

The DOE Nuclear Physics SBIR/STTR Program

SBIR/STTR Exchange Meeting
August 13-14, 2019
Gaithersburg, MD

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Outline

- DOE SBIR/STTR goals, organization, and administration
 - The Sequential Phase IIA and IIB awards
- The Nuclear Physics (NP) and DOE Isotope Program Missions
 - Executing these missions within the NP SBIR/STTR program
- Exchange meeting goals and agenda
- NP SBIR/STTR Applications and Grants (FY 2019)
- NP SBIR Topics/Subtopics
 - How are they developed
- The DOE NP SBIR/STTR Program in FY2020
 - New funding levels
 - Commercialization and outreach efforts
- Presentation Notes
- Expectations for Professional Conduct
- Conclusions

SBIR/STTR Program

SBIR: Small Business Innovation Research **STTR:** Small Business Technology Transfer.

- **SBIR:** Set-aside program for U.S. small businesses (SB) to engage in Federal Research and Development (R&D) with potential for commercialization. (Participations: **SB: minimum 66 % for Phase I and 50% for Phase II, Research Institution (RI): optional**)
- **STTR:** Set-aside program to facilitate cooperative R&D between SB and U.S. RI with potential for commercialization. (Participations: **SB: minimum 40%, RI: minimum 30%**)
- **“Both”:** submitted for consideration as SBIR or STTR (both). Must satisfy the minimum participation requirements listed above for both SBIR and STTR.
- Congressionally-mandated programs, funded by a small percentage of the extramural R&D budget set aside within each DOE technical program that participates.
- **2016 reauthorization bill has provided funding for the program until September 2022**

	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019	----	FY2022
SBIR	0.028	0.029	0.030	0.032	0.0320	0.0320	----	0.0320
STTR	0.004	0.0045	0.0045	0.0045	0.0045	0.0045	----	0.0045
Total	3.20%	3.35%	3.45%	3.65%	3.65%	3.65%	----	3.65%



The DOE SBIR/STTR Phases (FY19)

PHASE I: FEASIBILITY, PROOF OF CONCEPT

- Award Amount: \$150,000 (guideline), \$225,000 (max.)
- Project Duration: 12 months



PHASE II: CONTINUE R/R&D FOR PROTOTYPES OR PROCESSES

- Award Amount: \$1,000,000 (guideline), \$1,500,000 (max.)
- Project Duration: 2 years



SEQUENTIAL PHASE IIA OR IIB: CONTINUE R/R&D FOR PROTOTYPES OR PROCESSES

- **PHASE IIA:** FOR CERTAIN PROTOTYPES, PRODUCTS, OR PROCESSES THAT NEED MORE DEVELOPMENT
- **PHASE IIB:** FOR R&D FUNDING REQUIRED TO TRANSITION AND/OR INNOVATION TOWARDS COMMERCIALIZATION.
- Award Amount: \$1,000,000
- Project Duration: 2 years



PHASE III: COMMERCIALIZATION

- Federal or Private Funding (non-SBIR/STTR funds)
- No dollar or time limits



- New Sequential Phase IIC to help increase commercialization potential



Phase I Funding Opportunity Announcements Participating DOE Programs (FY 2019)

Phase I Release 1

- Office of Advanced Scientific Computing Research (ASCR)
- Office of Basic Energy Sciences (BES)
- Office of Biological and Environmental Research (BER)
- **Office of Nuclear Physics (NP)**

Phase I Release 2

- Office of Cybersecurity, Energy Security, and Emergency Response (CESER)
- Office of Defense Nuclear Nonproliferation (NA)
- Office of Electricity (OE)
- Office of Energy Efficiency and Renewable Energy (EERE)
- Office of Environmental Management (EM)
- Office of Fossil Energy (FE)
- Office of Fusion Energy Sciences (FES)
- Office of High Energy Physics (HEP)
- Office of Nuclear Energy (NE)

FY19 SBIR/STTR award funding levels and requirements on Research Institution participation

Phase I

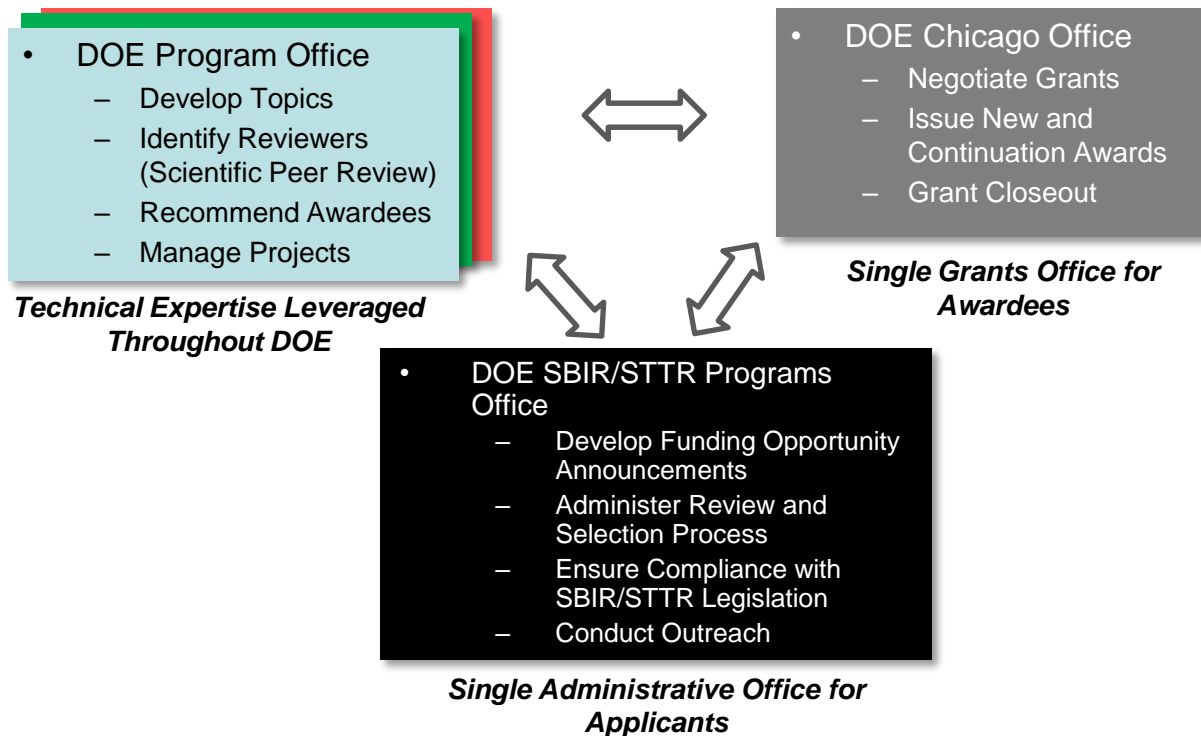
Grant	Max award (\$k)	Small Business (Level of Effort)	Research Institution (Level of Effort)
SBIR	150	Min 66%	Optional
STTR	150	Min 40%	Min 30%

Phase II

Grant	Max award (\$k)	Small Business (Level of Effort)	Research Institution (Level of Effort)
SBIR	1000	Min 50%	Optional
STTR	1000	Min 40%	Min 30%

Beginning in FY20 Phase I amounts will be \$200k and Phase II will be \$1100k. Participation requirements are the same.

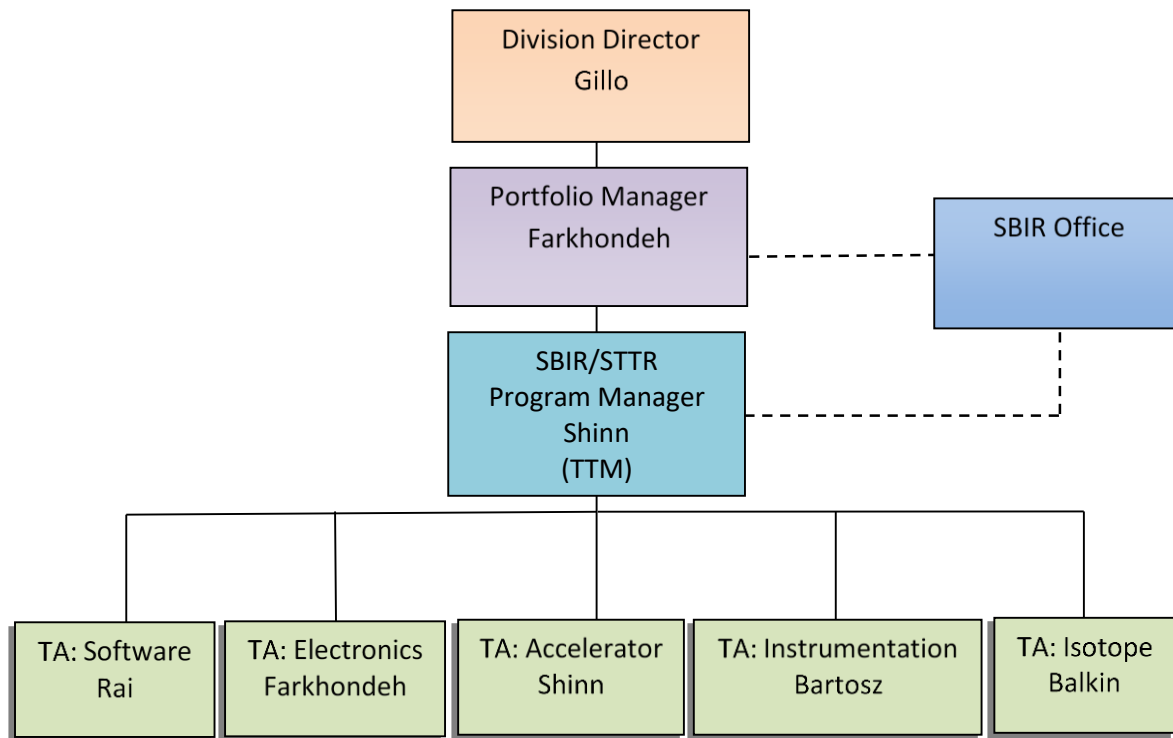
Operation of the DOE SBIR and STTR Programs



- NP recommends what R&D gets funded, but is otherwise freed of much of the administration of those funds.



NP SBIR/STTR Org. Chart 10/01/2018



Technical Topic Manager (TTM)

Activities

- Communicate w/ SBIR Office
- Prepare annual solicitation
- Chair 1st step panel review
- Organize & Chair Exchange Meeting
- Rank proposals
- Recommend funding
- Visit companies
- Read progress and final reports
- 2nd year continuation

Topic Associate (TA)

Activities for Assigned Topics

- Provide input to annual solicitation
- *Assign reviewers
- *Assess proposals
- Manage assigned grants
- Read reports assigned

*Time Sensitive tasks



Sequential II A and IIB

2012 SBIR/STTR Reauthorization permitted agencies to issue **sequential Phase II awards**

- 15 USC 638 (ff) Additional SBIR and STTR awards. (1) Express authority for awarding a sequential Phase II award. A small business concern that receives a Phase II SBIR award or a Phase II STTR award for a project remains eligible to receive 1 additional Phase II SBIR award or Phase II STTR award for continued work on that project.
- Only Phase II awardees are eligible
- Only 1 additional Phase II award may be made per Phase II project

Invitation needed → **Phase IIA:** For certain prototypes, products, or processes that need more than a single Phase II award. Starts immediately upon completion of the Phase II.

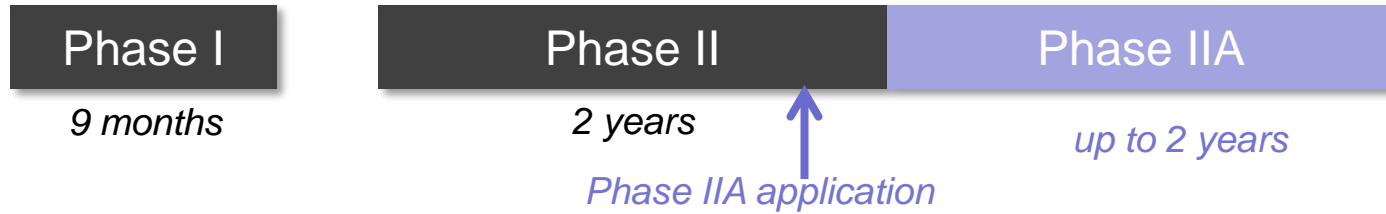
- *DOE NP Program Managers will select the topics/subtopics for which Phase IIA applications will be accepted (By subtopic invitation only)*

No Invitation needed → **Phase IIB:** For R&D funding required to transition an innovation towards commercialization. Starts immediately after completing a Phase II or up to 1 year later.

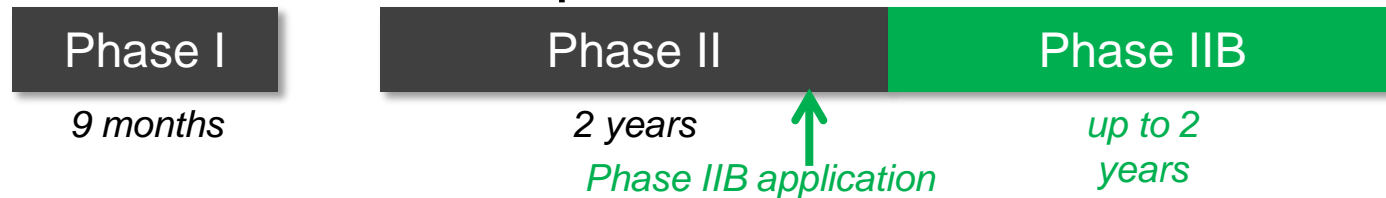
In the FY 2019 Phase II cycle: NP received 5 Phase IIB applications, peer reviewed all and 0 were funded. We received 4 Phase IIA applications and funded 3 of them. **Sequential IIA and B compete with new Phase II applications, so the success rate is usually lower.**

Sequential Phase II timing

Sequential Phase IIA



Sequential Phase IIB



No Fund Extensions and Sequential Phase II Eligibility

- A company can only receive a Sequential Phase II award if their Phase II project has completed.
 - Phase IIA applicants should not request no fund extensions
 - Phase IIB applicants should not request no fund extensions if they are still working on their Phase II project at the time of application.



The NP SBIR/STTR Exchange Meeting

- NP is seeking to effectively assess the performance of NP supported SBIR/STTR projects in contributing to the NP mission and goals. Started in FY2010, the Exchange Meeting is designed to serve that purpose and to achieve the following goals:
 - To **provide a platform** for small businesses to present the status of NP-supported Phase II grant work to the NP community and Federal Program Managers.
 - To offer an opportunity to **exchange information** regarding the **companies' capabilities** and the technical needs of the NP programs.
 - To **strengthen the ties** of the SBIR/STTR businesses **with the community** and enhance the possibilities for commercialization.
- For this year's meeting, all Phase II awardees at the end of Year-1, Year-2 (started in FY18 and 17) and awards still active or recently concluded under "no cost extension" are invited. A total of **32** SBIR/STTR PI presentations will be given in 2 days, **25** oral, and **7** poster.
- FY 2019 Phase II awardees are invited as participants only and will be invited to present in the next two year's meetings.
- Also included are four keynote talks related to the NP user facilities, their capabilities and needs in view of the NP SBIR/STTR program.
- A talk by Dr. Claudia Cantoni from the DOE SBIR/STTR Program Office will be at the end of the 2nd day of the meeting.

2019 Exchange Meeting Agenda (Day 1)

Meeting Agenda-Day 1

Time	Dur. (min)	Grant Title	Speaker	Organization	NP SBIR/ STTR Topic	Grant Status
Tuesday, August 13, 2019						
8:30 AM	5	Welcome and Opening Remarks	Gillo, Jehanne	DOE, Office of Nuclear Physics		
8:35 AM	5	Introductory Remarks	Farkhondeh, Manouchehr	DOE, Office of Nuclear Physics		
8:40 AM	35	NP SBIR/STTR Program Overview	Shinn, Michelle	DOE, Office of Nuclear Physics		
9:15 AM	20	Harvesting, Monitoring and Radiochemical Separation	Hull, Ethan	PHDs Co., TN	Instrumentation	End Year 1
9:35 AM	20	Low Cost, High-Density Digital Electronics for Nuclear Physics	Skulski, Wojtek	SkuTek Instrumentation, NY	Electronics	End Year 1/PH IIB
9:55 AM	20	A Magnetized Injector for Electron Cooling Applications	Mayes, Christopher	Xelera Research LLC, NY	Accelerator	End Year 2/NCE
10:15 AM	25	Coffee Break (poster session)				
10:40 AM	35	NP Low Energy Facilities and the SBIR/STTR Program	Dickerson, Clay	Argonne National Laboratory		
11:15 AM	20	Techniques for energetic ion assisted in-situ coating of long, small diameter, beam pipes with compacted thick crystalline copper film	Custer, Arthur	Poole Ventura Inc, CA	Accelerator	End Year 1
11:35 AM	20	Development of Gen-II LAPPDTM Systems For Nuclear Physics Experiments	Foley, Michael	Incom Inc., MA	Instrumentation	End Year 2/new IIA
11:55 AM	75	Lunch Break (on your own)				
1:10 PM	35	Jefferson Lab and the NP SBIR/STTR Program	Keppel, Cynthia	Thomas Jefferson National Accelerator Facility		
1:45 PM	20	Accurate Spin Tracking on Modern Computer Architectures for Electron-Ion Colliders	Abell, Dan	RadiaSoft LLC, CO	Accelerator	End Year 1
2:05 PM	20	High power, high repetition rate, 700 – 850 nm pulsed laser	Tian, Wenyan	Q-Peak, Inc., MA	Accelerator	End Year 2
2:25 PM	20	Design and Fabrication of the ASoC: a System-on-Chip Data Acquisition System	Mostafanezhad, Isar	Nalu Scientific, LLC, HI	Electronics	End Year 2
2:45 PM	20	IP Access Gateway	Radulescu, Radu	Telluric Labs, NJ	Electronics	End Year 1
3:05 PM	25	Coffee Break (poster session)				
3:30 PM	20	Distributed digital data acquisition system with network time synchronization	Warburton, William	XIA LLC, CA	Software	End of Year 1
3:50 PM	20	Dynamic friction in magnetized electron coolers for relativistic beams	Bruhweiler, David	RadiaSoft LLC, CO	Accelerator	End Year 2/ new IIA
4:10 PM	20	A novel ionizing particle beam fluence and position detector array using the Micromegas technology with multi-coordinate readout	Galyaev, Evgeny	Radiation Detection and Imaging Technologies, LLC, AZ	Instrumentation	End Year 1
4:30 PM	20	Manufacturing and Packaging of Reliable Alkali Photocathodes via Sputtering	Bhandari, Harish	Radiation Monitoring Devices, Inc., MA	Accelerator	End Year 1
4:50 PM	60	Optional Gathering to Discuss Challenges and Best Practices for Commercialization				

Given the positive feedback, we are continuing the informal discussion between interested participants on best practices for commercialization at the end of the first day.

2019 Exchange Meeting Agenda (Day 2)

Meeting Agenda-Day 2

Time	Dur. (min)	Grant Title	Speaker	Organization	NP SBIR/ STTR Topic	Grant Status
Wednesday, August 14, 2019						
8:30 AM	20	A Scalable Additive Manufacturing Technology For Large Area Printed Circuit Boards	Kumar, Nalin	UHV Technologies, Inc., KY	Electronics	End Year 1
8:50 AM	20	Scintillating Bolometer Crystal Growth and Purification for Neutrinoless Double Beta Decay Experiments	Bhandai, Harish	Radiation Monitoring Devices, Inc., MA	Instrumentation	End Year 2/new IIA
9:10 AM	20	Long length welded NbTi CIC superconducting Cable for Accelerator Applications	Tomsic, Michael	Hyper Tech Research, Inc., OH	Accelerator	End Year 2
9:30 AM	20	12-bit 32 Channel 500MSps Low Latency ADC	Baranauskas, Dalius	Pacific Microchip, CA	Accelerator	End Year 1
9:50 AM	25	Coffee Break (poster session)				
10:15 AM	20	Long-Term Radiation Rugged Rotary Vacuum and Water Seals in Heavy-Ion Accelerators	Lalli, Jennifer	NanoSonic, Inc, VA	Instrumentation	End Year 1
10:35 AM	35	The Relativistic Heavy Ion Collider Facility and its SBIR/STTR Opportunities				
11:10 AM	20	A novel injection-locked amplitude-modulated magnetron at 1497 MHz	Johnson, Rolland	Muons, Inc., IL	Accelerator	End Year 2/NCE
11:30 AM	75	Lunch Break (on your own)				
12:45 PM	20	Multi-Channel Readout IC for Nuclear Physics Experiments	Bikkina, Phaneendra	Alphacore Inc., AZ	Instrumentation	End Year 1
1:05 PM	35	DOE Isotope Program and Facilities and the SBIR/STTR Program				
1:40 PM	20	Resonant Polarimetry and Magnetometry.	Roberts, Brock	Electrodynamic, NM	Accelerator	End Year 1
2:00 PM	20	High Power Extremely Narrow Linewidth Diode Laser for Polarizing ³ He Target	Lu, Steven	Raytum Photonics, VA	Instrumentation	End Year 1
2:20 PM	20	Low RF loss DC conductive Ceramic for High Power Input Coupler Windows for SRF Cavities	Kanareykin, Alexei	Euclid Techlabs LLC, OH	Accelerator	End Year 1/PH IIB
2:40 PM	25	Coffee Break (poster session)				
3:05 PM	20	Multi-scale modeling for beam-beam depolarization	Zilberter, Ilya	Tech-X Corporation, CO	Accelerator	End Year 2
3:25 PM	35	Update on the Department of Energy SBIR/STTR Program, Q/A				
4:00 PM	0	Adjourn				

2019 Exchange Meeting Posters (Day 1&2)

Poster Presentations*

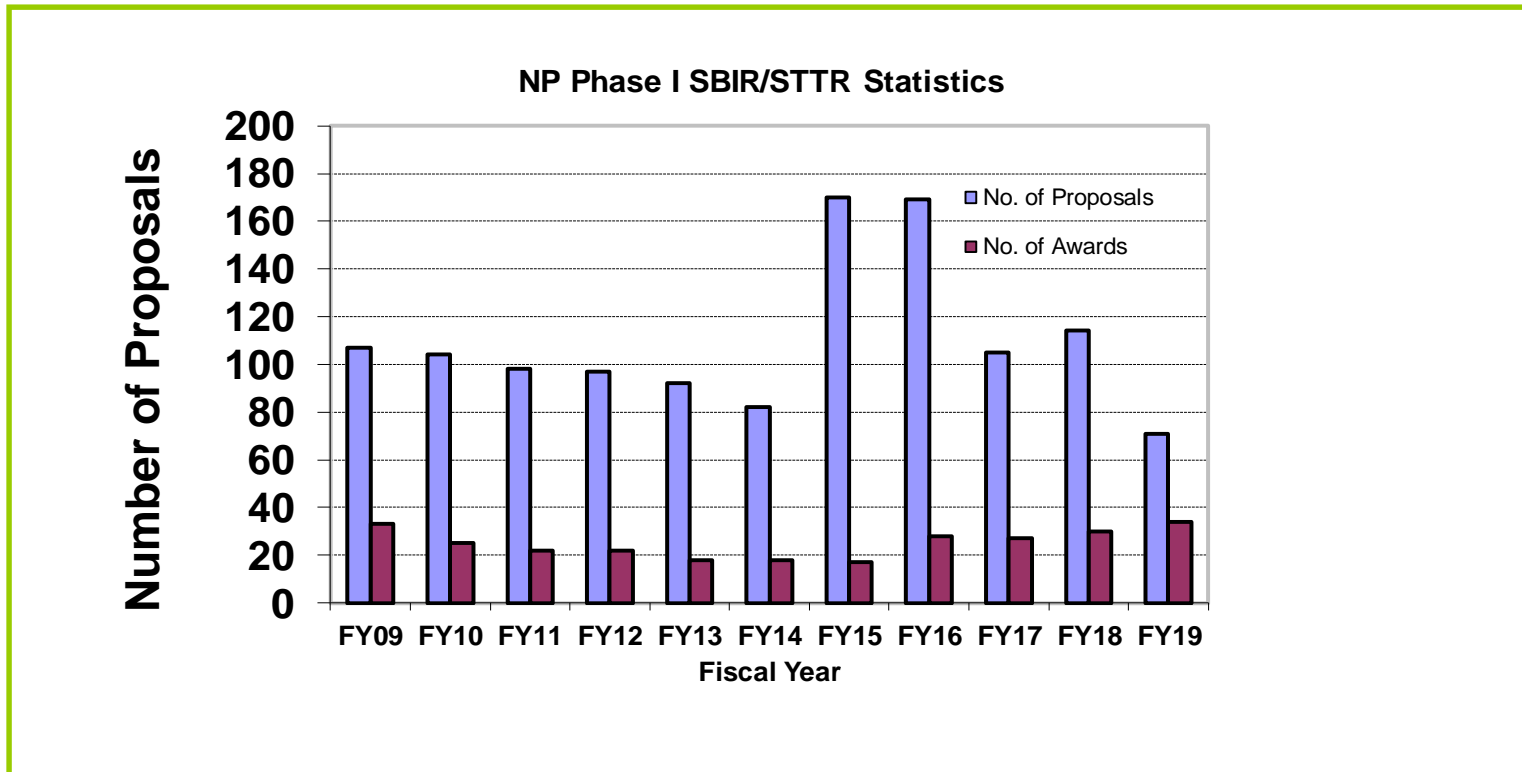
Grant Title	Presenter	Organization	NP SBIR/ STTR Topic	Grant Status
Tuesday & Wednesday, August 13-14, 2019				
Diamond Strip Detectors for Charged Particle Tracking	Tabeling, Joseph	Applied Diamond, Inc., DE	Instrumentation	End of Year 2
Robust Wire Scanner for High Intensity Beam Profile Diagnostics	Andonian, Gerard	Radiabeam Technologies, LLC., CA	Accelerator	End of Year 2/NCE
Pixel Array Germanium Detectors for Nuclear Physics	Kiser, Matthew	PHDs Co., TN	Instrumentation	End of Year 2/NCE
Data Processing Electronics for Silicon Photomultipliers	Skulski, Wojtek	SkuTek Instrumentation, NY	Electronics	Year II/PH IIB
Flat Field Emitter Based on Ultrananocrystalline Diamond (UNCD) Film for SRF Technology	Kanareykin, Alexei	Euclid Techlabs, LLC, OH	Accelerator	End of Year 2
Radiation Hard High Speed Camera System for Accelerator Beam Diagnostics	Bikina, Phaneendra	Alphacore Inc, AZ	Instrumentation	Year II/PH IIA
Acid-Free Electropolishing of SRF Cavities	Hall, Timothy	Faraday Technology, Inc., OH	Accelerator	End of Year 2/NCE
Refractory Oxides with Tunable Porosity and Geometry as Versatile Fast-Release Solid Catchers for Rare Isotopes	Sampathkumaran, Uma	InnoSense LLC, Torrance, CA	Instrumentation	Year 2 Phase IIB/NCE

* Posters will be displayed in the meeting room and the presenters available during coffee breaks



NP Phase I SBIR/STTR Applications and Awards

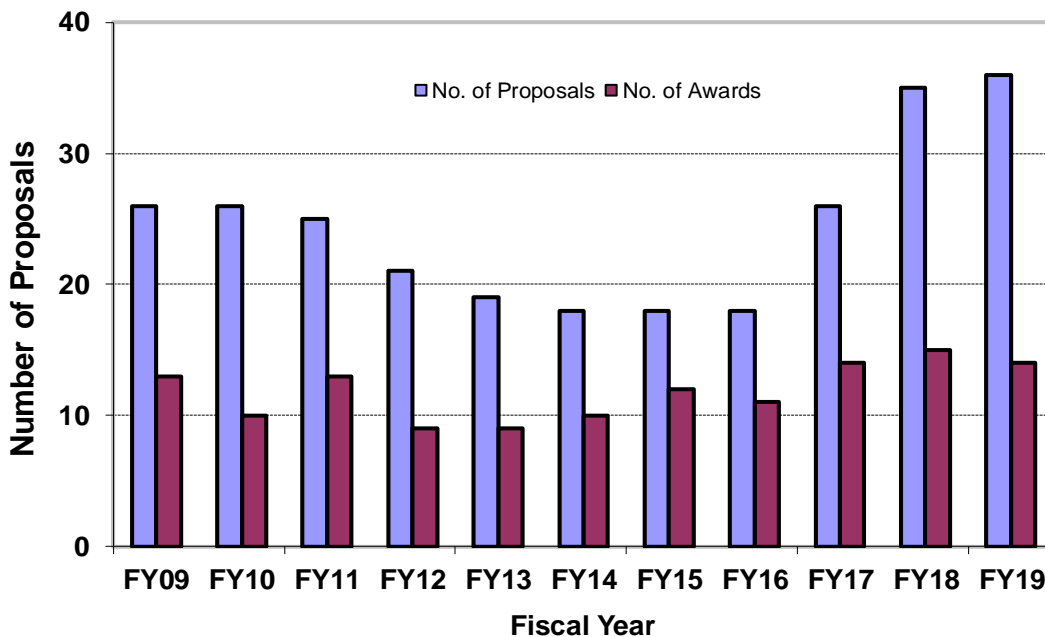
- NP received a Total of **148** LOI and **71** phase I proposals in FY 2019, with **305** review requests for a total of **~ 176** mail reviews. Total of **34** proposals funded. (cf 30 in FY18)





NP Phase II SBIR/STTR Applications and Awards

- The increased set aside level that occurred from FY13-16 and the last few year's authorizations has offset the decrease in awards that occurred after the FY 2011 change in maximum SBIR award amounts from \$750K to \$1M.



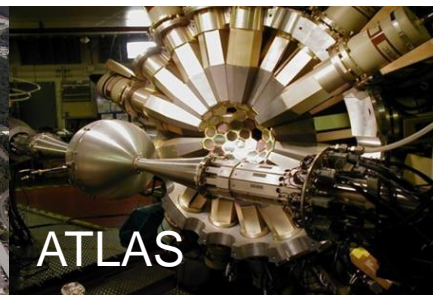


Nuclear Physics Mission

Discovering, exploring, and understanding all forms of nuclear matter

The Scientific Challenges

- The existence and properties of nuclear matter under extreme conditions, including that which existed at the beginning of the universe
- The exotic and excited bound states of quarks and gluons, including new tests of the Standard Model
- The ultimate limits of existence of bound systems of protons and neutrons
- Nuclear processes that power stars and supernovae, and synthesize the elements
- The nature and fundamental properties of neutrons and the neutrino and their role in the evolution of the early universe





DOE Isotope Program Mission

The **mission** of the DOE Isotope Program is threefold:

- Produce and/or distribute radioactive and stable isotopes that are in short supply, associated byproducts, surplus materials and related isotope services.
- Maintain the infrastructure required to produce and supply isotope products and related services.



Isotope Production
Facility (LANL)



Brookhaven Linac
Isotope Producer

- Conduct R&D on new and improved isotope production and processing techniques which can make available new isotopes for research and applications.
- This can relate to the Isotope Topic
- Attend Dr. Eva Birnbaum's presentation for more details



How the NP Mission translates into programs

- NP's major program areas are:
 - Heavy Ion Nuclear Physics
 - Medium Energy Physics
 - Nuclear Structure-Nuclear Astrophysics
 - Fundamental Symmetries
 - Nuclear Theory
 - Isotope Development and Production for Research and Applications
 - Accelerator Science and Technology is a major component that facilitates all of the NP subprograms.
- } Low Energy Nuclear Physics



NP SBIR/STTR Topics for FY 2019 support those programs

- Software and Data Management
 - Electronics Design and Fabrication
 - Accelerator Technology
 - Instrumentation, Detection Systems and Techniques
 - Isotope Science and Technology
-
- Every year there is subtopic revision, based on community input.

Our SBIR/STTR Program → NP mission and strategic priorities are tied to our community and its facilities

- The 2016 National Academy of Sciences review of the DOE SBIR/STTR Phase II program had several recommendations. Two of significance are:
 - DOE should seek to develop programs linking Laboratories' procurement actions with relevant SBIR/STTR projects.
 - DOE should examine from a strategic perspective how the relationship of SBIR/STTR with the National Laboratories works today.
- We believe that the adoption by a Lab of the product from a finished grant more likely is to ask that a prototype or method be ready for testing in a NP application by the grant's conclusion
 - This increases the likelihood there will be hardware that can be rapidly purchased and deployed to fulfill the NP community's needs.
 - Which should lead to higher rates of commercialization



Our Topic narratives reflect areas of NP strategic importance – our “brand”

- Within each Topic, our subtopics reflect the following strategy,
- Use SBIR/STTR funding of small businesses to maintain leadership in technology areas where NP has unique needs.
 - SRF accelerators and related technologies (e.g. cryogenics)
 - Polarized sources
 - CW RF sources
 - High current ion sources
 - Detectors with emphasis on particle identification
- And we are interested where applicable in R&D that advances the recently published DOE Initiatives on AI/ML, Large-Scale Instrumentation, and QIS
- <https://www.energy.gov/science/initiatives>

Subtopic requests must be right-sized & timed

- Match Facility Accel. Improvement Projects and Capital Equip. activities and mid-term upgrade plans to 3 year SBIR/STTR funding cycle.
 - Same for universities or other collaborations working on detectors.
- Coordinate with other Offices to not duplicate efforts unless a particular technology is synergistic.
 - An example might be lower cost SRF cavity fabrication that would benefit from additional investment.
- Projects must be of sufficient value to the NP community to justify the investment



The key to commercialization is to build relationships through communication

- Our scientific community needs products and methods for an identified future need that requires some R&D, but have constraints, in funding or workforce, that make it hard to pursue
- The NP SBIR/STTR program is structured to foster partnerships between business and community to fulfill those future needs
- The conundrum – how are we, as a Federal agency to publicize a company's product to the wider community without creating the appearance of an unfair advantage to these companies?
 - Use the required public announcement of our awards
 - Last 3 years found on DOE SBIR-STTR Office awards page
- Let reviewers and leadership at facilities & universities know what companies received awards.
- Add DOE press releases on SBIR/STTR awards to the News section on our landing page
 - Make this resource known to our community



FY18 Commercialization Outcomes

- The DOE SBIR-STTR Office collects Ph III (other Federal funding) outcomes for sales to US National Laboratories
 - We took the extra step of writing PIs
- We also expanded this request to include sales to other US and foreign research institutions
- Collected responses for FY18
 - Not everyone responded, so the numbers represent a lower bound
 - Will be an annual process

- FY18 Phase III & other worldwide sales was ~ \$4M
- Sales to Labs roughly equal to other research institutions
- Accelerator sales, primarily in sources, magnet components, and diagnostics accounted for about 25% of the total
- The majority was in instrumentation – detectors and electronics
- Sales of hardware based on awards made over 5 years earlier
 - It underscores the fact it takes time for Phase II prototypes to become products



NP SBIR/STTR Program Updates - FY19/20

- We wish to better connect businesses to the NP community.
 - We provide the link to the SBIR/STTR Office awards page to all reviewers, as well as Lab and University Center points of contact
- We are co-funding awards with other SC Offices. In FY19, we contributed to ASCR, BES, and HEP awards
- Starting in FY20, NP has chosen these award amounts:
 - Phase I - \$200 k (1 year)
 - Phase II - \$1.1 M (2 years)
- We instituted changes to this meeting –
 - We've decided to stay at 20min oral talks, moving the PIs who are working under a NCE to present posters to keep meeting at 2 days



Presentation Notes

- We have a tight agenda and must stay on time for each oral presentation.
- Authors of posters will be available during the coffee breaks.
- Sessions will start sharply at the time stated on the agenda. Please take your seat a few minutes before the start of each session to allow the first presentation to begin on time.
- Make sure your presentation file is uploaded on the display laptop before the start of your session. We do not want you to use your own computer.
- For Q&A sessions, please make your comments/questions short and use the coffee and lunch breaks for follow up.

Total presentation (min)	Presentation (min)	Q&A (min)	5 and 2 minutes warning (min)
35	29	6	24 & 27
20	17	3	12 & 15

The SC microsite on Diversity, Equity & Inclusion now posted on the SC website.

The direct link is:

<https://science.energy.gov/sc-2/research-and-conduct-policies/diversity-equity-and-inclusion/>

“The DOE Office of Science (SC) is fully committed to fostering safe, diverse, equitable, and inclusive work, research, and funding environments that value mutual respect and personal integrity. Effective stewardship and promotion of diverse and inclusive workplaces that value and celebrate a diversity of people, ideas, cultures, and educational backgrounds is foundational to delivering on the SC [mission](#). The scientific community engaged in SC-sponsored activities is expected to be respectful, ethical, and professional.

The DOE SC does not tolerate discrimination or harassment of any kind, including [sexual or non-sexual harassment](#), bullying, intimidation, violence, threats of violence, retaliation, or other disruptive behavior in the federal workplace, including DOE field site offices, or at national laboratories, scientific user facilities, academic institutions, other institutions that we fund, or other locations where activities that we support are carried out...”

Conclusions

- NP uses the Congressionally-mandated SBIR/STTR Program –
 - To fund R&D that benefits the NP community
 - To build and sustain a US-based commercial infrastructure that serves society in areas other than nuclear science
- Five years of funding is equivalent to that of a large research effort
 - FY14-18 funding amounted to \$81M
 - With input from NP Program Managers and the community, the NP SBIR/STTR program uses those funds for R&D that advances our core technologies as well as new initiatives
- NP uniquely fosters connections between the NP community and the small businesses that serve it through this annual meeting