This millennium will witness the advent of a new generation of satellite-based radar altimeters, enabling an enhanced standard of global oceanographic measurements. The Water Inclination Topography and Technology Experiment (WITTEX) would consist of a constellation of three co-planar small-satellite radar altimeters. A single orbiting altimeter can measure only the along-track component of sea surface height. Three co-planar satellites, spaced apart by several hundred kilometers, will have their respective groundtracks laterally separated because of the Earth’s rotation. At any given latitude, sea surface height (SSH) observations occur within minutes of each other, so that the cross-track surface gradient can be measured as well as the usual along-track gradient. Thus the two-dimension geostrophic currents can be derived from the observed surface gradient. Track separation may be adjusted during mission operations by selection and maintenance of the inter-satellite spacing. Thus, measurement of the two-dimensional surface gradient can be optimized during a single flight mission.

The SSH data are free of off-nadir errors, since all measurements enjoy the accuracy inherent to pulse-limited geometry. The enabling technology for these satellites is the Delay-Doppler Altimeter (DDA). The DDA technique requires much less transmitter power than a conventional altimeter, which translates into a much smaller satellite. Small satellites, on the order of 65 Kg, allow multiple altimeters to be put into orbit from a single Taurus class or smaller launch vehicle. In addition the DDA has a smaller footprint (250 m in the along-track direction), better precision (by a factor of ~2), and is able to get reliable measurements closer to the shoreline (within 1 km) than conventional altimeters.

The Johns Hopkins University Applied Physics Laboratory has also proposed a variation to the above constellation called WITTEX-Wide, which offers enhancements to the Jet Propulsion Laboratory’s (JPL) Wide Swath Ocean Altimeter (WSOA) concept. From a TOPEX-class orbit as proposed by JPL, that instrument would sweep out a measurement swath approximately 200-km wide. As acknowledged by JPL, there are inherent limitations on the accuracy of WSOA measurements, especially due to satellite attitude sensitivity and unknown path delay errors. Flying two DDA satellites as ‘outriggers’ to the WSOA could minimize these errors. The resulting three-satellite constellation is known as WITTEX-Wide. Either WITTEX or WITTEX-Wide opens new horizons for space-based radar ocean altimetry. Possible missions include improved ENSO indication and monitoring, direct observation of two-dimensional geostrophic currents, improvement of global ocean models, improvement of wind and wave data forecasts, and for the first time collection of useful height signals in the littorals. With this next generation of radar altimeters, new opportunities for space based ocean monitoring missions will be realized.