Flight Software Group

(Courtesy LASP)

The LASP Flight Software Group has a rich history of developing flight software for planetary and earth-orbiting missions, beginning as early as the Galileo mission, and continuing today with the GOES-R/EXIS and MAVEN Remote Sensing instruments.

Embedded Systems

Flight Software is the "intelligence" that efficiently directs onboard operations, orchestrates the functionality of flight hardware to perform specific tasks, and protects against anomalies. LASP has experience with software architectures ranging from small to complex systems, both with and without a real-time operating system (RTOS). LASP also develops the GSE software systems necessary to develop, test, and integrate science instruments and spacecraft systems. Software is tested extensively at the component, subsystem, and integrated system levels. Tests types include functional and performance, stress, and long duration. LASP Flight Software systems are robust and reliable.

Design Philosophy

The art of embedded system design seeks the right balance between allocation of functionality to digital-logic and to software code. Flight Software provides adaptability, configurability, reliability, and ease-of-maintenance over hardware-only solutions.

There are many stakeholders at LASP involved in a typical embedded systems project, including project management,

scientists and engineers. LASP Flight Software Group members are involved early in the hardware design process, and work closely with each of these groups, and in-particular electrical engineers, to ensure that the planned system is the best solution.

LASP has documented processes that cover all phases of the software development life-cycle. Software quality assurance engineers ensure compliance and perform audits. LASP uses tools during software development that include revision control (SVN), issue tracking, and a document record and control system. We track requirements and design and test information from development and verification activities through to flight software release.

Flight Software Capabilities

LASP has a proven successful record of developing custom software solutions for unique and diverse applications.

Mechanisms and features

- Instrument doors and shutters
- Filter wheels
- Scan motors
- 2-axis pointing platforms
- Sequence engines
- Command and telemetry handling
- Instrument safing and anomaly response
- State machines

Source Lines of Code for Recent Flight Software Projects
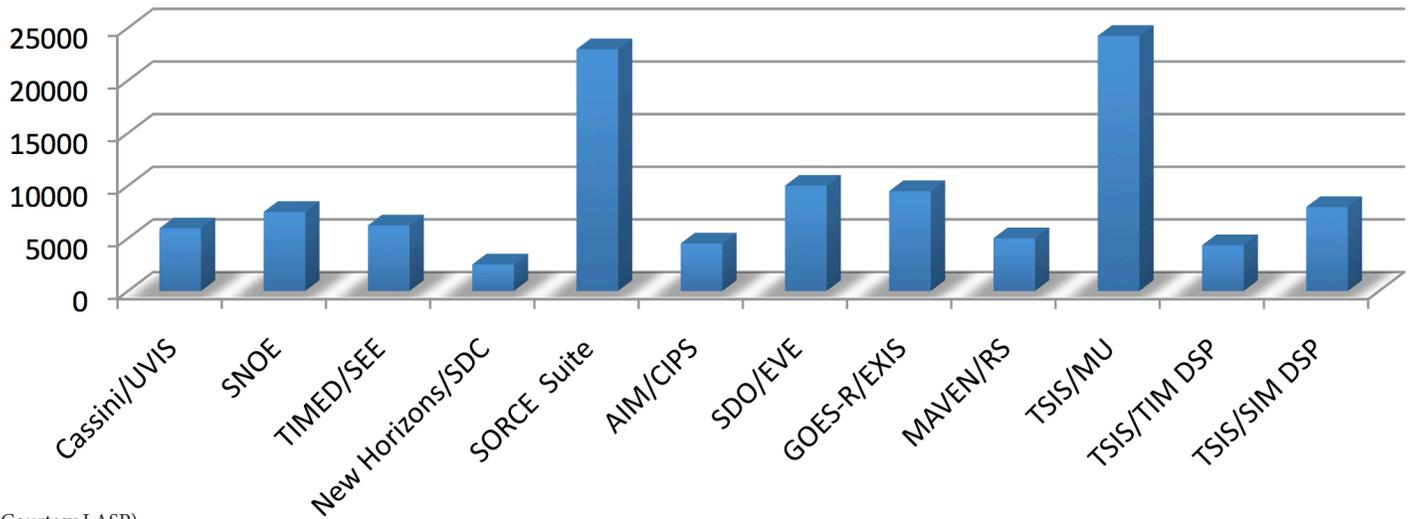
(Courtesy LASP)

Development
- Processes compliant with
  - ISO 9001
  - NASA 7150.2(a)
- Common software languages
  - C/C++
  - Ada
  - Assembly
- Standard development tools

Science instruments
- Dust counters
- UV spectrometers
- Imagers
- Electrical substitution radiometers (ESR)

Processors
- Amtel 8051
- RAD6000/750
- Motorola Coldfire
- UT699 LEON 3FT
- MA31750

Communications interfaces
- MIL-STD-1553
- RS-422
- SpaceWire

For more information about LASP Flight Software services, visit http://lasp.colorado.edu/home/mission-ops-data/operational-software/ or contact Gail Tate at 303-492-6825 or gail.tate@lasp.colorado.edu.
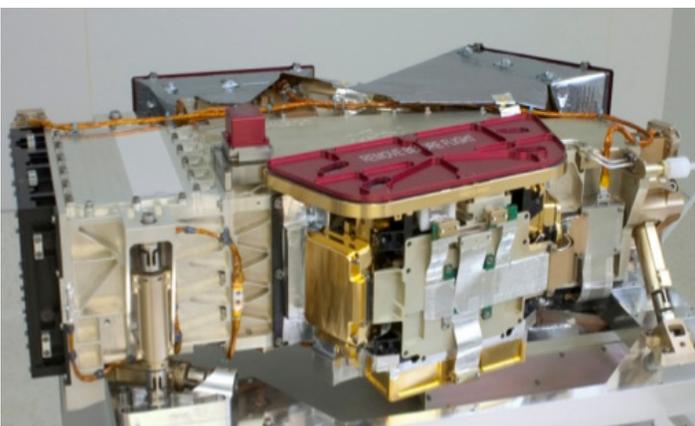
The Remote Sensing package aboard the MAVEN spacecraft, was conceived, designed, and built at LASP. The Imaging Ultraviolet Spectrograph (IUVS) will offer clues to how Mars might have lost its atmosphere.
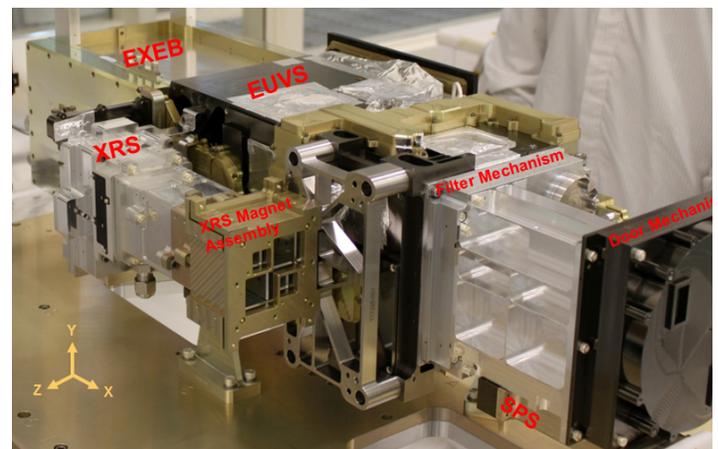
The GOES-R EXIS instrument will detect solar soft x-ray irradiance and solar extreme ultraviolet spectral irradiance in the 5–127nm range.

The Laboratory for Atmospheric and Space Physics (LASP) combines all aspects of space exploration through our expertise in science, engineering, mission operations, and data management. As an institute at the University of Colorado Boulder, LASP includes students throughout our activities. Learn more at http://lasp.colorado.edu.