NRCS

Snow Survey & Water Supply Forecasting Program

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Snow Survey Centennial Celebration
1906-2006

SNOTEL ELECTRONICS HISTORY

Prior to the advent of the meteor burst radios, a small remote sensing program was on going at Utah State University (USU), Logan, Utah. Beginning in 1964, a professor and some students of the water resources department remotely measured five mountain sites for snow water and precipitation. The radios they used were two watt CB's (citizen band) with weighting type transducers. The sites were interrogated by flying over them in a fixed-wing aircraft and counting tones, which were than graphed to estimate their measurements.

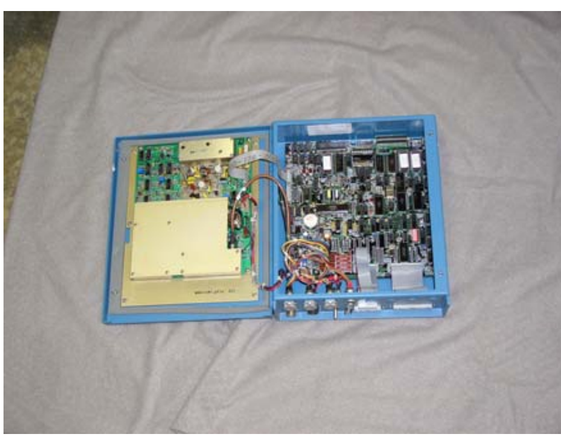
A new generation of radio was introduced in 1966. The radios were developed using a Motorola transmitter and receiver, along with a network of mountain top repeaters. This system allowed the researchers to interrogate the electronic data sites from their office. The project personnel were also doing some measurements for the Bureau of Reclamation, which was studying the results of cloud seeding. The study lasted 6 years. In 1972, the combined efforts of USU and Thiokol Corporation created what was called the Hydrologic Telemetry (HiTel) system, which would be expanded in the coming years, collocating their electronic equipment with existing manually read snow courses . The radios were now operating on 172.55 MHz and the system was expanded to 15 HiTel sites that were adjacent to snow courses established and maintained by the USDA-Soil Conservation Service.

In 1975, the USDA-Soil Conservation Service began the initial planning to convert snow courses in key watersheds to obtain near real-time hydrologic data. A new radio technology was needed and a contract to Western Union was awarded. Western Union contracted with Secode Electronics, which was the manufacturing arm of Communications Industries, to supply meteor burst radios. In the back room of the radio design was a team of Boeing engineers. Boeing was interested in meteor burst technology for military applications. This small team was formed in 1975 under the name of Meteor Communications Consultants (MCC). In 1980, this team became known as MeteorComm Corporation (MCC). Western Union contracted to install and maintain the first meteor burst sites, which were called SNOTEL (SNOw TELemetry), using the Metracom radio. Within a short time, it became evident that the job of keeping an operational, real time data base running was a bigger job than Western Union could handle. The Soil Conservation Service started to staff up with their own electronic and hydrologic technicians to install and maintain the SNOTEL network, with the first ones coming on board in 1979-80.

In 1980 the electronic package at remote sites consisted of a Metracom radio, produced by Secode Electronics of Dallas, TX. See photos below.


The radio measured 17x15x4 inches and weighted 13 pounds. It had a mother board, four sensor interface cards, a power control unit, two 24 ampere-hour battery packs, and a 36 volt battery pack. The radio consisted of a receiver board, transmitter board, an exciter board, a data acquisition board, and a control logic board. The power control unit contained the main power switch, and a transformer which stepped up the 12 volts from the main batteries to 36 volts for the transmit battery. The nominal forward power was 300 watts. These radios were upgraded via a new board to what was called a microprocessor/data acquisition board which gave us maximum, minimum, and average temperatures. Prior to this upgrade we had only current temperature data. We could only get one report per day and the site ID was programmed into the radio through a 40 conductor plug, which was hard wired for the octal site address. The antennas were decibel product, dual element yagi's, with a feed element which would equate to the current balun. These feed elements were not water tight and would get wet and then corrode, causing the reverse power to rise and sometimes fry the transmitter.

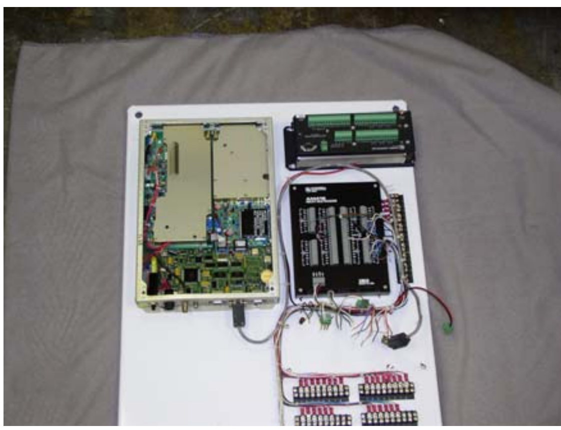
It could be said, "Timing is everything or the mother of invention is necessity". With the eruption of Mt. Saint Helens, the next generation SNOTEL radio was needed. The 550 radio was designed and produced by MCC in Kent, WA. See photos below.



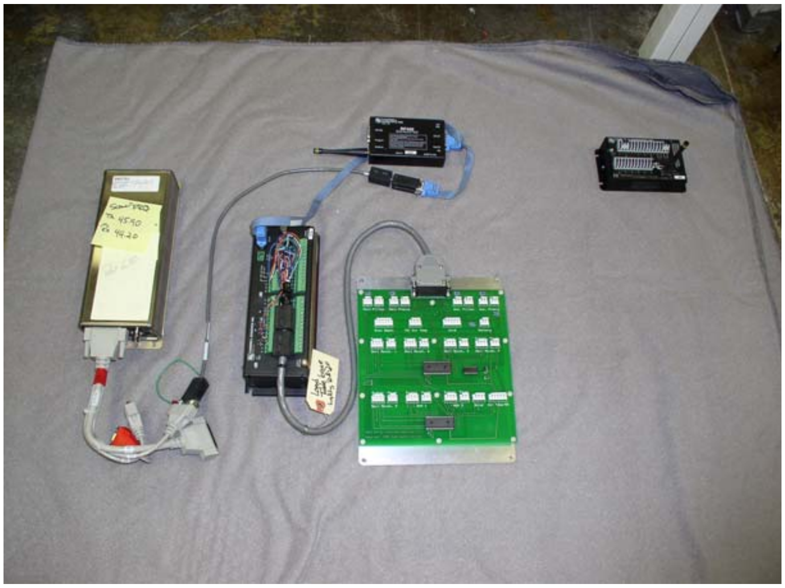

With the eruption, the National weather Service wanted special monitoring around the mountain, so they provided funds to the Soil Conservation Service to install seven sites. The sites needed to have some capabilities that the Secode radio did not have. These included rapid snow melt or snow (ash) accumulation when it's above freezing and the ability to send out an alert. The 550 series radios were designed and built during the summer of 1980 and installed around the mountain that fall. These radios measured 13x11x3 inches, weighed 8 pounds, and transmitted at 300 watts, requiring a 36 volt battery pack. We had maximum, minimum, and average temperature, and entered the site address through a series of thumb wheel switches. They could be programmed for event reporting, which was a disaster, as the transducer output varied so much during the day that there were constant events being transmitted. We still used the single or double battery packs with two 24 ampere-hour batteries in each, and a 36 volt pack.

The next generation of radios was the MCC 550A unit, with 12 volt 100 watt transmitters. They were extremely troublesome. We had data spikes (anomalies), performance problems, power problems and antenna problems. We began using Scala antennas at the same time we started using 550A radios. The data spikes we noticed were mostly on temperature sensors. We moved, re-oriented, and shielded the sensors. The power problems were associated with too many transmissions, too little solar power, with batteries that were too small. The MCC 550B was designed to clear up these problems and operated with a 12 volt battery and had 100 watts output.

A new era in SNOTEL instrumentation started in 1999 with the introduction of the MCC 545 series of radios. These would also be the precursors to the radio and sensor configuration we now use. See photos below.

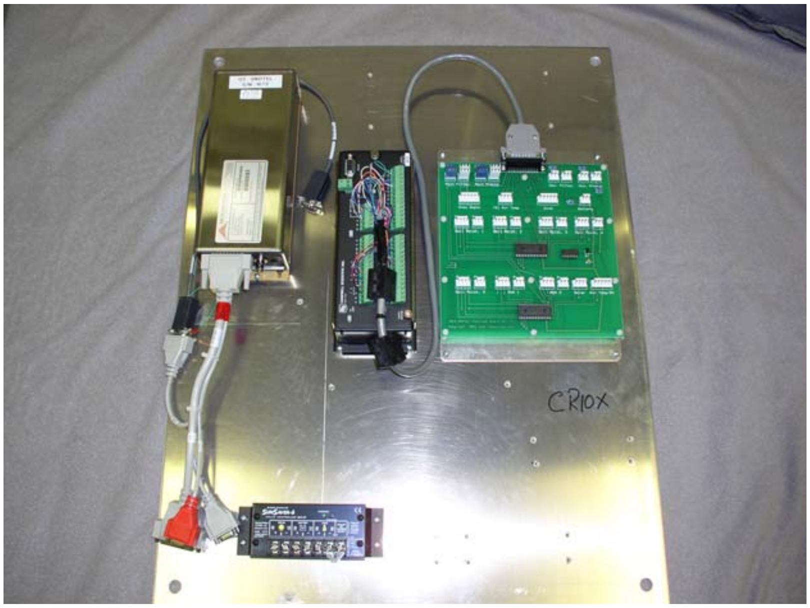



The MCC 545A measuring 14x10x2 inches and weighting 4 lbs., does not have data acquisition capability, so the need for a data logger is necessary. SNOTEL sites were becoming what is called fire weather instrumented sites. These sites have soil moisture and temperature, wind, solar radiation, relative humidly, precipitation, and snow depth sensors, along with the standard snow water equivalent and air temperature sensors. The MCC 545B was introduced in 2002 measuring 9x4x2 inches and weighting 3.5 lbs. See photo below.



The 545B has a 100 watt transmitter and RF receiver that operates on a 90 degree phase shift key which is different than the MCC 550 and 545A series. This has required the entire SNOTEL system, of nearly 800 remote sites, to be upgraded to the MCC 545B/Campbell cr10x combination, which was scheduled for completion by October 1, 2006. The sites use either a Campbell 1632 multiplexer or a Dan Judd interface board to connect the sensors to the cr10x data logger.

Another small test project is running in the Utah DCO it consists of MCC 545B, Campbell cr10x, Campbell cr205 and rf400, Judd interface board, pillow and precipitation transducers. The project has a typical SNOTEL site and a remote soil stack 2.5 miles away in another drainage, transmitting back through the SNOTEL station. The remote soils stacks consist of 10 soils probes 5 in a conifer stand and 5 in a deciduous aspen stand. The test project is in conjunction with graduate work being done at USU, Logan, Utah.



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