FSGC/Space Florida and NASA Kennedy Space Center Technology Development and Commercialization Program

2025 Program Announcement & Request for Proposals

Supporting Kennedy Space Center's Technology Goals through university involvement

Sponsored by

Florida Space Grant Consortium www.floridaspacegrant.org

Space Florida www.spaceflorida.gov

Timeline:	March 17, 2025	Request for Proposals Issued
	April 14, 2025	Notice of Intent and Abstract sent to fsgc@ucf.edu
	May 30, 2025	Proposals Due
	July 28, 2025	Grants Announced
	On or after August 5, 2025	Awards made (subject to receipt of funding from NASA and Space Florida for 2025 program cycle)

Background

NASA is one of leading federal agencies in technology transfer and is well known for its space-related Spinoffs. The transfer and commercialization of technologies developed by NASA is not only core to its mission, it is mandated by the Space Act of 1958 that established the agency. Kennedy Space Center (KSC) researchers develop new technologies and make scientific breakthroughs on a regular basis. While all are developed for NASA's mission to explore space, some of these inventions are also technological breakthroughs in commercial applications, capable of being transformed into a variety of potentially disruptive products. As a result, the KSC Technology Transfer Office (TTO) patents these technologies and makes them available to the private sector for commercialization.

However, many of these technologies require significant R&D beyond NASA's efforts to develop them into minimally viable products with proven potential in commercial applications. And, in many cases, industry is not willing to invest in this needed development and validation work at these early stages.

Therefore, KSC has once again teamed with FSGC and Space Florida to provide Florida universities a competitive opportunity to further develop select KSC patented or patent-pending technologies for commercial uses. This year's FSGC-Space Florida-KSC Technology Development and Commercialization Program RFP have topic areas for two KSC patented technologies that fit these criteria. We are now seeking proposals to conduct needed development and testing of these technologies as described in the topic areas.

The RFP contains all publicly available information and references to available patent information for these technologies. Additional information will be provided under a Non-Disclosure Agreement with KSC.

Contact for More Information…
Dr. Jaydeep Mukherjee, FSGC Director
NASA Florida Space Grant Consortium, 12354 Research Parkway, Room 218
Orlando, FL 32826-0650
Tel # 407-823-6177 Email: jaydeep.mukherjee@ucf.edu

Request for Proposal

FSGC and the KSC TTO worked collaboratively to identify two KSC patented or patent-pending technologies for this program with strong commercial potential. We are now issuing this request to Florida universities for proposals to further develop the following technologies for commercial applications:

Topics:

Self-Cleaning Seals (KSC-TOPS-101)
https://technology.nasa.gov/patent/KSC-TOPS-101

Electrodynamic dust shield technology maximizes performance of seals in harsh, dusty environments

In space applications, seals for hatches, suit ports, airlocks, and docking systems for pressurized volumes such as habitats, rovers, and space suits must be kept clean. This is necessary to achieve the extremely low leak rates required to ensure that crews will have sufficient breathable air for extended missions on planetary surfaces. Dusty environments, such as those of the Moon and Mars, pose challenges because seals (elastomeric and otherwise) – as dust accumulates on them – will no longer perform as designed, substantially increasing leak rates. Similarly, terrestrial applications involving environments with high dust concentration and pressurized systems (e.g., mining, material handling) must maintain clean seals to ensure safety and uptime. Motivated by the hazard lunar regolith poses to seals – and thus to achieving a sustained lunar presence – researchers in the Electrostatics and Surface Physics Laboratory at NASA's Kennedy Space Center (KSC) have developed seals that actively self-clean in a continuous or periodic manner.

Please see the attached KSC Technology Transfer Opportunity Sheet (TOPS) for more information about this technology. Patent numbers are included, if issued.

Improved Lunar Regolith Simulant Ion Implantation (KSC-TOPS-102)
https://technology.nasa.gov/patent/KSC-TOPS-102

Emulating solar wind exposure in high-fidelity regolith simulants

The production of high-fidelity extraterrestrial regolith simulants is important for the development of future in-situ resource utilization (ISRU) and remote sensing technologies. For these materials, the mechanical properties can be readily replicated but the absorbed material, electrostatic, and dielectric properties of lunar, Martian, or asteroid regolith can be difficult to simulate.

Innovators at the NASA Kennedy Space Center have developed a methodology and system that can implant helium, hydrogen, and other ions in regolith simulants to emulate the exposure of the simulated regolith to phenomena like solar winds. The system has been successfully prototyped and demonstrated to implant helium ions in simulated regolith and advancements in the material processing have led to low levels of contaminants in the regolith. The ion implanted regolith may be used to develop advanced ISRU, in-space mining, and remote sensing technologies.

Please see the attached KSC Technology Transfer Opportunity Sheet (TOPS) for more information about this technology. Patent numbers are included, if issued.

If you require non-publicly available information for these technologies, to include discussions with the KSC inventors, prior to being awarded funding and establishing a license agreement, then the university must sign a Non-Disclosure Agreement with KSC before this information can be provided. These discussions may be

subject to export control restrictions depending on the technology and the level of information provided. The non-disclosure agreements forms are attached to this document.

If funded, an Agreement with KSC must be established prior to starting work.

KSC POC:

Delvin VanNorman
Technology Transfer Program
Technology Portfolio Manager
Software Release Authority
Research & Technology Management Office (UB-T)
Kennedy Space Center, FL 32899

O: 321.867.6927
C: 321.698.7028

delvin.vannorman@nasa.gov

Important Considerations:

Proposals that include collaboration with U.S. companies are highly encouraged!

While the TOPS list possible commercial applications based on NASA's market research, *proposals should identify the most viable commercial applications based on university knowledge/expertise*. While not required, please include U.S. companies currently providing products and services to meet those applications, if known.

The RFP contains all publicly available information and references to available patent information for these technologies. NASA TOPS are publicly available documents available through the NASA Technology Transfer Portal (https://technology.nasa.gov/). The Portal provides TOPS for all NASA's patented and patent-pending technologies available for licensing. *Please contact Delvin VanNorman if you have any technology or license agreement questions.*

Required NASA Agreements:
KSC typically grants U.S. entities legal permission to evaluate its patented or patent-ending inventions for commercial potential through Non-Exclusive Evaluation License Agreements. These agreements only allow development/validation work; they do not allow marketing, production or selling of a product/service based on the invention. A university awarded work through this program must establish this type of agreement with KSC to perform awarded work. The application for the license agreement is accessed through NASA's Automated Technology License Application System (ATLAS) via (Apply to License) link on technology information page at https://technology.nasa.gov. Once the application is accepted a draft of the Evaluation License will be sent to the university for review. Universities incur no costs for these license agreements and there are no obligations to NASA other than to provide a written report of the results to KSC at the end of the project. The term for these agreements is 1-2 years and can be extended if needed.

Once the agreement is established, KSC will transfer all available technical information associated with NASA's development of the technology to the awarded university Principle Investigator (PI). However, keep in mind that while publicly available information for the technology is not subject to U.S. export control restrictions, non-publicly available information transferred under the license agreement may have export control restrictions. This will depend on the technology and the information.

An Evaluation License Agreement Application must be submitted to the KSC TTO by the university before an agreement can be established. The KSC T2 Specialist identified in the TOPS is the POC for application submissions and for establishment of a license agreement. Please contact them as soon as possible after award for an application and instructions on how to submit.

If you require non-publicly available information for these technologies, to include discussions with the KSC inventors, prior to being awarded funding and establishing a license agreement, then the university must sign a Non-Disclosure Agreement with KSC before this information can be provided. These discussions may be subject to export control restrictions depending on the technology and the level of information provided.

Sample of the Non-Disclosure Agreement is attached to this RFP**.**

Results:
Projects results from this program will be provided to the KSC Technology Transfer Office through a written report.

Project results could lead to follow-on work through this program, through partnerships with KSC laboratories, though the U.S. Government Small Business Innovation Research Program (www.sbir.gov/), and specifically through the NASA SBIR/STTR program (http://sbir.nasa.gov/). Also, please check with your university's tech transfer office for other programs.

Project results may establish a basis for commercial investment in technologies that prove to have strong commercial viability. This could lead to commercial sponsored research to further develop the technology for commercialization.

If university PI's and students develop patentable content based on KSC's technology as a result of awarded work, then the KSC TTO will collaborate with the university technology transfer office to establish joint-ownership agreements, if applicable, and to promote commercialization of the overall intellectual property.

The KSC TTO will work with university PI's and students awarded work under this program who choose to commercialize the technology themselves (through their own start-up company or existing company) after project completion. These companies can apply for commercial licenses from KSC to commercialize the technology.

The KSC TTO, through its marketing efforts to industry, may identify companies with interest in the technology and will refer these companies to awarded university PI's, if both parties agree.

Projects and Budget

Project	Description	Budget	# of Grant Awards
Self-Cleaning Seals	In space applications, seals for hatches, suit ports, airlocks, and docking systems for pressurized volumes such as habitats, rovers, and space suits must be kept clean. This is necessary to achieve the extremely low leak rates required to ensure that crews will have sufficient breathable air for extended missions on planetary surfaces. Dusty environments, such as those of the Moon and Mars, pose challenges because seals (elastomeric and otherwise) – as dust accumulates on them – will no longer perform as designed, substantially increasing leak rates. Similarly, terrestrial applications involving environments with high dust	$25K	Estimate of 1 grant to be awarded.

	concentration and pressurized systems (e.g., mining, material handling) must maintain clean seals to ensure safety and uptime. Motivated by the hazard lunar regolith poses to seals – and thus to achieving a sustained lunar presence – researchers in the Electrostatics and Surface Physics Laboratory at NASA's Kennedy Space Center (KSC) have developed seals that actively self-clean in a continuous or periodic manner.		
Improved Lunar Regolith Simulant Ion Implantation	The production of high-fidelity extraterrestrial regolith simulants is important for the development of future in-situ resource utilization (ISRU) and remote sensing technologies. For these materials, the mechanical properties can be readily replicated but the absorbed material, electrostatic, and dielectric properties of lunar, Martian, or asteroid regolith can be difficult to simulate. Innovators at the NASA Kennedy Space Center have developed a methodology and system that can implant helium, hydrogen, and other ions in regolith simulants to emulate the exposure of the simulated regolith to phenomena like solar winds. The system has been successfully prototyped and demonstrated to implant helium ions in simulated regolith and advancements in the material processing have led to low levels of contaminants in the regolith. The ion implanted regolith may be used to develop advanced ISRU, in-space mining, and remote sensing technologies.	$25K	Estimate of 1 grant to be awarded.

Eligibility

Grants are intended for faculty researchers from FSGC affiliated universities and colleges. Please see Appendix A for a listing of FSGC affiliates. Proposals from non-affiliated Florida universities, colleges, community colleges, and industry will be viewed more favorably if the project involves collaborations with FSGC affiliates. Other non-academic organizations are also eligible to receive grant awards, especially if their proposed projects include involvement with FSGC affiliates.

Since FSGC is funded by NASA under a Cooperative Agreement and as required under the Terms and Conditions for a Cooperative Agreement the following conditions apply:

a. **Research proposals from PIs who are US citizens may include direct support funds e.g. Salary, travel etc. However, proposal from PIs who are non-US citizens may be selected for funding (based on their reviews) provided that NO salary, stipend, travel or any other form of direct support to the non US citizen PI is funded from this award.**
b. **Non-US citizens may receive support from their universities and these funds may be used as part of the 50% matching cost share required for the grant.**
c. **Students supported and funded by PIs under this program must be US citizens only – no exceptions are allowed. Permanent residents are not considered as US citizens for the purposes of this program.**

Indirect Costs:

Based on the indirect cost rate requested by FSGC from our prime sponsor, NASA, all proposals under this RFP will carry the flow down indirect cost rate of 10% (**to be calculated on total direct cost**). The executed

Master Agreement with your institution will be the base document for all awards received by your institution from FSGC via the respective project specific Task Orders to be executed for each awarded project.

Flow-down clauses in the Master Agreement, amongst others, will include restriction on indirect cost to 10% of total direct cost, no other administrative costs, except for indirect cost, will be supported by UCF funds and foregone overhead may be used by your institution to meet mandatory cost share requirements. Support for these projects are solely from the NASA Florida Space Grant Consortium and Space Florida.

Matching:
The Consortium is required to match its prime award from NASA (from which the awards under this program will be funded). Therefore, applicants will be required to match **50%** of their requested funds with non-federal funds from their institution. Foregone overhead may be used to meet mandatory cost share requirements. Match can be in the form of either cash or in-kind, including waived indirect costs, academic release for faculty members, student stipends, instrument, and computer time. However, equipment purchases and/or cost of pro-rated use cannot be considered as match.

Timeline

March 14, 2025	Request for Proposals Issued
April 14, 2025	Notice of Intent and Abstract sent to fsgc@ucf.edu
May 30, 2025	Proposals Due
July 28, 2025	Grants Announced
On or after August 5, 2025	Awards made (subject to receipt of funding from NASA and Space Florida for 2025 program cycle)

Equipment
Purchase of Equipment is not allowed under this training grant. " Equipment " will be defined as any single non-expendable item having an acquisition cost of $5000 or more. However, if an awardee institution uses a lower cost threshold in their definition of equipment, then that lower cost threshold will be used to determine whether any item is "equipment" or not.

Delivery
The signed proposal (main proposal and signed cover page) must be uploaded to the Florida Space Grant Consortium website. The proposal should be a pdf file. To upload the proposal, you must also sign up for an FSGC online account at www.floridaspacegrant.org. You must provide an e-mail address and create a username and password. The email address should be a university email address.

Failure to submit the proposal exactly in the manner stated here will result in the proposal being considered as incomplete and will not be considered for review and participation in the funding process.

Proposers are requested to provide a notice-of-intent to FSGC, including a generalized proposal summary of no more than 500 words, title of project, PI's name and institution, to fsgc@ucf.edu by April 14, 2025. Proposals should contain adequate technical detail to enable a peer view process.

Proposers should follow the format outlined below:

1. Completed Signature Page (see attached)
2. Project Summary (limit 200 words)
3. Significance of Project
4. Work Plan

5. Potential Sources for Continued Support, including commercial or government support
6. Key Personnel and Levels of Commitment, including details of student involvement in the project
7. References
8. Budget (showing funding allocation to each participating organization)
9. Support letters (if any)
10. Co-PI's Standard Curriculum Vita (including list of relevant publications)
11. Signed KSC Non-Disclosure Agreement (NDA) (attached) if there is a need to ask questions during the proposal writing phase

Proposals will be limited to ten (10) pages in length (exclusive of items 1, 8, 9, 10, and 11 above), preferably less. The proposal must be single- or double-spaced, using standard size (8 1/2" x 11") paper, in no smaller than 12-point font with a minimum of 1" margins on all sides for each page. Use an easily readable font face (e.g. Geneva, Helvetica, Times Roman). All pages must be numbered. No supplementary materials will be accepted, and over-length proposals may not be submitted for merit review.

Please note that KSC cannot respond to questions from proposers about the topic area during the proposal phase until an NDA (see attached) has been signed. KSC and any university performing funded work within our topic areas will need to sign a Non-Exclusive Evaluation License Agreement. This should be signed after FSGC has awarded the project but before the university begins work. This license agreement will be provided without cost and can be put in place in about three weeks. See section on "Required NASA Agreements".

Performance Period
The performance period cannot be for more than 1 year. The starting date can be as early as August 1, 2025.

Evaluation of proposals:
The proposals will be evaluated by the Kennedy Space Center. Each proposal will be judged and scored on its own merits using the criteria listed below:

1. Scientific/technical merit of the proposed project
2. Potential for continued project development, including commercial or government support
3. Qualifications of the project team as evidenced by related refereed publications and award success
4. Commercial company collaborators on the project
5. Soundness of proposed work plan, budget, and schedule (soundness includes identification of the needed development path to commercialization for the technology, description of where/how the project fits into that path, description of how the project will build on the NASA solution, identification of potential commercial applications the project work is targeting.
6. Student involvement in the project – proposals having higher numbers of student participation is strongly encouraged and will be weighted favorably.

Other issues will be considered in the award of grants when evaluations based on the six above-listed criteria indicate substantially equal merit. These other issues may include amount and quality of matching contributions (please include documentation showing matching contributions); geographic diversity; and level of collaboration between industry and academia.

Intellectual Property
Due to the use of NASA funding for this grant program, grant recipients shall follow all applicable NASA rules and regulations for the ownership and use of intellectual property developed under any grant project. As sponsors of the grant program, FSGC and UCF have no ownership or control of such intellectual property,

unless a sponsor is also a direct participant, or intended beneficiary, of any grant project. In such cases, intellectual property rights shall be covered under a separate agreement with the grant recipient.

Publications
Principal Investigator may publish the results of the work in its own form. FSGC will require a copy of any publication within 60 days of the publication date.

Principal Investigator's publication shall acknowledge support of FSGC AND Space Florida by inclusion of the following sentence in the published document " THIS PROJECT WAS SUPPORTED BY THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION THROUGH THE UNIVERSITY OF CENTRAL FLORIDA'S NASA FLORIDA SPACE GRANT CONSORTIUM AND SPACE FLORIDA".

International Compliance
Projects involving international recipients must comply with all applicable export control laws and federal regulations. Proposals that feature international participation should include a brief section on their plans to comply with federal requirements or describe why such requirements do not apply to their project.

Reporting

A final technical report is due 13 months after commencement of project. This final report may contribute to follow on proposals that can be submitted to other agencies for continued support of the project. The grant program sponsors may coordinate with Principal Investigators to submit their final reports or abstracts for presentation and publication at upcoming Space Congress events and other space-related conferences. FSGC may establish a special seminar or conference where all funded research will be reported.

FSGC may contact PIs and students of approved projects from time to time for additional reporting information.

Any financial or programmatic changes, including student involvement, will require prior approval of FSGC before such changes can be implemented. Failure to meet the proposal goals in relation to student recruitment for the project may result in reduced funding.

Since FSGC is a Cooperative Agreement Grant with NASA, student demographics and other information is required for onward submission to NASA HQ as part of our annual report. We do not send individual information. All the information is aggregated and then compiled into our annual report to NASA. NASA in turn uses this information to present Space Grant program highlights to Congressional delegates to secure future years funding for the National Space Grant program through the NASA Education Office.

.

Leveraged Funding

Proposers must indicate in their proposals whether their project is receiving funds from other sources, or whether they are involved in similar projects that are funded by state or federal grants. These other funding sources should be listed.

Confidential Information in Proposals

Patentable ideas, trade secrets, privileged or confidential commercial or financial information, disclosure of which may harm the proposer, should be included in proposals only when such information is necessary to

convey an understanding of the proposed project. Such information must be clearly marked in the proposal and be appropriately labeled with a legend such as,

"The following is (proprietary or confidential) information that (name of proposing organization) requests not to be released to persons outside UCF, except for purposes of review and evaluation."

Awardee Responsibility

a) Recipient of the FSGC award must ensure that students being supported through this project are US citizens only (permanent residents are not allowed) and that the students submit their completed longitudinal tracking form, awardee questionnaire form and student authorization form to FSGC within 7 days of their hire on the project.
b) If a student, supported with these award funds, graduates before the end of the project, the final report must be collected in a timely manner from the student so that it can be incorporated into the researcher's final report when it is due.
c) NASA STEM Gateway. This is the Office of STEM Engagement official system of record. The required information includes an abstract of the work and details of the students participating in the project along with a list of publications and presentations. Instructions will be sent before the end of the award.

2025 KSC Technology Development and Commercialization Program
Sponsored by FSGC and Space Florida

PROPOSAL COVER PAGE

Name of Project: _____

Faculty or Industry PI:_____

Department/Institution: _____

Address: _____

_____

Phone: _____ Fax: _____ E-mail: _____

Budget Request: Note: A detailed budget justification is required.
Grant $_____
Matching Contribution $_____
Total Project Cost $_____

Does your project have any student participation? Yes ___ No ___

If yes, how many? _____

Start Date:_____ Ending Date: _____

_____ _____
(Signature) Faculty PI / Date (Signature) Department Head / Date

_____ _____
Name Name

_____ _____
Title Title

_____
(Signature) Institute Official / Date

_____
Name

_____
Title

APPENDIX B
FSGC Affiliates

Universities and Colleges

Bethune-Cookman University (Dr. Masood Poorandi) (poorandm@cookman.edu)

Broward College (Dr. Rolando Branly) (rbranly@broward.edu)

Embry-Riddle Aeronautical University (Dr. Terry Oswalt) (oswaltt1@erau.edu)

Eckerd College (Dr. Nazarré Merchant) (merchann@eckerd.edu)

Florida Atlantic University (Dr. Frederick Bloetscher) (fbloetsc@fau.edu)

Eastern Florida State College (Dr. Mevlut Guvendik) (guvendikm@easternflorida.edu)

Florida Gulf Coast University (Dr. Michael Fauerbach) (mfauerba@fgcu.edu)

Florida Institute of Technology (Dr. Marco Carvahlo) (mcarvahlo@fit.edu)

Florida International University (Dr. Berrin Tansel) (tanselb@fiu.edu)

Florida Polytechnic University (Dr. Kais Jribi) (KJribi@floridapoly.edu)

Florida State University (Dr. Alan Hanstein) (alan.hanstein@challengertlh.com)

Florida A&M University (Dr. Charles Weatherford) (charles.weatherford@famu.edu)

Miami Dade College (Dr. Carlos Genatios) (cgenatio@mdc.edu)

University of Central Florida (Dr. Yunjun Xu) (Yunjun.Xu@ucf.edu)

University of Florida (Dr. Josephine Allen) (jallen@mse.ufl.edu)

University of Miami (Dr. Qingda Yang) (qdyang@miami.edu)

University of North Florida (Dr. Nirmal Patel) (npatel@unf.edu)

University of South Florida (Dr. Stephanie Carey) (scarey3@usf.edu)

University of West Florida (Dr. Amria Gautam) (amishra1@uwf.edu)

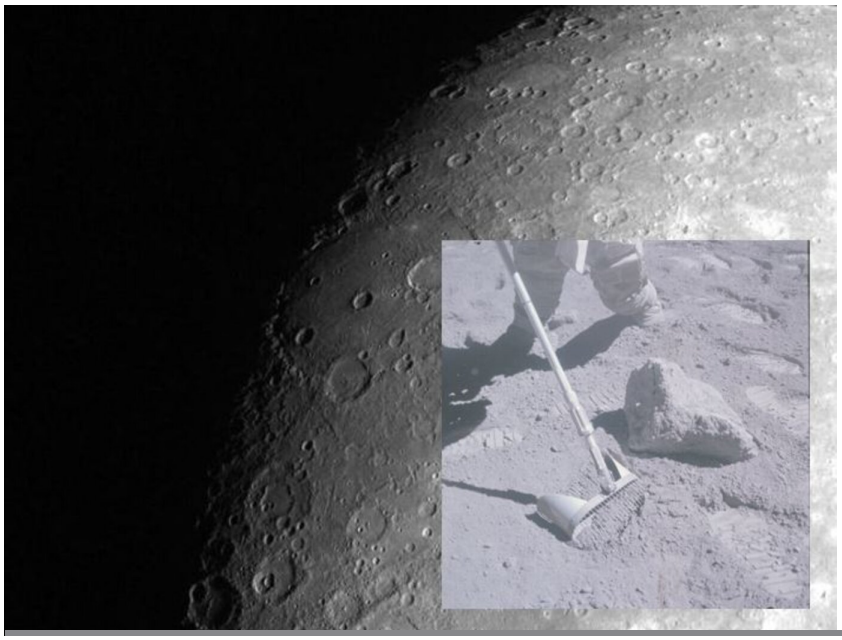
Other Organizations

Astronauts Memorial Foundation (Mr. Thad Altman) (taltman@amfcse.org)

Kennedy Space Center (Ms. Patricia Gillis) (patricia.j.gillis@nasa.gov)

Orlando Science Center (Ms. Jill Goddard) (JGoddard@OSC.ORG)

Space Florida (Mr. Trevor Jones) (tjones@spaceflorida.gov)



National Aeronautics and Space Administration

NASA

TECHNOLOGY SOLUTION

Mechanical and Fluid Systems

Improved Lunar Regolith Simulant Ion Implantation

Emulating solar wind exposure in high-fidelity regolith simulants

The production of high-fidelity extraterrestrial regolith simulants is important for the development of future in-situ resource utilization (ISRU) and remote sensing technologies. For these materials, the mechanical properties can be readily replicated but the absorbed material, electrostatic, and dielectric properties of lunar, Martian, or asteroid regolith can be difficult to simulate.

Innovators at the NASA Kennedy Space Center have developed a methodology and system that can implant helium, hydrogen, and other ions in regolith simulants to emulate the exposure of the simulated regolith to phenomena like solar winds. The system has been successfully prototyped and demonstrated to implant helium ions in simulated regolith and advancements in the material processing have led to low levels of contaminants in the regolith. The ion implanted regolith may be used to develop advanced ISRU, in-space mining, and remote sensing technologies.

BENEFITS

- Higher-fidelity regolith simulants: ion implantation produces regolith simulants that more accurately represent soils exposed on extraterrestrial bodies without an atmosphere.
- Lower contamination: improved materials handling reduces contamination from trapped interstitial gases.
- Improved R&D resources: the system provides improved materials for developing advanced space mining and exploration technologies.

APPLICATIONS

The technology has several potential applications:

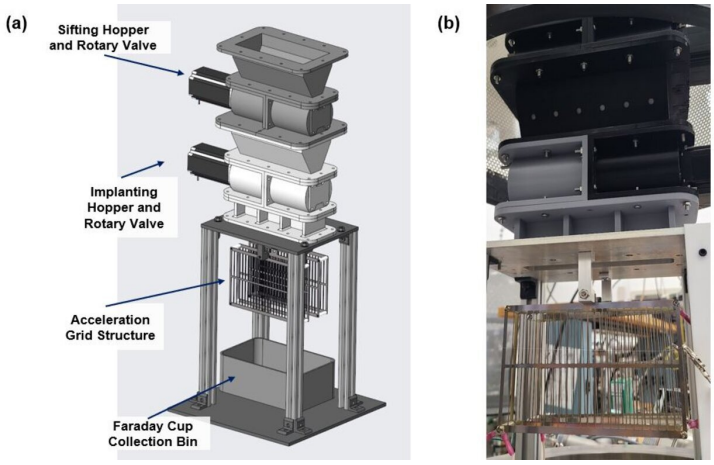
- Space technology development: production of regolith simulants for developing in-space mining, regolith processing, and sensing technologies.
- Plasma processing: possibly adaptable to treat other forms of granular material with a plasma (i.e., accelerated ions) including seeds or pharmaceuticals.

THE TECHNOLOGY

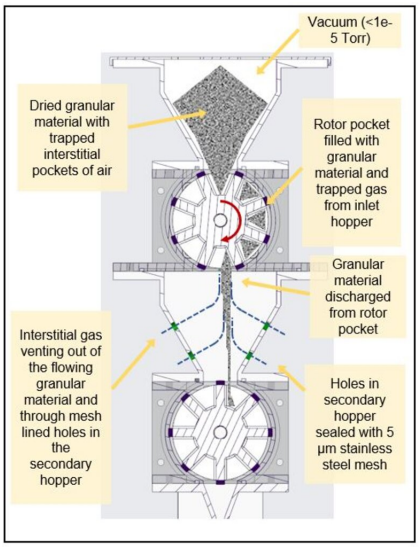
Researchers and other technology developers require regolith simulants that accurately emulate the properties of lunar, Martian, and asteroid soils to ensure that the processes, devices, tools, and sensors being developed will be usable in an active mission environment. To move toward higher fidelity regolith simulants, NASA has developed a system that takes typical regolith simulants and implants ions of relevant elements to better simulate the conditions of extraterrestrial soils.

The ion implantation device developed here is composed of three key elements as shown in the figure below: two hopper and rotary valve elements and the acceleration grid structure. To perform the ion implantation, the system is first placed within a vacuum chamber, pumped down, and gases of the elements of interest are pumped into the chamber. The system then first passes a mass of granulated lunar regolith simulant through two stages of hoppers and rotary valves to condition the material. Key to the system is a process for interstitial gas removal (a source of contamination) as shown in the figure on the right. After conditioning, the regolith simulant is passed between two parallel electrodes under a high voltage, accelerating ions of the process gas and implanting those ions within the regolith simulant at controllable depths.

The related patent is now available to license. Please note that NASA does not manufacturer products itself for commercial sale.



A CAD drawing of the ion implantation system (a) and an image of the prototype in-use at NASA (b).



A schematic showing the contaminant removal process in the ion implantation system.

PUBLICATIONS

Lunar Helium-3: Mining Concepts, Extraction Research, and Potential ISRU Synergies, 2021, AIAA ASCEND 2021, https://ntrs.nasa.gov/citations/20210022802

technology.nasa.gov

NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

KSC-14634, KSC-TOPS-102

More Information

National Aeronautics and Space Administration

Agency Licensing Concierge

Kennedy Space Center

MS LASSO-012
Kennedy Space Center, Fl 32899
202-358-7432
Agency-Patent-Licensing@mail.nasa.gov

www.nasa.gov

NP-2015-02-1387-HQ

National Aeronautics and Space Administration

TECHNOLOGY SOLUTION

Electrical and Electronics

Self-Cleaning Seals

Electrodynamic dust shield technology maximizes performance of seals in harsh, dusty environments

In space applications, seals for hatches, suit ports, airlocks, and docking systems for pressurized volumes such as habitats, rovers, and space suits must be kept clean. This is necessary to achieve the extremely low leak rates required to ensure that crews will have sufficient breathable air for extended missions on planetary surfaces. Dusty environments, such as those of the Moon and Mars, pose challenges because seals (elastomeric and otherwise) – as dust accumulates on them – will no longer perform as designed, substantially increasing leak rates. Similarly, terrestrial applications involving environments with high dust concentration and pressurized systems (e.g., mining, material handling) must maintain clean seals to ensure safety and uptime.

Motivated by the hazard lunar regolith poses to seals – and thus to achieving a sustained lunar presence – researchers in the Electrostatics and Surface Physics Laboratory at NASA's Kennedy Space Center (KSC) have developed seals that actively self-clean in a continuous or periodic manner.

BENEFITS

- Provides active, self-cleaning capabilities: NASA's self-cleaning seals electrically lift and remove dust from their surface without requiring human intervention.
- Prevents seal performance degradation in harsh environments: Preventing accumulation of dust and other particulates (e.g., lunar regolith) on seals helps prevent wear and tear and maintain sealing efficiency.

APPLICATIONS

The technology has several potential applications:

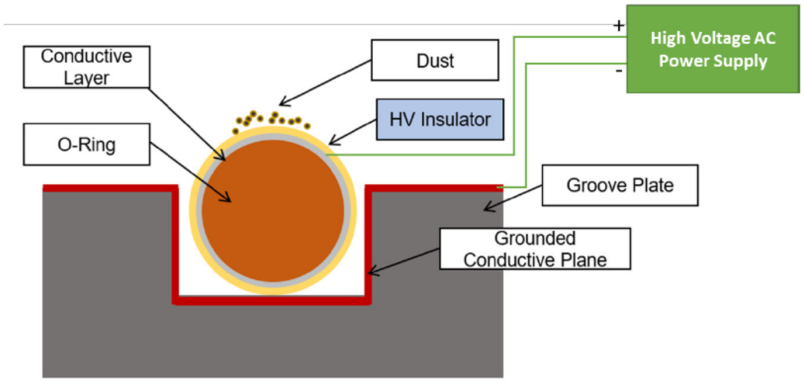
- Space applications: Self-cleaning seals for hatches, suit ports, airlocks, and docking systems for pressurized volumes (e.g., habitats, rovers, space suits) in dusty environments such as the lunar surface
- Mining: Preventing seal degradation from dust and particulate accumulation generated by drilling, blasting, and transporting materials
- Food and beverage processing: Protecting processing / packaging equipment seals from contamination by dust from dry ingredients
- Material handling: Preventing dust accumulation on machinery (e.g., conveyer systems, robotic systems, etc.) seals
- Pharmaceutical manufacturing: Protecting mixing, milling, and packaging equipment seals from accumulation of fine dust from powdered chemicals, raw materials, etc.
- Other: The invention may prove useful for a variety of other applications in environments with high dust concentrations that expose sealing surfaces to potential particle contamination

THE TECHNOLOGY

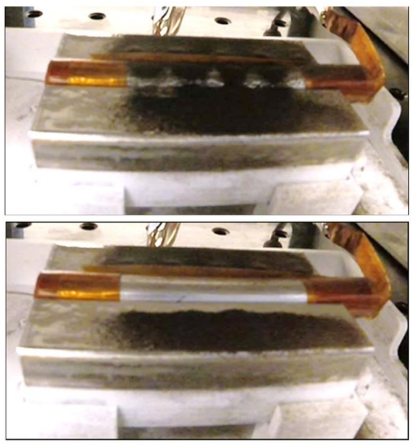
This NASA innovation applies the concepts of electrodynamic dust shielding (EDS) to develop seals (e.g., O-rings) with active self-cleaning capabilities. NASA's self-cleaning seals are manufactured in the following manner: A seal with a conductive surface (or otherwise fabricated to be conductive) is generated and an electrical connection, lead or electrode is attached. Next, a dielectric material is coated or placed over the conductive surface of the seal. (NOTE: Using conductive elastomer materials eliminates the need for a conductive cover layer) A high voltage (nominally >1kV) power supply is connected to the conductive layer on the seal and grounded to the metallic groove or gland that houses the seal.

Given the design, dust accumulates on the outer dielectric layer (a high-voltage insulator) of the seal. To clean the seal, a time varying alternating voltage is applied from the power supply, through the high voltage lead and onto the conductive layer of the seal. When this voltage is applied, the resulting electric field produces Coulomb and dielectrophoretic forces that cause the dust to be repelled from the sealing surface. In practice, NASA's self-cleaning seals could be operated in continuous cleaning mode (actively repelling dust at all times, preventing it from ever contacting the seal surface) or in a periodic cleaning cycle mode (removing dust from the seal surface at regular intervals).

NASA's self-cleaning seals have been prototyped and demonstrated to be highly effective at dust removal. The invention could serve as the basis of an active, self-cleaning seal product line marketed for in-space and/or terrestrial applications. Additionally, companies developing space assets destined for operation on dusty planetary surfaces (e.g., the Moon) may be interested in leveraging the technology to protect seals from dust/regolith accumulation, ensuring continuous low leakage operations.



A cross sectional diagram of NASA's electrodynamic self-cleaning seal system.



Prototype testing of NASA's electrodynamic self-cleaning seals. The images show a 50mm section length of a silicon O-ring placed within a silver groove plate. On the top, black dust coats the surface prior to the application of alternating voltage. On the bottom, voltage has been applied to the system, repelling dust from the seal surface.

technology.nasa.gov

NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

KSC-14456, KSC-TOPS-101

More Information

National Aeronautics and Space Administration

Agency Licensing Concierge

Kennedy Space Center

MS LASSO-012
Kennedy Space Center, Fl 32899
202-358-7432
Agency-Patent-Licensing@mail.nasa.gov

www.nasa.gov

NP-2015-02-1386-HQ

National Aeronautics and
Space Administration

NONDISCLOSURE AGREEMENT

In consideration of the disclosure in confidence by NASA, Kennedy Space Center to "**UNIVERSITY NAME"** hereinafter "UNIV," of proprietary information including research regarding **KSC-14634 Improved Lunar Regolith Simulant Ion Implantation ,** hereafter called "Subject Information", UNIV agrees to the following terms:

UNIV agrees to not disclose the Subject Information to a third party or use the Subject Information for other than evaluation purposes for considering the feasibility of licensing the Subject Information.

UNIV shall not be barred from using or disclosing received Subject Information if the information: (a) is in the public domain; (b) is rightfully in UNIV's possession prior to the date of this agreement; or (c) becomes known to UNIV without restriction from a third party who was under no restriction regarding the use or disclosure of the Subject Information.

UNIV shall not be liable for the disclosure of received Subject Information if the disclosure is made in response to an order of a court of competent jurisdiction, provided however that UNIV will first give notice to NASA before such disclosure so a protective order, if appropriate, may be sought by NASA.

Neither this agreement nor the disclosure of Subject Information by NASA shall be deemed by implication, or otherwise, to vest in UNIV any present or future rights in any patents or other property of NASA, and no license is granted herein.

This Agreement shall be governed by United States Federal Law for all purposes, including, but not limited to, the validity and interpretation of the agreement.

Distribute the Subject Information only to UNIV employees who meet the export control restrictions listed below:

A. Within the United States, the Subject Information shall not be made available to foreign persons, as defined by 22 CFR § 120.16.

B. The Subject Information shall not be provided to any person (as defined by 22 CFR §120.14) on the Consolidated Screening List available at www.export.gov (including but not necessarily limited to: the Bureau of Industry and Security, Denied Persons List, Unverified List and Entity List; Office of Foreign Assets Control, Specially Designated Nationals and Blocked Persons, and Changes to List of Specially Designated Nationals and Blocked Persons; Directorate of Defense Trade Controls, List of Statutorily Debarred Parties; Bureau of International Security and Nonproliferation, Federal Register notices for nonproliferation sanctions determinations).

C. The Subject Information are "technology" within the meaning of the Export Administration Regulations (EAR) at 15 CFR Parts 730-774 and, depending upon its application, the International Traffic in Arms Regulations (ITAR) 22 CFR Parts 120-130.

D. Notwithstanding any provisions contained herein, UNIV is hereby put on notice that export of any data containing all or a portion of the Subject Information may require some form of export authorization from the U.S. Government before they are either sent outside of the United States or made available to nationals of a foreign country either within the United States or abroad. Failure to obtain necessary export authorizations may result in RECIPIENT's criminal liability under U.S. laws.

E. NASA makes no representations as to export authorization requirements for the Subject Information. Similarly, NASA makes no representations that any authorization(s) required to export the Subject Information, if any, will be issued. Nothing granted to UNIV herein provides any such export authorization.

UNIV certifies that neither it nor any employees to whom UNIV distributes the Subject Information is a foreign person (as defined by 22 CFR §120.16) or listed on any of the aforementioned "denied Parties/persons" lists.

The restriction imposed by the Agreement on UNIV shall automatically expire five (5) years after the date of execution of this Agreement.

_____ _____

Signature Date

Company Name:
Company Representative Name:
Company Address:
Company Representative Phone:
Company Representative E-Mail:

Please return the hand signed and dated agreement to Jeff Kohler in the Kennedy Space Center Technology Transfer Office. A scanned copy of the completed agreement can be e-mailed to jeffrey.a.kohler@nasa.gov and is the preferred method for returning agreements. Hard copies of agreements can be faxed to 321-867-2050 or mailed to Technology Transfer Office, Mail Code: UB-T, Kennedy Space Center, FL 32899.

National Aeronautics and
Space Administration

NONDISCLOSURE AGREEMENT

In consideration of the disclosure in confidence by NASA, Kennedy Space Center to "**UNIVERSITY NAME"** hereinafter "UNIV," of proprietary information including research regarding **KSC-14456 Self - Cleaning Seals ,** hereafter called "Subject Information", UNIV agrees to the following terms:

UNIV agrees to not disclose the Subject Information to a third party or use the Subject Information for other than evaluation purposes for considering the feasibility of licensing the Subject Information.

UNIV shall not be barred from using or disclosing received Subject Information if the information: (a) is in the public domain; (b) is rightfully in UNIV's possession prior to the date of this agreement; or (c) becomes known to UNIV without restriction from a third party who was under no restriction regarding the use or disclosure of the Subject Information.

UNIV shall not be liable for the disclosure of received Subject Information if the disclosure is made in response to an order of a court of competent jurisdiction, provided however that UNIV will first give notice to NASA before such disclosure so a protective order, if appropriate, may be sought by NASA.

Neither this agreement nor the disclosure of Subject Information by NASA shall be deemed by implication, or otherwise, to vest in UNIV any present or future rights in any patents or other property of NASA, and no license is granted herein.

This Agreement shall be governed by United States Federal Law for all purposes, including, but not limited to, the validity and interpretation of the agreement.

Distribute the Subject Information only to UNIV employees who meet the export control restrictions listed below:

A. Within the United States, the Subject Information shall not be made available to foreign persons, as defined by 22 CFR § 120.16.

B. The Subject Information shall not be provided to any person (as defined by 22 CFR §120.14) on the Consolidated Screening List available at www.export.gov (including but not necessarily limited to: the Bureau of Industry and Security, Denied Persons List, Unverified List and Entity List; Office of Foreign Assets Control, Specially Designated Nationals and Blocked Persons, and Changes to List of Specially Designated Nationals and Blocked Persons; Directorate of Defense Trade Controls, List of Statutorily Debarred Parties; Bureau of International Security and Nonproliferation, Federal Register notices for nonproliferation sanctions determinations).

C. The Subject Information are "technology" within the meaning of the Export Administration Regulations (EAR) at 15 CFR Parts 730-774 and, depending upon its application, the International Traffic in Arms Regulations (ITAR) 22 CFR Parts 120-130.

D. Notwithstanding any provisions contained herein, UNIV is hereby put on notice that export of any data containing all or a portion of the Subject Information may require some form of export authorization from the U.S. Government before they are either sent outside of the United States or made available to nationals of a foreign country either within the United States or abroad. Failure to obtain necessary export authorizations may result in RECIPIENT's criminal liability under U.S. laws.

E. NASA makes no representations as to export authorization requirements for the Subject Information. Similarly, NASA makes no representations that any authorization(s) required to export the Subject Information, if any, will be issued. Nothing granted to UNIV herein provides any such export authorization.

UNIV certifies that neither it nor any employees to whom UNIV distributes the Subject Information is a foreign person (as defined by 22 CFR §120.16) or listed on any of the aforementioned "denied Parties/persons" lists.

The restriction imposed by the Agreement on UNIV shall automatically expire five (5) years after the date of execution of this Agreement.

_____ _____

Signature Date

Company Name:
Company Representative Name:
Company Address:
Company Representative Phone:
Company Representative E-Mail:

Please return the hand signed and dated agreement to Jeff Kohler in the Kennedy Space Center Technology Transfer Office. A scanned copy of the completed agreement can be e-mailed to jeffrey.a.kohler@nasa.gov and is the preferred method for returning agreements. Hard copies of agreements can be faxed to 321-867-2050 or mailed to Technology Transfer Office, Mail Code: UB-T, Kennedy Space Center, FL 32899.

MODEL NONEXCLUSIVE RESEARCH PATENT LICENSE AGREEMENT

(NON-ANNOTATED)

June 3, 2020

Instructions:

- Remove this first page prior to finalizing the agreement.
- The Table of Contents can be updated automatically by clicking on any portion of the Table, then right click and select "Update Field," and select "Update Entire Table."
- All of the portions highlighted in yellow need to have language inserted, and all of the portions highlighted in blue are optional to include in the license agreement.
- This Research License does not permit NASA to loan any software, material or equipment. Any transfer of software, material, or equipment will require a separate agreement in addition to this License Agreement (e.g. Software Usage Agreement, Material Transfer Agreement, or property loan – additional Nondisclosure Agreement may be needed). Any collaborative activities also requires an additional agreement (e.g. Space Act Agreement).
- If you have any questions regarding this Agreement, including whether the blue highlighted sections should be included, please consult your Patent Counsel/Attorney.

LICENSE AGREEMENT

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

AND

INSERTCOMPANY

NONEXCLUSIVE RESEARCH LICENSE AGREEMENT DN-INSERT

LICENSE COMMENCEMENT DATE: INSERT

TABLE OF CONTENTS

NONEXCLUSIVE RESEARCH LICENSE AGREEMENT

PREAMBLE

This Nonexclusive Research License Agreement ("AGREEMENT") is entered into between the National Aeronautics and Space Administration (NASA), an agency of the United States, hereinafter referred to as LICENSOR, having its headquarters in Washington, D.C., and INSERT, a [Choose one and remove the rest: corporation, limited liability company, sole proprietor, etc.] of the State of INSERT, having its principal place of business at INSERT, hereinafter referred to as LICENSEE, as of the date of execution of the last PARTY hereto.

WITNESSETH:

WHEREAS, under the authority of 35 U.S.C. § 200 et seq., the U.S. Department of Commerce has issued Licensing Regulations (37 CFR Part 404) specifying the terms and conditions upon which research licenses may be granted for inventions assigned to LICENSOR;

WHEREAS, LICENSOR is the assignee of the LICENSED PATENT(S) and/or LICENSED PATENT APPLICATION(S);

WHEREAS, LICENSEE desires to research the invention embodied in the LICENSED PATENT(S) and/or LICENSED PATENT APPLICATION(S) for specific applications;

WHEREAS, LICENSEE, in consideration of the grant of a license under the LICENSED PATENT(S) and/or LICENSED PATENT APPLICATION(S), will pay a nonrefundable license fee; and,

WHEREAS, LICENSOR has determined that the granting of a license to LICENSEE under the LICENSED PATENT(S) and/or LICENSED PATENT APPLICATION(S), limited to research for specific applications, will enable LICENSEE to determine whether further licensing for commercialization purposes is desired, and the granting of such license to LICENSEE will therefore be in the public interest.

NOW, THEREFORE, in accordance with said Patent Licensing Regulations, and in consideration of the foregoing and of the terms hereinafter contained in this AGREEMENT, the LICENSOR and LICENSEE agree as set forth below:

ARTICLE I: Definitions

"EXCLUDED INFORMATION" shall mean information that:

(a) Was publicly available before the LICENSE COMMENCEMENT DATE ;

(b) Was known to LICENSEE before the LICENSE COMMENCEMENT DATE, provided that LICENSEE shall have the burden of establishing such prior knowledge by competent written proof;

(c) Becomes publicly available after the LICENSE COMMENCEMENT DATE through no act or omission of LICENSEE;

(d) Is made available to LICENSEE, under no obligation of confidentiality, by a THIRD PARTY having the right to disclose such information after the LICENSE COMMENCEMENT DATE; or

(e) Is independently developed by LICENSEE, provided that LICENSEE shall have the burden of establishing such independent development with written documentation.

"LICENSE COMMENCEMENT DATE" shall mean the date that the last PARTY has executed this AGREEMENT.

"LICENSE EXPIRATION DATE" shall mean the last day that this AGREEMENT is in effect, whether by expiration or termination.

"LICENSE TERM" shall mean the period of time starting with the LICENSE COMMENCEMENT DATE and ending with the LICENSE EXPIRATION DATE.

"LICENSED AREA" shall mean the United States of America, its territories, and its possessions.

"LICENSED FIELD(S) OF USE" shall mean INSERT. [**INSERT THE FOLLOWING LANGUAGE IF THERE ARE OTHER FIELDS OF USE THAT ARE EXCLUSIVELY LICENSED:** LICENSED FIELD(S) OF USE shall not include the following: InsertPriorExclusivelyLicensedFields.]

"LICENSED INVENTION(S)" means the invention(s) defined by the claims of the LICENSED PATENT(S), and/or the invention(s) described in the LICENSED PATENT APPLICATION(S), and as may be further limited by ARTICLE II.

"LICENSED PATENT APPLICATION(S)": [Insert a list of all applicable patent applications using the below template. If there are no patent applications, remove all of the yellow highlighted language and state "None"]

- U.S. Patent Application No.: INSERT
  - Title: INSERT
  - Filing Date: INSERT
  - NASA Case No.: INSERT

The LICENSED PATENT APPLICATION(S) identified above (if any) shall include any non-provisional, continuation or divisional patent application(s) (specifically excluding patent applications containing new matter) derived from a LICENSED PATENT APPLICATION or LICENSED PATENT.

"LICENSED PATENT(S)": [Insert a list of all applicable patents using the below template. If there are no patents, remove all of the yellow highlighted language and state "None"]

- U.S. Patent No.: INSERT
  - Title: INSERT
  - Issue Date: INSERT
  - NASA Case No.: INSERT

The LICENSED PATENT(S) identified above (if any) shall include any corresponding reissue patent(s) and modifications of patent(s) by means of certificates of correction or reexamination certificates and shall include any patents maturing from the LICENSED PATENT APPLICATION(S).

"PARTY" or "PARTIES" shall mean LICENSOR and LICENSEE, individually and collectively.

"PURPOSE" shall mean research on and evaluation of the LICENSED INVENTION(S) for use in the LICENSED FIELD(S) OF USE. PURPOSE excludes the sale and offer for sale of the LICENSED INVENTION(S). Any use of the LICENSED INVENTION(S) for other than research and evaluation purposes, such as for commercial or industrial use or sale, shall be made only pursuant to the terms of a commercialization license. Any such commercialization license shall be subject to 37 CFR Part 404, and there is no guarantee by LICENSOR that the LICENSED INVENTION(S) will be available for such licensing or that LICENSOR will grant such license.

"REPORTING PERIOD" shall mean the period for which reporting is required. For this AGREEMENT, the period is every six (6) months from the LICENSE COMMENCEMENT DATE and at the LICENSE EXPIRATION DATE.

"TECHNICAL INFORMATION" shall mean any information or data received from LICENSOR that is related to the LICENSED INVENTION(S), and any information or data that LICENSEE produces that is derived from or contains such received information or data.

"THIRD PARTY" shall mean any legal entity other than the LICENSOR and the LICENSEE.

ARTICLE II: License Grant

2.1 LICENSOR hereby grants to LICENSEE a terminable, fee-bearing, nonexclusive license to practice, i.e., to make, or use, the LICENSED INVENTION(S) as limited to the

LICENSED AREA and as limited to the LICENSED FIELD(S) OF USE and PURPOSE, as defined in ARTICLE I.

2.2 LICENSOR, upon request, will use reasonable efforts to grant LICENSEE, in accordance with 37 CFR Part 404, a license to practice any inventions assigned to LICENSOR, without which license or licenses, the practice of the LICENSED INVENTION(S) under this AGREEMENT would result in infringement. The grant of said license or licenses shall be limited, however, to the extent necessary to practice the LICENSED INVENTION(S) under this AGREEMENT. There will be no such grant where said inventions are licensed exclusively.

2.3 Notwithstanding anything to the contrary in this AGREEMENT, LICENSEE shall take the license granted in this ARTICLE II subject to any outstanding licenses or other rights in THIRD PARTIES under agreements executed by LICENSOR before the LICENSE COMMENCEMENT DATE.

2.4 LICENSOR reserves all rights not expressly granted to LICENSEE in this AGREEMENT.

2.5 This AGREEMENT does not grant any rights to practice any enhancements or modifications to the LICENSED INVENTION(S) beyond the termination or expiration of this AGREEMENT; i.e., any such enhancements and modifications shall be subject to LICENSOR's rights in the LICENSED INVENTION(S).

ARTICLE III: Sublicenses

3.1 LICENSEE shall not grant any sublicenses under this AGREEMENT.

ARTICLE IV: Term of License, Modification, and Termination

4.1 Unless either PARTY terminates this AGREEMENT in accordance with this ARTICLE IV at an earlier date, the license granted in ARTICLE II will automatically terminate without notice to the LICENSEE **[Insert the term and remove this blue highlighted language - recommended 12 months or less, but not longer than 24 months]** INSERT (INSERT) months after the LICENSE COMMENCEMENT DATE, except as may be expressly provided otherwise herein or agreed to in writing by LICENSOR.

4.2 The PARTIES may terminate or modify this AGREEMENT by mutual consent upon such terms as they may agree in writing.

4.3 LICENSOR and LICENSEE each have the right to unilaterally terminate this AGREEMENT upon thirty (30) days notice in writing to the other PARTY.

4.4 Upon termination or expiration of this AGREEMENT for any reason all rights and licenses granted to LICENSEE hereunder shall automatically terminate.

4.5 The termination or expiration of this AGREEMENT shall not affect any rights or obligations of either PARTY that have matured before the termination or expiration and which are intended by the PARTIES to survive the termination or expiration, including the Articles entitled "Non-Disclosure" and "Export Control."

ARTICLE V: Royalty and Payment

5.1 In consideration of the license granted in ARTICLE II, LICENSEE shall remit to LICENSOR a nonrefundable license fee in the amount of INSERT U.S. Dollars ($INSERT) upon the execution of this AGREEMENT by LICENSEE. Payment shall be denominated in United States dollars and made payable to the National Aeronautics and Space Administration online through the NASA Shared Services Center (NSSC) via https://www.nssc.nasa.gov/home.

The payment shall reference the NASA Center name and number of this Agreement. LICENSOR's acceptance of such fee does not eliminate LICENSOR's right to contest the accuracy of such payment in the future.

ARTICLE VI: Reports

6.1 LICENSEE shall submit to LICENSOR written reports within thirty (30) calendar days of the end of every REPORTING PERIOD. To ensure that any proprietary information submitted by LICENSEE is protected to the fullest extent of the law, LICENSEE should mark with a proprietary notice any portions of the report that are considered proprietary to LICENSEE.

6.2 Each report shall include the following information applicable to the most recent REPORTING PERIOD:

(a) A narrative description of LICENSEE's activities under this AGREEMENT.

(b) Serial number, filing date and title of all patent applications covering inventions arising from activities under this AGREEMENT.

(c) A list of the geographic locations at which the LICENSED INVENTION(S) is being researched and evaluated.

6.3 Each report shall include a certification by an officer of LICENSEE that the LICENSEE is complying with the terms and conditions of this AGREEMENT and that the responses to each part of Section 6.2 are accurate and complete.

6.4 A final report shall be submitted to LICENSOR by LICENSEE within thirty (30) calendar days after the termination or expiration of this AGREEMENT.

ARTICLE VII: Use of the NASA Name

7.1 LICENSEE may use the name of LICENSOR, or the acronym "NASA," only in truthful statements concerning its relationship with LICENSOR. The letters 'NASA' may be used in such truthful statements only if they are:

(a) used in their normal typed or printed form;

(b) the same size, color, and intensity as the rest of the words in a sentence;

(c) not used in their stylized version as they appear in the NASA logotype or NASA insignia; and

(d) not used to indicate that NASA endorses the LICENSEE's products, processes, etc.

7.2 Uses of the letters 'NASA', other than those specified in Section 8.1, shall require the express written approval of LICENSOR. Approval by LICENSOR shall be based on applicable law (i.e., 51 U.S.C. §§ 20141, 20111-20113; and 14 CFR § 1221.100 et seq.) and NASA policy governing the use of the letters 'NASA' and the words 'National Aeronautics and Space Administration' and shall not be unreasonably withheld.

ARTICLE VIII: Disclaimer of Warranties

8.1 LICENSOR MAKES NO REPRESENTATIONS OR WARRANTIES, EXPRESS, IMPLIED, OR STATUTORY, AS TO ANY MATTER WHATSOEVER.
8.2 ALL REPRESENTATIONS AND WARRANTIES, EXPRESS, IMPLIED, OR STATUTORY, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE EXCLUDED HEREUNDER.

ARTICLE IX: Risk Allocation and Indemnification

9.1 LICENSOR makes no representation, extends no warranties of any kind, either express or implied, and assumes no responsibility whatsoever with respect to use, or other disposition by LICENSEE or its transferees of devices incorporating or made by the use of (a) the LICENSED INVENTION(S) or (b) information, if any, furnished under this AGREEMENT.

9.2 LICENSEE shall indemnify LICENSOR, its officers and employees, and hold them harmless against all liabilities, demands, damages, expenses, or losses including, but not limited to, attorney's fees, court costs, and the like, arising (a) out of the use by LICENSEE or its transferees of the LICENSED INVENTION(S) or information furnished under this AGREEMENT, or (b) out of any, use, or other disposition by LICENSEE or its transferees of devices, processes, or compositions, made by use of such inventions or information.

9.3 It shall be the sole responsibility of the LICENSEE to ensure that any and all embodiments of the LICENSED INVENTION(S) are safe under all circumstances.

9.4 Independent of, severable from, and to be enforced independently of any other enforceable or unenforceable provision of this AGREEMENT, other than as provided in Sections 9.1 and 9.2, or other than for infringement of one PARTY's intellectual property rights by another PARTY, (including any engagement in licensable activities by LICENSEE beyond the scope of the license provided by this AGREEMENT), neither PARTY will be liable to the other PARTY (nor to any THIRD PARTY claiming rights derived from the other PARTY's rights) for incidental, consequential, special, punitive, or exemplary damages of any kind, including lost profits, loss of business, or other economic damage, and further including injury to property, as a result of breach of any warranty or other term of this AGREEMENT, regardless of whether the PARTY liable or allegedly liable was advised, had reason to know, or in fact knew of the possibility thereof.

ARTICLE X: Points of Contact

10.1 The following points of contact are designated for their respective PARTY and are responsible for keeping this information current by providing updated information as warranted. These points of contact are the principal representatives of the PARTIES involved in the performance of this AGREEMENT.

LICENSOR		**LICENSEE**	
Name:	INSERT	Name:	INSERT
Title:	INSERT	Title:	INSERT
Address:	INSERT	Address:	INSERT
Telephone:	INSERT	Telephone:	INSERT
Facsimile:	INSERT	Facsimile:	INSERT
Email:	INSERT	Email:	INSERT

ARTICLE XI: Notices

11.1 All notices hereunder will be in writing and will be delivered and effective as follows:

(a) Every notice required or contemplated by this AGREEMENT to be given either PARTY may be delivered in person; sent by commercial courier or U.S. mail, addressed to the PARTY for whom it is intended, at the address specified in ARTICLE X; or may be emailed (however a hard copy must concurrently be sent by commercial carrier or U.S. mail and attached to the email) to the PARTY for whom it is intended, at the email address specified in ARTICLE X.

(b) Any notice will be effective on the date that it is hand delivered or on the fifth business day after it was deposited with the commercial courier or the U.S. mail, with the exception of emailed notices which will be effective on the date the email is received and read as evidenced by a response confirming receipt, if such read date is earlier than the effective date of the concurrently sent hard copy.

(c) As used in this ARTICLE XI, a reference to a particular date means the date itself, if a business day, otherwise the first business day after the date.

ARTICLE XII: Disputes

12.1 All disputes arising under this AGREEMENT shall be referred by the PARTIES in writing to the appropriate Point of Contact identified in ARTICLE X of this AGREEMENT. The Points of Contact will consult and attempt to resolve all issues arising from the implementation of this AGREEMENT. If they are unable to come to agreement on any issue, the dispute will be referred to the PARTIES' duly authorized representatives, or their designees, for joint resolution. If the PARTIES remain unable to resolve the dispute, then the LICENSOR'S duly authorized representative, or its designee, will issue a written decision that will be the Final Agency Decision for the purpose of judicial review. Nothing in this ARTICLE XII limits or prevents either PARTY from pursuing any other right or remedy available by law upon the issuance of the Final Agency Decision.

ARTICLE XIII: Assignment

13.1 LICENSEE may not assign or transfer this AGREEMENT. Any assignment or transfer of this AGREEMENT or any interests hereunder (e.g. assignment, sale, bankruptcy, merger, security interest) that was not approved by LICENSOR is null and void ab initio.

ARTICLE XIV: Governing Law

14.1 This AGREEMENT will be interpreted and enforced in accordance with United States federal law.

ARTICLE XV: Export Control

15.1 Notwithstanding any provisions contained herein, LICENSEE is hereby put on notice that the LICENSED INVENTION(S), including LICENSED INVENTION(S) technical data, services and hardware that incorporated the LICENSED INVENTION(S), and/or TECHNICAL INFORMATION, may be subject to U.S. export control laws and regulations, specifically including, but not limited to, the requirements of the Arms Export Control Act, 22 U.S.C. 2751, et seq., including the International Traffic in Arms Regulation ("ITAR"), 22 C.F.R. 120 et seq.; and the Export Administration Act, 50 U.S.C. App. 2401-2420, including the Export Administration Regulations, 15 C.F.R. 730-774. Failure to obtain necessary export authorizations may result in criminal liability of LICENSEE under U.S. laws.

LICENSEE has the independent duty to ensure that if required, the proper license is obtained. LICENSOR neither represents that an authorization shall not be required nor that, if required, it shall be issued. Nothing granted herein to LICENSEE provides any such export authorization.

ARTICLE XVI: Non-Disclosure

16.1 Except for EXCLUDED INFORMATION, LICENSEE shall hold TECHNICAL INFORMATION received from LICENSOR in confidence, and agrees not to disclose the TECHNICAL INFORMATION to any THIRD PARTY without prior written permission from LICENSOR.

16.2 For purposes of maintaining the TECHNICAL INFORMATION in confidence, LICENSEE shall:

- **(a)** Use, disclose, or reproduce such TECHNICAL INFORMATION only as necessary under this AGREEMENT;
- **(b)** Safeguard such TECHNICAL INFORMATION from unauthorized use and disclosure;
- **(c)** Allow access to such TECHNICAL INFORMATION only to LICENSEE'S employees requiring access for research and evaluation activities pursuant to this AGREEMENT;
- **(d)** Except as otherwise indicated in ARTICLE 16.2(c), preclude disclosure outside LICENSEE'S organization;
- **(e)** Notify LICENSEE'S employees with access about their obligations and ensure their compliance this ARTICLE XVI; and
- **(f)** Return or dispose of all TECHNICAL INFORMATION upon the LICENSE EXPIRATION DATE.

ARTICLE XVII: Entire Agreement

17.1 Except as may be expressly provided otherwise herein, this AGREEMENT constitutes the entire agreement between the PARTIES concerning the subject matter thereof. No prior or contemporaneous representations, inducements, promises, or agreements, oral or otherwise, between the PARTIES with reference thereto will be of any force or effect. This AGREEMENT may only be modified by written agreement of the PARTIES.

ARTICLE XVIII: Counterparts

18.1 This AGREEMENT may be executed in separate counterparts, each of which so executed and delivered shall constitute an original, but all such counterparts shall together constitute one and the same instrument. Any such counterpart may comprise one or more duplicates or duplicate signature pages, any of which may be executed by less than all of the PARTIES, provided that each PARTY executes at least one such duplicate or duplicate

signature page. The PARTIES stipulate that a photocopy of an executed original will be admissible in evidence for all purposes in any proceeding as between the PARTIES.

ARTICLE XIX: Acceptance

19.1 In witness whereof, each PARTY has caused this AGREEMENT to be executed by its duly authorized representatives:

LICENSOR:	**LICENSEE:**
National Aeronautics and Space Administration	InsertCompanyName
By:	By:
Name: INSERT	Name: INSERT
Title: INSERT	Title: INSERT
Date:	Date: