Project Scope:
- Improve ILC's Gas Mask Assembly Line Efficiency
- Automate Buckle Sorting Step
  - Take Buckles From Box and Place with Correct Orientation onto Spindle
  - Correct Orientation is defined by:
    - Wavy sides of buckle frames, Sliders on one side, Slider crimp gaps facing same direction
    - No Unattended Operation
    - No Damage to Black Oxide Coating
    - No Physical Damage to Buckle
    - Our Task:
      - Categorize gates into Priorities (A,B,C); Bring "A" models to Full Prototype; Bring "B" models to Full Design & Model; Bring "C" models to Full Design + Rough Model
      - Big Arrows show full prototypes

Test Methods:
Crump Detection
- Measure time taken for slider orientation to be detected
- Measure success ratio as correct detection/processing
- Configure timings for actuator and wire wheel
- Measure rate that buckles fill up queue

In Plane Orientation
- Determine optimal brush rpm speed
- Determine optimal brush shape
- Record success of gate at processing different buckle clump sizes
- Success defined by no jamming in subsequent funnel

Planning Stage
- Synthesize wants/metrics/constraints to gain understanding of problem.

<table>
<thead>
<tr>
<th>Wants</th>
<th>Metrics/Constraints</th>
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<tbody>
<tr>
<td>Orient Correctly on Spindle</td>
<td>&gt; 5,500 buckles per 7.5 hour day</td>
</tr>
<tr>
<td>Don't damage Buckle</td>
<td>Approval by ILC Safety Manager</td>
</tr>
<tr>
<td>Operate Unattended</td>
<td>Fit in full-size truck bed</td>
</tr>
<tr>
<td>Easily Serviceable</td>
<td>No deformation, No scratches</td>
</tr>
<tr>
<td>Work without undue maintenance</td>
<td>99.96% buckle loading accuracy</td>
</tr>
<tr>
<td>Cost &lt; task</td>
<td>&lt;60 db noise</td>
</tr>
<tr>
<td>Integrate easily</td>
<td></td>
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</tbody>
</table>

Concept Selection Stage
- Concentrate on Realistic Concepts
- BRAINSTORM

Prototyping and Testing Stage:
- Drawing Package created that consists of 6 specific gates
  - 2 gates chosen to be the focus of attention
  - models split into A,B,C categories based on importance
  - A models - Crimp detection & In Plane Orientation
  - B models - Hopper & Intermittent Feed
  - C models - C.O.G. Rail & Spindle Loader
  - Working prototypes created for the A models
  - Physical models created for the B models
  - CAD drawings created for the C models
  - Test methods created for the A models

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