

Curiosity Rover

Pictures So Good You Can See Flex Circuits!

Tom Woznicki - Flex Circuit Design Company

Big kudos to the folks at Jet Propulsion Laboratory for the continued success of their Mars rover programs. Curiosity has been performing flawlessly since landing in Gale Crater back in August.

As mentioned in an earlier PCB007 article (June 2008) I had a very small part in creating the flex circuits for Curiosity - creating trace layouts for about a dozen flex circuits and checking gerber files for most of the flex circuits in the rover. It was great fun to be part of such an ambitious program, but I never got to actually see the flex circuits themselves. What a pleasant surprise to find that pictures that Curiosity is sending back are so good you can see the flex circuits!

In October the mission used the Mars Hand Lens Imager (MAHLI), which is the camera out on the very end of the robot arm, to capture a set of 55 high-resolution images, which were stitched together to create a high-resolution full-color self-portrait. The resolution is so good you can almost read the silk screen legends on the flex circuits.



Figure one - Curiosity self-portrait
Courtesy NASA/JPL-Caltech

Figure two is a close up of the mast and you can see portions of the large flex circuit assemblies that travel through the pivots and connect the cameras and instruments on the mast with warm electronics box.

These flex circuit on the mast are not the longest of the flex assemblies - the flex assemblies that run out to the arm are 35 feet long, created by splicing several long flex circuits together. They obviously work - these high resolution pictures

were transmitted through these 35 foot flex assemblies! The same composite self-portrait shows the bracket where the flex circuits from the robot arm plug into wire harnesses that go into the warm electronics box (figure three). JPL has a better picture of the robot arm during assembly that shows the flex circuits running from the wire harness transition, along the arm and up to the instruments and camera at the very end of the arm (figure four).

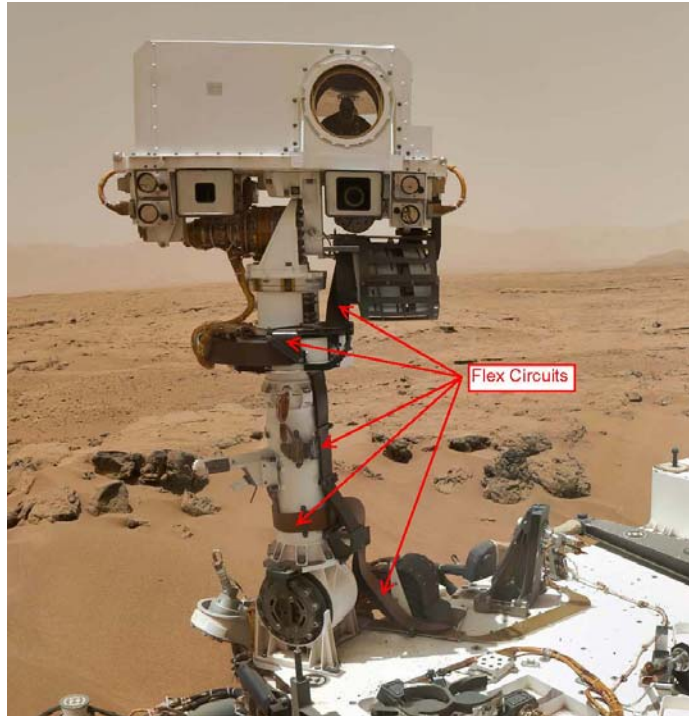


Figure two - close up of the mast.
Courtesy NASA/JPL-Caltech.

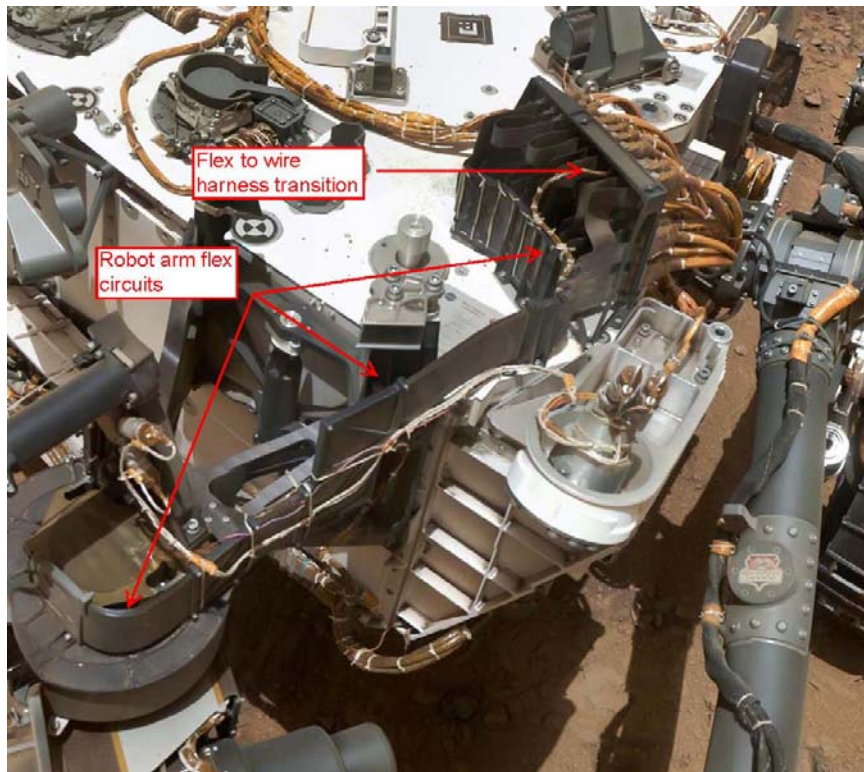


Figure three - start of robot arm flex circuits
and transition to wire harnesses. Courtesy NASA/JPL-Caltech

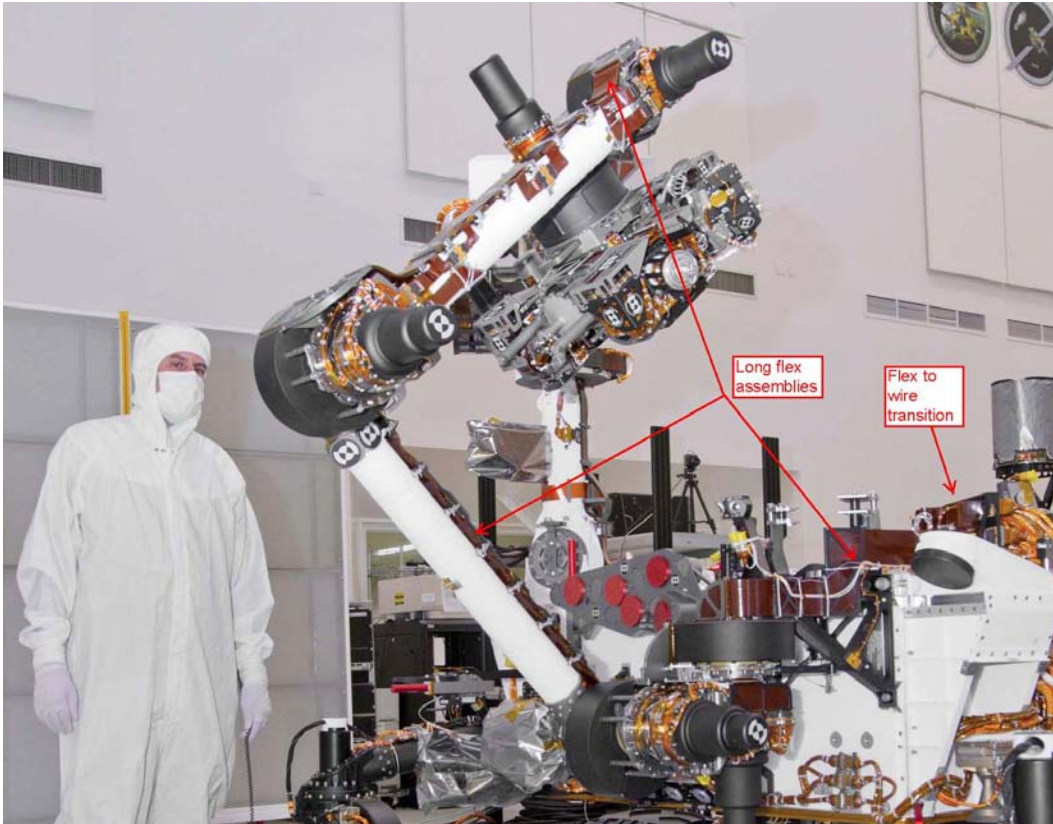


Figure four - the robot arm during assembly showing the flex assemblies. Courtesy NASA/JPL-Caltech.

You can download and closely examine these pictures for yourself from Wikipedia. http://en.wikipedia.org/wiki/Curiosity_rover. You can also get more info on the Curiosity flex assemblies at the website of vendor that built them - Pioneer Circuits in Santa Ana, CA. www.pioneer-circuits.com. Info on the continuing mission of Curiosity can be found at <http://mars.jpl.nasa.gov/msl>.

Tom Woznicki is the president of Flex Circuit Design Co., a consulting company in San Jose, CA. Flex Circuit Design Co. specializes in designing flexible printed circuits for OEMs and flex circuit manufacturers. For more info go to www.flexdude.com. (c) Copyright 2013, Flex Circuit Design Co. All rights reserved.