

BRIEF INTRODUCTION ABOUT CHINESE MARTIAN MISSION YINGHUO-1. J. S. Ping¹, Z.H. Qian¹, X. Y. Hong, W. M. Zheng¹, L.W. Fung¹, Q.H. Liu¹, S. J. Zhang¹, K. Shang¹, N.C. Jian¹, X. Shi¹, M.Y. Wang¹ (Shanghai Astronomical Observatory, CAS // Nandan Rd.80, Shanghai ,P.R. China, 200030, pjs@shao.ac.cn).

Abstract: The 1st Chinese Mars Probe, Yinghuo-1 will explore the space weather of the Mars, and test the deep space communication and navigation techniques. Different from common deep space mission, the astronomical Very Long Baseline Interferometry (VLBI), DOR/DOD and 1-way Doppler, are developed and applied to determine the s/c orbit and position. Part of these open loop tracking methods has been tested in Chang'E-1, MEX and other missions.

Introduction: Since the beginning of the new century, Mars exploration has attracted the huge attention from space communities. A new race and cooperation in lunar and planetary exploration has started. Being a beginner in this area, China has launched her 1st lunar orbiter Chang'E-1 successfully, and has got many new scientific results from this exploration. Beyond this, a joint Russian-Chinese Martian mission, Yinghuo-1 (YH-1) & Phobos-Grunt (FGSC), has been developed and promoted solidly.

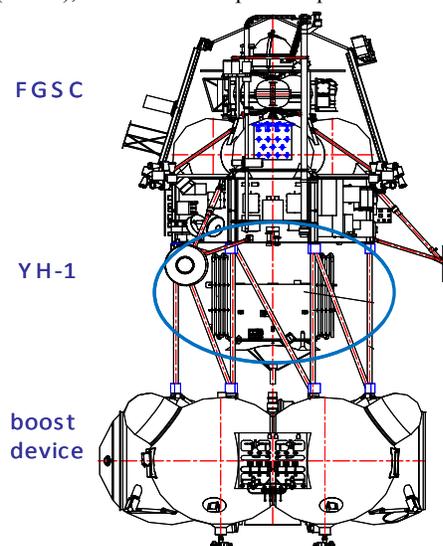


Figure 1, Launching Package of YH-1 and FGSC

Lavochkin Association and IKI of Russia side will be responsible for developing the FGSC; Shanghai Academy of Spaceflight Technology and CSSAR/CAS will be responsible for developing the YH-1 mission. They will coordinate the issues of joint launching and joint exploration.

After a successful launching, the joint spacecraft YH-1 & FGSC will be sent to a transfer orbit flying to the Mars. After 10-11 months, the joint craft will arrive the Martian system, and will be eject into an equatorial orbit of 800x80000km, with a period of ~72 hours, inclination of 1° ~ 5° . See Figure 2 about the configuration of the transferring orbit. The joint craft will fly in this orbit for about 3 circles, then they will

be separated, FGSC will change its orbit to find change of landing on Phobos, and YH-1 will free-fly in this orbit for 1 year.

YH-1 is a small satellite focused on investigating the Martian space environment and the solar wind -Mars interaction. FGSC is a sampling return mission to land on the 1st Martian satellite, Phobos, and take some (0.1-0.2kg) soil back to the Earth. YH-1 and Phobos-Grunt forms a two-point measurement configuration in the Martian space environment. Equipped with similar plasma detecting payload on two spacecraft would give some coordinated exploration around Mars. The two S/Cs will also carry out satellite-to-satellite radio link, so as to study the Martian ionosphere by using radio occultation links at UHF. The 6 kinds of payloads will carry out 4 directions of the main scientific objectives:

- Martian space environmental structure, plasma distribution and characteristic in the regions;
- Solar wind-atmosphere coupling and energy deposition processes, and Martian ions escaping processes and possible mechanisms;
- Martian and Phobos surface imaging;
- Regional gravity field of the Mars.

Considering that the Chinese deep space tracking system is still under construction, there will not be any uplink system in China can meet the power requirement of uplink communication for a distance about 2AU. To simply and minimize the designation, an X-band receiver and X-band transmitter system have been adopted for onboard communication. There is not a common PLL transponder used for tracking. To solve the tracking and OD problem, an USO-based 1-way open loop concept will be used for the s/c, and the ground astronomical VLBI system[2] will be used to receive the radio signal, so as to retrieve the DOR/DOD and Doppler information. The open loop observable will be applied for S/C positioning and OD.

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