Antarctic Automatic Weather Stations: 1988
Field Report for AS 87-88

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Introduction:

The automatic weather stations (AWS) in Antarctica measure air temperature, wind speed and wind direction at a nominal height of three meters above the surface, and air pressure at the electronics enclosure. Some AWS units measure relative humidity and/or the air temperature difference between three meters and 0.5 meters above the surface. The AWS unit is controlled by a micro-computer which updates the data at a nominal 10 minute interval and transmits three to five data points for each sensor at a nominal 200 second interval to ARGOS equipped polar orbiting satellites.

The AWS units in Antarctica support the following studies:

a. Barrier wind flow along the Antarctic Peninsula and the Transantarctic Mountains,
b. Katabatic flow down the Adelie coast, Byrd Glacier, Beardmore Glacier and Reeves Glacier,
c. Mesoscale circulation on the Ross Ice Shelf,
d. Climatology of Byrd Station and Dome C,
e. Sensible and latent heat fluxes on the Ross Ice Shelf,
f. Oceanographic support,
g. Meteorological support for air operations using a local user terminal (LUT) at McMurdo,
h. Influence of Amundsen-Scott Station on the local climate.

Field Work, 1987-1988 Field Season:

The field work for the austral summer (AS) 1987-1988 involved the following:

On the Polar Star cruise from Punta Arenas to McMurdo AWS 8916 was installed on Scott Island, AWS 8905 on Inexpressible Island was repaired, AWS 8909 was installed at the 4000 ft. level on the Reeves Glacier, 8929 was installed on Inexpressible Is at the Snow Cave for Dave Bromwich, and AWS 8923 was recovered from Martha I Site.

The RTG was lifted out of the snow at Ferrell Site. Patrick and Allison sites near the South Pole were removed and Clean Air was raised. The aerovanes were replaced at Elaine and Lettau Sites. Two boxes of batteries and a solar panel were installed at Clean Air. AWS 8927 was replaced with 8901 at Jimmy Site. Marilyn, Schwerdtfeger, and Gill Sites were repaired and raised as necessary, and AWS units 8927, 8923, and 8921 were installed on the Reeves Neve for Bromwich and Parish.

AWS 8910 at Siple was repaired and placed in operation by Bill Trabucco.

Locations

Table 1 gives the Argos ID at the AWS Sites and the dates that the ID was started or stopped at the site. The data tapes and files are organized according the the Argos ID so the information in Table 1 is necessary in order to be certain that one has the correct site. The stop date could be because the unit was removed from the site, the unit stopped, or the use of the site was ended.

Table 2, Figure 1, and Figure 2 give the AWS site name. Argos ID, latitude, longitude, elevation, and the ID start date for the last start at that site. The Byrd Station start date is 5 Feb 80. The AWS unit has operated continuously since the initial start. Figure 1 and Figure 2 show the AWS sites in Antarctica. The prior location for Schwerdtfeger Site was in error because the minutes for the latitude and longitude were not converted to fractions of a degree. The use of the Argos location system should reduce errors in the site locations. Figure 3 shows the layout of the AWS unit.

Calendar of Events

Date	Event
Nov 87	Bill Trabucco repairs 8910B at Siple
28 Nov 87	Lee Powell of Dr Bentley's group services 8908B and 8911B via Twin Otter.
2 Dec 87	Professor Stearns departs for Punta Arenas, Chile
7 Dec 87	Professor Stearns departs on Polar Sea for Palmer
11 Dec 87	Professor Stearns arrives Plamer, AWS 8902B/2 for BAS unloaded
22 Dec 87	George Weidner and Rabindra Basnyat leave Madison
24 Dec 87	Arrive Christchurch New Zealand
25 Dec 87	Prof. Stearns installs 8916B/2 on Scott Island
28 Dec 87	Prof. Stearns repairs 8905B on Inexpressible Is. and 8909B on Reeves Glacier at 4000 ft. level
29 Dec 87	Prof. Stearns installs 8929 on Inexpressible Is.
30 Dec 87	Weidner and Basnyat arrive McMurdo
1 Jan 88	Prof. Stearns retrieves 8923 at ice edge.
2 Jan 88	Prof. Stearns arrives McMurdo
4 Jan 88	Weidner, Stearns, Basnyat, Lt. Rodie, LCDR Fandey LCDR Bronsink, AMHC Karo and AMH2 Gisey raise RTG at Ferrel Site and raside tower
8 Jan 88	Prof. Stearns and Basnyat arrive South Pole
11 Jan 88	Prof. Steanrs and Basnyat retrieve 8921B
11 Jan 88	Prof. Stearns and Basnyat retrieve 8901B
12 Jan 88	Prof. Stearns and Basnyat service 8918B at Pole
12 Jan 88	Dr. Bromwich arrives McMurdo
14 Jan 88	Weidner and Bromwich install 8901B/2 at Jimmy site and retrieve 8927B.
14 Jan 88	Stearns and Basnyat return from Pole
15 Jan 88	Twin Otter arrives McMurdo
16 Jan 88	Weidner and Bromwich service 8924B and 8915B
18 Jan 88	Weidner and Basnyat service 8925B
19 Jan 88	Weidner, Stearns and Bromwich deploy 8927B and 8923B via Twin Otter in Reeves' Neve.
20 Jan 88	Stearns, Bromwich and Basnyat deploy 8921B via Twin Otter in Reeves' Neve
25 Jan 88	Bromwich and Stearns leave McMurdo
27 Jan 88	Weidner and Basnyat leave McMurdo
29 Jan 88	Weidner, Stearns and Basnyat arrive Madison.

Table 1. AWS site, ID, latitude, longitude, ID start date, and ID stop date for 1986, 1987 and 1988.

Location or name	AWS ID	Lat. (deg)	Long. (deg)	ID Start Date	ID Stop Date
D-10	8901	66.70 S	139.80 E	12 Dec 85	25 Sep 86
	8912			4 Nov 86	
D-47	8914	67.38 S	138.72 E	13 Nov 85	01 Jul 86
				20 Nov 86	
D-57	8916	68.18 S	137.52 E	17 Nov 85	10 Jun 86
				23 Nov 86	30 Sep 87
D-80	8919	70.02 S	134.72 E	11 Dec 85	
Dome C	8904	74.50 S	123.00 E	13 Jan 83	
Byrd Stat.	8903	80.00 S	120.00 W	5 Feb 80	
Siple Stat.	8910	75.90 S	83.92 W	5 Dec 87	
Marble Point	8906	77.43 S	163.75 E	5 Feb 80	
Ferrell	8907	78.02 S	170.80 E	10 Dec 80	
Whitlock	8913	76.24 S	168.66 E	23 Jan 82	
Buckle Is.	8928	66.87 S	163.24 E	20 Feb 87	
Scott Is.	8916	67.37 S	179.97 W	25 Dec 87	
Marilyn	8915	79.98 S	165.03 E	10 Jan 87	
Schwerdt.	8924	79.94 S	169.83 E	24 Jan 85	
Gill	8925	80.00 S	179.00 W	24 Jan 85	
Bowers	8909	85.20 S	163.40 E	11 Jan 86	29 Mar 86
Elaine	8911	83.15 S	174.46 E	28 Jan 86	
Lettau	8908	82.59 S	174.27 W	29 Jan 86	
Martha I	8923	78.31 S	172.50 W	1 Feb 84	1 Jan 88
Martha II	8900	78.38 S	173.42 W	11 Feb 87	
Manuela	8922	74.92 S	163.60 E	6 Feb 84	
	8905			15 Feb 87	27 Jun 87
				29 Dec 87	
Shristi	8909	74.70 S	161.57 E	28 Dec 87	
Sushila	8921	74.30 S	161.30 E	20 Jan 88	
Sandra	8923	74.49 S	160.49 E	19 Jan 88	
Lynn	8927	74.23 S	160.37 E	19 Jan 88	
Larsen Ice	8926	66.97 S	60.55 W	1 Jan 86	
Dolleman Is.	8917	70.59 S	60.92 W	18 Feb 86	
Butler Is.	8902	72.21 S	60.34 W	1 Mar 86	18 Jul 87
Uranus Gl.	8920	71.43 S	68.93 W	6 Mar 86	
Clean Air	8918	90.00 S		29 Jan 86	
Patrick	8905	89.88 S	45.00 E	28 Jan 86	16 Jan 87
	8921			17 Jan 87	11 Jan 88
Allison	8900	89.88 S	60.00 W	28 Jan 86	23 Jun 86
	8901			16 Jan 87	27 Jun 87
Jimmy	8927	77.87 S	166.81 E	1 Feb 87	12 Jan 88
	8901			12 Jan 88	

Table 2. AWS locations, Argos ID, and ID start date for 1988.

Site Name	ID	Lat. (deg)	Long. (deg)	Elev. (m)	ID Start Date
Purpose: Katabatic wind flow; G. Wendler, Univ. of Alaska.					
D-10	8912	66.70 S	139.80 E	240	15 Jan 84
D-47	8914	67.38 S	138.72 E	1560	13 Nov 85
D-80	8919	70.02 S	134.72 E	2500	11 Dec 85
Dome C	8904	74.50 S	123.00 E	3280	13 Jan 83
Purpose: Climatic record; C. Stearns, Univ of Wisconsin.					
Byrd Stat.	8903	80.00 S	120.00 W	1530	5 Feb 80
Siple Stat.	8910	75.90 S	83.92 W	1054	10 Dec 87
Clean Air	8918	90.00 S		2836	28 Jan 86
Purpose: NSFA Support network.					
Marble Point	8906	77.43 S	163.75 E	120	5 Feb 80
Ferrell	8907	78.02 S	170.80 E	45	10 Dec 80
Whitlock	8913	76.24 S	168.70 E	275	23 Jan 82
Buckle Is.	8928	66.87 S	163.24 E	520?	20 Feb 87
Scott Is.	8916	67.37 S	179.97 W	30?	25 Dec 87
Purpose: Ross Ice Shelf network; C. Stearns, Univ of Wisconsin.					
Marilyn	8915 U,T	79.98 S	165.03 E	75	16 Jan 84
Schwerdt.	8924 U,T	79.94 S	169.83 E	60	24 Jan 85
Gill	8925 U,T	80.00 S	179.00 W	55	24 Jan 85
Elaine	8911 U,T	83.15 S	174.46 E	60	28 Jan 86
Lettau	8908 U,T	82.59 S	174.27 W	55	29 Jan 86
Martha II	8900 U,T	78.38 S	173.42 W	18	11 Feb 87
Purpose: Reeves katabatc flow; Bromwich and Parish, Oh & Wv					
Manuela	8905 U,T	74.92 S	163.60 E	80	15 Feb 87
Shristi	8909 U,T	74.70 S	161.57 E	1200	28 Dec 87
Sushila	8921 T	74.30 S	161.30 E	1431	20 Jan 88
Sandra	8923	74.49 S	160.49 E	1525	19 Jan 88
Lynn	8927 U,T	74.23 S	160.37 E	1772	19 Jan 88
Purpose: Barrier Wind, Antarctic Peninsula; C. Stearns, U of W.					
Larsen Ice	8926	66.97 S	60.55 W	17	1 Jan 86
Dolleman Is.	8917	70.58 S	60.92 W	396	18 Feb 86
Butler Is.	8902	72.20 S	60.34 W	91	1 Mar 86
Uranus Gl.	8920	71.43 S	68.93 W	780	6 Mar 86
Purpose: Testing					
Jimmy	8901	77.87 S	166.81 E	200	12 Jan 88

U - AWS unit has relative humidity sensor
T - AWS unit has vertical temperature difference sensor

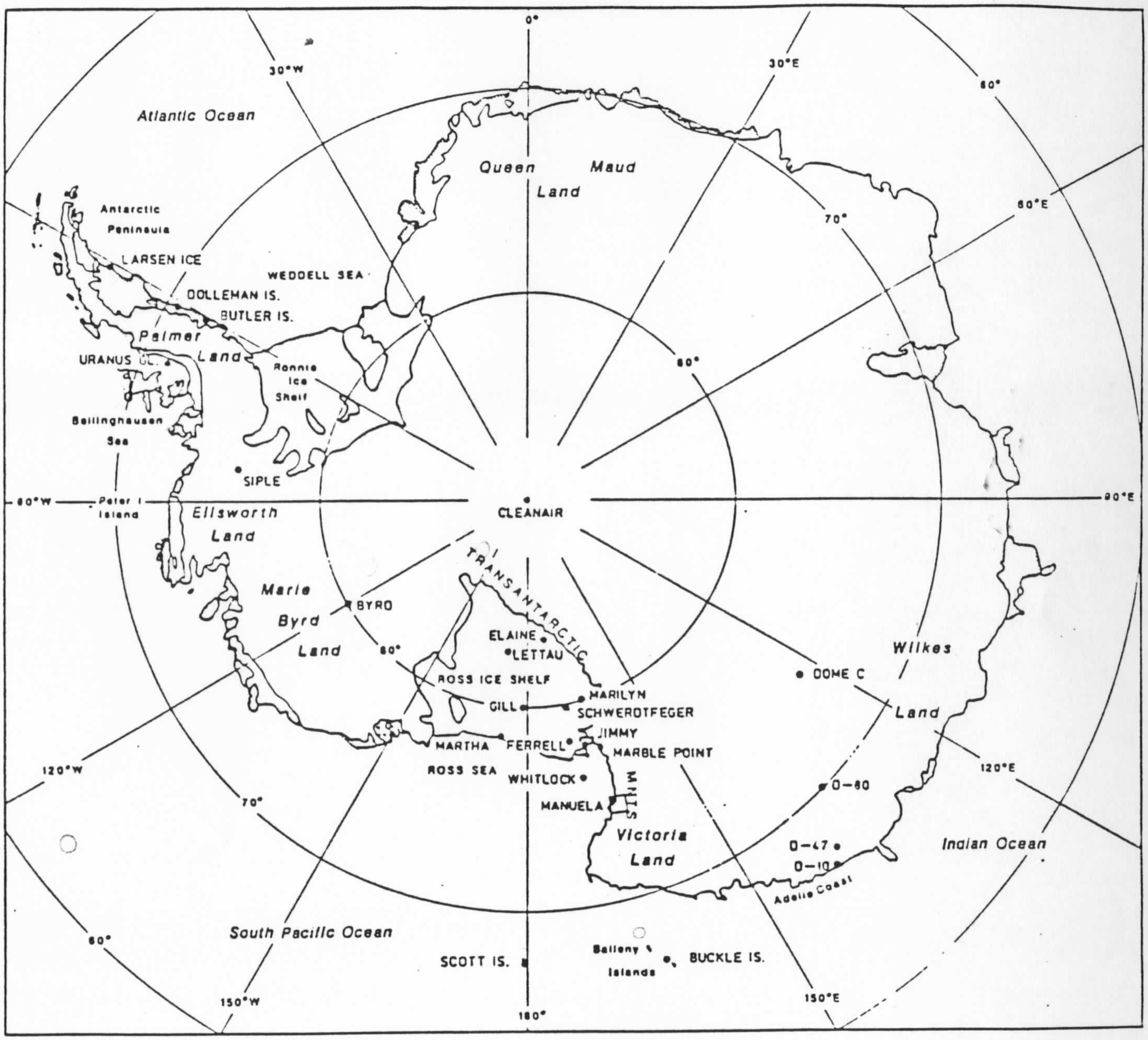

Figure 1. Map of Antarctica giving the locations of the AWS units for 1988. The units in the rectangle about Manuela Site are shown in Figure 2.

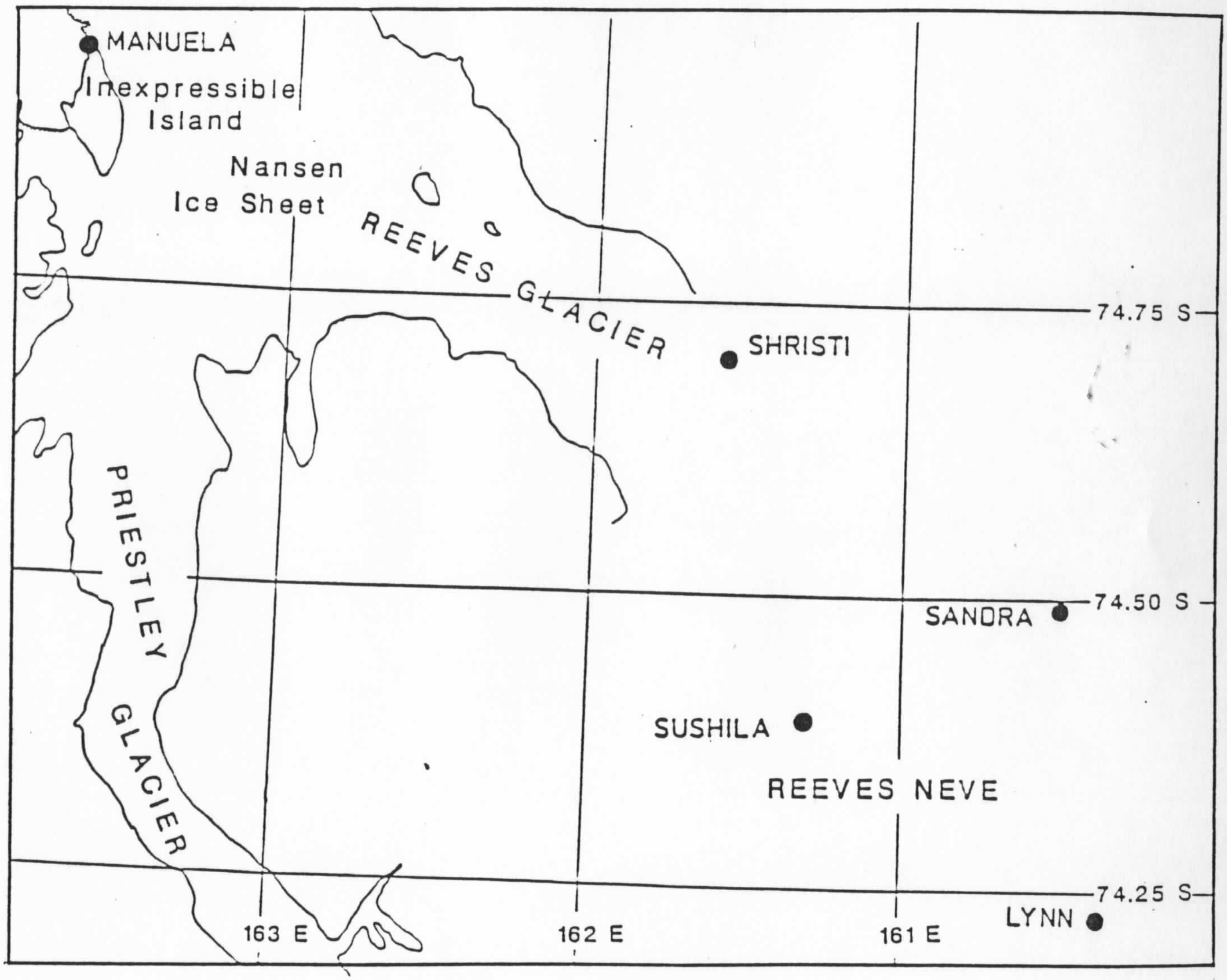

Figure 2. Map showing the location of AWS units in the vicinity of the Reeves Glacier and is the insert for the rectangle about Manuela Site in Figure 1.

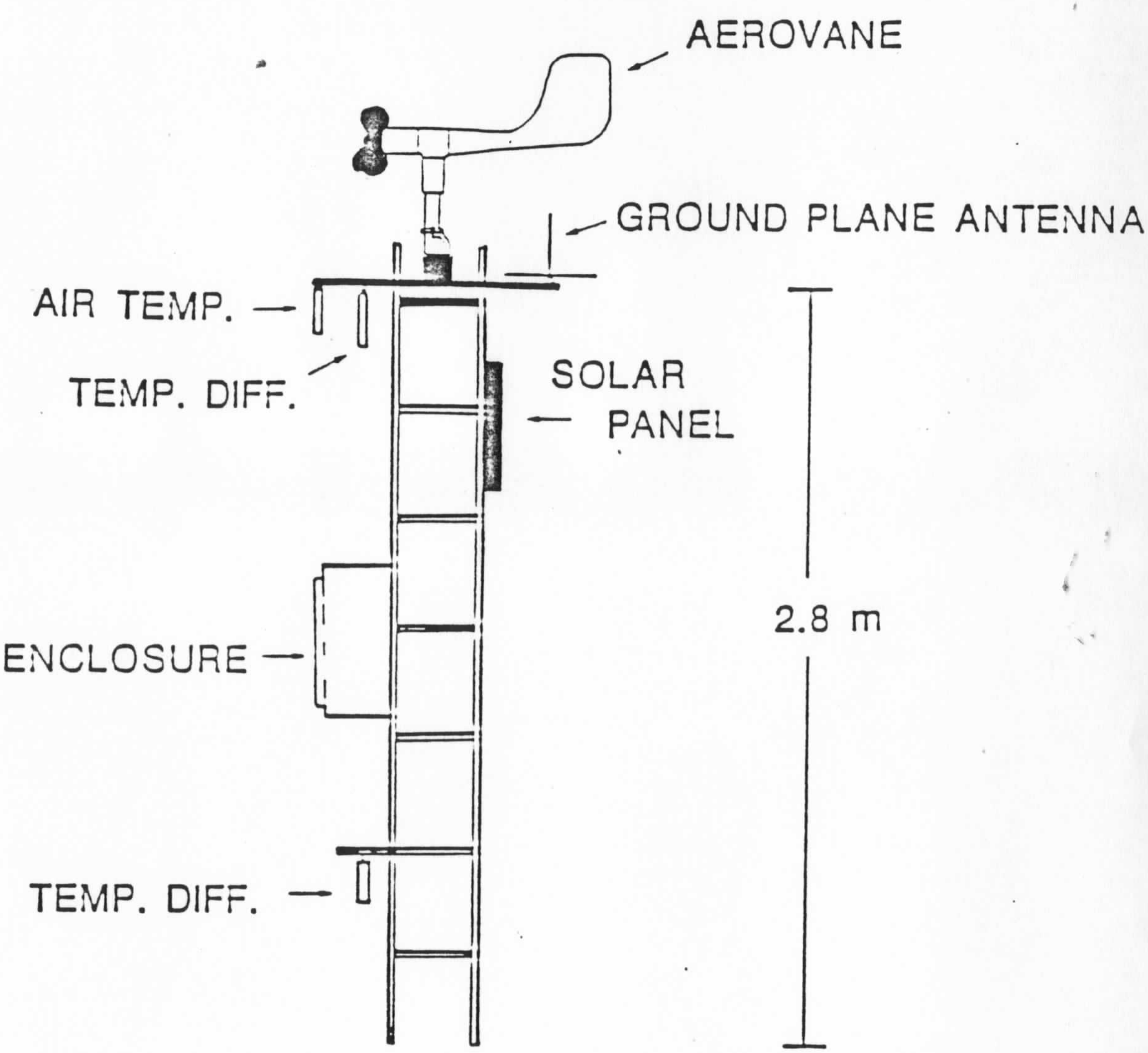

Figure 3. Layout of the AWS unit used in Antarctica. Nine gel cell batteries of 40 ampere hour capacity each are used in the cold regions of Antarctica such as South Pole and six batteries are used in the warmer regions such as the Ross Ice Shelf.

AWS Staion Status for 1987

Staion ID	Field Sited	Station Status Summary
8900B	Martha II	Operated for entire year
8901B	Patrick	Ceased TX June 87 (1)
8902B	Butler Island	Ceased TX July 87 (2)
8903AR	Byrd	Operated for entire year
8904AR	Dome-C	Operated for entire year
8905B	Manuela	Ceased TX June 87 (3) (A)
8906BR	Marble Pt.	Operated for entire year
8907BR	Ferrell	Operated for entire year
8908B	Lettau	Operated for entire year (A)
8909B	New AWS	Replace 8909B at Bower
8910B	Siple	Started Nov 87 (4)
8911B	Elaine	Operated for entire year
8912B	D-10	Operated for entire year
8913A	Franklin Island	Operated for entire year
8914B	D-47	Operated for entire year (A)
8915B	Marilyn	Batteries failed June 87 (A)
8916B	D-57	Ceased TX August 87 (5)
8917B	Dolleman Island	Operated for entire year (A)
8918B	Pole	Operated for entire year
8919B	D-80	Operated for entire year
8920B	Uranus Glacier	Operated for entire year
8921B	Allison	Operated for entire year
8922B	Greenland	Operated for entire year
8923B	Martha I	TX only AS summer (6) (A)
8924B	Schwerdtfeger	Operated for entire year (A)
8925B	Gill	Operated for entire year (A)
8926B	Larsen Ice Shelf	Operated for entire year (7)
8927B	Jimmy	Operated for entire year (A)
8928B	Buckle Island	Operated for entire year (8)

Keys

(A) - Aerovane Problem
(1) - 8901B found to have weak transmitter
(2) - Suspect bad power connection
(3) - Aerovane destroyed and tail took out dipole antenna
(4) - Battery + shorted to tower. Repaired by Bill Trabucco
(5) - 8916B was not retrieved for 1987 new station used ID
(6) - 8923B transmitter very weak and frequency shifted
(7) - 8926B batteries not charging
(8) - 8928B station likely buried on Buckle Island

IV. Plans for the third year 1 July 1988 to 30 June 1989:

A. AWS Operations:

The new CPU and interface boards for the AWS unit will be designed, constructed and tested. The original and expensive tower intially used will gradually be replaced with a less expensive and stronger tower. Batteries and solar panels will be required for five AWS units including four RTG powered units planned to be replaced.

The anticipated field work during the AS 88-89 are as follows:

1. Removal of the AWS units at D-47, D-57, and, if possible, D-80 by Didier Simone. The units are to be upgraded with new CPU and interface boards, waterproof enclosures, short booms and equiped with a snow depth sensor, snow temperature and snow heat flux sensors.

2. Replace RTG powered units with battery powered units at Byrd Station, Marble Point and Ferrell Sites. Marble Point and Ferrell will require two helicopter flights each and Byrd will require an LC-130 flight to McMurdo with the RTG.

3. Consider removal of the RTG powered unit at Dome C and replace with a battery powered unit. LC-130 flight to Dome C with cat to lift out and load the RTG into the LC-130. Will need at least two hours of ground time.

4. Trip to the Beardmore Glacier to repair the AWS unit at Bowers Site at 85.20 S, 163.40 E, 2014 m.

5. Service AWS units on Reeves' Neve via Twin Otter as necessary

6. Ice Breaker Cruise
    b. Install two AWS units, one to the west of Inexpressible Island and one at the snow cave site on Inexpressible Island.

7. Replace 8902 on Butler Island and service 8926 on the Larsen Ice Shelf (BAS?)

B. AWS Data Services:

AWS data on magnetic tape will be distributed to the following user:

Mr. John Shanklin
British Antarctic Survey
Cambridge, England

Dr. David Bromwich
Institute of Polar Sciences
Columbus, Ohio

Professor Thomas Parish
University of Wyoming
Laramie, Wyoming

Professor Robert Renard
Naval Post Graduate School
Monteray, California

Professor Gerd Wendler
University of Alaska
Fairbanks, Alaska

Others at the request of Dr. John Lynch, Project Manager, NSF-DPP. The 1987 AWS data book will be sent to more than 54 users including several libraries which will serve as archives for the data. Data will be available on floppy disks in the IBM-PC format.

C. AWS Research:

Research will continue in the following areas

1. Barrier wind flow along the Antarctic Peninsula and the Transantarctic Mountains,

2. Foehn type katabatic wind flow down the Byrd and Beardmore Glaciers,
3. Climatology of Byrd Station and Dome C,

4. Mesoscale circulation on the Ross Ice Shelf,

5. Sensible and latent heat fluxes on the Ross Ice Shelf,

D. AWS Improvements:

Work will start on the design of the new CPU and interface boards using the recently introduced CD74HC series of integrated circuits. The expected changes are as follows:

1. Increase the RAM memory so that the three transmissions between data updates will contain different information so that more data can be transmitted,

2. Protect the input circuits from electrostatic pick up due to blowing snow,

3. Redesign the reference voltages to reduce the likelyhood of the amplifier latching up,

4. Add eight +/- 1 millivolt inputs to the system for amplifying thermocouple voltages so that temperature gradients and heat fluxes in the snow can be measured,

5. Put the multiplexers on the interface board to reduce the wiring complexity,

6. Provide for sampling inputs less frequently than the nominal update period of 10 minutes. This will allow for the measurement of slowly varying quantities such as snow temperature and depth to the snow,

7. Include a sonic system for measuring the depth to the snow so that accumulation rates can be determined.