

The Radio Active Pilot

Part 4: Amateur Radio Based Weather Station

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Abstract - In this installment of the series on radios and paragliding, we describe how amateur radio can be used to monitor weather conditions at remote flying sites using a computer or cell phone. A high level overview of the technology and system architecture is provided. Web site addresses are also provided for additional information.

Have you ever traveled an hour or more to a remote flying site only to find conditions could not support a feather, let alone a paraglider. Or perhaps you waited for hours hoping conditions would get better, only to find an empty logbook at the end of the day. I know I have on many occasions. Parawaiting may be one of the vagaries of our sport; but it doesn't have to be that way.

My wife and I fly at the Torrey Pines Gliderport in San Diego, CA (<http://www.flytorrey.com>). Although most days are good for flying due to winds that blow like clockwork over the Pacific Ocean each day, there are days when a trip to the Gliderport results in more parawaiting than paragliding. Several weather stations within a few miles of the Gliderport give conditions. However, they can't replace an onsite weather station, since conditions a few miles down the coast can be very different than at the Gliderport. A weather station located at the flying site would solve the problem.

Installing a weather station isn't particularly difficult. The problem comes when you want to remotely access the system. Some weather stations provide a telephone interface that allows callers to phone for a voice response. Being able to call for the weather is useful, but what if you could retrieve the data from the Internet? Or what if you could use your cell phone to display weather conditions? Better yet, rather than you calling the weather station, how about the weather station calling you when flying conditions were good? Seems like a tall order, but that is exactly what I did, and it would not have been possible if it were not for amateur radio.

TORREY

Torrey is what the locals affectionately call the Torrey Pines Gliderport. It's a great place to paraglide and/or parawait. Torrey has wonderful flying facilities including a fully stocked shop, full time instructors, and even a café that serves breakfast and lunch. However, the infrastructure is a challenge. For example, there is no commercial AC power source; all power comes from solar cells. The number of phone lines is also limited due to the remoteness of the facility. Installing a weather station that provides Internet access wasn't going to be easy.

In the US Hang Gliding Nationals project (see Part 3 of this series), we described how amateur radio and the Automatic Position and Reporting System (APRS) protocol provided a data link from an airborne pilot to the local wireless APRS network and eventually to the Internet. In that application, the pilot broadcasts latitude and longitude information. For this project, the GPS receiver, which provides position information for the pilot, is replaced by a weather station that sends: wind speed, wind direction, temperature, and barometric pressure. Humidity, rainfall, and other weather parameters can be sent, but are of less interest for paragliding.

The beauty of the wireless solution is that no telephone lines or Internet access is required. In fact, by adding solar cells to supply power, the system can be used to monitor remote mountain weather conditions.

THE EQUIPMENT

Although monitoring weather conditions is very different from monitoring a pilot's location, the components used are nearly identical. Both use a Terminal Node Controller (TNC) and both use a two-meter transceiver. In addition, both require a local IGATE to forward the data to the Internet for distribution. The difference is that one uses a weather station, while the other uses a GPS receiver.

Purchasing a weather station can be like purchasing a camera; there are many options and accessories. A rain gauge, sun shield, and humidity sensor are a few of the more frequently used add-ons. Computer software for logging, displaying, and analyzing weather data is also available. You can also purchase a telephone interface to support remote phone access. Fortunately, for this project I would need only an anemometer to sense wind speed and direction and an outdoor temperature sensor.

The anemometer and temperature sensor connect to the weather station console. The console converts the analog measurements to a digital data stream that is sent to the TNC, which converts the data into audible tones that can be transmitted over a two-meter transceiver. From this point on, the system is identical to the US Hang Gliding National's system.

There are many fine weather stations available on the market. I selected the Peet Brothers (<http://www.peetbros.com/>) Ultimeter 2000 weather station because of its APRS compatibility, which was an important consideration for selection.

THE WEB

Once the data is transmitted to the APRS Internet System (APRS-IS), it is available everywhere on the Internet. It's now just a matter of writing a web page to display it. Generic APRS web pages have been developed to display raw data in the form of a table. Although the data provided is useful, it is hard to get a sense of past conditions. A graph is better suited to display large datasets and allows a user to easily read current and past weather conditions.

The main web page (<http://w9if.net/cgi-bin/torreywx/wx.pl>) provides graphs for wind speed, wind gust, wind direction, barometric pressure, and temperature for the past 4 hours. Historical conditions for the past 1, 2, 3, and 7 day periods are also available on separate pages. The astute reader will notice a hang glider flying over the site. The hang glider literally flies over the page with the speed and direction of the wind. Although a hang glider is shown, paragliders also fly at random over the map.

The system has been a huge success with several hundred hits each day. It has been operational for three years and has allowed hundreds of pilots to remotely determine flying conditions.

ET PHONE HOME

Accessing weather conditions from a computer is nice, but that was only half of my goal. I didn't want to be limited by the need for a computer. I wanted anytime and anywhere access. With the help of a web enabled cell phone that is exactly what I get.

Using a custom Wireless Application Protocol (WAP) program, a cell phone can connect to the weather station and display flying conditions. You can find out more by visiting http://w9if.net/cgi-bin/torreywx/wap_info.pl. If you already own a cell phone with Internet access, point your browser to http://w9if.net/cgi-bin/torreywx/wx_wap.pl to get weather conditions at Torrey Pines.

You would think that I had everything I could ask for. I had the ability to determine weather conditions from any computer and when not connected to the Internet, I could use my cell phone. However, being lazy, I wanted the weather station to call me when conditions favored flying. A little more software programming and I had it. My computer checks the weather station every fifteen minutes during the day and when conditions support flight, sends an email to my cell phone. There have been many instances during the day when I was in a meeting at work and was called by the weather station.

Setting the cell phone to vibrate mode allowed me to excuse myself gracefully and explain I had a splitting headache and needed to get some fresh air.

CONCLUSION

If you think this project was a lot of work ... it was. It's not a kit that you can buy and install in a few hours. What originally was supposed to be a weekend project turned out to take several months. Installing the custom hardware was only half the battle. Writing custom software was also a big effort, and testing the system took even more time. You may ask why am I describing a system that will be difficult to duplicate. The simple answer is that this article was not intended to provide instructions for building your own system. It was intended to show how amateur radio can be used to support flying activities, and in that vein, I hope I have reached that goal.

This is the last part of this series. Although we covered a lot of ground, there is a lot more that amateur radio offers. I hope I gave you enough interest that you got a license.

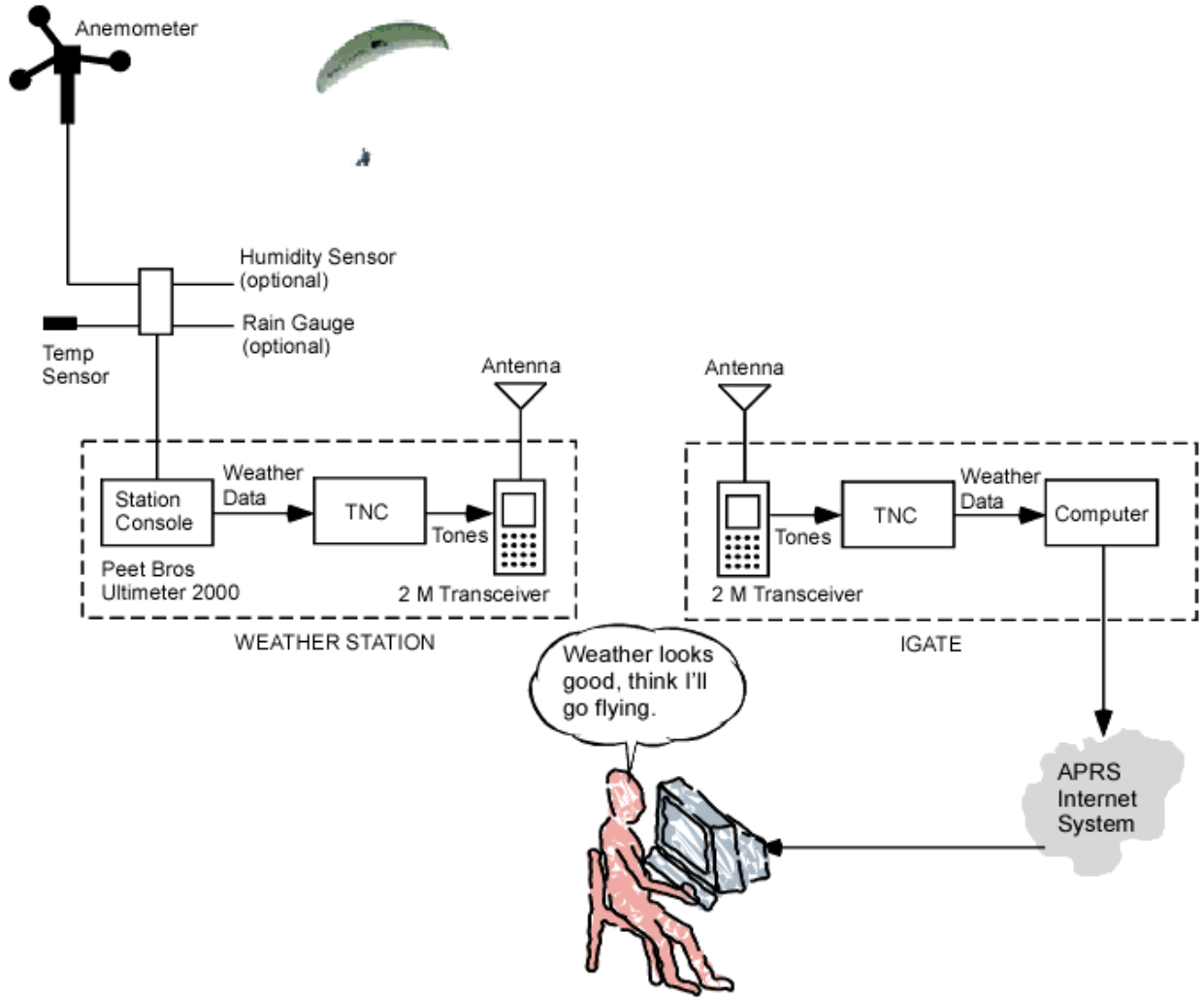
I have made it habit in my paragliding articles to thank my wife, Sharon, a pilot and amateur radio operator who introduced me to paragliding. Thank you, you will always be the wind beneath my wing.



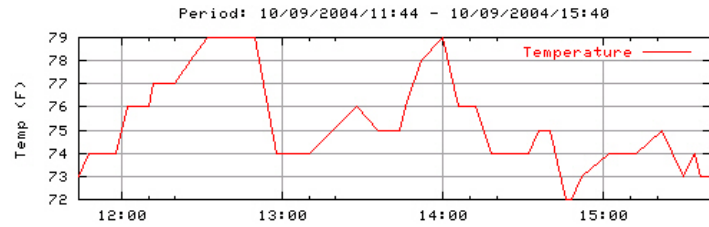
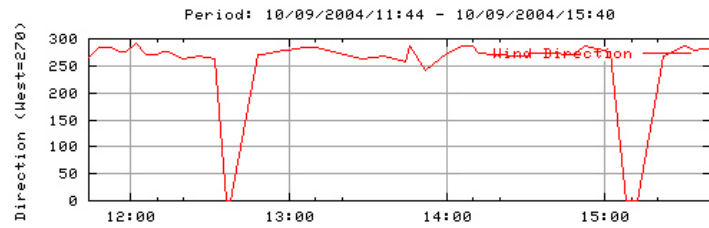
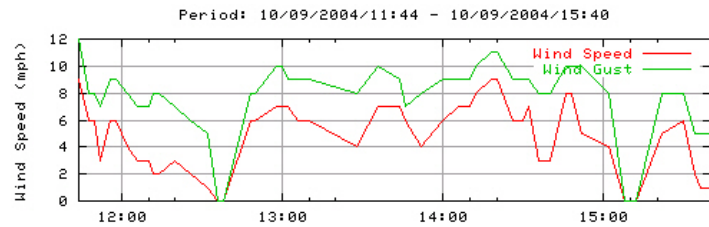
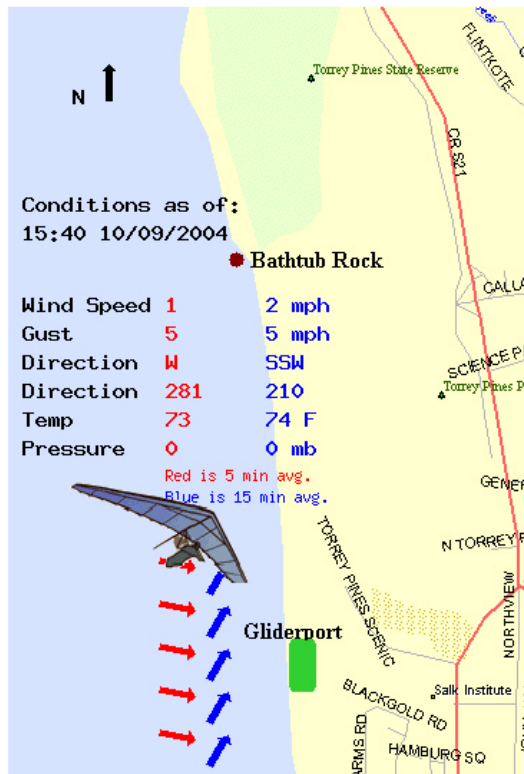
Part 4 - Figure 1. Weather station anemometer (left) and antenna (right) at the Torrey Pines Gliderport in San Diego California.



Part 4 - Figure 2. Weather station console (upper left), TNC (lower left), and two meter transceiver (right) comprise the indoor components of the system.



Part 4 - Figure 3. Weather Station System Architecture



Part 4 - Figure 4. Graphs display wind speed, direction, and temperature. Current conditions are overlaid on the map at the left.



Part 4 - Figure 5. Cell phone can be used to retrieve weather conditions.