

Today's lecture will commence at 1:15pm



Forthcoming Events

MADE

For your diaries:-

Test #1

Friday 10th February (covering Define and Measure)

Test #2

Friday 31st March (covering complete course materials)

Open from 1pm on the Friday – close midnight following Monday

1 hour duration, multi-choice (approx. 40 questions)



Forthcoming Events

Improve phase 3rd and 17th February

Control phase 24th February and 3rd March

Project Reviews 21st and 28th April

Mornings 08:30 -12:00

Half hour - 5 mins DMAIC and 5 min Q&A



Level 5 – Continuous Improvement with Industry 4.0

Improve 3 – SMED

Single

Minute

Exchange of

Dies

Improve 2 - SMED



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Single Minute Exchange of Dies is the reduction or re-setting of tool changeovers

Its objectives are :-

- Allow more changeovers
- Become more flexible
- Reduce batch sizes
- Reduce inventory
- Increase machine capacity

- All equipment changeovers to be completed within single digit minutes (less than 10)
- Reduce labour to complete the changeover
- Reduce the parts, tools and materials in changeovers
- Standardise the changeover (SOP)
- Reduce the amount of material so first off is a conforming part

- The changeover itself does not add value to the customer but is a NVA task thus must be minimised (as we have previously discussed)
- They cannot be eliminated but can be significantly reduced

There are four main elements to the changeover task:-

- Delivery to the workplace of materials, jigs, tools etc
- Removal and fitting of replacement jigs
- Aligning, measuring and checking new jig
- Trial runs, checking materials and adjustments

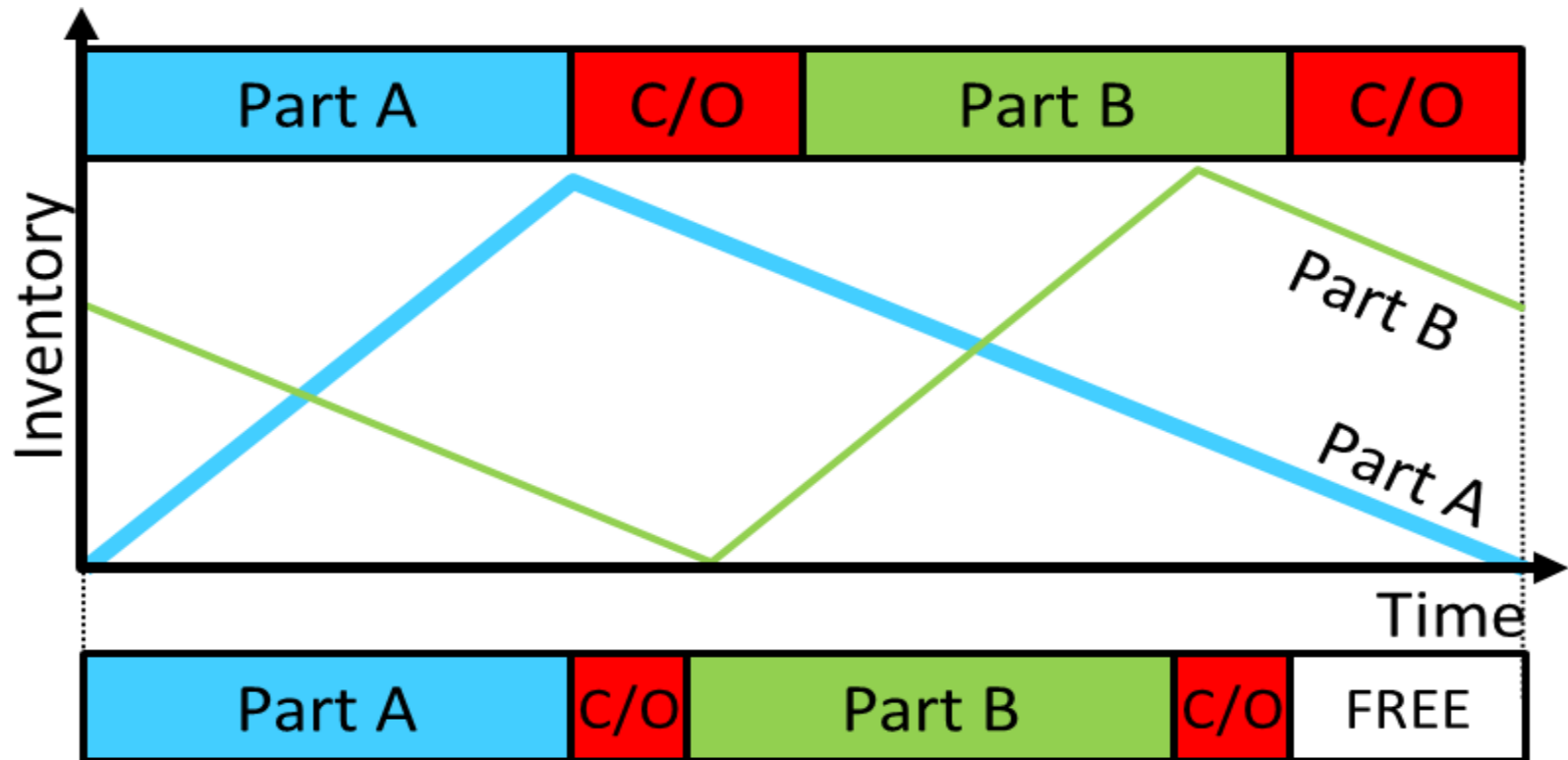
Typical problems encountered:-

- Lack of equipment and tools
- Drawing queries
- Material issues
- Labour allocation
- Lack of communication between departments
- Paperwork delays, permits to work etc
- No defined instructions

There are though two fundamental categories we can split each task into:-

- Internal Activities (online) – removing and mounting the dies (only performed when machine is on stop)
- External Activities (offline) – transporting dies and tools, organising labour, materials and authorisation paperwork etc (can be performed when machine is still operational)

Improve 2 - SMED



The steps to improve the process:-

- Observe the current process
- Clasify each task by either online or offline
- Eliminate online activities or convert to offline
- Improve online activities
- Improve offline activities

Observe the current process:-

- Watch (record) the tool change
- Make a drawing of layout and movements
- Record all elements and times – see work combination tables (p186 The Lean Toolbox)
- Record all machine settings and parameters
- Analyse the process Capture opportunities

Differentiate between online and offline:-

- Move all the elements which can be moved from online to offline

Convert from online into offline:-

- Move all the elements which can be moved from online to offline
- Eliminate the activity – dedicate machines or material sizes, grades etc
- Use pre-set tooling

Improve online Activities:-

- Minimise number of tools
- Standardise bolts/head sizes
- Minimum thread length
- 'C' washers
- Colour code tools/fittings
- Standard setting blocks
- Positive location

Improve 2 - SMED



**EXTRA
LIGHT LOAD**
Yellow
Color Coded



LIGHT LOAD
Blue
Color Coded



MEDIUM LOAD
Red
Color Coded



HEAVY LOAD
Green
Color Coded

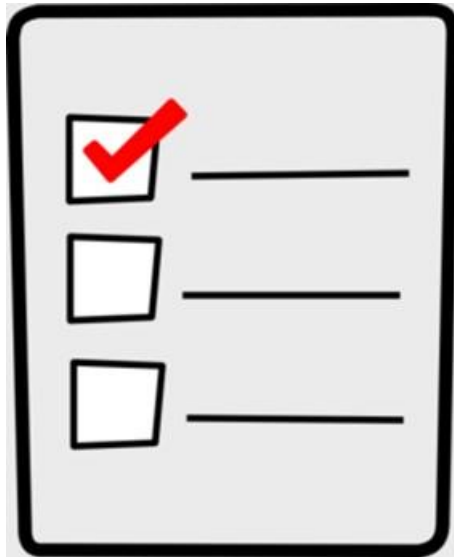


**EXTRA
HEAVY LOAD**
Brown
Color Coded

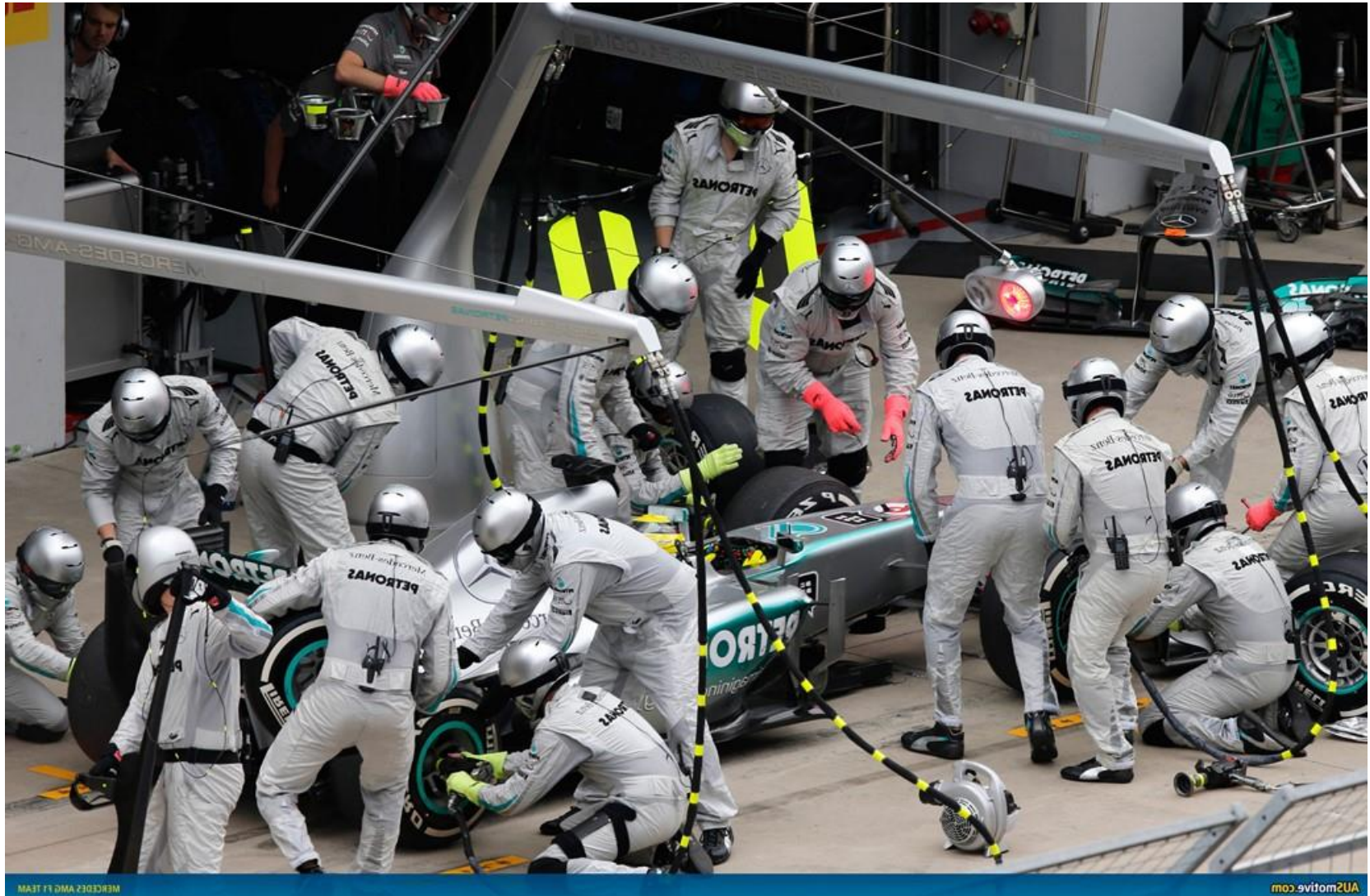
Improve offline Activities:-

- Store tooling next to workplace
- Tooling readily available
- Pre changeover checklist
- Detailed SOP's

Improve 2 - SMED



Improve 2 – SMED example



Improve 2 – SMED example



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Comparison

- **Tools available**
- **Tyres available**
- **1 nut on F1 car**
- **Operators available**
- **F1 cycle time under 3 seconds**
- **Jims cycle time 30 mins!**



Level 5 – Continuous Improvement with Industry 4.0

Improve 4 – TPM

Total

Productive

Maintenance



Total Productive Maintenance traditionally seen as the maintenance Dept activity

Many of the maintenance activities are well within the abilities of the machine operators (car maintenance, checking fluids, changing light bulbs etc)

If we can free up some of the routine tasks like checking machine condition we can free up the maintenance function for more involved activities

- Process owners are often the best people to spot condition abnormalities
- Minor faults can be rectified quickly when spotted
- Process owners can often give the best feedback on machine performance

- The 5 pillars of TPM

- Autonomous Maintenance

- Planned Maintenance

- Training

- Improvement Activities

- Design for Manufacture

Autonomous Maintenance:-

- Appropriate maintenance performed by operators on their own equipment
- Elimination of waste through operator involvement
- Data collection and developing action plans to resolve
- Improve the machine OEE (availability, performance and quality)

Planned Maintenance:-

- More in depth tasks performed by skilled trades (although sometimes as emergency repairs!)
- Is periodic and routine developed in conjunction with past performance and designated engineers
- Developed from supplier knowledge and recommendations
- Skilled trades can act as coaches to operators

Training:-

- Decide what is appropriate and achievable to the workforce
- Provide applicable training to the workforce
- Provide technical support initially to support the activities
- Train in data collection
- Fully document the processes and required outputs from the activity

Improvement Activities:-

- Everyone within the area to participate
- Set achievable targets
- Multi-discipline teams
- Show the current state (may use OEE to identify problem areas)
- Document the outcomes and improvements (FMEA and control plan updates)
- Celebrate the success

Design Activities:-

- Feed back to designated engineers
- Feed back to equipment suppliers and change current designs and/or incorporate in future machine design reviews
- Mistake Proof (Poka Yoke) where possible

Improve 3 - TPM



Further reading 'The Lean Toolbox' P149 SMED, P129 TPM