We present the discovery and the follow up Very Long Baseline Interferometry (VLBI) imaging of the z=5.84 radio-loud quasar PSO J352-15 at 23.9 x 11.3 mas resolution (139 x 66 pc). This quasar has the highest radio-to-optical flux density ratio (R > 1000) at such a redshift, making it the radio-loudest source known to date near z ~ 6. The VLBI observations at 1.54 GHz resolve this quasar into multiple components with an overall linear extent of 1.62 kpc (0.28") and a total flux density of 6.6 +/- 0.4 mJy, which is about half of the emission measured at a much lower angular resolution. The morphology of the source is compatible with either a radio core with a one sided jet, or a Compact or a Medium-size Symmetric Object (CSO/MSO). If the source is a CSO/MSO, and assuming an advance speed of 0.2c, then the estimated kinematic age is \sim 10^4 yr. We discuss the VLBI results in the context of quasar-mode feedback during the earliest formation of Active Galactic Nuclei (AGN) and the most massive galaxies. We also present the potential of carrying out H 21 cm absorption studies toward this quasar to detect the neutral IGM, as well as studying the apparent proper motion of the jet components at such high redshifts.