

RADIANT

FLIGHT SOFTWARE



Radiant is the Space Dynamics Laboratory's (SDL) fully reusable core flight software solution for small spacecraft. For compatibility with various architectures and systems, SDL developed Radiant without ties to specific hardware platforms. Radiant targets a real-time Linux environment with possible future 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 any 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. Radiant is currently in use across at least eight different small satellite missions.

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

Users can develop new applications against the Radiant Application framework, which provides a structured development paradigm and simple access to other applications or subsystems.

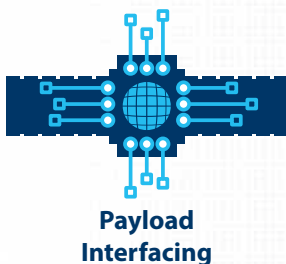
ISO-9001 COMPLIANT

SDL developed the Radiant software suite in compliance with its ISO-9001:2015 registered Quality Management System software development procedures. These procedures include a documented method to control and verify software development to ensure that the finished product meets specified requirements within schedule and budget constraints. This is accomplished through measurable benchmarks and traceability using:

- 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



Space Dynamics[™]
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RADIANT MINIMUM REQUIREMENTS

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

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

RADIANT SAMPLE SYSTEM SETUP

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

