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Technical Comment

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Comment on "Effect of Pulse Length and Ejector Radius on Unsteady Ejector Performance"

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Propulsion engineers have been fascinated with thrust augmentation for decades, and they have perfected it in many forms (e.g., afterburning, external burning, fuel and oxidizer injection, bypass fans, and ejector devices) [1]. In particular, thrust augmentation created by steady and pulsating flow ejectors that use the ambient air has been the focus of a great deal of attention for jet engines and rockets [2]. Although ejectors have disarmingly simple geometries, their aerodynamics and thermodynamics can be very complex. The author of [3] is therefore to be commended for executing and reporting a careful experimental study of the complex thrust-augmenting ejectors applicable to pulse detonation engines (PDEs).

This research highlights two of the key issues that remain to be considered and resolved for PDE thrust augmentation. First, because all ejector thrust augmentation depends on the principle of spreading the available kinetic energy across the entrained ambient air to increase the total momentum of the exhaust jet, ejector performance diminishes rapidly with vehicle forward speed [2]. This must be true for unsteady PDE ejectors as well, and so it is critical to examine and understand their behavior when the surrounding air is in motion. Second, ejector thrust augmentation is strongly dependent on the details of the flowfield in the neighborhood of the entrance (for example, in the case of constant area ejectors, the thrust augmentation is generated entirely by suction on the surface of the ejector inlet). Thus, it is critical to examine and understand precisely how the geometrical configuration influences the performance of unsteady PDE ejectors when the surrounding air is moving and only periodically entrained. To summarize, it is the performance of PDEs in flight that will determine their usefulness, and many related questions remain to be answered.

Finally, because all propulsion devices are capable of thrust augmentation, any future comparison with PDEs requires that the other devices be given fair credit for their own thrust augmentation potential. It is therefore important to note that practical ejectors can provide static or stationary thrust augmentation factors for steady-state airbreathing engines of at least 1.4 [2].

References

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