

SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
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THE NEWLY DEVELOPED DEEP SPACE COMMUNICATION INSTRUMENTS FOR JAXA VENUS
MISSION

Abstract

PLANET-C (P-C) or Venus Climate Orbiter (VCO) shall employ the first lineup of communication instruments developed for JAXA deep space activities in the coming decade. P-C is now in the phase to test compatibility among all the onboard instruments. The qualification and validation of flight model (FM) components will continue till the end of March 2009. The newly developed communication instruments for P-C are X-band digital transponder (X-TRP), high-gain antenna (HGA), low-gain antenna (LGA), and traveling wave tube amplifier (TWTA). The data directly collected from FM components is utilized to refine P-C link operation design. X-TRP was developed as an in-house product of JAXA. Based on the experience gained from the past JAXA deep space missions; NOZOMI and HAYABUSA, the compact and versatile digital transponder had been designed. The breadboard model (BBM) was well investigated and contributed to its further ameliorations. Then, FM was constructed via proto model (PM). Its regenerative ranging function strongly supports enhanced link coverage in deep space activities and opens the way for small satellites to challenge planetary explorations. The low phase noise and high frequency stability will allow an enhanced use as a Ka-band transmitter in the future. The lightweight HGA was a key to introduce gimbals in the future missions. Its lightness enables to make a room for gimbals and avoid unwanted perturbations during movement for tracking. It has a structure of quartz honeycomb disk with arrayed slots on its surface. Due to its narrow relative bandwidth, transmit and receive antennas were prepared separately for each frequency. The P-C adopted these antennas as ones fixed on its body. Avoiding gimbals further helped to reduce mass and survive a harsh inferior planetary environment. The LGA was made as a lens antenna with a broad pattern enabling a link establishment in any spacecraft safe-mode attitudes. It eventually needed a height for placement to prevent from pattern degradation due to interference on the spacecraft surface. TWTA for the first use in JAXA planetary exploration is a 20W output power-efficient amplifier. The power efficiency alleviates thermal conditions of inferior planet explorers. The P-C power amplifiers are composed of TWTA and buck-up solid-state power amplifiers that are used in an exclusive manner during the mission. Further discussions on the onboard communication FM instruments for our Venus mission will be presented the conference.