Antarctic Automatic Weather Stations

AS 82-83

Field Report, McMurdo Area
Penisula Area Deployment

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Itinerary, McMurdo area

28/12/82	Leave Madison, Wisconsin
31/12/82	Arrive McMurdo
4/01/83	Visit Jimmy Site to install beacon for helicopter ADF testing.
5/01/83	Visit Jimmy Site to remove AWS 8911 and three boxes of three 12 vdc batteries.
6/01/83	Marble point then to Asgard to remove AWS 8908 and terminate the site.
10/01/83	Laurie Site to remove AWS 8910 and install AWS 8911 after conversion to 12 vdc.
14/01/83	Manning Site after starting for Meeley.
17/01/83	Establish Nancy Site near White Island with AWS 8908 which measures relative humidity and has been converted to 12 vdc power.
18/01/83	Meeley Site by helicopter to install beacon, batteries, and solar panels.
20/01/83	Aborted trip to Dome C by C-130. Flew down Byrd Glacier on return flight.
24/01/83	Laurie Site to install AWS 8911 after wiring correction and find Ferrell Site.
25/01/83	Whitlock Site on Franklin Island by helicopter from the Glacier.
28/01/83	Install box and tower at new Jimmy Site in the Windless Bight at Bucky Wilson's RTG.
30/01/83	Stearns and Weidner leave for Christchurch N.Z.
9/02/83	AWS 8918 installed at Jimmy Site.

MCMURDO AND PENISNULA AREAS.

AWS 8908 and AWS 8911 were converted to 12 vdc operation.

Nancy Site was installed near White Island.

Jimmy Site was relocated to Windless Bight.

Whitlock on Franklin Island was visited.

Ferrell and Meeley sites were found.

Asgard Site was removed.

Marble Point and Manning were visited.
Ice Rise and Spine sites were installed at the Antarctic Pensinsula.

Fig 1 gives the location of the AWS units in the vicinity of McMurdo. Each site has a name which stays with the site and the center of the circle has the last two digits of the AWS ID. This year two different AWS units were at Jimmy and Laurie Sites and AWS unit 8908 has been at two different sites. As the stations stop operating and/or need modification at McMurdo, there will continue to be considerable shuffling. Modifications to units can not be made in the field. A unit already modified and operating will have to be taken out to the site, installed and the previous unit returned to McMurdo for future modification. So the rule will be that the site name remains while the ID changes. Fortunately this can happen only once each year. Fig 2 shows the AWS unit located at the Ice Rise on the Larsen Ice Shelf and proposed future locations for the AWS units. Fig. 3 shows the continent wide AWS units and Fig 4 a possible deployment in the vicinity of Byrd Glacier. No additional deployments should be made until the causes of the recent AWS problems can be resolved.

STATION TOLERANCES

The units should be calibrated each time that they are visited. These calibrations are not going to agree and one does not want to change the entire data set each year nor does one really know which calibration is the most accurate.

The tolerances suggested are those of the WMO for synoptic meteorology and are plus or minus the following values.

Pressure	1 mb
Temperature	.5 C
Wind speed	1 m/s
Wind direction	10 deg
Relative Humid.	5 %

Based on the above tolerances the data will not be changed unless the new calibration is outside of the above tolerances. A record of all calibration data in the lab and in the field will be maintained at Wisconsin and is available to anyone on request. In the future, one person should devote his/her time at the sites to recording calibration data at ten minute intervals. Every-body runs around doing something that is useful and we find on our return that not enough data was recorded or it was forgotten altogether. Also the pressure gauges should be checked against the McMurdo pressure prior to and after each trip to a site to determine if anything has happened to the pressure gauges during the trip. An additional benefit is that there is a chance of determining the elevation of the sit relative to McMurdo. The time on the ground at one of the Ross Ice Shelf sites is usually of the order of two hours so that measurements made every ten minutes with or without the Argos test set will be sure to catch the satellite pass.

Table 1. Current AWS Deployment

McMurdo area

Site	AWS ID	Location	Elevation	Start	Stop
Manning	8905	78.77 S, 166.85 E	30 m ?	25/11/80	
Marble Pt	8906	77.43 S, 163.75 E	120 m ?		
Ferrell	8907	78.02 S, 170.80 E	30 m ?	10/12/80	
Nancy	8908	77.91 S, 168.17 E	30 m ?	17/1/83	
Laurie	8911	77.55 S, 169.90 E	20 m ?	23/1/83	
	8910			15/12/81	18/4/82
Jimmy	8911	77.80 S, 166.72 E	200 m ?	7/12/81	20/7/82
	"	" "	"	24/10/82	5/1/83
	8918	77.75 S, 167.67 E	30 m ?	9/2/83	21/3/83
Whitlock	8913	76.08 S, 168.33 E	221 m	23/1/82	
Meeley	8915	78.52 S, 170.18 E	30 m ?	4/12/80	
Asgard	8908	77.60 E, 161.15 E	1750 m ?	1/2/80	6/1/83

Other AWS units

Dome C	8904	74.50 S, 123.00 E	3280 m	4/2/80	31/1/83
Byrd	8903	80.00 S, 120.00 E	1530 m	/2/80	
Siple	8909	75.90 S, 84.30 E	900 m	1/1/82	

Peninsula Area

Ice Rise	8912	66.90 S, 60.60 W	50 m ?	7/2/83	
Spine	8919	67.60 S, 66.00 W	1540 m ?	9/3/83	20/3/83

8912
80 7

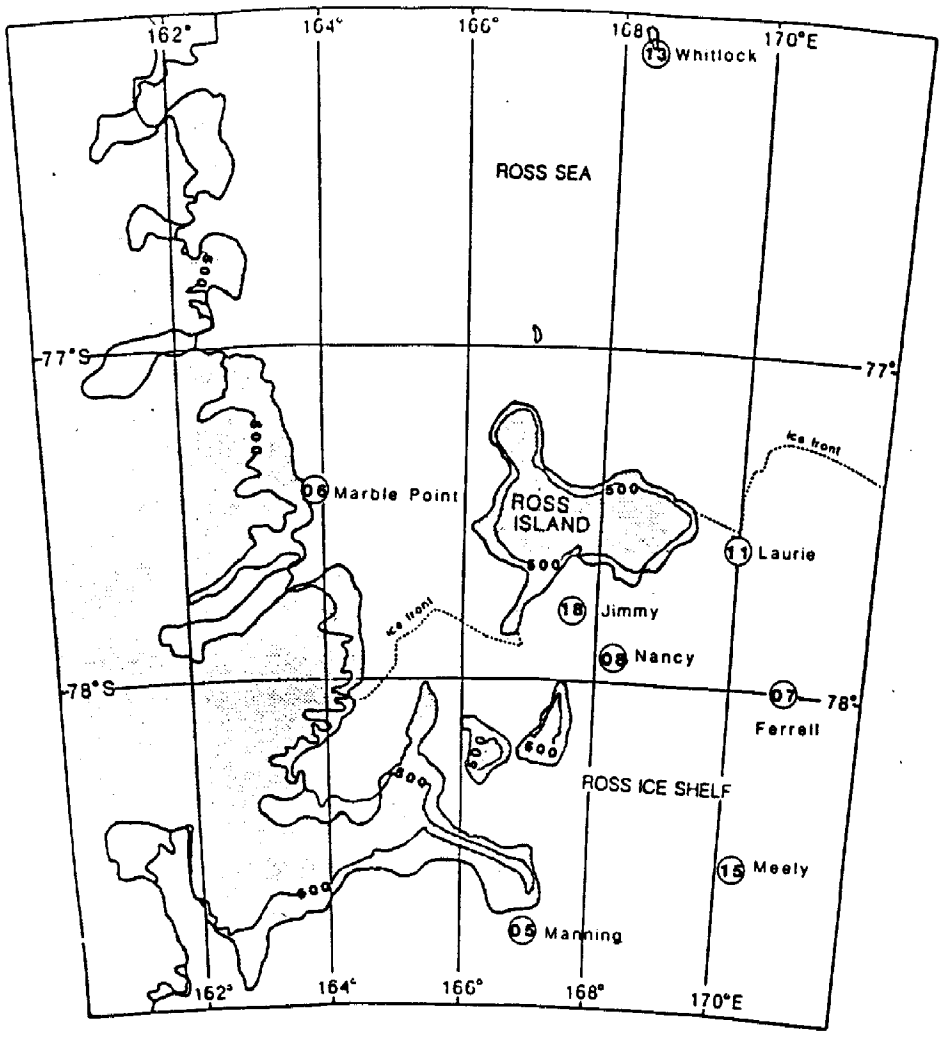

Fig 1. Map showing the locations of the AWS units in the McMurdo area as of 1/2/83. The last two digits of the ID are inside the station circle and the name of the site is to one side. Refer to Table 1 for more detailed information.

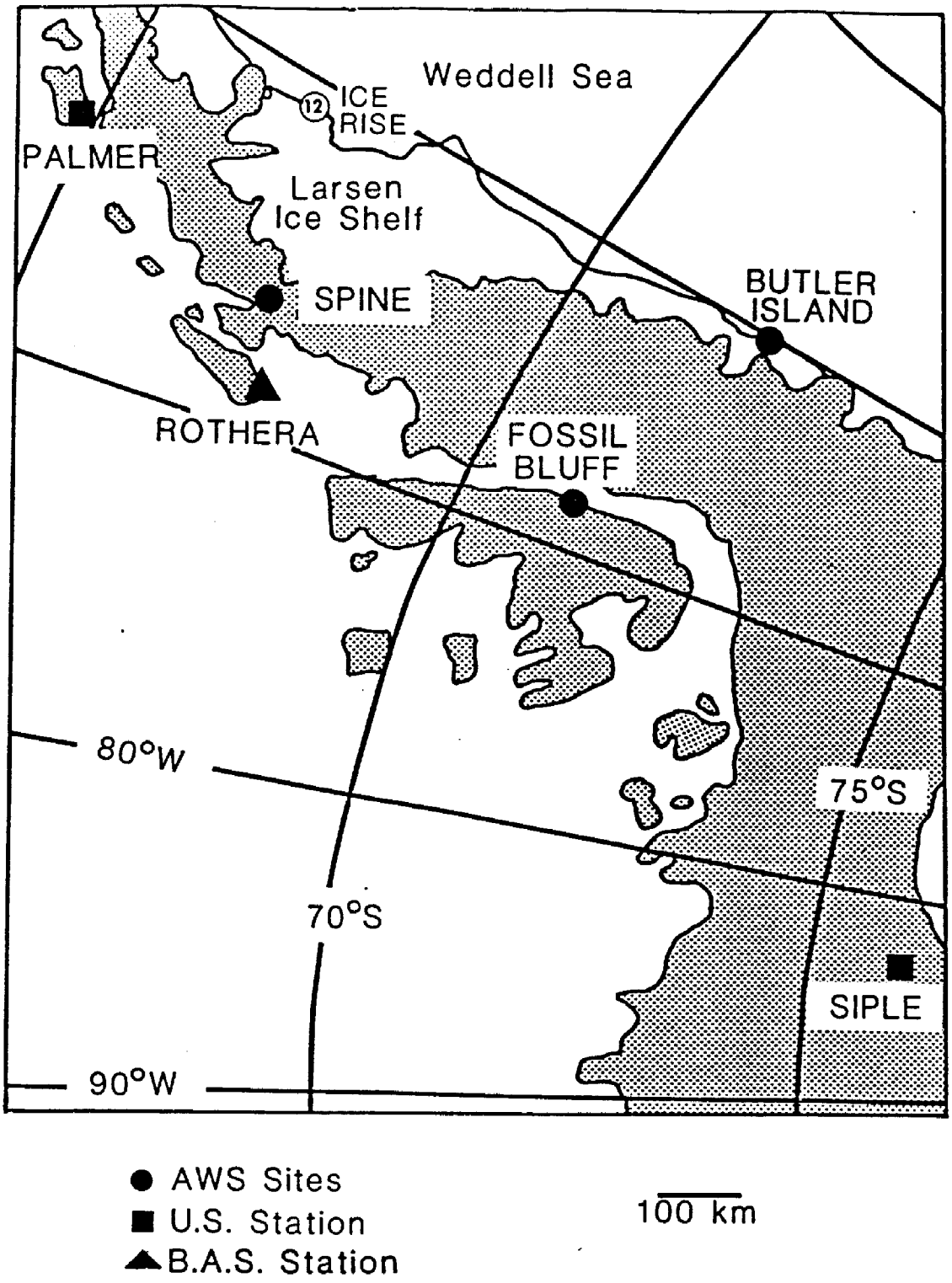

Fig 2. Map of the AWS units in the vicinity of the Antarctic Peninsul which are being installed by the British Antarctic Survey. AWS 8912 at the Ice Rise on the Larsen Ice Shelf is the only unit operating.

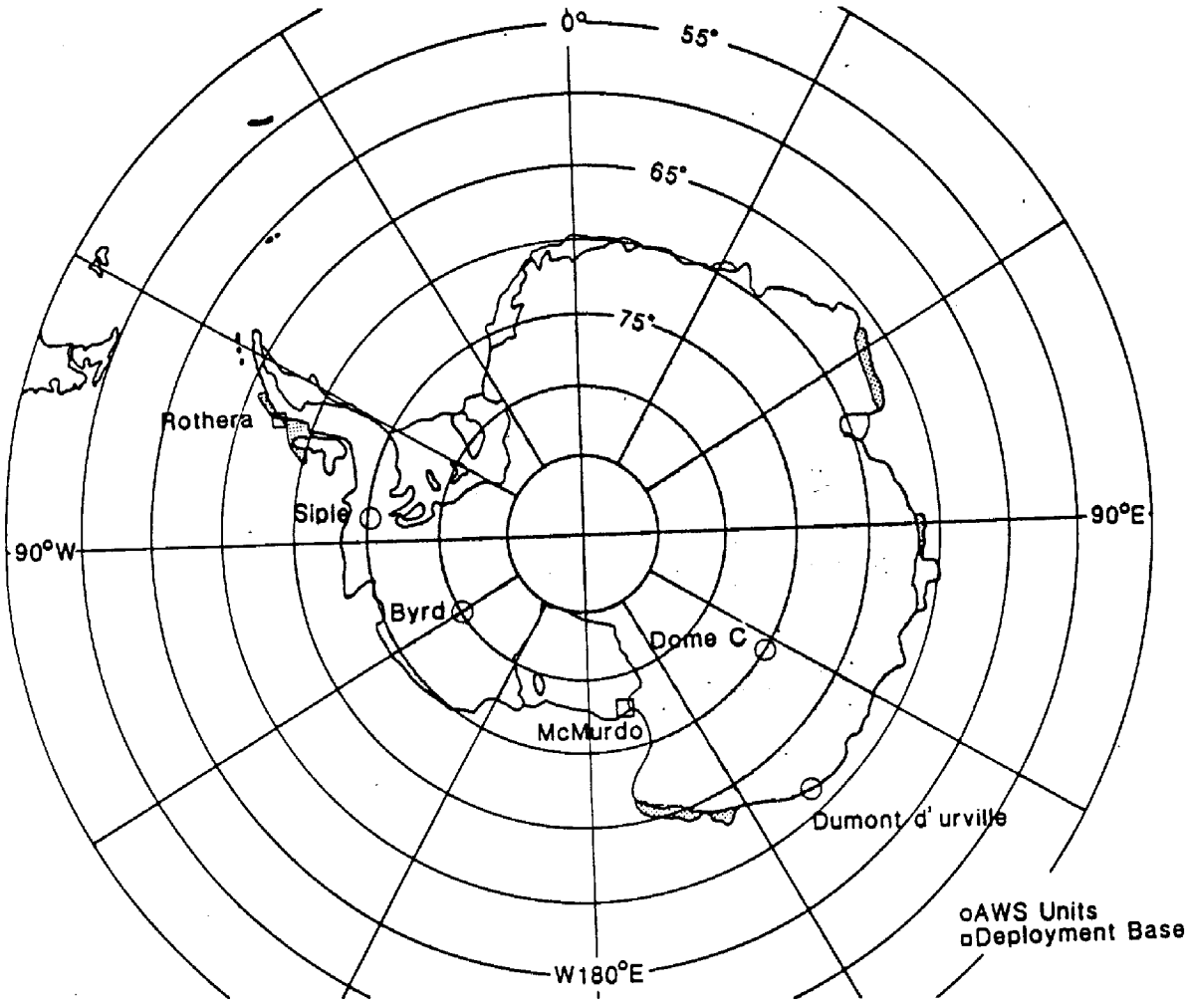

Fig 3. Map of the Antarctic Continent showing the location off the AWS units not shown on Fig 1 and 2 or associated with deployment from Dumont d'Urville. AWS 8904 at Dome C stopped transmitting 31/1/83 after three years of flawless operation recording a low temperature of -82.2 C

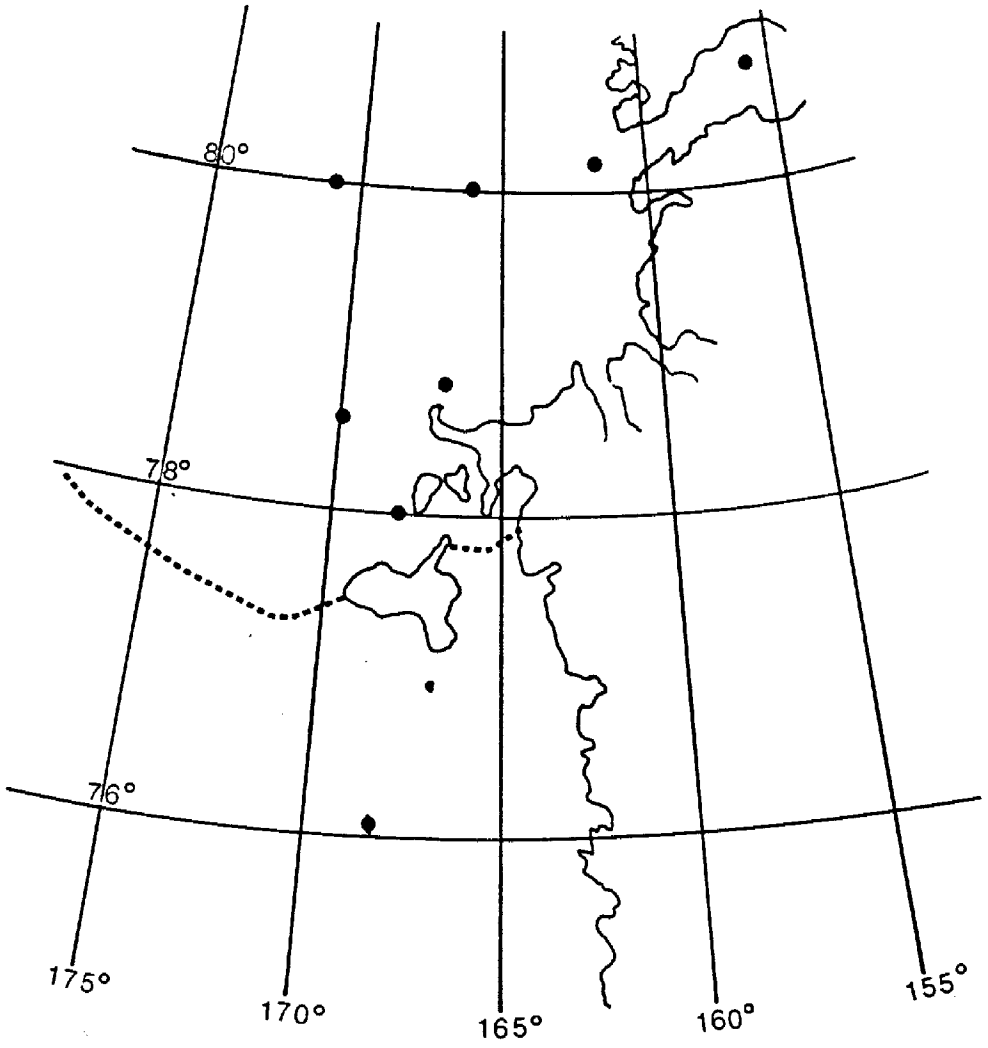

Fig 4. Possible future deployment of AWS units in the vicinity of Byrd Glacier in AS83-84 and AS 84-85. The units remaining in the vicinity of Ross Island are also shown. The purpose is to study the barrier wind.

Marble Point AWS 8906

6/01/83 77.43 S, 163.75 E, 120 m

Aerovane 11-80-07 removed. 9.22 vdc @ 1800 rpm

Aerovane 03-78-14 installed. 9.20 vdc @ 1800 rpm

Field Calibration;

Item	Test Set	Measured	Corection AS 82-83	Corection AS 81-83
Air temperature	-1.0 C	0.8 C	+1.8 C	+0.5 C
Pressure	977.4 mb	978.3 mb	+0.8 mb	+.5 mb
Wind speed	Wind speed(m/s)=.2303*(#bits)-0.161			
Wind direction	0 =north, increasing clockwise			0

Site was visited on the way to Asgard. The visibility was poor. The station was in good condition with the barrel anchors in place and the guy wires tight.

Asgard AWS 8908

6-01-83

Aerovane 11-80-11 removed

The station was removed after the visit to Marble point and all items including the barrels and RTG were removed. AWS 8908 was subsequently modified to operate on 12 vdc power and reinstalled at Nancy Site along with the humidity element which was rechecked at McMurdo before deployment to Nancy Site.

Manning AWS 8905

14/01/83 78.77 S, 166.85 E, 30 m(est)

Aerovane 03-78-10 removed

Aerovane 12-78-09 installed

Field Calibration;

Item	Test Set	Measured	Correction AS 82-83	Correction AS 81-82
Air temperature	-8.5 C	-7.8 C	+0.7 C	-0.6 C
Pressure	983.2 mb	983.2 mb	.0 mb	-0.5 mb
Wind speed	Wind speed (m/s) = .2397 *(3bits) - .127			
Wind direction	North = 0, increasing clockwise		0	

Manning was the alternate for a trip originaly planned for Meeley. The station was spotted by Slotten. The RTG was below the snow level about 50 cm. The minimum thermometer installed last season had the wire in the bottow as did all others. The box as raised one tower rung or about 15 inches The sensor cable was not long enough to extend the tower another 5 feet. This should be done next season and the RTG should be lifted onto a platform. When raising the tower, new anchor boards and guys will be needed. The snow accumulation from 11/80 to 11/81 was 64 cm and from 11/81 to 1/83 was 37 cm.

Nancy Site AWS 8908

17/01/83 77.91 S, 168.17 E, 30 m (est)

Aerovane 11-80-07 installed

Beacon Frequency 235.8 mHz

Field Calibration:

Item	Test Set	Measured	Correction
Air temperature	-4.3 C	-4.9 C	-.6 C
Pressure	993.5 mb	994.8 mb	+1.3 mb
Wind speed	Wind speed (m/s) = 2297* (#bits) +.466		
Wind direction	North = 0, increasing clockwise		0

This is a new site. Power is three boxes of three twelve volt batteries charged by a 10 watt solar panel. A beacon transmitter was installed. The guys were fifty feet of chain going to boards 2 x 4 feet anchored in the snow. Snow level after installation was 15 inches up on the tower at the level of the first rung from the bottom. The site is north of the desired location but should be satisfactory.

Meeley Site AWS 8915

18/01/83 78.52 S, 170.18 E, 30 m (est)

Aerovane 12-78-10 removed

Aerovane 03-78-09 installed

Beacon Frequency 235.65 mHz

Field Calibration;

Item	Test Set	Measured	Correction
Air temperature		-2.5 C	
Pressure	987.9 mb	987.5 mb	-0.5 mb
Wind speed	Wind speed (m/s) = .2296*(#bits) -.508		
Wind direction	North= +353.6 deg, increasing clockwise		+6.4 deg

The site was not serviced last season. The old batteries were charged briefly and the new box of 12 volt batteries and the solar panel were installed and checked to see that the connection were correct. The new battery was buried on top of the old batteries. The beacon transmitter was installed. The flag on the bamboo pole on the tower was ragged and may have interferred with the wind measurement. This is only speculation but the torn rag could have tangled with the prop. Boom height above the snow was about 9 feet. The aerovane prop was rubbing on the decal which could have decreased the wind speed. There was a slight hollow in the snow(5 cm) at the tower base. The guys were in good shape and the tower was erect. Snow accumulation data is not available because time did not allow photographs to be taken during installation in AS 80-81.

Ferrell Site AWS 8907

24/01/83 78.02 S,170.80 E, 20 m (est)

Aerovane 03-78-08 was removed

Aerovane 12-78-16 installed

Beacon Frequency 235.2 mHz

Field Calibration;

Item	Test Set	Measured	Correction
Air temperature	Argos test set not available		
Pressure			
Wind speed			
Wind direction	North = 0, increasing clockwise		0

Comments

Field calibrations were not done because the Argos test set was on the Glacier for the trip to Franklin Island. The beacon transmitter was installed. The station was in excellent condition and snow accumulation from 12/80 to 1/83 was 110 cm.

Whitlock Site AWS 8913

25/01/83 76.08 S, 168.33 E, 221 m (By barometric difference)

Aerovane 00-00-00 Left in place because screws would not come out.

Field Calibration;

Item	Test set	Measured	Correction
Air temperature	-4.8 C	-4.5 C	+0.3 C
Pressure	954.3 mb	953.7 mb	-0.6 mb
Wind speed	Use previous calibration		
Wind direction	North = 346 deg, increasing clockwise		+14 deg

Aerovane could not be removed. The tower was leaning slightly to the north. The barrell anchors did not have weights in them and were not actually anchoring the tower. An snow anchor board to the south and an additional line to the battery box to the south west were installed. The tower base was frozen into the ice which was doing the actual anchoring. The snow must melt during the summer. 400 lbs of weight should be carried out next year to anchor the barrels along with an entire boom assembly to replace the aerovane.

Laurie Site AWS 8911

10/01/83 77.55 S, 169.9 E, 30 m

Aerovane 12-78-09 removed

Aerovane 03-78-07 installed

Beacon Frequency 235.5 mHz

Field calibration;

Item	Test set	Measured	Correction
Air temperature	Argos test set not available		
Pressure	" " " " "		
Wind speed	Wind speed (m/s) = .2352*(#bits)-.470		
Wind direction North = 0, increasing clockwise			0

The AWS unit had stopped transmitting the previous April. The power was okay. AWS 8910 was removed and AWS 8911 was installed after conversion to 12 vdc. The old batteries were removed and three boxes of 12 vdc batteries and a 10 watt solar panel were installed. A beacon transmitter was installed although the station is easily found. The tower was well anchored with no signs of stress on the tower. The liquid column was broken in the minimum thermometer. The modification to AWS 8911 had not been made correctly and two other trips to the site were required before the station operated correctly on 23/01/83. The snow accumulation from 11/81 to 1/83 was 38 cm.

Jimmy Site (Windless Bight) AWS 8918

9/02/83 77.75 S, 167.67 E, 30 m (est)

Aerovane 03-78-09 removed when at Starr Glacier

Aerovane 11-80-09 installed

Field Calibration;

Item	Test set	Measured	Correction

Calibration was not done at time of installation. Use initial method for processing data.

Jimmy Site was removed from Starr Glacier above McMurdo on 5/1/83 and relocated at Bucky Wilson's RTG at Windless Bight. The site was installed without the AWS unit on 9/2/83. Mike Savage installed AWS 8918 on 9/2/83 upon his return from Dumont d'Urville. AWS 8918 was questionable and only operated for 40 days stopping on 21/03/83.
at Bucky Wilson's RTG at Windless Bight. The site was installed without the AWS unit on 9/2/83. Mike Savage installed AWS 8918 on 9/2/83. AWS 8918 was found not to be operating perfectly and operated for about 40 days stopping on 21/03/83 after being turned on 9/02/83.

Byrd AWS 8903

Location 80.0 S, 120.0 E, 1530 m

Aerovane 00-00-01 in place

This site was not visited in AS 82-83

The snow accumulation from Dec 80 to Dec 81 was 71 cm.

Dome C AWS 8904

Location 74.50 S, 123.00 E, 3280 m

Aerovane 03-78-05 in place

This site was not visited in AS 82-83 due to fog at the surface which prevented landing the C-130. The AWS unit stopped transmitting on 31/01/83 and showed signs of trouble about 1/01/83 when the temperature data became erratic. A new station will be constructed for installation in AS 83-84 using the same ID.

Siple AWS 8909

Location 75.90 S, 84.30 E, 900m

Aerovane 03-78-12 in place

The site was not visited in AS 82-83 due to transportation problems. Two five foot tower sections were sent to Siple so that the tower could be raised by the station people according to their judgement. The snow was at the top of the box in January 83 or about five feet deep. In AS 83-84 the station should be converted to 12 vdc and powered by batteries and solar panel. The tower height should be increased at that time enough to survive the accumulated snow for three years.

Antarctic Peninsula

Ice Rise, Larsen Ice Shelf AWS 8912
Antarctic Peninsula

7/02/83 66 deg 57's, 60 deg 36' W, 50 m estimated

AWS 8912 is operating satisfactorily. Calibration data at the site is not available yet.

Spine AWS 8919

9/03/83 67 deg, 39'S, 66 deg,05'W, 1680 m

AWS 8919 was installed although it was known that the pressure was not being measured correctly. The unit subsequently failed 20 /03/83

Butler Island AWS 8902

This unit was deployed by the BAS but upon installation at Butler Island the unit did not operate. The unit was removed leaving the tower and other equipment in place on Butler Island and will be returned to Wisconsin for repairs.

AWS units not operatating

AWS 8902

This unit has failed and will be returned to Wisconsin for repairs and then returned to the BAS in AS 83-84

AWS 8904

This unit failed at Dome C on 31/01/83. A new unit should be constructed to operate on the RTG and with the same ID for installation at Dome C in AS 83-84.

AWS 8910

This unit failed at Laurie Site in April 82 and has been returned to Wisconsin. This unit will be repaired, modified for 12 vdc operation and used for testing the relative humidity and temperature difference installation proposed for the next year. Cause of failure needs to be determined.

AWS 8911

This unit was installed at Laurie Site after conversion to 12 vdc operation in AS 82-83. The unit failed on 28/3/83.

AWS 8914

AWS 8916

AWS 8917

This unit is not operating and is to be returned to Wisconsin for repairs.

AWS 8918

This unit is not operating and a replacement unit will be constructed to operate on 12 vdc and include moisture and vertical temperature

difference for installation in AS 83-84. The same ID will be used.

AWS 8919

Aerovane Record AS-82-83

number	from	to	slip	bear	brush	pot
00-00-00		Whitlock 1/82				
00-00-01		Byrd 12/81				
03-78-05	Ferrell AS 81-82	Dome C				
03-78-07	Dome C	Laurie	#	#		#
03-78-08	Ferrell	M				
03-78-09	Jimmy	Meeley			#	#
03-78-10	Manning	M				
03-78-12		Siple 01/82				
03-78-14	Byrd 12/81	Marble Pt				
03-78-16	Asgard 12/80					
12-78-09	Laurie	Manning				#
12-78-10	Meeley	W		#	#	#
12-78-16		Ferrell				#
11-80-07	Marble Pt	Nancy				
11-80-09		Jimmy				
11-80-11	Asgard		#			#

M In inventory at McMurdo and needs to be repaired
Item repaired
W Returned to Wisconsin with a slow tachometer

Inventory- McMurdo

2 extension cords- 4 plug about 20 feet long

1 extension cord 8 plug about 3 feet long

1 6 vdc, 10 W solar panel which can be converted to 12 vdc

3 6 vdc gel cell batteries

1 12 volt gel cell battery

3 12 vdc battery boxes 3 batteries each for Siple wired for 6 pin plug

1 6 vdc battery box with 10 batteries wired for 12 vdc with small 3 pin plug

2 empty battery boxes

2 3 foot tower sections -could be base of tower

8 5 foot tower sections

1 7 foot tower section

1 1800 rpm motor for spin test of aerovanes

Aerovane parts

6 pots, new

9 bearing sets, new, large and small

allen wrenches

spline wrenches

3 brush sets, new

3 rubber gaskets for base

2 aerovanes 12-78-10 and 3-78-008 not repaired

4 props for aerovanes

4 aerovane mounting posts

1 roll of mylar tape, aluminized

Inventory, shipped to Madison

Gray tool box
with assorted tools

Blankenship's case

Martha's case

Model 5121 humidity probe

Frequency meter

Brunton compass and tripod

Orys soldering iron

AWS calibration boxes

Shunt regulator, broken

Moisture monitor

Tip Decoder

drill

Inverter

12 vdc power supply

Camera tripod

Barometer cases

Electronic components

4 generator anemometers

Aerovane 12-78-10 which has the slow tachomoter.

Aerovane parts needed for next year

Brushes

Screws for base and prop

Slow tachometer fixed

Modifications for the AWS units for AS 83-84

1. The humidity probe used on AWS 8908 at the Asgard Site apparently operated satisfactorily. After removal from Asgard the circuit for the humidity probe was studied and it should be possible to make a similar circuit for future probes on the presently deployed AWS units. A chip Intersil 7606 can be used to amplify the signal and send it to the channel previously reserved for humidity. The data from previous updates will not be stored for previous updates. Only the last update will be transmitted.

The electronics need to be assembled prior to the trip to Antarctica then the stations will have to be modified at McMurdo or Rothera. The sensor will have to be mounted on the boom near the temperature sensor. An additional plug may need to be installed on the electronics box. The power consumption is slightly greater but should not be a problem and depends upon the design of the circuitry which has yet to be determined.

2.AWS 8909 at Siple needs to be modified for 12 vdc power as was successfully done this past season for AWS 8908 and 8911.

3. The vertical air temperature from about 50 cm to about 3 m could be used to determine the vertical flux of sensible heat using the appropriate theory and the wind speed. The vertical temperature difference can be measured using a five junction set of thermocouples and the Intersil 7606 chip. It is expected that the vertical temperature difference can be determined to better than 0.1 C. The method has been tried on Plateau Station data and appears to give reasonable values for the vertical sensible heat flux. This

modification would be similar to the moisture measurement and would used one of the channels previously used for battery voltage.

4.Another possible modification is to modify the read only memory in the AWS unit. The modification would be to not measure and store the internal temperature for the previous 4 updates as the temperature is only needed to 1.0 C in order to correct the pressure data for temperature to within 0.1 mb as the internal temperature changes slowly. Then one could store wind speed and direction for the last 4 updates as this information would be more useful to the meteorologist. Another way to obtain more data is to remove the check sum from the program. One should be wary of modifying the read-only-memory on a system that is working so very well. A mix of stations with different formats would increase the complexity of the data processing but not to a large extent.

5. An additional possibility is to design a new station operating system that would include everything that any body could possibly want.

Data Word

The present data word is as follows:

```
                        [       +10         ][       +20         ][ +30]
   1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2

1  [ T external (12)      ] [ T internal(12)      ] [ Checksum(8) ]

2  [ Pressure   (16)              ] [ P(-10)(8)  ] [ Checksum(8) ]

3  [ Speed(8)     ] [ Direction(8)] [  RH(8)      ] [ Checksum(8) ]

         External Temperature Difference
4  [T(-10)(6)] [T(-20)(6)] [T(-30)(6)] [T(-40)(6)] [ Checksum(8) ]

         Internal Temperature Difference
7  [T(-10)(6)] [T(-20)(6)] [T(-30)(6)] [T(-40)(6)] [Checksum(8)  ]

6  [ P(-20)(8)    ] [ P(-30)(8)    ] [ P(-40)(8)    ] [ Checksum(8) ]

7  [Mean Wind(8) ] [Vect Dir(8)  ] [ Cycle(8)     ] [ Checksum(8) ]

8  [Battery(8)    ] [ Zener(8)     ] [ Heater(8)    ] [ Checksum(8) ]
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The above was the first data word for the AWS IIA units and has worked very well. It was designed prior to any experience with the Argos system and as a result the transmission had a large number of checksums so that it would be possible to recover the data if it was garbled during the transmission. Based on three years of experience the data is transmitted so well that at most only one check sum would be needed.This would make available seven 8 bit words for data. The internal temperature is needed to only 1 C in order to correct the pressure data for temperature to 0.1 mb and the internal temperature changes less than 1 C in 40 minutes so the past internal temperature does not need to be stored. This makes available three 8 bit words. In addition only the battery voltage is needed and the zener and heater make another two 8 bit words available for a total of twelve 8 bit words. These words could be used for four values of

relative humidity leaving eight unused 8 bit words. The mean wind speed and direction could be replace by four past values each leaving two unused words. These could be used for measuring the vertical temperature gradient. Some packing could be done by using differences from the mean value as is done for pressure and temperature at the present time. The above changes would require reprogramming the read-only memories and might be limited by the memory in the unit. Another change that could be made is in the intervals between updates which is now 3 times the transmission interval, nominally 200 sec. This could be changed to 6 times which would result in virtually continuous coverage by the satellites as the interval between passes is of the order of one hour and the storage above would provide 80 minutes of past data at a nominal 20 minute interval. This is something that needs to be decided by all and would take place only by rotating AWS units between sites.