Boulder Fluid and Thermal Sciences Seminar Series

Tuesday, April 26, 2016
3:30pm-4:30pm (refreshments at 3:15pm)
Bechtel Collaboratory in the Discovery Learning Center (DLC)
University of Colorado, Boulder

Simulating Turbulence with Pitch-Wise Uniformity Across a Turbine Cascade Entrance

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Aircraft operating at high altitudes and low velocities are susceptible to turbine engine performance losses due to low operating Reynolds numbers in the turbine section. Cascade wind tunnels are used to simulate two-dimensional flow characteristics associated with turbine operating conditions in order to identify and suppress undesirable flow phenomena such as boundary layer separation. It is important to simulate pitch-wise uniform flow characteristics across the turbine cascade entrance. Two passive, square-bar turbulence generating grid arrangements were explored to simulate pitch-wise uniform turbulence, one grid assembly was perpendicular to the inlet flow and the other parallel to the turbine cascade. Reynolds numbers in this study were 50k and 100k, based on turbine axial chord, and grids were placed at three different locations upstream of the turbine cassette to simulate freestream turbulence intensities ranging from 3% to 6%. Turbulence produced by an innovative T-Bar turbulence grid assembly oriented parallel to the turbine cascade had better pitch-wise uniformity than that produced by a mesh grid oriented perpendicular to the inlet flow; however, blade-to-blade periodicity of surface pressure coefficient profiles appeared to be insensitive to turbulence grid configuration.

Biography: Lt Col Kurt Rouser earned a B.S. in Aeronautical Engineering from the USAF Academy (USAFA) in 1995. From 1995-1998, he served as Turbine Engine Technology Analyst in the National Air Intelligence Center at Wright-Patterson AFB, OH. From 1998-2000, he was assigned to the Propulsion Directorate, Oklahoma City Air Logistics Center (OC-ALC), Tinker AFB, OK as TF-33 Maintenance Engineer, Lead TF-33 Test Engineer and Executive Officer. In 1999, he completed an M.S. in Aviation Science from OK State University, where he subsequently became an adjunct professor. In 2000, he was reassigned to the KC-135 System Program Office, OC-ALC, as Lead Depot Standardization Engineer and began teaching at Southeastern OK State University. In 2002, he completed an M.S. in Aeronautical Engineering at the Air Force Institute of Technology (AFIT) and began teaching in the Department of Aeronautics at USAFA. In 2005, he reported to the Arnold Engineering Development Center, Arnold AFB, TN where he served as Aeropropulsion Test Technology Project Engineer and Operations Officer for turbine engine testing in the 717th Test Squadron. In 2008, he returned to AFIT and completed a PhD in Mechanical Engineering in 2012. He subsequently returned to the USAFA Department of Aeronautics, where he is currently Assistant Professor. In 2014, he joined the Dean of the Faculty staff as Deputy Associate Dean for Educational Innovation, where he is responsible for a staff of six directors for instructional design, educational technology, academic assessment, faculty development, the Academy Scholars Program, and the Scholarship of Teaching and Learning Program.