NLC - The Next Linear Collider Project

NLC Installation Planning

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Team Coordinator
**Definition of Installation**

- **Activities required to:**
  - prepare, coordinate and complete the installation operations and any associated logistics

- **To include all labor, materials and equipment required to:**
  - transport, situate, affix, **align**, interconnect, exhaust, **checkout** and condition all components and hardware from a central storage facility or manufacturing facility to its operational location within the support housings, klystron galleries and tunnels.

- **Does not include:**
  - fabrication, assembly, component quality control, commissioning or software installation

- **Elements of the installation system**
  - “installable unit”: work package that gets installed. May range from complex subassemblies to single items, must be as pre-assembled as possible prior to installation.
  - “kitting”: the process of assembling installable units and combining them into transportable units. Includes all supports and hardware required to affix and interconnect the components in their operational location.
  - “transportable unit”: combinations of installable units sized for transport
Installation TSET

• Goals:
  – Provide uniformity for cost estimates, schedules and technical issues related to installation
  – Establish standard models for common activities
    • (labor type, crew size, duration, linkages, flow charts, equipment)

• Methodology:
  – Start with “Cost Template”, apply to all areas
  – Use relevant portions of cost template to generate schedules
  – Apply resource loading (iterate through cost & schedule)
  – Develop work-flow models
Purpose of the Cost Template

- Provide method of uniform costing of similar installation tasks throughout the machine
- Simplify each areas costing exercise ???
- Provide a complete listing of required installation tasks
  - Requires thinking in detail about how we plan to install the machine
- Using the task list should provide means of developing schedules and resource loading
- Find the installation cost drivers & examine ways of reducing them
  - what assembly can be done prior to installation
  - what tooling or fixturing can make the job faster & more reliable
Cost Template Methodology

- Hierarchical structure established for installation tasks
- “Expert’s” assigned to develop detailed task lists
- Task assigned a resource code, crew size, unit of measure and rate of installation by the expert which is reviewed by the TSET
- Some common tasks reviewed as a group, applied to each component
  - transportation: where, how much, how far
  - alignment
  - kitting
- Task can rolled up to a summary task to be used by area cost estimators
Schedule for Installation Cost Estimates

- Task list generated (Rev 0) 2/17
- Remaining columns populated 3/2
- Reviewed/revised by TSET 3/9-16
- Ready for area use ? 3/23

- First project review 4/20-21
- Final Cost/Schedule to Proj.Plan. 7/14
### Installation and Checkout

#### Installation Management

#### Area Installation

- **Pre-Installation (Title I, II ED&A)**
- **Cable Plant Installation (Construction)**
- **Components Installation (Construction)**

#### General Area Tasks

#### RF Systems

- **Klystron/Modulators**
- **Waveguide & Components**

#### Accelerator Girder-Type B

<table>
<thead>
<tr>
<th>Task Description</th>
<th>Code</th>
<th>Rate</th>
<th>Unit of measure</th>
<th>Quantity</th>
<th>Scaling Factor</th>
<th>Total Hours</th>
<th>Labor Cost</th>
<th>Duration (min.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kit installable unit</td>
<td>ALMS</td>
<td>3</td>
<td>support/person-hour</td>
<td>0.4</td>
<td>supports</td>
<td>1</td>
<td>1</td>
<td>0.8</td>
</tr>
<tr>
<td>Girder Installation Equipment &amp; materials</td>
<td>TECHM</td>
<td>2</td>
<td>holes/person-hour</td>
<td>5.6</td>
<td>holes</td>
<td>8</td>
<td>1</td>
<td>0.7</td>
</tr>
<tr>
<td>Transport component, etc.</td>
<td>ALMS</td>
<td>3</td>
<td>support/person-hour</td>
<td>0.8</td>
<td>supports</td>
<td>1</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>Surface transport</td>
<td>TECHM</td>
<td>2</td>
<td>bolts/person-hour</td>
<td>12.5</td>
<td>bolts</td>
<td>8</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>Surface to tunnel transport</td>
<td>ALMS</td>
<td>3</td>
<td>support/person-hour</td>
<td>0.8</td>
<td>supports</td>
<td>1</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>Tunnel transport</td>
<td>TECHM</td>
<td>2</td>
<td>support/person-hour</td>
<td>0.5</td>
<td>supports</td>
<td>1</td>
<td>1</td>
<td>1.0</td>
</tr>
</tbody>
</table>

#### Pedestal Support-Type A

<table>
<thead>
<tr>
<th>Task Description</th>
<th>Code</th>
<th>Rate</th>
<th>Unit of measure</th>
<th>Quantity</th>
<th>Scaling Factor</th>
<th>Total Hours</th>
<th>Labor Cost</th>
<th>Duration (min.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-D Blueline</td>
<td>ALMS</td>
<td>3</td>
<td>support/person-hour</td>
<td>0.4</td>
<td>supports</td>
<td>1</td>
<td>1</td>
<td>0.8</td>
</tr>
<tr>
<td>Drill holes</td>
<td>TECHM</td>
<td>2</td>
<td>holes/person-hour</td>
<td>5.6</td>
<td>holes</td>
<td>8</td>
<td>1</td>
<td>0.7</td>
</tr>
<tr>
<td>Install anchor bolts</td>
<td>TECHM</td>
<td>2</td>
<td>bolts/person-hour</td>
<td>12.5</td>
<td>bolts</td>
<td>8</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>Install support</td>
<td>TECHM</td>
<td>3</td>
<td>support/person-hour</td>
<td>0.8</td>
<td>supports</td>
<td>1</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>Rough align support</td>
<td>ALMS</td>
<td>3</td>
<td>support/person-hour</td>
<td>0.8</td>
<td>supports</td>
<td>1</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>Grout (form, grout, cleanup)</td>
<td>TECHM</td>
<td>2</td>
<td>support/person-hour</td>
<td>0.5</td>
<td>supports</td>
<td>1</td>
<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>Intermediate align movers</td>
<td>ALMS</td>
<td>3</td>
<td>support/person-hour</td>
<td>0.6</td>
<td>supports</td>
<td>1</td>
<td>1</td>
<td>0.6</td>
</tr>
<tr>
<td>Connect cables to movers</td>
<td>TECHM</td>
<td>1</td>
<td>support/person-hour</td>
<td>6</td>
<td>supports</td>
<td>2</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>Checkout &amp; position movers</td>
<td>TECHM</td>
<td>2</td>
<td>support/person-hour</td>
<td>1.5</td>
<td>supports</td>
<td>1</td>
<td>1</td>
<td>0.3</td>
</tr>
</tbody>
</table>

#### Install Girder

<table>
<thead>
<tr>
<th>Task Description</th>
<th>Code</th>
<th>Rate</th>
<th>Unit of measure</th>
<th>Quantity</th>
<th>Scaling Factor</th>
<th>Total Hours</th>
<th>Labor Cost</th>
<th>Duration (min.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Install Girder</td>
<td>TECHM</td>
<td>5</td>
<td>girders/person-hour</td>
<td>0.075</td>
<td>girders</td>
<td>1</td>
<td>1</td>
<td>2.7</td>
</tr>
<tr>
<td>Intermediate Align Girder</td>
<td>ALMS</td>
<td>3</td>
<td>girders/person-hour</td>
<td>0.33</td>
<td>girders</td>
<td>1</td>
<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>Connect water lines (manifold to girder)</td>
<td>TECHM</td>
<td>1</td>
<td>connection/person-hour</td>
<td>4</td>
<td>connection</td>
<td>2</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Connect cables</td>
<td>TECHM</td>
<td>1</td>
<td>connection/person-hour</td>
<td>8</td>
<td>connection</td>
<td>4</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Interconnect vacuum</td>
<td>TECHM</td>
<td>2</td>
<td>connection/person-hour</td>
<td>0.6</td>
<td>connection</td>
<td>3</td>
<td>1</td>
<td>2.5</td>
</tr>
</tbody>
</table>

#### Magnet Systems

#### Instrumentation

#### Lasers

#### Vacuum Systems

#### Racks

#### Global control Phase II

#### System Checkout & Test

#### Global Installation

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**Color Legend**

- Installation TSET fills in = [ ]
- Project "look up" table = [ ]
- Area Costing engineer fills in = [ ]
- Calculated in spreadsheet = [ ]

Duration column can be used as a reality check