Abstract Submitted for the DFD19 Meeting of The American Physical Society

Sloshing and its effects on thermal mixing in aircraft fuel tanks¹ CONNOR ROHMANN-SHAW, DUNCAN BORMAN, MARK WILSON, University of Leeds — Modern aircraft designs are becoming ever more complex, with higher demands on their performance capabilities. As the thermal loads from the airframe, engine, electrical systems etc. increase, one of the key challenges is thermal management. A solution is to use the fuel as a coolant; fuel is used as a heat sink for components around the aircraft and then recirculated back into the fuel tanks. To fully optimise this method however we must expand upon existing thermal management models by better understanding the thermal mixing process internal to the fuel tanks, with particular attention given to the role of fuel sloshing. The multi-phase Volume of Fluid method of free-surface tracking is used to predict fluid motion, which we couple to the thermal flow field using the Boussinesq approximation. Using these numerical simulations, we investigate the effect that sloshing has on thermal mixing, allowing us to inform future design considerations. Experiments undertaken using thermocouples to measure the evolution of the temperature field in a turbulent free-surface flow will also be presented.

¹Supported by the EPSRC [grant EP/L01615X/1]

Connor Rohmann-Shaw University of Leeds

Date submitted: 31 Jul 2019

Electronic form version 1.4