Alpine Weather Stations

Design Considerations for Everest

Jared Campbell

CAMPBELL SCIENTIFIC

Abstract

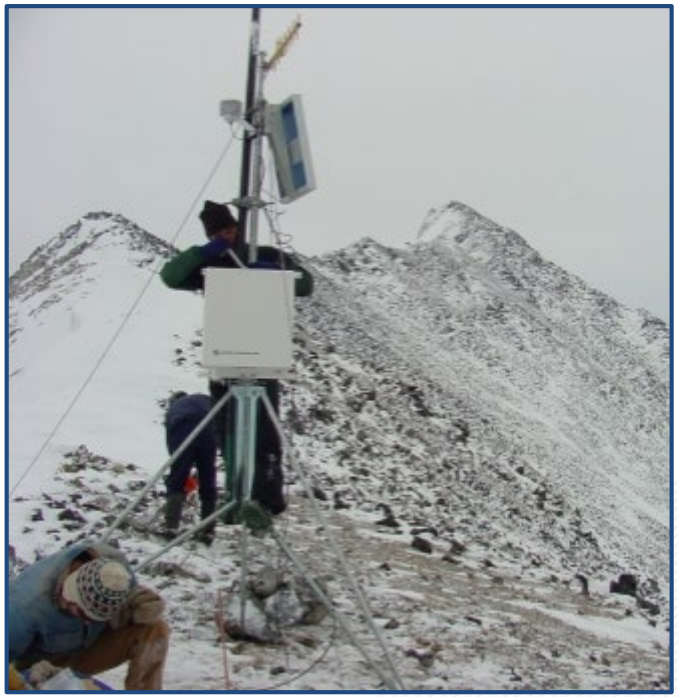
Campbell Scientific has recently worked on projects to provide equipment used for the world's highest weather stations at altitudes above 7,000 meters. Engineers from Campbell Scientific helped design the stations to meet project climatological and meteorological objectives, resulting in a specific set of requirements unlike any other mountain weather station.

The sensors and electronics on these weather stations must perform in intense environmental conditions experienced on high mountain peaks, like hurricane-force winds and extreme cold. The station design had to accommodate complex installation needs—lightweight enough to carry up the mountain, simple enough to install without tools, and easy to set up quickly in a hazardous, low-oxygen environment. The remote nature of the installation necessitated a rock-solid communications platform that allows for continuous, remote critical weather data transfer.

Testing the functionality of these stations was performed in various Rocky Mountain sites and at Mount Washington, New Hampshire, known for being one of the harshest environments in the United States when it comes to measuring weather.

This presentation will explore the design challenges, testing process, and implementation of preparing weather stations to operate above 7,000 meters, including the highest elevation weather station in the world.

Why go with Campbell Scientific?



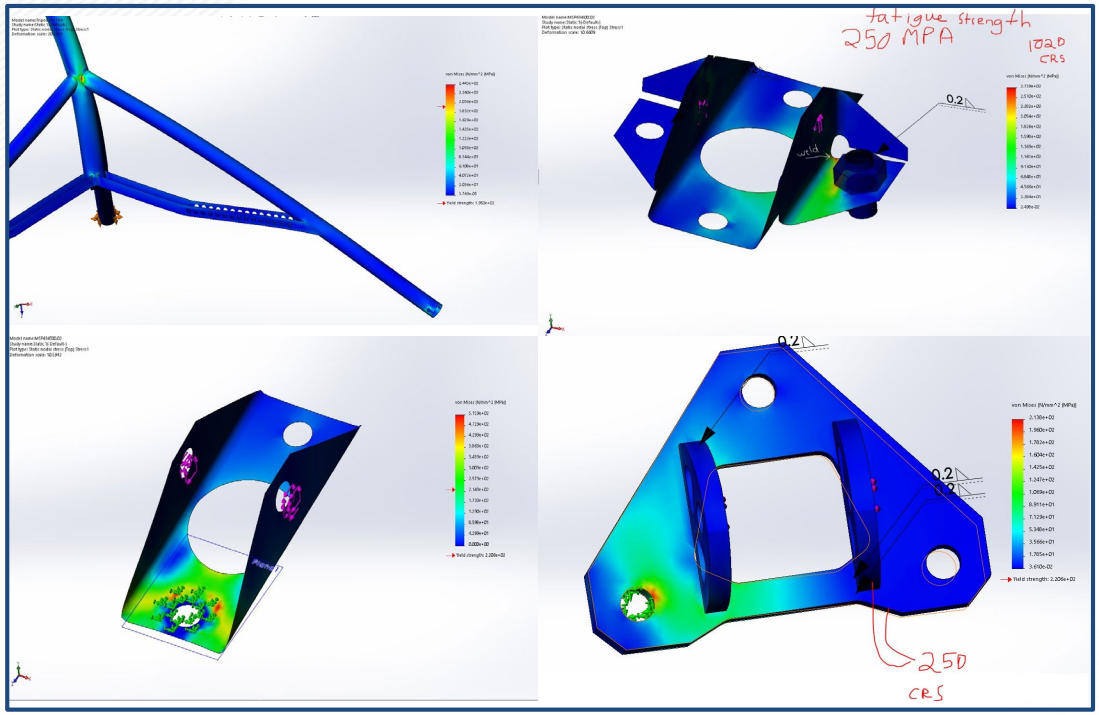
-Photo by Campbell Scientific

Design Challenges

- Extreme conditions
  - -60 °C, 105 m/s wind
- How to anchor?
- 2 hours to deploy
- Gloved hands
- 16 kg max weight per Sherpa
- Continuous communications
- Withstand flying debris
- 5 months: design, test, iterate, deploy

Design Challenges

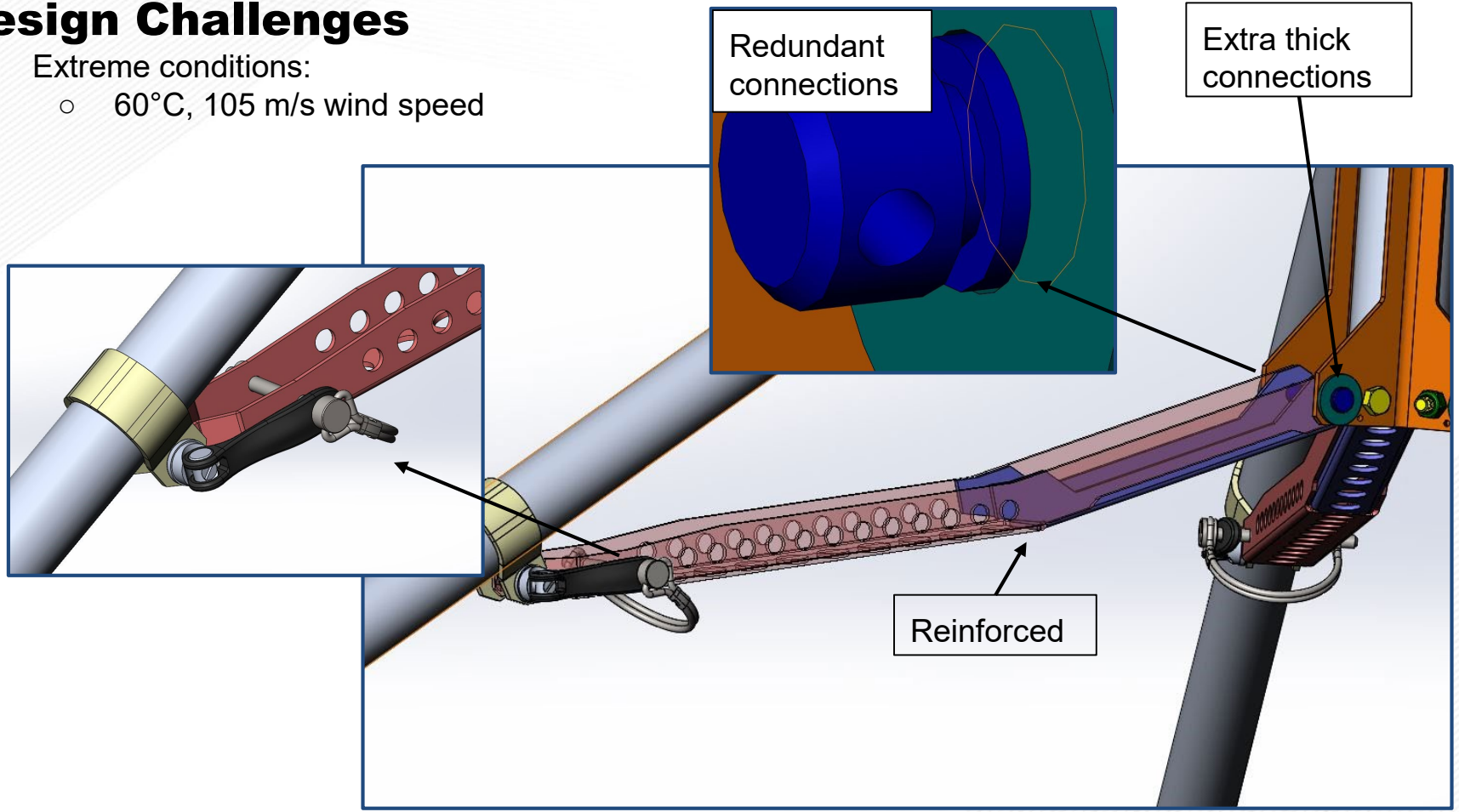
- 105 m/s (235 mph) wind speed
- How to anchor



-Photo by Baker Perry

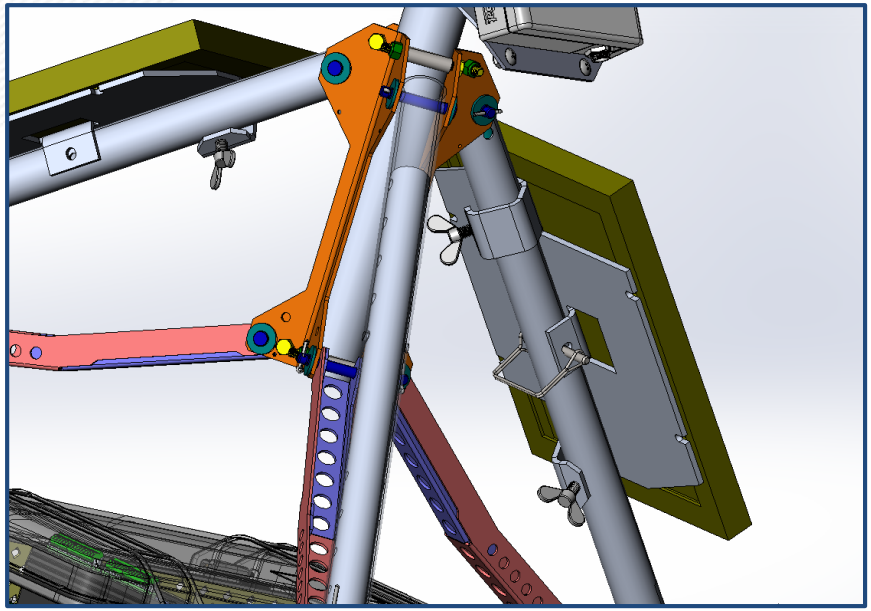
Design Challenges

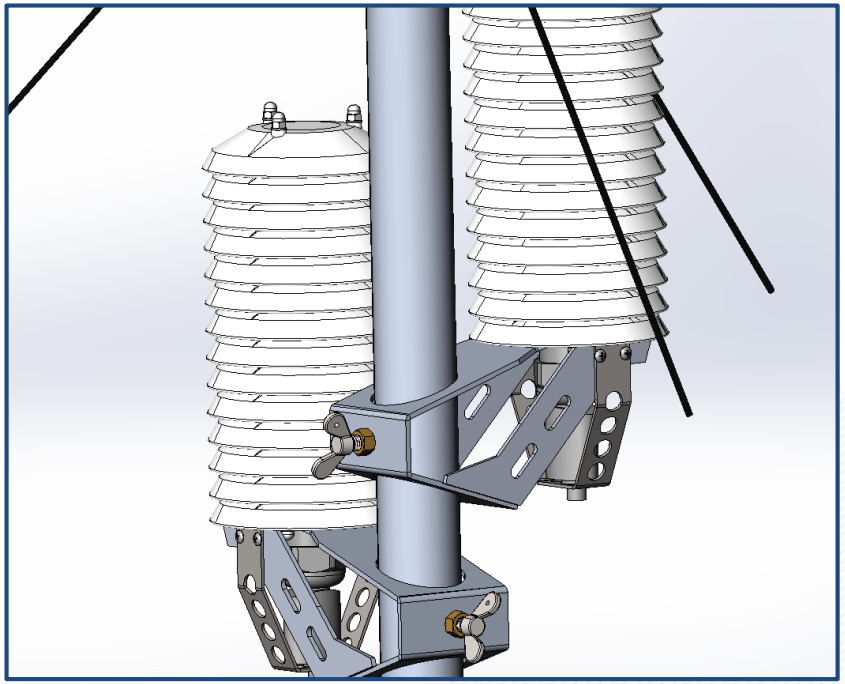
- Extreme conditions:
  - 60°C, 105 m/s wind speed



Design Challenges

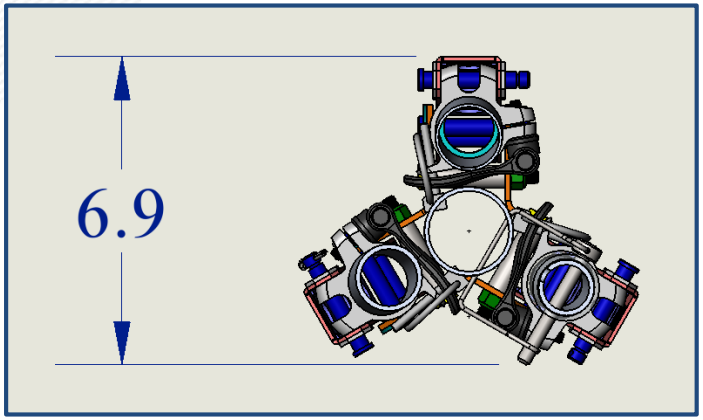
- 2 hours to deploy
- Gloved hands





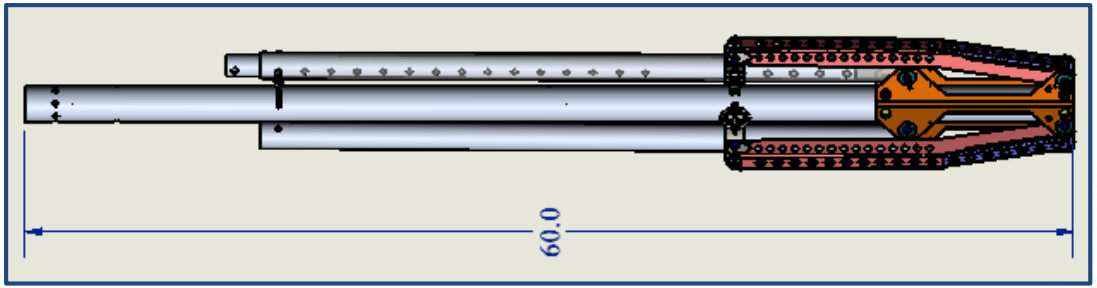
Design Challenges

- -60 °C (-76 °F)
- 16 kg max weight per Sherpa



Battery pack 4x lead acid
15 kg (33 lbs)

-Photo by Campbell Scientific



Design Challenges

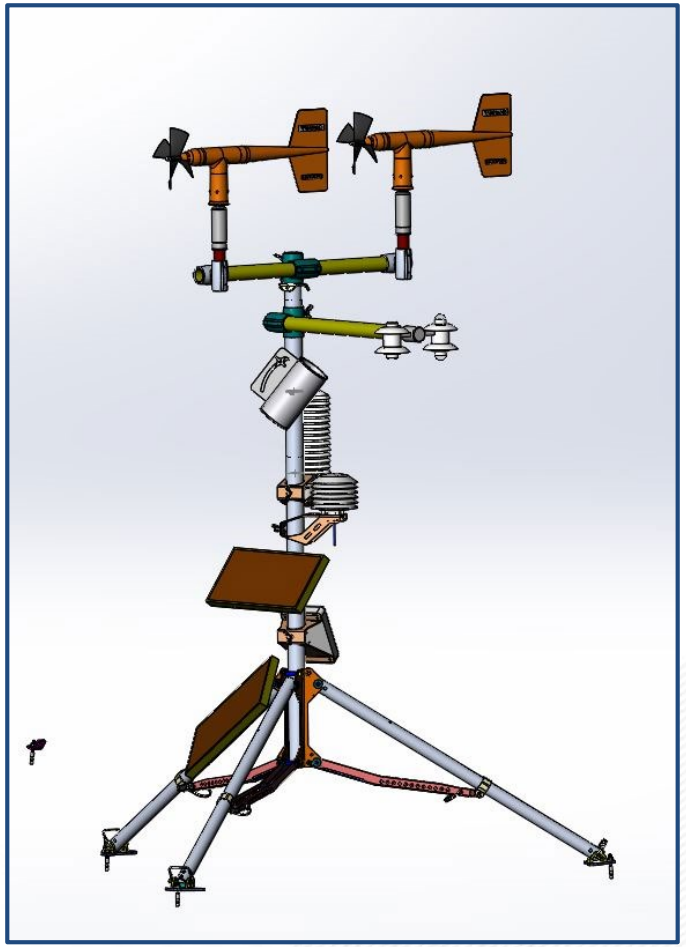
- Continuous communications
- Withstand flying debris

Continuous Comms:

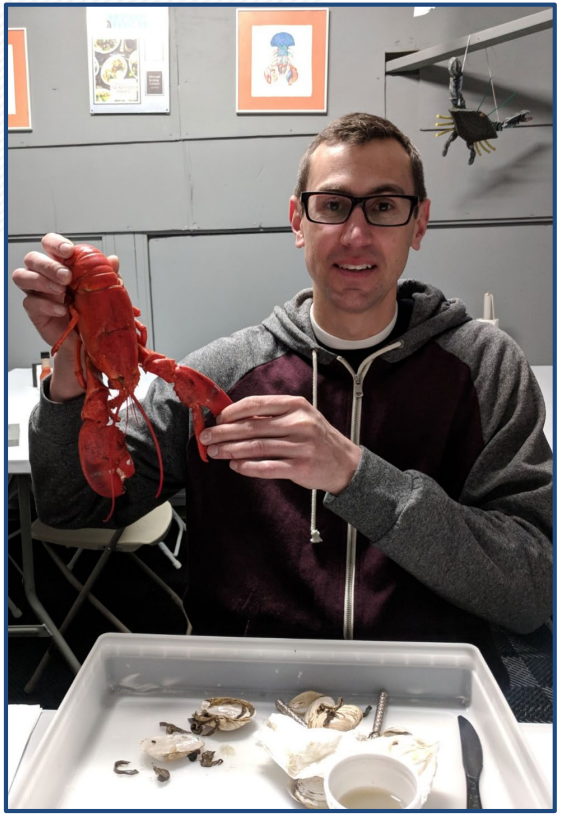
- Thuraya
- 400 MHz radios
- Cell
- SD card
- Internal memory

Withstand Debris:

- 2x anemometers
- 4x temperature
- 2x solar



New Hampshire for Harsh Testing?



-Photo by Campbell Scientific

Mount Washington Observatory, New Hampshire, USA

-Photos by Campbell Scientific

-Photo by Campbell Scientific

-Photo by Campbell Scientific

-Photo by Baker Perry

-Photo by Campbell Scientific

It takes a TEAM

But here are just a few people who helped make this happen

Gary Roberts

- Communications Product Manager

Mike Hansen

- Systems Implementation Manager
- Programmer

Steve Gunderson

- Sales Engineer
- Project Manager

THANK YOU!

Video Links

Animation

Data

Campbell Sci YouTube: Episode 1

Campbell Sci YouTube: Episode 2

Campbell Sci YouTube: Episode 3

Campbell Sci YouTube: Episode 4