

**Department of Atmospheric Science  
Academic Plan (2009-2014)**

**Mission and Aspirations:**

The Department of Atmospheric Science (ATSC) in the College of Engineering and Applied Science will provide excellent education, research, and service in our discipline. ATSC faculty and staff have established an international distinction for excellence in the following areas: cloud and aerosol physics and chemistry, boundary layer processes, stratospheric aerosols and gases, and airborne/balloon-borne instrumentation and observing systems.

Our goal is to maintain and build upon these strengths with a significant effort to focus on two themes: 1) keeping our faculty engaged with our airborne observing facilities (aircraft and balloon), maintaining their state of the art capability, and being responsive to scientific community, state and national needs, and 2) developing new capabilities and expertise in the areas of climate change.

**Relevant Institutional Issues:**

ATSC continues to broaden its program (*Creation of the Future 3*, Motifs 1 and 4) with the addition of faculty in atmosphere-biosphere interactions, and plans to add a cloud-precipitation modeling component to our program; complementing and building upon existing strengths in the area of “environment and natural resources” (Motif 2 and 4). The modeling position takes advantage of UW’s expertise in the area of computational science. We are proposing to use the NSF/UW/NCAR petascale computer to be built in Cheyenne and the joint appointments with NCAR. One consequence of this is expanding student opportunities for hands-on experience with high performance computing. One component of our plan is to increase involvement of the department with State of Wyoming issues (Motif 5 energy and technology) in the area of water resources (particularly the weather modification program), air quality and wind energy through the Wind Energy Research Center (WERC).

We are continuing investigations into the replacement of our premier facility, the King Air Research Aircraft. This not only addresses the UP3 goal of building excellence in research infrastructure, but also emphasizes our commitment to maintaining a state-of-the-art research capability on the UW campus.

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**Action Items:**

**Goal 1: Develop and maintain core strengths**

ATSC is unusual in the sense that it has developed around a core objective of excellence in airborne atmospheric observing facilities. To keep these facilities scientifically relevant, competitive, and state-of-the-art, we need to maintain a critical mass of faculty who share hands-on interest in airborne observations. Our goal here is to retain existing faculty, and to recruit new faculty with the scientific and hands-on interest to maintain and develop these capabilities, especially in anticipation of several retirements over the next 5-10 years.

- a) Aircraft: Over more than three decades, the research aviation theme has attracted faculty and staff specialized in airborne instrumentation and observing because of the opportunities

- provided by having an in-house aircraft We are now one of the few universities with this type of facility, which has grown in scope and sophistication such that we are entering our 22<sup>nd</sup> year of operation as an NSF National Lower Atmospheric Facility.
- b) Scientific ballooning began at the University of Wyoming in 1971 under the direction of Professors Jim Rosen and Dave Hofmann, Department of Physics and Astronomy. Since 1991 this program has continued measurements in Laramie and Antarctica under the direction of Terry Deshler in ATSC. UW is one of three sites in the United States (the only one at a university) which continue to conduct atmospheric research using balloon-borne instruments. The measurements from Laramie cover almost 4 decades and continue to provide a unique record of stratospheric aerosol over that period. This record is still used by the scientific community to understand stratospheric chemistry which has implications for climate change. This capability—differing from the King Air since it is not a facility effort, but the effort of one principal investigator—is highly developed and requires continued faculty involvement to remain scientifically relevant and of high quality.

Action item: Initiate an external review each 7 years of departmental research and educational productivity and priorities --first being Fall 2009).

### **Goal 2: Build ties with UW climate community**

Recruitment of the Wyoming Excellence Chair in Atmosphere-Biosphere Interactions proceeded this year to the selection of a very strong, senior-level candidate. While this position became frozen because of the economic downturn, we assume that it will be filled during the next year or so pending easing of the economic downturn. This senior-level position, funded at a 75% ATSC, 25% RR level, will have a large impact on the department's focus both in the research and educational areas and will also require significant startup needs in terms of facility and engineering support continuing over the first three years of the UP3 period.

A second mechanism to strengthen ties to the climate community is ATSC's SOLPIN initiative within the NSF/EPSCoR proposal will further extend ATSC's research reach. The impact of this 5-year project on the department is large in terms of equipment and funding for faculty, staff and students. Also, it will be to reinforce the cloud-precipitation modeling initiative (Goal 4), to update the cloud physics measurements on the King Air, and also to add an ESS director position.

These research areas will be in the context of the ESS degree initiative, and are expected to focus on in situ and remotely sensed atmospheric data and integration into regional-scale climate models. The educational impact will be mostly in the ESS program where most of the ESS director's teaching will be focused. This goal ties into UP3 Motifs 2 and 4 in building upon existing strengths in the environment and natural resources areas.

### **Goal 3: Earth System Science program development**

The new undergraduate interdisciplinary program in Earth System Science (ESS) was begun with our leadership and gained Board of Trustee approval in Spring 2004. Our effort to develop the ESS/ATSC concentration is well underway. As the program attracts increasingly larger numbers of students, the lack of an administrative home becomes increasingly problematic even though the College has taken on some of the recruitment and advising functions. We plan the following actions:

- Increase enrollment in ESS/ATSC concentration to ~15/year in 5 years
- Recruit an ESS Director (AP senior research scientist or lecturer), initially with funding from the NSF/EPSCoR project titled Earth System Interactions in Complex Terrain program in which the ESS educational initiative plays a significant role.

- Continue to develop ESS/ATSC curriculum and assessment strategy
- Ease out of ES participation

#### **Goal 4: Cloud-precipitation modeling**

ATSC has been mostly focused on atmospheric observation, but the NSF/NCAR/UW petascale computing center to be based in Cheyenne has motivated us to seek a stronger modeling component in the department, building upon our strong expertise in the cloud observational area. This person will be working with NCAR modelers to improve the parameterization of cloud processes such as ice nucleation and warm rain growth in weather and climate models, mainly using data collected on the UWKA. Such efforts will require massively parallel computing such as planned for the Cheyenne facility. One possibility that will be explored will be the joint UW/NCAR positions that are tied to this new computer with the majority share of such a joint position being with our department.

#### **Goal 5: UWKA facility replacement**

The UW King Air is over 30 years old, and there is concern about the airframe fatigue lifetime given the highly turbulent research missions that have been flown in this period. We seek to replace the airplane with a twin-turboprop aircraft of similar size but a bit more expanded capabilities, maintaining our low altitude, short range, rapid deployment observing niche in the NSF lower atmospheric research facility aircraft fleet. The groundwork for this is to be developed in the following stages:

- Study fatigue life of existing airframe (subcontract)
- Study availability of production twin-turboprops (subcontract)
- Upgrade our in situ cloud physics probes in preparation for new aircraft, including flow modeling to study particle sorting, flow distortion, and drag issues.
- Conduct community workshop in Laramie to explore community needs.
- Develop funding plan.

#### **Goal 6: Build on service to State**

The departmental expertise in clouds, aerosols, and chemistry will be made more available to the State. Examples of current department collaborations are: a) providing the Wyoming State Water Commission expertise in weather modification project design and evaluation as well as airborne and ground-based observing of cloud properties; b) providing the State Department of Environmental Quality expertise in air quality issues in the Pinedale region; and c) continuation of studies of wind resource assessment and forecasting to facilitate wind energy development efforts. ATSC plan to be attentive to these areas and how it can serve the State.

**Implementation Time Line:**

<b>Goal</b>	<b>Timeline</b>
1. Develop and maintain core strengths	
a. ATSC external review	Fall 2009?
2. Build ties with UW climate community	
a. Recruitment	Faculty start AY2010?
b. Infrastructure	Complete end AY2011
3. ESS development	
a. ESS director	Recruit AY2010
b. Increase enrollment	
4. Cloud-precipitation modeling	
Faculty hire	Start AY2011
5. Replacement research aircraft	
a. Instrument upgrades	5 year development (through 2014)
b. Airframe life study	Spring 2009
c. Airplane selection study	Spring 2009
d. Community workshop	Fall 2010
e. Funding obtained	?
6. Service to State	Ongoing

**Previous Planning Accomplishments:**

<b>Action Item (2004-2009 plan)</b>	<b>Status</b>
ATSC will work through the Colleges to develop the plan to implement the UESS degree program and the allocation campus-wide of 3-5 faculty positions to support the UESS start-up during the period 2004-2009. It recommends that one position be associate UESS director, and be responsible for recruitment, advising, and internship management.	This proposed degree program is one of the Action Items within the University Academic Plan. An ESS steering committee was established under direction of R. Kelly which submitted a proposal to AA which the Board of Trustees approved in May 2004. Currently there are ~20 ESS majors in all concentrations.
ATSC seeks to build strength in the area of climate dynamics.	We responded to the NSF/EPSCoR RFP for faculty recruitment in the area of “climate ecology”, and made CPM requests (3/4 ATSC and 1/4 Renewable Resources) for a position in 2006 and 2007. The second try was successful with Wyoming Excellence Chair. AY07-08 search resulted in offer that was declined. Renewed search for “atmosphere-biosphere interactions” this year is aimed at larger applicant pool, and was successful in selecting a senior-level, high visibility candidate. Unfortunately, this position has been frozen because of the economic downturn.
ATSC work with the Engineering Dean to withdraw from participation in the Engineering Science program.	This goal is pending further building of the ESS/ATSC undergraduate major.
ATSC will revise its graduate program curriculum, and have this in place for Fall 2004.	This has been completed, and AY06-07 was the first year of implementation of the new curriculum.

ATSC will seek to increase the number of students in its graduate degree program with emphasis on PhD production.	New emphasis is in place, with partial success (presently 21 students, 43% PhD and 43% women). Main obstacle is inability to recruitment sufficient number top-level students
ATSC will implement a routine assessment of the results of its MS and PhD program including surveys of recent graduates as discussed above.	Not completed. Database of past students has been obtained from Foundation, and questionnaire will go out this Fall.
ATSC will seek to recruit scientific staff to the goal of increasing research productivity. Recruitment will be in the areas indicated in the above discussion, and will include both research scientists and post doctoral researchers. Funding will come from external grants and departmental resources.	Presently there are six research scientists and post-docs working for department PI's. Emphasis to increase PI productivity continues.