Graduate Colloquium, Aerospace Engineering

WPI

Airborne Particle Deposition in Jet Engine Hot Sections

Should I Board a Flight during a Sandstorm

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Abstract

The subject of deposition in gas turbine hot sections has seen an explosion of interest in the last thirty years. Growth markets for commercial aviation (Asia, Africa, and the Middle East) are known to be regions with elevated micron-sized particulate, both naturally occurring and man-made. This increased traffic in regions of heightened airborne particulate levels has resulted in loss of engine performance, increased maintenance intervals, and accelerated deterioration of engine components. At the same time, two key technological advances have combined to render modern gas turbines more susceptible to this increased particulate load. First, the pursuit of higher performance and efficiency has led to hot gas temperatures in modern engines that exceed melting temperatures of nearly all ingested particulate. Second, higher fidelity computational tools have significantly shortened the design cycle of modern engines while at the same time allowing for more complex designs that are operating closer to their peak efficiency. In some cases, this has resulted in products that have a reduced ability to compensate for erosion, deposition, and wear. Meanwhile, researchers have struggled to understand and model the complex physics of deposition at relevant engine operating conditions (high pressure and temperature). Full engine tests are prohibitively expensive and provide limited detailed data for CFD modeling and validation. To close this gap, Dr. Bons' lab has spent over two decades researching gas turbine deposition and providing key data, insights, and models to the engine community. In this presentation, he will share some of these insights as a pattern for tackling other multi-disciplinary challenges as tomorrow's engineers.

Dr. Bons received his PhD in Aeronautical and Astronautical Engineering from MIT in 1997. Prior to this, he worked for 4 years at the Air Force Research Laboratory in Dayton Ohio. From 1997-2002 he was an assistant professor at the Air Force Institute of Technology (AFIT) in Dayton, Ohio and from 2002-2007 he was an associate professor in the Department of Mechanical Engineering at Brigham Young University (BYU) in Provo, Utah. He has been part of the Aerospace Engineering faculty at OSU since 2007 and is the director of the Turbine Aerothermodynamics Laboratory at the Aerospace Research Center (https://mae.osu.edu/tal). His research interests include gas turbine hot section performance, turbine cooling, and deposition as well as active flow control for wings, propellors, and turbines. He and his wife Becky have 6 children and 12 grandchildren and live in Dublin, OH. He is a fellow of ASME and an associate fellow of AIAA. He is also associate editor for the AIAA Journal of Propulsion and Power.