# ENAE 691 SATELLITE DESIGN

# THERMAL CONTROL

# Homework

University of Maryland, College Park
Department of Aerospace Engineering
February 15th, 2023

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# Question 1:

- Pick one of the thermal control hardware components listed below and summarize what it is used for (Aerospace application), how it works, under what conditions an engineer would choose to use it instead of other thermal solutions, and a spacecraft it has flown on. Please site your sources of information. ~1-2 paragraphs
  - Cryocooler
  - Phase Change Material
  - Louvers
  - TEC – Thermo-Electric Cooler – aka Peltier Coolers
  - Loop Heat Pipe

# Question 2:

- How big does a radiator with the following coatings and environments need to be to stay below 40C while dissipating 50W of electronics power? Show your work. Use metric units. Note that it is possible to not be able to size a radiator to meet these conditions.
- Coatings:
  - Optical Solar Reflector (alpha=0.09 emissivity=0.78)
  - White Paint (alpha=0.2 emissivity=0.92)
  - Black Paint (alpha=0.92 emissivity=0.89)
- Environment:
  - Nadir Radiator Earth Oriented:
    - Albedo=0.3*1419W/m2
    - Earth IR=239 W/m2
  - L3 anti sun face: no environmental heating
  - Sun facing:
    - Solar: 1419 W/m2

| | Optical Solar Reflector | White Paint | Black Paint |
|---|---|---|---|
| Nadir Radiator Earth Oriented | | | |
| L3 Anti Sun | | | |
| Sun Facing | | | |

# Question 3:

- Size the maximum diameter of a 20mm tall cylindrical G10 thermal spacer around a stainless-steel bolt (6.35mm diameter) that will be used to isolate two plates to limit the heat transfer to 0.25W. Make sure to account for the conduction of the bolt. Show your work. Use metric units.
- G10 conduction = 0.6 W/mK
- Stainless-steel conduction = 15 W/mK