

Electric Propulsion System based on Small Hall Thruster SPT-20M for Microsatellites

Andriy V. Loyan, Taras A. Maksymenko
National Aerospace University, Kharkiv, 61070, Ukraine

a.loyan@khai.edu, m.taras.a@gmail.com

Based on great experience in Electric Propulsion gained in KhAI from 60's we are focused on development of Electric Propulsion System (EPS) for Microsatellites as one of the main tasks. We select Hall thruster (or SPT) as a promising candidate with high enough specific impulse 1500 s. Studies of developed small Hall Thruster SPT-20M has shown acceptable level of efficiency (30-35%) on low power consumption (100 W) [1]. Such system will serve for drag compensation of residual atmosphere, solar pressure and other disturbance of environment and orbit maintenance with prescribed accuracy.

General structure of developed EPS is shown on fig. 1.

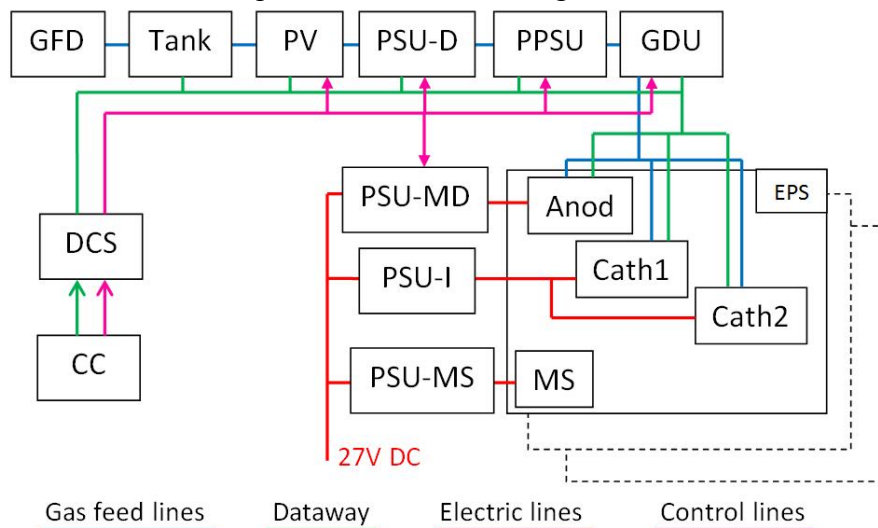


Figure 1 - Scheme of EPS:

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|--|---|
| GFD – gas-filling device; | PV – Pyro-Valve; |
| GDU – Gas-Distributing Unit; | PSU-D – Discharge Power Supply Unit; |
| PSU-MD – Main Discharge Power Supply Unit; | PSU-I – Ignition Block; |
| PSU-MS – Power Supply Unit for Magnetic System; | Cath1, Cath2 – Cathodes; |
| DCS – Diagnostic and Control System; | CC - Central Computer; |
| PPSU – Precise Pressure Stabilization Unit | |

Thruster description (fig. 2):

- Hall Effect Thruster assembly consists of Anode block and two cathodes;
- Thruster type – Hall effect thruster SPT-20M;
- Cathode type – heaterless hollow cathode;
- Working gas – Xe (99,9998%);
- Total efficiency – 30-35 %;
- Gas flow rate - 0.32 mg/s;
- Xe ions energy – 220...260 eV;
- Mass - less 240 gr;

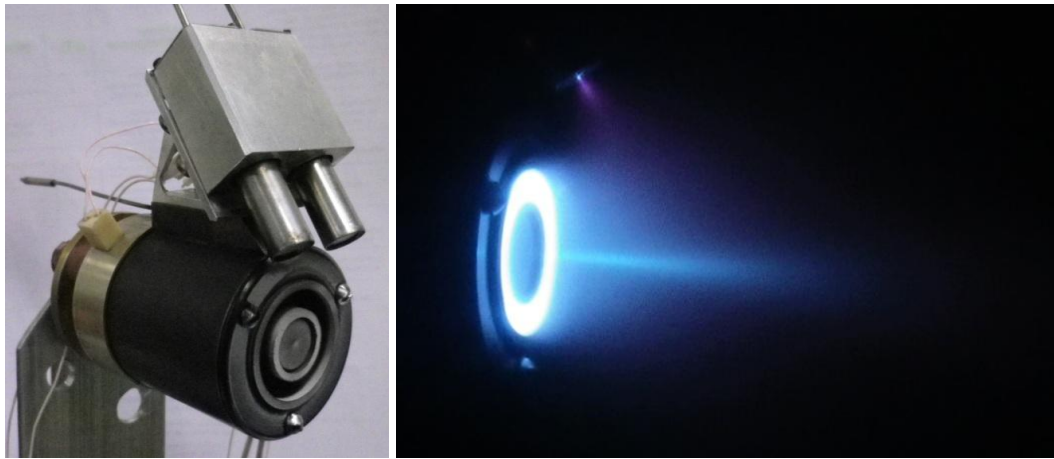


Figure 2 – Small Hall Thruster SPT-20M

PPU Description (table 1; fig. 3):

- individual for each thruster;
- total efficiency 92%;
- overall dimension 97x85x50 mm;
- mass - 210 grams + 560 grams radiation protection;

Table 1

	Main discharge unit	Ignition unit	Magnetic system supply unit
Voltage	Const; 290+/-5 V	800 V; special VACH	up to 5 V I=
Current	320 mA	60 mA	Const; 4.2 A
Operation time	long duration	start mode	long duration

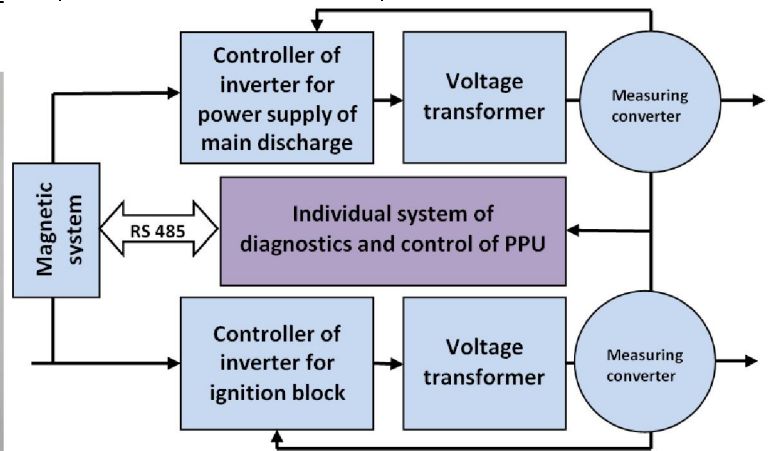


Figure 3 – General view and scheme of PPU for SPT-20

All systems of EPS pass complex long duration qualification tests on vacuum test bench, on vibration and environment stands. And as next obvious step we see manufacturing qualification and flight model with corrected parameters for concrete task.

References

- ¹ Loyan A.V. Performance investigation of SPT-20M Low Power Hall Effect Thruster [Electronic resource] / A.V. Loyan, T.A. Maksymenko – Access mode: http://erps.spacegrant.org/uploads/images/images/iepc_articledownload_1988-2007/2007index/IEPC-2007-100.pdf – 22.06.2012.