

Aerospace

Project
Management



Systems
Engineering



Software
Engineering



Firmware
Engineering



FLIGHT SOFTWARE DEVELOPMENT FOR A ROTORCRAFT LANDER SAMPLING SYSTEM

APPROACH

- Ensure software meets requirements of NPR 7150.2D Class C mission
- Work closely with the client's software, FPGA, QA, electrical, and mechanical teams
- Perform trade studies to select OS, file system, and static analysis tools
- Create flight software
 - > Design data flow with custom publish/subscribe architecture
 - > Design modules via UML state and sequence diagrams
 - > Create custom interface transfer frame (ITF) with CCSDS packets
- Develop DevOps system to automate builds and testing
 - > Unit tests, system level tests, code coverage, static analysis dashboards
 - > Automatic code generator driven by shared telemetry and command
- verify CPU utilization and comms throughput

RESULTS

- Developed flight software framework, system architecture, and implemented logic for 24 modules
- Created digital twin simulator
 - > Simulated electrical modules (lander, power distribution units, motor power card, motor coordinator card) and mechanisms (sample delivery carousel, percussive drill, blower, valves, and heaters)
- Integrated single-board computer (SBC)
- Created lander simulation via OpenC3 COSMOS
 - > Commands, communications, telemetry visualization
- Reliability through error detection and correction (EDAC) and scrub of all memory, cyclic redundancy check (CRC) on I/O, journaled filesystem, and redundant firmware
- Wrote formal documentation and wiki how-to's for client handoff and maintenance

KEY TOOLS & TECHNOLOGIES

- RTEMS OS
- LEON3FT processor
- CCSDS
- TSIM and GRMON
- YAFFS2 file system
- OpenC3 COSMOS (Ruby scripting)
- GitLab CI/CD
- Multi-drop RS485/LVDS