

**. Innovation[X] 2021-2022 Proposal Application**

The School of Innovation and Innovation Partners are calling for proposals for the next round of our Innovation[X] Program, which provides grants that allow multidisciplinary teams of faculty, undergraduates, graduate students, and postdocs to work together to address complex real-world challenges.

Faculty may apply for grants of up to **\$20,000** to facilitate year-long projects. The number of grants to be awarded will depend on funding and application levels. Funding begins September 1, 2021.

Additionally, we have partnered with the Mays Innovation Research Center to fund a set of proposals to study the process of innovation itself. Successful proposals for this subset will pursue topics such as, barriers to or preconditions for innovation, the effects of law and policy on innovation, the behavior or psychological requirements for innovation, innovation and health, the social impacts of innovation, international comparisons of innovation, or novel measurements of innovation.

Proposals are due by 11:59 PM on our **newly extended** deadline of **February 22, 2021** and must be submitted using this online form.

NOTE - Only one team leader/faculty member needs to submit a proposal for a given project.

Reminder of Requirements:

- Teams must consist of an interdisciplinary set of faculty members, and must include two (2) faculty members from different colleges/schools.
- Teams must include a multidisciplinary team of 10-20 students, both undergraduate and graduate, from across the university.
- At least 8-10 of these students must be undergraduates.
- The team must include students from at least two (2) different colleges/schools.
- Students must participate in the project for both Fall 2021 and Spring 2022 semesters, with limited exceptions.
- Proposals should demonstrate a team-based approach to a complex problem and include meaningful deliverables.

Please contact Assistant Director Emily Finbow at [innovationx@tamu.edu](mailto:innovationx@tamu.edu) or 979-862-6071 with questions.

. For which tracks would you like your proposal to be considered?

- Track A - Traditional Innovation[X] Project
- Track B - Special Track - "Process of Innovation" Innovation[X] Project
- Both Track A and Track B

. Project Title

Accelerating Electron Beam Technology Adoption by Empowering Entrepreneurs

. Please provide the following information for the Primary Point of Contact for the Project (Project Leader)

. Prefix

Prof

. First Name

Suresh

. Last Name

Pillai

. Email Address

s-pillai@tamu.edu

. Phone Number

979.458.3229

. Gender Identity

- Man
- Woman
- Trans Man
- Trans Woman
- Genderqueer
- Non-Binary/Gender non-conforming
- Not listed above, please specify
- Prefer not to respond

. Ethnic and Racial Identity

- Hispanic/Latino/a/x
- American Indian or Alaska Native
- Asian/Pacific Islander/Desi-American
- Black/African American

- White
- Bi-racial / Multi-Racial (please specify):
- Not listed (please specify):
- Prefer not to respond

. *Project Information*

. Please provide brief background/context for the issue this project seeks to address. (2,000 character maximum)

Electron beam (eBeam) and X-ray technologies are critically important because the ionization radiation they generate can be used for sterilization, pasteurization, and cross-linking polymers. Sterilization, pasteurization, and polymer cross-linking technologies are critically important for the medical device, pharmaceutical, biotechnology, automotive, and food processing industries. Approximately 300 pharmaceutical/medical device/biotechnology companies are spread across Texas, contributing approximately \$54 billion to the state's economy. The automotive and the food processing industries in Texas jointly contribute approximately \$33 billion to the economy. Yet, there is NOT ONE commercial eBeam or X-ray service provider in Texas. These industries have to ship their products out of state for these services, or substitute these technologies with other costly or inefficient technologies. There is, therefore, a highly lucrative business opportunity for entrepreneurs to design, build, and operate eBeam and X-ray service centers all across Texas to cater to industries. In some instances, these technologies may be needed in-line within the manufacturing process, in some instances, the technology may be needed at the end of the manufacturing process, or at times, the products could be shipped to a commercial eBeam/x-ray service facility within a few hours driving distance. Therefore, there is a need for highly technical and specific information that will be of value to entrepreneurs who are interested in entering this market and investing in eBeam and X-ray technology -based businesses. The State of Texas has financial and other incentive plans that could be leveraged by entrepreneurs. TAMU's National Center for Electron Beam Research (NCEBR) at TAMU is the world leading authority on the commercial adoption of these technologies. In this project, NCEBR will develop resources to empower innovative entrepreneurs to build lucrative eBeam/X-ray technology businesses in Texas

. What are the goals for this project? (5,000 character maximum)

The goal of the project is to prepare a comprehensive 5-to-10 year technology and business development roadmap that will empower entrepreneurs to invest in electron beam (eBeam) and X-ray technology businesses in Texas. The specific objectives of the proposed project are to 1) Identify the current and future markets for eBeam and X-ray services based businesses across Texas, 2) Identify the technology configurations (in-line/end of line/in-house/commercial service facility) that these different industries need in their manufacturing processes, 3) Identify the technical specifications for the eBeam and X-ray equipment for each of these different configurations 4) Identify the possible commercial vendors for the equipment to meet the specific configuration (in-line /in-house/3rd party service provider), 5) Identify the ideal geographical locations and logistical considerations for siting these eBeam/X-ray facilities /service centers across Texas, 6) identify the equipment capital costs and operating costs for building and operating eBeam/X-ray businesses in Texas, 7) Identify the economic incentive programs that are available to entrepreneurs in invest in such businesses in Texas, 8) identify the financial and capital resources available for investing in such technologies in Texas, and 9) identify the "opportunity zones" that are available in Texas as part of the State of Texas' economic development and job creation program . A collateral goal of this project is to expose 16 TAMU students (12 undergraduate and 4 graduate students) about eBeam and X-ray technologies and highlight the business and employment opportunity in these industries. We are confident that we can impart strong highly technical experiential education about eBeam and X-ray technologies to these 15 TAMU students majoring in either business, engineering, or life sciences. Not only will the students become proficient in these technologies, but by participating in this project they will acquire a wide variety of hard and soft professional skill sets. Presently in the US, there are only two large commercial eBeam /X-ray service providers namely Steris and Sterigenics controlling about 12 eBeam/X-ray service facilities in the midwest, west coast and east coast. Besides them, there are only two other eBeam/X-ray service providers namely Steri-Tek and E-Beam Services (each of them having a single facility each). Besides a significant dearth of eBeam/X-ray capacity in the US, there is no such technology/business road-map for these technologies that is easily accessible for entrepreneurs for any region of the US let alone the world. The NCEBR at TAMU has been recognized by the USDA as the National Center for Electron Beam Research, it has been recognized by the Vienna-based International Atomic Energy Agency (IAEA) as a Collaborating Center for eBeam technology applications and more recently, has been designated by the US Department of Energy's National Center for Low Energy eBeam Research. Besides focusing on advancing fundamental and translational research in eBeam and X-ray technologies, the NCEBR major goal is advancing the commercial adoption of these technologies around the world. One of the major goals of these activities is to remove/reduce/eliminate the need to use radioactive isotopes such as cobalt-60 and cesium-137 from commercial use. Reducing commercial use of radioactive isotopes is of significant homeland security value. Therefore, providing eBeam and X-ray technologies to Texas industries rather than them having to rely on cobalt-60 for some of their applications has significant importance to the national security of this country as well.

. What are anticipated outcomes from this project? (e.g., publications, website, app, data collection for further research/grant) (2,000 characters maximum)

The primary outputs of this project will include a comprehensive, heavily referenced document that will contain all the pertinent information required by entrepreneurs who are keen on investing in eBeam and X-ray technology businesses across Texas. In addition to the hard copy document, the information will be stored on the OAKTrust digital repository at the TAMU library for posterity. Additionally, the information will be stored on a project website that will be used for collecting and curating information and displaying information for interested users and stakeholders. Besides these outputs, the other work products will include peer-reviewed research papers that focus on the study design and the data collection methods. The major outcome of this project will be the creation of multi-million-dollar eBeam and X-ray businesses across Texas catering to the pharmaceutical, biotechnology, medical, automotive and food processing industries in Texas. The long-term impact of this project will be transdisciplinary and interdisciplinary collaborations across Texas A&M University in the area of eBeam and X-ray technologies. The other outcomes will include the development of an eBeam/X-ray technology based certificate programs with instructors from the College of Agriculture and Life Sciences, Mays Business School, and the College of Engineering. As mentioned earlier, the 16 students involved in this project will develop deep technical expertise in eBeam and X-ray technologies. By virtue of their involvement in the project, there is a strong likelihood that they would find employment possibly within the new eBeam/X-ray businesses that would be created as a spin-off from this project. We are confident that this technology/business roadmap that is customized for Texas can be replicated all across the other states in the US.

. Is this proposed project an extension of existing work or a new endeavor? (1,200 character maximum)

The participating researchers on this project have successfully worked together in the past as part of the the National Center for Electron Beam Research at Texas A&M University (NCEBR). The NCEBR is a unique campus resource that is specifically focused on promoting the applications of eBeam and X-ray technologies. Some members of the team have worked in the past as part of "Just Beam it" project of the College of Veterinary Medicine and Biomedical Sciences's One-Health Program. However, this effort at developing a resource for the investor/entrepreneur community is an entirely new endeavor. The proposed project dovetails with other on-going projects we have related to expanding the adoption of eBeam and X-ray technologies across the US and around the world.

. Is Institutional Review Board (IRB) approval required for this project?

No

. *Team Participants*

. Please list all Team Leaders below (including yourself), including Prefix, Name, Title, and Department/School.

Dr. Suresh D. Pillai - Director, National Center for Electron Beam Research/Professor of Microbiology, Department of Food Science and Technology, College of Agriculture & Life Sciences  
Dr. Saurabh Biswas - Executive Director for Commercialization and Entrepreneurship, Associate Professor of Practice, Dept. of Biomedical Engineering, College of Engineering  
Dr. Neil Geismar - Center for Executive Development Professor, Dept. of Information and Operations Management, Mays Business School

. Do any of the team leaders listed above have plans for a sabbatical or other extended leave away from campus during the 2021-22 academic year? Note: Selecting "yes" will not automatically disqualify a team, but rather will indicate that we need to have a discussion with your team about the nature of the planned leave in relation to the project.

No

. Please list all Team Contributors below, including Name, Title, and Department/School. *Please exclude anyone you already listed as a Team Leader.*

. Do you plan to assign someone other than a faculty leader as a “project manager” for your team (i.e., a graduate student, postdoc, staff person)?

- Yes
- No
- Not sure yet

. What would be the ideal composition of team members for this project? What majors, disciplines, skills, backgrounds, or perspectives would you like to have on the team? (2,000 characters maximum)

We will recruit students from the College of Agriculture and Life Sciences, Mays Business School and the College of Engineering that represent the demographic profile of the university campus. We would pay special attention to make sure that we recruit students to the project who are first-generation college students and also from underrepresented groups. The project team leaders have deep expertise in the science and engineering aspects of eBeam and X-ray technology, entrepreneurship, and in operations management. We will recruit students from Engineering, COALS and the Mays Business School and the graduate students from the Interdisciplinary Master of Biotechnology Program. We will form student teams made up of individuals from these different disciplines. We will be actively seeking and recruiting students who are majoring in engineering technologies, mechanical engineering, entrepreneurship, biomedical engineering, biotechnology, food processing, and business. Each team will be tasked with collecting and generating pertinent information as it relates to each of the 9 specific objectives. To enhance trans and cross disciplinary learning, each student team will comprise students from the different disciplines. Our goal is to identify students who are willing to learn how to design and execute a systematic data collection and analysis of information, data visualization, and hone and develop their skills in oral and written communication including professional social media communications. We are hopeful that such an approach will result in an enriched learning environment for the students that will ultimately contribute to their professionalism.

. Will your team also include any external organizations or individuals as either partners, clients, study subjects, beneficiaries of the work, etc.?

For the data collection phase we will reach out to our industry contacts in the biotechnology/biomedical consortia including BioHouston, BioMedSA, BioAustin, etc. They will be involved , but not in any official capacity. We will collaborate with them to obtain specific datasets related to business information, industry hubs, etc. We will also engage with our network of entrepreneurs and investors as well as eBeam and X-ray technology providers to ensure that the information we generate is of highest caliber that can be of value in executive decision makkng. Besides tapping into our established professional networks, we will create a Linkedin account for this project as a portal to build up additional networks for potential partners, clients and stakeholders. The primary beneficiaries of this project will be the business community in Texas and elsewhere who could utilize the information to invest in and build up eBeam and X-ray based businesses. We also expect the equipment providers to utilize the information we generate to assist them in their discussions with possible investors. The project outputs could be used by regional chambers of commerce to attract investors into their region to cater to the industries that require eBeam and X-ray services

. *Travel*

. Does your proposal include travel for students beyond Bryan/College Station?

- Yes
- No
- Not sure yet

. Where would the team travel?

Not Applicable

. When do you anticipate that this travel would take place? (e.g., Fall 2021, Spring 2022, some other academic break, TBD)

Not Applicable

. Do you expect that all students selected for the team would be able to travel, or just a select number?

Not Applicable

. *Collaboration with Students*

. Ideally, how many undergraduate students would you select to participate on this team? (Numeric responses only, please)

12

. Ideally, how many graduate students would you select to participate on this team?

3

. Ideally, how many professional or doctoral students would you select to participate on this team?

1

. How will you facilitate collaborative inquiry on the team? How often and in what format will the team meet? How will you divide tasks? How you will ensure effective management of the project (e.g., appoint a student as a project manager, assign that role to a faculty leader, etc.)? (2,500 character maximum)

The project team will be divided into 3 functional teams that will focus on a) sterilization of medical devices and pharmaceuticals focus area, b) food processing industry focus area, and c) the polymer cross-linking materials application focus area. Each of these functional teams will comprise of both undergraduate and graduate students. Each team will be headed up by a Team Leader (a master's student). There will be an overall Project Student Leader (a doctoral student). Dr. Pillai will serve as the lead PI and will have overall responsibility on the project. He will be responsible for ensuring the progress of the project and the project meeting its stated objectives. He will have responsibility on the project finances and student hiring. On an operational level, Dr. Pillai will oversee the data collection and synthesis as it relates to technology needs and configurations. The Co-PI, Dr. Geismar will oversee the data collection and synthesis as it relates to business locations, and information pertaining to logistical considerations for eBeam/x-ray technology as it relates to facility locations. The Co-PI, Dr. Biswas will oversee aspects of the projects that pertain to the state financial incentive programs, and information for the investor community. Each group will be assigned specific tasks and deliverables time-lines. The student teams will be as follows: Project Student Leader (1) Medical Device/Pharma Focus Area (comprised of 5 members, one will serve as Team Leader) Food Processing Focus Area (comprised of 5 members, one will serve as Team Leader) Polymers/Materials sciences Focus Area (comprised of 5 members, one will serve as Team Leader) The different teams will meet weekly. The entire project team will meet monthly for 2-hour project team meetings. Short presentations will be expected in order to update the entire team of progress. The Team Leaders and the Project Student Leader will utilize Gantt charts and other project management tools. The PI (Dr. Pillai) will attend the weekly meetings alongwith one or more of the faculty leadership team. Project management will be assigned to the graduate students on the project. Given social distancing guidelines, the entire project team will meet virtually via Zoom. The smaller teams will meet in person. As the pandemic subsides, face to face meetings will be encouraged. The students will submit posters for the TAMU Student Research Week in Spring 2022 highlighting the project components.

. What might students gain from their participation (e.g., conducting research directly with subjects, contributing to publications, using language skills)? What unique and differentiated learning opportunities would be available for graduate students? (2,500 character maximum)

The students will benefit from this project in atleast three primary ways. Firstly, the students will obtain specific technical knowledge as it relates to eBeam and X-ray technologies, deep understanding of how these technologies are utilized in the different industries, and understanding the current challenges in not having these technologies readily available in Texas. Besides this, the students will get to understand concepts in supply chains, logistics, decisions involved in siting of eBeam/X-ray service facilities locations, determining capital and operating costs of a high technology centered business, determining the valuations of companies, concepts and first principles of venture capitalists. Secondly, the students will acquire a variety of professional skills during this project. This will include working in teams, project management, working on tangible project objectives, meeting project deliverables, and tracking project progress. The doctoral student on the project team will acquire significant experience in project management and mentoring undergraduate students. The masters level graduate students will also obtain significant experience in project management, empowering as well as mentoring undergraduate students. Thirdly, the students will gain from participating in this project by obtaining ample opportunities to develop and hone a variety of "soft skills" including working in teams, preparing technical documents, presenting technical data, data visualization, speaking with industry professionals, organizing and running meetings. There is no doubt that students on this project will definitely strengthen their presentation skills.

. *Timeline and Budget*

. Identify the timeline for the project, including start, completion and major project milestones.

*NOTE - You may use the text box or upload a table or file in the next question.*

. Timeline Upload (if needed)

[Innovation\[x\] Project timeline.docx](#)

14.9KB

application/vnd.openxmlformats-officedocument.wordprocessingml.document

. Total Budget Request (numeric response only, please). As a reminder, the maximum amount that can be requested is **\$20,000**.

\$19,296

. You may upload a budget table here encompassing the categories below, or you may complete the fields below through this form as applicable.

For each item listed below or on your budget table upload, please enter both dollar amount and any relevant notes/justification.

. GRADUATE OR RESEARCH ASSISTANTSHIP (PHD) (*Suggested range: \$15-18/hour; note: RAships for students in graduate school should include costs for tuition remission and fees*)

\$ 0. The doctoral student who will serve as the Project Student Leader will be supported by the PI's other grant support. The student will include this project as part of his/her dissertation research. This student will not be supported on these project funds

. RESEARCH ASSISTANTSHIP (*Suggested range: \$12-15/hour*)

\$ 0. The 3 Masters students who will contribute their time to this project will include this project as part of their thesis research. These students will not be directly supported on this project. We will find other funds to support them.

. INSTRUCTION (Teaching) - PHD STUDENT

. POST-DOCTORAL OR STAFF EFFORT

. UNDERGRADUATE STUDENT STIPEND OR WORK STUDY (*Suggested range: \$11-14/hour*)

Undergraduate students : 6 @ \$11/hour for 15 hours per week for 15 weeks = \$15,296 (\$14,850-stipend + \$ 446-fringe). Out of the 12 undergraduate students, 6 will be supported in Fall 2021, and the other 6 students will be supported in Spring 2022 semester. In the semesters the students are not being financially supported they will earn 3 undergraduate research credits for their participation.

. INSTRUCTIONAL, RESEARCH OR OFFICE SUPPLIES

. COMPUTERS AND MINOR EQUIPMENT



. TRAVEL - DOMESTIC

. TRAVEL - INTERNATIONAL

. CONTRACT WORK

. MEETINGS - BUSINESS

. OTHER - MISC.

. Please briefly note below any other sources of project funds. *(Projects that match or leverage additional funds are strongly encouraged. Please note any such funds, awarded or proposed, here so that we understand the comprehensive outlay for the project.)*

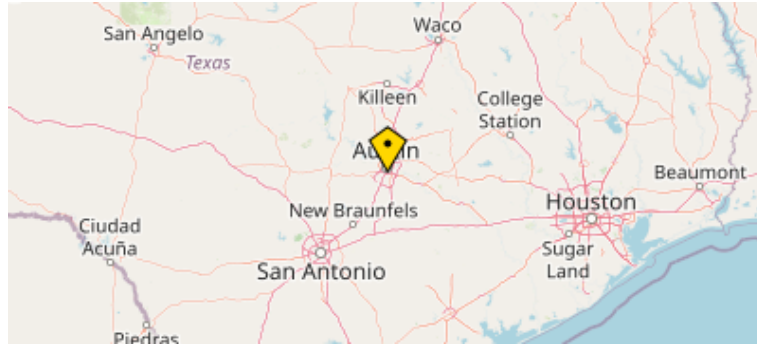
The PI currently has over \$ 2 million in external research funding that in one or another pertains to eBeam and X-ray technologies. Even though none of these funds have been specifically earmarked to this project, the effort on the projects (especially the PI time) will benefit the proposed project

. Please name a Unit/Business Manager who could administer funds for project, if requested. Include their name, email address, and phone number:

**Location Data**

**Location:** ([30.230392456055](#), [-97.724296569824](#))

**Source:** GeolIP Estimation



# Accelerating Electron Beam Technology Adoption by Empowering Entrepreneurs

## Project Timeline with Key Deliverables

**Student recruitment for project – Summer 2021**

**Project Kick-Off – August 30, 2021**

**Project Teams Finalized and Student Project/Team Leaders Chosen: September 8<sup>th</sup>**

Deliverables	Description	Time-Line (months)			
		1-3	4-6	7-9	10-12
Deliverable # 1	Identify the current and future markets and market sizes for the eBeam and X-ray services- based businesses across Texas				
Deliverable 1a	Data and information review and verified report				
Deliverable # 2	Identify the specific steps where these technologies are needed in the manufacturing steps in these different industries				
Deliverable 2a	Data and information review and verified report				
Deliverable #3	Identify the technical specifications for the required eBeam and X-ray equipment to address the present and emerging needs				
Deliverable 3a	Data and information review and verified report				
Deliverable # 4	Identify the optimal configuration for the equipment (in-line /in-house/3rd party service provider) for the different applications of these technologies				
Deliverable 4a	Data and information review and verified report				
Deliverable # 5	Identify the ideal locations and logistical considerations for siting these eBeam/X-ray facilities /service centers across Texas				
Deliverable 5a	Data and information review and verified report				
Deliverable # 6	Identify the economic incentive programs available in Texas				
Deliverable 6a	Data and information review and verified report				
Deliverable # 7	Identify the “opportunity zones” that are available in Texas				
Deliverable 7a	Data and information review and verified report				
Deliverable # 8	Final Project Report				