Many industries use assembly lines to speed up production, reduce costs, and improve safety. The automotive and food industries are well known users of assembly lines. What assembly line industries can we think of?
This an example of the assembly line for the Southwest Airlines Florida One.
Today's Learning Objectives

- After today’s class, students will be able to:
  - Discuss the importance of engineering in manufacturing processes.
  - State that Industrial Systems Engineering (ISE) encompasses the design, analysis and evaluation of the whole manufacturing process.
  - Describe how an engineer can help enhance productivity, speed, quality, cost and sustainability in the manufacturing process.
  - Identify the core, fundamental principles of Lean (eliminating waste) and Sigma (reducing variation in the product).
  - Explain the fundamental difference between PUSH and PULL systems on the assembly line.
## Sequential Workflow

<table>
<thead>
<tr>
<th><strong>Pull System</strong></th>
<th><strong>Push System</strong></th>
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<tbody>
<tr>
<td>Create product or service as they are demanded</td>
<td>Makes forecasts/assumptions about demand</td>
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<tr>
<td>Used on lower volume/specialized products</td>
<td>Medium to high volumes of standard products</td>
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<tr>
<td>Requires more communication and coordination to changeover between products</td>
<td>Made for stock because demand is assumed to be predictable and stable</td>
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<tr>
<td>Reduces inventory and excess production/waste</td>
<td>Large spikes in inventory and work-in-process</td>
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Sequential Workflow (cont’d)

Push vs. Pull → Fast Food vs. Sit-Down restaurants
Agenda

Overview 10 min
1st Production Run (PUSH) 10 min
2nd Production Run (PULL) 10 min
Discussion/Improvement Cycle 15 min
3rd Production Run (PULL) 10 min
Discussion 15 min
Clean-Up and Item Checkout 10 min

Total 80 min
Production Line Overview

A Customer Orders a set of Mr. Potato Heads

3 Variations of Mr. Potato Heads Assembled

Customer Receives and Checks Order
The Process

- **Team Roles:**
  - 1 Operations Manager
  - 9 Operators
  - 1 Final Tester
  - 2 Customers
  - 1-2 Transporters
  - 2 ISE’s

- **Sequentially,**
  - Process must flow from Operators to Final Tester (FT) to the Customer
Additional Notes

• Transporters are the only people who can move parts between tables.

• Operators cannot leave their assigned workstations.

• If you do not get an order in on time, still give it to the customer as quickly as you can.
Production Run Order

- First run → Push
  - The first order occurs at time 1 minute
  - Teams will receive an order every 1 minute after first.
  - Orders delivered more than 75 seconds after the order is placed will be considered late.

- Second Run → Pull
  - Teams will implement the pull order system.

- Improvement Cycle
  - Teams will have 10-15 minutes to improve their system.

- Third Run → Pull
  - Teams will implement their revised system.
Production Issues

- **WIP (Work In Process)**
  - Any partially finished product
  - Labor & material have been used, but item is not complete and cannot be sold for profit

- **Wrong Order**
  - A finished and verified product, but incorrect per customer order
  - Costs extra to return and correct customer issue, but product can be sold elsewhere

- **Defective Product**
  - Went through entire assembly process but found to be not within specifications
  - Must be re-worked or scrapped, causing wasted time and money
Important Takeaways

- The push and pull systems each yield different results. There are pros and cons to each and best fit different situations.

- By eliminating or minimizing different forms of waste, productivity and net profitability can be increased.

- ISEs have the ability to design, analyze, and oversee the operation of a system for sustained efficiency.
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<thead>
<tr>
<th>Topic</th>
<th>Document Type</th>
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<tr>
<td>Marble Delivery System</td>
<td>None</td>
</tr>
<tr>
<td>Quality and Productivity</td>
<td>Executive Summary</td>
</tr>
<tr>
<td>Circuits</td>
<td>Executive Summary</td>
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<tr>
<td>Solar Meter</td>
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<td>Solar Cell</td>
<td>Memo (Combined)</td>
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<td>Beam Bending</td>
<td>Memo</td>
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<td>Wind Turbine (7B)</td>
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<tr>
<td>Problem Solving Project (8C)</td>
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Preview of Next Lab

- Lab 3- Circuits Lab
  - Understand how voltage, current and resistance are measured
  - Apply Ohm’s Law, Power Law, Kirchhoff’s Current Law and Kirchhoff's Voltage Law
  - Observe polarity of certain electrical components
  - Review the reading, take Carmen quiz, and complete the pre-class assignment!