ACOUSTIC MEASUREMENTS ON MARS 2020 ROVER WITH THE ENTRY, DESCENT AND LANDING [EDL] MICROPHONE SYSTEM. Jason A. Mezilis[1], Jeffrey M. Megivern[2], Kyle Edelberg[2], Mike Houge[1]; [1]Zandef Deksit Inc., Los Angeles CA jmezilis@gmail.com; [2]NASA JPL, Pasadena CA jeffrey.m.megivern@jpl.nasa.gov

Introduction: NASA's Mars 2020 rover will carry two microphone payloads to the surface in Feb. 2021. While these two systems are of separate design and operation, there is considerable potential for overlap in the science and acoustical observations they will return to Earth. This poster highlights operations of the microphone associated with the Entry, Descent and Landing [EDL] system including overall design and operational parameters, as well as projected scientific gains and public outreach benefits associated with this groundbreaking instrumentation.

Design: The EDL microphone is classified as a technology demonstration, therefore an off-the-shelf studio instrumentation style microphone has been selected for this system. The DPA 4006 capsule and associated MMA-A digital audio interface have been chosen for their high dynamic range and rugged design characteristics, which will equally enable distortion-free capture of the landing rockets as well as subtle sounds of the Martian wind and all manner of audible rover operations in between.

EXTERNAL MOUNT 1/2" DIAPHRAGM DPA 4006 OMNIDIRECTIONAL CAPSULE

Primary Function: The EDL microphone is primarily designed to operate during the "seven minutes of terror" associated with descent of the lander through the Martian atmosphere and final landing on the surface. The microphone will record sounds of parachute deployment, heat shield release, rocket firing of the sky crane, and final touchdown of the wheels on the surface. This audio will be paired and synchronized with onboard video capture of the EDL sequence for a compelling and scientifically engaging multimedia presentation. Latter monitoring of the audio during the final landing will yield helpful diagnostic data of EDL system functionality. Completion of this initial acoustic recording cycle will constitute "mission success" of the EDL microphone.

Secondary Function: Following successful implementation during the EDL sequence, the EDL microphone will continue to record surface audio at selected opportunities during the lifetime of the rover. At this point operations will coincide with activation of the microphone onboard the SuperCam instrument, and the possibility exists therein for overlap between these two systems for redundancy of acoustic observations, including coordination for true stereo audio capture [1] on the Martian surface via simultaneous operations.

Calibration techniques: Much like the visual systems on board the Mars 2020 rover, audio capture will require a method of calibration in order to properly quantify the effects of the Martian atmosphere on the propagation of acoustic waves across the surface. While detailed theoretical studies [2] have been conducted regarding the curiously predicted behavior of soundwaves on Mars, any implementation of a microphone system for scientific measurements [including diagnostic analysis of various onboard mechanisms] will require an initial gathering of specific in situ observation of how the atmosphere has altered the audio signal prior to capture.

Detailed measurements at NASA's Jet Propulsion Laboratory utilizing onboard drilling instrumentation have provided initial results suggesting an ideal candidate for this calibration source. These initial tests have also provided key data to accurately compensate for positional concerns of the EDL microphone with regards to its placement on the rover chassis.

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References:

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