

# Polar Climate & Weather Station

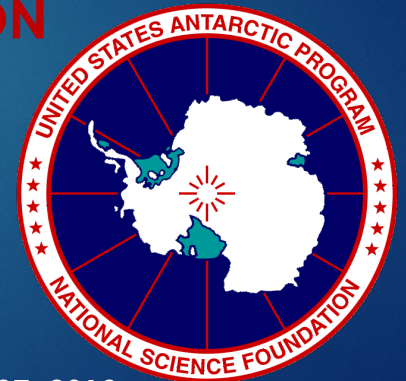
## The Next Generation Surface Meteorological Observing System: *A Status Report*



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**MADISON AREA TECHNICAL COLLEGE**  
**UNIVERSITY OF WISCONSIN-MADISON**

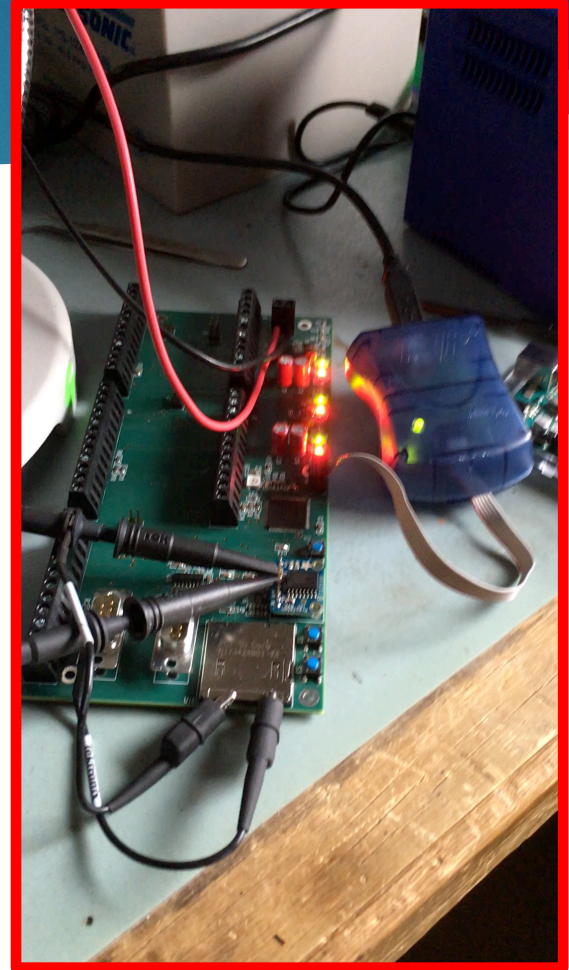


14<sup>th</sup> Workshop on Antarctic Meteorology and Climate – June 25-27, 2019



# Outline

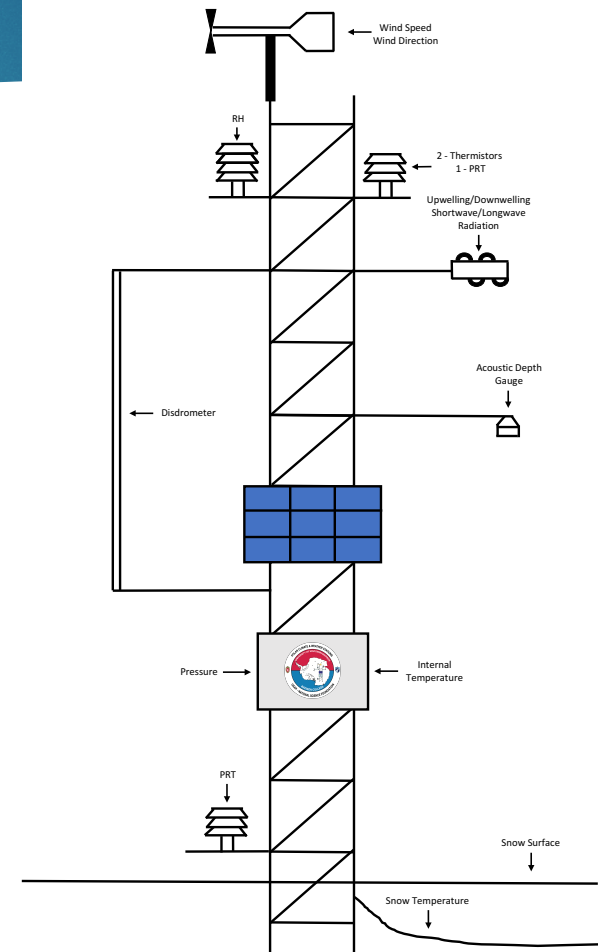
- ▶ Recap: *Goals/Objectives*
- ▶ Basic Instrumentation Suite
- ▶ Status Report
  - ▶ Project Status
  - ▶ PCWS in the Field...
- ▶ A Few Lessons Learned
- ▶ Successes...so far
- ▶ Future Plans
- ▶ Acknowledgements/Questions?





# Recap: Goals/Objectives

- ▶ **The Madison AWS/PCWS**
  - ▶ Generation of a new electronic core system
  - ▶ Climate and Weather Applications
  - ▶ Expanded basic observational suite
- ▶ **Students involved in the project**
  - ▶ One-of-a-kind experiences
- ▶ **Impact in the Classroom**
  - ▶ Unique data and observations to study weather and climate
- ▶ **The Community**
  - ▶ The AWS network becomes a community asset



Courtesy Carol Costanza



# Expanded Basic Instrument Suite

## ► Temperature

- Apogee thermistors & PRT
- 3 levels: 3 m, 0.5 m, & surface
- 3 sensors at 3 meter level
  - 2 Thermistors, 1 PRT (Apogee)

## ► Relative Humidity

- Vaisala HMP-155
- (Temperature collected as well)

## ► Pressure

- Paroscientific Digiquartz 215A

## ► Wind

- Taylor Engineering High Wind System
- RM Young

## ► Acoustic Depth Gage

- SR-50A Campbell Scientific

## ► 4-Component Radiation

- Kipp & Zonen CNR-4

## ► Acoustic Disdrometer

- ISAW Flowcapt 4
- *One test system only*

## ► Communications:

- Iridium

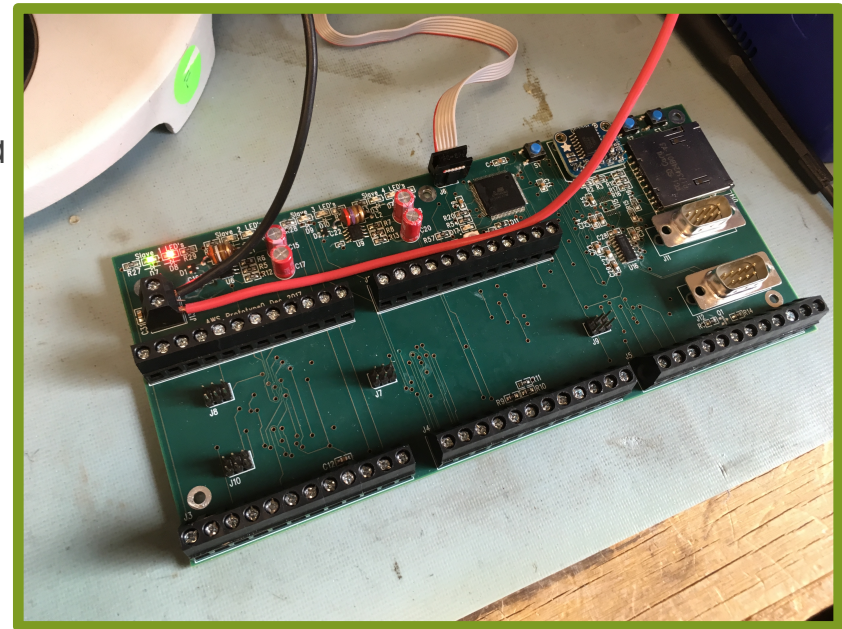
## ► Record on-board:

- SD Card Storage
- Internal Memory



# First Installation – How did it go?

- ▶ Version 0.1 found running after the winter of 2018!
  - ▶ But, it likely stopped working after temperature got below -40°F due to a flaw (now fixed!)
- ▶ Board performance did very well
  - ▶ No breaks in the surface mounting or connections
- ▶ The board did not have communications
  - ▶ Multi-failures of the UHF communications





# Sarah Polar Climate & Weather Station

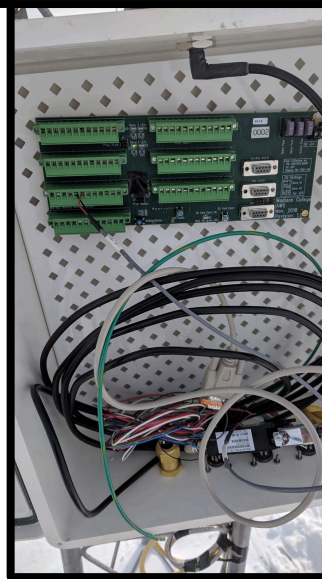
## McMurdo Ice Shelf, near Ross Island, Antarctica

77.868° South Latitude  
166.921° East Longitude

*Named in honor of:*

Sarah Jean Thorsland  
(2000 - 2013)

Madison Area Technical College &  
Antarctic Meteorological Research Center  
Space Science and Engineering Center  
University of Wisconsin-Madison



**Sarah AWS**



# Project Status

- ▶ Version 1.0 board...built!
  - ▶ 4 sensors-ready:
    - ▶ Temperature
    - ▶ Pressure
    - ▶ Relative Humidity
    - ▶ Wind
  - ▶ Basic testing in -85°C freezer
- ▶ Installed on the ice February 2019
  - ▶ Non-working iridium communications
    - ▶ Gov't shutdown issues
    - ▶ Planning for gov't shutdown issues
  - ▶ Sensors not installed as a result
  - ▶ Board is running



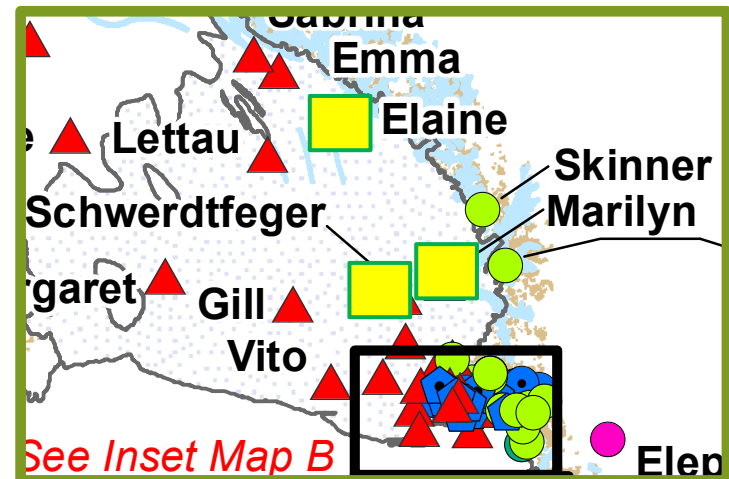
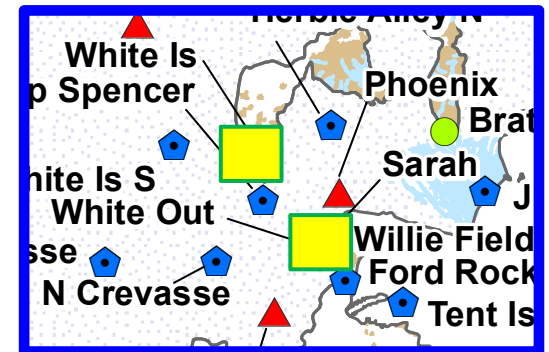


# PCWS in the Field...

- ▶ All planned field testing involves *side-by-side* testing
  - ▶ All are missions of opportunity (No special requests)
  - ▶ via UW-Madison AWS program O-283

## ▶ Planned installs:

- ▶ **Sarah PCWS at Willie Field AWS test site**
  - ▶ Upgrade
- ▶ **White Island AWS site**
  - ▶ High wind speed (based on Norton, in prep.)
- ▶ **Marilyn AWS site**
  - ▶ Variable relative humidity (e.g. Norton, in prep.)
  - ▶ Side-by-side-by-side test with NIWC
- ▶ **Elaine AWS site**
  - ▶ Side-by-side-by-side test with NIWC
- ▶ **Schwerdtfeger AWS site**
  - ▶ Side-by-side-by-side test with NIWC



# A Few Lessons Learned

- ▶ Purchasing & Acquisition
  - ▶ No small effort
  - ▶ Advance a “small” 2-year school into new directions...
  - ▶ Moderate success
- ▶ Student Experiences
  - ▶ Science Technology Engineering and Math (STEM)
    - ▶ Not for all students
    - ▶ Discovery for most students!
- ▶ Timeline for development is nearly as originally proposed...

# Successes...so far

- ▶ Students!
  - ▶ 8 Students in total have directly worked on this project
    - ▶ 5 Electronics
      - ▶ All going into electronics for a career!
      - ▶ Milwaukee School of Engineering (MSoE)
    - ▶ 3 Meteorology
      - ▶ One moving into science policy influenced by this project!
      - ▶ One majoring in atmospheric and oceanic sciences
      - ▶ One considering a career in forecasting
- ▶ First constructed system
  - ▶ Viable system!
  - ▶ Reasonable costs
  - ▶ Fully documentable design





# Future Plans

- ▶ Finish electronic revisions on the printed circuit board (version 1.1)!
  - ▶ Programming
  - ▶ Data storage/record on board
- ▶ Sensor integration and testing
  - ▶ Flowcapd disdrometer
  - ▶ Acoustic Depth Gauge
  - ▶ 4-component radiation
- ▶ Long duration deep freezer testing (~1 year)
- ▶ Test field installations in 2019-2020 field season
- ▶ Testing site at Madison College
- ▶ Power System testing
- ▶ User-level Documentation
- ▶ Publishing Norton et al. on AWS extremes
- ▶ Final creation of the ~10 AWS systems

# Acknowledgements

- ▶ Thanks to the NSF:
  - ▶ **NSF Geoscience Directorate, Office of Polar Programs and Office of Integrative Activities, Major Research Instrumentation Program - Grant #1625904**
  
- ▶ The PCWS Team!
  - ▶ Without the team, this work would not be possible!
  - ▶ **Madison College**
    - ▶ Grants Office
    - ▶ School of Arts and Sciences/ Department of Physical Sciences
    - ▶ School of Applied Sciences, Engineering & Technology/Department of Electronics and Electrical Engineering Technology
  - ▶ **UW-Madison**
    - ▶ Antarctic Meteorological Research Center
    - ▶ Automatic Weather Station Program



Questions?

Thank You For Your Attention!!!

<https://madisoncollege.edu/antarctic-meteorology-project>  
[mlazzara@madisoncollege.edu](mailto:mlazzara@madisoncollege.edu)

*“The AWS network of stations that Chuck Stearns had the foresight to establish has made working in Antarctica much safer and has also lead to our ability to learn about a site in advance of actually spending a field season there.”*

Dr. Julie M. Palais, on the passing of Dr. Charles Stearns, 2010