JLC Site Study
JLC in flatland
JLC Layout

**Injection System**

- **2nd IP**
- **e⁺ beam**
- **e⁻ beam**
- **damping ring (1.98GeV)**
- **collimation, FFS**
- **e⁺ target**
- **e-gun**
- **linac (1.98GeV)**
- **linac (10GeV)**
- **spin rotator**
- **pre-linac (8.5GeV)**
- **high intensity X-ray laser facility**

**Pre-linac (8.5GeV)**

**Pre-damping ring**

**Damping ring (1.98GeV)**

**Main linac**

**High intensity X-ray laser facility**

**Linac (1.98GeV)**

**Linac (10GeV)**

**Linac (1.98GeV)**

**Pre-linac (8.5GeV)**

**Injection System**
Klystron tunnel
(inner diameter 4.5m)

Distance between 2 tunnels = 5 m,
30 cm connecting tubule in every 3~12.5m

Accelerator tunnel
(inner diameter 3m)
Layout of Conventional Facilities

AT: access tunnel (6m$^2$)  
UT: utility tunnel (4m$^2$)

MB: cooling(10), ventilation(9in, 8out)  
(1500m$^2$, 1000m$^2$)

Accelerator tunnel  
Klystron tunnel
Access Hall (AH) with inclined shaft
200m² (20~25m²)

Experimental Hall (EH)
40m x 40m x 84m
Construction Schedule

TBM (300m/month/TBM)

Main linac (11km)

BDS (4km)

Main linac (11km)

NATM (1.7km)

NATM (2.3km)

years

1 2 3 4 5

utility and access tunnels

1/3 of tunneling

2/3 of tunneling

1/3 of supports

3/3 of tunneling

2/3 of supports

2/3 of supports

1/2 of utility

2/2 of utility full accelerator components

excavation

muck disposal

tunnel lining

utilities and accelerators
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<td>Conventional Facilities</td>
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<td>Local promotion</td>
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<td>Research infra.</td>
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<td>Living &amp; cultural infra.</td>
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Selection of sites (2001.9 ~ 2002.10)

Purpose: selection of multiple candidate sites based on scientific investigation

Two aspects in necessary conditions

(1) **Technical**: Construction of long tunnel, stable operation in many years
   Stable ground and quite environment without artificial vibrations

(2) **Sociological**: research infrastructure for foreigners
   International/domestic transportation, cultural/living env., local promotions

**Literature search**: geology, geography, active faults, seismic centers, traffic facilities, rare animals, cultural properties, power lines etc.

**Field survey**: access point check, confirmation of the literature search

Selection from two view points:

1. Good geology
2. National/local research and development bases (> 1000ha)
Procedure of site selection

1. Geology choice (based on Geological Survey of Japan, AIST)
   plutonic rocks, basalt, metamorphic rocks, and sedimentary rocks/andesite older than Tertiary Era
   So, more than 70 regions have been selected by the geology.

2. Exclusion of active faults (seismic centers)
   (based on the new edition of “Active Faults in Japan”)
   to avoid destruction of facilities

3. Exclusion of faults and complicated heterogeneous geologies
   to avoid fracture zones for the TBM tunneling

4. Exclusion of precipitous terrain and highland more than 1000m above sea level.
Site Candidates

Gray: Bad Geology
Red: Active faults
Green (Blue): 1000 (2000) m above Sea level

1. Hidaka
2. Kitakami
3. Murakami
4. Abukuma, Kita-Ibaraki
5. Aichi - Gifu
6. Hiroshima
7. Seburi
8. Okinawa

Mount Tsukuba, KEK
SPring-8
Mt. Mutsu-Ogawara

: Research and Development Based (> 1000ha)
Spectra of Ground Motion
Based on Broadband Seismic Network Laboratory (F-net), NIED.

Niigata-Shibata (3), shake
Fukushima-Hirono (4), granite
Aomori-Tamari, andesite

Aichi-Asahi (5), granite
Fukuoka-Seburi (8), metamorphic
Okinawa-Kunigami, sand stone
Ground Motion at the Fuji experimental hall

measured by N. Yamamoto, T. Matsui

Fuji
1993-07-12 16:30

Amplitude (m/Hz^0.5)

Frequency (Hz)

Integrated Amplitude (m)

250nm
40nm
10nm
Configuration of tunnel route

- Straight tunnel of more than 20 km long
- No volcano in the vicinity
- Cross no fault and lineament
- Uniform geology as much as possible
- Vertical interval should not exceed 300m on ground surface.
- Cross no arterial railroad
- Cross no highway road
- Good access to airports and highways

Additionally,
- Accessibility of construction vehicles
- No hot spring in the vicinity
- Outside of national parks
- No quarry in the vicinity
- Existence of cities in the vicinity
Japan Geology and Site Candidates

付録2 全国地質図と候補地（ルート）
Kita-Ibaraki site

Hanazono Shrine
Abukuma site

Around the IP

(land use in 100m mesh)

thickness of the ground on the tunnel >50m,
inclination for drain
Tunnel configuration plan at KEK site

JLC @ KEK Site (Plan A: 22km)
Tunnel Layout
KEK site (route A, 22km)
Ground Motion Measurement at KEK

2 sensors (CMG40T)
in 2003.1 ~ 3.31

GM measurements in 2001.3

sand or glass beads

80m
Major characteristics and issues of 14 representative routes in 8(good geology) and 4(research & development bases) regions.

<table>
<thead>
<tr>
<th>n</th>
<th>representative route</th>
<th>L km</th>
<th>geology</th>
<th>geography</th>
<th>altitude m</th>
<th>depth m</th>
<th>power KV(MW)</th>
<th>°C</th>
<th>major issues</th>
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<tbody>
<tr>
<td>1</td>
<td>Hidaka</td>
<td>28</td>
<td>granite, hornfels</td>
<td>base of - mountains</td>
<td>270</td>
<td>38-499</td>
<td>187(526)</td>
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<td>power supply capacity, Route 274 tunneling in alluvial valley, snow (2m)</td>
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<td>Kitakami</td>
<td>31</td>
<td>granite</td>
<td>hilly terrain</td>
<td>100</td>
<td>80-600</td>
<td>275(746)</td>
<td>10</td>
<td>power flow, quarry, no city</td>
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<td>3</td>
<td>Murakami</td>
<td>30</td>
<td>granite</td>
<td>highland</td>
<td>-5 ~ 70</td>
<td>36-563</td>
<td>154(154)</td>
<td>14</td>
<td>power supply capacity, snow(1m), old mines mylonite region, quarry, no city, hot spring</td>
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<td>Abukuma</td>
<td>36</td>
<td>granite</td>
<td>highland</td>
<td>390</td>
<td>30-300</td>
<td>275(962)</td>
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<td>power flow, golden eagle, quarry</td>
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<td>Kita-Ibaraki</td>
<td>30</td>
<td>granite</td>
<td>highland</td>
<td>210~310</td>
<td>40-330</td>
<td>275(1138)</td>
<td>13</td>
<td>power flow, natural park, quarry</td>
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<td>Aichi-Gifu (Asuke)</td>
<td>22</td>
<td>granite</td>
<td>highland</td>
<td>78~407</td>
<td>20-200</td>
<td>500(2788)</td>
<td>15</td>
<td>highway, semi-national park, quarry hot spring</td>
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<td>base of - mountains</td>
<td>100~200</td>
<td>50-370</td>
<td>500(2788)</td>
<td>15</td>
<td>active faults (3km)</td>
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<td>Hiroshima (east)</td>
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<td>hilly terrain</td>
<td>250~300</td>
<td>40-450</td>
<td>500(1748)</td>
<td>13</td>
<td>clump of rhododendron (1km)</td>
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<td>Seburi</td>
<td>38</td>
<td>granite</td>
<td>hilly terrain</td>
<td>110~230</td>
<td>60-520</td>
<td>500(2788)</td>
<td>16</td>
<td>dam construction, quarry, hot spring</td>
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<td>10</td>
<td>Mutsu-Ogawaara</td>
<td>22</td>
<td>andesite agglutinate</td>
<td>base of - mountains</td>
<td>70 ~ 90</td>
<td>35-220</td>
<td>154(292)</td>
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<td>snow (1m), no city</td>
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<td>11</td>
<td>Tsukuba (KEK)</td>
<td>22</td>
<td>andesite agglutinate</td>
<td>sedimentary layers</td>
<td>-50</td>
<td>80</td>
<td>500(1788)</td>
<td>14</td>
<td>urban area, stability, road vibration</td>
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<td>Mt. Tsukuba (Bucyozan)</td>
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<td>granite, metamorphic</td>
<td>hilly terrain</td>
<td>40</td>
<td>30-500</td>
<td>500(1788)</td>
<td>14</td>
<td>JR Mito line, Route 50, Joso tunnel, semi-national park, quarry, hot spring</td>
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<td>Harima (Spring8)</td>
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<td>ophiolite, shale etc.</td>
<td>hilly terrain</td>
<td>40</td>
<td>28-365</td>
<td>500(6712)</td>
<td>14</td>
<td>heterogeneous geologies, Chikusa-river, Chizukyu line, hot spring</td>
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<tr>
<td>14</td>
<td>Okinawa</td>
<td>24</td>
<td>phylite, sand</td>
<td>hilly terrain</td>
<td>50</td>
<td>47-326</td>
<td>(1756)</td>
<td>22</td>
<td>power supply capacity, rare animals, no city</td>
</tr>
</tbody>
</table>

*"no city" means that there is no large city with more than 100,000 population within 30km of the site.
* This shows the total power instead of nearest power line, which is available in Okinawa as at May, 2003.
Flow chart of future effort

1. Publicity of JLC
2. Preparation for environmental assessment
3. Vibrational & geological survey
4. Comprehensive evaluation with experts
5. Drilling survey etc.
6. Environmental assessment

Timeline:
- 0 month
- 12 months
- 24 months
- 36 months