Trip Report

Adélie Land, Antarctica

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SUMMARY

Four automatic weather stations (AWS) have been deployed in Adélie Land, East Antarctica in support of a joint United States-French study of the katabatic wind phenomenon.

AWS sites had been established at D-10, D-47, and D-57 in previous seasons, but only the unit at D-57 was functioning, and its performance was erratic. We repaired these three stations and they are now functioning properly.

A new AWS site was established at D-80. It is also working properly.

Travel to the stations was via a 5 vehicle overland traverse party. A total of 880 km were traversed from 1 January - 26 January 1983. The traverse party consisted of 6 members of Expéditions Polaires Françaises, Dr. Gerd Wendler and Yugi Kodama of the University of Alaśka, and myself.

Travel between McMurdo Station and Dumont d'Urville Station was via U.S. C-130 aircraft.

D-10

AWS 8901

latitude:	66 deg 42 min South
longitude:	139 deg 48 min East
elevation:	240 meters
distance from coast:	10 kilometers
Argos hex id:	8B17A

- Station had failed due to broken antenna cable. New cable installed.
- Past pressure values were 17.4 mb low due to malfunction of AWS 8900 1 mHz oscillator. Oscillator replaced.
- **AWS 8900 had been in place. Removed 0600 Z 26 Dec 82.** This AWS later installed at D-80.
- Voltage regulator serving batteries had failed (shunted current from solar panel away from batteries at 11.5 volts rather than 14.6 volts) and as a result batteries were low, but still servicable. New regulator installed.
- Past wind direction wiring ok.
- **AWS 8901 installed 0013 Z 1 Jan 83.**
- The aerovane that was purchased new this year was installed.
- Aerovane wiring convention:
  pin 7: generator +
  pin 6: generator −
  pin 3: pot
  pin 4: wiper
  pin 5: pot

  Resistance between pins 4 and 5 increases for N-E-S-W rotation of the aerovane.
- 5 foot tower section added.
- Batteries charged.
- Snow accumulation here is approx 1 meter per year due to drifting around the tower. Last season the tower and solar panel were dug out and repositioned.
- The navigator determined that the orientation of the aerovane was correct to within one degree.

- The electronics box was repositioned higher on the tower, more cable was spliced onto the power line, and additional guy wires were added.

- Calibrations were determined as follows:

  ** wind speed reads 8.7 percent high **

  ** wind direction reads correct **

  ** pressure reads 2.15 mb low **

  ** temperature reads correct **

  Determination of wind speed calibration coefficients was accomplished by inputting known voltages and comparing output of Argos Test Set to values of wind speed specified by manufacturer of aerovane (.1056 volts / mile per hour). Voltages were input from 1 to 14 volts in increments of 1 volt. Linear curve fit was then made to these data. Correlation coefficient = 1.0000

  Wind Speed (m/s) = .2503 * (# bits) + .1210

  The previous wind speed calibration equation was:

  Wind Speed (m/s) = .2721 * (# bits)

  Therefore the wind speed was overstated by 8.7 % minus a constant offset of .12 m/s.

D-47

AWS 8914

latitude:	67 deg 23 min South
longitude:	138 deg 43 min East
elevation:	1560 meters
distance from coast:	110 kilometers
Argos hex id:	8B4BF

- The station had been installed 2 years earlier with AWS 8914 electronics, but had never been received by satellite.
- Cause of problem traced to bad antenna. New antenna installed.
- Carrier frequency found to be 1128 Hz high (satellite can only tolerate +/- 1200 Hz freq error). Adjusted freq to 401.650000 mHz
- **Station on the air at 09 Z 24 January**
- 5 foot tower section added. Electronics box repositioned and guy wires added. Solar panel dug out and repositioned.
- Wind direction orientation ok.
- Batteries and solar panel ok.
- Voltage regulator shunting current away from batteries at 13.3 volts. Replaced IC and now regulates at 14.6 volts.
- Removed old aerovane. Installed aerovane which had been in storage at Dumont d'Urville. Before installing aerovane I replaced generator brushes and examined slip rings and bearings.
- Aerovane wiring convention:

  pin 1: generator +
  pin 2: generator -
  pin 3: pot
  pin 4: wiper
  pin 5: pot

  Resistance between pins 4 and 5 increases for N-E-S-W rotation of the aerovane.

- Calibrations determined as follows:

  ** wind speed reads 19.8 percent high **

  ** wind direction reads correct **

  ** pressure reads 1.13 mb low **

  ** temperature reads correct **

Wind speed calibration accomplished in same manner as with AWS 8901. Correlation co-efficient = 1.0000.

Wind Speed (m/s) = .2266 * (# bits) - .06

Therefore the previous equation overstated the wind speed by 19.8 percent.

D-57

AWS 8916

latitude:	68 deg 11 min South
longitude:	137 deg 32 min East
elevation:	2103 meters
distance from coast:	210 kilometers
Argos hex id:	8B506

- Station has been operating intermittently since being deployed two years ago.

- Cause of intermittent operation traced to failed voltage regulator. Regulator did not shunt current away from batteries and consequently battery voltage was allowed to rise to more than 15 volts. This resulted in frequency error in oscillator which led to non-reception by satellite. Batteries were at 15.9 volts when we arrived.

- Replaced IC in voltage regulator and confirmed voltage regulation at 14.6 volts.

- Found transmitter frequency to be 1040 Hz high. Adjusted to 401.650000mHz

- Added 5 foot tower extension. Dug out and repositioned solar panel. Snow accumulation here about .5 meters/year. Electronics box repositioned and guy wires added.

- Removed old aerovane. Installed new aerovane 12-78-07-79 which had been in storage at Dumont d'Urville. Before installing aerovane I replaced generator brushes and examined slip rings and bearings.

- Aerovane wiring convention:

  pin 1: generator +
  pin 2: generator -
  pin 3: pot
  pin 4: wiper
  pin 5: pot

  Resistance between pins 4 and 5 increases for N-E-S-W rotation of the aerovane.

- Calibrations determined as follows:

  ** wind speed reads 22.3 percent high **

  ** wind direction reads correct **

  ** pressure reads 0.40 mb low **

  ** temperature reads correct **

  Wind speed calibration accomplished in same manner as with AWS 8901. Correlation co-efficient = 1.0000.

  Wind Speed (m/s) = .2221 * (# bits) - .00

  Therefore previous equation overstated the wind speed by 22.3 percent.

D-80

AWS 8900

latitude:	70 deg 01 min South
longitude:	134 deg 43 min East
elevation:	2500 meters (+/- 50 m)
distance from coast:	440 kilometers
Argos hex id:	8B129

- A new station was installed using AWS 8900.
- Station on the air with all sensors operating correctly at 1315Z 14 January.
- Transmitter frequency adjusted.
- Small 10 watt solar panel mounted dirctly on tower.
- Aerovane used was one that had been in storage at Dumont d'Urville. Disassembled, inspected and new generator brushes installed.
- Aerovane wiring convention:
  pin 6: generator +
  pin 7: generator -
  pin 3: pot
  pin 4: wiper
  pin 5: pot

  Resistance between pins 4 and 5 increases for N-E-S-W rotation of the aerovane.

- Calibrations determined as follows:

  ** wind speed reads 11.7 percent high **

  ** wind direction reads correct **

  ** pressure reads 0.61 mb low **

  ** temperature reads correct **

  Wind speed calibration accomplished in same manner as with AWS 8901. Correlation co-efficient = 1.0000.

  Wind Speed (m/s) = .2430 * (# bits) - 0.111

  Therefore previous equation overstated the wind speed by 11.7 percent.

TECHNICAL NOTES

1. Voltage Regulators:

The regulators at D-10 and D-57 had failed. In addition, I had two additional failures in the field of new regulators that I tried to install. Finally I figured out the problem: the integrated circuit in the regulator cannot tolerate a voltage greater than about 18 volts. The open circuit output of the large solar panels is 21 volts. If the regulator is presented with this voltage, it will fail. However, once loaded down with the low impedance of the batteries the voltage of the solar panel falls to about 16 volts. Therefore **it is imperative that the batteries be connected to the solar panel before the voltage regulator is connected to the solar panel.** Failure to have done this is the reason that the station at D-57 has transmitted erratically for the last two years.

A new regulator should be developed that can tolerate the voltage of the open circuit solar panel.

2. Frequency errors:

The correct carrier frequency for all the AWS transmitters is 401.650000 MHz. The transmitter contains an 8X frequency multiplier, and is driven by a high stability oscillator. The frequency of this oscillator should be 50.206250 MHz. A previous document erroneously specified the oscillator frequency as 50.206375 MHz which gives a carrier frequency of 401.651000, or 1000 Hz too high. The satellite can only tolerate a frequency error of 1200 Hz. I found the three AWS units in the field to all be about 1000 Hz too high, and reset them to the correct frequency.

3. Antenna cables:

The antenna cable at D-10 had seperated at the junction of the fitting and the cable. This cable did not have the right angle fitting as did the other stations, and as a result the cable was forced to make a sharp right angle bend. It is necessary that **spare antenna cables with TNC connectors (screw fittings) at both ends and a right angle fitting at one end be brought along on future trips.**

4. Towers:

All the towers have been installed using wire ropes for guy wires, turnbuckles, and cable clamps. Also, the anchors ("deadmen") have been frozen into the snow surface by pouring liquid water into the anchor holes and

allowing the anchors to freeze in before loading the tower. **This technique has made for extremely stable towers and should be used on all future deployments.**

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Addendum

As of the time of this writing, 4 March 83, the AWS established at D-10, D-47, D-57, and D-80 are all functioning properly and the data is being received by satellite. Unfortunately, the AWS at Dome C which forms the terminus of the station array failed at the end of January 1983 for unknown reasons after operating successfully for 3 years. It was not possible to fly to Dome C for repairs due to the latenesss of the season.