Fermilab

Report of the Fermilab ILC Citizens' Task Force

June 2008

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Executive Summary

Fermi National Accelerator Laboratory convened the ILC Citizens' Task Force to provide guidance and advice to the laboratory to ensure that community concerns and ideas are included in all public aspects of planning and design for a proposed future accelerator, the International Linear Collider.

In this report, the members of the Task Force describe the process they used to gather and analyze information on all aspects of the proposed accelerator and its potential location at Fermilab in northern Illinois. They present the conclusions and recommendations they reached as a result of the learning process and their subsequent discussions and deliberations.

While the Task Force was charged to provide guidance on the ILC, it became clear during the process that the high cost of the proposed accelerator made a near-term start for the project at Fermilab unlikely. Nevertheless, based on a year of extensive learning and dialogue, the Task Force developed a series of recommendations for Fermilab to consider as the laboratory develops all successor projects to the Tevatron. The Task Force recognizes that bringing a next-generation particle physics project to Fermilab will require both a large international effort and the support of the local community. While the Task Force developed its recommendations in response to the parameters of a future ILC, the principles they set forth apply directly to any large project that may be conceived at Fermilab—or at other laboratories—in the future.

With this report, the Task Force fulfills its task of guiding Fermilab from the perspective of the local community on how to move forward with a large-scale project while building positive relationships with surrounding communities. The report summarizes the benefits, concerns and potential impacts of bringing a large-scale scientific project to northern Illinois.

The Fermilab ILC Citizens Task Force resulted from the recommendations of an earlier citizens' group, the Fermilab Task Force on Public Participation. That first task force recommended that Fermilab convene a new dedicated Task Force as soon as the ILC became a real prospect for Fermilab but before key decisions were made, so that local citizens could weigh in on issues that would affect the community. In late summer of 2006, Fermilab put out a call for nominations to the ILC Citizens' Task Force. Of the nearly 100 nominations received, 25 finalists were selected to serve. Ultimately, 26 members saw the process through to the end and participated in the development of this report.

Meeting once a month from January 2007 through April 2008, the Task Force conducted extensive study and discussion of the ILC and related topics. Members took site tours, heard presentations from a wide range of experts from Fermilab and other organizations, and engaged in dialogues and exercises to explore topics in detail.

Besides its specific recommendations, the Task Force acknowledges three broad realizations that emerged from the process and that served as a point of departure in writing the report.

The Value of Fermilab
The research conducted at Fermilab and the people who work at the laboratory make significant contributions to the advancement of scientific discovery, technological innovation and the regional economy. Given its role in developing technological and human resources within northern Illinois, Fermilab is a resource to be valued, whether or not the laboratory ultimately hosts the ILC. Reinvestment in Fermilab's future a matter of local and national concern.

The Value of High Energy Physics to the U.S.
Hosting a next-generation accelerator at Fermilab would strengthen continued scientific leadership by the United States and build on Fermilab's central role in

the international physics community and the nation's commitment to research in basic science.

The Value of U.S. Investment in Basic Science

Although it is not for this Task Force to offer judgments as to which scientific endeavors should have priority over others in the nation's decision-making, the Task Force recognizes a value in the nation making the kind of long-term investment in research and eventual application of research that projects like the ILC represent.

While the Task Force supports each of these conclusions, they should not be interpreted as support for building a project such as the ILC at Fermilab regardless of cost, impact and configuration. Any large project built at Fermilab, and particularly one extending beyond the current physical borders of the site, must be planned and built with care, caution and sincere consideration of community concerns.

The report outlines a wide range of potential community concerns and makes detailed recommendations on issues of construction, environment, health and safety, economics, political considerations and community engagement. Key recommendations include:

- Develop a sound rationale and justification for bringing a next-generation particle accelerator to Fermilab that is primarily based on the science and other benefits to the entire nation, rather than on the local economic benefits generated by the distribution of tax dollars.
- Look for ways to locate offsite surface facilities so that they have the least impact on the community and potentially bring some benefit.
- Do everything possible to make land transfers and easements fair, equitable and voluntary.
- Potentially hazardous or disturbing activities such as rock removal, radioactive materials management, or major transportation activities should be centered on the Fermilab site to the extent possible, rather than at off-site facilities.
- Discuss in detail, and as early in the process as possible, the levels and types of radiation that will be produced, how they will be managed and the relevant risks.
- Recognize that community priorities do not always match technical priorities and some things may need to be reordered to ensure public understanding and input on key issues.
- Adopt the goal of no permanent impact on water quality and quantity, wildlife habitat and other natural resources, at the end of the project.
- Incorporate "green" practices whenever possible.
- Learn from the past, particularly from the SSC experience, and apply the lessons learned.
- Prepare a detailed analysis and understanding of the economic impact of the United States hosting the next-generation accelerator vs. participating in an offshore accelerator.
- Local government entities should have high priority for early and ongoing communications regarding requirements, plans and impacts.
- Design with the end in mind to make decommissioning efficient and minimize community impacts.

And most important:

- Inform and engage the community at every step of the process and use community input to minimize negative impacts and maximize benefits of any large-scale scientific project.

Chapter 1
Purpose

In this report of the Fermilab ILC Citizens' Task Force, the members of the Task Force describe the process they used to gather and analyze information about the International Linear Collider and its potential location at Fermi National Accelerator Laboratory in northern Illinois. They present the conclusions and recommendations they reached as a result of what they learned.

While the Task Force's charge was specifically to provide guidance to Fermilab on the ILC, it became clear during the process that a near-term start for the ILC was unlikely. Nevertheless, based on a year of extensive learning and dialogue, the Task Force developed and herein presents a series of extensive recommendations for Fermilab to consider in its ongoing efforts to create a successor accelerator-based particle physics program to the Tevatron collider. The report recognizes that bringing a next-generation accelerator to Fermilab will require both a large international effort and the ongoing support of local communities. While the Task Force conceived its recommendations in response to the then-proposed parameters of a future ILC, they apply directly to any large project at Fermilab—or at another laboratory—in the future.

The ILC Citizens' Task Force has taken on its task with great enthusiasm and rigor. The report comprises the collective sentiment of the 26 Task Force members. (Task Force members are listed in Appendix A). Its conclusions and recommendations reflect the extensive education received throughout this process as well as the foundations of each member's community experiences and values. While each member of the Task Force comes from a separate viewpoint and experience base, the common thread of concern for the communities in which members live and raise families drove the initial commitment to serve on the Task Force and shaped its recommendations.

The Task Force recognized from the beginning that the ILC project was both very long-term and highly uncertain. The value of the Task Force's contribution is to identify and characterize the nature of community concerns and issues relating to any project of the scope of the ILC. The work of the Task Force was not an attempt to get community buy-in for a future Fermilab project, nor do Task Force members speak for the whole community.

Aerial view of Fermilab

While the report covers many topics, its core purposes are:

- To provide Fermilab with a set of recommendations to help guide its interactions with local communities and their residents. This includes providing recommendations regarding community outreach and timing.
- To outline the many implications and potential impacts of bringing – or not bringing – a future large-scale physics project to northern Illinois.

These considerations permeate the discussion of each of the topics discussed in this report. The Task Force has taken great care to consider the best interests of communities throughout northern Illinois in making its recommendations.

With this report, the Task Force is fulfilling its charge of guiding Fermilab from the perspective of the local community on how to move forward with a large-scale project while building positive relationships with surrounding communities. This report also summarizes the benefits, concerns and potential impacts of bringing such a large-scale scientific project to northern Illinois.

The Task Force has also taken the responsibility of making recommendations regarding public participation in the planning and implementation stages, as each piece would have an impact on the community.

Chapter 2

Origins and Purpose of the Fermilab Citizens' Task Force

The SSC Experience

The ILC is not the first large-scale accelerator to be proposed for northern Illinois that would extend beyond the Fermilab property. In partnership with Department of Energy, the laboratory worked to become the host of the Superconducting Super Collider in Illinois in the late 1980s. The planned SSC energy was far higher than that of the Large Hadron Collider currently being completed in Switzerland and would have had a total tunnel circumference of over 50 miles.

Local citizens, particularly an organization called CATCH, "Citizens Against the Collider Here," mounted an aggressive campaign opposing the SSC's construction in Illinois. This citizen action resulted from the belief that DOE and the state of Illinois did not engage in open and honest interaction with the public over the siting of the facility, and from the many concerns of the public surrounding potential impacts and extensive land takings. Ultimately, DOE chose a site in Waxahachie, Texas for the SSC. In 1993, after 23 km of tunnel had been dug at an expense of over $2 billion, Congress canceled the project. With vivid memories of the mistakes in public interaction from the 1980s, Fermilab had no wish to repeat the SSC experience.

The First Community Task Force

In 2004, Fermilab convened its first Community Task Force of local citizens to ask for their recommendations on how the laboratory should interact with local communities when issues arise that affect both the laboratory and the community. This Task Force ultimately provided Fermilab with an extensive list of recommendations, which the laboratory incorporated into Fermilab's policy for public participation. Through this process, Fermilab learned that decisions made with public participation are better decisions not just for the community but also for the laboratory. To Fermilab's surprise, the laboratory found that not only did it have nothing to fear from public participation in laboratory planning and decision-making, it had much to gain.

Task Force member Ron Bedard

The first community task force developed detailed recommendations to guide Fermilab in conducting future public participation activities. The history of this task force and its recommendations can be found at www.fermilabcommunity.org/.

Fermilab had initially approached the process of public participation with some trepidation. Laboratory staff worried that the neighbors might expect to have input on scientific and technical decisions in which they lacked expertise. This was not the case. Rather, the neighbors offered their input on the implications for surrounding communities of laboratory actions and decisions, including constructing and running large projects. Fermilab had wondered how successful the laboratory could be in developing working relationships with neighbors and even getting CATCH members to participate. Both worked out well, and the experience of the Fermilab Community Task Force on Public Participation was a positive one for all participants.

A key recommendation of that first Task Force was to convene a new Task Force as soon as the ILC became a real prospect for Fermilab, but before any actual decisions were made, so that the community could weigh in on key issues. As a result of this recommendation, Fermilab convened the Fermilab Citizens' Task Force in 2006.

Forming the Fermilab Citizens' Task Force

Timing, the first Task Force had suggested, is everything. Fermilab should convene the new ILC Task Force well before making important decisions (exact siting, for example), but after establishing the general parameters of the new machine. Waiting too long would mean that citizen input would have little impact. Starting too early would involve too many unknowns for the group to act meaningfully. By the end of 2006, the Global Design Effort for the

ILC had agreed on a general design, DOE had confirmed its interest in building the ILC at Fermilab subject to cost and LHC results, and Fermilab had converged on a general north-south alignment with the laboratory at the center, but with flexibility for the exact siting of tunnel and surface structures.

Throughout the process, Fermilab worked closely with an experienced public-participation consultant, the Perspectives Group, to plan, design and facilitate and evaluate the operations of the ILC Task Force.

In late summer of 2006, Fermilab put out a call to the community for nominations to the ILC Citizens' Task Force. The stated purpose of the Task Force was to provide guidance and advice to Fermilab to ensure that community concerns and ideas are included in all public aspects of ILC design including:

Orientation of the beam line

- Location for the underground tunnels
- Community issues related to locating an underground tunnel
- Surface structures located off the Fermilab property
- Where to locate surface structures
- Aesthetic issues
- Features that could be included to benefit communities

Construction-related issues

- Timing of activities
- Safety
- Mitigating noise, traffic, and other disruptions

Task Force members tour the Tevatron.

Fermilab-community relationships

- Maximizing the economic benefits to the region
- Communicating and working with neighbors
- Building effective relationships with local governments and communities
- Strengthening the role of the community in the long-term mission of Fermilab

Timeline of the Fermilab ILC Citizens' Task Force

July 2006
Announcement of the Task Force and Call for Nominations

September 2006
Nominations Received

November 2006
Members Selected and Formally Invited

January 2007
First Meeting and Orientation

October 2007
Final Information and Education Meeting

November 2007
Identify Key Topics for Recommendations

January 2008
Begin Work on Recommendations and Final Report

June 2008
Recommendations and Final Report Complete

The laboratory had hoped for at least enough nominations to create a diverse 15-member group. Press coverage of the formation of a new Task Force was strong, and Fermilab ultimately received nearly 100 nominations. A committee of previous Task Force members and Fermilab envoys to the community selected 25 members—a larger-than-optimal number, but one dictated by the high quality of the nominees and their connections to the community. Over the course of the year, several members were unable to participate, and the Task Force added several new members to make sure all key community perspectives were included. Ultimately, 26 members saw the process through to the end and participated in the development of this report.

The members included:

- Members of local municipal and county governments (a mayor, county board members, city council members, aldermen, economic development officials, a park board member)
- Local business people
- A stay-at-home mom
- A local journalist
- Members of environmental organizations and environmental consultants
- A science communicator
- A retired airline pilot, founding member of CATCH
- A college teacher
- A neighborhood association chair
- School district superintendents
- The Executive Director of a construction-industry labor-management organization
- A Department of Energy official
- A physicist from a neighboring laboratory
- A Fermilab physicist

Appendix A has a full list of members and their affiliations.

The Task Force Process

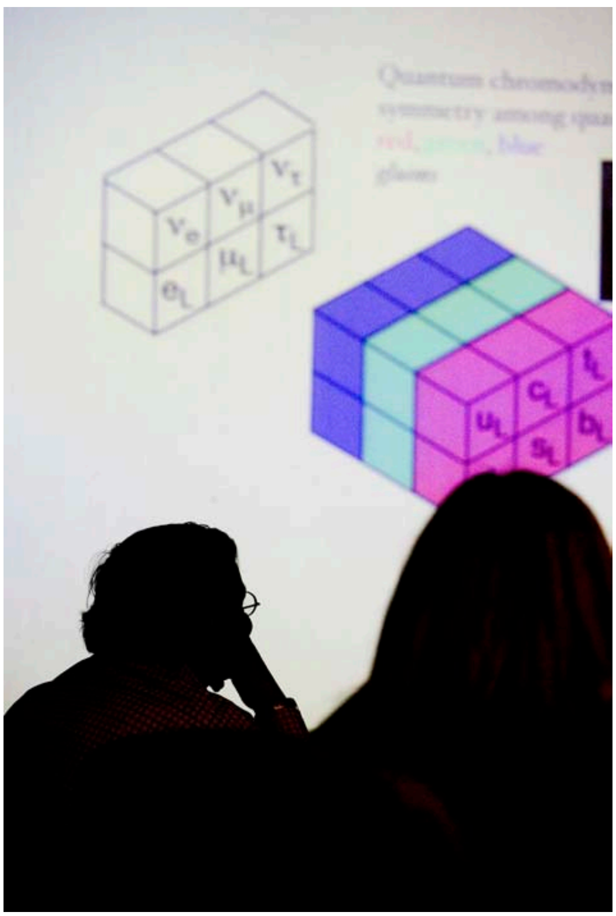
The Task Force began operations with an all-day Saturday workshop in January, 2007. Subsequent meetings took place one evening per month. Meetings were open to all. Members of the press attended several meetings, and the Task Force received significant local media coverage. The Task Force agreed to devote much of 2007 to learning about all aspects of the ILC.

A wide range of experts from Fermilab and other organization gave presentations to the Task Force. Fermilab Director Pier Oddone and Deputy Director Young-Kee Kim attended many of the meetings and engaged with Task Force members on key issues. Some of the topics and presenters included:

- The science of particle physics, and Fermilab's place in the global physics community (Fermilab Physicist Chris Quigg)
- The ILC itself: its likely dimensions, energies, configuration, and the science it would enable (Judy Jackson, Fermilab Director of Communication)
- The Global Design Effort, the worldwide organization created to design and develop a cost for the ILC (GDE Director Barry Barish)

- Issues related to siting an underground tunnel and surface structures, including property rights, siting criteria and possible tunnel orientations (Fermilab staff and Joe Sobanski, Metropolitan Water Reclamation District of Greater Chicago)
- Environmental issues, including impacts on ground water, radiation, construction issues, impacts of surface structures, potential environmental benefits (Rod Walton, Fermilab)
- Safety, including radiation safety
- Construction-related issues, including timing, safety, noise, pollution and how to mitigate impacts (Vic Kuchler, Fermilab)
- Surface structures, including locations, footprints, aesthetic issues, potential benefits to communities (Vic Kuchler, Fermilab)
- Economic impacts of building or not building the ILC at Fermilab (Dave Carlson, Fermilab and Ken Olsen, Linear Collider Forum of America)
- Governance of an international science facility
- Community issues, such as communicating and working with neighbors, building relationships with local governments, strengthening the community role in the long-term mission of Fermilab.

Agendas, materials, photos, and videos of all task force meetings can be found at www.fnal.gov/pub/neighbors/ilc_task_force.html



Task Force members learn about particle physics.

Appendix B contains a full list of Task Force meetings and topics.

In addition to the regular meetings, the Task Force participated in a tour of the NuMI tunnel to understand more about the construction and operation of underground projects. Task Force members also participated in several meetings and conferences hosted at Fermilab to discuss the work of the Task Force and participate in dialogues about public participation with scientists from Fermilab and other projects from around the world.

By the end of November, 2007, the Task Force had completed the education phase of its work and had identified topics that merited community input to develop its recommendations and conclusions in a report to Fermilab. Fermilab, in turn, pledged to incorporate the Task Force recommendations into its planning and policy development to the greatest possible extent. In January, 2008, the Task Force outlined the contents of its report and its recommendations with the goal of presenting its report to Fermilab by late spring 2008.

my view

Bill Batte

Prior to joining the ILC Task Force, Bill Batte had served on several committees dealing with matters of public policy.

The ILC Task Force stood out from those previous Task Force experiences for its level of open communication between the members and Fermilab as well as the laboratory's willingness to mold a site plan together rather than have the Task Force sign off on a predetermined plan.

In summarizing his thoughts about the ILC review process at Fermilab, Batte indicated that, "The Task Force has provided an indispensable platform for examining the impact of the ILC project on the wider communities of our region and the nation."

"As community volunteers, we were exposed to exhaustive information about the ILC, which, contrary to any prior expectation, was presented in an unbiased format. There was no indication of any predetermined agenda."

While Batte expects readers of this Task Force report to exercise their own critical judgment, he wants them to know that the Fermilab leadership was openly receptive to all questions, opinions and criticisms presented to them by Task Force members. He does not recall any situation where issues were avoided by the Fermilab staff.

"This is a critically important way to address this kind of public policy – from the standpoint of considering all of the constituents that will be affected. As someone once said, sunlight is the best disinfectant."

By the end of the task force process, Batte, who had only driven through Fermilab previously, felt he had a good grasp of the laboratory's science and the ILC-siting issues. He entered the process undecided on the project, and left convinced of the need for the United States to host the ILC and for the project to sit at or near Fermilab, where the technological and scientific skills to make it work reside.

Batte looked at the ILC with some of the skepticism expected of a career banker and the perspective of a former economics professor. He sought information through the task force process that looked at the local and national impacts of the ILC and, conversely, the effects of losing out on the project.

"When products and jobs can be made cheaper overseas, a nation has to find a different niche. If you hollow out your basic industries, then you have to lead in highly advanced technology, or you have nothing," Batte said. "How long will our technological edge last without support from long-term science projects? Long-term projects have the best pay-offs."

Chapter 3
Setting the Stage

In presenting its analysis, concerns and recommendations, the Task Force acknowledges that the year-long process described above has shaped its perspective and approach. The report grows out of a collective experience informed by the presentations, inquiry, discussion and recommendations that have made up this process, as the Task Force has sought answers to its questions and presenters have addressed their respective fields in connection with the ILC and Fermilab.

This process has allowed the Task Force to become better informed without losing sight of its role in providing objective feedback. Accordingly, it is appropriate to acknowledge three broad realizations that have emerged from the Task Force process and that served as a point of departure in writing the report.

The Value of Fermilab

The Task Force has come to recognize that Fermilab, the research conducted there, and the people who work there make significant contributions to the advancement of scientific discovery, technological innovation, the regional economy and the local community. Given its role in developing technological and human resources within northern Illinois, Fermilab is itself a resource to be valued independently of whether or not the ILC is pursued, making reinvestment in Fermilab's future a matter of local and national concern.

The Value of High Energy Physics to the U.S.

Should the international community pursue development and construction of the ILC or another successor project to the LHC, the location of the project in the United States and specifically at Fermilab should receive serious consideration. Hosting a next-generation collider would strengthen continued scientific leadership by the United States and build on the central role that Fermilab already plays in the international physics community and the nation's commitment to research in physics.

The Value of U.S. Investment in Basic Science

The Task Force recognizes the value of the kind of long-term investment in basic science research that the ILC and similar projects represent. American leadership and competitiveness depend on consistent investment and commitment to the technologies, research, and people that are associated with a project on the scale of the ILC. As Americans, we value our longstanding position as leaders in scientific research and discovery. America should not be willing to become a perennial runner-up to other regions of the world, or worse to get out of the game completely.

While the Task Force supports each of these sweeping conclusions, it should not be interpreted as support for building a project such as the ILC at Fermilab regardless of cost, impact and configuration. Any large project built at Fermilab, particularly those extending beyond the current physical borders of the site, will need to be planned and built with care, caution and consideration of community concerns.

Thus, the Task Force remains focused on the purpose set before it. This report lays out a clear, objective, conscientious assessment of the challenges posed by locating a next-generation accelerator at Fermilab and of the considerations that will have to be made in regard to the community and its concerns. It gives particular emphasis to effective communication. The challenges include issues related to siting, the construction of off-site facilities, worker safety, public health, environmental issues, construction, economic considerations, political considerations, learning from past projects, and community engagement. The report offers both general insight into community concerns and specific recommendations.

my view

Emily Demar

Emily Demar used to watch astronauts compete to win a spot on the Mercury 7 launch in her favorite movie “The Right Stuff.” It epitomized all that the second-generation American viewed as good about her nation: technological know-how, drive, passion, leadership.

Demar now sees parallels between the movie and science, particularly particle physics. Science draws together a collection of ambitious people to work toward a common goal that captures the imagination of the world.

“I see scientists as the modern astronauts or cowboys – the passionate at the frontier. Science is where the passion is now,” Demar said. “I hope we don’t lose that. That is what got us ahead.”

As a local newspaper columnist, Emily knows that the large-scale project will affect many more people than just those living close to the laboratory. She wanted to bring the voice of the everyday resident to the discussion and find answers for the questions she knows will arise if the ILC moves forward.

Having also worked as a staff assistant in Fermilab’s computing division and at the Illinois Math and Science Academy, she knew that science skills benefit individuals. Yet, before becoming a member of the Task Force, she never really thought deeply about the value of scientific skills to the nation.

“I wanted to bring a local perspective,” said Demar, a life-long native of Aurora. “But it quickly became a national perspective. When I worked at Fermilab, I only saw my small role. The Task Force really opened my eyes to how Fermilab fits into a wider national program of scientific leadership. We have long been number one in science. I didn’t really think about that before. We can’t let that disappear.”

Though you can’t always predict what industrial or medical applications will arise from research in basic science, history suggests that discoveries will be made, Demar said. The bigger the risk, the longer the project timeline and the more unpredictable the prize, the greater the reward. Long-term science ventures drive technological advancements that spawn private-sector jobs and life-style improvements such as the World Wide Web.

In a global economy, the United States cannot afford to hop in and out of the basic science game, Demar said. As a park board trustee, she understands the need to work collaboratively with people and the need to invest government money with reliable partners. She wouldn’t spend park board money with a company not expected to finish the job, so she questions why other countries would want to invest with the United States if it backs out of its funding commitments as occurred with the FY2008 federal budget that slashed the United States’ promised contributions to the ILC and ITER, an international fusion-energy collaboration. Such actions hurt Fermilab’s reputation with the local community and the nation’s chances of remaining a leader in a world where the costs of scientific projects increasingly require international partnerships.

“It doesn’t take a physicist to read the handwriting on the wall, if this country allows its science and technology leadership to slip away,” Demar said.

Chapter 4
Current Status of High Energy Physics Research

It's a simple idea. Take the smallest possible particles and give them the highest possible energy. Make them collide and then study the results. This simple idea has led to the science of particle physics, the technology of particle colliders, and a deep understanding of the nature of the physical universe. Beginning with the earliest colliders from the 1930s, each generation of particle accelerators and colliders has built on the achievements of the previous ones, raising the level of technology and the potential for discovery ever higher. And with each succeeding generation of colliders, their cost and scale increase.

my view

Terri Voitik

I am grateful to have spent this year working with everyone on the Task Force. I have learned so much and hopefully we have made a positive impact in helping to bring this wonderful project to the United States.

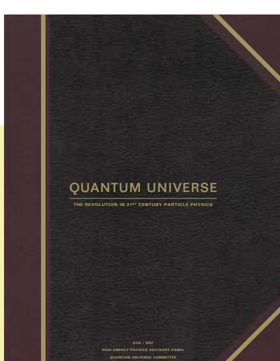
The universe is overwhelmingly beautiful. I have always been extremely fascinated by the smaller world; the moss on the forest floor that resembles its own miniature forest, the beauty of the crystal snow flakes as they land on my coat during a snowfall, the way that the grains of sand rearrange themselves after each ocean wave… It all seems to have a heart and mind. However, in the world of quantum physics, so miniscule and magical – that is where the soul resides!

The Quantum Universe

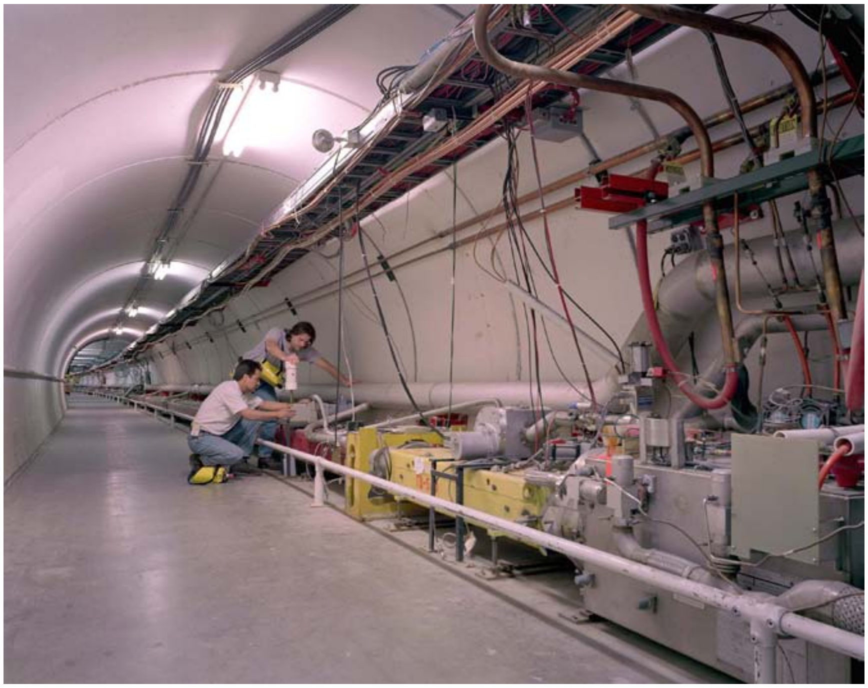
Now, at the start of the 21st century, the field of particle physics has reached the most exciting period in 50 years. We live in an age when the long-awaited opportunity to explore great questions is leading toward a revolutionary new understanding of the universe. The technological means are now at hand to address some of the most fundamental and fascinating questions about the nature of the universe:

- Are there undiscovered principles of nature: new symmetries, new physical laws?
- How can we solve the mystery of dark energy?
- Are there extra dimensions of space?
- Do all the forces become one?
- Why are there so many kinds of particles?
- What is dark matter?
- What are neutrinos telling us?
- How did the universe come to be?
- What happened to the antimatter?

The next generation of accelerators will at last provide the tools for discovery that scientists have anticipated for decades.



Two engaging and easy to read reports on the quantum universe are available free at the laboratory or for download at http://www.interactions.org/quantumuniverse/



Inside the Tevatron tunnel

Today's Accelerators

Fermilab is the nation's only dedicated laboratory for accelerator-based particle physics and currently operates the highest-energy accelerator in the world, the Tevatron. Some 1500 physicists from across the nation and around the globe collaborate on experiments at the Tevatron. However, Fermilab will soon lose this position.

The Large Hadron Collider at CERN near Geneva, Switzerland will soon begin operating with an energy seven times higher than the Tevatron's. The LHC will bring together physicists from dozens of nations to collaborate in experiments at the new energy frontier. It will open up the Terascale, the region of ultra-high energy where physicists believe they will discover answers to many of their most profound questions.

Once operations at the LHC begin producing physics results, Fermilab's Tevatron will shut down. Many U.S. particle physicists have already joined the CERN experiments, and many more will do so when the Tevatron ceases operations in 2009 or 2010. At this point, the U.S. will lose its traditional role as the leader in the international field of accelerator-based particle physics.

Next-Generation Accelerators

For many years, the global community of particle physicists has explored the question of what accelerator should follow the LHC. In the late 1990s, they converged on a linear collider as the successor to the LHC—the International Linear Collider (ILC). The ILC has the most mature technology to address the basic questions of 21st century physics from a different perspective from the LHC's. Results from the LHC will confirm whether or not the ILC has the appropriate energy to make it the right choice for the next machine.

The LHC has a circular design that accelerates protons in opposite directions around a large ring until they reach collision energy. By contrast, the ILC would consist of two linear accelerators that face each other and hurl some 10 billion electrons and their antiparticles, positrons, toward each other at nearly the speed of light. Superconducting accelerator cavities operating at temperatures near absolute zero would give the particles more and more energy until they smash together at the center of the machine. Stretching approximately

Comparison of Recent Colliders

Name	Location	Date Built	Particles	Size	Energy
Tevatron	Fermilab	1983	Protons- anti-protons	Circular, 6.3 km	2 TeV
SSC	Texas	1991 (never completed)	Proton-proton	Circular, 87 km	20 TeV
LHC	CERN	Start up in 2008	Proton-proton	Circular, 27 km	14 TeV
ILC Stage 1	TBD	TBD	Electron-positron	Linear, 30 km	500 GeV
ILC Stage 2	TBD	TBD	Electron-positron	Linear, 50 km	1 TeV

HOW DOES THE ILC WORK?

Supersymmetry. Dark matter. Extra dimensions. Scientists have proposed the International Linear Collider (ILC), a next-generation project designed to smash together electrons and their antiparticles at a higher-than-ever energy, to learn more about these and other mysteries of the universe. The ILC Global Design Effort team, which includes more than 60 scientists and engineers from around the world, has agreed on the baseline configuration for the roughly 31-kilometer long, 500 billion-electronvolt (GeV) particle collider.

The Linacs
Scientists will use two main linear accelerators ("linacs"), one for electrons and one for positrons, each 12 kilometers long, to accelerate the bunches of particles toward the collision point. Each linac consists of 8,000 superconducting cavities nestled within a series of cooled vessels to form cryomodules. The modules use liquid helium to cool the cavities to -271°C, only slightly above absolute zero. Scientists will launch traveling electromagnetic waves into the cavities to "push" the particles through, and accelerate them to energies that will total 500 GeV.

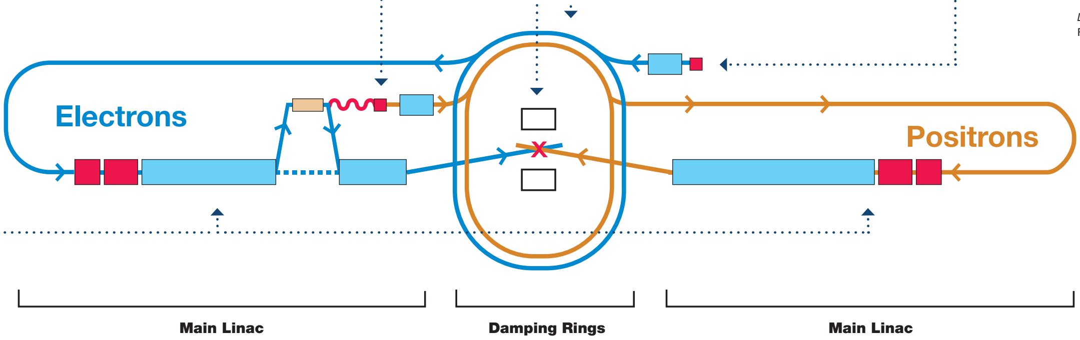
Positrons
Positrons, the antimatter partners of electrons, do not exist naturally on earth. To produce them scientists will send the high-energy electron beam through an undulator, a special arrangement of magnets in which electrons are sent on a "roller-coaster" course. This turbulent motion will cause the electrons to emit a stream of photons. Just beyond the undulator the electrons will return to the main accelerator, while the photons will hit a titanium-alloy target and produce pairs of electrons and positrons. The positrons will be collected and launched into their own 250-meter 5-GeV accelerator.

The Detectors
Traveling towards each other at nearly the speed of light, the electron and positron bunches will collide with a total energy of 500 GeV. Scientists will record the spectacular collisions in two giant particle detectors. These work like gigantic cameras, taking snapshots of the particles produced by the electron-positron annihilations. The two detectors will incorporate different but complementary state-of-the-art technologies to capture information about every particle produced in each collision. Having these two detectors will allow vital cross-checking of the potentially-subtle physics discovery signatures.

The Damping Rings
When created, neither the electron nor the positron bunches are compact enough to yield the high density needed to produce collisions inside the detectors. Scientists will solve this problem by using seven-kilometer-circumference damping rings, one for electrons and one for positrons. In each ring, the bunches will travel through a series of wigglers that literally "wiggle" the beam to emit photons. This process makes the bunches more compact. Each bunch will circle the damping ring roughly 10,000 times in only two tenths of a second. Upon exiting the damping rings, the bunches will be a few millimeters long and thinner than a human hair.

Electrons
To produce electrons scientists will fire high-intensity, two-nanosecond light pulses from a laser at a target and knock out billions of electrons per pulse. They will gather the electrons using electric and magnetic fields to create bunches of particles and launch them into a 250-meter linear accelerator that boosts their energy to 5 GeV.

Drawing not to scale
February 2007



35 kilometers (21.75 miles) in length, the beams would collide 14,000 times every second at extremely high energies—500 billion electron-volts (GeV). Each collision creates an array of new particles, and physicists analyze the results of these collisions for clues to some of the most fundamental questions of how the universe works. The current baseline design would allow for an upgrade to a 50-kilometer, 1 trillion-electron-volt (TeV) machine during the second stage of the project.

International Nature of High-Energy Physics Research

From the outset, the enormous cost and scale of the ILC dictated that its design and construction would be a global project. The worldwide physics community formed the Global Design Effort, an international organization of physicists and engineers to collaborate on the ILC design, with many countries, including the US, contributing resources. Conventional wisdom says that, to host the project, a nation must pledge to pay roughly half the cost, including most of the physical construction of the tunnels and underground facilities. The U.S. physics community and the U.S. Department of Energy declared their interest in hosting the ILC in the U.S., at Fermilab, if the cost proved affordable and if LHC results validated its planned energy. At least three other regions of the world including Europe and Asia are also exploring the possibility of hosting the ILC.

By the end of 2006, the GDE had agreed on a general design, DOE had confirmed its interest in building the ILC at Fermilab subject to cost and LHC results, and Fermilab had converged on a general north-south alignment with the laboratory at the center, but with flexibility for the exact siting of tunnel and surface structures. Several factors, including the favorable stable geology of a large bedrock layer 100 meters below ground and the large investment in resources and facilities that exist at Fermilab itself, determined this orientation.

High Costs of the ILC

In early February, 2007, the ILC Global Design Effort released its Reference Design Report, containing a preliminary design for the machine—and a preliminary cost, in "ILC Value Units." Depending on the interpretation, estimates of the actual cost in U.S. dollars ranged from about $8 billion to nearly $30 billion (The report can be downloaded at http://www.linearcollider.org/cms/?pid=1000437). The Department of Energy, the chief U.S. funding agency for the ILC, had anticipated a lower estimate. Later in February, at a meeting of the High Energy Physics Advisory Panel, DOE Under Secretary for Science Raymond Orbach asked the particle physics community to propose an alternative plan to the ILC, in the event that its construction schedule stretched out because the cost was too high.

U.S. Funding Challenges

Then, in mid-December 2007, Congress passed and the President signed an Omnibus Funding Bill that resulted in the Consolidated Appropriations Act for Fiscal Year 2008. The Act cut federal funding for U.S. R&D for the ILC from the $60 million in the President's FY2008 Budget Request to $15 million. Since one quarter of the fiscal year had already passed by the time the bill became law, the $15 million had already been spent. In the U.S., research and development for the ILC was over for the rest of the fiscal year.

Further, the FY2008 budget zeroed funding for the U.S. contribution to the international ITER fusion power project, for which the U.S. had committed $160 million for the current fiscal year, through high-level interagency agreements. Canceling funding for the U.S. share of ILC R&D and zeroing the nation's contribution to ITER called into question the ability of the U.S. to collaborate reliably on large international science projects.

Current Status of the ILC

The multibillion-dollar ILC cost estimate and a strong signal from DOE that a fast start for the project was unlikely mean that the probability of an ILC sited at Fermilab in the near-term future has become remote. However, a return to a leadership role regarding the technology of the energy frontier remains a long-term vision for U.S. particle physics and for Fermilab. Results from the LHC must still confirm the design and energy of the ILC or any next-generation machine. In the meantime, Fermilab has proposed a much smaller project, Project X, to address key questions of 21st-century particle physics.

Impact of ILC Funding on the ILC Task Force

It was against the backdrop of a very large, expensive and uncertain international project that Fermilab sought input from its neighbors to understand the community perspective regarding the long-term pursuit of the ILC at Fermilab. Task Force members were aware of this uncertainty from the start. However, the full implications of the added financial concerns became clear only after the Task Force had begun its activities. The announcement of the projected cost of the ILC came in February, 2007, just after the Task Force held its first meeting. The funding cancellation came in December, 2007, just as the Task Force was beginning to write this report. Acknowledging the uncertainty, the Task Force remained unanimously determined to complete its work and stay on task.

Chapter 5
Bringing a Next-Generation Accelerator to Fermilab

5

It is not difficult to identify many potential advantages and benefits of hosting a next-generation particle accelerator at Fermilab. However, it is also important to look at the costs and challenges. This section identifies the potential benefits and outlines the many community concerns that must be addressed before such a decision makes sense. It provides key recommendations to consider in the decision-making process.

A. The Benefits of Locating a Next-Generation Accelerator at Fermilab

The main benefits of bringing a next-generation accelerator to Fermilab will only become evident as key discoveries are made and any resulting advances in science and associated technologies flow from the completed project. However, the Task Force recognizes that there are a number of additional benefits of locating the project here in the United States, and, more specifically, at Fermilab.

American Science and Economic Leadership

Among the strongest motivations for locating a new accelerator in the United States is to maintain and advance American scientific competitiveness and leadership in the global community. The role of the United States in funding and developing other large-scale scientific projects, and in early support for development of the ILC, has afforded it a leadership position in the worldwide scientific community. If the next-generation lepton collider were built outside the United States, then Fermilab and the nation would, to a significant extent, cede that leadership role to the host country. Ultimately, from a technological perspective, this goal is also closely intertwined with the objective of maintaining a future position of global economic competitiveness. As stated previously, many members of the Task Force find this to be one of the most important and compelling arguments for U.S. investment in a next-generation particle accelerator.

Inside a particle detector at Fermilab

Positive International Relationships

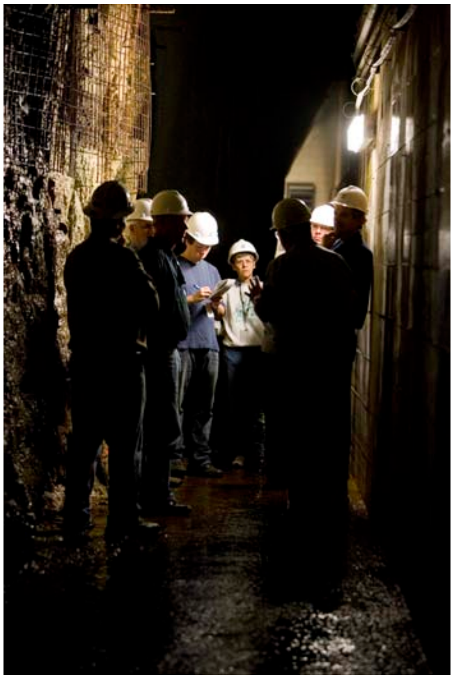
A closely related benefit is demonstrating that the U.S. is committed to the goal of continuing to be a fully engaged and reliable partner in the future endeavors of the international scientific community. Not hosting at least one of the world's major physics projects here in the U.S. could compromise our nation's ability to influence the global future of "big" science. It is also important to maintain a high level of trust on the part of our international partners by keeping our country's commitments. The Task Force fears that such trust has already been lost as a result of recent budget cutbacks and the nation's failure to live up to our commitments on ILC design and the international fusion power project, ITER. Withdrawal from the ILC process altogether or significant under-funding of existing commitments can only diminish the credibility and standing of the United States in the eyes of other nations invested in physics and other cooperative ventures.

Science Education

A historical strength of the United States has been its centers of higher education. Fermilab offers educational opportunities for many scientists and students. Fermilab's ability to remain at the cutting edge of science provides numerous research and learning opportunities for universities, departments, faculty members and students from across the country to conduct research directly at Fermilab or by building on the discoveries made there. These academic programs further benefit from the elite students they attract from around the world to study at these universities. Fermilab also helped to establish and continues to support the Illinois Math and Science Academy to accelerate the development of Illinois students who have demonstrated an exceptional aptitude for math and science.

More information on the Illinois Math and Science Academy can be found at imsa.edu

Locating the next-generation accelerator at Fermilab would continue to provide direct access and invaluable hands-on experience for thousands of U.S. scientists, engineers, students and participating industries at one of the world's most exciting science projects. In 2004, *BusinessWeek* noted that America is losing its long-term leadership in science and technology: "The depressing reality is that when it comes to educating the next generation in these subjects, America is no longer a world contender. In fact, U.S. students have fallen far behind their competitors in much of Western Europe and in advanced Asian nations like Japan and South Korea." At a time when the U.S. is losing ground in science education, the ILC would provide an enormous incentive for U.S. students to pursue science and engineering degrees.



Task Force members tour the NuMI tunnel

Maximizing Existing Investments

Building a next-generation accelerator at Fermilab would take advantage of the significant investment the country has made in making Fermilab a premier high-energy physics laboratory. This includes the many resources of the laboratory's existing physical infrastructure and the proven expertise of its scientific and technical workforce. The 1993 cancellation of the Superconducting Super Collider, which sought to recreate this infrastructure in a completely new location, continues to influence the issue of where to locate a future accelerator today.

There are other reasons to consider Fermilab as the site of a next-generation particle accelerator:

- Major physics laboratories throughout the world have other long-term, large-scale high energy physics projects in operation such as the LHC located at CERN in Europe and JPARC in Japan.
- Once the LHC comes on line and starts producing results, Fermilab will close down the Tevatron collider, thereby being in a position to reallocate substantial physical and human resources to the ILC project.
- Additional supportive infrastructure exists in the region in the form of strong universities, Argonne National Laboratory, large-scale utilities and an international transportation hub.
- The underground geology of northern Illinois is well suited for the construction of tunnels for an underground accelerator.

Technology Incubation

Hosting a next-generation accelerator at Fermilab would facilitate American spin-off innovations and future competitiveness in the technologies that would be expected to emanate from its basic research programs. Examples of prior spin-off innovations resulting from basic physics research include the World Wide Web, created to facilitate work at the particle accelerator at CERN in Switzerland. Basic physics research also resulted in the invention of the transistor and of the core superconducting wire and cable for MRI (magnetic resonance imaging). Particle detector technology spawned PET (positron emission tomography) scanning technology. While such spin-offs are impossible to predict and may be very long-term, basic research is an important fundamental building block of technology. Locally, an example of the benefits from high-energy physics research is Illinois's first-to-be-approved proton beam cancer treatment center, to be built near the Fermilab campus. To the extent that major centers of research are magnets for the best minds and for technological investment, the United States stands to lose if the major international centers of research are located overseas. Not only does this encourage American researchers and technicians to focus or locate elsewhere, but it also reduces the influx of talented and accomplished international professionals into the nation's economy.

Task Force members Roger Vernon and Jayme Muenz

Local Economic Benefits

Fermilab has a significant impact on the economy of the region and the state. As recently as 2006, the laboratory paid $195 million in total compensation to its employees, most of it spent or invested in local communities. In 2006, Fermilab spent $70 million in procurements from businesses located within the state of Illinois. Any decision to limit reinvestment in Fermilab as a preeminent center of research would have significant economic costs in terms of jobs and spending. Fermilab brings highly educated and accomplished professionals to the area, while requiring a range of other occupations in support of its work. These employees contribute to the communities and development of the region. Fermilab's presence supports the development of other businesses and investment within the area, including the ventures of former employees of Fermilab or those companies that would take advantage of the human resources associated with the two national laboratories in the area. A reduction in the number of professionals working and living at or near Fermilab would remove well-educated, diverse, engaged members of the community.

Community Relationships

Finally, failing to pursue the ILC or a similar project potentially misses an opportunity for the laboratory to build new ties to the community. As this Task Force experience has already demonstrated, it is possible for Fermilab to articulate to an interested public what it does and why, and the value of its activities. A next-generation accelerator project would force Fermilab to engage with the community to an even greater extent than in the past. Such interaction would not only potentially lead to greater understanding within the community, but it would also facilitate Fermilab's own examination of its role as a responsible neighbor, economic engine and center of education. At the extreme, the loss of Fermilab entirely would be a major blow to the region. Fermilab provides education, recreation, arts, culture and a major environmental oasis in a rapidly growing region.

B. Recognizing the Challenges and Community Concerns

It is not difficult to build a strong and compelling case to invest in a next-generation particle accelerator in the U.S. and specifically at Fermilab. However, these reasons combined do not constitute an automatic declaration to do so. As experience with the SSC, discussed earlier in this report, showed, the community will not simply accede to a project of such magnitude based on the government's arguments that it is a good thing.


Task Force members tour the NuMI tunnel

Deciding to locate a next-generation particle accelerator at Fermilab would be merely the first of many challenging decisions. If Fermilab were selected to host the ILC, the actual siting of the facility—determining where to build the tunnels and surface facilities—would be an even greater challenge and the single largest cause of public concern and potential opposition to the project.

There are many drawbacks to building an accelerator in a highly populated suburban area such as that surrounding Fermilab. Hosting a project that extends beyond the site boundaries would raise significant concerns for local communities. People will raise myriad issues regarding potential impacts (inconvenience from construction, fear of radiation, questions about land use, proximity to "my house," effect on property values, environmental issues, impact on water supply) and will question whether Fermilab is the best or most appropriate location for the facility.

Construction impacts, land acquisition, and health, safety, and environment concerns are all real, tangible issues that must be discussed and addressed before any decision is made. These impacts are not mere perceptions, particularly for those neighbors who will deal with the noise and traffic of construction or even face the loss of property. Are the impacts on the few justified by the larger societal benefits of project like the ILC? Not automatically, and certainly not to those few.

C. Addressing Community Concerns

Addressing community concerns and the many other challenges associated with a mega-project will require great effort and care.

To make the case for hosting a next-generation accelerator at Fermilab, the DOE and project supporters must develop a sound rationale and justification. It will not suffice to state that Fermilab is the best site or that the accelerator will bring continued economic benefits to the surrounding communities. The decision to site the accelerator cannot be viewed by the public as a unilateral, *a priori*, or a politically-driven decision. Presenting the project as a "done deal," is likely to enhance community opposition, as the SSC experience showed. The cornerstone of any process must be a mutually beneficial relationship with the community to establish an open process that engages, respects and acts on community input. The community would look to such a process to accomplish several things:

- Build the level of trust necessary to sustain an ongoing, positive relationship between the surrounding communities and the laboratory during planning, construction, and operations
- Reduce the potential for misunderstandings and help curtail the spread of misinformation
- Provide a well-understood mechanism for local communities to raise concerns and voice questions.

The remainder of this report outlines many of the challenges that must be addressed, discusses the many issues that must be built into such a responsible process, and provides detailed recommendations for implementing such a process.

Chapter 6
Learning from Past Projects

Several large projects have occurred in the region throughout the years with direct relevance to the construction of any future accelerator. Two of these projects, the Superconducting Super Collider and the original development of Fermilab, have very powerful lessons, while the expansion of O'Hare and the Chicago Metropolitan Water Reclamation District's Deep Tunnel project are also instructive. This chapter includes a section written by Task Force member Craig Jones, who was a founding member of Citizens Against the Collider Here – Illinois. It reflects his direct experience in the SSC siting process.


Task Force members tour the NuMI tunnel

Superconducting Super Collider

Fermilab sought to become the host of the Superconducting Super Collider in the late 1980s. It would have had an energy far higher than that of the Large Hadron Collider currently being completed in Switzerland and an underground tunnel with a circumference of over 50 miles beneath the communities surrounding the laboratory. At that time, local citizens, particularly an organization called CATCH, "Citizens Against the Collider Here," mounted an aggressive campaign opposing the SSC's construction in Illinois. This citizen action resulted from the belief that DOE and the state of Illinois did not engage in open and honest interaction with the public over the siting of the facility, and from the many concerns of the public surrounding potential impacts and extensive land takings. Ultimately, the process used and the citizen action contributed to DOE choosing a site in Waxahachie, Texas for the SSC. In 1993, after 23 km of tunnel had been dug at an expense of over $2 billion, Congress canceled the project, citing its large expense as the main reason.

O'Hare Airport Extension

O'Hare International Airport is one of the largest and most important airline hubs in the United States. Some years ago it became apparent that the level of departures and arrivals necessitated airport expansion. The expansion would promote increased economic activity both at O'Hare and locally. As in the case of the SSC, O'Hare expansion would require significant land acquisition. Also like the SSC, there is very little flexibility in determining what land is to be taken. The homes that are close to the new runway sites, but not taken, would be subjected to increased noise levels and consequently would likely suffer somewhat lower property values. There was a large and organized opposition to the airport expansion.

Original Development of Fermilab

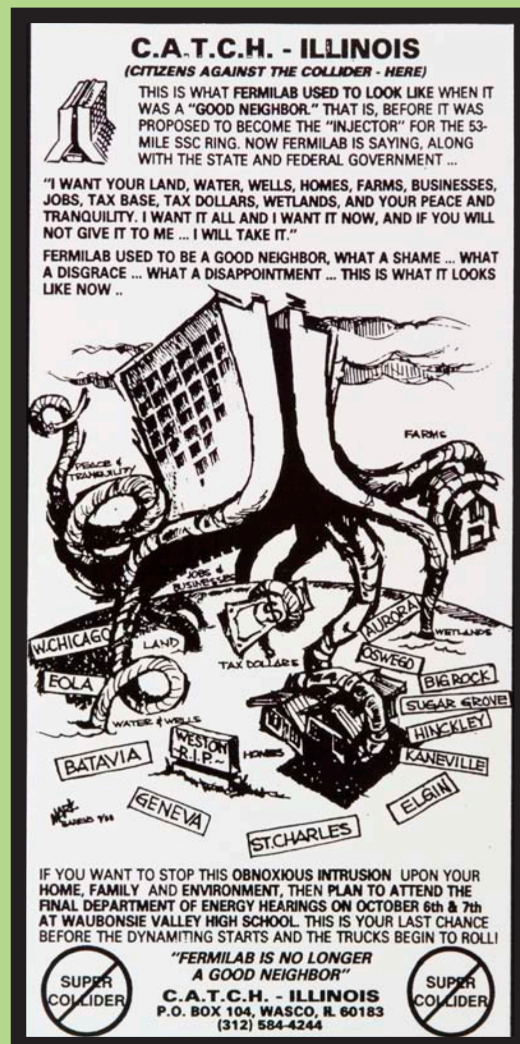
The book *Poliscide* (Theodore J. Lowi, Benjamin Ginsberg, et al., *Poliscide*, New York, NY: Macmillan Publishing Co., Inc., 1976.) detailed a study of the politics of the siting of Fermilab in the late 1960's. *Poliscide* noted that the process of land acquisition consisted of "unusually harsh methods," including a lack of competent appraisals (only a few homes were appraised at all), withholding information, rushed negotiations, late payments and inconsistent treatment of property owners. The authors concluded that "when a central government authorizes a project or delegates any kind of powers that are not accompanied by some rather explicit standards of conduct, these powers are implemented according to the values of the localities where the implementation takes place." The authors further concluded that localities are likely to abuse the power they assume because of the void left by lack of federal government guidelines.

The Deep Tunnel Water Management Project

The Chicago Metropolitan Water Reclamation District's Deep Tunnel water management project also has lessons for Fermilab. It required extensive subsurface easements but little surface land. The program was well publicized before it began, its benefits were carefully explained, and it had little opposition. There was no issue of radioactivity and following construction citizens raised few property-value concerns.

A Citizen's Perspective on The Superconducting Supercollider

By Craig Jones



The advertisement on the right appeared in area newspapers in 1988. It pictures Wilson Hall at Fermilab as an octopus whose tentacles are reaching out to seize farms, homes and businesses. This is not a flattering picture and far from how most area residents view Fermilab today. How this situation developed is the subject of this section.

In 1988, Illinois vied with a group of other states to make Fermilab the site of the proposed Superconducting Super Collider. A fierce opposition to the project arose from landowners near the proposed tunnel site. Logically enough, the greatest depth of opposition was from those landowners closest to the proposed 53-mile long tunnel. There were, however, many others involved as well. The battle began in late January, 1988, and continued to November, 1988 when the federal government announced the choice of Texas as the SSC site. The effect that the organization of homeowners (Citizens Against The Collider Here-Illinois, or CATCH) had on this decision has been debated ever since.

The quest for the SSC began in 1983, with appropriation of funds for R&D for the project. Occasional newspaper articles appeared, but no specific details were available. In September 1985, the magnet design determined the 53-mile circumference of the proposed accelerator. Its size, in conjunction with the fact that a Fermilab facility would serve as the injector, made possible a reasonable estimate of which homeowners would be affected if it were built in Illinois. But it took more than two years, until February 3, 1988, before notification to homeowners was made by the Department of Energy, and another six days until the State of Illinois, the entity that would seize property from home owners, would mail them their notices.

Details of the project became available in area libraries on January 22, 1988, at the direction of the Department of Energy. The Scope Hearing at Fermilab was scarcely a month away at this point. The people who would become the organization known as CATCH were consequently at a significant disadvantage in speaking at that event, in organization, and in knowledge of the project. In its "Dear Illinois Property Owner" notification letter, the Illinois Department of Energy and Natural Resources (ck. Now it's just the DNR.) stated that Illinois and ENR had been working on the project for "nearly four years." In the face of this statement, the Department went on to state that "this letter is part of a continuing effort by the State of Illinois to keep its citizens and elected officials informed about the progress of the SSC project." This was the homeowners' first notification in that "continuing effort" to keep them informed. It was February 9, 1988. CATCH had nine days to prepare for the Scope Hearings.

This set the tone for the remainder of the conflict, which was characterized by the use of state police to limit CATCH's access to various public sites of importance in the conflict, a lack of transparency in all areas, and stonewalling on the release of documentation and methodology for the state's economic claims. This reduced the state's economic case to the status of assertions. CATCH was repeatedly told by Fermilab personnel and the state that they, the people, did not matter, only the physical characteristics of the proposed site were important. As the conflict neared an end in October and November of 1988, the pro-SSC case dwindled to petty epithets and implied threats by pro-SSC groups. During the year some homeowners were threatened with arson and some received crank telephone calls. The CATCH telephone recorder occasionally contained strings of profanity and obscenities. In late summer and fall, my family and I received a number of telephoned death threats. I view these abuses as an indirect result of the political atmosphere fostered by the state of Illinois. The selection of the Texas site for the SSC was announced in November of 1988, with yet another death threat within minutes of the announcement.

The onslaught of the powerful political apparatus of the state of Illinois left an indelible impression on members of CATCH. The state's tactics in the early days motivated many to mount resistance. Threat of "quick take" eminent domain was bad enough, but the manner in which homeowners were treated early in the conflict ensured intense opposition. My view is that the state's actions in the early phases of the conflict were critical, but many in CATCH would disagree and choose instead to focus on Fermilab as the physical manifestation–the epicenter–of the entire sordid experience.

B. Understanding Community Concerns

During the SSC conflict, promoters of the SSC tended to dismiss homeowners' concerns regarding the presence of a tunnel because, from their point of view, there was no radiation danger. However, value determination is subjective, not objective or intrinsic. The value of a good or service, or of a home, is determined by the perceptions of individuals in the market place, whether or not their perceptions are accurate. A potential buyer of a home located above or near the tunnel must be concerned not only with his own perceptions or beliefs about the risks involved, but with the perceptions and beliefs of potential buyers, whether or not they are correct.

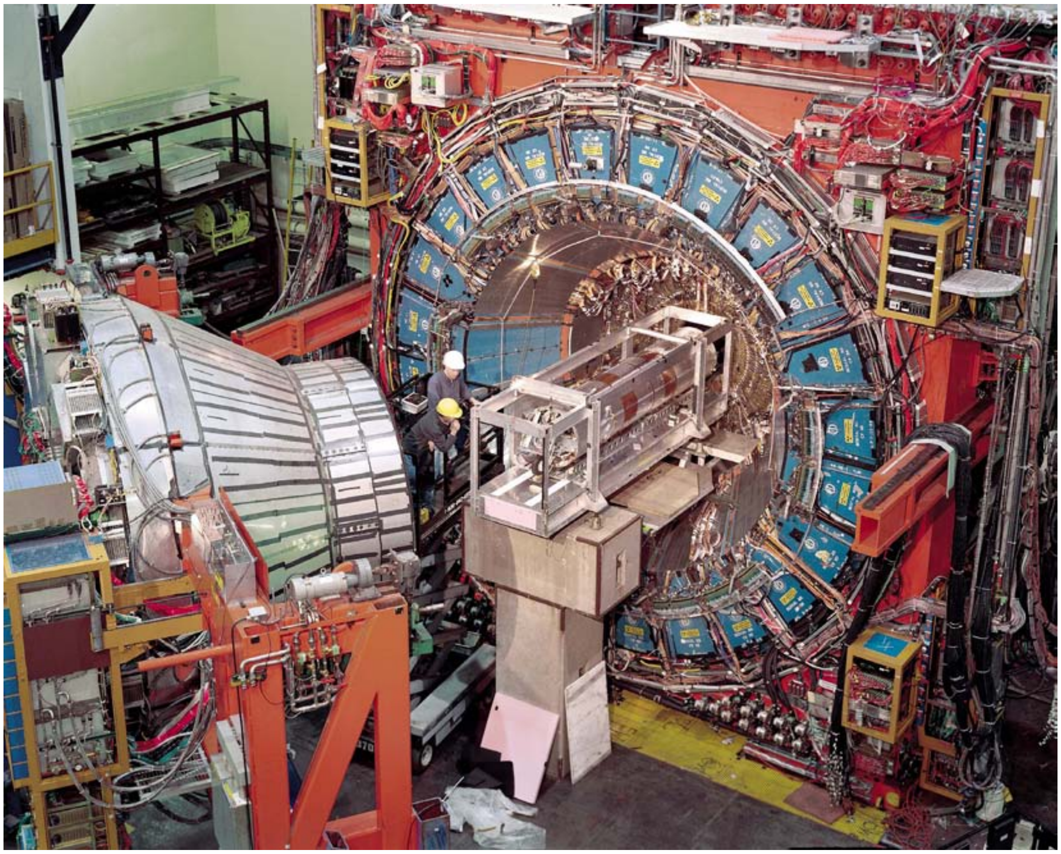
The more complex an issue, the less likely that individuals may be willing or able to educate themselves about it. And even though a source of information is available (Fermilab scientists), homeowners are unlikely to trust those whom they view as having an inherent bias. Even if a potential buyer is informed about the nature of the project, he must consider the perceptions of potential buyers if he ever expects to sell the property. What do these considerations tell us about land acquisitions and concerns for home values of the projects under discussion?

O'Hare is the most straightforward case. The land taken is on the surface. After the acquired homes, those adjacent to the acquired land are the most affected, and the primary effect is clear – noise. Some will be more affected by the noise levels than others, but all must consider the effect of the noise on potential buyers for their property. While some homes may be acquired by the project for what is presumably just compensation, those homes that remain will have a different problem – attempting to get compensation for the increased noise levels they suffer. These costs might be identified by surveys or real estate comparables and regression analyses, but it would probably be very difficult to obtain statistically significant results. In some cases, homeowners may not receive compensation for these harms.

The benefits of the Deep Tunnel in the city of Chicago were more clearly evident to the public and probably more evenly distributed than the benefits of increased commerce claimed for the airport expansion. Small payments were made for subsurface easements, as the circumstances justified. Some home values may have actually increased because of the improved water control.

Fermilab's operations have hitherto been largely confined to the original 6,800 acre site. No properties in the area have easements for tunnels or any other extensions of Fermilab activity. It is therefore not surprising if home values have not been negatively affected by

proximity to the laboratory. They may even be enhanced by access to Fermilab's open spaces. It is interesting to note that the ongoing neutrino experiment (MINOS) at Fermilab, which sends neutrinos to a target in Soudan, Minnesota, has stirred little controversy even though the particles' paths take them underground and under homes (but not in a tunnel; the particles travel through the earth). This can be attributed to at least two factors: a good job of establishing and maintaining transparency by the laboratory, and the fact that no subsurface takings were required therefore no notification to property owners was necessary and no easements were noted on property titles.


The CDF detector at Fermilab

The ILC, if built, would be different from the above in this respect. Easements would appear on the titles to property over the proposed projects' tunnels. This is a red flag calling attention to presence of the tunnel beneath the property. Because of the information and education costs involved and the impossibility of educating an entire market of potential buyers, there is the potential for some impact in terms of lower home values.

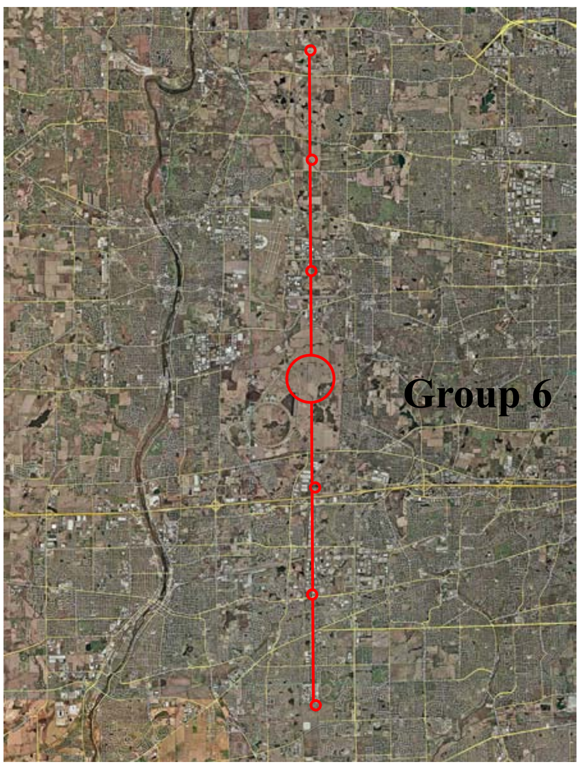
In summary, large projects that result in land takings, easements and other demonstrable impacts will result in considerable community outrage and action. The ILC would fall squarely in this category. When combined with the dual history of Fermilab's original development and the SSC, there is little doubt that Fermilab would have to conduct an overwhelming amount of public communication and public participation if the ILC were to be a success. The following sections provide detailed recommendations for these actions.

Chapter 7
Location, Construction and Operation of Facilities Beyond Fermilab's Borders

A. Background

Technical requirements for the ILC facility, as currently designed, would require it to be oriented in a manner that allows for:

- two straight tunnels at a slight angle to each other and meeting in a central hall where particle collisions and experiments would take place
- tunnels extending 15 km in each direction (30 km total with a potential future expansion to 50 KM)
- a second set of parallel tunnels for service and safety access
- tunnels placed in a geologic stratum that can support the high level of stability and precision needed for the project
- access shafts and surface facilities at required periodic locations (approximately every 5 km)
- a concentration of support facilities and tunnel access at the center where the particle collisions would take place
- availability of and connection to needed infrastructure such as roads, power sources and cooling water.



Task Force Members attempted to identify potential lines for the ILC tunnel and locations for surface facilities that would disrupt the fewest surrounding properties. To view all of their attempts, go to http://www.fnal.gov/pub/neighbors/ilc_meeting_materials.html

The current thinking regarding the building of a proposed ILC at Fermilab is that the center of the tunnel, where the collisions and experiment take place, would be located directly beneath the 6,800 acre laboratory. This would allow many of the surface structures, administrative functions, operational activities, construction access and debris removal to occur on existing Fermilab property.

Preliminary analysis of an ILC centered on Fermilab's campus suggests that the tunnels would be best placed about 100 meters (330 feet) below ground on a generally north-south orientation. This places the tunnels in very stable rock with little groundwater.

Although the Task Force received some descriptive information about the nature of the needed surface facilities, detailed specifications for the facilities are not yet known. What is known is that surface facilities will be required every 5 to 6 kilometers along the tunnel route. This is the practical limit of piping distances from the cryogenic cooling system required to run the experiments at super-cooled temperatures. These facilities would also provide access to the tunnel through vertical shafts, as well as serve as locations for buildings needed to support the ongoing operations and maintenance of the accelerator, and provide required emergency egress points.

The Task Force heard estimates that these surface facilities would require between 5 and 10 acres of land to accommodate all facilities, buffers, and possible community uses. The suggested orientation centering on the Fermilab site would require as many as six such facilities located beyond Fermilab's borders. Each would most likely require land acquisition from parcels that are in existing use, as little open land currently exists in this corridor and more development is occurring every year.

In addition to acquiring property for surface facilities, the project would require easements from all property owners directly above the tunnels, as property rights in Illinois grant property ownership to the center of the earth.

The Task Force spent significant time discussing and considering the challenge of locating surface facilities. At its May 2007 meeting, the Task Force worked with Google Earth projections of the possible ILC corridor and tried to identify possible surface facilities in areas with the least impact on existing property owners and neighbors. It was a daunting task and could not be done without some disruption as there is little suitably vacant or underutilized land within the areas required for construction. The results of these attempts appear on line at http://www.fnal.gov/pub/neighbors/ilc_meeting_materials.html

B. Key Community Concerns

Construction would be the most visible phase of the ILC project. Projects of the size and scope of the ILC will ultimately be seen or known by almost everyone in the surrounding communities. It is important not to let people find out about the project by the sights and sounds of construction. By then, it is certainly too late to build the type of good communication and relationships required.

The design, construction and operations of the beam line and surface facilities outside the boundaries of Fermilab's campus have the potential to be the most controversial aspects of the project, as well as to elicit the most opposition from communities and the directly affected individuals. Notwithstanding the many unknowns about the likely locations and configurations of the surface facilities, the Task Force identified some of the potential public concerns and made general recommendations to address those concerns.

Discussion with the chief engineer of the Deep Tunnel Project in Chicago indicated that the presence of a tunnel beneath a property has practically no impact on surface (homes, stores, parks, etc.) structures and facilities. The Deep Tunnel, however, does not have cryogenic cooling systems every 5 km or a particle accelerator located within its tunnels. Therefore, it can be anticipated that those who would be living or working above an accelerator tunnel would raise questions and concerns about the accelerator beneath them.

The surface facilities would affect citizens in at least two ways. First, there would be impacts to the community from locating, constructing and operating an accelerator-related facility in the community. Impacts on property values, quality of life, zoning, air and water quality, noise and other issues would need to be estimated and addressed. Second, some individuals would be directly affected (e.g., the use of their land for surface facilities; being located near the facility; having the tunnel located under their property).

Any future accelerator at Fermilab would go through several phases: design, construction, and operation. Building and sustaining the desired symbiotic relationship between the laboratory and its neighboring communities during these phases would require a broad, flexible and open process that adapts to dealing with different issues and concerns at different times and on different levels.

Issues During Design

In the design phase, there would be concerns about site layout issues, including location, impact, and aesthetics, especially for the parts of the accelerator extending beyond the boundaries of Fermilab. Affected communities should have avenues for voicing comments and concerns during the site layout process. Information on property rights and eminent domain would have to be made publicly available, with forums for open discussion. The process for land acquisition would need to be laid out in detail, discussed, and modified as necessary. Both local government bodies and affected individuals must be encouraged to participate, in order to make the process as smooth and cooperative as possible.

Environmental issues would also need to be addressed in the design phase. Environmental studies and impact statements should be made public and easily accessible. The potential impact of the underground tunneling on local water supplies, use of cooling water, and air emissions would all need to be specifically addressed along with all other environmental issues.

Issues During Construction

As in any construction project, the public would also be concerned with noise, pollution, traffic, erosion, safety and possible damage to property. As a tunneling project, the ILC would raise concerns about impacts to their foundations, noise and vibrations from tunneling, and potential long-term impacts of having a tunnel beneath their homes. Disruptions, congestion and other nuisances would be unavoidable, given the size of the project. However, close coordination of the construction work with local communities could minimize the impact of the construction.

Safety and health issues would be another major concern to the surrounding communities, both during construction and in subsequent operations. The public would demand proper assurances that the accelerator construction follow the basic dictum "do no harm" and that it repair any unavoidable impacts of construction. These assurances should be specific, documented and, where feasible, measured.

Also of significant concern to local communities would be environmental impacts. In particular, impacts on surface and groundwater would need to be modeled and monitored very closely. Runoff from construction sites, excess erosion, and intersection with drinking water aquifers during construction are just a few of the issues of concern.

Issues During Operations

When the accelerator began operating, its impact on surrounding communities might become more difficult to quantify. To date, Fermilab has operated its experiments with very few community impacts, but these projects have always been fully contained on the Fermilab property.

It is critical for local communities to become aware of the likely long-term impact of having a next-generation accelerator at Fermilab. Answers to many specific questions would be needed. Table 1 lists some foreseeable questions that Fermilab would need to address.

TABLE 1. Potential Questions that May Need to Be Addressed about Locations of the Surface Facilities Required by a Next-Generation Accelerator

- How can the off-site facilities' size and impacts be minimized?
- Why can't everything be underground?
- Will all surface activities be safe?
- How will access be controlled?
- How will access points be secured?
- If my child breaks into a building, will he fall down a big hole? Contract radiation poisoning? Get electrocuted?
- Will surface facilities create a nuisance (noise, trash, light)?
- Will surface facilities be unattractive? Can they be designed to blend into the community?
- Will surface facilities detract from the value of my property?
- After construction, will there be a noticeable additional ongoing traffic on our streets?
- Who decides how large these facilities will be and where they will be located?
- How will these surface facilities and locations be used/affect me/my neighborhood/the community during construction versus normal operations over time?
- Will radioactive material be delivered or removed through these off-site access points?
- What types of equipment and/or material will be delivered or removed through these access points and at what frequency? Can delivery traffic be restricted to certain hours?
- Will these sites be 100 percent maintained by Fermilab?
- Will condemnation of properties be required to proceed or complete these access points?
- What happens if the accelerator should cease before completion, like the SSC?
- What happens once the accelerator construction work is complete?
- What happens to surface land and facilities when the accelerator operations cease. Would they revert to local government?
- After the accelerator experiments are complete, will the tunnels be available and useful? Will there be residual contamination of concern? Can public access be arranged to take advantage of a tourist destination or other possible uses?
- What is the expected lifetime of the accelerator?
- How does the total mass of required buildings get incorporated into the surrounding communities (very different scales)?

C. Recommendations

The location of the beam line in terms of impact refers directly to the location of the tunnel, access shafts, and surface facilities. The impacts of construction are known to most people and are not unusual. Beyond the impact of construction, people will have questions and concerns and will desire input to decisions regarding the placement of the tunnels and the surface facilities in their neighborhoods and communities.

Locating the Beam Line (Tunnel Route)

- With significant public input to identify key community concerns, values, and issues, Fermilab should develop a description of how the "best" beam line (tunnel) location will be determined.
- The public and local communities should have input into the development of the criteria to be used to arrive at a decision regarding the beam line location.
- As the work on the beam line location proceeds, all information should be made available; decision-making processes should be transparent; and, community input should be sought.
- In communicating with the public, Fermilab should provide facts and information that are correct and identify any potential future expansions or revisions such as the future possibility of extending the length of tunnel.
- Openly discuss and compare the pros and cons of various beam line and surface facility locations in relationship to the previously identified criteria.
- Identify the issues and concerns that residents above or near the beam line or surface facilities will have (e.g. radiation, trash, undesirable light, noise, traffic, appearance, security, etc.) and have real answers. An extensive amount of modeling will be needed in order to have adequate and accurate information.

Locating Surface Facilities

- Because the surface facilities have the potential for being the most controversial aspect of the project, the Task Force recommends that the public be involved as early as practical in this matter.
- Once a tunnel alignment has been determined, Fermilab representatives should meet with potentially affected landowners and community leaders as soon as possible. Early communication with affected landowners is essential.
- Within the technical and geologic constraints required for the accelerator, the tunnel alignment should be finalized using criteria that minimize the number of off-site surface facilities as well as the potential impacts of those facilities.
- When considering the tunnel alignment, potential surface facilities should, to the extent possible, be located in existing industrial and commercial areas and should avoid residential and dedicated open space or natural areas.
- Locations of surface facilities must be as flexible as possible to accommodate the concerns of the communities and individuals.

Designing Surface Facilities

- Surface facilities should be designed to minimize the acreage needed and the impact on adjacent properties, including operational impacts such as emissions and noise. It is important that these goals be incorporated into the design of the surface facilities. Detailed designs and functional descriptions of the facilities will be needed, to provide early, accurate and complete information to the public.
- Surface facilities should be designed to blend with adjacent land uses and community values.
- Where possible, the design should incorporate options for multiple uses of the sites if there is interest in doing so from the local community (e.g. public park, educational or multiple-use centers). Designing them with such uses in mind may help with the public's acceptance of the facilities.

my view

John Brining

Constructing the ILC will cost billions of dollars and provide work to local contractors and construction workers, building material suppliers, architects, and all the businesses that support the construction crews for five to seven years.

“The proposed 2008 capital bill in Illinois right now has $25 billion for the whole state to fix roads, airports, everything,” said John Brining, executive director of the Oak Brook-based Construction Industry Service Corporation, the largest labor management organization for union construction in the nation. “We are talking about spending those kinds of dollars in a short time at Fermilab. This is a project that would be unparalleled in Illinois. The immediate economic impact is important: the jobs that will be created. Also important are the jobs that will be left behind to maintain it. The impact will be huge.”

Brining joined the Task Force, and its predecessor the Fermilab Community Task Force on Public Participation, to bring his expertise as a tradesman who has worked at Fermilab and as a board member of the DuPage County Workforce Development Board and on the Citizens’ Migration Task Force for the SCC. He also wanted to give his hometown, Naperville, a voice in such a large project near its border.

“It’s a monumental project, not only in size and scale, but for the physics community,” he said. “We need to get that message out.”

Contractors, Union building trades organizations and groups are ready and willing to undertake the project and have assured him of on-time and on-budget work. But they will need ample notice to start building up a pool of skilled workers and forming a consortium of building trades, contractors and Fermilab representatives to handle the logistics of manpower requirements and project bidding specifications.

“The building trades are hungry for this, and will make it a high priority,” Brining said. “Fermilab has been an important component and important player in the construction industry over the years. That, in turn, helps the region. When you have a large union workforce, it pays dividends.”

Beyond construction, the ILC will require maintenance and technician workers for 20 to 30 years of operation, diversifying the local community with an infusion of skilled, well-paid workers and their families.

“In the United States, since we have lost our industrial base, much of our traditional good paying blue collar jobs are hard to find. After completing a union apprenticeship, a skilled trades person can expect to earn a total package of $70,000 or more.” Brining said. “It really helps to support the local economy when you have high-paid blue-collar workers. Those wages are spent at the grocery store, restaurants, etc…”

Brining said the Task Force’s report brings up legitimate concerns about cost, environmental, neighborhood and political considerations, but none that present serious roadblocks to building the ILC.

“I think all of the concerns can be mitigated,” he said. “The United States has a leadership role to play here, and we need to step up. Those construction dollars are well spent.”

The accelerators developed at Fermilab to study high-energy physics led to the creation of proton therapy machines to treat cancer. Recently, Brining has been fielding calls for subcontractor referrals to build a proton therapy center in DuPage County operated by Northern Illinois University.

Brining expects similar spinoffs from the ILC which will help keep blue collar jobs thriving.

“I think it is critical for the American economy that we maintain our leadership in scientific research and development creating advances in science and technology that will be transferable to industry,” Brining said. “Who is going to build those buildings and products?”

Land Acquisition

- To the extent feasible, land for surface facilities should be acquired through voluntary agreements with the current landowners. Condemnation proceedings should only be used when all other options have failed.
- Underground easements would require detailed explanations and understanding of the impacts of having a tunnel over 300 feet beneath one's home. Significant community communication would be required, not just with those requiring easements.

Construction

- Where an option exists to conduct operations or activities at on-site Fermilab facilities as opposed to off-site facilities, the on-site option should be preferred. The work and activities of the off-site facilities should be minimized to avoid impacts. In that regard, any potentially hazardous or potentially disturbing activity such as rock removal, radioactive waste management, or major transportation activities should be centered on the Fermilab site to the extent possible, as opposed to the off-site surface facilities.
- Communicate and maintain a frequently updated schedule of operations by all media possible.
- Akin to the "sidewalk superintendent" viewing holes in the construction fences of city buildings, invite the public to see the tunneling and other operations, via live or TV presentations, videos, tours, etc.
- Dust containment will be important, as dust is the most visible contaminant to be produced.
- This project will be only 20 to 30 miles long, and many people would be reassured by learning details of the Metropolitan Water Reclamation District's "Deep Tunnel" project, that has so far tunneled 109 miles in similar communities.

Life-Cycle Thinking

- Design and construction of an accelerator should be done with the end in mind to ensure that decommissioning and deconstruction of the facility could be done efficiently and with the least impact on surrounding communities.
- Give thought to future use of the tunnel after the end of experiments and plan ahead for transition to the use as much as practicable.
- Give thought to the reuse of off-site properties. Consider building in a return of land to local government as part of the up-front agreements.

Chapter 8
Health and Safety

A. Background

Protecting health and safety for site workers and the public is probably the most important factor in the construction and operation of a future accelerator. As with any large and complex project, the possibility of worker injury during construction is real. All projects at Fermilab are governed by strict U.S. Department of Energy safety regulations which are are taken from the Occupational Safety and Health Administration. The Department of Energy system of laboratories puts an extremely high priority on safety, and Fermilab has a very strong safety record, often exceeding safety achievements seen in similar private industrial operations.

The greatest risk to public safety is likely to occur from construction traffic, as additional traffic and large construction vehicles will be added to area roadways. During construction there is no risk of exposure to or injury from radiation as no radioactive materials will be produced or handled. The radioactive material that would be produced by an accelerator would be a by-product of its operations.

Once operations begin, radioactive waste materials will be collected in a controlled manner, safely packaged and ultimately disposed of off-site. Radiation control on all DOE sites is very highly regulated and access would be carefully controlled during operations. The tunnel location would make it virtually impossible for any public exposure to radiation to occur during the operation of the accelerator itself. The risk would be present should radiation somehow leak into cooling water and be released into surface waters on Fermilab and then into offsite locations, or should there be an accident in the transfer and transportation of radioactive waste materials off the Fermilab site. In both cases, the level and duration of exposure should be small and unlikely to result in a serious public-health risk.

Fermilab joining international safety standard

Source: Fermilab Today, Thursday, April 24, 2008

When it comes to safety, Fermilab leads the way. A team of auditors recommended Fermilab's registration under what will soon become an international safety standard.

The auditors with NSF International Strategic Registrations spent last week at Fermilab reviewing the laboratory's safety and health systems.

Achieving registration under Occupational Health and Safety Assessment Series 18001 - Safety and Health Management Systems meets a major commitment made by the Fermi Research Alliance, which manages Fermilab, in its contract with DOE.

"Congratulations to Fermilab on this significant accomplishment," said Joanna Livengood, DOE Fermi site office manager. "The laboratory clearly demonstrated its commitment to top-notch safety and health and joins companies internationally recognized for their excellence."

Taking a proactive stance on safety, Fermilab voluntarily applied for the OHSAS registration and subjected itself to the safety audit. Rafael Coll, ES&H, organized the effort.

"OHSAS 18001 is quickly becoming the international safety standard," Coll said. "Fermilab is leading the way in registering under this new standard."

As part of the review, auditors interviewed employees about their safety practices and their knowledge of the Fermilab Safety Policy.

"The auditors praised Fermilab's S&H program," said Bill Griffing, head of the ES&H section at Fermilab. "They were most impressed by the openness and willingness of those they interviewed to engage in knowledgeable and frank discussions about worker safety. The unrehearsed nature of the responses convinced the auditors that we have a healthy safety culture committed to continuous improvement."

Fermilab can soon claim the distinction of meeting international standards for environmental management as well as safety and health management. Last fall, Fermilab celebrated the international recognition of the laboratory's environmental management practices when the laboratory achieved the ISO 14001 registration.

Managing radiation from underground experiments at Fermilab is not new. Both the current Tevatron and the NuMI projects generate small amounts of radioactive materials. In 2006, Fermilab experienced its first-ever release of a radioactive material, tritium, from the site in the surface waters of Indian Creek. Though the release was significantly below any level of concern, Fermilab immediately notified neighbors, took aggressive action to isolate and correct the situation which caused the release, and has been actively monitoring the situation ever since, posting all results on a public web site to keep the community informed.

Task Force member Brett Larsen

B. Key Community Concerns

Considering all aspects of the accelerator project, there would be potential exposure to radiation, dust, volatile organic compounds, hazardous air pollutants, water pollution, hazardous waste, noise, light and vibration.

While the actual risks to public health and safety are likely to be small, the Task Force believes that the public's fear of radiation and distrust of government are reality-based. The public does not differentiate among the many forms and levels of radiation. The specter of any radiation is often enough to generate fear and trepidation. Potential public exposure, no matter how small or imagined, must be addressed.

Another issue that touches public health and safety is Fox River water—how much would be required, how would it be treated for re-entry, what safety issues would exist at the intake and return, and how would they be addressed? These issues would affect all those who use the Fox River for recreation (boaters, swimmers, fishermen) or for drinking water.

With regard to worker safety, the Task Force believes that the public readily grasps the hazardous aspects of major construction projects, and would not be unduly concerned about worker safety issues during construction. However, potential worker exposure to radiation during operation is a factor that would set this project apart from other major construction projects and might engender community concern.

C. Recommendations

The Task Force recognizes that linear colliders have been built before, and that many of the concerns are known. These "known factors" simply need to be communicated to the public. The public needs to be reassured that life would continue as before once the construction is completed, i.e., that the air will be breathable, the water drinkable/fishable/paddleable, and that quality of life would be the same as before.

The Task Force recommends that Fermilab maintain the same openness and transparency in communication with the public that the laboratory has exhibited in the past.

- Like all large-scale projects, especially underground projects, an accelerator project must incorporate worker safety in all aspects from design through construction, operation and decommissioning.
- Fermilab should explain its safety record and policies and procedures to the public in a way that is understandable and can be related to similar projects that the public knows.
- All data regarding the health and safety record at Fermilab should be readily accessible to the public.
- Fermilab should be prepared to discuss and explain to the public all aspects of radiation connected to the new accelerator.
- When accidents happen or safety issues arise, Fermilab should continue its policy of open and transparent communication with the community.
- Radiation is a major issue with the public. The importance of education about radiation, its types, levels, and effects on human health, cannot be overemphasized. Fermilab needs to be able to discuss in detail the levels and types of radiation that would be produced, how they would be managed, and the relevant risks. This information needs to be produced as early in the planning process as possible.
- Air quality and ventilation must be explained fully with regard to both worker safety in the tunnels and the degree to which any hazards could be released.

Chapter 9
Environment

9

A. Background

Because of the early stage of ILC planning, the Task Force received relatively little information about potential environmental impacts. Prior to implementation of the ILC or of any accelerator construction project, a federal Environmental Impact Statement would be prepared. This requirement of any large project would involve a detailed analysis of all potential environmental and socioeconomic impacts of both construction and the operation. The goal of Fermilab is to build and operate the new accelerator with no significant environmental impacts.

Like all projects at Fermilab, a new accelerator would be regulated by the full range of federal and state environmental laws. Fermilab is permitted by the State of Illinois for all discharges to water and air and this would continue for a new accelerator. Illinois also has a strict no-degradation policy with regard to groundwater. The proposed location of the ILC in the Galena dolomite stratum would place it at a location below the existing groundwater aquifer, where no wells for drinking water or irrigation exist. Some wells go deeper than this level, but there is no water for use in the Galena.

Fermilab currently uses significant quantities of water to cool the Tevatron. This water is collected from sources on the site, sometimes supplemented with water piped from the Fox River (as long as the river level is sufficent) and stored in large on-site ponds. The cooling water system is designed to be a closed loop, meaning that water is continually recycled on-site. Water is lost to evaporation and in extremely dry periods does need to be replenished. Conversely, in extremely wet times, water does need to be released from the site in a controlled manner.

Traditional construction impacts can be assumed for activities on Fermilab as well as for the six off-site surface facilities. Construction of the tunnels and halls required for the ILC would result in an enormous volume of crushed rock that would require recycling or disposal.

B. Key Community Concerns

A wide range of environmental issues concern the public, not only during accelerator construction, but also in the operating phase. Among the most important of these issues are water table impacts, the use of Fox River water, loss of open land, wildlife impacts, air and water pollution, and recycling opportunities (e.g., for construction debris).

The ILC project would extend well beyond the borders of the Fermilab property. Citizens have an increasing concern over dwindling natural resources. Kane County has already alerted the public to potential ground water shortages by 2030, and this would heighten concerns about ground water impacts during both construction and operation, including water usage by off-Fermilab site facilities.

There are issues regarding air/dust dispersal, trash, sewage from tunneling operations and project operation, heat transfer, energy usage from on and off Fermilab property. There would also be considerable concern regarding any possible release of radioactive or hazardous materials into waters or the air.

C. Recommendations

Fermilab has already stated that its goal would be to build and operate any future accelerator with no significant environmental impacts. The Task Force recommends clarifying and expanding those goals:

- Adopt the goal of no permanent impact on water quality and quantity, wildlife habitat, other natural resources, at the end of the project.
- Incorporate "green" practices whenever possible, and communicate this to the public.
- Connect to or enhance wildlife corridors in the project, committing dollars to the preservation and restoration of natural resources, and taking advantage of every recycling opportunity.

- Design with the end in mind, i.e., the possible uses of the tunnel and surface properties after decommissioning.
- Communicate potential damage from tunneling operations to private property, and the minimal potential for damage from earthquake action.
- When environmental issues arise, Fermilab should continue its policy of open and transparent communication with the community, as exemplified by the laboratory's tritium management program.

Fermilab environmental program receives international recognition

Source: Fermilab Today, Monday, October 15, 2007

Last Thursday, Oct. 11, Fermilab and local DOE officials celebrated the international recognition of the laboratory's environmentally sound management practices in a small ceremony in Wilson Hall.

"I'm presenting today a plaque that certifies Fermilab's registration for ISO 14001," said William Rutledge of NSF International Strategic Registrations. The non-government organization provides management systems registrations worldwide. "Not many organizations of your caliber have done this."

The ISO 14001 standards require an organization to meet a stringent set of criteria. The organization must have an infrastructure and management plan that allows it to comply with environmental laws and standards, to improve its environmental performance and to achieve measurable environmental objectives. The standards are not a government requirement. Instead they signify an organization's commitment to best environmental practices.

"This might seem like the culmination of our efforts, but this is only the beginning. Now we have to maintain our standard and improve on it," said Paul Kesich, manager of the Environmental Protection Team at Fermilab, who led the laboratory's effort to get certified.

ISO 14001 certifies that an organization has an environmental management system that assesses the environmental impacts of all activities taking place across the organization, from the planning of major new projects to the daily activities of workers. As part of the system, managers must communicate with their employees about environmental aspects of their work and look at ways to minimize the environmental impact of daily activities.

"This is a notable achievement for Fermilab," said ES&H Director Bill Griffing after the ceremony. "We have always had a reputation for environmental excellence in the United States. The ISO 14001 registration puts our name on a list of corporations recognized internationally for their excellent environmental management systems."

Chapter 10
Economics

A. Background

The economic impact of a project like the ILC would be significant to the region. To the extent possible, it is important to quantify potential costs and benefits of the project, as well as the potential impacts of closing or drastically reducing the activities of Fermilab, as discussed earlier. This section discusses areas where economic impacts need to be explored and accurately presented.

Construction Impact

The impact of construction expenditures for a project of the magnitude of the ILC could be expected to benefit Illinois firms, as well as to increase demand and potentially raise wages for Illinois labor. It is not possible at this early stage to differentiate among possible local, regional and national benefits. While much of the advanced technology of a future accelerator, including tunneling technology, is not likely to be procured in northern Illinois, the region is likely to benefit more than other areas of the country due to the efficiency of local sourcing and the impacts of the rising costs of transportation.

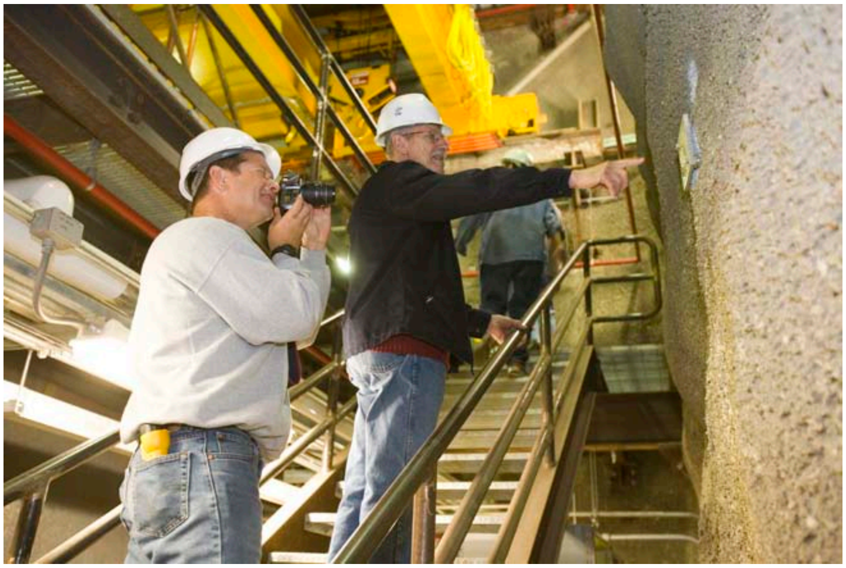
There would also be costs associated with construction, including local and state government provisions of services (water, sewer, fire and police), a potential for reduced property tax base due the federally-owned surface facilities, road construction, repair, and upgrades resulting from heavy truck traffic, environmental degradation, ground water issues, and possibly land acquisition costs. It is not yet certain who would pay these various costs, but they were specific commitments of local and state government for the proposed Superconducting Super Collider in 1988.

The increased demand for labor for an accelerator construction project could increase the cost of labor as the market got tighter. It would be a temporary construction phase issue, but could have an effect on business and employment patterns during construction and during the readjustment of those patterns when the construction activity ceased. The Chicago and northeast Illinois construction industry is well positioned and qualified to build a project of this magnitude. The original construction of Fermilab and all of the subsequent research projects used local labor as did Argonne National Laboratory. The construction boom in the area has lasted many years and has not overtaxed the contractor or manpower base. Projects like the Deep Tunnel, I-355 Tollway, O'Hare Airport expansion, and general construction projects of many different scales and dimension continue to be built successfully throughout the region.

Task Force members tour the NuMI tunnel

Long-Term Impact

Over the longer-term operational phase of a new accelerator, the local and regional economies would also benefit. Significant local procurements would be required to keep the laboratory and the accelerator working. As with the Tevatron, there would be a large payroll associated with accelerator operation, much of it staying close to Fermilab. Appendix C includes two figures showing a recent summary of overall economic impacts of Fermilab and the payroll distribution for FY 2007. (These data were produced and distributed by Fermilab.)



Task Force members tour the NuMI tunnel

The quality of people associated with a new accelerator that would become part of the community would enhance the region's level of human capital. This could have a positive effect on educational institutions, encouraging more young people to pursue technical training and graduate degrees, especially in the sciences. Colleges, universities and related institutions would benefit from association with technicians, engineers and scientists.

Some of the costs for the construction phase would persist into the operations phase, such as fire, sewer, potential environmental degradation and loss of property taxes.

International Governing Model

Unlike the SSC, the ILC is designed as a truly international project with shared costs and responsibility. The host government would likely be required to pay for the civil construction (tunnels, shafts, other physical infrastructure) associated with the project. The cost of building and running the experiment itself within the tunnels and underground halls would be shared by all participating countries.

There is still considerable uncertainty as to how much of the total initial investment and ongoing costs of operating a new global accelerator would directly benefit local and U.S. individuals and firms. However, the host country certainly would receive a majority of such economic benefits. Selecting the ultimate host location for a next-generation collider will depend on the commitment of the prospective host government to support the project and the estimated costs associated with a specific site.

B. Key Community Concerns

Unlike in private industry where labor and contracts are considered as costs of doing business, government projects generally view such items as assets or benefits. While the business and jobs brought to Illinois by a new accelerator may appear as a benefit to Illinois, to the rest of the nation they would be seen as a cost paid by their tax dollars, and rightly so. It is worth noting that when the Texas site for the SSC was announced, political support for the project from the remaining states dwindled. This underscored the pork-barrel (or quark barrel as it was called by some in the press) nature of support for the SSC.

The SSC experience is an important lesson for a future accelerator. If it is to be funded, the entire nation must believe that it is in their best interest as well. Those interests must be firmly rooted in the value of the science itself and the U.S. benefits of hosting that science. This science project should not be judged or evaluated by the number of jobs it produces or the number of dollars it delivers to northern Illinois. Outreach and education about the value of this project would be needed far beyond northern Illinois.

my view

Craig Jones

Great strides have been made by Fermilab's Office of Communication and the Perspectives Group, in conjunction with the Fermilab Community Task Force and the ILC Task Force in making the processes of siting projects such as the ILC more transparent. One result of these efforts has been the "Recommendations for Public Participation" compiled by the Fermilab Community Task Force on Public Participation. Another is the Final Report of this body, the ILC Citizens' Task Force. These and the investigations that preceded them are great steps forward in minimizing the probability of future unpleasantness. Those whose efforts produced this deeper and broader knowledge of the issues should be commended. I thank them for allowing me to present my personal history of the SSC conflict and my conclusions about what that history bodes for the future. I thank them as well for considering my economic arguments.

I have made no judgment on whether the ILC should be built at Fermilab, or built at all, because I do not have the information to compare it to other worthy science projects, an issue that was not within the purview of our Task Force. My real concern is that politicians and bureaucrats, who are not party to the Recommendations for Public Participation, will be deeply involved in future project promotion as they were with the SSC. There is thus a danger that the process will once again become politicized, a situation that I consider responsible for much of the disharmony that occurred during the SSC conflict. I respect the scientific goals of the ILC and the dedicated scientists who pursue them, but should the ILC siting process take on the characteristics of the SSC conflict, my sympathies would lie firmly with the affected property owners. How we govern ourselves and the ways our government treats its citizens are far more important than any science project.

How future sitings will develop is not clear. I would suggest generous compensation for all property owners for their homes and land, including that taken for subsurface easements. This would probably require special legislation, but would do more to avoid serious confrontation than any other single action. It might be done before the final few degrees in orientation of the project, allowing property owners to bid for lucrative buyout offers in a kind of competition (within technically acceptable limits). The government could then resell the property acquired for subsurface easements to recoup much of the land acquisition expense. In 1988, the State of Illinois claimed property values would not be affected by the SSC. This initiative would give government the opportunity to put its money where its mouth is. The more closely we can approximate a voluntary exchange of property without the threat of eminent domain, the further we are from a costly confrontation.

The ILC process is not a competition among states as was the SSC, but an international undertaking. Perhaps that will make it less confrontational. Much will depend on how proponents of the ILC comport themselves. For now, we may find considerable satisfaction in the reports issued by the two Task Forces which provide a framework for transparency and community involvement. In the future it will be the responsibility of Fermilab management and employees, and most importantly the community, to maintain and comply with the spirit of those documents.

C. Recommendations

Task Force members are quite aware that the U.S. resources to build a future accelerator will come from the taxes of all Americans. Accordingly, the cost of constructing such an accelerator should not be portrayed as simply an economic benefit to the people of Illinois. That benefit is not the reason to build such machine and run experiments. That cost cannot justify building an accelerator to the people who will pay for it. Rather, it is important to fully explore and embrace the many other benefits articulated earlier in this report with regard to the value of science, education and discovery. The following should be explored fully:

- Prepare a detailed analysis and understanding of the economic impact of the United States hosting the next-generation accelerator vs. participating in its construction and operation in another country. What are the likely returns on the investments the U.S. would make in either case? What are the potential opportunity costs to U.S. businesses in terms of R&D and future development that could occur based on previous experiences such as the Tevatron?
- The case for and ultimate commitment to a future accelerator must be built on its real purpose—scientific research and the production of knowledge—rather than defining construction and operation costs as benefits.
- Any meaningful economic impact study should include all who are affected, including those who pay the taxes to fund the project. *This requires a focus on the real benefits of this scientific endeavor.*

Chapter 11
Political Considerations

A. Background

The direct vicinity of the proposed ILC project area includes four counties and over a dozen additional political subdivisions that represent, in different ways and at different levels, the constituents who would be affected by its consideration, construction and operation. While current Fermilab projects are largely contained within the confines of federally controlled property, the ILC would be built directly adjacent to local communities, homes and workplaces.

In order for a new accelerator to become a successful project, there must be strong support and unity among the communities and the political subdivisions that represent the communities. Given the intellectually complicated definition of a next-generation particle accelerator project, this is a high hurdle to jump. Unlike proposing the construction of a new auto manufacturing plant, or a new major office complex, it is more difficult to visualize how an accelerator will affect the communities nearby. Traditional construction and industrial projects usually have direct and understandable benefits to the residents themselves.

From the beginning, Fermilab has recognized the need for effective communication of the need, value and purpose of a future accelerator. While high energy physics does not translate quickly into modern economic contribution or value to the average resident, and although it is more difficult to understand the quest for an undiscovered particle, Fermilab recognizes the need to continuously educate and inform and listen to the communities that surround it.

One need look no further than the SSC experience to understand how crucial long-term political support is to a future accelerator project.

B. Key Community Concerns

Most people take a lively proprietary interest in their immediate surroundings and have chosen where they live because that place has a particular appeal to them. With time, they establish emotional ownership of their property and neighborhood, and they often view projects of considerable magnitude as a threat. When such a threat becomes imminent, public opposition is quite predictable.

Task Force members hear presentation by Fermilab Deputy Director Young-Kee Kim

The ILC would be a huge project with significant impacts. Proponents focus on the positive aspects and see the potential negatives as obstacles to be overcome. There is no question that people who face the prospect of a five- to ten-acre industrial site arriving in their neighborhood at the expense of their or their neighbors' homes will object to being reduced to obstacles to something they perhaps don't understand or see the need for, or that they simply don't want.

The Task Force has struggled to identify how and when to share information, with whom, how best to disseminate it, and how to accommodate the fact that the project in question is only vaguely defined as to location (on its north/south axis) and other crucial details. It is quite a challenge to reach consensus on effective strategy.

It is easier to deal with a shopping center proposed for a vacant patch of land at the edge of town than to anticipate the most effective way to approach a 20-to-30-mile long tunnel 300 feet underground, full of subatomic particles zooming at close to the speed of light. In the first case, at least the territory is familiar and well traveled. In the second case, too much is unclear, nebulous and esoteric, with assurances about things most citizens don't adequately comprehend, coming from public agencies and government that, unfortunately, citizens perceive as less than forthcoming.

Make no mistake: nearly all neighbors love Fermilab as it quietly conducts research within its boundaries and provides the community with a wealth of environmental, recreational, educational and cultural benefits. However, push those boundaries north and south 10 miles, even 300 feet underground, and those affected will take notice. If the effect appears overstated, you merely need to attend a local zoning meeting discussing a variance involving

my view

Mollie Millen

Mollie Millen worked in the Kane County Development Department when Fermilab bid to host the Superconducting Super Collider in the 1980s.

It was a process that expanded her view of the laboratory and high-energy physics.

"I saw the pro-side of the SSC. I saw all the good things about it coming here," Millen said. She also understands the challenges to hosting the International Linear Collider.

The SSC project, which eventually went to Texas, gave Millen insight into particle physics and its value to the area. The process also reinforced her belief that all development proposals will face opposition.

She joined the ILC Citizens' Task Force to share that experience as well as experiences that she gained serving as a Kane County planning commissioner, former Kane County director of subdivisions and zoning, and as a community volunteer.

"I thought that after 20 years of watching public hearings and seeing the emotions, that I could bring some real-world experiences to the Task Force," Millen said. "You will always have opponents. The approval process is going to be emotional, and not all objections are going to be fact-based."

Millen stressed a need for Fermilab to start communicating with the public early and to provide as much information as available, especially about hot-button topics such as radiation. She stressed that a strong leader can rally objectors to almost any project, especially those offering few specifics to quell residents' concerns.

"One job of the Task Force was to begin preparing the public for what may happen," she said. "This will go a long way to helping, but this will not be easy. But I sure hope it happens."

"I can't imagine how any other industry on that site can bring us that world-wide recognition that the ILC would," Millen said. "Look at the notoriety that the deep tunnel gets in Chicago."

She doubts the general public will want to delve deeply into the science behind the ILC, but that residents will want to know the ILC's economic implications for the area, its role in keeping open space at Fermilab, and what the laboratory as a whole provides surrounding communities.

Along with working on the Task Force, Millen has learned about Fermilab through bird-watching hikes, visits to the art series shows and volunteering to restore the prairie.

"I was just awed by the whole thing," she said. "That we have this national laboratory in our backyard and that it offers so much for the community."

an above-ground swimming pool being proposed too close to a neighbor's bedroom window. Those tunnel access points will certainly get the public's attention and likely provide lively community theatre.

If political leadership cannot see the positive value and contribution that a future accelerator may bring, not only will they not support the project and help to work with their constituents, they will instead become formidable opposition.

C. Recommendations

It is helpful to remember that the initial vocal opposition to change generally moderates as people find many of their fears are unfounded. Most opposition is effectively engaged by early and frequent dialogue, complete information, honest and reliable answers to questions, and a worthy project presented by trustworthy people who support and believe in its value. Throughout this report, the Task Force has clearly established the need to reach out early and often with information, honestly and completely presented. Detailed recommendations follow.

- One effective way to get information to the public is through local government. There is a network already in place and local officials who know their territory and issues. They are in a position to help a project or fight it. They know the critical people in their towns to get on board to accomplish things. They can provide an outlet for positive or negative information on a proposal. As the ill-fated SSC showed, when whole communities organize against what they perceive as a common threat, they will oppose the threat vigorously and for as long as necessary. Local governmental entities should have high priority for early and ongoing communications regarding requirements, plans and possible impacts.
- To be successful, given the mix of voter preference to various political parties or independence, this project cannot afford to become a trophy for any one party. A broad base of bipartisan support for the project and funding as well as willingness to tolerate the inconvenience of developing it is a very critical success factor. While Fermilab has travelled this road of bipartisanship carefully in the recent past, much more attention will be required. A new accelerator will affect millions of Americans, not just a few thousand of the lab's closest neighbors.
- Because the project's conceptual development, funding, construction and operation would span several decades and innumerable terms of office at all levels, ongoing effective and constructive communication and education are essential. Strong long-term political leadership will be essential to achieving the vision of the ILC or any project of that magnitude. The project will have to prove, on a continual basis, that it represents the right investment.

Chapter 12

Community Engagement

A. Background

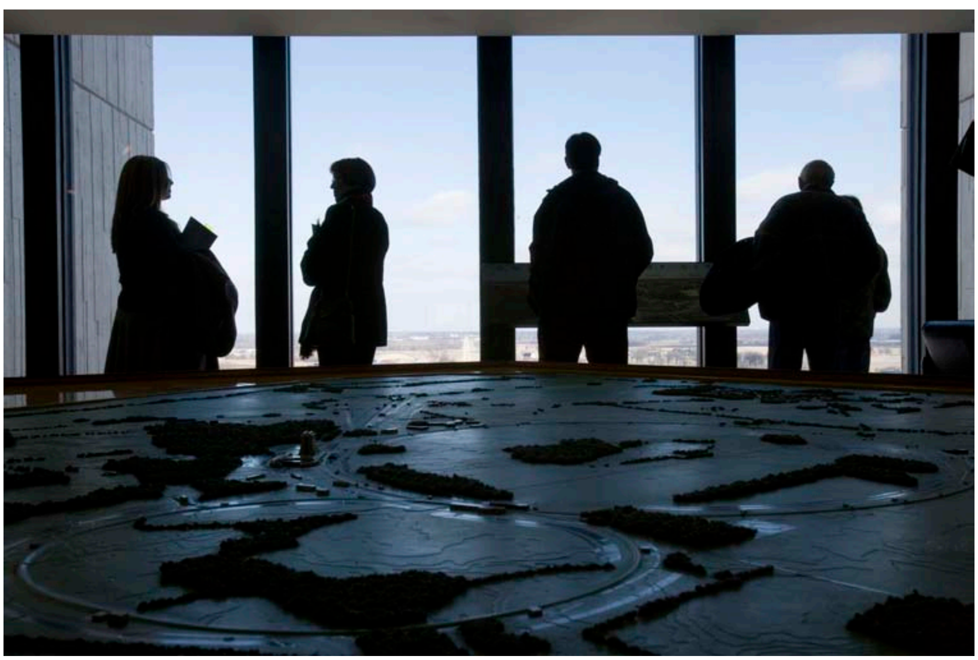
The mission of the Fermilab ILC Citizens' Task Force was to provide guidance and advice to Fermilab to ensure that community concerns and ideas are included in all public aspects of ILC planning, design, construction, and operation. The focus has been the potential benefit of doing things properly.

Fermilab seeks to foster collaboration and transparency in its operations, as a public entity, as a community partner, and as a global partner. We live in a democracy with high expectations for accountability, and where process often means as much as product. In recent years, Fermilab and its projects have demonstrated accountability consistently in reaching out to and listening to the laboratory's neighbors. Although the laboratory may have learned this approach through some difficult lessons such as the SSC, they have learned it, and it is now an integral part of how the laboratory operates.

Fermilab staff sought input into the planning of the ILC by working systemically at several community levels including, but not limited to, the international community of scientists and governments, the federal and state levels with involvement from many groups, and the regional and local levels. The Task Force organized early in the planning process in the fall of 2006 to focus on community input at local and regional levels.

Fermilab asked the Task Force for guidance and advice to ensure that community concerns and ideas are included in all public aspects of ILC planning and design. In doing so, the staff demonstrated its enthusiasm for the possibility to bring a next-generation accelerator to Fermilab as well as for openness in the planning process as they engaged and involved stakeholders in an effort to develop the best possible vision for future science and research possibilities.

B. Key Issues for Community Engagement



Task Force members tour Fermilab.

Perhaps the best way to outline community concerns and offer a way to plan for effective community engagement is to examine the types of conversations within the Task Force itself. These topics and dialogues are similar to those that will need to occur in a broader context in the community. Many of these topics were discussed earlier in the context of specific recommendations and are repeated here to highlight the types of possible public interactions.

Possible Site Orientation

The Task Force spent several meetings discussing possible site orientation choices. The intent was to position the ILC in a manner that was optimal for its operation, and the least disruptive to the area and residents. The Task Force tried to incorporate land for the above-ground support structures that were most possibly attainable for this project. The most interesting part of this exercise was that the Task Force moved from this discussion to planning a vision of what the specific land requirements and possible structures might look like in a manner that would enhance the surrounding area. As a group, the Task Force went from ta pragmatic and utilitarian beginning to a discussion envisioning maintaining and enhancing the neighborhoods through the placement of the above ground support structures. This discussion also led to questions about property rights and impacts on specific property owners.

Task Force members Emily Demar, Mike Herlihy, Harry Weertz, and Phil Bus explore possible placement of the tunnel and surface facilities

Appearance, Size, Other Uses of Possible Access Buildings and Sizes, Configurations, Aesthetics, and Locations of Access Buildings and Tunnels

The discussions of this topic took place over the course of several meetings. The results still seem rather intangible, as project designers do not yet know specifics for these buildings in any great detail. Task Force discussions included estimates on uses of the structures, possible varied configurations of land amounts needed, possibilities including partially underground structures to multiple above ground structures. These discussions would need to continue in a very public way when the specific needs of the project are better determined. Again, the tenor of the discussion was how to create these structures in a visionary way that enhances the neighborhoods where they occur.

The actual tunnels need to be explained in detail, so that people can better grasp how far down the tunnel is located, what the access tunnels would be like. Neighbors need to understand safety precautions taken for scientists, maintenance personnel and the public.

Visuals to Explain the Science

This topic should be released in a series of articles in the multiple media formats discussed in this section. This presentation must include effective graphics and descriptions (similar to those the Task Force received) written so that the public can easily understand the scientific goals from both a theoretical and practical perspective.

Major Pieces and Parts of the Collider Itself (Including Parts Onsite at Fermilab vs. Parts Offsite)

Again, visuals would help with this discussion and should include references not only to the structures both on and offsite but also the connections of the new accelerator both locally and internationally. This section should also include the pictures and descriptions of the boring tools and process to create the tunnels. Tours should be available to the public of the tunnels before the machine is operational in order to familiarize them with this general concept and to put them more at ease about the finished product (and to better understand the science involved).

Why is the Collider Here vs. Farther West or at Another Location?

The Task Force discussed the asset of the current Fermilab facilities, the infrastructure already in place, the favorable underground geography, the international culture already in existence, and the projected lower cost of building in this location.

Property Values and Property Rights

These topics need further investigation, possible legislative action, and a very open discussion with the public. This discussion would best include the impact that Fermilab and other facilities have on surrounding properties both in the immediate vicinity and in the region. It needs to be determined to what extent having such a facility is truly an asset. Any property should ideally be obtained through voluntary purchase, as that is one important aspect of a democracy. This process needs to be as transparent to the public as possible.

Safety and Radiation

This is most meaningfully discussed when impact is presented in practical day-to-day language. Accelerator designers need to determine how much radiation the accelerator would generate, how radioactive material would be disposed of, and the processes for daily safety and emergency procedures outlined for the public. People are most put at ease when there are comparative and understandable explanations from similar situations. The Task Force is very aware of the level of concern from citizens about the radiation situation in nearby West Chicago. The safety issues of this project need to be well presented publicly on repeated occasions.

Noise During Construction and Operation

The Task Force discussed the real economic asset of this project as bringing new jobs, construction, and ancillary supportive industry to this area. They should be highlighted. So too should be the implications of construction and operation of this facility. One of the best communication pieces in this area is to have a well advertised and communicated troubleshooting contact source (phone number, website) where regular updates are provided on construction progress and where people can get quick response to their concerns. People seem to understand that patience is required during construction but are better able to cope with it if they are informed and reminded of the benefits throughout the process.

Feeling Informed About the Project and Believing Their Opinions are Sought and Heard

This entails setting up the mechanisms for communications in a variety of formats discussed throughout this section: Websites with updates, podcasts showing processes and used for education, an email system providing updates, working with media through regular news releases, providing forums and other public discussions for people to share questions and air concerns, a hotline for expressing concerns, etc. The key is to set up reliable mechanisms that respond promptly to concerns and questions.

Benefits of Project to the Community and Economic Issues, Maximizing Economic Benefits

Aside from hosting an international project of cutting-edge science, the economic benefits of this project both locally and regionally should be regularly highlighted. Many of these benefits have already been listed. Add to this list the calculation of the compounding effect of dollars spent and re-spent in the local economy. Any data that can be formulated and highlighted helps people to better comprehend this type of project as an asset on its own and as an asset through supportive industries and the infusion of dollars into the local and regional economies. These projections may include a cost/benefit analysis that also highlights what would be lost should this project not end up in this area or in the United States.

Environmental Issues and Benefits, Including Carbon Footprint of Project

This requires further analysis, especially the projection of impact on the carbon footprint of the project. This would best be presented through an explanation that uses the positive experience of Fermilab with regard to the environment. The estimates of the impact of the ILC should be presented in a parallel comparative fashion to Fermilab. Again, Fermilab was built with the vision of environmental sustainability before it was fashionable. Fermilab was green before green was cool and popular, and the Task Force discussed similar expectations for future projects.

How the ILC May Affect Community Access to Fermilab

While this needs to be more specifically determined, this discussion needs to be framed in a similar fashion to our overall discussion that a future accelerator will only enhance the Fermilab facility and vice versa. There will be an impact. This impact will either be planned in a least invasive or in a most enhancing way. The vision must be shared with the public, and as based on the experience with Fermilab, this would be an excellent venue to gain input from the public in planning around the science and technology of this project.

C. Recommendations

Task Force Members Herman White and Charles McCormick

The optimal relationship for Fermilab to maintain with its neighboring communities has always been symbiotic, with benefits for both laboratory and community. Constructing and operating a future accelerator at Fermilab must be based upon developing and strengthening this type of relationship. The Task Force has noted the many benefits for neighboring communities that would result from building a new accelerator at Fermilab. It is obviously important that those benefits be widely accepted within the region as clearly outweighing the costs, both real and perceived, resulting from the location, construction and operation of the new machine. It is equally important to minimize those costs to the greatest extent possible, and to the satisfaction of local communities as far as possible.

Perhaps less well appreciated is the importance of broad community support. The "I" in ILC stands for International. Physicists from all over the world would come to Fermilab to work. A local community that embraces both the work done there, and the people who do it, would help to make the ILC a more desirable, productive project to work on.

In the end, the type of mutually beneficial relationship that Fermilab and the surrounding communities would hope for with a future accelerator can only come about if communication and accommodation become cornerstones for that relationship. It is important for the laboratory to provide accurate and readily accessible public information on all aspects of the project, with emphasis on benefits, costs and local impact. As with any symbiotic relationship, it must be a two-way interchange, with each side accommodating the other to maximize benefit for both.

This report endeavors to provide Fermilab with detailed insights into the issues and concerns of the community that need to be understood, discussed and considered for any successful project. Below are detailed recommendations for how this should be achieved.

1. Identify Audiences

The Task Force recommends that Fermilab identify all stakeholder organizations, groups, and communities that might be affected by the planning, construction, and operation of the ILC. These groups can include, but are not limited to, the following:

Local Stakeholders

Local communities will most likely feel the greatest direct impact of the construction and operation of the ILC.

- Local property owners and municipalities, especially those in the construction path of the ILC and locations likely to see long-term and permanent housing of ILC employees
- Residents of Kane and DuPage counties
- Locally-based employees and contractors, especially those who may qualify for future construction and operation contracts

Regional Stakeholders

These stakeholders will want to provide input and receive information on issues of interest to the region around Fermilab's northern Illinois location.

- Transportation officials and authorities, especially those representing transportation systems in northern Illinois that may be directly affected by the construction of a future accelerator
- Regional construction firms and contractors, especially those who may qualify for future construction and operation contracts
- Regional hospitality industry representatives, especially during the operation of a global accelerator that would require housing of and subsistence for periodic visitors

National Stakeholders

Fermilab will need to inform state and federal stakeholders of many national and global issues related to a future accelerator, including support for U.S. funding, national and international scientific and funding collaborations, and global direction of the construction and operation.

- State and federal government officials
- The Department of Energy
- The National Science Foundation and other related national science agencies
- National construction contractors, especially those who may qualify for future construction and operation contracts
- Scientific community
- Tax-paying citizens.

International Stakeholders

Because the ILC is a global effort, all potential international partners, companies and organizations should be included in the communication efforts for the ILC project.

- International physics and engineering organizations involved in the design, construction and operation of the future accelerator
- International governments, especially those who directly fund and/or make in-kind contributions to the accelerator
- International educational and research institutions, primarily those who would be involved with the science mission of the accelerator
- International construction firms, especially those who may qualify for future construction and operation contracts.

The timing of communication efforts for each of these stakeholders will be different for each group. A communication plan addressing each should be created and periodically reviewed throughout the design, construction, and operation of a future accelerator.

2. Plan the Timing of Communication Efforts

Communication should be part of the continuous efforts of both the Fermilab and ILC Public Affairs organizations. Communication must occur throughout the life of the project. There will never be one single "good time" to talk to the public and to stakeholders about a future accelerator. ILC Task Force recommendations include the following:

- Communication to local stakeholders has already begun through the ILC Community Task Force. Fermilab should build upon the community connections forged through this group.
- A strong communications plan should use minor and major project design and development milestones as opportunities for communication.
- Start regular communications with all stakeholders early and repeat them often. People move in and out of the Fermilab area, people have many

competing priorities for their time and attention, and design and development plans naturally change over time. Frequency and message consistency will be needed to keep the information in front of the public, especially those in the local and regional areas around Fermilab.

Once Fermilab has determined the timing of communication efforts, staff should develop a robust plan using many different communication methods and outlets.

3. Employ Various Communication Methods

Communication methods for a future accelerator should incorporate diverse outreach tools, media, and venues because people today acquire information from a variety of sources. Staff should develop visual communication tools and information to use in multiple media types and communication formats.

An obvious outlet for accelerator-related information is the traditional news media, including newspapers, science journals, television stations and radio stations including public radio and television. However, more and more people do not use traditional media as their primary news and information sources, so other communication methods may include the following:

- Dedicated project Website
    - Regularly updated information
    - A scientist-led question/answer section
    - Links to visual images and videos from exterior sources
    - Weblogs (blogs)
    - Regularly updated project podcasts and vodcasts
    - Videos about the science, the accelerator project, and Fermilab discoveries
    - PowerPoint presentations
    - Visual presentations to show the process of siting the accelerator and the extent of possible sites
    - Visuals to explain the history of community concerns regarding the Superconducting Supercollider and other similar controversial projects
    - Images, drawings of major pieces/parts of the collider itself (including/parts onsite at Fermilab and parts offsite)
- Teacher education efforts and a speaker's bureau led by the Fermilab Education Department
- A DVD-format video about the project that can be used at community and adult organization meetings (Kiwanis, Rotary, Lions)
- Ongoing meetings, presentations, stakeholder discussions and community forums held according to the communication timing plan
- Periodic update letters addressed directly to residents and businesses along and near the accelerator path
- Periodic updates via newsletters to local communities and newsletter articles written for use by organizations that publish their own newsletters
- Outreach to informal locations "where the people are" such as parks, festivals, fairs, malls, libraries
- Brochures to explain the science, the project, and particle physics in general, available at outreach events and upon request
- Copies of reports made available to local libraries, community centers, and upon request by individuals
- Fermilab Open House in the format of the periodic Argonne Open House.
- A dedicated phone number for a recorded message with short project updates
- A phone number for people to reach a person who can answer questions - While this may seem difficult given the global scale of the project, it will show stakeholders, especially those who are local, that Fermilab cares about their input and opinions.

We recommend that website content be reusable in many formats. For example, images can be used in PowerPoint presentations and brochures. Descriptions written for periodic newsletter updates can be used for a recorded phone message.

4. Explain the Science and Explain the Accelerator Project

The proposed ILC project represents basic research in the fundamental properties of matter and holds potential for unanticipated discoveries in both science and technology.

Communication needs to emphasize what scientists hope to learn from a future accelerator project and convey to the community the value of scientific exploration in laymen's terms, differentiating between applied science and basic research and explaining the benefits of both. Messages should be clear, easy to read and easy to receive. Avoid overusing scientific jargon and acronyms.

Task Force member Dan Lobbes.

- Use simple tools to get points across, such as uncomplicated language, comparisons, analogies, and graphical illustrations. Simple language is effective in explaining complex ideas. Relating scientific principles or objectives to everyday experiences or commonly understood themes can help illustrate a point. For example, explaining Dark Matter in the context of black and color jellybeans as was recently done at Fermilab is fun, and speaks volumes in explaining the point being made.
- Support the project objectives with real world-experience (both successes and lessons learned). Illustrate for the community the known experience on complex technical topics lends a measure of confidence in planning and design. For instance, comparisons to well-known real-world examples (such as the Chicago Metropolitan Water Reclamation District's Deep Tunnel Project) can demonstrate the available existing knowledge in specific areas, such as underground tunneling.
- Help the community and nation grasp the importance of science discoveries. Offering examples of discoveries and technologies that have come from basic research at Fermilab in particular, such as proton therapy or MRI technology, helps people assess the value of doing science at Fermilab and the potential for future scientific contributions. Sharing Fermilab scientific contributions puts the successes in a positive light. Augment any discussions with examples from basic research at the (also local) Argonne National Laboratory, as appropriate.
- Help the community grasp the importance *to the community* of local science discoveries. It is a significant point of pride that science discoveries have been made at Fermilab. Research here has long been at the forefront of international science, and Fermilab has played a key role in maintaining America's leadership in science, especially in particle physics. This leadership position is about to be lost when the Tevatron ceases operation. This has not just been a source of national pride and discovery but has provided amazing opportunities and resources to local schools.

5. Start the Discussion Broadly

Begin the science and project discussions in a broad context to provide a framework for comprehending specific details that follow. Historical context may help set the stage for the project. Understanding what has been done before and what has led to where we are can help clarify the need or desire for the project. Identifying the major project components (e.g., conception, design, planning, schedule, budget, participants, construction and operation) defines project scope and scale. General location provides a sense of place and proximity.

6. Explain the Rationale for Locating the ILC at Fermilab

The public and interested communities need to be informed about why Fermilab is being considered to host a future accelerator. It is important that public interaction contribute to decision-making. The opportunity for public input should address both the issues considered and the decision-making process itself. In order to gain public trust and acceptance of the project, Fermilab should involve the public and ask for their input before any final hosting decision is made.

In considering the suitability of Fermilab as the host site for the a future accelerator, DOE should address the following issues before rendering any final decision:

- Clarify the limitations and requirements for sites. The ILC, for example, has certain technical needs, and the underlying geology of a selected site also must meet certain requirements and characteristics (e.g. length of tunnel, periodic surface structures, linearity, north-south orientation, cryogenics, construction access, emergency exits). Any location must possess the characteristics to provide a viable site.
- Establish the exhaustive and multifaceted rationale for locating and centering the facility at Fermilab, including technical and economic criteria. Openly discuss and compare the pros and cons of a Fermilab-centered site.
- Consider alternatives including green-field sites at other locations in the U.S.
- Include any potential future expansions or revisions such as the possibility of extending the total length of tunnel.
- Conduct analyses to address the issues and concerns that residents will raise before the decision is made (radiation, safety, trash, light and noise, traffic, water quality, effects on property values) and have real answers available.
- Consider all input from diverse publics as an integral part of the decision process.
- Demonstrate that the decision to site the accelerator at Fermilab was not automatic, and that the funding agencies considered and evaluated various options before making the decision. Show that other viable options for U.S. sites have been identified and considered in terms of costs and benefits. A comparison of those options should clearly indicate that Fermilab is the best site. Illuminate the relative advantages and disadvantages of hosting the accelerator at Fermilab for both the project and the affected communities, including issues that are not directly quantifiable.
- Describe how the hosting decision was made, who were the players and decision-makers, and the role of the international scientific community in the decision.
- Recognize that decision-makers heard and fully considered community concerns about locating the accelerator and that they acknowledged and addressed public input.

Task Force members Harry Weertz and Michele Nichols-Yehling.

7. Explain the Uncertainty

As of the writing of this report, there are many uncertainties associated with a future accelerator at Fermilab. We recommend that Fermilab describe for the community the variables and uncertainties that an accelerator project entails and the efforts to address those uncertainties. For example:

- **Community participation:** Chartering and implementing the Fermilab ILC Citizens' Task Force and writing this report is helping to address that uncertainty;
- **Siting the project:** Sharing what is known, describing what needs to be decided and identifying community concerns can engender useful feedback for siting consideration and planning;
- **Timeline:** Particularly in the early stages of a project, the community needs to understand that there are unknowns in the schedule that depend upon other variables, such as budgets, collaborative agreements, or technology and scientific results. Engaging the community openly at appropriate intervals can help the community understand the timeline and influencing factors;
- **Funding:** United States Congressional budget decisions affect large U.S. science projects, as do the funding decisions of participating governments and scientific partners. The community and nation may want to understand how these variables must align for a successful project to occur;
- **Priorities:** Disparate priorities among scientific collaborations exist and need to be resolved;
- **Governance:** Collaborators need to develop a structure of governance for an international project such as the ILC. Other international collaborations, such as the International Space Station or ITER may provide workable examples.

8. Build & Maintain Trust

Building and maintaining community trust begins with an open working relationship with the community. Inviting inquiry and allowing for community involvement creates two-way communication channels between Fermilab and the public. We recommend the following:

- Establish an open and transparent process.
- Be proactive to get factual information about key community issues to the public as early in the process as possible. Be forthcoming with project details and answer questions from the public. When an exact answer is unknown, say so and say why.
- Recognize that every question from the public is important and deserves an answer. Do not minimize or discount the importance of public concerns
- Recognize the power of misinformation and its ability to spread. React quickly to correct misinformation through a variety of channels.

The communication process to address specific concerns of the public might include the following steps:

- Anticipate and identify possible community concerns.
- Plan the project to address and mitigate the concerns.
- Demonstrate that Fermilab is listening to and responding promptly to community concerns.
- Provide factual information to be ready to answer concerns.
- Communicate actions being taken in response to community concerns.
- Put worst-case possibilities in layman's terms.
- Equate information to everyday life examples.

Frequently Asked Questions to be addressed in the various communication tools might include:

- What kinds of particles are colliding in this particle collider? Are they radioactive?
- Where does the radiation come from?
- What is radiation?

- Will radiation affect the ground water?
- What are the levels of radiation produced during operation of the accelerator? (Compare to medical x-rays, etc.)
- How might radiation affect my family and me?
- How does Fermilab protect the community from radiation?
- Will the accelerator pass under or near my house?
- Will there be noise during construction or operation phases?
- How long will construction last, and what will happen if one or more of the construction phases are delayed after it starts?
- Will construction and tunneling affect my pets?
- How will this project affect my property values?
- What are my property rights in relation to the construction or operation of the accelerator?
- What safety measures are in place with regard to construction or operation of the accelerator, not only for employees but also for the communities involved?

9. Acknowledge the Past and Potential Negatives

Learn from the past. Acknowledge past experiences with Kerr-McGee in West Chicago, the Superconducting Supercollider, and the development of Fermilab, and compare these examples to the proposed accelerator project. Prepare for possible negative reactions to the project based on these historical experiences:

- Acknowledge the West Chicago experience with radioactive thorium and explain how the accelerator project differs. Explain the differences in radiation sources and emission and the safety measures planned for the project.
- Learn from local opposition to the SSC in the 1980s. Community involvement and an open communication process—including the rapid response to correct misinformation—can engender the community understanding needed for a successful project.
- Acknowledge the experience of the creation of Fermilab in the 1960s and the envelopment of the town of Weston. Demonstrate how Fermilab's stewardship of the prairie and open space on its grounds adds to the quality of life in the surrounding communities. The grounds are available for residents to enjoy recreational and educational activities. Discuss the annual homecoming held for the previous residents and farmers of the town.

10. Make Public Participation Interesting and Engaging

Understanding all aspects of the ILC project is essential to garnering community interest at all levels. The project plan should encourage community participation and explore ways to present information so that it captures the community's imagination. Engaging the community in a shared mission will help to heighten awareness, forge working relationships and create a sense of ownership in the long-term success of the project.

- Find ways to engage the public in the project. The Fermilab Citizens' Task Force is a great beginning to develop a strategy for public participation. Continue the efforts throughout the project's life.
- Community outreach should be interesting and engaging. Communicators for the project need to convey a sense of wonder to ignite community interest and a sense of purpose for scientific exploration and discovery. For instance, creative presentations capture the imagination, and engaging the audience affirms the learning experience. Fermilab's Mr. Freeze show, for example, captivates the audience with theatrics while demonstrating scientific principles.

Chapter 13
Summary

This report attempts to outline the key community concerns and recommendations that resulted from a year-long process in which local stakeholders addressed the possibilities and ramifications of bringing a next-generation accelerator to Fermilab. Fermilab did not convene the Task Force to be cheerleaders for the laboratory or for its future. Indeed, members were carefully selected by other interested stakeholders to represent a diverse range of perspectives and interests from the region where a future accelerator would be sited and that it could affect. Nevertheless, over the course of this project, the Task Force developed a deep appreciation for the scientific research at Fermilab and the way that it is carried out. The Task Force fully appreciates the value of basic research and discovery and of maintaining (or perhaps regaining) America's leadership in science. However, this has not translated into automatic support for the ILC.

In general, the Task Force recognizes that bringing a future accelerator to Fermilab could be beneficial to the United States and to the region. However, as detailed in this report, doing so will not be an easy process. Beyond the obvious political and financial hurdles, there are many legitimate community concerns that must be directly addressed and overcome.

The goal of the many detailed recommendations in this report is to help Fermilab design a legitimate and transparent decision-making process to provide the greatest chance of building a next-generation accelerator that has the least negative and most positive impact on the community. Paramount among these recommendations are:

- Develop a sound rationale and justification for bringing a next-generation accelerator to Fermilab that is primarily based on the science and other benefits to the entire U.S. and not primarily on the local economic benefits generated by the distribution of tax dollars.
- Look for ways to site surface facilities outside Fermilab boundaries so that they have the least negative impact on the community and potentially bring some benefit.
- Do everything possible to make all land transfers and easements fair, equitable and voluntary.
- Recognize that community priorities do not always match technical priorities and that some steps may need to be reordered to ensure public understanding and input on key issues.
- Keep environmental impacts to a minimum, particularly regarding local water.
- Learn from the past, particularly the SSC experience, and apply those lessons to keep from falling into the same traps.
- Design with the end in mind to make decommissioning efficient and minimize community impacts.

And most important:

- Inform and engage the community at every step of the process and use their input to maximize the opportunities for a successful outcome for the nation, the laboratory and the local community.

Appendices

Appendix A.

Task Force Members

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Naperville

Marge Brown
Wayne Park Commission
Wayne

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Mayor
City of Warrenville

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County Development and Amateur Cosmologist
Batavia

John M. Carlson
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Geneva

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Stay-at-home mother and freelance writer
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Campton Township

Brett R. Larson
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President, Larson-Becker Co., groundwater industry distributor
Batavia

Dan Lobbes
The Conservation Foundation staff member, Fermilab neighbor
Batavia

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Hendrik Weerts
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Scientist, Fermilab National Accelerator Laboratory
Naperville

Michelle Yehling
Museum Educator
Aurora

Jim Zay
DuPage County Board Member
Carol Stream

Appendix B.

Task Force Meetings and Topics

January 27, 2007 – Retreat and Tour

March 1, 2007 – Particle Physics

- Overview of Particle Physics and Fermilab's contribution
- Introduction of Meeting Calendar

March 27, 2007 – The ILC

- Introduction to the ILC

May 1, 2007 – The Global Design Effort

- Conversation with GDE Director Barry Barish

May 22, 2007 – Property Rights and Locating the ILC at Fermilab

- Understanding legal implications of property rights
- Identify criteria for siting
- Best orientations for the tunnel

June 26, 2007 – Environmental Issues

- Managing potential environmental impacts of the ILC

July 24, 2007 – Construction-Related Issues

- Timing
- Safety
- Mitigating impacts

September 25, 2007 – Surface Structures

- Facility sizes and needs
- Aesthetic issues
- Features that could be included to benefit communities

October 23, 2007 – Economic Issues

- Understanding economic impacts of Fermilab
- Potential economic impacts of the ILC

November 27, 2007 – Deep Tunnel Project and Final Report Topics

- Lessons learned from the Deep Tunnel Project in Chicago
- Identification of key final report topics

January 22, 2008 – Planning for the Final Report

February 26, 2008 – Review Annotated Outline of Final Report

March 25, 2008 – Review of Draft Final Report

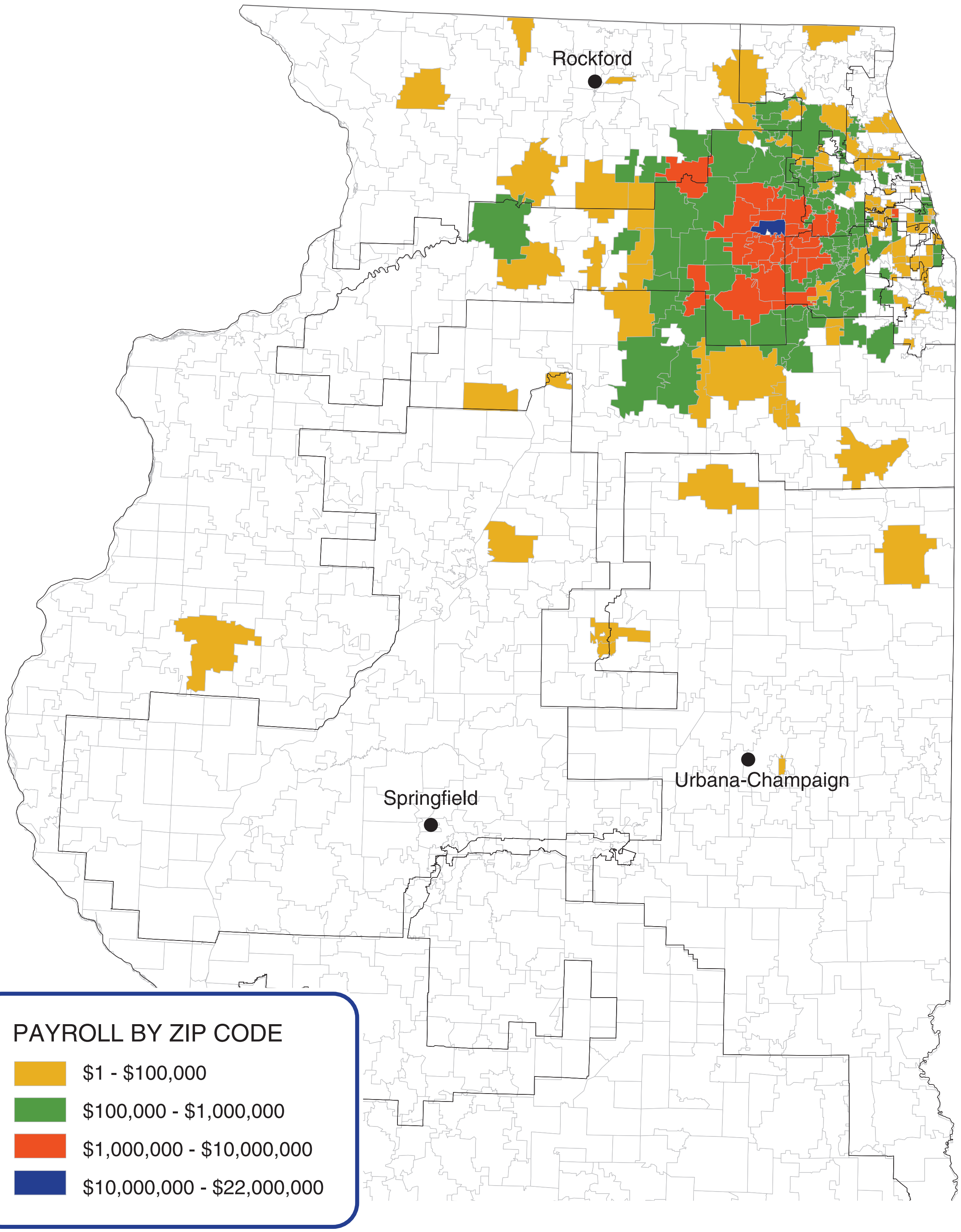
April 30, 2008 – Revisions to Final Report

June 3, 2008 – Final Meeting, Presentation of Report

Fermilab

PAYROLL DISTRIBUTION FY2007

Total = $150,760,670



Fermilab

Fermilab and the Community

Economic Impacts

Annual federal research budget	$350 million
Employees	
• Total	1,960
• Living in Fox Valley or western DuPage County	90 percent
• With Ph.D.'s	463
• Scientists	380
• Computer professionals	280
• Engineers	300
• Technicians/technical specialists	530
• Serving as community volunteers or on community public boards	dozens
Payroll	$150.7 million
Illinois income tax withheld	4.0 million
Visiting researchers and college students	
• Total	2,300
• Out-of-state and international	1,844
• In-state academic	456
• In-state industrial	3
Subcontractors working part-time on site	hundreds
Laboratory purchases from Illinois businesses	FY2006
• Total	$70,340,000
• Women-owned businesses	$ 7,618,000
• Minority-owned businesses	$ 4,339,545
• Construction spending	$18,169,000
• Percentage of total purchases in Illinois	59 percent

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Appendix D.

Glossary

Antimatter
A form of matter in which each particle has the opposite set of quantum properties (such as electric charge) to its ordinary matter counterpart. For example, an anti-electron, or positron, has the same mass as an electron but a positive charge instead of a negative charge.

Argonne National Laboratory
The nation's first national laboratory and a current U.S. Department of Energy multiprogram laboratory located in DuPage County, Illinois.

CATCH
Citizens Against the Collider Here, a local citizens' group formed in the late 1980s to oppose the location of the SSC in northern Illinois.

CERN
The world's largest particle physics laboratory, located outside Geneva Switzerland, home of the Large Hadron Collider.

Cryogenics
The production of very low temperatures (below -238 °F) and the study of the behavior of materials at those temperatures.

Dark energy
A hypothetical form of energy that permeates all of space and tends to increase the rate of expansion of the universe.

Dark matter
A hypothetical form of matter that does not emit or reflect enough electromagnetic radiation to be observed directly, but whose presence can be inferred from gravitational effects on visible matter.

DOE
United States Department of Energy

Electron
A fundamental subatomic particle that carries a negative electric charge and orbits the nucleus of an atom.

Electron volt
One electron volt is the amount of energy equivalent to one volt multiplied by the charge of a single electron (This is a very small amount of energy.)

Fermilab
Fermi National Accelerator Laboratory

GDE
The Global Design Effort, an international team of physicists and engineers coordinating the planning the proposed International Linear Collider.

GeV
One billion electron volts

High-Energy Physics or Particle Physics
The study of the elementary constituents of matter and the interactions between them. Many elementary particles do not occur under normal circumstances in nature, but are created during energetic collisions of other particles, as occurs in particle accelerators.

ILC
The International Linear Collider, a proposed successor to the Large Hadron Collider. The ILC would use two opposing linear accelerators to create collisions between beams of electrons and positrons.

ITER
An international project located in France to research how fusion could be used to generate electrical power and to gain the necessary data to design and operate the first electricity-producing plant.

JPARC
The Japan Proton Accelerator Research Complex, a particle physics research center in Japan.

Km
Kilometer, a length of measurement equal to 0.62 miles.

LHC
The Large Hadron Collider in Geneva, Switzerland, a circular collider 27 km in circumference designed to produce proton-proton collisions at an energy of 7 TeV per beam. It will begin operations in late 2008.

Linear Accelerator
A linear accelerators, or linac, accelerates particles in a straight line with a target at one end. Some linear colliders create collisions between two opposing beams of particles.

MINOS
The Main Injector Neutrino Oscillation Search, a long-baseline neutrino experiment designed to observe the phenomena of neutrino oscillations, an effect related to neutrino mass. MINOS uses two detectors, one located at Fermilab, at the source of the neutrinos, and the other located 450 miles away, in Soudan, Minnesota

NuMI
Neutrinos at the Main Injector is a facility at Fermilab that uses protons from the Main Injector accelerator to produce an intense beam of neutrinos for the MINOS Experiment

MRI
Magnetic Resonance Imaging, a medical imaging technique used to visualize the structure and function of the body.

Particle Accelerator
A device that uses electric fields to propel electrically charged particles to high energies.

Particle Collider
A type of a particle accelerator that creates high-energy collisions between particles in directed beams, producing showers of other particles for detection and analysis.

PET
Positron Emission Tomography, a nuclear medicine imaging technique that produces a three-dimensional image or map of functional processes in the body.

Project X
A proposed linear accelerator at Fermilab with the currently planned characteristics of the ILC combined with Fermilab's existing Recycler Ring and the Main Injector accelerator. Cryomodules, radio-frequency distribution, cryogenics and instrumentation for the linac would be the same as or similar to those used in the ILC at a scale of about one percent of a full ILC linac.

Proton
A stable elementary particle made of quarks that is a component of all atomic nuclei and carries a positive charge equal to that of the electron's negative charge.

Positron
An elementary particle of antimatter that has the same mass as an electron but the opposite electrical charge

SSC
Superconducting Super Collider

TeV
1 trillion electron volts

Tevatron
The world's highest-energy particle accelerator, built at Fermilab in 1983, can reach an energy level of 2 trillion electron volts (TeV) in its proton-antiproton collisions. Built in 1983 and located at Fermilab, the Tevatron will cease operations in about 2010 when the LHC starts operating at CERN.