NASA is working with the international community to develop the next generation of geodetic instruments and networks to determine the terrestrial reference frame with accuracy better than one part per billion. These instruments include Global Navigation Satellite System (GNSS) receivers, Very Long Baseline Interferometry (VLBI) systems, and Next Generation Satellite Laser Ranging (SLR) stations. The development of these instruments and the needed integrating technology will require contributions from a broad variety of optical, microwave, antenna and survey engineering suppliers. These needs include but are not limited to:

- Broadband feeds capable of receiving GNSS signals, Ka-band feeds integrated with broadband feeds, and matching antennas that meet or exceed the slewing and duty cycle requirements of the IVS VLBI2010 specifications.

- VLBI system components including > 4 Gbps recorders, phase/cable calibrators, frequency standards / distribution systems and cluster or GPU-enhanced correlators that meet or exceed the requirements of the IVS VLBI2010 specifications.

- Cost-effective data transmission for e-VLBI from a global network of 30 VLBI stations operating up to 8 Gbps.

- Compact, low mass, space-qualified for MEO, SLR retroreflector arrays with greater than 100 million square meter lidar cross section, with a design that assures the ability to determine the array center to the center of mass of the spacecraft to a millimeter.

- A very high quantum efficiency (>50% at 532nm), low instrument noise, multi-pixilated detector for SLR use in the automated tracking.

- Wide band GNSS antenna and RF front-end technologies accommodating all expected GNSS signals in the next decade, and offering at least an order of magnitude improvements over COTS devices in terms of multipath rejection, and stability of output relative to temperature.

- Continuous, reliable co-location monitoring and control system for the relative 3-D displacement of geodetic instruments within a geodetic observatory to better than 1 mm.
- Single chip RF processors with selectable bandpasses from 1.1GHz to 2.2GHz. Greater than 50dB of gain and IF bandwidths from 10 to 60 MHz. Space-capable technology covering -40C to +85C and greater than 50 kRad TID.

- Space qualified GNSS array covering 1.15 to 1.61 GHz. Deployable from a compact, stowed position to a collector area of 1 - 2 meters, >40% efficiency. Array elements independently fed or phase combined; multiple polarizations available.

Proposals should show an understanding of one or more relevant science needs, and present a feasible plan to fully develop a technology and infuse it into a NASA program.