Welcome to The Laboratory for Atmospheric and Space Physics

The 29th annual National Space Symposium April 8-12

Engineering Division

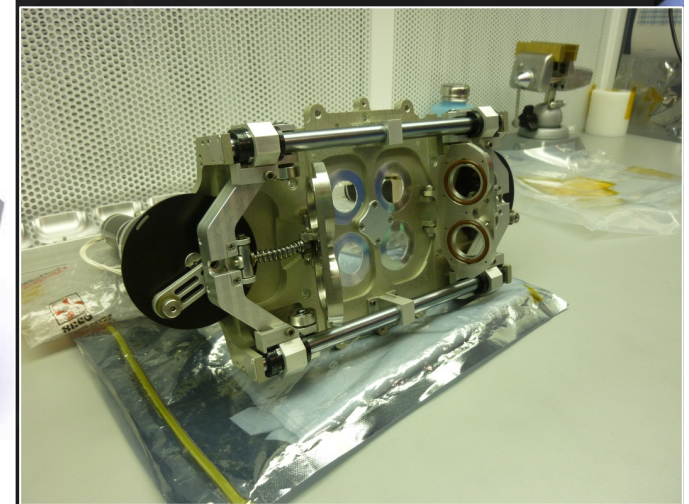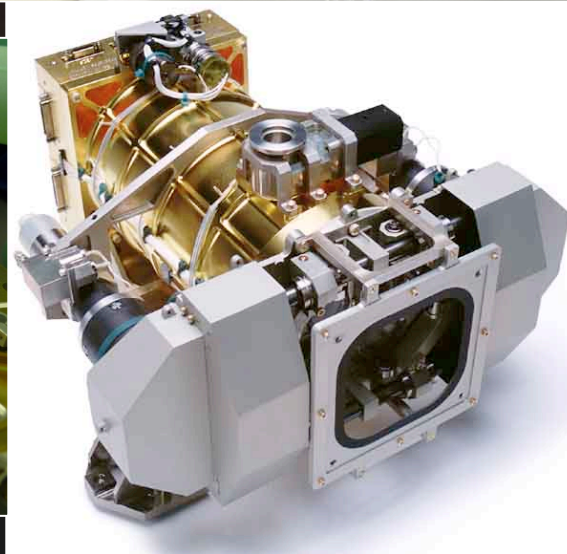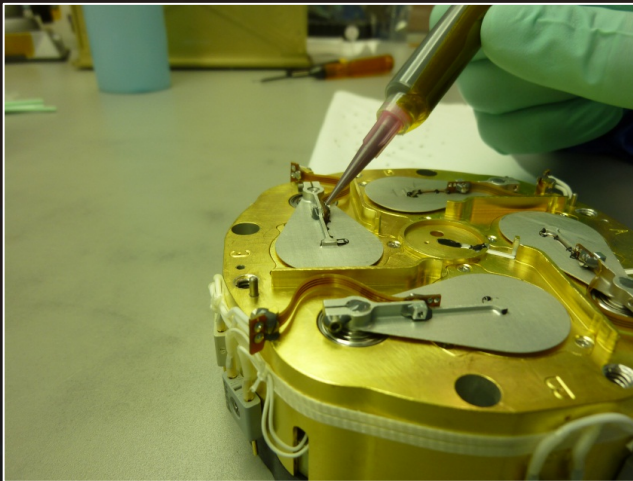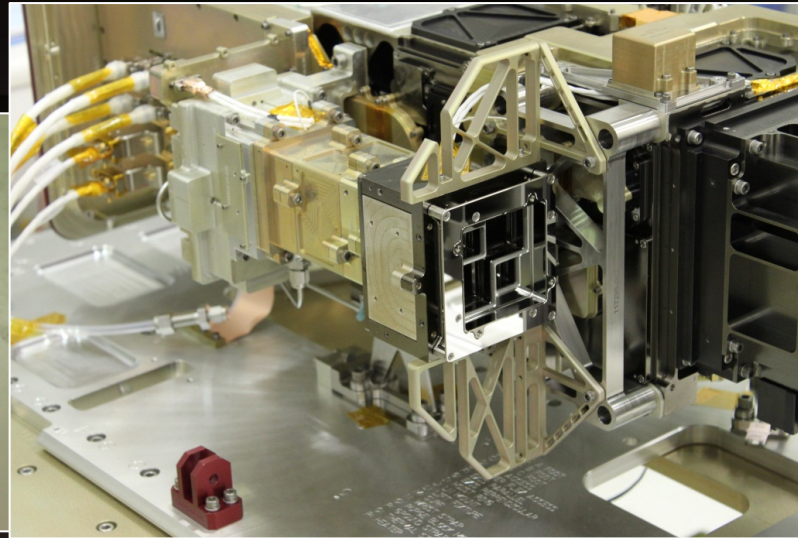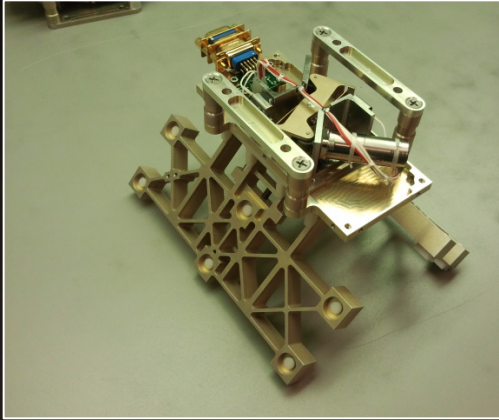Presentation by Tom Sparn

Planetary Science • Space Physics • Solar Influences • Atmospheric Science • Engineering • Mission Operations & Data Systems
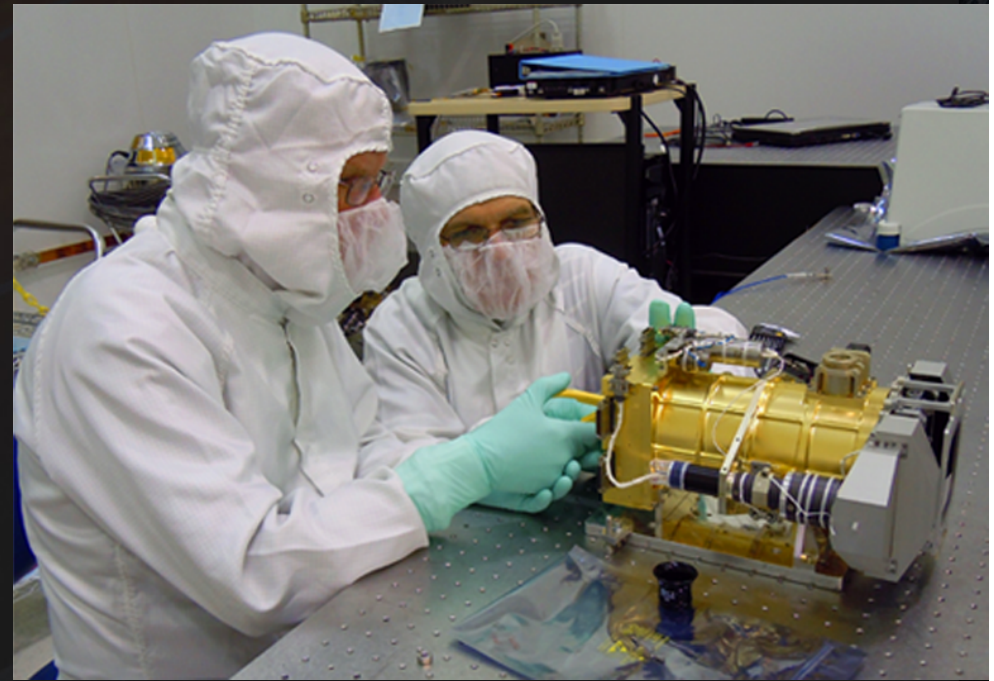
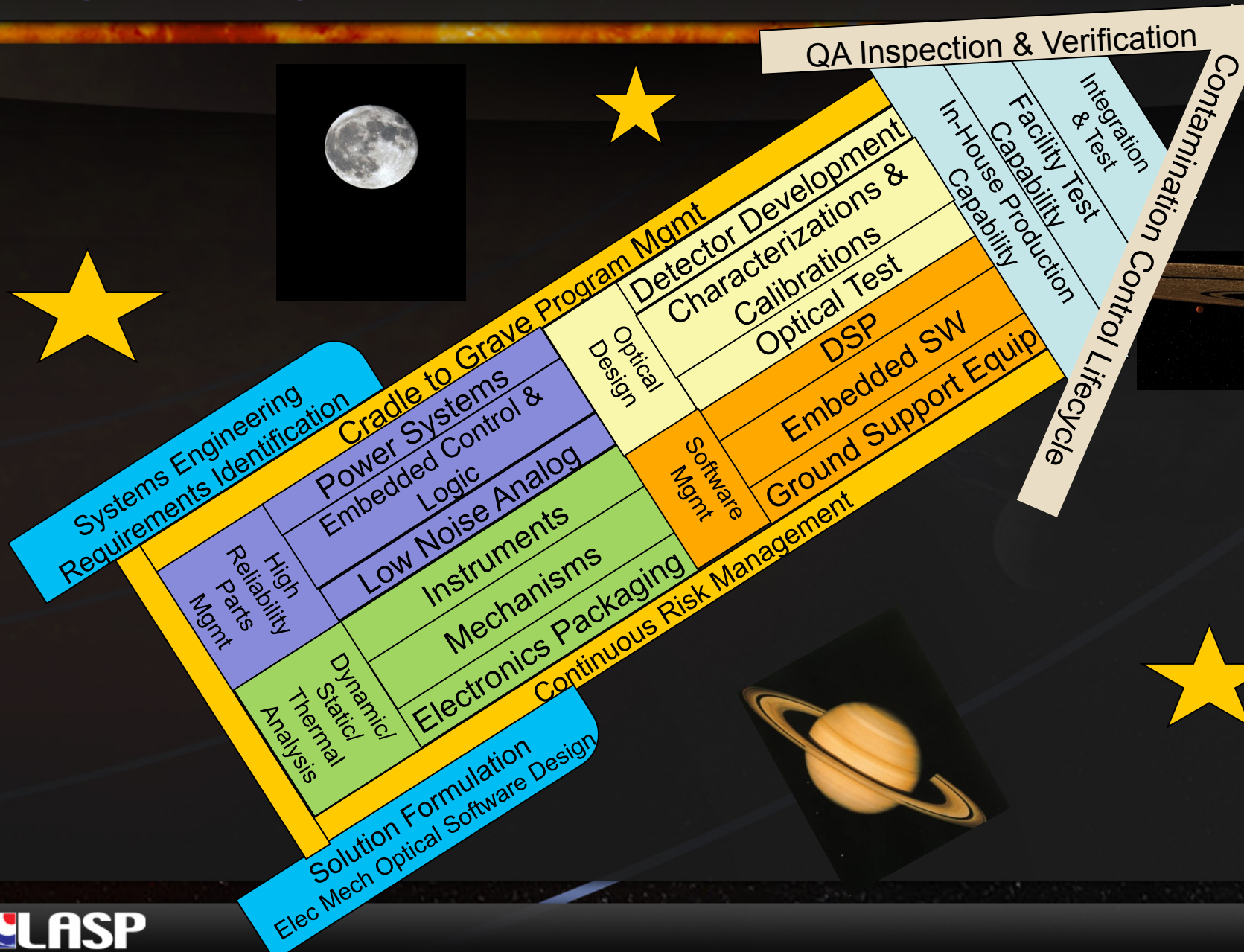*http://lasp.colorado.edu*

ENGINEERING DIVISION

Engineering

LASP Engineering uses its innovative mix of on-site facilities, skilled personnel, and close collaboration with scientists to build, test, and calibrate instruments, spacecraft, and space flight system components.

Engineering: Core Competencies to Build it RIGHT

QA Inspection & Verification

Contamination Control Lifecycle

Integration & Test

Facility Test Capability

In-House Production Capability

Detector Development

Characterizations & Calibrations

Optical Test

DSP

Embedded SW

Ground Support Equip

Cradle to Grave Program Mgmt

Optical Design

Software Mgmt

Systems Engineering
Requirements Identification

Power Systems

Embedded Control & Logic

Low Noise Analog

Instruments

Mechanisms

Electronics Packaging

High Reliability Parts Mgmt

Dynamic/ Static/ Thermal Analysis

Continuous Risk Management

Solution Formulation
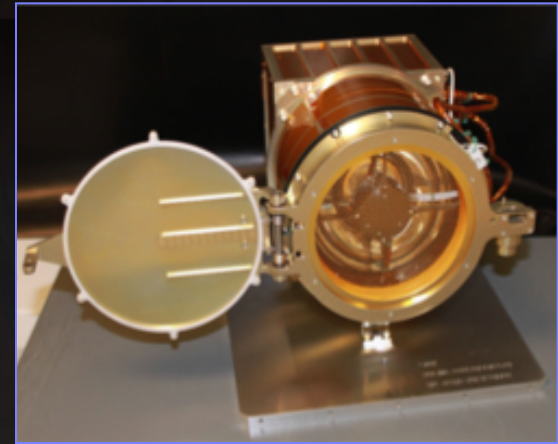Elec Mech Optical Software Design
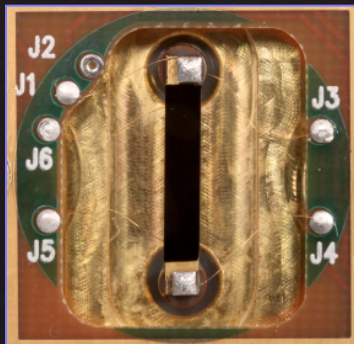
LASP

LASP Sensor Technology

- CCD Imagers
- Dust Detectors
- Electric Fields
- Photodiodes:
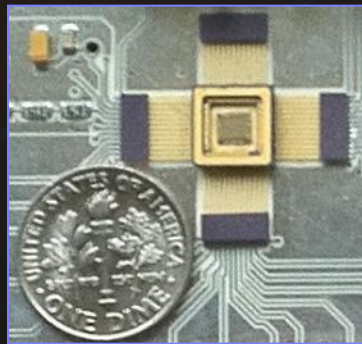- Electrometer ASIC
- Particle Sensors
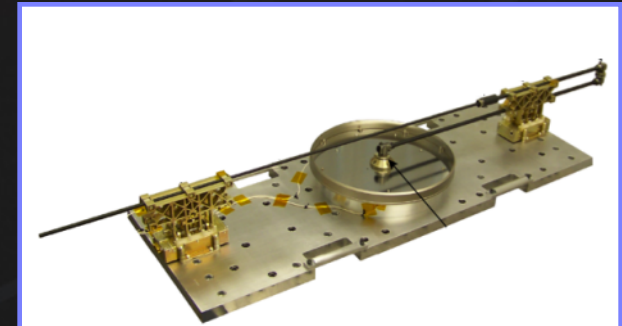- Radiometers
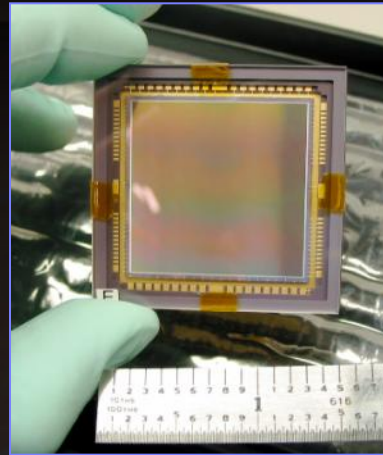
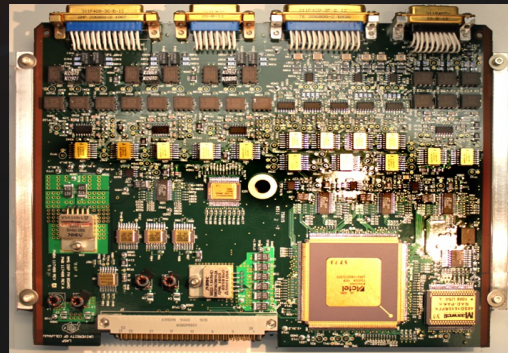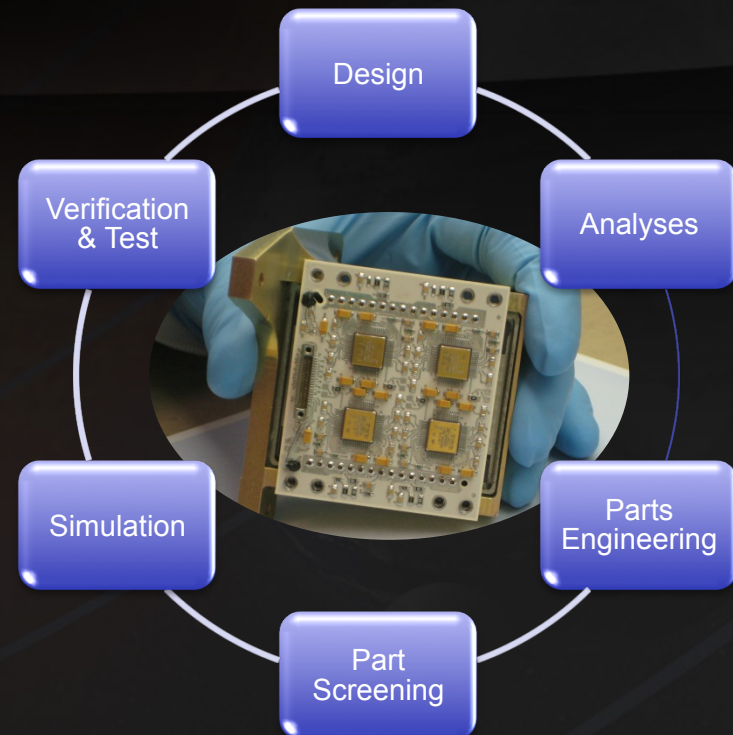
CIPS CCD

LDEX

TSIS ESR

GOES ASIC

MMS Boom

# Electrical Engineering

Broad range of capabilities:

- Power Systems
- Analog Design
- Digital Design
- FGPA Design & Simulation
- Control Systems
- RF Systems
- PWB Design
- Parts Engineering
- Parts Screening

Details

Mechanical Engineering

Mechanical Engineering: more than just parts
- Opto-mechanical implementations
- Spacecraft structures
- Thermal control design
- Mechanical static, dynamic, and thermal analysis and testing
- Gimbaled platforms for pointing systems
- Kinematic mounts and vibration isolation
- Electronics packaging including high voltage accommodations

Details

Thermal Design

Mech Analysis

Instrument Design
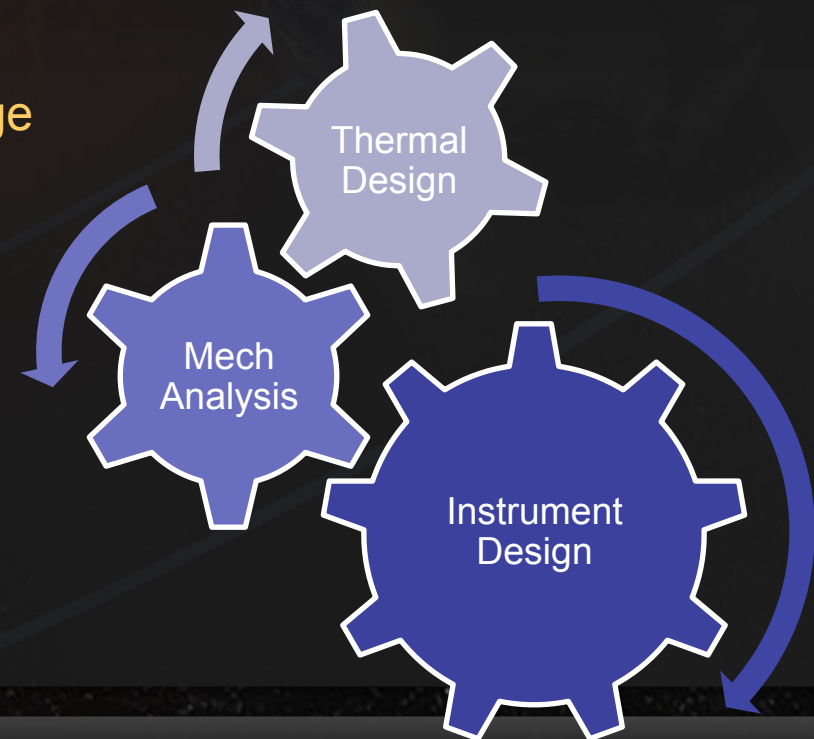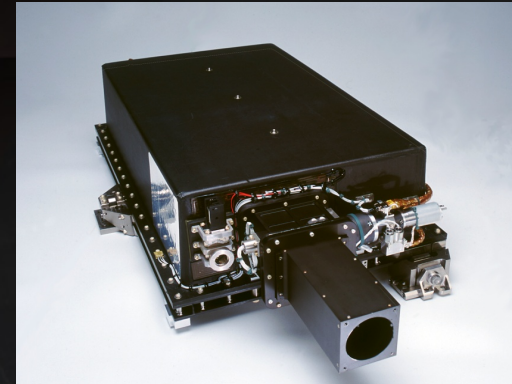
Software Development

Flight Software provides
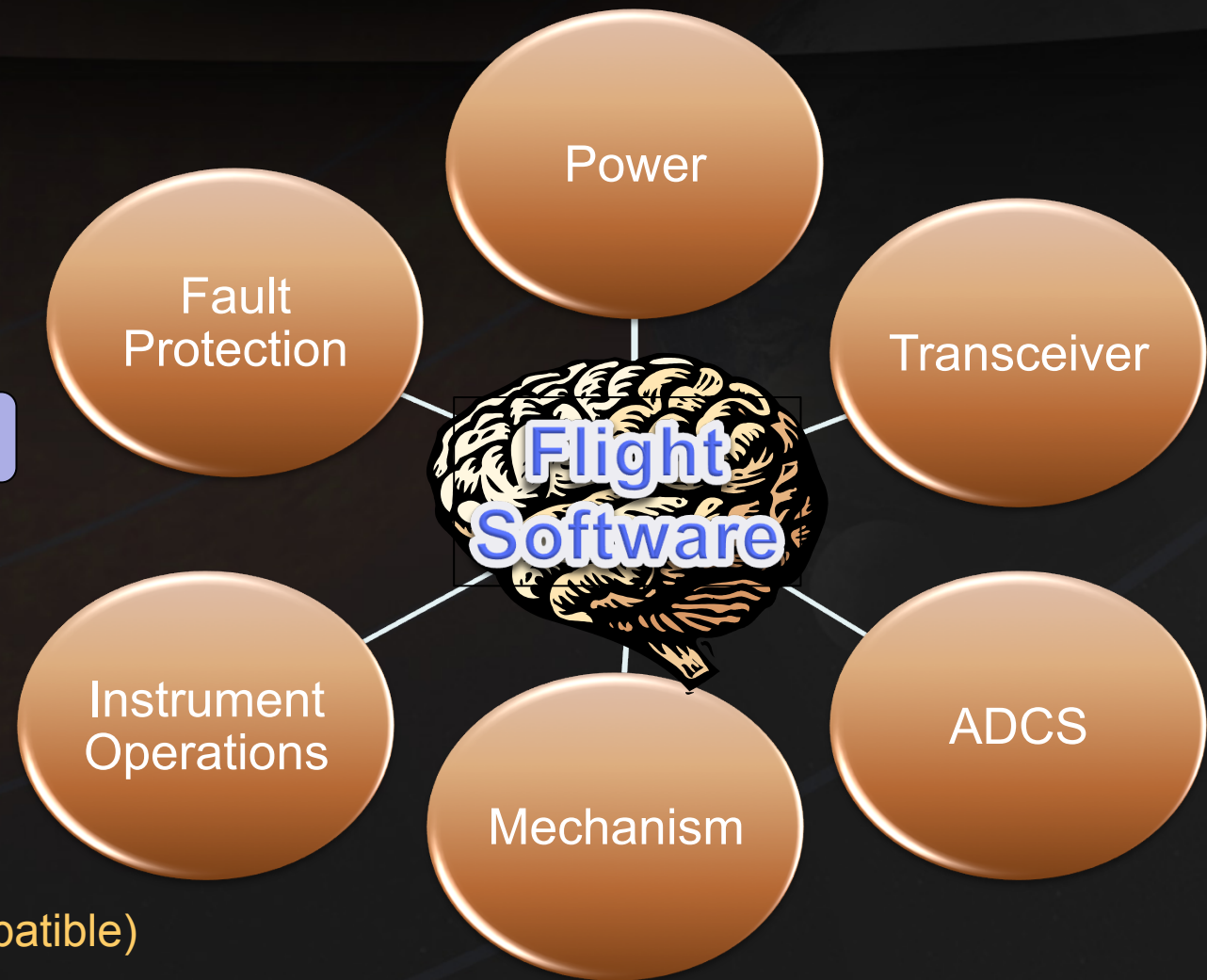- adaptability
- configurability
- reliability
- ease-of-maintenance

C/C++

Ada

Assembly

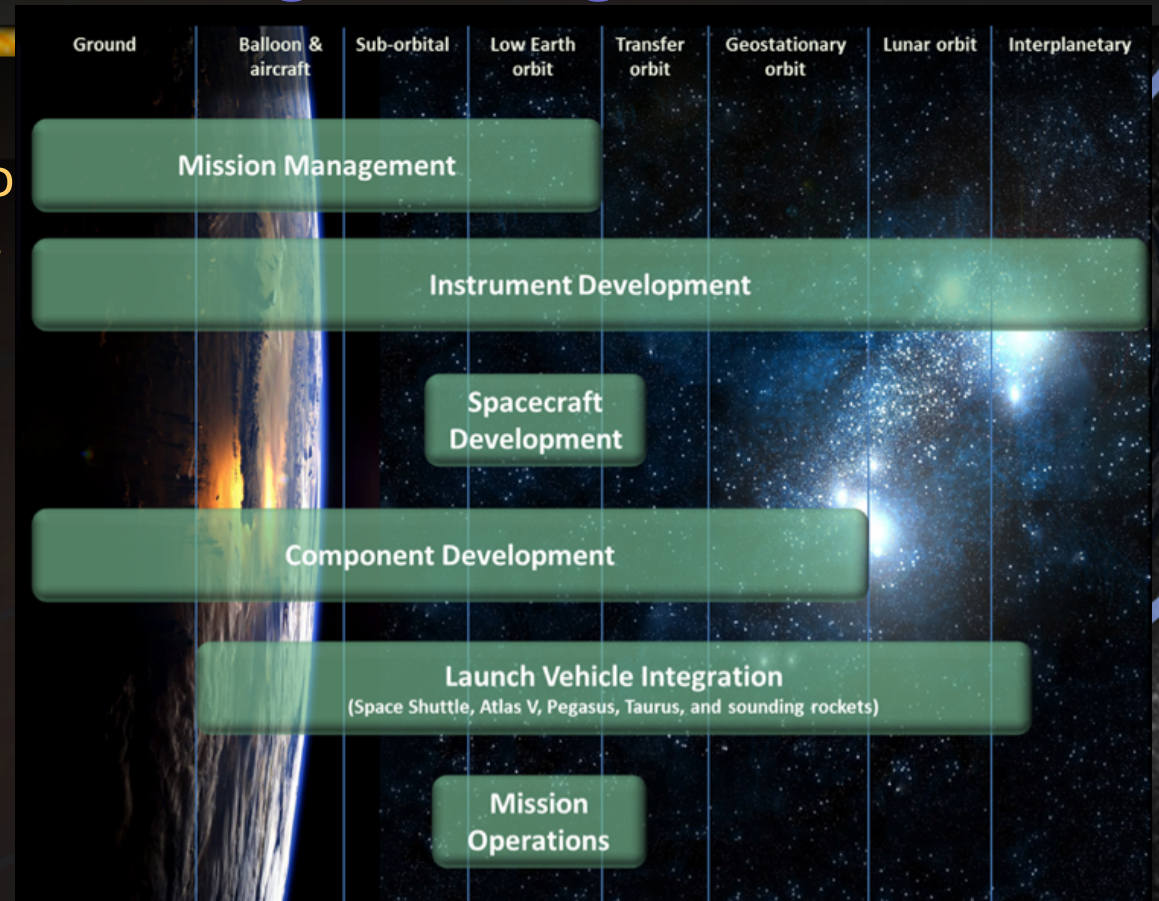LASP Flight Software Engineering Process is compliant :
- ISO 9001
- NASA 7150.2(a)
- CMMI Level 2 (compatible)

Power

Fault Protection

Transceiver

Flight Software

Instrument Operations

Mechanism

ADCS

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Systems Engineering

Linking scientific objectives to Engineering implementations by:

- Developing and managing requirements <u>from concept through orbit</u> operation
- <u>Optimizing</u> functional and physical functionality
- Identifying, defining, and <u>mitigating technical risk</u>
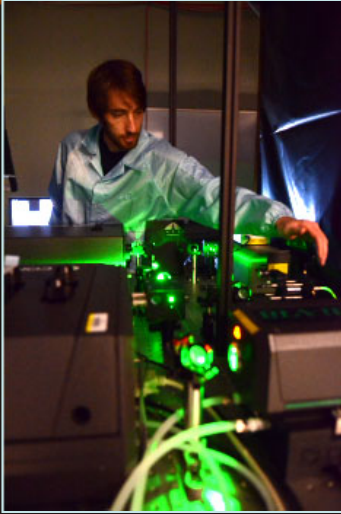- Establishing <u>verification and validation</u> paths for all system elements

Ground	Balloon & aircraft	Sub-orbital	Low Earth orbit	Transfer orbit	Geostationary orbit	Lunar orbit	Interplanetary

Mission Management

Instrument Development

Spacecraft Development

Component Development

Launch Vehicle Integration
(Space Shuttle, Atlas V, Pegasus, Taurus, and sounding rockets)

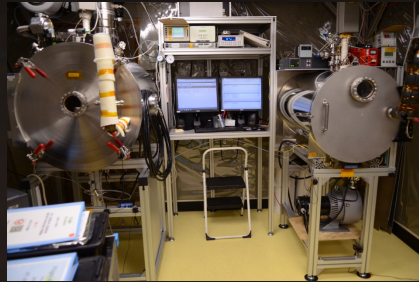Mission Operations

Mission

Integration

Instrument

Component

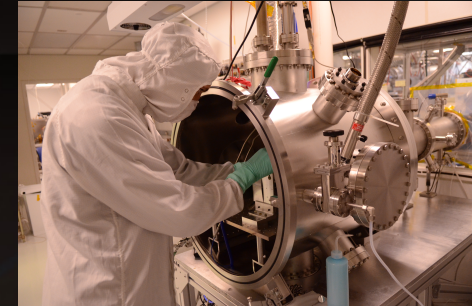**LASP Systems Engineering: Experience on all levels**

Test Facilities

Optics Labs such as Total Solar Irradiance Radiometer Facility (TRF): able to characterize TSI instruments to 0.01% absolute accuracy

Vacuum Bake Out Tanks

Multiple vacuum chambers: for optical characterization and calibration of detectors, optical components, and fully integrated instruments.

Heliostat Lab:<10 arc-second solar tracking error

Environmental test chambers: support ambient pressure temperature testing and thermal cycling of instrument component and subsystems

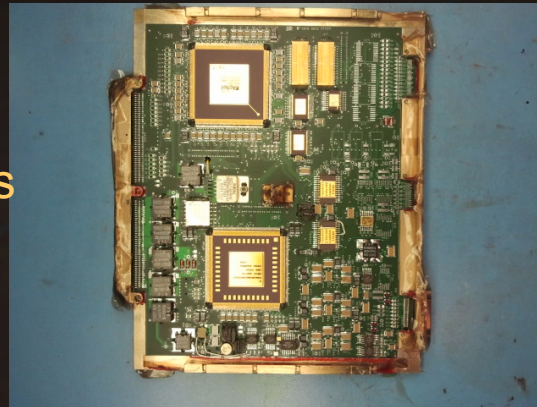Details

In-House Production Capabilities

Machine Shop
- CNC
- Manual milling

Metrology Lab
- Zeiss CMM
- Video Comparator

Electrical Assembly
- Certified technicians
- PWB assembly
- Harness/cables
- FPGA

Polymerics Lab
- Certified techs
- Spray booth

Cleaning lab
- Ultrasonic or wipe
- Vacuum bake-out

Mechanical Assembly
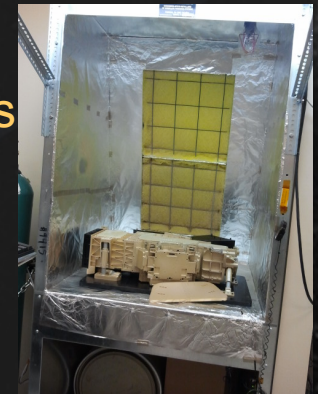- 000 fasteners
- 1-64 helicoils
- Bearings, optics, etc

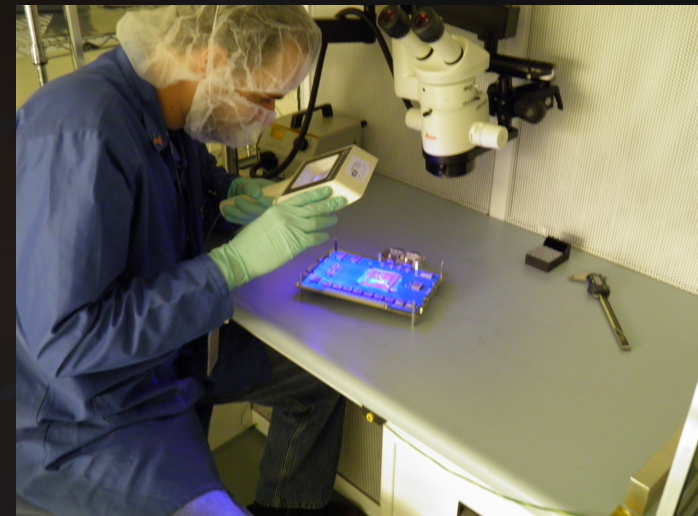Details

LASP

Flight Assurance

Oversee program compliance with Mission Assurance requirements

- Quality Management System (QMS) based on ISO 9001:2008 model
- Workmanship Inspection
  - NASA-STD-8739
  - IPC Standards
- Anomaly Resolution and Reporting
- Corrective And Preventive Action (CAPA) System

Thank you for your attention.
While at the National Space Symposium please contact Thomas Sparn (303) 591-1861 if you have further questions.

Contact LASP

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