Prospects for an International Linear Collider: the Fermilab Perspective

Steve Holmes

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Outline

• The Fermilab Long Range Plan
• ILC Physics Opportunities
• International Context
• ILC Performance Parameters and Layouts
• ILC Technology Requirements and Challenges
• Fermilab Activities and the Inter/National Context
The Fermilab Long Range Plan
Vision

• The Fermilab Director established the Fermilab Long Range Planning Committee (FLRPC) in the spring of 2003. The committee report is available at: http://www.fnal.gov/directorate/Longrange/Long_range_planning.html

• The overarching vision is that Fermilab will remain the primary site for accelerator-based particle physics in the U.S. in the next decade and beyond. Two fulfillments of this vision are presented in the report:
  – As host to an International Linear Collider Fermilab would be established as a world center for the physics of the energy frontier for decades.
  – If the linear collider is constructed elsewhere, or delayed, Fermilab would strive to become a world center of excellence in neutrino physics, based on a (SClinac) multi-MW “Proton Driver”, still with significant LC participation.

• The ILC is established within the FLRP as the primary goal. However, in the event of delay the Proton Driver would provide a forefront physics program while at the same time advancing preparations for an ILC.
The Fermilab Long Range Plan
Recommendations

• In support of this vision the FLRPC report offers a series of recommendations:
  – Linear Collider recommendations aim at establishing leadership in two significant technical areas (e.g. linac and sources), playing a leading role in the major engineering systems test, and taking the steps necessary to allow Fermilab to make a strong bid to become LC host laboratory.
    ➢ Goal is to establish Fermilab as a leading contender for host lab or significant contributor if sited elsewhere.
  – Proton Driver recommendations aim at establishing the physics case, and developing the SC linac technology to the point that a cost benefit analysis can be done and the linac/synchrotron technology selection made.
    ➢ Leading to documentation sufficient to support CD-0 (mission need).

Fermilab is pursuing linear collider and proton driver R&D in parallel. The cold decision allows close alignment of these paths.
ILC Physics Opportunities
Electroweak Symmetry Breaking

• What causes the Higgs field?
  – The data so far is consistent with a Standard Model Higgs, but …

• We will know more in a few years:
  – Improved top and W mass measurements from the Tevatron
  – If a SM Higgs exists, either it will be seen at the Tevatron or it will be discovered with the first substantial data samples from the LHC.

⇒ However, discovery of a Higgs boson is just the start ….
ILC Physics Opportunities
Electroweak Symmetry Breaking

Once the “Higgs boson” is discovered at the Tevatron or LHC, then what?...

• Does the Higgs generate
  – W and Z masses?
  – fermion masses?
  – its own mass?

• Does it have $J^{PC} = 0^{++}$?

• Are there multiple Higgs bosons (as predicted in Supersymmetric (SUSY) models)?

• Is it accompanied by other new particles?
ILC Physics Opportunities
Exploration of the Higgs sector with a Linear Collider

• $e^+e^- \rightarrow Z H$ gives a large clean sample of tagged Higgs bosons independent of decay mode.
  – LHC makes good measurements of relative branching ratios.
  – ILC makes few % measurements of many branching ratios.

• ILC and LHC together will be very powerful in deciding what kind of Higgs it is.
  – Couplings to fermions are very different in SUSY models.
  – ILC separates SUSY Higgs from SM Higgs up to very high $M_A$.
  – ILC can measure spin-parity of Higgs.
• Are the four forces unified at very high energy?
  – In the Standard Model the three forces are not quite unified

• Why is gravity so weak?
  – Why is $F_{\text{grav}} \approx 10^{-42} \times F_{\text{elec}}$?
  – Why is $M_w << M_{\text{Pl}}$?
  – Why is $M_H << M_{\text{Pl}}$?

$\Rightarrow$ We are looking for a mechanism to stabilize the Higgs mass and keep it from rising to the Planck scale.
ILC Physics Opportunities
Unification of forces: Some possible answers

• Hidden Extra Dimensions
  – They can be used to disperse the intrinsic strength of gravity, making it seem weak to us.

• Supersymmetry
  – Stabilizes the Higgs mass.
  – Is necessary in string theory.
  – Leads to unification of gauge forces.
  – Fits as dark matter.

• Variations (e.g., technicolor)
  – Higgs boson may be fermion-pair composite, analogous to Cooper pairs

• Something we have not thought of yet
International Linear Collider View

- An internationally constructed and operated electron-positron linear collider, with an initial center-of-mass energy of 500 GeV, has received strong endorsement by advisory committees in North America, Europe, and Asia as the next large High Energy Physics facility beyond LHC.

- An international panel, under the auspices of ICFA, has established performance goals (next slide) as meeting the needs of the world HEP community. The performance document is available at:

  http://www.fnal.gov/directorate/icfa/LC_parameters.pdf

- The International Technology Recommendation Panel has recommended, and ICFA has accepted, that the International Linear Collider design be based on superconducting rf technology.
International Performance Specification

- Initial maximum energy of 500 GeV, operable over the range 200-500 GeV for physics running.

- Equivalent (scaled by 500 GeV/√s) integrated luminosity for the first four years after commissioning of 500 fb⁻¹.

- Ability to perform energy scans with minimal changeover times.

- Beam energy stability and precision of 0.1%.

- Capability of 80% electron beam polarization over the range 200-500 GeV.

- Two interaction regions, at least one of which allows for a crossing angle enabling γγ collisions.

- Ability to operate at 90 GeV for calibration running.

- Machine upgradeable to approximately 1 TeV.
International Linear Collider
Physical Layouts and Configurations

Two concepts developed to date:
- TESLA TDR
- USLCSG Study

Possible considerations:
- Energy/luminosity tradeoffs at "500" GeV
- Undulator vs. conventional e\(^+\) source
- Upgrade energy
- Head on vs. crossing angle IR
- Upgrade injector requirements
- One vs two tunnels

Next iteration = best of both
# ILC Performance Parameters

<table>
<thead>
<tr>
<th></th>
<th>TESLA/TRC</th>
<th>U.S. Study</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Center of Mass Energy</strong></td>
<td>500 800</td>
<td>500 1000</td>
</tr>
<tr>
<td><strong>Design Luminosity</strong></td>
<td>34 58</td>
<td>26 38 10$^{-33}$ cm$^{-2}$ sec$^{-1}$</td>
</tr>
<tr>
<td>Linac rf frequency</td>
<td>1.3</td>
<td>1.3 GHz</td>
</tr>
<tr>
<td>Unloaded/loaded gradient</td>
<td>24/24 35/35</td>
<td>28/28 35/35</td>
</tr>
<tr>
<td>Pulse repetition rate</td>
<td>5 4 5 Hz</td>
<td></td>
</tr>
<tr>
<td>Bunches/pulse</td>
<td>2820</td>
<td>4886</td>
</tr>
<tr>
<td>Bunch separation</td>
<td>337</td>
<td>176 337 nsec</td>
</tr>
<tr>
<td>Particles/bunch</td>
<td>2 1.4 2 $\times 10^{10}$</td>
<td></td>
</tr>
<tr>
<td>Bunch train length</td>
<td>950</td>
<td>860 950 $\mu$sec</td>
</tr>
<tr>
<td>Beam power</td>
<td>11 18 11 23 MW/beam</td>
<td></td>
</tr>
<tr>
<td>$\gamma\varepsilon_H/\gamma\varepsilon_V$ at IP</td>
<td>10/.03 8/.015 9.6/.04</td>
<td></td>
</tr>
<tr>
<td>$\sigma_x/\sigma_y$ at IP (before pinch)</td>
<td>554/5 392/3 543/6 489/4 nm</td>
<td></td>
</tr>
<tr>
<td>Site AC power</td>
<td>140 200 180 356 MW</td>
<td></td>
</tr>
<tr>
<td>Site length</td>
<td>33 46 km</td>
<td></td>
</tr>
<tr>
<td>Tunnel configuration</td>
<td>Single Double</td>
<td></td>
</tr>
</tbody>
</table>

Note: Injector upgrade not required for 1 TeV in U.S. study.
ILC Requirements and Challenges
Energy: 500 GeV, upgradeable to 1000 GeV

• RF Structures
  – The accelerating structures must support the desired gradient in an operational setting and there must be a cost effective means of fabrication.
    ➢ 24-35 MV/m × 20 km
    ➢ ~21,000 accelerating cavities/500 GeV

• RF power generation and delivery
  – The rf generation and distribution system must be capable of delivering the power required to sustain the design gradient
    ➢ 10 MW × 5 Hz × 1.5 msec
    ➢ ~600 klystrons and modulators/500 GeV
  – The rf distribution system is relatively simple, with each klystron powering 30-36 cavities.

⇒ Demonstration projects: TTF-I and II; SMTF in conceptualization phase
**ILC Requirements and Challenges**

**Energy**

**Linac RF Unit (TESLA TDR):** 10MW klystron, 3 modules × 12 cavities each

Total for 500 GeV: 584 units (includes 2% reserve for failure handling)
ILC Technology Status

Accelerating Structures

• The structure proposed for 500 GeV operation requires 24-28 MV/m.
  – 24 MV/m achieved in 1999-2000 TTF cavity production run
  – 13,000 hours operation in TTF (Two 8-cell cryomodules @ ~16 MV/m)

• The goal is to develop cavities capable of 35 MV/m for the energy upgrade to 800-1000 GeV (but installed in ILC phase 1).

• Progress over the last several years has been in the area of surface processing and quality control.
  – Multiple heat treatments
  – Buffered chemical polishing
  – Electro-polishing
  – Several single cell cavities at 40 MV/m
  – Five nine-cell cavities at >35 MV/m

• Dark current criteria established based on <10% increase in heat load
  – 50 nA/cavity
ILC Technology Status
Accelerating Structures

Comparison of low and high power tests (AC73)

S. Holmes, MIT Seminar, December 2004
ILC Technology Status
Accelerating Structures

Recent results from AC70
- First cavity processed in DESY EP facility

\[ \sigma_0 \]

\[ \begin{array}{c}
10^{11} \\
10^{10} \\
10^{9}
\end{array} \]

\[ E_{\text{acc}} \text{ [MV/m]} \]

**TESLA 800 specs:**

- 35 MV/m \( @ Q_0 = 5 \times 10^9 \)
- 2 K
ILC Technology Status
Accelerating Structures: Dark Current

Radiation emissions of BCP and EP cavities (vertical test stand). Note: EP cavities exhibit lower emissions at 35 MV/m than do BCP at 25 MV/m.

Dark Current measurement on 8-cavity CM (ACC4) ~15 nA/cavity at 25 MV/m
ILC Technology Status
Accelerating Structures

• One electropolished cavity (AC72) installed into cryomodule ACC1 in TTF-II (March 2004)

• Cavity individually tested in the accelerator with high power rf.

• Result: 35 MV/m
  – Calibrated with beam and spectrometer
  – No field emission detected
  – Good results with LLRF and piezo-tuner
ILC Technology Status
Accelerating Structures: Gradient Limits

Cornell/Nov 16, 2004:
“A 1.3 GHz single cell niobium cavity of the re-entrant shape reached $E_{\text{acc}} = 46 \text{ MV/m}$ at a Q above $10^{10}$ at $T = 1.9 \text{ K}$. This corresponds to a surface magnetic field of 1750 Oe and a peak surface electric field of 101 MV/m. The cavity was electropolished and baked at 100 C. There was very little field emission.”
ILC Technology Status
RF Sources

• Three Thales TH1801 Multi-beam klystrons fabricated and tested.
  – Efficiency = 65%
  – Pulse width = 1.5 msec
  – Peak power = 10 MW
  – Repetition rate = 5 Hz
  – Operational hours (at full spec) = 500 hours
  – Operational hours (<full spec) = 4500 hours

• Independent MBK R&D efforts now underway at CPI and Toshiba

• 10 Modulators have been built
  – 3 by Fermilab and 7 by industry
  – 7 modulators are in operation
  – Based on Fermilab design
  – 10 years operation experience
ILC Requirements and Challenges
Luminosity: 500 fb\(^{-1}\) in the first four years of operation

- The specified beam densities must be produced within the injector system, preserved through the linac, and maintained in collision at the IR.

\[
L = \frac{f_{\text{rep}} n_b N^2}{4\pi\sigma_x\sigma_y} H_D = \frac{P_b N}{4\pi\sigma_x\sigma_y E_{CM}} H_D
\]

\[
\delta_b \propto \frac{\gamma N^2}{\sigma_x^2\sigma_z} \Rightarrow L \propto \frac{P_b}{E_{CM}} \sqrt{\frac{\delta_b}{\varepsilon_y}} H_D
\]

- Sources
  - 80\% e- polarization
  - ~1e+/e-; polarized?

- Damping Rings
  - $\varepsilon_x/\varepsilon_y = 8.0/0.02$ μm

- Emittance preservation
  - Budget: 1.2 (horizontal), $\times$ 2 (vertical)

- Maintaining beams in collision
  - $\sigma_x/\sigma_y = 540/6$ nm

⇒ Demonstration Project: ATF
ILC Technology Status

Damping Rings

- The required emittances, $\varepsilon_x/\varepsilon_y = 8.0/0.02 \mu\text{m}$, have been achieved in the ATF at KEK.

- Performance is consistent with IBS, however,
  - Single bunch, $e^-$
  - Circumference = 138 m
ILC Technology Status
Damping Rings

• The total length of the ILC beam pulse is:
  \[2820 \times 337 \text{ nsec} = 950 \mu\text{sec} = 285 \text{ km} (!)\]

• This creates many unique challenges in the ILC damping ring design:
  – Multiplexing the beam (\(\times 16\) in the TELSA TDR)
    ➢ Requires fast (~20 nsec rise/fall time kicker for single bunch extraction)
  – Circumference is still \(~285/16 = 18\) km
    ➢ Space-charge is an issue because of the large \(C/\varepsilon_y\) (a first for an electron storage ring).
    ➢ \(X/Y\) “transformer” used to mitigate.

• A number of ideas exist for reducing the circumference and associated challenges.
ILC Technology Status
Damping Rings

• Multi-Bunch Trains with inter-train gaps
• always inject and eject the last bunch in a train
• kicker rise time < 6 ns, but fall time can be ~gap length
• beam loading maintained by ~100 m ring with shared RF system
• ~6 km ring filled by transfers of undamped trains from the ~100 m ring

J. Rogers
ILC Technology Status
Emittance Preservation

• Emittance growth budget from DR to IR is:
  – \( \times 1.2 \) (horizontal), \( \times 2.0 \) (vertical)

• Sources of emittance growth include:
  – Wakes
    ➢ Single bunch controlled by BNS damping
    ➢ Multibunch controlled by HOM dampers and tune spread
  – Alignment and jitter
    ➢ Vertical dispersion \( \times \) momentum spread = emittance growth
    ➢ Controlled by alignment and correction algorithms (feedback)
    ➢ Alignment tolerances \(~300 \, \mu\text{m}, 300 \, \mu\text{rad};\) BPM resolution \(~10 \, \mu\text{m}\)

• Maintaining beams in collision
  – Intra-train feedback
ILC Technology Status
Examples of Outstanding Issues

• RF Structures and Source
  – Establish gradient goal
  – Develop US capability for fabricating high gradient cavities
  – Coupler design
  – Controls/LLRF
  – Industrialization

• Particle Sources
  – Conventional e+

• Damping Rings
  – New design concepts to reduce circumference

• Emittance Preservation
  – Alignment of structures inside cryomodules
  – Instrumentation and feedback systems

• Maintaining Beams in Collision
  – Feedback
  – Head-on IR?

• Machine Protection
  – Collimation systems

• Civil
  – 1 tunnel vs. 2
  – Near surface vs. deep

⇒ Significant R&D program required to develop reliable design, cost & schedule estimates.
Fermilab and the ILC
http://ilc.fnal.gov/index.html

• Fermilab has participated significantly in both warm and cold linear collider R&D over the preceding decade.

• Fermilab has publicly expressed a desire to serve as ILC host laboratory.

• Fermilab participated in the Technology Recommendation process:
  – Expressed a commitment to significant ILC participation independent of the technology chosen.
  – Expressed a preference for the cold technology based on the opportunity for an integrated approach to the two possible futures.
  – Stated “In the event of a cold decision Fermilab would be ready and able to assume the leadership role in establishing a U.S. collaboration to push the SCRF development under the aegis of an international LC organization.”

Following the cold technology decision Fermilab is now preparing to follow through on that commitment with our national and international partners.
Fermilab and the ILC
Recent Activities

• NLC
  – X-band structures fabrication
    ➢ 5 of the 8 structures at successful NLCTA test were built by Fermilab
    ➢ Includes first structures to meet the NLC performance specification for gradient/breakdown rate

• SCRF
  – Operation of 15 MeV photoinjector (identical to TTF injector)
  – SCRF cavity development for FNPL and CKM (now defunct)

⇒ Extremely talented scientific & engineering group in place that is now redirected to work exclusively on superconducting structures.
Fermilab and the ILC
Fermilab as Host

• The FLRP advocates preparation of a Fermilab bid to host an international linear collider project and identifies attributes that we believe make Fermilab/northern Illinois very attractive as potential host:
  – Fermilab
    ➢ Scientific and engineering expertise in forefront accelerator technologies
    ➢ Significant experience in construction and operations of large accelerator projects
    ➢ The leadership mantle of U.S. high energy physics
  – Northern Illinois
    ➢ Strong scientific base, including two national laboratories and five major research universities
    ➢ Geology ideally suited to a linear collider
    ➢ Transportation and utilities infrastructure system that could support LC construction and operations.
Fermilab and the ILC
Fermilab as Host

- Civil/siting studies
  - Four representative Illinois sites have been investigated
    - Three deep, one shallow; two traversing site, two to the west
    - Latest site was investigated as part of the USLCSG study
      - Deep; west; warm and cold incarnations.
    - Collaboration formed with NIU Geology Department in late FY2003

- Public Outreach
  - Public opinion survey (baseline) completed in 2002.
  - Community task force formed to recommend process for interacting with the public on a variety of issues, including the need to extend facilities off site.
**ILC Configuration**

**Tunnel Layout**

<table>
<thead>
<tr>
<th>SERVICE ENCLOSURE TUNNEL</th>
<th>ENCLOSURE ACCESS SHAFT</th>
<th>ACCELERATOR ENCLOSURE TUNNEL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FUNCTION:</strong> HOUSE RF, KLYSTRONS AND MODULATORS, RADAR, PUMPS, POWER, TRANSFORMER, HVAC, UNIT, PROVIDE ACCESS TO LOW AND CRYO HALLS / EQUIPMENT</td>
<td><strong>FUNCTION:</strong> CONNECTION BETWEEN ENCLOSURE BUILDING AND SERVICE TUNNEL FOR SERVICE HANDLING, EXIT ELEVATOR AND SERVICES</td>
<td><strong>FUNCTION:</strong> HOUSE ELECTRON SOURCES, POSITRON SOURCE, DICHROMOGENS, BEAM TRANSFER LINES, AND POSITRON BYPASS LINE AND MAGNETS.</td>
</tr>
<tr>
<td><strong>DIMENSIONS:</strong> 13.5 FT INSIDE DIAMETER TUNNEL</td>
<td><strong>DIMENSIONS:</strong> 10 x 20 FT ELLIPSE SHAFT FRAM</td>
<td><strong>DIMENSIONS:</strong> 13.5 FT DIAMETER TUNNEL</td>
</tr>
<tr>
<td><strong>ATMOSPHERE CONDITIONS:</strong> DRIELESS CEILING, DRY WALLS AND FLOOR</td>
<td><strong>ATMOSPHERE CONDITIONS:</strong> DRIELESS CEILING, DRY WALLS AND FLOOR</td>
<td><strong>ATMOSPHERE CONDITIONS:</strong> DRIELESS CEILING, DRY WALLS AND FLOOR</td>
</tr>
<tr>
<td><strong>MATERIAL HANDLING:</strong> VIA BATTERY TVC/STRAILERS</td>
<td><strong>SERVICES IN SHAFT:</strong> - AC HOUSE POWER AND LIGHTING CONDUTS - AC POWER SUPPLIES - COMMUNICATION DUCTS - VENTILATION AIR DUCTS - COOLING WATER PIPING (SECONDARY LOOP) - FIRE PROTECTION PIPING - SLUMP PUMP DEPOT - CRYO PIPING</td>
<td><strong>MATERIAL HANDLING:</strong> NONE PROVIDED</td>
</tr>
<tr>
<td><strong>SHEILDING:</strong> 20' CONCRETE OR ROCK FOR &quot;MINIMAL OCCUPANCY WITHOUT INTERLOCK DETECTORS&quot;</td>
<td><strong>ACCESS/EXIT CONTROL:</strong> VIA ACCESS SHAFT</td>
<td><strong>ACCESS/EXIT CONTROL:</strong> VIA ACCESS SHAFT PASSES EVA'S BETWEEN SERVICE 8 ACCELERATOR TUNNELS @ 200 FT. MAX. EXIT DISTANCE</td>
</tr>
<tr>
<td><strong>ACCESS/EXIT CONTROL:</strong> VIA ACCESS SHAFT PASSES EVA'S BETWEEN SERVICE 8 ACCELERATOR TUNNELS @ 200 FT. MAX. EXIT DISTANCE</td>
<td><strong>ACCESS/EXIT CONTROL:</strong> VIA ACCESS SHAFT</td>
<td><strong>ACCESS/EXIT CONTROL:</strong> VIA ACCESS SHAFT</td>
</tr>
</tbody>
</table>

**Occupancy:**
- During installation - 40 MILE
- During operation - 1 MILE
- During maintenance - 5 MILE

**MAIN LINAC TYPICAL SECTION**

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*S. Holmes, MIT Seminar, December 2004*
Fermilab and the ILC
Cryomodule Fabrication and SMTF

• The first imperative is establishment of US-based capability in the fabrication of high gradient superconducting accelerating structures.
  – Assume the fabrication of ~20,000 ILC accelerating structures will be shared among the three regions.
  – Significant U.S. SCRF expertise at: Argonne, Cornell, Fermilab, Jefferson Lab, Los Alamos, Michigan State
  – Experience extends to both development and fabrication (e.g. SNS), but at gradients significantly below 35 MV/m

• The vehicle is the SMTF (Superconducting Module and Test Facility).
  – “The goal is to strengthen U.S. capabilities in high gradient and high Q superconducting accelerating structures in support of the International Linear Collider (ILC) and other accelerator projects of interest to U.S. laboratories.”
  – Collaboration of major DOE and NSF laboratories and universities, with international participation.
  – Incorporate ILC, $\beta<1$ (Proton Driver, RIA), and possibly CW test areas.
Fermilab and the ILC
Cryomodule Fabrication and SMTF

• Expression of Interest submitted to Fermilab Director.
  – Based on commitment to play a leading role following the cold decision.
  – Provisional goal is fabrication and testing of three U.S. plus one European high
    gradient cryomodules by 2008. (in close coordination with the GDE).

• Interested partners: ANL, BNL, Cornell, FNAL, JLab, LANL, LBNL, MIT,
  MSU, NIU, ORNL, Pennsylvania, SLAC (, DESY, INFN, KEK)

• Concept of a possible evolution (ILC portion):

1) A0 injector
   One Module, Cryo, RF, no beam

2a) Add Beam
   One RF Unit

2b) ILC injector
   Possible ILC test bed

3) $50-100M
   2005-06
   2008-…
ILC Activities Worldwide
International

• ILCSC organized and functional
  – Under auspices of ICFA
    http://www.fnal.gov/directorate/icfa/International_ILCSC.html
  – Goal: “Promote construction of a linear collider through world-wide collaboration”

• Major activities include:
  – Preparation of world-wide “consensus document”
    http://flc25.desy.de/lcsurvey/
  – International performance document
  – Technology decision
  – Development of an international framework
  – Initial meeting of the ILC collaboration 11/13-15 at KEK
    http://lcdev.kek.jp/ILCWS/
ILC Activities Worldwide
International Framework

• Organization
  – Global Design Effort (GDE) to develop CDR and then engineering design
    ➢ Reliance on (three) regional design centers
  – Regional Efforts
    ➢ ILC-Americas collaboration forming with multi-institutional participation
  – Construction and operation based on host lab/international project model
    ➢ ECFA Study on governance (“host lab/international project”)

• Support
  – Several meetings of the regional funding agencies
  – Sorely need increase in resources starting in FY2006

• Timelines
  – GDE established (w/ Director) in early 2005
  – CDR complete 1-2 years later
  – Construction timeline likely to be paced by the political path
ILC Activities Worldwide
National

• USLCSG established and functioning
  http://www.slac.stanford.edu/~hll/USLCSG/
  – Development and implementation of a strategy for bringing an international linear collider to reality
  – Coordination of U.S. R&D activities
  – Preparation of the U.S. bid to host

• Identification of LC as highest mid-term priority in the Office of Science 20-year plan
  – On-shore ILC will probably require Presidential Initiative

• Formation of ILC-Americas collaboration underway with first meeting at SLAC, October 14-16.
  – Broad participation from DOE and NSF support laboratories and universities.
ILC Beyond the Next Generation
CLIC
Summary

• An internationally constructed and operated linear collider is identified by the world HEP community as the next forefront machine beyond the LHC.
  – The ILC offers extraordinary opportunities to extend the reach of LHC into areas we know will remain unexplored at the TeV mass scale.

• Activities in support of ILC R&D and design development are being organized at the international level.
  – ITRP complete; ILC regional and international collaborations forming
  – (There is plenty of work to go around to all interested parties)

• Fermilab has publicly stated its aspiration to serve as host lab to the ILC.

• SMTF is the integrating device for a U.S. effort in superconducting rf development, and for Fermilab’s effort on the dual vision of its future.

• We are seeking the support of the scientific community, as well as the public and their elected representatives, for the R&D program required to develop a complete design, cost estimate, and schedule for this extraordinary project.