Installation TSET Report
Costing Workshop:
April 24 - 27, 2000

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Where Installation $’s Reside

- **Injector Systems**
  - Sources-1.2.2.6
  - Damping Rings-1.2.3.6
  - Pre-Linac & BC2-1.2.4.6
- **Main Linac-1.3.4**
- **Beam Delivery-1.4.2.6**
- **Installation Support Services-1.6.4**
Today’s Costing Methodology

- Area Installations - Used 20% of Acquisition Costs
  - 10% Labor & 90% M&S

- 1.6.4 Installation Support Services
  - 1.6.4.1 System Engineering & Admin
    - 15% of Labor in Logistics Support & Interface Integration
  - 1.6.4.2 Logistics Support
    - Includes development and on-going support for logistics database, work-flow & space modeling, temporary staging storage, surface & tunnel conveyance, portable services
    - Didn’t include $ for installation drawings (assumed in areas)
  - 1.6.4.3 Interface Integration & Test
    - Small amount included for “between areas hand shake”
## Comparison to Lehman Numbers

<table>
<thead>
<tr>
<th>WBS Branch</th>
<th>Lehman</th>
<th>Current</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sources, Pre-Linac &amp; BC-2</td>
<td>78</td>
<td>38.1</td>
<td>-51%</td>
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<tr>
<td>Damping Rings</td>
<td>47</td>
<td>44.6</td>
<td>-5%</td>
</tr>
<tr>
<td>Main Linac</td>
<td>251</td>
<td>139.9</td>
<td>-44%</td>
</tr>
<tr>
<td>Beam Delivery</td>
<td>34</td>
<td>25.2</td>
<td>-26%</td>
</tr>
<tr>
<td>Installation Support Services</td>
<td>0</td>
<td>33.2</td>
<td>+100%</td>
</tr>
<tr>
<td>Total</td>
<td>410</td>
<td>281</td>
<td>-31%</td>
</tr>
</tbody>
</table>
Future Costing Methodology:
Installation Cost Template

• Want to provide uniformity across machine
  – Experts estimate what they know, capture info once
  – TSET will review details and reasonability of estimate
  – Building an RS Means type cost catalog
  – Provides means of capturing details when known and refining estimates as new information becomes available

• Want to be able to respond “quickly” to changes
  – (Installation by it’s nature lags)

• By counting hours and types of labor, can establish resource loading, work-flow patterns, characterize infrastructure requirements

• Determine number of transportable units needed to estimate travel times, methods and access points
Costing Template

• Each Area Installation Divided into 5 Broad Categories
  – Installation Preparation
  – Installation Management
  – Alignment
  – Component Installation
  – System Checkout
NLC - The Next Linear Collider Project

Alignment Categories

Alignment looks at an Area in a global way breaking it into:

- Management, Preparation and Equipment
- Pass 1: Network Survey (bare, unoccupied tunnel)
- Pass 2: Blueline Survey
- Pass 3: Stand Alignment
- Pass 4: Component Alignment
- Pass 5: Component Map (under vacuum & at temperature)
Component Installation Categories

Component systems are looked at globally and applied to an Area

- General Tasks
- Cable Plant Systems
- RF Systems: Modulators, Klystrons, Distribution System, Accelerators, LLRf
- Magnet Systems
- Instrumentation Systems: Collimators, Dumps, Special Instrumentation
- Laser Systems
- Vacuum Systems
- Electronic Enclosures: Racks & TEEs
- Sources (Gun) Systems
- Rafts (assembled girders)
- Shielding Systems
NLC - The Next Linear Collider Project

Task Categories within Component Installation

Tasks applied to each component system

- Kit Component Assemblies
- Transport Component: Surface, Tunnel, Gallery
- Support Component
- Position & Affix Component
- Connect Cables
- Connect Water
- Component Checkout
- Special Tasks: oil fill, protective cover, etc.
How the Template is Used

• Generic Hierarchical (relational) structure developed
• Within each task category detailed tasks are identified
  – drill hole, install anchor bolt, position & affix mover support, etc
• Detailed tasks are assigned:
  – Task duration
  – Crew team consisting of number of people & labor type
  – Hourly rates applied from Labor Rate Table
  – Efficiency Factor (RS Means uses for installation 60-65%)
• Apply generic structure and component groupings to specific area
• Count quantities
• Costs easily roll up
Magnet Systems Example

How many types of components get installed?

How much does the equipment cost and how many sets do you need?

How many components can fit on a 20’ X 8’ truck?

Do they need a support? Does the support move?

How many cable connections to the device? Quick or complicated?

How many water connections to the device? Quick or complicated?

How much time does it take to check out the component?

Are there special tasks that haven’t been covered?
Magnet Systems Example

General task category:

Detailed task:

Crew team assignment:

Labor Rate Table:
Advantages- Disadvantages of this Methodology

- **Advantages**
  - Simplifies a complex set of tasks
  - Respond to changes quickly
  - Allows for “what if” scenarios
  - Add detail as known
  - Allows for non-standard applications
  - Provides uniformity to project

- **Disadvantages**
  - Difficult to provide a partial roll-up
  - Takes a while to do initial estimate
Plan to Finish the Estimate

- Applied this method to magnets systems and modulators and klystrons, not yet reviewed by TSET

- Where will we be by May review:
  - LIKELY to have 1st iteration done for:
    - Magnets, Rf systems, Vacuum systems, Racks & TEEs, Rafts
  - MAY have 1st iteration done for:
    - Instrumentation systems, Alignment, Laser systems, Source (Gun) systems
  - UNLIKELY to have 1st iteration done for:
    - Cable Plant, Shielding Systems, System Checkout
    - Validation by internal review, comparison to other machines, compare to RS Means for similar tasks, and unitization
Plan to Finish

- Will estimate Installation Preparation and Management as % of other costs
  - Management will include Contract Labor Supervision and oversight by NLC personnel
- Goal to have complete 1st iteration done by September
- Cost drivers will appear after first complete roll-up