Adjustable Coolant Clamp (ACC)

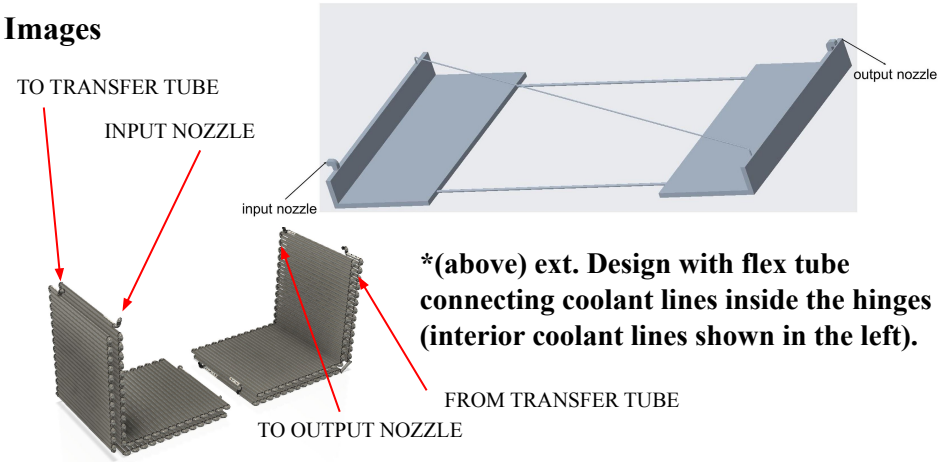
Goal

- Design a lower mass, low volume, lower cost heat transfer system dedicated to cool the XR-100 Discharge Supply Unit (DSU) components (located in the Power Processing Unit).

Objectives

- Decrease the mass, volume, and cost of a coolant plate design relative to the current state of the art, while simultaneously improving heat flux capabilities relative to the SOA technology.
- Aim to meet the current ground testing PPU cooling requirements for high-powered Nested Hall Thrusters (NHT) while still maintaining a long thruster life span.
- Projected TRL level of 3

Images



***(above) ext. Design with flex tube connecting coolant lines inside the hinges (interior coolant lines shown in the left).**

Team

- Dr. Sean Reilly, Thermal Systems Engineer, NASA JPL (SME)
- Dr. James Gilland, Senior Scientist, Ohio Aerospace Institute (NASA-GRC) (SME)
- Hrishikesh Sathyanarayan, undergraduate student (Mechanical Engineering, Rutgers Univ.) (Principal Investigator)
- Bharg Shah, graduate student (Aerospace Engineering, Rutgers Univ.) (Co-I)
- Garrett Craig, undergraduate student (Biomedical Engineering and Nursing, Duquesne Univ.) (Co-I)
- Devin Lewis (Aerospace Engineering, Rutgers Univ.) (Co-I)
- Siddharth Sambath Ramkumar (Aerospace Engineering, Rutgers Univ.) (Co-I)
- Gaurav Pandey (Mechanical Engineering, Drexel Univ.) (Co-I)
- Kate Hazaveh (Computer Software Engineering, Drexel Univ.) (Co-I)

Taxonomy

- TX01.2.01 (Integrated Systems and Ancillary Technologies)
- TX01.2.2 (Electrostatic)

Expertise: Heat Transfer and Thermodynamics, Electronics, Mechanics, Project Management and Manufacturing, Cost optimization, Material Science, CAD development (Fusion 360, Solidworks)

Metrics and Performance Parameters

SOA (TRL ~7)

- Independent structural and heat transferring components
  - 27.94 cm x 19.81 cm x 1.905cm for one DSU unit
  - $2251.32 per DSU unit
  - Heat transferred to 2D cold plate region

ACC (TRL ~ 3)

- 3D printed alumide hinges → easy to manufacture
- Interwoven structural and heat transferring components efficiently
  - 20 cm x 44 cm x 6 cm (1cm thick) for one DSU unit
  - $1238.29 per DSU
  - 5.6 kg per unit
  - Utilization of liquid Ammonia Coolant ($-60^{o}C < T < 100^{o}C$ for $NH_3(l)$)
    - More compatible with aluminum
  - Higher surface area → more efficient heat flux relative to SOA
  - Easily scalable for any NASA mission or for commercial use