The Mars 2020 Rover Mission:
EISD Participation in Mission Science and Exploration

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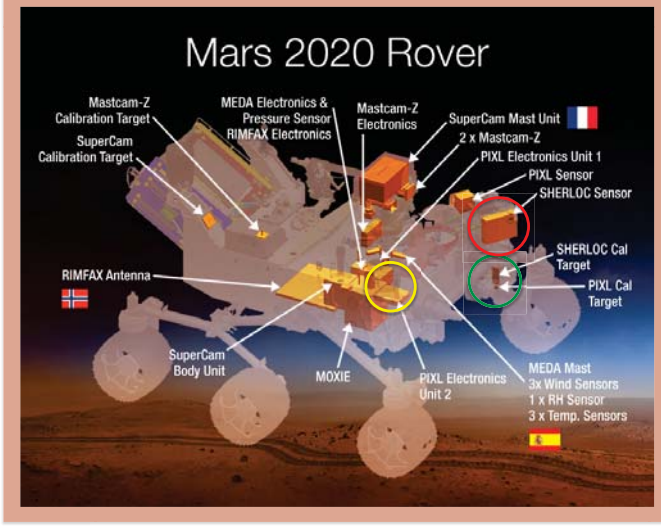
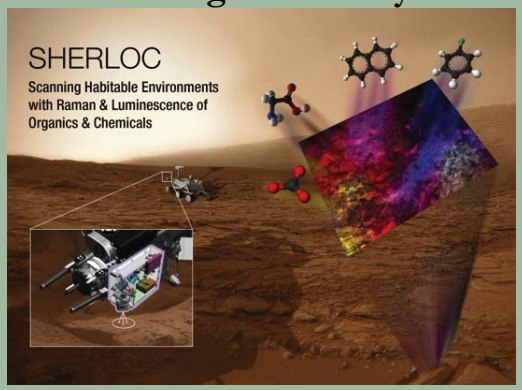
The Mars 2020 Rover Mission: A Search for Potential Biosignatures on Mars



The Mars 2020 Rover mission will search for potential biosignatures on the martian surface, use new techniques to search for and identify trace-level organics, and prepare a cache of samples for potential return to Earth. Identifying trace organic compounds is an important tenet of searching for potential biosignatures. Previous landed missions have experienced difficulty identifying unambiguously martian, unaltered organic compounds, possibly because any organic species have been destroyed on heating in the presence of martian perchlorates and/or other oxidants. The SHERLOC instrument on Mars 2020 will use ultraviolet (UV) fluorescence and Raman spectroscopy to identify trace organic compounds *without heating* the samples. The SHERLOC instrument (red circle), calibration target (green circle), and internal electronics (yellow circle) are shown in the figure at left.

JSC ARES scientists will serve on the SHERLOC organics-detection instrument team. The SHERLOC calibration target will serve for both instrument calibration and also to test the degradation response of space suit materials to the martian surface environment.

The SHERLOC Instrument: A Novel Approach for Trace Organics Analysis



The Scanning Habitable Environments with Raman & Luminescence for Organics & Chemicals (SHERLOC) instrument is a UV fluorescence / Raman instrument that was selected as part of the Mars 2020 rover instrument suite. The SHERLOC instrument is capable of detecting a wide range of organic compounds and minerals of interest in the search for potential biosignatures, without the need for heating steps used by instruments flown in previous Mars missions. The identity and abundances of organics measured by SHERLOC will be compared with gas and liquid chromatography-mass spectrometry (GCMS, LCMS) analyses of analog samples at JSC.

The SHERLOC Calibration Target:

Science for Both SMD and HEOMD

The calibration target would be mounted on the rover's body, directly exposed to the chemistry, dust, radiation, and weather of Mars. Calibration targets would include a suite of space suit materials, a trio of carbon-bearing silicate targets, and a martian meteorite as targets. The martian meteorite would be the first rock that we know of to complete a round trip between planets and would therefore serve a supplementary EPO role. Together, the suite of targets would meet instrument requirements for *spectral*, *spatial*, and *imaging* calibration of SHERLOC.

Space suit materials in the SHERLOC calibration target would be exposed directly to the martian surface environment throughout the proposed lifetime of the Mars 2020 mission. The SHERLOC instrument would analyze the polymer targets periodically for instrument calibration, and is also capable of discerning their chemical composition and monitoring for environmentally-induced changes. Concurrently, we anticipate a laboratory study using materials samples taken from the same batches as the flight coupons. They would be exposed in a Mars chamber, analyzed periodically with laboratory instrumentation, and tested for materials properties such as tensile strength and abrasion resistance. Results from the two sample sets would be correlated to generate a measure of the expected service lifetimes of space suit materials under martian ambient conditions.

Material	Current Use in NASA Space Suits
Orthofabric	Outer layer for most of EMU
3 oz. Teflon fabric	Outer layer for glove, back of hand, gauntlet
Polycarbonate	Helmet bubble
RTV Silicone	Glove palm
Vectran	Glove palm
Spectra	EMU structural element
6 oz. polyester	EMU restraints

Top: The SHERLOC calibration target will be similar to the MAHLI camera target on MSL, shown here. *Center:* The space suit materials (listed at *Bottom*) which will be included in the SHERLOC calibration target. These materials will calibrate SHERLOC and serve to test material response to the martian surface environment.