

# Permanent station GPS/GNSS antenna monuments and mounts supported by UNAVCO

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### Summary

We compare eight long-term monuments and mounts currently in use in UNAVCO-supported projects. The designs range in height from 0 to 3 meters; substrates into which they are installed include soil, bedrock, and concrete; and costs range from approximately \$30 to \$15000. The more expensive options may be considered more stable, but in many places outside the US, logistical, economical, and material constraints make installation of deep- and shallow-drilled braced monuments at best difficult and at worst impossible. Simpler single-mast or concrete monuments offer less expensive, more portable installation options with acceptable stability.

#### When choosing a monument and mount, consider:

- Stability needed (precision needed)
- Funds available
- Time available for installation Site security
- Materials available (esp. international work)
- Site accessibility Site substrate

#### Requesting support from UNAVCO

UNAVCO is a non-profit, membership-governed consortium that supports and promotes Earth science by advancing high-precision techniques for the measurement and understanding of deformation.

UNAVCO can provide assistance with design, purchasing, and construction of geodetic monumentation to NSF- and NASA-funded scientists.

To request support from UNAVCO, fill out a support request form at: http://www.unavco.org. For questions, contact support@unavco.org. For more information on monuments and mounts, check out http://facility.unavco.org/kb.







Concrete pillar







mast





Custom

measure methane

bog.

release in a Minnesota

**Antenna Mounts** 

SCIGN mount

Expensive but precise. Only needed if using a SCIGN dome.

#### Monument

#### 4-5 stainless steel legs Description

in a tripod configuration cemented into the substrate up to depths of about 40 feet; welded together at the top.

Deep drilled

braced

4-5 1" diameter stainless steel legs in a tripod configuration epoxied or pounded into the substrate up to depths of about 5-6 feet; welded

together at the top.

Shallow braced

Of variable design, but typically consisting of reinforced concrete set within a tubular concrete form. The leveling mount and GPS antenna are secured to a stainless steel pin which is anchored within the top of the pillar.

#### A single 4"-diameter, 20'-long pillar containing pressurized, two-phase carbon dioxide to prevent thawing at the monument's base. Set ~16' deep into the ground; coupled to the permafrost with a slurry

of sand and water.

Thermopile

Lightweight aluminum mast bolted onto bedrock. Can be produced at heights of 0.5m, 1m, and 2m (1m shown here).

Polar mast

#### 1.25" diameter threaded stainless steel mast cemented into bedrock. Throughout the Rio Grande network, masts used are ~5' long set into holes 16-24" deep.

#### Stainless steel Shallow foundation pin w/ mast Threaded pin cemented

or epoxied into the ground with a removable mast screwed onto it. Throughout the Afar network, masts used are 1" diameter, 0.5m-long stainless steel screwed onto a 10"-long threaded stainless steel pin cemented into bedrock.

#### all-thread cut to custom height, cemented or epoxied into bedrock or cement.

5/8" all-thread

5/8" stainless steel UNAVCO works with scientists to design custom monumentation when needed. Solutions are often simple and cost-effective, like the mount used here to fix a GPS antenna to a sawed-off tree to

### Substrate

#### Bedrock, unconsolidated

#### Bedrock (drilled), unconsolidated (pounded)

Bedrock, unconsolidated

# Permafrost

### Bedrock, concrete

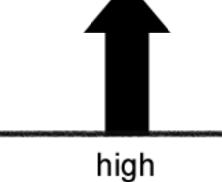
# Bedrock

#### Bedrock, concrete

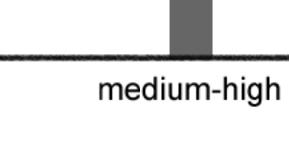
Bedrock, concrete

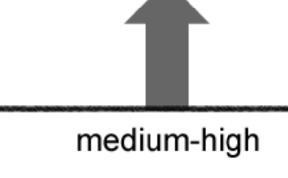
# Stability



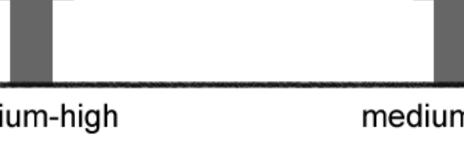


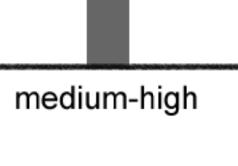


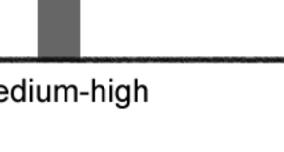


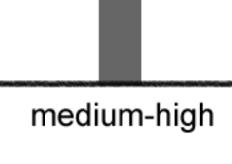


medium-high









1 hour

Install Time

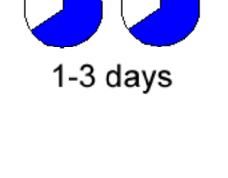








1-3 days



2-3 people





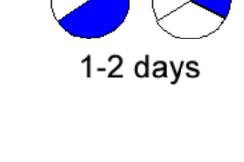






1 person

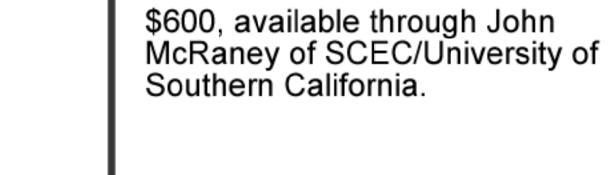














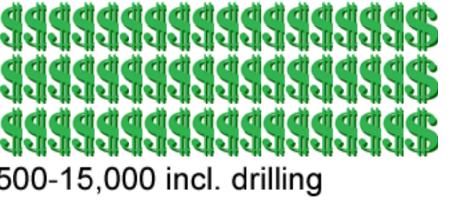
Site Impact

Drilling

Requirements

Labor





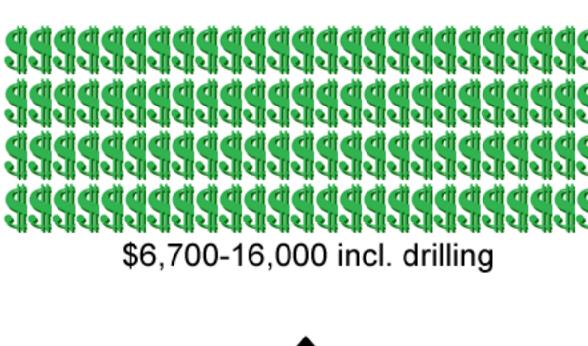


medium





medium



high

1 person + drill crew









\$150

low

1-2 people



\$130

low





low

## SECO 2072-series stainless steel adapter

Less expensive and also precise. Used in the US National Geodetic Survey's CORS network.

\$225, available from www.surveying.com.



#### Cup and brass adapter

Inexpensive but no leveling ability. Allows for antenna to be aligned to north.

\$50, custom machined.















low









Afar, Ethiopia; RETREAT,

Italy; Iceland







Plate Boundary Observatory, BARGEN, PANGA, Costa Rica



Numerous incl. GGN

Plate Boundary Observatory

TAMDEF, POLENET, Mauna Loa

Rio Grande, GGN

