Air Force SBIR STTR INNOVATION
TECHNOLOGY WITH DEMONSTRATED RELEVANCE
BETTER PERFORMANCE IN HIGH-TEMPERATURE AND RADIATION ENVIRONMENTS

TOPIC NUMBER:
AF103-080

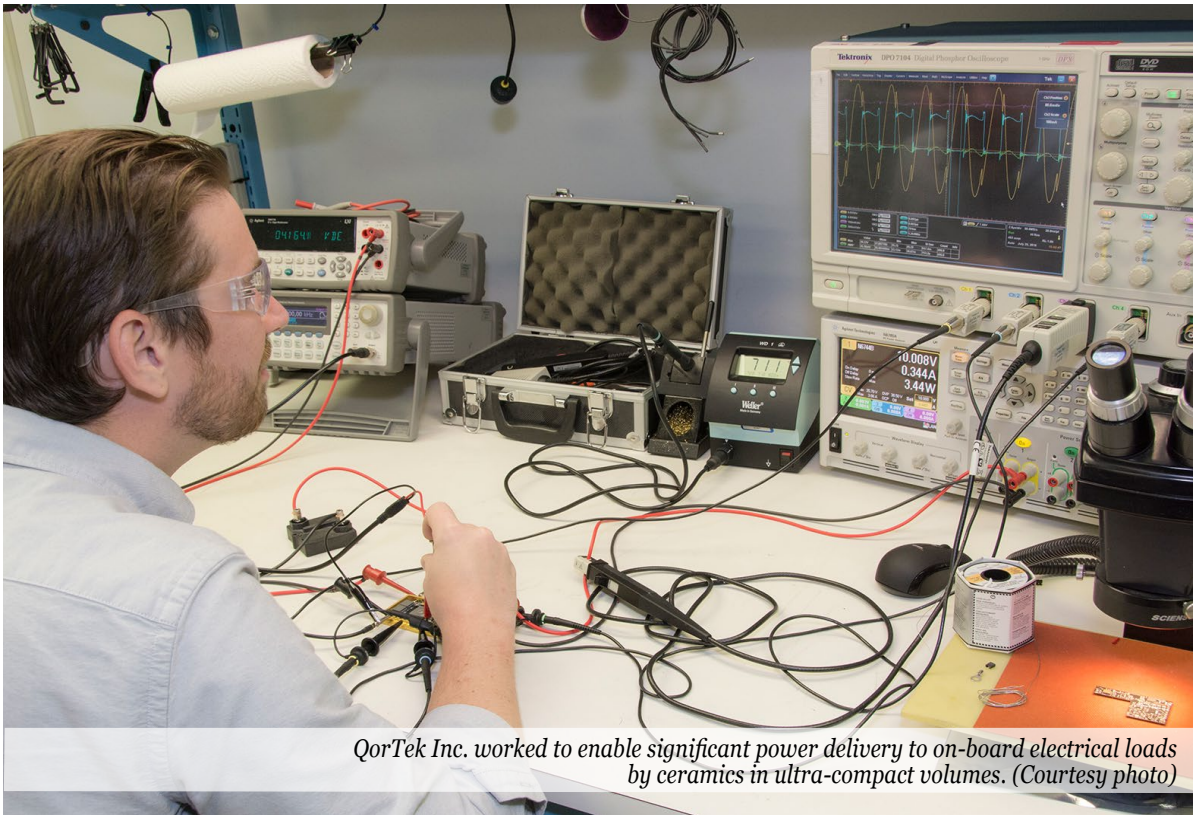
TOPIC TITLE:
Radiation-Resistant, High-Efficiency Direct Current-Direct Current (DC-DC) Converters for Spacecraft Loads

CONTRACT NUMBER:
FA9453-12-C-0102

SBIR COMPANY NAME:
QorTek Inc.
Williamsport, PA

TECHNICAL PROJECT OFFICE:
AFRL Space Vehicles Directorate,
Kirtland AFB, NM

PUBLISHED:
August 2016



QorTek Inc. worked to enable significant power delivery to on-board electrical loads by ceramics in ultra-compact volumes. (Courtesy photo)

PAVING THE WAY

FOR NEW COST-CUTTING SPACE POWER TECHNOLOGY

Spacecraft power systems are typically large and heavy, adding significant cost to government and commercial missions. However, a Pennsylvania-based small business is pushing the boundaries to create a more compact solution that boosts reliability and drives down the price.

Backed by the Air Force Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Program, QorTek Inc. developed a new ceramics-based electronics technology that is smaller and lighter, as well as better suited for high-temperature and radiation environments, than traditional space power systems.

Officials at Air Force Research Laboratory's Space Vehicles Directorate say the effort was a success as the new part performed well under initial radiation testing. That sets the stage for a whole new class of power solutions for missile and space applications.

continued >

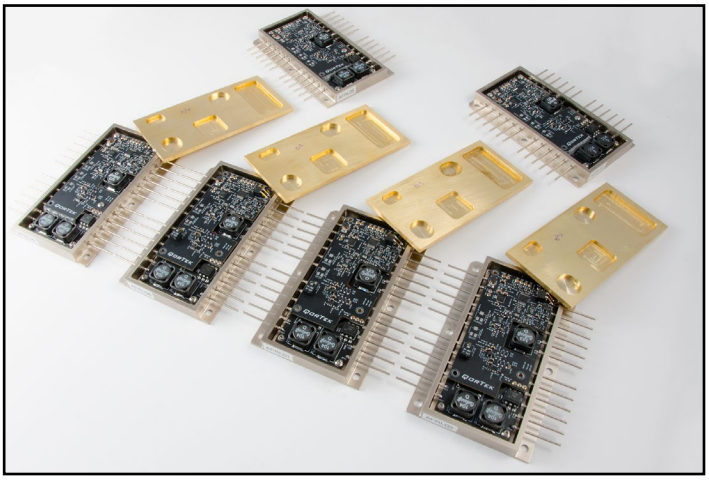
377ABW-2016-0032

BIG REWARDS, YET LITTLE PROGRESS BEFORE NOW

Components of modern power converters are inherently unsuited for the severe environment of space, so designers usually add significant amounts of thermal and radiation protection. In addition to being bulky, these systems tend to cause the most reliability issues among all systems on a space mission.

The ability to reduce failure risks at higher temperature or radiation exposure levels would boost the dependability of power systems while simultaneously lowering weight and creating additional space, which translates into reduced launch costs.

Ceramic transformers have tremendous potential to accomplish the task – as they are both inert to radiation and handle wide thermal operating environment extremely well. However, despite superiority compared to traditional magnetics-based systems for space needs, ceramics have not been widely transitioned into power applications for munition, missile or space systems.



Under SBIR, QorTek developed a range of DC-DC converters based on a novel ceramic power core designs. (Courtesy photo)

AIR FORCE SBIR PROGRAM SUPPORTED NEW APPROACH

Making a breakthrough required a new way of thinking to enable significant power delivery to on-board electrical loads by ceramics in ultra-compact volumes. This also led to a way of enabling efficient switching power supplies without the need to incorporate large magnetic transformers or costly digital processors.

The Air Force and Department of Defense have focused on enhancing space power electronics through advances in materials and designs. Under the Air Force SBIR, QorTek developed a range of DC-DC converters based on a novel ceramic power core designs that have now successfully gone through mechanical and thermal testing as well as a range of radiation exposure testing.

ECONOMIC DEVELOPMENT POTENTIAL

The early success led QorTek to spinout a new small business dedicated to developing advanced ceramic transformers, sensors and energy harvesting devices. This new company has recently been awarded SBIR funding from National Science Foundation and NASA to develop its advanced ceramics technology and is working with major defense contractors, the Air Force, the Army, the medical community and the commercial sector in transitioning this new technology into products.

Company officials say the new technology also is being considered for use in a range of satellites and next-generation “smart” munitions as well possible applications by the electronics and energy industries.

QorTek has been honored with a U.S. Small Business Administration Tibbetts Award for its participation in the Air Force SBIR/STTR Program.