# South Pole Meteorology Instrumentation Timeline

## Part I – Temperature Sensors

**11 January 1957**
Toluene minimum thermometer installed in "thermoscreen" instrument shelter 250 feet upwind of the station. From the 1957 turnover report, it appears as though there may have been other thermometers in the shelter but this is the only one documented. Height above snow surface: 5 feet.

**6 March 1957**
"Thermohm" resistance thermometer was installed in the thermoscreen and connected to a recorder in the office. Height above snow surface: 5 feet. This was probably used for the hourly temperature readings.

**2 April 1957**
Five more resistance thermometers were installed (type L&N Wheatstone 100ohm Cu) at the following heights: -10 meters (in snow), on snow surface, in thermoscreen, +5 meters, and +10 meters (last two were on wind mast). These were remote reading sensors, and they were shielded but not aspirated.

**20 October 1957**
A 5-day thermograph was installed in the thermoscreen at 4.5 feet.

**23 November 1958**
New thermograph and liquid-in-glass maximum and minimum thermometers were installed at 5 feet above the surface, presumably in the thermoscreen.

**11 January 1960**
Liquid-in-glass thermometers were taken out of service. Hourly and max/min temperatures were taken from aspirated thermohm apparently installed Dec. 1957 on the wind mast. Height was periodically measured and adjusted within a range of 3.0 to 5.5 feet.

**17 March 1960**
Additional below-surface thermohms were installed at -2.0, -4.0, -6.0, -7.0 and -8.0 meters.

**4 December 1962**
Still more subsurface thermohms had been installed by this time, but 5 of the most shallow sensors became inoperative when their wires were cut by the construction crew.

**1 August 1963**
Report indicates that a toluene minimum temperature thermometer was still in use, 4 feet above surface in instrument shelter. Aspirated thermohms with remote reading were also still in service.

The station had an aspirated psychrometer but it was determined that temperatures were too low to make humidity measurements.

**4 December 1965**
Minimum temperature thermometer no longer listed as in service.
Aspirated thermohms surveyed to be at following heights: 38.3 ft., 23.8 ft., and 6.5 ft. Subsurface thermohms were at: -7.3 ft., -8.9 ft., -10.5 ft.

**27 December 1966**
"H-B red liquid" minimum temperature thermometer installed; height above surface listed as 6 ft. in Feb. 1969.

**31 December 1967**
New aspirated thermohm installed on wind mast; height above surface listed as 8 ft. in Feb. 1969. No other thermohms are listed in Feb. 1969.

**31 October 1972**
Only temperature sensor listed at this time is the "L&N 100 ohm" aspirated thermohm that was installed 12/31/67. Height above surface on this date was 5 ft.

**31 October 1973**
Same as above: thermohm height 4 ft. Max/min thermometers and sling psychrometer listed as stand-by (backup) instruments only.

**18 December 1974**
Aspirated thermohm moved to new location upwind of dome; height above surface 6 ft.

**24 December 1974**
Weather Bureau office moves from Old Pole to the dome (first floor of science building).

**1 November 1975**
Met operations transferred to the New Zealand Weather Service.

**November 1977**
Esterline Angus temperature recording chart was installed: Speed Servo II Model L1101S. The scale on this chart went down to -75C.

This is probably also when the Rosemount temperature probe was installed on the Aerovane tower approximately 75 meters from Skylab. (This probe is shown in later reports to be connected to the Esterline Angus recorder.) The Rosemount was a platinum resistance temperature device (RTD): Model 442ARG Alphaline Temperature Transmitter; connected to an aspirator.

**1979 Winter**
Esterline Angus temperature chart was in use and paper was changed monthly. In February the temperature probe and aspirator housing were raised on the tower to the standard height (needed due to snow accumulation).

## 1981 Winter
Temperature system was the above-mentioned Rosemount probe and Esterline Angus chart recorder. There was also a Newport model 268 digital temperature display. A calibration system was worked out for the chart recorder and digital display.

## 1984 Winter
The aspirator motor for the temperature probe failed in May. It was not fixed as of station opening, and they decided that it wasn't really necessary. Temperatures were still comparing well with the NOAA sensor.

## 1984 – 1985 Summer/Winter
The aspirator motor for the temperature probe was replaced in late summer and worked through the winter. Temperatures may have read high during light winds while the aspirator wasn't working.

## 1985 – 1986 Summer/Winter
The temperature system, presumably still the Rosemount probe and Esterline Angus chart, worked fine through the year. The probe was raised from 3 ft. to 2 meters above the surface during the summer.

## 1989-1990 Summer
Two Omega temperature probes were installed: platinum RTD probes Model PR-14-3-100-V4-6-E with Qualimetrics motor aspirated radiation shields, model 8150-A. Rosemount system most likely remained the primary temperature reading while the new sensors were evaluated and compared.

## 1991 – 1992 Summer/Winter
Temperature sensors consisted of the old Rosemount/Esterline Angus system and the two Omega probes, which were connected to digital displays. Appears as though Omega "Temp 1" was the primary sensor by this time although the Esterline Angus chart was often used for local observations. This was the set-up through the remainder of the 1990s. All temperature probes were aspirated and they were all raised to 2m during the summer.

## 1992 – 1993 Summer/Winter
The Watcher files were used to obtain wind and temperature data for local observations. It was decided that the Omega temperature data logged in the Watcher files was more accurate than the recording chart (which was connected to the Rosemount probe). The Omega datalogger recorded the 6-hour maximum and minimum temperatures on its paper chart.

The aspirator assembly for the Rosemount temperature probe was rebuilt in October after the motor had been stalling at times during the winter. A new radiation shield was also installed.

### 1993 – 1994 Summer
The primary Omega temperature sensor was replaced with a new unit during the summer and was mounted at 6 ft. above the snow surface.

### 4 April 1997
The aspirator fan failed and was replaced on the Rosemount temperature sensor.

### 17 October 1997
The Rosemount temperature sensor was raised to 2 meters above the surface. The Omega sensors were raised to 1.6m and 1.7m.

### 25 November 1997
All three temperature sensors (one Rosemount and two Omega RTD's) were confirmed to be within the WMO standard height range of 1.25 to 2.00 meters.

### December 1998
The Omega datalogger failed on the $4^{th}$. Within a few days after the datalogger failure, an Omega digital display was installed and connected to the primary Omega temperature sensor. This new display, model DP41-RTD had max/min capability and was used for the six-hourly max and min temperatures.

### February 2000
The two Omega RTD temperature probes were raised to be within the standard WMO height range.

### February 2002
Both of the Omega temperature probes were swapped out with new, calibrated probes of the same model.

### 26 March 2002
The primary temperature reading (Omega Temp 1) started drifting up to 4ºC warmer than the other sensors. The signal cables on the Omegas sensors were switched so that the official and Watcher temperature came from the secondary Omega probe.

### 9 July 2002
The troublesome Temp1 probe was swapped out with a calibrated spare but the drifting problem did not cease. Official readings continued to be taken from the other Omega sensor.

### 9 October 2003
The aspirator units for both Omega temperature sensors were replaced.

## October 2003
All three of the temperature sensors were raised to approximately 2 meters above the snow surface.

The ancient Esterline Angus temperature recording chart stopped working; this was the only readout for the Rosemount RTD probe.

## November 2003
The secondary Omega temperature probe and its digital display were swapped out with a calibrated pair.

## 19 January 2004
The FMQ-19 surface observing system was installed. See the Station History Timeline for more information. The FMQ-19 was to become the official observing system in February 2005.

## April 2004
The secondary temperature display started to occasionally drift several degrees higher than the other instrument, similar to what was occurring in 2002. (Since the signal cables were switched that year, this system that was originally called Temp 1 was now the Temp 2 secondary sensor.) The other Omega sensor, now labeled Temp 1, worked fine through the season.

## 14 December 2004
The aspirator fan failed on the FMQ-19 secondary temperature sensor (AT/RH #2).

## 16 December 2004
ATS technicians replaced the entire AT/RH #2 unit on the Clean Air tower of the FMQ-19 system.

## 12 February 2005
The Met department moved from the Science Building in the dome to wing B2 of the new South Pole Station. The first official observation from the AN/FMQ-19 surface observing system was logged at 0150 UTC. Temperature observations were taken from the AT/RH#1 sensor at the Clean Air tower. See the supplemental document titled "2005 Met Transition" for information about the instrumentation with the FMQ-19.

The AT/RH #1 sensor is slightly higher than the #2 sensor, and typically reads about 0.3ºC warmer.

## 16 September 2005
The FMQ-19 temperature/RH sensor heights were measured. AT/RH #1 was at 1.51m above the snow surface and AT/RH #2 was at 1.43m.

## 8 January 2006
The temp/RH #2 sensor unit at the Clean Air tower was swapped out with a calibrated unit.

## 16 January 2006
The temp/RH #1 sensor unit at the Clean Air tower was swapped out with a calibrated unit.

## 25 January 2006
The temp/RH units and the FDCU at the Clean Air tower were raised, after which the temperature sensor heights were measured to be 1.98m (#1) and 1.85m (#2) above the snow surface.

## February 2006
An equipment log was added to the department's Access database for the purpose of documenting preventative maintenance, calibrations, and repair work on Met equipment. Computer issues and data losses can also be recorded in the equipment log.

## 4 November 2006
A new TDAU server for the FMQ-19 surface observing system was installed in the station's Network Operations Center (NOC). An upgraded version of the Airport Weather Advisor (AWA) display software was loaded on the new server.

## 6 January 2007
The heights above snow surface of the FMQ-19 temperature sensors were checked: sensor #1 was at 1.85m and sensor #2 was at 1.74m. (Official hourly observations are taken from sensor #1.)

## 24 March 2007
It was discovered that the latest version of the AWA software would set the temperature sensors to "inoperative" when the temperature dropped below -62C. One-minute sensor data readings were still available but the system would not generate 5-minute average temperatures or 6-hour max and min temperatures when it was colder than -62C. The meteorologists used the one-minute data for hourly observations and identification of the 6-hourly extremes until a software fix was implemented.

## 26 April 2007
The AWA data display software was upgraded from version 7.1 to version 7.2. The primary purpose of this upgrade was to fix the problem of the temperature sensors being set to "inoperative" whenever the readings dropped below -62C.

When the temperature first went below -62C again on May 19$^{th}$, the AWA still set the sensors to inoperative. It was then discovered that the temperature device settings had to be changed to show a model selection of YSI 44034. This is the only model for which the software will accept temperatures below -62C.

## 28 October 2008

It was relayed by the winter-over staff to the incoming Senior Meteorologist that the AT/RH#2 sensor had been given temperature readings that were 1C to 2.5C warmer than the AT/RH#1 sensor since the previous summer season. Although there were spare sensors on station, it was discovered that these spare sensors were returned to South Pole sometime in the summer 2007 uncalibrated after being shipped out to USAP Cal Labs in the summer of 2006. Because of this discovery that faulty sensor was never replaced with a properly working one. Inspection of the AT/RH#2 sensor on the 28th revealed an inoperative fan to be the cause of the erroneously warm temperature readings. E-mails were sent to Glen Scheon and Mike Rugg to notify them of the issue and to determine as to whether or not South Pole Meteorology would be able to get calibrated replacements for the Clean Air tower and to have the spares on station calibrated by the end of the summer season.

## 07 November 2009

A broken aspirator fan on AT/RH#1 was causing a large temperature discrepancy between it and AT/RH#2. Low winds and increasing incoming solar radiation was causing AT/RH#1 to read as much as 5°C warmer than AT/RH#2. Due to a similiarity in height off the surface, the primary temp sensor was switched from AT/RH#1 to AT/RH#2. SOPP techs arriving on the 10th to install the summer instrumentation also replaced the fan in AT/RH#1. A spare temp sensor was also left with the South Pole Met Dept.

## March 2011

The AT/RH sensors are both below the minimum WMO stated height of 1.25m. Due to cable length and accumulating snow, both sensors can no longer be raised any farther from the snow surface. Plans are in the works to replace the current Clean Air instrument tower with a new, trailer-mounted system, similar to the Skiway tower.

## 18 April 2011

The meteorologists replaced the AT/RH#2 sensor with another calibrated unit. This was done after a lag time was noted in the temperature data. An investigation revealed the fan motor to the unit malfunctioned.

## 25 April 2011

The newly installed AT/RH#2 sensor began showing the same lag time in temperature data as the previous one. However, with cold temperatures and no other unit available, this sensor was left in place. A note was made about the issue in the metadata files.

## 11 November 2011

SOPP technicians replaced the fans for two of the three temperature/relative humidity sensors that failed during the winter season. Currently, both temperature sensors at the clean air sector are operational.

## 11 January 2012

Construction of the raised platform Clean Air tower was completed. The two temperature/relative humidity sensors located on the old Clean Air tower was relocated to the raised platform tower Tuesday afternoon and fiber splicing was completed Wednesday morning. This relocation resulted in no transmittal of data from the temperature/relative humidity sensors from 1930Z on January 9th, 2012 to 2215Z on January 10th, 2012.

## 03 April 2012
The meteorologists replaced the AT/RH#1 sensor on the Clean Air Tower with another calibrated unit. This was done due to the failure of the aspirator fan motor.

## 15 April 2012
The meteorologists replaced the AT/RH#1 sensor with a second calibrated unit on the clean air tower. This was done due to another malfunction of the aspirator fan motor. Once the fan was brought inside and allowed to warm up, it was connected to a power supply and was found to be operational. This led to the conclusion that the grease applied to the bearings was not removed during testing and calibration by SPAWAR personnel during the summer season. The grease applied to the bearings is not able to withstand the harsh temperatures at Pole, and needs to be replaced with a Teflon spray, as is done on the NOAA meteorological equipment.