

Process Planning

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Basics

- ▶ Process - a group of related tasks with specific inputs and outputs – exist to create value for the customer
- ▶ Process design - what tasks need to be done and how they are coordinated among functions, people, and organizations
 - ▶ Planning, analyzing, and improving processes is the essence of OM
- ▶ Process strategy - overall approach of an organization for physically producing goods and/or providing services
 - ▶ Vertical integration, capital intensity, process flexibility, customer involvements

Process Planning

- ▶ Process planning determines how a product is to be produced or a service to be provided.
- ▶ Necessary decisions
 - ▶ Converts design into workable instructions for manufacture
 - ▶ Decides components to be made in-house and to be procured from supplier
 - ▶ Select processes and equipment
 - ▶ Develops and documents manufacturing specifications

Outsourcing

- ▶ **Vertical integration**
 - ▶ The degree to which a firm produces the parts that go into its products
- ▶ A major decision is how much of the work to be done outside the firm – depends on:
 - ▶ Cost – Cheaper to make it or buy it
 - ▶ Capacity – less than full capacity or sufficient capacity
 - ▶ Quality – in-house allows better quality control
 - ▶ Speed – who can provide goods faster
 - ▶ Reliability – specified quality and desired time
 - ▶ Expertise – Keeping control over expertise and production

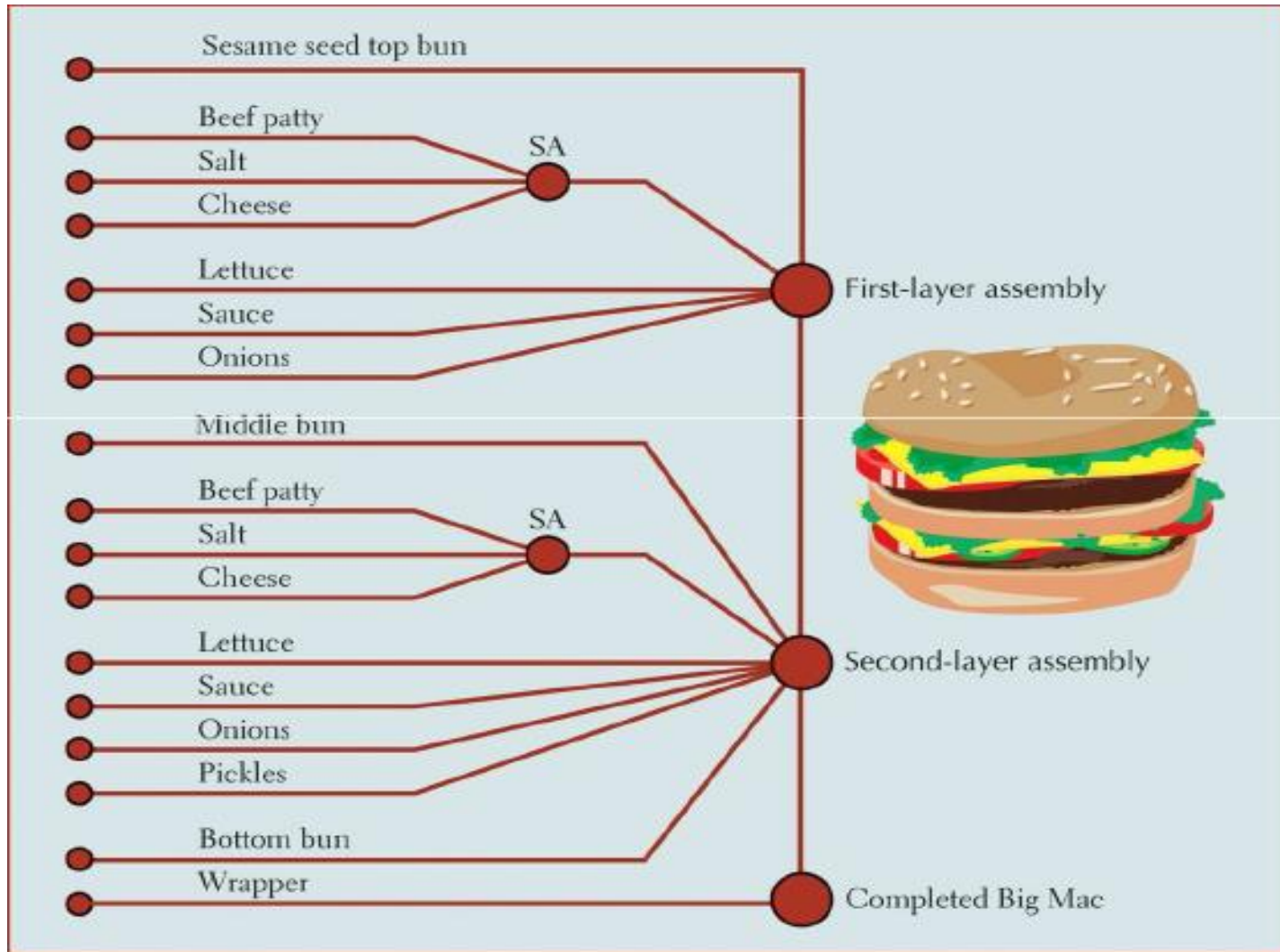
Product analysis

- ▶ Analyze design specs and creating documents to communicate how to manufacture
 - ▶ 1. Assembly chart
 - ▶ 2. Operations process chart
 - ▶ 3. Process flowchart
- ▶ Bill of material (BOM) is the list of materials and components that go into the product; including the quantity

Assembly chart

- ▶ Schematic diagram that shows the relationship of each component part to its parent assembly, grouping of parts that make up a sub-assembly, and overall sequence of assembly
- ▶ Also known as product structure diagram
- ▶ Does not include instructions for preparing each item; rather the purpose is to show the assembly flow

Assembly diagram example



Class Exercise


Create an assembly chart for the tree stand shown in the figure for a single worker, And a three worker assembly line. Also create the BOM.



Operations process chart

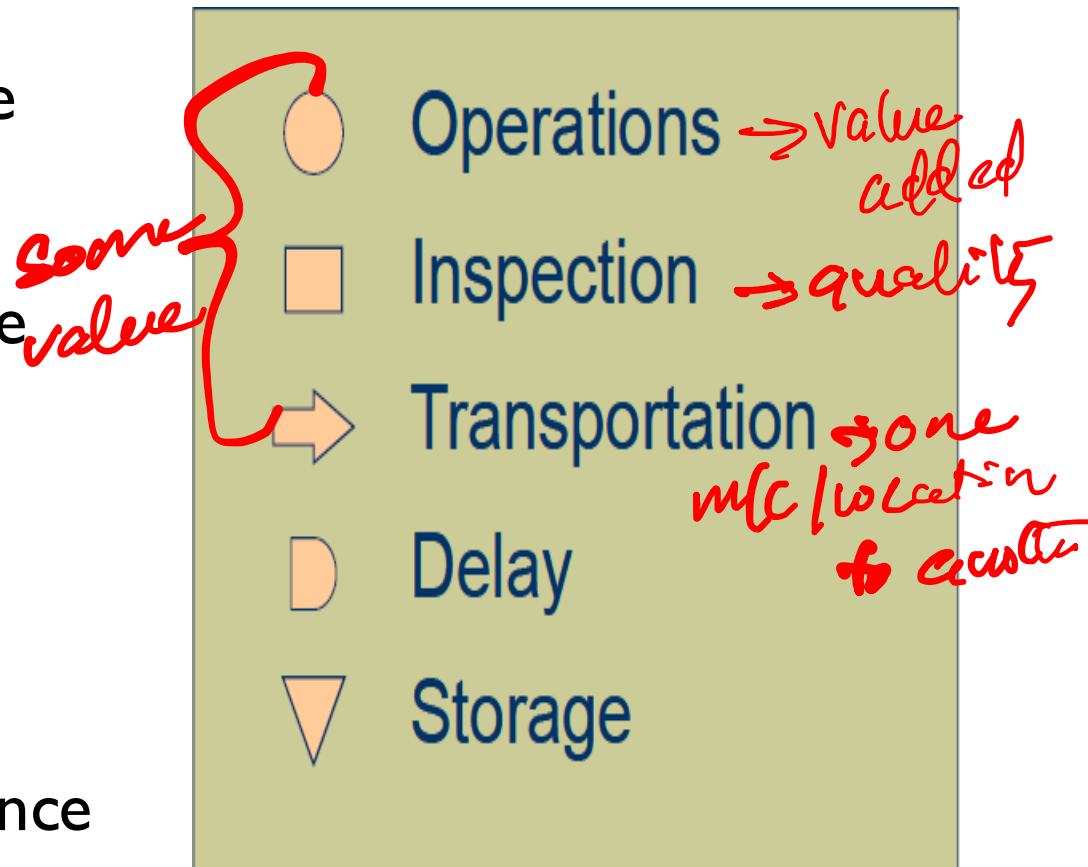
- ▶ Shows how a product is to be fabricated
- ▶ Resembles an assembly chart, but has more information
 - ▶ For each item listed in the assembly chart – a series of operations is added that describe how each item is to be fabricated
 - ▶ Contains information on the machines, tools, fixtures, gauges, time necessary, etc.
- ▶ Used as the source of operational requirements of job design

An Example

An Operations Sheet for a Plastic Part				
Part name		<u>Crevice Tool</u>		
Part No.		<u>52074</u>		
Usage		<u>Hand-Vac</u>		
Assembly No.		<u>520</u>		
Oper. No.	Description	Dept.	Machine/Tools	Time
10	Pour in plastic bits	041	Injection molding	2 min
20	Insert mold	041	#076	2 min
30	Check settings & start machine	041	113, 67, 650	20 min
40	Collect parts & lay flat	051	Plastics finishing	10 min
50	Remove & clean mold	042	Parts washer	15 min
60	Break off rough edges	051	Plastics finishing	10 min

Process flow chart

- ▶ Also known as flow process charts, describe the process using five standard symbols to highlight non-productive activities.
- ▶ Details of each process are not necessary; but time required and distance between processes are a must



An Example

Just In Time (JIT)

Date: <div></div>						Location: <div></div>		
Analyst: <div></div>						Process: Applesauce		
Step	Operation	Transport	Inspect	Delay	Storage	Description of process	Time (min)	Distance (feet)
1	●	➡	□	D	▽	Unload apples from truck	20	
2	○	➡	□	D	▽	Move to inspection station		100 ft
3	○	➡	■	D	▽	Weigh, inspect, sort	30	
4	○	➡	□	D	▽	Move to storage		50 ft
5	○	➡	□	D	▽	Wait until needed	360	
6	○	➡	□	D	▽	Move to peeler		20 ft
7	●	➡	□	D	▽	Peel and core apples	15	
8	○	➡	□	D	▽	Soak in water until needed	20	
9	●	➡	□	D	▽	Place on conveyor	5	
10	○	➡	□	D	▽	Move to mixing area		20 ft
Page 1 of 3						Total	450	190 ft

150

70 = ?
150
10%

20
30
15
5
70
↓
value added.

Type of processes

- ▶ Production processes are categorized into four:

- ▶ 1. Projects → Product doesn't move - man, materials, machines move.
- ▶ 2. Batch production
- ▶ 3. Mass production
- ▶ 4. Continuous production

- ▶ Project is a one-at-a-time production of a product to customer order

- ▶ Ship building
- ▶ Aircraft
- ▶ Construction

} usually large & complex products.
① Inefficiency.
② Delay.

Fixed Position layout

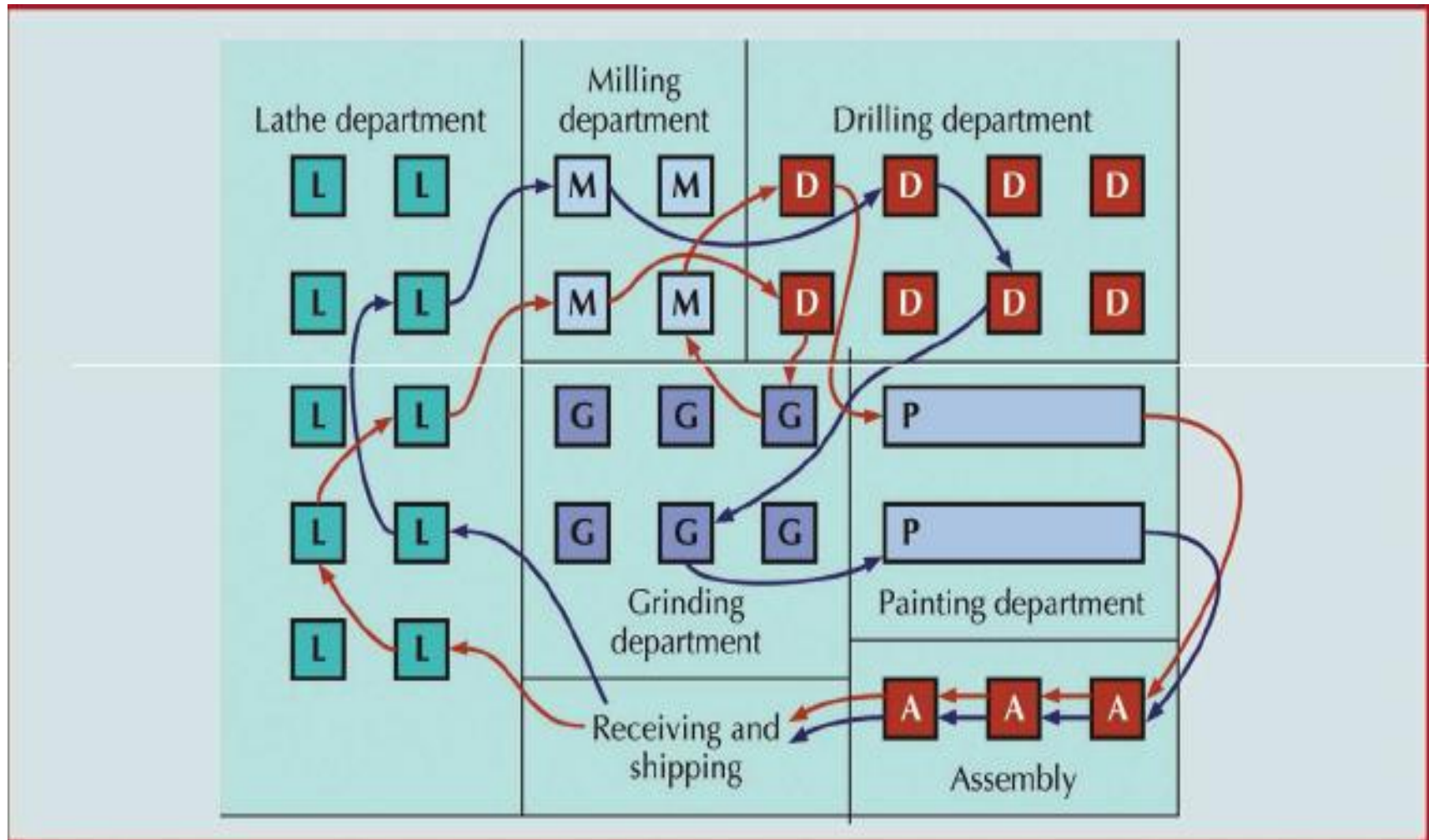
- ▶ Fixed position layouts are used in projects where the product cannot be moved
 - ▶ Used when the product is too fragile, bulky, or heavy to move
 - ▶ Equipment, materials, workers, and other resources are bought to the production site
- ▶ Equipment utilization is low – specifically because many times it is cheaper to leave the equipment idle at the site
 - ▶ Cost of moving is expensive
 - ▶ Mostly leased or sub-contracted

Man & machines & starting
Product moves.

Batch production

- ▶ Processes many different jobs through the production system at the same time in groups (batches)
- ▶ Also know as job shop or intermittent production
- ▶ Products are made to customer order, low in volume, with fluctuating demand
flexible
- ▶ *m/c* Equipment tends to be general purpose and work force is highly skilled so that variety of items can be produced

Functional layout schematic



Jobshop Example



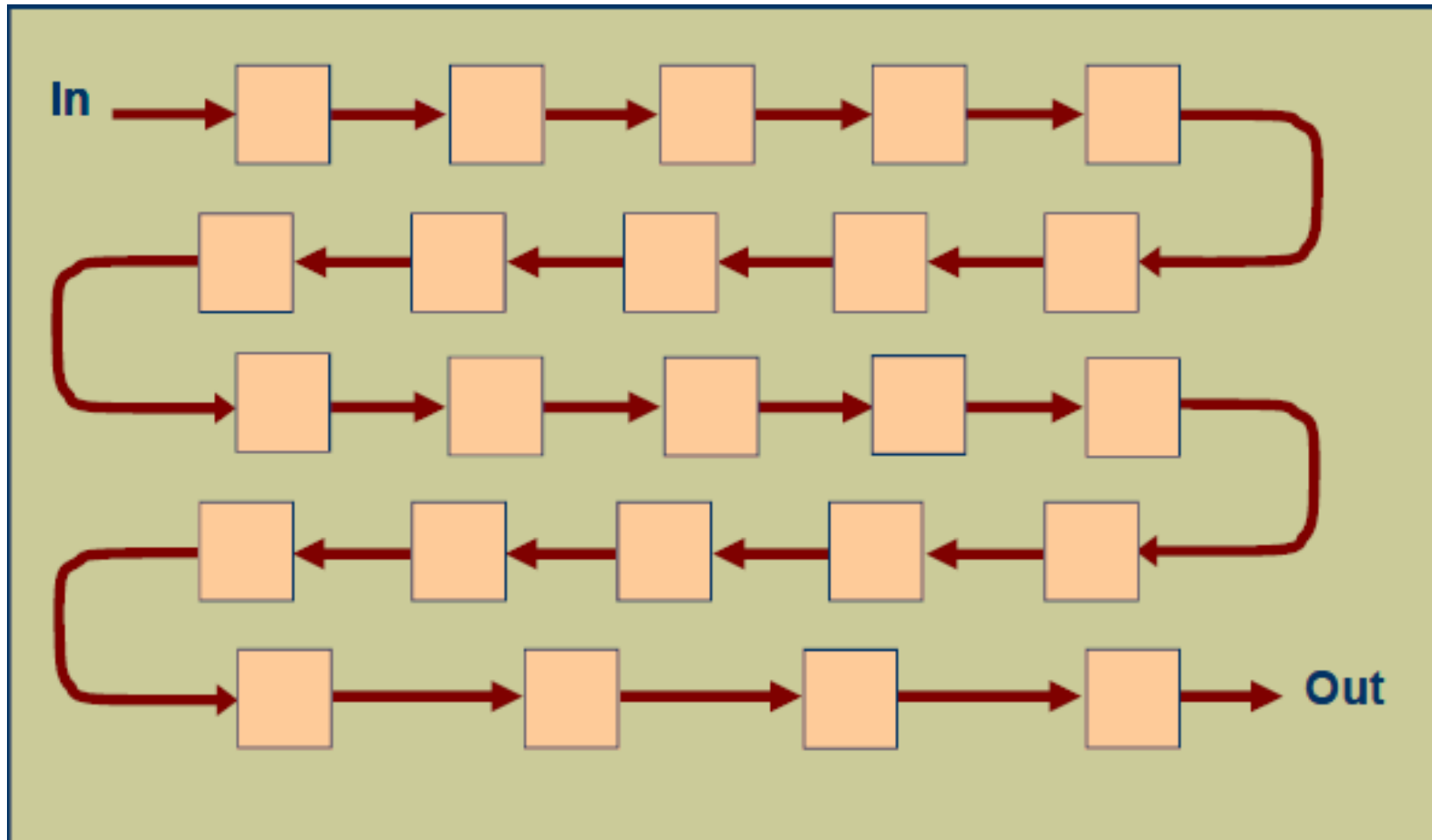
Mass production

- ▶ Produces large volumes of a standard product for a mass market
- ▶ Also known as flow lines or assembly lines
 - ▶ Automobiles, televisions, personal computers, etc.
- ▶ Demand is stable and product volume is high which results in dedicated equipment for the particular product
- ▶ Capital intensive, specialized equipment, limited labor skills – high efficiency, low per-unit cost, ease of control, speed

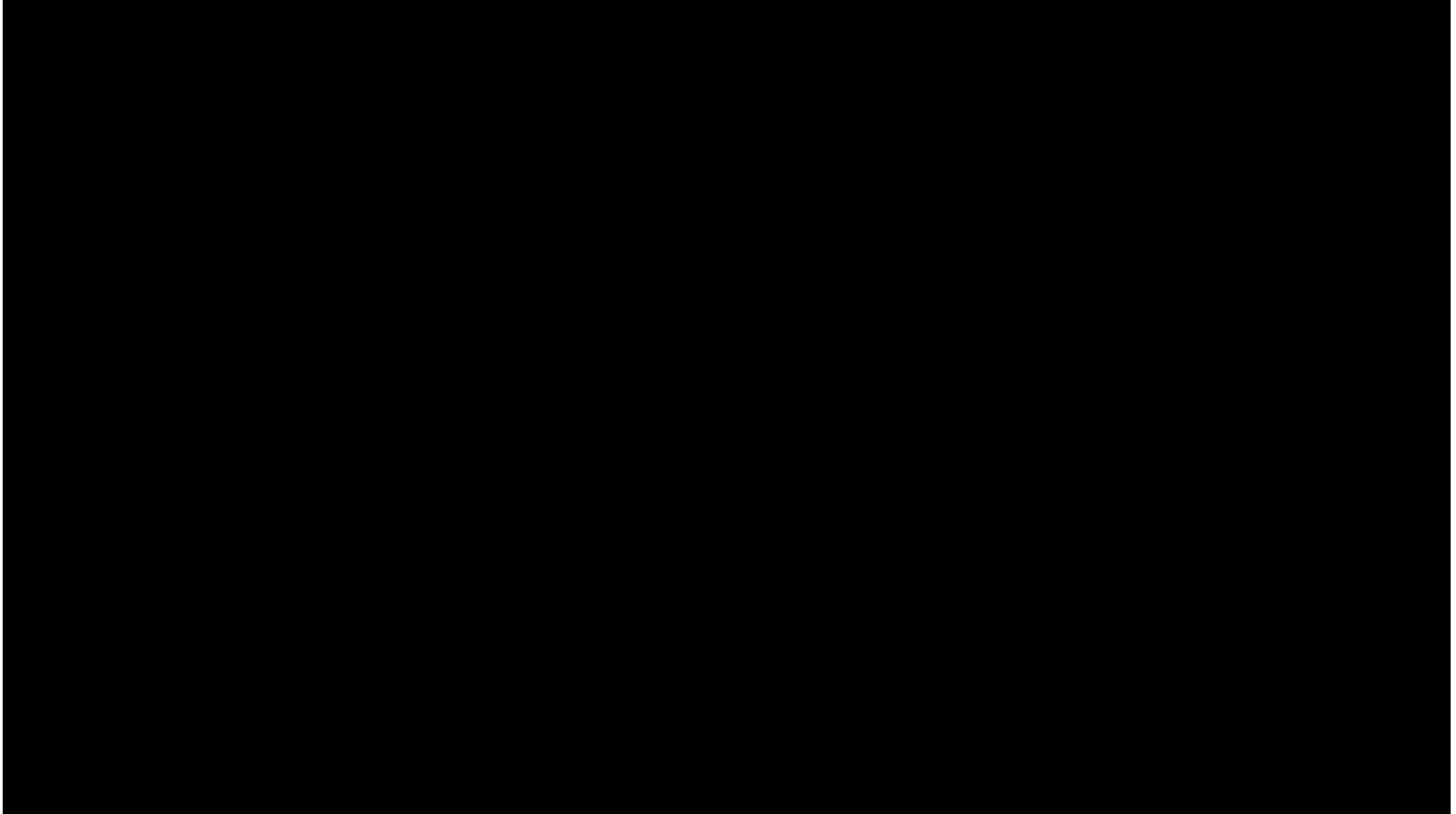
Ford.

Henry Ford Steelhead Labor.

Product Layout Schematic



Assembly Line Example



Continuous process

- ▶ Very high volume commodity products that are very standardized
- ▶ System is highly automated, runs 24 hours a day – called process industries
Crude oil refineries, metal forges
- ▶ Output is continuous, not discrete – implies individual units are measured rather than counted
- ▶ Efficiency, ease of control, capacity are benefits

Process selection

