PMAD FOR THE NEXT GENERATION SPACECRAFT

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The next generation spacecraft is reducing the power, mass and volume envelope for the power system. The Power Management and Distribution (PMAD) function has traditionally been the largest consumer of power system allocations (excluding the source.) On Cassini, PMAD was 75% of the allocated power, volume and mass for the power conditioning equipment. The next generation spacecraft has defined the need for power system miniaturization and multi-mission adaptability.

The PMAD functional block provides power conversion and the load switching interface between the user and the power system. Power conversion will provide the user specified voltages and internal PMAD house keeping power. Every load is connected via a power switch which protects the system from load faults and provides telemetry. A command interface is provided to control the switches and access telemetry.

The PMAD miniaturization approach is to reduce the size without losing system flexibility The functions of PMAD can be broken down to repeated functions and system specific functions. The repeated functions arc candidates for in-accessible packaging techniques such as *hybridization* and *mixed signal asics.* The system specific functions must utilize packaging techniques which arc either accessible or programmable,

The load switching function is repeated for every load on the spacecraft, Cassini used a first generation hybrid power switch (SSPS). The SSPS is designed specifically for the Cassini system. The next generation power switch will be a simpler version with the capability to switch different voltages on either the high or low side. The new topology permits different switch configurations to accommodate specific load requirements. The switch will still provide the telemetry and fault protection required for each load. The added flexibility will increase the functional adaptability of the PMAD functional block to different load classifications.

Power conversion contains both repeated functions and system specific functions. The pulse width modulation (PWM) and synchronous rectification are repeatable among different power converters. The power transformer, input/output filters and control feedback loop are accessible outside of the hybrid. The hybrid can be used in different topologies to optimize performance for different system requirements. The hybrid power converter combines high density packaging with system design flexibility without sacrificing efficiency.

The command interface is a mission specific function. Recent developments in field programmable gate arrays (FPGAs) have provided a means for miniaturizing the command interface without sacrificing the system flexibility. The FPGA is important to maintaining multi-mission capability without invoking a command interface standard,

The next generation PMAD is answering the challenges from the 'faster-better-cheaper" mission profiles. The high density packaging combined with design flexibility provides a functional PMAD building block for the power system. The next generation PMAD provides system adaptability without sacrificing power, mass and volume.