

AUTOMATIC WEATHER STATION: *THE NEXT GENERATION POLAR CLIMATE AND WEATHER STATION*



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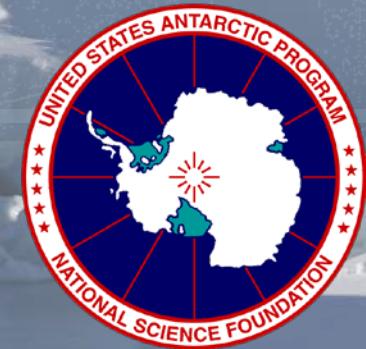
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AREA | TECHNICAL
COLLEGE

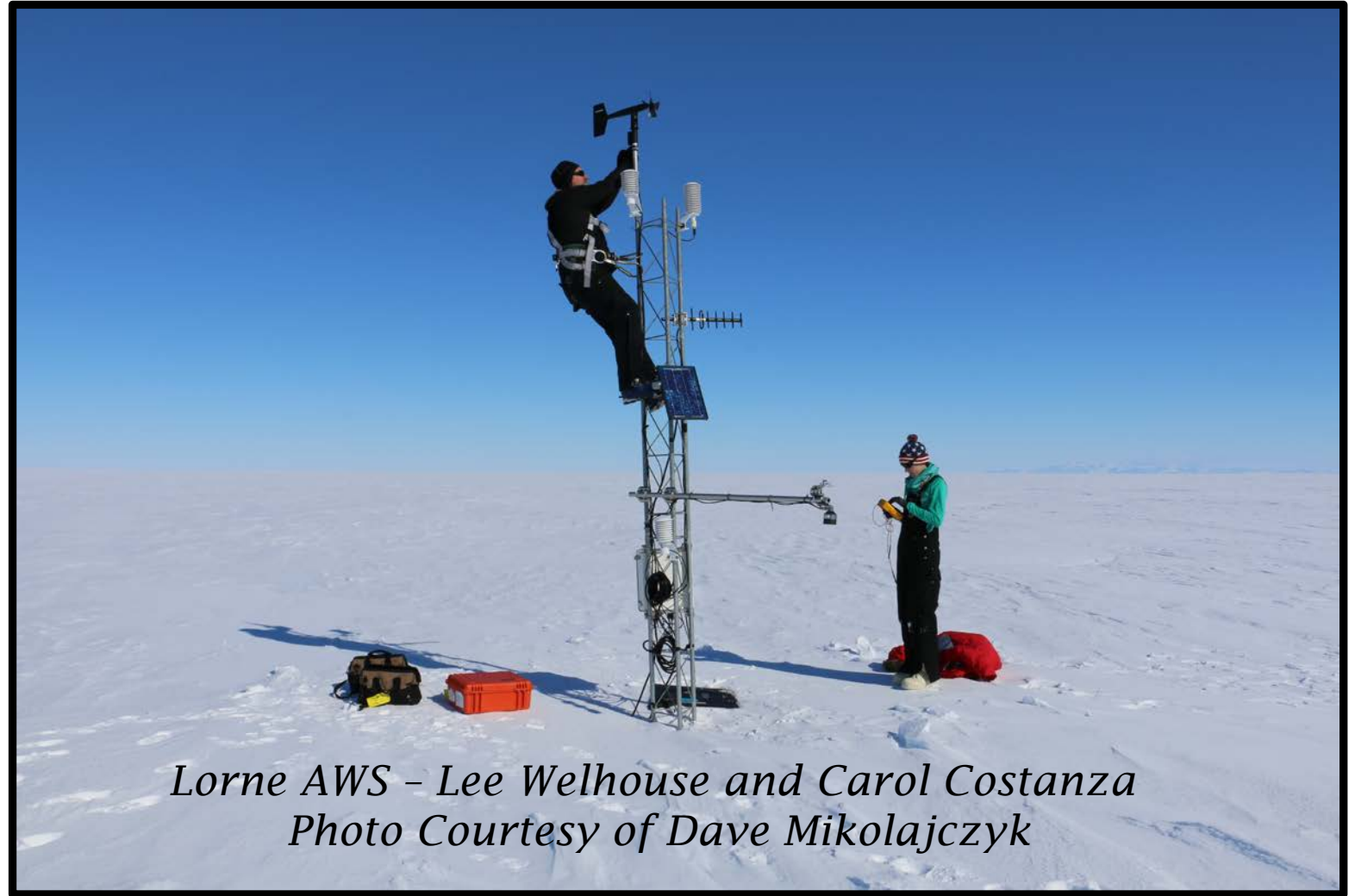


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OUTLINE

- **Why**
are we doing this?
- **Who**
is involved?
- **What**
are we doing?
- **Where**
is this happening?
- **When**
will we do this?
- **How**
will we accomplish this?



WHY

- The original Wisconsin AWS is really set up for weather observing and not climate
- Original Wisconsin AWS no longer able to be built
- Commercial-off-the-shelf systems limitations
 - Not polar-centric
 - Quirks
 - Meant for use - anywhere - world wide



*Thwaites AWS from December 2015
Photo courtesy of Dave Mikolajczyk*



WHO



Madison Area Technical College

- Teaching-focused Technical College
 - Program areas such as Electrical Engineering Technology
- 12 county district
- Over 40,000 students
- 25 years of teaching weather and climate
- Big increase in enrollment in the 2000's



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University of Wisconsin-Madison

- 'R-1' Research educational institution
 - Top 10 in research funding
 - Over 40,000 students
- Famous hub of meteorology since 1948
 - Satellite Meteorology
 - Climate Science
 - Three generations of Antarctic meteorology
- 38 year history of Antarctic Automatic Weather Stations (AWS)
 - At 60 locations



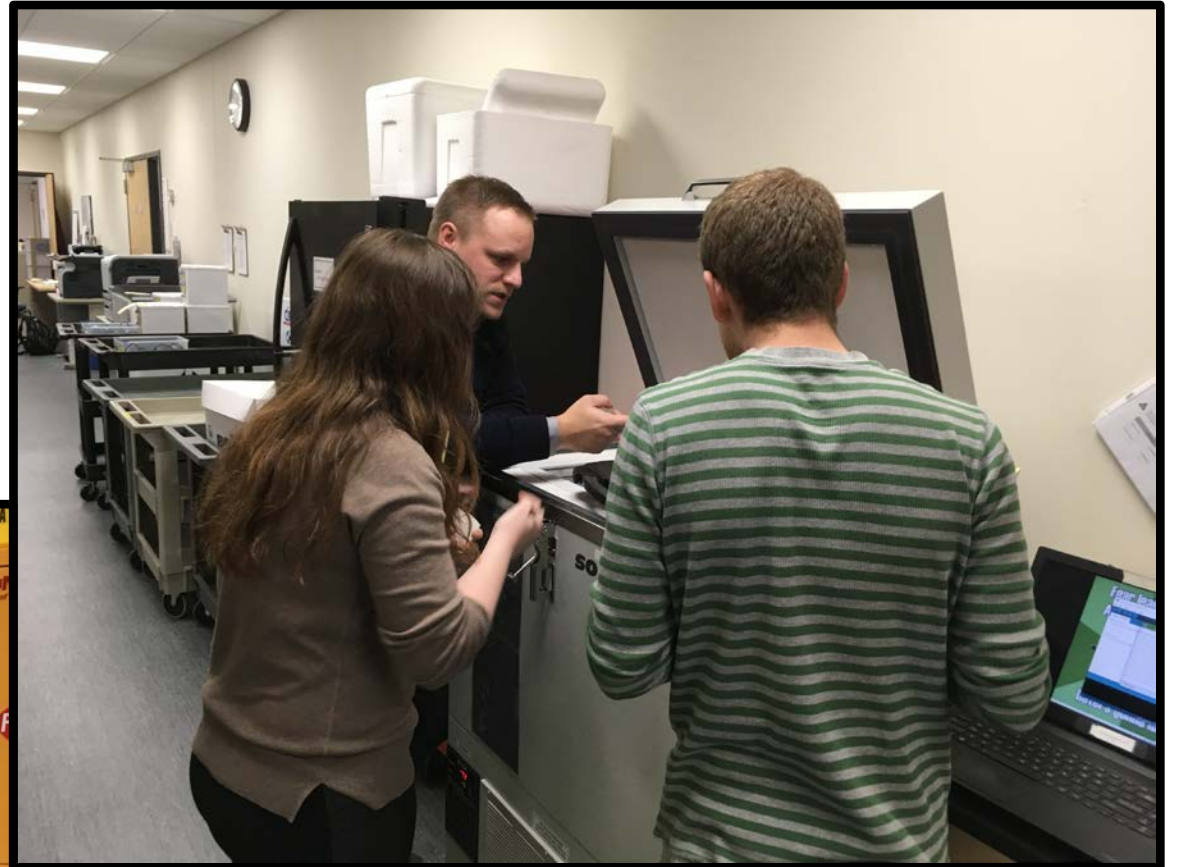
WHAT

- Create the future automatic weather station for remote polar operations
- A surface sentinel observing system for weather *and climate*
 - *Polar Climate and Weather Station (PCWS)*
- National Science Foundation
 - Major Research Instrumentation (MRI) grant
 - Office of Polar Programs – Geosciences Directorate
- Type of MRI: Instrumentation *Development* Proposal
- The new system to be called the “**Madison AWS or PCWS**”
 - **UW-Madison** and **Madison College**
 - Next stage after the “Wisconsin” AWS



WHERE

- Testing at Madison College
 - -85°C Freezer



Lee Welhouse, Rikki Decklever, Forbes

Filip

- Future testing at UW-Madison
 - (Cold Chamber, Sensor Integration)
- Other outdoor testing



STATUS

- Testing of -85°C Freezer behavior
- One set of sensors purchased
 - Temperature sensor testing in progress
 - Test setup at Willie Field this coming field season
- Electronics under design and testing
 - Multiple tests underway
- Elements under reconsideration:
 - Power system especially battery technology
 - Tower/Mast & Mounting System
 - Communications
 - **GPS to be considered a “sensor” perhaps****
 - ****Automated Polar Observing System (APOS) report of 2012 – “integrated” networks/backbone systems Collocation - we would be the weather on a backbone APOS network**

Sensor Suite

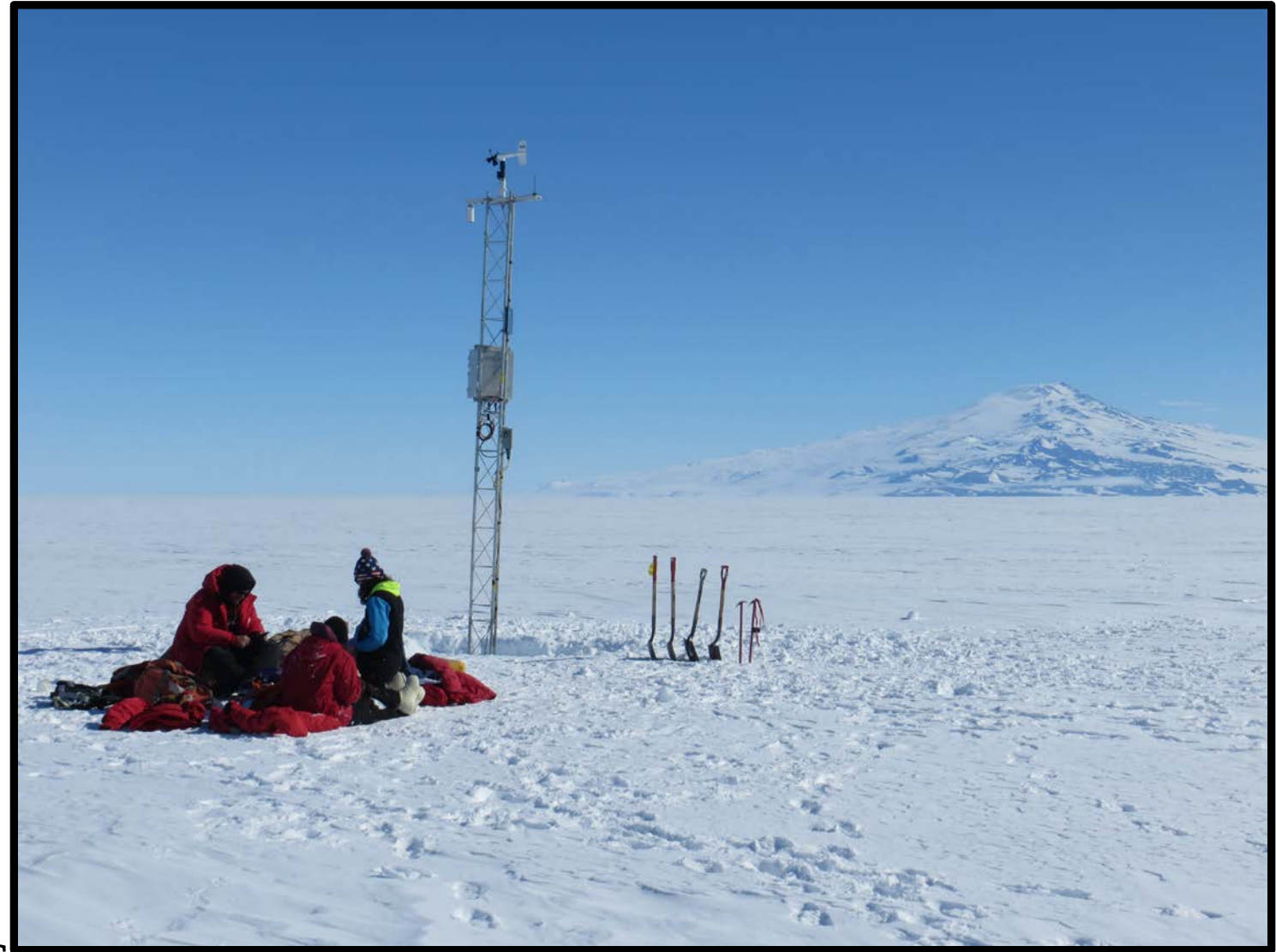
- Temperature (3) & Multi-level
- Pressure
- Wind & High Speed Wind
- Relative Humidity
- Acoustic Depth Gauge
- 4-Component Radiation
- Considering: Disdrometers



WHEN

Stages of development

- Year 1:
 - Equipment purchase
 - Electronics development
 - Support studies
- Year 2:
 - Electronics refinement
 - Integration
 - Testing
- Future:
 - Up to 4 proto-types constructed
 - +10 systems to be built...



*Laurie II AWS - Lee Welhouse and Carol Costanza
Photo Courtesy of Dave Mikolajczyk*



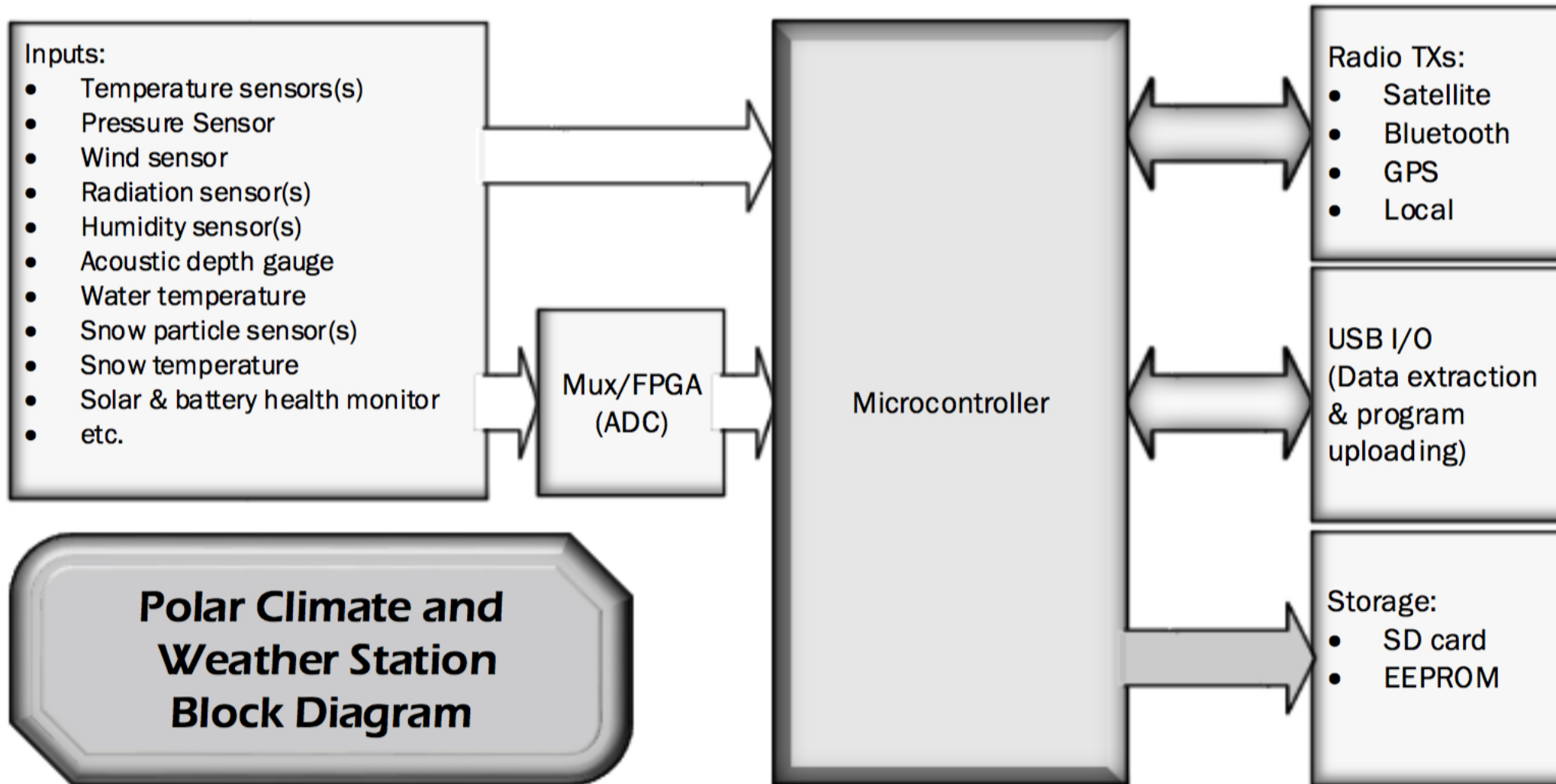
HOW

- Focus on the electronics core development
 - Engineering is a critical aspect of the project
- Utilize well known sensors, and expand the suite:
 - Current: Temperature, pressure, snow accumulation, relative humidity, wind (including high speed systems)
 - Expanded: Radiation, snow particle, surface temperature (snow, water, etc.)
- Be able to have both weather and climate level observations
 - e.g. Multiple temperature sensors (not common on current AWS systems)
 - Internal temperature calibration check (non-existent on AWS systems)
- Maintain quality control system
- Involve throughout the project



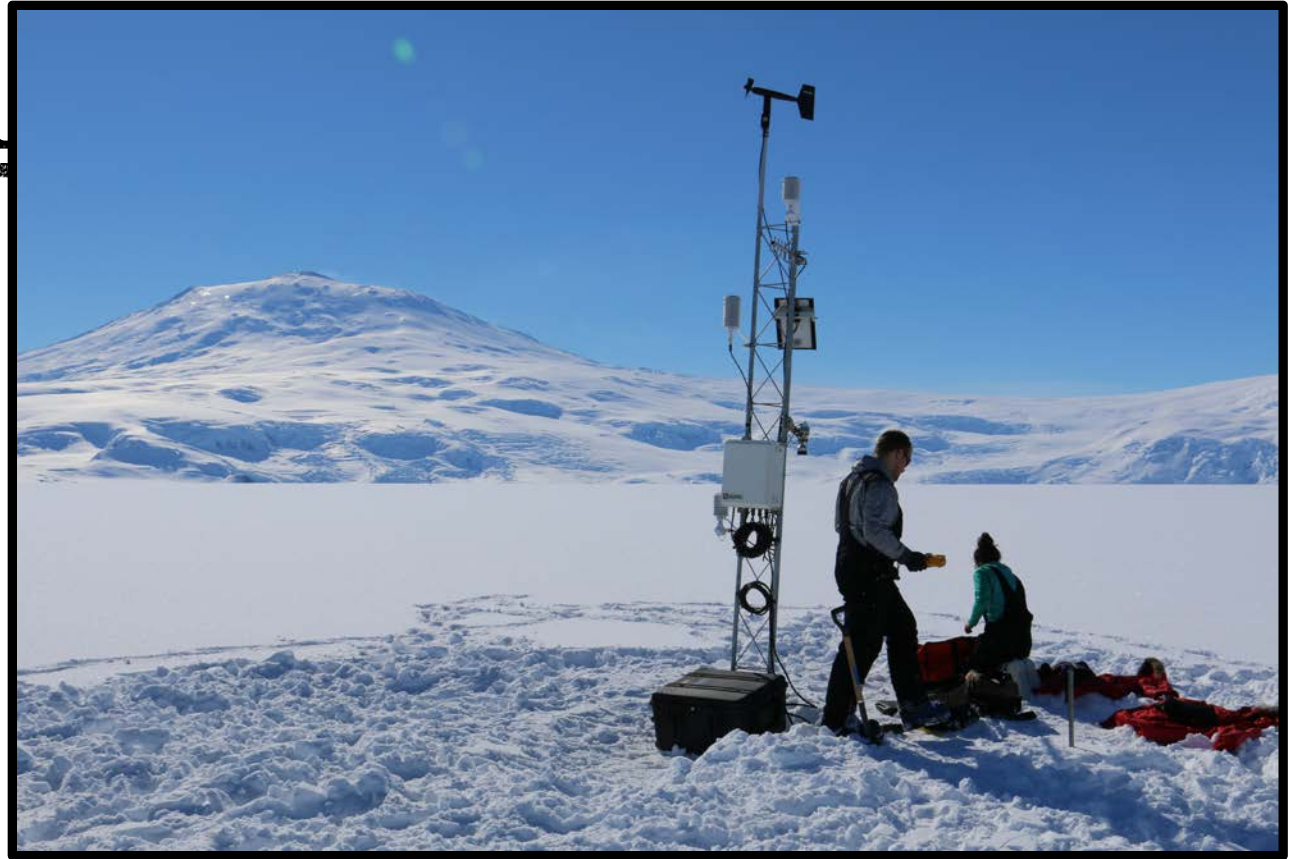
MADISON PCWS BLOCK

DIAGRAM



PROJECT GOALS

- The Madison AWS/PCWS
 - Generation of a new electronic core system
- 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



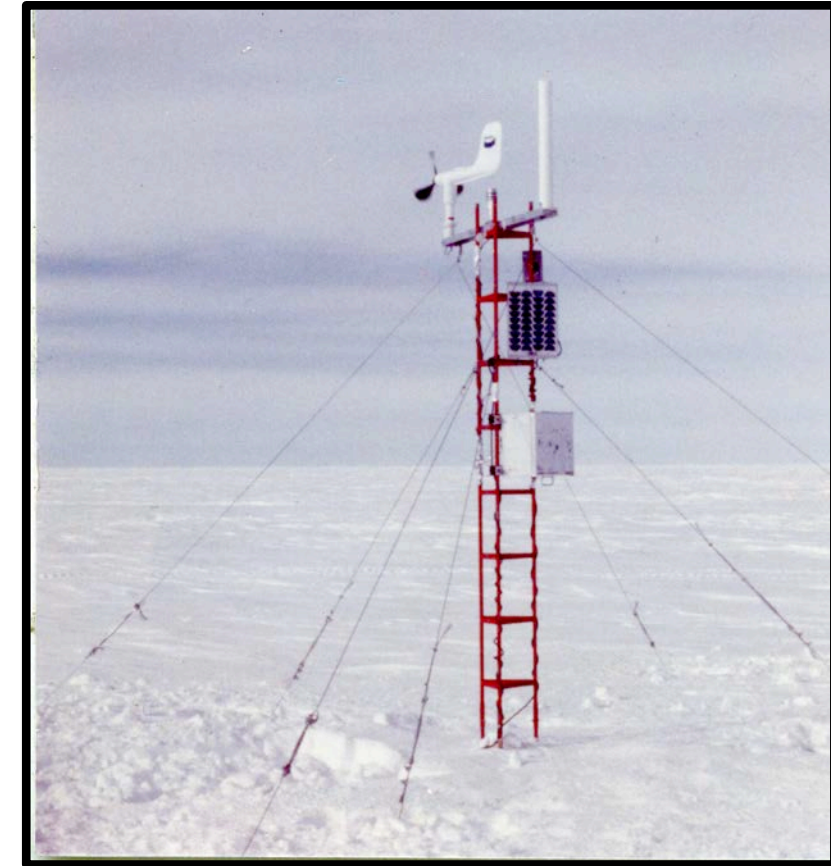
*Windless Bight AWS – Lee Welhouse and Carol Costanza
Photo Courtesy of Dave Mikolajczyk*



NOW FOR SOMETHING COMPLETELY DIFFERENT

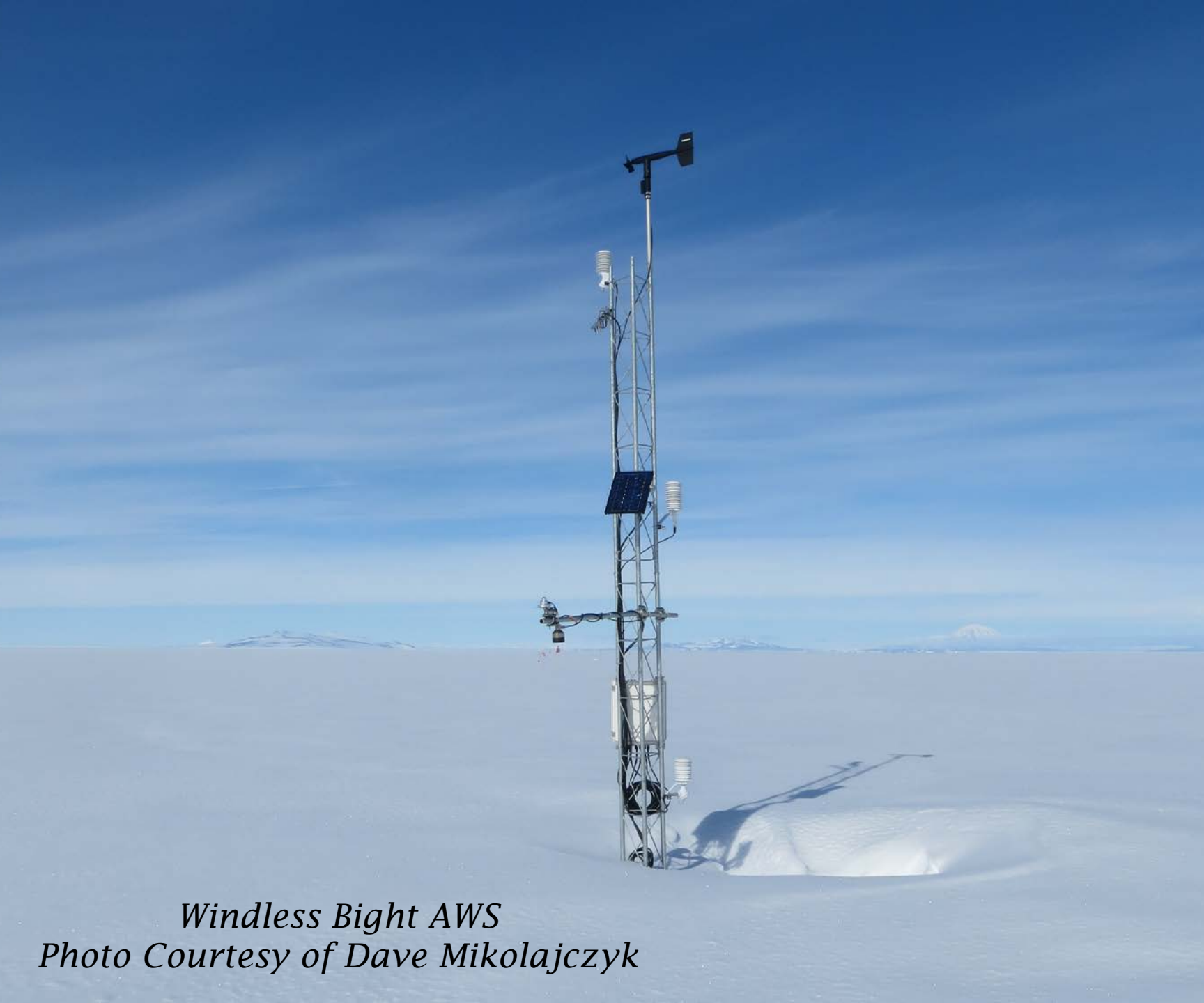
- What are the record high temperatures in Antarctica?
- Signy Research Station:
 - 19.8°C (67.6°F)
 - 30 January 1982
- Esperanza Research Station:
 - 17.5°C (63.5°F)
 - 24 March 2015
- D-80 Automatic Weather Station:
 - -7.0°C (19.4°F)
 - 28 December 1989

Skansi, M. d. L. M., et al. (2017), Evaluating highest-temperature extremes in the Antarctic, *Eos*, 98, <https://doi.org/10.1029/2017EO068325>.



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*Windless Bight AWS
Photo Courtesy of Dave Mikolajczyk*

QUESTIONS?

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 - School of Arts and Sciences
 - School of Applied Science, Engineering and Technology
 - Grants Office
- **UW-Madison/SSEC**
 - AMRC Staff
 - Support Staff
 - Directors

