

IAF SPACE PROPULSION SYMPOSIUM (C4)
New Missions Enabled by New Propulsion Technology and Systems (9)

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UPDATES ON THE DEVELOPMENT OF A WATER PROPULSION SYSTEM AT IRS

Abstract

A water electrolysis propulsion system has been developed at IRS, University of Stuttgart, Germany, in cooperation with ArianeGroup, Lampoldshausen, Germany. In an electrolyzer water is being dissociated into its gaseous components hydrogen and oxygen, which form a propellant combination with one of the highest performances. Unlike traditional satellite propellants, such as hydrazine, which is toxic, carcinogenic and highly flammable, water offers great advantage during handling and performance. Expensive handling of the propellant, or at launch site will become obsolete. Also, no dangers during launch or at failure occur to human or environment. From a low-pressure storage tank, water is fed to an electrolyzer which decomposes it by applying a low voltage. The gases generated are then stored in separate high-pressure gas tanks until thrust is demanded. Energy is only added to the propellant when on orbit. The electrolyzer is of PEM type and has been developed at IRS during a PhD thesis, in cooperation with ArianeGroup. The electrolyzer is capable of generating highly pressurized and dried gases with absence of gravity. Dry gases are needed for combustion process in the thruster. When thrust is needed, the gases are pressure fed from the gas tanks to the one Newton bi-propellant thruster engine, where they are recombined in stoichiometric mixture ratio and expelled. High combustion temperatures of hydrogen/oxygen mixtures are a challenge to the thruster engine. The evolution of the thruster development will be presented. Ignition of the thruster is carried out via catalyst. Currently, investigations on 3D-printing a water tank are carried out, which should offer cost advantages in manufacturing propellant management devices.