JWST : Pathfinder for Long-Duration Solar System Missions.

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Introduction: The James Webb Space Telescope (JWST) will not only explore the secrets of the distant universe but it may provide the key to the exploration of our solar system with both manned and unmanned long-duration missions.

The JWST utilizes passive thermal control with large sun shades to create and maintain a large 40 Kelvin environment for the 6.6 meter mirror and the four instruments throughout the 5 to 10 year life of the mission.

The development of large-scale, long-duration passive thermal control to 40K will allow the unrestrained use of three key technologies :

- Low Temperature Electronics (LTE)
- High Temperature Superconductors (HTS)
- Cryogenic Ice Storage (CryoIce)

This will revolutionize the designs and opportunities of large-scale, long-duration manned and unmanned missions throughout the solar system.

Low Temperature Electronics (LTE): It has been shown that LTE can dramatically reduce the mass and increase the complexity and sensitivity of scientific instruments and flight electronics that are designed to operate at 40K temperatures.

High Temperature Superconductors (HTS): When the room is at 40K, High Temperature Superconductors become Room Temperature Superconductors and can be used anywhere : High Current HTS can be used for power storage and radiation shielding, Hybrid HTS / LTE circuits hold promise for new scientific instruments and power control systems.

Cryogenic Ice Storage (CryoIce): At 40K, key volatile raw materials (O2, L2, Ar, H2O) can be stored as ices with zero cryogenic boil off for years or decades. H2 could be stored as an ice or slush at 10K - 20K with active cooling, but this cooling would require much less power than current high temperature (200K - 300K) mission designs.

This poster will present examples in each category of realistic designs that could revolutionize space systems when operated in a passively cooled 40K environment over a long-duration manned or unmanned mission.