Marquette University: Professor receives Department of Energy grant through ASCEND program

Posted on Tuesday, Mar 2, 2021

Contact: Kevin Conway, Associate Director of University Communication (414) 288-4745 – office, (414) 202-9329 – mobile, kevin.m.conway@marquette.edu

MILWAUKEE —Dr. Ayman EL-Refaie, Werner Endowed Chair in Secure/Sustainable Energy and professor of electrical and computer engineering in the Opus College of Engineering at Marquette University, has been awarded a grant from the U.S. Department of Energy to develop the next generation of electric drivetrains for aerospace propulsion. The award has a phase one value of $1.6 million over 18 months.

This grant is a part of the Advanced Research Projects Agency-Energy's (ARPA-E) Aviation-class Synergistically Cooled Electric-motors with iNtegrated Drives (ASCEND) program. The goal will be to develop an electric drivetrain which meets or exceeds the ARPA-E's system-level targets for power-to-weight ratio and system efficiency.

Marquette was awarded the grant with subawards and partnerships with National Renewable Energy Lab, Florida State University and Raytheon Technologies Research Center. Dr. Nathan Weise, assistant professor of electrical and computer engineering at Marquette, is a co-principal investigator on the grant.

"We are appreciative for this opportunity given by the Department of Energy to pursue the development of a very high specific power, high efficiency electric propulsion system for aerospace applications," EL-Refaie said. "This project will involve the development of an advanced electric motor, as well as an integrated

power converter and a thermal management system."

The team will develop a novel motor enabled by additive manufacturing and a novel thermal management scheme; novel modular power electronics topology; and tight integration concepts coupled with advanced and shared thermal management system. The first phase of the project will focus on finalizing a conceptual design, sub-component and component testing, and risk retirement. Phase two, which is expected to be at a level of $3.82 million over two years, will focus on component procurement, system integration, and verification testing of the technology.

"This is a very exciting time for Dr. El-Refaie and his research teams," said Dr. Kristina Ropella, Opus Dean of the Opus College of Engineering. "That his work has drawn two high-profile grants from Department of Energy to advance electric drivetrain development is a testament to the innovative work he is doing at Marquette."

EL-Refaie was awarded a $5 million grant in October through the DOE's Office of Energy Efficiency and Renewable Energy for research that aims to develop novel drivetrains that will lead to more affordable, efficient, and secure electric transportation.

ASCEND projects work to develop innovative, lightweight, and ultra-efficient all-electric powertrain with advanced thermal management systems that help enable efficient net-zero carbon emissions for single-aisle passenger commercial aircraft. The program works to decrease energy usage and associated carbon emissions for commercial aircraft propulsion systems.