

RTEMS APPLICATION SPOTLIGHT

Dawn

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:

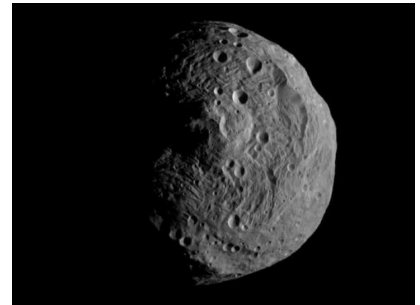
- Training
- Standard Support
- Legacy Support
- RTEMS Application Assistance
- Board Support Package Development
- Application Design and Development
- Ports to New Architectures
- System Architecture Design

On-Line Applications

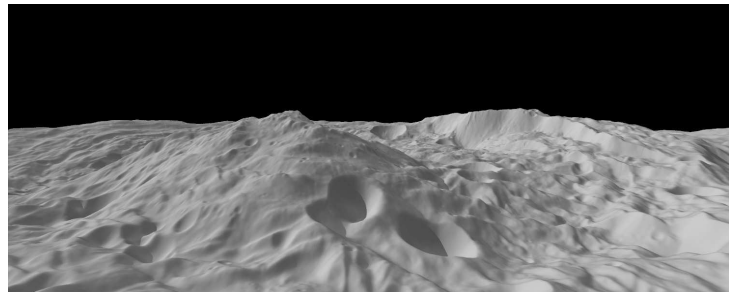
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On September 27, 2007, NASA's Dawn space-craft was successfully launched from Cape Canaveral, Florida to begin its 3 billion kilometer (1.7 billion mile) journey to the asteroid belt. On July 18, 2011, NASA released this photograph of Vesta taken by the framing camera running RTEMS. Dawn will continue to investigate Vesta before heading to Ceres. Dawn is scheduled to reach Ceres in 2015.



The Dawn spacecraft contains a science payload of two identical Framing Cameras – both of which are running RTEMS on a SPARC LEON2 processor. These cameras are the scientific imaging system of the Dawn spacecraft and provide a backup system optical navigation. To obtain two-dimensional images in one broadband and seven narrow band spectral channels, each camera is equipped with a filter wheel in front of the single CCD sensor. The sensor provides a resolution of 1024 x 1024 pixels. Each camera is controlled and its data is processed by a Data Processing Unit, which was completely developed and verified at Institut für Datentechnik und Kommunikationsnetze (IDA). The following photograph is a view of Vesta's South Polar Region.



An enhanced version of the VMC "System-on-Chip (SoC)" approach is used for the implementation of all functionalities together with a SPARC LEON2 processor core within reprogrammable Xilinx FPGAs. Including an internal camera image mass memory of 8 Gbit, the complete processor system has a volume of 600 cm³, a mass of 520 g and a power consumption of less than 7 W. Each camera is controlled and its data is processed by the LEON2 based Data Processing Unit (DPU). The free real-time operating system RTEMS is used as basis for a complete instrument control and on-board data processing system, implemented in a sophisticated on-board command language (OCL). An earlier version of the Framing Camera was a critical component of the Venus Express spacecraft and also used RTEMS.

References:

- Mission Home Page
 - <http://dawn.jpl.nasa.gov/>
- Dawn Fact Sheet
 - http://dawn.jpl.nasa.gov/mission/dawn_fact_sheet.pdf
- IDA Home Page
 - <http://www.ida.ing.tu-bs.de/index.php>
- RTEMS Wiki Page
 - <http://www.rtems.com/wiki/index.php/Dawn>