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Development of a Ground Operations Demonstration Unit for Liquid Hydrogen at Kennedy Space Center

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NASA operations for handling cryogenics in ground support equipment have not changed substantially in 50 years, despite major technology advances in the field of cryogenics. NASA loses approximately 50% of the hydrogen purchased because of a continuous heat leak into ground and flight vessels, transient chilldown of warm cryogenic equipment, liquid bleeds, and vent losses. NASA KSC needs to develop energy-efficient cryogenic ground systems to minimize propellant losses, simplify operations, and reduce cost associated with hydrogen usage. The GODU LH2 project will design, assemble, and test a prototype storage and distribution system for liquid hydrogen that represents an advanced end-to-end cryogenic propellant system for a ground launch complex. The project has multiple objectives and will culminate with an operational demonstration of the loading of a simulated flight tank with densified propellants. The system will be unique because it uses an integrated refrigeration and storage system (IRAS) to control the state of the fluid. The integrated refrigerator is the critical feature enabling the testing of the following three functions: zero-loss storage and transfer, propellant densification/conditioning, and on-site liquefaction. This paper will discuss the design of the system, the current status of the installation, and the test objectives.

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