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PRECISE - DEVELOPMENT OF A MEMS-BASED MONOPROPELLANT MICRO CHEMICAL PROPULSION SYSTEM

Abstract

PRECISE (chemical μPRopulsion for an Efficient and accurate Control of Satellites for Space Exploration) aims for the advancement of research and technologies needed for the development, manufacturing and operation of MEMS-based monopropellant Micro Chemical Propulsion Systems (μCPS). The term chemical micro propulsion is used for propulsion systems with thrust levels in the order of microNewtons up to several milliNewtons and generating thrust primarily by means of chemical energy of the propellant itself. The primary objective is the development of a μCPS necessary for highly accurate attitude control manoeuvres of satellites as they were not feasible until today with propulsion systems of this size. Further aspects need to be considered for a consistent development:

- Definition of requirements and specifications, comprising S/C demands
- Research of propulsion aspects like catalysis
- Development of crucial components
- Test facility infrastructure and diagnostics
- Numerical development, simulation and comparison
- Manufacturing, assembly, integration and testing of the CPS

A revolutionary feature of μCPS using MEMS technologies is the very compact, lightweight and modular architecture. The micro thruster weighs only few grams and is etched on a silicon wafer. The diagnostic sensors are installed on a chip which is placed on top of the thruster to monitor mass flow,

pressure and temperature in the thruster and propellant feed lines which have a diameter of approximately 20μm. With such compact dimensions, micro thrusters can be easily clustered to the modular micro propulsion system and integrated on practically every desired location of satellites.

The concept of PRECISE is based on the involvement of companies and universities who are all experienced for their respective field in the project. Two universities are involved, the University of Twente and the Space Science Center of the University of Surrey. In addition, two large research organizations are involved, the National Center for Scientific Research (CNRS) and the German Aerospace Center (DLR), and finally three industrial partners namely Astrium Space Transportation, NanoSpace AB and NPO Mashinostroyenia, with NPO and the Space Science Center as the two potential end-users in the consortium. The presentation will give a project overview and a first insight on project results.

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