

*Training*

**SET-UP TIME REDUCTION**

**or**

**Pit Stop-style Changeovers**

# ***WHY ?????***

In the heyday of large-scale mass production, production engineers used to agree that *the fewer the changeovers, the better.*

However, in today's market, where large product variety, small output volumes, and short delivery are all daily realities, *factories are having to make frequent product-model changeovers* to match production to current market needs.

# ***WHY ??***

**IN TODAY'S WORLD WITH GREATER PRODUCT VARIETY and MORE DEMANDING CUSTOMER SERVICE ...**

- We cannot necessarily dedicate equipment,**
- We must maximize the use of expensive equipment, and**
- we wish to have less investment in inventory**

# ***How a Quick Changeover Helps***

- ◆ **Smaller lot sizes**
- ◆ **Lower inventory**
- ◆ **Better quality**
- ◆ **Shorter lead times**

- ◆ **More frequent changeovers, better flexibility**
- ◆ **Better reaction time to Customer orders & requests**
- ◆ **On-time deliveries**
- ◆ **Improved profitability**

# ***WHY ???***

**Reduced Set-Up Time**



**More Frequent Set-Ups**



**Smaller Lot Sizes**



**Reduced Inventories**



**Better Quality**



**Reduction in Waste**



**Greater Flexibility**



**Improved On-time Deliveries**



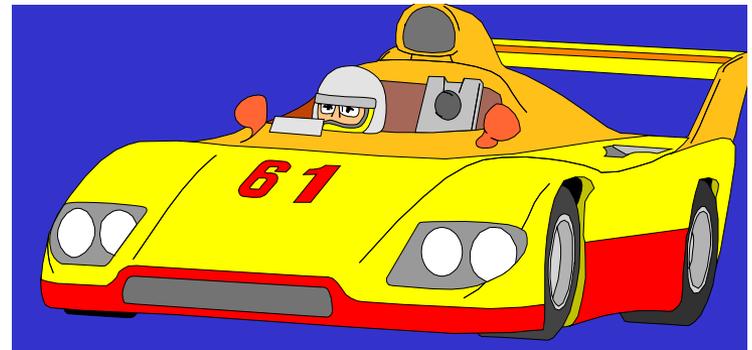
**COMPETITIVE ADVANTAGE !!!**

# ***SIMPLY PUT***

**So that we can deliver...**

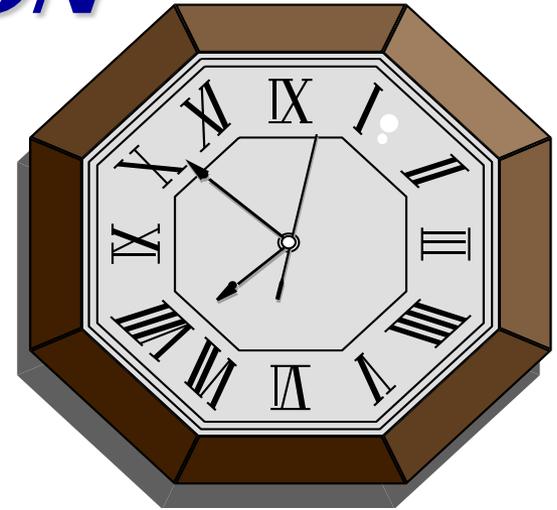
- what the Customer wants**
- when the Customer wants it**
- with good quality from the first piece**
- at the lowest cost**

**like a *Pit Stop*...**



# ***SET-UP TIME DEFINITION***

The amount of time taken to change a machine from the ***last good part*** of a production run to the ***first good part*** of the next production run



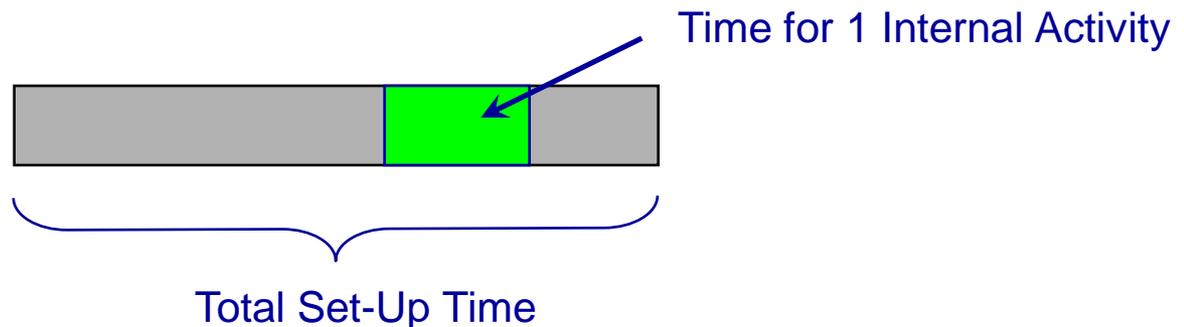
***CLOCK TIME, not LABOR TIME !***

# ***What are Internal Activities ?***

## ***What's External ?***

**Internal** Activities are those that must be performed while the machine is turned off and not making parts.

- 📄 Opening/Closing of the press, taking out or inserting a mold into a press, etc.
- 📄 Exchange of and adjustment of dies



# *What are Internal Activities ?*

## *What's External ?*

**External** Activities are those that can be performed while the machine is on and making good parts.

- 📄 Getting materials and tools
- 📄 Clean-up of the workplace
- 📄 Paperwork
- 📄 Sharpening die

Red = times for  
External Activities



Total Set-Up Time

# ***THE 4 STEPS TO IMPROVEMENT***

**1. Identify activities and document the process**



**2. Separate internal & external activity**



**3. Convert internal to external activity**



**4. Reduce all remaining activity**



## ***THE 4 STEPS TO IMPROVEMENT***

### ***1. Identify Activities and Document the Process***

- 1. Observe the process (everybody)**
- 2. Identify and time the steps in the process**
- 3. List tools, materials, equipment, information needed during the process**
- 4. Determine the frequency and history of changeovers**
- 5. Document the problems in the process**

## ***THE 4 STEPS TO IMPROVEMENT***

### ***2. Separate Internals from Externals***

- 1. Develop checklists for all items necessary for the Set-Up... tools, gauges, materials, documentation, etc.**
- 2. Perform prior checks on all items to insure proper function and fit**
- 3. Stage all items close to the workplace such as die carts, tool boards, instructions, etc.**

***...in much the same manner as an operating room procedure***

## ***THE 4 STEPS TO IMPROVEMENT***

### ***3. Convert Internals to Externals***

- 1. Prepare operating conditions prior to the setup or changeover**
  - preheat molds, pre-adjust parts**
- 2. Standardize necessary functions**
  - change the fewest parts**
  - minimize or eliminate adjustments**
- 3. Use intermediary fixtures/jigs**
  - preset tools, position dies**

## ***THE 4 STEPS TO IMPROVEMENT***

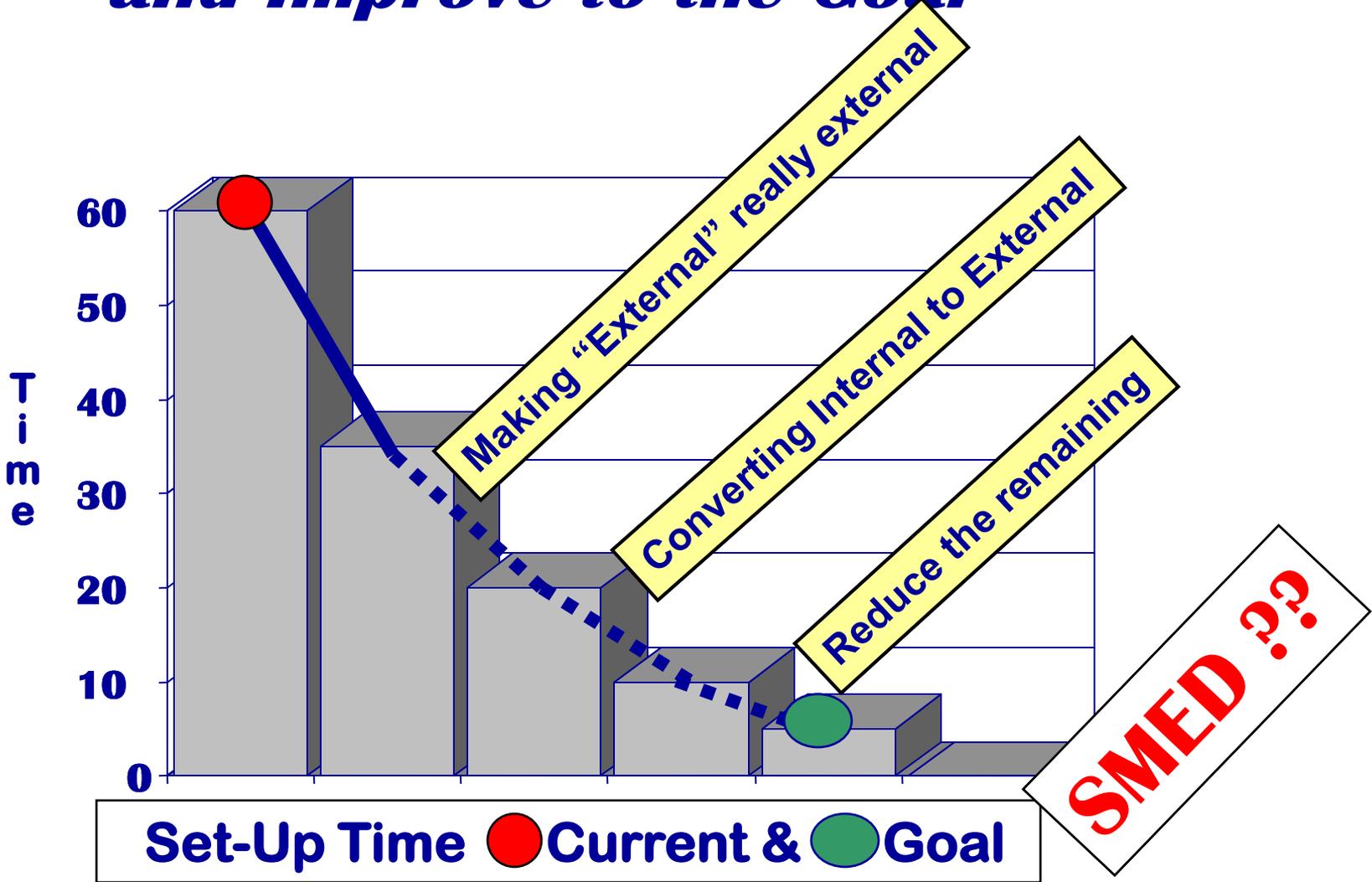
### ***4. Reduce All Remaining Activity***

- 1. Perform parallel operations**
- 2. Improve clamping mechanisms**
  - one turn, one motion methods**
- 3. Eliminate all adjustments**
  - numerical settings versus feel**
- 4. Automate activities where appropriate**

# ***The Seven Rules***

- 1. Set-Up begins and ends with the 5S's**
- 2. Change internal into external, *THEN* improve the rest of the internals**
- 3. Bolts are your enemies**
- 4. If you have to use your hands, make sure your feet stay put**
- 5. Don't rely on special, fine-tuning skills**
- 6. Standardize all Set-Up operations**
- 7. Standards are standards; they are not flexible**

# *Establish the Current Position and Improve to the Goal*



# ***The Lean Team Tools***

# ***5 Times Why ??????***

<p><b>What is the purpose?</b></p>	<p><b>5 Why's</b> Is this activity necessary? Can it be eliminated?</p>	<p>Eliminate any unnecessary activity</p>
<p><b>Where is this being done?</b></p>	<p><b>5 Why's</b> Why does it have to be done in this place? Where should this be done?</p>	<p>Combine and / or move closer</p>
<p><b>When is this being done?</b></p>	<p><b>5 Why's</b> Why are we doing this now in relation to other things? When should this done?</p>	<p>Combine activities Organize parallel activities Re-arrange sequence of activities</p>
<p><b>Who is doing this?</b></p>	<p><b>5 Why's</b> Why is this person doing it? Who should do it?</p>	<p>Combine or change people to speed overall task completion</p>
<p><b>How is it being done?</b></p>	<p><b>5 Why's</b> Why are we doing it this way? Is there a simpler or better way? How should this be done?</p>	<p>Simplify or improve method</p>

# ***WORKSHOP WORKSHEETS***

## ***KEY SET-UP TOOLS***

- **Set-Up TIME OBSERVATION SHEET**

\_\_\_ define and time the steps in the Set-Up process

- **Set-Up OBSERVATION GRAPH**

\_\_\_ display the relative time involved in each of the Set-Up steps

- **OPERATIONS LAYOUT**

\_\_\_ record flows, distances, and the layout of equipment & inventory

- **EXTERNAL CHECKLIST for Set-Ups**

record the equipment, materials or information needed to perform a Set-Up

# Set-Up Observation Sheet - Video Tool # 1

Thomas&Betts		<b>CHANGEOVER -- OBSERVATION SHEET</b>						3	<~	3	<~										
Seq No	PERSON ~ ELEMENT	Crew	Int Ext	Start Tape Counter	Finish Tape Counter	Elapsed Time (hh:mm)		INDIVIDUAL ELEMENT TIME (minutes)													
						Element	Cumulative	3	6	9	12	15	18	21	24	27	30	33	36	39	42
1	call for and get fork lift driver	1	Ext	7:33 AM	7:55 AM	0:22	0:22	[Gantt chart bar]													
2	Stop press remove strip from main press	1	Int	7:55 AM	8:13 AM	0:18	0:40	[Gantt chart bar]													
3	Get tools, move to main press, look for crowbar	1	Ext	8:13 AM	8:26 AM	0:13	0:53	[Gantt chart bar]													
4	Prepare new side die for install on bolster	2	Ext	8:26 AM	8:44 AM	0:18	1:11	[Gantt chart bar]													
5	Stop side press after magazine runs out	1	Int	8:44 AM	8:49 AM	0:05	1:16	[Gantt chart bar]													
6	Remove main die, unbolt, 12 bolts (no clamps)	2	Ext	8:49 AM	9:32 AM	0:43	1:59	[Gantt chart bar]													
7	Unfasten pusher arm; unthread 2 allen machine r	3	Ext	9:32 AM	9:42 AM	0:10	2:09	[Gantt chart bar]													
8				9:42 AM				[Gantt chart bar]													
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<b>Crew-Hrs Internal ~&gt;</b>						<b>0:23</b>	<b>3:07</b>				<b>&lt;~ Crew-Hrs External</b>				----- clock hours -----						
Monday 18-February-2002 17:42						3-Page Total:				<b>Internal: 0:23</b>				<b>External: 1:46</b>				<b>Int+Ext: 2:09</b>			

Enter either an "I" or "E" in these cells for colors to signify Internal or External activity

To clear, select range "Gantt", then press Delete key



# **Group Activities on the Shop Floor**

1. OBSERVE and document the current process
2. Characterize and analyze each of the activities
  - ❖ Identify activities & document the process
3. Record problems and opportunities for improvement
4. Brainstorm ideas & establish priorities for change
  - ❖ Separate internals from externals
  - ❖ Procedure for external prep
  - ❖ Reduce all (remaining) internal activities
5. Develop new procedures & new equipment
6. Establish the recording of performance each Set-Ups
6. Perform the new Set-Up procedure
  - ❖ Simulate the new activities as needed
  - ❖ Look for further improvements
7. Refine the new procedure
8. Repeat, document and train on the new process
9. Measure, review performance, make further improvements

*Set-Up*

**End**