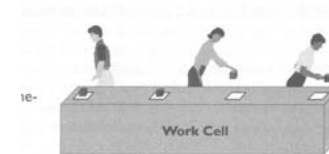


Lean Concepts

- **Be customer focused:** Customer's want defines value. Be on-time, responsive, flexible, and fast.
- **Standardise and level workflows:** Mimic continuous one-piece flow, minimise WIP, use visible measures.
- **Manage capacity:** Increase process uptime, reduce set-up times, find 'lost' capacity.
- **Eliminate waste:** Identify non-value add activity, then modify, combine, eliminate those tasks.
- **JIT production and delivery :** Not too early - never late; always done right first time; equipment always works when needed.



Figure 21-2 TPS flow equipment



is and batch production versus one-piece flow

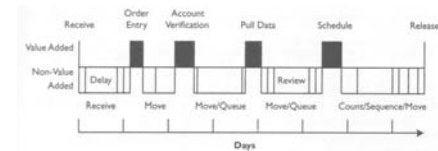
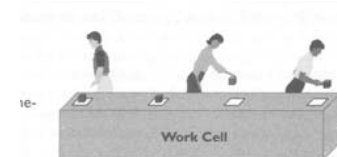
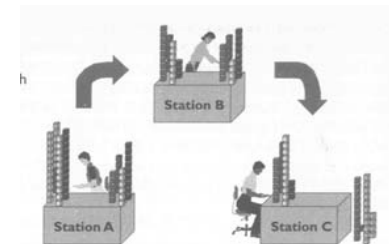


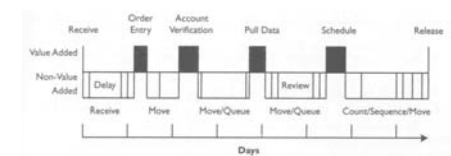
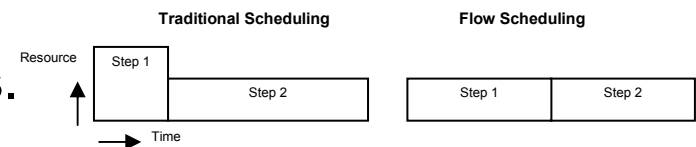
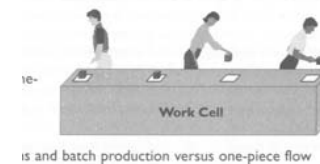
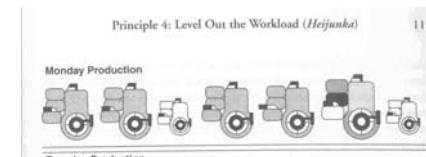
Figure 21-1. A non-lean flow in an account verification process



is and batch production versus one-piece flow

To Be Lean = Eliminate Non-Value

- **Match lot sizes to customer demands:**
Use kanbans; end WIP (no stock).
- **Use pull scheduling** instead of push scheduling. (Takt time)
- **Schedule to the rate-determining step** (the bottleneck) then debottleneck process.
- **Facilitate fast feedback:** Arrange sequential operations next to each other for fast feedback from 'customer' to 'supplier' operation if something in-process is wrong.
- **Value-stream map** to locate waste (non-value) and design it out.

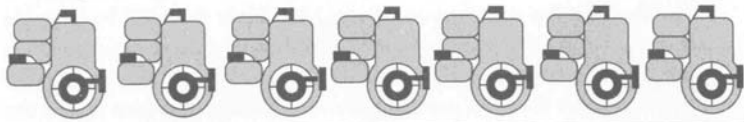


Schedule to Match Takt Time

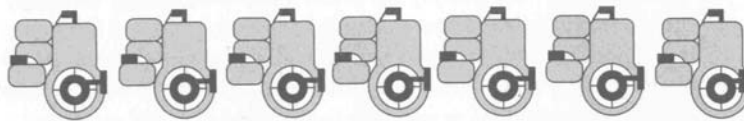
Principle 4: Level Out the Workload (*Heijunka*)

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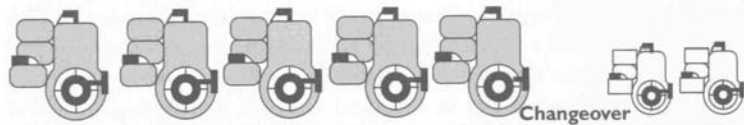
Monday Production



Tuesday Production



Wednesday Production



Thursday Production



Friday Production

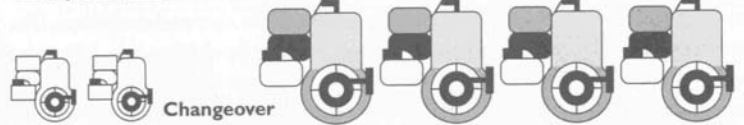
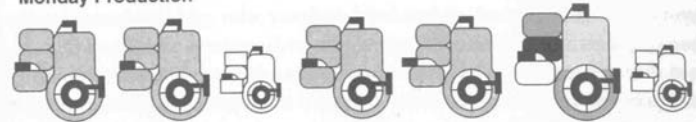


Figure 10-2. Traditional production (unleveled)

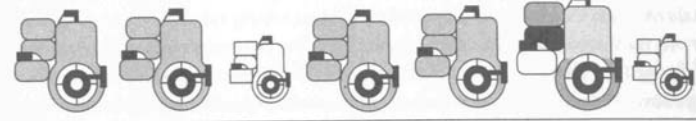
Principle 4: Level Out the Workload (*Heijunka*)

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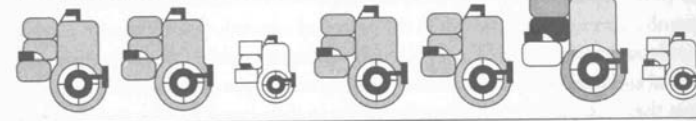
Monday Production



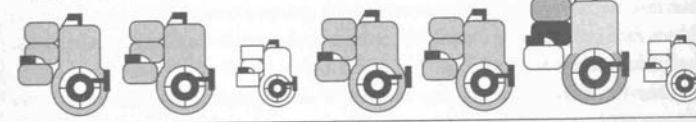
Tuesday Production



Wednesday Production



Thursday Production



Friday Production

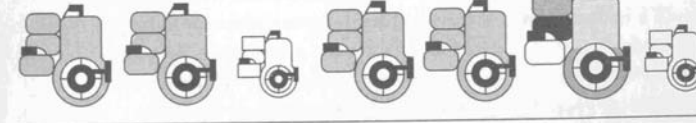


Figure 10-3. Mixed model production (leveled)

Refine Your Value Adding Stream

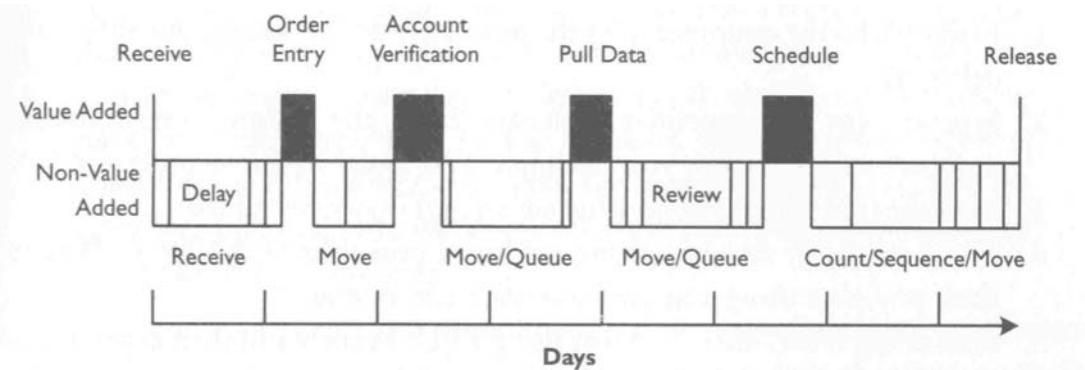


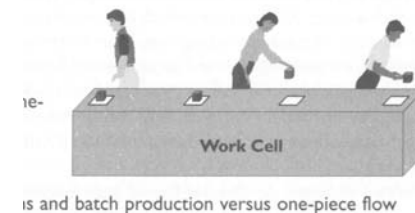
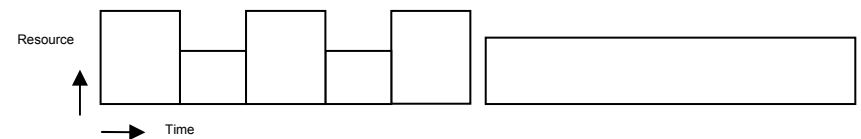
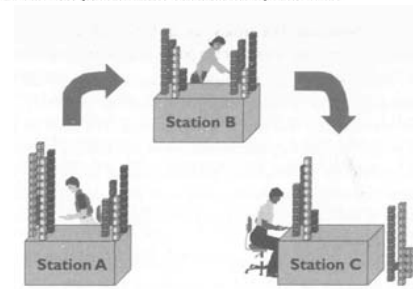
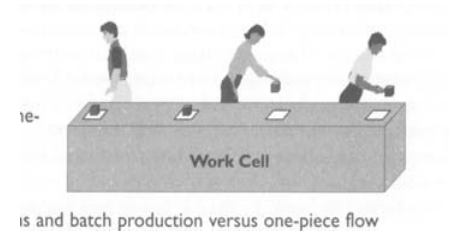
Figure 21-1. A non-lean flow in an account verification process

	Before	After
Production Lead Time (dock to dock)	37.8 days	29.2 days
Production Lead Time (saw to weld)	3.75 days	0.8 days
# of Forklift Moves	11	2
Travel Distance (dock to dock per mast)	1,792 feet	1,032 feet
Shop Order Input Time (per mast)	207 minutes	13 minutes

Figure 8-5. Results of lean transformation of mast operation

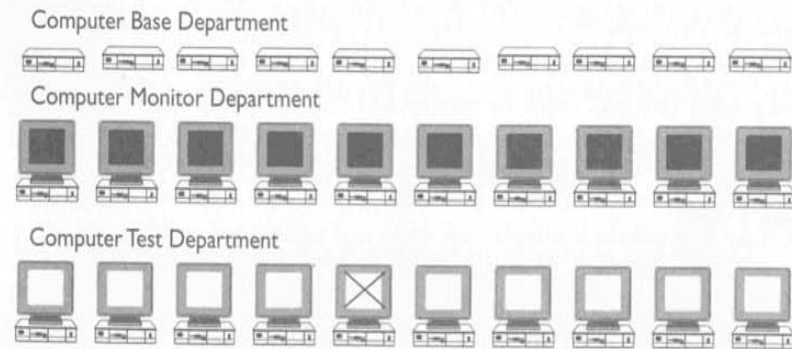
To Have Flow = Standardise & Level

- **Mimic continuous flow** – one unit at a time at the rate the customer wants.
- **Minimise WIP** – remove buffers between customer and supplier to respond to changed demand. Small amounts of inventory frequently restocked.
- **Even and level** production and schedules.
- **Use visible control measures** to show up deviations from requirement.



Benefit of Flow

minutes of value-added work are needed to make that computer.



- Complete processing of first batch of 10 takes 30 minutes
- First good computer ready in 21 minutes (plus transport time)
- There are at least 21 sub-assemblies in process at a time

Figure 8-1. Batch processing example

make the first computer ready to ship. In fact, the three minutes is pure value-added time. What flow has done is to eliminate overproduction and inventory.

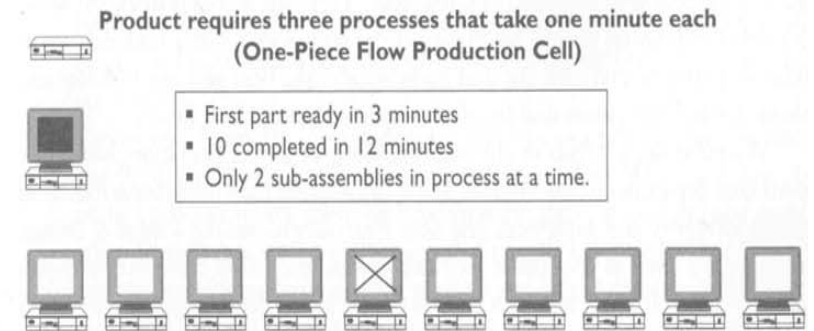


Figure 8-2. Continuous flow example

Why Faster Means Better in a Flow

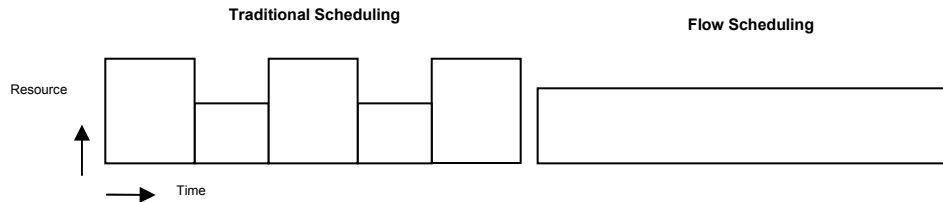
- Flow eliminates over-production and inventory.
- Batching is slow and wasteful!

When Applied To Maintenance

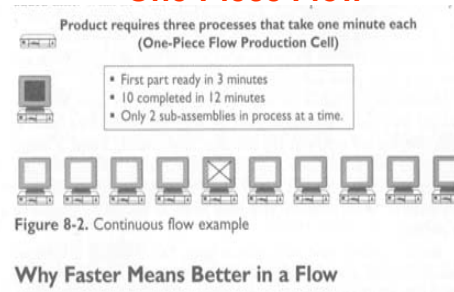
Responsiveness To Customer



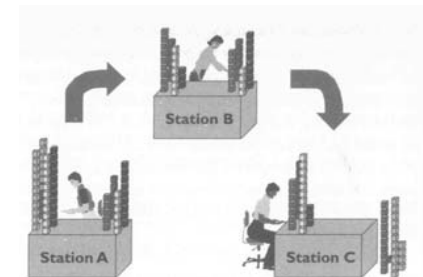
Level To Bottleneck



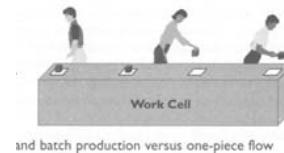
One-Piece Flow



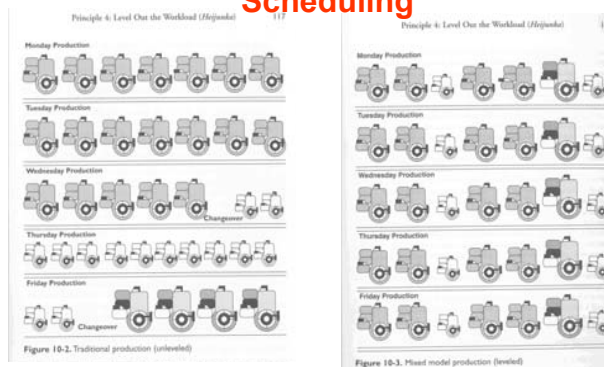
Minimise WIP > JIT



Visual Controls



Takt Time Scheduling



Eliminate Non-Value

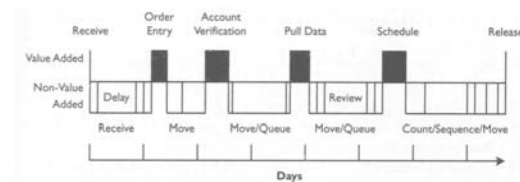


Figure 21-1. A non-lean flow in an account verification process