SPACE PROPULSION SYMPOSIUM (C4)
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# QUALIFICATION TEST SERIES OF THE INDIUM NEEDLE FEEP MICRO-PROPULSION SYSTEM FOR LISA PATHFINDER

**Abstract**

The Laser Interferometer Space Antenna project (LISA) is a co-operative program between ESA and NASA to detect gravitational waves by measuring distortions in the space-time fabric. LISA Pathfinder is the precursor mission to LISA designed to validate the core technologies intended for LISA. One of the enabling technologies is the micro-propulsion system based on field emission thrusters necessary to achieve the uniquely stringent propulsion requirements. A consortium consisting of Astrium GmbH and the Austrian Institute of Technology-AIT was commissioned by ESA to develop and qualify the micro-propulsion system based on the Indium Needle FEEP technology. Several successful tests have verified the proper Needle FEEP operation and the thermal and mechanical design of subcomponents of the developed system. This includes the verification of the compatibility of the thruster with a flight representative Power Control Unit (developed by Galileo Avionica S.p.A) during the qualification testing. A flight representative qualification model of the Needle FEEP Cluster Assembly equipped with one active Thruster Cluster Assembly has performed a qualification program consisting of acceptance, vibration, shock, thermal vacuum, and life test. For all functional tests, the flight representative power control unit developed by Galileo Avionica S.p.A was used. Furthermore, the compatibility of the thruster with the flight representative Neutralizer Unit, under development and qualification at TAS-I Florence site, was investigated. Measurements have shown the exceptional stability of the thruster. During the acceptance test compliance to all the applicable requirements have been shown such as a thrust resolution of 0.1N, thrust range capability between 0 and 100N, thrust overshoot much lower than the required 0.3N and many others. In particular important is the voltage stability of the thruster (<1% over the duration of the testing) and the confirmation of the very low thrust noise.