

Facility Request Form for Educational Activities

Part I: General Information

Requestor Name	Deanna Hence
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Faculty Advisor Name (if student requestor)	

Part II: Project Description

Project Title	The University of Illinois DOW Education, Research and Outreach (UIDOW) Project
Project Location	Urbana, IL and surrounding region
Start and End Dates of Field Deployment	23 February 2016 – 16 March 2016
NSF Facilities requested (type and # of systems)	1 Doppler on Wheels
Number of Expendables requested (if applicable)	

Part III: Educational Activities Description

Number of students actively involved	Graduate: 15 Undergraduate: 50
Desired training activities conducted by Facility Staff including time in the field	Training on operation of DOW, especially if the DOW is to be left at UI without a CSWR Operator
Desired teaching activities conducted by Facility Staff including time in the field	A seminar presentation for the students and faculty would be welcome
Additional special requirements that pertain to Facility support	none
Ancillary/Oppportunistic Outreach Activities	University Students: On public display for several hours for viewing by survey classes K-12: Middle/high school visits Public: Public open house

Part IV: Operational Requirements

Please specify data access needs (e.g., real time)	Would need real-time data for use in class projects
Please specify data analysis needs	UI has software in-house for data processing
Please specify communications needs	None

The University of Illinois DOW Education, Research and Outreach (UIDOW) Project

The University of Illinois at Urbana-Champaign is requesting a 21 day (preferred dates Feb 23, 2014-March 16, 2016) campus deployment of a Doppler on Wheels (DOW) for classroom-instruction (in ATMS 410, Radar Remote Sensing and ATMS 314, Mesoscale Dynamics), outreach (We will give tours of the facility to hundreds of undergraduates in ATMS 100, General Meteorology and ATMS 120, Severe and Hazardous Weather), and research (4-6 undergraduates will use the data for ATMS 492, Capstone Undergraduate Research Experience, in Fall 2016 following the deployment).

The University of Illinois DOW Education, Research and Outreach (UIDOW) Project has three principal objectives:

1. Enhance instruction in ATMS 410 *Radar Remote Sensing*, ATMS 314 *Mesoscale Dynamics*, ATMS 505, *Weather Systems*, and ATMS 201 *General Physical Meteorology*

The primary course to use the DOW will be ATMS 410, Radar Remote Sensing. ATMS 410 is a comprehensive radar meteorology course that covers principles of radar, including conventional, Doppler, and polarization radar, precipitation measurement and microphysical interpretation of radar data, Doppler processing including VAD analysis, dual-Doppler radar analysis, radar profiling, airborne meteorological radars and spaceborne meteorological radars. A fundamental deficiency of this course in the past has been lack of access to a radar facility where students could actually see the components of a radar and operate and collect radar data. The University of Illinois recently completed a comprehensive field campaign studying nighttime elevated convection, but even here we could only expose a few undergraduates to field operations with the ground based radars because of remote distant deployments and requirements to have trained operators on site (limiting available seats in the facilities). Placing a DOW on campus would allow us to introduce an entire class of 40-50 students to radar operations in the context of active precipitation events. These data would also allow the students to exercise software such as SOLO that would allow them to experience the basics of radar processing. We can arrange to have the Lincoln WSFO scan using VCP-11 so that limited dual-Doppler data could be collected, albeit on a long baseline. We expect about 25 undergraduates and 10 graduates to enroll in the course. The course will have a teaching assistant familiar with radar processing that will help with student activities. The radar will be used to illustrate concepts taught in class such as, for example, the relationship between maximum unambiguous range, the Nyquist velocity and the PRF, velocity folding, antenna size and its impact on beam width, bright band identification, ground clutter, anomalous propagation, reflectivity in snow vs. rain, the relationship of reflectivity to precipitation rate etc. Data from the radar will also be used in class projects. The nature of these will depend on the weather and clear air conditions encountered during the deployment. The course is taught by Prof. Deanna Hence, who has used sophisticated radars in her research projects for 10 years.

In ATMS 314, Mesoscale Dynamics, we will make collaborative use the DOW to collect data on precipitating weather systems that occur during the deployment. The primary objective will be to use these data in lectures and lab exercises to better understand the meso-meteorological concepts. The data will also help illustrate mesoscale analyses, and provide the students with a

sense of field data collection on the mesoscale. When appropriate, we will combine the DOW with our departmental observing assets, which includes a radiosonde system. This course is taught by Prof. Jeff Trapp, who has authored a mesoscale meteorology textbook, and also led two DOW educational deployments while he was at Purdue University.

We expect a high level of collaboration and joint projects between the students of ATMS 314 and 410, as an opportunity for the students of each class to put what they are learning in class into a complimentary context. We also plan to have students in four other classes visit the radar, and learn how radar technology enhances forecasting, understanding of mesoscale circulations, and atmospheric processes. Professors Lasher-Trapp, Frame, Snodgrass, and Nesbitt plan to use the radar as part of their respective courses and will take selected groups of students on short deployments as part of their instruction.

2. Introduce a broad spectrum of students to state of the art meteorological radar technology

We propose to place the DOW on the University of Illinois campus near the Department of Atmospheric Sciences and give tours of the facility to our large survey classes, ATMS 100 and ATMS 120. These courses, taught by Dr. Jeffery Frame (who rode with the DOWs in VORTEX II for two years) and Mr. Eric Snodgrass (who operated and analyzed data from NCAR's SPOL radar as part of the UI led Rain in Cumulus over the Ocean (RICO) experiment), have close to 1000 students enrolled across several course sections. We will arrange for all of them to see the facility. We will introduce the facility in the classroom before hand so that the student's best utilize their time on the tour. We expect that this experience alone may draw some students toward becoming atmospheric science majors or minors.

3. Provide data for research analysis in ATMS 492 Capstone Experience for Seniors

Undergraduates in Atmospheric Sciences at the University of Illinois typically have a senior capstone research or professional experience. Formally, students register for ATMS 492 and receive 4 credit hours for this experience. We propose to use the DOW as a vehicle to conduct research experiences for 4-6 undergraduates. These students would learn to operate the radar during its stay at the University, operate during a storm during the 3-week period, and subsequently analyze the data to study some aspect of storm structure. The study would be tailored to scientific questions related to the observed storm modes. For example, if a winter cyclone passed through, the focus may be on banding; if an arctic front passed through the radar domain, the focus may be on frontal structure; if late season convection occurs, the focus may be on mesoscale structure of the observed convective system. Professors Hence, Trapp, Rauber, Nesbitt, Frame and Snodgrass would all be involved in the supervision of these students. All of these professors have worked with radar systems and each has particular complementary interests that would enhance the experience of the undergraduates working with them. The Capstone projects are a semester long. Students would register for ATMS 492 in Fall 2016, following the deployment in Spring 2016.

4. Engage the Urbana-Champaign community through outreach and education opportunities

We propose having a public open house to encourage the community to visit the DOW. As with the previous DOW deployment, we will coordinate with our local NPR (WILL) and television station (WCIA) to announce the public outreach period and to feature the DOW in their programming. Our previous experience indicates that these activities will result in a large number of visitors. We will also coordinate with campus organizations such as the STEM-FEM Alliance and other scientific and engineering student organizations to advertise to their members and to provide a wide array of opportunities for students to interact with the facility.

We also propose coordinating with local middle schools, high schools, and Parkland College for visits with the DOW. During the last visit of the DOW to the University of Illinois, the radar was taken to one middle school (Mahomet) and one high school (St. Thomas More). Through coordination with the local schools, we can greatly expand the visibility of the atmospheric sciences as a field of interest and opportunities for students to interact with scientific technology.

Feasibility Analysis

Project: The University of Illinois DOW Education, Research and Outreach (UIDOW) Project

Location: Champaign, IL

Duration: 23 Feb – 16 March 2016 (preferred; requests a 21-day period)

Requesting PI/Host: Deanna Hence

Summary: CSWR finds this request feasible and thinks that it is an appropriate use of the DOW for educational purposes. There are no known scheduling conflicts during this time period. There is a DOW educational request immediately prior, from 1 Feb to 21 Feb 2016, at Plymouth State University (Plymouth, NH). If both educational requests are approved, CSWR will coordinate efficient crewing, ferrying and scheduling between projects. This is the PI's first requested use of a DOW for educational purposes. The PI is a new faculty member (PhD 2011). The DOW previously has been used at UI for education projects (2010, 2012). The collaborating PI/requestor, Jeff Trapp, has used DOWs for education. . This request draws upon the 10 years of radar experience of the requesting PI as well as the collective radar, field, and educational experiences of several of the department faculty members in order to improve upon the successful previous DOW deployments.

Longer analysis:

The requested use is well planned. The deployed DOW would be used to enhance learning in several graduate and undergraduate courses during the Spring 2016 semester. Several of the faculty members involved in these courses have field and/or DOW experience, which will further enrich the students' learning experiences with the DOW. UI students enrolled in *General Physical Meteorology*, *Weather Systems*, *Radar Remote Sensing*, *Mesoscale Dynamics*, and *Capstone Undergraduate Research Experience* courses will assist in the deployments and data collection. Students enrolled in *Radar Remote Sensing* and *Mesoscale Dynamics* courses will assist in deployment planning, data collection, and will use the data for case studies and/or integration into other, available data sets (e.g., a University-owned sounding system, the local 88D radar). Extensive synergy is planned between the *Mesoscale Dynamics* and *Radar Remote Sensing* courses while the DOW is in residence at UI. The students enrolled in a two-semester *Capstone Undergraduate Research Experience* course (4-6 students) will be extensively involved in the planning, operation and analysis of the DOW data for their senior research project. Students enrolled in introductory level and general education meteorology courses (~1000 students) (*General Meteorology* and *Severe and Hazardous Weather*) also will learn about the DOW (and general radar principles) and have hands-on tours of the DOW.

As with all relatively short educational DOW deployments, there is a risk that the weather will not be favorable, however, given the wide diversity of potential phenomena in this area and the PI's willingness to collect data in a wide range of weather phenomena, this is unlikely.

In addition to a university-wide open house (targeting all UI students and the general public), the PI proposes several public outreach events at local K-12 schools and the local community college. Local media will be engaged in advertising outreach events, as well as featuring an informational segment on the DOW and its applications.

CSWR staff will train the PI and the students in DOW operations, data transfer, and the use of software during the deployment and will assist with verifying accurate dual-polarization calibration at the start of the project. A driver/operator will remain with the DOW. A DOW engineer will be available to travel to the University of Illinois for emergency maintenance. As needed, CSWR staff will assist the PI and students in use of radar analysis software, interpretation, and the post-processing of the radar data.