# Experimental Determination of the Dynamic Hydraulic Transfer Function for the J-2X Oxidizer Turbopump-Part Two-Results and Interpretation

## ABSTRACT INFORMATION

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## AUTHOR INFORMATION

### Author/Presenter Name: Tom Zoladz

**Affiliation** NASA Marshall Space Flight Center-ER42  
**Address** NASA Marshall Space Flight Center-ER42  
**City** MSFC  
**State** AL  
**Zip** 35812  
**Telephone** 256.544.1552  
**Telefax** 256.544.1630  
**e-mail:** thomas.f.zoladz@nasa.gov

### 2nd Author: Sandeep Patel

**Affiliation** Optical Sciences Corporation  
**Address** NASA Marshall Space Flight Center-ER42  
**City** MSFC  
**State** AL  
**Zip** 35812  
**Telephone** 256.544.7386  
**Telefax** 256.544.1630  
**e-mail:** Sandy.patel@nasa.gov

### 3rd Author: Erik Lee

**Affiliation** Jacobs Engineering  
**Address** NASA Marshall Space Flight Center-ER42  
**City** MSFC  
**State** AL  
**Zip** 35812  
**Telephone** 256.961.2662  
**Telefax** 256.544.1630  
**e-mail:** erik.n.lee@nasa.gov

### Additional Author(s): Dave Karon

**Affiliation** Concepts NREC  
**Address** 217 Bilings Farm Road  
**City** White River Jct.  
**State** VT  
**Zip** 5001  
**Telephone** 802.280.6127  
**Telefax** 802.296.2325  
**e-mail:** dkaron@conceptsnrec.com
MANAGEMENT APPROVAL

The individual below certifies that the required resources are available to present this paper at the above subject JANNAF meeting.

Responsible Manager authorizing presentation: Lisa Griffin
Title/Agency: Branch Chief Propulsion Fluid Dynamics-ER42
Telephone Number: 256.544.8972  e-mail: lisa.w.griffin@nasa.gov  Date: 6-9-2011
Experimental results describing the hydraulic dynamic pump transfer matrix (Yp) for a cavitating J-2X oxidizer turbopump inducer+impeller tested in subscale waterflow are presented. The transfer function is required for integrated vehicle pogo stability analysis as well as optimization of local inducer pumping stability. Dynamic transfer functions across widely varying pump hydrodynamic inlet conditions are extracted from measured data in conjunction with 1D-model based corrections. Derived Dynamic transfer functions are initially interpreted relative to traditional Pogo pump equations. Water-to-liquid oxygen scaling of measured cavitation characteristics are discussed. Comparison of key dynamic transfer matrix terms derived from waterflow testing are made with those implemented in preliminary Ares Upper Stage Pogo stability modeling. Alternate cavitating pump hydraulic dynamic equations are suggested which better reflect frequency dependencies of measured transfer matrices.