SPACE EXPLORATION SYMPOSIUM (A3)
Mars Exploration – Part 1 (3A)

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ACCURACY SIMULATION OF ORBIT DETERMINATION FOR YH-1

Abstract

Russia and China signed a cooperative agreement on the joint exploration of Mars on March 26, 2007. The project includes the launch of the YH-1, the Chinese first mars orbiter. YH-1 will be launched together with Phobos-Grunt in November, 2011. In August, 2012, YH-1 will be ejected into an orbit of 800km/80000km, with a period of about 72 hours, and inclination of 21-35 around Mars. The main scientific objectives of YH-1 include investigation of plasma environment and magnetic field, study of Martian ion escape processes and Mars gravity field in equatorial regions.

YH-1 has been equipped with the x-band Ultra-Stable-Oscillator (USO), whose frequency stability is about 1E-11/day. The tracking system will be performed by Chinese VLBI Network(CVN), and the possible measurements include one-way Doppler and ΔDOD/ΔDOR.

Taking into account the errors of Mars gravity field, Solar radiation pressure, Mars ephemerides and tracking data, YH-1 orbit accuracy is assessed by means of simulation analysis, using Orbit Determination And Analysis System (BODAS) developed at Beijing Aerospace Control Center (BACC). The results show that the accuracy of orbit determination, only with less than 1-cycle-length 1-way Doppler tracking data, is worse than 10km under current tracking condition. The participation of ΔDOD/ΔDOR tracking data will improve the observability geometry and the precision of orbit determination. In addition, the stability of USO frequency, including offset and frequency shift, is a key issue for orbit accuracy, which are significantly associated with systematic error of 1-way Doppler measurement and dynamical model errors as solved parameters. The errors of Mars gravity field, solar radiation pressure, Earth orientation parameters and Mars ephemerides have limited impact on the orbit accuracy, orbit errors produced by which is less than 1km for orbit determination with 1-cycle-length tracking data.