

SECTION C

DESCRIPTION/SPECIFICATIONS/STATEMENT OF WORK

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C.1 INTRODUCTION

Fermi National Accelerator Laboratory (FNAL or the Laboratory) is one of the U.S. Department of Energy's (DOE or the Department) Office of Science (SC) single program laboratories. The Laboratory is a Federally Funded Research and Development Center (FFRDC) established in accordance with the Federal Acquisition Regulation (FAR) Part 35 and operated under this management and operating (M&O) contract, as defined in FAR 17.6 and DOE Acquisition Regulation (DEAR) 917.6.

The mission of the Laboratory is to deliver breakthrough science and technology in the area of high energy physics, and to drive discovery by building and operating world-leading accelerator and detector facilities, performing pioneering research with national and global partners, and developing new technologies for science that support U.S. industrial competitiveness. DOE programs are carried out in partnership with academia, the private sector, other DOE national laboratories, the international scientific community, and other government agencies. The Laboratory also performs work consistent with the DOE mission for entities other than DOE. The Contractor will advance the frontiers of science and technology through broad interdisciplinary R&D programs that answer fundamental questions, solve technical problems (locally, regionally, nationally, and internationally), and develop and apply technologies to address societal needs.

DOE employs a Performance Based Management Contract (PBMC) to enable the Contractor to achieve highly effective and efficient management of the Laboratory resulting in a safe and secure environment, outstanding science and technology results, more cost-effective operations, and enhanced Contractor accountability.

The Contractor has the responsibility for total performance under the contract, including determining the specific methods for accomplishing the work effort, performing quality control, and assuming accountability for accomplishing the work under the contract. Accordingly, this PBMC provides flexibility, within the terms and conditions of the contract, to the Contractor in managing and operating the Laboratory.

Desired results of this contract include improved Contractor operational efficiencies, allocations of Contractor oversight resources to direct mission work, and streamlined and more effective line management focused on a systems-based approach with increased reliance on the results obtained from certified, nationally recognized experts and other independent reviewers.

Under this PBMC, it is the Contractor's responsibility to develop and implement innovative approaches and adopt practices that foster continuous improvement in accomplishing the mission of the Laboratory. DOE expects the Contractor to employ effective and efficient management structures, systems, and operations that maintain high levels of quality, safety and security in accomplishing the work

required under this contract, and that, to the extent practicable and appropriate, rely on national, commercial, and industrial standards that can be verified and/or certified by independent experts.

C.2 IMPLEMENTATION OF DOE'S MISSION FOR FNAL

The Laboratory's mission focus is in high energy particle physics. FNAL brings specific strengths and competencies to the DOE laboratory system to produce excellent science and advanced technologies with the cooperation and involvement of the scientific and regional communities. In support of its SC mission, FNAL builds and operates major scientific facilities. These facilities serve not only the basic research of the DOE, but they reflect FNAL and DOE stewardship of national research infrastructure that is made available on a competitive basis to a wide range of university, industry, and government researchers.

C.3 CORE EXPECTATIONS

(a) General

The relationship between DOE and its national laboratory management and operating contractors is designed to bring best practices for research and development to bear on the Department's missions. Through application of these best practices, the Department seeks to assure both outstanding programmatic and operational performance of today's research programs and the long-term quality, relevance, and productivity of the laboratories against tomorrow's needs. Accordingly, DOE has substantial expectations of the Contractor in the areas of: program delivery (or development) and mission accomplishment; laboratory stewardship; and excellence in laboratory operations and operational business management.

(b) Program Development and Mission Accomplishment

The Contractor is expected to provide effective planning, management, and execution of assigned research and development programs. The Contractor is expected to execute assigned programs so as to strive for the greatest possible impact on achieving DOE's mission objectives, to aggressively manage the Laboratory's science and technology capabilities and intellectual property to meet these objectives, and to bring forward innovative concepts and research proposals that are well-aligned with DOE missions. The Contractor shall propose work that is aligned with, and likely to advance, DOE's mission objectives, and that is well matched to Laboratory capabilities. The Contractor shall strive to meet the highest standards of scientific quality and productivity, "on-time, on budget, as promised" delivery

of program deliverables, and first-rate service to the research community through user facility operation.

The Contractor is expected to demonstrate benefit to the nation from R&D investments by transferring technology to the private sector and supporting excellence in science and mathematics education to the extent such activities are consistent with achieving continuous progress towards DOE's core missions.

(c) Laboratory Stewardship

The Contractor shall be an active partner with DOE in assuring that the Laboratory is renewed and enhanced to meet future mission needs. Within the constraints of available resources and other contract requirements, the Contractor, in partnership with DOE, shall:

- (1) Maintain an understanding of DOE's evolving Laboratory vision and long-term strategic plan and address the evolution of Laboratory capabilities to meet anticipated DOE and national needs.
- (2) Attract, develop, and retain an outstanding work force, with the skills and capabilities to meet DOE's evolving mission needs.
- (3) Renew and enhance research facilities and equipment so that the Laboratory remains at the state-of-the-art over time and is well-positioned to meet future DOE needs.
- (4) Build and maintain a viable portfolio of research programs that generates the resources required to renew and enhance Laboratory research capabilities over time.
- (5) Build and maintain a positive relationship with the broader national and international research community, to enhance the intellectual vitality and research relevance of the Laboratory, and to bring the best possible capabilities to bear on DOE mission needs through partnerships.
- (6) Build a positive, supportive relationship founded on openness and trust with the regional community.

(d) Operational and Business Management

The Contractor shall effectively and efficiently manage and operate the Laboratory through best-in class management practices designed to foster world-class research. Contractor shall, at the same time, protect and properly maintain DOE property, facilities, and intellectual assets; as well as

ensure the health, safety and security of workers, the public and the environment. The Contractor shall operate the Laboratory in accordance with all applicable laws, regulations, and requirements. The Contractor shall manage the Laboratory cost-effectively, while providing the greatest possible research output per dollar of research investment, and, accordingly, develop, deploy and maintain integrated management systems and practices that are designed to enhance research quality, productivity and mission accomplishment consistent with meeting operational requirements.

C.4 STATEMENT OF WORK

(a) General

The Contractor shall, in accordance with the provisions of this contract, provide the intellectual leadership and management expertise necessary and appropriate to manage, operate, and staff Fermi National Accelerator Laboratory (FNAL) (also referred to as "Fermilab"); to accomplish the missions assigned by DOE to the Contractor; and, to perform all other work described in this Statement of Work (SOW). DOE missions are assigned through strategic planning, program coordination, and cooperation between the Contractor and DOE.

Inasmuch as the assigned missions of the Laboratory are dynamic, this SOW is not intended to be all-inclusive or restrictive, but it is intended to provide a broad framework and general scope of the work to be performed at FNAL during the term of this contract. This SOW does not represent a commitment to, or imply funding for, specific projects or programs. All direct work will be authorized by DOE in accordance with the provisions of this contract.

All work under this contract shall be conducted in a manner that protects the environment, assures the safety, health, and security of employees and the public, and protects the safety and security of federal real, personal, and intellectual property. In performing the contract work, the Contractor shall implement appropriate program, operational and project management systems to ensure safe operations; track progress and maximize cost- effectiveness of work activities; develop integrated plans and schedules to achieve program objectives incorporating input from DOE and stakeholders; maintain sufficient technical expertise to manage activities and projects throughout the life of a program; utilize appropriate technologies and management systems to improve cost efficiency and performance; and, maintain Laboratory facilities and infrastructure as necessary to accomplish assigned missions.

(b) Research and Development (R&D)

The central mission of the Laboratory is to provide scientific leadership needed to carry out world class science and technological innovation to support the programs and missions of SC and DOE (<https://www.energy.gov/science/science-programs>). While the Laboratory is primarily involved with areas of high energy physics research, it also serves key roles in other programs sponsored by DOE through direct involvement or application of capabilities that potentially impact multiple disciplines. A central aspect of this mission, often involving all of its core competencies, is the conceptualization, design, construction, and operation of major scientific user facilities available to university, industry and government researchers.

(1) Mission Accomplishment

The science and technology delivered by the Laboratory is to have meaningful impacts on the relevant technical fields and provide quality leadership that advances the mission goals of the DOE, the sponsoring program, and the scientific community. The primary sponsor of work at the Laboratory is DOE Office of Science.

Additionally, the Contractor is authorized to pursue other DOE and non-DOE programs, subject to required approvals, such as Strategic Partnership Projects (SPP), Cooperative Research and Development Agreements (CRADA) and Laboratory Directed Research and Development (LDRD), that serve to integrate core capabilities and deploy science and technology to industry in support of the broader DOE mission. Other DOE program sponsors may include National Nuclear Security Administration (NNSA), Environmental Management (EM), Energy Efficiency and Renewable Energy (EERE), etc.

The Contractor is expected to maintain a forward-looking science and technology portfolio that is engaged with and cognizant of scientific priorities and emerging opportunities across SC, while also delivering world-leading research for its primary sponsors. This effort typically involves multi-institution collaborations, including universities, other national laboratories and research institutes, the international scientific community, and the private sector; thus, a strong cooperative approach with well-chosen leadership roles is highly desired. The current major programs and synergistic efforts are summarized below:

(i) SC High Energy Physics (HEP)

SC HEP is the largest sponsor of work at FNAL. The focus of this work targets frontier research in experimental and theoretical high energy physics and closely related fields such as cosmology; the contractor shall provide intellectual and technical leadership in international particle physics experiments; perform research and development in accelerator science, experimental detector design and computing for the SC HEP program, operate HEP sponsored user facilities, centers, and initiatives and carry out construction projects supporting high energy physics area as assigned.

(ii) SC Basic Energy Sciences (BES)

The Contractor shall support world-class major scientific user facilities in furtherance of BES research priorities. Principal efforts include the Linac Coherent Light Source-II and application of knowledge and capabilities to support the planning and delivery of future accelerators.

(iii) Other Programs

The Contractor is responsible for the conduct of such other programs and activities as the Parties may mutually agree, including:

- (A) The providing of the facilities of the Laboratory to the personnel of public and private institutions for the conduct of research, development, and demonstration work, either within the general plans, programs and budgets agreed upon from time to time between DOE and the Contractor, or as may be specifically approved by DOE. The Laboratory facilities shall be made available on such other general bases as DOE may authorize or approve;
- (B) The conduct of research and development work for non-DOE sponsors which is consistent with and complementary to the DOE's mission and the Laboratory's mission under the contract, and does not adversely impact or interfere with execution of DOE-assigned programs, does not place the facilities or Laboratory in direct competition with the private sector and for which the personnel or facilities of the Laboratory are particularly well adapted and available, as may be authorized, in

writing, by the Contracting Officer;

- (C) The dissemination and publication of unclassified scientific and technical data and operating experience developed in the course of the work;
- (D) The furnishing of such technical and scientific assistance (including training and other services, material, and equipment), which are consistent with and complementary to the DOE's and Laboratory's mission under this contract, both within and outside the United States, to the DOE and its installations, Contractors, and interested organizations and individuals.

(2) Research Facilities and Major Scientific User Facilities

Central to the Laboratory's leadership and research and development mission is the design, construction and operation of world-class major scientific user facilities and their utilization to provide impactful science and technology results to DOE, the scientific community, and industry. The Laboratory currently hosts major scientific user facilities for DOE serving thousands of scientists per year. The Contractor is responsible for simultaneously maintaining complementary capabilities critical to leadership and excellence in design, construction, and operation of scientific user facilities in continuous and close collaboration with DOE. Design ranges from upgrades of current facilities to conceptualizing new facilities that meet the evolving needs of state-of-the-art science with new instrumentation technologies. Construction is typically a multi-year, complex process requiring extremely detailed planning and execution to meet requirements on time and within resource limits. Operation requires efficient and effective integration of a wide range of activities including core research programs, research, and development to maintain the capabilities of the facilities, partnerships involving multiple organizations and funding sources, and user support; underpinned and enabled by excellence in safety, security, and business and operational management systems, and productivity. Operation also includes effectively managing the allocation of facility time to optimize the research program of the facility.

The operation of user facilities includes developing and maintaining user communities for the facilities. In addition to the scientific stewardship of the facilities, maintaining user communities requires stewarding the visiting scientists and

students that are guests of the Laboratory every year as well as management of the agreements to engage the user facilities. The Contractor shall maintain effective operations of existing and planned user facilities, onsite lodging (as available), other appropriate facilities, and provide effective customer service to ensure user facilities are well maintained, safe, secure, and user friendly.

(i) HEP User Facility

Fermilab Accelerator Complex is operated as a user facility and consists of four accelerators that work together to provide world-class particle beams for experiments.

Booster Neutrino Beam: The Booster accelerator is a ring 1,500 feet in circumference that receives 400 MeV protons from the linac and accelerates them to 8 GeV. These protons are used to generate secondary particle beams to serve the experimental program. The Booster Neutrino Beam is produced to serve several operating and planned Short-Baseline Neutrino (SBN) oscillation experiments.

Muon Campus: A portion of the proton beams are extracted to create muon beamlines serving the Fermilab Muon Campus beginning in 2016 where the presently-running Muon g-2 experiment is situated and the Muon-to-electron Conversion (Mu2e) experiment is under development.

Neutrinos at the Main Injector (NuMI): The Main Injector takes the 8 GeV energy protons from the Booster and accelerates them to 120 GeV. These highly energetic protons strike a carbon target to generate muons that subsequently decay to muon neutrinos, resulting in the most intense neutrino beam in the world. The muon neutrino beam is used for studies of both the disappearance of muon neutrinos and the appearance of electron and tau neutrinos. Two experiments currently gather data from the NuMI beam line, a third is starting operations, and a fourth is proposed.

Proton Improvement Plan-II (PIP-II): PIP-II comprises an 800 MeV linear accelerator, or linac, based on superconducting radio-frequency (SRF) technologies. Recent advancements in SRF technologies, both at Fermilab and at partner laboratories in the U.S. and around the world, allow the construction of this unique accelerator.

Upon completion, PIP-II will accelerate protons at up to 800 MeV, over its 215-meter length, with an instantaneous beam power of more than 1 megawatt.

(ii) HEP Scientific Areas and Experiments

MicroBooNE: This 170 ton experiment which began operations in 2015, measures low energy neutrino cross sections and investigates the unexpected excess events observed by the MiniBooNE experiment. The detector serves as the necessary next step in a phased program towards the construction of massive, kiloton scale liquid argon time projection chamber (LArTPC) detectors, the preferred technology for the future Deep Underground Neutrino Experiment (DUNE). Data taking with MicroBooNE has completed and several research papers have been published, with more analyses underway.

ICARUS: The ICARUS collaboration is investigating signs of physics that may point to a new kind of neutrino called the sterile neutrino. Other experiments have made measurements that suggest a departure from the standard three-neutrino model. ICARUS is also to be investigating the various probabilities of a neutrino interacting with different types of matter as well as neutrino-related astrophysics topics. Commissioning of the detector started in 2021 and initial data-taking has begun.

Short-Baseline Near Detector (SBND): The SBND will be one of two liquid argon neutrino detectors sitting in the Booster Neutrino Beam (BNB) at Fermilab as part of the Short-Baseline Neutrino Program. The ICARUS-T600 is the “far” detector in the program, a refurbished 760 ton LArTPC device 600 m downstream from the BNB neutrino source. SBND is a new 112 ton active volume LArTPC located only 110 m from the source employing many of the design features of the planned DUNE detectors. These activities are hosted at Fermilab involving large scale international collaboration. The SBND was recently completed and moved to the detector hall and is anticipated to begin installation and commissioning in 2023. SBND will record over a million neutrino interactions per year. By providing such a high statistics measurement of the un-oscillated content of the booster neutrino beam, SBND is a critical element in performing searches for neutrino oscillations at the Fermilab Short-Baseline Program.

Muon g-2: The Standard Model of Particle Physics makes detailed and very precise predictions about the behavior of muon particles in the presence of a strong magnetic field. The Muon g-2 experiment was designed to achieve world-record precision in measuring these behavior of muons (to one part in a billion). The experiment is a great test of the Standard Model and any deviation from the predictions will constitute a major discovery. After starting data collection in 2018, the experiment released its first results in spring 2021 and expects to announce results with 4X more data in 2023.

Mu2e: The Mu2e experiment searches for a very rare process called muon-to- electron conversion with a sensitivity almost 10,000 times greater than previous experiments, opening a significant window for new discoveries. Observing muon-to-electron conversion will remove a hurdle to understanding why particles in the same category, or family, decay from heavy to lighter, more stable mass states. Physicists have searched for this since the 1940s. Discovering this is central to understanding what physics lies beyond the Standard Model. The experiment is presently completing its construction phase and will be moving into installation and testing.

NOvA: The NOvA far detector in Ash River, MI utilizes the NuMI beam to directly observe and measure the transformation of muon neutrinos into electron neutrinos with great precision. NOvA will also make important indirect measurements of the mass ordering of the three known neutrino types, which will be a key piece of information in determining the currently unknown masses of neutrinos.

DUNE: DUNE is a leading- edge, international experiment for neutrino science and proton decay studies. DUNE will consist of two neutrino detectors placed in the world's most intense neutrino beam. One detector will record particle interactions near the source of the beam, at Fermilab in Illinois. A second, much larger, modular detector will be installed more than a kilometer underground at the Sanford Underground Research Laboratory in Lead, South Dakota – 1,300 kilometers downstream of the source. DUNE has three scientific thrusts: exploring whether and how neutrinos might be the reason the universe is made of

matter; using neutrinos as a probe of astrophysical objects ranging from our own Sun to distant supernovae; and moving closer to realizing Einstein's dream of a unified theory of matter and energy by searching for proton decay.

Quantum Science: Fermilab operates the Superconducting Quantum Materials System Center, one of five DOE National Quantum Information Science Research Centers, where FNAL is leading research in areas including: quantum computing applications and simulations, quantum sensing, quantum communications, electronics and controls for quantum information science.

MAGIS-100: The Matter-wave Atomic Gradiometer Interferometric Sensor, also known as MAGIS-100, is a pathfinder quantum instrument under construction at Fermilab that aims to explore fundamental physics with a 100- meter-long atom interferometer. This novel detector will search for ultralight dark matter, test quantum mechanics in new regimes and pave the way for future gravitational wave detectors. The detector will be housed in a 100- meter-deep shaft at Fermilab that was constructed for a neutrino experiment many years ago. To explore aspects of long-distance quantum entanglement, scientists will drop groups of atoms down a vacuum tube, probed by beams of laser light.

(iii) HEP International Collaborations

In accordance with DOE policies, and in consultation with DOE, the Contractor shall maintain a broad program of international collaboration in areas of research of interest to the Laboratory and to DOE. FNAL is the host laboratory for a number of experiments with large international participation, both ongoing and under construction, including the Deep Underground Neutrino Experiment and the Short Baseline Neutrino Program.

Fermilab routinely engages with the Large Hadron Collider (LHC) program at CERN, Geneva, Switzerland, including the Compact Muon Solenoid (CMS) experiment. FNAL serves as the lead laboratory for the planned US contributions to the LHC accelerator and the CMS detector. It also hosts a CMS remote control room and a very active research program for American researchers.

In support of these programs, the Contractor also performs high performance scientific computing and grid computing in support of Fermilab's major research facilities and international efforts as directed.

Working with DOE Office of Science, the Contractor is closely involved in developing and implementing many aspects of the international agreements that enable these collaborative programs, including overseeing day-to-day execution of US-based projects and research activities with a wide array of international partners and collaborators. The Contractor ensures safe and reliable access to facilities required to perform these activities.

(iv) Accelerator Research and Development

The primary technology of particle physics is that of accelerators, and the advance of the field has been closely tied to breakthroughs in accelerator development. Those advances have also driven new discoveries and enabled completely new capabilities in other leading research areas supported by the Office of Science. The Contractor is expected to continue to perform a significant role in research, development and fabrication support in these technologies, and broadly engages with other communities, for scientific applications across a broad spectrum of research.

Long-term research goals include developing technologies to enable breakthroughs in particle accelerator size, cost, beam intensity, and control, with research activities categorized into five thrust areas: 1) accelerator and beam physics; 2) advanced acceleration concepts; 3) particle sources and targetry; 4) radio-frequency acceleration technology; and 5) superconducting magnets and materials. The laboratory has unique or leading capabilities in several of these areas, including SRF cavity fabrication, testing and performance enhancement; high-field magnet development and testing; and high-power target development. These are critical testbeds that enable the national program in advanced accelerator technology R&D.

In addition, the mission of the Fermilab Accelerator Science and Technology (FAST) Facility is to develop a fully-equipped R&D accelerator chain intended to support

research and development of accelerator technology for the next generation of particle accelerators. The primary focus of this effort is the Integrable Optics Test Accelerator (IOTA) ring, which will be able to accept injection with either of the following:

- 150 MeV electrons from a photoinjector-based superconducting RF linear accelerator.
- 2.5 MeV protons (H⁺) from the IOTA proton injector.

(3) Scientific Program Management

The Contractor shall manage the resources and capabilities of the Laboratory and provide leadership for the Laboratory as a scientific institution supporting the DOE mission. Leadership is essential in methods of integrated line management to ensure intra- and inter-laboratory team building and cooperation while supplying a safe working environment. The Contractor is charged with maintaining and enhancing the intellectual resource base in order to avoid erosion of the scientific and engineering foundations at the Laboratory and to promote world leadership prominence in areas as mandated by SC. The Contractor is also responsible for the employment of the principal personnel engaged in the SOW efforts and for the readiness and training of all personnel and on-site facility users and collaborators.

Execution of the Laboratory's mission is built on its core capabilities that are each, in turn, an integration of Laboratory personnel, facilities and equipment. The current Laboratory core capabilities include Particle Physics, Large Scale User Facilities and Advanced Instrumentation, Accelerator Science and Technology, and Advanced Computer Science, Visualization and Data. These capabilities exist within the Laboratory and provide a foundation to deliver its mission and customer focus, to perform a complementary role in the DOE laboratory system, and to pursue its vision for scientific excellence and pre-eminence in support of the SC and DOE missions. The stewardship of these capabilities, involving continuous improvement and development of new capabilities where required, is thus a critical aspect of the Contractor's responsibility for scientific program management at the Laboratory. The Contractor shall direct these core capabilities into creative research projects for DOE in partnership(s) with universities, other federal laboratories and agencies, the international scientific community, and the private sector to meet the mission of the Laboratory and DOE objectives.

The Contractor shall develop and manage partnership activities in support of the DOE mission. Mechanisms for partnerships include strategic partnership projects, cooperative research and development agreements, direct assistance programs, employee temporary assignments, user facility agreements, memoranda of cooperation, memoranda of understanding, memoranda of agreement, license agreements, privately funded technology transfer, and other arrangements as approved by DOE in which research and development resources are leveraged with private sector partners. Efforts to develop broad based partnerships with academic research institutions, other agencies, other DOE laboratories, the international scientific community, and with the private sector are essential to the long-term viability of the Laboratory.

The Contractor shall ensure the Laboratory contributes to U.S. technological competitiveness by conducting basic and applied research, and through development and demonstration activities facilitating transfer and deployment of technologies into useful products and processes through partnerships with the private sector. The Contractor shall make it possible for the private sector to join in development/operation activities with the Laboratory to enhance teamwork and technology transfer. Cooperation with industrial partners may include long-term strategic partnerships aimed at commercialization of Laboratory inventions or the improvement of industrial products. The Contractor shall respond to specific near-term technological needs of industrial companies with special emphasis given to working with the types of businesses identified in the Small Business Subcontracting Plan clause of this contract. The Contractor may also capitalize on its location by developing productive relationships with regional and local companies and through forums such as conferences, workshops, and traveling presentations. It is anticipated that these organizations will be particularly effective participants in the Laboratory's technology transfer activities in promoting a mutually beneficial relationship between DOE and the communities surrounding the Laboratory.

(c) Protection of Workers, the Public, and the Environment

The safety and health of workers and the public and the protection and restoration of the environment are fundamental responsibilities of the Contractor. The Contractor shall establish an environment, safety and health (ES&H) program operated as an integral, but visible, part of how the organization conducts business, including prioritizing work and

allocating resources based on risk reduction. A key element is implementation and sustainment of an Integrated Safety Management System to ensure all work activities are performed in a manner that prevents disruption of the Laboratory's missions by preventing fatalities, minimizing injuries and illnesses, minimizing exposures to hazardous substances and materials, preventing environmental releases in excess of established limits, implements as-low-as-reasonably-achievable releases and exposures, and preventing property loss.

The Contractor shall maintain an organization that supports effective ES&H management by ensuring appropriate levels of ES&H staffing and competence at every level within FNAL. Specifically, the Contractor shall assure that employees are trained, qualified, and involved in aspects of the organization's activities, including providing input to the planning and execution of work, and identification, mitigation, or elimination of workplace hazards. The Contractor shall, similarly, assure that subcontractor employees are trained and qualified on job tasks, hazards, DOE and FNAL safety policies, expectations, and requirements, and shall flow down applicable ES&H requirements down to subcontractors. The Contractor shall, as appropriate, consider ES&H performance in selection of its subcontractors and incorporate ES&H requirements into subcontracts.

The Contractor shall perform all activities in compliance with applicable health, safety, and environmental laws, orders, regulations, national consensus standards, governing agreements and permits executed with regulatory and oversight government organizations.

Incorporating integrated line management, the Contractor shall put in place a system that clearly communicates the roles, responsibilities, and authorities of line managers. The Contractor shall hold line managers, including direct reports, accountable for implementing necessary controls for safe performance of work in their respective area of responsibility. The Contractor shall establish effective management systems to identify deficiencies, resolve them in a timely manner, ensure that corrective actions are implemented, (addressing the extent of conditions, root causes, and measures to prevent recurrence) and prioritize and track commitments and actions.

(d) Management and Operation of the Laboratory

The Contractor shall manage, operate, protect, maintain, and enhance the Laboratory's ability to function as a DOE national laboratory, provide the infrastructure and support activities, support the accomplishment of the Laboratory's missions, and assure the accountability to the DOE under the results-oriented, performance-based provisions of this

contract. The Contractor shall establish and maintain an integrated management system capable of producing implementation-level plans, programs and procedures for the management and operation of the Laboratory. The Contractor shall implement a broad scope contractor assurance program to assess the overall performance in and drive continuous improvement of Laboratory operations and management.

(1) Strategic Planning

The Contractor shall conduct a strategic planning process and develop institutional business plans and strategic facility plans in consideration of DOE provided planning guidance and strategic planning material to assure consistency with DOE missions and goals.

(2) Business Management

(i) Human Resources Management (HR)

The Contractor shall have an HR system designed to attract and retain outstanding employees in accordance with DOE expectations, policies, and procedures. The Contractor shall maintain a market-based system of compensation and benefit plans to motivate employees to achieve high productivity in scientific research and laboratory operation.

The Contractor also shall create and maintain at the Laboratory an environment that promotes equity, diversity, and inclusion (DEI); and fully utilizes the talents and capabilities of a diverse workforce. This includes but is not limited to: maintaining best practices in DEI space as they relate to science, technology, engineering, and math (STEM) disciplines; communicating frequently and clearly with community on these topics; evidence-based evaluation of existing program and policies; and establishing, developing, and maintaining effective relationships with institutions and individuals working to support traditionally underrepresented groups and improve inclusion in STEM fields.

(ii) Financial Management

The Contractor shall maintain a financial management system responsive to the obligations of sound financial stewardship and public accountability. The overall system

shall include an integrated accounting system suitable to collect, record, and report all financial activities; a budgeting system that includes the formulation and executions of all resource requirements needed to accomplish projected missions and formulate short- and long-range budgets; an internal control system for all financial and other business management processes; and a disbursements system for both employee payroll and supplier payments. The internal audit group for the Laboratory shall report to the most senior governing body of the Contractor's parent organization(s).

(iii) Purchasing Management

The Contractor shall have and manage a DOE-approved purchasing system to provide purchasing support and subcontract administration. The Contractor shall, when directed by DOE, enter into subcontracts for the performance of any part of the work under this contract. The Contractor may also enter into subcontracts for the performance of any part of the work under this contract when authorized by DOE.

The Contractor shall also strive to promote diversity in all of the Laboratory's subcontracting efforts with emphasis on the use of the types of businesses identified in the Small Business Subcontracting Plan clause of this contract, as well as full and open competition.

(iv) Property Management

The Contractor shall have and manage a DOE-approved property management system that provides assurance that the Government-owned, contractor-held property is accounted for, safeguarded, and disposed of in accordance with DOE's expectations and policies. The Contractor shall perform overall integrated effective and compliant planning, acquisition, maintenance, operation, management, and disposition of Government-owned personal and real property, and any Contractor-leased facilities and infrastructure used by the Laboratory in accordance with DOE expectations.

(v) Legal Services

The Contractor shall maintain legal support for all contract

activities including, but not limited to, those related to patents, licenses, and other intellectual property rights; subcontracts; technology transfer; environmental compliance and protection; employee and labor relations; contractor ethics; and litigation and claims.

(vi) Information Technology Management

The Contractor shall maintain information systems necessary to meet Laboratory requirements, which includes activities involving general purpose programming, data collection, data processing, report generation, software, electronic and telephone communications, and cyber security. The Contractor shall provide computer resource capacity and capability sufficient to support Laboratory-wide information management requirements.

(vii) Other Services

The Contractor shall provide other services necessary for Laboratory operations, including support to the DOE Fermi Site Office.

In addition, the Contractor shall perform all activities necessary resulting from the termination of Superconducting Super Collider Laboratory (SSCL) Contract No. DE-AC35-89ER40486.

(3) Project Management

The Contractor shall maintain a project management system, consistent with DOE project management requirements, to ensure that projects are completed within scope, budget, and schedule.

(4) Environmental Management

Unless otherwise directed by the Contracting Officer, the Contractor shall plan and execute the DOE's environmental program activities in accordance with DOE program goals, initiatives, strategies, guidance letters, and approved project baselines in areas such as:

- (i) Environmental remediation and facility deactivation, decommissioning, decontamination, and demolition in accordance with the site's Comprehensive Environmental Response Compensation and Liability Act (CERCLA) Interagency Agreement and with DOE Orders;

- (ii) Construction and maintenance of facilities and infrastructure to provide adequate protection of the public, employees, the environment, and Government-owned materials, facilities, and equipment; and
- (iii) Tritium management.

The environmental management program shall be conducted in a safe and cost-effective manner leading to increasing DOE, regulatory and public confidence in cleanup efforts. Program elements will include:

- (i) Implementing comprehensive project management systems to track progress, maintain regulatory compliance, and increase cost effectiveness of work activities;
- (ii) Developing integrated plans and schedules for involving the participation of DOE, regulators, and other stakeholders in decision making and priority setting of environmental restoration activities; and
- (iii) Maintaining technical depth to propose and implement cleanup activities commensurate with commercial practices in the areas of cost, implementation, schedule, and public acceptability.

The Contractor shall establish and maintain systems to effectively manage and implement an environmental restoration program in accordance with goals and objectives set forth by the Department. The systems must ensure that the technical approach is consistent with DOE cleanup strategies to complete all Records of Decision in accordance with the current approved baseline; to implement an overall system to effectively and efficiently manage all groundwater and contaminated soil cleanup activities; to expedite final disposition of facilities awaiting decommissioning and decontamination; and to achieve delisting from the National Priority List. Contractor support shall be provided to DOE as directed by the Contracting Officer.

(5) Community Involvement

The Contractor shall maintain a systematic approach and commitment to engagement with the regional community. The Contractor's overall community involvement program shall:

- maintain a strong, integrated, proactive community involvement and communications program;
- appropriately address the community's substantive concerns;
- ensure the community's awareness of the importance of the long-term basic research supported by DOE and the SC;
- ensure the community has positive relationships with the Laboratory and confidence in its decision-making processes; and
- establish constructive external partnerships in support of DOE's overarching mission and strategic objectives.

(6) Safeguards and Security (S&S)

The Contractor shall provide a fully integrated safeguards and security program to ensure that laboratory sensitive information, property and other interests and activities are protected from theft, diversion, terrorist attack, industrial sabotage, radiological sabotage, chemical sabotage, biological sabotage, espionage, unauthorized access, compromise, and other acts that may have an adverse impact on national security; the environment; or pose significant danger to the health and safety of DOE Federal and contractor employees or the public. S&S programs must be based on the results of vulnerability and risk assessments which are used to design and provide graded protection in accordance with an asset's importance or the impact of its loss, destruction, or misuse. The Contractor shall provide a secure environment protecting property and other assets through the conduct of an integrated risk-based approach to security operations. The Contractor shall establish and maintain policies and procedures for operations in accordance with established DOE requirements. The Contractor shall establish a training program which ensures appropriate personnel are competently trained, and fully qualified to perform the tasks within their assigned responsibilities under both normal and emergency conditions.

(7) Cyber Security

The Contractor shall ensure the development, operation, management, and integration of an ongoing program for cyber security management consistent with DOE requirements. The Cyber Security Program must assess risks associated with computer and network security from both external and internal

perspectives. The Contractor shall develop and maintain a structured Cyber Security risk management process to ensure that priorities are established and cyber security risks are managed through a process of identifying and assessing threats, vulnerabilities, asset value, and existing protection measures; developing and implementing appropriate policies and controls; promoting awareness of those policies and controls; and monitoring, evaluating, and improving the effectiveness of policies and controls.

(8) Emergency Management

The Contractor shall maintain an emergency management system in accordance with DOE requirements including, but not limited to, emergency preparedness plans, procedures, response, drills and exercises, occurrence notification and reporting, and operation of an Emergency Operations Center.

(9) Waste Management

The Contractor shall maintain and manage a waste management program in an integrated manner such that waste is managed consistently and in compliance with all applicable regulatory requirements and DOE expectations. Waste management activities include: timely characterization, consolidation, segregation, and storage of waste; treatment that complies with storage and/or disposal criteria; efficient shipment of waste for treatment, storage, and/or disposal; maintaining sufficient and compliant waste storage space at the Laboratory to accommodate waste generation and waste backlog; and implementation of an effective waste minimization and pollution prevention programs.

(10) Laboratory Facilities and Infrastructure

The Contractor shall manage and maintain government-owned buildings and facilities at the Laboratory, together with the utilities and associated infrastructure. Recognizing that these facilities are a national resource, they may also be made available, with appropriate agreements, to private and public sector entities including universities, industry, and local, state, and other government agencies. The Contractor shall perform overall integrated planning, acquisition, upgrades, and management of Government-owned, leased, or controlled facilities and real property accountable to the Laboratory. The Contractor shall strive to employ facilities management practices that are best-in-

class and integrated with mission assignments and business operations. The maintenance management program shall strive to maintain Government property in a manner that promotes and continuously improves operational safety, worker protection, environmental protection and compliance, property preservation, and cost effectiveness; ensures continuity and reliability of operations, fulfillment of program requirements, and protection of life and property from potential hazards; and ensures the condition of the assets will be maintained or improved using risk-benefit analysis tools and processes. Adequate investment will be applied to prevent degradation and assure appropriate operation.

The Contractor will implement a capital renewal program to revitalize and/or replace facilities and infrastructure that cannot meet the required functionality in support of mission accomplishment or is inefficient or cannot be adequately maintained.

(11) Sustainability

The Contractor shall assist DOE through direct participation and other support in achieving DOE's energy efficiency goals and objectives in electricity, water, and thermal consumption, conservation, and savings, including goals and objectives contained in Executive Orders. The Contract will support DOE's use of Energy Savings Performance Contracts (ESPC) and Utility Energy Services Contracts (UESC). The Contractor shall maintain and update, as appropriate, its Site Plan to include detailed plans and milestones for achieving site-specific energy efficiency goals and objectives.

(e) University and Science Education Program for Workforce Development

The Contractor shall help ensure that DOE has a sustained pipeline for the science, technology, engineering, and mathematics (STEM) workforce.

To this end, the Contractor shall seek to facilitate the laboratory workforce of tomorrow by working with colleges and universities, with special emphasis on Historically Black Colleges and Universities/Minority Institutions and initiate new programs to enhance science and mathematics education at all levels. The Contractor shall encourage participation by a diverse group of faculty and students in Laboratory programs to bring their talents to bear on important research problems and contribute to the education of future scientists and

engineers. The Contractor shall also conduct programs for students and faculty to enrich mathematics and science education. A particular purpose of these programs is to encourage members of under-represented societal groups to enter careers in science and engineering needed by the laboratory.

The Contractor shall maintain its programs of cooperation with the academic and educational community and with nonprofit research institutions for the purpose of promoting research and education in scientific and technical fields of interest to DOE's programs and the laboratory workforce needs. This cooperation may include, but is not limited to, such activities as:

- (1) Operation of the U.S. Particle Accelerator School;
- (2) Joint experimental programs with colleges, universities, and nonprofit research institutions;
- (3) Interchange of college and university faculty and Laboratory staff;
- (4) Student/teacher educational research programs at the pre-collegiate and collegiate level;
- (5) Post-doctoral programs;
- (6) Arrangement of regional, national, or international professional, meetings or symposia;
- (7) Use of special Laboratory facilities by colleges, universities, and nonprofit research institutes; or,
- (8) Provision of unique experimental materials to colleges, universities, or nonprofit research institutions or to qualified members of their staffs.

All work in this area must align to mission and workforce needs, funding availability, and appropriate controls to assure responsible execution.

C.5 PLANS AND REPORTS

The Contractor shall submit periodic plans and reports, in such form and substance as required by the Contracting Officer. These periodic plans and reports shall be submitted at the intervals, to the addresses, and in the quantities as specified by the Contracting Officer. Where specific forms are required for individual plans and reports, the Contracting Officer shall provide such forms to the Contractor. The

Contractor shall require subcontractors to provide reports that correspond to data requirements the Contractor shall be responsible for submitting to DOE. Plans and reports submitted in compliance with this provision are in addition to any other reporting requirements found elsewhere in other clauses of this contract. It is the intent of DOE to consult with the Contractor to determine the necessity, form, and frequency of any reports required to be submitted by the Contractor to DOE under this contract.