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C2Or3B-03: Development and Demonstration of Mobile Hydrogen Liquefaction and Storage System

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A mobile hydrogen liquefaction and storage unit has been developed to demonstrate the liquid hydrogen (LH₂) value chain including hydrogen production, liquefaction, storage, transfer, and recovery. This unique LH₂ technology demonstrator, or LS20 mobile system, is one of the primary systems for a multipurpose LH₂ test platform that tests controlled storage and zero-loss transfer methodology. The LS20 system has been designed, fabricated, and tested at GenH₂ Corp. The system consists of an electrolyzer, gas precooler, Ortho-Para hydrogen converter, cryocooler-based hydrogen liquefier, portable LH₂ storage tank, ultralight LH₂ fuel tank for aviation application, safety devices and sensors, automated venting system, and associated sensors, instrumentation, and control system. The LS20 system was successfully demonstrated by continuous hydrogen liquefaction according to the design specification with help of an automated control system and maintained LH₂ at a desired level without boiloff loss. In addition to liquefaction and controlled storage of LH₂, zero-loss LH₂ transfer, boiloff gas recovery, and re-liquefaction were successfully demonstrated with the LS20 mobile system. The results provide proof-of-concept data for future LH₂ infrastructure design as well as the critical LH₂ refilling and servicing methodology for many hydrogen mobility applications. The system design, fabrication, operational methodology, and test performance results are discussed in this paper.

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