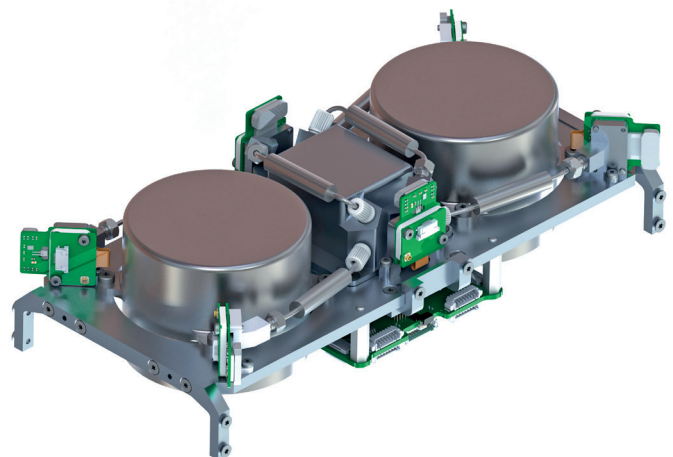# NanoProp 6DOF

The GomSpace NanoProp 6DOF is designed on **mature technology** for the **ESA RACE mission**. 6DOF propulsion is an enabling technology for advanced guidance navigation and control such as **close-proximity operations** and **formation flying**.

The NanoProp 6DOF means providing **six degrees of freedom** with rotation and translation capabilities along all three spatial axes of the spacecraft. 6DOF was developed in order to meet the current trend towards more innovative and capable CubeSats.

The propulsion system enables a range of **highly advanced CubeSat missions**, such as autonomous formation flying, rendezvous and docking, close inspection, and more. A complete 6DOF system would consist of two modules each containing two propellant tanks, one plenum tank and 6 thrusters.

Furthering on the already flight-proven NanoProp 6U cold gas micro-propulsion system, the main modifications for the 6DOF system are:

- To increase the number of thrusters, change their position and orientation.
- Increase the propellant volume to meet higher requirements on delta-V and total impulse.

- Reduce energy comsumption by improving the thruster units thermal insulation.
- Flexible design capable of choosing the number of thrusters as well as the thrust level (1mN or 10mN) of the individual thruster.

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Technical Information

NANOPROP 6DOF MODULE - KEY FEATURES:	
System Schematic	• Six MEMS thrusters • Two propellant tanks with an integrated fill and drain port • One plenum tank • Two plenum valves • Six thruster valves • Eight filters • One interface and control electronic board

Functionality	• Six thrusters with pulse-mode operation
	• Norminal thruster level: 1 mN or 10 mN
	• Minimum impulse bit: 25 µNs
	• Total impulse: 65-100 Ns
	• Specific impulse: 50 s
	• Propellant: Butane
	• Propellant capacity: 122 g (or 240 ml)
	• Temperature range:
	  – Operating: -5 ºC to 50 ºC
	  – Non-Operating: -10 ºC to 55 ºC
	• MEOP: 5.6 bar (Reached at 55 ºC)

Interface	• CAN and I2C interface • 5VDC and 32VDC electrical interface
Software command	• Thruster control • Valve/heater control • Tank temperature/pressure control

Mass and demensions	• L x W x H: 200 mm x 100 mm x 55 mm
	• Dry mass: 682 g
	• Centre of mass with respect to the coordinate system origin (mm)
	  – X = - 0.34
	  – Y = + 9.60
	  – Z = - 1.58

NanoProp 6DOF Schematics

Pressure sensor
Temperature sensor
Heater
Liquid Butane
Vaporized Butane
Normally closed valve

Propellant tank
Plenum tank
Thruster unit