

LOCAL GEODETIC TIE BETWEEN THE VLBI ANTENNA
REFERENCE POINT AND THE SCAR GPS SITE
AT SYOWA STATION, ANTARCTICA (ABSTRACT)

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A local geodetic tie between the VLBI (Very Long Baseline Interferometry) antenna reference point in the air and the nearby SCAR GPS site on the ground was made at Syowa Station during the wintering period (April–December 1992) of the 33rd Japanese Antarctic Research Expedition (JARE-33). By attaching a one-frequency and 4 channel GPS receiver at the periphery of the 11 m S/X-band antenna dish, which was pointing to the zenith, GPS relative positioning was done between the SCAR GPS site (No. 23-16 geodetic marker) as a fixed point to obtain the location of the GPS receiver electrical phase center.

Such GPS relative positionings were made for 12 baseline solutions of 8 azimuths, and Cartesian coordinates of the center of a presumed circle on which these 8 electrical phase centers must overlie were obtained. There is a constraint that the antenna heights of the above electrical phase centers must coincide with each other, constituting a plane which is parallel to the ground surface. Iterative trial and error adjustment was made for the presumed center of the antenna dish to find the least square error for the residual radius (= calculated radius minus actual radius based on the mechanical design value). Since the mechanical design value between the antenna reference point and the antenna dish center along a plumbline is known, Cartesian coordinates of the VLBI antenna reference point can be estimated with the resultant offset vector (dx , dy , dz) from the VLBI antenna to the SCAR GPS site.

The finally estimated offset vector was $(dx, dy, dz) = (-11.68 \text{ m}, -74.06 \text{ m}, -12.02 \text{ m})$. Because of limited functioning and short duration tracking (30 min) by the one-frequency GPS receiver, the convergent error was $\pm 10 \text{ cm}$ for each direction. Thus precise connection to obtain 1–2 cm accuracy is desired on the future expeditions.

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