NASA STTR 2018 Phase I Solicitation

T3.02 Intelligent/Autonomous Electrical Power Systems

Lead Center: GRC

Participating Center(s): JPL

Technology Area: TA3 Space Power and Energy Storage

Missions to Mars and beyond experience communication delays with Earth of between 3 to 45 minutes.Â Due to this, it is impractical to rely on ground-based support and troubleshooting in the event of a power system fault or component failure.Â Intelligent/autonomous systems are required that can manage the power system in both normal mode and failure mode.

In normal mode, the system would predict energy availability, perform load scheduling, maintain system security and status on-board and ground based personnel. One aspect of overall system autonomy would be solar array characterization, for spacecraft utilizing this technology.Â One drawback of current satellite systems is the lack of adequate means of determining solar panel or cell status. Being able to automatically characterize solar panel status can enhance energy availability prediction.Â Similar technology to access that status of battery systems would further enhance these predictions.

In failure mode, the system must identify a fault or failure and perform contingency planning to react or reconfigure the system appropriately to move it back into normal mode of operation, without human involvement.Â The technologies to detect and identify specific failures in both the generation, distribution and storage systems are needed along with strategies to utilize the failure data to identify recovery strategies for the power system.

With the potential of future manned missions to Mars, this technology will become increasingly important for electrical power management and distribution.Â Specific areas of interest include:

- Autonomous/intelligent PMAD.
- Failure detection strategies.
- Recovery strategies.
- Generation and storage characterization.