**Overview:**

Synthes is a world leader in the medical device and orthopedic trauma market. They develop and manufacture internal and external fixation devices, as well as instruments used by surgeons.

**Problem:**

Automate the assembly process for the Pangea Locking Cap.

**Project Scope:**

Produce detailed plans for a functional design of a Pangea Locking Cap Assembly Machine, and illustrate key functionality with a limited prototype.

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**Present State / Desired State**

<table>
<thead>
<tr>
<th>Present State</th>
<th>Desired State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fully Manual Process</td>
<td>Fully Automated Process</td>
</tr>
<tr>
<td>Parts Batched, Excess Stored in Inventory</td>
<td>Single Part Process Batch Size Equals Shipment Size</td>
</tr>
<tr>
<td>40 Second Cycle Time</td>
<td>5 Second Cycle Time</td>
</tr>
<tr>
<td>Maximum Torque Via Clutch, No Minimum</td>
<td>Clutch for Protection, Torque Sensor Insures Min &amp; Max Torque</td>
</tr>
<tr>
<td>Cross Threading Inspected by Eye</td>
<td>Cross Threading Detection Using Position and Torque Sensing</td>
</tr>
</tbody>
</table>

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**Concept Selection**

- **Linear**
- **Turntable**

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**Final Concept:**

- Rotating turntable holding the parts under vertically actuated driving head
- In-line motor, torque sensor with feedback, and clutch
- Body holder with adjustment springs to prevent cross threading and damage of the part

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**Testing/validation**

- Does bit fit into screw properly?
- Change linear actuator settings for depth, adjust turntable for x & y position
- Do springs hold screw & body together with enough force to thread?
- Use different spring constant
- % Yield loss due to cross threading
- Check alignment of parts
- % Yield loss due to surface coating scratching
- Slow driver speed, look into possible coatings for bit

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**Special Thanks to Nate Cloud**