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Shock tube investigation of aerospace fuels for zero-carbon future: A US-Germany collaboration

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Introduction

This project results from a long-standing international collaboration between the University of Central Florida (UCF) and the German Aerospace Center (DLR). This effort supported integrated graduate and undergraduate student teams consisting of 6 participants per year to pursue 2-month research projects at the German Aerospace Center (DLR) on next-generation propulsion and power generation technologies. Researchers from UCF and DLR will focus on new and disruptive research in advanced materials and combustion. Technical areas of focus are i) superior turbine cooling geometries enabled by 3D printing superalloys, ii) high temperature and sand-resistant jet turbine coatings, and iii) new fuels that enable high combustion efficiency with reduced emissions. The new integrated focus on materials and combustion will train the next generation of interdisciplinary global scientists to support advanced gas turbine and hypersonic initiatives. Graduate and undergraduate student teams will acquire knowledge in experimental design during pre-preparation training in Spring under directed research modules at UCF while communicating with international mentors. In the summer, they will perform measurements using unique facilities at DLR.

In the combustion area, we have so far focused on low-carbon fuels since the year 2017. 4 students have gone to Germany to work on shock tube-related projects. Experimental investigations into hydrogen (H_2) fuel are quickly becoming top priorities in the combustion community due to the increasing demand for H_2-powered turbine engines, both for turbine power plants and aircraft propulsion. H_2 is a favorable fuel source because of its zero-carbon emissions and its natural abundance in chemical compounds such as methane (CH_4), water (H_2O), and ammonia (NH_3), allowing it to be mined from many sources through electrolysis. Similarly, we have looked into the effects of CO_2 dilution for low-emission methane combustion cocnepts.

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