

Abstract

A feasibility study for the design of a passively cooled thermal space coupled with thermal storage was conducted. A cold space compartment was designed around an existing vapor compression system used to generate an ice/water reservoir. The temperature of the cold space was measured and compared with theoretical calculations. Two designs were implemented using 1/8" foam core; a single layered cold space box with an interior volume of 1.24 cubic feet, and a dual layered cold space box with an air gap to be used for insulation with the same external dimension but a reduced interior volume of 1.1 cubic feet. It was determined, for the single layered box a steady-state temperature of 15°C and for the dual layered box a steady-state temperature of 14°C. These temperatures are not suitable for refrigeration. In order to achieve a lower temperature, thermal fins were added to the wall separating the reservoir from the cold space. A temperature decrease of approximately 1°C was achieved by the fins. A smaller compartment with a volume of 0.5 cubic feet was built and tested with a dual layered insulation, half width box with fins was recorded with a temperature of 8°C . The thermal storage feasibility study determined that by allowing the reservoir to completely fill with ice, the temperature of the reservoir can be maintained at 4°C with a corresponding cold space temperature below 10°C for 12 hours without the need of the compressor running.