ABSTRACT

From AFF to CCNT: JPL's Evolving Family of Multi-Function Constellation Transceivers

Yoaz Bar-Sever, Jeff Srinivasan, Jeff Tien, Larry Young

Jet Propulsion Laboratory, California Institute of Technology

JPL is developing novel RF tracking sensors for both NASA's New Millennium Program constellation missions, ST-3 and ST-5. ST-3, the Separated Spacecraft Interferometer, is a two-satellite formation in heliocentric orbit designed to demonstrate various technologies required for space interferometry. Scheduled for a 2005 launch, ST-3 will fly JPL's Autonomous Formation Flying (AFF) sensor for sub-cm inter-spacecraft ranging accuracy and 1 arcmin bearing accuracy. ST-5, the Nanosatellite Constellation Trailblazer, is a three-satellite constellation in geosynchronous transfer orbit designed to test and validate technologies in advance of MagCon, the large magnetospheric constellation scheduled to enter engineering development in 2006. Scheduled for launch in late 2003, each of the ST-5 spacecraft will carry JPL's Constellation Communications and Navigation Transceiver (CCNT), integrating inter-spacecraft ranging, communications, and GPS-based absolute positioning.

We will describe the profiles and requirements of the ST-3 and ST-5 missions, and discuss the unique technological challenges each of them presents. We will then describe the design and implementation approach for the AFF and CCNT. Both the AFF and CCNT trace their heritage to GPS receivers, using measurements of both RF carrier phase and a ranging code. They will operate, however, at very different frequency bands: the AFF at Ka-band, and the CCNT at S-band. Finally, we will address the extreme challenges posed by planned constellations such as LISA an MAXIM.