A New Frontier in the Chicago Suburbs

Settling Fermilab, 1963–1972

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In 1968, Milton Stanley Livingston described the frontier as a symbol of progress, adventure, and challenge for scientists: "There is in mankind a driving urge to explore the unknown. In past ages much of this exploration was geographical—the search for new continents and new seas. In our generation the most challenging frontiers lie in the search for new knowledge about nature and about man, and the most dramatic progress has been made on the frontiers of science. . . . The frontier of high energy and the infinitesimally small is a challenge to the mind of man. If we can reach and cross this frontier, our generation will have furnished a significant milestone in human history."[1] Livingston was then associate director of the National Accelerator Laboratory, a newly authorized project of the Atomic Energy Commission (AEC). The laboratory in Batavia, Illinois—later named Fermi National Accelerator Laboratory, or Fermilab—houses the world's highest energy particle accelerator. To physicists, accelerated particles are among the necessary tools for exploring their scientific frontiers.[2]

The frontier has long been a central

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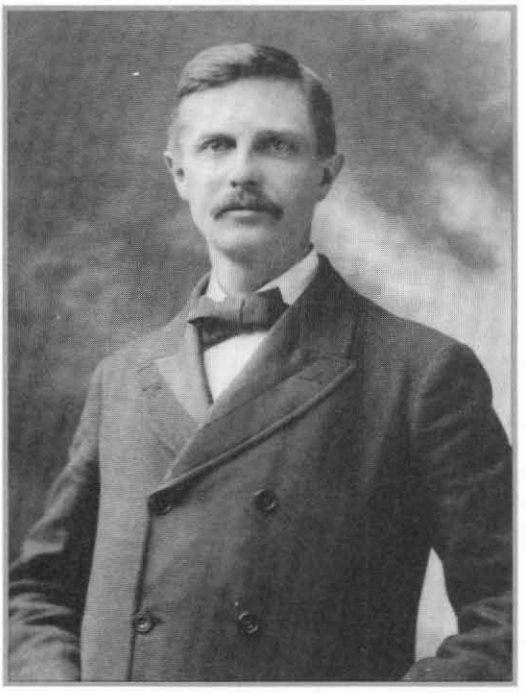
[1]Livingston, *Particle Physics: The High-Energy Frontier* (New York: McGraw, 1968), pp. 2–8. Frontiers of technology have been as compelling for American researchers as frontiers of science. See Joseph J. Corn, *The Winged Gospel: America's Romance with Aviation, 1900–1950* (New York: Oxford University Press, 1983); Walter A. McDougall, . . . *The Heavens and the Earth: A Political History of the Space Age* (New York: Basic Books Inc., 1985).

[2]As a student at Berkeley, Livingston had built the first circular particle accelerator, the cyclotron, which his mentor Ernest Orlando Lawrence conceived around 1928. Lawrence also embraced the frontier image. For example, the title of his Nobel Prize acceptance speech in 1939 was "The New Frontiers in the Atom," *Science*, 94 (1941), 221–25. See also J. L. Heilbron and Robert W. Seidel, *Lawrence and His Laboratory: A History of the Lawrence Berkeley Laboratory* (Berkeley: University of California Press, 1989), I, 1–8.

image in American history. In an address delivered in July of 1893 in Chicago, on the occasion of the four hundredth anniversary of the landing of Columbus in the Western Hemisphere, frontier historian Frederick Jackson Turner offered his renowned thesis that confrontation of the frontier by pioneering settlers of the American West during the eighteenth and nineteenth centuries brought about such distinctive American cultural traits as economic and political equality, individualism, and democracy: "The existence of an area of free land, its continuous recession, and the advance of American settlement westward, explain American development." For Turner, "the frontier is productive of individualism . . . [and] has from the beginning promoted democracy."[3]



FREDERICK JACKSON TURNER

To the frontier itself—the "hither edge of free land"—Turner ascribed the power to Americanize, to foster a national character.[4] The demanding process by which the conditions of nature at the frontier "master the colonist" (rather than the other way around) promoted American individualism: "The frontier is the line of most rapid and effective Americanization. The wilderness masters the colonist. It finds him a European in dress, industries, tools, modes of travel, and thought. It takes him from the railroad car and puts him in the birch canoe. It strips off the garments of civilization and arrays him in the hunting shirt and the moccasin. . . . In short, at the frontier the environment is at first too strong for the man. He must accept the conditions which it furnishes, or perish." Turner saw the power in the frontier to generate American

[3]Turner, "The Significance of the Frontier in American History," in *The Turner Thesis: Concerning the Role of the Frontier in American History*, ed. George Rogers Taylor (Lexington, Mass.: Heath, 1956), pp. 1–18. See also Turner, "Contributions of the West to American Democracy," in ibid., pp. 19–33; William Cronon, "Revisiting the Vanishing Frontier: The Legacy of Frederick Jackson Turner," *Western Historical Quarterly*, 18 (1987), 157–76; Richard White, "Frederick Jackson Turner," in *Historians of the American Frontier: A Bio-Bibliographical Sourcebook*, ed. John R. Wunder (New York: Greenwood, 1988), p. 667. Turner was not the first to link the frontier with democracy or national traits. For other examples, see Ray Allen Billington, *America's Frontier Heritage* (New York: Holt, 1966), pp. 4–6.

[4]Turner, "Significance of the Frontier," p. 2. See also Billington, *America's Frontier Heritage*, p. 16. Turner's lack of precision in his definitions of the frontier provided his critics with "a happy hunting ground." Other definitions besides the hither edge of free land include: the edge of settled territory, the line of settlement, the "West" itself, and a "form of society" (see ibid.).

attitudes of optimism, individualism, dynamism, and courage, to support the confidence to venture beyond the safe and familiar, and to instill "anti-social" attitudes and produce "antipathy to control." Those tendencies supported democratic traits, such as the ability to question authority.[5] At the frontier, American easterners and Europeans could descend to a primitive level of history and establish frontier communities that would recapitulate the evolution of civilization from hunter, to trader, to farmer and capitalist. In the process, they forged American commitments to pragmatism and democracy. Whether the members of the frontier community were explorers, colonists, settlers, migrants, cowboys, or farmers, they all drew on the frontier itself, according to Turner's thesis, in order to create their distinctive American outlook. That view was, in principle, individualistic, progressive, practical, egalitarian, and democratic.[6]

Subsequent historians quickly pointed out aspects of frontier life that Turner overlooked, including savagery committed towards Native Americans, animals, or the land itself. More recently, historians have noticed that Turner's "American" outlook is white and male-gendered. But while Turner's thesis has fallen into some scholarly disfavor, its rhetoric and imagery remain alive, and in the popular mind, the thesis still serves as a provocative description of the nation's growth.[7] Frontier stories—dramatized by the entertainment industry and written into the history books read by generations of Americans—have become part of the mythology of the American heritage. In the 1890s up to eighteen thousand people witnessed each showing of Buffalo Bill Cody's "Wild West and Congress of Rough Riders of the World." The frontier myth has been further preserved by such recreations as Frontierland at Disneyland.[8]

As the Livingston passage above illustrates, the frontier myth has been of central importance in shaping the self-image of American scientists. Yet historians of science have not devoted much attention to that issue.[9] This examination of a particular unconscious re-creation of the frontier myth

[5]Turner, "Significance of the Frontier," pp. 2, 14.

[6]Cronon, "Revisiting the Vanishing Frontier"; White, "The Frontier and the American Mind," paper presented at the Newberry Seminar in American Social History, 1993–1994, Chicago, Jan. 18, 1994, p. 2, Fermilab History Collection, Fermi National Accelerator Laboratory, History Archives, Batavia, Ill.

[7]See Cronon, "Turner's First Stand: The Significance of Significance in American History," in *Writing Western History: Essays on Major Western Historians*, ed. Richard W. Etulain (Albuquerque: University of New Mexico Press, 1991), pp. 73–101; Cronon, "Revisiting the Vanishing Frontier," pp. 158–62; Billington, *Frederick Jackson Turner: Historian, Scholar, Teacher* (New York: Oxford University Press, 1973), pp. 444–71; Billington, *America's Frontier Heritage*; White, "Frederick Jackson Turner," p. 672; Nancy Shoemaker, "Teaching the Truth About the History of the American West," *Chronicle of Higher Education*, 40, no. 10 (1993-1994), A48; *Chicago Tribune*, July 8, 1992, Sec. 1, p. 1, cols. 5–6, p. 13, cols. 1–6; White and Patricia Nelson Limerick, *The Frontier in American Culture: An Exhibition at the Newberry Library, August 26, 1994–January 7, 1995*, ed. James R. Grossman (Berkeley: University of California Press, 1994).

[8]White, "The Frontier and the American Mind," pp. 1–2; *Chicago Tribune*, May 22, 1994, Sec. 13, p. 14, col. 1.

[9]Turner called for "attention to the frontier as a fertile field for investigation," but few historians of science have tried to answer that call (see Turner, "Significance of the Frontier," p. 2; William Coleman, "Science and Symbol in the Turner Frontier Hypothesis," *American Historical Review*, 72 [1966–1967], 22–49; A. Hunter Dupree, *Science in the Federal Government: A History of Policies and Activities* [Baltimore, Md.: Johns Hopkins University Press, 1986]; Merrit Roe Smith, "Frontiers of Change," *STS Newsletter*, Sept., 1993, pp. 1–2).

by the high-tech world of "high-energy physicists" may at first seem quite remote from the society of the American frontier. Like crewmembers of the starship *Enterprise*, however, particle physicists see themselves on a mission to "explore new worlds" and "boldly go where no one has gone before."[10] Their quest employs particles energized within large and expensive accelerators. Such is the case at Fermilab, which centers around a four-mile ring of magnets and electronics that accelerate protons to energies in the range of 500 to 1,000 giga electron volts (GeV). The site of the laboratory is a 6,800-acre parcel of land formally turned over to the United States government by the State of Illinois in 1969.[11] Frontier imagery motivates Fermilab physicists, and a rhetoric remarkably similar to that of Turner helps them secure support for their research. Moreover, ideals resembling those described in Turner's thesis have helped shape Fermilab's culture and physical site.

Several historians have recently reexamined the American frontier story as a cultural myth, an often-told narrative that has come to symbolize America's ideology and moral consciousness. According to historian James R. Grossman, artists, such as Frederick Remington, historians, such as Turner, and showmen, such as Buffalo Bill Cody, helped imprint the American frontier myth on popular consciousness. Different storytellers, however, have focused on different aspects of the myth. For example, Cody's re-creation included the mutual savagery of cowboys and Indians in battle, aspects that Turner overlooked. Historian Richard White notes that for Turner, "the axe and the plow were the tools of civilization; for Buffalo Bill, civilization's tools were the rifle and the bullet." Each erased parts of the larger myth. Both were able to deliver powerful messages because of "the very ubiquity of the icons of the frontier."[12]

Turner's version of the myth permeated academia. Even European historians "caught the infection," applying the myth to other countries and other periods, including German medieval history.[13] The myth also extended into politics. Theodore Roosevelt published two articles in the *Century Magazine* describing his personal frontier experience. Woodrow Wilson wrote popular articles glorifying the frontier in American history. In the debate over Franklin Delano Roosevelt's New Deal, politicians on both sides found the myth useful, with proponents arguing that closing the frontier meant that the government now had to offer the security and opportunities that the West had formerly provided, and opponents arguing that government meddling in the marketplace "would undermine the frontier-bred individualism and self-reliance that was the nation's principal strength."[14]

Scientists also embraced the myth. On December 2, 1942, when Enrico Fermi achieved the first self-sustaining nuclear

[10]*Star Trek 25th Anniversary Special*, prod. and dir. Donald R. Beck, 92 min., Paramount Pictures, 1991, videocassette.

[11]*Illinois Compiled Statutes, 1992* (St. Paul, Minn.: West Pub. Co., 1993), I, 735–36.

[12]Richard Slotkin, *Gunfighter Nation: The Myth of the Frontier in Twentieth-Century America* (New York: Atheneum, 1992), pp. 5–6, 10–11; White, "The Frontier and the American Mind," pp. 1–5; Grossman, Introduction, pp. 1–4, in ibid.

[13]Billington, *Frederick Jackson Turner*, pp. 444–47.

[14]Theodore Roosevelt, "Frontier Types," *Century Magazine*, 36 (1888), 831–43, and "In Cowboy Land," ibid., 46 (1893), 276–84; Billington, *Frederick Jackson Turner*, pp. 444–47.

chain reaction under Stagg Field at the University of Chicago,[15] Arthur Holly Compton, director of the Chicago Metallurgical Laboratory, reported to James Bryant Conant, president of Harvard, that "the Italian navigator has just landed in the new world."[16] Fermi would serve as a model for Robert Rathbun Wilson, when Wilson became the first director of Fermilab. The two were colleagues in the wartime Atomic Energy Research Project at Los Alamos, New Mexico.

Seeking advice on how to proceed in science following the dramatic applications made in World War II, Franklin Roosevelt referred to the frontier myth in a November 17, 1944, letter to Vannevar Bush, director of the White House Office of Scientific Research and Development: "New frontiers of the mind are before us, and if they are pioneered with the same vision, boldness, and drive with which we have waged this war we can create a fuller and more fruitful employment and a fuller and more fruitful life."[17]

In his July 5, 1945, response, Bush also utilized the frontier imagery. Using language reminiscent of Turner, Bush described an endless scientific frontier in his effort to galvanize government support of basic research: "The pioneer spirit is still vigorous within this Nation. Science offers a largely unexplored hinterland for the pioneer who has the tools for his task. The rewards of such exploration both for the Nation and for the individual are great. Scientific progress is one essential key to security as a nation, to our better health, to more jobs, to a higher standard of living, and to our cultural progress."[18] As a result, the National Science Foundation was established in 1950, ushering in a golden age of funding for basic scientific research through the 1960s.[19]

Fifteen years after Bush's *Endless Frontier*, John Fitzgerald Kennedy inspired the nation with frontier imagery of space exploration when he accepted his party's presidential nomination. Kennedy evoked familiar heroic tales as he spoke of "the frontier of the 1960s, a frontier of unknown opportunities and perils, a frontier of unfulfilled

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[15]Albert Wattenberg, "The Fermi School in the United States," *European Journal of Physics*, 9 (1988), 88–93. For a complete account, see Richard Rhodes, *The Making of the Atomic Bomb* (New York: Simon, 1986), pp. 394–442; Richard G. Hewlett and Oscar E. Anderson, Jr., *The New World, 1939/1946*, A History of the United States Atomic Energy Commission, Vol. 1 (University Park: Pennsylvania State University Press, 1962), p. 112. Following his wartime work at Los Alamos, Fermi continued his research at the University of Chicago and directed the Argonne National Laboratory.

[16]Conant added that "the earth was not as large as he [Fermi] had estimated, and he arrived at the new world sooner than he had expected." See Compton, *Atomic Quest: A Personal Narrative* (New York: Oxford University Press, 1956), p. 144.

[17]Roosevelt to Bush, Nov. 17, 1944, in Bush, *Science—the Endless Frontier: A Report to the President on a Program for Postwar Scientific Research* (1945; rpt. Washington, D.C.: National Science Foundation, 1960), pp. vii–xxvi, 3–4.

[18]Bush to Roosevelt, July 5, 1945, in Bush, *Science—the Endless Frontier*, pp. 1–2. In his memoirs, Bush recalls, "I remember when I was told [in 1919] that the frontier had been occupied, that all of man's wants had been met, that science had come to the end of a trail, that future growth would depend only on increase of population." See Bush, *Pieces of the Action* (New York: Morrow, 1970), p. 3.

[19]See Daniel J. Kevles, *The Physicists: The History of a Scientific Community in Modern America* (New York: Knopf, 1978). Currently, science statesmen are questioning whether the scientific frontier is now closing. See Leon M. Lederman, *Science: The End of the Frontier?* (Washington, D.C.: American Association for the Advancement of Science, 1991).

hopes and threats." He referred to "uncharted areas of science and space, unsolved problems of peace and war, unconquered pockets of ignorance and prejudice, unanswered questions of poverty and surplus," and he asked Americans "to be new pioneers on that new frontier."[20] During the same period several science fiction adventure series—*Voyage to the Bottom of the Sea, Lost in Space,* and eventually *Star Trek*—became popular television features.[21]

The frontier imagery passed into the writings and speeches of the four founders of Fermilab, whose story begins in that era. Allusions to the frontier helped Edwin Leo Goldwasser of the University of Illinois, Leon Max Lederman of Columbia University, Norman F. Ramsey of Harvard University, and Robert Wilson of Cornell University forge supportive coalitions of scientists, businessmen, and local, state, and federal governmental agencies.

In the early 1960s exciting breakthroughs in particle physics fueled physicists' desire for a laboratory operating at energies higher than the maximum energies available at Brookhaven National Laboratory (BNL) on Long Island (33 GeV in 1960) and at CERN, the European laboratory in Geneva (26 GeV in 1959).[22] Numerous proposals for new American particle accelerators were submitted to the AEC. Ramsey was asked in 1962 to chair a joint panel of Kennedy's Scientific Advisory Committee and the General Advisory Committee of the AEC in order to evaluate those proposals.

Reporting in May of 1963, the Ramsey panel endorsed the need for a frontier instrument in the energy range of several hundred GeV. Since the University of California at Berkeley had ample experience in building accelerators, the panel recommended that the first priority should be the "prompt construction of a 200-GeV proton accelerator by LRL" (Lawrence Radiation Laboratory) at Berkeley.[23] The panel effectively phased out a competing lower energy proposal from the Midwestern Universities Research Association (MURA) based in Madison, Wisconsin. Physicists at Berkeley proceeded to design the new 200 GeV machine, completing the design in June of 1965.

The Ramsey panel's report also stressed that future high energy laboratories be nationwide, rather than regional, facilities, having not only an in-house research staff but also a strong representation from outside users. The notion of democratic accelerator access for all physicists, regardless of their home institution, was a newly emerging concept in the history of accelerators. It was presented as an expansion of BNL's policy of offering beamtime to all deserving proposals. In June of 1963 the democratic access ideal was detailed in an informal paper by Lederman. Lederman, who was then a member of a committee headed by Myron Lindsay Good to review the Ramsey panel's report, presented "The Truly National Laboratory" (TNL), an alternative to Brookhaven's access policy that favored regional users. TNL was intended as a pun on BNL. The ultimate governing body of

[20]"Kennedy and Johnson Open the Campaign: Acceptance Speeches of the Democratic Nominees," *U.S. News & World Report,* July 25, 1960, pp. 100–02.

[21]Gene Roddenberry, the creator of *Star Trek,* persuaded Paramount to back the show by drawing on the popularity of westerns and billing *Star Trek* as a "wagon train to the stars" (see *Star Trek 25th Anniversary Special*).

[22]See Laurie M. Brown, Max Dresden, and Lillian Hoddeson, eds., *Pions to Quarks: Particle Physics in the 1950s Based on a Fermilab Symposium* (New York: Cambridge University Press, 1989); Brown, Dresden, Hoddeson, and M. Riordon, *The Rise of the Standard Model* (New York: Cambridge University Press, 1995).

[23]Ramsey, "The Early History of URA and Fermilab: Viewpoint of a URA President (1966–1981)," in *Annual Report of the Fermi National Accelerator Laboratory* (Batavia, Ill.: The Laboratory, 1987), pp. 156–61.

Leon Max Lederman, a founder of Fermilab, receives the National Medal of Science in 1965 from President Lyndon Baines Johnson.

the TNL, to which even the director of the laboratory would be responsible, would be a national management consortium with representatives from all of the major research universities in the country. Lederman emphasized that "all users will have a 'right of access' to the machine" strictly on the basis of physics merit and that "the enthusiasm and cooperation of the entire high energy community can be assured" if the "facilities are accessible as a right to any physicist bearing a competitively acceptable proposal."[24]

Half a decade later, the TNL would offer Fermilab its original model, as well as its original name, the National Accelerator Laboratory. Frederick Seitz, president of the National Academy of Sciences, responded to Lederman's call for a national consortium to manage the laboratory by forming an association of presidents of the nation's research universities, the Universities Research Association, Inc. (URA), in January of 1965.[25] Under Ramsey's direction, URA developed strategies for building consensus in Washington.

The accelerator design that Berkeley presented in June of 1965 was projected to cost over $340 million. The timing was poor for such an expensive proposal because Congress believed that high-energy physics

[24]Lederman, "The Truly National Laboratory," AGS Accelerator Department Internal Report AADD–6, Part II, Super-High Energy Summer Study, June 25, 1963, Fermilab History Collection.

[25]Ramsey, pp. 157–61.

was overfunded and that too large a proportion of those funds was going to California. Non-Berkeley physicists complained that they had not been granted enough running time on the Berkeley machines. In that context, Wilson, director of Cornell University's Laboratory of Nuclear Studies, entered the story of the 200 GeV accelerator. He had studied physics at Berkeley in the 1930s under Ernest Orlando Lawrence. During World War II, he worked at Los Alamos on the first atomic bomb and afterwards designed innovative accelerators at both Harvard and Cornell. He also served as an active member of a group that planned an idealistic international accelerator intended as a model for peaceful, worldwide collaboration.[26]

Wilson's machines were marked by their frugality and innovation. He was outraged by the Berkeley design for the 200 GeV machine, a design he considered conservative (overdesigned) and far too expensive.[27] Late in 1965, he put forth a bold alternative that cost only $50 million. The design used economizing features that he had developed in designing the Cornell electron synchrotron, such as small magnets and austere experimental facilities. He estimated that for only $100 million more he could achieve 600 GeV or even 1000 GeV. While Berkeley's accelerator physicists dismissed those economizing suggestions, the AEC did not. The agency announced a cost ceiling of $240 million, and Berkeley was then obliged to prepare a design of "reduced scope."

Politically, the debates during 1965 focused on the location of the new laboratory. While Berkeley had assumed that the site would be in California, physicists and politicians questioned that assumption. In April of 1965, after receiving Colorado's independent site proposal, the AEC began to advertise for other proposals. One hundred and twenty-five were received, suggesting more than two hundred sites, with one or more from each of forty-six states. By September of 1965, the AEC had reduced the number of proposals to eighty-five, and in March of 1966, with the help of a National Academy of Sciences site evaluation committee headed by Emanuel Ruvin Piore of IBM, only six remained, including two Illinois sites: the village of Weston, in western Du Page County, and Barrington.

The struggling, lower-income residents of Weston, a dying community, hoped for revival and progress, although the community had no clear idea of what progress would mean. Initially they looked to the new physicist settlers for economic salvation. When a Northern Illinois Gas Company official contacted Weston Mayor Arthur Theriault about the possibility of proposing a local site for a federal atom-smasher project, Theriault believed that his villagers would embrace the plan. Anticipating economic development by accommodating the atomic energy project, the community of Weston extended its hospitality on April 8, 1966, to the National Academy of Sciences team surveying proposed sites for the new atom smasher.

The site matched the agreed upon criteria and also offered 6,800 acres of free land, sufficient for the laboratory and for future expansion within the site boundaries. All of the sites offering proposals were expected to donate free land, but the Weston land was especially agreeable farmland, with suitable utilities, geological composition, and

[26]Hoddeson, "Establishing KEK in Japan and Fermilab in the U.S.: Internationalism, Nationalism and High Energy Accelerators," *Social Studies of Science*, 13 (1983), 1–48; Kolb and Hoddeson, "The Mirage of the World Accelerator for World Peace: Origins of the Superconducting Super Collider, 1953–1983," *Historical Studies in the Biological and Physical Sciences*, 24 (1993), 101–24.

[27]Wilson, "Some Proton Synchrotrons, 100–1000 GeV," TS, Sept., 1965, Fermilab History Collection.

the project. On January 15, 1967, the position was offered to Wilson. That the man selected to create Fermilab was born in a Wyoming town named Frontier and that Fermilab was sited in the suburbs of the city central to Turner's thesis are coincidences. But they assumed significance to Fermilab's history, for the multiple relationships among different frontiers—physical, emotional, intellectual—became woven into the fabric of the discourse. Wilson's early life as a cowboy and as an assistant in a blacksmith's shop fostered his personal frontier identity. Practical solutions, boldness, individuality, frugality, innovation, democracy, and self-reliance were among his ideals.[36]

We may envision the frontier as a migrating region with shifting boundaries that represent the evolving nature of civilization. There are two subregions of the frontier. The more familiar area just before the boundary is used as a preparation ground as well as a point of departure. It is the last outpost to replenish supplies. Beyond that is the uncharted wilderness, the real frontier. Any pioneering settlement on the frontier causes a disruption of the existing system. That impact is followed by reintegration of the old and new elements into the new system, which to the victors is "better." As historian William Cronon interprets Turner, "the whole point of the frontier had been to vanish. . . . [I]ts 'purpose' in Turner's scheme was to prepare the way for the civilization that would ultimately replace it."[37] In that sense, Fermilab brought new frontiers to the Midwest.

Wilson saw the Weston site as a promising environment for a physics frontier laboratory, a base that could nurture creativity and individualism. He also immediately and intuitively recognized the resonance between the new laboratory and the frontier mythologies of both physics and American history.[38] The physical advantages of the site had been recognized much earlier by Native American inhabitants, particularly around the area known locally as the Big Woods, which evoked for Wilson a vision of the frontier. As an artist, as well as physicist and accelerator builder, he perceived the site's open spaces as a blank canvas upon which to design the laboratory. Simple elegance in the physics program and in the physical layout of the laboratory became a priority, along with preserving the site's natural beauty while building on it the world's foremost scientific instrument. As a condition of accepting the position of director on March 7, 1967, Wilson secured the AEC's guarantee that he would have complete control over the creation of the facility.

Initially, the Chicago hinterland presented Wilson with a dilemma. Unlike the sites of other major American laboratories, Weston offered neither a metropolitan nor a university setting. How could he persuade top physicists to work in what appeared to be an undeveloped wilderness? In 1966, the western border of Du Page County met Kane County in gently rolling, widespread farmlands. Temporary offices for the new laboratory were set up in Oak Brook, about halfway between Weston and Chicago, while the site at Weston was settled by an advance team of physicists.

With a "Westward Ho" attitude, Wilson drew on the rhetoric of the frontier in his

[36]Hoddeson, "Wilson's Way," March, 1994, MS, Fermilab History Collection. By the early twentieth century, cowboys, an important element in Buffalo Bill's Wild West shows, had assumed their place among the icons of frontier mythology (see White, "The Frontier and the American Mind," p. 10).

[37]Cronon, "Revisiting the Vanishing Frontier," p. 167.

[38]Wilson, "The Richtmyer Memorial Lecture—Particles, Accelerators, and Society," *American Journal of Physics*, 36 (1968), 490–95.

invitations to prospective employees, stressing the adventure and opportunities the new site and new physics program offered. He asked Edwin Goldwasser, a physicist-diplomat from the University of Illinois, to serve as his deputy director. The two became a powerful team, with direct access to government leaders, particularly members of the Joint Committee on Atomic Energy, which was responsible for funding large high-energy physics projects.[39] They instantiated Lederman's ideal of a truly national laboratory accessible to all and managed democratically, underscoring that ideal by naming the laboratory the National Accelerator Laboratory, a name President Johnson endorsed. Open experimental areas would allow egalitarian exploration of the physics frontiers.

Hoping to redeem what Los Alamos had wrought upon the world, Wilson and Goldwasser planned a "Science City," which, unlike Los Alamos, would be without fences or security clearances.[40] They envisioned an institution that would support peaceful and democratic actions and actually would help strengthen equality and civil rights locally. Wilson stated that "in the course of giving a very large acceleration to our particles, let us hope that we can contribute at least a small acceleration to society."[41] Wilson and Goldwasser wanted the laboratory to serve as a model that could inspire creative community solutions to social, economic, and cultural problems. The laboratory's policy on human rights, drafted in the turbulent year of 1968, was "to seek the achievement of its scientific goals within a framework of equal employment opportunity and of a deep dedication to the fundamental tenets of human rights and dignity." The policy emphasized: "Prejudice has no place in the pursuit of knowledge. . . . It is essential that the Laboratory provide an environment in which both its staff and its visitors can live and work with pride and dignity."[42]

Wilson and Goldwasser also stressed the ecological integrity of the site—the preserving of natural habitats, protection of the land, and in general using what the site provided with minimal disturbance. Put forth at a time when the ecology movement was just taking root in national policy, those ecologically sensitive goals helped to assuage the fears of local residents that the new installation would negatively impact their quiet lives. Thus, unlike Los Alamos and Brookhaven, Fermilab's site was not designed to resemble a military camp. Nor like the Lawrence-Berkeley Laboratory (formerly LRL) or the Stanford Linear Accelerator Center did it assume the model of a university campus. Fermilab's site was constructed to evoke a romantic image of nineteenth-century life on the original midwestern prairie, with expanses of open land, farmhouses, barns, and natural habitats.

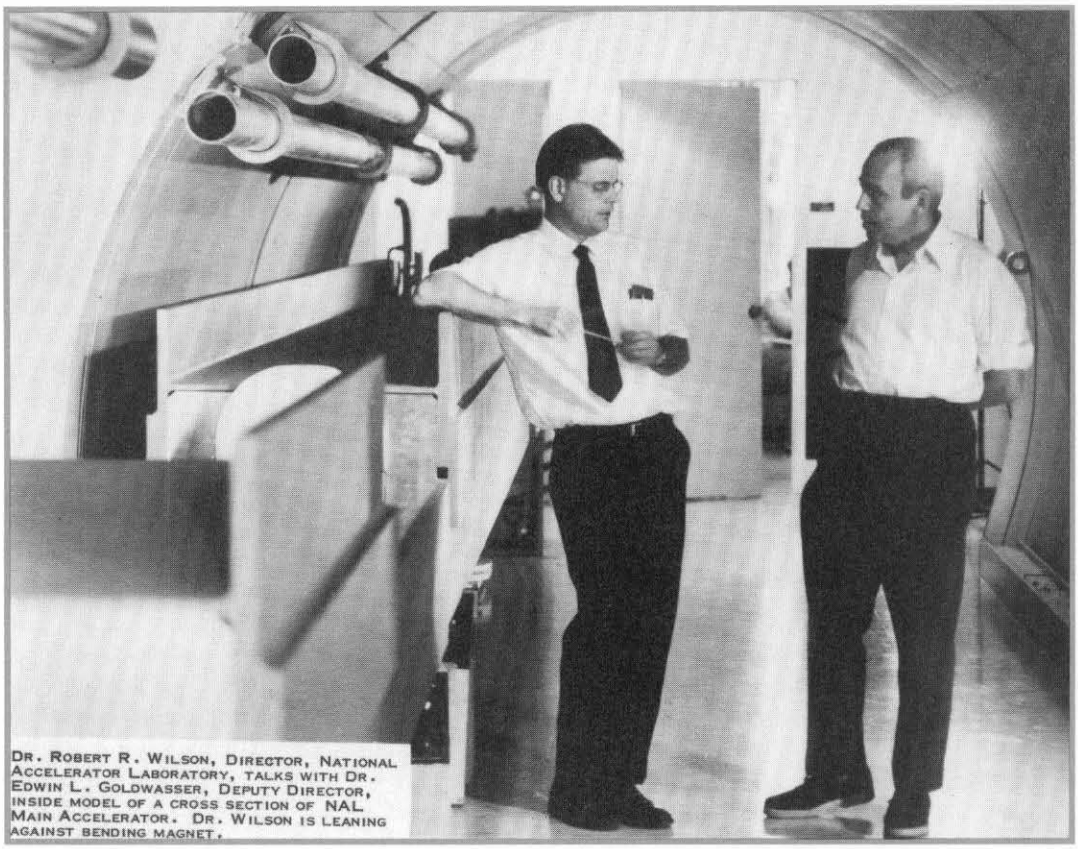
As an economy measure, the older farmhouses on the land as well as the relatively new houses that were in the village of Weston were restored for use as offices and later as visitor housing. Numerous native animals and even a herd of North American bison inhabit the site. In 1969, at its first annual Arbor Day ceremony, Fermilab instituted communal planting of thousands of trees and shrubs in an effort to help re-create the original woodland. Beginning in 1974, Fermilab's Prairie Restoration Project

[39]Goldwasser, "Science and Man: Breaking New Ground at Batavia," *Bulletin of the Atomic Scientists*, Oct., 1969, pp. 7–10.

[40]*Wall Street Journal*, Feb. 11, 1983, p. 21, cols. 1–2; Goldwasser, pp. 7–10.

[41]Wilson, "The Richtmeyer Memorial Lecture," p. 494.

[42]Goldwasser, p. 9.

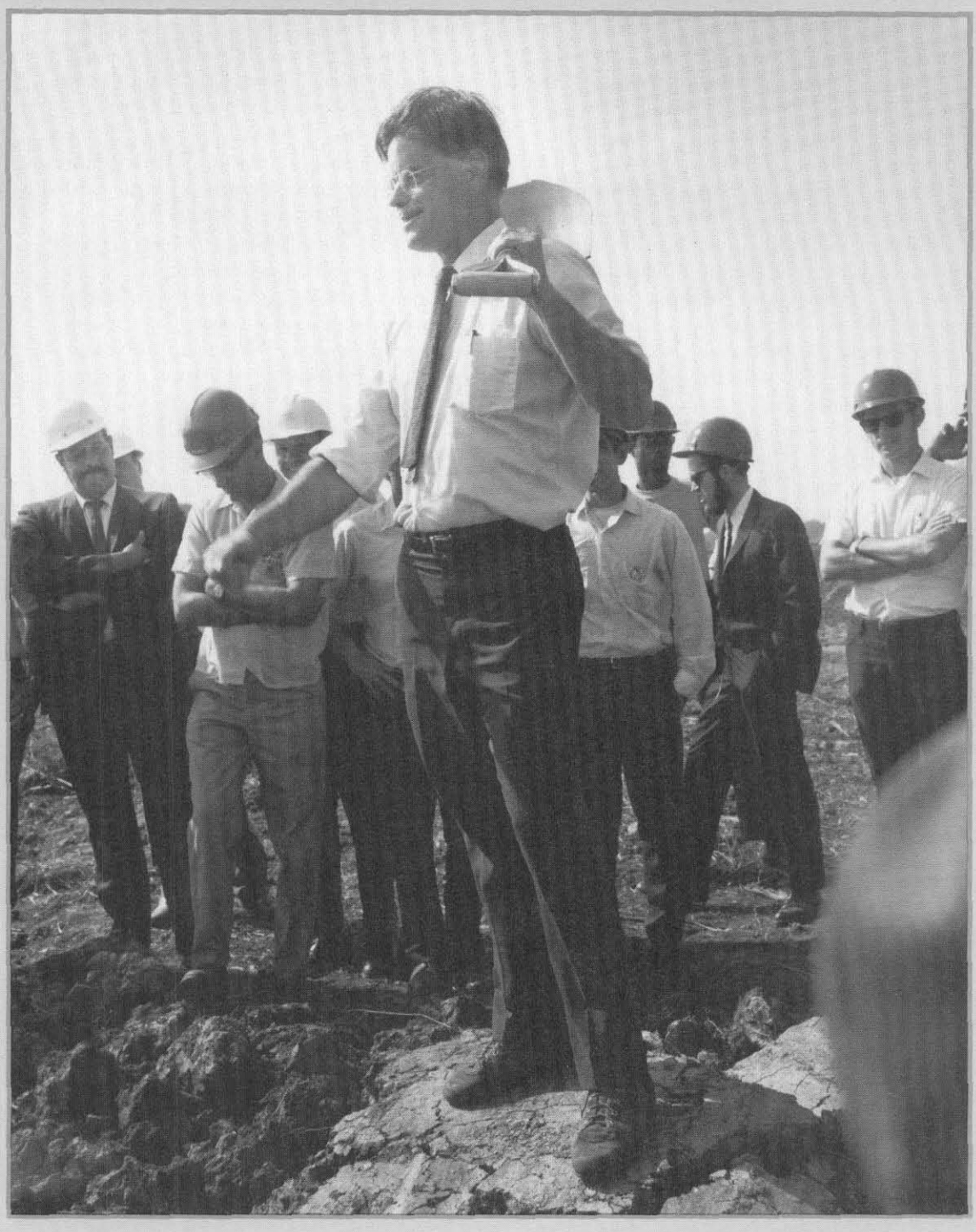


Robert Wilson of Cornell University (left) accepted the position as Fermilab's first director on March 7, 1967. His deputy director was Edwin Goldwasser of the University of Illinois. Both men worked to preserve the ecological integrity of the site.

in the center of the main accelerator ring drew on employees and volunteers from surrounding communities to work with the Morton Arboretum to reintroduce seeds and reestablish true prairie vegetation. The reconstructed prairie revitalized the original habitats into a wildlife sanctuary, and in time it grew into one of the largest in the United States.[43]

Turner ended his address at the Columbian Exposition on a note of closure: "Since the days when the fleet of Columbus sailed into the waters of the New World, America has been another name for opportunity. . . . Each frontier did indeed furnish a new field of opportunity, a gate of escape from the bondage of the past." But he explained that "the American energy will continually demand a wider field for its exercise," and "never again will such gifts of free land offer themselves. . . . And now,

[43]National Accelerator Laboratory, *The Village Crier*, June, 1969, pp. 1, 4.



Robert Wilson participated in the Fermilab groundbreaking in 1969. Wilson hoped that the laboratory would serve as a model for creative solutions to social, economic, and cultural problems in the community.

four centuries from the discovery of America . . . the frontier has gone, and with its going has closed the first period of American history."[44] Where would America find its new frontiers in the second period?

In much the same way that the Columbian Exposition symbolized Chicago's rebirth—a phoenix rising from the ashes of the 1871 fire—the frontier was reborn in studies of the atom, the nucleus, space, the genome, and countless technologies. Historian Thomas Parke Hughes has characterized the century of American history between 1870 and 1970 as an era of "technological enthusiasm" in which Americans "acquired traits that have become characteristically American." The last third of the era began three years after "the Italian navigator" landed in the "new world" of atomic energy. Vannevar Bush brought science into its golden age of funding by portraying research as an endless frontier to a nation impressed by the prowess of scientists who had worked on the atomic bomb and radar during World War II.[45] The next four decades of science policy would be driven by a cold war defense-based economy. Fermilab was created in that era.

What are we to make of the overlaps in rhetoric between Turner and the Fermilab community? What of their common celebration of such frontier values as individualism, empiricism, simplicity, equality, courage, discovery, independence, and naturalism? The physicists who planned Fermilab saw the laboratory as a utopian settlement that met social, cultural, and scientific needs. They emphasized democratic access, individualism, human rights, ecological balance, and the solution of social, economic, and political problems. And as the site was transformed into a managed international high-energy physics laboratory, Fermilab's founders worked to re-create an actual remnant of Turner's American frontier.

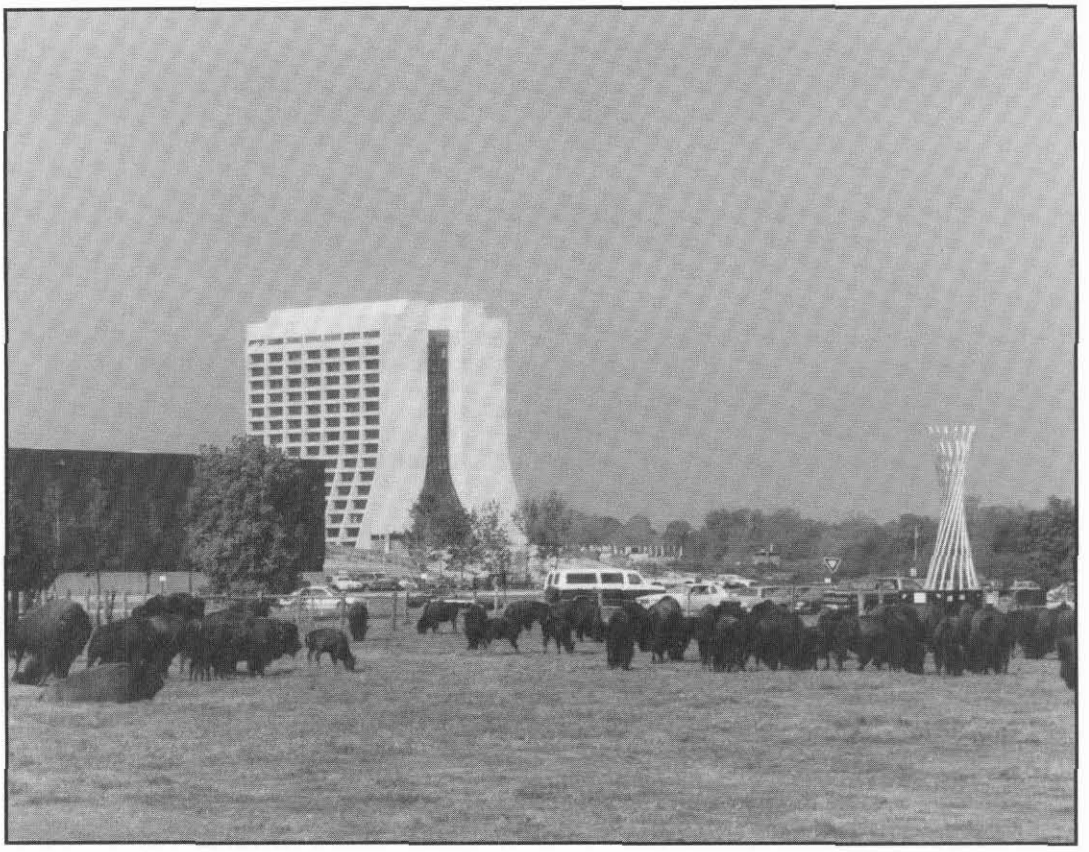
While it is tempting to try to apply Turner's thesis to Fermilab, detailed study of the history reveals other explanations for the overlaps between Turner and Fermilab. For example, the United States government allowed Fermilab's builders to take an individualistic approach in order to cut costs, which in turn allowed Fermilab to be the first national laboratory to offer broad democratic access of its research tools to any physicist submitting a proposal of sufficient merit. Democratic accelerator access was a natural value for American high-energy physicists in the early 1960s, following the sizable increase in particle energy required for advancement on the physics frontier. Owing to the high cost of sufficiently energetic accelerators, few machines could be supported. The consequence was centralization of research at those few centers and pressure from members of the exponentially expanding community of particle physicists for a democratic user policy.[46]

In actual practice, both in science and pioneering settlements, individualism and ruggedness turned out to be far less useful than cooperation. And at Weston, farmers and other settlers had to vacate their land for the sake of science, just as Native American tribes, including the Potawatomi, Sauk, and Fox, led by such legendary lead-

[44]Turner, "The Significance of the Frontier," p. 18.

[45]Hughes, *The American Genesis: A Century of Invention and Technological Enthusiasm, 1870–1970* (New York: Viking, 1989), p. 1; Compton, p. 144; Bush, *Science—the Endless Frontier.*

[46]Westfall, "Fermilab's Experimental Program during the Wilson Era," TS, 1993, Fermilab History Center. Ironically, Fermilab's user orientation became a disadvantage in the 1980s era of very big experiments, which required strong in-house groups to build and maintain large apparatus (see ibid.).



Fermilab began its Prairie Restoration Project, which includes the reintroduction of prairie vegetation and wildlife, in 1974. Above, a herd of North American bison graze in front of the lab site.

ers as Chechepinqua, Shabbona, and Black Hawk, had been driven by white settlers into drier, distant areas of the Great Plains and the northern Rocky Mountains for the sake of the land. Both were accomplished in the name of progress. Scientifically, the intellectual-*free* territory actually decreased as a result of the research activities at Fermilab and other high-energy laboratories, for the fruits of the research narrowed the particle physics frontier to only the most fundamental problems.[47] Fermilab's ecological concerns and appreciation of civil rights do not reflect Turner's thesis, but rather the personal values of Fermilab's founders and popular opinion during the late 1960s.

What is compelling about the associations that accompany the mythology of the American frontier and the settlement of Fermilab is the light that those associations shed on the self-image of physicists as frontierfolk and how physicists have used frontier imagery in establishing their ambitious

[47]Cronon, *Nature's Metropolis*. See also Susan E. Hirsch and Robert I. Goler, *A City Comes of Age: Chicago in the 1890s* (Chicago: Chicago Historical Society, 1990); Lowi and Ginsberg; Steven Weinberg, *Dreams of a Final Theory* (New York: Pantheon Books, 1992).

projects. Fermilab was conceived during the Kennedy era—a period in which the frontier myth had currency in America. During the early years of Ronald Reagan's administration, when the frontier was again an idealistic slogan, the Superconducting Super Collider project was adopted. Reagan referred to the myth explicitly in his second inaugural address: "[A] settler [who] pushes west and sings a song, . . . [t]hat's our heritage, that's our song." President Reagan recalled the myth again, more alarmingly, in his support of the Star Wars Program.[48]

But whereas images of scientific "wagon train[s] into the frontier of our comprehension of the universe"[49] excited congressmen during the Reagan and George Bush eras, such symbolic rhetoric was less potent in the early 1990s, when projects having more immediate social returns were emphasized.[50] Historians have yet to unravel the full range of cultural and political significance of the frontier in American science and culture and to comprehend the provocative associations with frontier imagery reflected, for example, in the striking correlations between periods in which science is well supported and times when it is popular to conjure up the spirit of the frontier.

[48]Irving J. Sloan, ed., *Ronald W. Reagan, 1911–* (Dobbs Ferry, N.Y.: Oceana Publications, 1990), pp. 199–204; Daniel O. Graham, *The Non-Nuclear Defense of Cities: The High Frontier Space-Based Defense Against ICBM Attack* (Cambridge, Mass.: Abt Books, 1983), pp. vi–viii, 1–15.

[49]Lederman, "What Can We Learn From the Supercollider's Demise?" *The Scientist*, Nov. 29, 1993, p. 12.

[50]"Policy Makers Invoke New Paradigm for Science and Technology," *APS News*, June, 1994, p. 2.

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