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# C2Po2B-05: Tuning hydrogen boil off via inert gas insulation purge in a vapor cool shielded fuel tank

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Vapor cooled polymer composite tanks for liquid hydrogen are a new opportunity for light weight power-system integration into unmanned aerial vehicles. Vapor shielding has the ancillary benefit of pre-conditioning the hydrogen for use by a fuel cell. However, the mass flow rate required by a fuel cell should be matched by the natural boil-off rate of the tank. With limited ability to vary insulation thicknesses, the challenge becomes satisfying the fuel cell consumption in UAV at different mass flow rates when at varying stages of flight from take-off, cruising, and landing. This paper details how batch purging with helium or argon in the vapor cool shielded insulation layer can affect the mass flow rate of hydrogen, to aid in optimal fuel-cell feed rates. A 5-shell vapor cooled shielded tank is used with two layers of insulation including aerogel, and helium or argon, and two vapor channels. A more complete understanding of system-level thermal conductance is determined by measuring mass flow of hydrogen leaving the tank during hypothetical flight missions.

**Author:** GITTER, Yulia (Washington State University HYPER Lab)

**Co-author:** Dr LEACHMAN, Jacob (Washington State University HYPER Lab)

**Presenter:** GITTER, Yulia (Washington State University HYPER Lab)

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