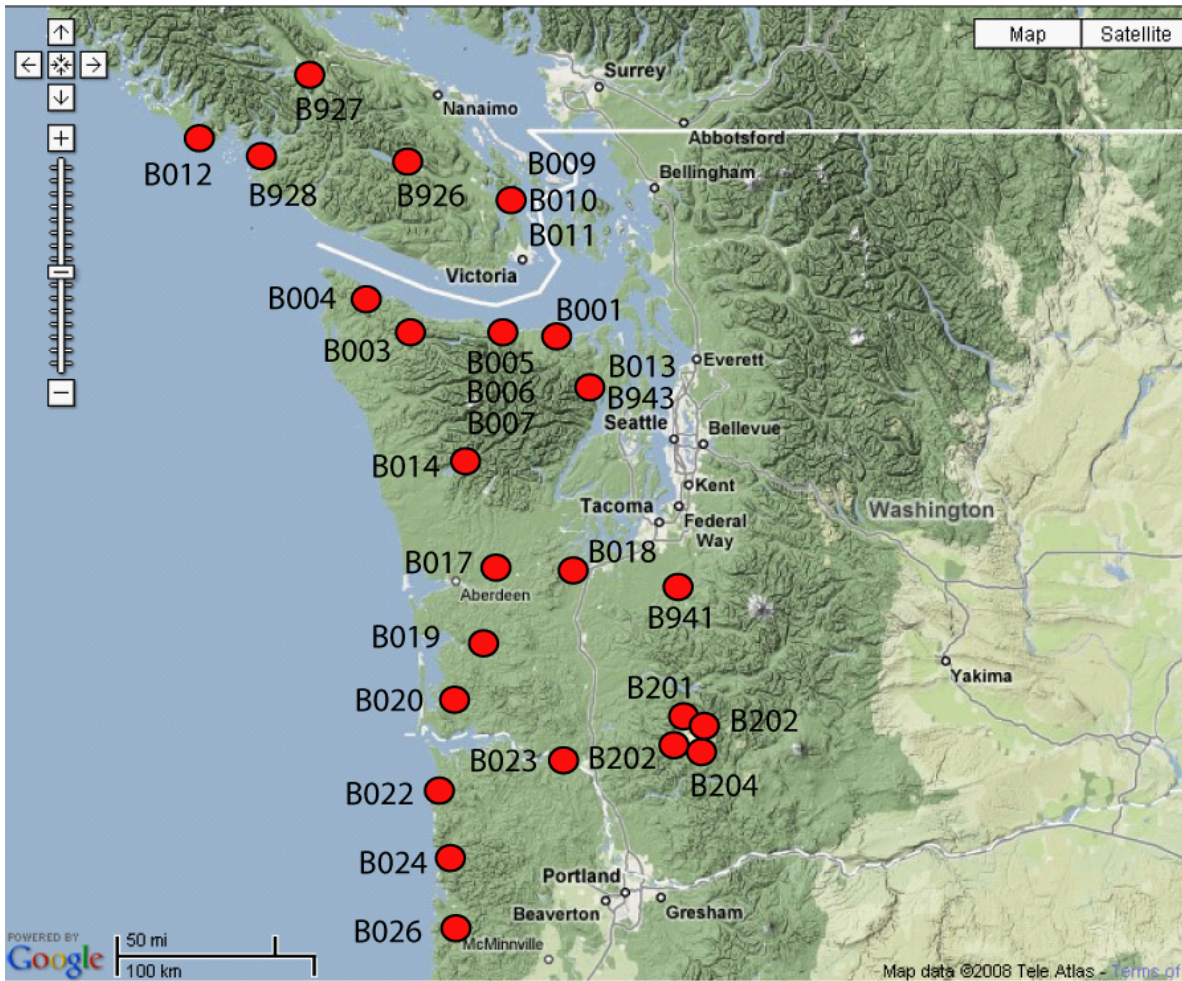


Station Notes for B204, marble204bwa2007

Latitude: 46.136 (WGS 84)
Longitude: -122.169 (WGS 84)
Elevation: 784.2 m / 2573nft
Install Depth: 241.6 m / 792.5 ft
Orientations: CH0=235.9, CH1=175.9, CH2=115.9, CH3=85.9
Install Date: August 1, 2007
GTSM Technologies #: US50
Executive Process Software: Version 1.14
Logger Software: Version 2.02.2
Home Page: www.unavco.org/instrumentation/networks/status/pbo/overview/B204
Notes Last Updated: September 23, 2020

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

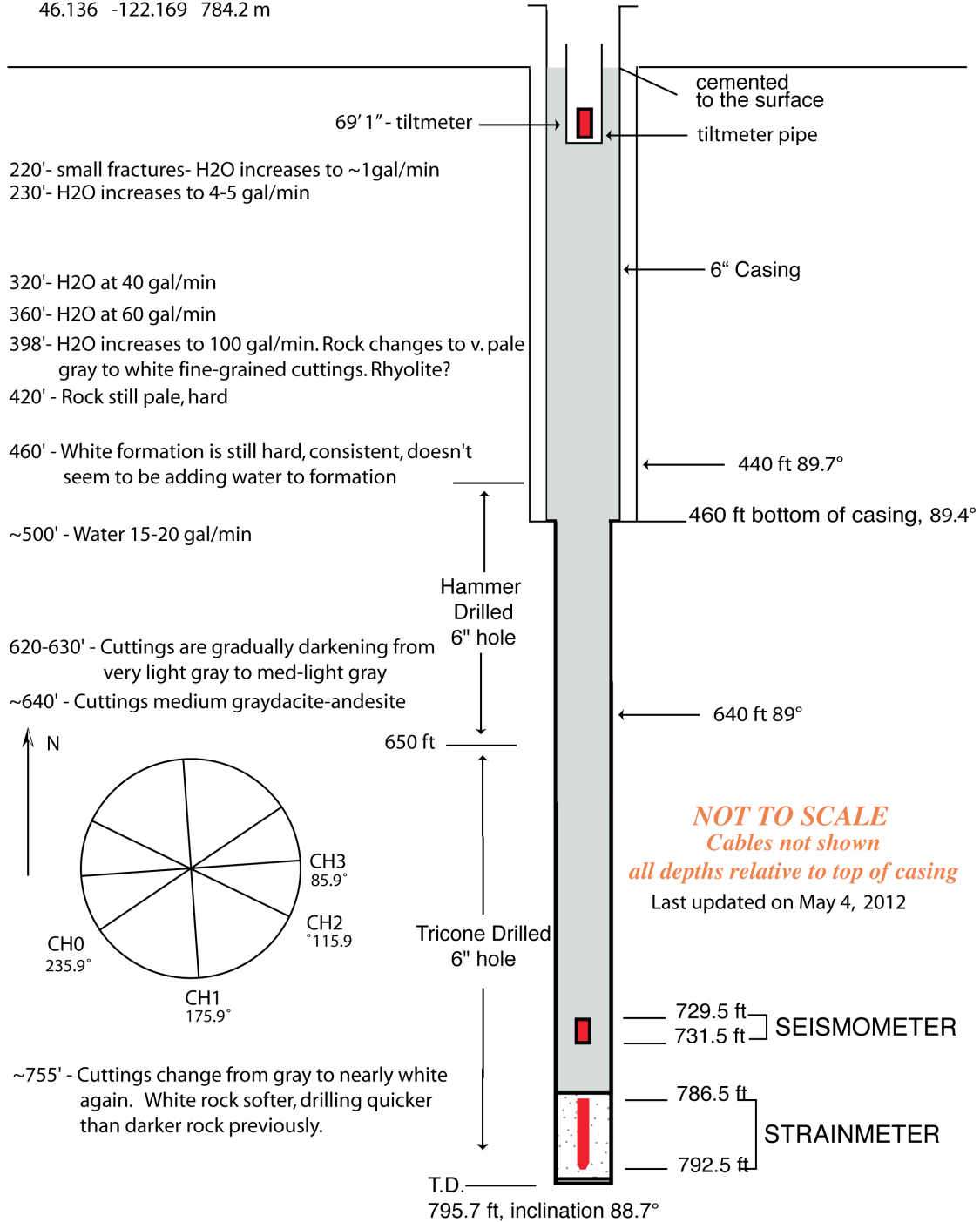
·Orientations are in degrees East of North.



Pacific Northwest PBO strainmeter network, April, 2008

B204 marble204bwa2007

46.136 -122.169 784.2 m



Instrumentation at Strainmeter

Instrument	Units	Bottle/ASCII Scale Factor	Seed Scale Factor
Pore Pressure	Hecto Pascals	NONE INSTALLED	-
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

July 31, 2007, UTC

18:00 - Onsite

18:34 - US50 on test

18:42 - Downhole temperature reading 1.892V

18:52 - Down hole temperature reading 2.004V

20:00 - Crew working on trench and pad

21:45 - Got self pointing VSAT to work

August 1, 2007, UTC

00:05 - Pad poured.

00:40 - Leave site.

August 1, 2007, UTC

16:00 - Arrive onsite. Begin working on cutting down casing.

17:08 - Generator on.

17:54 - Reboot logger. While trying to download data the USB process Froze.

18:22 - Reboot again. Pulling data. Data looks good.

19:32 - Mark sand line and sound hole. 797'10" from original casing height. 795'8" from new casing height.

19:56 - Put centralizers on GTSM.

20:18 - Shutdown GTSM to move to install area.

20:28 - GTSM turned back on.

21:00 - Test trip. Install at 792 feet. Install zone was chosen using ATV, full wave form sonic, Caliper, e-tool, and a bore hole camera. Data from Rob Harris's high resolution temp probe was also used. Nearest area of water entering hole appeared to be at 200m.

According to drilling notes the rock in the install zone is softer than rock higher up, but it is very consistent and not fractured.

21:15 - Shut down GTSM to prepare for install.

21:36 - Compass test. X: 0.952 1.462 Y: 0.976 1.457

21:59 - Note grout batch: 161597333R7

22:01 - Start mixing grout. 1.7 Gal Bag X 9 bags

22:05 - Last bag of grout added.

22:07 - Add last of original water. Mix looks rather thick.

22:08 - Added 0.2 Gal more water. Mix looks much better

22:15 - Finish Mixing. Load baler.

22:25 - Baler on bottom.

22:31 - Baler out of grout.

22:33 - Baler out of hole.

22:35 - GTSM in hole. Move capstan over hole. Due to the nature of install we used the capstan

directly over the hole with out quarter block.
22:52 - GTSM on the bottom of hole. Stopped the capstan for the last 15m due to the slipping.
Allowed the cable to slip around the capstan and could feel the GTSM sink into the grout.
22:54 - GTSM turned on.
23:09 - RT board getting to G3 Meas Max and G2 Meas OOB. Temp 0.932 X: 1.040 Y: 1.411
23:11 - Called good
23:45 - Off site.

August 2, 2007, UTC

After yesterday's strainmeter install, today was entirely uphole work to give the grout over 24 hrs of curing. This site presented unique challenges in that the borehole was drilled in close proximity to where the forest service will potentially position their rock crusher for infrequent quarrying. As such, our green enclosure had to be placed away from the wellhead, which had to be cutoff at or below surface. We cut a notch in the casing and ran the strainmeter cable 70' along a 3-6' deep trench to a "safe" site for the uphole electronics and enclosure. The cable was then encased in concrete for protection and thermal isolation, and finally backfilled. A block footing was poured around the wellhead for additional protection, with a flange and cover tacked onto the casing just below surface level to ensure future access for seismic and tiltmeter work.

15:45- On site. Begin trenching for TEG propane line and anchor enclosure and racks to pad.
16:50 - Shut down GTSM and move GTSM uphole electronics into the enclosure.
17:15 - Restart GTSM, set up for finishing off trenching, and concreting in GTSM cable on the run between the wellhead and the enclosure.
17:35 - Drove over cable, but sandwiched the cable between some 2x6's for protection.
17:40 - Resume trenching with excavator.
19:15 - 19:20 - Weld flange back onto casing.
20:30 - 21:15 - Pour concrete into wellhead form and trench (6 cubic yards).
21:40 - Finish digging TEG propane trench and wire uphole electronics for seismics.
23:45 - Install TEG and VSAT post

August 3, 2007, UTC

00:20 - Backfill around wellhead.
00:54 - Start backfilling trench
01:20 - Finished backfilling

August 3, 2007, UTC

16:13 - Begin lowering seismometer
17:00 - Seismometer touches grout (781.5')
17:07 - Pull back 50' - seismometer depth is 731.5'
17:15 - 17:06 - Trip in 1.5" tremi pipe
18:15 - 17:45 - Lower tiltmeter pipe
18:45 - 21:15 - Pump cement to surface

2. General Information

- B204 is one of four borehole strainmeters installed on Mt St Helens. The other three are B202 on Windy Ridge, B204 on Marble Mtn, and B201 at Coldwater.

- Sensitivities of all EH channels corrected in the dataless on March 4, 2010.

3. Strainmeter Maintenance

- August 14, 2007
00:30 UTC - Andy and Wade arrived on site.
00:40 - Begin filling in trench and cleaning up site. The cement in the bore hole dropped pretty far. The tilt meter pipe is 18 inches below surface. Wade could pull it up about a foot, and it feels like it is sliding in the cement. Next time they are on site they will finish the cement job.
03:30 - Leave site.
- November 18, 2007 – Wade Johnson visited the site to get the station back online. The VSAT had hung up. Wade rebooted and it, and it came right back up. He set TEG to "remote" operation, which means that the TEG startup and shut down is controlled onboard the TEG. It will turn itself off when voltages are above 13.5 and turn itself back on when they are lower than 11.8 V.
- May 9, 2008 – Mike and Korey visited the site. The road was cleared to Cougar snow-park (3.5 miles from site). They hiked the rest of the way to check the status of the site. No visible sign of enclosure/TEG/VSAT on arrival. Probing locates the enclosure under roughly 10 feet of snow. Dug pit and expose half of the enclosure and TEG in hope that they will dry out enough to try starting on the next visit.
- May 13, 2008 – Mike, Korey, and Emily hike back into site. Rainy conditions were starting to melt some snow on the road in, but the site was still quite buried. Once onsite they got into the enclosure to check battery voltages:
2 batteries on GTSM - 1.3 Volts - need to be replaced (expected).
2 banks of 4 on Mains - 3.1 Volts - need to be replaced (not expected, the TEG was likely trying to fire, causing draw-down).
Looked at TEG, and noticed that there was no pressure coming in from the tank. Next located and dug down to the propane tank, which was empty. They also noticed the smell of propane near the tank. To get the site running again, it will need 10 new batteries and a refill of the propane tank. This will not be possible until all the snow has melted, probably at least another month from now.
- September 26, 2008 – The VSAT was repaired by Wade and this site is now back online.
- October 19, 2008 – Wade visited the site to continue repairs. A bunker was installed and GPS antennas was re-routed to top of the bunker. The rain gauge still needs to be moved. The TEG also will need to be moved into bunker. The TEG will be mounted to a bumper post inside the bunker.
- November 20, 2008 – Wade Johnson and crew installed a tilt meter.
- March 18, 2009 – The logger was upgraded from version 1.15 to 2.02.2.

- April 24, 2009 – Mike Gottlieb visited the site. There was 3-4 ft of snow in the area, but the bunker has radiated enough heat to melt the snow touching it. The site looked physically fine after winter, although the TEG was not running. Batteries looked good (strainmeter at 11.9 V and mains at 11.3) but the TEG appeared to have failed. It would not attempt to fire when local start was engaged. The fuel gage in the TEG showed low psi (~3) and digging up the tank-side gage showed it on E. Will need more propane to restart site. While on-site, Mike also disabled the auxiliary power supply to the strainmeter and rewired the TEG to start only through the LVD. Both of these should help prevent unnecessary discharge of batteries.
- June 4, 2009 – Mike Gottlieb visited the site. Propane (larger tank) will be delivered next week. All batteries need to be replaced. Apparently the power changes made last time to save the batteries were ineffective. The TEG is expected to work once batteries and fuel are replaced.
- June 14, 2009. Mike Gottlieb visited the site. Site has 800 gal propane. TEG started after ~15 attempts, (it started 2x, but sputtered out). Replaced the batteries. Everything came back online except the GTSM. After some investigation, it was apparent the fiber optic cable had failed, and replacing this fixed the problem. Replaced the home-made rain gage connector with premade connector. Site was fully operational when I left.
- October 19, 2009 – Mike Gottlieb installed a Setra pressure sensor, and upgraded to blue fiber optic modems.
- April 21, 2010 – The road is snowed in starting at Marble Mt SnoPark, roughly 1 mile before the station. A ranger told Mike Gottlieb it would probably be another month before this melts out. After hiking into the station, Mike verified that the propane tank is empty, and will need to be refilled. The batteries at this station are also dead, and need to be replaced. This will have to wait until the road is clear.
- June 2, 2010 - Propane was refilled in late May. Replaced the 5 dead batteries with new ones. Started TEG. Two batteries were on the GTSM side and 3 on the mains. These batteries had died over the winter when power was lost.
- June 21, 2010 - Removed failed tiltmeter. Instrument had been recording flatline 0s for some time. Attempted to install replacement, but new instrument failed pre-install testing and was not deployed.
- July 2, 2010 – Mike Gottlieb installed a tilt meter to replace a failed unit removed on previous visit. Lowered tilt meter to a depth of 70'1", which was 11" higher than the previous instrument. Oriented with positive x at 45 deg magnetic. Set baud rate to 9600, and connected tilt meter to marmot serial port.
- August 3, 2010 - Mike Gottlieb visited the site. He found the Vsat to be offline. Status showed TCP acceleration as failed. Power cycle did not help. Signal strength good, but he couldn't get a cross pole test. Found damage (several punctures) to the feedhorn, it will need to be replaced. The cables for the GTSM and Q330 gps antennae were severed, as was the rain gage cable. All components were still on site. Antennae were replaced and the rain gage was repaired. Mike set up a broadband seismometer for orientation. It was unlocked at 11:50 PDT. The broadband is oriented at 0 deg, ± 3 degrees (the brunton does not work well inside

the bunker). One potential problem is vibrations from the TEG creating noise on the broadband. Also ran birddog for seismic calibration.

- August 5, 2010 – Mike Gottlieb visited the site at 17:25 to pick up the broadband seismometer and replace the broken VSAT ODU. On August 9, 2010 the GTSM stopped communicating. Cause is either failed 1 port fiber optic modem, powerbox, or logger board. Will require site visit to diagnose/repair.
- September 2, 2010 – Mike found the GTSM charging breaker to be tripped. Reset breaker and replaced 2 dead GTSM batteries. GTSM is currently running again.
- October 19, 2010 – Mike visited the site. Tiltmeter found to be unresponsive when directly connected to console port. Will need to be replaced.
- August 9, 2011 – Removed tiltmeter due to firmware problem, and installed a new one. New depth is ~1' higher than previous due to sand down hole. Also noted the tiltmeter pipe is full of water. Tiltmeter was functional and communicating at time of departure.
- November 7, 2012 – Rain gauge was found to have the cable torn out. It was replaced with a different gauge. This new rain gauge appears to also be under-recording precipitation (only showing 1 mm in the last 30 days, should be >200 mm).
- December 28, 2012 - Road was open to marble mountain snow park, so it was about a 1 mile ski in from there. 4-5 ft. of snow were at the site, the VSAT dish was totally covered in snow. Once this was cleared, site began communicating again.
- April 3, 2013 – Mike visited the site. VSAT looked good, could get to Internet. Could not get out from behind cisco though, nor could he ping the VSAT IP. The cisco was replaced, which appears to be working better.
- 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>
- October 8, 2014 – Powerbox charging circuit was failing and overcharging the gtsm batteries, it was replaced.
- January 22, 2015 – When Liz arrived on-site, she could hear the TEG running. The propane tank was 55% full. On opening the site, the IDU only had one light on, the power light. Power cycled IDU at the power inverter. The IDU would not register an IP with the field laptop. Swapped out power inverter, tested connection voltages, and looked for faulty wiring. No problems found. All lights on the IDU flashed on and off a few times, then would not come back on at all. Liz replace the IDU power wiring, but no change. Replace rusty lock. IDU needs to be replaced.
- January 30, 2015 – Replaced IDU, ODU, VSAT cable, and power supply.
- June 23, 2015 – Batteries had no capacity and needed to be replaced. The 3 mains batteries were replaced and a second bank of three should be added.

- July 14, 2015 – TEG failed, capacitors in limiter converter burned up. Replaced TEG.
- August 19, 2015 – Found IDU with System and transmit lights off, rebooted IDU. Came back up fine, can log on and status is operational.
- September 22, 2015 – Added a timer to the VSAT. Set to power cycle (5 min off) at midnight UTC
- December 9, 2015 – Cisco router had failed, lan ports were no longer working. Replaced router with spare removed from B208 last year. Uploaded config file, site is on ASA.
- January 2, 2016 – Site was offline due to recent heavy snowfall. Brushed snow off VSAT dish. Station communications returned.
- June 16, 2016 – Station had lost comms. The VSAT was showing signal strength of 29. No visible movement or damage to dish/ODU, all nuts and bolts were tight. Tried replacing IDU, cable, ODU. Initially unable to find satellite H1 with any combination of hardware. Signal strength ranging from 0 up to 29 for range of azimuth adjustment. Ended up loosening and turning the whole pole mount westward and finding a satellite (H1?) about 20 degrees further west than expected. Peaked signal strength around 74, but cross pole would not go above low 60s with occasional fails. This was true for both combinations of hardware, so the original IDU/cable/ODU were left in place. Communications were restored, but are very slow. Speedtest: 1871 ms ping, 0.3 Mbps download, 0.14 Mbps upload. The dish is now pointed significantly differently (~20 deg further west, similar elevation) than it was before. As there was no indication that the dish had been moved to cause the outage (it is high in the air so not likely bumped, all hardware was tight, and it was so far off Mike had to rotate the whole pole mount), it is unclear why this was necessary or why this even worked.
- July 14, 2016 – Found TEG off. Mains batteries were at 10V, GTSM at 12.2V. Connected generator w/ iota to Mains. Tried to fire TEG, but it wouldn't start. Looks like sparking from lead to electrode over to the steel gas line rather than inside the combustion chamber. Repositioned gas line and tried again. TEG started but was running rough, adjusted air and fuel pressures until it sounded better. Replaced mains batteries (4) with new ones (12.8V). Run generator on GTSM batteries (with GTSM disconnected) for 2 hours. TEG output looked a little low (only 4.5 A) but may still have been warming up. Reconnected all equipment, checked in, looked good. GTSM drawing 80W to charge its batteries, but should settle down in a day or two. If TEG output does not increase, will need to come back and tweak again.
- August 4, 2016 – Visited site to adjust TEG, comms were not staying on.
- August 10, 2016 – Coms were acting funny, replaced cisco router.
- August 16, 2016 – LVD2 kept cycling off, power system at site was not stable. TEG was outputting slightly less than it claimed, but should still be enough. GTSM charging system is dumping energy somewhere. System amps show only about 14 watts consumed to run strainmeter, but 50 watts were being drawn into the isolation block. Possibly the GTSM batteries are failing? Removed the 2 batteries and moved one from the mains bank (new this year) to the GTSM. For now, site has 1 GTSM battery and 3 mains. Need to let the site reach

steady state again and see if this solved the problem, if not, may need to adjust/replace powerbox.

- August 23, 2016 – GTSM was consuming too much power. Visited site to tune powerbox charging and add batteries. Added 5 more mains batteries, for a total of 8 mains and 1 gtsm.
- June 23, 2017 – Station ran out of propane this spring and went offline. All batteries died. Propane was able to be delivered on June 21. Station batteries were replaced and station was brought online June 23. All batteries were dead, replaced w/ 2xGTSM and 6xMains. TEG fired and stayed on with new batteries. Set chops and quads on GTSM.
- August 23, 2017 – TEG had turned off the previous week, and station batteries were dropping. Comms had been offline for 5 days. Batteries were 11.3 V mains, 12.2 V GTSM. Manually restarted TEG. Sounded like too much air (running lean). Turned down air until combustion sounded better. Ran 15A IOTA charger until gas generator ran out of fuel. Came back and picked up generator on August 24. Mains were at 12.3 V, GTSM at 13.3 V. TEG was outputting 6 A (72 W).
- August 29, 2017 – Station continued to have power problems, TEG was not keeping up with load and VSAT was cycling up and down. Recharged batteries with iota for 6 hours. Tuned TEG and got VSAT up to 6.2, which was as high as Mike could get it to go. Mike had to turn up the fuel pressure higher than he wanted, but this was the only way to increase output.
- March 19, 2018 – Site went offline in late February during storm. Skied in with sled with Honda generator, 1 charged battery, and battery charger. Mains batteries were at 7V and GTSM batteries were at 5V, too low to save. Will need to bring more batteries. Tried to start TEG using 1 good battery Mike brought, didn't start. Gas ok (although smelled gas by tank, probably slow leak), at 40% and decent pressure at TEG. Spark electrode was very worn down. Tried replacing with new one. Got TEG to ignite ~2x, but it wouldn't stay on (continued clicking, then turned off at end of ignition sequence). Played with electrode gap a bunch, but couldn't find a distance that would ignite consistently or stay on. Eventually gave up as bunker was getting too much unburned propane in it. Left old spark electrode in place, with a new one inside the TEG also. Will need to figure out something else to try, as adjusting the spark gap did not get the TEG to work.
- May 3, 2018 – Logger failed (causing rapid reboots of all boards) and was replaced.
- August 16, 2018 – TEG was off for about 10 days, Mike visited to get it working again. Replaced 2 GTSM batteries with fully charged ones. Removed ones may still be good, but would take too long to charge with TEG.
- November 2, 2018 – Logger was hung. Event and Environ lights were solid. No logger light, no ethernet connection, and nothing on serial. Rebooted logger, only gibberish on serial output. Tried new compact flash card, still nothing. Replaced logger. This was the second logger failure this year, this one was only installed on 5/3/18. VPN tunnel was not staying up on cisco. Tried replacing router, no change. TEG output was low, causing coms LVD to drop every 20-30 minutes. This might be the cause of poor downloads. Also VSAT connection was not great, maybe due to tree growth. Will need another visit for TEG maintenance, will see if that helps. If not, will need to move VSAT dish higher on hill. Found 2" of standing water inside bunker. better drainage is needed.

- May 8, 2019 – All batteries were dead on arrival, replaced all batteries. Tried TEG, was in local, no sound of starting. Adjusted gap, still could not hear ignition. Could hear gas, problem could be spark electrode or spark ignition unit or control module. Should replace whole TEG, this one has been slowly failing for a few years. Fuel tank was at 60%. Left 8 new batteries in place, but not connected to any loads.
- May 31, 2019 – Replaced TEG, it was missing the SI module and DC/DC modules, so had to steal them from the old TEG. Started all equipment at 1220 local.
- June 18, 2019 – Compact flash card had failed, replaced compact flash card.
- March 12, 2020 – Replaced marmot.
- June 25 – TEG was off, batteries need to be replaced. Ordered more propane.
- July 9, 2020 – Replaced batteries, 2 GTSM batteries and 6 mains batteries.
- July 28, 2020 – Could not get VSAT to pass transmit test last visit. Worked on VSAT again. Tried new config file, power supply, new IDU. None of it helped. Tested 5 ODU's, found 3 that seemed functional, 2 would not pass transmit test. New IDU's worked with good ODU, but not any better than old IDU. Left old IDU, new ODU. Speed test was not encouraging with any combination of equipment.
- August 6, 2020 – Old logger would not mount compact flash cards, installed new logger. Rebooted marmot. Q330 firmware remotely upgraded by Wade.