LUNAR EXOCAM - REMOTELY DEPLOYABLE IN SITU SENSOR SUITE TO INFORM LUNAR PSI

Jason A. Mezilis [1], Kris Zacny [2], Will Hovik [2], Ashley Korzun [3]
(1) Zandef Deksit Inc., Los Angeles CA   info@zandefdeksit.com;
(2) Honeybee Robotics, Altadena CA; (3) NASA Langley Research Center, Hampton, VA

ABSTRACT

Lunar ExoCam is a remotely deployed lunar payload delivery module enabling a fully immersive 360° environmental characterization of regolith dispersion captured during the final descent of a lunar lander.

Ejecting and reaching the lunar surface prior to the descending vehicle, the ExoCam sensor suite is poised to gather in-situ measurements throughout the full cycle of plume-surface interaction (PSI), utilizing various onboard instrumentation to capture synchronous data over time.

Following completion of the landing cycle and surface activity, these data are relayed via Wi-Fi back to the lander for subsequent transmission to Earth.

REMOTELY DEPLOYED SENSOR SUITE

List of instrumentation in deployed sensor module, including (but not limited to) the following:

360° Spherical FOV Camera
- 30 fps, HD video capture of regolith disbursement, rocket descent
- Observation in tandem with particle sensor, light beacon, and coupons (below)

360° Particle Sensor
- In-situ characterization of particle size and speed over time
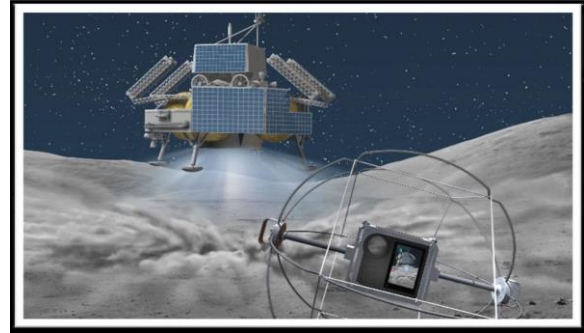
Light Beacon
- Mounted on the payload ejection module affixed to the lander chassis
- Provide visual light-dimming reference to assist measurement of particle dispersion cloud density

Accelerometer
- Provide surface density measurement of the lunar surface at point(s) of impact

Coupons
- Analyze adhesion properties of lunar dust onto different materials

Lunar ExoCam deploys a Camera Module to the lunar surface, capturing PSI data prior to final descent

CURRENT DEVELOPMENT

Following a 2020 NASA Flight Opportunities grant, two remotely ejectable ExoCam test payloads were successfully deployed on Oct.14th 2021 from a VTVL test vehicle in Mojave, CA from a representative height, measured as analogous to desired impact tolerances that would be experienced by a notional lunar ejection.

The representative sensor payloads included GoPro MAX 360° HD video cameras (recording at 30fps), with integrated custom particle sensor systems developed with students at Arizona State University. Both systems recorded continuously throughout the deployment and surface impact, capturing HD video and particle impact (amplitude) measurement that was later able to be re-sequenced.

These payloads were ejected from the rocket via a coordinated RF-triggered release with the launch provider, outperforming expectations as to their projected target accuracy and validating this new method of payload delivery in a relevant test environment.

FUTURE DEVELOPMENT

These in-situ data will dramatically improve studies and analysis models that can be used to plan future surface science exploration and examine methods of protecting key lunar infrastructure.