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C1Po1A-02: Energy of Fluid (EOF) Simulation of Large-Scale Densification and Solidification of Hydrogen

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The current research develops a finite volume-based Computation Fluid Dynamic (CFD) model utilizing an Energy of Fluid (EOF) approach to generate a simulation of the densification of liquid hydrogen (LH2) in the Integrated Refrigeration and Storage (IRAS) experimental tank for the Ground Operations Demonstration Unit for Liquid Hydrogen Project (GODU-LH2) at the Kennedy Space Center (KSC). The computational code will integrate a commercial software pressure-based model with User Defined Functions (UDF) generated and added to the model. The modified model will solve the energy equation in terms of internal energy and provide temperature and pressure calculations for a given tank geometry. This method will decrease computational time when compared to the built-in commercially available Enthalpy solvers. Currently the research focused on utilizing User Defined Scalars (UDS) compared to the enthalpy model and a lumped node analysis to show the written UDS is as accurate as the built-in solvers, and the models will be verified using known solutions for solidification and validated with the experimental results from the Cryogenics Test Laboratory (CTL) at KSC for the IRAS densification process.

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