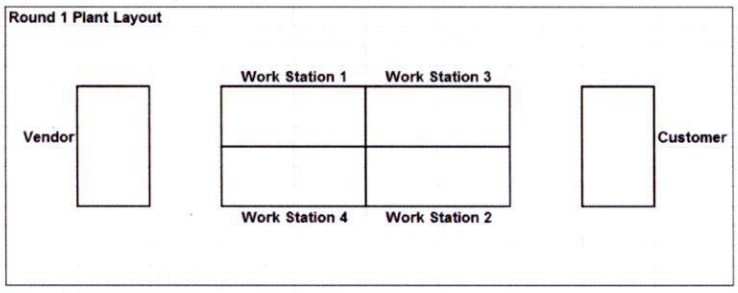
The Paper Airplane Factory

SWEA IE E2E

November 2015

Round 1 – 5 minute round

- Teams elect a team leader
- 4 are craft persons
  - Craft persons to build an entire airplane by themselves
  - No refolding – wrong folds must be scrapped
  - Team leader is also a craft person
- Team leaders – meet with me
- Team leaders you will have 5 minutes to
  - Set up plant as below
  - Train your employees



Round 1 - Discussion

- Was it easy to build the airplane?
- Did you need more training?
- What problems did you have?
- How could the plant have worked better?

Craft Production

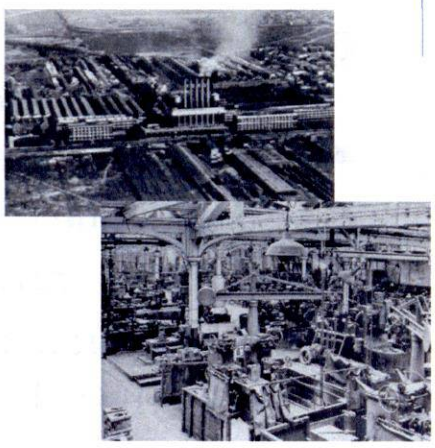
- Art – not a science
- No standards – each product or piece produced is unique

Problems with Craft Production

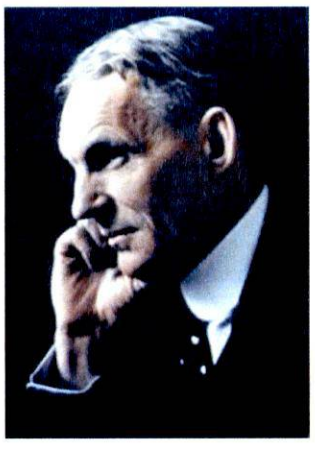
- Can take years to train crafters
- Turn over creates hardship
- Quality often low due to lack of standards
- Product availability limited by number of skilled crafters
- Delivery times can be very long

Industrial Revolution

- 18th to 19th Century
- Driven by
  - Technology Improvement
  - Mechanization
- Major changes in
  - Agriculture
  - Manufacturing
  - Transportation
- Major turning point in history
  - Sustained growth
    - Average Income
    - Population
    - Living Standards



Henry Ford



- 1863 – 1947
- Founded Ford Motor Company in 1903
- Father of Mass Production and the Assembly Line
- "Nothing is particularly hard if you divide it into small jobs"

Mass Production

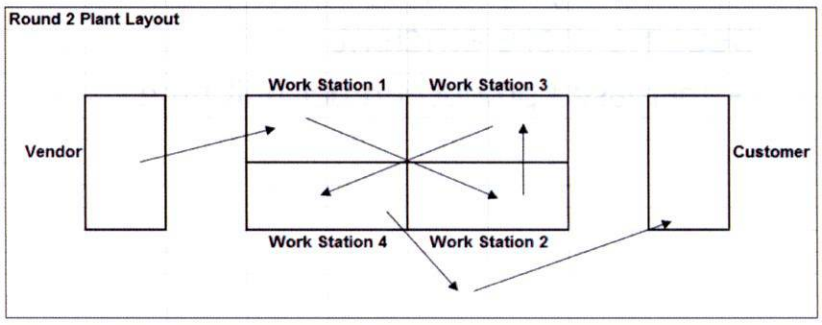
- Excellent system offering many advantages to craft production
- Piece Part Metrics
- Assembly Line
- Workers are incentivized to produce
- Increased production drives down production costs

Round 1 - Score

- Display costing system

Round 2 – 5 Minute Round

- Plant to run as an assembly line
- 4 team members to staff assembly work stations
- Team Leader – you have 5 minutes to prepare your plant
- Determine what each work station is going to do.
- Setup plant as below



Round 2 - Discussion

- How did the assembly line work?
- What problems did you have?
- How could the plant have worked better?

Benefits of Mass Production

- Employees require less training
  - Turnover less painful
- By dividing up tasks, employees become more efficient
  - Increased production per unit time

Problems of Mass Production

- Incentivizing production encourages over production
  - Increases inventory and associated costs
- Each station tends to push WIP to the next station whether they need it or not
  - Push Production

Problems of Mass Production

- Not designed to adjust quickly to changes or special demand
  - Makes 1 thing very well
  - Variety can be a problem

"People can have the Model T in any color – so long as it's black"

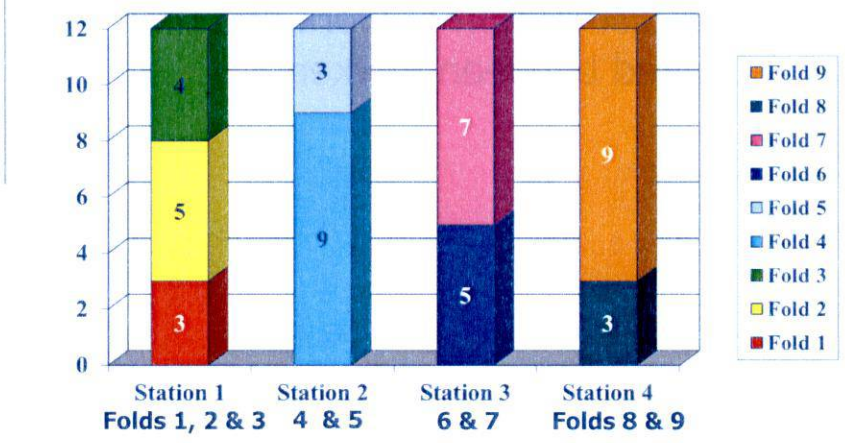
Toyota Production System

- Organizes manufacturing and logistics for the automobile industry
  - Includes suppliers and customers
- Major precursor to "Lean Manufacturing"
- Originally called "Just-in-Time Production" or JIT
- Heavily influenced by America
  - Henry Ford
  - W. Edward Deming
  - Super Markets

Lean Production

- Quality at the Source
- Level loading
- Pull
- Pace

Work Station Loading – Lean Condition



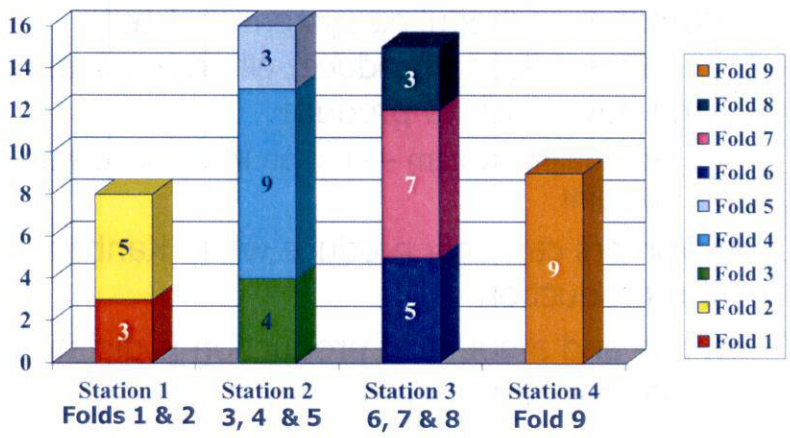
PULL Production

- Kanban – scheduling system that tells workers what to produce, when to produce it, and how much to produce.
  - Scheduling system --- not an inventory control system!
- Workers can only produce when Kanban calls for production
- Pace and amount of production is dictated by what the customer PULLs.

Level Loading

- Even distribution of work and time required between workers

Work Station Loading – Base Condition



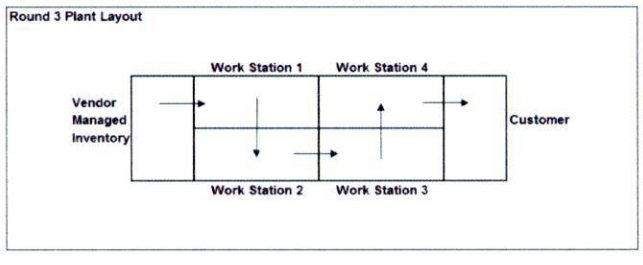
Round 2 - Score

Round 3 – Level Loading

- Step 1: Pick one person to make an entire airplane.
- Step 2: Using sheet provided, record the time it takes to make each individual fold of the airplane.
- Step 3: Divide the folds up among your assembly line employees so that every station has the same cycle time.

Round 3 – 5 Minute Round

- Implement Kanban
  - Teams are allowed to fill Kanban prior to start of simulation
    - One piece of WIP between stations
    - One finished plane
- Implement Level Loading
  - Divide folds and time equally between work stations
- You have 15 minutes to prepare your plant and fill your Kanbans
- Reconfigure plant as below



Round 3 - Discussion

- What worked well?
- What didn't work so well?
- How was the Kanban?

Round 3 - Score

Round 4 – Final Round

- Earnings/loss for this round will determine who gets future business – The Winner!
  - All previous scores are thrown out!
- Key changes
  - You now sell 4 different airplanes
  - You can only sell what the customer calls for
  - You can only sell in the order the customer calls for it
- Configure your plants as you see fit
  - Tables
  - People
  - Kanban
- You have 15 minutes to prepare your plant and fill any Kanbans you may have

Round 4 - Score

Round 4 - Discussion

- Did you learn anything?
- Did you have fun?

Questions

Credits

- Information provided by
  - Simplex Improvement
  - Wikipedia