December 2011 MSS/LPS/SPS Joint Subcommittee Meeting
ABSTRACT SUBMITTAL FORM

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ABSTRACT INFORMATION

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ABSTRACT SUBMITTAL FORM

Unclassified Abstract

(250-300 words; do not include figures or tables)

Simulations were made for the LOX tank subjected to the simulated Ares I flight loads under the conditions with anti-vortex baffles and without the baffles. The results showed that roll maneuvering and side loads due to pitch and yaw can all lead to swirling flow inside the tank. The vortical flow due to roll is symmetrical with respect to the tank center line, while those induced by pitch and yaw maneuverings showed two vortices side by side. The swirling flows are undesirable as they cause surface dip during the late stage of drainage and non-uniform flow velocity in the drainage pipe. The present study found that the secondary swirling flow velocity component can be as high as 10% of the draining velocity. Vortex dynamic physics is analyzed to show that the swirling flows in the drainage pipe during the Upper Stage burn are mainly the results of the residual vortices inside the tank due to conservation of angular momentum. This study demonstrated that anti-vrtex baffles can effectively suppress the swirling flows in the drainage pipe. The effect of the anti-vortex baffle hole sizes is also discussed.