

# The Role of NASA's Global GPS Network in Regional and Global Geodesy and Modernization Plans for Integrating New GNSS Observables



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NASA supports the Global Navigation Satellite System (GNSS) infrastructure through a network of 75 permanent stations called the Global GPS Network (GGN). The GGN is operated cooperatively by JPL and UNAVCO with JPL providing the PI role to provide coordination of NASA-supported GNSS activities.. GGN data are contributed to the International GNSS Service (IGS) global network. GGN stations make up approximately 20 percent of the IGS and are some of its longest running core stations. GGN sites provide 1 to 30 second sampling and a number of stations have available real-time data streams. Data are used to produce highly accurate products that are essential for Earth science research and other multidisciplinary and educational applications. Products include GNSS precise satellite orbits, Earth rotation parameters, global tracking station coordinates and velocities, satellite and tracking station clock information, zenith tropospheric path delay estimates, and global ionospheric maps. These global data and products form the critical framework that regional GNSS networks depend upon. The GGN is currently being upgraded to accommodate additional GNSS observables as they become available including the new GPS L2C and L5 signals, Galileo, and GLONASS. Careful consideration is being made to integrate new equipment and observations without adversely affecting the time series measurements at critical stations. As part of this effort, a special new monument design is being tested at UNAVCO's Colorado test facility. The monument can accommodate multiple antennas that can be used for collocated observations while new site equipment is phased into operation. Also, as an example of combined NSF/NASA funded efforts, recent updates to the UNAVCO developed Translation, Edit, and Quality Control Software (TEQC) supporting GNSS developments are discussed.

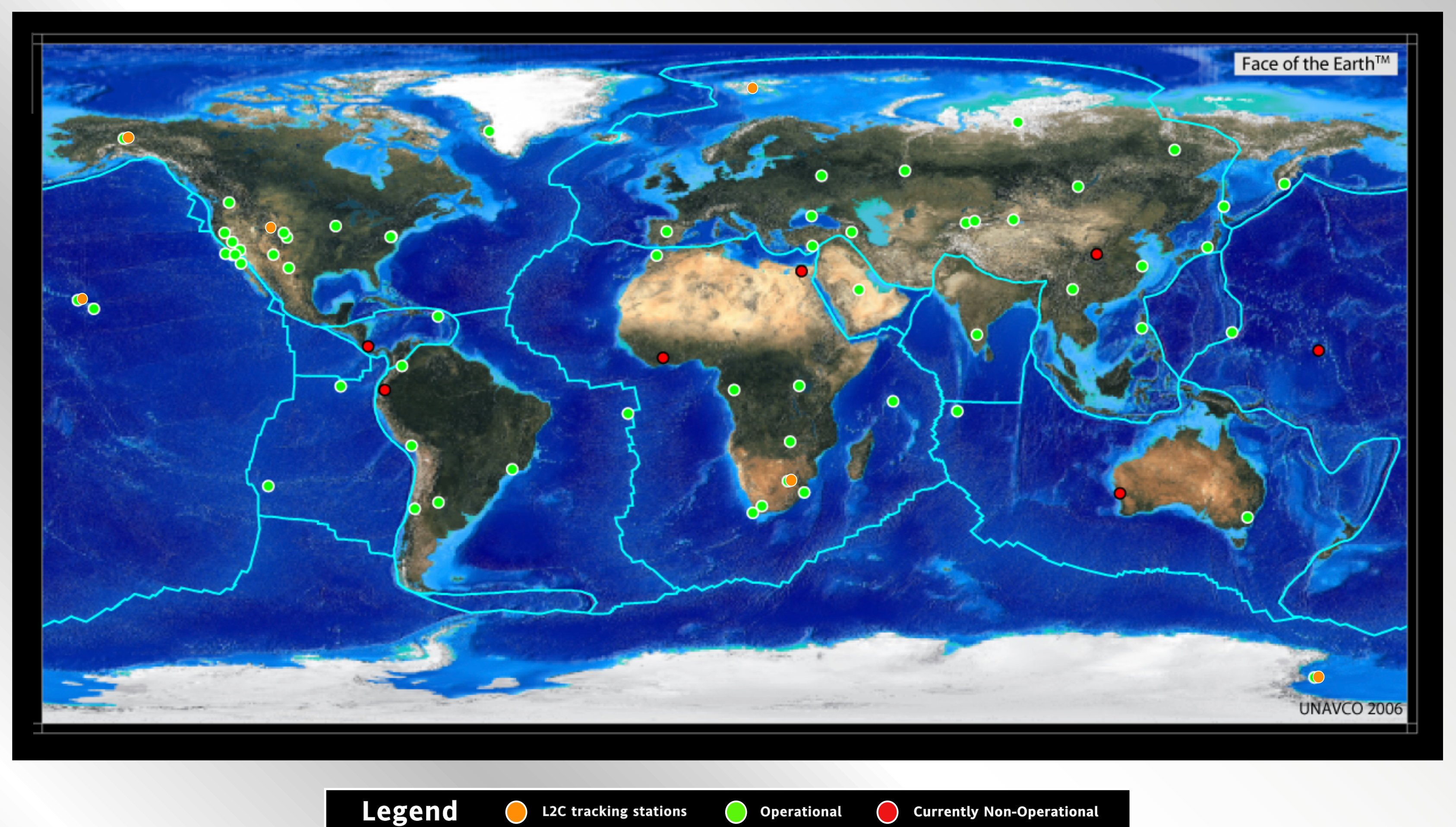
## Global Civilian Tracking of the Block II-RM L2C signal Experiment

UNAVCO is supporting JPL with logistical and equipment configuration support for the "First demonstration of Global Civil Tracking of the Block II-RM L2C Signal (GCTL2C)" experiment funded by NASA. The objectives of this demonstration project are to show the feasibility to track and the benefits for the IGS community from this new civilian signal. Using existing NASA/JPL/UNAVCO capabilities and the existing GGN network distribution, six new L2C capable GPS receivers have been deployed to existing GGN and IGS stations. These six stations are shown in yellow on the map and include co-locations with KOKB, FAIR, HRAO, NYAL, MCMZ, and one system which is not co-located is running at UNAVCO.

## Translate, Edit and Quality Control Software (TEQC)

In 2005, TEQC was updated to read the L2C code pseudorange from Trimble .dat and RT17 formats resulting from L2C tracking capability of their NetRS GPS receiver. The L2C code pseudorange can be output in RINEX 2.11 as the observable "C2". The quality check (qc) mode of teqc was modified to allow C2 to be used in place of a P2 code pseudorange if P2 is not present, which is the case with Trimble data as only one code pseudorange per carrier frequency is reported. A complete RINEX 2.11 extension for TEQC to report L5 observables and Galileo observables is in planning, pending acceptance of RINEX 2.11 by the IGS.

## Global GPS Network Station Map



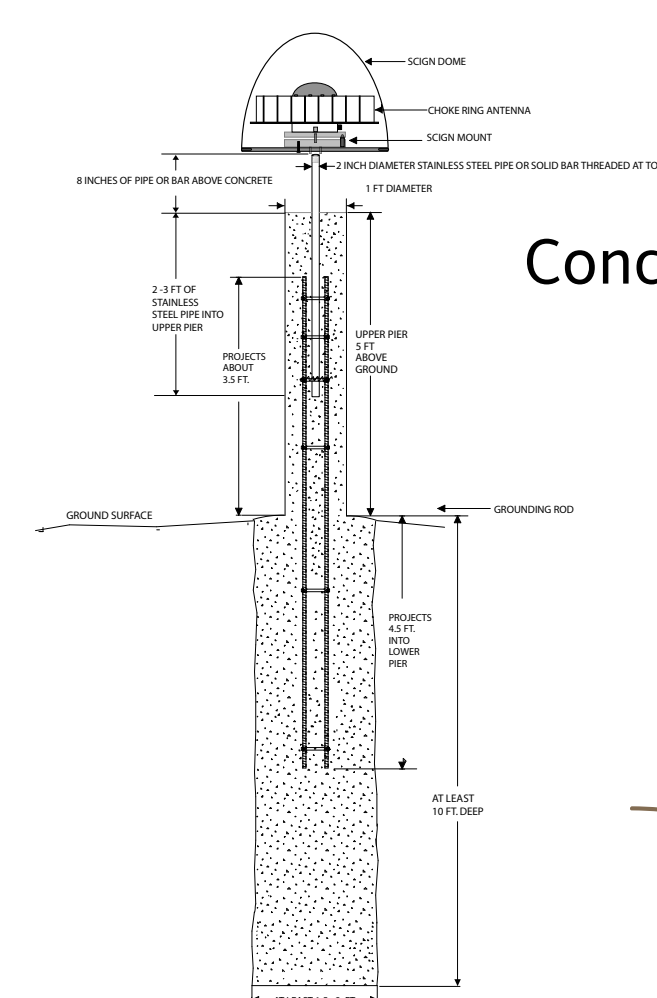
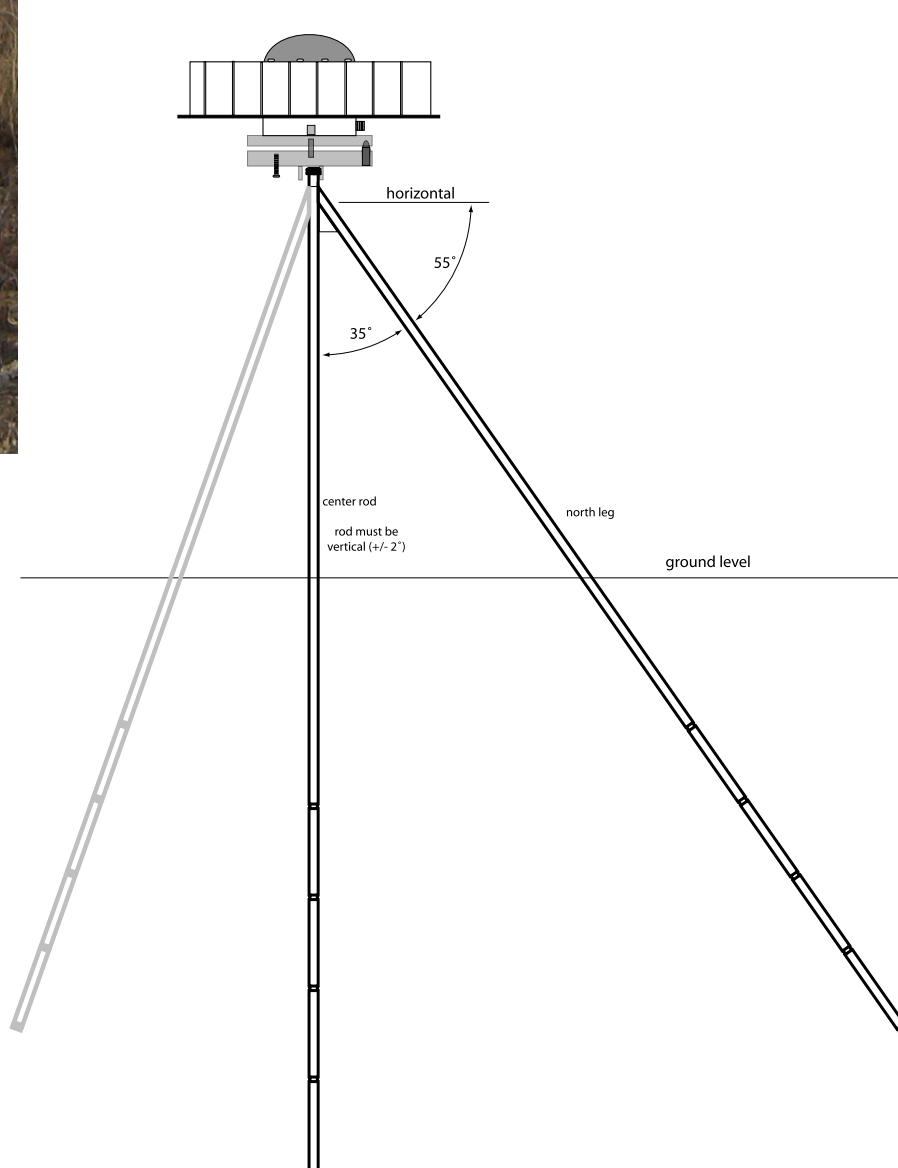
## GGN Antenna and Monumentation Calibration Experiment

UNAVCO is constructing an antenna and monumentation calibration facility at Marshall Field just outside Boulder, Colorado. Various experiments and antenna tests will be conducted to gain better knowledge of the effects of equipment swaps on position solutions. Also, effects such as multipath relating to antenna height and the effects of a radome will also be investigated. There will be various types of monuments installed for the experiment. One of which will be a tri-pillar design which will hold three antennas at equal distances from each other. The attractiveness of this design would be low installation cost, geodetic marker separate from the antenna mounts for ease of surveying, and an attempt to avoid wavelength related interactions at the GNSS frequencies. Marshall field already contains a deep drilled braced monument which was installed 2 years ago as part of the Plate Boundary Observatory (PBO). This site could possibly be used as a reference for monument stability comparisons of the newly installed monuments.

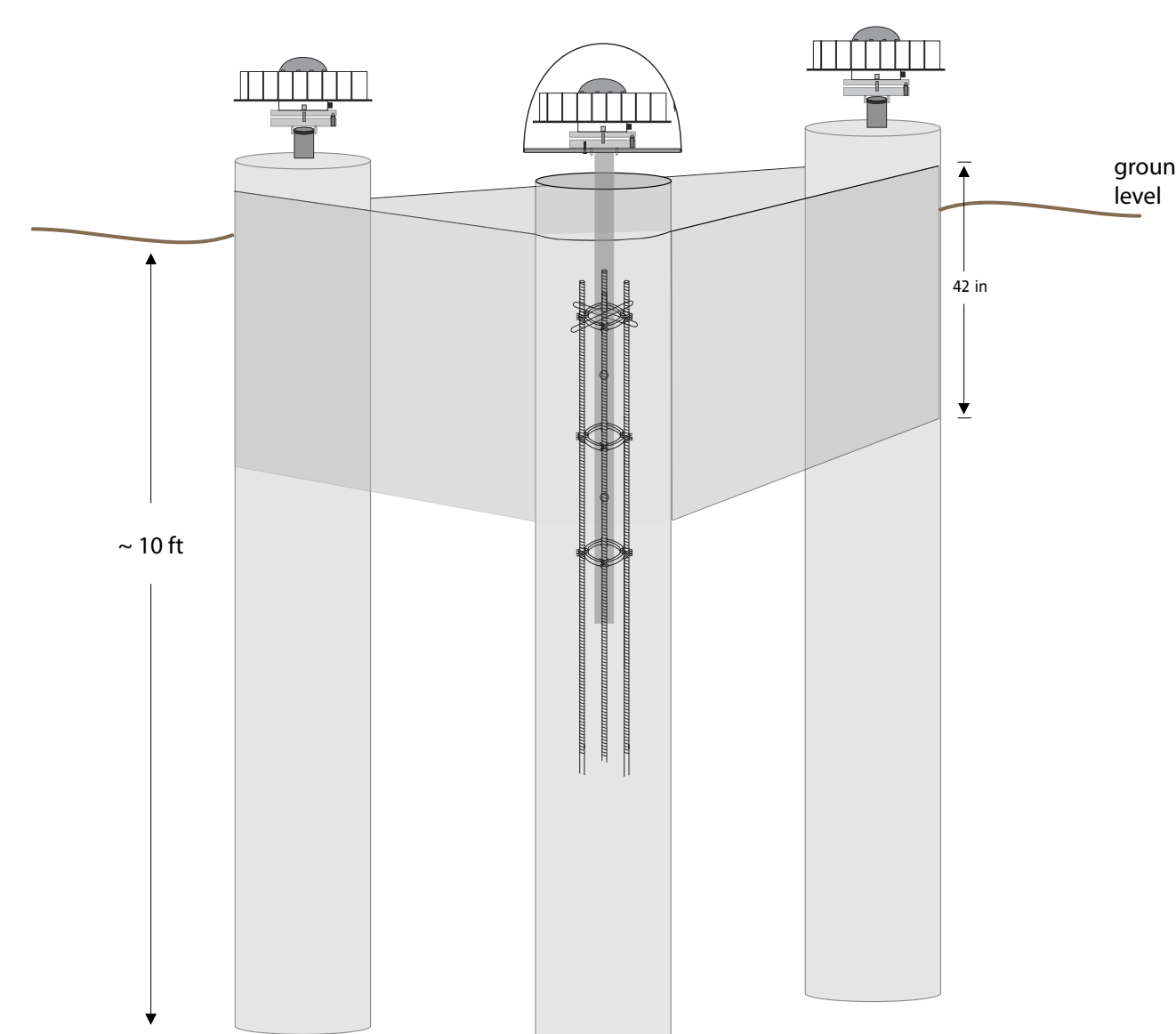


Deep drilled braced monument at Marshall field part of the Plate Boundary Observatory (PBO).

SCIGN Short (or Deep) drilled braced monument



Concrete Pillar



Side view of Tri-Pillar

## The Unification of African Reference Frames (AFREF) Project



The African Geodetic Reference Frame (AFREF) was conceived as a unified geodetic reference frame for Africa to be the fundamental basis for the national and regional three-dimensional reference networks fully consistent and homogeneous with the International Terrestrial Reference Frame (ITRF). The project will be designed, managed and executed by African countries with the assistance and advice of the international geodetic community. This will enhance the skills of African geodesists, surveyors and researchers in geodesy and the applications of Global Navigational Satellite Systems (GNSS) and the Global Positioning System (GPS) in particular. UNAVCO will participate in the upcoming AFREF technical meeting in South Africa in July 2006.

For more information please see: <http://geoinfo.uneca.org/afref/>