1. INTRODUCTION

Starting at about GMT 2021-06-22, 173/10:05:00, one of the International Space Station (ISS) crew began about a 60-minute exercise period using the BD-2 treadmill equipment located in Zvezda Service Module.

2. QUALIFY

The information shown in the spectrogram of Figure 1 was calculated from SAMS sensor 121f03 measurements made in the US Laboratory. This plot focuses on the lower-frequency, structural mode and crew activity regime of the vibratory environment, including crew activities such as BD-2 exercise. It shows increased structural vibration excitation contained between about GMT 09:00 and 11:00 as imparted by the crew exercising, first on the Velo equipment in the Russian segment of the space station, then on the BD-2 treadmill in the Zvezda Service Module. Note the heightened vibrations (red, horizontal streaks) during the exercise period between roughly 0.5 Hz and 2 Hz. This is typical of crew exercise and is a necessary vibratory disturbance required on the space station for crew health.

3. QUANTIFY

In order to quantify the impact of the BD-2 exercise, we focus below 5 Hz and show root-mean-square (RMS) values for five SAMS sensor heads distributed throughout the ISS. For example, Figure 2 shows X-, Y-, and Z-axis values in red computed during the exercise period and we contrast that to the black trace for data outside of the exercise period **and** between GMT 08:35 and 12:35. Four more plots of RMS acceleration values versus time for SAMS sensors distributed throughout the ISS are shown, and similarly marked in red, starting with Figure 3 on page 2. Relative to the BD-2 exercise period that took place on GMT 2021-06-10 and described at this link, the 2 exercise periods here (for Velo and BD-2) were unremarkable and pretty much on par with ambient or baseline vibratory environment. This is not to say there was no impact because Figure 1 clearly indicates excitation, it is just that in a relative sense, the magnitude was much less than from a previously analyzed data set at the aforementioned link.

4. CONCLUSION

While the RMS values for the two SAMS sensors in Columbus show the largest impact due to BD-2 exercise, the difference above ambient is not much above the baseline or ambient environment. This most likely is attributable to either protocol or vigor/exertion. The other SAMS sensors in the US LAB and the JEM show similar, small impact for the exercise period. These assertions are best interpreted by examining the median values tabulated in the Table 1 on page 4 and comparing to the data set from a previous BD-2 exercise period on GMT 2021-06-10 shown at this link.

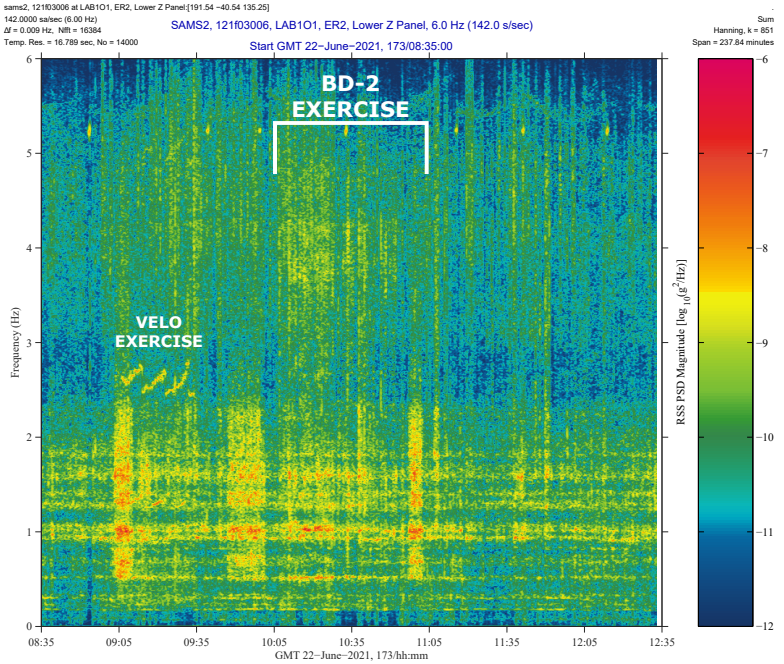

Fig. 1: Spectrogram showing Velo & BD-2 Exercise on GMT 2021-06-22.

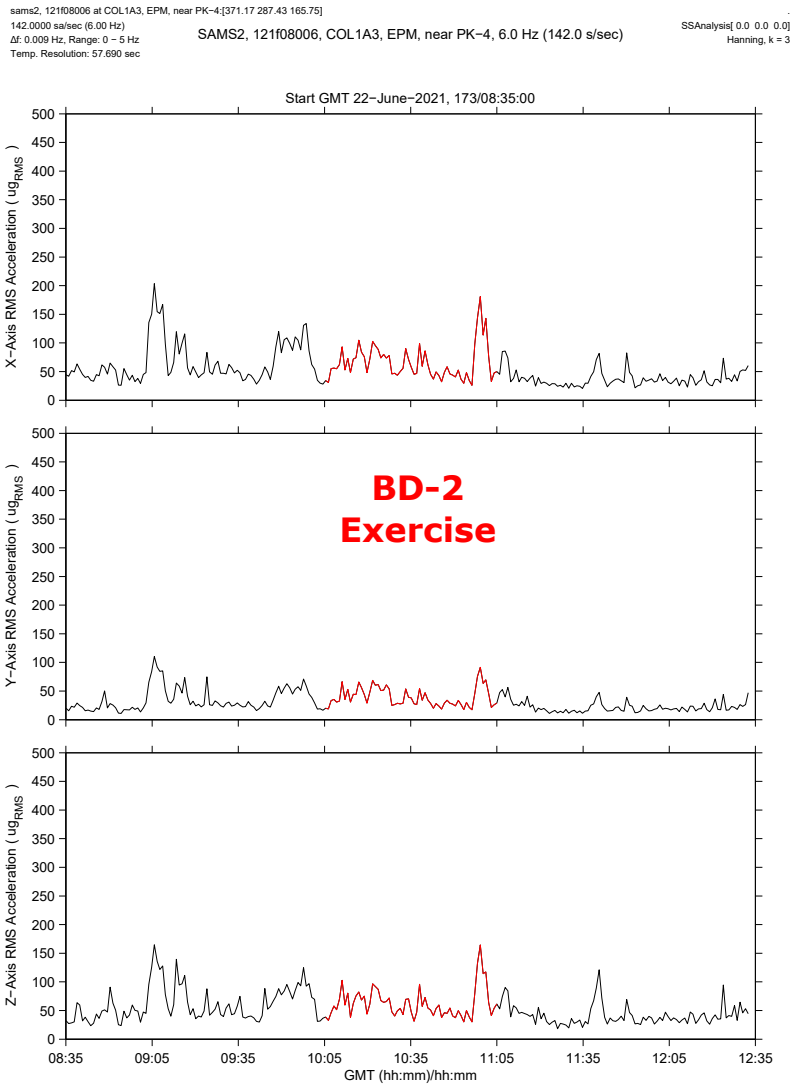

Fig. 2: RMS Below 5 Hz for SAMS 121f08 sensor in COL.

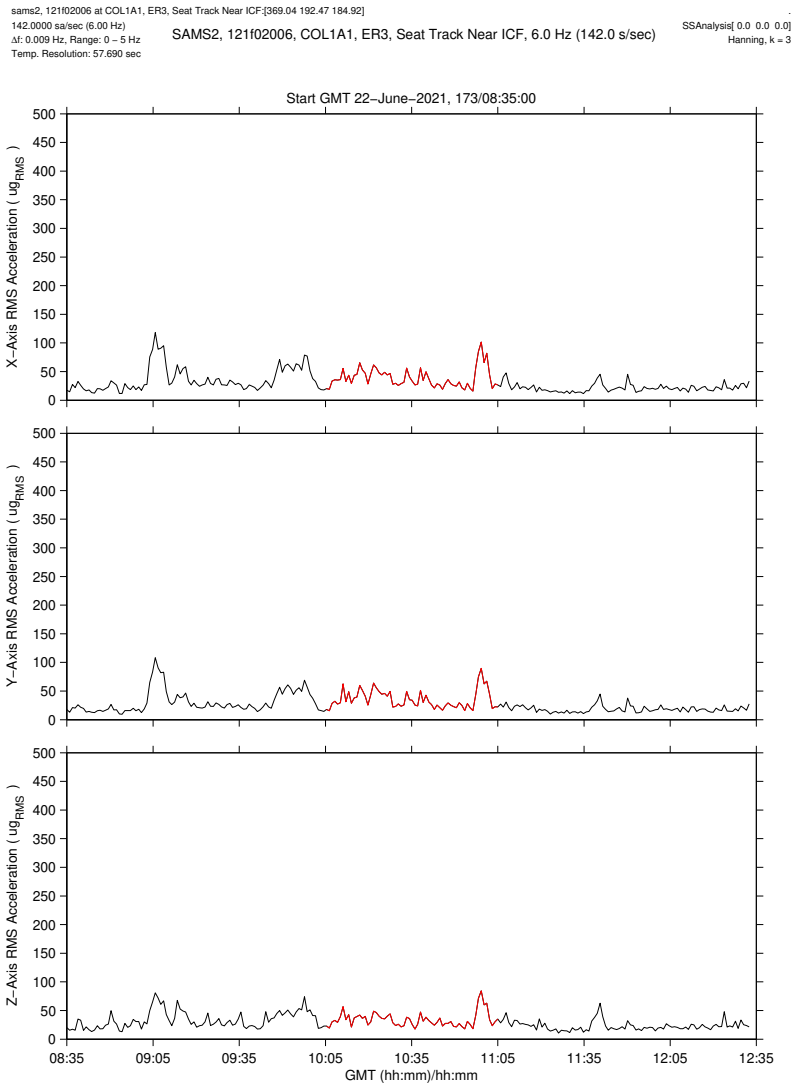

Fig. 3: RMS Below 5 Hz for SAMS 121f02 sensor in COL.

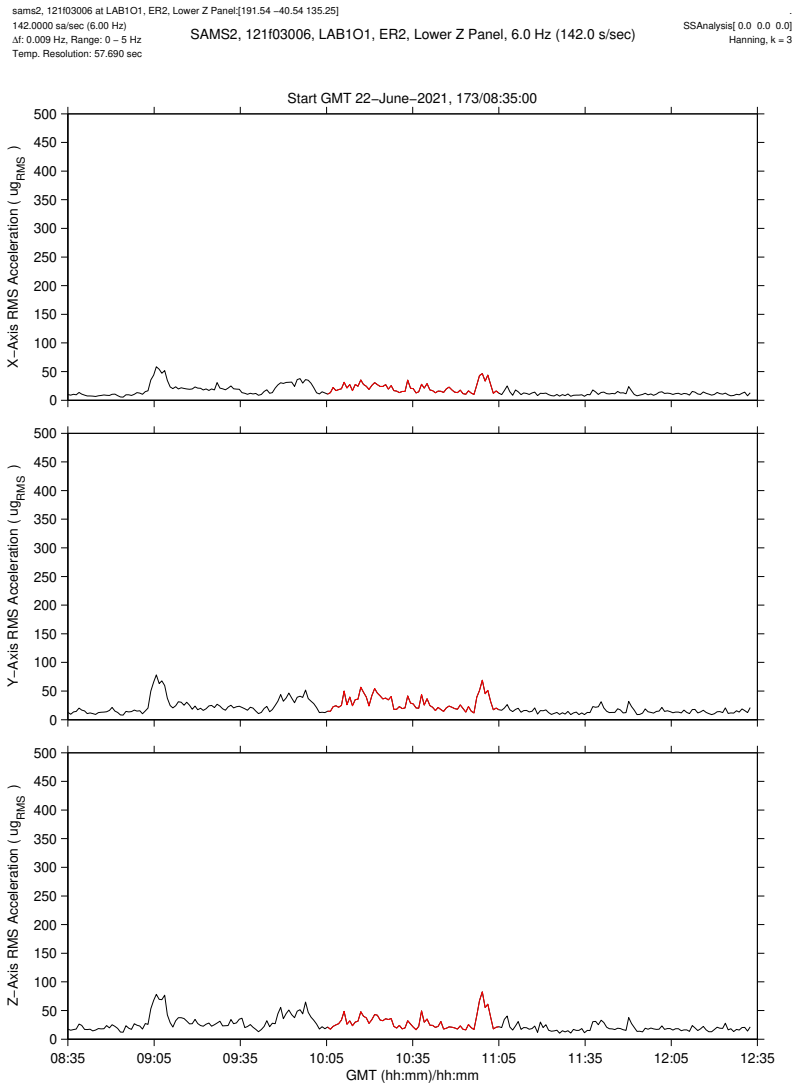

Fig. 4: RMS Below 5 Hz for SAMS 121f03 sensor in LAB.

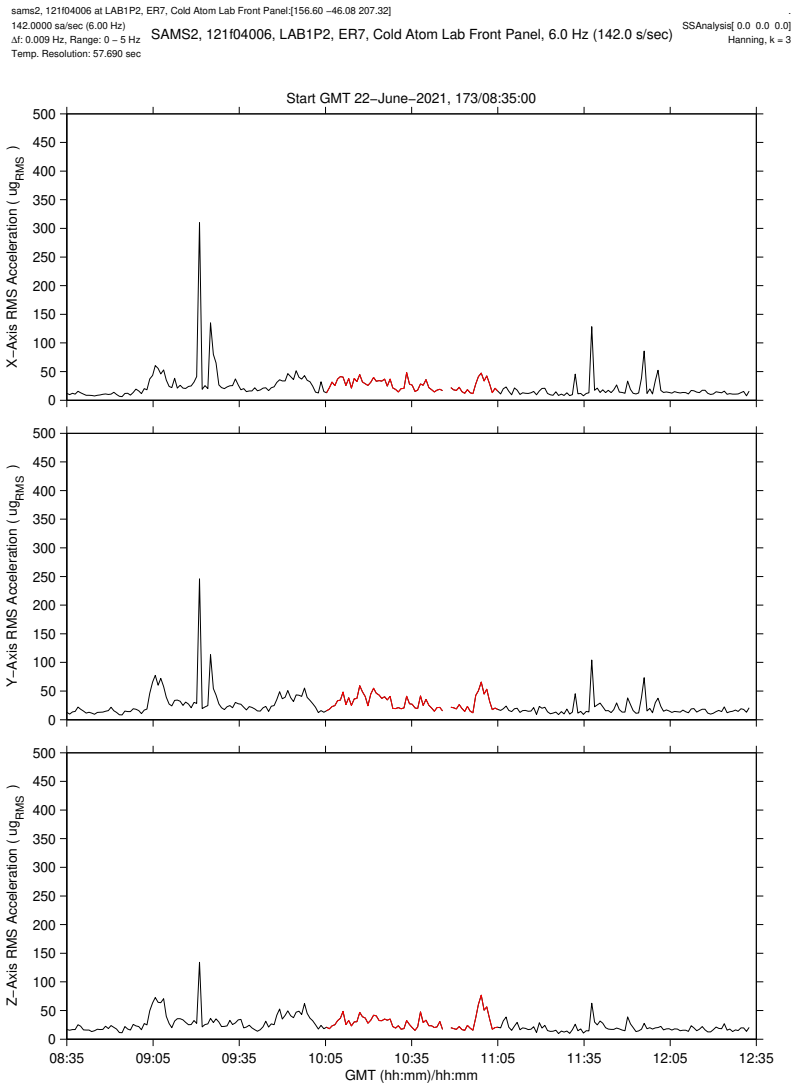

Fig. 5: RMS Below 5 Hz for SAMS 121f04 sensor in LAB.

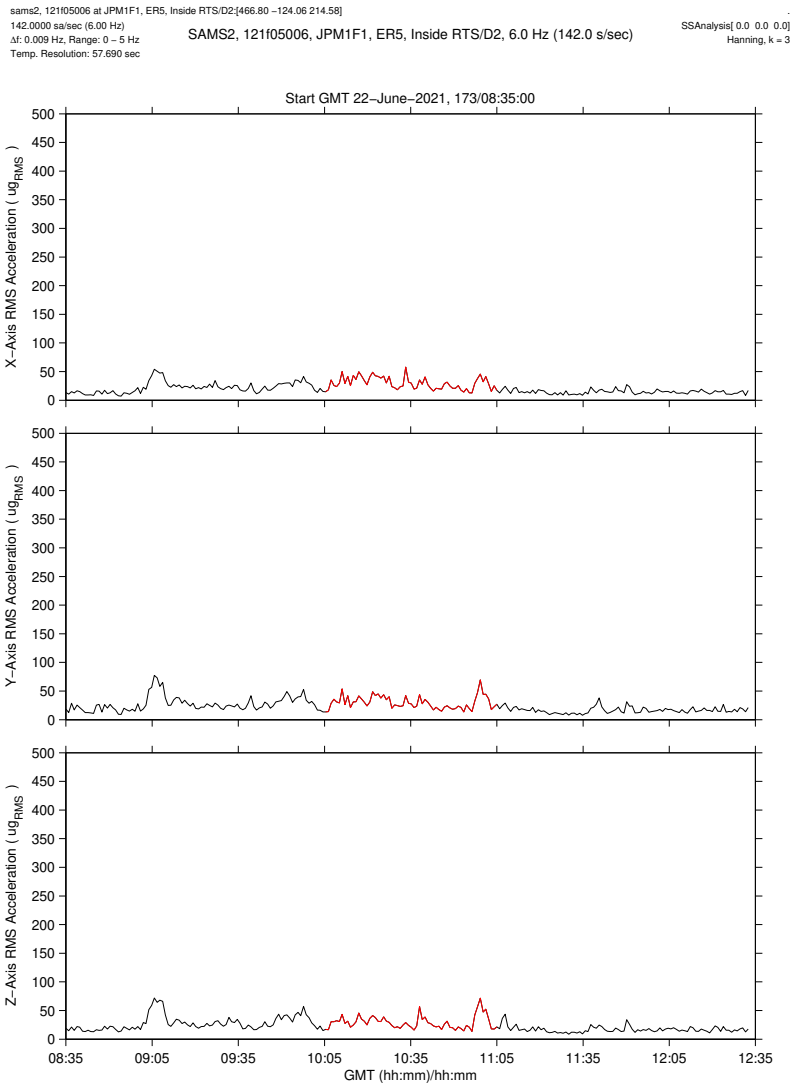

Fig. 6: RMS Below 5 Hz for SAMS 121f05 sensor in JEM.

Table 1. RMS Below 5 Hz, Compare BD-2 vs. Non-BD-2 Exercise Periods.

DURING EXERCISE PERIOD				
		Per-Axis RMS (micro-g)		
Location	Sensor	X	Y	Z
COL1A3	121f08	55.7	33.8	54.4
COL1A1	121f02	33.4	29.5	31.0
JPM1F1	121f05	27.9	27.5	27.3
LAB1P2	121f04	25.8	25.2	25.6
LAB1O1	121f03	19.3	24.4	25.4

NON-EXERCISE PERIOD				
		Per-Axis RMS (micro-g)		
Location	Sensor	X	Y	Z
COL1A3	121f08	43.0	23.1	42.3
COL1A1	121f02	23.3	19.8	23.8
JPM1F1	121f05	16.3	19.6	19.0
LAB1P2	121f04	15.8	18.1	20.0
LAB1O1	121f03	12.0	16.0	20.5