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Design and Construction of a Liquid-Fuel Detonation Tube Facility CALVIN YOUNG, JACOB MCFARLAND, Texas AM University, PRAVEEN RAMAPRABHU, University of North Carolina, Charlotte — A new facility is built in order to facilitate the study of multiphase phenomena occurring in liquid-hydrocarbon fueled detonations. The mechanisms behind detonations in this regime are many, and occur over a wide range of time scales. As such, the process of droplet combustion, through breakup, vaporization, and reaction, has yet to be fully characterized. To capture such phenomena, measurements of high temporal and spatial resolution are required. For this purpose, a detonation tube is constructed and fitted with a host of diagnostics. A novel in-situ method of particle sizing is implemented to characterize droplet sizes and particle volume fractions. Further laser-optical systems are introduced for high-resolution imagery and video, Schlieren imagery, and pyrometry. Via these tools, important data on liquid-fuel combustion in the detonation regime, from the individual particle up to jets and sprays, is obtained. Through collaboration with simulation developers, this data will be used to improve and validate simulation capabilities and models, such that multiphase reactions in detonations may be predicted accurately and efficiently.

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