



# T0026-P Evaluation of a Medical Chest Drainage System Functional in the Microgravity Environment



## Problem Statement

- If an astronaut experiences a collapsed lung (pneumothorax), medical suction is required to inflate the lung through a thoracic chest tube. This requires a medical chest drain and suction.
- Medical suction clears the airway, empties the stomach, decompresses the chest, and keeps operative fields clear.
- There is currently no medical suction capability that would work in the microgravity environment. Current medical thoracic suction is dependant upon gravity and fluid to operate.
- End users of the mature technology include hospitals, aeromedical transport, and military medicine.

## Technology Development Team

- C. Marsh Cuttino, MD  
Orbital Medicine, Inc  
[Orbitalmedicine@gmail.com](mailto:Orbitalmedicine@gmail.com)
- Funded by Orbital Medicine
- Stanford University  
Purdue University  
Medline Industries, Inc  
SPARK Engineering, LLC

## Proposed Flight Experiment

### Experiment Readiness:

- The experiment will be ready for flight May 2012.

### Test Vehicles:

- The preferred test vehicle is the parabolic aircraft. Future iterations would benefit from the longer period of microgravity available in sRLV's when they are available.

### Test Environment:

- This experiment is for parabolic flight.

### Test Apparatus Description:

- The experimental system includes a suction pump, a modified commercial dry suction chest drainage system, and a thoracic chest tube placed in a pneumothorax simulator.
- The system includes suction gages to monitor vacuum fluctuations, and photographic analysis of the system during parabolic flight will determine the effectiveness of four configurations of biologic fluid entrapment mechanisms.



## Technology Maturation

- The testing in parabolic flight will allow confirmation of the basic technology elements in a representative environment for TRL 5.
- Computational Flow Dynamics will be used to optimize the final design and complete final integrated engineering.
- Evaluation of configuration and optimization with repeated testing and consolidated construction will allow for progression to TRL 6.

## Objective of Proposed Experiment

- The objective of the experiment is to demonstrate suction and determine the capability of the device to isolate biological fluids into a suction canister in microgravity.
- The May 2012 flight demonstrated the proof of concept. The parabolic flights will be used to select the optimum configuration of fluid containment and verify feasibility of medical dry suction.

**Human Research Roadmap: Inability to Adequately Recognize or Treat an Ill or Injured Crew Member:  
EXMC 4.09: Lack of medical suction and fluid containment capability for chest tube and airway management.**