Thermal Amine Equipment

Space Acceleration Measurement System (SAMS) Data Analysis

Introduction

Cygnus NG-11

S.S. Roger Chaffee at the Space Station

Mission type	ISS resupply
Operator	NASA
Spacecraft properties	
Spacecraft	S.S. *Roger Chaffee*
Spacecraft type	Enhanced Cygnus
Manufacturer	Northrop Grumman Thales Alenia Space
Start of mission	
Launch date	17 April 2019, 20:46:07 UTC
Rocket	Antares 230
Launch site	MARS LP-0A
Contractor	Northrop Grumman
Orbital parameters	

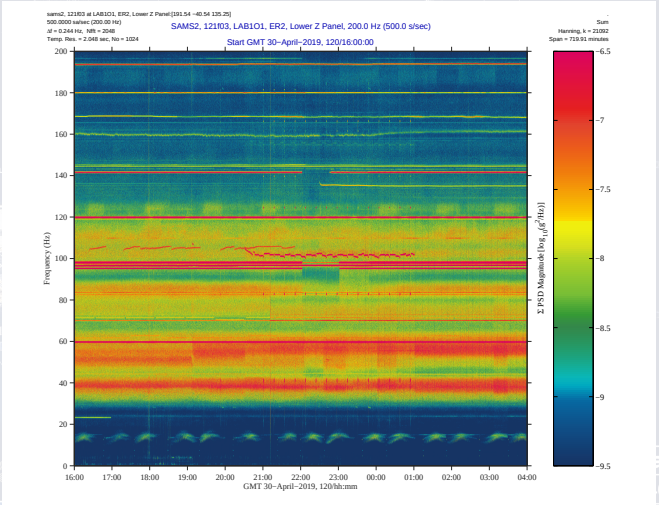
On Tuesday, GMT 2019-04-30 (Day 120), the Thermal Amine equipment, located in EXPRESS Rack 2 (LAB1O1) was was activated and checked out, including a powercycle of the Adlink Mini-PC to get ground telemetry and successful vacuum leak checks of all 4 scrubber beds. The Thermal Amine Scrubber is an upgraded version of the Amine Swingbed and will be used as a long-term CO_2 scrubber on the International Space Station (ISS).

The Thermal Amine equipment was launched on NG-11 and provides the capability to operate the Life Support Rack (LSR), a Carbon Dioxide Removal Assembly for up to 7 crew members. This capability comes instead of continuously running two Carbon Dioxide Removal Assemblies (CDRAs).

Scrubber Noise

Reports suggest the Thermal Amine Scrubber was introducing noise into its power draw from EXPRESS Rack 2 (ER2), LAB1O1, around GMT 120/21:14.

This spectrogram was computed from measurements from a SAMS sensor mounted on ER2. Note the strong spectral disturbance that starts at about 20:30 at around 101.6 Hz, and strong pulse trains at about 41.7, 83.2, 124.8 and 166.3 Hz, the first one starting at about 21:00:08.

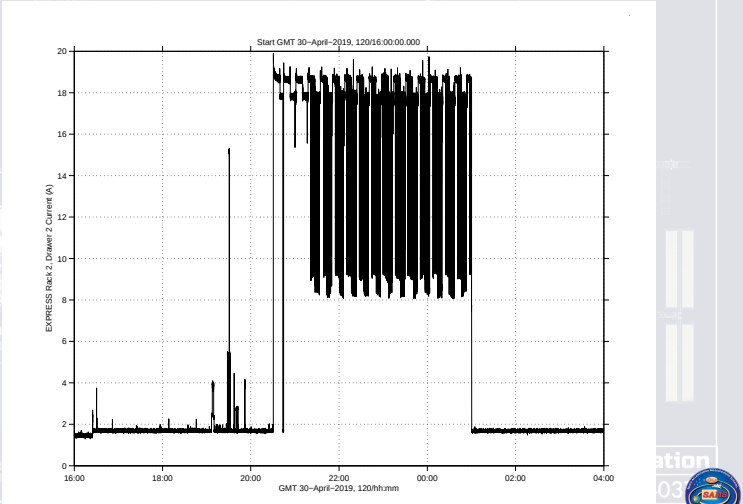


ER2, Drawer 2 Current

This figure shows a plot of current draw from drawer 2 of EXPRESS Rack 2 (ER2).

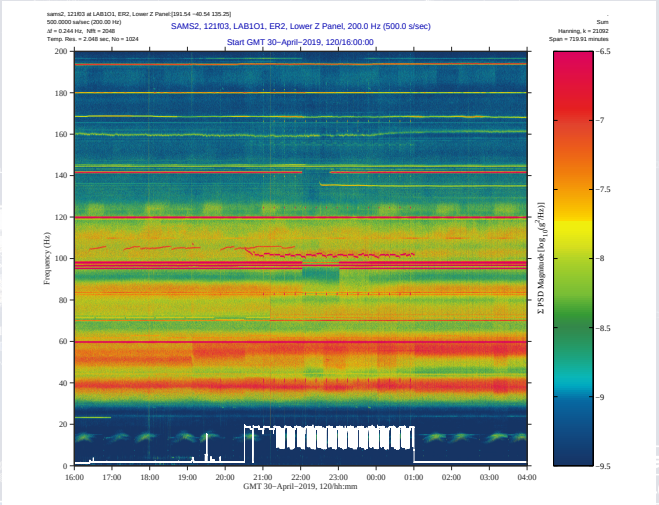
The drawer 2 current jumps about **tenfold** from under 2 A to nearly 20 A at GMT 20:30:42.

The next page will overlay this information along with the SAMS spectral data from the previous page to show a strong correlation between transitions in current and acceleration data.



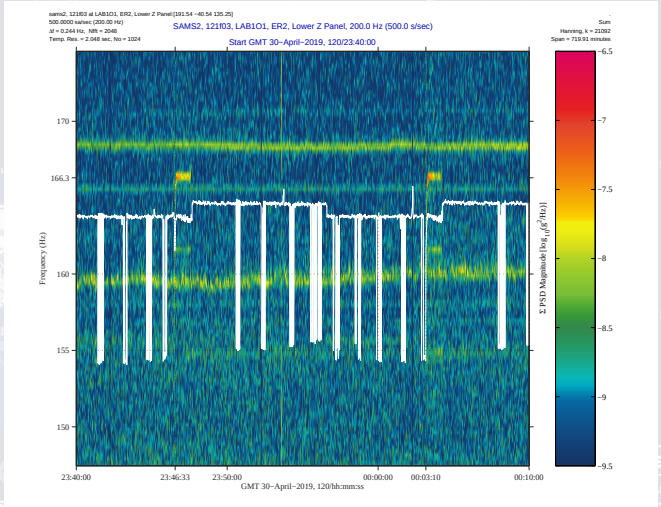
Acceleration/Current Overlay

The spectrogram here was computed from measurements made by a SAMS sensor mounted on ER2. *It includes an overlay of ER2 drawer 2 current (the white trace along the bottom).* Note the temporal alignment of the white trace (current) with the strong spectral disturbances near 41.7, 83.2, 101.6 Hz, 124.8 and 166.3 Hz. This suggests correlation between the current & vibrations or both of those to a 3rd variable that is unaccounted for here.



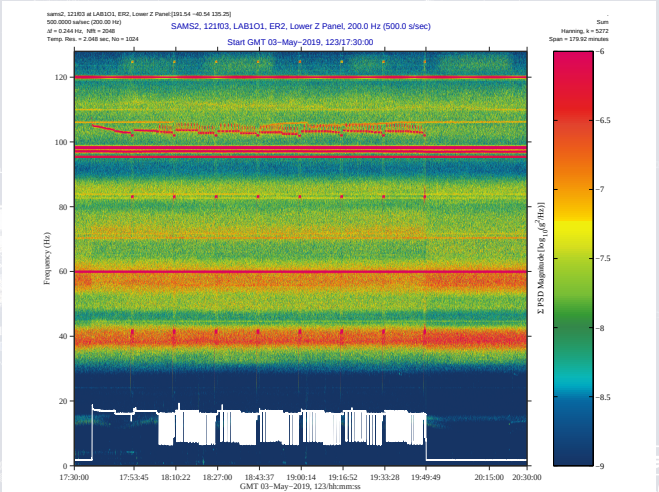
Some Transition Details

In this zoom-in, we have translated the white, current overlay trace for ER2 drawer 2 current up to near some tell-tale vibrations that occur at about 166 Hz. Note the temporal alignment of transitions of the white trace (current) with the narrowband vibration disturbances near 166 Hz.



Similar Ops on Later Date

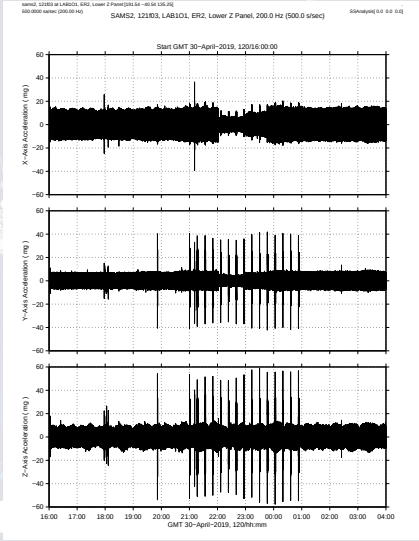
On GMT 2019-05-03, the Thermal Amine team attempted nominal operations again. This time with activation at about GMT 123/17:35 and deactivation later, at 123/20:05. The color spectrogram here was computed from SAMS measurements made on ER2, along with ER2 drawer 2 current as a white overlay trace. Note a strong correlation between the current associated with this payload and the vibration measurements made nearby with the SAMS.



GMT 2019-04-30 Accel. vs. Time

This 3-panel plot shows X-, Y- and Z-axis acceleration measurements versus time from the SAMS sensor mounted near the Thermal Amine equipment on GMT 2019-04-30.

Note the large, impulsive accelerations primarily aligned with the YZ-plane. These peaks top out at over 100 mg peak-to-peak on the Z-axis.



GMT 2019-05-03 Accel. vs. Time

This 3-panel plot shows X-, Y- and Z-axis acceleration measurements versus time from the SAMS sensor mounted near the Thermal Amine equipment on GMT 2019-05-03.

Note the large, impulsive accelerations primarily aligned with the YZ-plane. These peaks top out at nearly 120 mg peak-to-peak on the Z-axis.