Data Visualization Software for the MinXSS CubeSat

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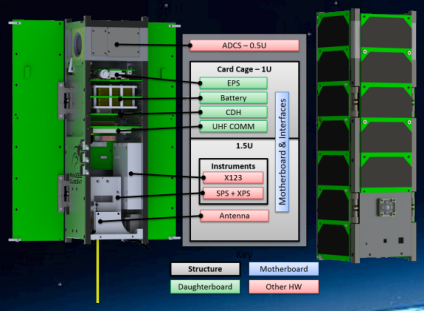
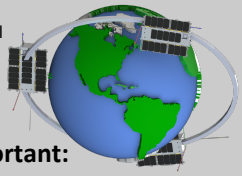


Software Purpose:

To create an user-interactive ground software for visualizing and comparing housekeeping data (such as temperature of instruments & power levels) with the satellite's orbital location relative to the earth and sun.

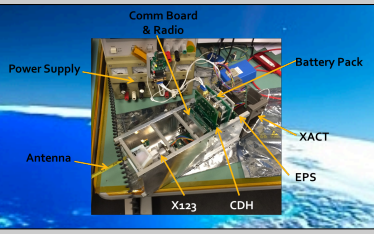


Why it's Important:

- Monitoring the CubeSat's state of health is a key part of satellite operations during flight and also during pre-flight tests
- This software helps us to fully understand the changes in housekeeping data due to orbital position, specifically if the satellite is in the sunlight or eclipse

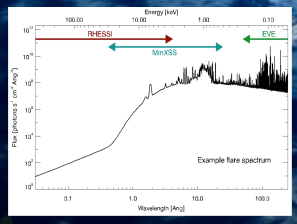
Mission Tests:

- To prove capabilities of MinXSS flight software, Data Vis Software, and DataView commands
- To functionally test the "integrated prototype"
- First seven tests were needed to debug flight & ground software. Mission tests #8 and 9 worked well.



MinXSS Science Purpose:

- To better understand solar flare soft x-ray (SXR) emission and its effect on earth's ionosphere, thermosphere, and mesosphere
- Spectral range of 0.5 keV to 30 keV hasn't been observed at high resolution (our resolution will be better than 0.15keV full-width half-max)



Software Capabilities:

- IDL user-interactive widget
- Calculates orbit from TLE (currently ISS TLE)
- Loads data files for CubeSat housekeeping data
- Features, like a scroll bar, allow the user to directly compare graphs

How it Works:

Housekeeping & Science Data → User Selected Options → X-Ray Spectrum Graph; Graphs of subsystem temperatures/power supply voltage/battery state of charge

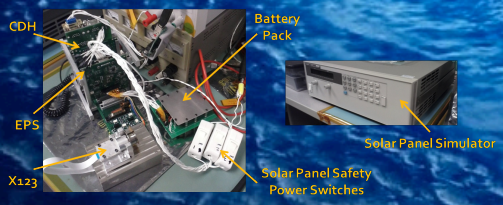
Time, TLE Data → Lat/Long Calculations → Orbital Location Map

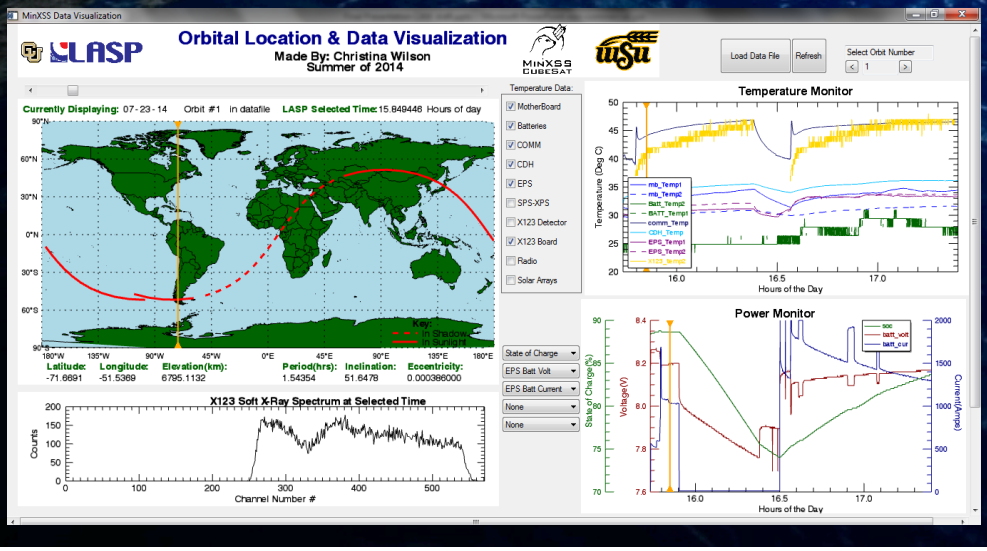
Mission Test 8:

- "Integrated prototype" (figure above)
- Power Supply used to simulate the sun charging the solar panels
- Ran for little over one complete (ISS) orbit
- Used Heavens Above to determine power on/off
- Battery heater toggled on/off to test command
- Radio command returned error

Mission Test 9:

- Assembled in CubeSat Card Cage (figure below)
- Solar Panel Simulator used to simulate the sun charging the solar panels & batteries
- Pre-entered power on/off time delays
- Ran for multiple (ISS) orbits
- X123 Powered off during eclipse





Test Results:

- Validated functionality of MinXSS hardware monitors
- Helped to improve MinXSS flight software operations modes
- Proved capabilities of Data Vis Software

Future Work:

- Improvements to perform real time analysis and plotting during ground tests
- Data Vis Software will be used to analyze flight data