Catapult launching tests of an unmanned aerial vehicle with a ramjet pulsed-detonation engine

Frolov Sergey, Aksenov Viktor, Ivanov Vladislav, Shamshin Igor

N. N. Semenov Institute of Chemical Physics, Russian Academy of Sciences, 4 Kosygin Str., Moscow 119991, Russian Federation; smfrol@chph.ras.ru

The air-breathing ramjet pulsed detonation thrust module (TM) for an unmanned aerial vehicle (UAV) designed for a subsonic flight at a speed of up to 120 m/s when operating on a standard aviation kerosene was developed using the analytical estimates and parametric multivariant three-dimensional (3D) calculations. The TM consists of an air intake with a check valve, a fuel supply system, a prechamber-jet ignition system and a combustion chamber with an attached detonation tube. Experimental samples of TM were fabricated, and their firing tests were carried out on a test rig with a thrust-measuring table. In firing tests, TM characteristics are obtained in the form of dependencies of effective thrust, aerodynamic drag and fuel-based specific impulse on fuel consumption at different speeds of the approaching air flow. It has been experimentally shown that the fuel-based specific impulse of the TM reaches 1000-1200 s, and the effective thrust developed by it reaches 250 N.

The paper also presents the results of catapult launching tests of UAVs powered with one and two paired TMs. The autonomous flight of an UAV with a new type of power plant is demonstrated. The difference from the US flight tests of the piloted Long E-Z aircraft powered by the multitube pulsed detonation engine (PDE), performed in 2008, is the natural (ram) rather than forced air supply into the engine. The results of catapult launching tests of UAVs with a take-off mass of up to 100 kg have shown that the PDE-based power plants provide a subsonic flight with acceleration and climbing. Due to the simplicity of design and low cost, as well as high propulsion performances, such power plants can be considered as an alternative to the propulsion units based on piston and turbojet engines for subsonic UAVs.

Figure 1 shows the 3D-model of the TM and a photograph of the air intake. Figure 2 shows the PDE powered UAVs in the flight.

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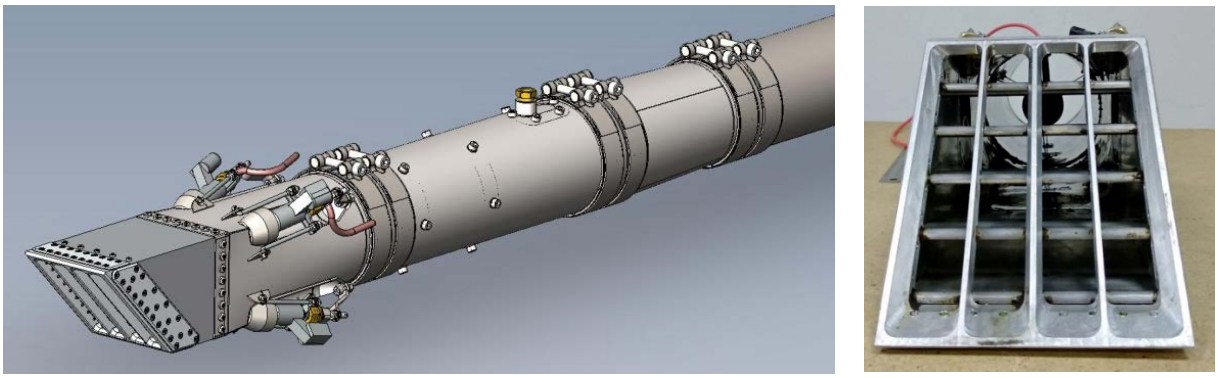

(a) (b)

Figure 1: The 3D-model of the TM (a) and a photograph of the air intake (b)

(a) (b)

Figure 2: The UAVs powered with one TM (a) and two paired TMs (b) in the flight