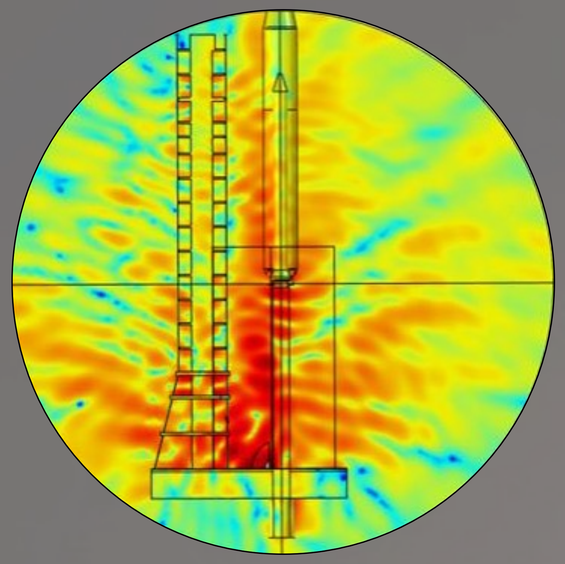
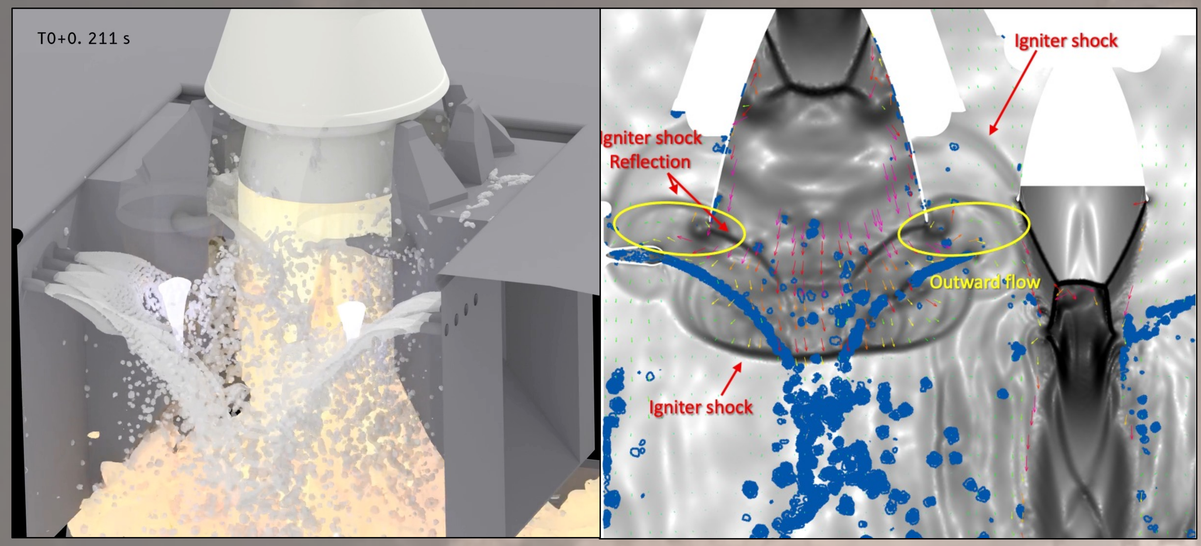
LIFTOFF ENVIRONMENTS



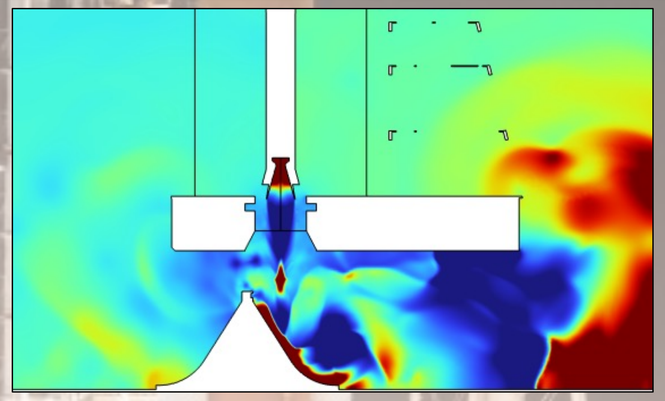
Computational Acoustics using COMSOL: Liftoff Acoustics (Pressure)

SLS Subscale Model Acoustic Test

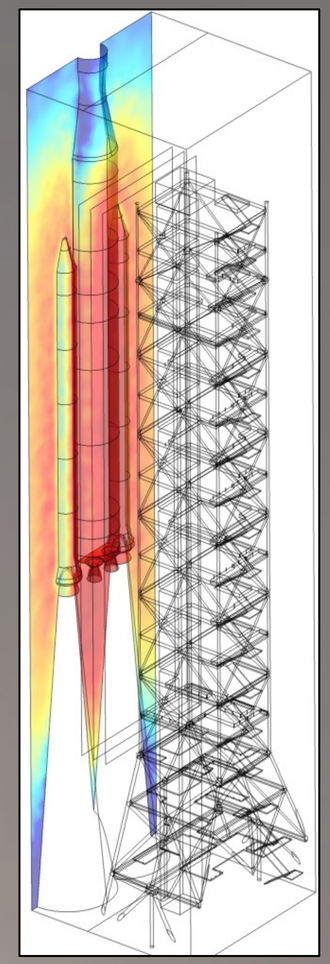
A Launch Environment, or Liftoff Environment, represents a source of loading during the hold-down or liftoff phase of a rocket launch. A launch vehicle is subjected to transient and oscillatory pressure loading on its exterior surfaces induced by engines and boosters during vehicle hold-down and liftoff. These pressure loads are a principal source of structural vibration which may result in the malfunction of vehicle components or the fatigue of exterior skin panels or component brackets. Additionally, the pressure loading gives rise to sound pressure inside the crew cabin which may impact the crew's health, safety, or ability to communicate.



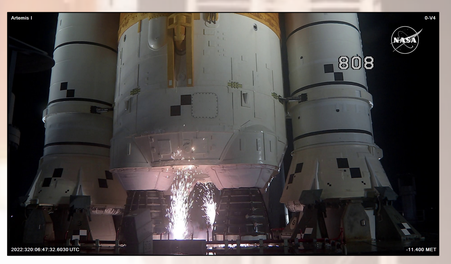
Computational Fluid Dynamics using Loci/STREAM-VoF: Igniter Shock



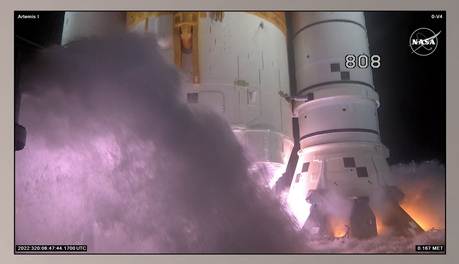
Computational Simulation using COMSOL: Ignition Overpressure & Duct Overpressure



Computational Acoustics using COMSOL: Liftoff Acoustics (Intensity)

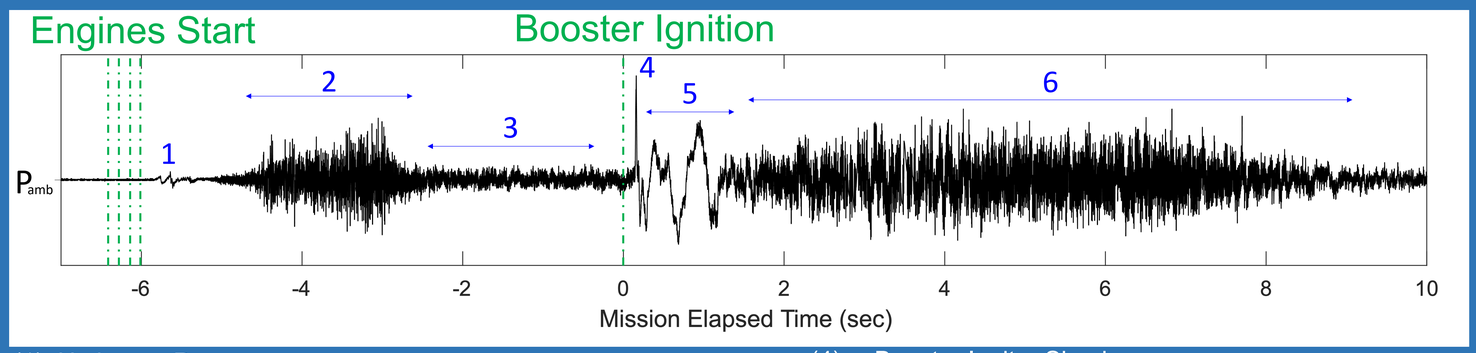


Hydrogen Burn-Off Igniters during SLS Hold-Down



Ignition Overpressure Protection and Sound Suppression System

Pressure Response on Vehicle



(1) Hydrogen Pop
(2) Engine Nozzle Flow Transient and Engine Overpressure
(3) Hold-Down Acoustics
(4) Booster Igniter Shock
(5) Booster Ignition Overpressure & Duct Overpressure
(6) Liftoff Acoustics and Infrasonic Acoustics

For the Space Launch System, the Launch Environments include Excess Hydrogen Pop, Core Stage Engine Overpressure, RS-25 Nozzle Flow Transient Acoustics, Hold-Down Acoustics, Booster Igniter Shock, Ignition Overpressure & Duct Overpressure, Liftoff Acoustics, and Infrasonic Acoustics.

Computational Acoustics, Computational Fluid Dynamics, Scale Model Acoustic Testing, Reduced-order Modeling, Data Processing, and Signal Processing are the primary tools and procedures used in predicting and quantifying Launch Environments.