Training the Next Generation of Space Professionals

Ground Systems Architecture Workshop 2015

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Space Exploration Uniforms
LASP has now sent instruments to every planet in the solar system and beyond (Voyager)
Unique Synergism within LASP

Student Involvement Throughout

- Mission & Science Operations
  - Spacecraft Operations
  - Payload Operations
  - Science Data Analysis
  - Mission Scheduling
  - In-House Facilities

- Science
  - Identify/Address Space Science Questions
    - Planetary
    - Atmospheric
    - Solar
    - Space Physics

- Development Flow

- Engineering
  - Design, build, test space system hardware

- Test & Calibration
Mission Operations & Data Systems

Operate Spacecraft & Payloads

Develop & Test New Systems

Integrated Professional & Student Operators

Process & Distribute Data to LASP Scientific Community and Beyond
## 33+ years of LASP Mission Ops

Past & Current Spacecraft/Instruments Operated by LASP

<table>
<thead>
<tr>
<th></th>
<th>Built S/C</th>
<th>Built Instr</th>
<th>Mission Ops</th>
<th>Instr Ops</th>
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<tbody>
<tr>
<td>SME (1981-1989)</td>
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<td>STRV-1A &amp; STRV-1B (1996-1998)</td>
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<td>QuikSCAT (1999-present)</td>
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<tr>
<td>SORCE (2003-present)</td>
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<tr>
<td>ICESat (2003-2010)</td>
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<td>AIM (2007-present)</td>
<td>✓</td>
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<td>Kepler (2009-present)</td>
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Current Mission & Science Operations

• **4 Satellites:** QuikSCAT, SORCE, AIM, Kepler  
  – **SORCE:** Mission to study solar irradiance  
  – **QuikSCAT:** Study ocean’s surface winds  
  – **AIM:** Study polar mesospheric clouds  
  – **Kepler:** Search for Earth size planets

• **Instruments on many different satellites including:**  
  – MAVEN (latest mission to Mars)  
  – Solar Dynamics Observatory/EVE  
  – Cassini UVIS: Study Saturn’s atmosphere, rings, & moons  
  – MESSENGER MASCS: Study Mercury’s atmosphere & surface  
  – New Horizons SDC: Study interplanetary dust (Pluto)  
  – Magnetospheric Multiscale (MMS) (launching March 12th)

Over $1B of space systems controlled from LASP
The Mission Operations Team

• Comprised of both Professional and Student operators
  – Two sets of eyes on all operations activities
• Professionals are in charge during realtime supports
  – Give command and planning approvals to students
• Students issue commands
  – Provide realtime and command planning support
Student Operators – “Command Controllers”

- 20 Graduate and Undergraduate students
- Students are involved in all phases of mission development and operation
- Routine responsibilities
  - Planning & Scheduling
  - Realtime commanding
  - Short and Long-term state of health trending
- Trained to operate all four LASP missions
Command Controller Training

• Hired once per year starting in January
  – This allows for a formal and consistent training as a group

• 10 week training starts in late May
  – Classroom lectures
  – Hands-on tasks
  – Shadowing of senior CCs
CC Training - Fundamentals

• Ops students are hired from all majors
  – Most are Engineering or Science but we accept any major
  – Starting sophomore or junior year

• LASP provides “Aerospace 101”
  – Thermal
  – Comm/C&DH
  – ADCS
  – Power
  – Remote Sensing
CC Training – Operations

• Realtime Commanding and Data Flows
  – How do commands get to the spacecraft?
  – How is data routed once it has been downlinked?
  – Pass protocol and on-console communications

• Command Planning
  – Routine (weekly) planning
  – Special activities
  – Generating command scripts
CC Training – LASP’s Missions

• Detailed instruction on the life of the missions LASP operates
  – Flight Directors (staff) are heavily involved
  – Emphasis is placed on changes to nominal operations

• Subsystems student leads instruct new CCs
  – Health and safety monitoring
  – Seasonal activities
  – Component degradation
Certification

• 3 certification exams throughout the summer
  – Given at 3 week intervals
  – Short-answer style
  – Questions apply lectures to operations tasks

• Oral certification
  – Covers information in the checklist
  – Nominal operations scenarios
  – Reaction to anomalous situations
Advanced Training

• Given the second summer of a CC’s career
• Advanced engineering and operations topics
  – CCSDS
  – Space Weather
  – DOORS
  – Earned Value
  – ITAR
• Enhances knowledge
• Provides exposure to standard engineering practices
After Graduation

- NASA
- Lockheed Martin
- Raytheon
- Northrop Grumman
- Sierra Nevada
- EchoStar
- DigitalGlobe
- SpaceX
- ULA

- JPL
- Ball Aerospace
- Boeing
- AGI
- Sandia National Lab
- Paragon Space Dev
- Aerojet
- Blue Origin
THANK YOU!