

# Spacecraft Thermal Management Systems

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## Variable Emittance Surfaces (VES)

### Electrochromic Cell:

- voltage application causes reversible change in color
- to be adjusted for thermal regulation (Figure 1)
- functions as a possible solution to low-cost, effective device to mitigate thermal loads

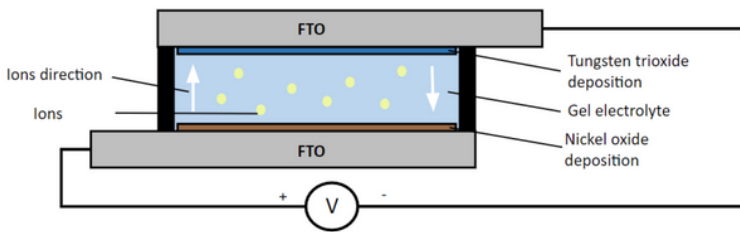


Figure 1: Electrochromic VES

### Electrophoretic Display:

- voltage applied allows for charged particles to migrate toward or away viewing plate
- VES alternative to allow for variable transparencies

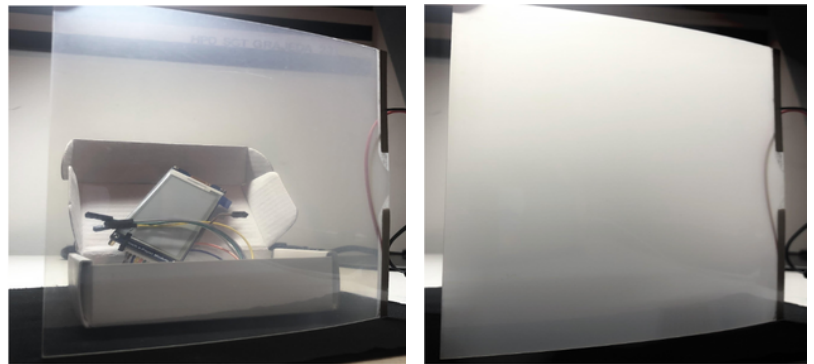


Figure 2: Smart Window -- Transparent (left) // Opaque (right)

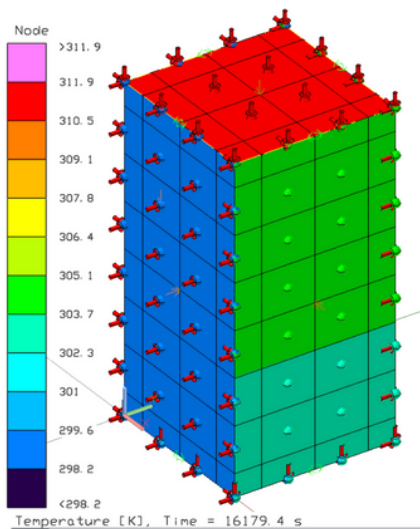


Figure 3: Temperature Gradient for Orbit

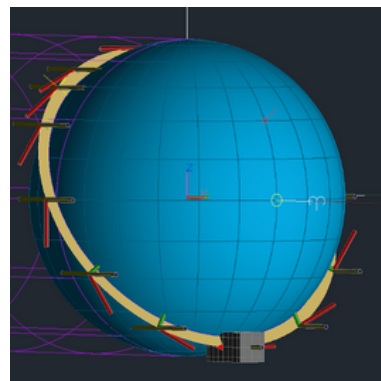


Figure 4: Orbit Trajectory

## Orbital Mechanics

- satellite operates in low-earth orbit (LEO) at 500km (Figure 4)
- orbit visual and thermal analysis conducted in Thermal Desktop

## Integrations and Environment Testing

### Thermal Vacuum System:

- simulates vacuum conditions for testing of VES
- designed and manufactured by STMS undergraduate researchers
- reaches vacuum gauge pressure of 0.01 Torr
- operational volume of 1000 cubic centimeters

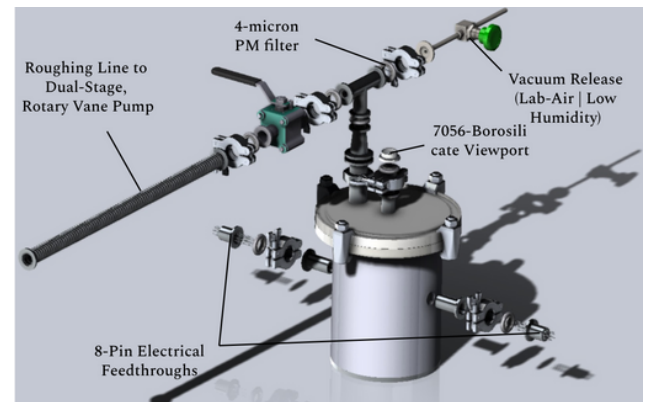


Figure 5: Thermal Vacuum System CAD