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NEW PROPULSION SYSTEMS: LANDERS: TIROIDAL SHEATH MOTOR COMBINES LIFT AND THRUST VS THRUST ONLY

Abstract

Using Astrobotic's M-1 Peregrine Lander to modify as the spec from being a junior member of Spacede-central's Coral Mission it was the most likely first flight and is very light at 1-ton wet.

As a lightweight it's a very sensitive setup to land it, because, as is standard the load is above the rockets so to land it takes mastery of 5 motors with a nuanced technique, larger landers have enough inertia to avoid this trouble.

Recently working on hovercraft powerheads in the 4500-5500 horsepower medium-heavy payload class, and, with historical awareness of early small payload tests using a long two-pipe yoke carrying fuel to the motor above.

This with needing to protect things from the dust became a ribbed nacelle with a toroidal sheath motor, this novel rocket motor type most likely never proposed before so presented as opening new ways to apply lift with thrust forces not available with thrust only.

This motor has vertical waves like a giant clam mouth in all polar directions, limiting exhaust velocity well below mach-1 to become a source of aerodynamic lift able to follow such a hard turn to fit the lander's 2.5m in diameter by 1.9m tall size so it must add the curve to that basis, tapering below.

This gave calculations with the total thrust of the 5 motors to compare to which first try showed the combined remaining thrust plus lift was 2x hovering force and available in a vacuum.

The waviness is to cool, slow and as a flow thicken the exhaust plume to increase the density and height of the boundary layer for more powerful lift, at near vacuum the flow will rejoin from a taper in the body.

The stability advantage is clear, other than re-routing the fuel and those controls, the Peregrine structure has a very strong and obvious way to attach the nacelle and motor for earthly tests.

The other major advantages are: The lower vacated space becomes the rover garage, doors open, out you go; the sealed-from-dust balcony level gets added internal payload area; the new sealed cone can house optical and sensors for solar-direct, astronomy and photos.

Simulation of this design appears straightforward, validation through full-scale tests at earth gravity with an atmosphere then calibrated to vacuum and lunar gravity, then zero gravity for free space will allow a first flight within a short time not needing full certification the goal.