RIT Propulsion Systems for All-Electric Telecommunication Satellites

IEPC-2013-xxx

Presented at the 33rd International Electric Propulsion Conference,
The George Washington University • Washington, D.C. • USA
October 6 – 10, 2013

Marcel Berger[1] and Michael Rath[2]
Astrium Space Transportation, 28199 Bremen, Germany

Hartwig Ellerbrock[3]
Astrium Space Transportation, 82024 Taufkirchen, Germany

Hans Leiter[4] and Josef Koecher[5]
Astrium Space Transportation, 74215 Moeckmuehl, Germany

The telecommunication satellite market currently undergoes a significant change in the definition of its propulsion systems. In the past the development of electric propulsion system was mainly focused on partial tasks. For instance, electric propulsion has become state of the art for north south station keeping. With the constantly and further increasing pressure on transponder-to-orbit-cost satellite designers and operators are willing to go the next step towards an all-electric telecommunication satellite.

The outstanding performance of the RIT Thrusters with its high Isp, its excellent thruster efficiency and low beam divergence, are providing clear advantages for improved satellite capabilities. Astrium decided to invest own funding in the Astrium electric propulsion system concept. This is based on building blocks providing highest design flexibility for a multiple application for nearly all satellite platforms. The proposed system will be developed product-oriented and satellite designers can further benefit from following design evolutions and improvements at minimal non-recurring efforts.

The concept is taking benefit of the heritage in Radiofrequency Ion Thruster (RIT) This paper presents the advantages of the ion gridded Radiofrequency technology, the technical maturity as well as the planned development up to qualification and the elements of customization as well as industrialization phase. In addition the EP building blocks, the functional chains consisting of Power Processing Unit (PPU), Thruster, Neutraliser, Flow Control Unit and Radiofrequency Generator (RFG) as smallest entity of a propulsion subsystem

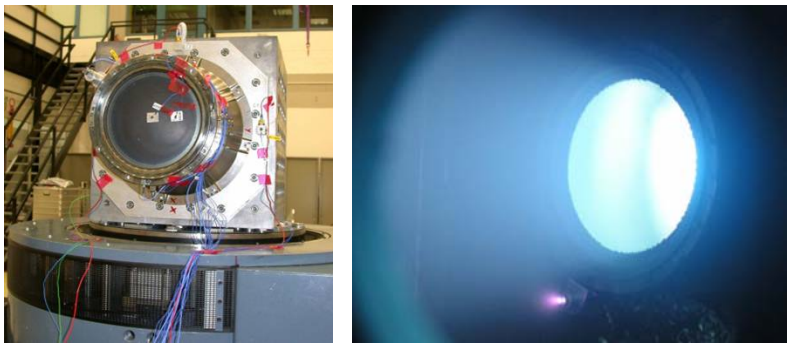

Figure 1: RIT22 development thruster during mechanical environment tests (left) and functional and performance tests in vacuum (right)

[1] Project Manager, TP41, marcel.berger@astrium.eads.net.
[2] Programme Manager, TP41, michael.rath@astrium.eads.net.
[3] Head of Business Development and Strategy, TP1, hartwig.ellerbrock@astrium.eads.net.
[4] Expert Electric Propulsion, TP42, hans.leiter@astrium.eads.net
[5] Head of Orbital Propulsion , TP4, josef.koecher@astrium.eads.net

are described. Various combinations of building blocks are presented as opportunity for satellite designers to customise the EP system to the specific mission needs. Although the propulsion system design could be different to previously developed ones, the development effort will be reduced thanks to the reuse of the qualified functional chains. A summary of the performances of selected system architectures will show technical benefits of the proposed solutions.

The system's advantages are then interpreted into business assets and opportunities. As will be shown, the gain of using all-EP solutions is depending on many parameters of which Launcher and transfer orbit scenarios are very influencing. By employing Astrium's extensive heritage in chemical propulsion systems, hybrid solutions consisting of chemical and electrical systems can also be considered beneficial in terms of mission flexibility and robustness.

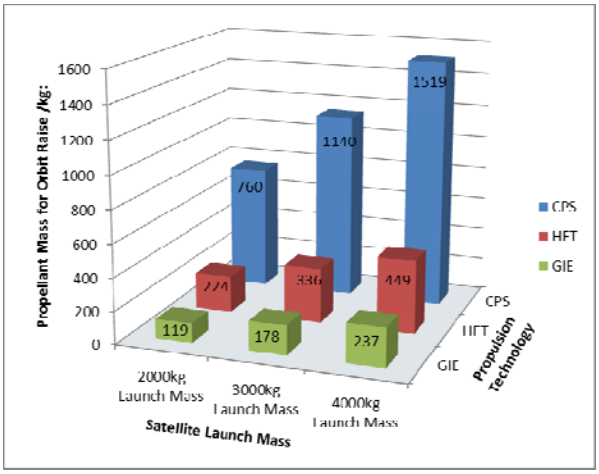

Figure 2: Propellant Mass Summary for different Propulsion Technologies and for different Satellite Launch Masses

Nomenclature

EP	=	Electric Propulsion
GIE	=	Gridded Ion Engine
HET	=	Hall Effect Thruster
PPU	=	Power Processing Unit
RFG	=	Radiofrequency Generator
RIT	=	Radiofrequency Ion Thruster