

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

2024 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:	February 15, 2024	Request for Proposals Issued
	March 15, 2024	Notice of Intent and Abstract sent to fsgc@ucf.edu
	April 15, 2024	Proposals Due
	April 30, 2024	Grants Announced
	On or after May 1, 2024	Awards made (subject to receipt of funding from NASA and Space Florida for 2024 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:

Capacitive Micro-Gravity Fluid Mass Gauge (KSC-TOPS-96)

An Accurate Method of Measuring Fluid or Gas Inside a Vessel

Measuring fluid mass in micro gravity, where fluid behavior is dominated by fluid properties, is a challenging problem. To address this problem engineers at NASA are developing a capacitance-based, mass-fraction gauge for vessels containing two-phase fluids. The vessel volume is enclosed with an array of electrodes, and a unique set of capacitance measurements of the enclosed volume are made between the electrodes. The capacitance measurements are scaled with appropriate weighting factors derived from Laplace's Equation to compensate for the highly non-uniform electric fields inside the measurement volume and achieve a greater level of mass fraction accuracy.

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

Self-Cleaning Coatings for Space or Earth (KSC-TOPS-99)

Transparent Electrodynamic Dust Shields Usable for Solar Cells

Reducing dust accumulation on any surface is key for lunar missions as dust can damage or impair the performance of everything from deployable systems to solar cells on the Moon's surface. Electrodynamic dust shields (EDSs) are a key method to actively clean surfaces by running high voltages (but low currents) through electrodes on the surface. The forces generated by the voltage efficiently remove built up, electrically charged dust particles. Innovators at the NASA Kennedy Space Center have developed a new transparent EDS for removing dust from space and lunar solar cells among other transparent surfaces. The new coatings operate at half the voltage of existing EDSs while being 90% thinner. These capabilities are enabled by an innovative combination of electrode patterning and a thin silica protective layer. The reduced thickness and lower voltage operation expands possibilities for integrating EDSs onto transparent surfaces across industries. NASA is looking for new or refined techniques to fabricate the layers of the EDS.

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:
Jeffrey Kohler
Kennedy Space Center
Technology Transfer Program
Mail Code: UB-T
Phone: (321) 749-6136
Email: jeffrey.a.kohler@nasa.gov
Website: <https://technology.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 Jeffrey Kohler 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
Capacitive Micro-Gravity Fluid Mass Gauge	Measuring fluid mass in micro gravity, where fluid behavior is dominated by fluid properties, is a challenging problem. To address this problem engineers at NASA are developing a capacitance-based, mass-fraction gauge for vessels containing two-phase fluids. The vessel volume is enclosed with an array of electrodes, and a unique set of capacitance measurements of the enclosed volume are made between the electrodes. The capacitance measurements are scaled with appropriate weighting factors derived from Laplace's Equation to compensate for the highly non-uniform electric fields inside the measurement volume and achieve a greater level of mass fraction accuracy.	\$25K	Estimate of 1 grant to be awarded.
Self-Cleaning Coatings for Space or Earth	Reducing dust accumulation on any surface is key for lunar missions as dust can damage or impair the performance of everything from deployable systems to solar cells on the Moon's surface. Electrodynamical dust shields (EDSs) are a key method to actively clean surfaces by running high voltages (but low currents) through electrodes on the surface. The forces generated by the voltage efficiently remove built up, electrically charged dust particles. Innovators at the NASA Kennedy Space Center have developed a new transparent EDS for removing dust from	\$25K	Estimate of 1 grant to be awarded.

	<p>space and lunar solar cells among other transparent surfaces. The new coatings operate at half the voltage of existing EDSs while being 90% thinner. These capabilities are enabled by an innovative combination of electrode patterning and a thin silica protective layer. The reduced thickness and lower voltage operation expands possibilities for integrating EDSs onto transparent surfaces across industries. NASA is looking for new or refined techniques to fabricate the layers of the EDS</p>		
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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 Training Grant and as required under the Terms and Conditions for a Training Grant 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

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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 March 15, 2024. 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 May 1, 2024. The ending date cannot be beyond May 8, 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 with special emphasis on student diversity 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.

2024 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

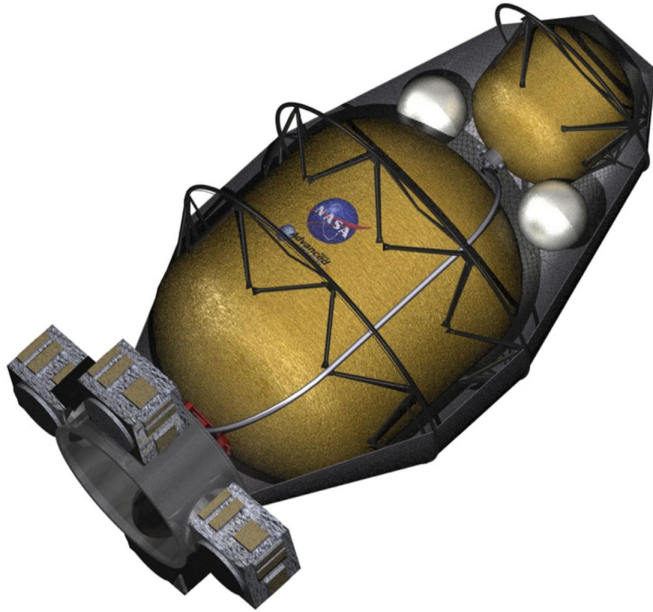
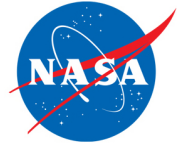
APPENDIX B FSGC Affiliates

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. Sergey V. Drakunov) (drakunov@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. Tristan Fiedler) (fiedler@fit.edu)
Florida International University (Dr. Berrin Tansel) (tanselb@fiu.edu)
Florida Polytechnic University (Dr. Seyed Soltani) (ssoltani@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. Brad Regez) (bregez@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. Ronald Lau) (rlau@spaceflorida.gov)



TECHNOLOGY SOLUTION

Instrumentation

Capacitive Micro-Gravity Fluid Mass Gauge

[An Accurate Method of Measuring Fluid or Gas Inside a Vessel](#)

Measuring fluid mass in micro gravity, where fluid behavior is dominated by fluid properties, is a challenging problem. To address this problem engineers at NASA are developing a capacitance-based, mass-fraction gauge for vessels containing two-phase fluids. The vessel volume is enclosed with an array of electrodes, and a unique set of capacitance measurements of the enclosed volume are made between the electrodes. The capacitance measurements are scaled with appropriate weighting factors derived from Laplace's Equation to compensate for the highly non-uniform electric fields inside the measurement volume and achieve a greater level of mass fraction accuracy.

BENEFITS

- Accurately Measures Fluid Mass
- Senses Entire Tank Volume
- Scalable to Different Sized Tanks



THE TECHNOLOGY

The capacitive micro-gravity fluid mass gauge with spatial regularization is a sensor that can be outfitted to propellant vessels and can provide a determination of the mass of liquid and gas inside the vessel volume with a determinable level of accuracy. The sensor consists of 1) a number of discrete electrodes that are installed to the inner surface of the vessel wall, 2) signal generating, digitizing, signal conditioning, and general support (e.g., power supply) electronics, 3) electrical connections between the electrodes and the electronics, and 4) the algorithm used to turn the set of capacitance measurements (i.e., the capacitance matrix) into a volume fraction. The electronics generate and apply a sinusoid to a single electrode, and then the electronics measure the charge on all other electrodes. Capacitance is simply the charge divided by the voltage. This is repeated for all electrodes, without repeating duplicates. For a vessel with a fixed volume, the volume fraction can be converted to the mass fraction using the Ideal Gas Law so long as the fluid constituents, temperature, and pressure are known.

APPLICATIONS

The technology has several potential applications:

- Tank and Vessel Transport
- Gas and Liquid Systems
- LNG Storage
- Hydrogen Storage
- Cryogenic Liquids Storage

National Aeronautics and Space Administration

Agency Licensing Concierge

Kennedy Space Center

MS LASSO-012

Kennedy Space Center, FI 32899

202-358-7432

Agency-Patent-Licensing@mail.nasa.gov

www.nasa.gov

NP-2015-02-1382-HQ

technology.nasa.gov

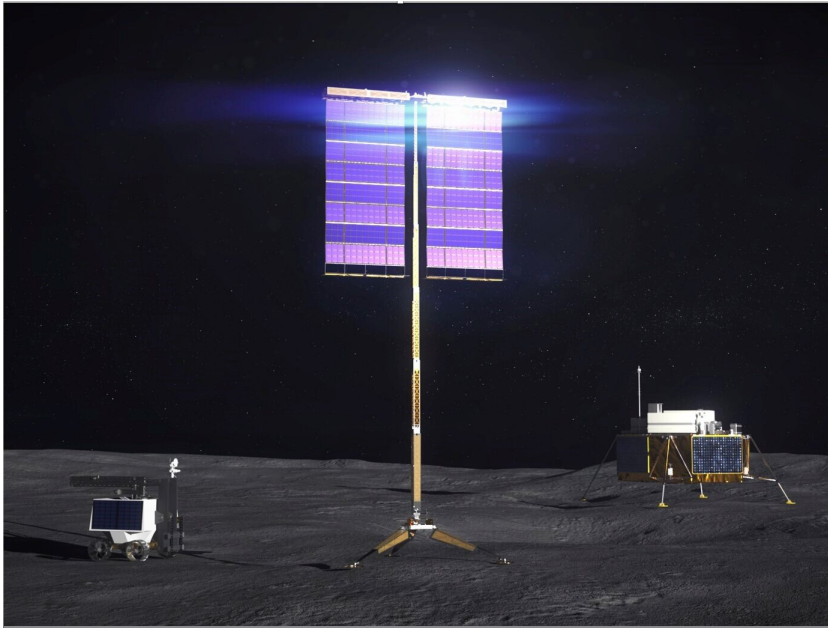
NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create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

KSC-14530, KSC-TOPS-96



TECHNOLOGY SOLUTION

Materials and Coatings



Self-Cleaning Coatings for Space or Earth

Transparent Electrodynamic Dust Shields Usable for Solar Cells

Reducing dust accumulation on any surface is key for lunar missions as dust can damage or impair the performance of everything from deployable systems to solar cells on the Moon's surface. Electrodynamic dust shields (EDSs) are a key method to actively clean surfaces by running high voltages (but low currents) through electrodes on the surface. The forces generated by the voltage efficiently remove built up, electrically charged dust particles.

Innovators at the NASA Kennedy Space Center have developed a new transparent EDS for removing dust from space and lunar solar cells among other transparent surfaces. The new coatings operate at half the voltage of existing EDSs while being 90% thinner. These capabilities are enabled by an innovative combination of electrode patterning and a thin silica protective layer. The reduced thickness and lower voltage operation expands possibilities for integrating EDSs onto transparent surfaces across industries.

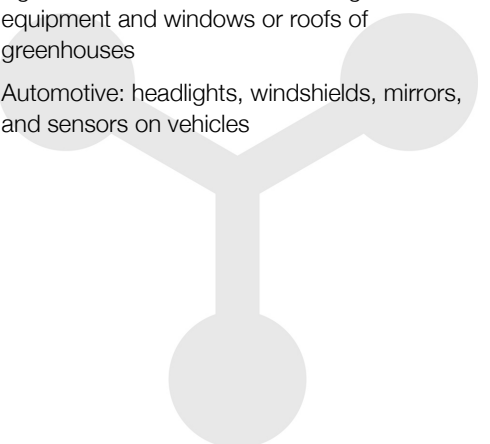
BENEFITS

- Energy savings and enhanced safety: Operates at half the voltage of current EDS technologies.
- High performance: Demonstrated over 90% dust removal efficiency.
- Manufacturing scalability: Vapor deposition process enables large scale manufacturing.
- Versatility: Applicable to a wide range of transparent surfaces including solar cells, glass, and other materials.

APPLICATIONS

The technology has several potential applications:

- Aerospace: solar cells, windows for spacecraft and stations, or spacesuit visors
- Terrestrial power: solar farms and rooftop solar panels
- Architecture: building windows
- Agriculture: windshields on farming equipment and windows or roofs of greenhouses
- Automotive: headlights, windshields, mirrors, and sensors on vehicles

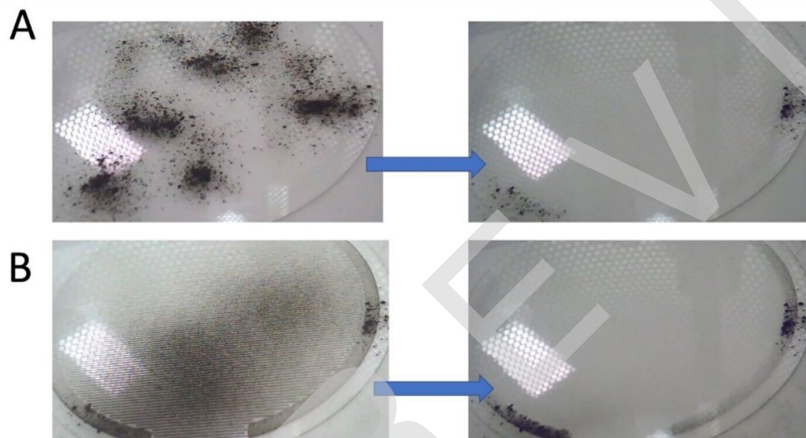


THE TECHNOLOGY

The new transparent EDS technology is lighter, easier to manufacture, and operates at a lower voltage than current transparent EDS technologies. The coating combines an optimized electrode pattern with a vapor deposited protective coating of SiO₂ on top of the electrodes, which replaces either polymer layers or manually adhered cover glass (see figure on the right). The new technology has been shown to achieve similar performances (i.e., over 90% dust clearing efficiency) to previous technologies while being operated at half the voltage.

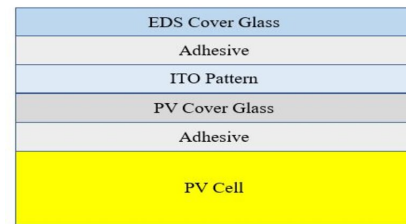
The key improvement of the new EDS coating comes from an innovative method to successfully deposit a protective layer of SiO₂ that is much thinner than typical cover glass. Using vapor deposition enables the new EDS to scale more successfully than other technologies that may require more manual manufacturing methods. The EDS here has been proven to reduce dust buildup well under vacuum and may be adapted for terrestrial uses where cleaning is done manually. The coatings could provide a significant improvement for dust removal of solar cells in regions (e.g., deserts) where dust buildup is inevitable, but water access is limited. The EDS may also be applicable for any transparent surface that must remain transparent in a harsh or dirty environment.

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



Examples of the EDS actively removing the dust from glass surfaces under vacuum when dust is placed by (a) a brush and (b) by a vacuum dust deposition system.

Conventional EDS



New EDS

Schematics showing the layer stack of the new EDS compared to conventional transparent EDS coatings.

technology.nasa.gov

More Information

National Aeronautics and Space Administration
Agency Licensing Concierge
Kennedy Space Center
MS LASSO-012
Kennedy Space Center, FI 32899
202-358-7432
Agency-Patent-Licensing@mail.nasa.gov
www.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-14465, KSC-TOPS-99



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-14530 Capacitive Micro-Gravity Fluid Mass Gauge**, 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

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