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# INNOVATIVE VRD SOLUTION FOR DEEP SPACE MISSIONS

**Abstract**

THE KEY PROBLEM: Large-scale Space Exploration Missions are impossible using a huge multi-stage launch vehicles with liquid engines, and relatively small payload. Moreover, it does not allow achieving higher velocity, and the required fast cargo and/or crew delivery to other planets of the Solar System.

INNOVATION: We propose to use the Universe extended medium "physical vacuum", which has allocated mass as inexhaustible resource of working medium for creation of reaction-propulsion thrust. We have built a vacuum reaction-propulsion device (VRD) for jet thrust using vacuum as working medium. VRD injects vacuum, accelerates it using external energy source, and outows it as a direct exhaust stream. Certain mass of vacuum obtains pulse and VRD obtains exactly the same opposite pulse. As a result, thrust force acts on VRD and VRD is accelerating.

ACHIEVEMENTS: We have already developed and tested 4 dierent conguration stand models of VRD with range of weight from 4 to 30 kg and consuming from 500 to 6000 W. The tests were carried in the air and in a vacuum chamber at 1/10000 mm Hg. Measured propulsive thrust was 0,05 N – 4 N. It was found that specic thrust of VRD is proportional to square frequency of VRD activator. Extrapolation of this relation in SHF band allows to predict that VRD thrust will exceed VRD weight at terrestrial gravity. We are working on SHF VRD scheme now.

POWER SUPPLY: On-board battery, recharged from photovoltaic converter, or/and other alternative energy sources (including nuclear power) can be used as an energy source for such VRD's.

EXPECTED INDICATORS: Estimated VRD's ight time from Earth to the orbit of Mars with a constant acceleration/decelerationof of 1G will be about 6 days.