NASA SBIR/STTR Technologies

T3.01-9976 - Advanced Microwave Electrothermal Thruster (AMET)

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Identification and Significance of Innovation

The AMET (Advanced Microwave Electrothermal Thruster) is a high-efficiency thruster which will use water propellant to enable various Lunar and Mars missions. The proposed AMET will incorporate a number of innovations to dramatically improve upon existing designs, including the use of a lower microwave frequency to permit the achievement of very high microwave generation efficiency with commercially-available magnetrons. The AMET is a particularly attractive option for this class of missions because it provides specific impulse (~800 seconds) well beyond the reach of chemical propulsion, it provides high thrust per unit power to keep transit times acceptably short, and it permits the use of an easily-storable propellant (water) which is known to be available on both the Moon and Mars.

Expected TRL Range at End of Contract (1-9): 4

AMET Concept Design not Included to Protect Patentable IP

AMET Uses Electrodeless Discharge to Heat Water Vapor with Microwaves

Technical Objectives and Work Plan

- Task 1. Define the System Requirements for the Phase 1 AMET Propulsion System
- Task 2. Identify an Appropriate Microwave Source for Phase 1 Work
- Task 3. Refurbish ORBITEC's Existing MET
- Task 4. Design and Fabricate Necessary Support Hardware for AMET System
- Task 5. Conduct AMET Demonstration Tests with Water Vapor Propellant
- Task 6. Analyze Test Data and Make Performance Calculations
- Task 7. Perform Numerical Modeling and Analysis on AMET Exhaust Plume
- Task 8. Create a Conceptual Design of a Flight-type AMET Prototype for Phase 2.

NASA Applications

The AMET has the potential to enable a broad spectrum of space missions to the Moon, Mars, and beyond by providing low-cost, high-performance electric propulsion using environmentally-benign water propellant which is known to be available in both the Lunar and Martian environments. The AMET will lend itself to mission architectures involving refueling at the Moon and Mars, minimizing launch costs by utilizing in-situ resources.

Non-NASA Applications

The AMET, and related MET propulsion systems, will also be very attractive for applications in Earth orbit for both DoD and commercial space operations. In one configuration, the AMET may be combined with a chemical rocket engine using hydrogen-oxygen, formed by on-board electrolysis, to form a highly flexible dual-mode propulsion system which can respond to emerging mission requirements with either electric propulsion or chemical propulsion, enabling mission planners to achieve high I_{sp} or high thrust, as needed.

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NON-PROPRIETARY DATA