PISCES LUNAR DUST FLIGHT EXPERIMENT

MoonRIDERS

PROGRAM UPDATE

Pacific International Space Center for Exploration Systems

Rob Kelso Executive Director, PISCES

July 2015

CES Strategic Plan Objective

PISC

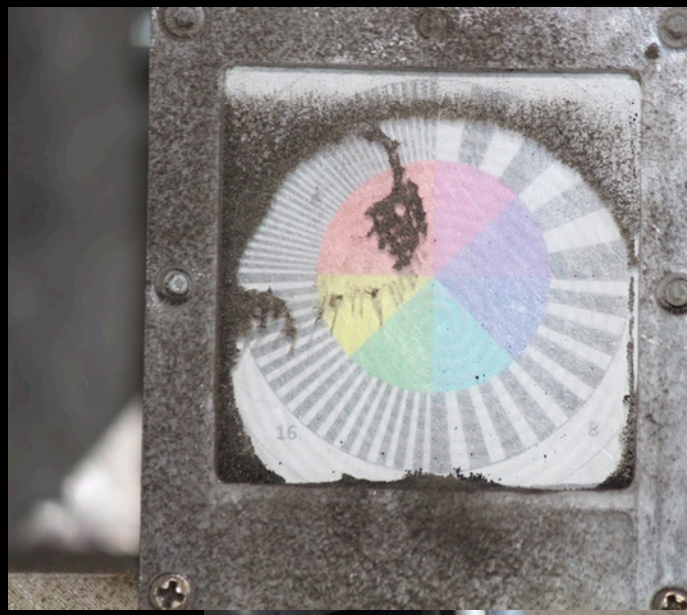
- NOLOGY DEVELOPMENT / DUAL-USE
- NOLOGY IN:
- altic construction (R&D)
- CES Planetary Rover systems upgrade/ egration
- and the PISCES Planetary Analogue Test Site PATS)
- CES lunar surface flight experiment – - onRIDERS
- ernational Robotics Mining Competition in waii - PRISM
- SA Laser Communications Relay Demonstration RD) and ground terminal
- rkforce Development – Intern and soon-to-be- nounced Coop Program

PISCES MoonRIDERS

search Investigating Dust
pulsion Removal Systems

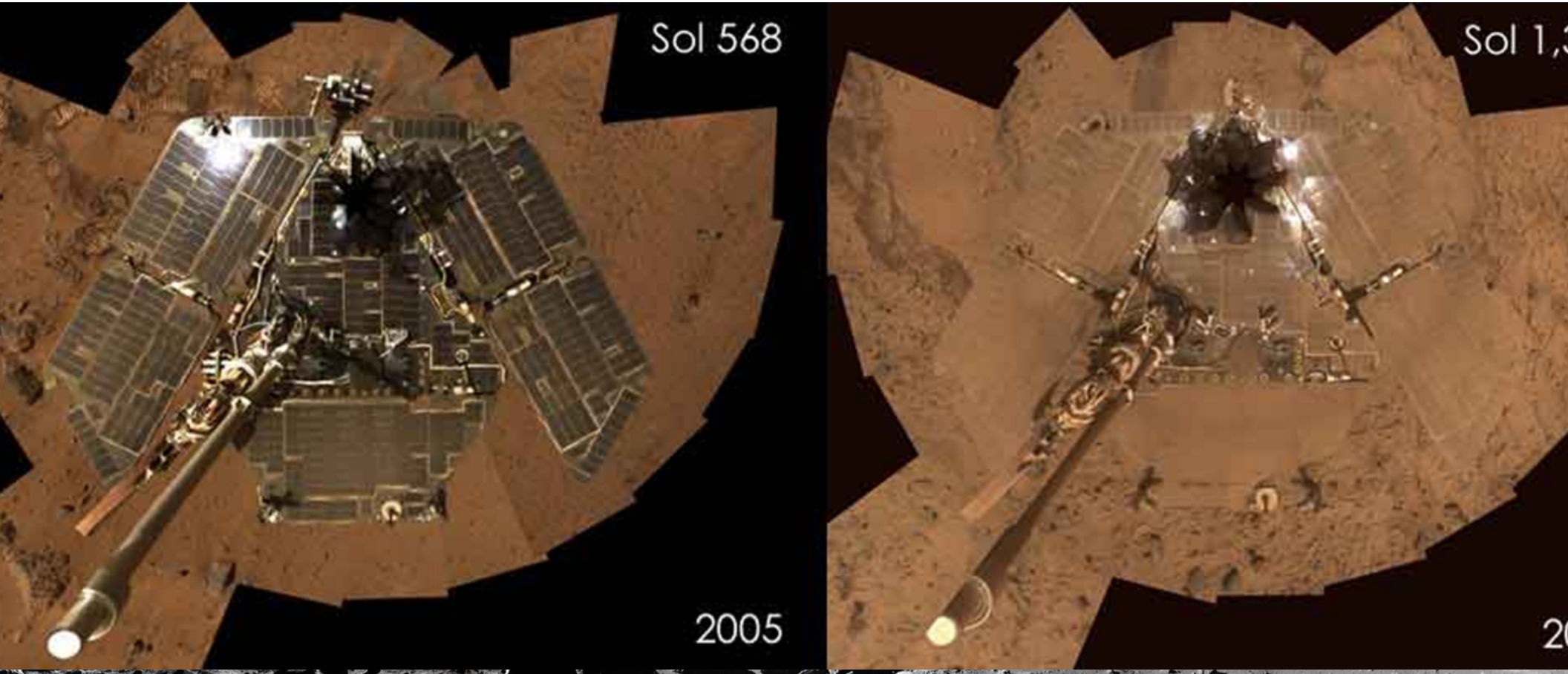
To develop, launch, fly and land on the moon a
i High School student-built lunar surface
ment, in concert with technology from the NASA
dy Space Center as a hosted payload on one of
coming Google Lunar X-Prize (GLXP) launch

: GLXP launch in early 2017



MOONRIDERS
Research Investigating Dust
Expulsion & Removal Systems

Dust is a significant issue for systems on moon and Mars.



e Dust Problem

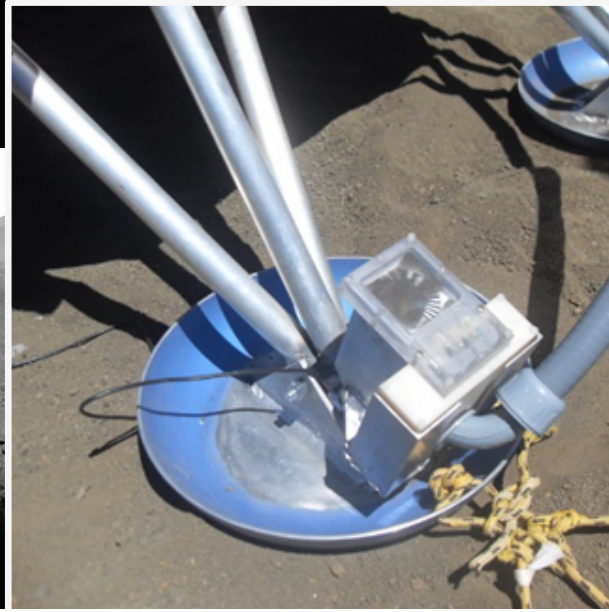
e conclusion of Apollo 17's
on in December 1972,
nwalking suits and space
ets are covered by lunar

MoonRIDERS

AT: to establish a joint flight test program between Hawaii school students and NASA for the testing of critical dust oval technologies on the lunar surface.

Y: (1) advance TRL of critical technology for surface ems

(2) to uniquely promote and encourage STEM education among Hawaii students (ranked 46 percentile)



MoonRIDERS

HO: four unique strategic partners

Academia/STEM: Two (2) Hawaii High School Teams:

- `Iolani HS / Private / Oahu
- Kealakehe HS / DoE public / Big Island

State: Pacific International Space Center for Exploration Systems

Federal: NASA-Kennedy Space Center / SwampWorks

Industry/Commercial Space: Google Lunar X-Prize teams

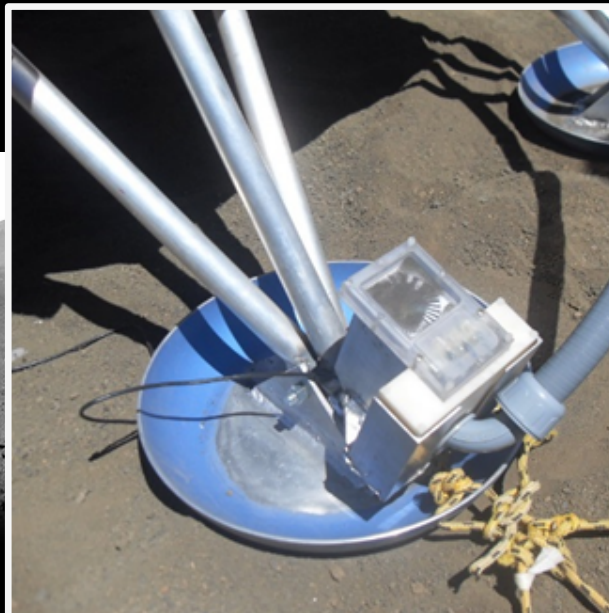
MoonRIDERS

INESS MODEL:

etup a “no-exchange of funds”. Non-reimbursable SAA

nly product, CAD models, hardware, are exchanged.

ASA-KSC provides mentoring session on lunar dust,
hysics of EDS, moon, issues with dust, etc.



PROGRAM UPDATES AND STATUS

KSC working extension of the SAA for MoonRIDERS

Development/testing of Flight Qual Unit planned for Nov '15

- Will be in flight configuration of ½-kg
  - Testing at vacuum shows good results
- KSC shifting plate material from glass to 'copper on kapton' with improved packing density of spiral.
  - Lowers voltage from 1.5kV to ~700v

Data analysis complete from March test to define flight and imaging config between EDS, mockup lander / rover

Re-evaluate options for a "re-duster" concept for depositing regolith the EDS

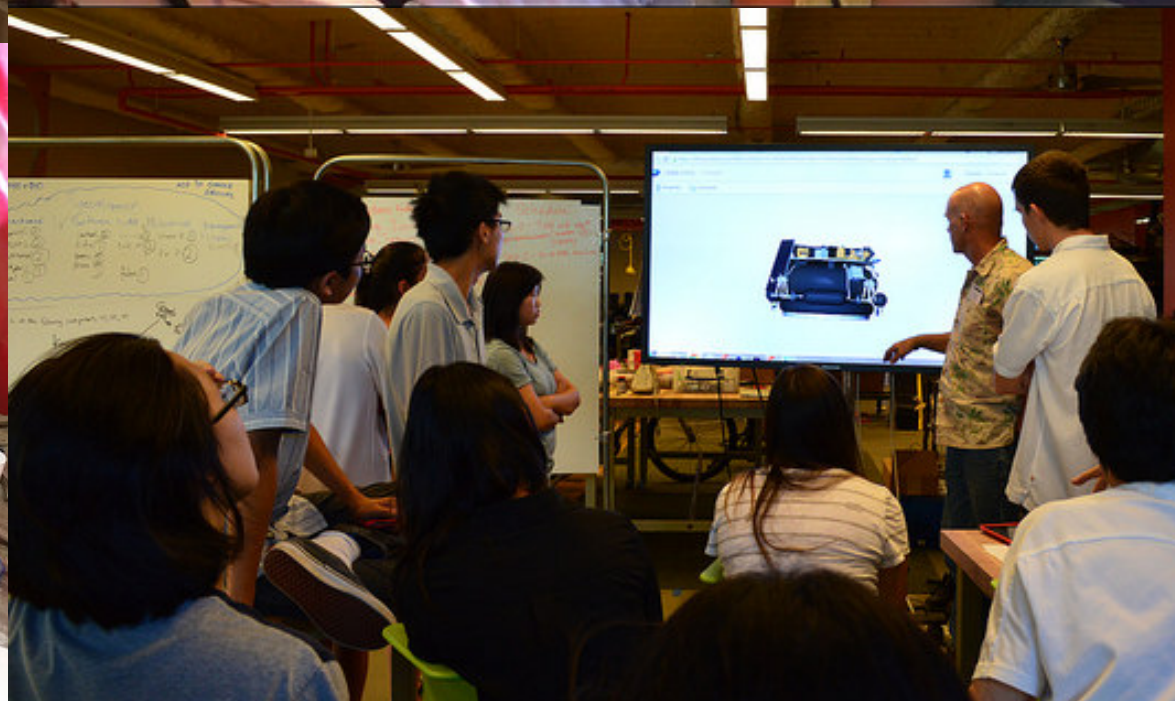
Some companies in the CATALYST project have expressed interest in camera lens application

PROGRAM UPDATES AND STATUS

- ght Imagery Testing planned for Hawaii in November
  - Use flight qual cameras in the optimal flight configuration between Rover, Land and EDS.
- ight engineering, hardware integration and test costs" $100K for ½-kg ckage
  - PISCES awarded $35K grant award within Hawaii to apply to integr. costs
- xt step – issue a payload contract after a team establishes a booster ntract
- sessing ops control center option from KSC LCC Firing Room 4

DEWALT

HAWAII
OCEAN
SCIENCE &

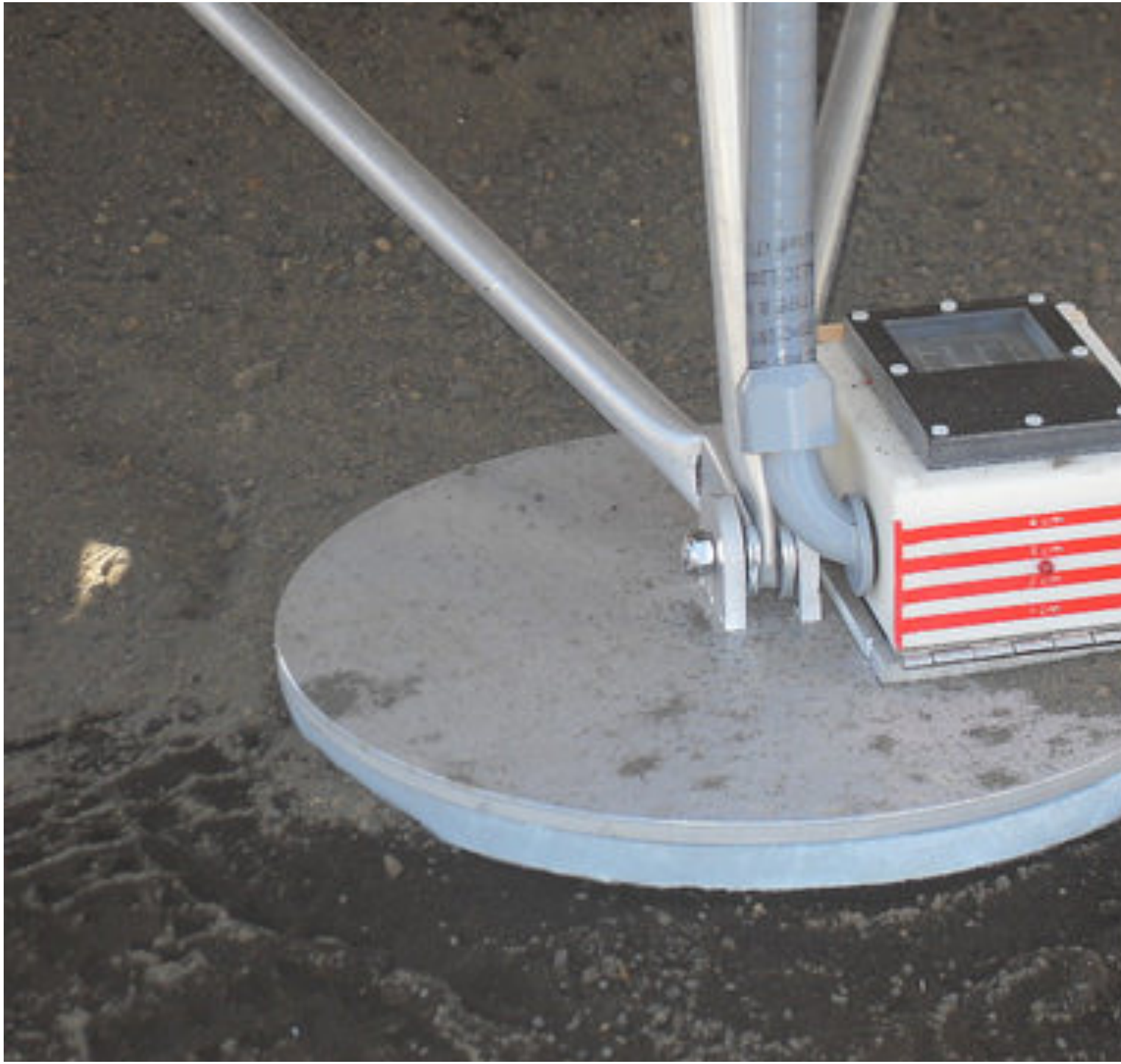


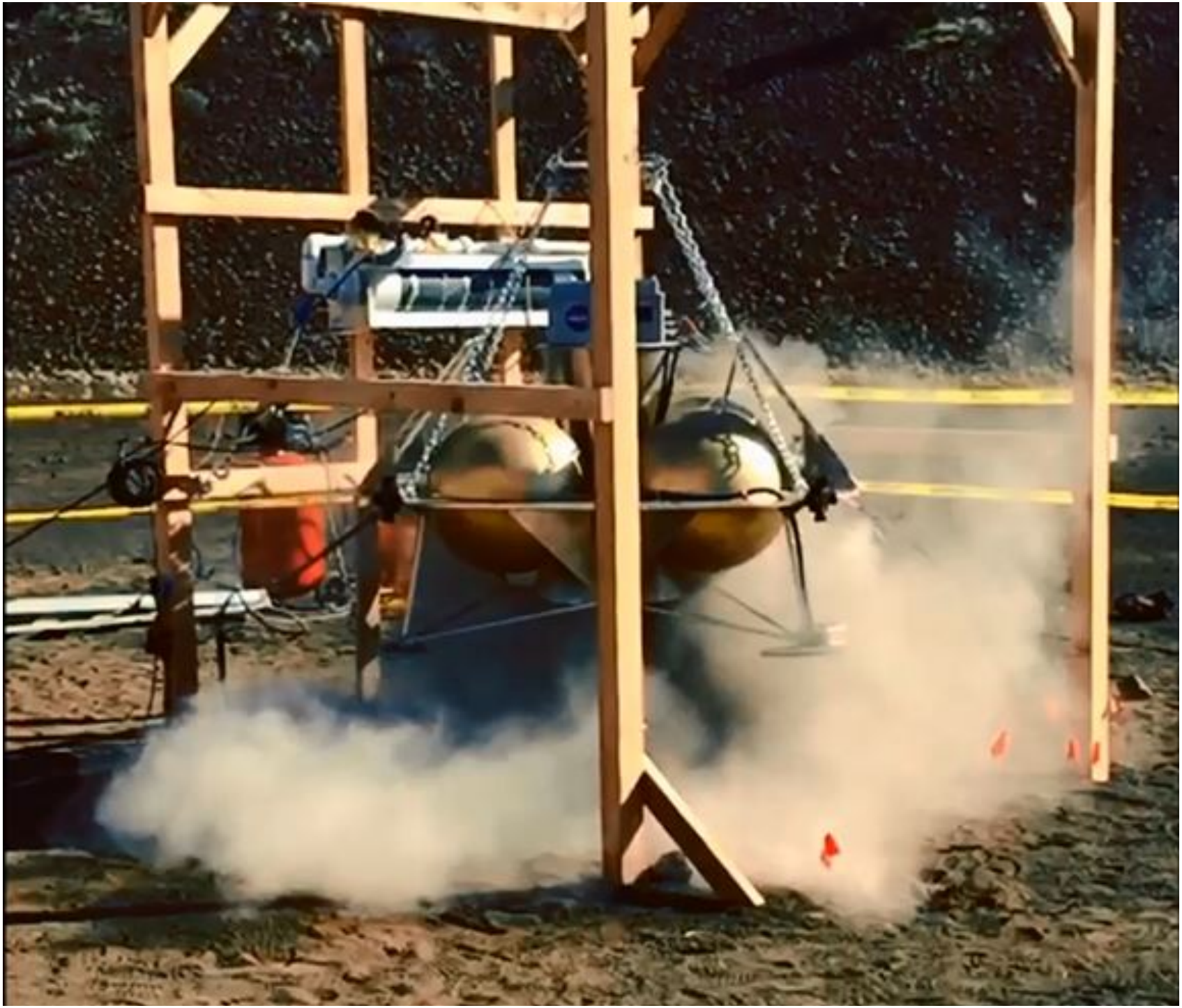
rch 2015
S Field Tests

sess locations,

ght
figurations,

agery
thodology





gery

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post

Lunar CATALYST

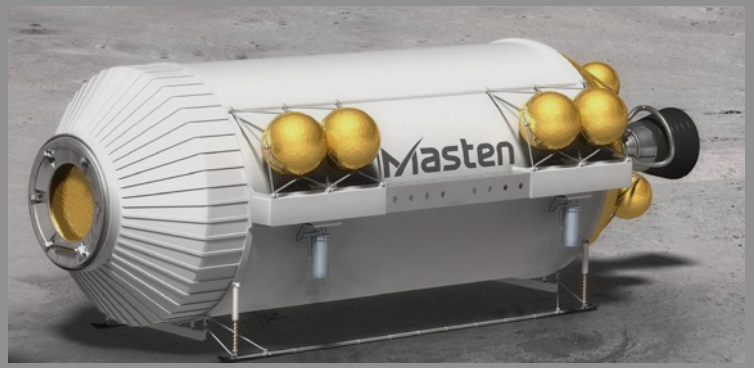
Lunar Cargo Transportation And Landing bY Soft Touch

PIS

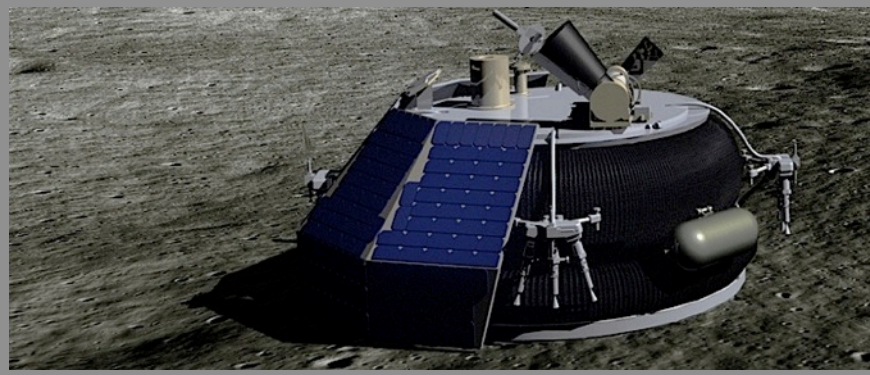
BRINGING THE MOON INTO EARTH'S ECONOMIC SPHERE

ccelerating private-sector lunar landing capabilities with NAS
expertise using public-private partnerships.

TROBOTIC



MASTEN SPACE



MOON EXPRESS

TE Schedule for MoonRIDERS

July 2015

Payload contract with GLXP provider

Design/configure student ops control center

Flight

Oct '1

IHS / KHS
- Post-test analysis
- Report/Briefing

Engineering integration, ICS, analysis between S/C and EDS

2016

May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan '16 | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | D

High School build new frames for Kapton shield unit.
Aug - Oct

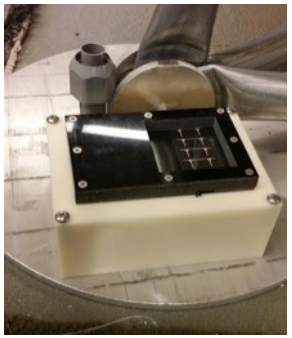
Flight Qual Unit
Nov '15 – Feb '16

HS deliver flight-qual frames to KSC
Dec '15

LFE EDS Test #2
Flight imaging test
EDS mockup
Nov. '15

Flight Unit
final build and test/ certification
March '16 – May '16

HS deliver flight frames to KSC
Mar '16



Delivery of Flight EDS to spacecraft
Sept '16

What's Next? MoonRIDERS-II /

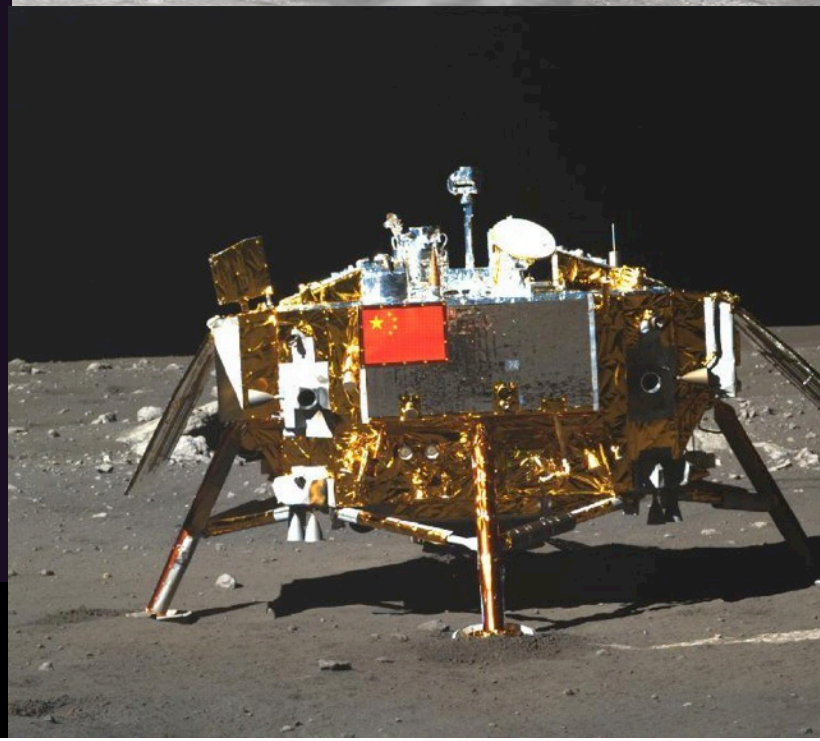
ssing flight opportunity options for
national instrument through *university*
porations :

panese/JAXA – SLIM / 2018 or SELENE-RP
"Smart Lander for Investigating Moon"
120 kg spacecraft

ina/CNSA - Chang'E-4 / 2019
Lander/rover; lunar farside

dia / Team INDUS

dination of scientific goals between
maps leading to instrument candidates.



"GO FOR
LAUNCH"

Backup