



# Air Force Research Laboratory | AFRL

*Science and Technology for Tomorrow's Aerospace Forces*

## **Success Story**

### **CAPTAIN JAMES P. LAKE RECEIVES AIR FORCE RESEARCH AND DEVELOPMENT AWARD**



Captain James P. Lake of the Propulsion Directorate, received the US Air Force Research and Development Award. He received this prestigious award based on his groundbreaking work with solid rocket motors and electrical propulsion systems for spacecraft.



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## **Accomplishment**

Capt Lake coinvented the world's first completely controllable solid rocket propellant. Solid rocket motors using this propellant can perform multiple start/stop/restart operations and produce varying levels of thrust. He also created fully automated spacecraft thruster test facilities for the High Power Hall thruster life test and the micro-pulsed plasma thruster (PPT) for the Technology Satellite 21.

Capt Lake's automated system records all performance and environmental data, calibrates the thrust stand, and executes emergency shutdown procedures without human intervention. His modifications for the micro-PPT testing now provide a three order-of-magnitude sensitivity increase in thrust measurement. The directorate saved over \$1 million after applying these innovations to these two programs.

## **Background**

Capt Lake's solid rocket motor provides controllable performance like that of a liquid rocket engine in a much simpler design and provides future Air Force spacecraft with more options for high thrust and reliable operation. Future missions, such as on-orbit servicing and next-generation kinetic energy interceptors, are active candidates for this first-of-a-kind solid rocket propellant.

Engineers design electric propulsion systems for spacecraft to fire for prolonged periods and they test them for long periods. The High Power Hall thruster test requires 7,200 hours to simulate a full space mission. This originally required human operators to monitor the thruster continuously 24 hours a day. Capt Lake's new control system eliminated the need for 24-hour monitoring and supervision, and replaced the test operators with automated software capable of making important decisions autonomously.

Micro-PPT spacecraft engines produce thrust levels in the micro-pound range, but operate continuously for an extended period. Accurate measurements during testing allow significantly enhanced precision in the calibration of these thrusters. Future generations of Air Force micro-satellites could benefit from this advancement in thrust measurement.

## **Additional information**

To receive more information about this or other activities in the Air Force Research Laboratory, contact TECH CONNECT, AFRL/XPTC, (800) 203-6451 and you will be directed to the appropriate laboratory expert. (02-PR-01)

Propulsion  
Awards and Recognition