the different institutes because of the lack of contiguous space and consequent limited contact with peers and professors. As the self-study states, “It isn’t so much the quantity as it is the quality of space. ATOC needs more co-location of faculty and laboratories in order to function as an academic department.” The ATOC self-study reflects optimism, but also anxiety, about the future of building plans in the geosciences, plans that seem to be viewed as a necessary means to resolving the problems of the present dispersal of ATOC faculty and graduate students.

It should be noted that a geosciences building has been planned for the east campus and will include space for ATOC:

http://www.colorado.edu/masterplan/history/Documents/East%20Campus/ECVfinaltask%20force%20reports.pdf

**Departmental mission, vision and identity:** There appears to be a significant discrepancy between ATOC’s stated commitment to being broadly rather than narrowly interdisciplinary in its approach to hiring and research agendas, on the one hand, and the sense made of that commitment by the ERC on the other. According to the ERC, ATOC has been handicapped by its commitment to making joint hires with the institutes. The ERC seems to view the unit’s approach as too haphazard and driven too much by externalities such as institute demand rather than by a faculty consensus about how the department wishes to distinguish itself. The ERC recommends discontinuing the current strategy for joint hires and instead making future hires solely within A&S.

Like the ERC, the IRC is critical of ATOC for lacking a clear identity and mission. The IRC’s report suggests that ATOC is in jeopardy because the broad range of its expertise is “shared by many other departments such as chemistry, geology, engineering, and environmental science, which makes establishing their identity more difficult.” In other words, by refusing to make a strategic commitment to depth and distinction in particular problem areas (example.g., climate change), ATOC puts itself at a disadvantage. This diffusion of focus seems to explain the IRC’s claim that ATOC has been “fighting an uphill battle” to obtain the resources it needs to run its department more effectively.

In its response to the IRC report, ATOC acknowledges that perhaps it should increase efforts to communicate its mission more effectively. However, this response does not adequately address the prior concern about the strategy (or lack of one) that ATOC has for defining its mission and vision in the first place. The point is not to downplay the importance of communication about a vision and mission. ATOC’s investment in appropriate communication strategies will be important not only to improve vitality within its own internal community of faculty and students but also to increase the unit’s effectiveness in making the case for meeting its stated unmet operational needs and achieving its goals for expansion. But the prior question about what exactly is to be promoted must be answered first, and both the internal and external reviews have raised doubt about whether that question has been answered satisfactorily.

Other issues that seem less urgent but are important and worthy of continued attention by the Department, the College of Arts and Sciences, and the Campus, are as follows:
Teaching Assistants: The self-study indicates that ATOC plans to maintain its current reduced number of labs if the university is unable to provide funding to increase the number of TAs. This issue also is tied to the question of whether ATOC should offer an undergraduate major.

Undergraduate major: ATOC indicates an interest in developing an undergraduate major, but it also intends to approach any such plans cautiously, pending its own assessment of its present capacities in light of what it argues are the needs (particularly in the form of staffing, TAs, and TTT faculty) that must be met in order to properly service an undergraduate major. The ERC notes that ATOC is in the “top tier” of atmospheric and oceanic sciences department, which is impressive, given the small size of the faculty. However, ATOC argues the case that it cannot offer an undergraduate degree with the number of faculty it currently has. It is unclear whether ATOC needs more faculty to offer an undergraduate major. Nor is it clear from the self-study that the campus needs an undergraduate major in atmospheric and oceanic sciences or, alternatively, what a more specific focus of an ATOC undergraduate major would be.

Mentoring of junior faculty: According to the self-study, the department chair is expected to meet regularly with young faculty members on an informal basis to discuss progress and identify problems. The department also recently began monthly meetings with all faculty “to address specific problems that young faculty members encounter” with teaching, research, and grant-writing. Junior faculty are encouraged to avail themselves of teacher training resources, such as FTEP.

The department does not, however, have a formally organized program for mentoring junior faculty. The self-study explains that a formal program is “not productive” and that “faculty members must be self-motivated to be successful.” Instead, the department encourages young faculty “to build their own informal mentoring relationships.” Because not all junior faculty are equally skilled at accomplishing this goal, not having a mentoring policy that places at least some responsibility on senior faculty to assist with or take an interest in mentoring junior faculty appears risky, especially given ATOC’s lack of contiguous space. The absence of formal mentoring could be a threat to retention.

VII. RECOMMENDATIONS

To the unit:

1. Review the range of faculty research interests and activities and produce a mission statement that reflects the department’s greatest strengths and informs a long-range hiring strategy. Through this process, it may become possible to promote the department more effectively as a coherent unit rather than simply a collective of highly successful entrepreneurial scientists who are dispersed not only physically but intellectually.

2. Produce a plan for formal mentoring of junior faculty.

3. Require that all new TAs take the Graduate Teacher Program’s fall orientation prior to being permitted to assist with undergraduate teaching. Because most first-year graduate
students in ATOC serve as TAs, and given that some if not all are likely to have no prior teaching experience, they should be given basic training about pedagogical theory and practice.

4. *Invest in a web resource for departmental graduate students to identify research opportunities at the various institutes and laboratories.* This is a relatively low-cost solution to the current problem of a lack of contiguous space where such information would be transmitted through word-of-mouth among peers and professors, and it ensures all graduate students equal access to such vital information.

5. *Make all necessary modifications to the departmental bylaws to ensure the rights and responsibilities of instructors, in accordance with the guidelines provided by the August 13, 2009 memorandum entitled “Academic Affairs Takes Action on BFA Instructor Task Force.”*

6. *To co-locate ATOC faculty more effectively, consider trading space with other units on campus.* In the process, efforts should be made to find ways to move faculty closer to the department’s administrative offices.

7. *If ATOC faculty wish to offer an undergraduate major, explain what the focus of the degree would be. Alternatively, consider strategies for integrating ATOC’s undergraduate curriculum with existing majors.*

To the unit, college, and campus

1. *Evaluate the benefits and disadvantages of hiring faculty on split appointments with institutes.*

2. *Assess the sources of staff needs and costs, specifically with respect to teaching versus research, and determine whether the campus is contributing at an appropriate level for undergraduate and graduate support needs.*

To the college and campus

*Clarify plans for a geosciences building and work with ATOC to improve its space problems in the interim.*

The chair of the Department of Atmospheric and Oceanic Sciences shall report annually on the first of April for a period of three years following the year of the receipt of this report (e.g. April 1st of 2012, 2013, and 2014) to the dean of the College of Arts and Sciences and to the provost on the implementation of these recommendations. Likewise, the dean shall report annually on the first of May to the provost on the implementation of recommendations addressed to the college. The provost, as part of the review reforms, has agreed to respond annually to all outstanding matters under her/his purview arising from this review year. All official responses will be posted online and made available for university community comment.