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The Gravity Probe B Gyroscopes[1] SAPS BUCHMAN, BRUCE CLARKE, MAC KEISER, DALE GILL, Stanford University, FRANE MARCELJA, ROBERT BRUMLEY, Boeing Company — The four redundant GP-B electrostatically suspended gyroscopes measure the orientation of the local inertial frame of reference as influenced by the spinning Earth. The GP-B gyros are designed to improve the drift performance of ground based instruments by a factor of about 10^6 or 0.3 milliarcsec/year. Four factors make possible this improvement: 1) low (10^{-11} m/s^2) acceleration environment provided by the drag free system, 2) averaging of suspension related torques provided by the roll of the spacecraft, 3) geometry of the sensors, and 4) low gas pressure environment. The gyros are fused quartz spheres of 19 mm radius, coated with 1.3 μm niobium, with a peak to valley surface uniformity of better than 1 ppm and a separation of centers of geometry and mass of better than 1 ppm of the radius. The gyroscopes were spun to $\sim$70 Hz and exhibited characteristic spin down times of 7000 to 25,700 years. The gyroscopes potential was maintained to within 15 mV of local ground (15 pC charge) using a fiber coupled mercury vapor lamp to produce UV photoemission at 254 nm. The system allowed charge management and measurement to 2 mV. We present engineering data of the gyroscope and UV systems, as well as novel technologies employed and lessons learned.

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