



Emergent Space Technologies, Inc. is helping to continue our understanding of the origins of the universe. With our expertise in spacecraft Guidance, Navigation, and Control (GNC), Emergent is part of a team headed by Lockheed Martin to work on the Hubble Space Telescope (HST) Lifetime Extension Initiative for NASA.

Deployed from a Space Shuttle in 1990, Hubble has provided illuminating pictures of the universe. A key component in enabling Hubble to capture these images of distant, faint objects is the Pointing Control System (PCS) which can accurately and steadily hold the telescope locked onto a target without deviating more than 0.007 arcsecond.

With the current uncertainty regarding servicing missions to HST, we are looking into ways of extending the life of the telescope as different PCS components onboard slowly begin to degrade. HST normally uses three gyros out of the six installed onboard the spacecraft to provide accurate pointing information. Over time these gyros eventually fail, leaving the spacecraft with less redundancy, and eventually with fewer than the number required for normal pointing. The HST Project has developed a Two Gyro Science (TGS) mode

for use when fewer than three gyros are available. Operational capability of TGS mode is expected in 2005.

Emergent is currently involved in the feasibility study of a new safemode called zero-gyro Kalman filter (ZGKF) that is a significant improvement over the current zero-gyro sun point (ZGSP) safemode. The new mode uses the magnetometer and sun sensor measurements in a Kalman filter to produce accurate estimates of the HST attitude and rate to feed into the sun pointing controller. When this new mode goes into development and then to operations, the HST can safely stay sun pointing with no gyros operating. The same Kalman filter design can also be used for safemode when there are no or reduced number of reaction wheels available for control.

Eventually as the HST comes to its end of life, it will be deorbited in a well-controlled operation to land the remains in a safe location on Earth. Before the deorbiting occurs, there will be a mission involving rendezvous and docking of the Deorbit Module (DM), either done robotically or from a Space Shuttle. The new ZGKF safemode designed and developed by Emergent will enable a safe rendezvous and docking of the DM.

