SYMPOSIUM ON TECHNOLOGICAL REQUIREMENTS FOR FUTURE SPACE ASTRONOMY AND SOLAR-SYSTEM SCIENCE MISSIONS (A7)
Technology Needs for Future Missions, Platforms (3)

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EUROPA TOMOGRAPHY PROBE (ETP) MISSION FEASIBILITY – SPACECRAFT DESIGN

Abstract

Europa Tomography Probe (ETP) is proposed as a European contribution to NASA's mission to Europa. ETP is a small spacecraft to be released by Europa Clipper during its nominal mission. It will complement the goals of the Europa Clipper mission by determining the deep interior structure of the moon through a combination of magnetic, gravity and altimetric measurements, in the simplest configuration, as more deeply described in the parallel scientific study of the mission. The probe hosts just one instrument (a magnetometer) and a transponder required for the Inter-Satellite Link (ISL) with the mother spacecraft. ETP will attain a nearly circular, polar orbit around Jupiter's moon at an altitude of about 200 km, by means of an autonomous guidance system. The minimum mission duration has been set to 3 months although, as a goal, it shall be the same as that of the mother spacecraft. The spacecraft design has been pursued by taking into consideration the main mission requirements and how they affect

the overall system in terms of mass, power and volume. The major design problems concerning each subsystem have been assessed and examined in order to satisfy the imposed mission constraints, such as maximum mass (250-400 kg), or attitude determination accuracy. A preliminary design of the attitude control system has been carried out in order to estimate how many reaction wheels desaturation maneuvers are needed and the propellant mass required to perform them. Furthermore, order to attain ETP's final orbit, a suitable propulsion system must be envisaged. This system sizing has been one of the main focuses in this feasibility study. The radiation analysis has been an essential part of the study, affecting directly the lifetime of the mission, but also the mass budget (due to need of radiation shielding). This feasibility study has been carried out under the design philosophy of determining the minimum required system mass and volume that allows to meet the mission requirements. The goal has thus been to assess what kind of small probe is needed to determine Europa's deep interior structure with the best possible accuracy, rather than what science return could be obtained with preassigned system constraints.