Award of contract from the Aviation Technical Services of Antarctica:

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Coastal Environmental Systems was confronted with several problems regarding the project to provide Automatic Weather Stations (AWS) for Aviation Technical Support (ATS) in the Antarctica. ATS, a Division of the United States Navy, did not even know if the system they needed was possible. Not only did it need to meet one of the most difficult environmental specifications on the planet; but it needed to be a 'Commercial Off The Shelf' (COTS) product to both meet their schedule and greatly lower their risk (using untried equipment in the Antarctic is very risky).

The Navy 's aviation experts declared the need because air traffic in the Antarctic is increasing. One aviator stated:

"What we are sometimes forced to do now is the equivalent of taking off in Seattle for New York – without knowing what the weather is like in New York until we get there, and even then, knowing only what we can see from out the window!"

What were the problems?

1. First of all, unlike ASOS equipment at McMurdo, the Automatic Weather Stations would not be disassembled and packed safely away for the winter. McMurdo station has an ASOS system (weather station seen at all major airports) but it is only active during the Antarctic summer. During the harsh winter months it is completely disassembled, packed up and stored in a warm place. These new stations, however, had to go into a sort of "hibernation state" over winter, then automatically come back on-line when spring came back around.

2. The second problem was *no electrical power* where they wanted the weather stations located. That left only three alternatives: really BIG battery packs that would have to be replaced yearly (at least), diesel generators, or solar power.

3. The third problem is related to the second. Some stations have a Ceilometer (cloud height) and a Visibility sensor. It appeared impossible to power these power hungry sensors unless AC power was available, or by using generators!

To solve these problems Coastal engineers relied on two things: extensive experience in polar work, and the power of the **ZENO® 3200** data acquisition system, the central "brain" or electronics of most of Coastal 's weather stations. How did this translate into a solution?

To solve the problem of over-wintering and, in fact, just surviving the Antarctic environment, Coastal used a completely **O-Ring sealed, 6061-T6 (mil-spec aluminum) machined enclosure.** Even in the extreme conditions of the Antarctic – no air would be exchanged or allowed to enter this enclosure. This meant no desiccant to change and no possible destruction of electronics by moisture. Once the enclosure was taken care of, our experience told us that many, if not most weather system failures in difficult, remote places, is due to moisture damage in connectors. To ensure survivability UNDERWATER CONNECTORS were used.

> *"Of course the station will not be underwater, but only underwater connectors are completely sealed from the environment," said Scott Newell, a Coastal engineer. "Cables and connectors on any weather station are its weakest link and biggest failure point – in this type of environment it simply never pays to use anything less than an underwater connector with a sealed cable," he added.*

But how to solve the power problem? Generators require fuel, have lots of moving parts and associated maintenance, and large battery packs were, well... *LARGE*! Moving large amounts of anything around the Antarctic is extremely difficult and a burden. Then there is the battery disposal problem or the pollution of the generator. Solar Power is the clear winner but that required sophisticated power management.

"Could the ZENO® 3200 's ZENOSOFT™ operating system turn the Ceilometer and Visibility

sensor on – say just once per hour or so?" Someone asked.

While the answer to this question was "sure," it didn't make anyone happy. The power requirements were still too large for a good engineering solution and the aviators did not want to wait up to an hour to find out the current conditions.

A solution was forged. Aviators and forecasters need data on demand, possibly only a few times a day - and they can live with the reality that they would not be able to have a complete hourly record of cloud height and visibility because the purpose of the project was, after all, to aid aviation. Coastal calculated that solar power could be used if the ZENO® and **ZENOSOFT™** were "smart" enough to receive a radio signal from the base station, activate the two power-hungry sensors *on demand*, sample and process the data, send the data back, then immediately deactivate the two sensors, all while doing the large amount of other required sampling of the less power hungry sensors.

The ZENO® 3200 can do this. When flight operations require it, a forecaster will press a key on the base station computer. Coastal's INTERCEPT™ PC software will send a message to the correct station (the 10 stations are on a single radio frequency, as each ZENO® 3200 is addressable). The ZENO®, which has been continuously sampling all the other sensors and reporting the data every 15 minutes, will power up the Ceilometer and Visibility sensor - wait until the sensors are warmed up - take a reading - then shut them back off. It will then report this data along with the other sensor data at its prescribed 15-minute interval.