The submission of an abstract is an agreement to complete a final paper for publication and attend the meeting to present this information. Complete all information requested in the author and co-author information sections; the first author listed will receive paper acceptance notices and all correspondence. Abstracts must be submitted electronically; submittal instructions are located in the call for papers. The abstract deadline date is June 13, 2011.

**ABSTRACT INFORMATION**

Title: Characterization Of Axial Inducer Cavitation Instabilities Via High Speed Video Recordings

Submitted for consideration to: □ MSS  ☑ LPS  □ SPS
For inclusion in Technical Area: 1 2 3 4 5 6
Security Classification of Presentation:  ☑ Unclassified
Security Classification of Paper:  ☑ Unclassified
Contract Number(s) Under Which Work was Performed: 109765361100
Is this paper an update?  □ Yes  ☑ No  Has it been presented elsewhere?  □ Yes  ☑ No  Is this a student paper?  □ Yes  ☑ No

**AUTHOR INFORMATION**

**Author/Presenter Name:**  Patrick Arellano  
**Affiliation** Pratt & Whitney Rocketdyne  
**Address** 6633 Canoga Avenue  RAB-24  
**City** Canoga Park  
**State** CA  
**Zip** 91309  
**Telephone** 818-586-0818  
**Telefax**  
**e-mail:**  Patrick.Arellano@pwr.utc.com

**2nd Author:**  Marinelle Peneda  
**Affiliation** Pratt & Whitney Rocketdyne  
**Address** 6633 Canoga Avenue  RAB-02  
**City** Canoga Park  
**State** CA  
**Zip** 91309  
**Telephone** 818-586-5175  
**Telefax**  
**e-mail:**  Marinelle.Peneda@pwr.utc.com

**3rd Author:**  Thomas Ferguson  
**Affiliation** Pratt & Whitney Rocketdyne  
**Address** 6633 Canoga Avenue  RFB-69  
**City** Canoga Park  
**State** CA  
**Zip** 91309  
**Telephone** 818-586-0354  
**Telefax**  
**e-mail:**  Thomas.Ferguson@pwr.utc.com

**Additional Author(s):**  Thomas 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**  
**e-mail:**  thomas.f.zoladz@nasa.gov
<table>
<thead>
<tr>
<th>MANAGEMENT APPROVAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>The individual below certifies that the required resources are available to present this paper at the above subject JANNAF meeting.</td>
</tr>
<tr>
<td>Responsible Manager authorizing presentation:</td>
</tr>
<tr>
<td>Title/Agency:</td>
</tr>
<tr>
<td>Telephone Number: e-mail: Date:</td>
</tr>
</tbody>
</table>
Sub-scale water tests were undertaken to assess the viability of utilizing high resolution, high frame-rate digital video recordings of a liquid rocket engine turbopump axial inducer to characterize cavitation instabilities. These high speed video (HSV) images of various cavitation phenomena, including higher order cavitation, rotating cavitation, alternating blade cavitation, and asymmetric cavitation, as well as non-cavitating flows for comparison, were recorded from various orientations through an acrylic tunnel using one and two cameras at digital recording rates ranging from 6,000 to 15,700 frames per second. The physical characteristics of these cavitation forms, including the mechanisms that define the cavitation frequency, were identified. Additionally, these images showed how the cavitation forms changed and transitioned from one type (tip vortex) to another (sheet cavitation) as the inducer boundary conditions (inlet pressures) were changed. Image processing techniques were developed which tracked the formation and collapse of cavitating fluid in a specified target area, both in the temporal and frequency domains, in order to characterize the cavitation instability frequency. The accuracy of the analysis techniques was found to be very dependent on target size for higher order cavitation, but much less so for the other phenomena. Tunnel-mounted piezoelectric, dynamic pressure transducers were present throughout these tests and were used as references in correlating the results obtained by image processing. Results showed good agreement between image processing and dynamic pressure spectral data. The test set-up, test program, and test results including H-Q and suction performance, dynamic environment and cavitation characterization, and image processing techniques and results will be discussed.