Abstract Submittal Form

JANNAF
62nd JPM / 10th MSS / 8th LPS / 7th SPS
Joint Subcommittee Meeting
Nashville, TN • June 1 – 4, 2015

Abstract Due Date: Friday, January 16, 2015

Fields with an asterisk (*) are required.

* Title: Characterization of the Ignition Over-Pressure/ Sound Suppression Water in the Space Launch System Mobile Launcher Using Volume of Fluid Modeling

* Submitted to: ☐ JPM ☒ MSS ☐ LPS ☐ SPS

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Unclassified Abstract (250 – 300 words; do not include figures or tables)

* The Space Launch System (SLS) Vehicle consists of a Core Stage with four RS-25 engines and two Solid Rocket Boosters (SRBs). This vehicle is launched from the Launchpad using a Mobile Launcher (ML) which supports the SLS vehicle until its liftoff from the ML under its own power. The combination of the four RS-25 engines and two SRBs generate a significant Ignition Over-Pressure (IOP) and Acoustic Sound environment. One of the mitigations of these environments is the Ignition Over-Pressure/Sound Suppression (IOP/SS) subsystem installed on the ML. This system consists of six water nozzles located parallel to and 24 inches downstream of each SRB nozzle exit plane as well as 16 water nozzles located parallel to and 53 inches downstream of the RS-25 nozzle exit plane. During launch of the SLS vehicle, water is ejected through each water nozzle to reduce the intensity of the transient pressure environment imposed upon the SLS vehicle.

While required for the mitigation of the transient pressure environment on the SLS vehicle, the IOP/SS subsystem interacts (possibly adversely) with other systems located on the Launch Pad. One of the other systems that the IOP/SS water is anticipated to interact with is the Hydrogen Burn-Off Igniter System (HBOI). The HBOI system's purpose is to ignite the unburned hydrogen/air mixture that develops in and around the nozzle of the RS-25 engines during engine start. Due to the close proximity of the water system to the HBOI system, the presence of the IOP/SS may degrade the effectiveness of the HBOI system. Another system that the IOP/SS water may interact with adversely is the RS-25 engine nozzles and the SRB nozzles. The adverse interaction anticipated is the wetting, to a significant degree, of the RS-25 nozzles resulting in substantial weight of ice forming and water present to a significant degree upstream of the SRB nozzle exit plane inside the nozzle itself, posing significant additional blockage of the effluent that exits the nozzle upon motor start leading to detrimental effects.

The purpose of the CFD simulations were to i) characterize the location of the IOP/SS water after it is ejected from the IOP/SS nozzles, ii) characterize the interaction of the IOP/SS system with the HBOI system and iii) characterize the interaction of the IOP/SS water with the RS-25 nozzles and the SRB nozzles.

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