COMBUSTION WEBINAR

Combustion Science Needed to Develop Hypersonic Aircraft

Speaker: Dr. James Driscoll, University of Michigan

Time: *October 17, 2020*
10 am EST; 4 pm Paris; 10 pm Beijing.

Meeting: *Zoom*

Registration (required):
Check *https://sun.ae.gatech.edu/combustion-webinar*
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Biography

Dr. James F. Driscoll is the A.B Modine chaired professor of Aerospace Engineering at the University of Michigan, U.S.A. His research focuses on two topics: obtaining a fundamental understanding of turbulent combustion by applying kilohertz imaging diagnostics, and the optimization of supersonic combustion within dual-mode ramjet-scramjet engines that propel hypersonic vehicles. His recent research has been funded by AFOSR, AFRL, NSF and General Electric. He received his Ph.D. from Princeton University in 1975 and he is a Fellow of the Combustion Institute and is a Fellow of the AIAA. He recently completed his term as the President of the Combustion Institute.

Abstract

NASA, the U.S. Air Force and Boeing are studying ways to fly drones (and eventually passenger airplanes) at hypersonic speeds. The X-51 was powered by a dual-mode (ramjet-scramjet) engine and Boeing identified several combustion-related problems. The X-51 suffered an unstart when gaseous ethylene fuel was replaced with liquid JP-7 during flight. Recently, we completed an eight-year collaborative research program with AFRL that also involved Dr. Kevin Bowcutt of Boeing, the designer of the X-51. It led to our model, called MASIV (Michigan-AFRL Scramjet in Vehicle) that simulates a generic X-43 vehicle that is trimmed during ascent. Proper control of the engine heat release distribution (i.e., the combustion) is required to avoid unstart, flameout, excessive heat transfer, incomplete combustion, and unwanted unsteady dynamics during the ramjet-to-scramjet transition. The MASIV model identified the need to optimize the finite-rate chemistry of the JP-7 surrogate fuel (as modeled by HYCHEM), as well as the jet-in-cross flow mixing, the scalar dissipation rates and the limitations imposed by thermal choking.