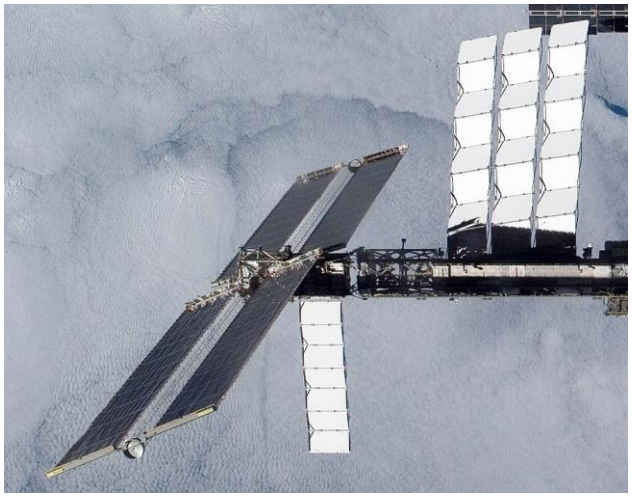
Heat Rejection Technologies



Name of Technology:
Variable Heat Rejection

Participating NASA Centers:
JSC (Lead); GRC, GSFC, JPL, KSC, LaRC, MSFC

Technological Area:
H3.04Thermal Control Systems

Vision for the Technology:
New spacecraft will require innovative variable heat rejection technologies to manage the severe environments ranging from deep space to being in full sun. Technologies are needed to adjust to thermal conditions along its journey. Conditions may require heat rejection while other situations may need heat energy to be transferred to other locations.

Challenges:
Variable heat rejection is the ability for a spacecraft to vary the amount of waste energy rejected. This occurs when a specific spacecraft experiences any one or combination of following scenarios:

- large variations in environmental sink temperature (i.e. 60K to 320K),
- large variations in required waste heat rejection (i.e. 600 watts to 9000 watts),
- and/or long periods of dormancy.

NASA Seeks to Meet the Following Specs:
Variable heat rejection typically is referred to via the term vehicle turn down ratio (TDR). A key performance goal for turndown is a TDR of:

- at least 4 to 1
- stretch goal of 10 to 1 (with waste heat rejection requirements as high as 10 kW)

Overview of Student Project:
NASA seeks innovative variable heat rejection technology solutions. Solutions may include new technologies as well as improving current technologies such as, thermal control fluids, advanced heat pipes, variable geometry, optical coating for radiators, etc.

Innovative Areas Student Projects Can Address:

A. Unique techniques (including coatings) and design for variable heat rejection

B. Improving current technologies

Project Phases

I. Analytical and experimental proof-of-concept of critical function and/or characteristics.

II. Component and/or breadboard validation in a laboratory environment.

Research Funded by NASA on this Topic:
Proposal Number: 14-1 H3.01-9240
Variable Heat Rejection Loop Heat Pipe radiator

Proposal Number: 15-2 H3.03-9079
Designer Fluid for use in a Single Loop Variable Heat Rejection Thermal Control System

Proposal Number: 18-2- Z2.01-2234
A Next Generation Spacecraft Heat Rejection System

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Proposal Number: 21-1- S3.06-2422
Passive Variable Heat Rejection Freeze-Tolerant Direct Condensation Heat Exchanger/Radiator

References:

H3.04Thermal Control Systems

Z2.01Active Thermal Control Systems for Space Exploration

Z2.01Thermal Management

Z2.01Spacecraft Thermal Management

S3.06Thermal Control Systems

S3.06Thermal Control Systems

S16.05Thermal Control Systems