

WESTFORD RADIO TELESCOPE

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MIT Haystack Observatory

MIT Haystack Observatory is an interdisciplinary radio science research center whose mission is to advance scientific research and technological developments in radio astronomy, geodesy, and geospace science.

The Westford Radio Telescope is a primary geodetic very-long-baseline interferometry (VLBI) site located 45 minutes northwest of Boston, Massachusetts.

Geodesy

Geodesy is the science of accurately measuring the geometric shape of the earth, its orientation in space, and its gravity field, including how these properties change over time. Haystack scientists and engineers make geodetic observations using a technique called very long baseline interferometry (VLBI). VLBI allows data from pairs of telescopes all across the globe to be combined, resulting in measurements much more precise than those of a single telescope. Haystack scientists also use other space geodetic techniques such as the global navigation satellites system (GNSS).



Westford is a fundamental station for the broadband VLBI Global Observing System (VGOS), the next-generation VLBI network. VGOS will support all aspects of earth system observations, and will enable sea-level measurements with an accuracy 10–20 times greater than current capabilities.

Westford is a station in the VGOS network of the NASA Space Geodesy Project (SGP). Observations with the NASA VGOS network in collaboration with partners from the International VLBI Service for Geodesy and Astrometry (IVS) will contribute to the determination of earth's shape and rotation with unprecedented accuracy.

Origin and historical usage

The Westford antenna was constructed in 1961 as part of Project West Ford at Lincoln Laboratory, to demonstrate the feasibility of long-distance communication by bouncing radio signals off a spacecraft-deployed belt of copper dipoles at an altitude of 3,600 km.

The antenna was converted to geodetic use in 1981 as one of the first two VLBI stations of Project POLARIS (National Geodetic Survey [NGS]) and has participated in geodetic VLBI observations on a regular basis ever since.



The site also serves as a testbed for the development of significant new equipment and techniques now employed in geodetic VLBI worldwide, and has been a GNSS fiducial point since the 1990s.

Equipment and capabilities

Westford is an 18.3-m broadband VLBI radio telescope currently operating in the 2–14 GHz frequency range. It is protected from the elements by a 28-meter-diameter, air-inflated radome constructed of 1.2-mm-thick Teflon™ fabric.

Major components of the VGOS data acquisition system at Westford include the following:

- Cryogenically cooled frontend
- Fiber-optic radio frequency (RF) downlinks and distributor
- Up-down converters (UDCs)
- ROACH digital backends (R2DBEs)
- Mark 6 recorder with expansion chassis
- Field control system
- Hydrogen maser