Manufacturing Improvement Project – Inventus Power

PURDUE UNIVERSITY | School of Industrial Engineering

Matthew Choi, Luke Collins, Vic Schul, Samir Mehta, Joe Mendoza

Client Background

Inventus Power is the leading battery manufacturer in the United States. They have multiple global manufacturing sites which produce three main types of products: battery packs, power supplies, chargers and docking stations. Their products are used in a multitude of industries including products military, medical, and consumer applications.

Project Scope

Our team's project scope focuses on their Conformable Wearable Battery (CWB) 3.6.2 and improving its manufacturing production. The CWB 3.6.2 is a product for the US military and is Inventus' largest contract valued at $1.2B. Given that this account is their largest by over 10 times the value of their second account, it is imperative that their production system is as efficient as possible. While expanding their manufacturing system to use automation to produce CWBs as quickly as possible, Inventus found that there were inherent built in errors in the process. Due to this they have failed to consistently meet their goal of producing 16 batteries per hour and currently produce around 12. Alongside this truncated throughput, the current ineptitude of the production line has resulted in an increase in operators required to produce the battery packs.

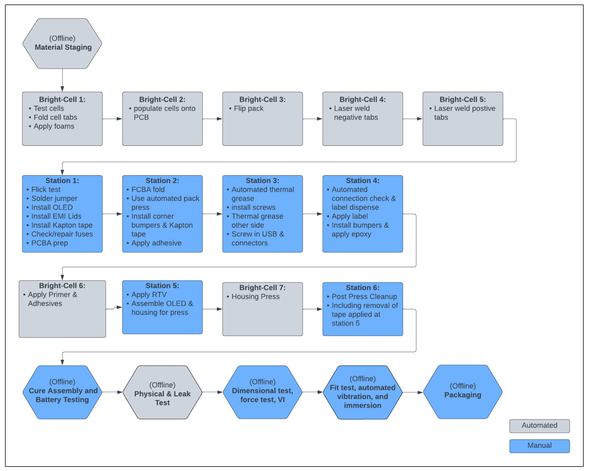
Project Goals:

- Increase throughput rate by 33%
- Improve line yield by 15%

CWB 3.6.2

Current System Model

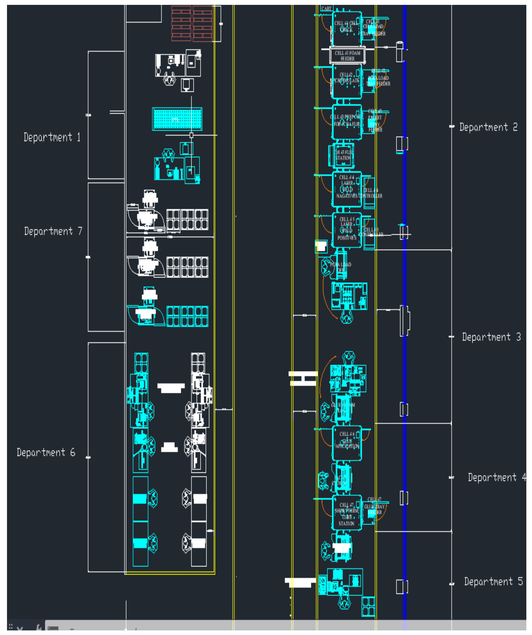
The current manufacturing process consists of both automated and manual stations. The process flow along with each station's cycle time can be found below.



Process Flow Chart

Station #	BC-1	BC-2	BC-3	BC-4	BC-5	1	2	3	4	BC-6	5	BC-7	6
Cycle Time (sec)	236	216	N/A	176	176	169	239	312	197	185	136	425	129

Time Study Table

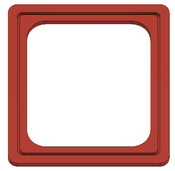


Initial Layout

Methodology

1. **Performed Time Study to Identify Bottlenecks**
   - Station five saw a cycle time of 794 seconds due to the amount of time an operator takes to initially clean the battery pack and then assemble the housings for the press.
   - For station three, the cycle time of 312.4 seconds can be attributed to a large collection of operators trying to accomplish many small steps in a small space. As a result, operators tended to work slower than expected or had too many battery packs to work through.

2. **Designed a mold to cast gaskets**
   - Inventus Power experiences yield loss from excess glue overspilling onto the pack, the CWB pack. We designed and 3D printed a mold to cast gaskets to protect the pack from glue overflow to replace their current method of taping the battery pack.



Gasket Mold

3. **Automation Analysis**
   - Many deficiencies in the production process are related to the Bright Cell (BC) equipment. During our time study, we observed the BCs stopping for many reasons such as no PCBs loaded in the cart, different batches of battery cells faulting the system, and identified a one second delay in each of the BCs. There are also deficiencies within the robots such as only picking up two battery cells at a time.

4. **Layout Improvements**
   - Material staging and cell loading preparation is done on opposite sides of the floor
   - Not all stations were in sequence, disrupting one piece flow and ultimately creating multiple areas of WIP on the production floor.

Recommendations

1. **Add WIP storage and add a glue machine**
   - To improve Bright Cell station seven, add additional inventory to the second stage of the automation. While the first pack is pressed in the housing an additional pack is loaded in the machine waiting to be pressed upon completion upon the first, increasing this inventory could increase operator output and reduce downtime through allowing continuous work.
   - To remove the bottleneck at station five, adding another automated glue machine would enable the operator to work on a second pack and insert screws and folds into the second machine before the first machine completes the automated process, resulting in an increase in the station's throughput rate.
2. **Research additional materials or solutions to protect the battery pack**
   - Operators currently taping the pack with tape is a large non-value add time along with a large consumables cost. While our gasket failed as the glue adhered to the gasket, we recommend exploring additional gasket materials or alternate solutions to taping the pack.

Prototype Gasket

3. **Automation Improvement**
   - To improve the BCs, change the fixture which picks up cells in BC-1 to allow for 4 battery cells at a time, add alarms when the PCBs are low to prevent downtime, remove the delays in each of the BCs. These are some of the improvements identified to reduce cycle time and achieve 16 packs/hr.
4. **Layout Improvements**