

Regolith Adherence Characterization (RAC) and the CLPS payload process

LSIC Dust Mitigation Focus Group
September 2021

Allison Goode
Aegis Aerospace

Agenda

- Aegis Aerospace Background
- RAC Introduction
- Lunar Engineering Challenges
- Commercial Lunar Payload Services (CLPS) Program
- RAC Timeline for CLPS
- Lander Integration Process
- Upcoming Opportunities

Aegis Aerospace

- Provides commercial, turn-key space services, spaceflight product development, and engineering services for the civil & commercial space and defense industries
- Develops lunar surface testing systems, 100kg-class satellites, and attached ISS payloads
- Created in 2021 through a merger between MEI Technologies, Inc. (founded 1992) and its commercial space sister company, Alpha Space Test & Research Alliance, LLC



RAC Introduction

- Purpose: To expand NASA's understanding of regolith interaction, especially adherence, with modern materials
- Two identical sample wheels
 - Perpendicular to and 30" from lunar surface
 - 15 samples each
 - A wheel exposed entire mission
 - B wheel exposed after landing
- Daily photographs after landing
 - Both sides of samples
 - 5.1 MP images
- Temperature, IR, and UV sensors
- Uses heritage MISSE avionics
- Launching in 2023 on Firefly's Blue Ghost lander
- Samples provided by NASA, academia, and industry



Lunar Engineering Challenges

- Environmental
 - Pervasive dust
 - Extended radiation exposure
 - Thermal extremes
 - Hard vacuum
- Logistic
 - Size and weight restrictions
 - Power and data restrictions
- Testing
 - TVAC
 - Vibration
 - EMI/EMC
 - System integration

CLPS Program

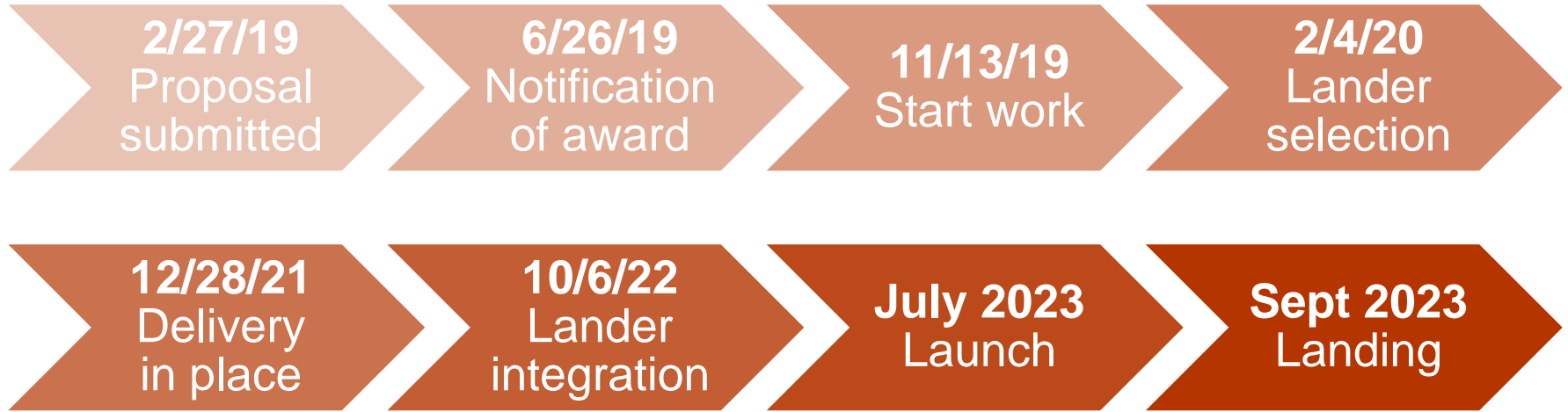
“Allows rapid acquisition of lunar delivery services from American companies for payloads that advance capabilities for science, exploration or commercial development of the Moon”

- 14 eligible lander vendors
 - Payloads designed to be lander-agnostic
 - Requirements are provided by payloads and used to match with a lander
- 2022 launches: Astrobotic and Intuitive Machines
- Multiple paths for payloads
 - Lunar Surface Instrument and Technology Payloads (LSITP)
 - Payloads and Research Investigations on the Surface of the Moon (PRISM)



RAC

RAC Timeline for CLPS



13 day surface mission at *Mare Crisium*



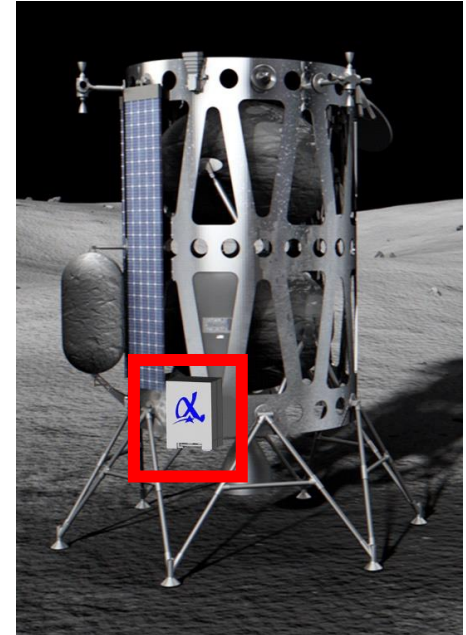
Lander Integration Process

- Exchange of Requirements
 - RAC requirements evaluated by Firefly for feasibility
 - Firefly has “Do No Harm” requirements
 - Requests for changes evaluated using change requests
 - Specific lander ConOps informs RAC’s testing regimen
- Required Support
 - RAC meets with Firefly team biweekly
 - Additional support for key reviews (PDR, PIPR, CDR, etc)
 - 24 planned deliverables over two years
 - Additional information about RAC as requested
- Test and Integration
 - Firefly to provide lander simulator for comms testing
 - Some payloads providing engineering unit
 - Opportunity to be present at lander-level integration
 - Integrated lander will perform full environmental testing
- All operational commanding from Firefly’s operations center

Opportunities with Aegis Aerospace

Space Testing as a Service (STaaS)™

- Future RAC flights
 - Passive materials science experiments
 - Environmental data and daily photos
- STEFF (Space Science Test and Evaluation Facility)
 - First launch targeted for Q1 2025 on Intuitive Machines Nova-C
 - Passive or powered experiments
 - Power, data, and 4 kg available for experiments
 - Enables commercial lunar testing as a service
- MISSE (Materials on the ISS Experiment)
 - Launches every 6 months
 - Passive or powered experiments
 - Commanding, continuous data, and monthly photos





Questions?

Resources

Allison Goode

RAC Deputy PI, Mission Engineer

allison.goode@alphaspace.com

Mark Shumbera

STEFF-1 PI, VP of Space Services

mark.shumbera@alphaspace.com

Matt Carter

RAC PI, Dir of Projects and Engineering

matt.carter@alphaspace.com

www.aegisaero.com