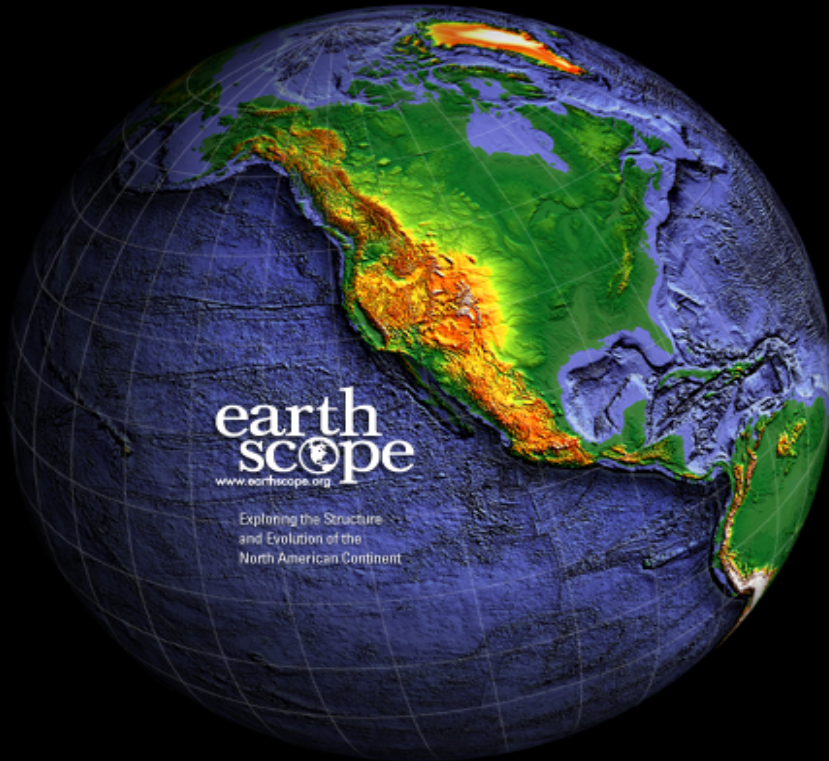
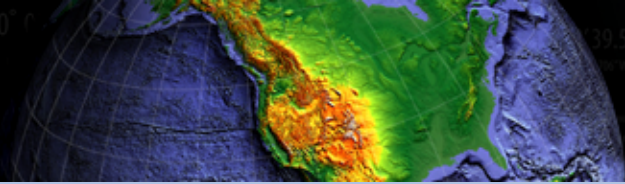


Transportable Array Experience in Outsourcing

Bob Busby
TA Manager



April 2016



Outsourcing

Motivation for outsourcing station equipment: “production engineering”

Reliability

Scale of production / Repeat orders

Cost

Technical requirement cannot be met with available parts

Frees engineering talent to concentrate on what they do best.

Obstacles to outsourcing station equipment

Documentation of requirements, drawings, materials, schedule

Distinguishing real from imaginary suppliers

Immediate need

Procurement Process

Tank Vault:

ADS 42" pipe → Freeman HDPE Cistern

Vault Electronics:

DIN rail mounted panel → Vault Interface Enclosure (VIE)

Sensor Cables:

Multiconductor, multishield, high density connectors and multiheaded cable ends.

AK Hut Process

Large object, multistep process, 5-8 per week

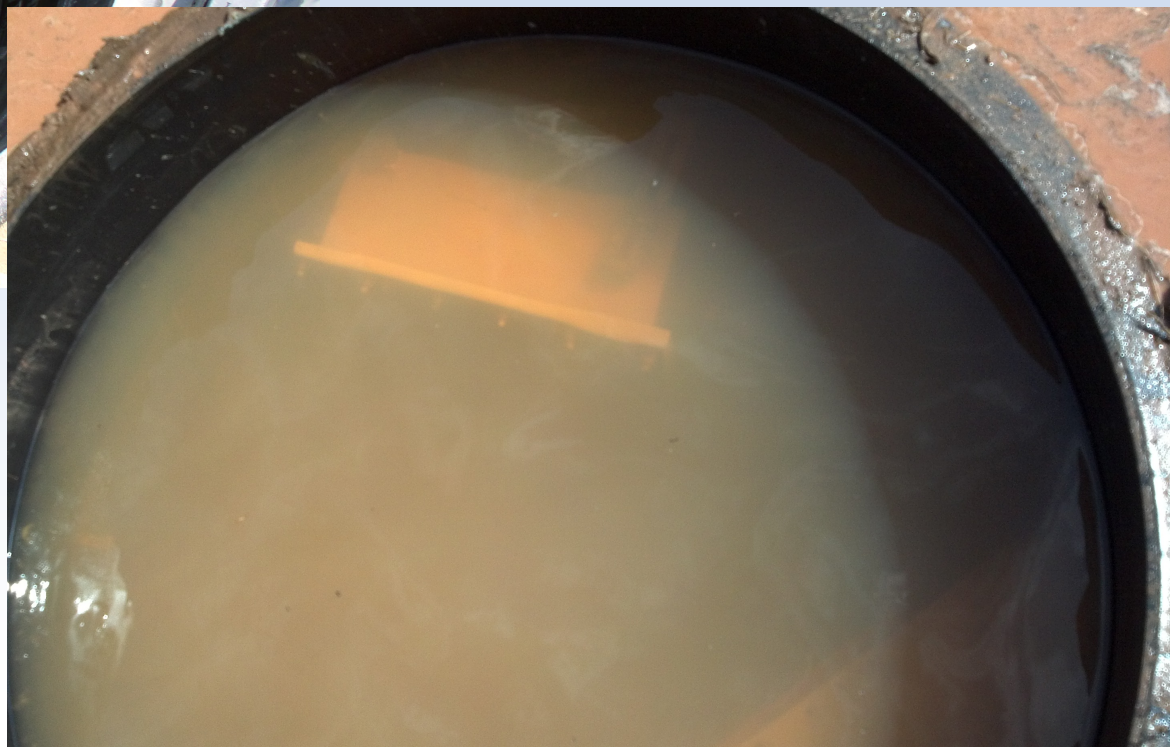


ADS 42" sewer pipe

Bad Deal



E04A Washington, 2006



E40A Minnesota, 2012
Lost GPS lock, otherwise ok

Station Design- Tank Vaults

<http://www.passcal.nmt.edu/taweb>



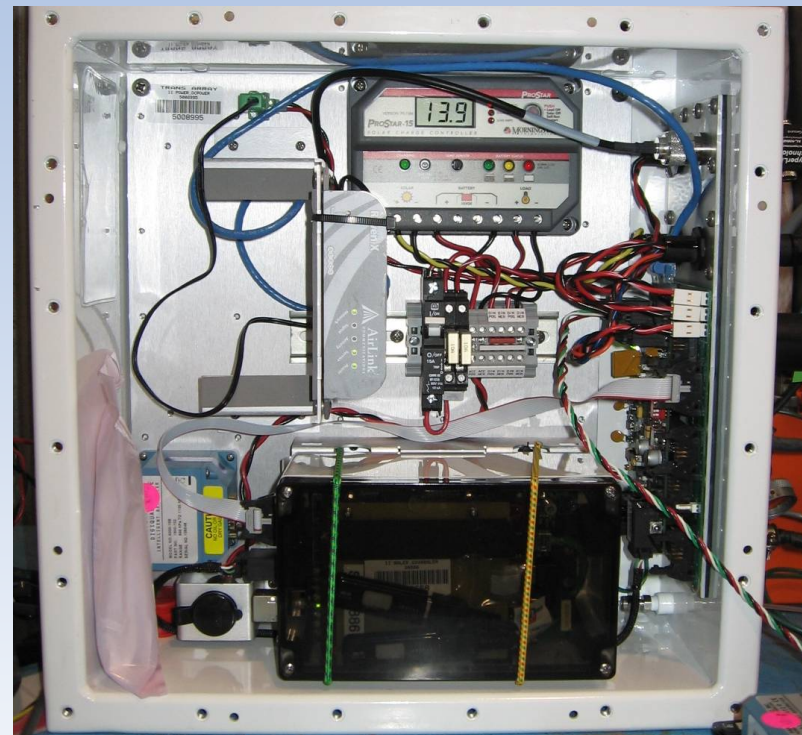
- \$1200
- 105 kg
- Installations begun in past month



RFP selected Freeman Engineered Products
for a custom rotomolded tank

Vault Interface Enclosure (VIE)

- 16x16x8" Enclosure, hangs inside vault.
 - IP68, 0.5" Lexan Clear lid, bulletproof!
- Q330 interfaces converted to industrial standard connections;
 - IDC flat ribbon, RJ45.
- Custom power regulation circuit
 - Faultfree switchover to alkaline backup battery
 - Signalling via existing data channels for power SOH
 - Sensor power regulation, filtered power for Q330 and Baler
 - High efficiency regulation, load shedding/mode switch on backup power
 - Independent fault isolation of powered devices.
- Station Integration
 - Integration of new Baler44CT, Environmental sensor
 - Simplified Data collection via new Baler44
 - Reset power cycle for comms equipment
 - Remotely controlled power interrupt for sensor
 - Monitor and signalling of pump operation
- Protected housing for electronics and auxiliary equipment-allowing better flexibility and increased reliability.
 - Allows economical packaging choices for small ancillary devices
 - Protects commercial modems, charge controllers and circuit boards.
 - Simplifies troubleshooting, acts as a field replaceable unit.
- Uniform cabling for installation
 - MS style connectors, molded termination
- Commercial production in large runs; Enclosure, cables, PCB, testing, etc
 - Custom cable fabrication, custom metal, factory assembly and testing.



VIE, Baler 44CT and Complete Data Set Status

The **VIE (Vault Interface Enclosure)** has been installed in all new TA stations built since the beginning of October 2009.

The implementation of the VIE has allowed for the station integration of the new **Baler44CT**, functionally equivalent to the Q330S used in ANSS.

This baler holds up to 2 x 16 Gb of field removable USB drive storage. The flat file structure allows simple access to data either locally or via remote ftp and http.

This feature allows for the daily download all Baler data. The final “Q” data archived at DMC is the Baler data plus any additional real-time data not present on Baler. We anticipate that by February of 2010 final Q data will be routinely available within a month of real-time. Older station equipment required the close of station and removal of physical Baler hardware to replay data. **Research (working) datasets are thereby more complete, and do not need to be amended.**



Connector Technology Inc.

Injection molded backshell for MS style connectors, colored by sensor type.

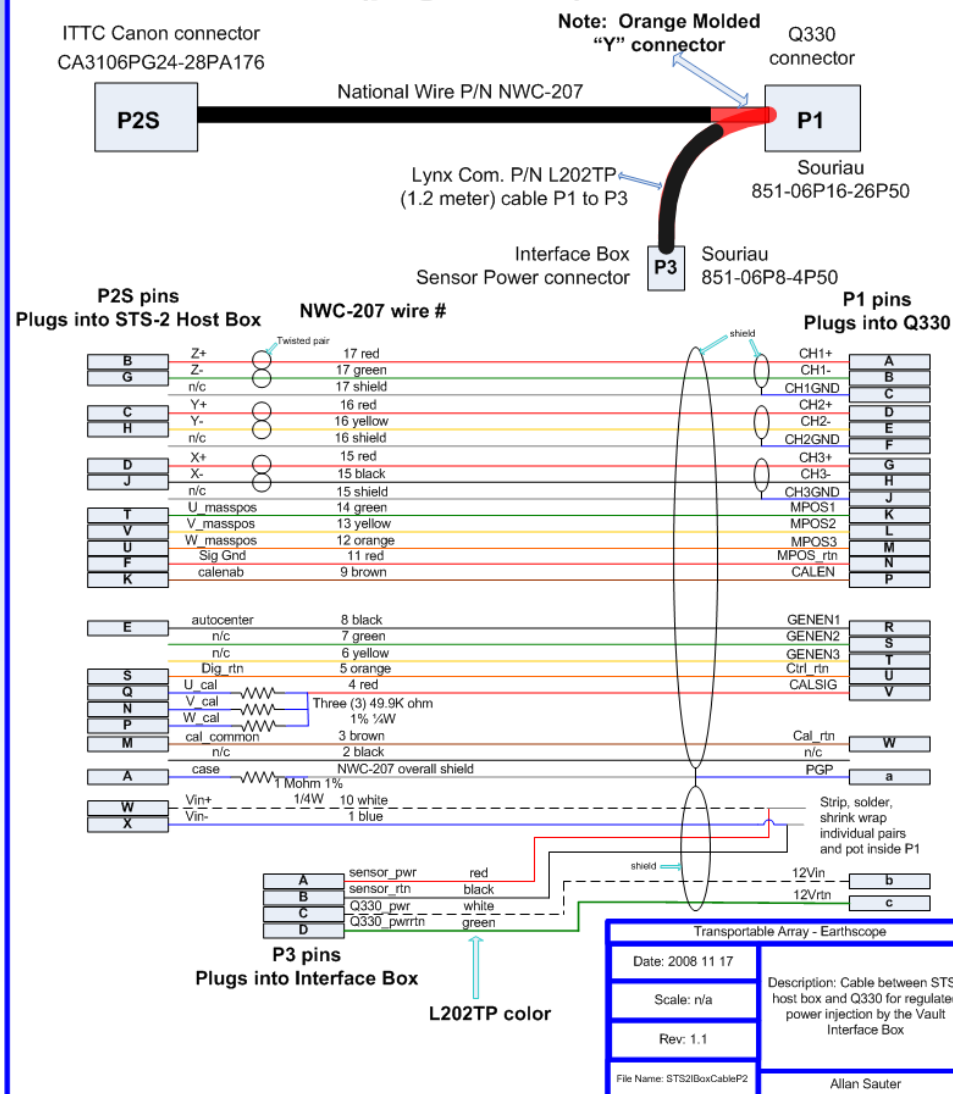
OEM producer for Nanometrics & Kinometrics

1000' Cable spools shipped direct from National Wire and Cable, stored for on call cable assembly.

Reorders by cable id are simple.

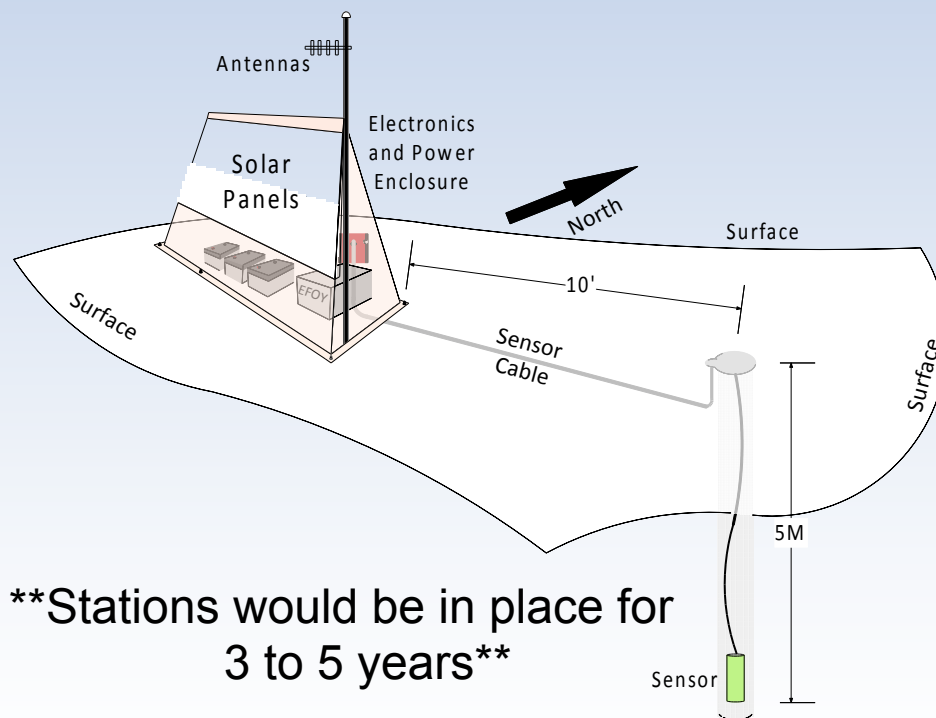
Extraordinarily reliable production.

TA STS2 Host Box to Q330 Cable for Use With Interface Box (page 2 of 2)



Basic Description of Buried Sensor Design for AK

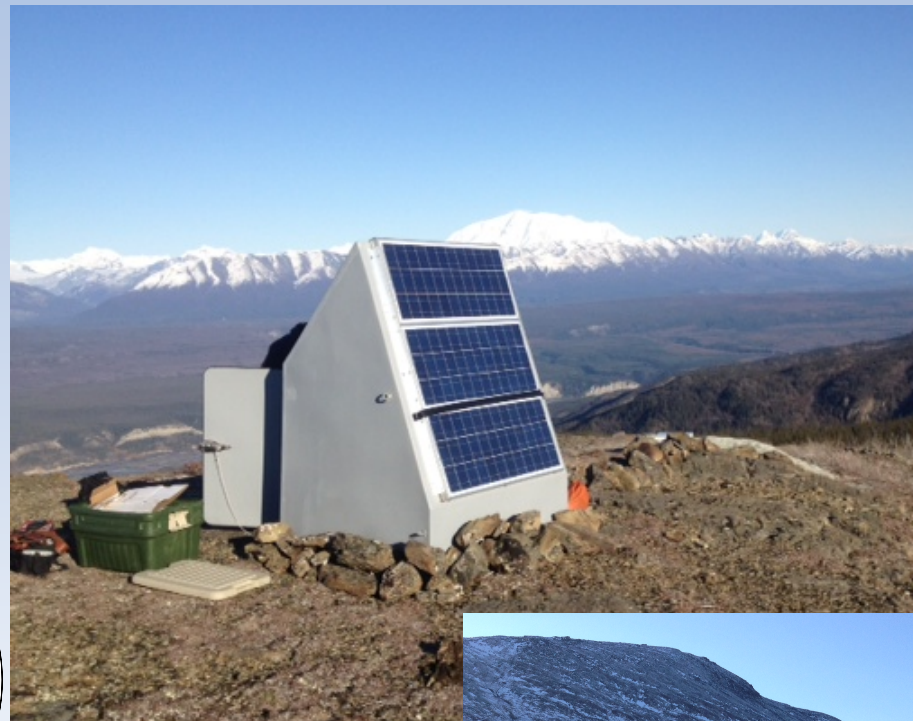
- Sensor: 3 component Broadband seismometer & auxiliary sensors
- Datalogger & local data storage
- Power & data telemetry



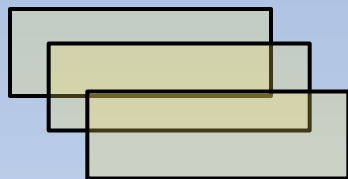
****Stations would be in place for 3 to 5 years****

Footprint ~10 feet X 20 feet

N25K Seismic Station



Hut Production



1) PV panels tested for output using Light box, wired in Socorro, shipped to AK

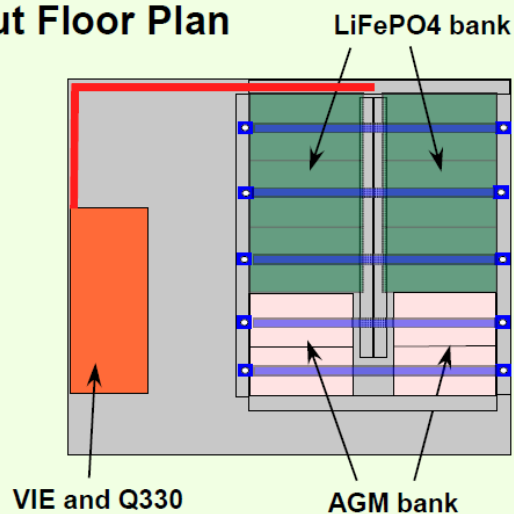
2) Hut fabricated in Palmer AK by CAC Plastics



3) Hut panel fabricated by Triverus in Palmer AK, Delivered to Anchorage, cable vendor, Polar Wire



Hut Floor Plan



5) Triverus mounts PV Panels, wired hut panel, and floor rails. Delivers hut to AOC

4) 8AWG Battery cables fabricated, Connected to terminal blocks, DIN rail added, delivered to Triverus

6) At AOC, Outfit VIE with comms terminal, mount VIE to Hut Panel, add Q330

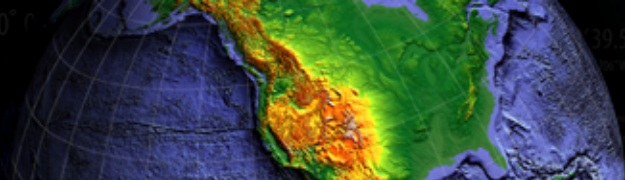


7) Load Hut with Batteries, Bag, Sensor (in case), flexible conduit, station kit, inventory checklist, Station Labels, crossbar mount

8) At staging, unpack, install Batteries in Bag

9) Onsite, mount crossbar, antenna, powerup.





Key Steps in the Process

Design:

Technical Requirements, cost target, manufacturability

Specification / Quotations / Procurement:

First Article(s):

Testing the delivered item

Usually time pressure to accept quickly and move into production

Production Checks

Validate against spec

Subtle changes can introduce issues

Production interruption

Starting and stopping inherently risks source supply

Engineering Changes

version control, definitive approval, cache changes

Stop production or change next produced

revert current inventory, recall produced items

With Volume Production: Avoid mass producing mistakes