

“CASE STUDY OF USING FLOCAD TO MODEL A GROUND TEST STATION LN2 HEAT EXCHANGER”

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ABSTRACT:

This paper will present a case study of using FLOCAD to model the heat transfer and boiling flow behavior of a LN2 ground station equipment heat exchanger. The unique aspect of this work is that is one of very few studies documenting the use of FLOCAD in the spacecraft thermal control community. The status of the state of the work is completed study which used the results of the simulation in order to guide and plan the execution of the thermal vacuum testing of the spacecraft hardware. The paper will review the theory of two-phase boiling flow and correlations used by SINDA/FLUINT as well as the terminology and nomenclature used within Thermal Desktop / FLOCAD regarding two-phase boiling flow heat transfer modeling and simulation. Results for using the ground station heat exchanger as a heat sink in a thermal vacuum test set up are shown in order to demonstrate the set-up and execution of a typical FLOCAD model. Results indicate that properly modeling of the two-phase behavior is critical in order to ascertain the time constant associated with the heat exchanger, as well as understanding the temperature distribution across the test equipment and prediction of required LN2 flowrates to be used during testing. The paper is meant to augment the FLOCAD user's manual and serve as a tutorial for thermal engineers and analysts wishing to learn and apply FLOCAD to industrial problems.

KEYWORDS: FLOCAD, two-phase flow, boiling, heat exchanger, thermal analysis