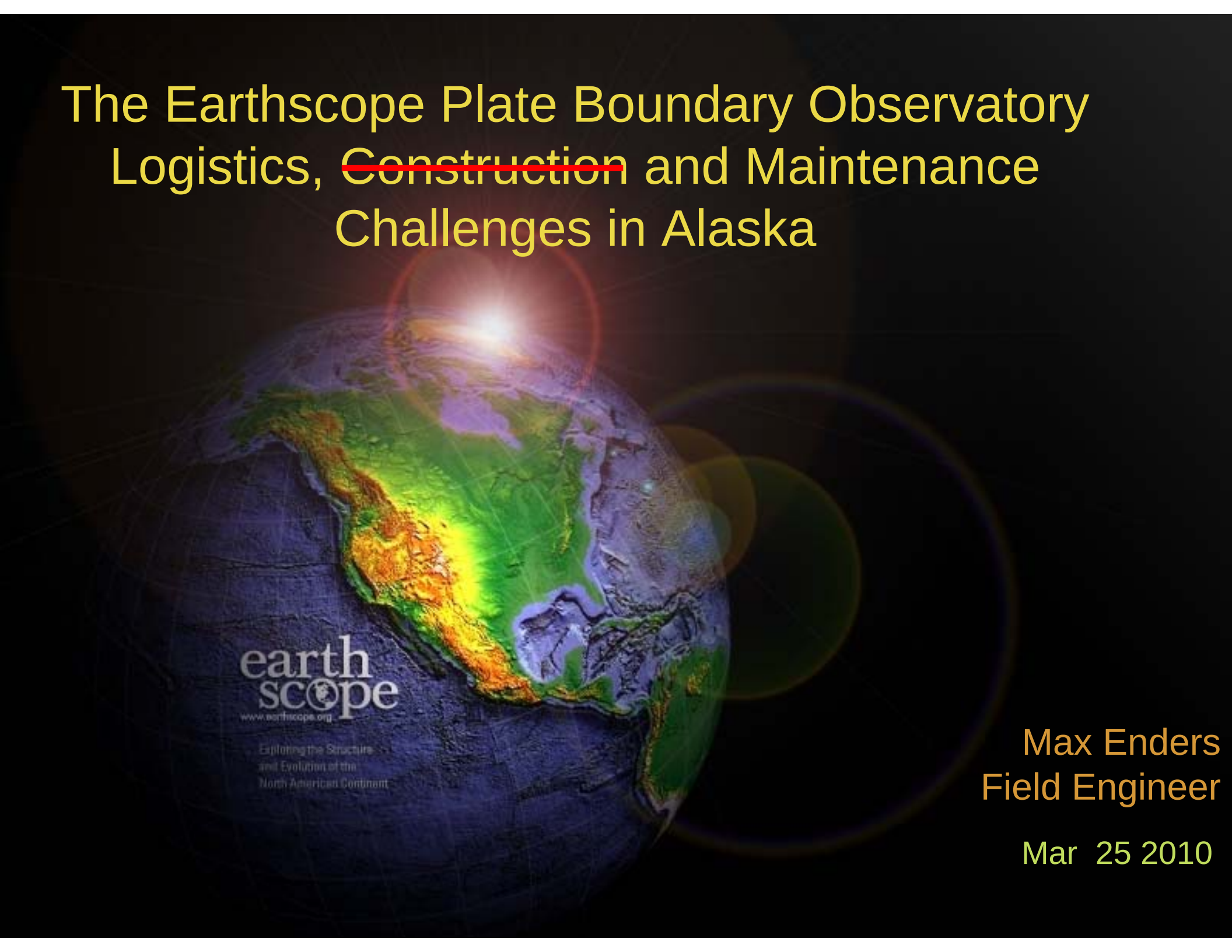
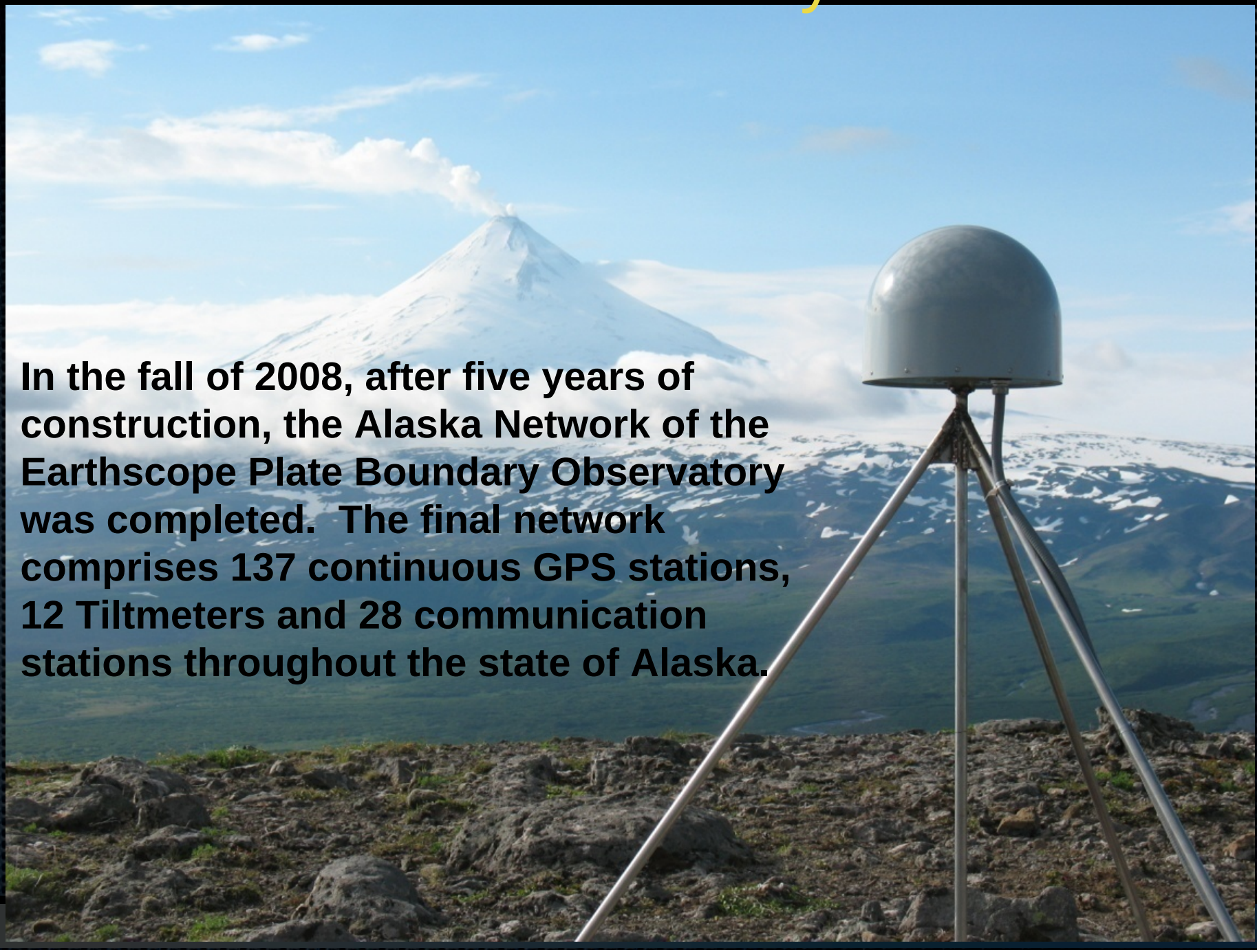
The Earthscope Plate Boundary Observatory Logistics, ~~Construction~~ and Maintenance Challenges in Alaska



Max Enders
Field Engineer

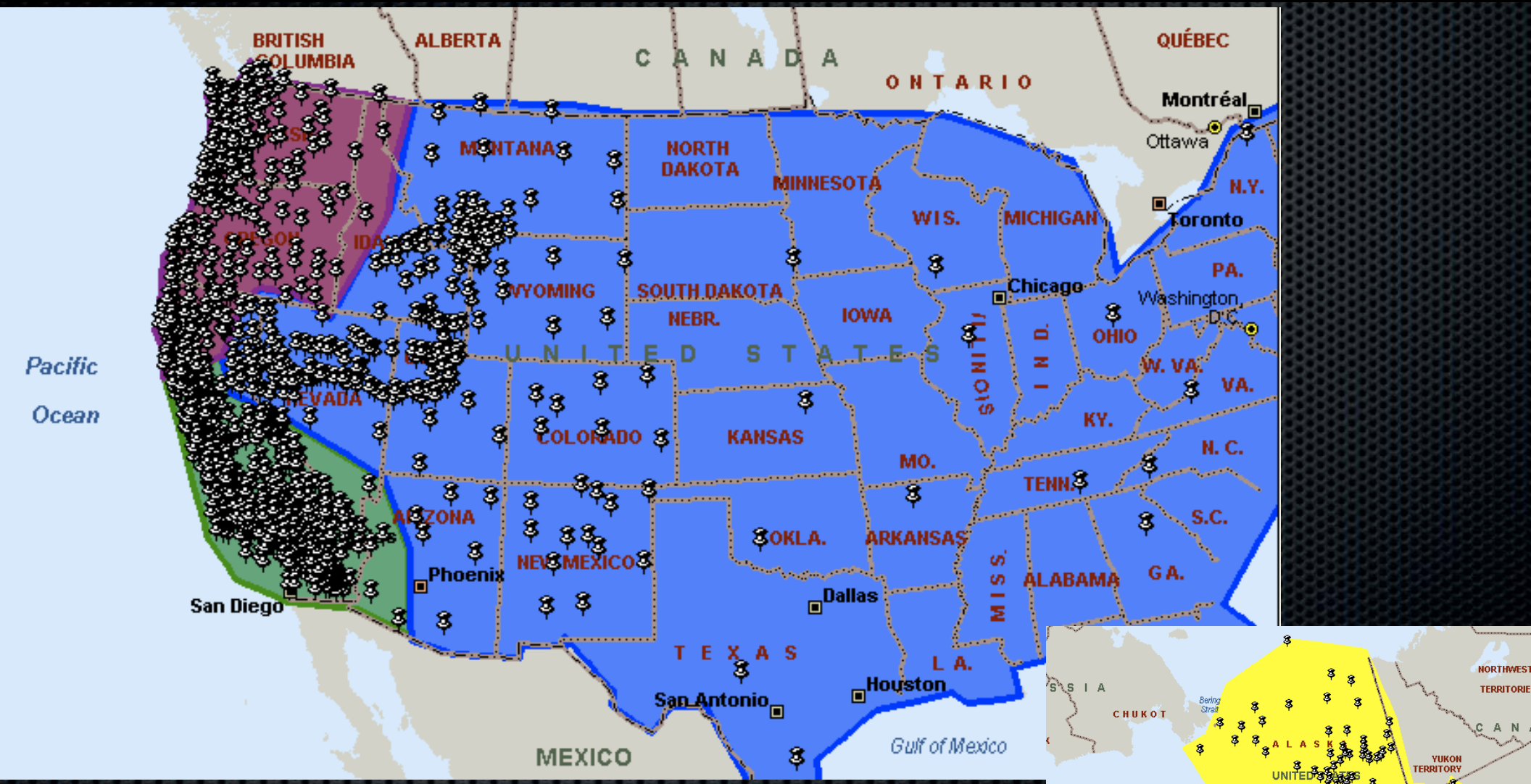
Mar 25 2010

Earthscope Plate Boundary Observatory Network - Alaska



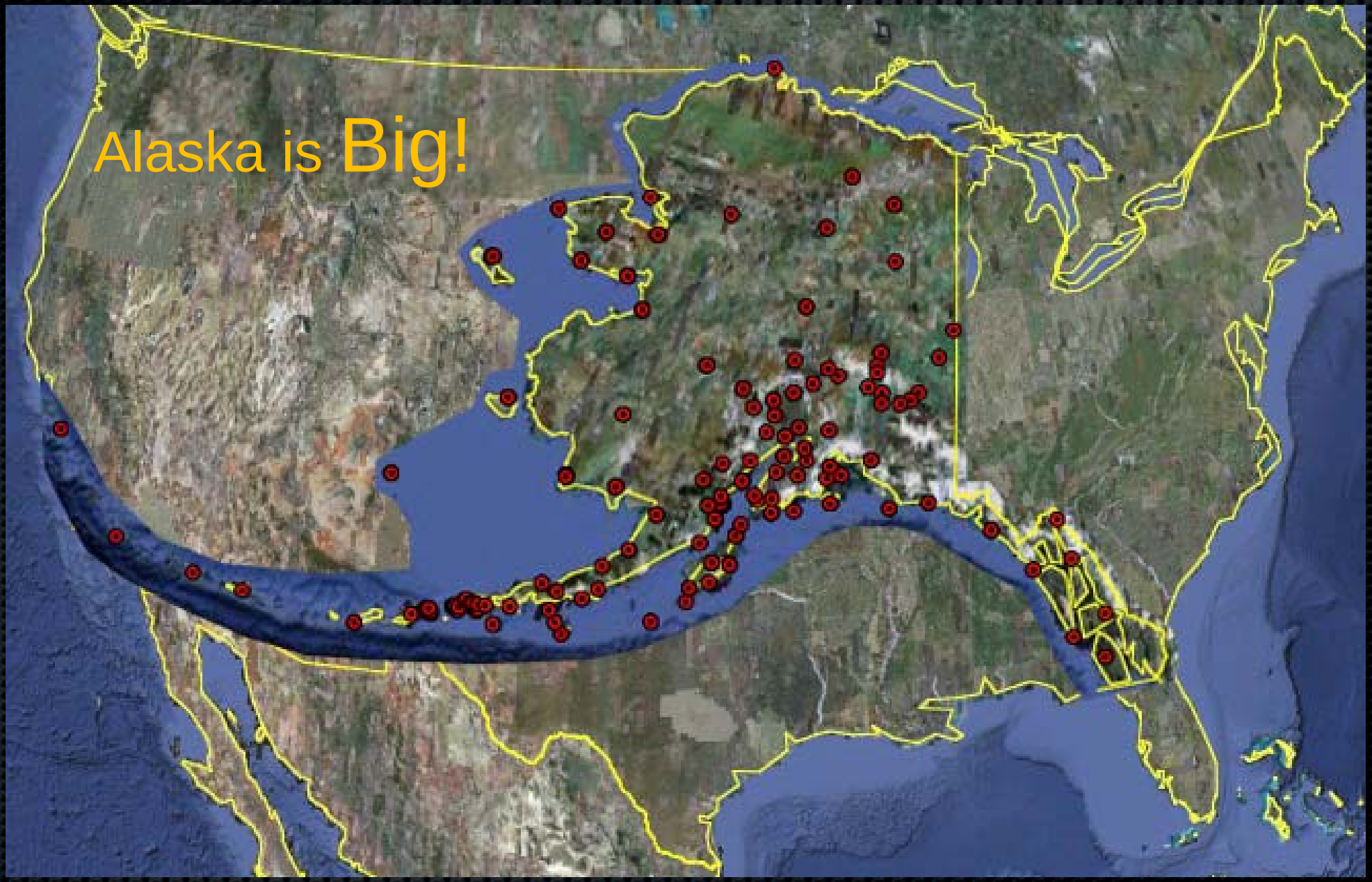
In the fall of 2008, after five years of construction, the Alaska Network of the Earthscope Plate Boundary Observatory was completed. The final network comprises 137 continuous GPS stations, 12 Tiltmeters and 28 communication stations throughout the state of Alaska.

Alaska Viewed From The Lower 48



The Lower 48 Viewed From Alaska

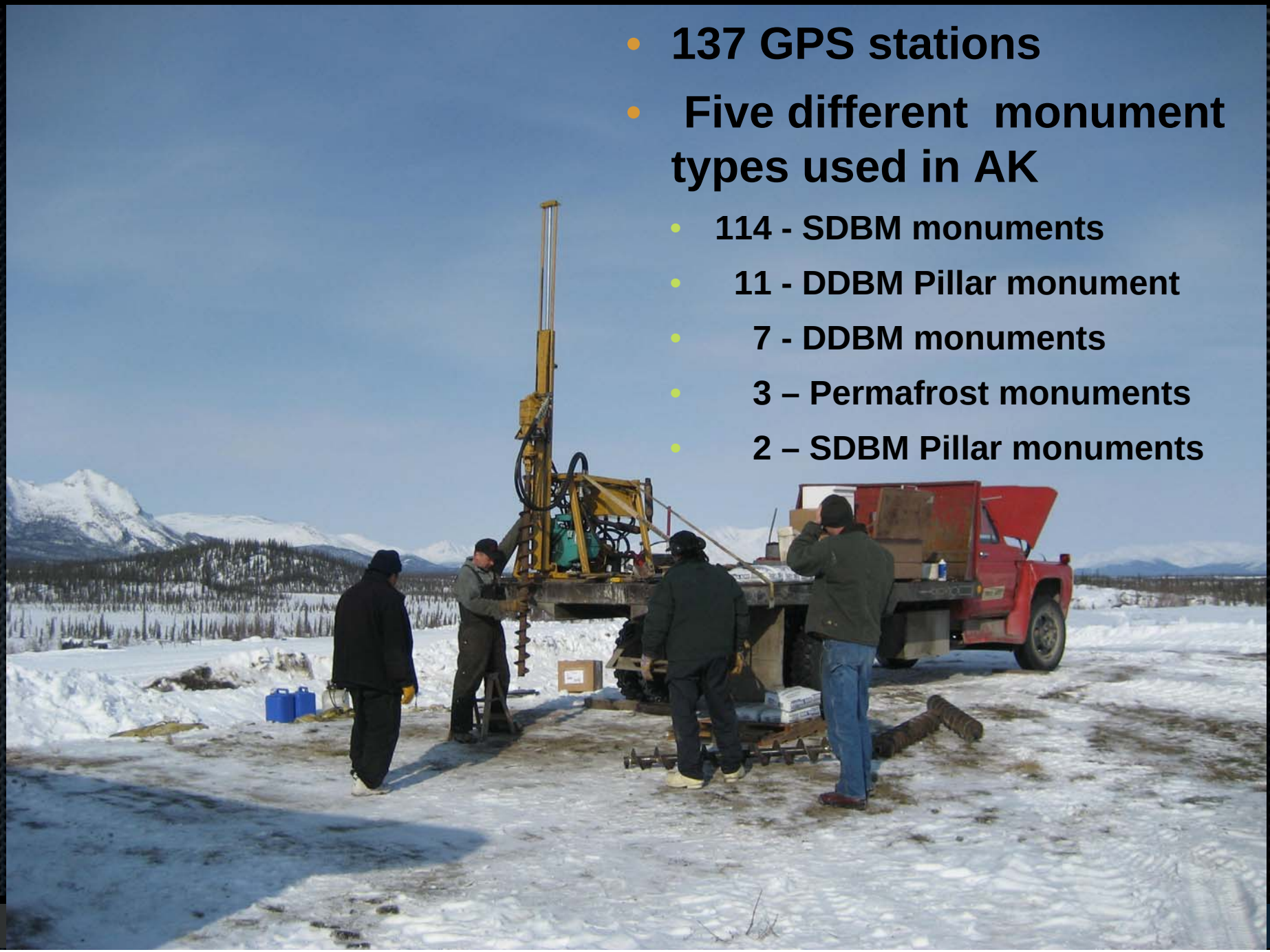
PBO Alaska



The Earthscope Plate Boundary Observatory Network; Alaska Region

- Station Construction – construction methods and logistics
- Station maintenance 2009 - troubleshooting, failures, repair and improvements.
- What's next?

GPS Stations In Alaska



- **137 GPS stations**
- **Five different monument types used in AK**
  - **114 - SDBM monuments**
  - **11 - DDBM Pillar monument**
  - **7 - DDBM monuments**
  - **3 – Permafrost monuments**
  - **2 – SDBM Pillar monuments**

UNAVCO Standard

DDBM AB33 Coldfoot

SDBM AV24 Westdahl

DDBM – AC23 Soldotna

UNAVCO Modified

Permafrost AB46 Arctic Village

Permafrost Monument
AB18 Kotzebue

SDBM Pillar – AV39 Unimak

Station Infrastructure

- Electronics and enclosure
  - Trimble NetRS and Trimble choke ring antenna at all sites.
  - Fiberglass hut.
  - Aluminum enclosure box and battery chest.

Station Infrastructure

- Po
  -
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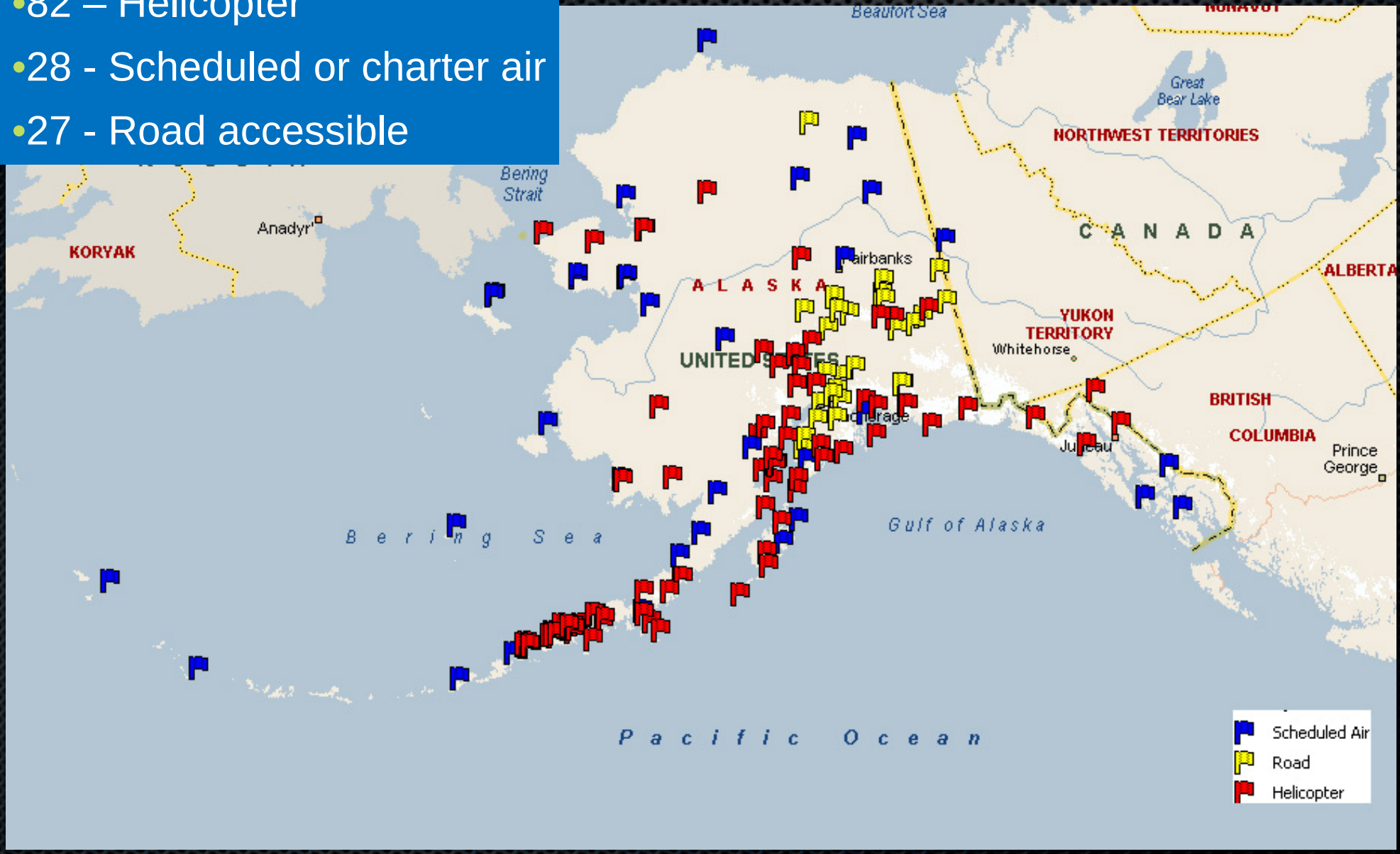
Communications

- **Telemetry Gateways**
  - **VSAT (Hughes and Starband)**
  - **DSL/Cable (Various providers)**
  - **WISP (GCI)**
  - **Cell Modem (AT&T, CDMA or 3G)**

Station Access

- 82 – Helicopter
- 28 - Scheduled or charter air
- 27 - Road accessible



Logistics

1. **Access**
   - **Helicopter, Scheduled or Charter Aviation and Road**

2. **Crew Staging**
   - **Air, Land, or Sea**
   - **Lodging – Lodge, Boat, Camp**

3. **Supply Staging**
   - **Air, Land, or Sea**

Helicopter Support

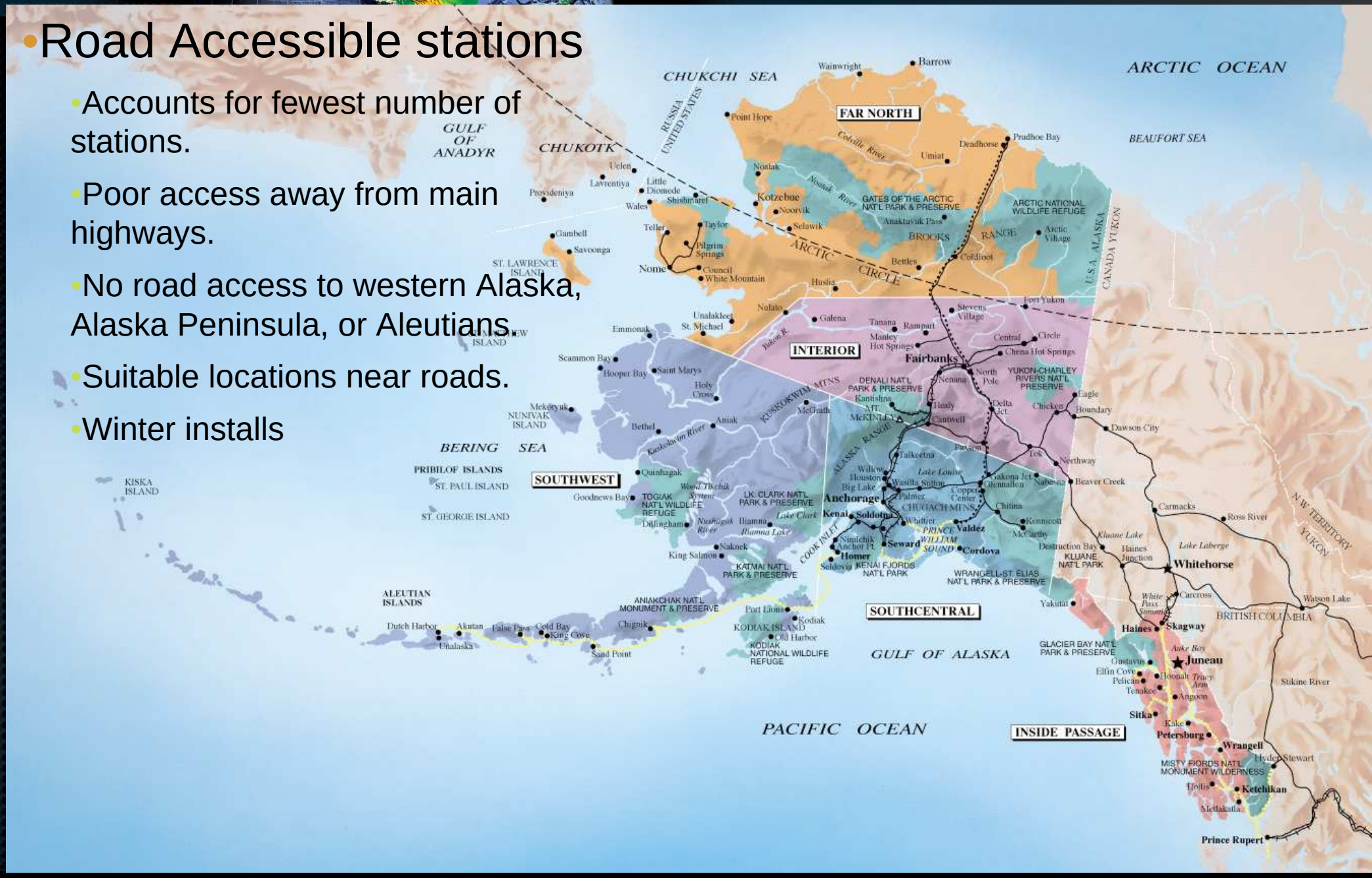
- **Helicopter Installs**
  - Only Access
  - Maximum flexibility
  - Supply staging area or research vessel
  - Skilled pilot required.
  - Helicopter crew assists with install.
  - Field crew experience.
  - Pre-build components.

Fixed Wing Accessible Sites

- Charter or Scheduled air
  - Well established air routes.
  - Easier and less costly then helicopter installs.
  - Every village has an airport.
  - Better infrastructure in villages.
  - Vehicles available to rent in villages.

Road Accessible Installs

- Road Accessible stations
  - Accounts for fewest number of stations.
  - Poor access away from main highways.
  - No road access to western Alaska, Alaska Peninsula, or Aleutians.
  - Suitable locations near roads.
  - Winter installs



Network Maintenance

- **Maintenance and Network Upgrades 2009**
  - **152 visits**
  - **126 June – Sept**

- **Three types of maintenance**
  - **Scheduled**
    - **Failed components**
    - **GPS component upgrades**
    - **Telemetry upgrades**
    - **Power upgrades**
    - **Data Downloads**
  - **Unscheduled**
    - **“Targets of opportunity”**
  - **5-Year battery replacement**

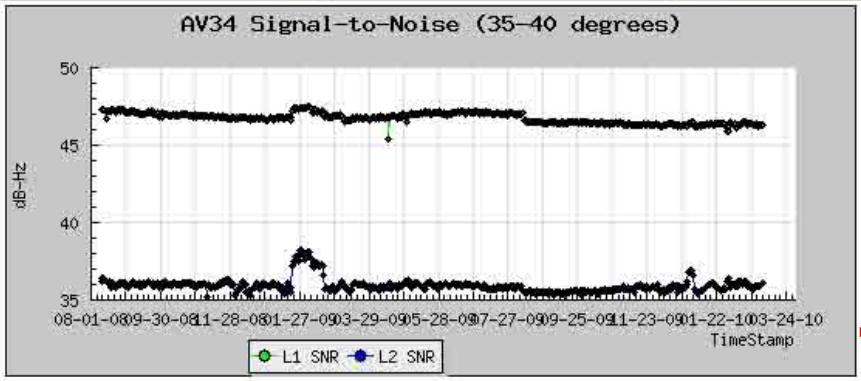
Station Down, Now What?

UNAVCO: Plate Boundary Observatory (PBO) - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://pboweb.unavco.org/plotting/src/public/qc.php?id=AV34

UNAVCO: Plate Boundary Observatory ... | UNAVCO: Plate Boundary Observa...



soh_v2_min,soh_v2_avg,soh_v2_max

Time For a Station Visit!

Year	DOY	Date	Filename	Pos Obs	Comp Obs	Percentage	MP1	MP2	QC Report
DATA GAP: 19 days									
2010	63	03-04-10	AV34201003040000a.T00	47837	46944	98.13	0.42	0.3	FULL QC REPORT
2010	62	03-03-10	AV34201003030000a.T00	47848	46476	97.13	0.42	0.31	FULL QC REPORT
2010	61	03-02-10	AV34201003020000a.T00	47841	46242	96.66	0.43	0.31	FULL QC REPORT
2010	60	03-01-10	AV34201003010000a.T00	47851	46948	98.11	0.42	0.31	FULL QC REPORT
2010	59	02-28-10	AV34201002280000a.T00	47840	46939	98.12	0.42	0.31	FULL QC REPORT
2010	58	02-27-10	AV34201002270000a.T00	47838	46995	98.24	0.43	0.31	FULL QC REPORT
2010	57	02-26-10	AV34201002260000a.T00	47836	46934	98.11	0.41	0.31	FULL QC REPORT
2010	56	02-25-10	AV34201002250000a.T00	47844	46951	98.13	0.41	0.32	FULL QC REPORT
2010	55	02-24-10	AV34201002240000a.T00	46450	45551	98.06	0.43	0.32	FULL QC REPORT
2010	54	02-23-10	AV34201002230000a.T00	46448	45548	98.06	0.43	0.33	FULL QC REPORT
2010	53	02-22-10	AV34201002220000a.T00	47854	46373	96.91	0.44	0.33	FULL QC REPORT
2010	52	02-21-10	AV34201002210000a.T00	47861	46969	98.14	0.43	0.32	FULL QC REPORT
2010	51	02-20-10	AV34201002200000a.T00	47862	46431	97.01	0.44	0.31	FULL QC REPORT
2010	50	02-19-10	AV34201002190000a.T00	46418	45518	98.06	0.42	0.31	FULL QC REPORT
2010	49	02-18-10	AV34201002180000a.T00	46417	45510	98.05	0.43	0.32	FULL QC REPORT
2010	48	02-17-10	AV34201002170000a.T00	46426	45524	98.06	0.43	0.31	FULL QC REPORT
2010	47	02-16-10	AV34201002160000a.T00	46430	45257	97.47	0.43	0.31	FULL QC REPORT

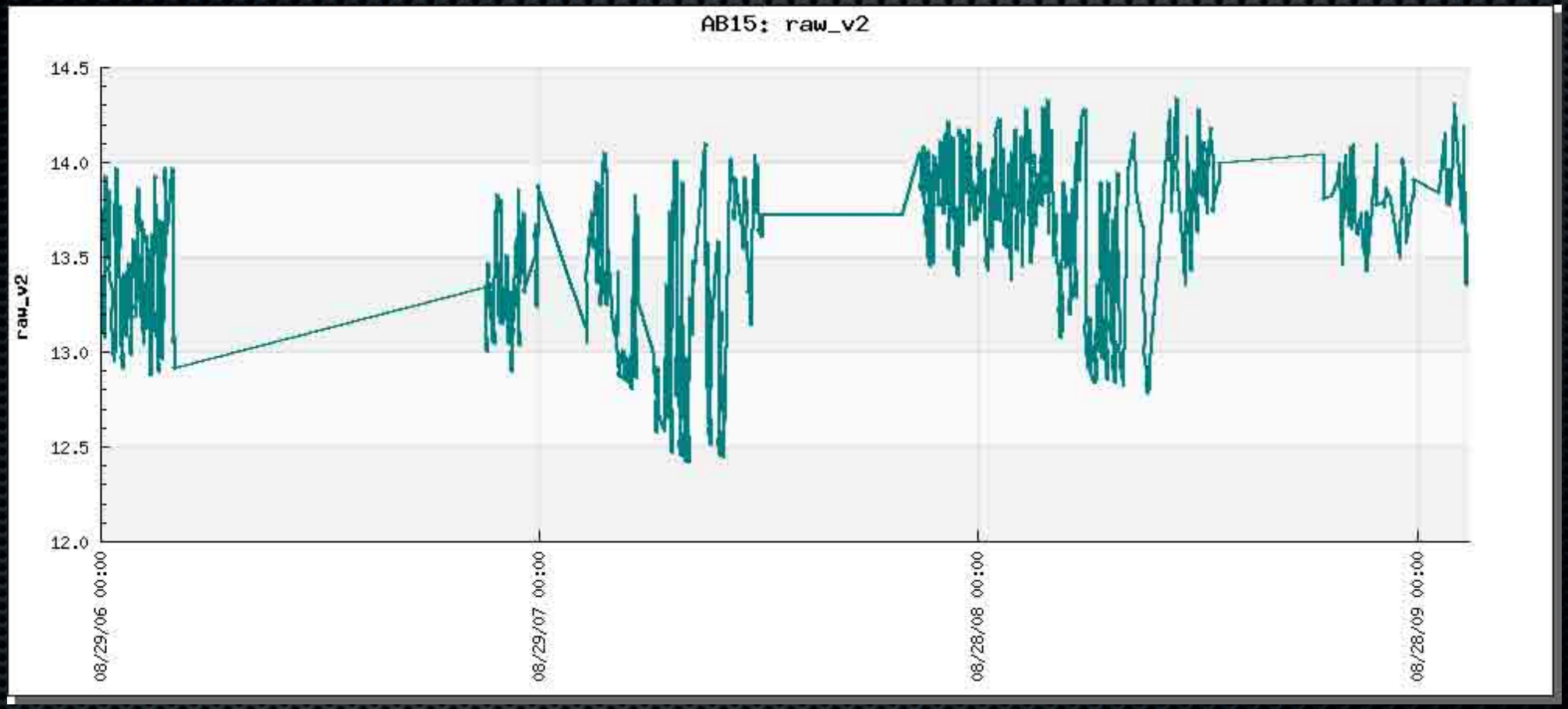
Done

Check the QC

UNAVCO: Plate Boundary Observator...

Year	DOY	Date	Filename	Pos Obs	Comp Obs	Percentage	MP1	MP2	QC Report
DATA GAP: 164 days									
2009	282	10-09-09	AB1520091009000a.T00	52066	49923	95.88	0.31	0.28	FULL QC REPORT
2009	281	10-08-09	AB1520091008000a.T00	52068	49845	95.73	0.31	0.27	FULL QC REPORT
2009	280	10-07-09	AB1520091007000a.T00	52055	49954	95.96	0.31	0.29	FULL QC REPORT
2009	279	10-06-09	AB1520091006000a.T00	52054	49939	95.94	0.31	0.28	FULL QC REPORT
2009	278	10-05-09	AB1520091005000a.T00	52054	49943	95.94	0.31	0.29	FULL QC REPORT
2009	277	10-04-09	AB1520091004000a.T00	52054	49950	95.96	0.31	0.28	FULL QC REPORT
2009	276	10-03-09	AB1520091003000a.T00	52055	49969	95.99	0.31	0.27	FULL QC REPORT
2009	275	10-02-09	AB1520091002000a.T00	52058	49971	95.99	0.31	0.29	FULL QC REPORT
2009	274	10-01-09	AB1520091001000a.T00	52055	49985	96.02	0.31	0.28	FULL QC REPORT
2009	273	09-30-09	AB1520090930000a.T00	52036	49998	96.08	0.31	0.29	FULL QC REPORT
2009	272	09-29-09	AB1520090929000a.T00	52041	48967	94.09	0.31	0.29	FULL QC REPORT
2009	271	09-28-09	AB1520090928000a.T00	52036	49964	96.02	0.3	0.28	FULL QC REPORT
2009	270	09-27-09	AB1520090927000a.T00	52041	49980	96.04	0.3	0.29	FULL QC REPORT
2009	269	09-26-09	AB1520090926000a.T00	52051	50020	96.1	0.3	0.27	FULL QC REPORT
2009	268	09-25-09	AB1520090925000a.T00	52056	49646	95.37	0.3	0.28	FULL QC REPORT
2009	267	09-24-09	AB1520090924000a.T00	52055	50017	96.08	0.3	0.29	FULL QC REPORT
2009	266	09-23-09	AB1520090923000a.T00	52057	49917	95.89	0.3	0.29	FULL QC REPORT
2009	265	09-22-09	AB1520090922000a.T00	52055	50023	96.1	0.3	0.27	FULL QC REPORT
2009	264	09-21-09	AB1520090921000a.T00	52051	50023	96.1	0.31	0.3	FULL QC REPORT
2009	263	09-20-09	AB1520090920000a.T00	52042	50008	96.09	0.31	0.28	FULL QC REPORT
2009	262	09-19-09	AB1520090919000a.T00	52054	50007	96.07	0.31	0.28	FULL QC REPORT
2009	261	09-18-09	AB1520090918000a.T00	52075	50044	96.1	0.31	0.28	FULL QC REPORT
2009	260	09-17-09	AB1520090917000a.T00	52074	50053	96.12	0.31	0.28	FULL QC REPORT
2009	259	09-16-09	AB1520090916000a.T00	52075	50057	96.12	0.31	0.29	FULL QC REPORT
2009	258	09-15-09	AB1520090915000a.T00	52075	50056	96.12	0.31	0.29	FULL QC REPORT
2009	257	09-14-09	AB1520090914000a.T00	52099	50044	96.06	0.31	0.28	FULL QC REPORT
2009	256	09-13-09	AB1520090913000a.T00	52100	50073	96.11	0.31	0.31	FULL QC REPORT
2009	255	09-12-09	AB1520090912000a.T00	52092	50066	96.11	0.31	0.27	FULL QC REPORT
2009	254	09-11-09	AB1520090911000a.T00	52093	49693	95.39	0.31	0.28	FULL QC REPORT
2009	253	09-10-09	AB1520090910000a.T00	52085	50047	96.09	0.31	0.27	FULL QC REPORT
2009	252	09-09-09	AB1520090909000a.T00	52082	50057	96.11	0.31	0.28	FULL QC REPORT
2009	251	09-08-09	AB1520090908000a.T00	52074	50061	96.13	0.31	0.27	FULL QC REPORT
2009	250	09-07-09	AB1520090907000a.T00	52044	50037	96.14	0.31	0.28	FULL QC REPORT

Check the Voltages



Time for a site visit!

Where You Want To Go

Where You Really Go

Station Failure Modes

1. Telemetry
   - DC VSAT
   - AC VSAT
   - WISP
   - T1/DSL/Cable
   - Cell Modems
   - Radios

2. Power
   - Swingsets
   - Solar Panels
   - Faulty Breaker

3. GPS Antenna
   - L2 failures
   - Cabling

4. GPS Receiver
   - Bad CF cards
   - Cabling/Dongle

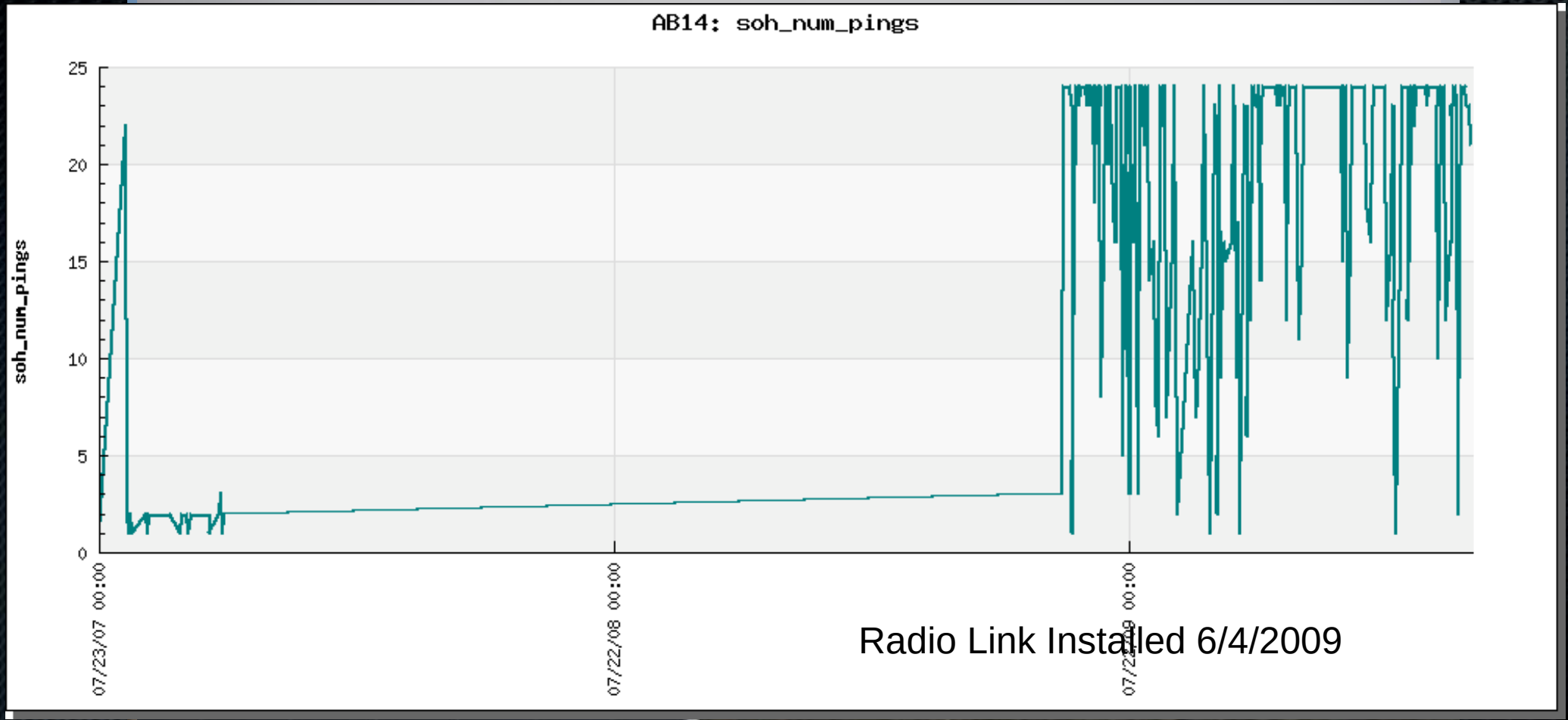
5. Animal Damage

Telemetry Improvements

- Manual download → → Cell modem
- Manual download → → VSAT
- Manual download → → Radio link
- WISP → → VSAT
- WISP → → Radio link
- DC VSAT → → Radio link
- VSAT → → Cell modem
- Radio link → → Cell modem

DC VSAT Upgrade

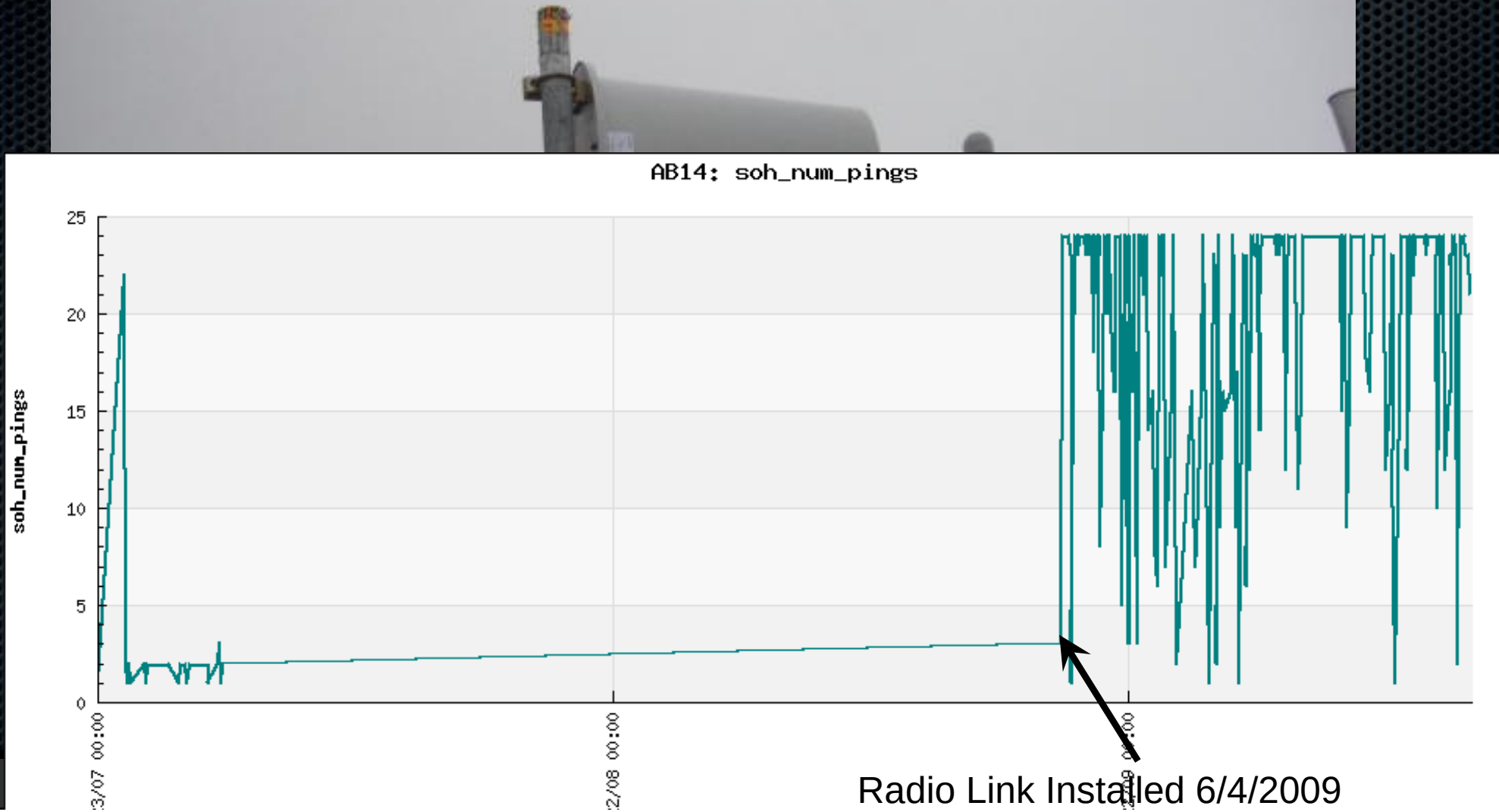
- **Solution – EB-1 Radio link to DSL Internet connection in Dillingham**
- **Station has been online continuously since upgrade**



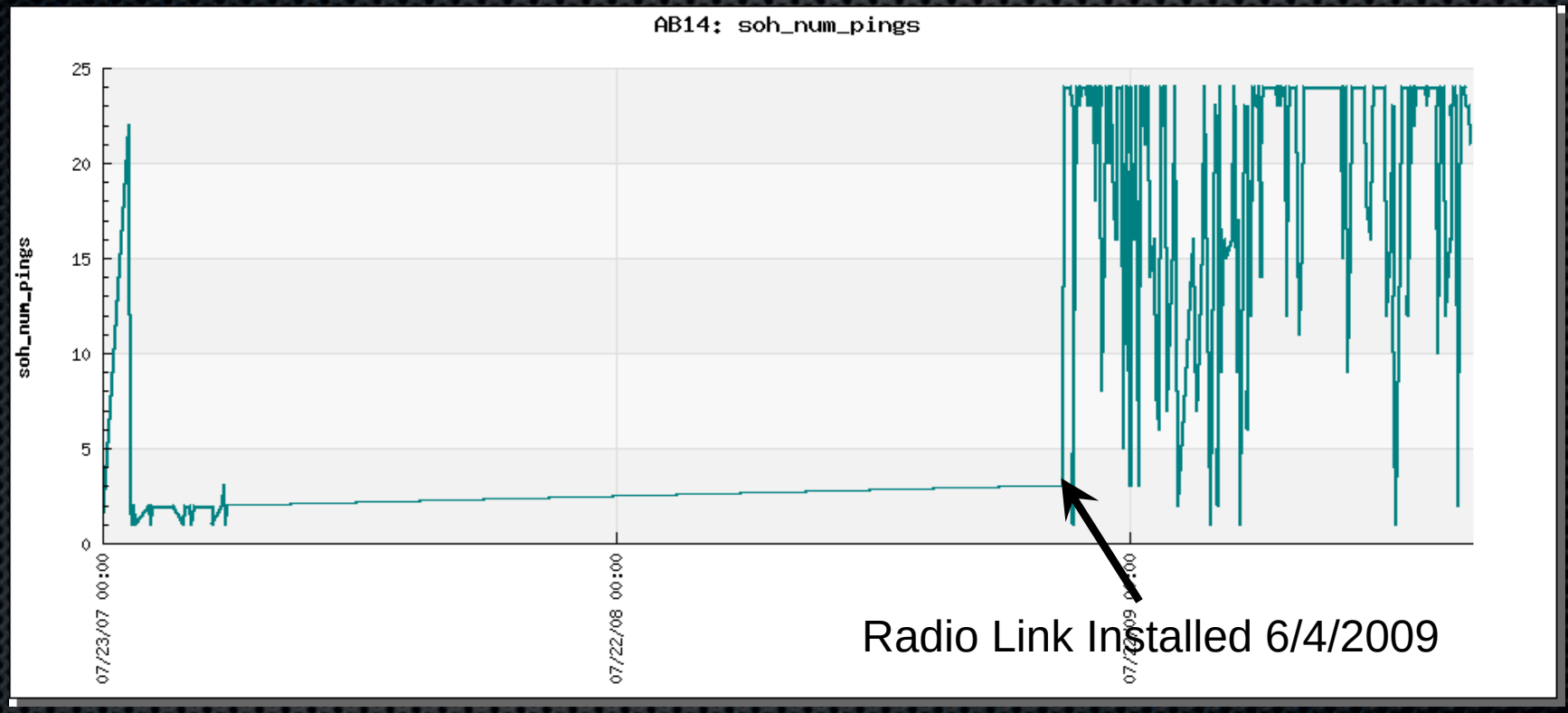
Radio Link Installed 6/4/2009

AB14 Dillingham

- **Solution – EB-1 Radio link to DSL Internet connection in Dillingham**
- **Station has been online continuously since upgrade**

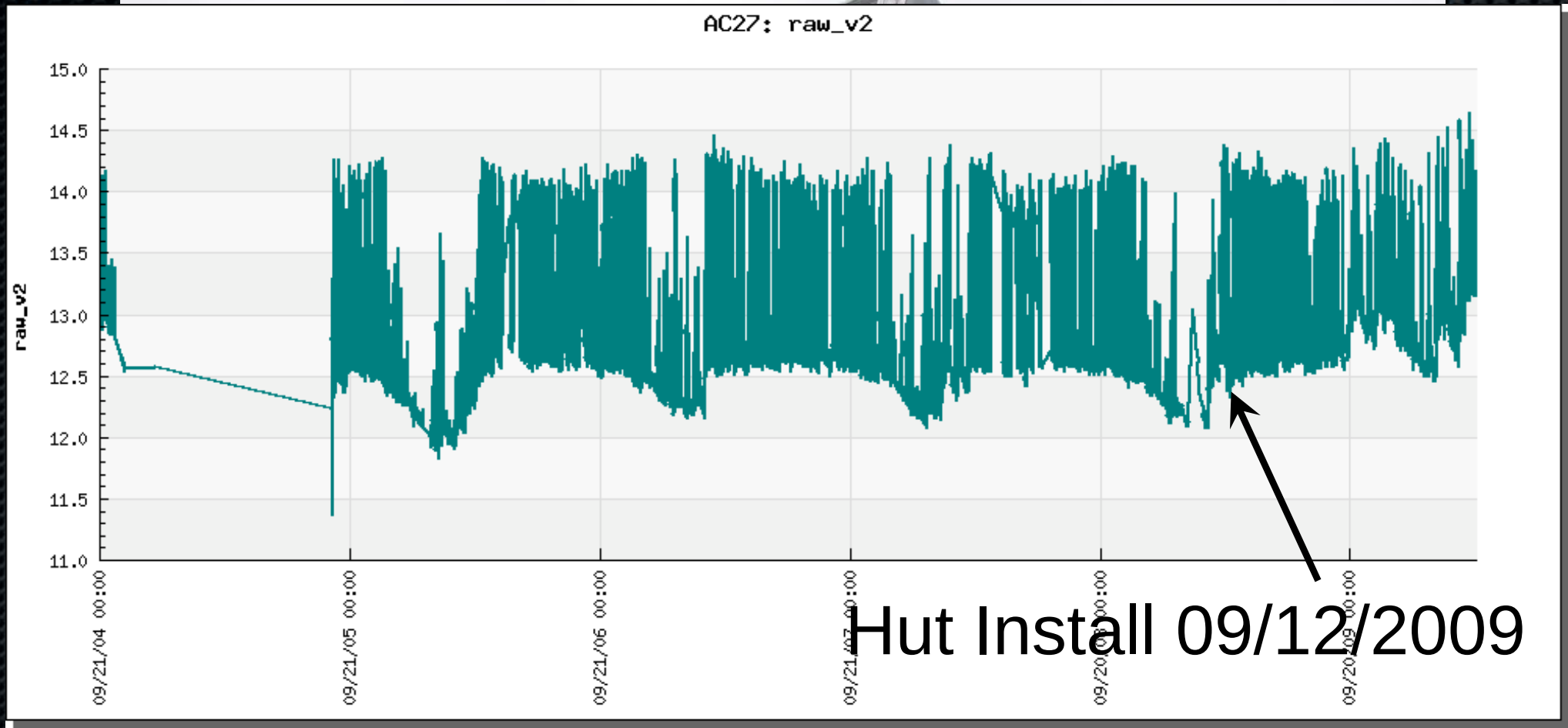


AB14 Dillingham - After



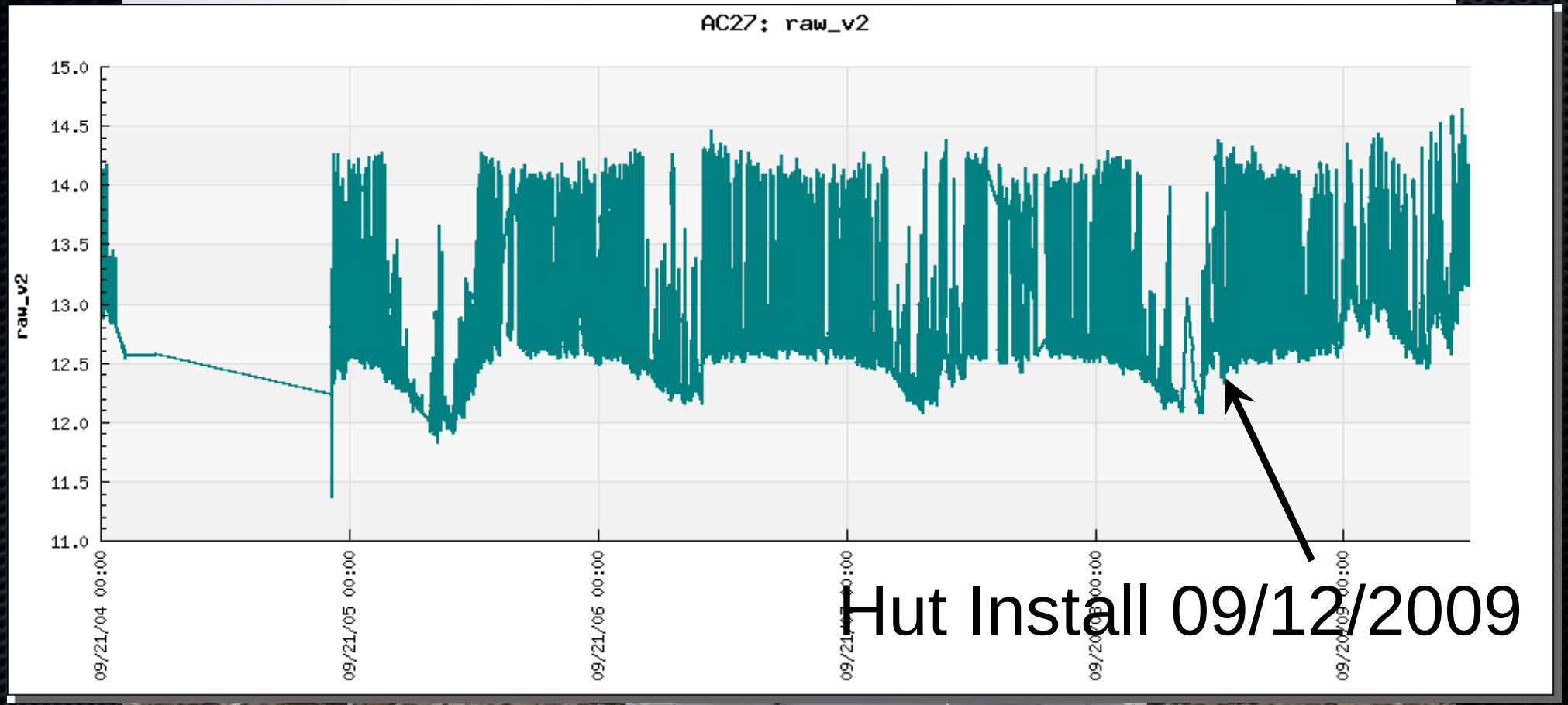
Station Power Upgrades

AC27 McNeil River

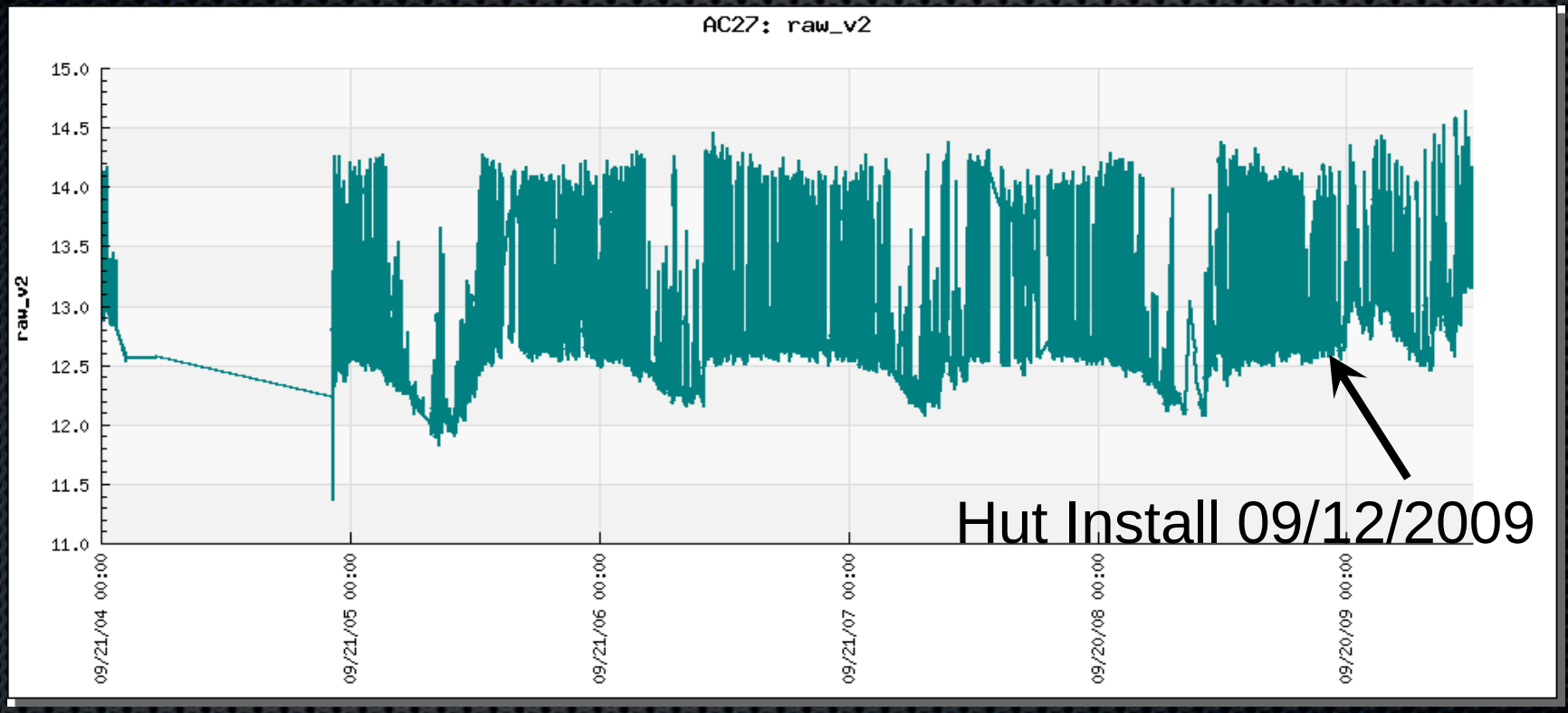


AC27 McNeil River

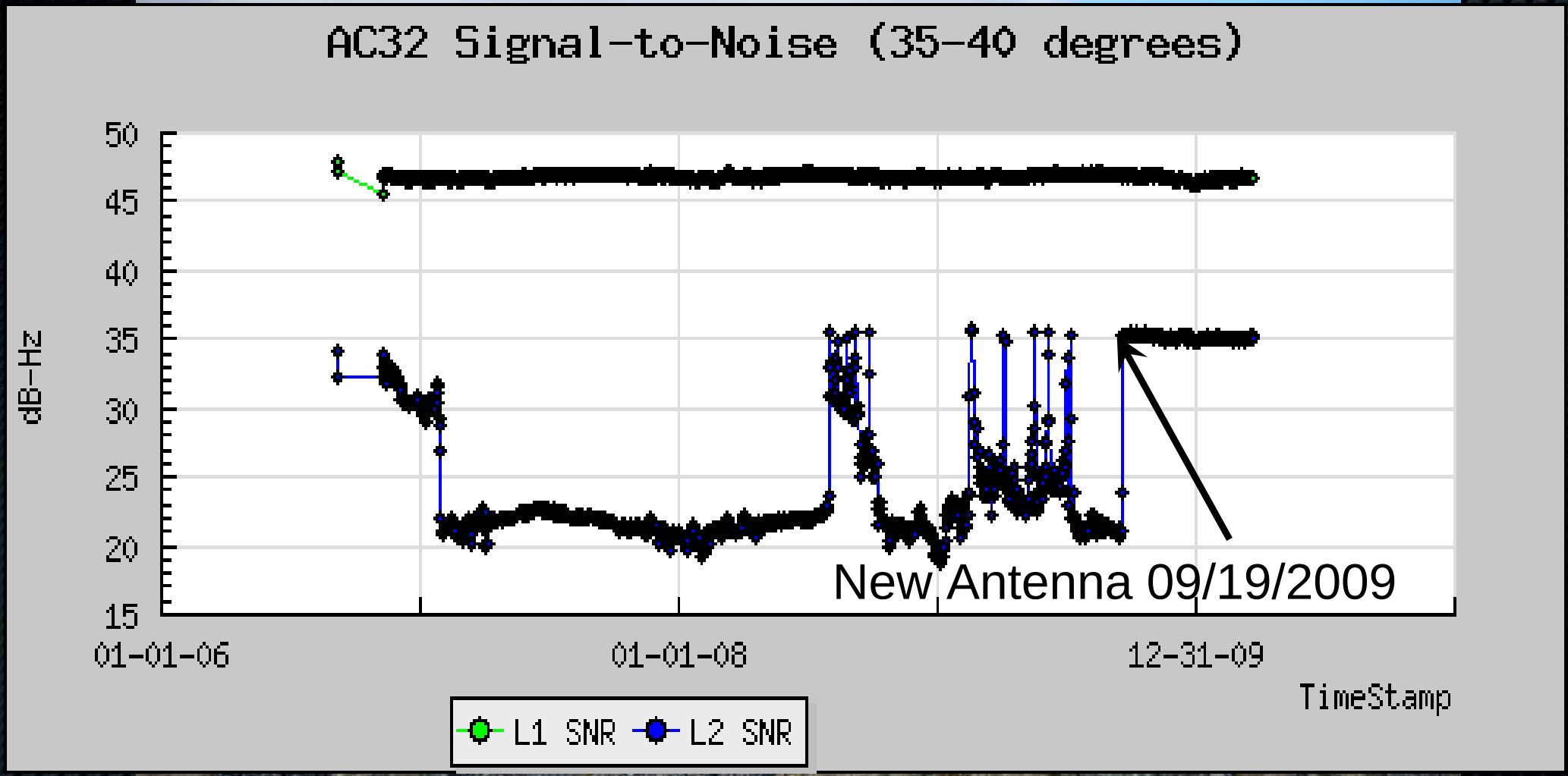
AC27 McNeil River



AC27 McNeil River



GPS Antenna L2 Tracking Failure



UNAVCO

Plate Boundary Observatory

Supporting EarthScope Geodetic, Seismic, and Tectonic Research

Go

PBO Network State of Health (SOH) Display

No Announcements found at this time. » Archived Alerts

Total Stations:	142	
Removed Stations:	5	
Fully Operational:	130	(94.89%)
Non-Operational:	6	(4.38%)
Warning Status:	1	(0.73%)
Manual Download:	13	(9.49%)
Unknown:	0	(0%)
Last Updated:	2009-09-22 13:45:05 mdt	

Status Colors	
	all parameters are in the nominal range
	at least one parameter is in the warning range
	at least one parameter is in the critical range
	at least one parameter is unknown or unavailable
	a manual download station
	a removed station

What's Next for 2010?

- 12 Webcams – Stardot NetCamSC
- Power Upgrades – 32 batteries/3 panel standard
- 5-Year Battery Replacements – 32 batteries @ 9 sites
- Augustine Volcano Comms Upgrades – Real time data
- Station Rebuilds – Montague Island, Yentna
- Questions?