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## ***NETL* REPORTS:**

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### ***NETL Student Collaborator Earns Master's Degree in Mechanical Engineering Nate Black Successfully Defends Thesis Based on Energy Department Technology***



Nathaniel Benjamin Black, a graduate student of Dr. Jeffrey Vipperman working under the National Energy Technology Laboratory's (NETL) University Research Initiative, passed his thesis defense on April 2 and was awarded a Master of Science in Mechanical Engineering from the Swanson School of Engineering at the University of Pittsburgh on April 26.

Black's thesis, "Active Combustion Throttle" (ACT), chronicles the development of the ACT, a fuel flow modulator that originated at NETL and was developed in collaboration with the University of Pittsburgh. The ACT is a compact, variable throttling valve targeted at adjusting and balancing fuel flow distribution on low-emission gas turbines. The technology was designed to work with existing sensing technology, the Combustion Control and Diagnostic Sensor (CCADS), which measures combustion flame quality in real time. CCADS was developed by NETL and licensed for commercialization. When used in conjunction with CCADS, the ACT will be an important component of real-time combustion management, allowing operators to control combustion systems regardless of wear in fuel delivery components or changes in fuel quality and type (fuel flexibility). These technologies will aid in developing more efficient, reduced-emission power plants by providing fuel flexibility, reduced emissions, better efficiency, and active combustion control.

"Black's work on this project over the past two years was exemplary," said Peter Hensel, an electronics engineer at NETL who worked as Black's technical project monitor.

During his collaboration with NETL, Black worked with the Energy System Dynamics Division of the Office of Research and Development. The division conducts research in gas-fueled (coal gas, natural gas, hydrogen) power systems, and, as a partner with this team, Black was conducted research on technology options to improve efficiency and operability, to reduce emissions and costs and to improve fuel flexibility. The division performs research in the areas of combustion science and technology, emissions reduction, fuel cells and dynamics of engines or other energy conversion devices. Under the guidance of fellow scientists and his advisor, Dr. Vipperman, Black worked with colleagues at NETL to investigate theoretical and fundamental phenomena to support program needs and develop new concepts.

Black was born in Americus, Ga. and resides in Bethel Park, Pa. He was recently hired at L-3 Communications, Brashear Division.

NETL's University Research Initiative facilitates a unique collaboration between NETL researchers and university professors and students at the University of Pittsburgh and Carnegie Mellon University in Pittsburgh, Pa., and West Virginia University in Morgantown, W.Va. The initiative enhances NETL's research capabilities while helping to produce the next generation of fossil energy researchers, establishing relationships with university professors who might not otherwise be aware of the fossil energy research needs. The initiative brings some of the brightest university undergraduate students into NETL's laboratories to become familiar with its research needs, research staff, and research facilities. The terms of the initiative require that at least two of the universities identify research projects that are appropriate to NETL's mission, and that the university researchers must agree to do at least part of the research at NETL labs.

NETL is one of the Department of Energy's national laboratories. The laboratory manages and implements a broad spectrum of energy and environmental programs. It employs approximately 1,100 federal employees and support-service contractors at its sites in Pittsburgh, Morgantown,, Tulsa, Ok., Fairbanks, Alaska, and Albany, Ore.

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