Air Force Research Laboratory | AFRL
Science and Technology for Tomorrow's Aerospace Forces

Success Story

DR. RUSSELL L. SPYKER RECEIVES THE AIR FORCE SCIENCE AND ENGINEERING AWARD FOR ENGINEERING ACHIEVEMENT

The Air Force awarded Dr. Russell L. Spyker of the Propulsion Directorate the Air Force Science and Engineering Award for Engineering Achievement. Dr. Spyker is the leader of a nationally renowned power electronics research and development team that generated astonishing results and productivity during 2001.

Air Force Research Laboratory
Wright-Patterson AFB OH

Accomplishment

An exceptionally resourceful engineer, Dr. Spyker, led his team in conducting ten multi-disciplinary research projects to develop original and inventive solutions to a number of aerospace electrical power system problems. Collaborating with industry partners, Dr. Spyker's accomplishments include the development of low-cost capacitor packaging, current transformers, solid-state circuit breaker research for the National Aeronautics and Space Administration's (NASA's) electric airborne power unit (APU) for the Space Shuttle, and ultra capacitor applications for battery-like performance with 100 times the life-cycle improvement over batteries.

Background

Capacitors for military application typically require costly, hermetically sealed units. The non-hermetic capacitor packaging developed under Dr. Spyker's leadership is one-sixth the cost of sealed capacitors and saves 30% weight and volume while meeting or exceeding military and commercial specifications. His ratiometric current transformer overcomes stray inductance, allows fine tuning after installation, reduces manufacturing costs, and provides a 70% weight and volume savings over the state-of-the-art.

The Air Force selected Dr. Spyker to serve on NASA's Independent Assessment Team for the electric APU, the highest priority upgrade program for the Space Shuttle. He identified several technology shortcomings including the lack of adequate short-circuit fuse protection.

The fault current from the proposed 270-volt direct current batteries could reach 4,000 amps, and no existing space-qualified circuit breaker could interrupt this magnitude of current. To solve this problem, Dr. Spyker experimented with an innovative design that incorporates solid-state switches in parallel with a circuit breaker. Dr. Spyker and his team completed the design, fabrication, and successful demonstration of his novel solid-state circuit breaker in six weeks, just in time to meet NASA's critical decision milestone on the electric APU program.

Searching for a replacement for low discharge-rate batteries that power thousands of military and commercial aerospace subsystems, Dr. Spyker and his team exploited the unique characteristics of ultra-capacitors, a new high energy density storage device. Using these capacitors at a slow discharge rate gives battery-like performance and offers nearly a hundredfold life-cycle improvement over existing batteries.

Propulsion
Awards and Recognition

Additional information

To receive more information about this or other activities in the Air Force Research Laboratory, contact TECH CONNECT, AFRL/XPTT, (800) 203-6451 and you will be directed to the appropriate laboratory expert. (01-PR-09)