RADIANT

Spacecraft Flight Software

Radiant is the Space Dynamics Laboratory's (SDL) modular, fully reusable core flight software solution for small spacecraft. Radiant was developed without ties to specific hardware platforms, allowing compatibility with various architectures and systems. Radiant runs in a real-time Linux environment with potential support for additional real-time operating systems.

MODULAR, FLEXIBLE ARCHITECTURE

Radiant is designed as a decentralized system of independent applications, where each application independently describes its own control and telemetry using XML. These XML capability descriptions also act as well-defined simulation boundaries for the system.

This decentralized architecture enables new missions to completely reuse applications without modification to the core Radiant flight software. Tasks often hard-coded, such as telemetry aggregation, health monitoring, mode transitions, system states, and memory protection, are all driven through XML configuration files. Relying on configuration rather than coded logic decreases development time while increasing flexibility on orbit. This adaptability enables SDL to fulfill a broad range of missions while minimizing software development and qualification. This TRL 9 software has completed successful on-orbit small satellite missions for SDL for years.

SEAMLESS INTERFACING

Radiant's modular architecture enables users to easily interface with mission-specific applications, hardware, ground test equipment, and software without core code modification. Radiant-based systems interface with test software across an Ethernet link. This provides full access to system telemetry and commanding and does not require a special mode of operation.

APPLICATION DEVELOPMENT

Radiant provides users with a structured development platform where they can develop new applications within the Radiant application framework, allowing simple access to other applications or subsystems.

AS9100D & ISO 9001 COMPLIANT

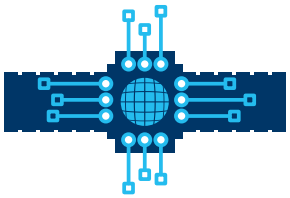
SDL incorporates a strict quality management system that is certified to the AS9100D and ISO 9001 standards. Our software development procedures include a documented method to control and verify development to ensure that the finished product meets specified requirements within schedule and budget constraints.

This is accomplished through measurable benchmarks and traceability using the following:

- Feature-driven agile development
- Formal inspections & peer reviews
- Static & dynamic code analysis
- Formal validation & acceptance tests
- Automated regression tests
- Managed configuration control & change processes
- Deficiency tracking & reporting

FEATURES

- Modular, flexible architecture enables reusability & minimizes development costs
- No ties to specific hardware components
- Seamless interfacing without code modification
- XML-defined messaging for universal compatibility



PAYLOAD INTERFACING

FAULT DETECTION & RECOVERY

FLIGHT SOFTWARE

UTAH STATE UNIVERSITY
SPACE DYNAMICS LABORATORY®

416 East Innovation Avenue | North Logan, Utah 84341 | info@sdl.usu.edu | www.sdl.usu.edu

SDL/18-1554 Rev. C

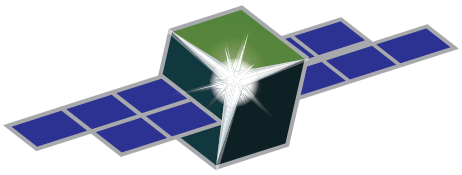
RADIANT Spacecraft Flight Software

RADIANT MINIMUM REQUIREMENTS

- 100 MHz CPU
- 256 MB RAM
- Linux-based operating system
- Read/write file system

RADIANT SAMPLE SYSTEM SETUP

The following diagram outlines a possible setup using Radiant flight software and illustrates Radiant's modular architecture and flexibility.



RADIANT MODULES

Command Processor

- Handles command routing, command execution timing, command schedule management & stored command sequences

Telemetry Processor

- Oversees telemetry collection, telemetry routing for downlink, throughput management, storage & logging

State of Health Monitor

- Conducts condition monitoring, autonomous events & application health monitoring

File Manager

- Enables file uplink, file downlink, file system access, on-orbit flight software updates, package management & memory scrubbing

Mission Manager

- Manages spacecraft state, mode transitions & framework for handling autonomous events

CCSDS Comm Link Module

- Provides a reusable interface for full CCSDS TC/AOS framing, packetization, virtual channels & FARM-1 frame validation

SSM Middleware

- Facilitates inter-process communication, publish/subscribe paradigm, capability registration/querying & GSE interfacing