This work investigates the performance of cryogenic multilayer insulation (MLI) as the radiation shields are spaced at different intervals. MLI is the preferred insulation for long duration cryogenic fluid tanks in space or in a vacuum chamber on earth. Most heat transfer through it is eliminated by using the vacuum to minimize gas conduction, using multiple radiation shields to minimize radiation, and designing long solid conduction paths into the system. Much research has been previously conducted on MLI at cryogenic temperatures using various techniques, however, the performance of the insulation when the layer spacing is carefully controlled and kept low (on the order of 1 layer/mm) has not been well characterized. Some previous investigators have alluded to an optimal spacing of the layers, but have not experimentally or quantitatively predicted its existence. This work both predicts the optimal density and then experimentally checks it using liquid nitrogen boil-off calorimetry.

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The public is welcome to attend.