Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

The Effects of Inducer Inlet Diffusion on Backflow TATE FANNING, Brigham Young University, RYAN LUNDGREEN, The Ohio State University, STEVEN GORRELL, DANIEL MAYNES, Brigham Young University, KERRY OLIPHANT, Concepts NREC — High suction performance inducers are used as a first stage in turbopumps to hinder cavitation and promote stable flow. Despite the distinct advantages of inducer use, an undesirable region of backflow and cavitation can form near the tips of the inducer blades. This flow phenomenon has long been attributed to "tip leakage flow", or the flow induced by the pressure differential between pressure and suction sides of an inducer blade at the tip. We examine the backflow of inducer geometries with a tip clearance of 0.4 mm to allow tip leakage flow and a tip clearance of 0 mm to remove tip leakage flow at varying flow coefficients under both single phase and cavitating conditions. Despite removal of the tip leakage flow, backflow persists, and upstream propagation is essentially unaffected. We have observed backflow penetrating 1.1 tip diameters upstream of the leading edge in the inducer with tip clearance, and 0.95 tip diameters in the inducer without tip clearance under the same flow coefficient for single phase conditions. A comprehensive analysis of these simulations suggests that blade inlet diffusion, not tip leakage flow, is the driving force for the formation of tip backflow.

Tate Fanning
Brigham Young University

Date submitted: 01 Aug 2016 Electronic form version 1.4