



Lunar Surface Innovation

C O N S O R T I U M

Extreme Access Focus Group Telecon

April 22, 2021

We'll start around 3:03

Dr. Angela Stickle
Senior Research Scientist
JHU Applied Physics Laboratory

Facilitator_ExtremeAccess@jhuapl.edu



JOHNS HOPKINS
APPLIED PHYSICS LABORATORY

Today's Agenda



- LSIC Focus Group Updates
- Who's Who in EA
- Upcoming Meetings/Opportunities
- Annual Goal, last chance for discussion!
- Open floor and Discussion

 Extreme Access 

 Pages

 Blog

PAGE TREE

- Annual Goal, 2021-2022
- > EA Conversations
- ▼ EA Monthly Meeting
 - **22 April 2021**
 - 11 March 2021
 - 11 February 2021
 - > 14 January 2021
 - > 10 December 2020

[Dashboard](#) / [Extreme Access Home](#) / [EA Monthly Meeting](#) 

22 April 2021

Created by Angela Stickle, last modified just a moment ago

The April EA telecon was rescheduled to April 22, 2021.

Add a comment below to sign in and discuss.

Please add yourself to the [Who's Who](#) if you haven't had a chance. Feel free to a

Today's hot topics:

[Subgroup Formation and Details](#)

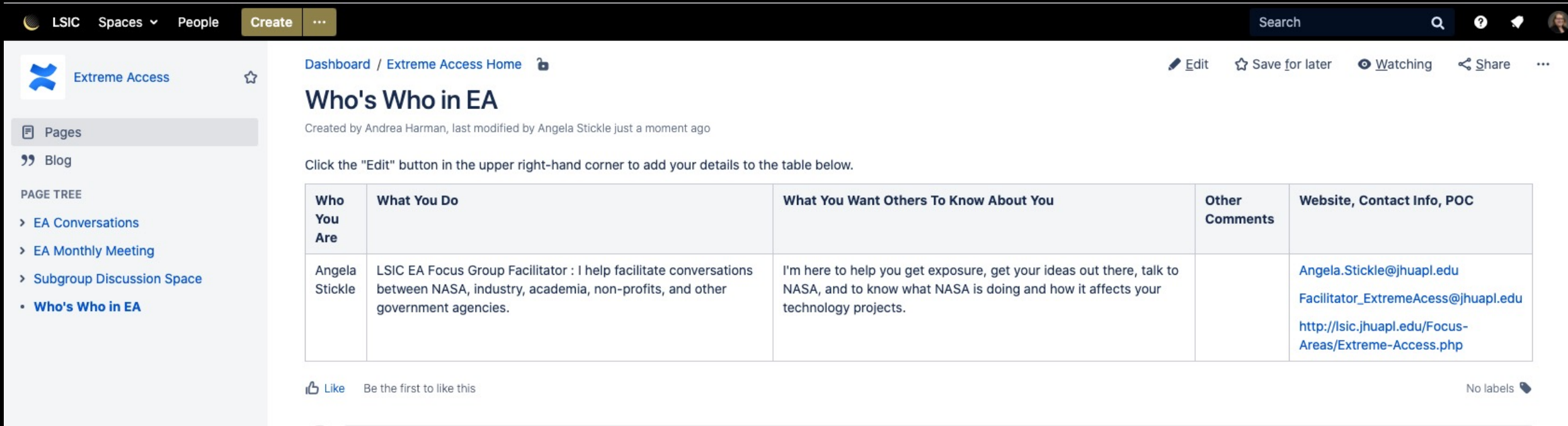
[Annual Goal, 2021-2022](#)

 Like Be the first to like this

1. Add a comment to sign in
2. Selecta an agenda topic and comment your thoughts
3. Follow-up after the telecon to continue to discussion!

Get to know the community

<https://lsic-wiki.jhuapl.edu/display/EA/Who%27s+Who+in+EA>



LSIC Spaces People Create ... Search

Extreme Access

Dashboard / Extreme Access Home

Who's Who in EA

Created by Andrea Harman, last modified by Angela Stickle just a moment ago

Click the "Edit" button in the upper right-hand corner to add your details to the table below.

Who You Are	What You Do	What You Want Others To Know About You	Other Comments	Website, Contact Info, POC
Angela Stickle	LSIC EA Focus Group Facilitator : I help facilitate conversations between NASA, industry, academia, non-profits, and other government agencies.	I'm here to help you get exposure, get your ideas out there, talk to NASA, and to know what NASA is doing and how it affects your technology projects.		Angela.Stickle@jhuapl.edu Facilitator_ExtremeAccess@jhuapl.edu http://lsic.jhuapl.edu/Focus-Areas/Extreme-Access.php

Like Be the first to like this No labels

Who's Who in ISRU: <https://lsic-wiki.jhuapl.edu/display/ISRU/Who%27s+Who+in+ISRU>

Who's Who in Surface Power: <https://lsic-wiki.jhuapl.edu/display/SP/Who%27s+Who+in+LSIC-Surface+Power>

Who's Who in E&C: <https://lsic-wiki.jhuapl.edu/pages/viewpage.action?pageId=6260179>

Who's Who in EE: <https://lsic-wiki.jhuapl.edu/display/EE/Who%27s+Who+in+LSIC-EE>


Extreme Environments – Apr 2021

Current Activity: Identifying and Classifying Specific Lunar Surface Environments

- Purpose and Products
 - “Breaking Down the Lunar Environment Monolith”
 - How do different environments stress technologies in different ways
 - How do specific lunar environment differ from descriptions of the general lunar environment?

April 13th LSIC-EE Working Meeting

- Brief backgrounds from each of the five subgroups
- Two smaller breakout groups collected opinions regarding the following:
 - The importance and urgency of exploring the different environments
 - Specific concerns and hurdles to technology development
 - Environmental impacts from exploration and habitation
 - Draw connections between different environments that could drive technology development

Polar Environments	Non-Polar Environments
Permanently Shadowed Regions (PSRs)	Apollo-style Environments
Areas of High Illumination (>55% Illumination)	Topographic Margins
Mixed Polar Environments	Lunar Pits & Lava Tubes
	Surface Anomalies

- You can still participate; discussion pages are open with **nearly 300 comments** (as of 4/20/21)!
 - Polar Environments: <https://lsic-wiki.jhuapl.edu/display/EE/Polar+Environments+Breakout>
 - Non-Polar Environments: <https://lsic-wiki.jhuapl.edu/display/EE/Non-Polar+Environments+Breakout>

Surface Power Activities: April 2021

- Annual Goal:

NASA needs power systems which can survive the lunar night and enable exploration. The over-arching goal of the surface power focus group is to provide specific recommendations to NASA for rapidly achieving appropriate-scale power-related technologies needed to enable sustained presence and exploration.

To work towards this, over the next year we will focus on connecting power experts to their potential user base, framed by the economic and institutional drivers that set the scale of power demand. This will enable us to identify near-term needs for immediate prioritization and long-term goals that impact early architectural decisions.

- **Highlights of upcoming activities and discussion**

- Upcoming and current workshops:

- Space Power Workshop
- Space Resources
- Nuclear Emerging Technologies

- **Survey of power users**— our FG will soon to be reaching out to other focus groups for information needed to analyze potential power systems

- ★ - **Power Beaming Workshop – 2 days, anticipated June/July**

- **Day 1: Context and Demand**
- **Day 2: Deeper Technical Discussions**

- ★ - **Themed telecon on Vertical Solar technologies** (date TBD) – joint telecon including Power, Dust, Extreme Environments, and others who are interested! → Late May (third or fourth Thursday)



LSIC | Long-form telecon May 27th

Solar Power: VSAT and Implications to Other LSIC Focus Areas

Current plan: 11:00 to 1:00 ET, Thursday May 27th

- 30 minutes of talks from each focus area
 - **Surface Power**
 - VSAT out-brief from Chuck Taylor
 - Thoughts on additional speakers?
 - **Dust Mitigation:** active DM for solar panels
 - **Extreme Environments:** Illumination considerations
- 30 minutes of discussion

LSIC | Open Discussion: Power Beaming Workshop

Tentative Date: July 8-9th , ~4-5 hours each day

Day One: High-level talks on Power Beaming.

- Role in the larger system – in particular cost and infrastructure trade
- Current Capabilities, including overview of modes
- Breakouts – use-cases for power beaming

Day Two: Deeper Technical Discussions

- Latest updates in Power Beaming - lightning talks and/or poster presentations
 - WoTM winners anticipated end of May, relevant LuSTR winner
- Panel on challenges and critical steps to advance power beaming
- Small-group breakouts
 - If possible, centered on *specific* topics.
 - Ranked choice of technical breakout sessions – fill the rooms by priority and lottery, randomize/duplicate beyond top choices?

We have our
monthly
telecon here

We'll work to
deconflict!

LSIC | Workshop on Lunar Mapping for Precision Landing

Precision landing and hazard avoidance systems are necessary to enable access across the lunar surface. Communication between lunar data providers and data users is necessary and, to date, has been inefficient.

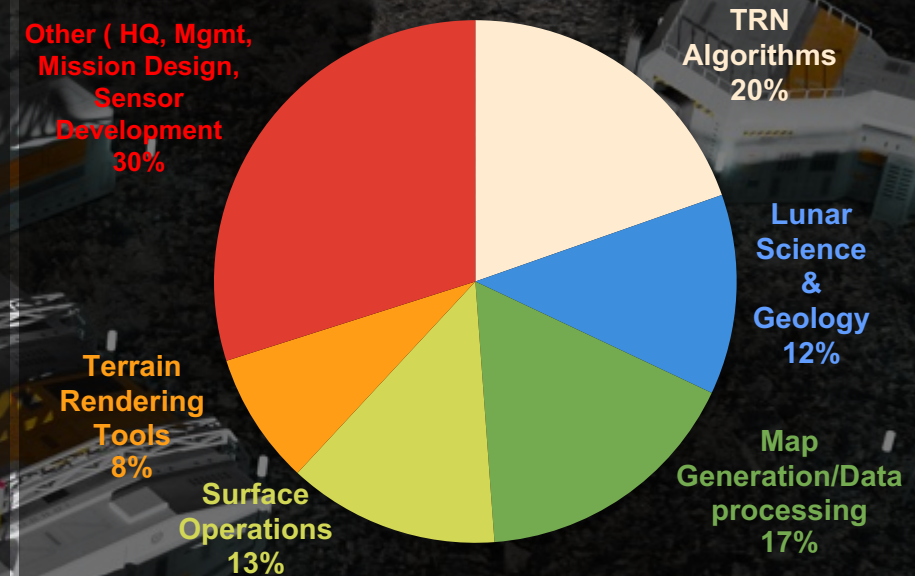
Workshop held March 2-4, 2021

425 attendees from over 138 institutions: 18% Academia, 34% Government, 34% Industry, and 12% Nonprofit

High priority challenges and needs identified:

- Terrain Relative Navigation (TRN) systems need lunar maps with unique characteristics.
- Industrial partners and navigation engineers are not fully utilizing existing lunar data.
- Standard data sets and controlled maps would be beneficial for testing algorithms.
- Current flight processor capability may be insufficient for advanced TRN algorithms and map processing.
- Targeted new missions and instrumentation would fill gaps in data needed for TRN systems.
- Standardized rendering tools, data verification and validations metrics, and metadata are desired.

425 REGISTERED ATTENDEES



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Upcoming Meetings

- Focus Group Telecons (2nd Thursday each month, 3-4 pm EST)
 - [April 22, 2021](#)
 - No May telecon because of Spring Meeting
 - In June we will resume our normal 2nd Thursday cadence
- LSIC Spring Meeting May 11-12
 - Registration is open!
 - Registration is free but **REQUIRED** to participate in poster or breakout sessions
 - <http://lsic.jhuapl.edu/News-and-Events/Agenda/index.php?id=124>
- Lunar Surface Science Workshop
 - Progress and Challenges: Updates from NASA HQ and Artemis (April 29, 2021 11-5 ET)
 - Free, but **registration is required**
 - <https://www.hou.usra.edu/meetings/lunarsurface2020/>
- Workshop on Terrestrial Analogs for Planetary Exploration
 - June 16-18, 2021
 - <https://www.hou.usra.edu/meetings/terrestrialanalog2021/>
- Planetary Data Workshop and Planetary Science Informatics and Data Analytics Meeting
 - June 28-July 2, 2021
 - <https://www.hou.usra.edu/meetings/planetdata2021/>



LSIC Spring Meeting

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Goals: NASA to provide information to you and also get feedback from you!

Keynote address by



Dr. Bhavya Lal
NASA Acting Chief of Staff

Meeting Information

Day one of the meeting (Tuesday, May 11th) will feature the keynote address and LSIC-wide plenary sessions, including networking sessions for the community. Pre-registration is required to attend the networking sessions (due to technical limitations, no exceptions can be made on the day of the meeting). A panel discussions will focus on funding and flight opportunities.

Day two (Wednesday, May 12th) will include panel discussions, technical lightning talks from the community, a poster and networking session, and group breakout sessions to discuss meeting topics in more detail.



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Other Notes of Interest

- Joint WG telecon on vertical solar technology (hosted by SP, Dust, EE), May 27
- PNT subgroup meeting, 18 May 3 pm ET
- Dr Ryan Watkins (ESSIO) presented at ISRU FG yesterday. Look for the recording to be up for lots of good info about NASA's lunar exploration plans
- Current Funding Opportunities:
 - Break the Ice Lunar Challenge
 - <https://breaktheicechallenge.com/>
 - Registration and System Architecture Submission Deadline: 18 June 2021
 - MUREP Space Technology Artemis Research (M-STAR)
 - Proposals due May 10
 - Technology Advancement and Applied Research on the ISS National Lab (Step-2)
 - Proposals due April 26
- <http://lsic.jhuapl.edu/Resources/Funding-Opportunities.php>

Reminder: LSIC EA Annual Goal

- Collaboratively decide on a 1-year goal for us to work on as a group
 - Actionable
 - Impactful
 - Relevant to focus area
 - Doable within 1 year
 - Uses capabilities of focus group members
 - Can be accomplished with existing resources
 - Inspired by current issues
 - Beneficial broadly to all stakeholders
- Won't be the only thing we work on! But it can be a focus/consensus need.

- Build a community and develop collaborative relationships among members
- Identify specific areas of interest on the Moon that require extreme access (e.g., lunar south pole, PSRs, lunar pits)
- For 1-2 areas of interest we will identify mission/system architecture elements needed to provide access (e.g., mobility challenges, comms, PNT, etc), including identifying specific technology needs and gaps, prioritizing development timelines, and providing a general roadmap and recommendations for needed technology, testing, and demonstrations.
 - Based on discussions and polls at last telecon, we're leaning towards lunar south pole + lunar pits

How? Let's discuss tasks!

1. Identify areas and/or environments of interest
2. Pick 1-2
3. Identify specific architectures to enable exploration of these areas. What are the environments like? What are the needs for mobility, PNT, comms, autonomy?
4. Evaluate current technology availability, compare to what is needed for (3). This will likely involve standing up several smaller subgroups.
5. Identify gaps, prioritize which are more important to close first
6. Roadmap, determine recommendations for specific tech development and/or demos
7. Throughout: keep in mind where will need input or tech crossover from other focus groups. Where does technology development require multiple inputs?
8. Write a report of some sort



EA Annual Goal

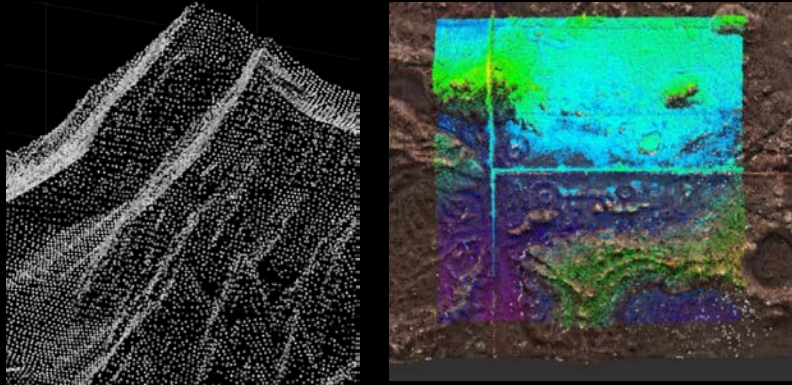
What are we missing?

What specific questions do we want to answer in these reports?

The screenshot shows a Confluence page for 'Extreme Access'. The page title is 'Subgroup Discussion Space', created by Angela Stickle on April 06, 2021. The main content states: 'We setup subgroups on an ad-hoc basis and as necessary to complete annual goals.' Below this is a section titled 'Extreme Access Subgroups' with a list of five items: 'Communications Technology (organizing)', 'Lunar Sheds/Wadis - recruiting members', 'Mobility Technology (organizing)', 'Position, Navigation, and Timing Technology (organizing)', and 'Terrain Relative Navigation Technology (organizing)'. To the right, there is a section titled 'Meeting Times' with the text 'PNT: 3rd Thursday of each month, 3 pm ET'. The left sidebar shows a navigation menu with 'Pages', 'Blog', and a 'PAGE TREE' containing 'Annual Goal, 2021-2022', 'EA Conversations', 'EA Monthly Meeting', and 'Subgroup Discussion Space' (which is expanded to show the same list of subgroups as the main content). At the bottom of the page, there is a 'Like' button and a 'Write a comment' field.

Subgroup formation to facilitate more in-depth discussions of technology and gaps

- Recruiting leads and participants.
- Expectation: 1 subgroup meeting (outside EA monthly telecon) to discuss ongoing tasks
- We will have occasional report-outs at regular monthly telecons
- Confluence can be used for discussion and resource compilation



- *Subgroup Goal*

- *Determine what technologies for extreme access exploration of the lunar surface*
 - *already exist*
 - *need to be modified for lunar surface work (dust mitigation, dealing with electrostatic discharge, etc.)*
 - *need to be developed*

- *Top level questions to address*

- *Suitability of different PNT options for specific EA environments (PSRs, lavatubes, polar regions, etc.)*
- *What kind of tech demos on the lunar surface are necessary to bring PNT sensors and systems to a higher TRL level?*

- *Meetings, next steps, contact info*

- *First meeting will be held 3rd Thursday in May (May 18) at 3 pm ET*
- *Will be announced on EA listserv*
- *Contact Sarah Withee sarah.withee@jhuapl.edu for more info*



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Discussion of Lunar Infrastructure

- Please join the discussion on the Confluence page for LSIC Extreme Access
<https://lsic-wiki.jhuapl.edu/pages/viewpage.action?pageId=6259700>
- We are continuing the discussion about potential future lunar architecture – infrastructure that would enable and facilitate future missions
- Where can we go on the surface that would:
 - Drive innovation?
 - Utilize technology currently being developed?
 - Answer high-priority science goals?
- What infrastructure is required? Why? Does it exist yet?
-

- Confluence is our record of discussions and a good repository
 - Confluence is free to you and available to all registered LSIC members
 - We will be using Confluence to document discussions and provide resources to LSIC members. All focus groups have a separate page so it's a good collaboration space.
 - To request an account, please email Andrea Harman: ams573@alumni.psu.edu
- Technology Spotlights/Lightning Talks at monthly telecons
 - Anyone can volunteer to give a lightning talk (10-20 mins)
 - Email Angela or Sarah, or comment on Confluence, to sign up!
- Updates to the webpage - <http://lsic.jhuapl.edu/Focus-Areas/Extreme-Access.php>
 - Notes, slides, recordings from telecons posted here

Follow the Code of Conduct for all Focus Group communications

Contact information

LSIC Director: Rachel Klima, SES-LSIC-Director@jhuapl.edu
<http://lsic.jhuapl.edu>

Focus Group Area	Listserv address	Facilitator
In-Situ Resource Utilization	LSIC_ISRU@listserv.jhuapl.edu	Karl Hibbitts
Surface Power	LSIC_Power@listserv.jhuapl.edu	Wes Fuhrman
Extreme Environments	LSIC_ExtremeEnvironment@listserv.jhuapl.edu	Ben Greenhagen
Extreme Access	LSIC_ExtremeAccess@listserv.jhuapl.edu	Angela Stickle
Excavation and Construction	LSIC_ExcavationConstruction@listserv.jhuapl.edu	Athonu Chatterjee
Dust Mitigation	LSIC_DustMitigation@listserv.jhuapl.edu	Jorge Núñez



LSIC Meeting Cadence

- **Bi-Annual Meetings (Spring and Fall)**
 - May 11-12 Spring Meeting (accepting Abstracts now)
- **Monthly Focus Group Meetings**
 - 2nd Tuesday of the Month 3:00-4:00 pm – Extreme Environment
 - 2nd Thursday of the Month 3:00-4:00 pm – Extreme Access
 - 3rd Wednesday of the Month 3:00-4:00 pm – ISRU
 - 3rd Thursday of the Month 12:00-1:00 pm – Dust Mitigation
 - 4th Thursday of the Month 11:00 am-12:00 pm – Surface Power
 - Last Friday of the Month 3:00-4:00 – Excavation and Construction
- **Thematic Workshops (as identified by FGs and NASA POCs)**
 - Workshops In development Funding, CLPS Provider, and Power Beaming

STMD Opportunities for Academia and Industry

STMD anticipates awarding ~\$600M to academia and industry supporting 2020 solicitations & awards

STMD Tipping Point Multiple Awards: *Jan – Mar 2020*

\$250M

Small Business Innovation Research (SBIR)/Small Business Technology Transfer (STTR) Phases I, II, II-E, Civilian Commercialization Readiness Pilot Program (CCRPP), Sequential: *Phase I Solicitation Jan – Apr 2020*

\$212M

Announcement of Collaborative Opportunity (ACO): *Jan – Mar 2020*

\$10M

Flight Opportunities Tech Flights: *Feb – May 2020*

\$10M

Early Career Faculty (ECF): *Feb – Apr 2020*

\$6M

Early Stage Innovations (ESI): *Apr – Jun 2020*

\$9M

NASA Innovative Advanced Concepts (NIAC) Phases I, II, III: *Phase I Solicitation Jun – Jul 2020*

\$4M

Space Technology Research Institutes (STRI): *Jun – Aug 2020*

\$30M

NASA Space Technology Graduate Research Opportunities (NSTGRO): *Sep – Nov 2020*

\$19M

SmallSat Technology Partnerships (STP): *Sep – Nov 2021*

\$3M

Centennial Challenges: *Varied release dates*

\$8M

NextSTEP Broad Agency Announcements (BAAs): *Varied release dates*

Varies

Lunar Surface Technology Research (LuSTR) Opportunities: *Coming soon!!!*

\$30M

Note: Funding awards are approximate and subject to change

Open Solicitations as of June 5, 2020

Solicitations were/will be open in the timeframe specified in italics