



## HIGH SPEED SHADOWGRAPH VISUALIZATION OF THE UNSTEADY FLOW PHENOMENA IN A VALVELESS PULSEJET ENGINE

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### KEYWORDS:

**Main subjects:** pulsed combustion, flow visualization

**Fluid:** high speed reactive flows, transient flow

**Visualization method(s):** Schlieren, shadowgraph

**Other keywords:** high speed imaging, synchronization

**ABSTRACT.** A pulsejet is a micro - propulsion device ideally suited for MAV applications because of its low cost, simplicity and scalability. Unsteady, complex mixing of fuel, air and residual hot gases in a pulsejet make analysis, modeling and scaling extremely challenging. A general methodology for the design of optimized pulsejet geometry is still not available.

In order to evolve such a design methodology, high speed flow visualization, employing a unique shadowgraph technique, has been effectively used to better understand the detailed pulsejet flow physics. An inline - intake, rectangular cross-section, valveless hydrogen-fuelled pulsejet, suitably modified with optical access for flow visualization was used for this experimental study. The figure shows time synchronized unsteady pressures inside the combustor chamber with the high speed images of the complex flow at the intake and the exhaust. It is seen that the intake and exhaust flows are coupled and driven in a resonant mode by the unsteady heat release, and hence the pressure rise, in the combustor chamber / tailpipe, while satisfying the Rayleigh criterion.

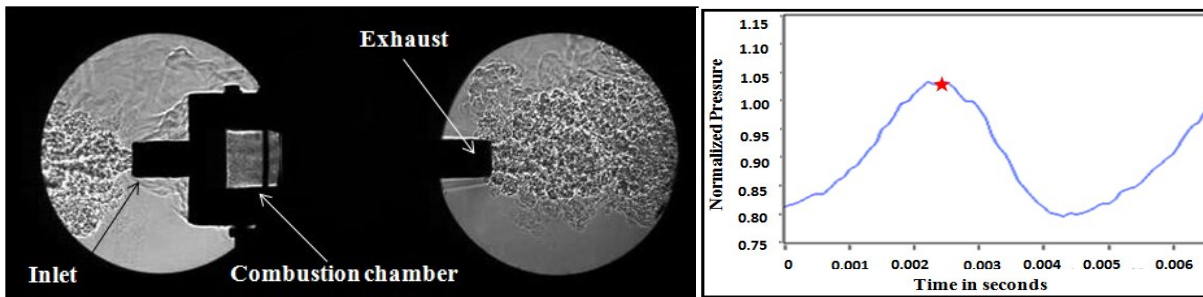


Fig. Pulsejet coupled intake and exhaust flow in synchrony with the combustor chamber pressure rise due to unsteady heat release.