Magnetospheric Multiscale (MMS)

RTEMS (http://www.rtems.com) is an Open Source RTOS providing a powerful development and run-time environment that promotes the production of efficient real-time embedded applications.

Features:

- Scalable Architecture
- Modified GPL License
- Multiple APIs - Classic, POSIX
- Event-driven multitasking
- Priority-based, preemptive scheduling
- Responsive Interrupt Management
- Optional Rate Monotonic Scheduling
- Priority Inheritance and Ceiling Protocols
- Intertask communication and synchronization
- Homogeneous and heterogeneous multiprocessor systems
- Reentrant ANSI C Library
- Add-on libraries including Python, Lua, and Tcl
- High performance BSD TCP/IP Stack
- Protocols: TCP, UDP, BOOTP, ARP, ICMP
- Servers: FTPD, HTTPD, TELNETD
- Clients: DHCP, NTP, DNS, TFTP

Processors Supported:

M680x0	ix86	Coldfire	ARM
M683xx	Pentium	MIPS	Blackfin
PowerPC	SuperH	SPARC	H8
NIOS2		SPARC64	

Available Services:

- Training
- Standard Support
- Legacy Support
- RTEMS Application Assistance
- Board Support Package Development
- Application Design and Development
- Ports to New Architectures
- System Architecture Design

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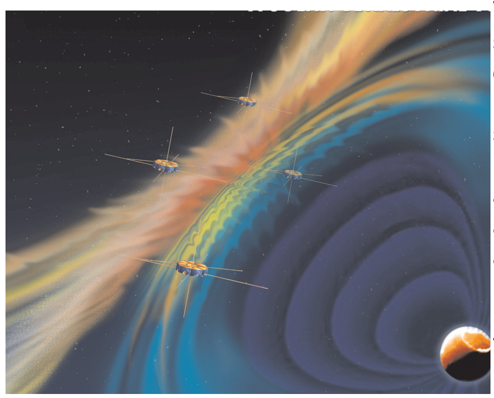
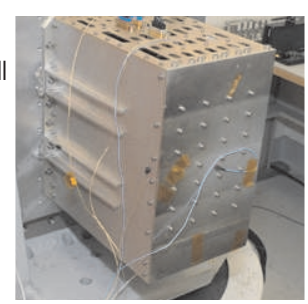
NASA's Magnetospheric Multiscale (MMS) mission is a Solar Terrestrial Probes mission is scheduled for launch in 2014. It consists of four identically instrumented spacecraft, will use Earth's magnetosphere as a laboratory to study magnetic reconnection, a fundamental plasma-physical process that taps the energy stored in a magnetic field and converts it—typically explosivly—into heat and kinetic energy in the form of charged particle acceleration and large-scale flows of matter.

Magnetic reconnection occurs universally in plasmas, the electrically conducting mixes of positively and negatively charged particles that account for an estimated 99% of the observable universe. It is the ultimate driver of the phenomena we know as "space weather." Eruptive solar flares, coronal mass ejections (CMEs), geomagnetic storms, and magnetospheric substorms all involve the release through reconnection of energy stored in magnetic fields.



The four MMS spacecraft will carry identical suites of plasma analyzers, energetic particle detectors, magnetometers, and electric field instruments as well as a device to prevent spacecraft changing from interfering with the highly sensitive measurements required in and around the diffusion regions. The plasma and fields instruments will measure the ion and electron distributions and the electric and magnetic fields with unprecedented high (millisecond) time resolution and accuracy. These measurements will enable MMS to locate and identify the small (10's of km) and rapidly moving (10-100 km/s) diffusion regions, to determine their size and structure, and to discover the mechanism(s) by which the plasma and the magnetic field become decoupled and the magnetic field is reconfigured. MMS will make the first unambiguous measurements of plasma composition at reconnection sites, while energetic particle detectors will remotely sense the regions where reconnection occurs and determine how reconnection processes produce large numbers of energetic particles.

The four satellites will be launched together on a single launch vehicle and inserted sequentially into Earth orbit. As they explore the dayside and nightside reconnection regions, the spacecraft will fly in a tetrehedral (pyramid) formation, allowing them to capture the three-dimentional structure of the reconnection sites they encounter.



Multiple embedded computers on this mission will use RTEMS on a space-hardened Coldfire microprocessor.

References:

- MMS Mission Home Page
  - http://mms.gsfc.nasa.gov
- Solving Magnetospheric Acceleration, Reconnection, and Turbulence (SMART)
  - http://mms.space.swri.edu/
- RTEMS Wiki Page
  - http://www.rtems.com/wiki/index.php/Magnetospheric_MultiScale