CHARACTERIZATION OF PUMP-INDUCED ACOUSTICS IN SPACE LAUNCH SYSTEM MAIN PROPULSION SYSTEM LIQUID HYDROGEN FEEDLINE USING AIRFLOW TEST DATA

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ABSTRACT

High intensity acoustic edgetones located upstream of the RS-25 Low Pressure Fuel Turbo Pump (LPFTP) were previously observed during Space Launch System (STS) airflow testing of a model Main Propulsion System (MPS) liquid hydrogen (LH2) feedline mated to a modified LPFTP. MPS hardware has been adapted to mitigate the problematic edgetones as part of the Space Launch System (SLS) program. A follow-on airflow test campaign has subjected the adapted hardware to tests mimicking STS-era airflow conditions, and this manuscript describes acoustic environment identification and characterization born from the latest test results. Fluid dynamics responsible for driving discrete excitations were well reproduced using legacy hardware. The modified design was found insensitive to high intensity edgetone-like discretes over the bandwidth of interest to SLS MPS unsteady environments. Rather, the natural acoustics of the test article were observed to respond in a narrowband-random/mixed discrete manner to broadband noise thought generated by the flow field. The intensity of these responses were several orders of magnitude reduced from those driven by edgetones.