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Development of an accelerating-piston implosion-driven launcher
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— The ability to soft-launch projectiles at velocities exceeding 10 km/s is of interest to several scientific fields, including orbital debris impact testing and equation of state research. Current soft-launch technologies have reached a performance plateau below this operating range. The energy and power density of high explosives provides a possible avenue to reach this velocity if used to dynamically compress a light driver gas to significantly higher pressures and temperatures compared to light-gas guns. In the implosion-driven launcher (IDL), linear implosion of a pressurized tube drives a strong shock into the gas ahead of the tube pinch, thereby forming an increasingly long column of compressed gas which can be used to propel a projectile. The McGill IDL has demonstrated the ability to launch a 0.1-g projectile to 9.1 km/s. This study focuses on the implementation of a novel launch cycle wherein the explosively driven pinch is accelerated down the length of the tube in order to maintain a relatively constant projectile base pressure early in the launch cycle. The experimental development of an accelerating driver which utilizes an explosive lens to phase the detonation wave is presented. The design and experimental performance of an accelerating-piston IDL is also discussed.

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