

**Electrical Propulsion in Dnepropetrovsk National University (Ukraine):  
results of development**

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**Abstract**

Active process of industrialization of near-earth space assumes design and development of high effective propulsion systems with a small thrust. The specific place among propulsion systems with a small thrust is taken the propulsion systems with use of electrical propulsion thrusters (EPT).

**Tasks for electrical propulsion:**

- Correction and keeping of parameters of spacecraft orbits;
- Attitude control of spacecraft;
- Fulfillment of orbital maneuvers of a spacecraft;
- Transfer of spacecraft from a low earth orbit (LEO) on geo stationary (GEO).

**Electric Propulsion Classification:**

- Hollow Thrusters (Stationary Plasma Thrusters, Thrusters with Anode Layer);
- Ion Thrusters (with bombardment ionization, radio-frequency ionization, contact ionization);
- Arcjet and Resistojet.

**Electric Propulsion Designers:**

- Ukraine: Dnipropetrovs'k National University, National Aerospace University (KhAI), DO «Yuzhnoye»;
- Russia: DO «FAKEL» (Kaliningrad), Moscow Aviation Institute, Institute of electrodynamics (Moscow), RDI Thermal Processes (Moscow), CRDI Mash (Korolev), Institute of Nuclear Energy (Moscow);
- USA: NASA John Glenn Research Center (Cleveland), Jet Propulsion Laboratory (Pasadena), Hughes Research Laboratory, Aerospace Companies, Universities;
- Germany: Stuttgart University, Hessen University;
- Great Britain; Italy; Japan; China;
- European Space Agency.

**Electrical propulsion thruster consists of:**

- Anode unit;
- Hollow cathode unit;
- Acceleration system.

**Thrusters developed in DNU:**

- Ion Thrusters: PIT-200C, PIT-200R;
- Hollow Thrusters: SPT (D-47, D-60), TAL (D-33, D-37, D-50).

Structures and parameters of the thrusters, developed in DNU are presented in the report.

**Electrical propulsion engine module consists of:**

- Electrical propulsion thruster;
- Feed subsystem;
- Power processing unit;
- Automatic control system.

**Facility and equipment for electric propulsion activity:**

- Vacuum chambers and pump systems;
- Measurement equipment (thrust, mass flow rate, electrical parameters etc.).

**Problems of the electrical propulsion development:**

- Design and optimization of the thrusters parameters;
- Design of the feed and storage subsystem;
- Design and optimization of the power processing and automatic control unit;
- Design and optimization of the hollow cathodes;
- Selection of the materials (electrodes, insulators, magnetic cores, heaters...);
- Design of the measurement instrumentation and test equipment;
- Optimization of the electrical propulsion engine unit operation;
- Problem of the stable regimes of SPT operation (dependence the amplitude and average value of the discharge current oscillation of electromagnet current; Dependence the amplitude and average value of the discharge current oscillation of the power supply output filter parameters).

In report the main results of the electric propulsion design and development in Dnipropetrovsk National University are presented.