

VESTA

Vacuum-Enabled Suppression Technologies for Aerospace

Abstract:

Microgravity and limited atmospheric control make fire suppression difficult in space. This work investigates vacuum-enabled fire suppression by starving flames of oxygen with depressurization, and later, the addition of fire suppressants to the affected module. The approach entails venting air from the afflicted module into an expanding module that utilizes Boyle's law to pull the pressure from a compartment. Fire is expected to extinguish as pressure decreases past a certain threshold. Additional considerations include fast airflow changes, which could momentarily intensify flames and call for a different depressurization profile.

Experiments will monitor burning glucose, tracking pressure, temperature, and flame conditions in a combustion chamber equipped with sensors. The study aims to determine extinction thresholds and assess whether combining CO₂ with depressurization improves suppression efficiency. Results will inform the feasibility of automated, low-resource fire suppression systems that reduce astronaut involvement, reduce human involvement in fire incidents, and enhance spacecraft safety.