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Author: Mr. Danetti Martino
Viterbi School of Engineering, USC, United States, danettim@usc.edu

Mr. Armen Aroutiounian
Viterbi School of Engineering, USC, United States, aaroutio@usc.edu

Mr. Fred Schaffer
Viterbi School of Engineering, USC, United States, fschaffe@usc.edu

Mr. Rohin Lengade
Viterbi School of Engineering, USC, United States, lengade@usc.edu

Mr. Michael Sola
University of Southern California, United States, mrsola@usc.edu

DEVELOPMENT OF A SMALL SCALE LOX/KEROSENE POWERED FLIGHT VEHICLE:
METHODS OF MASS AND COST OPTIMIZATION**Abstract**

To compete in The Collegiate Propulsive Lander Challenge, which is composed of multiple milestones such as throttling and thrust vector controlling a rocket engine, the University of Southern California Liquid Propulsion Lab (LPL) is developing a LOx/Kerosene ‘hopper’ composed of custom and commercial off-the-shelf (COTS) components. The scope of this paper covers the challenges, constraints, and innovations of the technologies developed by LPL to be used in future static hotfires to complete the aforementioned milestones.

LPL modified a previously static fired GOx/Kerosene engine to accommodate LOx as the oxidizer. The engine will be fired on LPL’s feed system ‘Hodor,’ a test stand referenced in IAC publication IAC-22-C4,IP,37,x72784. For throttling capability, a custom-made valve actuator was designed for the fuel main ball valve. Additionally, the feed system includes manual spring-loaded pressure reducing regulators that were automated using a COTS stepper motor and in-house 3D-printed gears, providing an inexpensive alternative to typical electronic pressure regulators. This enables remote pressurization of the propellant tanks and the capability to counteract regulator droop during engine firing. COTS quick disconnects (QD) are another expensive component with long lead times. LPL developed custom 3D printed remote QD systems for pre-launch operations. Each component and its associated systems/electronics underwent final qualification testing and verification prior to integration into the Hodor feed system.