Project Title: Benchmark Turbulent, Compressible Mixing Layer Measurements

Advisers: Prof. Greg Elliott (AE) and Prof. Craig Dutton (AE)

Project Description:
The fundamental objective of this project is the acquisition of benchmark, CFD validation-quality data for the canonical fluid dynamics problem of compressible, turbulent mixing layers. This database will provide high-quality measurements, particularly of shear layer mean velocities and Reynolds stresses, which can be used for comparison against computational simulations of the flow by RANS, LES, and DES methods. The measurement methods used include schlieren flow visualization, planar laser-induced fluorescence (PLIF), stereo particle image velocimetry (SPIV; primary method), filtered Rayleigh scattering (FRS), and hot-wire anemometry (HWA). Important quantities that are obtained, particularly from the SPIV measurements, are the full three-component mean velocity field and the full Reynolds stress tensor field. In order to improve the parameter range of this experiment, we will be heating the lower speed free stream on one side of the shear layer. On this project your task will be to assist a graduate student to obtain measurements utilizing one or more of the techniques described above in the heated shear layer experiment. This data will help determine the effect of temperature on the turbulent structures in the shear layer and the nature of the mixing between the two streams.

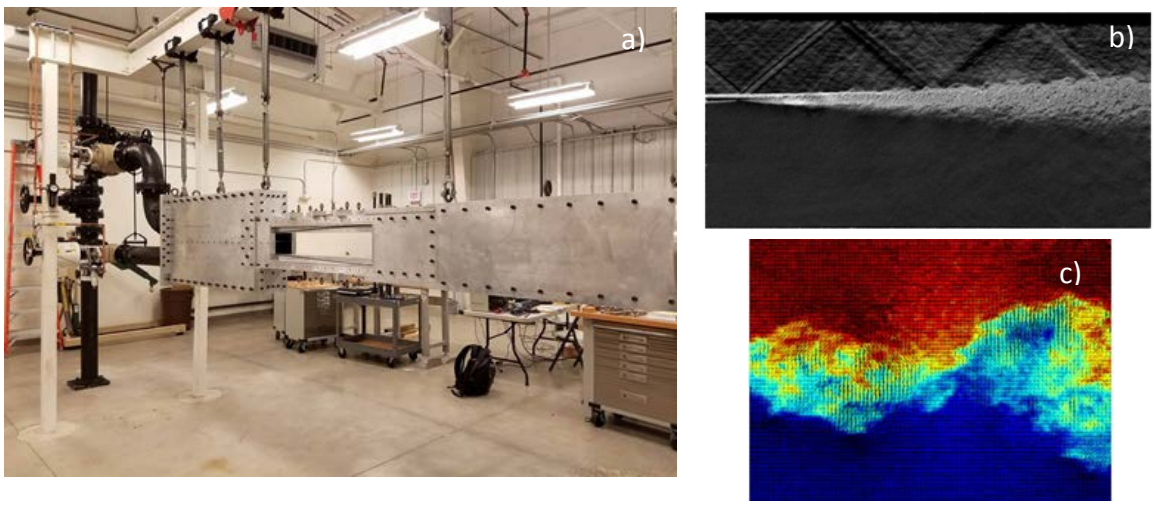

Fig. 1 Compressible mixing layer facility (a), schlieren visualization (b), and instantaneous SPIV image (c).

Student Background and Expected Research Activities:
We are seeking a highly motivated student who is interested in performing fluid dynamics *experiments*. Previous experience with advanced fluid measurement methods, such as stereo PIV or Mie scattering imaging, is not necessary. Previous fluid dynamics course work, especially in compressible flow, is desirable. This is a NASA-sponsored project, and the student selected will interact with our NASA Glenn technical monitors.

Points of Contact:
Prof. Greg Elliott (elliottg@illinois.edu) and Prof. Craig Dutton (jcdutton@illinois.edu

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