ENERGY EFFICIENT TRANSFER AND STORAGE OF LIQUID H2 WITH MAGNETIC LEVITATION

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Energy efficient, cost effective cryogenic distribution and storage technology of Liquid Hydrogen (LH) up to several miles and multi-tones has been strongly commanded for several NASA and DOE projects. For large scale and long term distribution and storage of LH, to significantly reduce the heat leak from outside to LH is one of the most crucial tasks. The conduction heat loss from the supports that connect the lines cold mass to the warm support structure is ultimately the most serious heat leak. The purpose of this project is to develop a Mag-Lev cryogen transfer line and storage tank using magnetic levitation by permanent magnets and high temperature superconductivity (HTS) to eliminate the mechanical contact and thus, the conduction part of the heat leak. An innovative insulation system is also proposed to improve the performance for both rigid and flexible lines. The novel design could reduce heat leak dramatically, is more flexible and has much less transfer loss of cryogens. AMAC has successfully completed all the tests for NASA feasibility studies of the Cryogen project. Comprehensive investigations of the concept design, various arrangements of High Temperature Superconductor (HTS)-Permanent Magnet (PM), material choice of HTS-PM, cryogenic cooling, and thermal insulations have been conducted analytically and experimentally. In order to verify the concept design, two demonstration modules have be constructed and successfully tested for magnetic suspension, horizontal and vertical stability, and other important performance. These technologies can also be developed focusing on DOE's LH missions.