Concept Review: Example

Design Configuration Downselect Process

• Generate sufficiently detailed sketches of potential configurations to permit reasonably accurate assessment
• Develop assessment matrix categories that include accounting for all appropriate system requirements
• Define the meaning of the categories
• Weigh the importance of the categories
• Perform all analyses needed for the categories
• Rate each candidate configuration in each category
• Calculate the composite rating
• Check to make sure it makes sense!
Concept Review: Example

Some Rating Categories

• Mechanics: Minimum natural frequency, load capacity, weight
• Performance: Size, speed
• Risk: Technological familiarity, Schedule risk
• Ilities: Reliability, Repairability, Maintainability
• Manufacturability: Parts count, Cost, Assembly
• Marketability: Ease of Growth, Design Uniqueness
Concept Review: Example

Some Rating Category Descriptions

• Technological familiarity: Are the materials and components similar to your experience base or are they new to you (or new to other industries)?

• Schedule risk: Is the vendor a known quantity? Can you purchase a component or system rather than design and build your own?

• Reliability: Are the components reliable? Are there a lot of them?

• Repairability/Maintainability: How easy is access, diagnosis, adjustment, alignment, etc?

• Parts count: Multiple parts, similar parts, existing parts can be a plus.

• Ease of Growth: Are there clear ways to increase the product’s capacity or features in the future?
Concept Review: Example

Sample Rating System

<table>
<thead>
<tr>
<th>Rating</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Very Good in this category</td>
</tr>
<tr>
<td>3</td>
<td>Good in this category</td>
</tr>
<tr>
<td>2</td>
<td>Average</td>
</tr>
<tr>
<td>1</td>
<td>Below Average</td>
</tr>
<tr>
<td>0</td>
<td>Bad at this category</td>
</tr>
</tbody>
</table>
### Concept Review: Example

#### Sample Decision Matrix

<table>
<thead>
<tr>
<th>Category</th>
<th>Wafer SubStages</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Weight</td>
<td>V</td>
<td>+</td>
<td>H</td>
<td>I</td>
</tr>
<tr>
<td>Mechanics</td>
<td>Fundamental Frequency &gt;100 Hz</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Alignment Deviation (for Trav. Mirror)</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Moving Stage Weight (Re Accel)</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Order of Stages (C'Bal,PropF,Accel)</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Performance</td>
<td>Footprint &lt; 43 in wide</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>300/450</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Risk</td>
<td>Technology Familiarity</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Low Schedule Risk</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Reliability</td>
<td>Reliability</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Repair/Maintainability</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Manufacturability</td>
<td>Parts Count</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Cost</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Assembly</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Marketability</td>
<td>Ease of Growth</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Total (W*R)</td>
<td>78</td>
<td>65</td>
<td>90</td>
<td>90</td>
</tr>
</tbody>
</table>

- The “H” and “I” Configurations score highest.
Concept Review: Example

SubStage Concept B: “Etch-a-Scan” or “+”

+ Lowest weight XY Slider
+ Dual X & Y-drive motors
+ Stationary Counterforces

- Many bearings needed
- Wide footprint
- Four linear motors required
- Two Counterforces required
Concept Review: Example

SubStage Concept D: “I“ Configuration

+ Narrow footprint
+ No X-Guide deflection due to X Slider traverse
+ Dual X-drive motors
+ Single Counterforce
+ Low Y mass

- Moving Counterforce
- Awkward cable drop
Concept Review: Example

Sample Structural Analysis

<table>
<thead>
<tr>
<th></th>
<th>X</th>
<th>R1</th>
<th>R2</th>
<th>R3</th>
</tr>
</thead>
<tbody>
<tr>
<td>inches</td>
<td>lbs</td>
<td>lbs</td>
<td>lbs</td>
<td></td>
</tr>
<tr>
<td>5.70</td>
<td>128.16</td>
<td>71.84</td>
<td>73.90</td>
<td></td>
</tr>
<tr>
<td>28.00</td>
<td>72.41</td>
<td>127.59</td>
<td>73.90</td>
<td></td>
</tr>
</tbody>
</table>

**TABLE II**
BEARING FORCE REACTIONS

First Substage Resonance with Slider in "Worst" Position
(124 Hz)

ConceptRevu.ppt
W. Dornfeld   Page 8
Concept Review: Example

Selected Approach

Major Features

• Dual Y-drive linear motors for proportional drive
• Single, stationary counterforce
• High stiffness and resonant frequency
• Lightweight moving stage
• Stiff, light chuck
• Access pivot