Report on the site visit to Dartmouth College

On behalf of the University Corporation of Atmospheric Research (UCAR) Membership Committee, Tom Bogdan and Todd Sikora (hereafter referred to as the evaluation committee) visited Dartmouth College on April 15, 2015 to evaluate its application for UCAR membership. Dartmouth is one of the oldest universities in the United States (founded 1769) and is a member of the Ivy League.

Upon arrival to Hanover, NH, on April 14, the evaluation committee was treated to dinner by Smith Professor of Physics, Mary Hudson, and Research Professor John Lyon. Professors Hudson and Lyon are members of the Department of Physics and Astronomy. Professor Hudson served as the primary ambassador for the evaluation committee’s site visit.

The site visit began on the morning of April 15 in Wilder Hall, home to the Department of Physics and Astronomy, with opening remarks by Tom Bogdan. Bogdan briefly commented on the benefits of UCAR membership to a small group including Professor Hudson, several post-doctoral scholars, several graduate students, and F. Jon Kull, Dean of Graduate Studies. Dean Kull then provided an overview of research at Dartmouth, and stated that the college is experiencing a “time of change” in the context of research in which Dartmouth is shifting its focus toward fostering multidisciplinary studies. One corresponding initiative is the cluster, interdisciplinary faculty teams which focus on an area of interest. Dartmouth is committing approximately $150M to hiring cluster faculty. One UCAR-related cluster is Ice, Climate, and Energy which involves the Thayer School of Engineering, the Earth Science Department, and the Institute of Arctic Studies. Each of those organizations is described in more detail below.

Throughout the remainder of the day, the evaluation committee met various members of the Dartmouth community representing the college’s various UCAR-related programs of study: Department of Physics and Astronomy, Thayer School of Engineering, Department of Earth Sciences, Department of Geography, and Institute of Arctic Studies. For each meeting, Tom Bogdan provided an overview of UCAR, the evaluation committee was briefed on the program’s UCAR-related research, and related questions were asked and answered. One common theme among the programs of study is the strong commitment to teaching and research mentoring at both the graduate and undergraduate level.

Program of Studies and Research

Department of Physics and Astronomy

The Department of Physics and Astronomy was represented by Professors Hudson and Lyon as well as Professor Kristina Lynch and Associate Professor Robyn Millan. The Department of Physics and Astronomy’s UCAR-related program of studies and research is in the field of space physics. The department has 22 faculty members, seven staff members, 27 undergraduate students, and 59 graduate students. Over the last five years, the department has granted 71 A.B. degrees, 13 M.S. degrees, and 32 Ph.D. degrees. Approximately 2/3 of the department’s faculty participate in UCAR-related research and approximately 1/3 of the graduate degrees cited above were for UCAR-related research.
Examples of recent department research activities include the development of a community model of solar wind interaction with the magnetosphere and balloon-based radiation belt experiments in coordination with the Van Allen Probes. Department faculty and students have collaborated with scientists from the NOAA Space Weather Prediction Center and NCAR’s High Altitude Observatory (HAO). Moreover, department faculty have served on high-level science committees such as co-chair of the NAS/NRC Committee on Solar and Space Physics.

Department facilities include smart classrooms and access to Dartmouth’s 2400+ Linux cluster. The department also has 25% time access to telescopes at the MDM Observatory near Tucson, AZ, and 10% time access to the South African Large Telescope. The department, as well as the remaining programs of study, benefit from a recent upgrade of campus connectivity via the NSF Campus Cyberinfrastructure – Network Infrastructure and Engineering Program. Associate Professor Millan gave the evaluation committee an insightful tour of the laboratory spaces for the balloon-based research mentioned above.

Thayer School of Engineering

Of the 51 faculty within the Thayer School of Engineering, six conduct UCAR-related research. The evaluation committee met with three faculty in Cummings Hall – Sherman Fairchild Professor of Engineering Ian Baker, Assistant Professor Rachel Obbard, and Associate Professor Simon Shephard. Between 2010 and 2014, the school granted 420 bachelor degrees, 274 masters’ degrees, and 74 doctoral degrees. Approximately 10 to 15 percent of the graduate students conduct UCAR-related research. UCAR-related research areas include geospace science; glaciology and climate; ice, snow, and firn science; climate and economic linkages; and environmental fluid mechanics. Collaborations exist between school personnel and other Dartmouth faculty (e.g., those within the Department of Physics and Astronomy) and with scientists at the nearby Cold Regions Research and Engineering Laboratory. The school possesses a 170,000 square foot facility for research and instruction. Specific facilities include an ice research laboratory and an HF radar laboratory.

Department of Earth Sciences

The Department of Earth Sciences has 11 faculty members. In the last five years, it has granted 53 B.A. degrees, 25 M.S. degrees, and five Ph.D. degrees. Faculty and graduate students conduct research on environmental geochemistry, environmental change in high latitude/high altitude settings, and watershed processes. Introductory instruction is focused on climatology and meteorology, hydrology, and oceanography. Areas of advanced instruction are environmental geochemistry, geophysics, environmental fluid dynamics and hydrology, and climate dynamics.

Department facilities include geochemical research laboratories, and equipment for field studies in glaciology, ice chemistry, hydrology, and geophysics. During the site visit, the evaluation committee met with Assistant Professor Erich Osterberg in the Sherman Fairchild Physical Sciences Center. Professor Osterberg provided an informative tour of an ice core analysis laboratory.
Department of Geography

The Department of Geography, located in the Sherman Fairchild Physical Sciences center, contains 12 faculty members and 60 undergraduate students. The evaluation committee met with the three faculty who most align with UCAR-related fields of study: Professor Francis Magilligan and Assistant Professors Jaclyn Matthes and Jonathan Winter. Although the department does not grant graduate degrees, faculty may hold adjunct appointments with other Dartmouth departments that do. Thus, Department of Geography faculty can advise graduate students. UCAR-related research is conducted in the areas of fluvial geology, ecosystem-atmosphere interactions, and applied hydroclimatology.

The department houses two computer laboratories. Those are the 26-machine Rahr Computer Laboratory, designed for GIS and data analysis applications, and the 10-machine Citrin Family GIS/Applied Spatial Analysis Laboratory. The department also possesses field equipment, such as GPS units and ocean optics sensors.

Institute of Arctic Studies

The Institute of Arctic Studies fosters interdisciplinary research and teaching in polar studies. The Institute does not have dedicated faculty lines, but its director is Myers Family Professor of Environmental Science Ross Virginia, who met with the evaluation committee during lunch. Professor Virginia was instrumental in Dartmouth’s receiving an NSF Integrative Graduate Education and Research Traineeship (IGERT) grant which allowed for the creation of a Ph.D. curriculum in polar environmental change. The evaluation committee met with two promising IGERT Fellows, Gifford Wong and Julia Bradley-Cook. Each intends to pursue science policy work upon graduation.

Progress in UCAR-related Sciences

Each of the UCAR-related programs of study cited above has documented recent progress in UCAR-related sciences. For example, the Department of Physics and Astronomy has been awarded nearly $9M in external funding over the last four years for UCAR-related research and its department personnel have published 135 refereed articles describing UCAR-related research over the last five years. Thayer School of Engineering faculty have published more than 100 refereed articles over the past five years covering UCAR-related research, and the school has garnered approximately $30M in external funding to support UCAR-related research. Noteworthy is Professor Mary Albert’s NSF award of $17.4M for her to lead and manage the U.S. Ice Drilling Program. The Department of Earth Sciences takes in approximately $600K per year in external funding. Over the past five years, the department has produced over 50 refereed journal articles. Members of the Department of Geography have secured several recent grants for UCAR-related research from NSF, NASA, and USDA. Finally, Professor Virginia, Director of the Institute of Arctic Studies, was recently selected by the U.S. State Department to be a partner leader of the Fulbright Arctic Initiative, an interdisciplinary research program involving 16 scholars who will collaborate on Arctic issues in the areas of water, energy, health, and infrastructure.
Participation in UCAR Activities

Despite not being a UCAR member, Dartmouth faculty members, staff, and students have been actively involved in numerous UCAR activities. Department of Physics and Astronomy and Thayer School of Engineering faculty, staff, and students are frequent visitors to the HAO, collaborating with scientists there. An HAO scientist, Dr. Roger Varney, is in residence at the Thayer School of Engineering as the 2015 Dartmouth-NASA Space Grant Visiting Young Scientist. Department of Earth Sciences students routinely attend NCAR-sponsored short courses and employ NCEP/NCAR reanalysis data in their studies. Finally, Department of Geography faculty use NCAR’s WRF model and Yellowstone.

Recommendation and Assessment of the Evaluation Committee

Mary Hudson, James Labelle, Robyn Millan, Hans Mueller, and Todd Sikora walk to lunch during the site visit (picture taken by Tom Bogdan).

The evaluation committee thanks the Dartmouth College community for being gracious hosts during the site visit. While UCAR-related activities at Dartmouth have largely been in the area of space weather research, there are clearly many other facets to Dartmouth’s scholarship and teaching that can potentially align with UCAR / NCAR. The evaluation committee thus finds that Dartmouth College fulfils the UCAR criteria for membership and, hence, recommends the college for UCAR membership.