Research on Detonative Propulsion in Poland

Piotr Wolański

Łukasiewicz Research Network-Institute of Aviation, Warsaw, Poland

Abstract

In this presentation historical aspect of research on detonative propulsion carried out in Poland will be given first.Then presentation will be focused on research conducted initially only at the Combustion Laboratory of the Institute of Heat Engineering of Faculty of Power and Aeronautical Engineering of the Warsaw University of Technology (WUT) and since beginning of a second decade of this century also at the Institute of Aviation and since 2019, after name change, at the Łukasiewicz Research Network-Institute of Aviation, in Warsaw.

A short information will be given about the initial ideas and initial efforts conducted jointly with prof. Tosh Fujiwara from Nagoya University and Mitsubishi Heavy IndustryLTD, Nagoya Guidance & Propulsion System Works, which lead to develop a joint patent on “Detonation Engine and Flying Object..”. This intensified our activities in research conducted initially on basic aspects of spinning detonation and then on the continuously rotating detonation (CRD) at the WUT. A few research on this aspect were conducted with Japanese researcher, then also joint research was initiated between WUT and Institute of High Performance Computing A*Star of Singapore. Our initial research brings attention of the Pratt & Whitney Company and a special invited Fellows Lectureat the UTRC & PW on 16 December 2008, East Hartford, USA on “Research on Continuous Rotating Detonation and its Potential Application for Propulsion Systems” was given, in which extensive research conducted at the WUT were presented. The same lecture was repeated month later at the P&W Rocketdyne at West Palm Beach in Florida USA. This, in our opinion, initiates transition in the USA from works conducted on Pulse Detonation Engines (PDE) to works on Rotating Detonation Engines (RDE).

As concerns our research, detailed information on basic works conducted on spinning detonation at WUT as well as works on rotating detonation in annular chamber for different gaseous fuel mixtures with air and oxygen will be presented. Also initial research conducted at WUT on modelling gaseous rocket engines with aerospike nozzles at simulated altitude condition will be given.Then basic information on big research project undertaking at the Institute of Aviation will be presented. This project was focused on development of the annular detonative chamber for the gas turbine engine and ended with demonstration of possibilities of improving overall engines efficiency by working on hydrogen fuel. Also a short information on development of the system which allow to support CRD for typical liquid fuels air mixtures in annular detonation chamber. Also short information will be given on research on gaseous rocket engines conducted at the Institute of Aviation on rocket and rocket-ramjet engines.

At the end information about monograph on: “Development of the RDE in Poland”, which is on final stage of preparation will be given. In this monography detailed description of all research conducted in Poland on CRD and RDE will be given as well as with a short summary of subjects discussed at the current Workshop.