

# Robonaut Ops Qualify

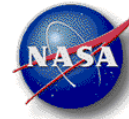
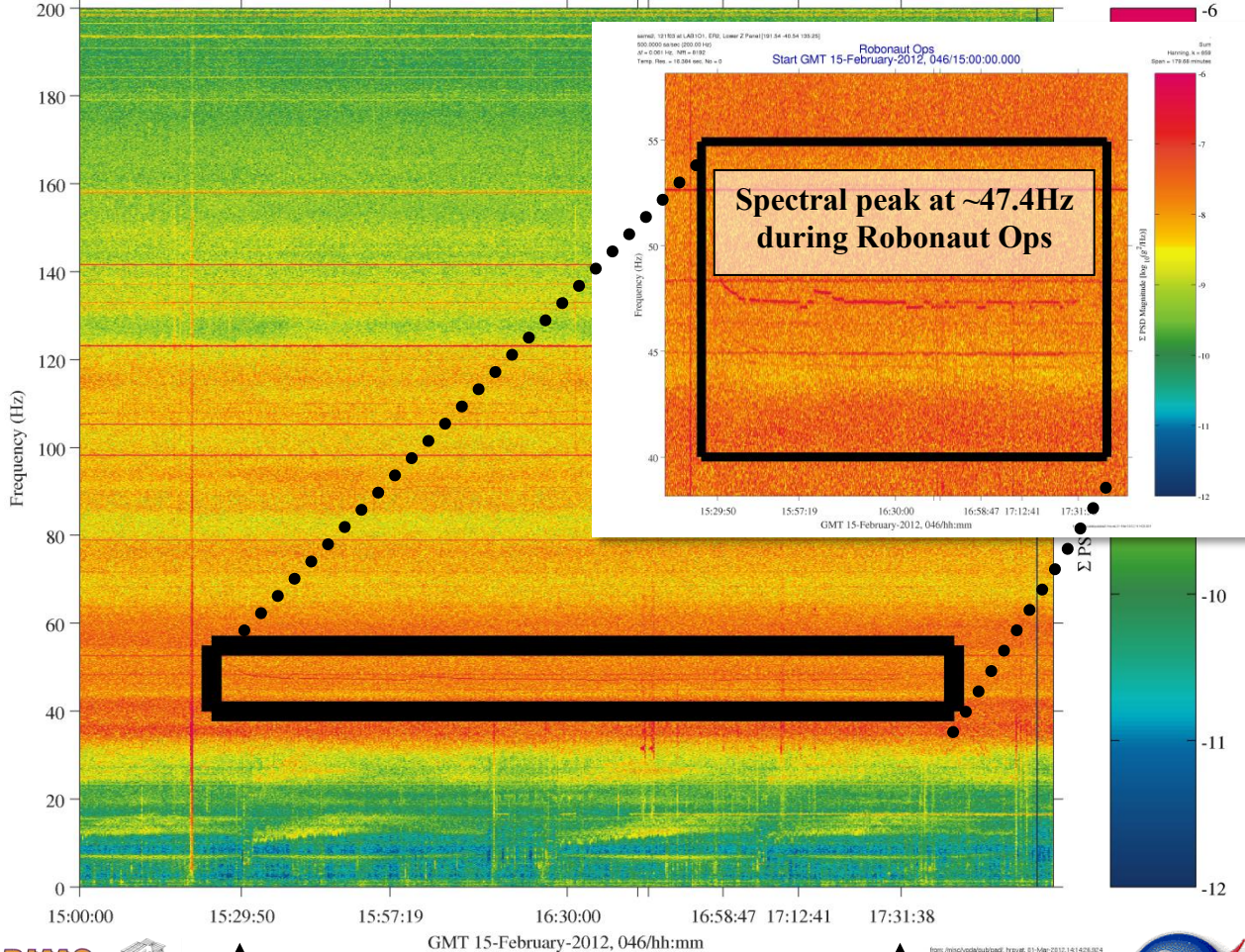


sams2\_121f03 at LAB1O1, ER2, Lower Z Panel [191.54 -40.54 135.25]  
 500.0000 sa/sec (200.00 Hz)  
 $\Delta f = 0.061$  Hz, Nfft = 8192  
 Temp. Res. = 16.384 sec, No = 0

Robonaut Ops

Start GMT 15-February-2012, 046/15:00:00.000

Span = 179.68 minutes  
 Hanning, k = 659



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Description	
Sensor	121f03 500 sa/sec (200 Hz)
Location	LAB1O1, ER2, Lower Z Panel
Plot Type	spectrogram

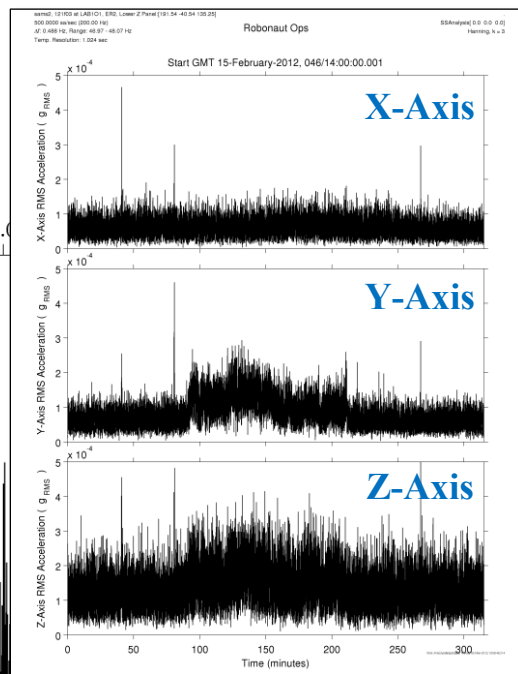
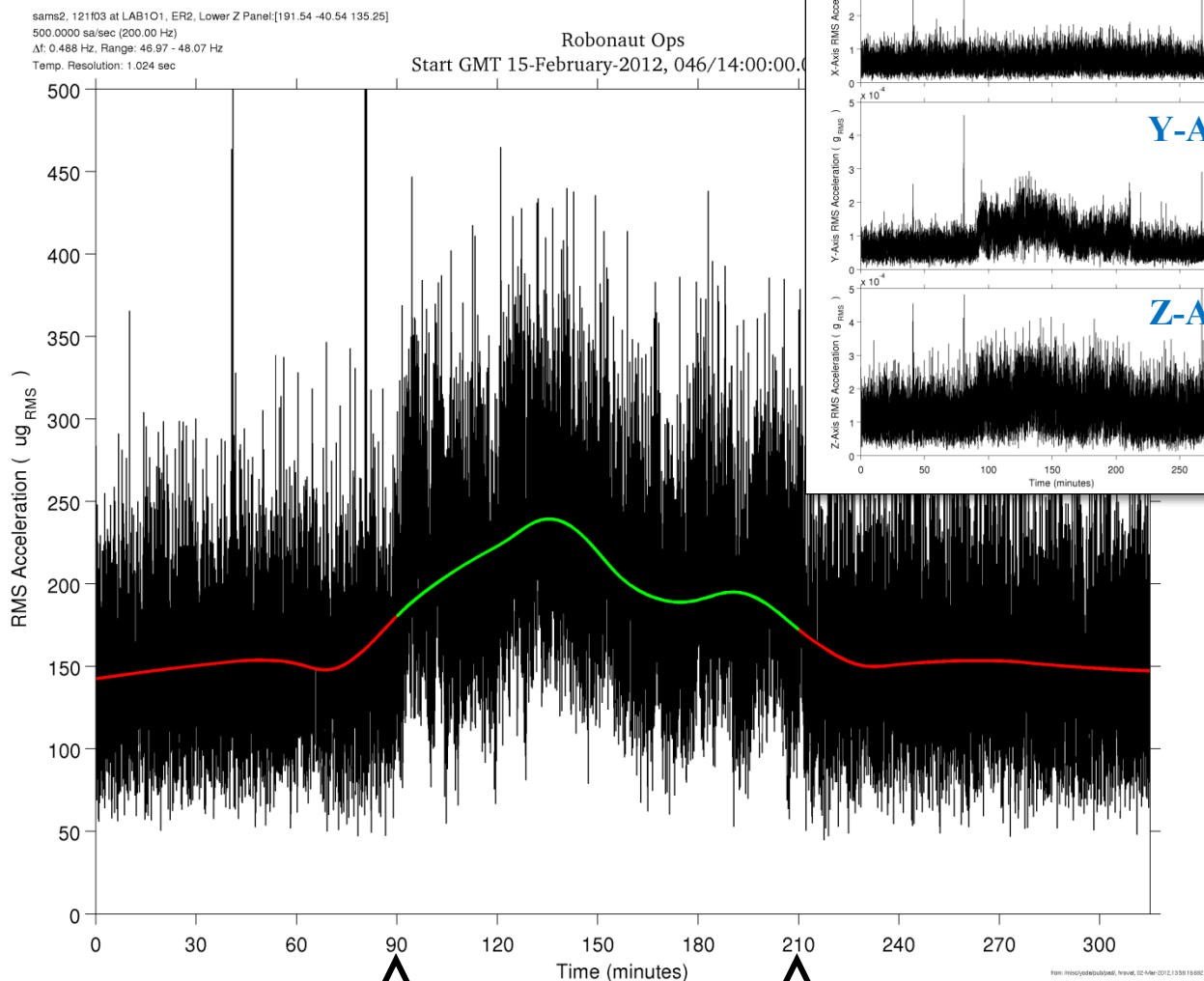
### Notes:

- Robonaut is a dexterous robot with a head, torso, arms, and hands. It was designed to perform tasks done by human hands and thus can use many of the same tools as an astronaut.
- Spectral analysis indicates that while some robonaut motion is not distinguishable from typical crew motion, ops associated with the humanoid does seem to introduce a narrowband peak that wanders a bit around 47 Hz throughout the operations.
- Also, “good motion” of arms, head, and/or torso can introduce transient effects.
- Robonaut operational events of interest on GMT 15-Feb-2012,046/hh:mm:ss were:

~ hh:mm:ss	event
15:29:50	start of ~47 Hz peak
16:43:00	“good motion”; both arms extend, head moves
16:45:00	repeat “good motion”
16:58:47	handshake with ISS CDR
17:09:51	rapid head tilt
17:12:41	move head, torso & arms
17:31:38	end of ~47 Hz peak

Regime:	Vibratory
Category:	Experiment Equipment
Source:	Robonaut Ops

# Robonaut Ops Quantify



Description	
Sensor	121f03 500 sa/sec (200 Hz)
Location	LAB101, ER2, Lower Z Panel
Plot Type	interval RMS vs. time

**Notes:**

- The spectral peak at ~47 Hz was the primary vibratory contributor during Robonaut Ops giving rise to the step of ~54 ugRMS above the “off” state for the frequency range from 46.97 to 48.07 Hz as shown in this table:

Robonaut Ops	ugRMS
“off” (before/after)	152
“on” (during)	206

- There were a couple of large transients noted during “good motion” (see the “Qualify” part of this handbook entry). The SAMS sensor registered acceleration vector magnitude transient peaks of about 11.46 mg and 9.50 mg around the time noted for those “good motion” entries, but it is not definitive that we can attribute those transients directly to the robonaut’s motion.



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Regime:	Vibratory
Category:	Experiment Equipment
Source:	Robonaut Ops

## Robonaut Ops Ancillary Info

In addition to the other information elsewhere in this handbook entry, the following notes were gleaned from voice loops communications:

### GMT 14-Feb-2012, Day 045

~ hh:mm:ss	event
16:53:00	readiness pose
17:00:00	“step 1.3 and 1.4” fingers move
17:01:38	arms move
17:02:40	head moves back (upright)
17:11:33	crew manually moves joints (elbow extension, forearm, shoulder move)
17:30:00	robo power applied (blue lights)
17:40:00	readying to power down due to ~2-hour time constraint

### GMT 15-Feb-2012, Day 046

~ hh:mm:ss	event
15:57:50	enable motor and fingers start to uncurl on right hand
15:58:12	fingers fully uncurled now
15:59:40	hard to see on video, but it looks like other hand’s fingers move
16:00:07	“step complete”
16:01:25	going to readiness pose
16:41:00	ready to do force sensor checkout
16:42:00	power is enabled (again)
16:43:00	“good motion”; both arms extend, head moves
16:44:00	head rotates
16:44:24	back to readiness pose
16:44:58	repeat “good motion”
16:45:44	head rotates
16:45:59	back to readiness pose
16:54:00	reset script done and “green/enable” pressed
<b>16:58:47</b>	<b>handshake with commander</b>
17:09:22	motion starts (arms)
17:09:51	rapid head tilt



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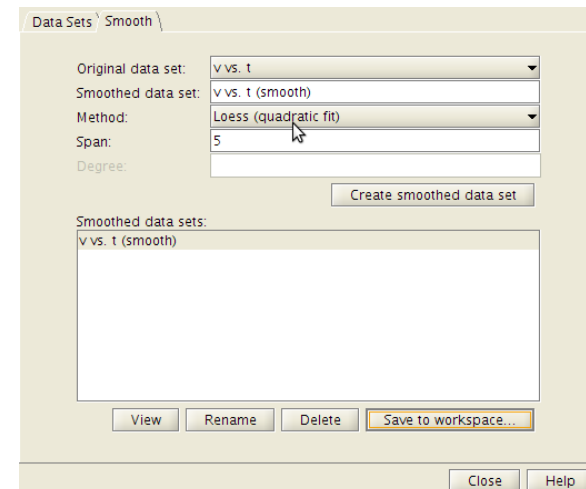
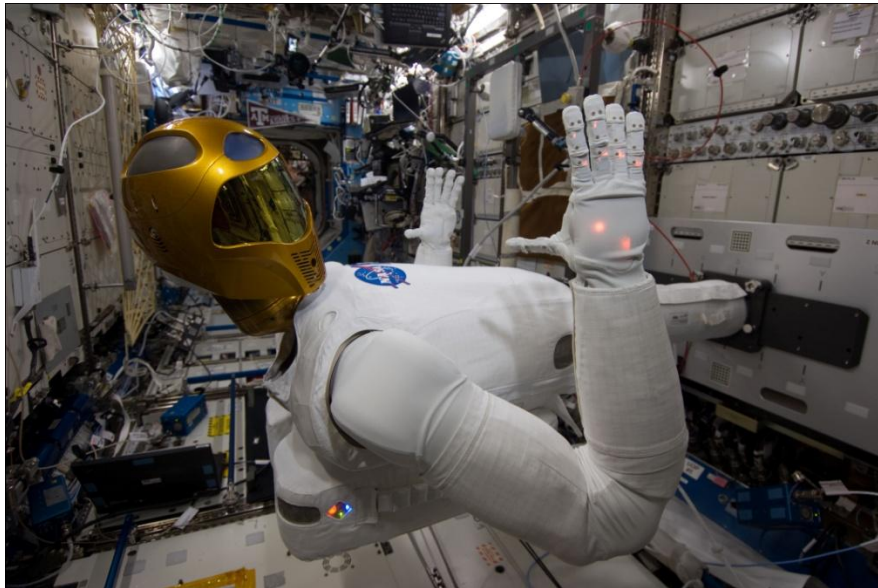


## Robonaut Ops Ancillary Info

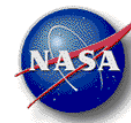
In addition to the other information elsewhere in this handbook entry, the following notes were gleaned from voice loops communications:

### GMT 15-Feb-2012, Day 046

~ hh:mm:ss	event
17:12:41	move head, torso & arms
17:13:09	“done with step 8”
17:15:22	[step 13] “the hello” arm movement and some sign language
17:16:06	“step 13 done”
17:26:28	motion during power down procedure
17:28:59	crew moves robonaut’s arms manually for lower profile in stowage bag
17:29:50	crew moves robonaut’s arms manually some more
17:31:00	robonaut power removed



Screenshot of MATLAB curve-fitting tool (cftool) used for smoothed version of interval RMS vs. time on the “Quantify” page.



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