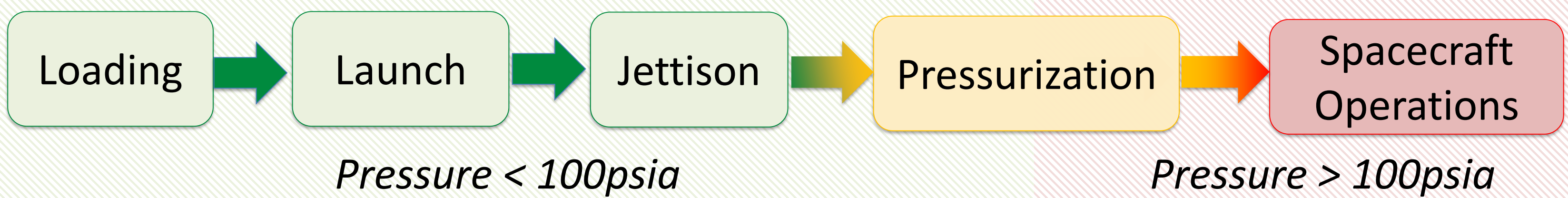
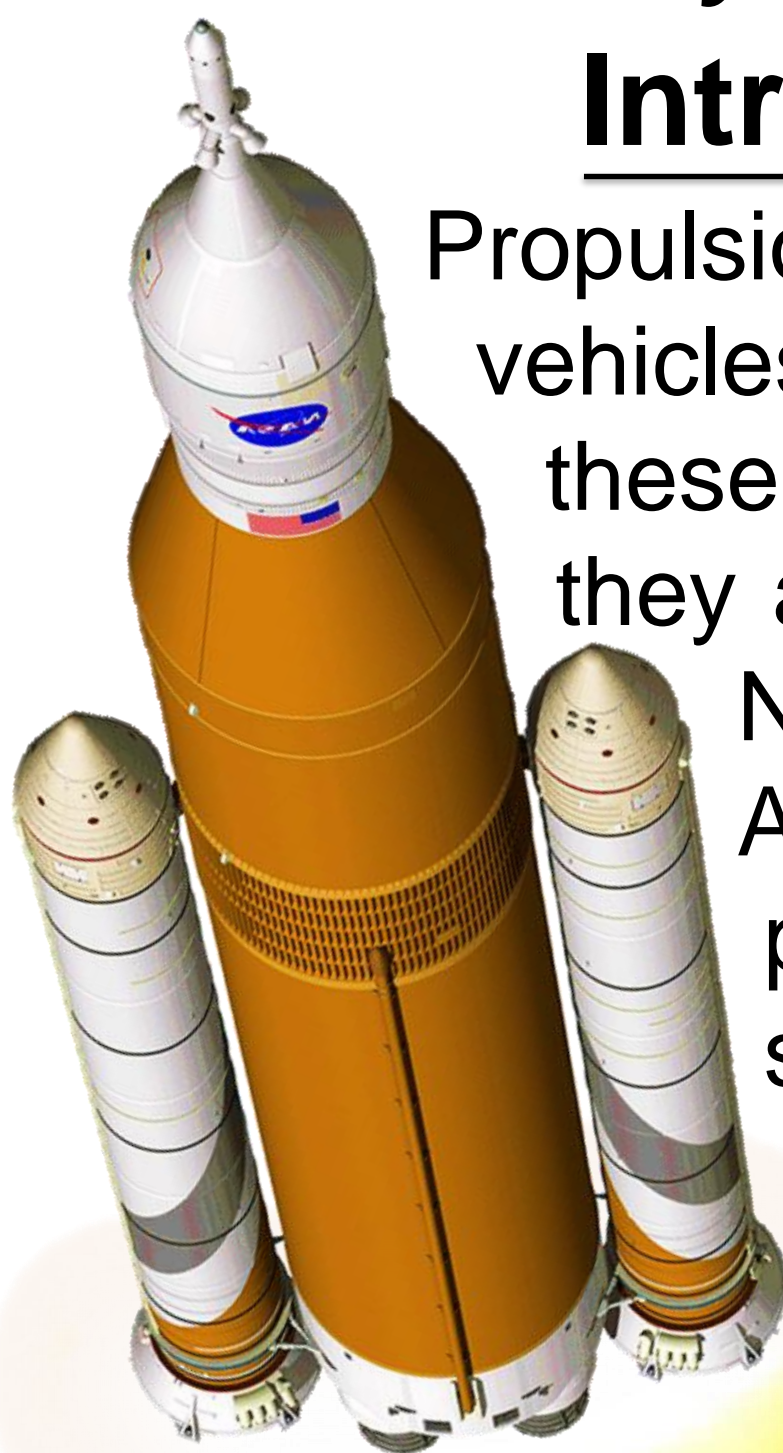


# Reducing Hazards of Propulsive Secondary Payloads by Implementing a Post Launch Pressurization System

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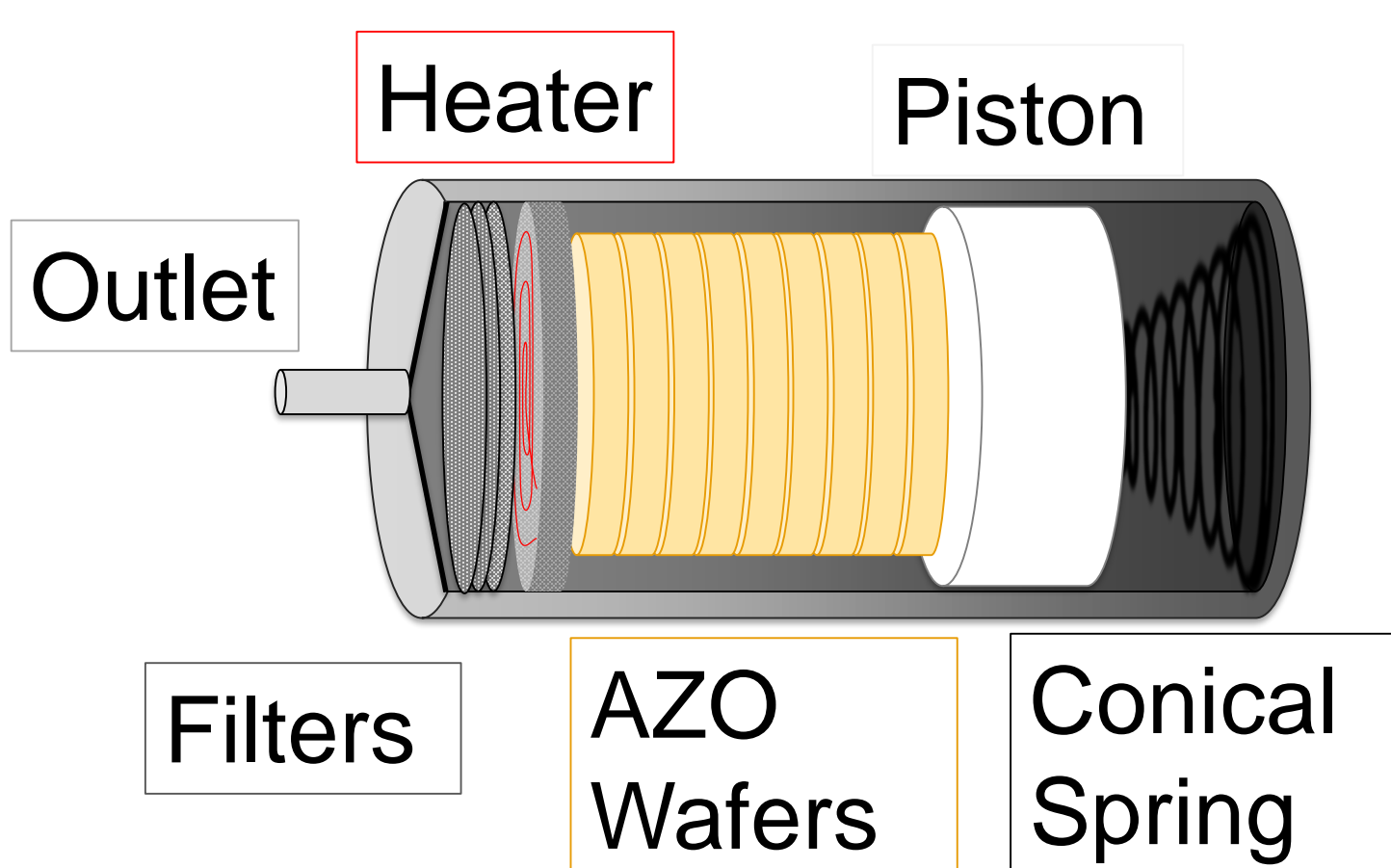
## Introduction

Propulsion systems on SmallSats and CubeSats are becoming more common as launch vehicles like SLS begin providing rideshares to destinations beyond low earth orbit. While these spacecraft are a solution to achieve advanced science objectives at lower cost, they are still subject to the same rigorous standards as other larger spacecraft, such as NASA STD-5019, due to the high pressures within their propulsion systems at launch. A Post Launch Pressurization System would allow a spacecraft to be launched at low pressure, then be pressurized through the controlled chemical decomposition of a solid reactant after the spacecraft is jettisoned from the launch vehicle. This increases the safety of the secondary spacecraft, and effectively mitigates risks to the launch vehicle and other payloads.



## Design Concept

Azodicarbonamide (AZO), a chemical used in foam production and industrial bread making, decomposes at 200° C with a gas volume production of 215-230 mL/g. This makes it an ideal reactant in the system. Decomposition occurs by a spring pushing pressed AZO powder into a coiled wire heater.



## Testing

Many aspects of the system have been characterized in the 3 previous phases of design maturation, including reaction and packing efficiencies. The goal of early testing during phase 4 is to qualify the mechanical design, which is unlike any previous designs. During open air decomposition testing, this system has rapidly created significant amounts of gas. Further testing will refine the piston mechanism and work to optimize reaction efficiency, restart capability, and packaging.

## Impact

Post Launch Pressurization allows small spacecraft to implement a propulsion system while avoiding fracture critical designation, driving down cost and development time. This allows for greater access to low cost platforms to complex in-space research by student and research groups, and reduces risk to ridesharing primary spacecraft.

## Acknowledgements

Daniel Cavender, mentor and PI; NASA Marshall Space Flight Center; and others who have contributed to previous design maturations of the system.