Development Plan

Over the next 20 years, the projects set forth the in the Development Plan will transform the laboratory. Informed by the *Guiding Principles*, the vision for the campus, and the laboratory Strategic Plan, they present a balanced portfolio of facilities and upgrades.

The following two pages provide a big picture overview of the projects via two diagrams. The first, a drawing from the Strategic Plan presented in Part I, notes the development projects in support of the laboratories core capabilities. The second is a location key map locating the proposed development projects. Individual project descriptions follow, completing Part III.

Completion of strategic development projects will culminate in a modern, state-of-the-art laboratory, positioned as the centerpiece of a global science program.

Strategic Plan

Scientific Discovery and Innovation

Accelerator Science and Technology	Advanced Computer Science, Visualization and Data	Particle Physics	Large-Scale User Facilities Advanced Instrumentation						
HL-LHC High-Field Magnets LCLS-II Quantum Systems Accelerator Science	HEPCloud Computing for Science Machine Intelligence Quantum Computing Active Archive Facility	Neutrino Science LHC Science Precision Science Cosmic Science Quantum Sensors	LBNF / DUNE PIP-II						
	People and I	nfrastructure	• • • • • • • • •						
Global Accelerator Center Technical District Modernization IERC	Next Generation Computing Center IERC	Intergrated Engineering Research Center	Long Baseline Neutrino Facility PIP-II Scientific Hostel Central Utility Building Expansion Wilson Hall 2.0 Arrival Region Improvements						

Development Projects Key Map



Legend

- 1. Wilson Hall 2.0
- 2. Integrated Engineering Research Center
- 3. Global Accelerator Center
- 4. Scientific Hostel

- 5. Technical District Modernization
- 6. Next Generation Computing Center (Possible site)
- 7. Next Generation Computing Center (Alternate site)
- 8. Arrival Region Improvements

- 9. Central Utility Building Expansion
- 10. PIP-II
- 11. Long Baseline Neutrino Facility

Wilson Hall 2.0

Core Capability:	Large-scale user facilities
Scope:	Portfolio of individual projects supporting ongoing renovation of existing 16-story office building
Area:	420,000 square feet
Year Built:	1972
Usage:	Research, administration and collaboration
Capacity:	750 staff currently

Significant technological, cultural and sociological changes have occurred since Wilson Hall's construction in 1972. Workplace design is more important than ever before. A fundamental shift has occurred in the way people work. Younger generations and recent graduates expect multiple possible types of workspaces, including ones that are more casual and open than just the office or the cubicle.

For these reasons, Wilson Hall 2.0 reimagines the iconic hub of Fermilab life and culture. As Fermilab moves into its next generation of workers, creating the open, inviting and collaborative international research community envisioned at Fermilab necessitates the renovation and reorganization of Wilson Hall. Workspaces will be transformed into places designed to foster collaboration, attract and retain the next generation of scientific researchers, promote well-being, and use space efficiently.

Wilson Hall 2.0 is not one large project but rather an umbrella encompassing several, recently completed, ongoing, or evolving and planned revitalization efforts over the next decade. Completing these projects will ultimately renovate the entire building. In that context, the following pages illustrate recent improvements to the atrium, highlights of the current Wilson Hall Renovations GPP project, and other planned improvements. When completed, the portfolio of projects will transform Wilson Hall into vital and relevant hub for the next era of science.



Recently Completed



An area for visitors to feel welcome while viewing Fermilab video presentations has been recently unveiled. Located behind the video wall are two fully renovated public restrooms.



Formerly heavy and off-putting concrete walls were removed to create an open and transparent entrance for a new director's office (beyond). Seating groups and planters have been placed around the atrium, creating a warm and hospitable environment.





The newly installed reception desk, staffed during business hours, directs business visitors to their destinations while informing the casual curious visitor about what to see and do during their visit.

The southeast and southwest corners of the atrium have been reimagined and renovated as "work café" areas. These function as informal collaboration and meeting spaces as well as alternative individual work areas offering a break from typical office space.

Current Projects

13th Floor Renovation Project: Wilson Hall has not had significant renovation since its original construction in the 1970s. The 13th-floor renovation is the first of many projects that will reimagine and modernize Wilson Hall for the next era. When completed in the summer of 2018, it will reveal a fresh, state-of-the-art, flexible and adaptable headquarters for the LBNF staff. Embodying the vision for the future, it establishes the prototype for future planned renovations of Wilson Hall. The diagram below illustrates the concept model floor plan. This concept informed the 13th-floor project and will serve as guidance for future ongoing floor-by-floor renovations.



Ground Floor Renovation – Step 1: Currently, much of the square footage on the ground floor is devoted to machine shops and other utilitarian uses. However, due to its convenient access, these areas present excellent potential as prime locations for broadly used employee and staff functions. In that spirit, machine shops will be relocated to suitable locations outside of Wilson Hall and the spaces re-imagined. The phase one renovation project creates two major new functional spaces. The first is an office suite and studio for the Creative Services Group. The second is a new Global Services Center. This center, located immediately adjacent to the well-traveled west entrance, will provide a welcoming and useful portal for the many international users arriving annually. The target completion date for these two projects is mid-2018.



Future Projects

Ground Floor Renovation-Step 2: Continuing the reimagining of the ground floor, a new wellness center centrally located for convenient usage by Fermilab staff is proposed. Replacing inconveniently located and inadequate founding era fitness center in the Village, the project will also include a modernized medical office and a new public corridor easily accessing the auditorium from the Wilson Hall main ground-floor entrance. New public toilet rooms for the auditorium and general usage are also included in the phase 2 scope.



Building Shell and HVAC: Wilson Hall's nearly 50 year old building shell and infrastructure are in need of renovation. Improvements should include the full replacement of all windows with new, energy-efficient windows and glass curtain walls. Also needed are comprehensive exterior concrete repairs. Together, these improvements will create an energy-efficient and maintainable shell while keeping the historic facade and architectural expression intact. The HVAC and plumbing systems are in need of major system replacements. Wilson Hall's core HVAC, plumbing and piping equipment and controls should be completely replaced with modern, state-of-the-art systems, allowing for greater control and efficiency. Combined, these projects will improve occupant comfort, reduce energy consumption and improve functional reliability, setting the stage for the next 50 years.



Elevator and Life Safety Upgrade: Designed and constructed between 1969 and 1972, Wilson Hall was conceived around that era's emerging trend of designing a building around a large, full-height atrium. In the intervening years, continuous improvement to life safety issues in atriums have evolved. Wilson Hall would benefit from implementing these life safety improvements. Additionally, from the beginning, Wilson Hall has had no freight elevator and insufficient passenger elevators to meet the daily demand. This will become increasingly problematic considering renovations overthe next decade. As illustrated, the project will install six new high-speed glass elevators, located in center of the atrium. Extending from the ground floor to the 15th floor of Wilson Hall, they will remedy a longstanding problem. The existing elevator shafts will be retrofitted with much needed freight elevators. Life safety improvements will include enclosure of the open atrium stairs and the installation of a smoke evacuation system for the atrium.





Integrated Engineering Research Center

Core Capability:	Particle Physics
Location:	Adjacent to Wilson Hall
Size:	93,500 square feet, four stories
Status:	Conceptual design
Usage:	Laboratory, office, technical and collaboration Space for 200 staff and users
Replace:	Obsolete facilities scattered throughout the site

Bringing people together is a vital feature of a collaborative international research community. The Integrated Engineering Research Center (IERC) creates a 93,000-square-foot facility promoting interdisciplinary collaboration and greater efficiency in designing, developing, building, commissioning and operating particle physics accelerator and detector facilities and equipment.

Replacing outdated laboratory space and obsolete facilities, the IERC will revitalize and streamline research in particle physics for the benefit of the particle physics community and the DOE Office of Science. The IERC will consolidate engineering and technical teams in a collaborative environment, bringing together engineering disciplines from Fermilab's Accelerator Division, Particle Physics Division and Scientific Computing Division. The result will be interdisciplinary collaboration built on existing laboratory capabilities and expertise, currently dispersed across the Fermilab site.

The IERC is a four-level structure with direct indoor connections to Wilson Hall at the ground level and atrium level, integrating staff directly in the vibrant center of Fermilab. The ground floor contains flexible high-bay space for state-of-the-art cleanrooms. The concourse level flows from the Wilson Hall atrium, connecting all the IERC via its two vertical collaboration zones. The concourse also accesses the Wilson Hall entrance plaza, invigorating and connecting the exterior spaces. The two upper floors contain flexible and reconfigurable space for engineers and staff.







Concourse Floor





Third Floor

Global Accelerator Center

Core Capability:	Accelerator science and technology
Location:	Directly south and attached to Wilson Hall, walking distance to PIP-II and LBNF science facilities
Size:	95,000 square feet, four stories
Status:	Conceptual design
Usage:	Laboratory, office, technical and collaboration Space for 300 staff and users
Notable:	Connection to WH includes expansion of WH dining, accommodating staff relocated to center of campus and replaces obsolete facilities across the site. It will be designed as Fermilab's first net-zero energy-efficient building.

Fermilab has transitioned from operations focused on high-energy colliding beams at the Tevatron to providing high-intensity proton beams for neutrinos and precision physics measurements using muons. Additionally, Fermilab leads national and international teams of accelerator scientists to develop transformational accelerator technologies for use across the site. This transition, combined with the condition and age of Fermilab accelerator facilities, creates the need to consolidate core research functions and modernize key support buildings.

In that spirit, the Development Plan proposes construction of the Global Accelerator Center. This modern facility will provide modernized working conditions for many laboratory staff, creating a unified culture with a strong sense of community both for the laboratory and national and international user community. It will house laboratory accelerator scientists and visiting and collaborating nationals, as well as international accelerator scientists.

The Global Accelerator Center will replace current, 40 year-old, outdated and inefficient buildings and portable trailers currently spread across the laboratory. It will enable integration of the accelerator science, operations, and technology community and allow these scientists to better support the science missions at the laboratory. In addition, the project will renovate for adaptive reuse two 1970s era buildings (the Cross Gallery and Transfer Gallery). The project will result in interdisciplinary collaboration built on existing laboratory capabilities and expertise, currently dispersed across the Fermilab site.



Scientific Hostel

Large-scale user facilities
Walking distance west of Wilson Hall
100 "microhotel" guest rooms, four stories
Conceptual design
Hostel, augmenting existing long-term housing on site

The phrase "eat-sleep-work to drive discovery" has become a Fermilab motto, capturing the atmosphere critical to implementing its role in the Particle Physics Project Prioritization Panel (P5) Strategic Plan, "Building for Discovery." Convenient temporary lodging is important to realizing laboratory goals and the creation of an open, inviting and collaborative international research community.

To that end, the Development Plan proposes the construction of a 100-room hostel as part of the laboratory complex. Drawing from the Master Plan vision, the *Guiding Principles* and the motto, the Scientific Hostel will be located near Wilson Hall, placing it in the dynamic center of activity. Designed for short-term visitors, one night through two weeks, the facility fills a niche not currently accommodated in Fermilab's Village housing. Planned operation via a private enterprise hospitality organization will also make the rooms available to general community surrounding Fermilab.

Providing modern, attractive, efficient rooms' it employs the emerging "millennial" design approach to lodging. This approach creates very compact guest rooms (1/2 to 2/3 the size of standard rooms). While economical to construct, the smaller rooms also encourage guests to use spaces outside of the room for work while staying at Fermilab. As Wilson Hall is only a quarter-mile walk through a pleasant wooded area, it encourages collaboration with colleagues within community gathering spaces the atrium.





The room designs use space efficiently while providing state-of-the-art technology to keep visitors connected and engaged during their working visits. This approach emphasizes stewardship of natural and financial resources as well as energy consumption.



Technical District Modernization

Core Capability:	Accelerator science and technology
Scope:	Portfolio of four projects in support of ongoing modernization of the Technical District
Usage:	Component processing assembly, office and technical
Status:	One project funded and in current development

For nearly 40 years the Technical District complex of industrial buildings has been home to the vital mission of design, development, fabrication, procurement and testing of accelerator components. Here Technical Division personnel not only build the components of the accelerators and detectors of today and the near future, but also think far in advance to prepare for the next generation of high-energy physics machines.

The Technical District is a complex of six major facilities along with several ancillary buildings and structures. As Fermilab embarks on its next major scientific initiatives, the complex is in need a makeover. In that spirit, the Development Plan proposes projects to modernize the complex. When completed, these projects will provide a renovated and reinvigorated Technical District, exemplifying the Master Plan Guiding Principles and setting the stage for its next 40 years and beyond.

Modernization Projects Key Map



Legend

- 1. ICB-A
- 2. Consolidated Machining Center (2a/2b alternate)
- 3. Industrial Buildings Revitalization
- 4. Industrial Center Gateway

Current Projects

ICB-Addition: Fermilab's ongoing ambitious science program is pressing the industrial facilities toward a particularly intense period of component processing and assembly. Responding to the evergrowing demand placed on the current infrastructure, the Department of Energy has approved the construction of the ICB–A project, providing additional high bay and supporting office space to meet this demand.





The project will build a new high-bay addition to the Industrial Center Building (ICB). The proposed addition will include 15,000 gross square feet at grade comprising 10,500 square-feet of high-bay space with 40-ton crane coverage and 2,400 square feet of low-bay space. When completed in 2019, the ICB addition will provide critical high-bay space for component processing and assembly, well positioning the complex for the future.











Future Projects

Consolidated Machining Center (CMC): In the spirit of consolidation and centralization, this proposed facility will replace 12 scattered, remote and obsolete buildings dating from the suburb and basecamp eras, enabling their demolition. Two possible locations are under consideration. One is the site currently occupied by the decommissioned Central Helium Liquefier. The other is as a mirror image to the current ICB-A project. In either case, the CMC's location will be convenient for both the Technical Division and the laboratory at large. The new CMC will also incorporate the functions and equipment currently located in the ground floor of Wilson Hall, freeing this space for the construction of the employee wellness center, part of WH 2.0.

Industrial Buildings Revitalization: Beyond IARC and IBC, the other four major buildings in the Technical District are IB-1, IB-2, IB-3 and IB-4. The exteriors of these buildings, all constructed early in the Wilson Years, are suffering significant deterioration of their metal siding and window systems. The revitalization project will design and install new energy-efficient siding and windows on all four buildings, preparing them for the next era. In addition to providing significant energy and maintenance savings, the overall aesthetics of the region will be improved, enhancing the campus experience and aiding efforts to attract and retain the next generation.





Industrial Center Gateway (ICG): The ICG is proposed as staff offices for the Technical Division HQ and support staff. Replacing current dark, narrow, bunker like office space, this 15,000-square foot building will provide modern, day-lit office space for about 40 division management and staff along with conferencing, collaboration and other common spaces. The location directly to the south of, and attached to, the pre-cast concrete industrial center (ICB) will provide a fresh and inviting "face" and clear entrance to the Technical Division. Providing transparency for visitors and a more functional organization of offices for management, engineers and scientists, it will also connect with other buildings, including the soon to be completed ICB addition. Exterior work will include reimagined roadways, pedestrian ways and courtyard to the south, visually unifying the new construction with the recently completed IARC facility.



Next Generation Computing Center

Core Capability:	Advanced computer science, visualization and data
Location:	Near Feynman Computing Center
Size:	80,000 square feet, three stories, plus berm space
Status:	Conceptual design
Usage:	Computing systems and archival data storage

Computational science is an important strategic theme at the laboratory. Fermilab's core capability in advanced computer science, visualization and data is at the heart of understanding and interpreting the scientific mission. Major computational science initiatives on the horizon include the HEP Cloud, an active archival facility, and a scientific workflow system.

Supporting these initiatives requires ongoing improvements in computational science infrastructure and facilities to keep pace with fast developing technology and scientific demands. The Development Plan proposes the construction of the Next Generation Computing Center (NGCC). Located in the Computing District near the iconic Feynman Computing Center (FCC), this facility will provide additional functionality complementing the FCC and setting the stage for the next generation.

Two major elements are included in the conceptual program for the new NGCC. The first is "big data" storage. This storage-driven component will provide large disk storage, tape storage and networking space. This space is planned to be located underground, protected from weather disasters, as it will house "treasure data" from experiments.

The second element is the construction of space to provide additional computing systems and equipment. Two system augmentations are envisioned; one system for business needs and a separate more open system for the scientific community and other generalpurpose needs. The project design process will investigate the use of open-air, state-of-the-art, and green cooling systems. When completed, the NGCC will provide much needed facilities and capacity for the next generation of computational science at Fermilab.



Arrival Region Improvements

Core Capability:

Large-scale user facilities

Scope:

Status:

Portfolio of six projects to improve campus arrival and major circulation areas, functionally and aesthetically Conceptual design

As noted in earlier in the FCMP, the visitor experience to the campus needs improvement. The main entrance is confusing and disorienting, and vehicular circulation and wayfinding is inadequate and at times unclear. Part II of the FCMP details several initiatives to address these issues. Building on those initiatives, the planning team developed a group of projects under the umbrella of the Arrival Region Improvements. These improvements will reimagine and transform the entire entrance experience from the Kirk and Pine intersection to Wilson Hall. The projects are multifaceted, bringing together integrative design improvements in campus landscapes, facilities, mobility and wayfinding,

The current entry experience misses the mark of creating the welcoming and informative visitor experience envisioned by the FCMP. As one of the first planned improvements, a new 24-hour, manned entrance gateway and gatehouse are proposed to address this first-impression issue. Presenting a fresh and inviting portal to the campus, it will replace the current outdated gate, confusing road configuration and off-putting concrete barriers. Central to the project is the new guardhouse replacing two existing obsolete structures. The most ambitious version of this plan will include a new state-of-the-art security office and visitor center.



Wilson Hall "front yard": This project reimagines the "front yard" of Wilson Hall (noted on map on facing page): the roads, parking and landscaping defining the reflecting pond. Major emphases of the design are removal of parking from the area, the elimination of the easternmost of the two access roads, integration of the new IERC, pedestrian and bike paths, and vehicle-free access to the pond from IERC to the reflecting pond.



Landscaping Improvements: Landscaping and other screening approaches are proposed to hide undesirable views of equipment and the like within the Arrival Region. The diagrams above show before and after renderings illustrating two of the most pressing areas for visual improvements via landscape interventions. Other landscape improvements are integrated within each of the other individual projects.

New roadways and pathways: This project envisions the construction of new connecting roads to better access the SBN area and ultimately provide access to LBNF. Also, considered are upgrades to the pathway from the Lederman Center and Scientific Hostel to Wilson Hall, including lighting and pedestrian amenities.



Central Utility Building Expansion

Core Capability:

Large-scale user facilities

Scope:

Status:

12,000-square-foot central utility building resulting in a 28,000-square-foot facility Conceptual design

The utility plant at Fermilab's Central Utility Building (CUB) has a proven, decades-long track record of efficiently providing heating and cooling water for both conventional and programmatic uses. The conventional side provides water for heating and cooling Wilson Hall, as well as the footprint area buildings south of Wilson Hall. The programmatic side of the plant provides treated water to experimental areas and facilities beyond the footprint.

As described elsewhere in the Development Plan, several projects in the vicinity are in the planning stages. This convergence of next-era developments presents an important opportunity for synergy of projects. Expanding the CUB will enable Fermilab to build on its efficiency while increasing its capacity to serve these new projects. One project that could use an expanded and upgrade CUB is the Integrated Engineering Research Center. Another is the Global Accelerator Center, proposed just south of Wilson Hall and very near the CUB. Finally, on the programmatic side, the Superconducting Linac Complex hosting the PIP-II and ultimately PIP-III accelerators is planned just to the east of the CUB and will benefit from process water.

The expansion is necessary and beneficial on two fronts. The first is assuring its continued efficient operation to meet current loads, by providing much needed space for maintenance access, equipment replacement and redundancy, and functional separation needs. Secondly, it will facilitate the provision of heating and cooling water to potential nearby developments noted previously. In summary, the enlarged facility will serve the needs for the next 20 years in a safe, maintainable, efficient and accessible manner.



PIP II

Core Capability:	Accelerator science and technology
Scope:	Complex of above- and below-ground structures and beamline
Usage:	Research, host international experiments
Status:	Currently in CD-1 design

The existing Linac and Booster have served Fermilab for decades. To improve and expand accelerator science and technology for the next era of science, the PIP-II project is in development. As part of a comprehensive, long-term, PIP II, Superconducting Linac Complex is at the core providing a powerful new accelerator. As a set of improvements to the existing accelerator complex, the Super Conducting Linac Complex will provide high-power proton beams in support of the Fermilab particle physics research program. PIP-II comprises the construction of a new 800-MeV superconducting linear accelerator injecting protons into the existing accelerator complex. Upon the completion of PIP-II, the existing 400-MeV linear accelerator will be retired from service. The immediate goal of PIP-II is to provide more than 1 megawatt of proton beam power onto the LBNF/DUNE neutrino production target (the PIP-II experiment facility). The secondary goal is to provide a platform for long-term development of the Super conducting Linac complex, supporting higher beam power to LBNF/DUNE and a broader research program based on high-power proton beams.



Long Baseline Neutrino Facility

Core Capability:	Large-scale user facilities
Scope:	Complex of above- and below- ground structures and beamline
Usage:	Research, host international experiments
Status:	Currently in CD-1 design

The Long-Baseline Neutrino Facility is an international mega-science project for hosting the Deep Underground Neutrino Experiment in the United States. Its location in the Neutrino Campus provides easy proximity to Core Campus facilities housing the international community of researchers and engineers supporting the science program. The resulting powerful particle accelerator complex will produce the world's most intense high-energy neutrino and antineutrino beams and send them 800 miles straight though the earth to the partner DUNE detectors in South Dakota. The complex, currently in the planning stages, will include the construction of several surface buildings, an earth berm and extensive underground construction. The scope of development will include additional roadways and access from the Core Campus as well as site configurations to accommodate the new facilities.







Cross Section of Project

Plan Implementation

Project	Proposed Funding	Current (2017 - 18)	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
Wilson Hall 2.0																						
13th Floor Renovation	Funded																					
Ground Floor Renovation - Step 1	Funded																					
Ground Floor Renovation - Step 2	GPP																					
Elevator and Life Safety Improvements	GPP																					
Floor by Floor Office Renovations	GPP																					
Building Shell and HVAC	SLI																					
Integrated Engineering Research Center	SLI																					
Global Accelerator Center	SLI																					
Scientific Hostel	Private																					
Technical District Modernization	-																					
ICB Addition	Funded																					
Combined Machining Center	GPP																					
Industrial Center Gateway	GPP																					
Industrial Buildings Revitalization	GPP																					
Next Generation Computing Center	Private																					
Arrival Region Improvements	-																					
Entrance Gatehouse / Visitor Center	GPP																					
Discovery Road Realignment	GPP																					
Central Utility Building Expansion	GPP																					
PIP-II	-																					
Long-Baseline Neutrino Facility	-																					

