UNCLASSIFIED UNLIMITED RELEASE

OPAG 2019

Terminal Sterilization Subsystem (TSS) Advanced Development to TRL6

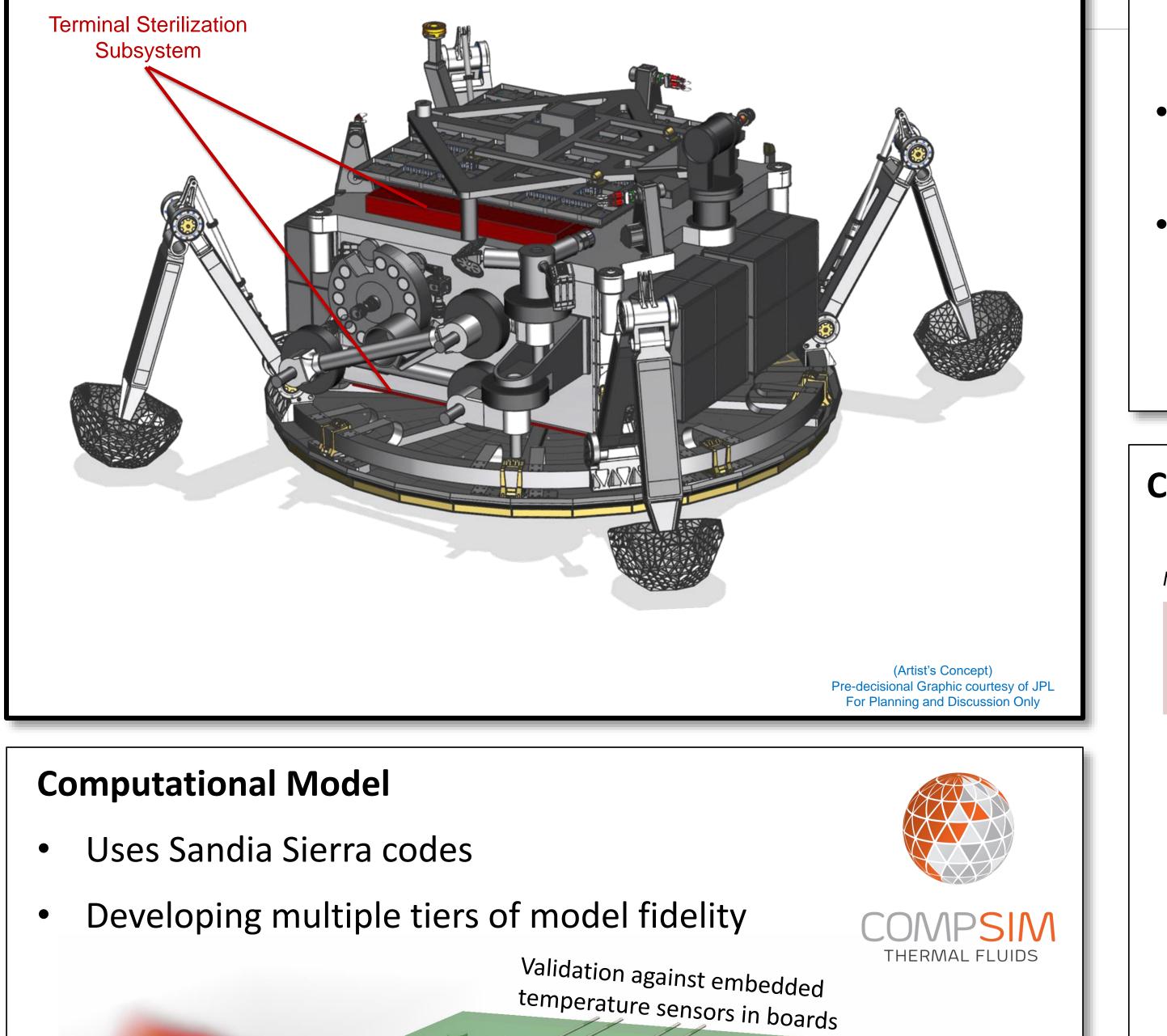


The Terminal Sterilization Subsystem (TSS) represents a revolutionary approach to Planetary Protection that uses energetic materials to rapidly heat up organic material and can be applied to other future icy moon exploration missions.

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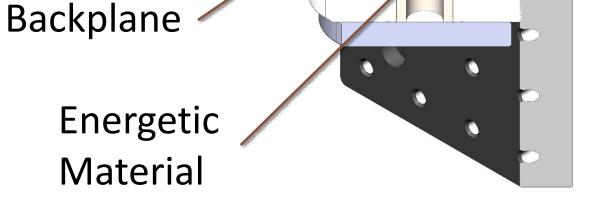
Objectives

- Heat <u>relevant components</u> enough to sterilize them
- Apply heat within a <u>10 second window</u> in accident scenarios
- Apply heat at end of successful mission



Experimental Prototype (SBS)

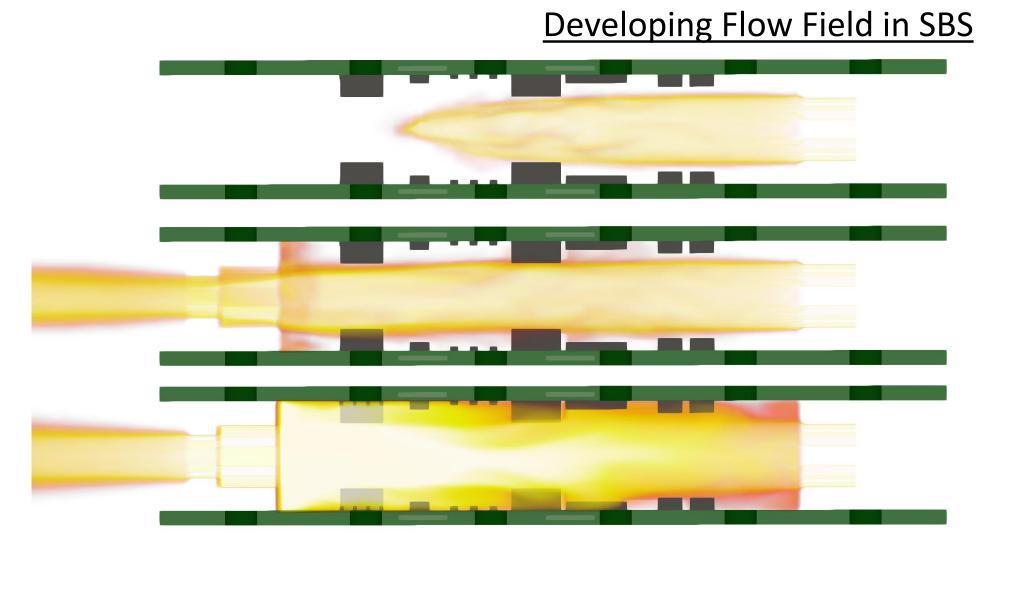
- Fully instrumented test setup
 - Temperature sensors integrated into board internal layers
- Realistically configured circuit boards exposed to combustion products
- Computationally tractable domain
- Flexible design to explore parameter space



Credibility & Development Approach Material Formulation & Characterization Small Scale In-Depth Screening Formulation Locked **Screening Tests** of Top Candidates (1 material) (50 materials) (4 materials) Demonstrate Function & Scaling SBS+ Sub-Box Small Tube Tests Sub-Box Large Additional tests Two PC Boards Characterize Two 6U to quantify any Heat Output custom size scaling effects **Environments** Testing Expose EM Samples to Quantify Changes in

Test Boards

- Participating media radiation
- Mixed phase (gas + particles)
- Combustion & decomposition reactions
- Conjugated heat transfer coupling
- Parallel scaling to billions of elements



Temperature (K)

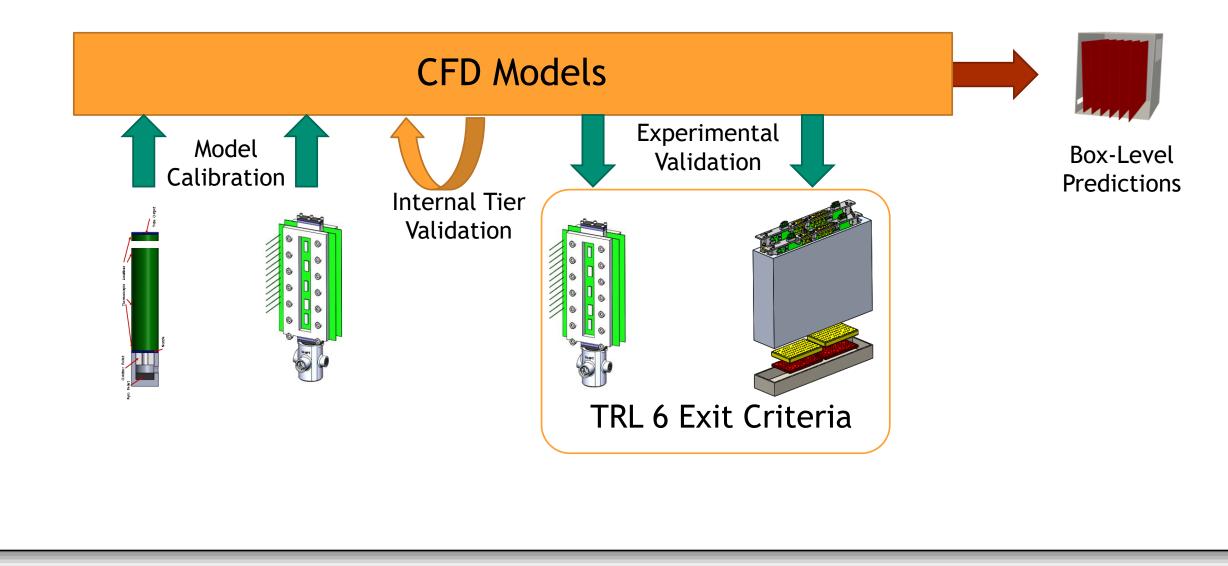
800 1000 1200

Temperature (K) 3.0e+02 600 800 1000 1200 1.5e+03

Desired Outcomes:

- Technology demonstrated at a range of scales on realistic geometries
- Experimentally validated model able to predict sterilization behavior on a variety of geometries
- Well defined process for manufacturing and operating the TSS
- Documented environmental robustness and measured limitations

Model Calibration & Validation Approach





interest Sandia National Laboratories is a multimission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.



