

Contracts Final Presentation 19-20 Feb. 2004

1. Title of the presentation

Artificial Magnetospheric Propulsion

2. Speaker

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3. Abstract

We present the work done in the frame of ESTEC Contract no 16360/02/NL/LvH. We start with a general discussion of the physical problems related to the proposed scheme for solar sailing, using an artificial magnetosphere. We consider the forces acting on the plasma bubble, and their transfer to the spacecraft. Upper and lower limits of the force acting on the bubble are established. The results of test particle dynamics are presented, concerning the interaction of the solar wind with a modified magnetic dipole. Propagation of the forces along the magnetic flux tubes, is considered, using a simple MHD theoretical model. Emphasis is made on the distribution of currents flowing in the immediate vicinity of the spacecraft. We also describe our model for plasma bubble formation and expansion. In this context, we have examined the possible use of photoionization to create the plasma, without the help of a plasma discharge. Results of PIC code simulations of the magnetized plasma expansion and its interaction with the solar wind are presented. An overall qualitative picture of the physical processes is given, and a quantitative estimate of the force acting on the spacecraft are given. Finally, we discuss the strategy for obtaining a more quantitative estimate of the magnetospheric propulsion efficiency. An additional programme, including experimental and numerical work is proposed.