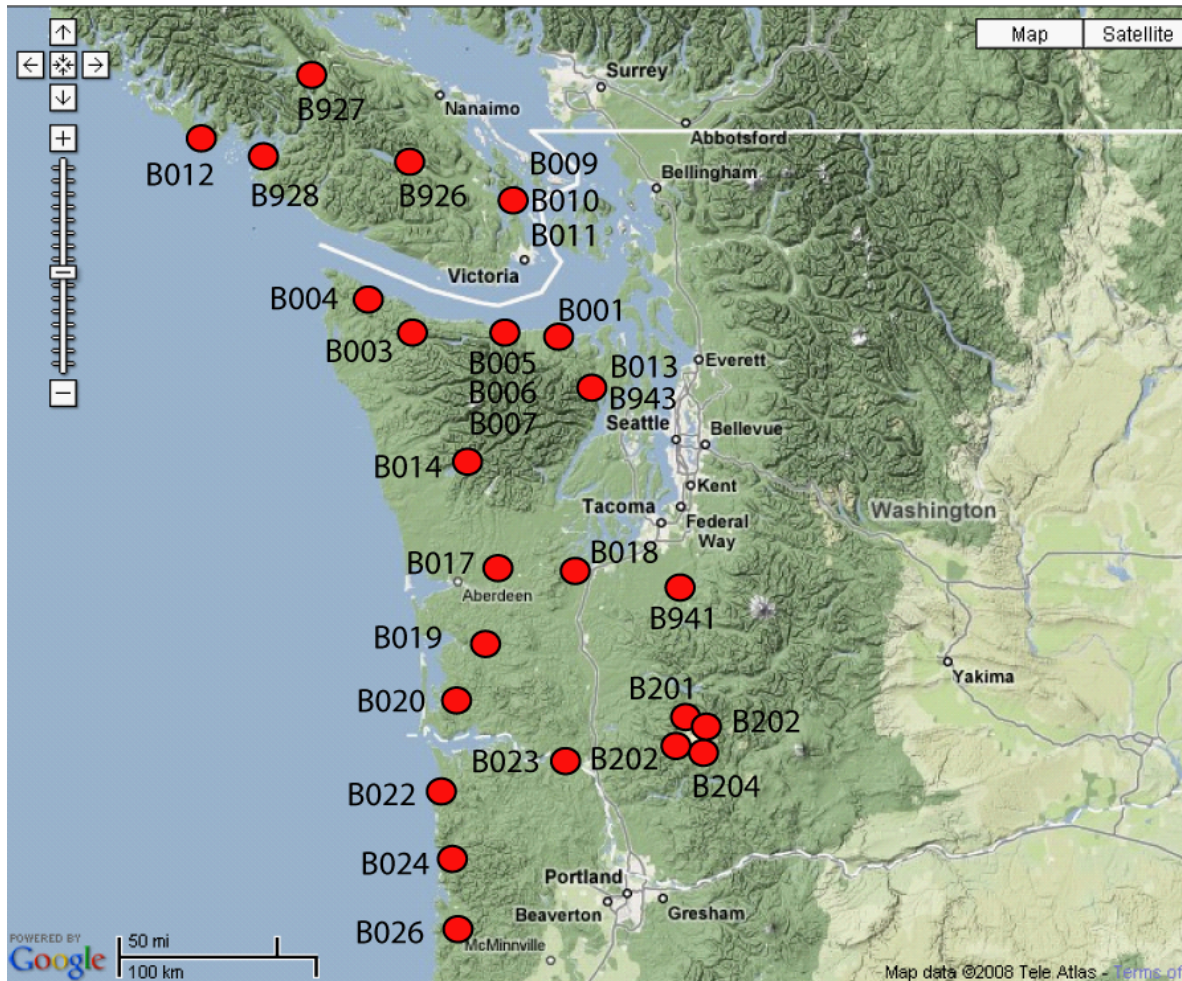


Station Notes for B202, windy202bwa2007

Latitude:	46.2447 (WGS 84)
Longitude:	-122.1367 (WGS 84)
Elevation:	1218.6 m / 3998 ft
Install Depth:	242.8 m / 796.5 ft
Orientations:	CH0=207.7, CH1=147.7, CH2=87.7, CH3=57.7
Install Date:	July 25, 2007
GTSM Technologies #:	US51
Executive Process Software:	Version 1.14
Logger Software:	Version 2.02.2
Home Page:	www.unavco.org/instrumentation/networks/status/pbo/overview/B202
Notes Last Updated:	October 14, 2020

·Install depth is from the top of the casing to the bottom of the strainmeter.

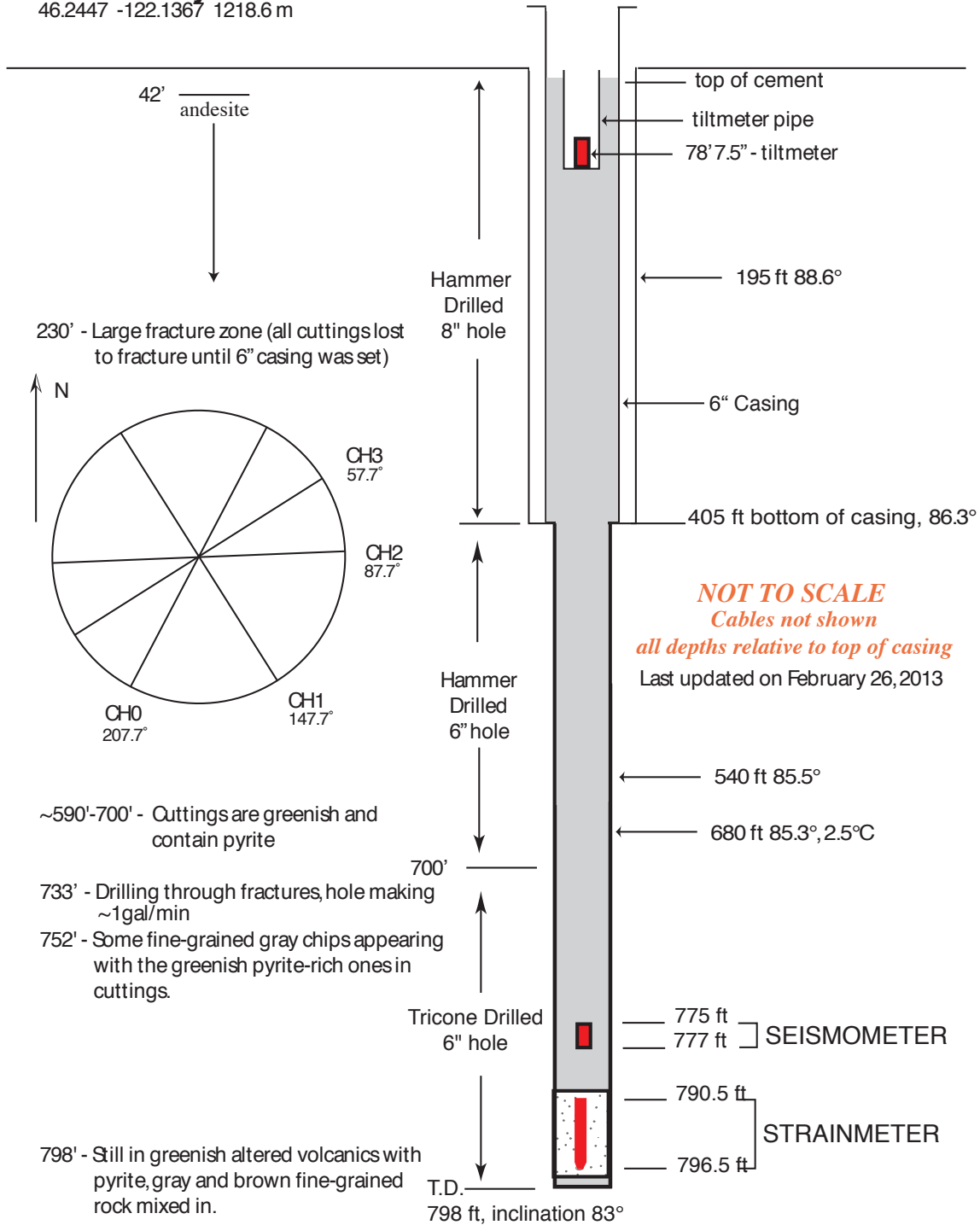
·Orientations are in degrees East of North.



Pacific Northwest PBO strainmeter network, April, 2008

B202 windy202bwa2007

46.2447 -122.1367 1218.6 m



Instrumentation at Strainmeter

Instrument	Units	Bottle/ASCII Scale Factor	Seed Scale Factor
Pore Pressure	Hecto Pascals	N/A	N/A
GTSM Barometer	Kilopascals	1.0	0.0001
Rain Gauge	Millimeters/hour	1.0	0.252
Down hole Temperature Sensor	Degrees Celsius	1.0	0.0001
Logger Temperature Sensor	Degrees Celsius	1.0	0.0001
Setra Barometer	Hecto Pascals	1.0	Unknown

1. Installation notes

Summary: The Windy Ridge site was installed on July 25, 2007. Weather was Sunny and breezy with temperatures between 65-75 F. Installation proceeded smoothly, although installation with the sand line was problematic in that it was difficult to determine which element during lowering was load bearing as the weight was transferred between the cable and the sand line at times and there was concern about slack accumulating in either. At about 20 m above the install zone, the weight was transferred to the cable, while trying to keep slack in the sand line at all times. The hole was inclined at 7 degrees at the bottom so insertion was slow but the strainmeter settled to the final target depth. New geophysical logs were taken in the morning, verifying that the bottom 3 m of hole are smooth with fractures. The hole above this is fractured with sections of highly fractured. The downhole temperature is near 0 C. There is a coupled flowing aquifer higher in the hole with water entering the borehole from behind the casing from a perched aquifer, and exiting in one of fracture zones below (Seen with video camera, and can also hear falling water). The water level remains at 730 m indicating that one of the fracture zones is highly porous. The water level is roughly equal to Spirit Lake. Water flow is estimated at 1-2 gal/min.

Note that all electronics were correct except that US56RT0 was installed in the slot where US51RT3 was expected.

July 22, 2007

1:30 UTC – Arrive at Windy Ridge. Set up GTSM21 US51

2:48 - US51 is turned on.

3:10 - Leave site

July 24, 2007

Grout: Masterflow 1341 Lot # 161594414R7 Bags numbers were in the range 234-256, there were gaps in this range. 9 bags of grout and 15.3 gallon's of distilled water were used.

23:53 - UTC - Begin mixing grout

23:55 - Last bag of grout added

23:57 - Last H2O added

July 25, 2007

00:05 - UTC - Begin pouring grout into baler

00:08 - Baler is full and sent down hole

00:12 - Baler hits bottom

Baler is lifted over the course of 5 minutes from working grout zone.

00:22 - Baler out of hole

00:24 - BSM started down hole

00:47 - About 1.5 ft above the bottom tie off, strainmeter slowly sinking

00:57 - Tie off point reached

01:00 - BSM powered up
01:12 - BSM renamed

July 26, 2007

15:45 UCT - lowering in seismometer to 777'

16:30 - tripping in 1.5" tremi
GTSM grout to 783.5'

22:00 - start pumping neat cement

23:645 - finished pumping (~5 yds)

July 27, 2007

00:21 - shutdown GTSM; bury cable and pour pad

02:02 - restart GTSM

July 27, 2007

16:45 - shutdown GTSM; anchor enclosure to pad and install uphole electronics

18:30 - GTSM setup inside enclosure and restarted

22:30 - shutdown GTSM to adjust DH temp; 0.051V was highest voltage we could get

22:40 - restart GTSM; install rain gauge

2. General Information

- No pore pressure infrastructure is installed at this site.
- This site has a tilt meter installed at 79.9 feet.
- Sensitivities of all EH channels corrected on March 4, 2010.

3. Strainmeter Maintenance

- August 3, 2007 - Steve Smith and Wade Johnson worked on the comms at B202 today. The site is now sending data over a 900Mhz radio to JRO and then to WSU over a high speed microwave link.

After visiting JRO to set up a radio they headed to B202.

02:30 UTC - Arrived B202

02:30 - 05:30 - Set up radio and cut trench for propane line. Shut down VSAT, reprogrammed electronics, and bolted TEG to mounting post.

05:40 - Left site

- August 13, 2007 – Propane tank was installed.
18:45 UTC - Propane guys arrived with a 1000 gal forest service green propane tank.
18:45-20:45 - Installed tank and propane line. Found broken hose in TEG, will be replaced with part from and extra TEG at B204.
20:45-21:00 - Cleaned up site. Tore down VSAT. Buried conduit for coms and power.
21:30 - Head to B204
The propane service's propane truck broke down. They will have to reschedule filling the tanks, probably when Cold Water is being drilled. There are 50 gallons of propane in the tank. Wade left the solar panels on and set the TEG to remote start. He also set the barometric pressure on the GTSM. The propane should last 50 days with this setup.

- July 25, 2008 – The site was in a dismal state when Korey and Mike visited it. The ranger told them that the snow pack had reached 20 feet in this location. A shelter like the one at the Quarry could be a good idea for this location, although Korey would recommend a slanted roof.



- November 19, 2008 – Wade visited the site to perform some maintenance.
- December 5, 2008 – Wade visited the site to get it online.
- July 6, 2009 – Onsite 12:00 PST
 Observations: propane gauge on empty, batteries dead, antenna bent and cable kinked.
 Maintenance: Installed five new batteries - TEG fired immediately. Data was downloaded manually, RTs upgraded to 1.20, Metadata taken, set quads, removed air stack from TEG to increase airflow, and Antenna straightened.
 Currently: Site is online, but needs propane and antenna/cable should be replaced.
 Conclusions: Site went off line 12/30/08. This was likely due to the antenna being damaged. Furthermore, this date correlates with a large weather event that occurred in the area. Data showed the site having power until the 9th of March when the TEG stopped running. This failure could be correlated to another large snow event that might have cut off the flow of oxygen inside the bunker.
- July 8, 2009 – Propane was refilled.
- July 17, 2009 – Logger upgraded to firmware version 2.02.2.
- Sept 30 & Oct 1, 2009 - The TEG was moved back outside next to the bunker, and a shelter was built to prevent damage from snow loading. This should improve the air flow to the unit. They also installed a Setra pressure sensor (UNID 28132 / SN 4026153), upgraded to an EB 6 (UNID 27427 / SN 884-9378) and panel antenna. They were unable to pull out the tiltmeter to replace it the time, and will need to return to finish that task

- Oct 12, 2009 – Wade Johnson and Mike Gottlieb visited the site and replaced the tiltmeter. It was installed at a depth of 78' 7.5".
- July 2, 2010 – Mike Gottlieb visited the site to get it back online. He found the TEG off and batteries dead. The propane tank was at 20%. He replaced the batteries and TEG started immediately. The propane company will top off tank next week. GTSM was not getting GPS time. Mike attempted the coldstart command and got response of "0 bytes received". He replaced the powerbox and quickly found the satellites.
- July 4, 2010 – Station was offline after previous visit. Mike returned and found the Ethernet plug was loose at the connection to the radio. Once it was secured the station came back online. It was also observed that the top had blown off the rain gage. It was disconnected in the meantime, and will need a new funnel top firmly attached during the next visit.
- October 29, 2010 – Installed 6 solar panels (2 swing sets).
- November 5, 2010 – Rain gauge top was replaced and rain gage was reconnected. Installed fuel cell and 6 solar panels.
- November 8, 2010 – Installed Dlinx serial to ethernet converter, and put fuel cell controls and diagnostics online.
- November 11, 2010 – Installed fuel cell and two 28L fuel tanks, and left TEG running. Set turn-on voltage on fuel cell and TEG to be the same (12.3 V), in order to keep both systems from freezing.
- August 11, 2011 – Station lost power in March, and has been offline since. Road recently opened for the summer. The batteries at this station were all at 1 volt. Mike removed the bad ones and installed 8 new batteries (2 gtms, 6 mains). 3 of the 6 solar panels were damaged by snow. Mike put the 3 good panels in a single rack and left the 3 bad ones disconnected. They should be replaced the next visit. He also installed 2 new 28 L methanol tanks for the EFOY fuel cell. He turned the fuel cell on, and it appeared to be functioning nominally. Propane tank still had 25% left. Apparently the TEG went off again this past winter before the fuel ran out (suffocation?). When new batteries were installed, the TEG fired right up. Tiltmeter was found functional but one axis was pegged. Warren re-leveled it remotely late in the day.
- October 25, 2011 – Replaced backpanel. New one has more terminals as well as a Morningstar PPT solar charge controller. Removed 6 panels (3 broken last winter, 3 ok), and installed 2 new ones with aluminum backing plates. The existing swingset/3 panel mount system was assembled such that the U-bolts prevented adding more panels. In the future, this set-up should be redesigned to allow for 4 panels. It was apparent that this design problem was also the cause of the broken panels last winter (they deflected and were broken against the bolts sticking out of the mount). This failure mode is not possible this winter. Installed large (55 gal) drum for methanol storage. Filled with 6x 28L cans, for a total of 43 gallons. Removed the duocart switch. Installed 4 gage battery jumpers on mains batteries. This site was moving to a new IP space as part of coms changes on Mount Saint Helens. All equipment was reassigned to the new space (but coms were not restored at CVO until Dec 15, 2011).

- June 6, 2012 – Batteries were dead (4.5 V) upon arrival. Replaced with 4 mains and 2 gt-sm batteries. Rain gage cable has been ripped from the instrument, and the whole unit should be replaced. This was not done at the time since they did not have a spare. Site was powered off upon arrival. Solar panels (2) were exposed from snow, but the batteries were too low for the MPPT charge controller to turn on. Once the batteries were replaced, solar input resumed. The TEG also started immediately. The Propane tank was at 55% (had to be dug from snow bank to check), down from 83% on 10/25/11. The Fuel cell had consumed almost all its fuel (~39 gallons) since 10/25/11. Operating hours are currently 3784, which means the unit ran ~2700 hours this winter. It was left disconnected until more fuel can be brought up. The TEG shut off 2x while the engineers were on site, apparently from charged batteries, but its on/off settings should to be checked/reset. The Radome and baseplate suffered damage during the winter and need to be replaced. They did not have a spare, so this will need to happen once the road opens.
- July 14, 2012 – Visited after road opened and found the logger board hung. After manually rebooting the logger board the site came back online. No data was recorded from June 8 – July 14, 2012.
- August 3, 2012 – Soldered connector onto the new rain gauge, and hooked it up. The previous gauge had the cable torn out over the winter. This one was set up with some strain relief for the cable. Picked up the broadband sensor at 11:38 local time. Added 4 x 28 l methanol for the fuel cell and reconnected it. Operating hours were 3784. Left fuel cell in automatic standby mode. Replaced the roof on the fiberglass enclosure that had been damaged by snow load in 2008.
- November 2, 2012 – Upgraded TEG. Tried to restart fuel cell.
- November 7, 2012 – Installed Campbell scientific datalogger.
- November 9, 2012 – Installed roof flashing. Installed 2 tanks and a duo-cart switch for the fuel cell.
- July 9, 2013 – Mike visited the site to get it back online.
- August 9, 2013 – Installed new TEG up the hill from the strainmeter, still needs propane to be hooked up in late August. Installed new 110 w fuel cell with 4 M28 fuel tanks (and 2 spares in bunker), replaced 2 solar panels with 4 on modified mount, and moved panels up the hill. Need to return on August 28 to move propane tank and hose, further secure swing sets, remove old TEG, and deal with possible GTSM GPS issue.
- August 29, 2013 – Mike Gottlieb met the propane company to finish installing the new TEG. He also rewired the Fuel Cell so all four tanks would be connected properly, and replaced a failed GPS antenna for the GTSM.
- May 29, 2014 – Mike Gottlieb hiked into station from JRO. Replaced the batteries, and restarted the TEG/solar/fuel cell. Propane tank had 35% left. 3.25 methanol cartridges were also left. The fuel cell reported error 11 at 160 operating hours (right before it quit working this winter) but seemed to be working fine now. Error 11 is "please check exhaust hose" and also "stack voltage is too low during operation". Perhaps the exhaust hose froze up or else the bunker had "insufficient fresh air". Station is currently operating again.

- July 20, 2014 – An active seismic experiment was scheduled for the nights of July 22, July 23 and July 30, 2014. <http://imush.org/blog/2014/07/20/realtime-recordings-of-the-active-shots>
- May 19, 2015 – Tiltmeter averaging rate increased to 360 to reduce noise.
- July 28, 2015 – Visited site for scheduled maintenance and to check interment radio connection. Downloaded Campbell datalogger data from winter. Upon arrival batteries were at 14.4V. TEG was on, but no output. TEG shouldn't be on at 14.4V, supposed to turn off at 13.7V. 4.7 A from Solar panels. Fuel cell was auto-off, hours at 1500, 1 full M28 left. Look at TEG, appeared to be losing ~1V of signal current across PSW1 when TEG was running, so the voltage at the sense module was only 13.5V despite 14.4V input. Will have to call Global and ask about this behavior. Very cold enclosure for fuel cell will not fit through doorway of bunker. Examined options and decided not to install. Will insulate fuel cell before next winter to reduce frequency of warm-up starts needed. Remove Campbell datalogger and brought it back to Portland. Will attempt to resolve ethernet connectivity issue and redeploy. Checked slave radio, VSWR was 6, S/N was -83/-125 dBm, but only ~90% receive rate. Master radio at JRO was slow to load, showed vswr of 28. Should visit JRO to inspect antenna/cable.
- August 19, 2015 – Visited site to prepare it for winter. Site running on solar power upon arrival. Mains - 13.43 V GTSM - 14.2 V. TEG was off and fuel cell was on standby. The fuel cell had run 32 hours since 7/28 visit. Worked on TEG. Replaced PSW1 with spare and cleaned contacts of rust. This will hopefully resolve problem with TEG not shutting off at upper set point. While working on TEG the 3A fuse blew and Mike did not have a spare. TEG was left off, will need to return and replace fuse. Built insulated cover for fuel cell, to reduce number of anti-freeze cycles needed over the winter. Left cover off, will need to put over fuel cell before winter.
- October 28, 2015 – Installed 4 new methanol M28 fuel jugs. Reset all counters on fuel tanks. Reinstalled Campbell datalogger, ftp functionality is now working. TEG was at 60% fuel, but not running. Fired easily, but would not stay on past ignition. Cleared sediment bowl, checked orifice, replaced fuel filter, no improvement. Left off, will need to return.
- November 6, 2015 – Reconnected the TEG wiring. Replaced the stick electrode in the TEG. The stinger on the tip of the old one was quite worn, apparently preventing the ignition signal from traveling to the spark ignition module. With repair, the TEG is working well again. Also added service fluid to the Fuel Cell. Station currently operating on TEG/solar, with the fuel cell in standby.
- March 31, 2106 – Site went offline in December. Mike Gottlieb hiked 8 miles to the site. He dug through ~12 ft of snow to access site. Power was still running, but the radio/antenna had been damaged by the snow and were non-repairable with equipment they hiked in with. They downloaded the GTSM, GPS, and power data. TEG was running and the solar panels were exposed. Fuel cell had 1 tank left, but was not recognizing it and had gone into error 40 (frozen) mode. Reset fuel counter but could not restart EFOY until it warms up. Will plan on moving radio/antenna to TEG post in the summer so that snow will not destroy it. Site will be offline (coms) until then, but should continue to collect data.

- August 3, 2016 – Radio/antenna did not survive the winter and needed to be replaced. Removed bullet radio and broken panel antenna. Installed AirGrid on same post (temporarily). Will move to TEG post next visit. Could not connect to JRO. Station was running on arrival, appeared to have run all winter. Solar was working, TEG was on but not charging (solar was doing all the charging). Fuel cell was in standby ready, 1 tank left. Hours 2861 (68 hours since 3/31).
- August 4, 2016 – Found some incorrect settings and fixed them. Connection now up.
- August 16, 2016 – Moved airgrid antenna from post at bunker to mount attached to TEG post. Ran direct burial ethernet cable in trench back to bunker.
- August 29, 2017 – Station went offline in march due to power problems. Road was finally open. Surveyed power system after winter. Batteries were dead and needed to be replaced. Propane was still at 40%. TEG would not fire due to corrosion on the fuel pressure switch. The leads were cleaned and the connectors were replaced, which allowed the switch to sense the fuel pressure and the TEG to start. Fuel cell used 3 M28s, but thought the 4th was empty and did not use it. Mike put full M28s on 1.1 and 1.2, and near empty M28s on 2.1 and 2.2. All four tanks were set as "full". Hours were 3858, no errors. Left 5 new (2017) batteries disconnected on site. Solar was working. The radome was broken and should be replaced (baseplate also). Should bring a spare choke ring in case the damage is more extensive. Rain gauge was also beat up, no longer level. Site will need more methanol and propane before winter
- July 2, 2018 – Swapped out failed logger. This logger was losing files last fall, and became unresponsive over the winter. New logger configured with the same settings. Still has a 256 MB card unfortunately, but Mike didn't have a 1 GB card with him when he discovered that. Replaced dead batteries with 2 banks of 4 mains batteries and 1 gtms. TEG wouldn't fire. Adjusted spark gap and got it working again. Replaced a shattered baseplate on the radome that was preventing the dome from sitting level. Still needs 7 more short screws, but radome is leveled again. Fuel cell was out of fuel, could not get the remote to display anything. Left 2 M28s on site, but unplugged the EFOY since it is not needed during the summer. Planning on replacing EFOY with horizon unit before next winter.
- November 8, 2018 – Visited site to tune power system prior to fall closure. TEG fuel filter checked, was clean. Cleaned corrosion off contacts for fuel pressure switch. Run test procedure, VSET at 40 mins was 6.29 V, which was good. Fuel cell error, Frozen. Took it back to Portland to let it thaw.
- November 20, 2018 – TEG igniting but not staying on. Replaced spark electrode. TEG 9s working for now, but should be watched. Re-installed fuel cell with 2 M28s. Remote was not working, so tried and set up with computer. Reset active fuel cartridges and levels. Button On command would not work, so could not confirm that it will start. Everything else seemed normal with fuel cell, left it in auto mode.
- June 19, 2019 – Found all batteries dead. They had survived all winter but died June 6, which was surprising since solar should have been working good by then. Datalogger showed TEG started consuming a lot of power (20-30 A) and that was what killed the batteries. It was giving some incorrect readings for Amps1 TEG (187 A) and amps 5 Main electronics (-9A). Set up 2x4 mains and 1 GTSM battery. Solar is working now. TEG won't start engines

will need to come back with more parts. Tried new electrode and confirmed fuel orifice was clear. Could hear the starting clicking, but couldn't tell if gas was flowing or not (the wind was too loud).

- September 12, 2019 – Replaced TEG that would no longer start. Fuel was at 40%. New TEG putting out 7 A, left in remote mode.
- September 25, 2019 – Replaced radome on choke ring antenna due to cracked baseplate. Adjusted spark gap on TEG, it didn't want to stay on when we arrived, but seemed to be more stable after adjustment. Went off again a day later and hasn't come back up.
- November 13, 2019 – TEG still was not coming back on with low power. Needed to try a couple last things to fix before winter. Attempt to start TEG. Fired on 2nd start signal, but would not stay ignited. Adjusted spark electrode very slightly, then it stayed on. Replaced voltage sensor module with recently programmed one, low 12.25, high 13.8. Replaced spark electrode with other (used and more worn down but best spare). Started immediately and stayed on. Put TEG back in remote start mode. Checked at 11:15, TEG was off. Batteries were at 13.19 when it shut off, well less than cutoff voltage just set for TEG. Able to restart it manually, but worrisome. Verify expected behavior from voltage sense module with lab power supply. Watched it turn off TEG at 13.8 and on at 12.24. Tested several times and was satisfied that it was behaving as expected, starting smoothly. Turned back on. it turned off again around 13.2. Have no more spare parts or adjustments to make, so will monitor to see if it comes back when voltage drops.

Checked logger. All channels were in G3, said 6 satellites but no GPS pulse. Coldstart shows bytes read = 0. Did not have GPS antenna or power box to replace it. Checked clock vs UTC, was 8 seconds slow. Manually correct drift with command date -s "8 seconds" and rebooted. Will need to replace powerbox/antenna in the spring, can reset manually if comes stay up before then. Rebooted charge controller.

- April 27, 2020 – Station went offline on June 17 due to low power. All batteries were dead. TEG was not starting. Adjusted spark gap and manually started, but combustion was too weak to stay on. Adjusted fuel to increase sound of combustion, appeared to stay on now (when set to local control). Turned off when switched to remote as new batteries were above the turn-off voltage. left in remote setting, not running. Should hopefully turn back on when voltage drops. No GPS time or pulse on Strainmeter, replaced powerbox. New powerbox tracked satellites pretty quickly. Adjusted clock speed from 100 to 400.
- September 29, 2020 – The breaker controlling solar power flipped late August. Mike reset it and solar power resumed normal operation. Cause of breaker trip was unclear. The TEG did not pick up the load after the solar died in August. It turned on, but never exceeded 0.5A output. Went through full setup process today, was able to achieve a VSET of 6V, which corresponds to about 95 W. Mike had to turn up the fuel pressure to 65 to achieve this, which is definitely higher than the factory set 42. Left in remote/off mode, as batteries were charged well from solar.