

BepiColombo mission to Mercury: Scientific Expectations and current status of Mercury Magnetospheric Orbiter (MMO)

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BepiColombo for the exploration of Mercury is the first collaborated mission between Europe (ESA) and Japan (ISAS). The aim of this mission is to clarify present and past of Mercury by investigating interior, surface, atmosphere, and magnetosphere, by 2 orbiters and 1 lander, which are MPO (Mercury Planetary Orbiter), MMO (Mercury Magnetospheric Orbiter), and MSE (Mercury Surface Element). Intensive contribution to this project is essentially expected for Japanese earth and planetary science community.

ISAS will provide the MMO spacecraft. In this paper, we report our scientific expectations for and current status of the MMO mission study, which was conducted by the ISAS Mercury Exploration Working Group.

Main scientific targets of MMO are 1) Structure and origin of Herman magnetic field, 2) Structure, dynamics, and physical processes of Herman magnetosphere, 3) Structure, variation, and origin of Herman Na atmosphere, 4) Macroscopic structure of Herman crust, and 5) Physical environment of inner solar system. For these targets, MMO will have 10 model payloads: Electron Spectrum Analyzer (ESA), Mass Spectrum Analyzer (MSA), Solar Wind Analyzer (SWA), High Energy Particle (HEP), Energetic Neutral Atoms (ENA), Magnetic Field sensor (MGF), Plasma Wave Instrument (PWI), Mercury Dust Monitor (MDM), and Mercury Imaging Camera for Atmosphere (MIC-A) and for Surface (MIC-S).

For these targets, MMO, which weighs about 200kg, is as a spinning spacecraft at 15 rpm whose spin axis is perpendicular to the Mercury orbital plane. MMO will be at polar orbit with the period of 9.2hour, the perihelion of 400km and the aphelion of 12,000km (~6RM). It is selected for the observations of large regions in the Herman magnetosphere, mappings of magnetic field and surface, and macroscopic imaging of the Na atmosphere.

The telemetry ability will be 20-160Mbytes/day (about 40Mbytes/day [ave]). Data production rate will show large seasonal variation, because the data rate of in-situ plasma instruments is correlated to the duration staying in the magnetosphere and varies in 20-75MB/day. So basic policy of the operation is storing in the high-production term and reproduction in the low-production term. Mission life is 1 Earth year (~4 Mercury year).

The specifications of the model instruments in this paper are for the basis of spacecraft investigations and not final ones. Actual selection of the instruments is based on the results of Announcement of Opportunity (A/O) in Japan and Europe. In the current plan (Jan 2003), the A/O for MPO (from ESA) and MMO (from ISAS) payloads will be issued in June 2003.