

AOSS Strategic Plan 2008 – 2013

PREAMBLE

In the next five years the University of Michigan will undergo a dramatic transition. President Coleman's interdisciplinary faculty initiative will not only create 100 new junior faculty lines in interdisciplinary research and teaching, but it is reasonable to expect that it will also shift the "regular" hirings in the various Schools and Colleges towards more interdisciplinary cluster hires.

One of AOSS' most unique strength is that it is an inherently interdisciplinary department. It is a nexus department that can facilitate broader university interdisciplinary initiatives. This interdisciplinary nature of AOSS is at the heart of this strategic plan.

AOSS MISSION STATEMENT

The mission of AOSS is to be a world-class academic department for the study of the atmosphere and space as components of a complex integrated system. AOSS wants to be known for the quality of its research and education.

AOSS supports and facilitates interdisciplinary research and education across the entire University of Michigan plays a major role in the mission of the entire university and in particular of the College of Engineering.

AOSS STRATEGIC GOALS

1. To make a meaningful contribution to the educational mission of the University of Michigan and the College of Engineering.
2. To be recognized as foremost in the College of Engineering and the University of Michigan for the quality and quantity of its research, relative to its size.
3. To be a world leader in a broad range of space and climate research disciplines.

4. To facilitate interdisciplinary research and education in climate change and space exploration across the entire University of Michigan.

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AOSS TACTICAL GOALS FOR 2008-2013

1. Be the best space science department among US universities.
2. Play a central role in unifying climate activities at the University of Michigan and thus establish the University as a premier institution in the integrated study of climate change (including sustainable energy sources).
3. Be the leading department at the University of Michigan in space hardware development and support extreme environment instrumentation across the university.
4. Be a leader of hands-on engineering education in the College of Engineering and in the nation.
5. Increase the AOSS student enrollment to 200 (75 undergraduates, 50 SGUS/MS/MEng, 75 PhD)
6. Stabilize the externally funded research volume above \$20M/year (2008 dollars)

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INTERDISCIPLINARY RESEARCH AND EDUCATION

AOSS is an unconventional department in the College of Engineering. While the department's roots are in traditional engineering disciplines (high-altitude studies in Aeronautical Engineering, vacuum tube research in Electrical Engineering and air quality work in Civil Engineering), today AOSS primarily focuses on interdisciplinary studies of climate change, the space environment and their implications for solar system objects. In addition AOSS has significant strength in other important research areas, such as air quality, atmospheric chemistry, high energy-density physics, and comets, just to list a few.

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In the last five years AOSS has made significant investments in climate research. The addition of

Richard Rood, Natalia Andronova, Xianglei Huang, Christiane Jablonowski and Allison Steiner has put the department among the top tier of his field. Our goal, however, goes beyond just building a strong climate department. We recognize that the success of interdisciplinary university-wide climate and energy programs require active participation from AOSS. As it will be discussed later, this recognition drives our priorities for T&TT faculty hires in the next five years.

AOSS is among the strongest space science departments in the world. This is another interdisciplinary field that has major impacts on both research and education across the CoE and the university. Space weather is evolving into a broad discipline integrating basic space science, space engineering, biomedical engineering, radiation shielding, energy production and distribution. It looks at the space environment, technological systems and humans working in this environment as a complex system that needs a highly interdisciplinary approach.

AOSS is a leader in hands-on teaching that provides students from throughout the College with important practical experiences. The MENG program in space engineering (joint with Aero) is interdisciplinary and it is based on the experience and capability to teach the actual practice of building space systems.

In the next five years we will focus our investments in areas where the interdisciplinary impact is the largest. We will try to take maximum advantage of the university-wide interdisciplinary faculty hire initiative to accomplish our goals and contribute to the broad initiatives of the CoE and the University of Michigan.

In light of the above considerations we are going to focus our faculty hires in two areas:

- Climate change
- Space weather

CLIMATE RESEARCH

The publication of the IPCC Report in 2007 and the subsequent infiltration of this report through the nation and world will fundamentally change the role of scientific investigation of the climate. Climate information will be in greater demand by many

elements of society. It will be imperative for scientists to adapt to this new reality – a reality that is evolving.

We expect that climate science will split in two basic directions:

- Research to investigate the basic understanding of climate change, and
- Scientific investigations to serve questions raised by other communities.

This bifurcation of climate science offers great opportunities to AOSS, the CoE and the University of Michigan. Our specific goals in the two areas are the following:

- To create an internationally recognized physical climate program at the UofM in close coordination with other departments (CEE, Geology, etc.).
- To help the UofM become a world-class institution in providing climate information for other communities (policymakers, social scientists, business community, etc.).

In order to accomplish these goals we will invest in both physical climate studies and climate response/adaptation efforts.

Physical Climate

The department in partnership with other departments needs to complement the existing capabilities to represent the physical climate system. Within AOSS the atmospheric capability is strong, and ocean is represented only by the interests of John Boyd. Atmospheric chemistry and biogeochemistry is strong. There are oceanographic interests in other departments, but we are not well integrated to address, collectively, coupled problems of climate change. The cryosphere is not represented, and there will be much activity in cryospheric science in the next five years. ~~Land-use and atmosphere-land interactions are not adequately represented.~~

We will follow two strategic elements:

- Strengthen the relationship with Geology, and cluster hire researchers in cryospheric and oceanographic sciences.
- Recognizing that weather is the interface of climate with the day-to-day world, hire researchers in regional weather-climate and atmosphere-land surface interactions.

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The main focus areas of AOSS are

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Response and Adaptation to Climate Change

The definitive nature and acceptance of the IPCC report will fundamentally change the scientific investigation of climate. There will be demands for climate information for adaptation. There will be a need to carry out numerical experiments to investigate strategies for global geo-engineering. There will be diverse demands on weather and climate data from fields such as public health, agriculture, energy. The relationship of weather and climate information to policy is less direct, but important. We need to position ourselves with the ability to perform research in weather and climate, and the ability to integrate their research with other fields as both collaborators and leads on applied research topics.

We think that the prime focus of climate science will shift away from physical sciences to the use of knowledge from physical science-based investigation by other fields. It will be necessary for the physical scientist to think of providing the best climate knowledge, climate information at any particular time, for a particular application together with its uncertainty. We have the opportunity to be leaders here.

The following specific topics are proposed as of potential interest:

- Regional climate and regional climate change (esp. Great Lakes?)
 - Water resources
 - ✓ Energy
 - ✓ Agriculture
 - ✓ Fisheries
 - ✓ Ecosystems
 - ✓ Human consumption
 - Environmental Impact
 - ✓ Water engineering projects
 - ✓ Alternative energy
 - ✗ Hydroelectric
 - ✗ Wind farms
 - ✗ Ethanol (biofuels) and land-use
 - ✓ Coal-fired electricity
 - ✗ Air quality and public health
 - ✗ Cost of coal emissions
- Weather and climate
 - Extreme weather and drought and floods

- Changes in dynamics and predictability in a warm-wet atmosphere
- Adaptation to climate change
 - Water for energy
 - Impact of changing snow cover
 - Water management (drought-flood) cycles
- Climate change and public health
 - Heat waves
 - Air quality
- Global geo-engineering

Five Year Plan

AOSS has significant strength to play a leadership role in meeting both the physical climate and the climate response/adaptation goals.

In order to meet the goals outlined above we need to hire a minimum of three additional T&TT faculty in the climate research area. Additional hires (beyond the three described below) need to be done in the collaborating departments in CoE, LS&A, SNRE, SPH and other units of the University of Michigan.

The three faculty to be hired in AOSS should be outstanding researchers in the following areas:

- Regional weather-climate modeling (possibly Great Lakes area),
- Atmosphere – Land surface interactions, and
- Cryosphere – Atmosphere interaction.

In addition, we should participate in proposals to President Coleman's interdisciplinary faculty hiring initiative and work with other units to add faculty in the enabling research for the Great Lakes Water Management toolkit.

SPACE WEATHER

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EDUCATION

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