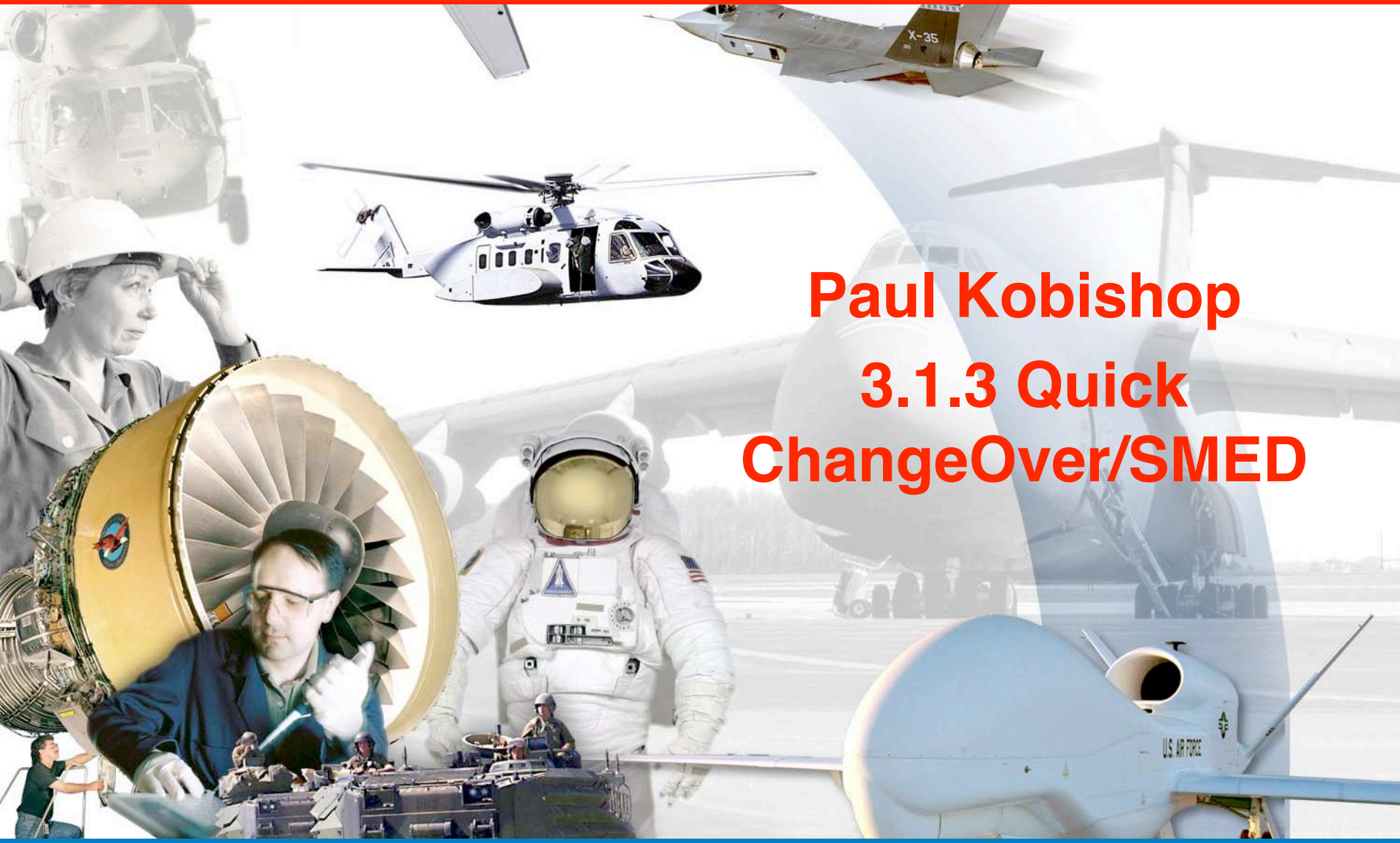
SUPPLIER EXCELLENCE ALLIANCE

Accelerating Supply Chain Performance

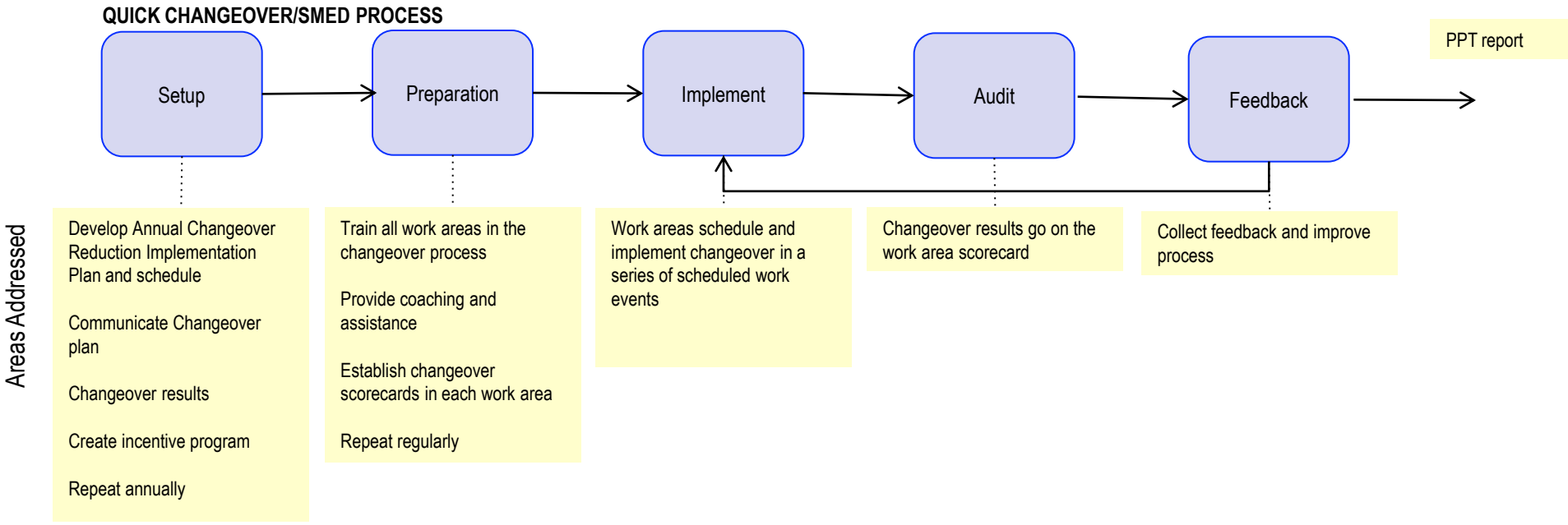


Paul Kobishop

3.1.3 Quick ChangeOver/SMED

3.1.3 Quick Changeover/SMED Process

The purpose of the quick changeover process is to place focus on the reduction of changeover times in order to achieve faster flow of product



3.1.3 Quick Changeover/SMED Process – How does your organization continually reduce changeover and setup times? How are changeover and setup times tracked and displayed on the factory floor? Have machine operators been formally trained in SMED methods? How is progress reviewed and recognized? What metrics are monitored?

Quick Changeover/SMED 3.1.3

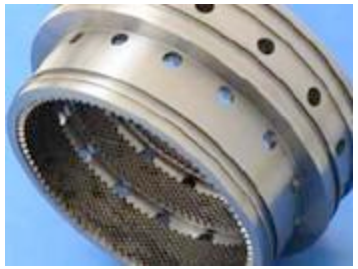
- How does your organization continually reduce changeover and setup times?
- How are changeover and setup times tracked and displayed on the factory floor?
- Have machine operators been formally trained in SMED methods?
- How is progress reviewed and recognized? What metrics are monitored?

JOINED ALLOYS LLC

- Brief History of Joined Alloys
  - 50 Years of experience
  - Integrated Capabilities
    - Vacuum, Torch & Induction Brazing
    - Welding
    - Heat Treating
    - Machining
    - Sheet Metal Fab

JOINED ALLOYS LLC

- Products
  - Honeycomb Seals
  - Turbine Nozzles
  - Bearing Housings



Recommended Reading

- *Quick Changeover for Operators: The SMED System*
- *5S for Operators: 5 Pillars of the Visual Workplace*
- *A Revolution in Manufacturing: The SMED System*. Shigeo Shingo
- *Kaizen Event Implementation Manual*. Geoffrey L. Mika.

Introduction: Stages of SMED

- Separate Internal and External Setup Steps
  - Can result in 30% - 50% reduction alone
- Convert Internal to External Setups
  - Examine internal setups which may be external
  - Find ways to convert internal to external setups
- Streamline All Aspects of Setup Operation
  - Analyze each detailed step and find ways to reduce or eliminate them

Internal and External

- Videotape the changeover process
- Review video with setup person. Document detailed explanation of work steps. Invite feedback.
- Study the video in detail and time each work step.
- Classify each work step as internal/external, dynamic/static

Changeover Observation Form

Department_____ Process_____ Date_____

Step	Foot Steps	Task/Description	Task Time in Seconds		Observation / Improvement Ideas / Comments
			External	Internal	

Setup Analysis

Part Number	
Part Description	
Print Number	

Revision Number	
Date Finalized	
Machine	
Alternate Machine(s)	

Part Orientation

Tools Required:

Standard Work (SWD)

STANDARD WORK DOCUMENT

Process: _____ Product: _____

SEQ	TASK DESCRIPTION	QUALITY CRITERIA	STANDARD TIME	VA	CODE

S = SETUP M = MOVE R = REQUIRED I = INSPECTION

Setup Analysis

Setup Analysis Chart

		Current Method				Proposed Method			
SEQ #	Element Description	Internal	External	Duration	Improving Idea	Internal	External	Duration	Comments

Setup Analysis

Set-up Packet **Part #**

Operator 1 Tasks			Operator 2 Tasks		
Sequence #	**Task**	**Settings**	**Sequence #**	**Task**	**Settings**

6S Audit Worksheet

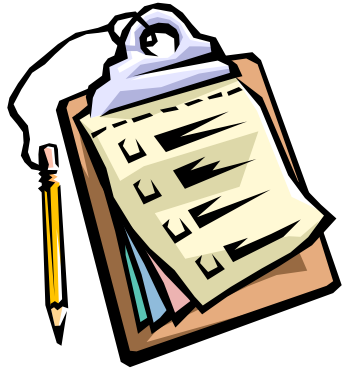
#	Task	Description	Score	Comments
1	Removal of unnecessary items	All unnecessary items not associated with the job are removed. Only work tools and products are present.		
2	Storage of cleaning materials.	Stored in a net manner. Handy and easily accessible. In good condition.		
3	Floor Cleaning	All floors are clean and free of debris, oil and grease, obvious dirt and grime. Cleaning is done daily.		
4	Bulletin Boards	All material posted up to date. Standard Work sheets posted and in use. Safety notices are included.		
5	Emergency Access	Safety and fire equipment unobstructed and accessible. Switches and emergency stops identified in red and are functioning.		
6	Items on Floor	Tools, WIP, empty bins etc. not left on floor. Items on floor assigned to parking space and in correct places.		
7	Aisles – Markings	Aisles and walkways clearly marked. Parking spaces clearly marked and at right angles to aisles.		
8	Aisles – Maintenance	Aisles are not used for staging WIP or obstructed by boxes, pallets or are slippery and wet. Well lit.		
9	Storage and Arrangement	Items in boxes or bins are not stacked leaning or crooked. Storage is done only in designated areas.		
10	Equipment Paint	All machines and equipment is painted and kept fresh looking. Everything 6ft and lower is painted regularly.		
		TOTAL SCORE **0 = Poor 5 = Excellent**		

6S Audit Worksheet

#	Task	Description	Score	Comments
11	Equipment Cleanliness	Machines and other equipment is kept spotless. They are continually wiped down by the operator.		
12	Equipment Maintenance	Controls are clearly labeled. Critical points are checked daily by operator. Adjustments made as needed.		
13	Equipment Storage	Nothing is place on top of the machines, cabinets or equipment. All guards are operational.		
14	Document Storage	Only necessary documents to the work area and process are visible and current. Stored neatly.		
15	Document Control	All documents are properly labeled and up to date. Documents are stored in numerical sequence.		
16	Tools and Gages	Tools, jigs, fixtures and raw materials are stored in a safe, easy-to-use place, clearly labeled.		
17	Tooling Accessibility	Tools are stored to facility quick changeovers. Any necessary gages are stored here also.		
18	Shelves, Desks, Benches	Free of junk piled on top. No hidden junk inside cabinets or drawers. Everything properly labeled.		
19	Shelves, Desks, Benches	All shelves, desks and benches are being used for the correct purpose.		
20	5S Control	There is a disciplined system in place, with regular audits. Follow-up happens with low scores		
		TOTAL SCORE **0 = Poor 5 = Excellent**		

Changeover Checklists

- Document tools, specifications and workers required
- Establish quality criteria: temperatures, pressure, feed rate, etc.
- Define correct measurements and dimensions for each work step
- Require physical checking of items on list
- Machine specific



Sample Checklist

Operation Checklist effective 4/30

Equipment: Line C Casepacker
Operation: Changeover to 3.5 lb size
Date: 5/7

	Employees trained for setup and operation (need 2 people)		
	Colleen R.	✓	Jody M.
✓	Elizabeth B.		Kyle B.
	Tools needed		
✓	automatic nut driver		
✓	hex wrench		
	rolling cart –at Line B 'til 10:30		
	Parts needed		
✓	elevator plate—3.5 lb. size		
✓	compression plate—3.5 lb. size		
✓	feed augur—3.5 lb. size		
✓	vacuum hose, towels, brushes for cleandown		
	Standard Operating Procedures to follow		
✓	SOP 001 (changeover)	✓	SOP 003 (cleandown)

Sample Checklist

SETUP CHECKLIST

	HAND TOOL LIST
	MACHINE TOOL LIST
	CLEANING LIST
	PART NUMBER QUALITY CRITERIA
	SPECIFICATIONS AVAILABLE FOR PART NUMBER
	BLUE PRINT AVAILABLE FOR PART NUMBER
	PRIMARY MACHINE IDENTIFICATION
	WORK INSTRUCTION POSTED
	TIME STUDY COMPLETED
	MATERIAL AT THE MACHINE
	SETUP DOCUMENTS AT THE MACHINE

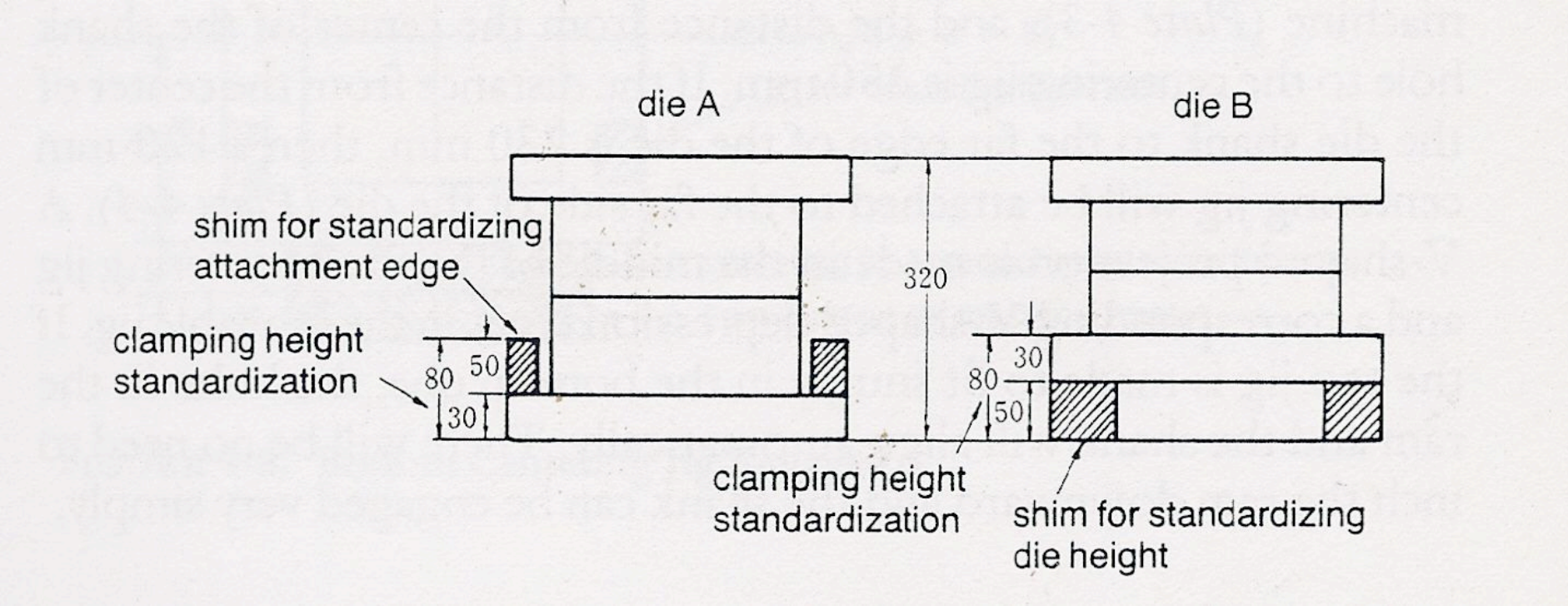
Convert Internal to External

- Separating internal and external alone won't get to Single Minute range
- Challenge: Find ways to convert internal steps to external ones
- Don't let old beliefs get in the way
- Apply the 3 techniques:
  - Advance Preparation of Operating Conditions
  - Function Standardization
  - Intermediary Jigs

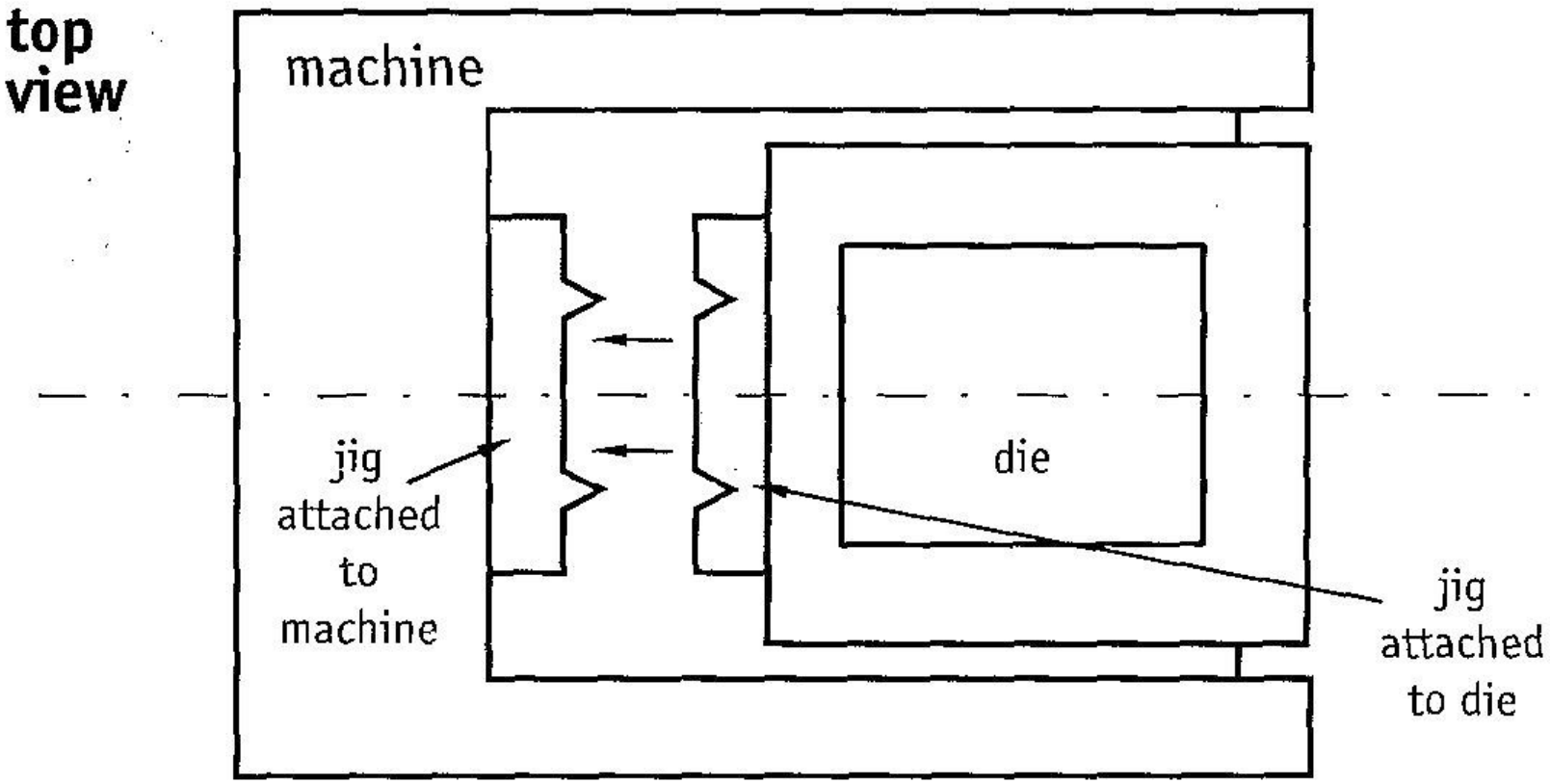
How to convert

- Get everything ready before the internal setup begins
  - Examples:
    - Holders or places for material staged in advance
    - Preheating part to operating temperature
    - Pre-cleaning necessary equipment
- Preparation is done while the machine is working on the previous job
- Moves should take place during external setup
- Material is put away after internal setup is complete
- Goal: Shorten machine downtime
- STANDARDIZE: Definition: Keeping something the same from one operation to another
- Focus on the elements critical to the setup. Not every external dimension needs to be identical
- The quickest replacement: replace nothing at all, or as little as possible

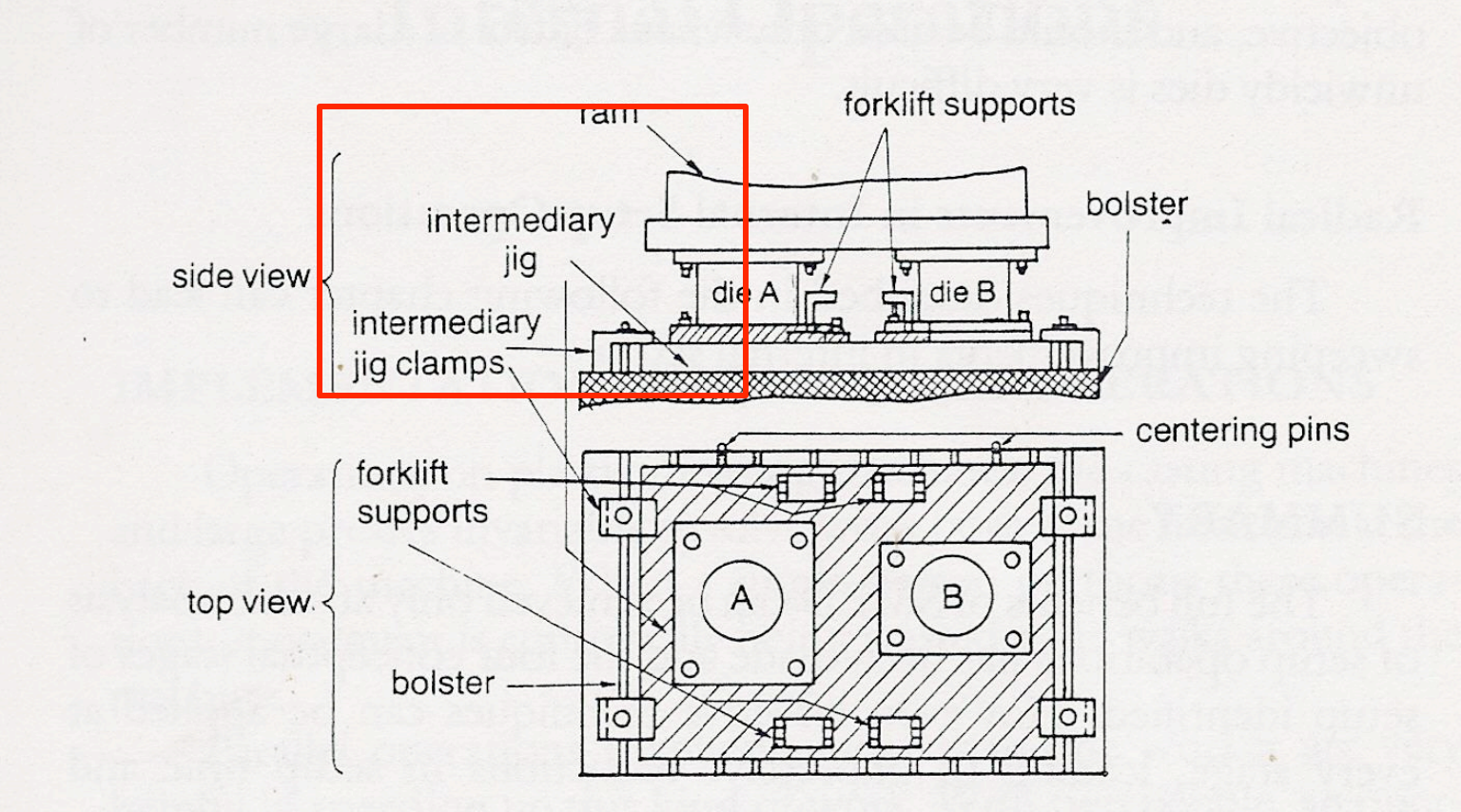
Standardizing Fixtures



Centering Dies

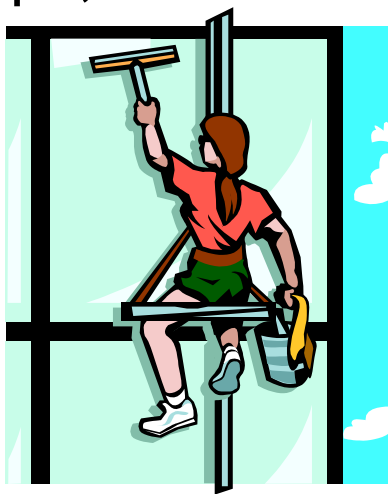


Intermediary Jigs



Streamlining

- Definition: Optimizing setup work steps, looking closely at each step's function and purpose
- Key to achieving the single minute range
- Two areas of focus: Improving internal setups, and improving external setups



Improving Internal Setups

- Parallel Work
- Move sequential work steps to parallel work steps by *adding people* and restructuring work
- Technique also applies to required work steps, not only setup

Improving External Setups

- Storage and transport of tools and parts
  - Store needed material at point of use
  - Organization and housekeeping
  - Use of color coding and location numbers
- Maintenance and repair of tools and needed materials

Eliminating Adjustments

- Adjustments can account for 50% of the total setup time
- Eliminating = eliminating, not just reducing
- Methods:
  - Numerical scales and standardized settings
  - Making imaginary center lines and reference planes visible
  - The Least Common Multiple (LCM) system. Modify the function, not the mechanism

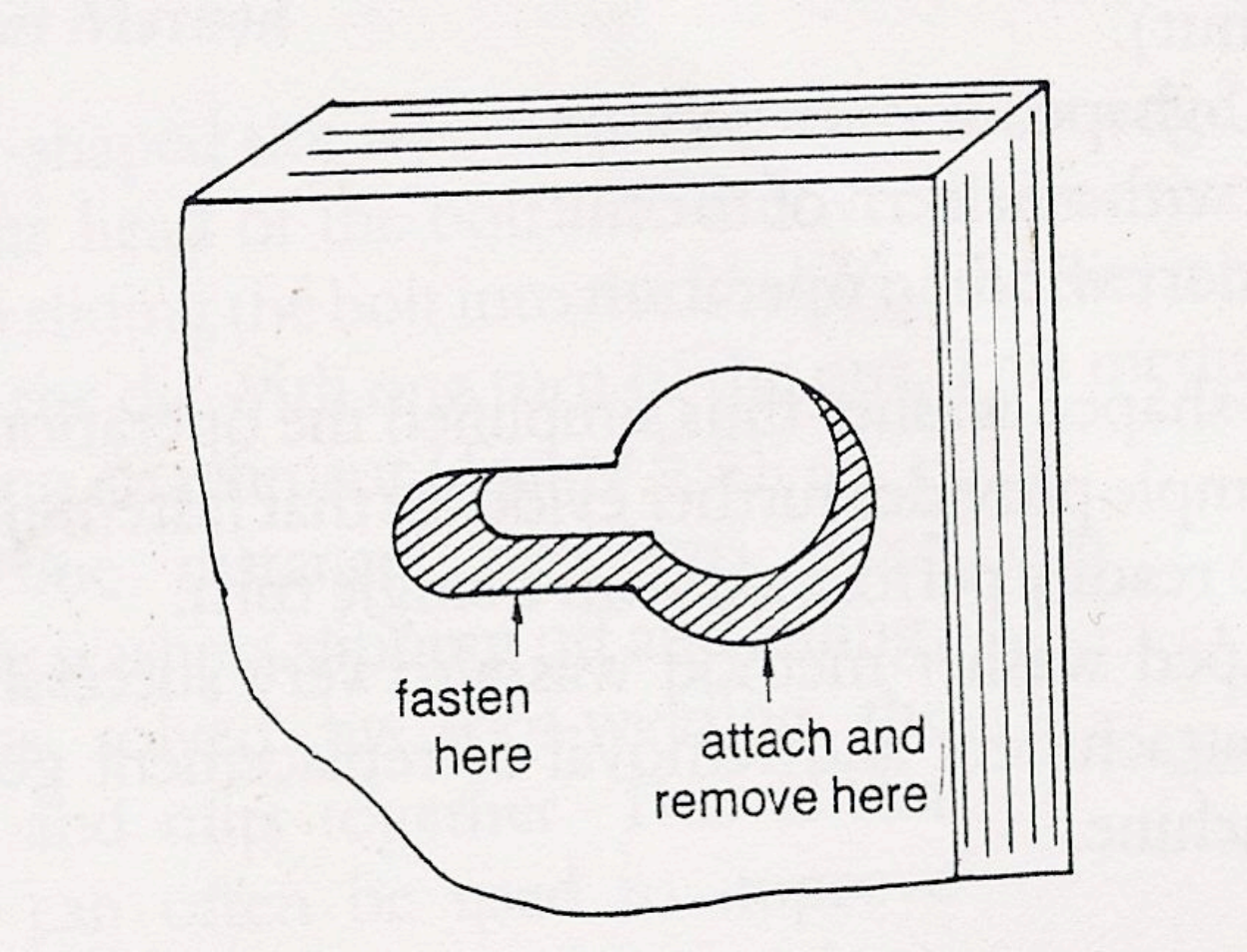
Functional Clamps

- In SMED, bolts are “the enemy”
  - They get lost
  - They get mismatched
  - They take too long to tighten
- Releasing and fastening only take place on the first and last turns
- Functional Clamp: An attachment device that holds objects in place with minimal effort
- Goal: Keep them attached to the machine, so they don’t get lost
- Methods: one turn, one motion, interlocking

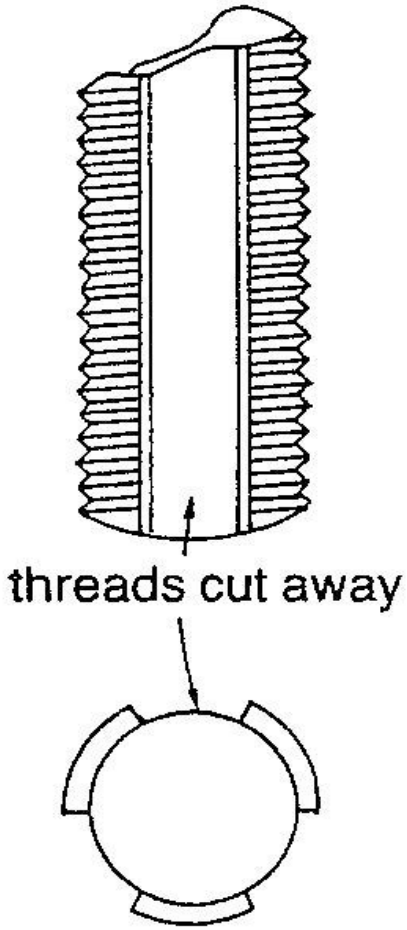
Mechanization

- Used after previous methods have been applied
- Used for fine tuning
- Does not necessarily improve the process itself
- Can be capital intensive
- Time savings are often low
- Practical uses:
  - Moving heavy objects
  - Electric drives for height adjustment
  - Energy of presses to move dies
  - Loosening dies by remote control

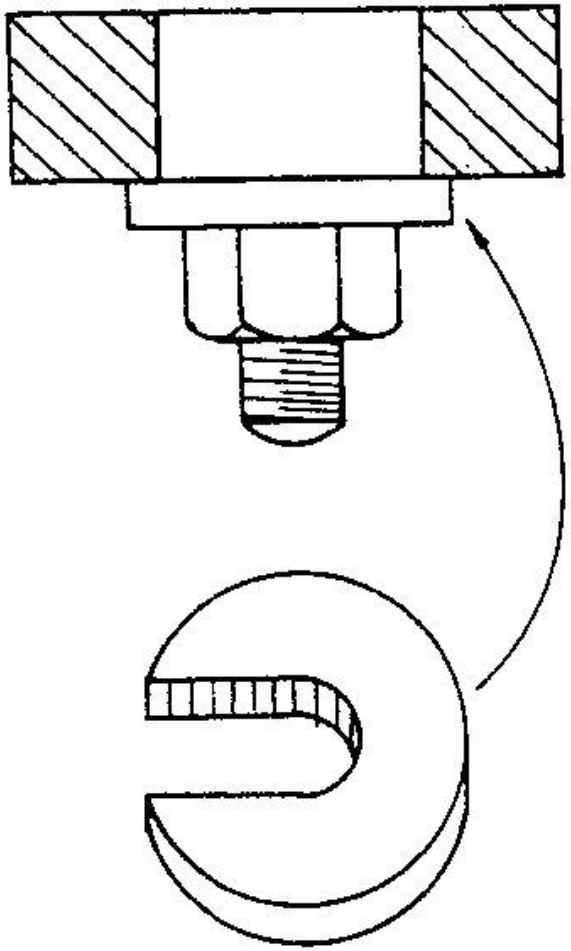
Pear Holes



Quick Connect Bolts



Slot Washers



1. SCOPE

This Lean Procedure describes the process for quick changeovers (i.e. Setup Reduction).

2. RESPONSIBILITY

2.1.	Process Champion	Operational Excellence Champion
2.2.	Process Owner	Engineering Manager

3. REFERENCES

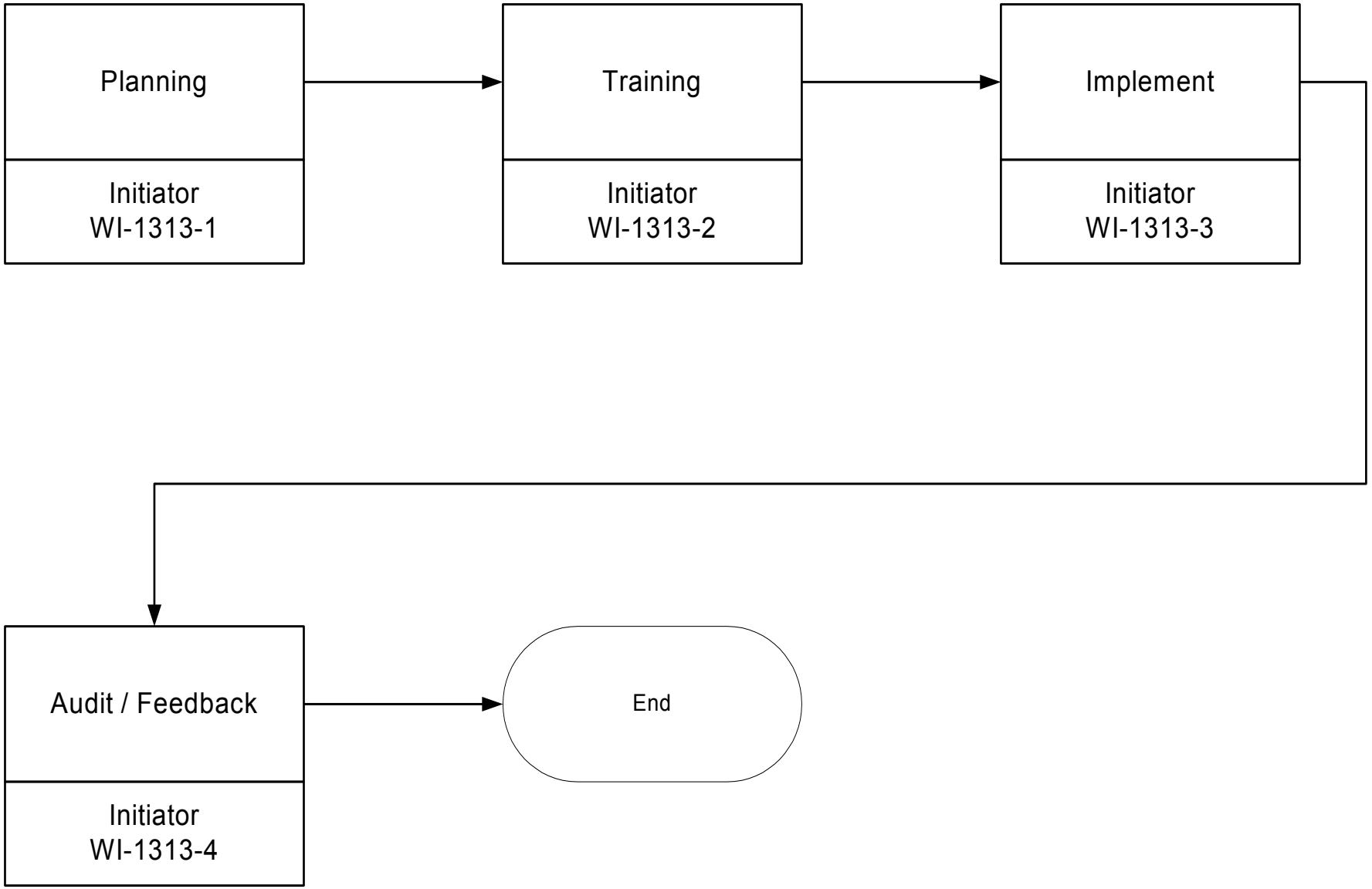
3.1.	WI-1313-1	Work Instruction – Planning
3.2.	WI-1313-2	Work Instruction – Training
3.3.	WI-1313-3	Work Instruction – Implementation
3.4.	WI-1313-4	Work Instruction – Auditing / Feedback
3.5.	LP-1313 Form 1	Form; 7 Wastes Observations Worksheet
3.6.	LP-1313 Form 2	Form; Motion Diagram
3.7.	LP-1313 Form 3	Form; Change Observation Form
3.8.	LP-1313 Form 4	Form; Review & Improvement Form
3.9.	LP-1313 Form 5	Form; Cost Justification Form
3.10.	LP-1313 Form 6	Form; Setup Log
3.11.	LP-1313 Form 7	Form; Process Audit Plan
3.12.	LP-1313 Form 8	Form; Process Problem Log

4. DEFINTIONS & TERMS

4.1.	LP	Lean Procedure
4.2.	Procedure	A revision-controlled document (Tier 2) composed of a process flow diagram, scope, process owner, process champion, supporting document(s), definitions/terms, title/ID block, approval, and date-revision history block.
4.3.	Process Champion	Advocate appointed by senior management team who consistently and energetically supports process owners.
4.4.	Process Owner	Person who has the ultimate responsibility for the performance of a process in realizing its objectives measured by key process indicators, and has the authority and ability to make necessary changes.
4.5.	References	These revision-controlled documents (e.g., Forms, Work instructions, etc.) support and flow down Procedure Requirements.
4.6.	Scope	Scope represents a common understanding of the process for the purpose of facilitating communication among the stakeholders and for setting authorities and limits for the process owner.

5. PROCESS

See attached Process Flow Diagram


Planning
Initiator
WI-1313-1
Training
Initiator
WI-1313-2
Implement
Initiator
WI-1313-3
Audit / Feedback
Initiator
WI-1313-4
End

SMED - Implementation

Material Needs:

- Equipment
- Computers
- Cameras
- Video Cameras
- Flip Charts
- Measuring Wheel
- Stop Watch
- Changeover Observation Form (LP-1313 Form 3)
- Review & Improvement Form (LP-1313 Form 4)

Establish Baseline:

- Select Setup – Pick a job or setup that is repeated on a somewhat regular basis. This will be the setup that is performed before and after the setup reduction event to measure improvement.
- Team – Identify team member who will perform the setup as well as 1 to 2 people to record & document all aspects of the setup.
- Video - Setup video camera to record the full setup in real time.
- Perform Setup – While setup is being performed, document each task along with the time spent. Also record whether the actions are “Internal” or “External”. Use Changeover Observation Form "LP-1313 Form 3".
  A) Document each task as “Internal” or “External” as well as the time spent on each.

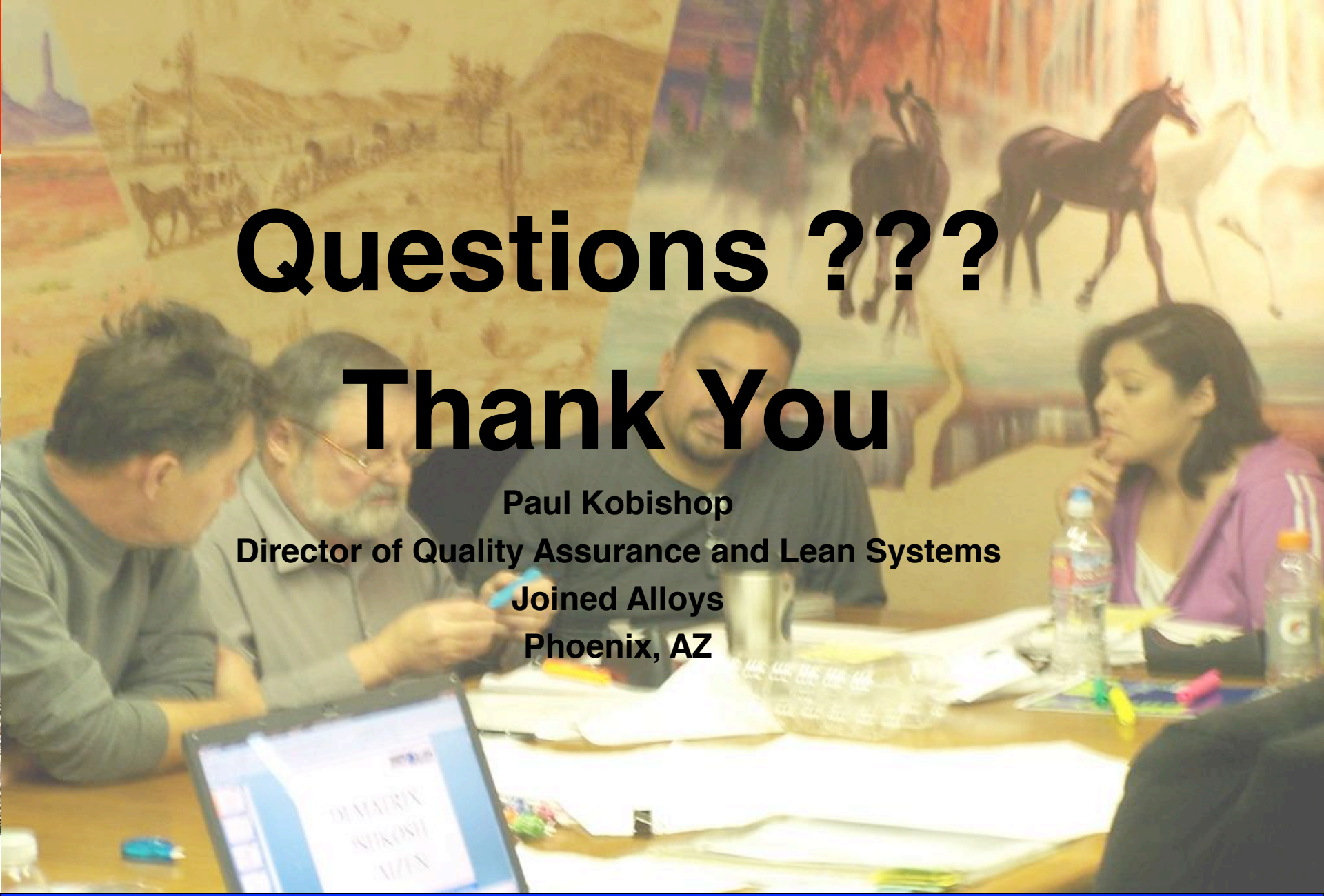
Item	Date	Standard	Actual	Note
1	1/17/2011	3.00	1.87	
2	1/20/2011	3.00	3.13	
3	1/31/2011	2.00	1.71	
4	2/1/2011	3.00	2.48	
5	2/9/2011	3.00	2.25	
6	2/23/2011	2.00	0.57	
7	3/31/2011	4.00	2.68	
8	4/4/2011	5.00	4.34	
9	4/5/2011	3.00	2.73	
10	4/11/2011	4.00	1.21	
11	4/21/2011	3.00	1.88	
12	4/26/2011	6.00	2.92	
13	4/26/2011	2.00	1.07	
14	4/27/2011	2.50	2.30	
15	5/9/2011	3.00	3.02	
16	5/10/2011	4.00	2.98	
17	6/9/2011	2.52	6.00	
18	6/15/2011	3.00	2.41	
19	6/21/2011	2.00	3.00	
20	6/27/2011	3.00	2.38	
21	7/25/2011	3.00	3.09	
22	7/26/2011	1.00	0.94	
23	7/27/2011	3.00	2.66	
24	8/3/2011	3.00	1.91	
25	8/4/2011	3.00	0.79	
26	8/10/2011	3.00	2.03	
	Total	79.02	62.35	
	Avg.	3.04	2.40	

SET UP STUDY - BY CELL 01/1/12 - 01/31/12				
Machine #	Machine	Cell	Standard Avg	Actual Avg
212	STAND ALONE	DiMatrix	NO DATA	NO DATA
213	Mori SH50	DiMatrix	NO DATA	NO DATA
214	Mori SH50	DiMatrix	NO DATA	NO DATA
215	Mori SH50	DiMatrix	NO DATA	NO DATA
			0.00	**0.00**
103	SL-3	Hive	1.54	1.67
106	SL-5	Hive	3.15	2.79
109	SL-50	Hive	3.00	3.00
203	RA3F	Hive	2.81	4.14
			2.62	**2.90**
110	Mori SL-150	JAS	2.26	3.29
111	Mori SL-200	JAS	1.83	3.33
113	Mori SL-200	JAS	2.25	3.58
114	Mori SL-200	JAS	2.75	3.70
209	Mori FM2	JAS	2.88	5.51
210	Mori FM2	JAS	2.33	5.54
211	Mori MV-40e	JAS	10.00	9.72
			3.47	**4.95**
101	SC-300	Mixed Model	2.50	1.00
102	SL-3	Mixed Model	1.74	1.45
105	DOOSAN S310N	Mixed Model	1.95	2.75
202	FADAL	Mixed Model	2.86	3.96
204	MC-1000VF	Mixed Model	2.18	4.38
205	MAM	Mixed Model	3.42	4.69
			2.44	**3.04**
115	SL-303	T-800	2.33	3.76
116	SL-400	T-800	2.50	3.76
201	MC-800	T-800	3.31	3.95
			2.71	**3.83**

SET UP STUDY - BY CELL			
Machine #	Baseline Avg 01/11 - 07/11	Sept. 11'	Jan. 12'
212	NO DATA	NO DATA	NO DATA
213	NO DATA	6.58	9.72
214	NO DATA	NO DATA	NO DATA
215	NO DATA	NO DATA	NO DATA
DiMatrix	**0.00**	**6.58**	**9.72**
103	3.07	NO DATA	5.54
106	6.55	4.10	1.00
109	3.41	5.43	2.02
203	4.23	3.34	4.69
Hive	**4.32**	**4.29**	**3.31**
110	3.61	2.53	3.33
111	2.45	2.50	3.96
113	5.00	6.16	3.58
114	3.60	4.26	2.75
209	2.11	3.07	3.76
210	3.57	4.00	3.70
211	3.56	2.84	3.76
JAS	**3.41**	**3.62**	**3.55**
101	3.39	5.17	3.95
102	6.07	5.70	4.38
105	2.71	3.24	3.29
202	NO DATA	NO DATA	2.79
204	3.10	5.63	4.80
205	5.30	5.10	2.92
Mixed Model	**4.11**	**4.97**	**3.69**
115	3.21	5.16	5.51
116	10.57	8.76	4.14
201	3.81	4.33	5.36
T-800	**5.86**	**6.08**	**5.00**

Seq.	Sec.	Cnvrt Min.	Rank	Desc.	Note
1	200	3.33	8	Prepare & Install Jaws	
2	100	1.67	12	Adjust to Cut Jaws	
3	70	1.17	14	Tighten Jaws	
4	56	0.93	18	Install Insert for Cutting Jaws	
5	199	3.32	9	Load Tools & Inserts	
6	403	6.72	5	Blue Jaws, Machine, & Measure	
7	50	0.83	19	Retrieve & Load 1st Part	
8	423	7.05	4	Set Offsets for 4 Tools	Slightly under 2 minutes per tool.
9	73	1.22	13	Load Program	
10	227	3.78	7	Check and Change Tool No.'s in Pgm	To match what is in the machine.
11	48	0.80	20	Set Chuck Pressure	
12	58	0.97	17	Skim Face for "Z" Zero Loc.	
13	65	1.08	15	Flip Part	
14	130	2.17	11	Measure & Set "Z" Zero	
15	20	0.33	22	Start Running Part	
16	60	1.00	16	Re-Boot Machine	
17	140	2.33	10	Re-Set "Z" Zero	
18	363	6.05	6	Start Part, Pull Chips, Put Away Tools	
19	48	0.80	21	Cut Additional Clearance on Jaws	
20	617	10.28	3	Finish Machining Side 1	
21	726	12.10	2	Finish Machine Side 2	
22	6000	100.00	1	1st Article Inspection	
	10076	167.93			E2 Setup Standard for this job is 180 Minutes

Metric	Pre-Kaizen	Post-Kaizen	Change
Internal Setup 3032	6 hours Avg. without FA	.5 hours Avg. without FA	**5.5 hours** **92%**
Standard Tools 3032	12 locations 12 of 30 locations	24 locations 24 of 30 locations	**12 tools** **200%**
Travel Distance 3032	914 ft	100 ft	**814 ft** **89%**
Internal Setup 3031	6 hours Avg. without FA	1.5 hours Avg. without FA	**4.5 hours** **75%**
Standard Tools 3031	0 locations 0 of 20 locations	13 locations 13 of 20 locations	**13 tools** **%**
Travel Distance 3031	874 ft	100 ft	**774 ft** **88.5%**



Questions ???

Thank You

Paul Kobishop

Director of Quality Assurance and Lean Systems

Joined Alloys

Phoenix, AZ