RTEMS Application Spotlight

Electra

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	

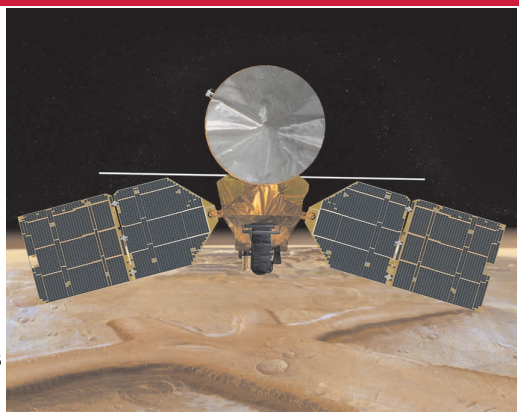
Available Services:

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

On-Line Applications Research (OAR) Corporation

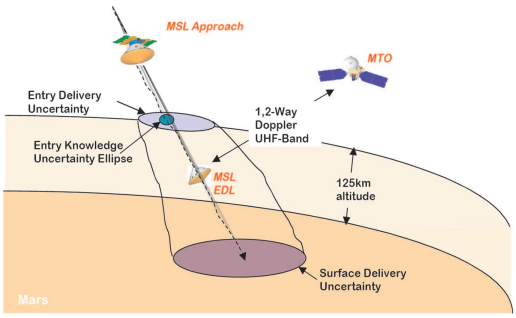
7047 Old Madison Pike
Suite 320
Hunstville, AL 35806
http://www.oarcorp.com
Phone: 256-722-9985
Fax: 256-722-0985

Developed by the Jet Propulsion Laboratory, the Electra is a software defined radio (SDR) which became baseline equipment for future Mars missions beginning with Mars Reconnais-sance Orbiter (MRO) launched in August 2005. These SDRs are nominally configured for Mars-local UHF opera-tion for data relay in the vicinity of 437MHz and are also capable of making high precision radiometric measurements in Doppler and range.



The Electra SDRs are a critical piece of the Mars infrastructure as they are used for relaying commands from Earth to landers on the Mars surface and for returning science and engineering data back to Earth using the Mars Reconnaissance Orbiters more powerful direct-to-Earth telecommunications system. Current plans call for the Phoenix, the first of the NASA Mars Scout programs, to be the first lander to utilize this capability. Phoenix is a stationary lander for studying Mars' north polar region in 2008. Data from Mars Reconnaissance Orbiter will help in selection of landing sites for future missions. Among the first planned for using this capability is a highly sophisticated rover called Mars Science Laboratory, now in development and slated to begin surface operations in 2010. Projections call for over 34 terabytes of data to be transferred back to Earth using the MRO and Electra infrastructure — more data than the previous five missions combined.

Electra features a space qualified Sparc V7 CPU at 25MHz and several megabytes of memory. Extremely modest by modern personal computing standards, there is excess computing capacity and memory sufficient for hosting an on board, real time navigation filter. Thanks to the low processing and RAM requirements of RTEMS, the base software capabilities leave well over half of the CPU and memory resources for other real-time applications such as real time navigation filtering. Utilizing spare Electra capacity for on board navigation frees other resources, such as the main spacecraft housekeeping computer, from involvement in such a computationally intensive, time critical task. Also, the radiometric data is locally available inside Electra and need not be transferred over the spacecraft bus.



References:

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  - http://mars.jpl.nasa.gov/mro/
- MRO Fact Sheet
  - http://mars.jpl.nasa.gov/mro/newsroom/factsheets/pdfs/MRO-060303.pdf
- Electra. Home Page
  - http://mars.jpl.nasa.gov/mro/mission/sc_instru_electra.html
- RTEMS Wiki Page
  - http://www.rtems.org/wiki/index.php/Electra