

**DEPARTMENT OF ENERGY
OFFICE OF SCIENCE
ACCELERATOR RESEARCH DEVELOPMENT AND PRODUCTION**



**FY2021 RESEARCH OPPORTUNITIES IN
ACCELERATOR STEWARDSHIP**

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Table of Contents

SECTION I – FUNDING OPPORTUNITY DESCRIPTION.....	1
SECTION II – AWARD INFORMATION.....	20
A. TYPE OF AWARD INSTRUMENT.....	20
B. ESTIMATED FUNDING.....	20
C. MAXIMUM AND MINIMUM AWARD SIZE.....	20
D. EXPECTED NUMBER OF AWARDS.....	20
E. ANTICIPATED AWARD SIZE.....	21
F. PERIOD OF PERFORMANCE.....	21
G. TYPE OF APPLICATION.....	21
SECTION III – ELIGIBILITY INFORMATION.....	22
A. ELIGIBLE APPLICANTS.....	22
B. COST SHARING AND INSTITUTIONAL COMMITMENTS.....	23
C. ELIGIBLE INDIVIDUALS.....	24
SECTION IV – APPLICATION AND SUBMISSION INFORMATION.....	25
A. ADDRESS TO REQUEST APPLICATION PACKAGE.....	25
B. LETTER OF INTENT AND PRE-APPLICATION.....	25
C. GRANTS.GOV APPLICATION SUBMISSION AND RECEIPT PROCEDURES.....	27
D. CONTENT AND APPLICATION FORMS.....	28
E. SUBMISSIONS FROM SUCCESSFUL APPLICANTS.....	40
F. SUBMISSION DATES AND TIMES.....	40
SECTION V - APPLICATION REVIEW INFORMATION.....	42
A. CRITERIA.....	42
B. REVIEW AND SELECTION PROCESS.....	45
C. ANTICIPATED NOTICE OF SELECTION AND AWARD DATES.....	47
SECTION VI – AWARD ADMINISTRATION INFORMATION.....	48
A. AWARD NOTICES.....	48
B. ADMINISTRATIVE AND NATIONAL POLICY REQUIREMENTS.....	48
C. REPORTING.....	49
D. REPORTING OF MATTERS RELATED TO RECIPIENT INTEGRITY AND PERFORMANCE (DECEMBER 2015).....	49
SECTION VII - QUESTIONS/AGENCY CONTACTS.....	51
A. QUESTIONS.....	51

B. AGENCY CONTACTS	51
SECTION VIII – SUPPLEMENTARY MATERIAL	52
A. HOW-TO GUIDES	52
B. POLICY PROVISIONS	74
C. ADMINISTRATIVE AND NATIONAL POLICY REQUIREMENTS	74
D. REFERENCE MATERIAL	80

UPDATES AND REMINDERS

WHAT'S NEW

This FOA serves as both the FOA and the National Laboratory Program Announcement. No separate “LAB” call is posted this year. DOE National Laboratories should refer to this FOA for instructions on how to apply.

Track 3 aims, teaming requirements, and intent have changed significantly. Please read the instructions carefully and follow them.

RECOMMENDATION

The Department of Energy (DOE) Office of Science (SC) encourages you to register in all systems as soon as possible. You are also encouraged to submit pre-applications and applications well before the deadline.

CURRENT AND PENDING SUPPORT AND BIOSKETCHES

The instructions for the content of current and pending support and biosketches have changed. Please read the instructions carefully and follow them.

REPORTING AND ADMINISTRATIVE REQUIREMENTS

DOE is implementing enhanced reporting requirements for applications and awards. Reporting and administrative requirements, including but not limited to those pertaining to other sources of support and potential conflicts of interest or commitment, are subject to change before the Federal award date. The terms and conditions of award will specify changed requirements: Applicants have the right to reject any proposed awards. Terms and conditions may be modified at the time of an award modification: Recipients have the right to reject such modifications and allow an award to expire.

GRANTS.GOV WORKSPACE

Applications submitted through Grants.gov at <https://www.Grants.gov> must be submitted through a “Workspace” or the applicant’s system-to-system service. Workspace permits members of a team to simultaneously work on their application in an online collaborative environment. Application forms may exist as both online webforms and downloadable forms. More information is available at <https://www.Grants.gov/web/grants/applicants/workspace-overview.html>.

UNIQUE ENTITY IDENTIFIER (UEI)

The Federal Government is transitioning from the Data Universal Numbering System (DUNS), assigned by Dun and Bradstreet at <https://fedgov.dnb.com/> to the UEI, assigned by the System for Award Management at <https://www.sam.gov>. Information systems including SAM.gov,

Grants.gov and PAMS (<https://pamspublic.science.energy.gov>) are being updated: Please follow the on-screen instructions or contact each system's Help Desk for additional information. Detailed information about the transition is available at <https://www.gsa.gov/about-us/organization/federal-acquisition-service/office-of-systems-management/integrated-award-environment-iae/iae-information-kit/unique-entity-identifier-update>.

DATA MANAGEMENT PLAN (DMP)

Applications submitted under this FOA are subject to the Office of Science Statement on Digital Data Management, published at <https://science.osti.gov/funding-opportunities/digital-data-management/>. Compliance with this statement is detailed in [Section IV](#) of this FOA.

ACKNOWLEDGMENT OF FEDERAL SUPPORT

SC guidance about how its support should be acknowledged is published at <https://science.osti.gov/funding-opportunities/acknowledgements/>.

PUBLIC ACCESS

Awards made under this FOA are subject to DOE's Public Access Plan (<https://www.energy.gov/downloads/doe-public-access-plan>). Full-text version of scientific publications must be made publicly accessible at no charge to readers.

Checklist for Avoiding Common Errors:

Item	Issue
Page Limits	Strictly followed throughout application, including particular attention to: <ul style="list-style-type: none"> - Research Narrative - Appendix 2 Narrative, if any - Biosketches - Data Management Plan(s) (DMPs) - Letter(s) of Recommendation, if any
Personally Identifiable Information	None present in the application
Research Narrative	Composed of one PDF file including all appendices
Project Summary / Abstract	Name(s) of applicant, PI(s), PI's institutional affiliation(s), Co-Investigator(s), Co-Investigator's institutional affiliation(s)
DOE Title Page	Follow instructions closely
Budget	Use current negotiated indirect cost and fringe benefit rates
Budget Justification (attached to budget)	Justify all requested costs
Biographical Sketches	Follow page limits strictly
Current and Pending Support	Ensure complete listing of all activities, regardless of source of funding
Data Management Plans (DMP)	<ul style="list-style-type: none"> - If referring to an experiment's DMP, describe the relationship to the proposed research - Include a DMP even if no experimental data is expected

Section I – FUNDING OPPORTUNITY DESCRIPTION

GENERAL INQUIRIES ABOUT THIS FOA SHOULD BE DIRECTED TO:

Technical/Scientific Program Contact:

Dr. Eric R. Colby
301-903-5475
Eric.Colby@science.doe.gov

STATUTORY AUTHORITY

Section 646 of Public Law 95-91, U.S. Department of Energy Organization Act
Section 901 *et seq.* of Public Law 109-58, Energy Policy Act of 2005

APPLICABLE REGULATIONS

Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards, codified at 2 CFR 200
U.S. Department of Energy Financial Assistance Rules, codified at 2 CFR 910
U.S. Department of Energy, Office of Science Financial Assistance Program Rule, codified at 10 CFR 605

SUMMARY

The DOE SC program in Accelerator R&D and Production (ARDAP) hereby announces its interest in applications to conduct cross-cutting use-inspired basic R&D to advance accelerator science and technology (AS&T) that supports SC's activities in physical sciences research, and which is of broader benefit to other U.S. government agencies and industry. Please note that the SC programs issue FOAs for program-specific AS&T R&D and that this announcement is for cross-cutting R&D.

SUPPLEMENTARY INFORMATION

The following program description is offered to provide more in-depth information on scientific and technical areas of interest to the SC Accelerator Stewardship program.

Please note that this FOA is only for opportunities within the Accelerator R&D Stewardship mission, which is to support cross-cutting advances in accelerator science and technology that could benefit researchers in multiple SC programs and have applications beyond physical science research. The SC programs in Basic Energy Sciences (BES), Fusion Energy Sciences (FES), High Energy Physics (HEP), and Nuclear Physics (NP) routinely issue separate FOAs for programmatic accelerator research and development that is aimed at facilities for their respective fields of study.

The Accelerator Stewardship program's mission is to support both fundamental accelerator science and use-inspired technology development of relevance to many fields and to disseminate

accelerator knowledge and training to the broad community of accelerator users and providers. Further information about the Accelerator Stewardship program may be found at <https://science.osti.gov/hep/research/accelerator-stewardship/>.

Many federal agencies have a vested interest in the success of accelerator R&D. Beyond SC, stakeholders include the DOE National Nuclear Security Administration (NNSA), the DOE Environmental Management Program Office (EM), the NIH National Cancer Institute, (NCI) the NSF Division of Physics, the DOD Office of Naval Research (ONR), the DOD Air Force Office of Scientific Research (AFOSR), the Defense Advanced Research Projects Agency (DARPA), the DHS Countering Weapons of Mass Destruction Office, the NASA Radiation Effects & Analysis Group, and the NIST Ionizing Radiation Physics Division, among others. Interested applicants are advised to learn about the missions of these agencies.

Program Objective

Central goals of Accelerator R&D Stewardship are to:

- Engage the expertise and facilities of the existing U.S. accelerator R&D ecosystem in a manner that enhances the ability of research sponsors to support innovative concepts;
- Enhance the accelerator technology capabilities of U.S. industry;
- Facilitate access to the accelerator R&D capabilities at the SC National Laboratories¹
- Drive a limited number of specific accelerator applications towards practical, testable prototypes in a five to seven (5-7) year timeframe;
- Foster collaboration between developers of accelerator technology and experts who apply accelerator technology;
- Provide the basic R&D foundation necessary for sustained innovation across a broad range of accelerator applications.

This FOA focuses on three distinct activities:

(1) applied research² that is focused on developing a prototype in response to a specific technical challenge,

¹ SC sponsors ten of DOE's National Laboratories: Ames Laboratory, Argonne National Laboratory, Brookhaven National Laboratory, Fermi National Accelerator Laboratory, Lawrence Berkeley National Laboratory, Oak Ridge National Laboratory, Pacific Northwest National Laboratory, Princeton Plasma National Laboratory, SLAC National Accelerator Laboratory, and Thomas Jefferson National Accelerator Facility. The other DOE National Laboratories (Idaho National Laboratory, Lawrence Livermore National Laboratory, Los Alamos National Laboratory, National Energy Technology Laboratory, National Renewable Energy Laboratory, Sandia National Laboratories, and Savannah River National Laboratory) are outside the scope of the Accelerator Stewardship program.

² The term "applied research" is used here in a manner consistent with colloquial usage in the field of accelerator R&D, referring to research that is in the early stages of development (Technology Readiness Level [TRL] 0-4) and encompasses work leading to a first prototype that demonstrates scientific feasibility. It does not include R&D leading to a demonstration of suitability for a particular application nor does it include R&D supporting commercialization of a product. In the context of DOE's authorizing legislation all work supported here is of a basic or fundamental nature.

- (2) basic research that broadly impacts many accelerator applications, and
- (3) developing coherent business plans for sectors of the accelerator science & technology space that can be used to inform long-term investment strategy.

These activities are divided into three separate “Tracks” in this FOA. Applications must address a topic in one Track **only**. Topics may not be combined between Tracks as the application format, eligibility requirements, project duration, funding limitations, and merit criteria differ significantly.

Applicants are encouraged to review the Accelerator Stewardship awards made to date at the webpage: <https://science.osti.gov/hep/research/accelerator-stewardship/awards/>.

Applications that are intended to meet specific BES, FES, or NP programmatic fields of research should be submitted in response to the FOAs issued by those Offices.

Applications that are not in direct support of a topic under the Tracks below (e.g., conferences, experimental operations, specific project R&D or fabrication) must be submitted to SC’s current annual FOA (DE-FOA-0002414).

Track 1: Accelerator Stewardship Topical Areas

Accelerator Stewardship Topic Areas are focused R&D efforts aimed at solving a specific accelerator application problem in a specific area. The desired end goal after one to two (1-2) grant cycles (e.g. three to six (3-6) years) is a working prototype technology at TRL-4³. This Track has broad eligibility requirements, see Section III.A for more information. Teams, comprising at a minimum an accelerator technology partner and an application partner, are expected to apply in this area, and develop an application that clearly defines the technology development pathway, teaming and management plan, IP allocation, and market opportunity (where applicable).

Applicants **must** provide evidence of the Stewardship Customer’s⁴ commitment to the proposed activity. This commitment may take the form of uncompensated effort; the provision of surplus materials, supplies, or equipment; the provision of access to facilities at no or reduced cost; voluntary cost sharing; mentoring, training, or coaching of personnel; or other methods of involving the Stewardship Customer in the proposed activity. See [Section III.B](#) for more information.

There are four topic areas active in Track 1 of this FOA:

- a) Particle Therapy Beam Delivery Improvements
- b) Ultrafast Laser Technology Program
- c) High Power Electron Accelerator Technology for Industrial Applications
- d) Compact Accelerator Technologies for Security and Medicine

³ Technology Readiness Levels (TRLs) are defined in DOE G 413.3-4 (2009).

⁴ “Stewardship Customer” is defined and examples of evidence or support are given in Section V.A.2.

Grant applications submitted under Track 1 should address specific research goals in only **one** of these topical areas.

In addition to the standard merit criteria applied to all scientific grant applications, grant applications submitted under Track 1 will be specifically reviewed for (1) the strength and breadth of the collaborative team and (2) the quality of the technology R&D plan. See Section V.A.2 for a description of the Merit Review Criteria, and Section V.B.2 for a description of the selection criteria.

(a) Particle Therapy Beam Delivery Improvements

Technical Contact: Eric Colby, 301-903-5475, Eric.Colby@science.doe.gov

Even with less than fully optimized treatment techniques, there have been reports of impressive local control rates using particle beam therapy for otherwise difficult-to-treat cancers. Although lower-cost proton beam options are starting to appear, today's proton beam facilities are costly to build and thus are not widely available. Based on their potential biological advantage, there is now increasing medical interest in exploring the use of other light ions for therapy; typically, beams up to carbon are considered.

While beam delivery ("gantry") systems for proton beams have been designed and constructed previously, they are typically large, massive, and costly. Accommodating heavier beams, up to carbon, with similar technology requires delivery systems that are even more massive.

Short dose deposition times, on the order of seconds, will require fast and efficient scanning in all three spatial dimensions. This will place new demands on the accelerator, beam line and detector systems to guide and verify dose placement.

Proposals in this topical area should address ideas for providing one or more of the following:

1. less massive and more compact beam delivery systems capable of delivering ion beams from protons up to carbon that are suitable for patient therapy;
2. technology that can provide for rapid (seconds) scanning of the beam over a tumor volume in three dimensions (that is: both transversely and longitudinally);
3. beam diagnostic technologies for ion beam therapy, with emphasis on increased readout speed and accuracy of position and dose.

To meet the teaming requirement, applications under this Track 1 topic area **are strongly encouraged to** include significant participation from all three of the following: (1) an institution with technical leadership in a relevant accelerator technology, (2) a medical institution with clinical experience in imaging and treatment for external beam radiotherapy (EBRT), and (3) a domestic company currently manufacturing EBRT products. Applications lacking significant participation from any of the three may score poorly under merit review.

The Particle Therapy Beam Delivery Improvements program of this FOA does **not** request designs for accelerators themselves but covers only ancillary devices that work in conjunction

with an accelerator. Applications to design an accelerator or accelerator complex are outside the scope of this call, and such application will be declined without review. Designs that are independent of the proton or ion beam accelerator, such that they can work with more than one type of accelerator, are preferred.

Further, the call for applications on beam diagnostic technologies for ion beam therapy is limited to diagnostics applied to the charged particle beam prior to its exit from the nozzle. Imaging technologies downstream of the nozzle, radiobiological studies, and clinical studies are supported by the National Cancer Institute, and applications in any of these topic areas will be declined without review.

Interested applicants are strongly encouraged to review the report of the workshop on Ion Beam Therapy, held January 9-11, 2013. The report provides an overview of the technical issues and required R&D to develop accelerator technologies for ion beam treatment of cancer. The report is available online at https://science.osti.gov/~media/hep/pdf/accelerator-rd-stewardship/Workshop_on_Ion_Beam_Therapy_Report_Final_R1.pdf.

(b) Ultrafast Laser Technology Program

Technical Contact: Eric Colby, 301-903-5475, Eric.Colby@science.doe.gov

Lasers are used or proposed for use in many areas of accelerator applications: as drivers for novel accelerator concepts for future colliders; in the generation, manipulation, and x-ray seeding of electron beams; in the generation of electromagnetic radiation ranging from THz to gamma rays; and in the generation of neutron, proton, and light ion beams. In many cases, ultrafast lasers with pulse lengths well below a picosecond are required, with excellent stability, reliability, and beam quality. With applications demanding ever-higher fluxes of particles and radiation, the driving laser technology must also increase in repetition rate—and hence average power—to meet the demand.

These applications have some general technological requirements in common:

- Ultrafast pulses (<1 ps)
- High average powers (>1 kW up to 100 kW or more)
- Diffraction limited beams
- Good (ps) to excellent (fs) pulse timing
- Robust and reliable operation

Many important applications also require, or can benefit from:

- High pulse energy (>0.01 J up to 1 kJ)
- High pre-pulse power contrast (better than 10^{-9})
- High wall plug efficiency (>20% with a goal of 30% or higher)
- Longer laser wavelengths (>1.5 μm out to 10 μm)

The primary goals of the Ultrafast Laser Technology Program are to develop the enabling technologies that will ultimately lead to construction of demonstration prototypes for one or more of the principal types of ultrafast lasers needed for accelerator applications, and to enhance

industry's capability to produce the necessary technologies.

Ultrafast lasers for accelerator applications fall into four broad laser types:

- Type I laser systems are used both to directly power laser-driven accelerators-on-a-chip, and as subassemblies of coherently combined fiber arrays used to generate higher pulse energies.
- Type II laser systems are used to excite plasma waves for particle trapping and high gradient acceleration, and for the generation of x-rays through Compton backscattering.
- Type III laser systems are used for generating high repetition rate radiation pulses through nonlinear processes, particularly high-harmonic generation (HHG).
- Type IV laser systems are used for plasma-based sources of protons, light ions, and neutrons.

The target performance parameters for each of the four ultrafast laser types are summarized in Table 1 below.

Table 1. Target performance parameters for the four principal types of ultrafast lasers

	Type I	Type II	Type III	Type IV
Wavelength (μm)	1.5-2.0	0.8-2.0	2.0-5.0	2.0-10.0
Pulse Energy	3 μJ	3 J	0.03–1 J	300 J
Pulse Length (fs)	300	30–100	50	100–500
Repetition Rate	1–1000 MHz	1 kHz	100 kHz	100 Hz
Average Power (kW)	Up to 3	3	3 and up	30
Energy Stability	<1%	<0.1%	<1%	<1%
Beam Quality	$M^2 < 1.1$	Strehl > 0.95	$M^2 < 1.1$	$M^2 < 1.1$
Wall-plug Efficiency	>30%	>20%	>20%	>20%
Pre-Pulse Contrast	N/A	> 10^{-9}	N/A	> 10^{-9}
CEP-capable	Required	N/A	Required	N/A
Optical Phase Noise	< 5°	N/A	< 5°	N/A
Wavelength Tunability Range	0.1%	0.1%	10%	0.1%

This initial phase of the Laser Technology Program will concentrate on basic research and engineering design studies to produce the breakthroughs in technology and design architecture necessary to make each of the four laser types practical. Grant applications are sought in these five topical areas:

- (1) **Ultrafast gain materials capable of very high average power.** Development of materials suitable for fiber or bulk usage, supporting amplification of <100 fs pulses, with excellent thermal conductivity, low thermal lensing, low saturation fluence, high damage threshold and small quantum defect will be key to increasing average power capabilities of ultrafast lasers. Materials must be scalable to average powers in the kilowatt range and above while maintaining excellent beam quality.
- (2) **Increased robustness and reduction in size of optical components.** Each will reduce the cost of ultrafast laser systems. Development of ultrafast optical coatings and materials capable of supporting <100 fs laser pulses with significantly increased damage threshold, excellent thermal stability, and low loss and low scatter will permit more compact, higher

reliability ultrafast lasers to be developed.

- (3) **Innovations in laser architectures, cryogenics, other advanced thermal management techniques.** Direct diode pumping, coherent combination, hybrid fiber/bulk systems, and the use of advanced cryogenic systems will be needed to significantly increase the average power performance of ultrafast lasers.
- (4) **Wavelength extension further into the infrared.** The development of efficient, robust, cost-effective ultrafast laser systems out to 10 microns in wavelength will enable new applications such as solid-state seeding for ultrafast CO₂ lasers and driving HHG hard x-ray generators, as well as open new opportunities in plasma acceleration and high harmonic generation. Significant increases in repetition rate are needed to achieve high average power.
- (5) **Improvements in laser quality.** Advances in pulse contrast, optical phase noise, flexible pulse shaping (both transverse and longitudinal), and precision synchronization to external references will directly impact both the quality and capability of the laser-based sciences.

The Ultrafast Laser Technology Program of this FOA includes initial R&D to identify promising technical avenues for developing ultrafast lasers of the four types discussed above. It does **not** include the engineering and construction of full-scale demonstration laser systems for any of the four types during this initial phase. Applications to develop full-scale demonstration laser systems are out of the scope of this FOA and will be declined without review.

To meet the teaming requirement, applications under this Track 1 topic area **are strongly encouraged to** include significant participation from each of the following: (1) an institution with technical leadership in a relevant laser technology, and (2) an institution with technical leadership in the application of laser technology to accelerators and/or (3) a domestic company currently marketing related laser products. Applications lacking significant participation from a laser technology or accelerator technology partner, or an industry partner, may score poorly under merit review.

Interested applicants are strongly encouraged to review the report of the workshop on Laser Technology for Accelerators, held January 23–25, 2013. The report provides an overview of the technical issues and required R&D to develop ultrafast laser technology for accelerator applications. The report is available online at https://science.osti.gov/~media/hep/pdf/accelerator-rd-stewardship/Lasers_for_Accelerators_Report_Final.pdf.

(c) **High Power Electron Accelerator Technology for Industrial Applications**
Technical Contact: Eric Colby, (301)-903-5475, Eric.Colby@science.doe.gov

Particle accelerator technologies have been applied to solve a range of issues in the energy & environmental (E&E) arena including: treating potable and waste water, removing pollutants from stack gases, increasing the energy efficiency of industrial material processing, remediating water-borne and soil-borne contaminants, and replacing radioactive sources in sterilization applications. In many cases the use of accelerator technology for these applications offers important performance advantages. Some of these energy and environmental applications are currently served by existing non-accelerator-based technologies; however, continued improvements in accelerator technology has lowered the cost and increased the reliability of this

technology, opening the possibility of broader use in energy and environmental applications.

These applications have some general technological requirements in common:

- The need to expose significant mass streams to kGy-class radiation fields, requiring:
 - Very high average beam powers (>500 kW up to 10 MW)
 - High wall plug efficiency (>50%)
- The need to operate economically in harsh industrial environments:
 - Low capital and operating costs
 - Robust, reliable, turn-key operation

The primary goals of the High Power Electron Accelerator Technology program are to develop the enabling technologies that may ultimately lead to construction of demonstration prototypes for one or more of the principal types of high power electron accelerators needed for E&E applications, and to enhance industry’s capability to produce the necessary technologies.

The general requirements for high power electron accelerators for E&E applications were identified at a workshop (see references below) and can be divided into four basic types of accelerator, summarized in Table 2 below.

Table 2. Target performance for high power electron accelerators for E&E applications:

	Type 1 Demo/Small Scale	Type 2 Medium Scale Low Energy	Type 3 Medium Scale High Energy	Type 4 Large Scale High Energy
<i>Example Applications</i>	<i>R&D, Sterilization, industrial effluent streams</i>	<i>Flue Gas, Waste water</i>	<i>Wastewater, sludge, medical waste</i>	<i>Sludge, Medical waste, Env. remediation</i>
Electron Beam Energy	0.5-1.5 MeV	1-2 MeV	10 MeV	10 MeV
Electron Beam Power (CW)	>0.5 MW	>1 MW	>1 MW	>10 MW
Wallplug Efficiency	>50%	>50%	>50%	>75%
Target Capital Cost*	<\$10/W	<\$10/W	<\$10/W	<\$5/W
Target Operating Cost†	<1.0M\$/yr	<1.5M\$/yr	<1.5M\$/yr	<12M\$/yr

*Total cost of the accelerator, including all supporting systems (e.g. power, cooling, control, safety).

†Total operating cost including all labor, supplies, repairs and electricity costs.

- Demo or Small Scale Systems are used for processing low-density material streams (gas or liquid) in moderate quantities, such as industrial effluent streams at flows of order 0.1-0.2 MGD, depending on dose. (1 MGD=1 million gallons per day).
- Medium Scale Low Energy Systems are used for processing low-density material streams

(gas or liquid) in high volumes, such as for electron beam treatment of flue gases at flow rates of 100,000-200,000 Nm³/hr, and wastewater treatment at flows of 1-1.5 MGD.

- Medium Scale High Energy Systems are used for processing high-density materials (solids and sludges) in moderate volumes, such as for medical waste sterilization and sludge treatment at mass flow rates of 20-70 kg/s.
- Large Scale High Energy Systems are proposed for use in processing large volumes of high-density materials, such as for environmental remediation of contaminated soil, medical waste sterilization, and sludge treatment at mass flow rates of 0.2-0.7 metric ton per second.

The High Power Electron Accelerator Technology Program has completed a set of feasibility studies and will focus in this next phase on achieving the necessary advances in efficient Radio Frequency (rf) power production and low cost accelerator structures. Grant applications are sought for proposals for enabling research and development. Applications submitted under this topic are to be for multi-year use-inspired R&D concepts leading to achievement of the stated performance metrics. Applications which do not directly address all the metrics of the subtopic area will be declined without review.

- High Efficiency High Average Power RF Sources.** The very high power accelerators required for energy and environmental applications will require highly efficient, low-cost sources of radiofrequency power. R&D to significantly improve the power efficiency of high-average-power (CW or high duty factor) radiofrequency tubes is sought. Net tube power efficiency (including focusing magnet power) must exceed 80%, and *average* tube power must exceed 250 kW, with a pulse format (peak power, pulse length) that is appropriate for either normal conducting or superconducting accelerators, and an output that is stably phase locked to an external reference. The proposed device must provide an economical route to producing 1 MW or more of average power by scaling, coherent combination, or both, at an rf tube cost that does not exceed \$1.50 per watt of average power output. *A detailed estimate of the tube's production cost must be included in Appendix 7 to support claims that the cost metric will be met.* There is particular interest in rf power sources operating at frequencies that are in widespread use at the large SC accelerators⁵.
- Economical Accelerator Structures for Megawatt-Class Beams.** Providing low-cost very high power accelerators for energy and environmental applications will require advances in the design and manufacture of accelerator structures to increase performance and reduce cost. R&D applications are sought for accelerator structures that are optimized for very high power transfer efficiency into high beam currents and optimized for low production cost and low operation cost for industrial use. Proposed R&D must lead to an accelerator design and a single-unit prototype structure that meets one of the following sets of requirements:
 - Superconducting radiofrequency, 1 MeV total voltage gain, 1 MW total power coupled to beam, 90% minimum rf-to-beam-power coupling efficiency, costing less than \$1.50/watt fully dressed (including couplers, cryostat, cryocoolers, magnetic and thermal shields); or
 - Superconducting radiofrequency, 10 MeV total voltage gain, 1 MW total power

⁵ See <https://science.osti.gov/user-facilities/user-facilities-at-a-glance/>

- coupled to beam, 90% minimum rf-to-beam-power coupling efficiency, costing less than \$3.00/watt full dressed (including couplers, cryostat, cryocoolers, magnetic and thermal shields); or
- iii. Normal conducting radiofrequency, 1 MeV total voltage gain, 1 MW total power coupled to beam, 90% minimum rf-to-beam-power coupling efficiency, costing less than \$0.50/watt fully dressed (including couplers, vacuum enclosure, cooling systems).

The voltage gain and coupled power requirements may be met by using multiple accelerating cavities, but the cost metric then applies to the entire system. *A detailed estimate of the accelerator structure's production cost **must be included in Appendix 7** to support claims that the cost metric will be met.* Note that in all cases, the cost metric does not include the cost of rf power generation and transmission to the accelerator, nor does it include peripheral systems such as the electron source, beam focusing and delivery, controls and diagnostics, shielding enclosures, etc. At a minimum, the prototype accelerator structure must be experimentally demonstrated to work at the required duty factor, at full accelerating voltage, without beam, but with performance characteristics that are consistent with accelerating 1 MW of beam. There is particular interest in rf accelerators operating at frequencies that are in widespread use at the large SC accelerators⁶.

The High Power Electron Accelerator Technology program of this FOA includes initial R&D to identify promising technical avenues for developing very high power electron accelerators of the four types discussed above. It does **not** include the engineering and construction of full-scale accelerator installations for any of the four types during this initial phase. Applications to develop a full-scale accelerator installation are out of the scope of this FOA and will be declined without review.

To meet the teaming requirement, applications under this Track 1 topic area **are strongly encouraged to** include significant participation from each of the following: (1) an institution with technical leadership in a relevant accelerator technology, (2) an institution with technical experience in applying accelerator technology to the energy or environmental application proposed, and/or a domestic company currently marketing related technology. Applications lacking significant participation in either of these two areas may score poorly under merit review.

References

As background, workshops were conducted to identify the accelerator technology research directions with the potential for high impact in E&E applications. Workshops relevant to this topic area include:

- *Workshop on Energy and Environmental Applications of Accelerators*, Edited by Stuart Henderson and Thomas Waite, (2015).
https://science.osti.gov/~media/hep/pdf/accelerator-rd-stewardship/Energy_Environment_Report_Final.pdf.

⁶ See <https://science.osti.gov/user-facilities/user-facilities-at-a-glance/>

- *Accelerators for America's Future*, Edited by Walter Henning and Charles Shank, (2009). <https://science.osti.gov/~media/hep/pdf/accelerator-rd-stewardship/Report.pdf>.

Compact Accelerator Technologies for Security and Medicine

Technical Contact: Eric Colby, (301)-903-5475, Eric.Colby@science.doe.gov

Accelerators are used as sources of high-energy x-rays and electrons for a variety of applications in security and medicine. Many of these applications can be significantly impacted in the near term by translating advanced component and system technologies from scientific research labs towards commercial applications and by developing use-inspired benchtop demonstrators in the next 3-6 years. For some applications, the adjustability of an accelerator source (in energy, energy spectrum, beam current, and power) could offer important performance gains. Similarly, the time structure of such a source could allow noise reduction and/or time resolved measurements. For some applications the presently available source is a radioactive isotope-filled capsule, which poses a security risk.

This group of applications have some general technological requirements in common:

- Compactness of the source
 - Often 10cm x 10cm x 30cm or less (including the electron source, accelerator, target/convertor, but not including supporting equipment)
- Primary (electron) beam energies in the <10 MeV range
 - Although some applications call for much more
- A wide range of energy adjustability
 - Typically by at least a factor of two (2), often by a factor of 10 or more
 - Often on a shot-by-shot basis
- A wide range of current adjustability
 - Typically by two to four (2 – 4) orders of magnitude
 - Often on a shot-by-shot basis
- Moderate primary beam power
 - Many applications are in the 50 W-500 W range, but some battery-powered applications require 1 W, and several other applications require 1 kW or more
- Robustness and reliability
 - Most applications need a source that can be used for thousands of hours without expert intervention
- Cost Competitiveness
 - Most applications require an overall source cost (including power supplies, cooling, controls, etc.) of less than \$1M, some applications require total source cost < \$100K.

The general requirements for high power electron accelerators for security and medical applications were identified at a 2019 workshop (see references below) and can be grouped into four basic types of accelerator, summarized in Table 3 below.

Table 3. Four types of compact electron accelerators to drive advanced security and medical applications

	Type I	Type II	Type III	Type IV
General Type	Ultra-low Power Portable	Low- to Moderate-Power	Moderate- to High-Power	VHEE ⁷
Example Applications	Emergency Response	Portable Conventional Radiotherapy, Radiography, Down well (DW), Chip & Circuit Inspection (CCI), Electronic Brachytherapy (eB), Pre-clinical RT Machine (PCRT)	Secondary Screening (SS), High Energy Density Physics (HEDP), Non-Destructive Testing (NDT)	FLASH-RT
Energy Tuning Range	0.3-4 MeV	0.1-14 MeV	0.1-10 MeV	6-250 MeV
Beam Power	1 W	eB: 50 W FRT, CCI, DW: 100 W Others: 300-500 W	HEDP: 500 W NDT, SS: 1000 W	100 W
Desired Maximum Size (accelerator only)	10x10x30 cm	eB: 1x1x1 cm NDT, DW:10 Dx22 L cm PCRT 20x20x25 cm Others: 10x10x60 cm	SS, HEDP:10x10x60 cm	20x20x50 cm
Special Features	LER: <12 kg, battery power, <300 W HER: <50 kg, line power, <1.2 kW	eB: Can be sterilized Inspection: 50 micron spot size Down well: 200 C operation	Inspection: Spot size <1 micron	
Target Capital Cost	<\$100k	eB: < \$600k NDT, Down well: <\$200k Others: <\$1M	<\$1M	FLASH-RT: <\$1M

- **Ultra-low Power Portable** systems – designed primarily for emergency response to perform radiography on either moderate density or high-density objects. These systems must be person-portable, rely on either battery power or limited line power, and be low cost. Beam energies range from a few hundred kilovolts to 4 MeV at less than a watt of beam power to provide broadband (i.e. bremsstrahlung) photons from 300 kVp-4 MVp.
- **Low- to Moderate-Power** systems – designed to provide either electron beams up to 250 MeV for cancer therapy, or to provide higher fluence photon sources in the 100 kVp-14 MVp range. Beam power requirements range from 50 Watts to more than 500 W to

⁷ VHEE – Very High Electron Energy, referring to the use of high energy electrons for cancer therapy.

provide the necessary fluence. Some uses require ultracompact formats—for example electronic brachytherapy sources must fit in an endoscope, and down-well source must fit in a 10 cm bore. For cancer therapy dose control must be very precise (2%), for still other applications spectral agility is important.

- **Moderate- to High-Power systems** – designed to provide high- to very-high-flux photon sources for high speed inspection of dense objects, sterilization of medical devices, food, and sterilize harmful insects. Photon energies in the 300 kVp-10 MVp range are needed, with beam powers ranging from 500 Watts to more than 1 kW to provide the necessary fluence.
- **High Energy systems** – designed to provide extremely narrowband and/or coherent sources of photons. These devices are typically not bremsstrahlung sources but require more complex radiation generation processes such as inverse Compton scattering or undulator radiation to produce photons in the required energy range and narrow bandwidth. These systems typically require energies on the order of 1 GeV and while beam power requirements are modest, beam quality becomes critical.

The primary goals of the Compact Accelerator Technology program are to (1) develop the enabling technologies that may ultimately lead to demonstration prototypes of one or more of the principal types of compact electron accelerator needed for security and medical applications, and to (2) enhance domestic industrial capability to produce the necessary technologies.

This initial phase of the Compact Accelerator Technology program will concentrate on use-inspired basic research to produce the breakthroughs in technology necessary to make each of the four compact accelerator types practical. Grant applications are sought in these three topical areas:

- High gradient radiofrequency accelerator technology.** Proposals for significant advances in normal conducting radiofrequency accelerator technology meeting the challenging Space Weight and Power (SWaP) and cost requirements in Table 3 are sought. The proposal must clearly define the R&D milestones and technical pathway to meeting the energy, beam power, and SWaP requirements defined for one of the accelerator types identified in Table 3 within 3-6 years. *A detailed estimate of the accelerator's expected production cost must be included in Appendix 7 to support claims that the cost metric will be met.*
- Efficient x-ray generation techniques.** Innovations in electron-driven photon generating technologies usable in the 60 kVp to 14 MVp range with significantly improved electron-to-photon conversion efficiency (as compared to optimized bremsstrahlung production) and improved spectral selectivity (e.g. <20% BW) are sought in a compact device that will withstand the required input electron beam power for one of the four types identified in Table 3.
- Design principles for “expert” accelerator control systems.** Proposals to advance the design methodology for accelerator control systems are sought. Innovations in the

systems integration of diagnostics, controls, data archiving, real-time simulation, data processing, and feedback are sought which incorporate modern data-science methods (e.g., machine learning, artificial intelligence) and support rigorous verification and validation. Please note that while portions of an example control system may be built to demonstrate design principles and methodology, the primary goal of this topic is to advance the underlying design principles and methodology.

The Compact Accelerator Technologies program of this Announcement includes initial R&D to identify promising near-term technical avenues for developing compact electron accelerators of the four types discussed above, and advanced radiation generating techniques. It does **not** include the engineering and construction of full-scale accelerators for any of the four types at this time. Proposals to develop a full-scale accelerator are out of the scope of this Announcement and will be declined without review. Applications to develop longer-term compact accelerator technologies (e.g., plasma wakefield accelerators, laser-driven accelerators, two-beam accelerators, THz accelerators) will be declined if submitted to Track 1. Eligible PIs may submit such proposals to Track 2.

To meet the teaming requirement, applications under this Track 1 topic area **are strongly encouraged to** include significant participation from **all three** of the following: (1) an institution with technical leadership in a relevant accelerator technology, (2) an institution with technical experience in applying accelerator technology to the security and/or medical application proposed, and (3) a domestic company currently marketing closely related security and/or medical technology. Applications lacking significant participation in any of these three areas may score poorly under merit review.

References

As background, workshops were conducted to identify the accelerator technology research directions with the potential for high impact on security and medical applications. Workshops relevant to this topic area include:

- *Accelerators for America's Future*, Edited by Walter Henning and Charles Shank, (2009). <https://science.osti.gov/~media/hep/pdf/accelerator-rd-stewardship/Report.pdf>.
- Additional information may become available in the forthcoming report: *Basic Research Needs Workshop on Compact Accelerators for Security and Medicine*, Edited by Mike Fazio, (2019). When available, the report may be found on the webpage at <https://science.osti.gov/hep/Research/Accelerator-Stewardship/Workshop-Reports>.

Track 2: Long-Term Generic Accelerator R&D

Technical Contact: Eric Colby, 301-903-5475, Eric.Colby@science.doe.gov

NOTE: Track 2 has restricted eligibility: only regionally-accredited U.S. academic institutions or domestic nonprofit organizations subject to section 501 (c)(3) of the Internal Revenue Code may apply.

Long-term generic accelerator R&D is basic research⁸ aimed at improving the theory, computational tools, and fundamental physical and technical understanding of accelerator science. Note that more restrictive eligibility requirements apply to this topic—see [Section III.A](#) for further information. Applications may include the involvement of either an individual PI or a collaborative team: Teams are expected to develop a single research application.

Advancements in basic accelerator science and technology enable new capabilities in virtually every area of accelerator application. Grant applications are sought for high-impact advances in the following general areas: beam physics, advanced computational methods for accelerator design and analysis, advanced data-science techniques (e.g., AI/ML⁹) for accelerator controls, beam diagnostics and feedback control, new superconducting materials, new materials and coatings for accelerator components, novel power sources for accelerators, new particle sources, novel magnet designs, novel lattice designs, compact accelerator technologies, and novel technologies for secondary beam production.

Applications that will lead to significant increases in performance (flux, brightness, polarization, coherence, stability, reliability, flexibility) and decreases in cost (construction cost, operating cost, physical size, complexity) are sought.

While R&D in this area is often far upstream of application, the areas where the research will have greatest impact can generally be identified. *It is essential that the application clearly articulate how the R&D meets a stated need of the Stewardship Customer.* See the detailed merit review questions in section V.A.2 under “Quality of the Accelerator Stewardship Opportunity”, and the selection considerations in section V.B.2 “Selection”.

During both pre-application and full application reviews, the stakeholder federal agencies will be contacted to confirm that the work is a priority (see [Section V.B.2](#)) and is not duplicative of existing efforts. Applications which are not encouraged by one or more of the stakeholder federal agencies will not be funded.

Track 3: Accelerator-Technology Sector Production Enhancement

Technical Contact: Eric Colby, 301-903-5475, Eric.Colby@science.doe.gov

The Office of Accelerator R&D and Production, SC-24.2 (ARDAP) was established in 2020 in recognition of the central importance of accelerators and related technologies to the current and future scientific capabilities stewarded by Office of Science programs. One of the objectives of ARDAP is to ensure a robust pipeline of next-generation accelerator science and technology to facilitate and support the existing broad scope of accelerator-based scientific research while providing technology advances and industrial strength that position the U.S. to lead the world for years to come.

ARDAP may make future investments to facilitate development of stronger production capabilities in key technology sectors. To support these investments, the initial phase of the

⁸ Specifically, it is basic research that is not intended for a specific facility or construction project

⁹ “AI/ML” refers to artificial intelligence and machine learning techniques

Accelerator-Technology Sector Production Enhancement program will concentrate on developing business plans covering these key technology sectors.

The following five accelerator technology sectors are strategically important for current and future accelerator facilities:

1. Advances in superconducting accelerator systems, including superconducting radiofrequency (SRF), superconducting magnets, and cryogenic engineering;
2. Beam physics and high-fidelity computer modeling, better diagnostics, artificial intelligence/machine learning (AI/ML)-based control systems, advanced focusing and beam cooling techniques;
3. Advances in high intensity electron, proton, and ion sources, megawatt-class targets for secondary particle sources;
4. Higher-average-power and higher-efficiency radiofrequency and ultrafast laser sources, power handling devices, high-precision/accuracy x-ray optics; and
5. High-risk, high-reward advances in particle sources, beam dynamics, acceleration techniques, and materials.

Grant applications are sought that will result in the development of coherent, comprehensive, quantitative business plans that synergistically leverage the complementary strengths of industry, the national laboratories, and academia, and will result in a domestic accelerator technology ecosystem that can support physical science for years to come. Track 3 awards may be up to 12 months in duration and are not renewable. Teaming requirements apply to this track, see below.

(1) Accelerator Technology Sector Business Plan

a. Enhanced Production Business Plan Analysis.

With a view of new, upgraded, and operating Office of Science accelerator facilities over the next 10 years, what is a feasible business approach to developing enhanced domestic production capabilities that can meet the anticipated production delivery requirements of one of the technology sectors listed above? The response must be a report containing a business plan that has, at a minimum, the following:

- i. A description of the optimal public/private partnership including:
 1. A discussion of the group of public and private institutions that should be directly involved in the partnership;
 2. A discussion of which technologies would need to be transferred from both DOE national laboratories and universities to this public/private partnership;
 3. A discussion of how an optimal partnership's management structure could work;
 4. A discussion of how best to affect the transfer of technology from both DOE national laboratories and universities to this public/private partnership;
 5. A discussion of where public funding would be needed to draw strong participants into the partnership and overcome existing market failures;

6. A discussion of how quality can be assured across the partnership of companies; and
 7. A description of how intellectual property is managed.
- ii. An analysis of the pathway to production at market scale.
 - iii. An analysis and projection of the market for this technology sector, discussing the optimal route to making the industry (or partnership) sustainable, and considering possible synergies with related technologies and markets.
 - iv. Description of what workforce development is needed to ensure the long-term success of this technology sector.
 - v. Discussion of other critical factors, not listed above, that would impact the viability of the eventual industry or partnership (e.g., regulatory issues).

Specifics of the public/private partnership need to be defined in the report, including what entities (domestic companies, DOE national laboratories, and/or universities) constitute it. Discussion of where existing and future market pull is likely to support industrial production, and where public funding is needed to overcome market entry costs is essential. Successful proposals will clearly differentiate technologies that will have significant leverage from market demand and industrial interest from those that require significant long-term federal investment. Awardees will communicate with ARDAP during the award to identify future accelerator production needs.

To meet the teaming requirement, applications under this Track 3 topic area **are strongly encouraged to** include significant participation from each of the following: (1) at least one institution with technical leadership in one of the accelerator technology sectors listed above, (2) multiple industrial companies currently active (or interested in becoming active) in this sector of the marketplace, and (3) a business school or business consulting firm with experience developing business plans in AS&T or in a technologically and economically similar marketplace. Applications lacking significant participation in any of these three areas may score poorly under merit review (see [Section V.A.2](#)).

Specifically not of interest are: (1) single-technology or single-vendor commercialization plans, and (2) R&D proposals seeking to perform technology transfer. Proposals of either type will be deemed unresponsive and will be declined without review.

Note that the final product will be a publicly available business plan describing the analyses listed above.

APPLICATION REQUIREMENTS

All applications submitted to this Funding Opportunity Announcement (FOA) must address one of the research topic areas described in the previous section. Further, all applications must conform to the format specified in Section IV of this FOA; each application will be pre-screened for responsiveness to the research area descriptions and for compliance with the application requirements.

Annual Meetings

PIs should plan on travelling to the Washington DC area for a two- to three-day annual PI meeting, beginning in FY2022

Open Science

SC is dedicated to promoting the values of openness in Federally-supported scientific research, including, but not limited to, ensuring that research may be reproduced and that the results of Federally-supported research are made available to other researchers. These objectives may be met through any number of mechanisms including, but not limited to, data access plans, data sharing agreements, the use of archives and repositories, and the use of various licensing schemes.

The use of the phrase “open-source” does not refer to any particular licensing arrangement but is to be understood as encompassing any arrangement that furthers the objective of openness.

Multi-Institutional Teams

Collaborative applications will not be accepted under this FOA.

SUBAWARDS

Multi-institutional teams must submit one application from a designated lead institution with all other team members proposed as subawardees.

DOE National Laboratories, other Federal agencies, and another Federal agency’s FFRDCs¹⁰ may be proposed as subawardees.

Note that the value of any such proposed subaward may be removed from any such prime award: DOE may make separate awards to Federally-affiliated institutions.

All entities submitting applications to this FOA must recognize the moral and legal obligations to comply with export controls and policies that limit the transfer of technologies with potential dual use. Applicants are reminded that international activities must comply with nonproliferation, sanction, and other protocols described at <https://www.export.gov>.

International activities related to special nuclear materials (SNM) are subject to additional requirements. Please see 10 CFR 810 for further information.

This FOA is to support scientific endeavors that could be described in scholarly publications. Do not submit applications containing restricted data or unclassified

¹⁰ An authoritative list of all Federally Funded Research and Development Centers (FFRDCs) may be found at <https://www.nsf.gov/statistics/ffrdclist/>

nuclear information as defined in the Atomic Energy Act of 1954, as amended, 42 USC 2011 et seq., 10 CFR 1017, 10 CFR 1045.

Section II – AWARD INFORMATION

A. TYPE OF AWARD INSTRUMENT

DOE anticipates awarding grants, interagency agreements, and National Laboratory authorizations under this FOA.

Multi-institutional teams must apply using a prime and subaward model with one application submitted by the lead institution.

Statement of Substantial Involvement

Not applicable.

B. ESTIMATED FUNDING

It is anticipated that approximately \$6,000,000 will be available for all Accelerator R&D Stewardship new and renewal awards.

Out of an estimated \$3,000,000 in FY 2021 funding, approximately \$1,000,000 may be awarded in the Track 2 topic area of Long-Term Generic Accelerator R&D, and approximately \$400,000 may be awarded in Track 3, Accelerator-Technology Sector Production Enhancement.

DOE anticipates that the total value of grants made under this FOA will be approximately \$3 million. DOE expects that, subject to the availability of future year appropriations, \$6 million will be used to support grants, national laboratory authorizations, and interagency awards under this FOA.

DOE is under no obligation to pay for any costs associated with preparation or submission of applications. DOE reserves the right to fund, in whole or in part, any, all, or none of the applications submitted in response to this FOA.

C. MAXIMUM AND MINIMUM AWARD SIZE

The award size will depend on the number of meritorious applications and the availability of appropriated funds.

Track 1 and Track 2: Maximum award size \$3,000,000. Minimum award size \$75,000.

Note: the ceiling and floor given above for Track 1 and Track 2 applications represent historical experience. Past practice is not an obligation to stay within the historic ceiling and floor.

Track 3: Maximum award size \$200,000. Minimum award size \$50,000.

D. EXPECTED NUMBER OF AWARDS

The exact number of awards will depend on the number of meritorious applications and the

availability of appropriated funds.

E. ANTICIPATED AWARD SIZE

(See [B. Estimated Funding](#) above.)

The award size will depend on the number of meritorious applications and the availability of appropriated funds.

F. PERIOD OF PERFORMANCE

(See [B. Estimated Funding](#) above.)

The period of performance will depend on the number of meritorious applications, the results of merit review, the program policy factors, and the availability of appropriated funds.

Track 3 applications must not have a period of performance that is longer than 12 months.

Continuation funding (funding for the second and subsequent budget periods) is contingent on: (1) availability of funds appropriated by Congress and future year budget authority; (2) progress towards meeting the objectives of the approved application; (3) submission of required reports; and (4) compliance with the terms and conditions of the award.

G. TYPE OF APPLICATION

DOE will accept new and renewal applications under this FOA.

Renewal Applications are accepted for Track 1 and Track 2 **only**. Renewal applications submitted to Track 3 may be declined without review.

Section III – ELIGIBILITY INFORMATION

A. ELIGIBLE APPLICANTS

All types of domestic applicants are eligible to apply, except nonprofit organizations described in section 501(c)(4) of the Internal Revenue Code of 1986 that engaged in lobbying activities after December 31, 1995.

In accordance with 2 CFR 910.126, Competition, eligibility for award is restricted as described below:

Track 1: Accelerator Stewardship Topical Areas

Applications for activities in Track 1: Accelerator Stewardship Topical Areas will be accepted from all responsible domestic organizations capable of meeting the objectives of this FOA.

Track 2: Long-Term Generic Accelerator R&D

Applications for activities in Track 2: Long-Term Generic Accelerator R&D will only be accepted from regionally-accredited U.S. academic institutions or domestic nonprofit organizations subject to Section 501 (c)(3) of the Internal Revenue Code.

Limiting eligibility to regionally-accredited U.S. academic institutions or domestic nonprofit organizations subject to Section 501 (c)(3) of the Internal Revenue Code is necessary because limits the pool of applicants to those most likely to be favorably reviewed. The restriction makes the best use of limited budgetary resources by increasing support for investigators at domestic institutions. The restriction also enhances the ability to find non-conflicted merit reviewers.

Track 3: Accelerator-Technology Sector Production Enhancement

Applications for activities in Track 3: Accelerator-Technology Sector Production Enhancement will be accepted from all responsible domestic organizations capable of meeting the objectives of this FOA.

Federally-affiliated entities must adhere to the eligibility standards below:

1. DOE/NNSA National Laboratories

DOE/NNSA National Laboratories are eligible to submit applications under this FOA and may be proposed as subawardees under another organization's application. If recommended for funding as a lead applicant, funding will be provided through the DOE Field-Work Proposal System and will be conducted under the laboratory's contract with DOE. No administrative provisions of this FOA will apply to the laboratory or any laboratory subcontractor. If recommended for funding as a proposed subawardee, the value of the proposed subaward will be

removed from the prime applicant's award and will be provided to the laboratory through the DOE Field-Work Proposal System and will be conducted under the laboratory's contract with DOE. Additional instructions for securing authorization from the cognizant Contracting Officer are found in [Section VIII](#) of this FOA.

2. Non-DOE/NNSA FFRDCs

Non-DOE/NNSA FFRDCs are eligible to submit applications under this FOA and may be proposed as subawardees under another organization's application. If recommended for funding as a lead applicant, funding will be provided through an Inter-Agency Award to the FFRDC's sponsoring Federal Agency. If recommended for funding as a proposed subawardee, the value of the proposed subaward may be removed from the prime applicant's award and may be provided through an Inter-Agency Award to the FFRDC's sponsoring Federal Agency. Additional instructions for securing authorization from the cognizant Contracting Officer are found in [Section VIII](#) of this FOA.

3. Other Federal Agencies

Other Federal Agencies are neither eligible to submit applications under this FOA nor to be proposed as subawardees under another organization's application.

This FOA does not support an applicant's commercial activity. Applications from for-profit organizations that propose a scientific scope of work related to current business activity or uses are considered to be commercial activity and will be declined. Applications containing a scientific scope of work that is or has been supported by or proposed to a Federal Small Business Innovative Research or Small Business Technology Transfer (SBIR / STTR) program are considered to be commercial activity and may be declined without merit review. All for-profit applicants must include a description, not to exceed 200 words, of how their proposed work will advance scientific understanding of a basic and fundamental nature as an appendix to the research narrative.

Applications that are submitted by applicants that have not submitted a required pre-application may be declined without further review.

B. COST SHARING AND INSTITUTIONAL COMMITMENTS

Cost sharing for basic and fundamental research is not required pursuant to an exclusion from the requirements of Section 988 of the Energy Policy Act of 2005.

Demonstrations of institutional or third-party commitment to the proposed activity, as described in Section IV.D., Appendix 12, are **strongly encouraged** for all applications.

Examples of non-Federal contributions that may be considered as demonstrating institutional or third-party commitment include, but are not limited to, the following:

- The provision of space, facilities, equipment, or resources at no or reduced charge;
- The provision of release time for faculty;

- The provision of scholarship support for students; or
- The waiver of facilities and administrative costs, in whole or in part.
- Third party contributions (e.g., state, private entities, etc.)

The institutional commitment is not to be documented on the application's budget: institutional commitments are neither a formal nor a voluntary committed cost sharing, but it must be described in Appendix 12.

Cost sharing and Institutional commitments may not include the following:

- Revenues or royalties from the prospective operation of an activity beyond the time considered in the award;
- Proceeds from the prospective sale of an asset of an activity; or
- Other Federal awards.

Additionally, cost sharing, may be required under a class patent waiver, if applicable, as discussed in Section VIII.

C. ELIGIBLE INDIVIDUALS

Individuals with the skills, knowledge, and resources necessary to carry out the proposed research as a Principal Investigator (PI) are invited to work with their organizations to develop an application for assistance. Individuals from underrepresented groups as well as individuals with disabilities are always encouraged to apply for assistance.

Section IV – APPLICATION AND SUBMISSION INFORMATION

A. ADDRESS TO REQUEST APPLICATION PACKAGE

Application forms and instructions are available at Grants.gov. To access these materials, go to <https://www.Grants.gov>, select “Apply for Grants”, and then select “Download Application Package.” Enter the Catalog of Federal Domestic Assistance (CFDA) number (81.049) and/or the FOA number shown on the cover of this FOA and then follow the prompts to download the application package.

Applications submitted through www.FedConnect.net will not be accepted. Applications may not be submitted through PAMS at <https://pamspublic.science.energy.gov>.

B. LETTER OF INTENT AND PRE-APPLICATION

1. Letter of Intent

Not applicable.

2. Pre-application

PRE-APPLICATION DUE DATE

The pre-application due date is printed on the cover of the FOA.

ENCOURAGE/DISCOURAGE DATE

The pre-application response date is printed on the cover of the FOA.

A pre-application is required and must be submitted by the date indicated on the cover of the FOA.

Pre-applications will be reviewed for responsiveness of the proposed work to the research topics identified in this FOA. DOE will send a response by email to each applicant encouraging or discouraging the submission of an application by the date indicated on the cover of the FOA. Applicants who have not received a response regarding the status of their pre-application by this date are responsible for contacting the program to confirm this status.

Applications that have not been encouraged by DOE may be declined without merit review.

The pre-application attachment must include, at the top of the first page, the following information:

Title of Pre-application
Principal Investigator Name, Job Title
Institution
PI Phone Number, PI Email Address

FOA Number: Include the FOA Number indicated on the cover of this FOA
 Application Type: [New or Renewal]
 Track # / Topic #

This information must be followed by a clear and concise description of the objectives and technical approach of the proposed research.

Proposed Research: What will be accomplished? What methods will be used? Why is the approach superior to existing approaches?

Stewardship Customer: Who, specifically, is the Stewardship Customer? What specific evidence is there that the proposed work addresses a priority need of the Customer? (See section V.A for the definition of “Stewardship Customer”, and examples of evidence of Customer need.)

Statement of Work: At a high level, what are the main tasks to be accomplished?

Description of results, products: What scientific and/or technical advances will result? How will the results be a significant advance over existing knowledge or techniques? How will the results be captured? (scientific papers, prototypes, patents, software packages, etc.)?

Teaming and Management Plan: With whom do you plan to team? What unique advantages does your group or team have? How do the group/team participants reflect the range of skills needed to complete the proposed research? How will the effort be managed?

Cost, Schedule, Milestones: Provide a high-level description of the cost, schedule, and major milestones of the proposed work. Include a table similar to the following:

Institution	Task Lead	Main Tasks & Milestones	Yr 1 [k\$]	Yr 2 [k\$]	Yr 3 [k\$]
University X	R. Doe	Complete design simulations of widget. Simulation support during testing.	30	10	10
	S. Jones	Engineer and build widget.	170	120	10
Laboratory Y	T. Smith	Consult during design phase. Test prototype widget at test facility Q.	10	50	120
Company Z	U. Brown	Consult during design phase. Design initial marketable version of widget.	20	50	130
Total			230	230	270

The pre-application may not exceed two pages, when printed using standard letter-size (8.5 x 11 inch) paper with 1-inch margins (top, bottom, left, and right). The font must not be smaller than 11 point. Figures and references, if included, must fit within the two-page limit.

After the description of the proposed research, include a listing of individuals known to be conflicted from serving as a reviewer. This list should include, for the PI and Senior/Key Personnel:

- Collaborators and Co-editors: List in alphabetical order all persons (first and last names

and their current organizational affiliation) who are, or who have been, collaborators or co-authors on a research project, book or book article, report, abstract, or paper during the 48 months preceding the submission of this pre-application. For publications or collaborations with more than 10 authors or participants, only list those individuals in the core group with whom the PI interacted on a regular basis while the research was being done. Also, list any individuals who are currently, or have been, co-editors on a special issue of a journal, compendium, or conference proceedings during the 24 months preceding the submission of this pre-application. If there are no collaborators or co-editors to report, state "None."

- Graduate and Postdoctoral Advisors and Advisees: List the first and last names and current organizational affiliations of your graduate advisor(s) and principal postdoctoral sponsor(s). Also, list the names and current organizational affiliations of your graduate students and postdoctoral associates.
- Personnel must be listed with their full first and last names and their institutions must be spelled out.

The pre-application must be machine readable. Do not submit a scanned image of a printed document.

PRE-APPLICATION REVIEW

Those pre-applications that are encouraged will be used to help SC begin planning for the application peer review process. SC's intent in discouraging submission of certain applications is to save the time and effort of applicants in preparing and submitting applications not responsive to this FOA.

The PI will be automatically notified when the pre-application is encouraged or discouraged. The DOE SC Portfolio Analysis and Management System (PAMS) will send an email to the PI from PAMS.Autoreply@science.doe.gov, and the status of the pre-application will be updated at the PAMS website <https://pamspublic.science.energy.gov/>. Notifications are sent as soon as the decisions to encourage or discourage are finalized.

PRE-APPLICATION SUBMISSION

The pre-application must be submitted electronically through the DOE SC Portfolio Analysis and Management System (PAMS) website <https://pamspublic.science.energy.gov/>.

There is no requirement to seek approval if teaming arrangements, proposed personnel, topics, or the anticipated title change between submitting the pre-application and when an application is submitted. Applicants are encouraged to inform their DOE Program Manager of such changes to ensure that their application is properly linked to their pre-application.

Detailed instructions about how to submit a pre-application are in [Section VIII](#) of this FOA.

C. GRANTS.GOV APPLICATION SUBMISSION AND RECEIPT PROCEDURES

Applications in response to this FOA must be submitted through Grants.gov. Detailed instructions for registering in and using Grants.gov are in [Section VIII](#) of this FOA.

D. CONTENT AND APPLICATION FORMS

LETTERS

Letters of support may be included with applications.

1. SF-424 (R&R)

Complete this form first to populate data in other forms. Complete all the required fields in accordance with the pop-up instructions on the form. The list of certifications and assurances referenced in Field 17 is available on the DOE Financial Assistance Forms Page at <https://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms> under Certifications and Assurances. Applicants are bound by their representations and certifications in SAM.gov.

DUNS/UEI AND EIN NUMBERS (FIELDS 5 AND 6)

The DUNS/UEI and Employer Identification Number (EIN) fields on the SF-424 (R&R) form are used in PAMS to confirm the identity of the individual or organization submitting an application.

- Enter each number as a nine-digit number.
- Do not use hyphens or dashes.
- SC does not use the 12-digit EIN format required by some other agencies.
- SC does not use the DUNS+4 format.

TYPE OF APPLICATION (FIELD 8)

A **new** application is one in which DOE support for the proposed research is being requested for the first time. A **renewal** application requests additional funding for a period of time following a current award. If the application requests a significant change in the scope of work, please consult with the Program contact identified in this FOA to determine if the application should be considered new or a renewal.

SC does not make use of the Resubmission or Continuation options.

Please answer “yes” to the question “Is this application being submitted to other agencies?” if substantially similar, identical, or closely related research objectives are being submitted to another Federal agency. Indicate the agency or agencies to which the similar objectives have been submitted.

2. Research and Related Other Project Information

Complete questions in fields 1 through 6 of the SF-424 Research and Related Other Project

Information form.

Note regarding question 4.a. and 4.b.:

If any environmental impact, positive or negative, is anticipated, indicate “yes” in response to question 4.a., “potential impact – positive or negative - on the environment.” Disclosure of the impact should be provided in response to question 4.b. First indicate whether the impact is positive or negative and then identify the area of concern (e.g., air, water, exposure to radiation, etc.). Should the applicant have any uncertainty, they should check “yes.”

DOE understands the phrase in field 4.a., “potential impact ... negative” to apply if the work described in the application could potentially have any of the impacts listed in (1) through (5) of 10 CFR 1021, Appendix B, Conditions that Are Integral Elements of the Classes of Action in Appendix B. (<http://www.ecfr.gov>)

Additionally, for actions which could have any other adverse impacts to the environment or have any possibility for adverse impacts to human health (e.g., use of human subjects, Biosafety Level 3-4 laboratory construction/operation, manufacture or use of certain nanoscale materials which are known to impact human health, or any activities involving transuranic or high level radioactive waste, or use of or exposure to any radioactive materials beyond de minimis levels), applicants should indicate a “negative” impact on the environment.

Lastly, 1) if there would be extraordinary circumstances (i.e., scientific or public controversy) related to the significance of environmental effects (10 CFR 1021.410 (b)(2)), 2) if the work is connected to other actions with potentially significant impacts (10 CFR 1021.410 (b)(3), or 3) if the work is related to other nearby actions with the potential for cumulatively significant impacts (10 CFR 1021.410 (b)(3)), applicants should indicate a “negative” impact on the environment.

The bulk of your application will consist of files attached to the Research and Related Other Project Information form. The files must comply with the following instructions:

PROJECT SUMMARY/ABSTRACT (FIELD 7 ON THE FORM)

The project summary/abstract is a summary of the proposed activity suitable for distribution to the public and sufficient to permit potential reviewers to identify conflicts of interest. It must be a self-contained document. Provide the name of the applicant, the project title, the PI and the PI's institutional affiliation, any coinvestigators and their institutional affiliations, the objectives of the project, a description of the project, including methods to be employed, and the potential impact of the project (i.e., benefits, outcomes). A sample is provided below:

Project Title

A. Smith, Lead Institution (Principal Investigator) A. Brown, Institution 2 (Co-Investigator) A. Jones, Institution 3 (Co-Investigator)
Text of abstract

The project summary must not exceed 1 page when printed using standard letter-size (8.5 x 11 inch) paper with 1-inch margins (top, bottom, left and right) with font not smaller than 11 point. To attach a Project Summary/Abstract, click “Add Attachment.”

If an application is recommended for award, the project summary will be used in preparing a public abstract about the award. Award abstracts and titles form a Government document that describes the project and justifies the expenditure of Federal funds in light of the DOE and SC mission statements at <https://energy.gov/mission> and <https://science.osti.gov/about/>.

- Do not include any proprietary or sensitive business information.
- DOE may use the abstract to prepare public reports about supported research.

DOE TITLE PAGE
(PART OF PROJECT NARRATIVE ATTACHED TO FIELD 8 ON THE FORM)

The application narrative must begin with a title page that will not count toward the project narrative page limitation. The title page must include the following items:

- The project title
- Applicant/Institution:
- Street Address/City/State/Zip:
- Postal Address:
- Lead PI name, telephone number, email:
- Administrative Point of Contact name, telephone number, email:
- FOA Number: DE-FOA-0002463
- DOE/SC Program Office: Accelerator R&D and Production
- DOE/SC Program Office Technical Contact: Eric.Colby@science.doe.gov
- DOE Award Number (if Renewal Application):
- PAMS Preproposal tracking number (if applicable):
- Research area or areas as identified in [Section I](#) of this FOA (if applicable):
- Include a table modeled on the following chart providing summary budget information from all collaborating institutions. Provide the total costs of the budget request in each year for each institution and totals for all rows and columns. Include the value of any institutional commitment being offered. If necessary, modify the table below for the correct number of years.

Name and Yearly Budget for Proposals with Multiple Institutions							
	Name	Institution	Year 1 Budget	Year 2 Budget	Year 3 Budget	Total Budget	Institutional Commitment
Lead							

PI							
Co-PI							
Co-PI							
Co-PI							

SAMPLE BUDGET TABLE

Important Instructions to the Sponsored Research Office of Submitting Institutions: SC requires that you create one single machine readable PDF file that contains the DOE Title Page, project narrative, biographical sketch, current and pending support, bibliography and references cited, facilities and other resources, equipment, data management plan, and other attachments. This single PDF file may not be scanned from a printed document and must be attached in Field 8 on the Grants.gov form. Do not attach any of the items listed in this paragraph separately in any other field in Grants.gov. If you do, these additional attachments will not become part of the application in PAMS.

PROJECT NARRATIVE (FIELD 8 ON THE FORM)

The project narrative **must not exceed a page limit of 16 pages for Track 1 and Track 2 applications, and must not exceed 6 pages for Track 3 applications** of technical information, including charts, graphs, maps, photographs, and other pictorial presentations, when printed using standard letter-size (8.5 x 11 inch) paper with 1-inch margins (top, bottom, left, and right). The font must not be smaller than 11 point. Merit reviewers will only consider the number of pages specified in the first sentence of this paragraph. This page limit does not apply to the Title Page, Budget Page(s), Budget Justification, biographical material, publications and references, and appendices, each of which may have its own page limit defined later in this FOA.

Do not include any websites (URLs) that provide supplementary or additional information that constitutes a part of the application. Merit reviewers are not required to access websites; however, Internet publications in a list of references will be treated identically to print publications. See [Section VIII](#) for instructions on how to mark proprietary application information. To attach a Project Narrative, click “Add Attachment.”

The narrative required depends on the Track to which the grant application is being submitted. Read this section carefully to understand the appropriate format and content to include.

Narrative Format for Track 1: Accelerator Stewardship Topical Areas

Track 1 grant applications must not exceed **16 pages** and must include the following sections, with a recommended page length for each section indicated in braces:

- A. {1 page} Background/Introduction.** Explanation of the importance and relevance of the proposed work as well as a review of the relevant literature. A brief description of research activities conducted by the primary team members and their R&D groups, including

accomplishments and impacts made during the recent past (typically the past three years), is also encouraged.

B. {6 pages} Proposed Research, Innovative Claims, Technical Rationale, and Approach. If appropriate, identify the hypotheses to be tested and details of the methods to be used. This section should describe the scientific and technical challenges, unique approach(es), and potential anticipated technical solutions in the topical area that will be addressed. Applications should clearly explain the technical approach(es) that will be employed and provide ample justification for their feasibility. This section should demonstrate that the proposer has a clear understanding of the state-of-the-art, and it should provide sufficient technical details to permit complete evaluation of the feasibility of the approach. Additionally, comparison with other ongoing research efforts should be provided indicating advantages and disadvantages of the proposed effort.

C. {2 pages} Program Plan & Risk Assessment. A narrative explaining the explicit timelines, milestone achievements, and quantitative metrics by which progress toward the goals can be evaluated. The proposed period of performance of the overall program, and each program phase, should be clearly stated. The narrative should include a specific plan detailing how all program metrics will be accurately assessed. This section should also identify major technical risk elements specific to the proposed approach, estimate the risk magnitude for each such element, and describe specific plans to mitigate risk.

D. {1 page} Statement of Work. Clearly and concisely define the technical work to be performed on a task-by-task basis, listing the durations and the dependencies among the tasks. The statement of work **must** include a table defining the program metrics to be applied.

For each task, provide:

- A general description of its objective;
- A detailed description of the approach to be taken to accomplish it;
- Identification of the primary organization responsible for task execution (prime, sub, team member, by name, etc.);
- The completion criteria for each task/activity – a product, event, or milestone that defines its completion.

E. {2 pages} Description of the results, products, transferable technology, and expected technology transfer path. Summarize the objectives associated with the proposed research and, where appropriate, the plans and capability to accomplish technology transfer and commercialization. If this application has a commercial product as the end goal, clearly describe the market opportunity. If intellectual property rights will be reserved and assigned, describe the expected assignment of such rights, the measures to be used to protect proprietary information, and include relevant agreements in Appendix 7. See also Section VIII. “Intellectual Property” for instructions on marking proprietary information in the application.

F. {2 pages} Teaming and Management Plan. A clearly defined organization chart for the program team that includes, as applicable: (1) the programmatic relationship of the primary team member; (2) the unique capabilities of the primary team members; (3) the task responsibilities of the primary team members; (4) the teaming strategy among the team members; and (5) the key personnel along with the amount of effort to be expended by each person during each year. Please include in Appendix 7: Other Attachment any formal teaming agreements that are required to execute this plan.

G. {2 pages} Cost, schedule, and measurable milestones for the proposed research, including estimates of cost for each task in each year of the effort, broken down by the primes and major subcontractors, total cost, and any cost sharing. (Note: Measurable milestones should capture key development points in tasks and should be clearly articulated and defined in time relative to start of effort.) Where the effort consists of multiple portions which could reasonably be partitioned for purposes of funding, these should be identified as options with separate cost estimates for each. Describe the institutional commitment being offered (see section III.B).

Narrative Format for Track 2: Long-Term Generic Accelerator R&D

Track 2 grant applications must not exceed **16 pages** and must include the following sections:

Background/Introduction: Explanation of the importance and relevance of the proposed work as well as a review of the relevant literature. Describe the application(s) that are most likely to be impacted by this work, citing prior workshops, studies, white papers, or other documented evidence of the need for progress in this application area[†]. A brief description of research activities conducted by the Principal Investigator and his/her group, including specific roles and responsibilities in collaborative research efforts, and accomplishments and impacts made during the recent past (typically the past three years), is also encouraged.

Multiple Investigators: In applications with more than one senior investigator, the accomplishments, milestones, and plans of each senior investigator must be clearly identified. Reviewers will be asked to assess the accomplishments and plans of each senior investigator and these evaluations will be used as input to the funding decisions.

Proposed Research and Methods: Identify the hypotheses to be tested (if any) and details of the methods to be used.

Project Objectives: This section should provide a clear, concise statement of the specific objectives/aims of the proposed project.

Timetable of Activities: This section should outline, year-by-year, all the important

[†] Please note that applications are scored on how well the proposed work meets the needs of one or more Stewardship Customers. See Section V.A.2 for a definition of the term “Stewardship Customer”, and for examples of what constitutes evidence of customer interest.

activities or phases of the project, including any activities planned beyond the project period. Successful applicants must use this project timetable to report progress.

Narrative Format for Track 3: Accelerator-Technology Sector Production Enhancement

Track 3 awards are considerably shorter in duration and smaller in scope, and consequently have an abbreviated application format. Track 3 grant applications must not exceed **6 pages** and must include the following sections, with a recommended page length for each section indicated in braces:

A. {1 page} Background/Introduction. Explanation of the importance and relevance of the proposed technology sector as well as a review of the relevant literature. Provide a brief description of the current market state and the state of any public/private collaborations and partnerships that exist in this sector. Outline the research and industrialization activities conducted by the primary team members participating in this proposal, including accomplishments and impacts made during the recent past (typically the past three years).

B. {2 page} Outline of the Business Plan. This section should provide an overview of the business plan that the collaboration expects to prepare. The questions identified under the Track 3 topic description above are the minimum requirements, but are neither comprehensive, nor sufficient to comprise a complete business plan. Describe the additional questions and discussion that are needed to provide a complete business plan.

C. {1 page} Proposed Information Gathering and Analysis. This section should describe the approach to gathering the required information to inform the development of the business plan. This section should describe the sources and methods, outline any meetings or other public input processes, and outline the analysis that will be completed.

D. {0.5 page} Statement of Work. Clearly and concisely define the work to be performed on a task-by-task basis, listing the durations and the dependencies among the tasks. This section must identify all key tasks and identify the contributions of the different team members for each of these tasks.

For each task, provide:

- A general description of its objective;
- A detailed description of the approach to be taken to accomplish it;
- Identification of the primary organization responsible for task execution (prime, sub, team member, by name, etc.);
- The completion criteria for each task/activity – a product, event, or milestone that defines its completion.

E. {1 page} Teaming and Management Plan. A clearly defined organization chart for the program team that includes, as applicable: (1) the programmatic relationship of the primary team members; (2) the unique capabilities of the primary team members; (3) the task responsibilities of the primary team members; (4) the teaming strategy among the team members; and (5) the key personnel along with the amount of effort to be expended by each

person. Please include in Appendix 7: Other Attachment any formal teaming agreements that are required to execute this plan.

F. {0.5 page} Cost, schedule, and measurable milestones for developing the business plan, including estimates of cost for each task of the effort, broken down by the primes and major subcontractors, total cost, and any cost sharing. (Note: Measurable milestones should capture key development points in tasks and should be clearly articulated and defined in time relative to start of effort.) Describe the institutional commitment being offered (see section III.B).

General Instructions That Apply to Track 1, Track 2, and Track 3 Grant Applications

It is important that the project narrative section provide a complete description of the proposed work, because reviewers are not obliged to read the last Appendix in any detail. Applications exceeding the page limits will be declined without review. The page count limitation does not include the Cover Page and Budget Pages, the Title Page, the biographical material and publication information, or any Appendices.

Do not attach any of the requested appendices described below as files for fields 9, 10, 11, and 12 in Grants.gov. Follow the below instructions to include the information as appendices in the single, bundled project narrative file.

APPENDIX 1: BIOGRAPHICAL SKETCH

Provide a biographical sketch for the PI and each senior/key person listed in Section A on the R&R Budget form.

- Provide the biographical sketch information as an appendix to your project narrative.
- Do not attach a separate file.
- The biographical sketch appendix will not count in the project narrative page limitation.
- The biographical information (curriculum vitae) for each person must not exceed 2 pages when printed on letter-size (8.5 x 11 inch) paper with 1-inch margins (top, bottom, left, and right) with font not smaller than 11 point

Detailed instructions may be found in [Section VIII](#) of this FOA.

WARNING: These instructions have been significantly revised to require disclosure of a variety of potential conflicts of interest or commitment, including participation in foreign government-sponsored talent recruitment programs.

The PI and each senior/key person at the prime applicant and any proposed subaward must provide a list of all sponsored activities, awards, and appointments, whether paid or unpaid; provided as a gift with terms or conditions or provided as a gift without terms or conditions; full-time, part-time, or voluntary; faculty, visiting, adjunct, or honorary; cash or in-kind; foreign or domestic; governmental or private-sector; directly supporting the individual's research or indirectly supporting the individual by supporting students, research staff, space, equipment, or other research expenses. All foreign government-

sponsored talent recruitment programs must be identified in current and pending support.

APPENDIX 2: CURRENT AND PENDING SUPPORT

Provide a list of all current and pending support for the PI and senior/key personnel, including subawardees, regardless of funding source. Provide the Current and Pending Support as an appendix to your project narrative. Concurrent submission of an application to other organizations for simultaneous consideration will not prejudice its review.

- Do not attach a separate file.
- This appendix will not count in the project narrative page limitation.

Detailed instructions may be found in [Section VIII](#) of this FOA.

APPENDIX 3: BIBLIOGRAPHY & REFERENCES CITED

Provide a bibliography of any references cited in the Project Narrative. Each reference must include the names of all authors (in the same sequence in which they appear in the publication), the article and journal title, book title, volume number, page numbers, and year of publication. For research areas where there are routinely more than 10 coauthors of archival publications, you may use an abbreviated style such as the *Physical Review Letters* (PRL) convention for citations (listing only the first author). For example, your paper may be listed as, “A Really Important New Result,” A. Aardvark et. al. (MONGO Collaboration), PRL 999. Include only bibliographic citations. Applicants should be especially careful to follow scholarly practices in providing citations for source materials relied upon when preparing any section of the application. Provide the Bibliography and References Cited information as an appendix to your project narrative.

- Do not attach a separate file.
- This appendix will not count in the project narrative page limitation.

APPENDIX 4: FACILITIES & OTHER RESOURCES

This information is used to assess the capability of the organizational resources, including subawardee resources, available to perform the effort proposed. Identify the facilities to be used (Laboratory, Animal, Computer, Office, Clinical and Other). If appropriate, indicate their capacities, pertinent capabilities, relative proximity, and extent of availability to the project. Describe only those resources that are directly applicable to the proposed work. Describe other resources available to the project (e.g., machine shop, electronic shop) and the extent to which they would be available to the project. For proposed investigations requiring access to experimental user facilities maintained by institutions other than the applicant, please provide a document from the facility manager confirming that the researchers will have access to the facility. Please provide the Facility and Other Resource information as an appendix to your project narrative.

- Do not attach a separate file.
- This appendix will not count in the project narrative page limitation.

APPENDIX 5: EQUIPMENT

List major items of equipment already available for this project and, if appropriate identify location and pertinent capabilities. Provide the Equipment information as an appendix to your project narrative.

- Do not attach a separate file.
- This appendix will not count in the project narrative page limitation.

APPENDIX 6: DATA MANAGEMENT PLAN

Provide a Data Management Plan (DMP) as an appendix to the research narrative.

- This appendix should not exceed a page limit of 2 pages including charts, graphs, maps, photographs, and other pictorial presentations, when printed using standard letter-size (8.5 x 11 inch) paper with 1-inch margins (top, bottom, left, and right)
- Do not attach a separate file.
- This appendix will not count in the project narrative page limitation.

The standard requirements for a DMP may be found in [Section VIII](#) of this FOA.

APPENDIX 7: OTHER ATTACHMENT

If you need to elaborate on your responses to questions 1-6 on the “Other Project Information” document, please provide the Other Attachment information as an appendix to your project narrative. Information not easily accessible to a reviewer may be included in this appendix, but do not use this appendix to circumvent the page limitations of the application. Reviewers are not required to consider information in this appendix.

- Do not attach a separate file.
- Include here any intellectual property agreements.
- Include here any formal teaming agreements that are required to execute the proposed work.
- Include here the required detailed cost estimates to support claims that the cost metrics of Track 1 Topic C or Track 1 Topic D can be met.
- This appendix will not count in the project narrative page limitation.

REMINDERS REGARDING ALL APPENDICES

- **Follow the above instructions to include the information as appendices to the project narrative file.**
- **These appendices will not count toward the project narrative’s page limitation.**
- **Do not attach any files to fields 9, 10, 11, or 12.**

3. Research And Related Budget

Complete the Research and Related Budget form in accordance with the instructions on the form (Activate Help Mode to see instructions) and the following instructions. You must complete a

separate budget for each year of support requested. The form will generate a cumulative budget for the total project period. You must complete all the mandatory information on the form before the NEXT PERIOD button is activated. You may request funds under any of the categories listed as long as the item and amount are necessary to perform the proposed work, meet all the criteria for allowability under the applicable Federal cost principles, and are not prohibited by the funding restrictions in this FOA.

Additional information is found in [Section VIII](#) of this FOA.

BUDGET JUSTIFICATION (FIELD L ON THE FORM)

Provide a justification that explains all costs proposed in the budget. The following items of advice are offered to assist you in developing a justification.

- Organize the justification by listing items in the same order as presented on the budget.
- Ensure that the narrative matches the budget in dollar amounts and language.
- Explain the line items. If costs are estimated, provide a basis for the estimate. Explain if costs are based on prior experience of similar activities. If a cost is based on the product of two numbers (such as a number of items at a per-item price), ensure that your math is correct.
- If including an inflationary factor for future budget periods, explain the basis for the inflationary factor.

Provide any other information you wish to submit to justify your budget request. Including items in the budget justification is not considered a form of cost-sharing: Provide the details of all personnel (key or other) who will be working on the award, regardless of their source(s) of compensation. Explain their source(s) of compensation if it is not from this award. Include the indirect cost rate agreement as a part of the budget justification.

Attach a single budget justification file for the entire project period in field L. The file automatically carries over to each budget year.

Additional information is found in [Section VIII](#) of this FOA.

4. R&R Subaward Budget Attachment(s) Form

Budgets for Subawardees: You must provide a separate R&R budget and budget justification for each subawardee. Download the R&R Budget Attachment from the R&R SUBAWARD BUDGET ATTACHMENT(S) FORM and either e-mail it to each subawardee that is required to submit a separate budget or use the collaborative features of Workspace. After the subawardee has either e-mailed its completed budget back to you or completed it within Workspace, attach it to one of the blocks provided on the form. Use up to 10 letters of the subawardee's name (plus.pdf) as the file name (e.g., ucla.pdf or energyres.pdf). Filenames must not exceed 50 characters.

If the project involves more subawardees than there are places in the SUBAWARD BUDGET ATTACHMENT(S) FORM, the additional subaward budgets may be saved as PDF files and appended to the Budget Justification attached to Field L.

Applicants should consult their local information technology (“IT”) support resources for any necessary assistance in converting the forms downloaded from Grants.gov into plain PDF files that can be combined into one non-Portfolio PDF file (the Budget Justification).

Ensure that any files received from subawardees are the PDF files extracted from the SUBAWARD BUDGET ATTACHMENT(S) FORM. Errors will be created if a subawardee sends a prime applicant a budget form that was not extracted from the application package.

Note: If an application proposes subawards to a DOE National Laboratory, a Federal agency, or another Federal agency’s FFRDC, the value of such proposed subawards may be deducted from any resulting award: Those classes of organizations may be paid directly by SC. However, the details of such proposed budgets are an essential for understanding and analyzing the proposed research.

5. Project/Performance Site Location(s)

Indicate the primary site where the work will be performed. If a portion of the project will be performed at any other site(s), identify the site location(s) in the blocks provided.

Note that the Project/Performance Site Congressional District is entered in the format of the 2 digit state code followed by a dash and a 3 digit Congressional district code, for example VA-001. Hover over this field for additional instructions.

Use the Next Site button to expand the form to add additional Project/Performance Site Locations.

6. Disclosure of Lobbying Activities (SF-LLL)

If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the grant/cooperative agreement, you must complete and submit Standard Form - LLL, “Disclosure Form to Report Lobbying.”

7. Summary of Required Forms/Files

Your application must include the following items:

Name of Document	Format	Attach to
SF 424 (R&R)	Form	N/A
RESEARCH AND RELATED Other Project Information	Form	N/A
Project Summary/Abstract	PDF	Field 7
Project Narrative, including required appendices	PDF	Field 8
RESEARCH & RELATED BUDGET	Form	N/A

Budget Justification	PDF	Field L
R&R SUBAWARD BUDGET ATTACHMENT(S) FORM (if applicable)	Form	N/A
Subaward Budget Justification (if applicable)	PDF	Field L of the subaward budget
PROJECT/PERFORMANCE SITE LOCATION(S)	Form	N/A
SF-LLL Disclosure of Lobbying Activities, if applicable	Form	N/A

E. SUBMISSIONS FROM SUCCESSFUL APPLICANTS

If selected for award, DOE reserves the right to request additional or clarifying information for any reason deemed necessary, including, but not limited to:

- Indirect cost information
- Other budget information
- Name and phone number of the Designated Responsible Employee for complying with national policies prohibiting discrimination (See 10 CFR 1040.5)
- Representation of Limited Rights Data and Restricted Software, if applicable
- Commitment Letter from Third Parties Contributing to Cost Sharing, if applicable
- Environmental Information

Applicants that are not institutions of higher education, that request indirect costs, and that do not already have an Indirect Cost Rate Agreement with their Cognizant Federal Agency or documentation of rates accepted for estimating purposes by DOE or another Federal agency, are advised to begin preparing an Indirect Cost Rate Proposal for submission, upon request, to the DOE contract specialist/grants management specialist who will evaluate your application if you are selected for award.

F. SUBMISSION DATES AND TIMES

1. Letter of Intent Due Date

Not applicable.

2. Pre-application Due Date

The pre-application due date is printed on the cover of this FOA.

You are encouraged to submit your pre-application well before the deadline. Pre-applications may be submitted at any time between the publication of this FOA and the stated deadline.

3. Application Due Date

The application due date is printed on the cover of this FOA.

You are encouraged to transmit your application well before the deadline. Applications may be submitted at any time between the publication of this FOA and the stated deadline.

4. Late Submissions

Delays in submitting letters of intent, pre-applications, and applications may be unavoidable. DOE has accepted late submissions when applicants have been unable to make timely submissions because of widespread technological disruptions or significant natural disasters. DOE has made accommodations for incapacitating or life-threatening illnesses and for deaths of immediate family members. Other circumstances may or may not justify late submissions. Unacceptable justifications include the following:

- Failure to begin submission process early enough.
- Failure to provide sufficient time to complete the process.
- Failure to understand the submission process.
- Failure to understand the deadlines for submissions.
- Failure to satisfy prerequisite registrations.
- Unavailability of administrative personnel.

You are responsible for beginning the submission process in sufficient time to accommodate reasonably foreseeable incidents, contingencies, and disruptions.

Applicants must contact the Program Office/Manager listed in this FOA to discuss the option of a late submission. Contacting the Program Office/Manager after the deadline may reduce the likelihood that a request will be granted.

DOE notes that not all requests for late submission will be approved.

Section V - APPLICATION REVIEW INFORMATION

A. CRITERIA

1. Initial Review Criteria

Prior to a comprehensive merit evaluation, DOE will perform an initial review in accordance with 10 CFR 605.10(b) to determine that (1) the applicant is eligible for the award; (2) the information required by the FOA has been submitted; (3) all mandatory requirements are satisfied; (4) the proposed project is responsive to the objectives of the FOA, and (5) the proposed project is not duplicative of programmatic work. Applications that fail to pass the initial review will not be forwarded for merit review and will be eliminated from further consideration.

2. Merit Review Criteria

Applications will be subjected to scientific merit review (peer review) and will be evaluated against the following criteria as found in 10 CFR 605.10 (d), the Office of Science Financial Assistance Program Rule.

- Scientific and/or Technical Merit of the Project;
- Appropriateness of the Proposed Method or Approach;
- Competency of Applicant's Personnel and Adequacy of Proposed Resources; and
- Reasonableness and Appropriateness of the Proposed Budget.

Merit reviewers will be asked to evaluate stewardship applications based on an additional criterion:

- Quality of the Accelerator R&D Stewardship Opportunity.

The evaluation process will include program policy factors such as the relevance of the proposed research to the terms of the FOA and the agency's programmatic needs. Note that external peer reviewers are selected with regard to both their scientific expertise and the absence of conflict-of-interest issues. Both Federal and non-Federal reviewers may be used, and submission of an application constitutes agreement that this is acceptable to the investigator(s) and the submitting institution.

The questions below are provided to the merit reviewers to elaborate the criteria established by regulation:

SCIENTIFIC AND/OR TECHNICAL MERIT OF THE PROPOSED RESEARCH (30% WEIGHT)

- For Track 1 and 2 proposals:
 - What is the scientific and/or technical innovation of the proposed research?
 - How might the results of the proposed work impact the direction, progress, and thinking in relevant scientific fields of research?

- What is the likelihood of achieving valuable results?
- Does the proposed work have the potential to significantly impact the Stewardship use described by the PI?
- How does the proposed work compare with other efforts in its field, both in terms of scientific and/or technical merit and originality?
- Does the proposed work have synergy with the SC mission?
- Is the Data Management Plan suitable for the proposed research and to what extent does it support the validation of research results?
- For Track 3 proposals:
 - How might the results of the proposed work impact industrialization of accelerator technology, including possible future federal research investments that could support future industrialization?
 - Will the likely resultant business plan credibly lead to long-term domestic industrial stability in this accelerator technology sector?
 - Will the proposed work have an impact on SC accomplishing its scientific research mission?
 - Is the Data Management Plan suitable for the proposed work and to what extent does it support the dissemination of results?

APPROPRIATENESS OF THE PROPOSED METHOD OR APPROACH (20% WEIGHT)

- For Track 1 proposals:
 - Does the plan clearly describe the current technology state, and the technical gaps that must be addressed, to realize the application?
 - Does the proposal clearly describe specific technical milestones that can be used to evaluate the progress of the R&D?
 - Does the Program Plan and Risk Assessment correctly identify the primary risks, and appropriate mitigations for each?
 - If intellectual property protection is required, has a clear plan been spelled out?
 - If the application could result in a commercial product, has the market opportunity been clearly assessed and described? How good is the market opportunity?
- For Track 2 proposals:
 - Does the proposed effort employ innovative concepts or methods?
 - How logical and feasible are the approaches?
 - Are the conceptual framework, methods, and analyses well justified, adequately developed, and likely to lead to scientifically valid conclusions?
 - Does the applicant recognize significant potential problems and consider alternative strategies?
- For Track 3 proposals:
 - Does the plan clearly describe the approach to gathering the information required to develop a coherent, comprehensive business plan?
 - What is the likelihood of developing a valid business plan?
 - Is the team complete?

- Is the approach sufficiently broad and inclusive such that companies and institutions not involved with the R&D work are likely to find the business plan valid?

COMPETENCY OF APPLICANT’S PERSONNEL AND ADEQUACY OF PROPOSED RESOURCES (15% WEIGHT)

- Does the proposed work take advantage of unique facilities and capabilities?
- What is the past performance of the leading members of the collaboration?
- Are the proposed plans for recruiting any additional scientific and/or technical personnel including new senior staff, students and postdocs reasonable, justified, and appropriate?
- Are the environment and facilities adequate for performing the proposed effort?
- Are the senior investigator(s) or any members of the research group that are being reviewed leaders within the proposed effort(s) and/or potential future leaders in the field?
- Additional questions for Track 1 proposals:
 - Does the Teaming and Management Plan clearly define the roles and responsibilities of all key participants?
 - Does the collaborative team have an appropriate balance of accelerator-technology-side experts and application-side experts?
 - If the application could result in a commercial product, does the team include an appropriate industrial partner?
- Additional questions for Track 2 proposals:
 - No additional questions.
- Additional questions for Track 3 proposals:
 - Does the Teaming and Management Plan clearly define the roles and responsibilities of all key participants?
 - Does the collaborative team have an appropriate balance of accelerator technology experts, industry experts, and experience developing long-range business plans?

REASONABLENESS AND APPROPRIATENESS OF THE PROPOSED BUDGET (5% WEIGHT)

- Are the proposed budget and staffing levels adequate to carry out the proposed work?
- Are all travel, student costs, and other ancillary expenses adequately estimated and justified?
- Is the budget reasonable and appropriate for the scope?
- Additional questions for Track 1 and Track 3 proposals:
 - Has the applicant listed institutional commitment?
 - Does the amount and type of institutional commitment provide evidence of substantial material participation and risk sharing by the institution?

As indicated above, the following questions are also provided to merit reviewers when evaluating the additional criterion:

QUALITY OF THE ACCELERATOR R&D STEWARDSHIP OPPORTUNITY (30% WEIGHT)

In the questions that follow, the term “Stewardship customer” is used broadly to organizations with a history of financial, intellectual, or physical support for research in the proposed subject matter. Stewardship customers may be SC programs (e.g., BES, FES, HEP, or NP), other DOE program offices (e.g., NNSA, EERE, ARPA-E), other Federal agencies (e.g., NIH, NSF, DoD, DHS), or industries that use accelerator technology.

For Track 3 proposals, consider the following criteria regarding the impact that the proposed business plan, *when completed and acted upon*, could have on domestic production capability.

- Does the proposed work provide significant scientific or technical advances of accelerator-related science and technology? (Accelerator-related technology includes such things as: superconducting magnets and RF cavities, RF and magnet power systems, specialized laser systems, specialized diagnostics and controls, and so on.)
- Will the proposed work result in substantial impact on the Stewardship customer’s needs?
- For the primary participating institution(s), is the activity reasonably consistent with the institution’s primary mission? (e.g., if a National Laboratory is involved, is the activity consistent with that Laboratory’s primary mission?)
- Is the PI/collaboration arguably the best performer/provider for the Stewardship activity? Are other entities capable of providing a substantially similar (or superior) capability?
- What evidence is there that the goal is important to the Stewardship customer? Does this proposal address issues that have been identified in writing (e.g., advisory committee reports, workshop reports, white papers, roadmaps) by the Stewardship customer? Does the Stewardship customer participate substantially and materially in this effort (e.g., by co-funding, cost-sharing, in-kind donation or equipment, donation of effort)?

B. REVIEW AND SELECTION PROCESS

1. Merit Review

Applications that pass the initial review will be subjected to a formal merit review and will be evaluated based on the criteria codified at 10 CFR 605.10(d) in accordance with the guidance provided in the “Office of Science Merit Review System for Financial Assistance,” which is available at: <https://science.osti.gov/grants/policy-and-guidance/merit-review-system/>.

2. Program Policy Factors

The Selection Official may consider any of the following program policy factors in making the selection, listed in no order of significance:

The Selection Officials may consider the following items, listed in order of decreasing significance:

- Scientific and technical merit of the proposed activity as determined by merit review, using the criteria set out in Section V.A.2;

- The advice of other federal agencies with specific expertise and interest in the accelerator R&D topics listed in this solicitation:
 - At the pre-application phase, and again
 - At the application review phase;
- Availability of funds;
- Availability and adequacy of existing accelerator infrastructure and computational tools;
- Amount of institutional commitment offered;
- Synergistic potential between the proposed activity and other activities supported by SC;
- Ensuring an appropriate balance of activities within SC programs;
- Previous performance;
- Extent to which the proposed work will:
 - Engage the expertise and facilities of the existing U.S. accelerator R&D ecosystem in a manner that enhances the ability of SC specifically, and other federal agencies generally, to benefit the Nation within their mission-spaces;
 - Enhance the accelerator technology capabilities and economic competitiveness of U.S. industry;
 - Foster collaboration between developers of accelerator technology and experts who apply accelerator technology;
- Degree to which the proposed work is synergistic with, but not duplicative of, existing awards;
- Other available advice and information.

3. Selection

The Selection Official will consider the findings of the merit review and may consider any of the Program Policy Factors described above.

4. Review of Risk

Pursuant to 2 CFR 200.205, DOE will conduct an additional review of the risk posed by applications submitted under this FOA. Such review of risk will include:

- Quality of the application,
- Reports and findings from audits performed under 2 CFR 200 or OMB Circular A-133, and
- Systems maintained under 2 CFR 180.

DOE may make use of other publicly available information and the history of an applicant's performance under DOE or other Federal agency awards.

Applicants with no prior performance of DOE awards may be asked to provide information about their financial stability and or their ability to comply with the management standards of 2 CFR 200.

5. Discussions and Award

The Government may enter into discussions with a selected applicant for any reason deemed

necessary, including but not limited to the following: (1) the budget is not appropriate or reasonable for the requirement; (2) only a portion of the application is selected for award; (3) the Government needs additional information to determine that the recipient is capable of complying with the requirements in 2 CFR 200 as modified by 2 CFR 910 (DOE Financial Assistance Regulation); and/or (4) special terms and conditions are required. Failure to resolve satisfactorily the issues identified by the Government will preclude award to the applicant.

C. ANTICIPATED NOTICE OF SELECTION AND AWARD DATES

DOE strives to make awards within six months of the receipt of applications.

Section VI – AWARD ADMINISTRATION INFORMATION

A. AWARD NOTICES

1. Notice of Selection

Selected Applicants Notification: DOE will notify applicants selected for award. This notice of selection is not an authorization to begin performance.

Non-selected Notification: Organizations whose applications have not been selected will be advised as promptly as possible. This notice will explain why the application was not selected.

2. Notice of Award

An Assistance Agreement issued by the contracting officer is the authorizing award document. It normally includes, either as an attachment or by reference, the following items: (1) Special Terms and Conditions, (2) Intellectual Property Provisions, (3) Federal Assistance Reporting Checklist and Instructions, (4) Budget Pages, (5) The Research Terms and Conditions, available at https://www.nsf.gov/pubs/policydocs/rtrtcoverlay_march17.pdf, and DOE Agency Specific Requirements, available at <https://www.nsf.gov/awards/managing/rtc.jsp>, (6) Applicable program regulations, 10 CFR 605 at <https://www.ecfr.gov/>, (7) DOE Assistance Regulations, 2 CFR part 200 as amended by 2 CFR part 910 at <https://www.ecfr.gov/>, (8) Application/proposal as approved by DOE, (9) National Policy Assurances to Be Incorporated as Award Terms in effect on date of award at <https://www.nsf.gov/awards/managing/rtc.jsp>.

TERMS AND CONDITIONS

Sample DOE Special Terms and Conditions for Use in Most Grants and Cooperative Agreements are located at <https://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms> under Award Terms.

The standard DOE financial assistance intellectual property provisions applicable to various types of recipients are located at:
<https://energy.gov/gc/standard-intellectual-property-ip-provisions-financial-assistance-awards>

NATIONAL POLICY ASSURANCES

The National Policy Assurances To Be Incorporated As Award Terms are located at <https://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms> under Award Terms.

B. ADMINISTRATIVE AND NATIONAL POLICY REQUIREMENTS

The following additional policy provisions are applicable to this FOA. The full text of each provision is in [Section VIII](#) of this FOA and may be accessed by navigating to the hyperlinks below:

- [1. Evaluation and Administration by Non-Federal Personnel](#)
- [2. Government Right to Reject or Negotiate](#)
- [3. Intergovernmental Review](#)
- [4. Modifications](#)

Awards made under this FOA are subject to the following Administrative and National Policy Requirements. The full text of each provision is in [Section VIII](#) of this FOA and may be accessed by navigating to the hyperlinks below:

- [1. Administrative Requirements](#)
- [2. Availability of Funds](#)
- [3. Conference Spending \(February 2015\)](#)
- [4. Commitment of Public Funds](#)
- [5. Corporate Felony Conviction and Federal Tax Liability Representations \(March 2014\)](#)
- [6. Environmental, Safety and Health \(ES&H\) Performance of Work at DOE Facilities](#)
- [7. Federal, State, and Local Requirements](#)
- [8. Funding Restrictions](#)
- [9. National Environmental Policy Act \(NEPA\) Compliance](#)
- [10. Nondisclosure and Confidentiality Agreements Representations \(June 2015\)](#)
- [11. Notice Regarding Eligible/Ineligible Activities](#)
- [12. Prohibition on Lobbying Activity](#)
- [13. Proprietary Application Information](#)
- [14. Publications](#)
- [15. Registration Requirements](#)
- [16. Rights in Technical Data](#)
- [17. Subaward and Executive Reporting](#)
- [18. Title to Subject Inventions](#)

C. REPORTING

Reporting requirements are identified on the Federal Assistance Reporting Checklist, DOE F 4600.2, attached to the award agreement. The standard checklist is available at <http://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms> under Award Forms: Individual awards may impose additional requirements.

D. REPORTING OF MATTERS RELATED TO RECIPIENT INTEGRITY AND PERFORMANCE (DECEMBER 2015)

DOE, prior to making a Federal award with a total amount of Federal share greater than the simplified acquisition threshold, is required to review and consider any information about the applicant that is in the designated integrity and performance system accessible through SAM (currently FAPIIS) (see 41 USC 2313).

The applicant, at its option, may review information in the designated integrity and performance systems accessible through SAM and comment on any information about itself that a Federal awarding agency previously entered and is currently in the designated integrity and performance

system accessible through SAM.

DOE will consider any written comments by the applicant, in addition to the other information in the designated integrity and performance system, in making a judgment about the applicant's integrity, business ethics, and record of performance under Federal awards when completing the review of risk posed by applicants as described in 2 CFR 200.205 Federal awarding agency review of risk posed by applicants.

Section VII - QUESTIONS/AGENCY CONTACTS

A. QUESTIONS

Questions relating to the Grants.gov registration process, system requirements, how an application form works, or the submittal process must be directed to Grants.gov at 1-800-518-4726 or support@Grants.gov. DOE cannot answer these questions. Please only contact the Grants.gov help desk for questions related to Grants.gov.

For help with PAMS, click the “External User Guide” link on the PAMS website, <https://pamspublic.science.energy.gov/>. You may also contact the PAMS Help Desk, which can be reached Monday through Friday, 9AM – 5:30 PM Eastern Time. Telephone: (855) 818-1846 (toll free) or (301) 903-9610, Email: sc.pams-helpdesk@science.doe.gov. All submission and inquiries about this FOA should reference the FOA number on the cover of this Announcement. Please contact the PAMS help desk for technological issues with the PAMS system.

Questions regarding the specific program areas and technical requirements may be directed to the technical contacts listed for each program within the FOA or below. Please contact the program staff with all questions not directly related to the Grants.gov or PAMS systems.

B. AGENCY CONTACTS

Grants.gov Customer Support	800-518-4726 (toll-free) support@Grants.gov
PAMS Customer Support	855-818-1846 (toll-free) 301-903-9610 sc.pams-helpdesk@science.doe.gov
Program Manager Scientific Contact	For questions about specific program areas and/or technical requirements, please contact Eric.Colby@science.doe.gov

Section VIII – SUPPLEMENTARY MATERIAL

A. HOW-TO GUIDES

1. How to Distinguish Between a New and Renewal Application

New Application: An application must be submitted as “new” in the following circumstances:

- When applying for funding to create a new research award that has not previously received DOE funding, including any funding for the current year.
- When applying for funding to support continued research from the same applicant institution as the current grant but with a significant change in fundamental nature of the research.
- When applying for funding to support continued research supported by an existing DOE award but at a new applicant institution.

Renewal Application: A renewal application is appropriate when funds are requested for an award that has no changes in the following items:

- The recipient/applicant institution
- The award’s senior leadership
- The fundamental nature of the award

A change in an award’s PI does not necessarily require submission as a new application: The change in personnel must be considered in light of other changes.

Renewal applications compete for funds with all other peer-reviewed applications and must be developed as fully as though the applicant were applying for the first time. Renewal applications must be submitted by the same sponsoring institution as that holding the current grant award for which renewal funding is requested, and the proposed research topic must be logical scientific extensions of the research that has been performed in the current award.

For renewal applications only, the PI is required to submit a Renewal Proposal Products section through SC’s PAMS website at <https://pamspublic.science.energy.gov>. The PI must enter into PAMS each product created during the course of the previous project period. Types of products include publications, intellectual property, technologies or techniques, and other products such as databases or software. As soon as the renewal application is assigned to a program manager, the PI will receive an automated email from PAMS (<PAMS.Autoreply@science.doe.gov>) instructing him or her to navigate to the PAMS Task tab to complete and submit the Renewal Proposal Products. The submitted product list will be sent for merit review as part of the application. The application will not be considered complete and cannot be sent for review until the product list has been submitted.

2. How Federally-Affiliated Organizations May Participate and Be Funded

VALUE/FUNDING FOR DOE/NNSA NATIONAL LABORATORIES AND NON-DOE/NNSA FFRDCs

For grant awards, the value of, and funding for, a DOE/National Nuclear Security Administration (NNSA) National Laboratory contractor, a non-DOE/NNSA Federally Funded Research and

Development Center (FFRDC) contractor, or another Federal agency's portion of the work will not be included in the award to the successful applicant. DOE will fund a DOE/NNSA National Laboratory contractor through the DOE field work authorization system or other appropriate process and will fund non-DOE/NNSA FFRDC contractors and other Federal agencies through an interagency agreement in accordance with the Economy Act, 31 USC 1535, or other statutory authority.

RESPONSIBILITY

The successful prime applicant/awardee (lead organization) will be the responsible authority regarding the settlement and satisfaction of all contractual and administrative issues, including but not limited to, disputes and claims arising out of any agreement between the applicant and any team member, and/or subawardee.

If an award is made to a DOE/NNSA National Laboratory, all Disputes and Claims will be resolved in accordance with the terms and conditions of the DOE/NNSA National Laboratory's management and operating (M&O) contract, as applicable, in consultation between DOE and the prime awardee.

If an award is made to another Federal agency or its FFRDC contractor, all Disputes and Claims will be resolved in accordance with the terms and conditions of the interagency agreement in consultation between DOE and the prime awardee.

3. How Federally-Affiliated Organizations May Apply

DOE/NNSA NATIONAL LABORATORY CONTRACTORS

DOE/NNSA National Laboratory Contractors, if eligible either as a prime applicant or a proposed team member on another entity's application, should ensure that their cognizant DOE/NNSA Contracting Officer provides written authorization. This authorization should be submitted with the application as part of the Budget Justification for DOE/NNSA National Laboratory Contractor File. [This is not required for the National Energy Technology Laboratory because it is a Government Owned/Government Operated (GOGO).] **Please note that failure to provide this authorization may result in rejection of an application prior to merit review.** If a DOE/NNSA National Laboratory Contractor is selected for award, or proposed as a team member, the proposed work will be authorized under the DOE field work authorization system or other appropriate process and performed under the laboratory Contractor's M&O contract, as applicable. The following wording is acceptable for the authorization:

“Authorization is granted for the _____ Laboratory to participate in the proposed project. The work proposed for the laboratory is consistent with or complementary to the missions of the laboratory and will not adversely impact execution of the DOE/NNSA assigned programs at the laboratory.”

NON-DOE/NNSA FFRDCs

Non-DOE/NNSA FFRDCs, if eligible either as a prime applicant or a proposed team member on another entity's application, should follow the following guidelines:

The prime applicant must obtain written authorization for non-DOE/NNSA FFRDC participation. The cognizant Contracting Officer for the Federal agency sponsoring the FFRDC contractor must authorize in writing the participation of the FFRDC contractor on the proposed project and this authorization should be submitted with the application. The written authorization must also contain a determination that the use of a FFRDC contractor is consistent with the contractor's authority under its award and does not place the FFRDC contractor in direct competition with the private sector, in accordance with FAR Part 17.5. **Please note that failure to provide this authorization may result in rejection of an application prior to merit review.** The following wording is acceptable for the authorization:

“Authorization is granted for the _____ Laboratory to participate in the proposed project. The work proposed for the laboratory is consistent with or complementary to the missions of the laboratory and will not adversely impact execution of the (insert agency) assigned programs at the laboratory. This laboratory is authorized to perform the work proposed in the application submitted under DOE Funding Opportunity Announcement <<Include the FOA number on the cover page>> by the following statutory authority (insert statute name, citation, and section).”

OTHER FEDERAL AGENCIES

Other Federal Agencies, if eligible either as a prime applicant or a proposed team member on another entity's application, must include in their budget justifications any specific statutory authorization (other than the Economy Act) that permits their receipt of an Inter-Agency Agreement or that authorizes the payment of certain costs.

4. How Consortia May be Used

INCORPORATED CONSORTIA

Incorporated consortia, which may include domestic and/or foreign entities, are eligible to apply for funding as a prime recipient (lead organization) or subawardee (team member).

Each incorporated consortium must have an internal governance structure and a written set of internal rules. Upon request, the consortium must provide a written description of its internal governance structure and its internal rules to the DOE contracting officer. There is no requirement that subawards be formalized into incorporated consortia.

UNINCORPORATED CONSORTIA

Unincorporated consortia (team arrangements), which may include domestic and foreign entities, must designate one member of the consortium to serve as the prime recipient/consortium representative (lead organization). There is no requirement that subawards be formalized into unincorporated consortia.

Upon request, unincorporated consortia must provide the DOE Contracting Officer with a collaboration agreement, commonly referred to as the articles of collaboration, which sets out the rights and responsibilities of each consortium member. This agreement binds the individual consortium members together and should discuss, among other things, the consortium's:

- Management structure;
- Method of making payments to consortium members;
- Means of ensuring and overseeing members' efforts on the project;
- Provisions for members' cost sharing contributions; and
- Provisions for ownership and rights in intellectual property developed previously or under the agreement.

Note that a consortium is applied for in one application and results in one award with subawards to consortia members. Multi-institutional teams may, if permitted under this FOA, submit collaborative applications with each institution submitting its own application with an identical research narrative, resulting in multiple awards to the collaborating institutions.

5. How to Submit Letters of Intent

Do not submit an LOI unless an FOA requires or allows their submission.

It is important that the LOI be a single file with extension .pdf, .docx, or .doc. The filename must not exceed 50 characters. The PI and anyone submitting on behalf of the PI must register for an account in PAMS before it will be possible to submit a letter of intent. **All PIs and those submitting LOIs on behalf of PIs are encouraged to establish PAMS accounts as soon as possible to avoid submission delays.**

You may use the Internet Explorer, Firefox, Google Chrome, or Safari browsers to access PAMS.

Submit Your Letter of Intent:

- Create your letter of intent outside the system and save it as a file with extension .docx, .doc, or .pdf. Make a note of the location of the file on your computer so you can browse for it later from within PAMS.
- Log into PAMS and click the Proposals tab. Click the "View / Respond to Funding Opportunity Announcements" link and find the current announcement in the list. Click the "Actions/Views" link in the Options column next to this announcement to obtain a dropdown menu. Select "Submit Letter of Intent" from the dropdown.
- On the Submit Letter of Intent page, select the institution from which you are submitting this LOI from the Institution dropdown. If you are associated with only one institution in the system, there will only be one institution in the dropdown.
- Note that you must select one and only one PI per LOI; to do so, click the "Select PI" button on the far right side of the screen. Find the appropriate PI from the list of all registered users from your institution returned by PAMS. (Hint: You may have to sort, filter, or search

through the list if it has multiple pages.) Click the “Actions” link in the Options column next to the appropriate PI to obtain a dropdown menu. From the dropdown, choose “Select PI.”

- If the PI for whom you are submitting does not appear on the list, it means he or she has not yet registered in PAMS. For your convenience, you may have PAMS send an email invitation to the PI to register in PAMS. To do so, click the “Invite PI” link at the top left of the “Select PI” screen. You can enter an optional personal message to the PI in the “Comments” box, and it will be included in the email sent by PAMS to the PI. You must wait until the PI registers before you can submit the LOI. Save the LOI for later work by clicking the “Save” button at the bottom of the screen. It will be stored in “My Letters of Intent” for later editing.
- Enter a title for your letter of intent.
- Select the appropriate technical contact from the Program Manager dropdown.
- To upload the LOI file into PAMS, click the “Attach File” button at the far right side of the screen. Click the “Browse” (or “Choose File” depending on your browser) button to search for your file. You may enter an optional description of the file you are attaching. Click the “Upload” button to upload the file.
- At the bottom of the screen, click the “Submit to DOE” button to save and submit the LOI to DOE.
- Upon submission, the PI will receive an email from the PAMS system <PAMS.Autoreply@science.doe.gov> acknowledging receipt of the LOI.

You are encouraged to register for an account in PAMS at least a week in advance of the LOI submission deadline so that there will be no delays with your submission.

WARNING: The PAMS website at <https://pamspublic.science.energy.gov/> will permit you to edit a previously submitted LOI in the time between your submission and the deadline. If you choose to edit, doing so will remove your previously submitted version from consideration. If you are still editing at the time of the deadline, you will not have a valid submission. Please pay attention to the deadline.

6. How to Submit a Pre-Application

Do not submit a pre-application unless an FOA requires or permits their submission.

It is important that the pre-application be a single file with extension .pdf, .docx, or .doc. The filename must not exceed 50 characters. The PI and anyone submitting on behalf of the PI must register for an account in PAMS before it will be possible to submit a pre-application. All PIs and those submitting pre-applications on behalf of PIs are encouraged to establish PAMS accounts as soon as possible to avoid submission delays.

You may use the Internet Explorer, Firefox, Google Chrome, or Safari browsers to access PAMS.

Submit Your Pre-Application:

- Create your pre-application (called a preproposal in PAMS) outside the system and save it as a file with extension .docx, .doc, or .pdf. Make a note of the location of the file on your computer so you can browse for it later from within PAMS.
- Log into PAMS and click the Proposals tab. Click the “View / Respond to Funding Opportunity Announcements” link and find the current announcement in the list. Click the “Actions/Views” link in the Options column next to this announcement to obtain a dropdown menu. Select “Submit Preproposal” from the dropdown.
- On the Submit Preproposal page, select the institution from which you are submitting this preproposal from the Institution dropdown. If you are associated with only one institution in the system, there will only be one institution in the dropdown.
- Note that you must select one and only one PI per preproposal; to do so, click the “Select PI” button on the far right side of the screen. Find the appropriate PI from the list of all registered users from your institution returned by PAMS. (Hint: You may have to sort, filter, or search through the list if it has multiple pages.) Click the “Actions” link in the Options column next to the appropriate PI to obtain a dropdown menu. From the dropdown, choose “Select PI.”
- If the PI for whom you are submitting does not appear on the list, it means he or she has not yet registered in PAMS. For your convenience, you may have PAMS send an email invitation to the PI to register in PAMS. To do so, click the “Invite PI” link at the top left of the “Select PI” screen. You can enter an optional personal message to the PI in the “Comments” box, and it will be included in the email sent by PAMS to the PI. You must wait until the PI registers before you can submit the preproposal. Save the preproposal for later work by clicking the “Save” button at the bottom of the screen. It will be stored in “My Preproposals” for later editing.
- Enter a title for your preproposal.
- Select the appropriate technical contact from the Program Manager dropdown.
- To upload the preproposal file into PAMS, click the “Attach File” button at the far right side of the screen. Click the “Browse” (or “Choose File” depending on your browser) button to search for your file. You may enter an optional description of the file you are attaching. Click the “Upload” button to upload the file.
- At the bottom of the screen, click the “Submit to DOE” button to save and submit the preproposal to DOE.
- Upon submission, the PI will receive an email from the PAMS system <PAMS.Autoreply@science.doe.gov> acknowledging receipt of the preproposal.

You are encouraged to register for an account in PAMS at least a week in advance of the preproposal submission deadline so that there will be no delays with your submission.

WARNING: The PAMS website at <https://pamspublic.science.energy.gov> will permit you to edit a previously submitted pre-application in the time between your submission and the deadline. If you choose to edit, doing so will remove your previously submitted version from consideration. If you are still editing at the time of the deadline, you will not have a valid submission. Please pay attention to the deadline.

7. How to Register and Submit an Application in Grants.gov

This section provides the application submission and receipt instructions for applications to SC. Please read the following instructions carefully and completely.

ELECTRONIC DELIVERY

SC is participating in the Grants.gov initiative to provide the grant community with a single site to find and apply for grant funding opportunities. SC requires applicants to submit their applications online through Grants.gov.

HOW TO REGISTER TO APPLY THROUGH GRANTS.GOV

a. Instructions: Read the instructions below about registering to apply for SC funds. Applicants should read the registration instructions carefully and prepare the information requested before beginning the registration process. Reviewing and assembling the required information before beginning the registration process will alleviate last-minute searches for required information.

Organizations must have a Data Universal Numbering System (DUNS) Number, active System for Award Management (SAM) registration, and Grants.gov account to apply for grants. If individual applicants are eligible to apply for this FOA, then you may begin with step 3, Create a Grants.gov Account, listed below.

Creating a Grants.gov account can be completed online in minutes, but DUNS and SAM registrations may take several weeks. Therefore, an organization's registration should be done in sufficient time to ensure it does not impact the entity's ability to meet required application submission deadlines.

Complete organization registration instructions can be found on Grants.gov here:

<https://www.Grants.gov/web/grants/applicants/organization-registration.html>

1) *Obtain a DUNS Number*: All entities applying for funding, including renewal funding, must have a DUNS Number from Dun & Bradstreet (D&B). Applicants must enter the DUNS Number in the data entry field labeled "Organizational DUNS" on the SF-424 form. For more detailed instructions for obtaining a DUNS Number, refer to:

<https://www.Grants.gov/web/grants/applicants/organization-registration/step-1-obtain-duns-number.html>

2) *Register with SAM*: All organizations applying online through Grants.gov must register with SAM at <https://www.sam.gov>. Failure to register with SAM will prevent your organization from applying through Grants.gov. SAM registration must be renewed annually. For more detailed instructions for registering with SAM, refer to:

<https://www.Grants.gov/web/grants/applicants/organization-registration/step-2-register-with-sam.html>

3) *Create a Grants.gov Account*: The next step is to register an account with Grants.gov. Follow the on-screen instructions or refer to the detailed instructions here:
<https://www.Grants.gov/web/grants/applicants/registration.html>

4) *Add a Profile to a Grants.gov Account*: A profile in Grants.gov corresponds to a single applicant organization the user represents (i.e., an applicant) or an individual applicant. If you work for or consult with multiple organizations and have a profile for each, you may log in to one Grants.gov account to access all of your grant applications. To add an organizational profile to your Grants.gov account, enter the DUNS Number for the organization in the DUNS field while adding a profile. For more detailed instructions about creating a profile on Grants.gov, refer to:
<https://www.Grants.gov/web/grants/applicants/registration/add-profile.html>

5) *EBiz POC Authorized Profile Roles*: After you register with Grants.gov and create an Organization Applicant Profile, the organization applicant's request for Grants.gov roles and access is sent to the Electronic Business Point of Contact (EBiz POC). The EBiz POC will then log in to Grants.gov and authorize the appropriate roles, which may include the Authorized Organization Representative (AOR) role, thereby giving you permission to complete and submit applications on behalf of the organization. You will be able to submit your application online any time after you have been assigned the AOR role. For more detailed instructions about creating a profile on Grants.gov, refer to:
<https://www.Grants.gov/web/grants/applicants/registration/authorize-roles.html>

6) *Track Role Status*: To track your role request, refer to:
<https://www.Grants.gov/web/grants/applicants/registration/track-role-status.html>

b. *Electronic Signature*: When applications are submitted through Grants.gov, the name of the organization applicant with the AOR role that submitted the application is inserted into the signature line of the application, serving as the electronic signature. The EBiz POC **must** authorize people who are able to make legally binding commitments on behalf of the organization as a user with the AOR role; **this step is often missed and it is crucial for valid and timely submissions.**

HOW TO SUBMIT AN APPLICATION TO SC VIA GRANTS.GOV

Grants.gov applicants can apply online using Workspace. Workspace is a shared, online environment where members of a grant team may simultaneously access and edit different webforms within an application. For each FOA, you can create individual instances of a workspace.

Below is an overview of applying on Grants.gov. For access to complete instructions on how to apply for opportunities, refer to:
<https://www.Grants.gov/web/grants/applicants/apply-for-grants.html>

1) *Create a Workspace*: Creating a workspace allows you to complete it online and route it through your organization for review before submitting.

2) Complete a Workspace: Add participants to the workspace, complete all the required forms, and check for errors before submission.

a. Adobe Reader: If you decide not to apply by filling out webforms you can download individual PDF forms in Workspace so that they will appear similar to other Standard forms. The individual PDF forms can be downloaded and saved to your local device storage, network drive(s), or external drives, then accessed through Adobe Reader.

NOTE: Visit the Adobe Software Compatibility page on Grants.gov to download the appropriate version of the software at:

<https://www.Grants.gov/web/grants/applicants/adobe-software-compatibility.html>

b. Mandatory Fields in Forms: In the forms, you will note fields marked with an asterisk and a different background color. These fields are mandatory fields that must be completed to successfully submit your application.

c. Complete SF-424 Fields First: The forms are designed to fill in common required fields across other forms, such as the applicant name, address, and DUNS number. To trigger this feature, an applicant must complete the SF-424 information first. Once it is completed, the information will transfer to the other forms.

3) Submit a Workspace: An application may be submitted through workspace by clicking the Sign and Submit button on the Manage Workspace page, under the Forms tab. Grants.gov recommends submitting your application package *at least 24-48 hours prior to the close date* to provide you with time to correct any potential technical issues that may disrupt the application submission.

4) Track a Workspace: After successfully submitting a workspace package, a Grants.gov Tracking Number (GRANTXXXXXXXX) is automatically assigned to the package. The number will be listed on the Confirmation page that is generated after submission.

For additional training resources, including video tutorials, refer to:

<https://www.Grants.gov/web/grants/applicants/applicant-training.html>

Applicant Support: Grants.gov provides applicants 24/7 support via the toll-free number 1-800-518-4726 and email at support@Grants.gov. For questions related to the specific grant opportunity, contact the number listed in the application package of the grant you are applying for.

If you are experiencing difficulties with your submission, it is best to call the Grants.gov Support Center and get a ticket number. The Support Center ticket number will assist SC with tracking your issue and understanding background information on the issue.

TIMELY RECEIPT REQUIREMENTS AND PROOF OF TIMELY SUBMISSION

Proof of timely submission is automatically recorded by Grants.gov. An electronic date/time stamp is generated within the system when the application is successfully received by Grants.gov. The applicant AOR will receive an acknowledgement of receipt and a tracking number (GRANTXXXXXXXX) from Grants.gov with the successful transmission of their application. Applicant AORs will also receive the official date/time stamp and Grants.gov Tracking number in an email serving as proof of their timely submission.

When SC successfully retrieves the application from Grants.gov, and acknowledges the download of submissions, Grants.gov will provide an electronic acknowledgment of receipt of the application to the email address of the applicant with the AOR role. Again, proof of timely submission shall be the official date and time that Grants.gov receives your application. Applications received by Grants.gov after the established due date for the program will be considered late and may not be considered for funding by SC.

Applicants using slow internet, such as dial-up connections, should be aware that transmission can take some time before Grants.gov receives your application. Again, Grants.gov will provide either an error or a successfully received transmission in the form of an email sent to the applicant with the AOR role. The Grants.gov Support Center reports that some applicants end the transmission because they think that nothing is occurring during the transmission process. Please be patient and give the system time to process the application.

8. How to Prepare an Application

APPLICATION PREPARATION

You must submit the application through Grants.gov at <https://www.Grants.gov/>, using either the online webforms or downloaded forms. (Additional instructions are provided in [7., above.](#))

You are required to use the compatible version of Adobe Reader software to complete a [Grants.gov](#) Adobe application package. To ensure you have the [Grants.gov](#) compatible version of Adobe Reader, visit the software compatibility page at <https://www.Grants.gov/web/grants/applicants/adobe-software-compatibility.html>.

You must complete the mandatory forms and any applicable optional forms (e.g., Disclosure of Lobbying Activities (SF-LLL)) in accordance with the instructions on the forms and the additional instructions below.

Files that are attached to the forms must be PDF files unless otherwise specified in this FOA. Attached PDF files must be plain files consisting of text, numbers, and images without editable fields, signatures, passwords, redactions, or other advanced features available in some PDF-compatible software. Do not use PDF portfolios or binders.

Please note the following restrictions that apply to the names of all files attached to your application:

- Please limit file names to 50 or fewer characters
- Do not attach any documents with the same name. All attachments must have a unique name.

- Please use only the following characters when naming your attachments: A-Z, a-z, 0-9, underscore, hyphen, space, period, parenthesis, curly braces, square brackets, ampersand, tilde, exclamation point, comma, semi colon, apostrophe, at sign, number sign, dollar sign, percent sign, plus sign, and equal sign. Attachments that do not follow this rule may cause the entire application to be rejected or cause issues during processing.

RENEWAL APPLICATIONS

For renewal applications only, the PI is required to submit a Renewal Proposal Products section through the PAMS website at <https://pamspublic.science.energy.gov>. The PI must enter into PAMS each product created during the course of the previous project period. Types of products include publications, intellectual property, technologies or techniques, and other products such as databases or software. As soon as the renewal application is assigned to a DOE Program Manager, the PI will receive an automated email from PAMS (<PAMS.Autoreply@science.doe.gov>) instructing him or her to navigate to the PAMS Task tab to complete and submit the Renewal Proposal Products. The submitted product list will be sent for merit review as part of the application. The application will not be considered complete and cannot be sent for review until the product list has been submitted.

RESUBMISSION OF APPLICATIONS

Applications submitted under this FOA may be withdrawn from consideration by using the PAMS website at <https://pamspublic.science.energy.gov>. Applications may be withdrawn at any time between when the applicant submits the application and when DOE makes the application available to merit reviewers. Such withdrawals take effect immediately and cannot be reversed. Please exercise due caution. After the application is made available to merit reviewers, the applicant may contact the DOE program office identified in this FOA to request that it be withdrawn.

After an application is withdrawn, it may be resubmitted, if this FOA is still open for the submission of applications. Such resubmissions will only count as one submission if this FOA restricts the number of applications from an applicant.

Note that there may be a delay between the application's submission in Grants.gov and when it is available to be withdrawn in PAMS. SC will usually consider the last submission, according to its Grants.gov timestamp, to be the intended version. Please consult with your program manager to resolve any confusion about which version of an application should be considered.

IMPROPER CONTENTS OF APPLICATIONS

Applications submitted under this FOA will be stored in controlled-access systems, but they may be made publicly available if an award is made. As such, it is critical that applicants follow these guidelines:

- Do not include information subject to any legal restriction on its open distribution, whether classified, export control, or unclassified controlled nuclear information.
- Do not include sensitive and protected personally identifiable information, including social security numbers, birthdates, citizenship, marital status, or home addresses. Pay particular

attention to the content of biographical sketches and curriculum vitae.

- Do not include letters of support from Federal officials.
- Do not include letters of support on Federal letterhead. Letters that are not letters of support (such as letters confirming access to sites, facilities, equipment, or data; or letters from cognizant contracting officers) may be on Federal letterhead.
- Clearly mark all proprietary or trade-secret information.

CHANGE OF AWARDEE INSTITUTION

If an awardee chooses to relinquish an award made under this FOA to permit the transfer of the award to a new institution, the new institution must submit an application under the then-available SC “annual” or “open” FOA.

9. How to Prepare a Biosketch

A biosketch is to provide information that can be used by reviewers to evaluate the PI’s potential for leadership within the scientific community. Examples of information of interest are invited and/or public lectures, awards received, scientific program committees, conference or workshop organization, professional society activities, special international or industrial partnerships, reviewing or editorship activities, or other scientific leadership experiences.

SC requires the use of the format approved by the National Science Foundation (NSF), which may be generated by the Science Experts Network Curriculum Vita (SciENCv), a cooperative venture maintained at <https://www.ncbi.nlm.nih.gov/sciencv/>, and is also available at <https://nsf.gov/bfa/dias/policy/nsfapprovedformats/biosketch.pdf>. The use of a format required by another agency is intended to reduce the administrative burden to researchers by promoting the use of common formats.

The biographical information (curriculum vitae) must include the following items within its page limit:

- **Education and Training:** Undergraduate, graduate and postdoctoral training, provide institution, major/area, degree and year.
- **Research and Professional Experience:** Beginning with the current position list, in chronological order, professional/academic positions with a brief description.
- **Publications:** Provide a list of up to 10 publications most closely related to the proposed project. For each publication, identify the names of all authors (in the same sequence in which they appear in the publication), the article title, book or journal title, volume number, page numbers, year of publication, and website address if available electronically. Patents, copyrights and software systems developed may be provided in addition to or substituted for publications. An abbreviated style such as the Physical Review Letters (PRL) convention for citations (list only the first author) may be used for publications with more than 10 authors.
- **Synergistic Activities:** List no more than Five (5) professional and scholarly activities related to the effort proposed.

In addition, the biographical sketch must include information to permit DOE to identify

individuals who are conflicted with or potentially biased (favorably or unfavorably) against the investigator. Include a section entitled “**Identification of Potential Conflicts of Interest or Bias in Selection of Reviewers**” that will not count in a page limit. Provide the following information in this section:

- **Collaborators and Co-editors:** List in alphabetical order all persons, including their current organizational affiliation, who are, or who have been, collaborators or co-authors with you on a research project, book or book article, report, abstract, or paper during the 48 months preceding the submission of this application. For publications or collaborations with more than 10 authors or participants, only list those individuals in the core group with whom the PI interacted on a regular basis while the research was being done. Also, list any individuals who are currently, or have been, co-editors with you on a special issue of a journal, compendium, or conference proceedings during the 24 months preceding the submission of this application. If there are no collaborators or co-editors to report, state “None.”
- **Graduate and Postdoctoral Advisors and Advisees:** List the names and current organizational affiliations of your graduate advisor(s) and principal postdoctoral sponsor(s). Also, list the names and current organizational affiliations of your graduate students and postdoctoral associates.

Personally Identifiable Information (PII): Do not include sensitive and protected personally identifiable information including social security numbers, birthdates, citizenship, marital status, or home addresses. Do not include information that a merit reviewer should not make use of.

10. How to Prepare Current and Pending Support

WARNING: These instructions have been significantly revised to require disclosure of a variety of potential conflicts of interest or commitment, including participation in foreign government-sponsored talent recruitment programs.

Current and Pending support is intended to allow the identification of potential duplication, overcommitment, potential conflicts of interest or commitment, and all other sources of support. The PI and each senior/key person at the prime applicant and any proposed subaward must provide a list of all sponsored activities, awards, and appointments, whether paid or unpaid; provided as a gift with terms or conditions or provided as a gift without terms or conditions; full-time, part-time, or voluntary; faculty, visiting, adjunct, or honorary; cash or in-kind; foreign or domestic; governmental or private-sector; directly supporting the individual’s research or indirectly supporting the individual by supporting students, research staff, space, equipment, or other research expenses. All foreign government-sponsored talent recruitment programs must be identified in current and pending support. SC requires the use of the format approved by the National Science Foundation (NSF), which may be generated by the Science Experts Network Curriculum Vita (SciENCv), a cooperative venture maintained at <https://www.ncbi.nlm.nih.gov/sciencv/>, and is also available at <https://www.nsf.gov/bfa/dias/policy/nsfapprovedformats/cps.pdf>. The use of a format required by another agency is intended to reduce the administrative burden to researchers by promoting the use of common formats.

For every activity, list the following items:

- The sponsor of the activity or the source of funding
- The award or other identifying number
- The title of the award or activity. If the title of the award or activity is not descriptive, add a brief description of the research being performed that would identify any overlaps or synergies with the proposed research.
- The total cost or value of the award or activity, including direct and indirect costs. For pending proposals, provide the total amount of requested funding.
- The award period (start date – end date).
- The person-months of effort per year being dedicated to the award or activity

If required to identify overlap, duplication of effort, or synergistic efforts, append a description of the other award or activity to the current and pending support.

Details of any obligations, contractual or otherwise, to any program, entity, or organization sponsored by a foreign government must be provided on request to either the applicant institution or DOE.

11. How to Prepare a Data Management Plan

In general, a DMP should address the following requirements:

1. DMPs should describe whether and how data generated in the course of the proposed research will be shared and preserved. If the plan is not to share and/or preserve certain data, then the plan must explain the basis of the decision (for example, cost/benefit considerations, other parameters of feasibility, scientific appropriateness, or limitations discussed in #4). At a minimum, DMPs must describe how data sharing and preservation will enable validation of results, or how results could be validated if data are not shared or preserved.
2. DMPs should provide a plan for making all research data displayed in publications resulting from the proposed research open, machine-readable, and digitally accessible to the public at the time of publication. This includes data that are displayed in charts, figures, images, etc. In addition, the underlying digital research data used to generate the displayed data should be made as accessible as possible to the public in accordance with the principles stated in the Office of Science Statement on Digital Data Management (<https://science.osti.gov/funding-opportunities/digital-data-management>). This requirement could be met by including the data as supplementary information to the published article, or through other means. The published article should indicate how these data can be accessed.
3. DMPs should consult and reference available information about data management resources to be used in the course of the proposed research. In particular, DMPs that explicitly or implicitly commit data management resources at a facility beyond what is conventionally made available to approved users should be accompanied by written approval from that facility. In determining the resources available for data management at Office of Science User Facilities, researchers should consult the published description of data management resources and practices at that facility and reference it in the DMP. Information about other Office of Science facilities can be found at <https://science.osti.gov/user-facilities/>.
4. DMPs must protect confidentiality, personal privacy, Personally Identifiable Information, and U.S. national, homeland, and economic security; recognize proprietary interests, business confidential information, and intellectual property rights; avoid significant negative impact

on innovation, and U.S. competitiveness; and otherwise be consistent with all applicable laws, and regulations. There is no requirement to share proprietary data.

DMPs will be reviewed as part of the overall SC research proposal merit review process. Applicants are encouraged to consult the SC website for further information and suggestions for how to structure a DMP: <https://science.osti.gov/funding-opportunities/digital-data-management>

12. How to Prepare a Research and Related Budget and Justification

The following advice will improve the accuracy of your budget request:

- Funds requested for personnel (senior, key, and other) must be justified as the product of their effort on the project and their institutional base salary.
- Funds requested for fringe benefits must be calculated as the product of the requested salary and, if present, the negotiated fringe benefit rate contained in an institution’s negotiated indirect cost rate agreement.
- Funds requested for indirect costs must be calculated using the correct indirect cost base and the negotiated indirect cost rate.
- You are encouraged to include the rate agreement used in preparing a budget as a part of the budget justification.
- Do not prepare a budget justification using the expired DOE form F4260.1.

If you are proposing indirect costs and do not already have an Indirect Cost Rate Agreement with your Cognizant Federal Agency or documentation of rates accepted for estimating purposes by DOE or another Federal agency, it is recommended that you begin preparing an Indirect Cost Rate Proposal to be submitted, upon request, to the DOE contract specialist/grants management specialist who will evaluate your application if you are selected for award.

For your convenience in preparing an Indirect Cost Rate proposal, a link to applicant resources, including indirect rate model templates, has been provided below: <https://science.osti.gov/sbir/applicant-resources/grant-application/>.

Budget Fields

Section A Senior/Key Person	For each Senior/Key Person, enter the requested information. List personnel, base salary, the number of months that person will be allocated to the project, requested salary, fringe benefits, and the total funds requested for each person. The requested salary must be the product of the base salary and the effort. Include a written narrative in the budget justification that justifies the need for requested personnel. Within the justification, explain the fringe benefit rate used if it is not the standard faculty rate.
Section B Other Personnel	List personnel, the number of months that person will be allocated to the project, requested salary fringe benefits, and the total funds requested for each person. Include a written narrative in the budget justification that fully justifies the need for requested personnel. Within the justification, provide the

	number of positions being filled in each category of other personnel.
Section C Equipment	For the purpose of this budget, equipment is designated as an item of property that has an acquisition cost of \$5,000 or more and an expected service life of more than one year, unless a different threshold is specified in a negotiated Facilities and Administrative Cost Rate. (Note that this designation applies for proposal budgeting only and differs from the DOE definition of capital equipment.) List each item of equipment separately and justify each in the budget justification section. Do not aggregate items of equipment. Allowable items ordinarily will be limited to research equipment and apparatus not already available for the conduct of the work. General-purpose office equipment is not eligible for support unless primarily or exclusively used in the actual conduct of scientific research.
Section D Travel	For purposes of this section only, travel to Canada or to Mexico is considered domestic travel. In the budget justification, list each trip's destination, dates, estimated costs including transportation and subsistence, number of staff traveling, the purpose of the travel, and how it relates to the project. Indicate the basis for the cost estimate (quotes from vendors or suppliers, past experience of similar items, or some other basis). To qualify for support, attendance at meetings or conferences must enhance the investigator's capability to perform the research, plan extensions of it, or disseminate its results. Domestic travel is to be justified separately from foreign travel. Within the budget justification, detail the number of personnel planning to travel and the estimated per-traveler cost for each trip.
Section E Participant/Trainee Support Costs	If applicable, submit training support costs. Educational projects that intend to support trainees (precollege, college, graduate and post graduate) must list each trainee cost that includes stipend levels and amounts, cost of tuition for each trainee, cost of any travel (provide the same information as needed under the regular travel category), and costs for any related training expenses. Participant costs are those costs associated with conferences, workshops, symposia or institutes and breakout items should indicate the number of participants, cost for each participant, purpose of the conference, dates and places of meetings and any related administrative expenses. Indicate the basis for the cost estimate (quotes from vendors or suppliers, past experience of similar items, or some other basis).
Section F Other Direct Costs	<ul style="list-style-type: none"> • Materials and Supplies: Enter total funds requested for materials and supplies in the appropriate fields. In the budget justification, indicate general categories such as glassware, and chemicals, including an amount for each category (items not identified under "Equipment"). Categories less than \$1,000 are not required to be itemized. Indicate the basis for the cost estimate (quotes from vendors or suppliers, past experience of similar items, or some other basis). • Publication Costs: Enter the total publication funds requested.

	<p>The proposal budget may request funds for the costs of documenting, preparing, publishing or otherwise making available to others the findings and products of the work conducted under the award. In the budget justification, include supporting information. Indicate the basis for the cost estimate (quotes from vendors or suppliers, past experience of similar items, or some other basis).</p> <ul style="list-style-type: none"> • Consultant Services: Enter total funds requested for all consultant services. In the budget justification, identify each consultant, the services he/she will perform, total number of days, travel costs, and total estimated costs. Indicate the basis for the cost estimate (quotes from vendors or suppliers, past experience of similar items, or some other basis). • ADP/Computer Services: Enter total funds requested for ADP/Computer Services. The cost of computer services, including computer-based retrieval of scientific, technical and education information may be requested. In the budget justification, include the established computer service rates at the proposing organization if applicable. Indicate the basis for the cost estimate (quotes from vendors or suppliers, past experience of similar items, or some other basis). • Subawards/Consortium/Contractual Costs: Enter total costs for all subawards/consortium organizations and other contractual costs proposed for the project. In the budget justification, justify the details. • Equipment or Facility Rental/User Fees: Enter total funds requested for Equipment or Facility Rental/User Fees. In the budget justification, identify each rental/user fee and justify. Indicate the basis for the cost estimate (quotes from vendors or suppliers, past experience of similar items, or some other basis). • Alterations and Renovations: Enter total funds requested for Alterations and Renovations. In the budget justification, itemize by category and justify the costs of alterations and renovations, including repairs, painting, removal or installation of partitions, shielding, or air conditioning. Where applicable, provide the square footage and costs. • Other: Add text to describe any other Direct Costs not requested above. Enter costs associated with “Other” item(s). Use the budget justification to further itemize and justify.
Section G Direct Costs	This represents Total Direct Costs (Sections A through F)
Section H Other Indirect Costs	Enter the Indirect Cost information, including the rates and bases being used, for each field. Only four general categories of indirect costs are allowed/requested on this form, so please consolidate if needed. Include the cognizant Federal agency and contact information if using a

	negotiated rate agreement. Within the budget justification, explain the use of multiple rates, if multiple rates are used.
Section I Total Direct and Indirect Costs	This is the total of Sections G and H

12. How to Register in PAMS

After you submit your application through Grants.gov, the application will automatically transfer into the Portfolio Analysis and Management System (PAMS) for processing by the DOE SC. Many functions for grants and cooperative agreements can be done in PAMS, which is available at <https://pamspublic.science.energy.gov>.

You will want to “register to” your application: a process of linking yourself to the application after it has been submitted through Grants.gov and processed by DOE.

You must register in PAMS to submit a pre-application or a letter of intent.

You may use the Internet Explorer, Firefox, Google Chrome, or Safari browsers to access PAMS.

Notifications sent from the PAMS system will come from the PAMS email address <PAMS.Autoreply@science.doe.gov>. Please make sure your email server/software allows delivery of emails from the PAMS email address to yours.

Registering to PAMS is a two-step process; once you create an individual account, you must associate yourself with (“register to”) your institution. Detailed steps are listed below.

CREATE PAMS ACCOUNT:

To register, click the “Create New PAMS Account” link on the website <https://pamspublic.science.energy.gov/>.

- Click the “No, I have never had an account” link and then the “Create Account” button.
- You will be prompted to enter your name and email address, create a username and password, and select a security question and answer. Once you have done this, click the “Save and Continue” button.
- On the next page, enter the required information (at least one phone number and your mailing address) and any optional information you wish to provide (e.g., FAX number, website, mailstop code, additional email addresses or phone numbers, Division/Department). Click the “Create Account” button.
- Read the user agreement and click the “Accept” button to indicate that you understand your responsibilities and agree to comply with the rules of behavior for PAMS.
- PAMS will take you to the “Having Trouble Logging In?” page. (If you have been an SC merit reviewer or if you have previously submitted an application, you may already be linked to an institution in PAMS. If this happens, you will be taken to the PAMS home page.)

REGISTER TO YOUR INSTITUTION:

- Click the link labeled “Option 2: I know my institution and I am here to register to the institution.” (Note: If you previously created a PAMS account but did not register to an institution at that time, you must click the Institutions tab and click the “Register to Institution” link.)
- PAMS will take you to the “Register to Institution” page.
- Type a word or phrase from your institution name in the field labeled, “Institution Name like,” choose the radio button next to the item that best describes your role in the system, and click the “Search” button. A “like” search in PAMS returns results that contain the word or phrase you enter; you do not need to enter the exact name of the institution, but you should enter a word or phrase contained within the institution name. (If your institution has a frequently used acronym, such as ANL for Argonne National Laboratory or UCLA for the Regents of the University of California, Los Angeles, you may find it easiest to search for the acronym under “Institution Name like.” Many institutions with acronyms are listed in PAMS with their acronyms in parentheses after their names.)
- Find your institution in the list that is returned by the search and click the “Actions” link in the Options column next to the institution name to obtain a dropdown list. Select “Add me to this institution” from the dropdown. PAMS will take you to the “Institutions – List” page.
- If you do not see your institution in the initial search results, you can search again by clicking the “Cancel” button, clicking the Option 2 link, and repeating the search.
- If, after searching, you think your institution is not currently in the database, click the “Cannot Find My Institution” button and enter the requested institution information into PAMS. Click the “Create Institution” button. PAMS will add the institution to the system, associate your profile with the new institution, and return you to the “Institutions – List” page when you are finished.

For help with PAMS, click the “External User Guide” link on the PAMS website, <https://pamspublic.science.energy.gov/>. You may also contact the PAMS Help Desk, which can be reached Monday through Friday, 9:00AM – 5:30 PM Eastern Time. Telephone: (855) 818-1846 (toll free) or (301) 903-9610, email: sc.pams-helpdesk@science.doe.gov. All submission and inquiries about this FOA should reference the FOA number printed on the cover page.

13. How to View Applications in PAMS

Each Grants.gov application submitted to the DOE SC automatically transfers into PAMS and is subsequently assigned to a program manager. At the time of program manager assignment, the three people listed on the SF-424 (R&R) cover page will receive an email with the subject line, “Receipt of Proposal 0000xxxxxx by the DOE Office of Science.” These three people are the PI (Block 14), Authorized Representative (Block 19), and Point of Contact (Block 5). In PAMS notation, applications are known as proposals, the PI is known as the PI, the Authorized Representative is known as the Sponsored Research Officer/Business Officer/Administrative Officer (SRO/BO/AO), and the Point of Contact is known as the POC.

There will be a period of time between the application’s receipt at Grants.gov and its assignment to a DOE SC program manager. Program managers are typically assigned two weeks after

applications are due at Grants.gov: please refrain from attempting to view the proposal in PAMS until you receive an email providing the assignment of a program manager.

Once the email is sent, the PI, SRO/BO/PO, and POC will each be able to view the submitted proposal in PAMS. Viewing the proposal is optional.

You may use the Internet Explorer, Firefox, Google Chrome, or Safari browsers to access PAMS.

Following are two sets of instructions for viewing the submitted proposal, one for individuals who already have PAMS accounts and one for those who do not.

If you already have a PAMS account, follow these instructions:

1. Log in to PAMS at <https://pamspublic.science.energy.gov/>.
2. Click the “Proposals” tab and click “Access Previously Submitted Grants.gov Proposal.”
3. Enter the following information:
 - Proposal ID: Enter the ten-digit PAMS proposal ID, including the leading zeros (e.g., 00002xxxxx). Do not use the Grants.gov proposal number. Use the PAMS number previously sent to you in the email with subject line, “Receipt of Proposal ...”.
 - Email (as entered in Grants.gov application): Enter your email address as it appears on the SF424(R&R) Cover Page.
 - Choose Role: Select the radio button in front of the role corresponding to the SF-424 (R&R) cover page. If your name appears in block 19 of the SF-424 (R&R) cover page as the authorizing representative, select “SRO/BO/AO (Sponsored Research Officer/Business Officer/Administrative Officer).” If your name appears in block 14 of the SF424 R&R cover page as the PI, select “Principal Investigator (PI).” If your name appears in block 5 of the SF424 R&R as the point of contact, select “Other (POC).”
4. Click the “Save and Continue” button. You will be taken to your “My Proposals” page. The Grants.gov proposal will now appear in your list of proposals. Click the “Actions/Views” link in the options column next to this proposal to obtain a dropdown list. Select “Proposal” from the dropdown to see the proposal. Note that the steps above will work only for proposals submitted to the DOE SC since May 2012.

If you do not already have a PAMS account, follow these instructions:

1. To register, click the “Create New PAMS Account” link on the website <https://pamspublic.science.energy.gov/>.
2. Click the “No, I have never had an account” link and then the “Create Account” button.
3. You will be prompted to enter your name and email address, create a username and password, and select a security question and answer. Once you have done this, click the “Save and Continue” button.
4. On the next page, enter the required information (at least one phone number and your mailing address) and any optional information you wish to provide (e.g., FAX number, website, mailstop code, additional email addresses or phone numbers, Division/Department). Click the “Create Account” button.
5. Read the user agreement and click the “Accept” button to indicate that you understand your responsibilities and agree to comply with the rules of behavior for PAMS.

6. You will be taken to the Register to Institution page. Select the link labeled, “Option 1: My institution has submitted a proposal in Grants.gov. I am here to register as an SRO, PI, or POC (Sponsored Research Officer, Principal Investigator, or Point of Contact).”
7. Enter the following information:
 - Proposal ID: Enter the ten-digit PAMS proposal ID, including the leading zeros (e.g., 00002xxxxx). Do not use the Grants.gov proposal number. Use the PAMS number previously sent to you in the email with subject line, “Receipt of Proposal ...”.
 - Email (as entered in Grants.gov proposal): Enter your email address as it appears on the SF424(R&R) Cover Page.
 - Choose Role: Select the radio button in front of the role corresponding to the SF-424 (R&R) cover page. If your name appears in block 19 of the SF-424 (R&R) cover page as the authorizing representative, select “SRO/BO/AO (Sponsored Research Officer/Business Officer/Administrative Officer).” If your name appears in block 14 of the SF424 R&R cover page as the PI, select “Principal Investigator (PI).” If your name appears in block 5 of the SF424 R&R as the point of contact, select “Other (POC).”
8. Click the “Save and Continue” button. You will be taken to your “My Proposals” page. The Grants.gov proposal will now appear in your list of proposals. Click the “Actions/Views” link in the options column next to this proposal to obtain a dropdown list. Select “Proposal” from the dropdown to see the proposal.

If you were listed as the PI on a prior submission but you have not previously created an account, you may already be listed in PAMS. If this is the case, you will be taken to the PAMS home page after agreeing to the Rules of Behavior. If that happens, follow the instructions listed above under “If you already have a PAMS account...” to access your Grants.gov proposal.

14. How to Register in Other Systems Before Submitting an Application

SYSTEMS TO REGISTER IN

Applicants must complete a series of registrations and enrollments to submit applications in response to this FOA. Applicants not currently registered with SAM and Grants.gov should allow **at least four (4) weeks** to complete these requirements.

You should start the process as soon as possible.

You may not be able to use your preferred Internet browser: Each system has its own requirements.

Applicants must obtain a DUNS number at <https://fedgov.dnb.com/webform>.

Applicants must register with SAM at <https://www.sam.gov/>. More information about SAM registration for applicants is found at [https://www.sam.gov/SAM/transcript/Quick Guide for Grants Registrations.pdf](https://www.sam.gov/SAM/transcript/Quick%20Guide%20for%20Grants%20Registrations.pdf). SAM maintains a complete user guide at [https://www.sam.gov/SAM/transcript/SAM Non Federal User Guide.pdf](https://www.sam.gov/SAM/transcript/SAM%20Non%20Federal%20User%20Guide.pdf).

Applicants must provide a Taxpayer Identification Number (TIN) to complete their registration in www.SAM.gov. An applicant's TIN is an EIN assigned by the Internal Revenue Service (IRS). In limited circumstances, a Social Security Number (SSN) assigned by the Social Security Administration (SSA) may be used as a TIN. You may obtain an EIN from the IRS at <https://www.irs.gov/businesses/small-businesses-self-employed/apply-for-an-employer-identification-number-ein-online>.

Do not use a SSN as a TIN. Obtain a TIN from the IRS using the website listed above.
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Applicants must register with FedConnect at www.FedConnect.net. The full, binding version of assistance agreements will be posted to FedConnect.

Recipients must register with the Federal Funding Accountability and Transparency Act Subaward Reporting System at <https://www.fhrs.gov>. This registration must be completed before an award may be made: you are advised to register while preparing your application.

REGISTERING IN GRANTS.GOV

Applicants must register with Grants.gov, following the instructions at <https://www.Grants.gov/web/grants/applicants/registration.html> and described above.

WHERE TO SUBMIT AN APPLICATION

You must submit the application through Grants.gov at www.Grants.gov, using either the online webforms or downloaded forms, or a system-to-system service

Submit electronic applications through the "Apply for Grants" function at www.Grants.gov. If you have problems completing the registration process or submitting your application, call Grants.gov at 1-800-518-4726 or send an email to support@Grants.gov.

Please ensure that you have read the applicable instructions, guides, help notices, frequently asked questions, and other forms of technical support on Grants.gov.

DOE SC PORTFOLIO ANALYSIS AND MANAGEMENT SYSTEM (PAMS)

Applicants must register in the Portfolio Analysis and Management System (PAMS) to submit letters of intent and pre-applications, to view merit reviewer comments, or to take a number of post-award actions.

B. POLICY PROVISIONS

1. Evaluation and Administration by Non-Federal Personnel

In conducting the merit review evaluation, the Government may seek the advice of qualified non-Federal personnel as reviewers. The Government may also use non-Federal personnel to conduct routine, nondiscretionary administrative activities. The applicant, by submitting its application, consents to the use of non-Federal reviewers/administrators. Non-Federal reviewers must sign a conflict of interest agreement and a certificate of confidentiality prior to reviewing an application. Non-Federal personnel conducting administrative activities must sign a non-disclosure agreement.

2. Government Right to Reject or Negotiate

DOE reserves the right, without qualification, to reject any or all applications received in response to this FOA and to select any application, in whole or in part, as a basis for negotiation and/or award.

3. Intergovernmental Review

This program is not subject to Executive Order 12372 Intergovernmental Review of Federal Programs.

4. Modifications

Notices of any modifications to this FOA will be posted on Grants.gov and the FedConnect portal. You can receive an email when a modification or an FOA message is posted by registering with FedConnect as an interested party for this FOA. It is recommended that you register as soon after release of the FOA as possible to ensure you receive timely notice of any modifications or other FOAs. More information is available at www.FedConnect.net.

C. ADMINISTRATIVE AND NATIONAL POLICY REQUIREMENTS

1. Administrative Requirements

The administrative requirements for DOE grants and cooperative agreements are contained in 2 CFR 200 as modified by 2 CFR 910 (DOE Financial Assistance Regulations).

2. Availability of Funds

Funds are not presently available for this award. The Government's obligation under this award is contingent upon the availability of appropriated funds from which payment for award purposes can be made. No legal liability on the part of the Government for any payment may arise until funds are made available to the contracting officer for this award and until the awardee receives notice of such availability, to be confirmed in writing by the DOE Contracting Officer.

3. Conference Spending (February 2015)

The recipient shall not expend any funds on a conference not directly and programmatically related to the purpose for which the grant or cooperative agreement was awarded that would defray the cost to the United States Government of a conference held by any Executive branch department, agency, board, commission, or office for which the cost to the United States Government would otherwise exceed \$20,000, thereby circumventing the required notification by the head of any such Executive Branch department, agency, board, commission, or office to the Inspector General (or senior ethics official for any entity without an Inspector General), of the date, location, and number of employees attending such conference.

4. Commitment of Public Funds

(a) A DOE financial assistance award is valid only if it is in writing and is signed, either in writing or electronically, by a DOE Contracting Officer.

(b) Recipients are free to accept or reject the award. A request to draw down DOE funds constitutes the Recipient's acceptance of the terms and conditions of this Award.

5. Corporate Felony Conviction and Federal Tax Liability Representations (March 2014)

In submitting an application in response to this FOA the Applicant represents that:

- It is **not** a corporation that has been convicted of a felony criminal violation under any Federal law within the preceding 24 months,
- It is **not** a corporation that has any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.

For purposes of these representations the following definitions apply:

- A Corporation includes any entity that has filed articles of incorporation in any of the 50 states, the District of Columbia, or the various territories of the United States [but not foreign corporations]. It includes both for-profit and non-profit organizations.

6. Environmental, Safety and Health (ES&H) Performance of Work at DOE Facilities

With respect to the performance of any portion of the work under this award which is performed at a DOE-owned or controlled site, the recipient agrees to comply with all state and Federal ES&H regulations, and with all other ES&H requirements of the operator of such site.

Prior to the performance on any work at a DOE-Owned or controlled site, the recipient shall contact the site facility manager for information on DOE and site specific ES&H requirements.

The recipient shall apply this provision to all subawardees at any tier.

7. Federal, State, and Local Requirements

With respect to the performance of any portion of the work under this award, the recipient agrees to comply with all applicable local, state, and Federal ES&H regulations. The recipient shall apply this provision to all sub awardees at any tier.

8. Funding Restrictions

Funding for all awards and future budget periods are contingent upon the availability of funds appropriated by Congress for the purpose of this program and the availability of future-year budget authority.

Cost Principles: Costs must be allowable, allocable and reasonable in accordance with the applicable Federal cost principles referenced in 2 CFR 200 as modified by 2 CFR 910 (DOE Financial Assistance Regulation).

Pre-award Costs: Recipients may charge to an award resulting from this FOA pre-award costs that were incurred within the ninety (90) calendar day period immediately preceding the effective date of the award, if the costs are allowable in accordance with the applicable Federal cost principles referenced in 2 CFR 200 as modified by 2 CFR 910 (DOE Financial Assistance Regulation). Recipients must obtain the prior approval of the contracting officer for any pre-award costs that are for periods greater than this 90 day calendar period.

Pre-award costs are incurred at the applicant's risk. DOE is under no obligation to reimburse such costs if for any reason the applicant does not receive an award or if the award is made for a lesser amount than the applicant expected.

9. National Environmental Policy Act (NEPA) Compliance

If question 4.a. on the "Research and Related Other Project Information" document indicates "potential impact on the environment", or if DOE's own review indicates it, DOE may ask the applicant to provide additional information on those impacts in order to prepare an environmental critique/synopsis per 10 CFR 1021.216. Note that this pre-award environmental critique/synopsis process would be separate from the preparation of a NEPA document such as an environmental impact statement (EIS) or an environmental assessment (EA). If DOE determines the latter documentation is necessary, this process would need to be completed, funded by and with the participation of the awardee, prior to them taking any action on the proposed project that could have adverse environmental effects or that could limit the choice of reasonable alternatives. Note that in most cases, even when "Potential Impact to the Environment" is checked "Yes," preparation of such NEPA documents is rarely necessary, but DOE has the expectation that the Applicant will disclose the potential, which would serve to initiate dialog with DOE if necessary. The inability to satisfy the NEPA requirements after an award would result in cancellation of the award.

10. Nondisclosure and Confidentiality Agreements Representations (June 2015)

In submitting an application in response to this FOA the Applicant represents that:

(1) It **does not and will not** require its employees or contractors to sign internal nondisclosure or confidentiality agreements or statements prohibiting or otherwise restricting its employees or contractors from lawfully reporting waste, fraud, or abuse to a designated investigative or law enforcement representative of a Federal department or agency authorized to receive such information.

(2) It **does not and will not** use any Federal funds to implement or enforce any nondisclosure and/or confidentiality policy, form, or agreement it uses unless it contains the following provisions:

a. *“These provisions are consistent with and do not supersede, conflict with, or otherwise alter the employee obligations, rights, or liabilities created by existing statute or Executive order relating to (1) classified information, (2) communications to Congress, (3) the reporting to an Inspector General of a violation of any law, rule, or regulation, or mismanagement, a gross waste of funds, an abuse of authority, or a substantial and specific danger to public health or safety, or (4) any other whistleblower protection. The definitions, requirements, obligations, rights, sanctions, and liabilities created by controlling Executive orders and statutory provisions are incorporated into this agreement and are controlling.”*

b. The limitation above shall not contravene requirements applicable to Standard Form 312, Form 4414, or any other form issued by a Federal department or agency governing the nondisclosure of classified information.

c. Notwithstanding provision listed in paragraph (a), a nondisclosure or confidentiality policy form or agreement that is to be executed by a person connected with the conduct of an intelligence or intelligence-related activity, other than an employee or officer of the United States Government, may contain provisions appropriate to the particular activity for which such document is to be used. Such form or agreement shall, at a minimum, require that the person will not disclose any classified information received in the course of such activity unless specifically authorized to do so by the United States Government. Such nondisclosure or confidentiality forms shall also make it clear that they do not bar disclosures to Congress, or to an authorized official of an executive agency or the Department of Justice, that are essential to reporting a substantial violation of law.

11. Notice Regarding Eligible/Ineligible Activities

Eligible activities under this program include those which describe and promote the understanding of scientific and technical aspects of specific energy technologies, but not those which encourage or support political activities such as the collection and dissemination of information related to potential, planned or pending legislation.

12. Prohibition on Lobbying Activity

By accepting funds under this award, you agree that none of the funds obligated on the award shall be expended, directly or indirectly, to influence congressional action on any legislation or appropriation matters pending before Congress, other than to communicate to Members of Congress as described in 18 USC 1913. This restriction is in addition to those prescribed elsewhere in statute and regulation.

13. Proprietary Application Information

Patentable ideas, trade secrets, proprietary or confidential commercial or financial information, disclosure of which may harm the applicant, should be included in an application only when such information is necessary to convey an understanding of the proposed project. The use and disclosure of such data may be restricted, provided the applicant includes the following legend on the first page of any document included in the application that contains such proprietary information and specifies the pages of the document which are to be restricted:

“The data contained in pages _____ of this document have been submitted in confidence and contain trade secrets or proprietary information, and such data shall be used or disclosed only for evaluation purposes, provided that if this applicant receives an award as a result of or in connection with the submission of this application, DOE shall have the right to use or disclose the data herein to the extent provided in the award. This restriction does not limit the government’s right to use or disclose data obtained without restriction from any source, including the applicant.”

To protect such data, each line or paragraph on the pages containing such data must be specifically identified and marked with a legend similar to the following:

“The following contains proprietary information that (name of applicant) requests are not released to persons outside the Government, except for purposes of review and evaluation.”

14. Publications

The recipient is expected to publish or otherwise make publicly available the results of the work conducted under any award resulting from this FOA. Publications and other methods of public communication describing any work based on or developed under an award resulting from this FOA must contain an acknowledgment of SC support. The format for such acknowledgments is provided at <https://science.osti.gov/funding-opportunities/acknowledgements/>. The author’s copy of any peer-reviewed manuscript accepted for publication must be announced to DOE’s Office of Scientific and Technical Information (OSTI) and made publicly available in accordance with the instructions contained in the Reporting Requirements Checklist incorporated in all Assistance Agreements.

15. Registration Requirements

Additional administrative requirements for DOE grants and cooperative agreements are contained in 2 CFR 25 (See: www.eCFR.gov). Prime awardees must keep their data in SAM current at www.SAM.gov. Subawardees at all tiers must obtain DUNS numbers and provide the DUNS to the prime awardee before the subaward can be issued.

16. Rights in Technical Data

Normally, the government has unlimited rights in technical data created under a DOE agreement, including the right to distribute to the public. Delivery or third party licensing of proprietary

software or data developed solely at private expense (“Limited Rights Data”) will not normally be required except as specifically negotiated in a particular agreement to satisfy DOE’s own needs or to insure the commercialization of technology developed under a DOE agreement.

If software is specified for delivery to DOE, or if other special circumstances exist, e.g., DOE specifying “open-source” treatment of software, then the contracting officer, after negotiation with the recipient, may include in the award special provisions requiring the recipient to obtain written approval of the contracting officer prior to asserting copyright in the software, modifying the retained Government license, and/or otherwise altering the copyright provisions.

17. Subaward and Executive Reporting

Additional administrative requirements necessary for DOE grants and cooperative agreements to comply with the Federal Funding and Transparency Act of 2006 (FFATA) are contained in 2 CFR 170. (See: www.eCFR.gov). Prime awardees must register with the new FSRs database at <https://www.fsr.gov> and report the required data on their first tier subawardees. Prime awardees must report the executive compensation for their own executives as part of their registration profile in SAM.

18. Title to Subject Inventions

Ownership of subject inventions is governed pursuant to the authorities listed below:

- **Nonprofit organizations or small business firms:** Under the Bayh-Dole Act (35 U.S.C. § 200 et seq.), nonprofit organizations or small business firms as defined by 35 U.S.C. 201 may elect to retain title to their subject inventions;
- **All other parties:** The federal Non-Nuclear Energy Act of 1974, 42. U.S.C. 5908, provides that the government obtains title to new inventions unless a waiver is granted (see below); and
- **Patent Waiver:** Applicants may request a waiver of all or any part of the rights of the United States in inventions conceived or first actually reduced to practice in performance of an agreement as a result of this FOA, in advance of or within 30 days after the effective date of the award. Even if such advance waiver is not requested or the request is denied, the recipient will have a continuing right under the award to request a waiver of the rights of the United States in identified inventions, i.e., individual inventions conceived or first actually reduced to practice in performance of the award. Any patent waiver that may be granted is subject to certain terms and conditions in 10 CFR 784. For more information, see <https://energy.gov/gc/services/technology-transfer-and-procurement/office-assistant-general-counsel-technology-transf-1> . Nonprofit organizations and small business firms do not need a patent waiver in order to retain title to their subject inventions (see above).

D. REFERENCE MATERIAL

Glossary of Useful Grants and Cooperative Agreement terms

Acquisition cost	<i>Acquisition cost</i> means the cost of the asset including the cost to ready the asset for its intended use. Acquisition cost for equipment, for example, means the net invoice price of the equipment, including the cost of any modifications, attachments, accessories, or auxiliary apparatus necessary to make it usable for the purpose for which it is acquired. Acquisition costs for software includes those development costs capitalized in accordance with generally accepted accounting principles (GAAP). Ancillary charges, such as taxes, duty, protective in transit insurance, freight, and installation may be included in or excluded from the acquisition cost in accordance with the non-Federal entity's regular accounting practices.
Administrative requirements	<i>Administrative requirements</i> means the general business management practices that are common to the administration of all grants, such as financial accountability, reporting, equipment management, and retention of records.
Advance payment	<i>Advance payment</i> means a payment that a Federal awarding agency or pass-through entity makes by any appropriate payment mechanism, including a predetermined payment schedule, before the non-Federal entity disburses the funds for program purposes.
Allocation	<i>Allocation</i> means the process of assigning a cost, or a group of costs, to one or more cost objective(s), in reasonable proportion to the benefit provided or other equitable relationship. The process may entail assigning a cost(s) directly to a final cost objective or through one or more intermediate cost objectives.
Allocability	<i>Allocability</i> means the principle which requires that an expense or service charged must directly benefit and be necessary for the performance of the project; when multiple projects are benefited reasonable proportions must be able to be assigned. See 2 CFR 200.405.
Allowable cost	<i>Allowable cost</i> means a cost incurred by a recipient that is: (1) reasonable for the performance of the award; (2) allocable; (3) in conformance with any limitations or exclusions set forth in the Federal cost principles applicable to the organization incurring the cost or in the award documents as to the type or amount of cost; (4) consistent with regulations, policies, and procedures of the recipient that are applied uniformly to both federally supported and other activities of the organization; (5) accorded consistent treatment as a direct or indirect cost; (6) determined in accordance with generally accepted accounting principles; and (7) not included as a cost in any other federally supported award (unless specifically authorized by statute). See 2 CFR 200.403.
Application	<i>Application</i> means a request for financial support of a project or activity submitted to DOE on specified forms and in accordance with DOE instructions. Also known as a proposal.
Appropriation Act	<i>Appropriation act</i> means the statute that provides the authority for Federal agencies to incur obligations to and make payments out of the U.S. treasury for specified purposes.
Approved budget	The approved budget for the Federal award summarizes the financial aspects of the project or program as approved during the Federal award process. It may include either the Federal and non-Federal share or only the Federal share, depending upon Federal awarding agency requirements. It must be related to performance for program evaluation purposes whenever appropriate. See 2 CFR 200.308(a).
Assurance	<i>Assurance</i> means a certification by an applicant, normally included with the application or State plan, indicating that the entity is in compliance with, or that it will abide by, a particular requirement if awarded a Federal grant.

Authorized organizational representative	<i>Authorized organizational representative</i> means the individual, named by the applicant organization, who is authorized to act for the applicant and to assume the obligations imposed by the Federal laws, regulations, requirements, and conditions that apply to grant applications or grant awards.
Award	<i>Award</i> means the provision of funds by DOE, based on an approved application and budget or progress report, to an organizational entity or an individual to carry out a project or activity.
Award documents	<i>Award documents</i> means the entirety of the documents describing the legal relationship between DOE and an awardee or recipient. The award documents include an Assistance Agreement and other documents which may be incorporated by reference or as attachments to the Assistance Agreement. The award documents are the official, legally binding document, signed (or the electronic equivalent of signature) by a contracting officer that: <ul style="list-style-type: none"> • notifies the recipient of the award of a grant; • contains or references all the terms and conditions of the grant and Federal funding limits and obligations; and, • provides the documentary basis for recording the obligation of Federal funds in the DOE accounting system.
Bayh-Dole Act	<i>Bayh-Dole Act</i> means a law which encourages universities and researchers to develop their inventions into marketable products; formal citation is Section 6 of the Patent and Trademark Amendment of 1980, Pub. L 96-517 as amended.
Budget	<i>Budget</i> means the financial plan for the project or program that the Federal awarding agency or pass-through entity approves during the Federal award process or in subsequent amendments to the Federal award. It may include the Federal and non-Federal share or only the Federal share, as determined by the Federal awarding agency or pass-through entity.
Budget period	<i>Budget period</i> means the intervals of time (usually 12 months each) into which a project period is divided for budgetary and funding purposes.
Business officer	<i>Business officer</i> means the financial official of the grantee who has primary fiscal responsibility for the grant. Also known as authorized organizational representative.
Capital assets	<i>Capital assets</i> means tangible or intangible assets used in operations having a useful life of more than one year which are capitalized in accordance with GAAP. Capital assets include: <ol style="list-style-type: none"> (a) Land, buildings (facilities), equipment, and intellectual property (including software) whether acquired by purchase, construction, manufacture, lease-purchase, exchange, or through capital leases; and (b) Additions, improvements, modifications, replacements, rearrangements, reinstallations, renovations or alterations to capital assets that materially increase their value or useful life (not ordinary repairs and maintenance).
Carryover	<i>Carryover</i> means unobligated Federal funds remaining at the end of any budget period that may be carried forward to another budget period to cover allowable costs of that budget period (whether as an offset or additional authorization). Obligated, but unliquidated, funds are not considered carryover.
Change in scope	<i>Change in scope</i> means an activity whereby the objectives or specific aims identified in the approved grant application are significantly changed by the grantee after award. Contracting officer prior approval is required for a change in scope to be allowable under an award.
Closeout	<i>Closeout</i> means the process by which a Federal awarding agency determines that all applicable administrative actions and all required work under an award have been completed by the grantee and the Federal awarding agency.
Competitive segment	<i>Competitive segment</i> means the initial project period recommended for support or each extension of a project period resulting from a renewal award.

Conference (domestic or international)	<i>Conference (domestic or international)</i> means a symposium, seminar, workshop, or any other organized and formal meeting, whether conducted face-to-face or via the Internet, where individuals assemble (or meet virtually) to exchange information and views or explore or clarify a defined subject, problem, or area of knowledge, whether or not a published report results from such meeting.
Consortium or sub-award agreement	<i>Consortium or sub-award agreement</i> means a formalized agreement whereby a research project is carried out by the grantee and one or more other organizations that are separate legal entities. Under the agreement, the grantee must perform a substantive role in the conduct of the planned research and not merely serve as a conduit of funds to another party or parties. These agreements typically involve a specific level of effort from the consortium organization's PD/PI and a categorical breakdown of costs, such as personnel, supplies, and other allowable expenses, including F&A costs. The relationship between the recipient and the collaborating organizations is considered a sub-award relationship.
Consultant	<i>Consultant</i> means an individual who provides professional advice or services for a fee, but not as an employee of the engaging party. To prevent apparent or actual conflicts of interest, grantees and consultants must establish written guidelines indicating the conditions of payment of consulting fees. Consultants also include firms that provide professional advice or services. See 2 CFR 200.459.
Continuation application/award	<i>Continuation application/award</i> means a financial assistance request (in the form of an application or progress report) or resulting award for a subsequent budget period within a previously approved project period for which a recipient does not have to compete with other applicants.
Contract	<i>Contract</i> means a legal instrument by which a non-Federal entity purchases property or services needed to carry out the project or program under a Federal award. The term as used in this part does not include a legal instrument, even if the non-Federal entity considers it a contract, when the substance of the transaction meets the definition of a Federal award or sub-award (see 2 CFR 200.1 Subaward).
Contractor	<i>Contractor</i> means an entity that receives a contract as defined in 2 CFR 200.1 Contract.
Contracting (or Grants Management) officer	<i>Contracting (or Grants Management) officer</i> means a DOE official responsible for the business management aspects of grants and cooperative agreements, including review, negotiation, award, and administration, and for the interpretation of grants administration policies and provisions. COs and GMOs are delegated the authority to obligate DOE to the expenditure of funds and permit changes to approved projects on behalf of DOE.
Contracting (or Grants Management) specialist	<i>Contracting (or Grants Management) specialist</i> means a DOE staff member who works with a contract or grants management officer and is assigned the day-to-day management of a portfolio of grants and/or cooperative agreements. These activities include, but are not limited to, evaluating grant applications for administrative content and compliance with statutes, regulations, and guidelines; negotiating grants; providing consultation and technical assistance to grantees; and administering grants after award.
Cooperative agreement	<i>Cooperative agreement</i> means a type of financial assistance used when there will be substantial Federal scientific or programmatic involvement. Substantial involvement means that, after award, scientific or program staff will assist, guide, coordinate, or participate in project activities.
Cost principles	<i>Cost principles</i> means the government-wide principles, 2 CFR 200 Subpart E (or, in the case of commercial organizations, the Federal Acquisition Regulation [48 CFR 31], or, in the case of hospitals, see Appendix IX to Part 200—Hospital Cost Principles, Appendix E, “Principles For Determining

	Costs Applicable to Research and Development Under Grants and Contracts with Hospitals”), on allowability and unallowability of costs under federally sponsored agreements.
Cost sharing or matching	<i>Cost sharing or matching</i> means the portion of project costs not paid by Federal funds (unless otherwise authorized by Federal statute). See also 2 CFR 200.306 Cost sharing or matching.
Deadline	<i>Deadline</i> means the published date and/or time that a grant application is to be submitted to the funding agency.
Debarment and suspension	<i>Debarment and suspension</i> mean the actions taken by a debaring official in accordance with OMB guidance at 2 CFR 180, “Non-procurement Debarment and Suspension,” to exclude a person or organization from participating in grants and other non-procurement awards government-wide. If debarred or suspended, the person or organization may not receive financial assistance (under a grant, cooperative agreement, or sub-award, or contract under a grant) for a specified period of time. Debarments and suspensions carried out pursuant to 2 CFR 376 are distinct from post-award suspension action by an awarding agency. See 2 CFR 901 for DOE implementation.
Direct costs	<i>Direct costs</i> mean costs that can be identified specifically with a particular sponsored project, an instructional activity, or any other institutional activity, or that can be directly assigned to such activities relatively easily with a high degree of accuracy. See 2 CFR 200.413.
Disallowed costs	<i>Disallowed costs</i> mean those charges to a Federal award that the Federal awarding agency or pass-through entity determines to be unallowable, in accordance with the applicable Federal statutes, regulations, or the terms and conditions of the Federal award.
Domestic organization	<i>Domestic organization</i> means a public (including a State or other governmental agency) or private non-profit or for-profit organization that is located in the United States or its territories, is subject to U.S. laws, and assumes legal and financial accountability for awarded funds and for the performance of the grant-supported activities.
DUNS number	<i>DUNS number</i> means a nine-digit number established and assigned by Dun and Bradstreet to uniquely identify a business entity.
Effort	<i>Effort</i> means the amount of time, usually expressed as a percentage of the total, which a faculty member or other employee spends on a sponsored project. No one is allowed to spend more than 100% total commitment on all academic activities, including grant-sponsored research, university-sponsored research, teaching, administration, advising and other contracted duties. Effort is indicated on the budget in units of person-months.
Equipment	<i>Equipment</i> means tangible personal property (including information technology systems) having a useful life of more than one year and a per-unit acquisition cost which equals or exceeds the lesser of the capitalization level established by the non-Federal entity for financial statement purposes, or \$5,000. See also 2 CFR 200.1 Capital assets, Computing devices, General purpose equipment, Information technology systems, Special purpose equipment, and Supplies.
Expanded authorities	<i>Expanded authorities</i> means authorization to grantees under certain research grant mechanisms which waives the requirement for prior agency approval for specified actions related to awards. Example: 90-day pre-award spending authority, no cost extensions for up to one additional year, and automatic carryover of unobligated funds from one budget period to the next. The expanded authorities are now contained in the standard terms and conditions for most research grants.
Expiration date	<i>Expiration date</i> means generally, the date signifying the end of the current project period, after which the grantee is not authorized to obligate grant funds.

Facilities and administrative costs	<i>Facilities and administrative costs</i> mean costs that are incurred by a grantee for common or joint objectives and that, therefore, cannot be identified specifically with a particular project or program. These costs also are known as indirect costs.
Federal financial report	<i>Federal financial report</i> means submitted on Standard Form (SF) 425, to indicate the status of awarded funds for the period covered. Frequency of reporting is specified in the Reporting Checklist provided as part of the award documents.
Financial assistance	<i>Financial assistance</i> means transfer by DOE of money or property to an eligible entity to support or stimulate a public purpose authorized by statute.
Financial status report	<i>Financial status report</i> means see Federal Financial Report.
Foreign travel	<i>Foreign travel</i> is meant to include travel outside of North America (Canada, Mexico, and the United States) and U.S. territories and possessions (Guam, American Samoa, Puerto Rico, the U.S. Virgin Islands. A trip is considered foreign travel for all legs of the itinerary if the traveler does not return to his or her post prior to departure for a foreign destination. Costs for foreign travel may be restricted by the language of a Funding Opportunity Announcement.
Funding opportunity announcement (FOA)	<i>Funding opportunity announcement (FOA)</i> means A publicly available document by which a Federal Agency makes known its intentions to award discretionary grants or cooperative agreements, usually as a result of competition for funds. Funding opportunity announcements may be known as program announcements, requests for applications, notices of funding availability, solicitations, or other names depending on the Agency and type of program. Funding opportunity announcements can be found at www.Grants.gov . An FOA may also be known as a solicitation.
Grant agreement	<p><i>Grant agreement</i> means a legal instrument of financial assistance between a Federal awarding agency or pass-through entity and a non-Federal entity that, consistent with 31 USC 6302, 6304:</p> <p>(a) Is used to enter into a relationship the principal purpose of which is to transfer anything of value from the Federal awarding agency or pass-through entity to the non-Federal entity to carry out a public purpose authorized by a law of the United States (see 31 USC 6101(3)); and not to acquire property or services for the Federal awarding agency or pass-through entity’s direct benefit or use;</p> <p>(b) Is distinguished from a cooperative agreement in that it does not provide for substantial involvement between the Federal awarding agency or pass-through entity and the non-Federal entity in carrying out the activity contemplated by the Federal award.</p> <p>(c) Does not include an agreement that provides only:</p> <ol style="list-style-type: none"> (1) Direct United States Government cash assistance to an individual; (2) A subsidy; (3) A loan; (4) A loan guarantee; or (5) Insurance.
Grant-supported project or activity	<i>Grant-supported project or activity</i> means those activities specified or described in a grant application or in a subsequent submission that are approved by DOE for funding, regardless of whether Federal funding constitutes all or only a portion of the financial support necessary to carry them out.
Grantee	<i>Grantee</i> means the organization or individual awarded a grant or cooperative agreement by DOE that is responsible and accountable for the use of the funds provided and for the performance of the grant-supported project or activity. The grantee is the entire legal entity even if a particular component is designated in award documents. The grantee is legally responsible and accountable to DOE for the performance and financial aspects of the grant-

	supported project or activity. Also known as awardee or recipient.
Grants.gov	<i>Grants.gov</i> (https://www.Grants.gov/) has been designated by the Office of Management and Budget as the single access point for all grant programs offered by 26 Federal grant-making agencies. It provides a single interface for agencies to announce their grant opportunities and for all applicants to find and apply for those opportunities.
Indirect costs (facilities & administrative)	<i>Indirect (F&A) costs</i> means those costs incurred for a common or joint purpose benefitting more than one cost objective, and not readily assignable to the cost objectives specifically benefitted, without effort disproportionate to the results achieved. To facilitate equitable distribution of indirect expenses to the cost objectives served, it may be necessary to establish a number of pools of indirect (F&A) costs. Indirect (F&A) cost pools must be distributed to benefitted cost objectives on bases that will produce an equitable result in consideration of relative benefits derived.
Institutional base salary	<i>Institutional base salary</i> means the annual compensation paid by an organization for an employee's appointment, whether that individual's time is spent on research, teaching, patient care, or other activities. Base salary excludes any income that an individual may be permitted to earn outside of duties for the applicant/grantee organization. Base salary may not be increased as a result of replacing organizational salary funds with grant funds.
Matching or cost sharing	<i>Matching or cost sharing</i> means the value of third-party in-kind contributions and the portion of the costs of a federally assisted project or program not borne by the Federal government. Matching or cost sharing may be required by statute or program regulation. Costs used to satisfy matching or cost-sharing requirements are subject to the same policies governing allowability as other costs under the approved budget.
Merit (or peer) review	<i>Merit (or peer) review</i> means the process that involves the consistent application of standards and procedures that produce fair, equitable, and objective examinations of applications based on an evaluation of scientific or technical merit or other relevant aspects of the application. The review is performed by experts (reviewers) in the field of endeavor for which support is requested. Merit review is intended to provide guidance and to the DOE individuals responsible for making award decisions.
Monitoring	<i>Monitoring</i> means a process whereby the programmatic and business management performance aspects of a grant are assessed by reviewing information gathered from various required reports, audits, site visits, and other sources.
NEPA	NEPA means the National Environmental Policy Act (NEPA), Public Law 91-190, as amended. NEPA requires Federal agencies to assess the environmental effects of proposed major Federal actions prior to making decisions.
No-cost extension	<i>No-cost extension</i> means an extension of time to a project period and/or budget period to complete the work of the grant under that period, without additional Federal funds or competition.
Non-Federal share	<i>Non-Federal share</i> means when cost sharing or matching is required as a condition of an award, the portion of allowable project/program costs not borne by the Federal government.
Obligations	<i>Obligations</i> when used in connection with a non-Federal entity's utilization of funds under a Federal award, <i>obligations</i> means orders placed for property and services, contracts and sub-awards made, and similar transactions during a given period that require payment by the non-Federal entity during the same or a future period.
OMB circulars	<i>OMB circulars</i> means government-wide guidance issued to Heads of Federal agencies by the Director of the Office of Management and Budget.
Other significant contributors	Other significant contributors mean individuals who have committed to contribute to the scientific development or execution of the project, but are not

	committing any specified measurable effort (i.e., person months) to the project. These individuals are typically presented at “effort of zero person months” or “as needed.” Individuals with measurable effort may not be listed as Other Significant Contributors (OSCs). Consultants should be included if they meet this definition.
Program participant	<i>Program participants</i> are the recipients of service or training provided at a workshop, conference, seminar, symposium or other short-term instructional or information-sharing activity funded by an external grant or award, or the training beneficiaries of the project or program funded by an external grant or award. A participant is not involved in providing any deliverable to the grantee or a third party or would not be terminated or replaced for failure to perform.
Participant support costs	<i>Participant support costs</i> means direct costs for items such as stipends or subsistence allowances, travel allowances, and registration fees paid to or on behalf of participants or trainees (but not employees) in connection with conferences, or training projects.
Person months	<i>Person months</i> is the metric for expressing the effort (amount of time) PD/PI(s), faculty and other senior/key personnel devote to a specific project. The effort is based on the type of appointment of the individual with the organization; e.g., calendar year, academic year, and/or summer term; and the organization’s definition of such. For instance, some institutions define the academic year as a 9-month appointment while others define it as a 10-month appointment.
Pre-application or pre-proposal	<i>Pre-application or pre-proposal</i> means a brief outline or narrative of proposed work and sometimes budget, for informal review by a sponsor to determine whether an application should be submitted. Three predominant reasons for requiring submission of a preliminary pre-application are: <ul style="list-style-type: none"> • Reduce the applicant’s unnecessary effort in proposal preparation when the chance of success is very small. This is particularly true of exploratory initiatives where the community senses that a major new direction is being identified, or competitions that will result in a small number of actual awards. • Increase the overall quality of the submission. • Distill the number of applications that will be submitted to the agency and the number of anticipated reviewers needed to review.
Pre-award costs	<i>Pre-award costs</i> means any cost incurred prior to the beginning date of the project period or the initial budget period of a competitive segment (under a multi-year award), in anticipation of the award and at the applicant’s own risk, for otherwise allowable costs.
Prior approval	<i>Prior approval</i> means written approval from the designated contracting officer.
Program Director/ Principal Investigator	<i>Program Director/ Principal Investigator</i> means the individual(s) designated by the applicant organization to have the appropriate level of authority and responsibility to direct the project or program to be supported by the award. The applicant organization may designate multiple individuals as program directors/principal investigators (PD/PIs) who share the authority and responsibility for leading and directing the project, intellectually and logistically. When multiple PD/PIs are named, each is responsible and accountable to the applicant organization, or as appropriate, to a collaborating organization for the proper conduct of the project or program including the submission of all required reports. The presence of more than one PD/PI on an application or award diminishes neither the responsibility nor the accountability of any individual PD/PI.
Program income	<i>Program income</i> means gross income earned by the non-Federal entity that is directly generated by a supported activity or earned as a result of the Federal award during the period of performance except as provided in 2 CFR 200.307

	paragraph (f). (See 2 CFR 200.1 Period of performance.) Program income includes but is not limited to income from fees for services performed, the use or rental or real or personal property acquired under Federal awards, the sale of commodities or items fabricated under a Federal award, license fees and royalties on patents and copyrights, and principal and interest on loans made with Federal award funds. Interest earned on advances of Federal funds is not program income. Except as otherwise provided in Federal statutes, regulations, or the terms and conditions of the Federal award, program income does not include rebates, credits, discounts, and interest earned on any of them. See also 2 CFR 200.407 Prior written approval (prior approval). See also 35 USC 200-212 “Disposition of Rights in Educational Awards” for inventions made under Federal awards.
Program Manager	<i>Program Manager</i> means the DOE official responsible for the programmatic, scientific, and/or technical aspects of a grant. The same role is filled by Program Directors, Program Officers, or Project Directors at other Federal agencies.
Progress report	<i>Progress report</i> means periodic, frequently annual, report submitted by the grantee and used by DOE to assess progress and to determine whether to provide funding for the budget period subsequent to that covered by the report.
Project/performance site	<i>Project/performance site</i> means location(s) of where the work described in the research plan will be conducted.
Project period	<i>Project period</i> means the total time for which Federal support of a project has been programmatically approved as shown in the award documents; however, it does not constitute a commitment by the Federal government to fund the entire period. The total award period comprises the initial competitive segment, any subsequent competitive segments resulting from a renewal award(s), and extensions.
Proposal	See application.
Re-budgeting	<i>Re-budgeting</i> means reallocation of funds available for spending between approved budget categories to allow best use of funds to accomplish the project goals.
Recipient	<i>Recipient</i> means the organizational entity or individual receiving a grant or cooperative agreement.
Renewal application	<i>Renewal application</i> means an application requesting additional funding for a period subsequent to that provided by a current award. Renewal applications compete for funds with all other peer reviewed applications and must be developed as fully as though the applicant is applying for the first time.
Research	<i>Research</i> is defined as a systematic study directed toward fuller scientific knowledge or understanding of the subject studied. See 2 CFR 200.1 Research and Development (R&D).
Research misconduct	Research misconduct means fabrication, falsification, or plagiarism in proposing, performing, or reviewing research, or in reporting research results, but does not include honest error or differences of opinion. See 10 CFR 733.
SAM.gov	<i>SAM.gov</i> is the System for Award Management (SAM) a consolidated service that includes Entity Registration, Assistance Listings, and other services for making, managing, and receiving Federal awards.
Scope of work	<i>Scope of work</i> means the aims, objectives, and purposes of a grant; as well as the methodology, approach, analyses or other activities; and the tools, technologies, and timeframes needed to meet the grant’s objectives. This includes the research or training plan included with the original grant application, along with any approved modifications.
Senior/Key Personnel	<i>Senior/Key personnel</i> means the PD/PI and other individuals who contribute to the scientific development or execution of a project in a substantive, measurable way, whether or not they receive salaries or compensation under the grant. Typically, these individuals have doctoral or other professional

	degrees, although individuals at the masters or baccalaureate level may be considered senior/key personnel if their involvement meets this definition. Consultants and those with a postdoctoral role also may be considered senior/key personnel if they meet this definition. “Zero percent” effort or “as needed” is not an acceptable level of involvement for Senior/Key Personnel.
Significant re-budgeting	<i>Significant re-budgeting</i> means a threshold that is reached when expenditures in a single direct cost budget category deviate (increase or decrease) from the categorical commitment level established for the budget period by more than 25 percent of the total costs awarded. Significant re-budgeting is one indicator of change in scope.
Small business concern	<i>Small business concern</i> means a business that meets the regulatory and size requirements established by the SBA at 13 CFR part 121.
Solicitation	See Funding Opportunity Announcement.
Stewardship Customer	An entity whose mission or research objectives encompass the proposed work. The Stewardship customer can be an SC program (e.g. BES, FES, HEP, and NP), another DOE program office (e.g. NNSA, EERE, ARPA-E) another federal agency (e.g. NIH, NSF, DoD, DHS), or a private industry that uses accelerator technology.
Subaward	<i>Subaward</i> means a legal instrument by which a recipient provides funds (or property in lieu of funds) to an eligible subrecipient (or a lower-tier transaction) to perform a substantive portion of the grant-supported program or project. The term includes such financial assistance when provided by any legal agreement (even if the agreement is called a contract) but does not include any form of assistance which is excluded from the definition of a grant, including the recipient’s procurement of property or services needed to carry out the project or program. The term includes consortium agreements.
Subrecipient	<i>Subrecipient</i> means a non-Federal entity that receives a subaward from a pass-through entity to carry out part of a Federal program; but does not include an individual that is a beneficiary of such program. A sub-recipient may also be a recipient of other Federal awards directly from a Federal awarding agency.
Supplement	<i>Supplement</i> means a request for an increase in support during a current budget period for expansion of the project’s scope or to meet increased costs unforeseen at the time of the new or renewal application. A supplement may increase support for future years in addition to the current year. Supplements require applications and are subject to administrative and merit review.
Terms and conditions of award	<i>Terms and conditions of award</i> means all legal requirements imposed on a grant by DOE, whether based on statute, regulation, policy, or other document referenced in the grant award, or specified by the grant award document itself. The award documents may include both standard and special conditions that are considered necessary to attain the grant’s objectives, facilitate post-award administration of the grant, conserve grant funds, or otherwise protect the Federal government’s interests.
Unallowable costs	<i>Unallowable costs</i> mean costs that cannot be charged, directly or indirectly, to Federal awards because the costs are prohibited by law, regulation (including applicable cost principles), or the terms and conditions of award. Costs that are not allowable, allocable, or reasonable are unallowable.
Unliquidated obligation	<i>Unliquidated obligations</i> mean unused funds for financial reports prepared on a cash basis, obligations incurred by the non-Federal entity that have not been paid (liquidated). For reports prepared on an accrual expenditure basis, these are obligations incurred by the non-Federal entity for which an expenditure has not been recorded.
Unobligated balance	<i>Unobligated balance</i> means the amount of funds under a Federal award that the non-Federal entity has not obligated. The amount is computed by subtracting the cumulative amount of the non-Federal entity’s unliquidated obligations and expenditures of funds under the Federal award from the

	cumulative amount of the funds that the Federal awarding agency or pass-through entity authorized the non-Federal entity to obligate.
Validate	In the context of the data management plan requirements, <i>validate</i> means to support, corroborate, verify, or otherwise determine the legitimacy of the research findings. Validation of research findings could be accomplished by reproducing the original experiment or analyses, comparing and contrasting the results against those of a new experiment or analyses, or by some other means.