



Phase-0 Program Solicitation

SC EPSCoR Solicitation Number 9-2024

A. Phase-0 Program Information

The goal of the Phase-0 Program is to encourage and support South Carolina small businesses in their proposal development activities to compete effectively for SBIR and STTR Federal funding. Phase-0 proposals can focus on either ADAPT in SC research priorities or the Vision 2030 SC Science and Technology Plan.

- The vision of “*AI-Enabled Devices for the Advancement for Personalized and Transformative Health Care in South Carolina*” is to build research capacity at the nexus of Artificial Intelligence (AI), life and social sciences, and bioengineering through fundamental research, education, workforce development, and industry engagement.
- The Vision 2030 SC Science and Technology Plan states “*Future growth of science – and technology-intensive companies and industries in South Carolina requires workers with S&E (Science and Engineering) degrees (Associate through Doctoral level), especially computer science, engineering, and data science, in addition to physical and life science degrees. This requires strong K-20 STEM education, including applied experiences, for all South Carolinians to ensure a robust workforce talent pipeline*”.

ADAPT in SC Research Priorities

Proposals may address one or more of the research themes of ADAPT in SC:

- **Biomedical AI** - Biomedical AI is an emerging interdisciplinary field where innovations sprout new theories, models, and algorithms in AI and data science and in synergistic integration of AI with targeted biomedical devices and their downstream applications in complex biomedical settings. Proposals on this topic will conduct research related to the development of theoretical foundations of biomedical AI, AI-ready data acquisition and preprocessing, multimodal data fusion technologies, deep learning algorithms, physics-informed ML models, and software tools to facilitate the use of mechanistic and AI models, sometimes with limited amounts of data.
- **XAI-enabled Biomedical Devices for Diagnostic and Planning Applications.** Explainability is crucial to rationalizing and cross-checking model outcomes to ensure that the AI-informed decisions made are reliable and trustworthy. The major challenge to implementing AI in biomedical devices is a tradeoff between the explainability and accuracy of the AI models. Highly accurate, complex models like deep neural networks (DNNs) trained by significant amounts of data tend to be less explainable, but explainable algorithms like decision trees usually lead to low accuracy for complex tasks. As an emerging field in trustworthy AI, XAI (Explainable AI) endeavors to find explanations for complex models using ante hoc or post hoc methods. Ante hoc methods address

explainability from the beginning, whereas post hoc methods rely on an external explainer of an already trained model. Proposals on this topic will use XAI to improve the explainability of the diagnostic or treatment decisions made from multimodal clinical data to provide insights into important causal factors and to obtain domain experts' trust, high prediction accuracy, and safe, continuous workflows from initial diagnosis to treatment end.

- **DL-Imaging Model-Enabled Biomedical Devices for Personalized Prognostic and Treatment Applications.** Novel DL (Deep Learning) techniques are needed to actualize high-performance biomedical devices for prognosis and/or treatment. Current devices for these purposes depend on multiple data sources to make the final treatment decision, directly guide the treatment, or implement the treatment. Constructing a model that can effectively integrate multimodal data remains a challenge. Moreover, in many applications, there are limited human samples (e.g., patients) from whom the data can be collected, not to mention the limited number of samples that clinical experts can effectively annotate. Building high-performance DL models from a limited amount of data is critical for the successful development of AI-enabled biomedical devices. Furthermore, the data collected by different investigators, labs, and instruments have an inherent bias. The ability to generalize DL models constructed from limited data sources to many application scenarios determines whether the AI-enabled medical devices can be effectively applied to a general group. Additionally, current clinical practice seeks to leverage big data repositories collected over many years while still tailoring treatment for individual patients. Therefore, developing DL models for medical devices is different from training DL models in general image or text classification, where a large amount of training data is available. The ADAPT in SC will focus on innovation in the DL models and training data processing. Proposals in this area will conduct fundamental research on creating DL models for AI-enabled biomedical devices for prognosis and/or treatment from limited data. Currently, there is a lack of expertise in foundational DL research in CRUs in SC. Thrust 2 aims to advance the field of AI-enabled medical devices for prognosis and/or treatment. The primary outcome of this thrust will be fundamental knowledge that governs generating high-performance, generalizable DL algorithms from limited data.
- **DT-Enabled Biomedical Devices for Rehabilitation and Therapy.** Rehabilitation is an important process for patients to optimize recovery following medical treatment. Today, for a given medical problem, there is a host of rehabilitation procedures and methods. However, determining the best or most suitable rehabilitation method for a given patient is difficult. Likewise, medical treatment of chronic diseases such as diabetes and cancer or rapidly developing ones such as sepsis requires physicians and patients to navigate through a sea of treatment pathways to identify the one suitable for the individual patient. An overarching scientific challenge is developing a system for an individual patient so that various available rehabilitation treatment regimens or active medical treatment pathways can be monitored and analyzed, and the outcome inferred. The use of AI-enabled digital twins (DTs) can be a viable solution. A DT is a virtual representation of an object or system that spans its lifecycle; it synced with the real system in real-time and uses simulation to analyze and forecast the future state, ML, and causal analysis to aid decision-making and design of the patient-specific treatment pathway. An AI-enabled rehabilitation DT would be an ideal platform for clinicians to design an optimal rehabilitation strategy for a specific patient to realize a personalized treatment pathway. For diabetes, cancer, or septic patients,

a DT can provide an intelligent assistant for the physician and patient to develop and optimize the treatment pathway dynamically. For the elderly and less serviced communities, DTs would provide additional AI-enabled, user-friendly instructional materials and devices.

Vision 2030 South Carolina Science and Technology Plan

Proposals may address one or more of the high-priority research areas and target industry sectors identified in [*Vision 2030 South Carolina Science and Technology Plan*](#). In this document, four high-priority research areas were identified: AI, Machine Learning, and Data Science; Advanced Materials; Systems Engineering; and Precision Biology.

- **Data science** is the collection, preparation, and analysis of data for visualization, decision making, and prediction. **AI** is a field that combines computer science and data science to interpret historical data, recognize patterns, and make predictions the way humans do. **Machine learning** is a subdiscipline of AI that draws on statistics and algorithms to provide models for learning and processing data autonomously without human intervention.
- **Advanced materials** are materials that are specifically engineered to exhibit novel or enhanced properties that confer superior performance relative to conventional materials.
- **Systems engineering** is an interdisciplinary field of research which takes a holistic view in the design, integration, and management of complex systems.
- On the human health side, **precision biology** is focused on tailoring disease prevention, diagnosis, and treatment to differences in genes, environment, and lifestyle. On the agricultural and environmental side, **precision biology** is focused on collecting and analyzing data about the soil, water, air, and microorganisms to inform decisions about crops, forestry, and water management.

The four high-priority research areas build on existing competitive advantages or will hold other research areas back if not further developed, align with federal agency funding priorities, and align with global technology trends. They represent new opportunities or a competitiveness threat depending on how quickly South Carolina companies adopt them.

Vision 2030 identified four target industry sectors: Advanced Manufacturing; Human Health Life Sciences; Information Technology; and Clean Tech, Sustainability, and Resiliency. Manufacturing is South Carolina's largest industry sector and spans food and beverage to automobile production. Advanced manufacturing refers to those industry segments with high R&D intensity (e.g., computer, electronics, optics, aerospace, pharmaceutical manufacturing) and medium-high R&D intensity (e.g., automotive, chemical manufacturing). Human health life sciences spans drugs, pharmaceuticals, biologics, medtech, testing and medical labs, and healthtech. Information technology includes computers, semiconductors, and related electronics manufacturing and software development, computer systems design, enterprise solutions, and network security. Clean tech, sustainability, and resiliency spans products and services that reduce emissions, improves energy efficiency, generate clean and renewable energy, improve management of waste and waste by farms, homes, offices, and industry; and

engineer more resilient and environmentally friendly buildings, transportation, and agricultural systems. The Figure below shows the high-priority research areas and their relation to the target industry sectors (taken from Vision 2030).

	ADVANCED MANUFACTURING	HUMAN HEALTH LIFE SCIENCES	INFORMATION TECHNOLOGY	CLEAN TECH, SUSTAINABILITY, AND RESILIENCY
AI, Machine Learning, Data Science	Autonomous vehicles	AI-assisted robotic surgery	Website chatbot	Power grid management
Advanced Materials	Composites and coatings	Orthopedic biomaterials	Semiconductors	Electric-vehicle batteries
Precision Biology	Synthetic biology	Immunotherapy	Wearable devices	Precision agriculture
Systems Engineering	Digital twins	Health care delivery	Network security	Connected transportation systems

B. Award Information

Maximum Funding Amount Per Award: \$10,000.00

Maximum Funding Amount for Undergraduate Student Internships: \$3,000.00

Award Duration: 12 months

Estimated Number of Awards: Depends on quality of proposals and available funds.

Anticipated Project Start Date: Monday, February 3, 2025

C. Eligibility

- Eligibility for Phase-0 funds is limited to South Carolina-based small businesses that are American-owned, for-profit, and registered with the South Carolina Secretary of State.
- If the proposing entity is more than 50% owned by another entity or entities, the majority owner(s) will be considered the proposing entity and is subject to the basic qualifications and consideration rules as outlined in the solicitation.
- Former SC EPSCoR Program Seed Funding PIs (e.g., GEAR, GEAR CRP, SAN, Phase-0) who did not submit final project reports to the SC EPSCoR State Office are not eligible to apply.
- **Note:** If the proposing entity has received a previous Phase-0 award, then the proposing entity will need to provide evidence of the outcome from the Phase-0 award in their proposal submission in the form of the official notification from a federal agency that the SBIR/STTR proposal was submitted or awarded. This must be included item number 4 of Section E below.

D. Deadline

Full Proposal – Monday, December 2, 2024 – 5:00 PM EST

E. Full Proposal Content

The sections below represent the body of the proposal. Failure to submit the required sections will result in the proposal not being accepted or being returned without review. *Note: Where indicated, the number of pages refers to the maximum number of pages allowed and must not be exceeded. Proposal Format: Use 1"-inch margins, Times New Roman, and font size not smaller than 10 or larger 12.*

1. Proposal Cover (2 Pages)

Use the Proposal Cover form in Appendix A.

2. Project Summary (1 Page)

Proposals must contain an NSF compliant project summary not to exceed one page in length. The Project Summary consists of a) an overview, b) statement on the intellectual merit of the proposed activity, and c) a statement on the broader impacts of the proposed activity. The overview includes a description of the activity that would result if the proposal were funded and a statement of objectives and methods to be employed. The statement on intellectual merit should describe the potential of the proposed activity to advance knowledge. The statement on broader impacts should describe the potential of the proposed activity to benefit society and contribute to the achievement of specific, desired societal outcomes. The Project Summary should be informative to other persons working in the same or related fields, and, insofar as possible, understandable to a broad audience within the scientific domain. It should not be an abstract of the proposal.

Describe the potential outcome(s) of the proposed activity in terms of a product, process, or service. Briefly describe the technical hurdle(s) that will be addressed by the proposed R&D, the goals of the proposed R&D, and a high-level summary of the plan to reach those goals. Discuss the expected outcomes in terms of how the proposed project will bring the innovation closer to commercialization under a sustainable business model. Briefly describe the potential commercial and market impacts that such a commercialization effort would have if successful and, if appropriate, potential broader societal impacts of the innovation.

3. Project Description (6 Pages Maximum)

The Project Description should clearly articulate its relation and applicability to the ADAPT in SC research priorities or the SC Science and Technology Plan. The Project Description section should have the following sections:

a. Objectives of the Proposed Work and Relevance

State the objectives of the proposed work, its significance, and how it relates to the ADAPT in SC research priorities or SC Science and Technology Plan outlined in the Program Objectives section.

b. Prior Relevant Research

Describe previous research relevant to the proposed work. This should not be limited to the work done by the business, or the investigators associated with the proposal. A description of the current need in the marketplace, anticipated target market, and how the innovation will address market needs should be included, along with a summary of the competitive landscape (e.g., how does the research innovation compare with competition currently on the market or in development).

c. Research and Development Plan

- Describe the business including R&D activities, current and previous commercial technologies, IP held by the business or its principal investigators, and the management structure. Also describe plans for administering the Phase-0 award.
- Describe the proposed research innovation and its applicability to the targeted SBIR/STTR solicitation(s). Include scientific explanation and how the proposed technology will satisfy the related requirements. If pursuing an SBIR/STTR Phase-1, provide description of the planned feasibility study to be undertaken during the Phase-1 award.

d. Timeline for Implementing Proposal Activities Chart

Include a timeline for implementing proposal activities. Describe each major proposal activity and identify the quarters during which the proposed activity will be conducted. Each activity must list the name(s) of the party responsible for completing the activity. Employ the chart template below immediately after the General Research Plan section. Add or delete rows as needed.

Activity	Year 1			
	Q1	Q2	Q3	Q4

4. Results from Prior SC EPSCoR Support (1 Page per Award)

Note: If the senior personnel have not received support from SC EPSCoR, include a statement to the effect. The purpose of this section is to assist reviewers in assessing the quality of prior work conducted with current or prior SC EPSCoR Program funding. If the PI on the proposal has received an award as PI from the SC EPSCoR Program since January 1, 2020, the following information must be provided:

- Title of the project, start date, date completed, and award amount.
- Summary of the results of the work completed, including accomplishments, supported by the award.
- Provide a copy of the SBIR/STTR proposal submission that was supported by the previous SC EPSCoR Phase-0 award. The copy of proof of the SBIR/STTR proposal submission should be included with the above information as a single PDF file. This evidence/documentation is in addition to the one-page limit.

If the project was recently awarded and therefore no new results may exist, briefly describe the proposed work.

5. References Cited

Reference information is required. Each reference must include the names of all authors (in the sequence in which they appear in the publication), the article and journal title, book title, volume number, page numbers, and year of publication.

6. Biographical Sketch

A biographical sketch is required for the PI and Co-PI in NSF format. **Please note** the new NSF Biographical Sketch format effective May 20, 2024. For more information on NSF format, visit <https://new.nsf.gov/funding/senior-personnel-documents#biographical-sketch-0bd>. Biographical Sketch must be created and certified in [SciENCv](#) (Science Experts Network Curriculum Vitae).

7. Synergistic Activities (1 Page)

A one-page Synergistic Activities document is required for the PI in NSF format. **Please note** the new NSF Synergistic Activities format effective May 20, 2024. For more information on the Synergistic Activity format, visit <https://new.nsf.gov/funding/senior-personnel-documents#synergistic-activities-ec2>

8. Budget

Use the Budget forms in Appendix B.

9. Budget Justification (2 Pages)

The budget justification must be composed of no more than two pages and must include the following sections:

- Senior Personnel
- Other Personnel
- Fringe Benefits
- Materials and Supplies
- Equipment
- Domestic Travel Support
- Other Direct Costs

10. Current and Pending Support

The PI and Co-PI must submit Current and Pending Support in NSF format. **Please note** the new NSF Current and Pending Support format effective May 20, 2024. Current and Pending Support must be created and certified in [SciENCv](https://new.nsf.gov/funding/sciencv) (Science Experts Network Curriculum Vitae). For more information, visit <https://new.nsf.gov/funding/senior-personnel-documents#current-and-pending-other-support-5db>

11. Letter of Support (Two Letters Maximum per Proposal)

Letters of Support with specific commitments from organizations that will provide resources for the project may be submitted with the proposal. Examples may include commitments to collaborate on one or more aspects of the project; share data or facilities; or provide organizational support for specific activities stated in the proposal.

12. SBIR/STTR Federal Solicitation being Pursued.

Proposals must contain *a complete PDF copy of each targeted SBIR/STTR Federal solicitation* identified in the proposal as the solicitation being pursued if a Phase-0 award is made. This must be downloaded from the federal agency website and then uploaded with the Phase-0 proposal. ***SBIR/STTR Federal proposal submission dates must be on or after March 1, 2025. Due dates prior to March 1, 2025 are non-negotiable.***

F. Budget Information

Funding for the Phase-0 Program is intended to support proposal development activities and not intended to support small business infrastructure.

- The Phase-0 Program is a cost-reimbursement program and awardees will be reimbursed for ***paid expenses NOT incurred expenses***. Small business infrastructure costs are not supported by this program. Therefore, the following costs are unallowable:
 - Computers, laptops, printers, software that is not project specific.
 - Rent for office space, utilities, facility maintenance, membership fees, etc.

- The budget requested *may not exceed \$10,000.00 per proposal*.
- Total salaries, wages, and fringe benefits requested for all project personnel (Section A, B, and C on budget page) may not exceed \$2,500.00 of the total Phase-0 budget requested.
- Total salaries plus consultant fees may not exceed 50% of the total budget requested.
- Travel support is allowed only to SBIR/STTR Conferences and to meetings with Project Officers at Federal Agencies. Travel expenses may be claimed only for the PI and Senior Personnel listed in the proposal. Reimbursement for travel expenses including per diem, mileage, lodging, and transportation will be in accordance with SC EPSCoR policy on domestic travel support posted on the SC EPSCoR website at [Travel Policy](#).
- Funding can also be allocated to grant writing service, preliminary data collection, USPTO patent and trademark fees, legal fees relating to patent and trademark fees, prototype development, and materials and supplies.
- Indirect costs are not allowed.
- Awardees must ensure that costs claimed under SC EPSCoR Program grants are allowable, allocable, and reasonable.

G. Submission Instructions

PIs should submit their proposals via the SC EPSCoR Portal at <https://scepacor.org/Solicitations/portal/>.

H. Proposal Review Process

Proposals will undergo two levels of review:

- a. Administrative Review. This review will determine which proposals will advance to the next level of review. This review is based on the whether the submitted material is complete and the current SC EPSCoR forms are used. Proposals that do not pass the Administrative Review will not be considered for funding.
- b. Proposal that successfully pass the Administrative Review will be sent to external evaluators for review based upon the following:
 - The proposal's technical merit and its relevance to the ADAPT in SC research priorities or the SC Science and Technology Plan.
 - The extent to which the proposed activity suggests innovative and creative concepts.
 - How well conceived and planned is the proposed activity.
 - The potential of success in executing the proposed activities.
 - The potential that the project will lead to SBIR/STTR funding.

I. Award and Reporting Requirements

- The SC EPSCoR State Office reserves the right to conduct site visits during the project period for evaluation and reporting purposes.
- Awardees are expected to provide required information and documentation to the SC EPSCoR State Office staff and External Evaluator as needed.

- A final project report will be due no later than 60 days after the end of the award.
- Projects with student interns will be required to include student demographic information and a 1-page PDF report from the student intern about their internship experience.
- Since this is a proposal development program, a copy of every SBIR/STTR Federal submission confirmation page identified in the proposal must be submitted to the SC EPSCoR State Office. If the submission to the federal agency results in an SBIR/STTR award, a copy of the Notice of Award must be submitted to the SC EPSCoR State Office.

J. Contact Information

General inquiries regarding this program should be made to:

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