Transportable Array demonstrates its new drilling rig and sensor emplacement routine for PASSCAL.

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With the expansion of TA Alaska into even more remote regions of Alaska and Canada it was necessary to develop and construct an extremely lightweight, high performance helicopter portable air rotary drill weighing less than 1700 lbs and capable of installing a 6" steel casing 2.7m deep in any type of ground including solid rock, frost shattered overburden, cobbles and frozen soils. Based on these parameters, a custom drill rig system was commissioned and tested by IRIS for specific use on the project. At PASSCAL we had the opportunity to be among the first testing locations for the newly constructed third generation Purple Drill. Ryan Bierma, and Max Enders along with Bob Busby from IRIS and Mike Lundgren from Lundgren Systems (rig developer) operated the rig, and then Ryan and Max demonstrated a mock installation of an STS-5A seismic sensor at the test site behind PASSCAL in Socorro, NM.

The borehole was drilled to a depth of 2.5 m while emplacing a schedule 10 steel casing at the same time. An aluminum plug was installed at the bottom of the casing, and grout was pumped into the bottom of the shallow borehole through the plug. About 2 liters of sand were poured into the hole and tamped down to create a level surface. The sensor was then lowered to the sand layer and oriented using an OCTANS system.

The team prepares to drill.
Mike Lundgren of Lundgren Systems gets the drill ready for work, as IRIS/PASSCAL's Pnina Miller looks on.

The drilling in progress.
Adding some shaft to the drill bit.

Removing the drill from the cased hole.

Max Enders of TA (standing, hardhat) watches as colleague Ryan Bierma (hardhat, kneeling) prepares the grout plug. Tim Parker (Nanometrics), Jason Hebert (PASSCAL), and Katrin Hafner (IRIS) look on.
Ryan Bierma (hardhat) checking the installation so far. Background observers L-R: Sandi Azevedo (TA), Paul Carpenter (PASCAL), Jason Hebert (PASCAL), Katrin Hafner (IRIS), and Carl Ebeling (UCSD, Project IDA)
Max Enders (left) listens to Ryan Bierma discussing sensor hookups. At right: Kevin Nikolaus (PASSCAL), Carl Ebeling (UCSD).

Sensor Emplacement

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TOOLs Required:
- Alignment tools, foot, mallet with hook
- Orienting Device: Octagon or APS with Notebook, camera, pen, pencil, sharpener
- Level, 25' measuring tape
- Bearing tool (tied off at the surface)
- O-ring O-ring guide
- Fish tape, pull wire
- Magnet and string, on the efficiency;
- A roll of duct tape for Plan B
- Phillips head screwdriver

Materials Required:
- Sensor Cabo
- 6 Lines of dry sand
- Lifting Line
- 1 pvc pipe 1" stacks
- Utility cord
- PVC cement or Silicone RTV (to run)

Annotations and Preparation
- Well casing cap, but don't drill
- Check hole for foreign objects
- Measure depth, top of casing
- Measure depth, top of casing
- Write down SN and BC, work
- Take a picture of SN and BC
- Leave the sensor in the box and install the sensor.

Procedure
1. Confirm orienting/lifting bracket attached

Sensor Emplacement
Kent Anderson of IRIS (left) assists Max Enders with some down-hole connections.

Max Enders and Ryan Bierma lowering the sensor to the sand layer. Carl Ebeling (UCSD) is at left; Justin Sweet (IRIS) is on the right, helping to guide the cables. Not visible at left, but shown in the video: Kevin Nikolaus (PASSCAL, center; Ramon Molina (PASSCAL, far right).
Max Enders demonstrates how to orient the buried sensor using the OCTANS IXSEA system. Background observers L-R: Jason Hebert (PASSCAL), Dean Childs (PASSCAL), Carl Ebeling (UCSD).