Spacecraft Thermal Management Systems

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Project Background

- CubeSats operate at a higher range of temperature than anything found on earth, yet they must still be able to manage it.
- Mechanical hardware can prove to be inefficient when it comes to smaller satellites such as these
- A Variable Electrochromic Device (VED) can absorb or reject heat as desired
- A VED can be operational with just a simple electrical current that runs through its membrane and in between its slides, allowing it to change its emissivity

Goal

- Design, manufacture and test a prototype VED by summer 2020

Objectives

- Can withstand P < 10e-3 Pa
- Gel-Electrolyte conductivity > 10e-4 S/cm
- Emissivity: 0.2 < ε < 0.8
- Consistent NiO & WO_3 deposition

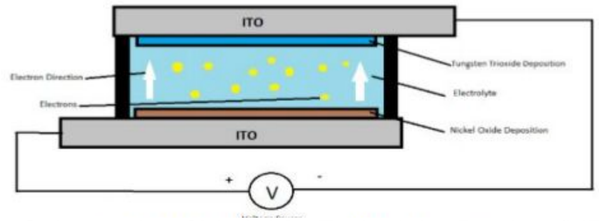


Fig 1: Schematic of Variable Emissivity Device (VED)

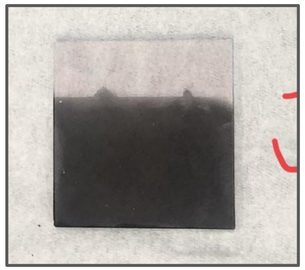


Fig 2: Nickel slide with uniform deposition

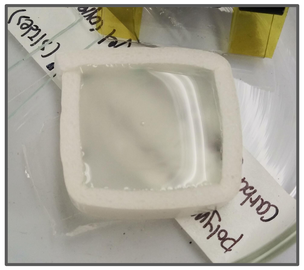


Fig 3: Initial gel-electrolyte synthesis

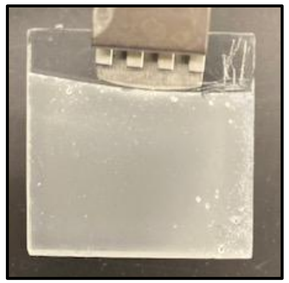


Fig 4: Tungsten slide with uniform deposition

Fig 5: Preliminary vacuum chamber design

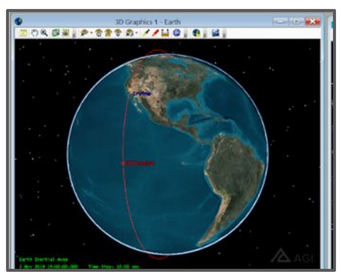


Fig 6: Initial orbit simulation

Fig 7: Emissivity testing set up for the E-ink team

Team Budget

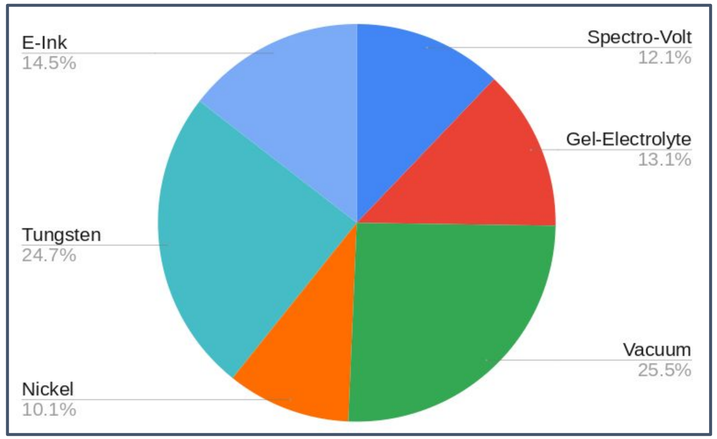
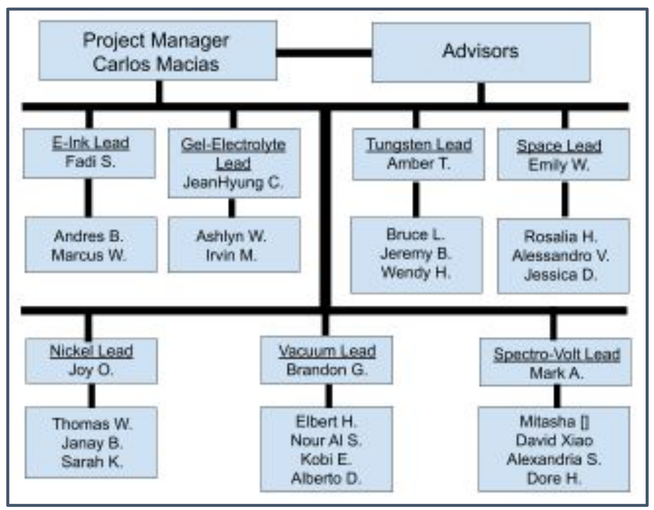


Fig 8: Total budget comes out to be $7,879 and is broken down per team in the following way

Team Organization



Timeline

Fall 2019	Winter 2020	Spring 2020	Summer 2020
-Synthesize preliminary gel -Design and manufacture an electrode holder -Build Test Setup for Emissivity Measurement	-Initiate Manufacturing Process of Vacuum Chamber -Build Relectance Test Setup -Create a test cell with epoxy sealant -Build Vacuum Testing Setup	-A complete report of simulation reports will be generated -Change the color of films using the potentiostat. -Begin integration of WO3 and NiO films and gel-electrolyte. -System Assembly	-Review the year and establish what worked and what didnt -Develop new tactics to tackle inefficiency -Establish improved structure and apply it for the upcoming year

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