

DESIGN METHODOLOGY OF EXPERIMENTAL SET-UP FOR PHASE CHANGE LIGHTER-THAN-AIR SYSTEM

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Abstract

This paper focusses on design and sizing of an experimental set-up to investigate the efficacy of employing Phase-change of a fluid inside a spherical balloon, to control its buoyancy. In conventional Lighter-than-air (LTA) systems, buoyant gases such as Hydrogen and Helium are used as lifting gases, and ballonets are used to control their buoyancy. An alternative means for providing buoyant lift and controlling the buoyancy is to use phase change fluids, subjected to temperature variations. Such a system can also be used in aerial platforms for exploration of atmosphere over other planets; by controlling the buoyancy of the phase-change fluid, we can control the altitude of operation of the system. The paper starts with a survey of literature of such systems which have successfully deployed. The mission requirements of such a system are presented, and the Lift and Heat transfer calculations to model the change in static lift are explained. Finally, the design calculations of a laboratory scale experimental setup are carried out, and conceptual sketches of the system are presented.

Keywords: Phase Change Balloon, Phase Change Fluids, Experimental Set-up, LTA System