

Mars Photos from Curiosity Compressed On Demand Using JPEG Encoder IP Core in MSSS Camera System

The multi-camera image and video system designed by Malin Space Science Systems for the Mars Rover uses real-time JPEG compression to efficiently transmit selected images to Earth

Woodcliff Lake, New Jersey — May 15, 2014 — CAST, Inc. salesperson Steve Lilly couldn't have imagined he'd help produce the galaxy's most prolific selfie-shooting robot when he took that first call from Malin Space Science Systems (MSSS). Yet that's what ended up happening, as the JPEG Encoder IP Core MSSS licensed from CAST now plays a key role in getting Curiosity Rover's amazing photos of Mars—and itself—back down to Earth.

The innovative system MSSS designed for the Mars Science Laboratory (MSL) rover uses three imaging systems: the Mars Descent Imager (MARDI) that captured the rover's landing, the Mars Hand Lens Imager (MAHLI) on the rover's robotic arm for close-ups of rocks and soil, and the dual-camera Mast Camera (Mastcam) on the rover's remote sensing mast. These four cameras feed the four-board MMM Digital Electronics Assembly (DEA), a box inside the rover's temperature-controlled interior that does image processing and JPEG compression and stores the images in 8 Gigabytes of non-volatile NAND Flash memory on each board.



A selfie taken by Curiosity Mars Rover's mast camera and compressed for transmission by the JPEG core available from CAST. Image Courtesy of [NASA/JPL-Caltech/MSSS](#)

Sending all the 2-Megapixel photos and 720p 6 fps video produced by the four cameras down the Earth-bound data stream in raw form would be too slow and expensive. Instead, the system automatically generates and transmits compressed thumbnails for everything it shoots. Scientists choose the most interesting of these images for further study, and the DEA retransmits the locally-stored full-resolution originals—or reruns the JPEG encoder with the desired degree of compression—and retransmits the requested media.

The selection criteria MSSS used for the JPEG Encoder Core were extremely rigorous. Implementation in a space-hardened integrated circuit package was essential, as were superb image quality and complete reliability. The clever on-demand compression function of the system further demanded extremely fast operation.

The JPEG-E Encoder Core MSSS selected had competitive specifications, a long and positive customer track record, and the complete backing of the experts at Alma Technologies, from whom CAST sources the core. CAST and Alma’s “experience it yourself” approach to selling IP further helped clinch the decision, as MSSS was able to evaluate and experiment with the encoder with their own image data sets using a bit-accurate model (BAM) and other resources before committing to a full production license.

“The JPEG Encoder we licensed from CAST had the best technical features for this demanding application, offering flexible transmission rate control and excellent compressed image quality in a reliable, proven IP product,” said Jacob Schaffner, Senior Electronics Engineer of Malin Space Science Systems. “They reduced risk by enabling our extensive pre-sale evaluation with an executable model of the core, and their expert technical support and flexible license terms helped make the project an all-round success.”

“Malin Space’s use of this JPEG encoder core on Mars typifies what we try to do with every customer: delivering tremendous function and utility wrapped up in an easy-to-use IP core that helps the customer focus on pushing their unique application beyond what was previously thought possible,” said Meredith Lucky, vice president of sales for CAST.

The successful IP partnership among the companies continues, and MSSS has under development even more innovative cameras for future space missions using Alma Technologies IP provided by CAST. And meanwhile, CAST salesperson Steve Lilly is able to feel some pride when seeing Curiosity called “[the undisputed King of Selfies](#).”

Malin Space Science Systems (MSSS) is a privately held company that performs space science research and designs, develops, and operates spacecraft cameras and instrument systems. Established in 1990 and based in San Diego, California, the company has produced visible and ultraviolet cameras for five recent planetary missions. It is currently operating four cameras on the Curiosity rover, two cameras on the Mars Reconnaissance Orbiter and one on the Juno Jupiter Mission. Learn more at www.msss.com.

Alma Technologies develops sophisticated, easy-to-use, high-quality IP products for integration in ASIC or FPGA designs and provides these to customers lacking the necessary know-how, time, or resources to develop them from scratch. Alma Technologies specializes in still image and video compression, cryptography, and serial flash memory controllers. Learn more at www.alma-tech.com.

CAST, Inc. is a 20-year-old developer, integrator, and aggregator of IP cores and subsystems. The company's royalty-free product line features 32-bit BA2x™ processors, 8051 microcontrollers, video and image compression, graphics processors, encryption, interconnects and interfaces, peripheral controllers, and more. See www.cast-inc.com for product details.

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