BACKGROUND

The Hubble Space Telescope was transitioned to gyro mode on August 28, 2005 in order to conserve the lifetime of the gyroscopes. Testing has shown that observations taken in 2 gyro mode are essentially indistinguishable from 3 gyro mode. HST was originally designed to use three rate-sensing gyros to provide fine pointing control of the observatory during science observations. Currently, 4 out of 6 gyros on the telescope are functioning. Without a servicing mission it was projected that the HST gyro system would continue to fail and the telescope would be left with too few gyros too point with by 2007. In order to extend the lifetime of the working gyros, one of the functioning gyros was turned off on August 28, 2005 and a new attitude control system that functions with only two gyros was used in combination with the Fine Guidance Sensors, which provide the fine-pointing information for the third control axis, during science observations. This new observing mode is expected to extend the observing lifetime of the telescope by 3 months.

Two gyro mode was tested in February 2005 using the 2-4 gyro pair and produced nominal results. The decision was made by the HST Project to transition to 2 gyro mode. After the transition, on-orbit tests were executed for all the functioning instruments on HST. The ACS programs were designed to test the PSF and pointing stability, the coronographic performance and moving target tracking.

PSF

Program 10458 to characterize the 2 gyro PSF consisted of images of 3 dense globular clusters: NGC 2298, NGC 1031 and NGC 6752. The ACS/HRC camera (pixel scale of 25 milliarcseconds) and filter F555W was used to take exposures of 10, 100 and 500 seconds in a combination of dithered and CR-split exposures. The same observations were done with both bright (V<13) and faint (V>14) guide stars, to verify that the pointing control is stable when using a faint guide star. The 10458 observations tested the telescope’s ability to racquire guide stars across occultation, while the program 10459 used the same observing sequence with NGC 2298 as a CVZ object to test the tracking over 90 minute orbits.

Analysis was done only on stars with S/N > 10. The photometry of these stars were measured at radii of 3 and 5 pixels. Stars that are not saturated and have accurate photometry were used to measure the x and y positions, ellipticity, position angle and FWHM. Plots of the measured FWHM for the August test data, February test data and 3 gyro data are shown in Figure 5. The results were nominal.

The August test also showed that the PSF gets broader over an individual orbit. This effect was larger than those expected from exposure time differences. The breathing model in Figure 7 shows the dependence is most likely due to normal changes in the Sun angle during an orbit.

JITTER

The jitter data from the August and February 2 gyro tests are compared to the 3 gyro jitter in Table 2. Jitter of this magnitude is hard to detect in science data.