



Transition

SBIR Topic Number:

AF95-096

Title:

Hall Thruster for Small, Low Power Satellites

Contract Number:

F04611-96-C-0023

Company Name:

Busek Company, Inc., Natick, MA

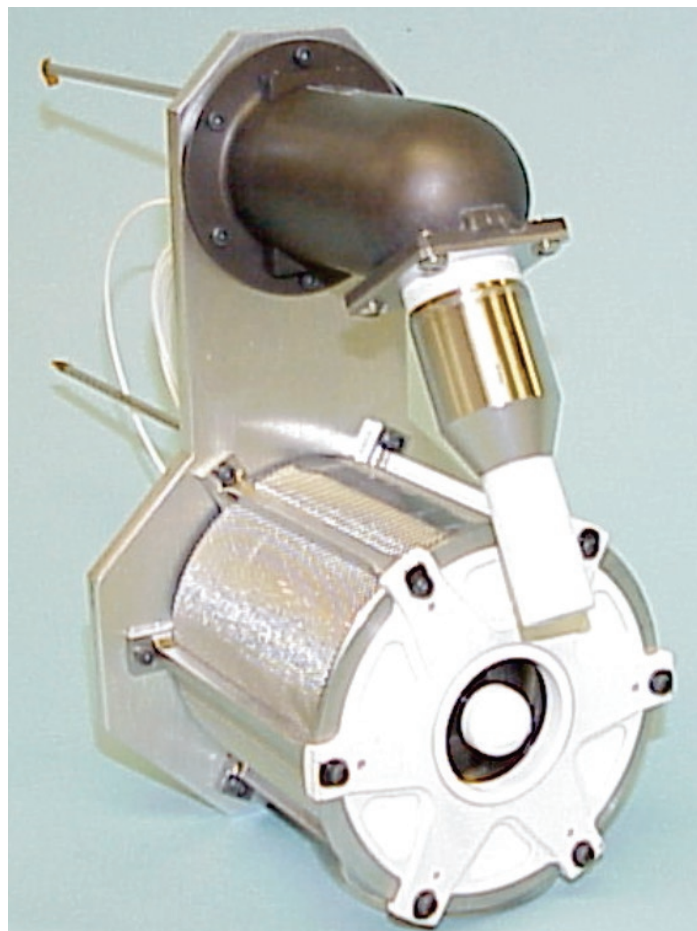
Technical Project Office:

AFRL Propulsion Directorate

Transition Office:

AFRL/PR

An example of Air Force supported SBIR technology that has been transitioned into an Air Force or other DoD system or subsystem or used by Air Force test ranges and facilities or maintenance depots.



Busek 200 W Hall Thruster (BHT-200)

New On-board Propulsion System to Power TechSat-21 Satellites

- SBIR funded development of advanced on-board satellite propulsion technology with first entirely U.S. designed “Hall” thruster
- Hall thruster offers low power requirements to operate the satellite and great increases in efficiency

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DISTRIBUTION A:
Approved for public
release; distribution
unlimited.

Air Force Requirements

The Air Force has the stated goal of gaining and retaining space dominance to protect U.S. interests in all parts of the world. This will require large numbers of new satellites with uninterrupted, all weather coverage of the Earth's surface. To provide these capabilities at reasonable cost, new propulsion technologies, which utilize fuel more efficiently, are being developed. These propulsion technologies use electrical energy to accelerate plumes of ions and electrons to more efficiently propel satellites thus lowering the cost to maintain and launch these spacecraft vital to our national interests.

SBIR Technology

Busek Company, Inc. was awarded Small Business Innovation Research (SBIR) contracts to construct and validate a 200 W Hall effect thruster (HET) propulsion system for the Air Force Propulsion Directorate (AFRL/PR). The 200 W HET system developed by Busek consists of three parts: the anode discharge where electrons are confined with magnetic fields and xenon ions are created and subsequently accelerated; the hollow cathode neutralizer which provides electrons to neutralize the ion beam produced by the anode; and the propellant and power management system which regulate electrical power and propellant flow to the anode and cathode. The system has an electrical efficiency of approximately 45% (thrust power output divided by total electrical power input) at its nominal operating power of 200 W. Typically Hall thrusters operate at higher powers (≥ 2 kW). Prior to this work, it was deemed impossible to scale down to such low power levels while maintaining a useful efficiency level. This challenge required Busek to innovate and design a new magnetic

field configuration as well as a new propellant distribution system within the anode body. These two innovations to the field of electric propulsion resulted in the first demonstration of an efficient low power Hall thruster. This effort was not only technically successful, it also resulted in a successful patent application for Busek.

Air Force Transition Payoff

This low power HET propulsion system developed by Busek recently competed to supply primary propulsion for the TechSat-21 constellation, and the follow-on Program – TacSat-2 (a.k.a. RoadRunner). These efforts are collaborative programs between AFRL/PR and AFRL/VS, the Space Vehicles Directorate, to demonstrate advanced satellite technologies. Although Busek did not initially expect to win the contract, they beat a number of competitors by showcasing their technical maturity (accomplished through the SBIR program) and short pulse Hall thruster operation not previously thought possible.

Spacecraft Propulsion Branch is managing the current phase of the propulsion system development for the on-orbit demonstration. The Critical Design Review (CDR) for the 200 W HET System is scheduled for Dec. 04, and launch is scheduled for late 2005.

Company Benefit

Northrop-Grumman Space Technologies (formerly TRW) teamed with Busek to demonstrate 200 W HET systems for primary propulsion. Due to this success, Busek is in talks with several other prime contractors to place their low power HET systems on other space vehicles.



U.S. AIR FORCE

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