

## Facility Request Form for Educational Activities

### Part I: General Information

Requestor Name	Dr. Sepideh Yalda and Ashley Orehek (Student)
Institution and Address	Millersville University, P.O. Box 1002 Millersville, PA
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Faculty Advisor Name (if student requestor)	Dr. Sepideh Yalda

### Part II: Project Description

Project Title	<b>Millersville University Educational DOW (MEDOW) Project-2016</b>
Project Location	Southeastern Pennsylvania
Start and End Dates of Field Deployment	March 28-April 8
NSF Facilities requested (type and # of systems)	2 DOW preferred
Number of Expendables requested (if applicable)	

### Part III: Educational Activities Description

Number of students actively involved	Graduate: 4 Undergraduates: ~ 60
Desired training activities conducted by Facility Staff including time in the field	Onsite training of the students
Desired teaching activities conducted by Facility Staff including time in the field	Classroom presentation in radar meteorology course.
Additional special requirements that pertain to Facility support	
Ancillary/Opportunistic Outreach Activities	University Students: Seminar for the undergraduate students  K-adult: <b>Public Weather Awareness Day</b> (public event whose primary participants are K-12 children and parents; over 500 attendees)  Grades 6-12: <b>Women in Mathematics and Science Conference</b> (350 female students grades 6-12 attend a conference dedicated to careers and opportunities in STEM fields)  Public Outreach: <b>Public Weather Awareness Day</b> is a community event, open and free to the public.

## Part IV: Operational Requirements

Please specify data access needs (e.g., real time)	Real time
Please specify data analysis needs	
Please specify communications needs	Between Weather Center (hub) and DOW

### Millersville University Educational DOW (MEDOW) Project-2016

Millersville University of Pennsylvania, located in the radar sparse Piedmont section of southeastern Pennsylvania in Lancaster County, is requesting a two-week deployment in proximity to campus of the Doppler on Wheels from 29 March – 8 April 2016. The Millersville [University] Educational DOW (MEDOW) project will provide an immersive and authentic learning component for scores of meteorology students in Radar Meteorology (ESCI 449), Meso- and Storm-Scale Meteorology (ESCI 444), and Physical Meteorology (ESCI 340) courses. Millersville Meteorology is 120 undergraduate meteorology majors, four faculty members, a staff meteorologist and a network and computer systems specialist in a Department of Earth Sciences with 10 faculty members serving a total 220 students that also includes programs in geology, oceanography, and earth sciences education. We have an established network of outreach activities with the local K-12 schools and the general public through our Weather Information Center and the Student Chapter of the AMS.

The project will have three principal objectives:

1. **Education (E):** provide undergraduate meteorology students in the courses, *Radar Meteorology*, *Meso and Storm Scale Meteorology*, and *Physical Meteorology*, with an opportunity to learn about the dual Doppler radar and its applications, and to utilize the system to collect data for further analysis and inclusion in course-related case study projects. This will be enhanced by a seminar given by a CSWR radar scientist.
2. **Outreach (O):** showcase the DOW to a broad audience of university students, secondary students, and the general public. There is a convergence of outreach opportunities that will take place during this period that in which the DOW will be incorporated (e.g. Public Weather Awareness Day; Annual Women in Math and Science Conference).
3. **Research(R):** As weather opportunities present themselves, especially considering that this visit would correspond to the mid-Atlantic transition season, we would plan for severe weather associated with fronts, low level inflow/outflow into those systems, and characteristics of inertial instability within the frontal boundary. In addition, we would like to demonstrate that hazardous weather warnings could be improved and refined if weather radar were operated in the relatively radar-sparse area of the piedmont section of southeastern PA.

**EOR** synergy: Millersville is fortunate to have special guest, Dr. Pam Heinselman (NSSL) visiting the university as the keynote speaker for the Annual Women in Science and Math Conference. She will also be a guest lecturer in *Radar Meteorology*, and has agreed to serve as a research mentor in planning investigations before the DOW arrives.

#### **a. Education**

The main objective of the education component of this proposed project is to advance student understanding of the weather radar as an instrument and its applications in the study of specific meteorological phenomena by allowing the students to have a direct hands-on experience. The primary focus of the project will be on the 29 students enrolled in the *Radar Meteorology* course. This is a 400-level undergraduate course which serves as an elective for meteorology majors, but as the enrollment suggests, nearly every student selects this elective. Students in this course will be trained to use the DOW system, and will utilize the system to collect data for use for the case study project that is part of the course requirement. It should be noted that several students enrolled in Radar Meteorology are concurrently enrolled in *Meso- and Storm-Scale Meteorology* so that their case studies may serve mutual interests. A seminar will be designed for the students in this course facilitated by the Center for Severe Weather Research (CSWR) staff scientist. In order to achieve this objective, students in the Radar Meteorology course will:

- Develop an outline for an experiment to use the DOWs to collect data necessary for a case study design
- Operate the dual DOW radars during a proposed observing period depending on the phenomena of interest
- Process and analyze the data collected and integrate their results into their final case study projects

In order to maximize the exposure and effectiveness of this unique educational opportunity, students in *Meso- and Storm-Scale Meteorology* and *Physical Meteorology* will also learn about the DOW and its applications as applied to topics covered in these courses such as the storm structure and radiative transfer. During the proposed period, the area is likely to experience a range of weather events including convection, fog, and wave trains among others that would be suitable for a case study.

Approximately three days of training are scheduled for the 29 students in the *Radar Meteorology* course, plus an additional 10 students not dual enrolled that may need to be trained.

Students in the *Radar Meteorology* course will meet with the course instructor ahead of time to identify and discuss possible case studies based on the expected conditions. The students will work with the course instructor, and will develop the appropriate experiment design. In this meeting, the instructor will work with the students to determine the scanning strategies best suited for the proposed case studies for optimum data collection.

Radar operations during the deployment will be performed by students and facilitated by group leaders. Some students received training and experience during the winter 2013-2014 as part of the OWLeS project, and during the summer 2015 PECAN project, and they could easily serve as leaders. A number of students in the course have prior field research experience, and this activity can be an appropriate setting for peer mentoring and teamwork. Furthermore, it can provide a unique research opportunity for students that have not had an experience with field research projects.

Special guest, Dr. Pam Heinselman, research scientist at the NOAA/National Severe Storms Laboratory and an affiliate assistant professor of the University of Oklahoma School of Meteorology, will be visiting Millersville for the Annual Women in Science and Math Conference and will provide instruction and mentorship in radar meteorology and in assisting students in the development of their research plans.

## **b. Outreach**

The outreach component of the proposed project will involve the demonstration of the DOW at the *Public Weather Awareness Day (PWAD)* event scheduled for 2 April 2016. PWAD is sponsored by the Millersville University Student Chapter of the AMS, and is open and free to the community. Over 500 people, mainly parents and school children, crowd into a university gym to experience a sundry of hand-on activities and a variety of games all designed to increase awareness on all topics related to weather and climate. Furthermore, the event includes representatives - mostly MU alumni - from NOAA, AccuWx, Weather Trends Int'l, and the Pennsylvania Emergency Management Agency, and many others. The DOW would undoubtedly be the center of attraction this year.

In addition, on 5 April 2016 Millersville University is hosting the *29<sup>th</sup> Annual Women in Mathematics and Science Conference*. The Conference brings in over 350 students from the surrounding schools, and is designed to introduce and encourage female students in middle and high school to pursue education and careers in Mathematics and Science. This year's Conference keynote speaker will be Dr. Pamela Heinselman from the National Severe Storms Laboratory. The Conference includes a demonstration period and provides a natural setting for further exposure. We will park the DOWs in front of the Student Memorial Center, where the Conference is taking place, and have conference attendees with special interest in weather and related technology tour the facility.

## **c. Research**

April is an excellent time for weather studies along the piedmont section of the mid-Atlantic region. Cold air outbreaks, strong and weak frontal boundaries, severe weather, heavy precipitation episodes including hail, and nimbostratiform shields with marine character on easterly flow are all part of the springtime mix. We do not expect there to be a paucity of weather

phenomena while the DOWs are here. In addition, we have long suspected that Millersville is in a radar sparse region with our closest radars at KCCX, KLWX, and KDIX at 150, 140, and 120 km distance, respectively. Consequently, at these distances and at the lowest tilt angle ( $0.5^\circ$ ), we cannot detect radar signatures within the lowest 4 – 4.5 km, essentially missing the entire boundary layer even under conditions of deep convection. We would use this data to make a case for the acquisition of a phased-array radar to close this radar void.

### **Tentative Proposed Schedule**

#### Pre-DOW

- March 25 Meeting to identify case studies
- March 28 Case study design meeting

#### DOW (DOW arrives on campus on March 28)

- March 29-31: DOW operations training on campus
- April 1: CSWR staff scientist provides a seminar for the undergraduate students
- April 2: Public Weather Awareness Day (Community Education and Outreach Event)
- April 3-4: Observing period and data collection
- April 5: 29<sup>th</sup> Annual Women in Mathematics and Science Conference
- April 6-8: Observing period and data collection
- April 9: DOW leaves campus

#### Post-DOW

- April 26 Case study presentations begin

## Feasibility Analysis

**Project: Millersville University Educational DOW (MEDOW) Project-2016**

**Location: Millersville University, Millersville, PA**

**Duration: 28 March – 8 April 2016**

**Requesting PI/Host: Dr. Sepideh Yalda and Ashley Orehek (Student)**

Summary: CSWR finds this request feasible and feels 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 funded education project immediately prior to this request in Illinois, so if this project is funded, CSWR ferry the DOW projects, not return the DOW to Boulder in between. The driver/operator will be switched.

An undergraduate student, under the guidance of her advisor, initiated and wrote this request.

The educational plan proposed by the PIs is typical for these deployments. The request is timed to capitalize on two, large, pre-scheduled outreach events, which will maximize the public impact.

Substantial outreach focusing on Women in Mathematics and Science is planned.

### Longer analysis:

The requested use is well-planned. The deployed DOW and collected data primarily would be used in Radar Meteorology course, but students enrolled in Meso- and Storm-Scale Meteorology and Physical Meteorology will have an opportunity to learn about the DOWs and data collection in various meteorological phenomena. As part of the Radar Meteorology course, under the guidance of their instructor, students will design DOW deployment strategies, operate the DOW to collect the requisite data, and analyze and synthesize the DOW data into a final presentation. Decisions to when/where deploy, DOW operation and data collection will be student-lead (under the guidance of a CSWR staff member), facilitated by student team leaders. This will allow for students to develop leadership/mentoring skills and also the ability to work in a team.

Two outreach events, Public Weather Awareness Day (PWAD) and the 29<sup>th</sup> Annual Women in Mathematics and Science Conference, are scheduled to occur during the proposed DOW deployment period. Hundreds of people are anticipated to be in attendance at each of these events, maximizing the educational benefit of the DOW visit within the local, public community. The 29<sup>th</sup> Annual Women in Mathematics and Science Conference is designed to encourage middle school and high school female students to pursue education and careers in Mathematics and Science, so having the DOW available for tours and as a focal point for discussion will greatly benefit this event by providing a hand-on opportunity for students to learn about a career in meteorology.

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 during the springtime in this area, this is unlikely. The PIs anticipate data collection in cold air outbreaks, strong and weak frontal boundaries, severe weather, and/or heavy precipitation events. CSWR staff will train the PIs and their 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 Millersville for emergency maintenance. A CSWR scientist, Wurman or Kosiba, likely will give a seminar at Millersville at the start of the project, (travel supported separately). CSWR staff will assist the PIs and their students in use of radar analysis software, and interpretation and the post-processing of the radar data.