

## MODERN RESEARCH AREAS OF SOLID HYPERSONIC RAMJET ENGINES

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### ABSTRACT

*The development of high-speed maneuverable unmanned aerial vehicle (LA) for monitoring inaccessible regions of Earth's atmosphere presents great scientific and practical interest. This article provide a review of technologies and methods, which can be used to achieve such an aircraft.*

### 1 OBJECTIVES

There is an opportunity to explore: the upper layers of the atmosphere, the ozone layer, storm clouds, tornadoes, clouds formed by the products of volcanic eruptions, etc. To investigate these inaccessible areas needs unmanned aircraft having a larger speed –  $M=5...7$ . The aircraft accelerates recoilless throwing device that uses the energy of a paste or solid fuels. Further overclocking LA to enter the upper atmosphere and monitoring, provides solid hypersonic ramjet engine (GPDTT). High-speed aircraft can significantly increase the stability of the flight path that will give the ability to capture fast-changing characteristics of the atmosphere in the place where the aircraft are significant external load (in volcanic clouds and lightning, tornadoes, etc.). High speed flight also contributes to the monitoring of a large area of the atmosphere for a limited time.

Known overseas projects the U.S., France, Germany, England, Japan, China, Canada, Australia, India, in order to fulfill the fundamental and multidisciplinary research to provide acceleration LA to hypersonic speeds, the output of the aircraft in space and input objects in the planetary atmosphere. Leading position in these studies are the United States. It

may be noted that in general, the projects are carried out for the Department of Defence.

### 2 TECHNOLOGIES AND METHODS

The emergence of new fuels and the development of the theory of combustion in supersonic flow, the creation of the principles of integration of thermal-hydro gazoerodinamicheskikh processes, basic design and optimization of engine design, has stimulated the development GPDTT in Russia.

Appeared new solid and pasty fusible metallouglevodorodnye and hydrocarbon fuels. These include the "hard kerosene", "solid metallokerosin", etc. The high values of density and composition of fuels themselves, calorific value, commensurate with the heat of combustion of liquid kerosene in the air, traditionally high reliability of motors with solid fuel, the ability of new fuel to the fire in the environment of a supersonic airflow and other factors, determine the prospects GPDTT.

In the theory of combustion in supersonic flow focuses on the process of vortex formation at the interface between chemically interacting supersonic airflow and subsonic flow of high-temperature combustion of fuel. The processes of formation, combustion and decay of vortices.

The principles of integration of thermal, gas and hydro aerodynamic processes possible to form structural systems GPDTT, gas-dynamic control systems of aircraft and aircraft to reduce drag.

Methods for optimizing the design based on sensitivity analysis and artificial intelligence

techniques have allowed reasonably create the optimal design for the mass and functional interactions of their parts.

### **3 SUMMARY**

Were tested models of various construction schemes GPDTT containing new solid, pasty and combustible fuel, gas-dynamic control system aircraft.

Preliminary studies have shown that for small-sized unmanned hypersonic aircraft designed for high-speed monitoring of the Earth's atmosphere, an important factor is the low weight, simplicity of design and operation. The layout and design of the engine, supersonic aircraft and missile devices are inextricably linked. These conditions are satisfied GPDTT. The results of years of work you can create an experimental model GPDTT for such aircraft.

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