

Open Source Lessons Learned with Open MCT

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Open Source CubeSat Workshop 2018



The Vision

- Closed —> Open
- Ground systems have traditionally been built on proprietary systems.
 - Duplication of effort - we continually re-create the same thing
- Let's move to a shared model for ground systems and build on each others work
- The internet economy as an analogy - companies may focus on their core differentiators and use existing infrastructure



Immediate Benefits

- Collaboration that works
- Use, adopt, make it your own, contribute
- No ownership issues
- Instant access
- Fork/Pull

A web based mission control framework. <https://nasa.github.io/openmct/>

| | | | |
|-----------------|----------------|---------------|-------------------|
| 📄 5,339 commits | 🌿 247 branches | 📦 23 releases | 👤 38 contributors |
|-----------------|----------------|---------------|-------------------|

Branch: master ▾ New pull request Find file Clone or download ▾

👤 charlesh88 and psarram [Frontend] Adds overflow scrolling to .l-view-section (#2039) ... Latest commit e19ce4a 5 days ago

| | | |
|-------------------|--|--------------|
| 📁 docs | [Documentation] Add security guide (#1900) | 4 months ago |
| 📁 example | Handle string states (#2019) | 21 days ago |
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| 📄 index.html | [Autoflow] Rewrite Autoflow Tabular using new APIs (#1816) | 6 months ago |
| 📄 jsdoc.json | Squashed commit of the following: | 2 years ago |
| 📄 karma.conf.js | [Plugin] Add imported root plugin (#1784) | 3 months ago |
| 📄 openmct.js | new-plot import (#1557) | 3 months ago |
| 📄 package.json | Enterprise-galactica (#1993) | a month ago |
| 📄 test-main.js | d3 selection filepath changed (#1898) | 4 months ago |

<https://github.com/nasa/openmct>

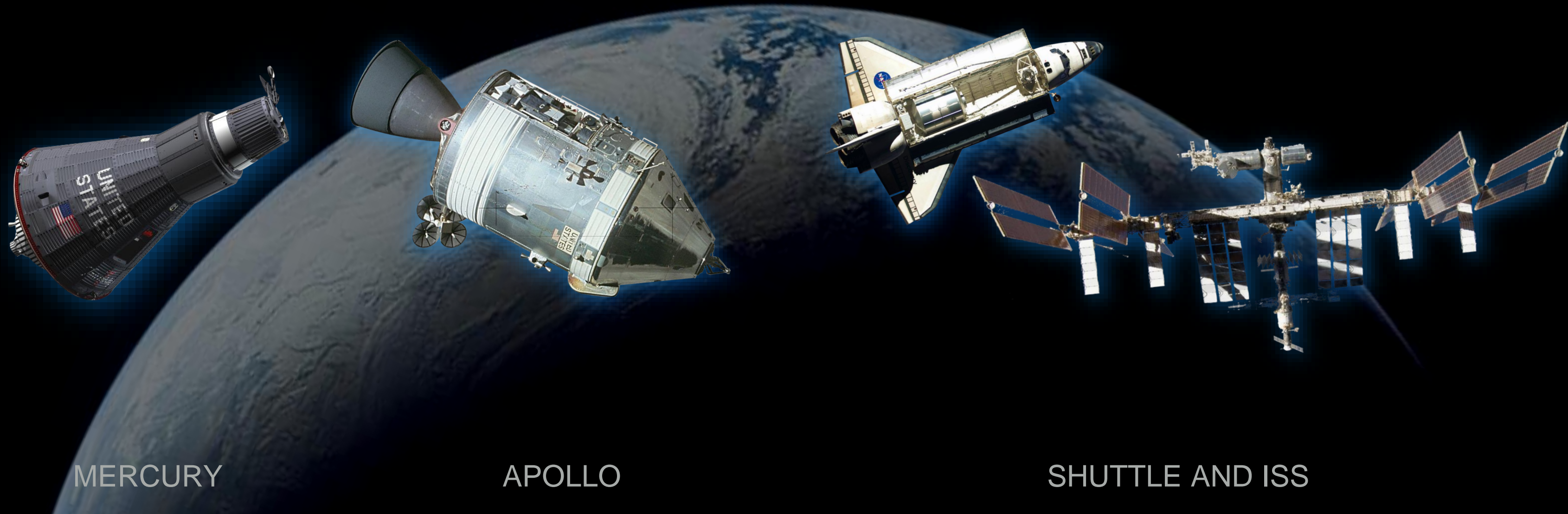


More benefits

- Better software
 - More eyes on your software
 - More users
 - A community that drives you to be better
- Yes, missions do some of this, but the environment is somewhat insular so there are benefits to a broader group of users and contributors



How have we advanced since the 1960's?



MERCURY

APOLLO

SHUTTLE AND ISS



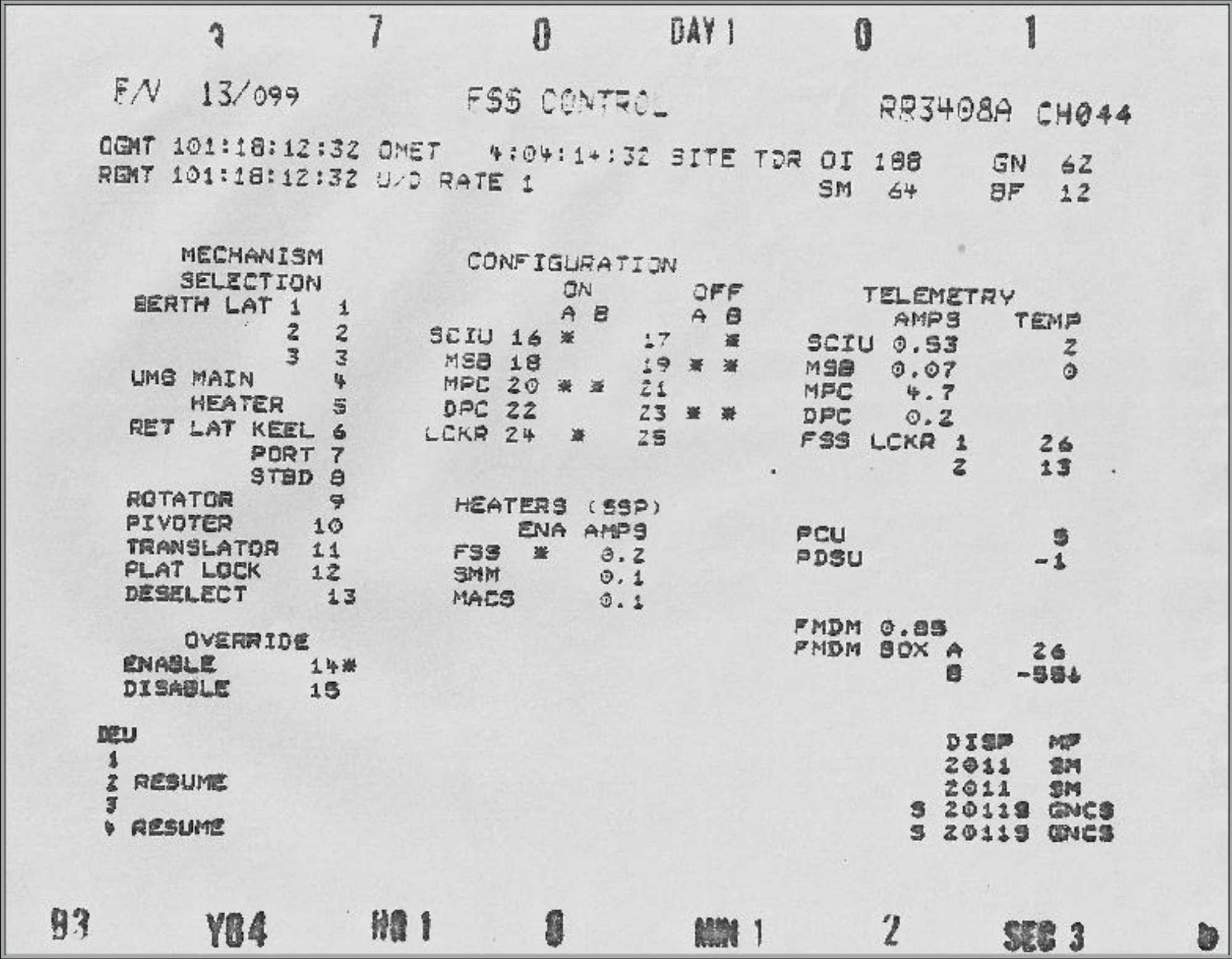
1960's



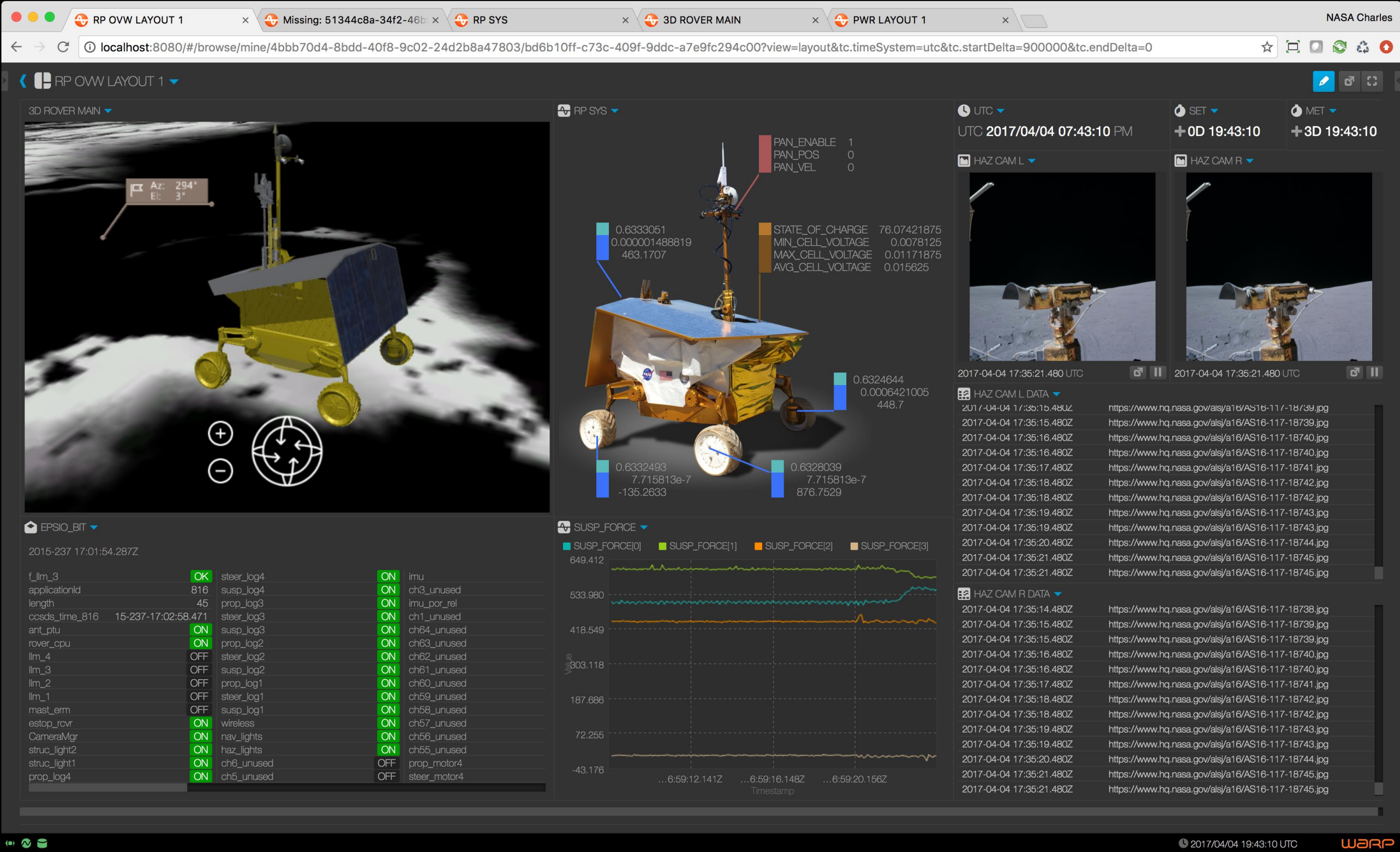
2000 and beyond



Can open source be a vehicle for advancing technology?



1980's Space Shuttle Display



Open MCT Display



The platform

- Open Mission Control Technologies - Open MCT

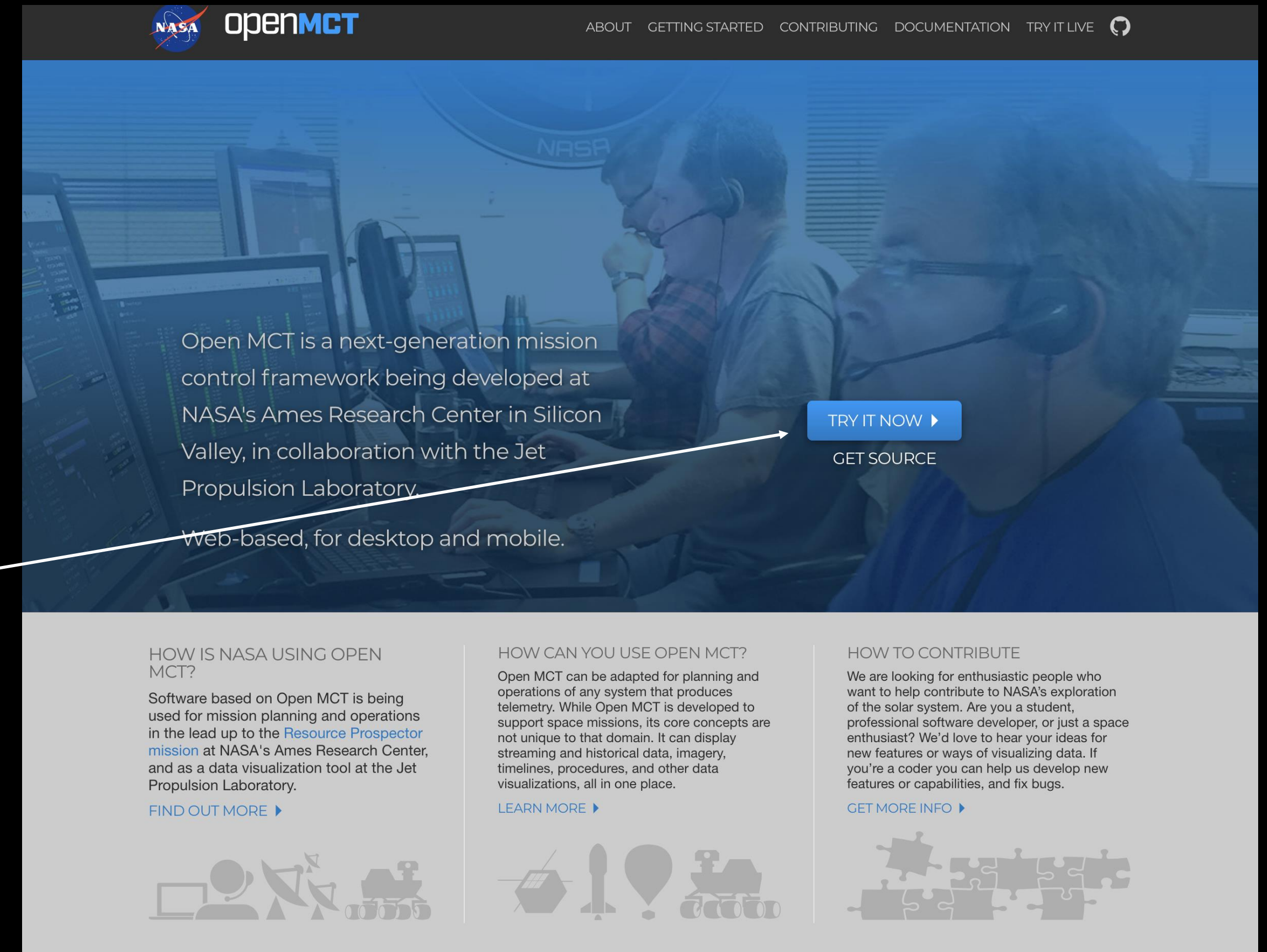
- Info

- <https://nasa.github.io/openmct/>

- From info site, click on Try it Now

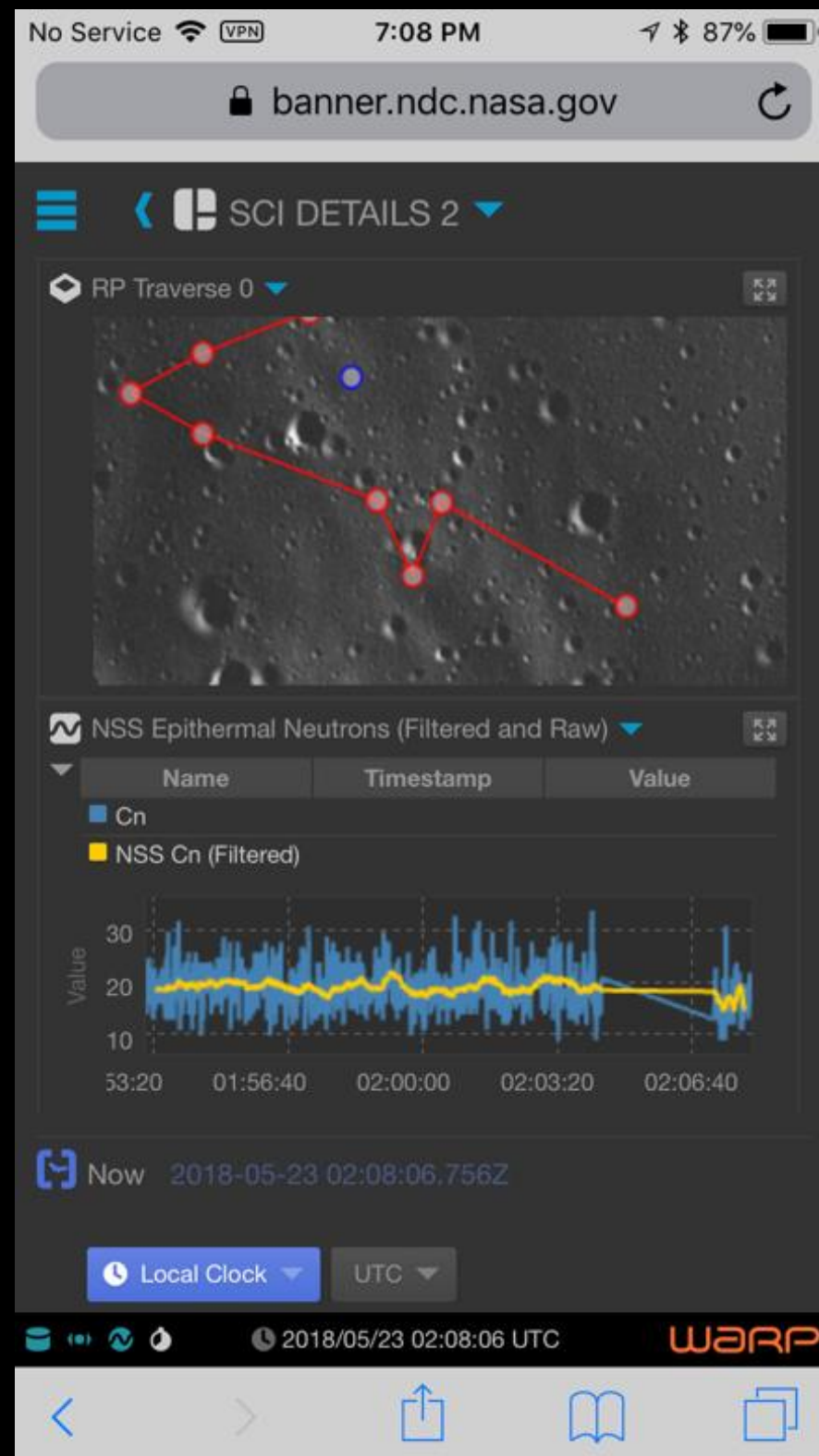
- Code

- <https://nasa.github.io/openmct/>

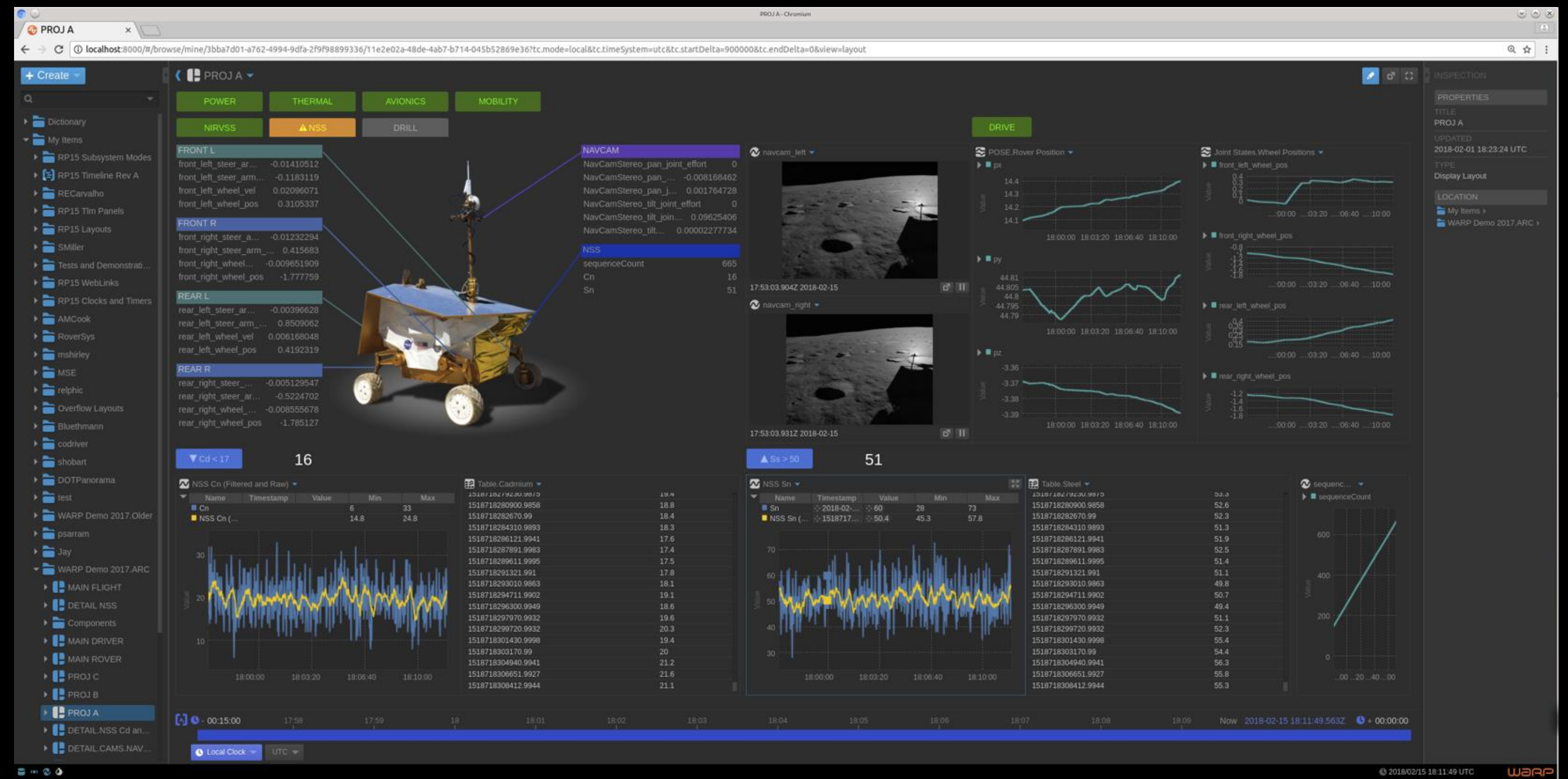




The Platform



Mobile

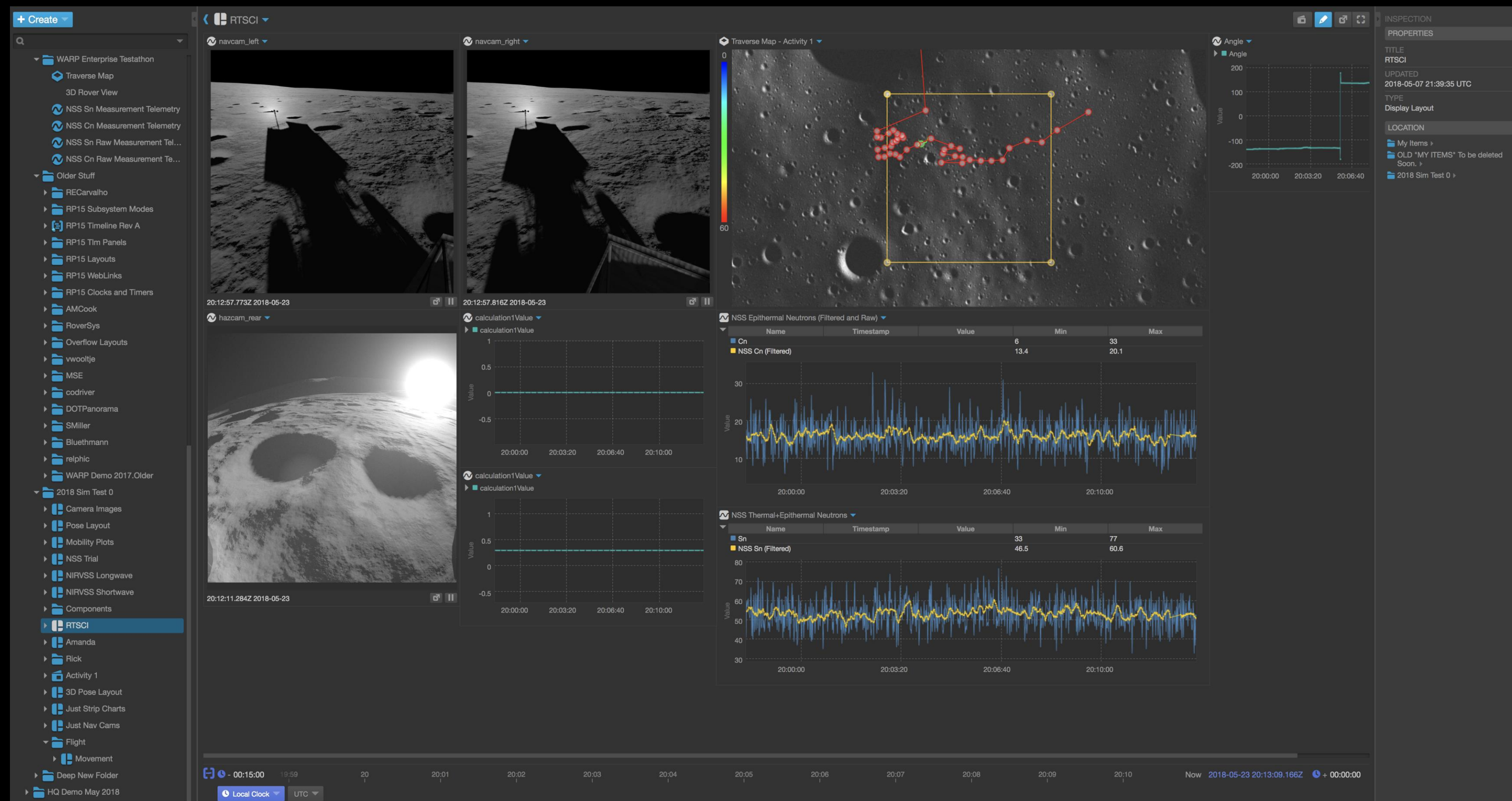


Desktop

<https://github.com/nasa/openmct>



All Your Data in One Place



All your
data here

Data Visualizations, cross domain

Inspector



Mix Data Across Domains

MAIN FLIGHT

Clocks and Timers

UTC

UTC 20:00:28

MET

+ 114D 23:10:28

SET

+ 112D 02:14:28

SS7 Timer

+ 840:09:05

Time in Current A...

MOBILITY

THERMAL

DRILL

AVIONICS

NIRVSS

NSS

WAVE

POWER

Unkown point hazcam_fron...

hazcam_rear

navcam_left

navcam_right

Images

Rover 3D WebGL Plugin

Rover Mobility Visual

3D Rover View

SS7 Procedures

WAR...

Timelines

Procedures

Telemetry

Widgets - logic driven

Science Station 7

Science Station 7

Drive AIM

Set Drilling Location

Prep for Drilling

Resource Graph Legend

Comms (Kbps)

Drive AIM

Set Drilling Location

Overview

Procedures Science Station 7

Start as having just arrived at Science Station and rover is nominal

Discuss Timeline, next steps

Take pictures, drive AIM

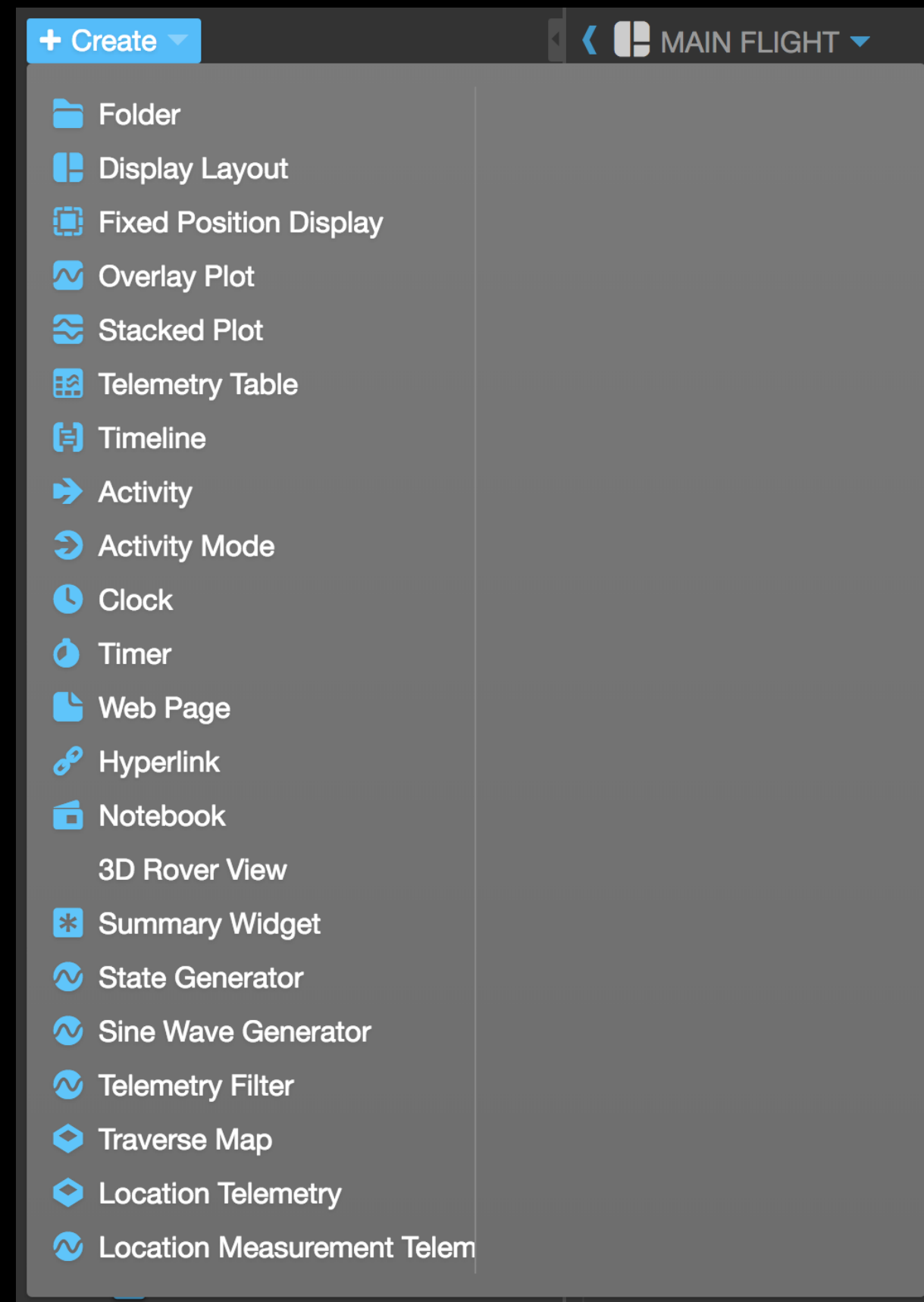
Select location to drill

Drive to drill location, park

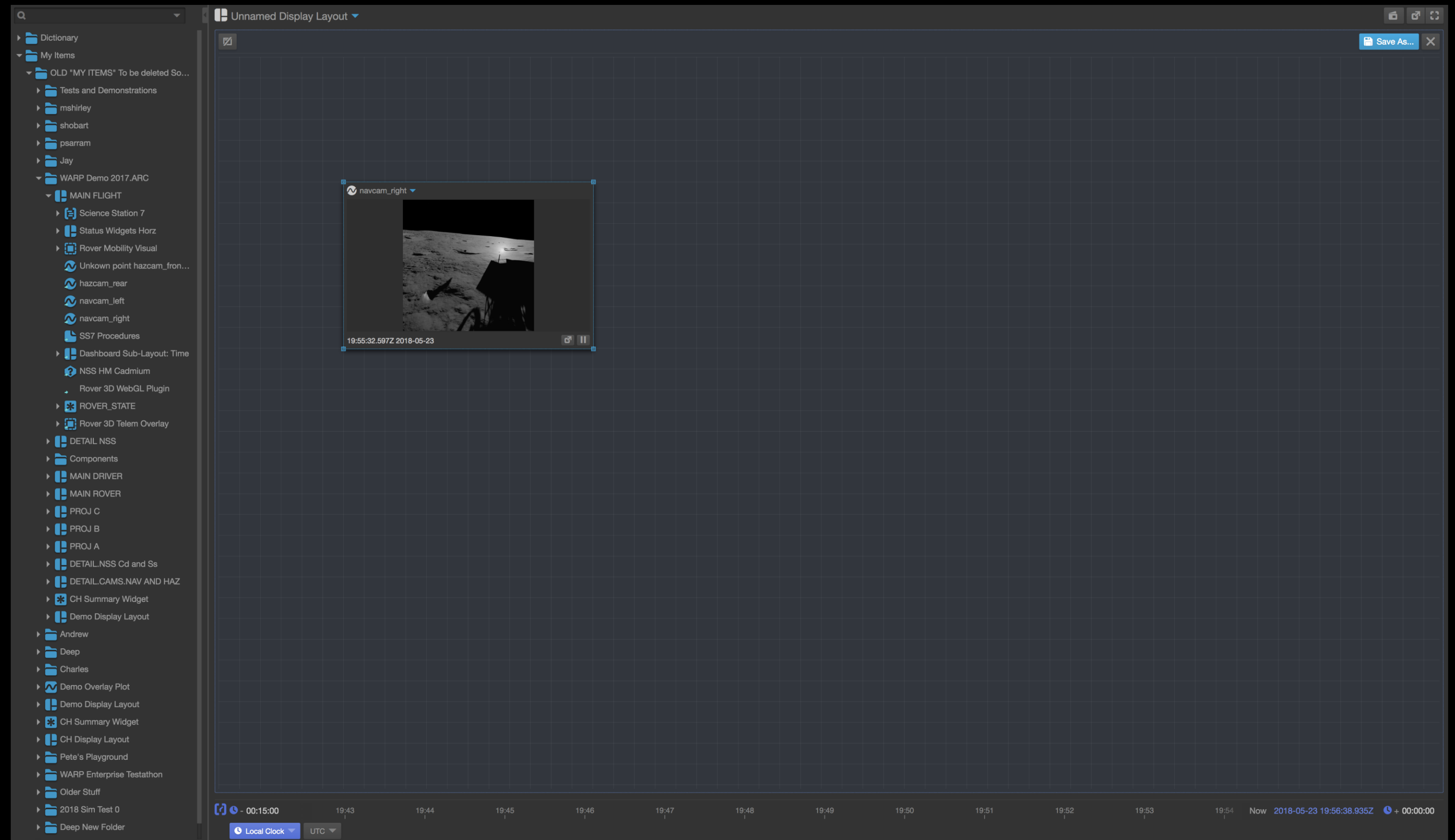
Add capabilities with plugins



Make Your Own Displays



Create

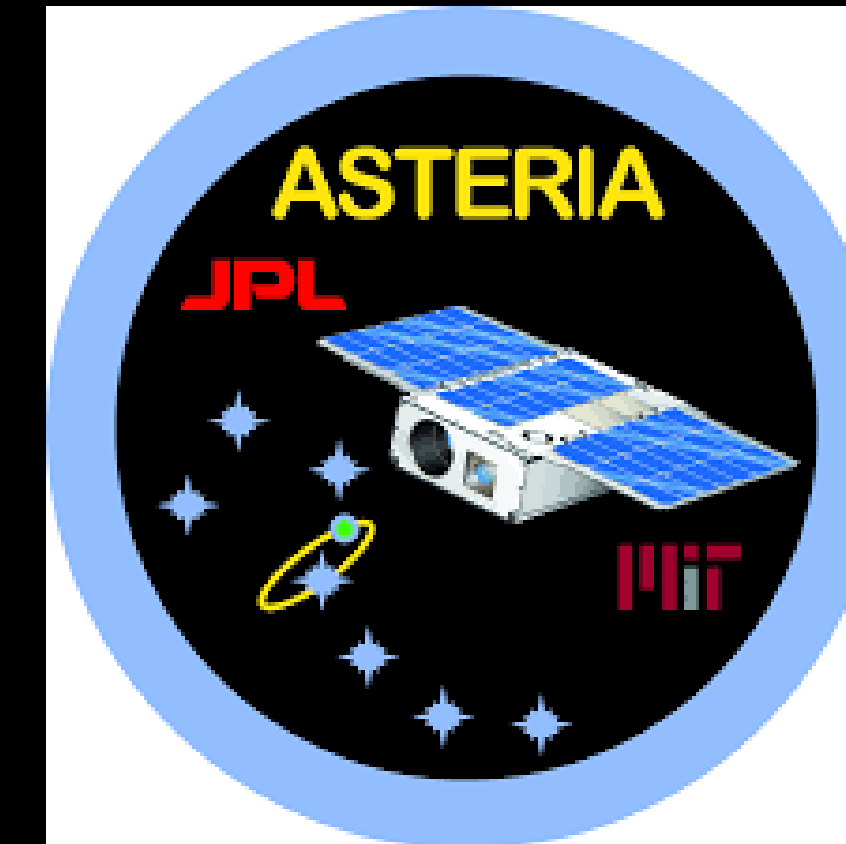


Build a display layout

<https://github.com/nasa/openmct>



Who has Open MCT in NASA



More...



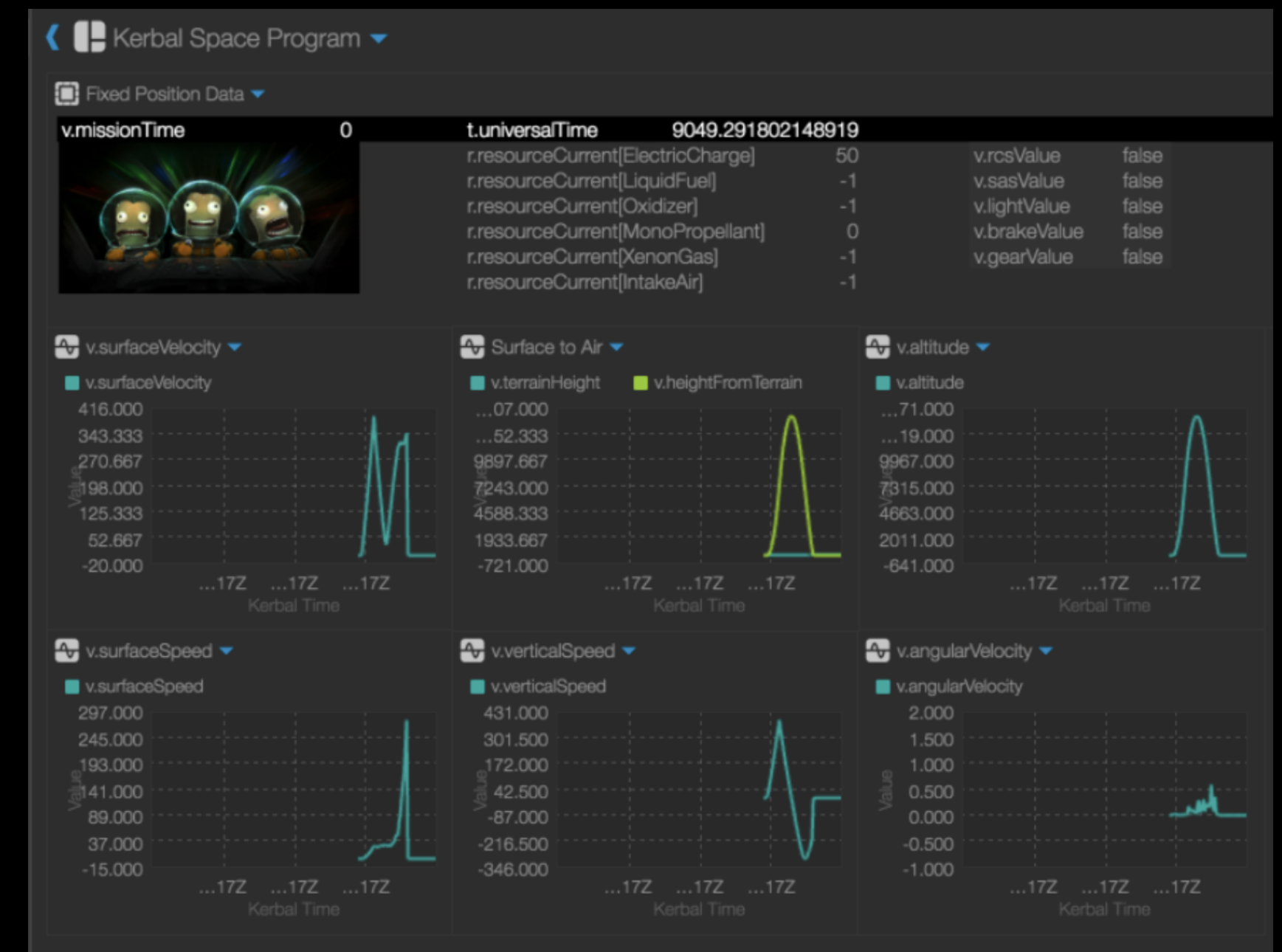
Samples from the community outside NASA

C-base backspace Berlin



<https://bergie.iki.fi/blog/nasa-openmct-iot-dashboard/>

Kerbal Space Program

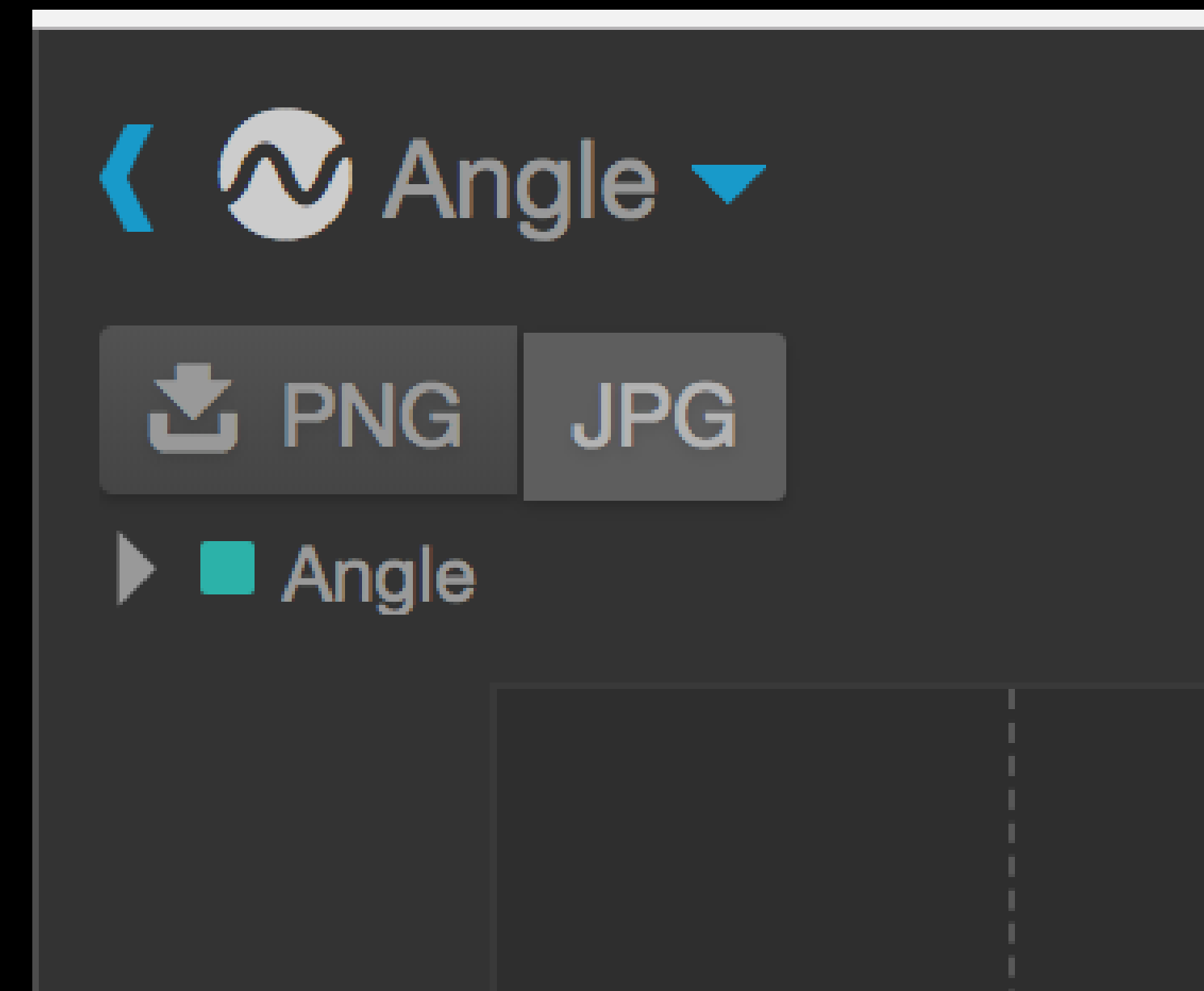


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Example Contribution

- Export plot as image
- Based on user requests
- Implemented by open source contributor






Contribution Process

- Sign Contributor License Agreement
- Make changes
- Submit Pull Request (PR)
- Circle CI runs unit tests, enforces code standards through tooling
- Code review by core team member
- Feedback or Merge



Building a Community 1

Active Web Presence

**openMCT**

ABOUTGETTING STARTEDCONTRIBUTINGDOCUMENTATIONTRY IT LIVE

Open MCT is a next-generation mission control framework being developed at NASA's Ames Research Center in Silicon Valley, in collaboration with the Jet Propulsion Laboratory.

Web-based, for desktop and mobile.

[TRY IT NOW ▶](#)

[GET SOURCE](#)

HOW IS NASA USING OPEN MCT?

Software based on Open MCT is being used for mission planning and operations in the lead up to the [Resource Prospector mission](#) at NASA's Ames Research Center, and as a data visualization tool at the Jet Propulsion Laboratory.

[FIND OUT MORE ▶](#)

HOW CAN YOU USE OPEN MCT?

Open MCT can be adapted for planning and operations of any system that produces telemetry. While Open MCT is developed to support space missions, its core concepts are not unique to that domain. It can display streaming and historical data, imagery, timelines, procedures, and other data visualizations, all in one place.

[LEARN MORE ▶](#)

HOW TO CONTRIBUTE

We are looking for enthusiastic people who want to help contribute to NASA's exploration of the solar system. Are you a student, professional software developer, or just a space enthusiast? We'd love to hear your ideas for new features or ways of visualizing data. If you're a coder you can help us develop new features or capabilities, and fix bugs.

[GET MORE INFO ▶](#)

Developers: Start Using Open MCT

1 CLONE THE SOURCE CODE

```
git clone https://github.com/nasa/openmct.git
```

2 INSTALL DEVELOPMENT DEPENDENCIES

```
npm install
```

3 RUN A LOCAL DEVELOPMENT SERVER

```
npm start
```

Running and building Open MCT in your local dev environment is very easy. Be sure you have [Git](#) and [Node.js](#) installed, then follow the directions on the left. Need additional information? Check out our [Getting Started](#) page.

<https://nasa.github.io/openmct/>

Active Repository

nasa / openmct

Watch219Star5,026Fork517

CodeIssues284Pull requests22Projects1Insights

Join GitHub today

GitHub is home to over 20 million developers working together to host and review code, manage projects, and build software together.

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Building a Community 2

- Provide a codebase that is clean, and fun to develop for
- Provide clear and comprehensive developer documentation
- Provide a simple and powerful Application Programming Interface (API)
- Tutorials for extending Open MCT with a focus on common use-cases.
- “Help-wanted” issues that cater to a range of abilities

nasa / openmct

Watch 219 Star 5,026 Fork 517

Code Issues 284 Pull requests 22 Projects 1 Insights

is:open label:"help wanted" Labels Milestones New issue

Clear current search query, filters, and sorts

37 Open 40 Closed Author Labels Projects Milestones Assignee Sort

- [Imagery] Duplicate image showing in history help wanted 1
#2012 opened 22 days ago by dtailor90
- [Tables] Add clear filter button to Table View column filters help wanted 2
#1989 opened on Apr 11 by charlesh88
- [Build] Unknown/unknown appear in About dialog help wanted
#1924 opened on Feb 22 by vicfx
- [Tree] Drop down arrow remains even though object has no children bug help wanted 15
#1826 opened on Dec 5, 2017 by dtailor90
- support bignum for number types not representable with float64 help wanted 3
#1788 opened on Oct 25, 2017 by larkin
- disable spellcheck on date fields help wanted 1
#1682 opened on Aug 18, 2017 by larkin
- Add telemetry plugin for DSN station telemetry and status enhancement help wanted 8
#1656 opened on Jul 25, 2017 by larkin
- Remove action is available for non-editable objects bug help wanted 4
#1542 opened on Apr 26, 2017 by akhenry
- [search] Provide a way to disable ElasticSearch from affecting Search help wanted
#1399 opened on Jan 12, 2017 by charlesh88 Stross
- [Fixed Position. Layouts] Better default sizing for new objects in Fixed Position views 5

<https://github.com/nasa/openmct>



Status & What's Next

- Open source is a proven means to enhance collaboration and adoption of mission operations software
- It is possible to build an “outside” community of contributors who add value to the software through contributions and feedback
- Future goals
 - Build an active community of mission contributors building on each other's work
 - Use open source as a vehicle for advancing technology