

## TRANSIENT THERMAL-STRUCTURAL ANALYSIS OF CRYOGENIC VESSELS

**PURPOSE:** Stimulate the thermal shock in a liquid nitrogen cryogenic vessel during the fill operation

HLA has performed a transient thermal-structural simulation of the fill operation of a liquid nitrogen cryogenic vessel. The analysis attempts to predict the structural response of the fill operation as a function of time. The heat transfer mechanism in conduction, convection, stable nucleate and film boiling regimes were included using classical solutions. Material properties at cryogenic temperatures obtained from published literature were used in the simulation of a temperature drop from +70 F to -320 F. The results of the analysis aim to shed light on the magnitude of stresses developed due to sudden thermal shock, and predict a cyclic load survival of the vessel.

