SPACE PROPULSION SYMPOSIUM (C4)
Electric Propulsion (4)

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THE ALTA FT-150 THRUSTER FOR THE LISA PATHFINDER AND LISA/NGO MISSIONS

Abstract

An improved design of the FT-150© FEEP thruster was successfully tested in Alta's Micropropulsion laboratory. The new design has dramatically increased the performance of this kind of thuster with respect to previous models and marks a major step forward in the LISA programme and in space propulsion capability. The test campaign took place in two parts. Firstly, the new design was tested to validate that the new configuration was compliant with the requirments of the Lisa Pathfinder mission with particular emphasis on the achievement of required total impulse and minimum and maximum thrust levels without degradation. The second part of the campaign was aimed at testing the representative DFACS cycles of the LISA Pathfinder mission using the EBB PCU commanding at 10 Hz and acquiring at 50 Hz. Both purposes of the campaign were successfully met. During the first part, more then 600 Ns of total impulse and about 2000 hours of firing time were achieved. Different thrust profiles were commanded with an average thrust of about 87 N. The minimum and maximum thrust were 1 N and 150 N respectively. Short periods at zero N were also commanded. No degradation of efficiency and performance was recorded during the entire test duration. In addition, the measured mass efficiency and specific impulse, 43 per cent and 5300 s respectively, demonstrated that the current design of the thruster is fully compatible with the much larger impulse requirement of LISA mission. The simulation of representative DFACS cycles at 10 Hz was also successfully performed. These new cycles highlight one of the main advantages of this technology: the controllability and response time that can be verified immediately with electrical feedback parameters like total voltage and beam current (data collected at 50 Hz during the test). The following representative DFACS Science-Mode cycles were performed: -from 3,5 to 45,5 N sinusoidal wave cycle with 20 second period superimposed with -2,5/+2,5 N 2,5 N every 100 ms sawtooth wave cycle, 1 N of minimum thrust, 41 N of maximum thrust -8 N every 100 ms sawtooth wave cycle.

The article provides a view of the thruster configuration, facility and test set-up, the electrical parameters of the thruster, the main parameters recorded by the diagnostic system and the details of the

behavior of the TA-PCU system during the simulation of the LISA Pathfinder mission.