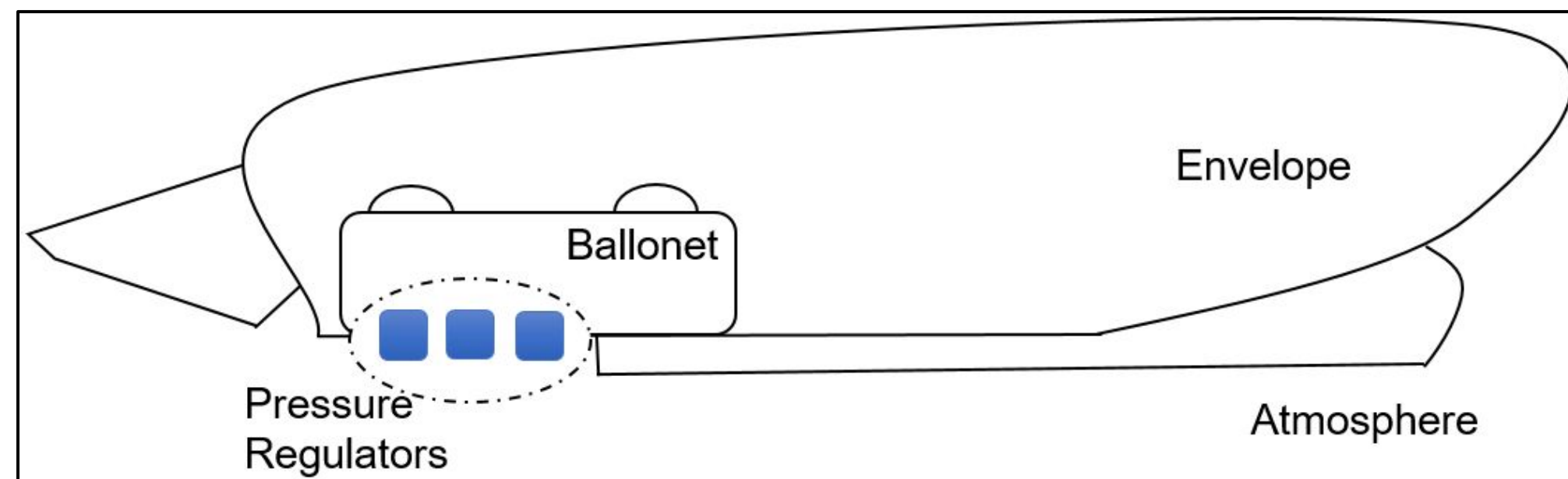


## Location of Current Valve System



## Existing Valve System is Complex

SolarShip Inc.'s aircraft uses air pressure regulating valves (ARV) to control the ballonet internal pressure in response to changes in atmospheric pressure. Pressure relief valves (PRV) are also used to vent helium from the envelope.

These valves are currently made with complex, active components that suffer from issues such as burping. This increases the the difficulty of both operating and maintaining the valves.

## Design Goals

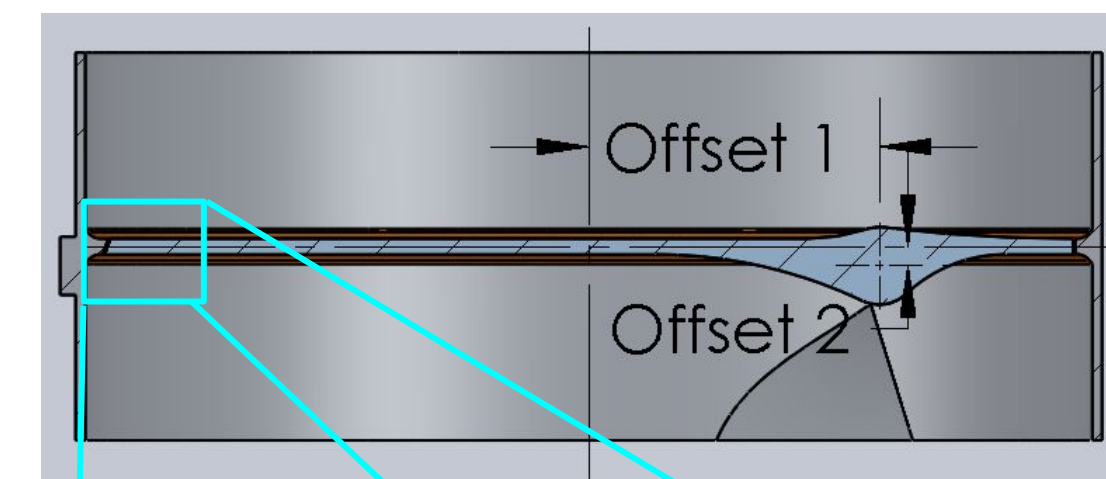
The goal is to design passive valves that minimize complexity, weight and cost.

To address the differences in the ARV and the PRV, two different designs are proposed.

## Verified Design Concepts and Goals

- ★ Magnet models and sealing concepts are verified through simulation
- ★ No active components used in proposed design
- ★ Materials proposed
- ★ Component failure characterised through Failure Modes Effect Analysis

## Proposed Design: Component Details

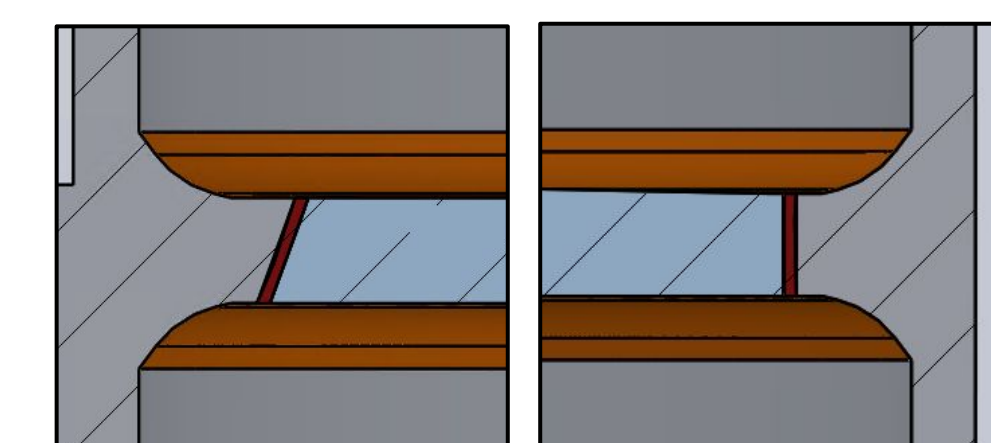


### Double & Triple Offset

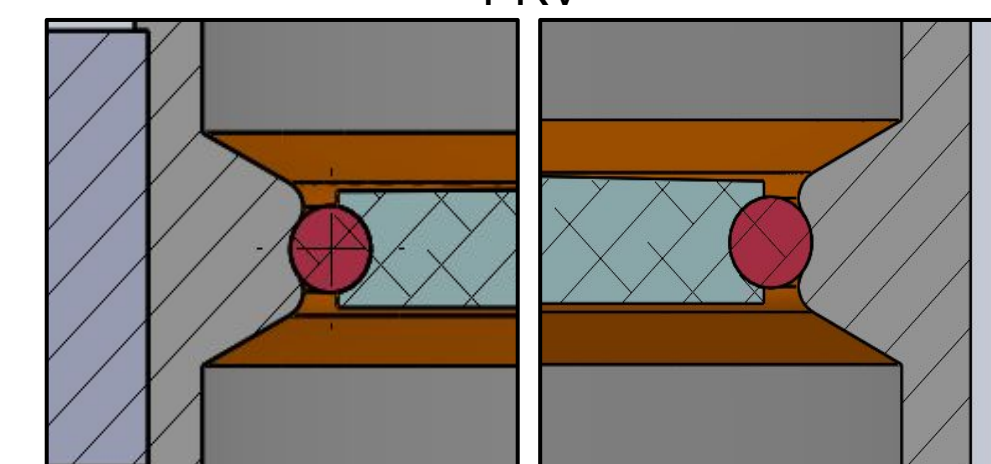
The disc is optimized for a large flow rate using minimal driving pressure. The ARV is designed for reversible flow, while the PRV is unidirectional.



Offset 3 unique to PRV



Cutaway views perpendicular to shaft axis showing disc edge, sealing and seating for PRV



Cutaway views perpendicular to shaft axis showing disc edge, sealing and seating for ARV.

### Seating

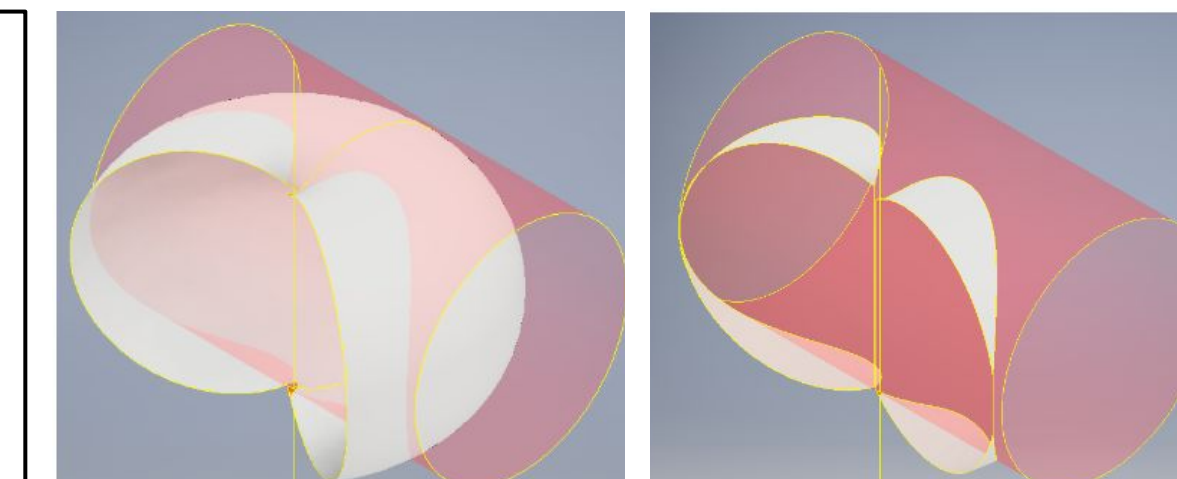
A different seat design is present for each valve body, due to the use of a third offset in the PRV.

### Sealing

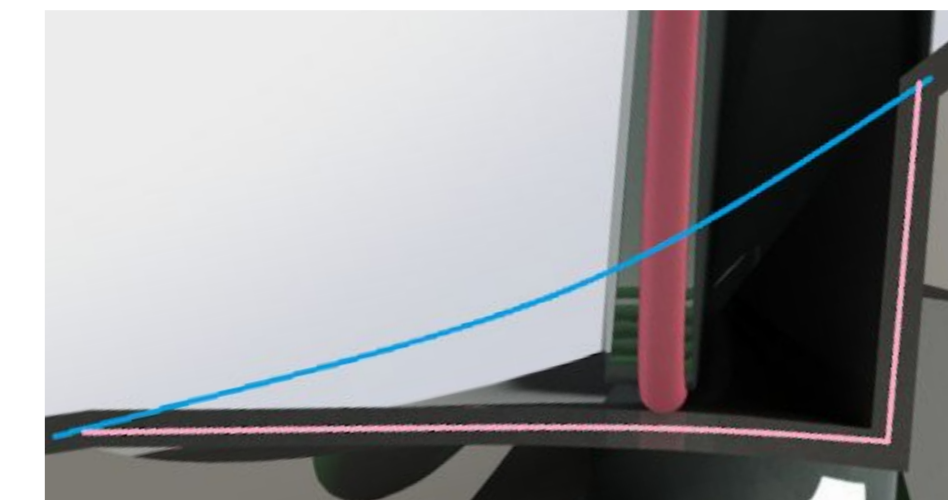
Nitrile rubber is selected for both the o-ring (ARV) and the gasket (PRV). Simulations were done to verify a complete seal.

### Spring

Acts on the shaft to provide resistance to the disc opening in either direction.



Left: White torus shows the volume the disc takes as it opens. This was added to the valve body (cylinder).

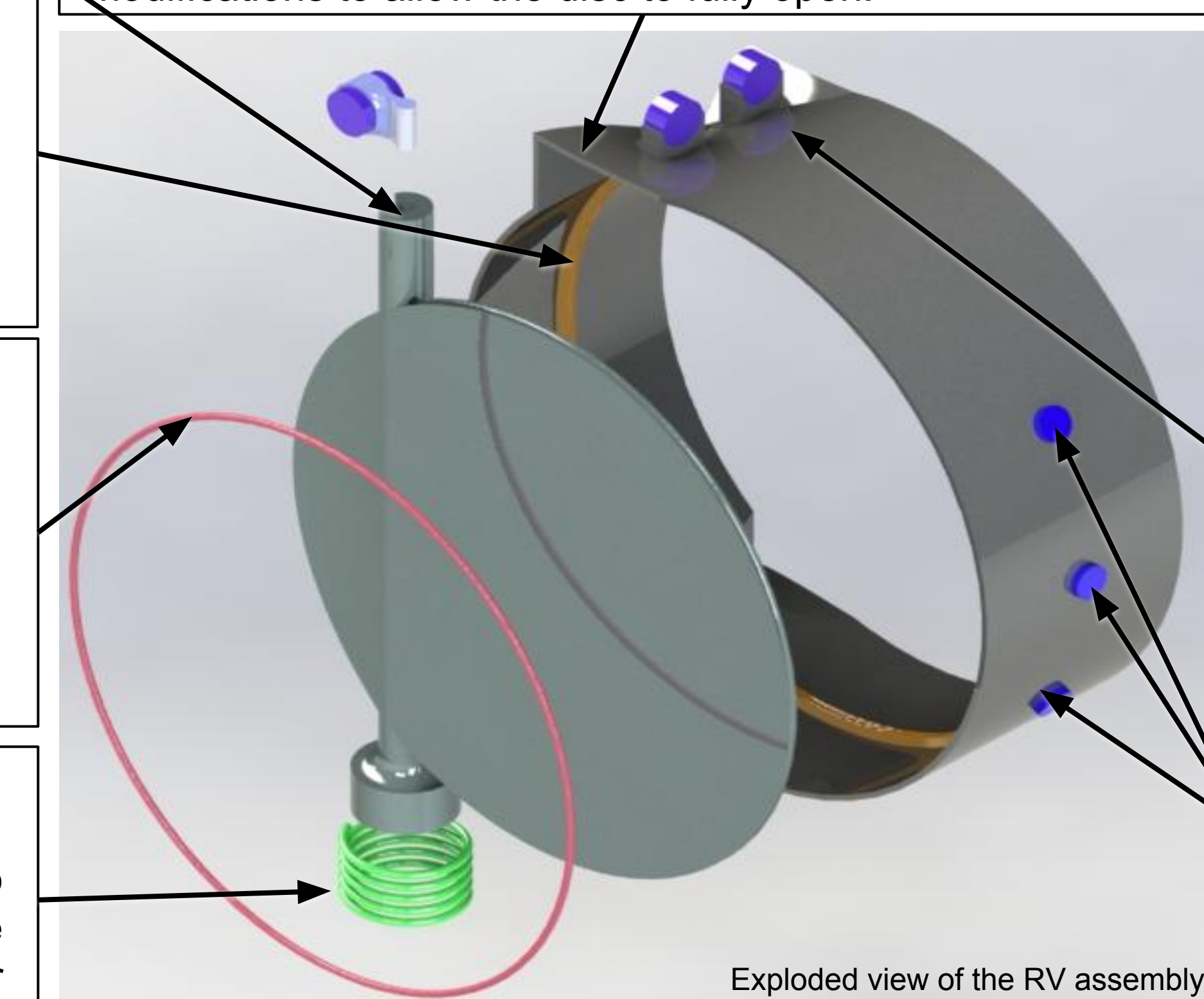


Top: Blue line shows original cylinder. Pink shows modification

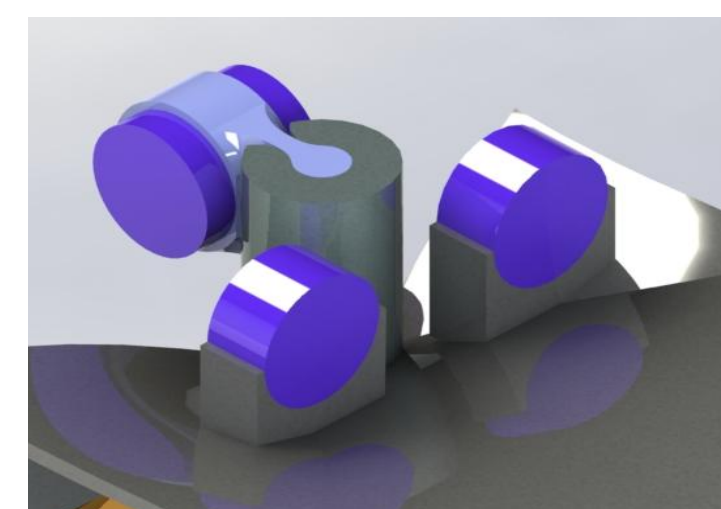
Bottom: Close up view of the Shaft Magnets

### Irregular Valve Body

Due to the use of large offsets, the valve body requires modifications to allow the disc to fully open.



Exploded view of the RV assembly



### Shaft Magnets

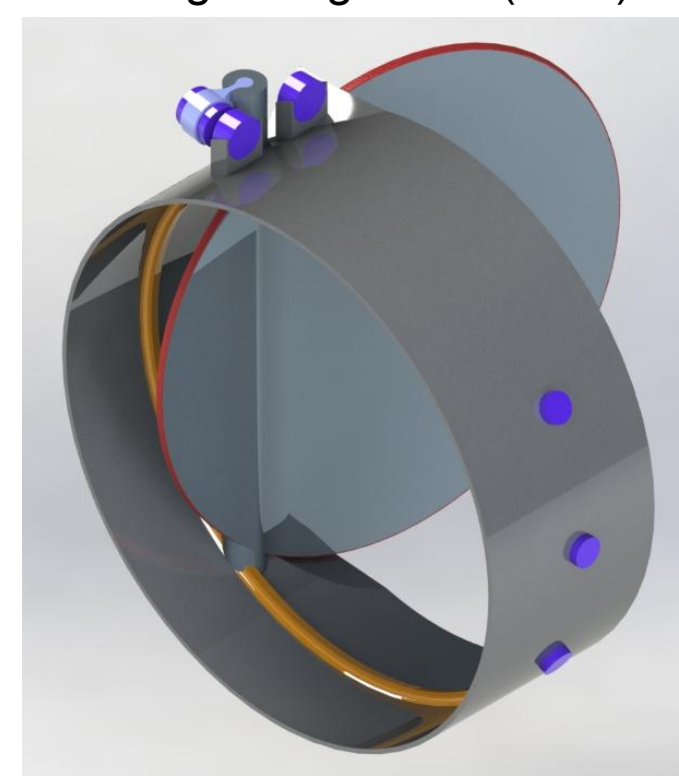
Provide an additional force that aids in closing the disc via magnetic repulsion.

### Sealing Magnets

These three attract the disc, which is made out of a magnetic material. This creates a more reliable seal.

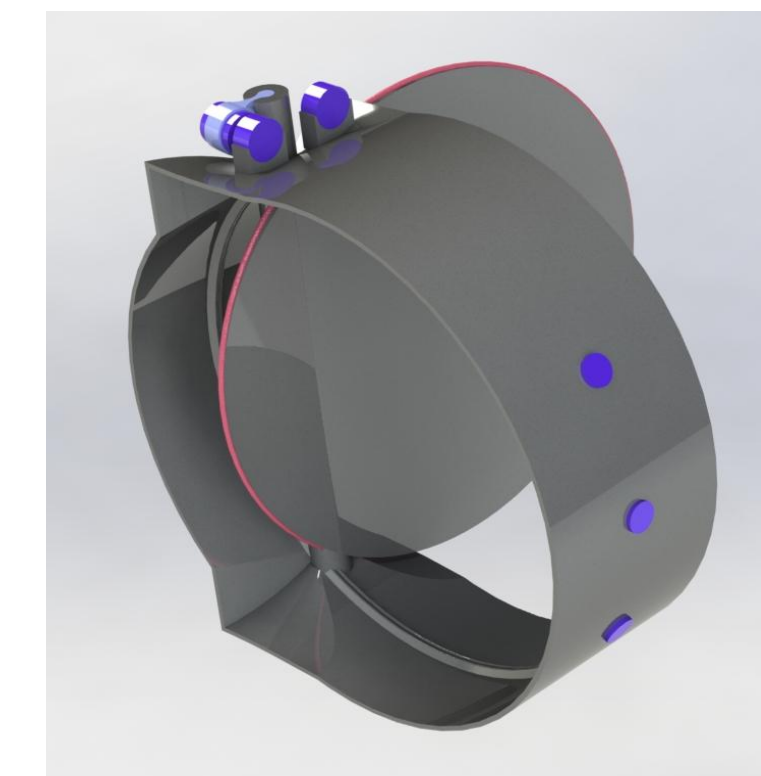
## Air Regulating and Pressure Relief Valves

Air Regulating Valve (ARV)



The ARV on the left is based on a double offset butterfly valve, while the PRV on the right incorporates a triple offset. This leads to different seating, sealing and disc edge designs. However, both use identical springs, shaft and sealing magnet systems.

Pressure Relief Valve (PRV)



## Future Testing

The proposed designs should undergo prototyping, benchmarking, and testing to verify concepts and meet standards.

## Acknowledgements

SolarShip Inc.  
Prof. Kesler  
MIE Department