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Ultra-fast Escape of a Octopus-inspired Rocket GABRIEL WEYMOUTH[1], University of Southampton, MICHAEL TRIANTAFYLLOU[2], Massachusetts Institute of Techonology — The octopus, squid, and other cephalopods inflate with water and then release a jet to accelerate in the opposite direction. This escape mechanism is particularly interesting in the octopus because they become initially quite bluff, yet this does not hinder them in achieving impressive bursts of speed. We examine this somewhat paradoxical maneuver using a simple deflating spheroid model in both potential and viscous flow. We demonstrate that the dynamic reduction of the width of the body completely changes the flow and forces acting on the escaping rocket in three ways. First, a body which reduces in size can generate an added mass thrust which counteracts the added mass inertia. Second, the motion of the shrinking wall acts similar to suction on a static wall, reducing separation and drag forces in a viscous fluid, but that this effects depends on the rate of size change. Third, using a combination of these two features it is possible to initially load the fluid with kinetic energy when heavy and bluff and then recover that energy when streamlined and light, enabling ultra-fast accelerations. As a notable example, these mechanisms allow a shrinking spheroid rocket in a heavy inviscid fluid to achieve speeds greater than an identical rocket in the vacuum of space.

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