

# Development of rocket engines with detonation combustion chamber

Michał Kawalec, Piotr Wolański, Witold Perkowski

Łukasiewicz Research Network - Institute of Aviation, Warsaw, POLAND

## Abstract

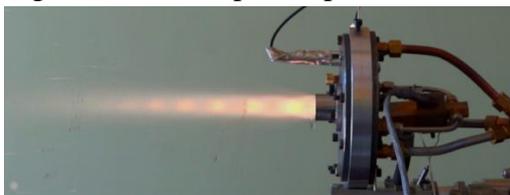
During last decade the Institute of Aviation has been conducting intensive research on applications of detonative combustion for different engines such as turbine engines, rocket engines as well combined cycle rocket-ramjet engines.

Research on rocket engines supplied by gaseous propellants allowed to observe the operation of the detonation combustion chamber. Experiments were carried out illustrating the influence of particular geometric parameters of the rocket engine combustion chamber on the number of detonation waves and, moreover, a parameter was found, which directly influences it. The analysis of mixture's composition has been conducted as well as an impact of geometric parameters of the chamber on detonation combustion process stability. Several methods of controlling the rotation detonation direction of waves have been investigated - incl. the use of sequential initiation or one direction initiation initiator.



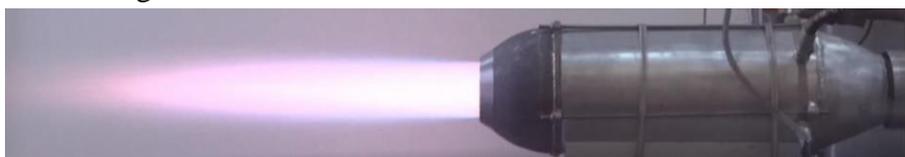
Rocket engine with detonation combustion chamber supplied by  $\text{CH}_4$  and  $\text{O}_2$ .

The next stage of the research was the use of liquid propellants. Annular-shaped and disc-shaped rocket engines were developed. In this solution, the propellants (nitrous oxide / propane) were injected to the chamber already vaporized or partially vaporized. The resulting detonation is stable and is characterized by high pressure peaks. The model engine itself has optimal performance, similar to commercial rocket engines.



Rocket engine with detonation combustion chamber supplied by  $\text{N}_2\text{O}$  and  $\text{C}_3\text{H}_8$ .

The presentation also shows research on the conceptual rocket-jet engine. The application of afterburning of the enriched mixture in the atmospheric air may improve the performance of such an engine.



Rocket-Ramjet Engine on stand test.

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