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Business Intelligence Report
June 2005

The Lean Team's Implementation at Micron Manufacturing

No new technology-
No consultants-
Reduced setup time 34% in first six months
Reduced setup time 53% to date
Returned $2.43 for every dollar invested in Lean…

"The majority of waste is not inside the machine!"

As told to Miles Free by Brian Hoff, and Dan Vermeesch.

PMPA Business Intelligence Report- Case File: Micron Lean Team

Company: Micron Manufacturing, PMPA Member founded in 1953 in Grand Rapids Michigan
Employees: 35
Equipment: Acme Multi spindles, Browne and Sharps, Escomatics, CNC Swiss and Vertical CNC equipment
Approach: Commitment to teamwork to implement lean methods to shorten setup times
Reason: Need to maintain customer satisfaction despite average production run shrinking, resulting in more setups; increase in proportion of setup time to run time.
BHAG*: Reduce setup time by 25% in first six months
*(Big Hairy Audacious Goal)
Accomplishments: Acme setup time reduced 34% in first six months; Return of $2.43 for each dollar invested; Almost half of employees comfortable doing these projects; two-thirds currently on teams; balance conversant with methods and language of lean
We never would have guessed: That the majority of the waste is not inside the machine

Left to right: Dan Vermeesch (Plant Manager), Mike Smith (Engineer), Dan Szczepanski (Esco Supervisor), Dave Seabrook (IT), Brian Hoff (Estimator).

Why Lean?

57% of Micron's sales originated off the Acme's. The average run quantity was shrinking which, in turn, caused the number of setups to go up. In essence the setup time was becoming a greater percentage of the order's total time, driving up costs. The team chose to focus on Acme Gridley setup reduction. Our order was: "Reduce setup time by 25% in the next 6 months". To eliminate waste, Lean was the logical choice.

Well logic is one thing, but you need management commitment to keep projects like this from becoming the flavor of the month.
We had commitment from our management – now we call the management team 'Team Strategy.' Team Strategy assigned 7 people to this task. The team members were not from the Acme Gridley department. This would give us fresh eyes and fresh perspectives to ask questions that would lead to success. This group was dubbed "The Lean Team-" an amazing display of originality. The Lean Team would spend 4 hours each Thursday afternoon for the next 6 months working on this project. Our supervisors were told that schedules must be maintained even if it meant overtime. We needed to commit ourselves!

So how'd you start?
For the first month the team:

- □ Read books about Lean skills and stories of Lean successes
- □ Did hands-on training with Team Strategy (our management team)
- □ Practiced what we learned on small projects in the Acme department
- □ Used historical setup data to determine the true average setup time
- □ Tracked on-going setups to understand the steps involved

Well that sounds easy enough
One of the initial roadblocks was the lack of a definition of "what is a setup?" When is the exact moment that a setup starts & ends? The team determined, due to our scheduling system, that a setup begins when the paperwork for the job is issued to the machine. It did not matter if a person was available to perform the setup. Time only stops for lunch and when we are closed. A setup is complete when the first piece samples are approved and signed off.

It was also necessary to define what constitutes a "complete setup". There are less complicated "changeovers" which may entail a length or thread size change. We needed to know when we were doing something more than that***. If a setup involved 3 out of 4 of the following tasks then it was considered a complete setup.*** The tasks were:

- □ Change Collets
- □ Change Cams
- □ Change Feed / Speed Gears
- □ Change Holders / Tooling

So the real key at this stage was defining what the setup is so that you can measure it?
In the first two months a baseline setup time was established by machine size. The Lean Team also broke down the setup into internal & external tasks. External tasks are those that could be completed while the machine is running. Internal tasks are those that must be done with the machine turned off. One of the tools that helped determine internal from external is a Spaghetti Diagram. *See* ***Appendix A Spaghetti Diagram***

A Spaghetti Diagram is a map of the floor plan around the work area, showing the path taken to do, in this case, our setup. Our diagram was centered on a machine specific work space and included the entire department. It was divided into 3 zones: Green (within arms reach of the machine being set up or aprox. 3'); Yellow (10' x 15'); and finally Red (everywhere outside the yellow zone). Prior to the start of the setup a Lean Team member was assigned to map where the setup person traveled. Because setup can be broken down into different tasks it was easier to have a different map for each of the tasks (cams, gears, etc.) We then compiled the data to get total time, step count and distance traveled. At the end of each trip we recorded a brief note about what the setup person needed & did. As painful as it sounds*, this tool delivered an incredible amount of information.* We even know what each one of those steps costs.

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What did the Spaghetti Diagram show you?
The biggest opportunity for savings wasn't in the machine- it was external stuff- tasks outside- way outside the machine. 53% of the setup was external to the machine. If we were going to knock off 25% of the set up time, there was likely to be a big chunk of it here. Up until this discovery we had spent so much of our efforts trying to do things to the machine to make it faster, more efficient, oftentimes with a significant price tag. We never saw the tombstone outside the machine that said "Here lies 53% of your setup time. May it NOT rest in peace." This was an important lesson for all of us, and since we had the data, there was no denial.

So how did you put this new knowledge to work?
Over the years we had organized our equipment & tooling in a manner best described as "tribal knowledge". If you're not a part of the tribe then you won't know where the stuff is kept. We believed we had placed items near where they should be used. The Spaghetti Diagram showed that we had a lot of work to do to make things easier to find, in ready to use condition, and nearer to its point of use. A large portion of that 53% was spent looking for stuff. Pusher pads, the form tool holder that worked so well last time, the parts chute that works with a particular part. There were many, many examples of time spent searching for items.

So just like that you walked away from your existing system? No grumbling, no grandstanding?
We knew what the cost per step was; we knew how many steps we had to take on average; the ever increasing number of setups helped get everybody to buy in. The team decided to use its new skills of 5-S (Sort, Set in place, Shine, Standardize, and Sustain) to create a new method for storing & organizing the stuff needed during a setup.

You staged a 5-S event?
Actually, we called it a Red Tag Fiesta. The Lean Team, with a lot of help from the Acme Department, pulled everything and determined if it should be kept, repaired, replaced, put away, stored, sold, or scrapped- writing this on a red tag. This is the first step of 5-S- "Sort". The team determined the best way to clean, label, paint, & inventory a specific type of item. They even knew the number of items to be processed and the time needed for each. Then the Acme Department assisted in performing the work so that we could stay on track with our project timeline. This system worked very well for collets, gears, and cams. While the items were being sorted by department personnel, the Lean Team determined how and where the items would be organized and stored. They created storage shelves, cam racks, setup drawers, and other systems. Everything is color coded by machine size. Anything used on a 9/16" Acme is colored blue. Anything for a 2 5/8" is red, and so forth.

001

☐ **Same as Above** **Name:** _____ **Mach #:** _____ **Date:** _____

Holder	**Possible Positions**	**Possible Mach Sizes**	**If Applicable: Specific machines that this holder works on.**			
			☐ 80	☐ 87	☐ 94	☐ 101
☐ Form	☐ 6th	☐ 9/16"	☐ 81	☐ 88	☐ 95	**Dovetail**
☐ Shave Block	☐ 1st	☐ 1"	☐ 82	☐ 89	☐ 96	
☐ Face Off	☐ 2nd	☐ 1 ¼"	☐ 83	☐ 90	☐ 97	☐ 5/8"
☐ BD/CO	☐ 3rd	☐ 2"	☐ 84	☐ 91	☐ 98	☐ 1 ¼"
☐ Thread Roll Block	☐ 4th	☐ 2 5/8"	☐ 85	☐ 92	☐ 99	
☐ Knurl Block	☐ 5th		☐ 86	☐ 93	☐ 100	

(Tool Holder ID Log used to ID each type of holder that could go into an Acme)

Everything is color coded?
Even the setup instructions are printed on matching colored paper so that anyone can easily tell what type of machine the item goes to. Visual organization means “so that anyone can tell just by looking.” Color coding does that for us.

So Set in place and Shine would be the next steps…

That’s right. All the various types of tool holders were gathered and identified by machine size, cross-slide location, and holder type. Each was cleaned, identified, (see table above), and inventoried. This satisfies the Shine portion of 5-S. Because the team members were not familiar with Acme tooling they relied heavily on the Acme personnel to assist in this task. Any holder that wasn’t in working order was either repaired or replaced. Old habits such as borrowing the mounting bolts from one holder for another were dropped. Every holder has the required fasteners. Once the holders were good to go and color coded they were placed onto color coded shelves. The exact place for each holder was marked so that anyone could easily tell if holders were missing or how many of that type are available- again we tried to keep it visual. Set in Place was now completed.

Color coded 9/16” Acme Gridley. Blue color indicates 9/16” Acme.

Tool storage area showing visual organization by machine by color.

Color coded drawers store pusher pads for machines.

It seems like once you got started your team had relatively few obstacles

The team's goal was to capture as much of the 53% of setup time that could be done externally and find a systematic way to have that work done & ready to go before the setup started. The 5-S of the Acme area would make this quick and easy on the person assigned to prep the setup stuff. However, the team found that each person who gathers all the stuff for a setup did so differently. The team needed to know what the very best method was and build that into a repeatable process. This was probably one of our toughest issues.

Many companies use setup carts. But the Lean Team wanted something more. They wanted a work surface / grocery cart in which one is handed a shopping list (setup instructions), walks

through the grocery store (the tooling area) in a specific route, and checks out (arrives at the machine) with exactly what they need, in the order that it's needed, and with each dish (tool or holder) ready to go into the oven (machine). To prepare for this they documented & observed several setups to determine how setups were put together, in what order, and all the tools needed for tearing out the old setup and putting in the new. They created a setup cart checklist used by the person preparing the cart to ensure that all necessary items are on the cart. This fits the bill for Standardize of the 5-S. (See ***Appendix B Setup Checklist***)

You standardize the way that the job is brought to the machine?
Yes, remember 53% of our set up time was external to the machine, with people walking all around the shop to get stuff. We wanted to eliminate "setup by walking around."

The team mounted all the wrenches, cleaning brushes, screwdrivers, and other tools needed to complete a setup onto the cart. Each item had a specific place, was shadow-outlined, and clearly labeled. We wanted to keep it visual, rather than 'tribal.' Of course, it took a few tries to get it right.

Now, who would prepare the carts and put away the tear down items? The system was designed so that no machine specific knowledge was needed- this kept the Acme personnel to make parts and perform setups. The color codes and ID numbers made it easy to collect the right items. Team Strategy drafted the material receiving & handling person for this task. Over a few weeks time the material handler was trained how to use the color codes, ID numbers, and setup instructions to put together a cart. Because they were already familiar with where items were stored, it was a good match. He was also shown how to re-sharpen tooling so that no tools were ever put away dull.

One other thing- the "setup cart guy" collected data on each setup. How long the setup and teardown carts took and any mistakes made preparing the cart. Mistakes were a result of weaknesses in the system and modifications were made prevent reoccurrence. Time was reduced by gaining experience with the system as well as discovering new methods for preparing the cart.

Which completes the 5-S's as this "Sustains" the improvement…
The team continued to collect setup data to determine if the desired results were achieved. At this point the 6 months was coming to an end. The team prepared a report to present to the Acme department and the management team. The results were amazing.

- Acme setup time reduced 34% (The goal was 25%)
- The team spent a total of 1056 man hours (there were many hours outside of the official Thursday meetings)
- The team had a documented plan for what to accomplish to achieve the remainder of the 53% of external setup time.
- By the end of the first year for each dollar invested we achieved a $2.43 return

The lean team continued to work on the project at a slower pace for the remainder of the year. They fine tuned setup cart preparation and continued to 5-S the Acme area. When the year was complete they had reduced setup a total of 47%. Today the setup takes 53% less time than it did at the start of 2001. The setup cart preparation is now averaging 18 minutes. The teardown cart is another 15 minutes. The setup cart guy conducts audits of the area each week to ensure that we identify any weaknesses and make corrections. (We may have milked a lot of time out of each setup but you can still hear the machines moo as you walk by). The project has since been handed over to the department itself. Their current focus is on reducing tool installation and adjustment through standardization of fasteners.

But I'm guessing the story doesn't end here
Well, while it is true that we've saved a lot of time and money as a result of our Lean Team project, *we have saved even more time/money from what we have learned from the methods and tools* used by the original Lean Team than through set up time reduction.

Additional projects addressed various issues ranging from:

- The creation of dedicated gage stations by the "Quality System Team"
- The shop-wide consolidation of all drills & taps by the "D & T Kaizen Team"
- Plant janitorial services by the "Rat Patrol"
- Continued honing of the set up reduction efforts in the Acme dept. by the "Delta Force" (delta means small change – the heart of the lean concept is to swing for base hits, not homeruns)
- To the standardization of all print packages by the "Quality System Team II"
- Value Stream mapping of our single biggest product family by "Lean Team 2"

We learned that you can successfully apply lean concepts and 5-S just about anywhere in your company.

You'll note that not one of the teams was involved in any way shape or form with getting more parts per hour off a machine. Even though improved output is commonly an *accidental* by-product of lean it is not the focus of lean. Lean is about reducing/eliminating waste surrounding a value-added activity. The oft used phrase in lean is "lowering the water so you can see the rocks." Look back at our list of team activities. They all lower the water. When the water is lowered it is far easier for the people standing in front of the machines 10 hours a day to deal with the rocks that they come across from time to time.

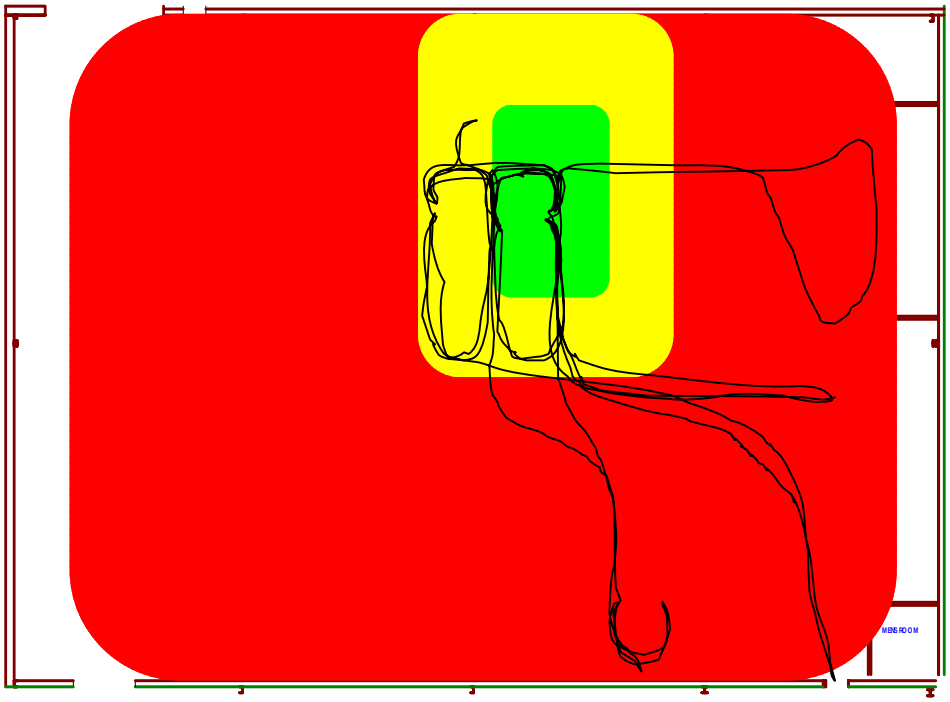
However the greatest institutional lesson that we learned through all of this was that while we were advancing important projects through our teams, we did not have a formal, organized method of determining, prioritizing and controlling the pace and direction of change. *We recognized the need for a process to manage change.* We determined we needed to have a broad-based strategy for change. From that need Team Strategy was borne of the management team. Membership on the team changed. The purpose of the team changed. The agenda changed. Team success scorecards were developed. Team review guidelines were developed so that each team presented its progress to Team Strategy monthly. Our pace of change itself changed.

So you have institutionalized your improvements in methods by sustaining a process of managing continuous improvement, managing change.
That's exactly right. From that first bold order to reduce the setup time, we've achieved a cultural change where two-thirds of our employees are on teams, our management no longer scowls when they see training (non productive) hours, and we've created a method to continue our improvements. No expensive new technology. No consultants. Just committed management, willing employees, training and a challenging problem.

We welcome questions. We encourage plant visits. We would love to hear what works for you. Seems like there's always room for … yep, you guessed it, more change.

Thanks guys, for sharing.

PMPA Business Intelligence Report- Case File: Micron Lean Team



Steps taken during Acme setup			
Task / Destination	Zone		
	Green	Yellow	Red
Tool Box	160		
Other Side of Machine		170	
Setup Cart	162		
Work Bench	72		
Teardown Cart	26		
Dept. Desk		132	
Load Stock		99	
Tool Area		84	
Mop Bucket		20	
QC Dept			116
Help Other Oper.			168
Check Other Mach.			120
Maint. Area			72
Totals	420	505	476
1401 Steps	30%	36%	34%
3502 Ft	1050 Ft	1263 Ft	1190 Ft

Appendix A Spaghetti Diagram

Job Pan: Matches Index Card ☐ Matches Layout ☐

Collets: On Mach ☐ On Cart ☐ Order ☐ Diff Mach ______

Pushers: On Mach ☐ On Cart ☐ Order ☐ Diff Mach ______

Gears: On Mach ☐ On Cart ☐ Order ☐ Diff Mach ______

Pads: On Cart ☐ Order ☐

Lead Cam: Cam:__________ On Mach ☐ On Cart ☐

Same as Layout ☐ Order ☐ Diff Mach_______

Setup Information

Job #: ____________________

Part #: ____________________

Date: ____________________

Setup Operator: ____________________

Prep Guy: ____________________

Machine #: ____________________

Machine Size: ____________________

Cross Slide

End Tool Slide (Use Two Tools for Every Setup)

	6th	1st	2nd	3rd	4th	5th
Cams	Cam:__________ On Mach ☐ Pos__ On Cart ☐ Same as layout ☐ Order ☐ Diff Mach______	Cam:__________ On Mach ☐ Pos__ On Cart ☐ Same as layout ☐ Order ☐ Diff Mach______		Cam:__________ On Mach ☐ Pos__ On Cart ☐ Same as layout ☐ Order ☐ Diff Mach______	Cam:__________ On Mach ☐ Pos__ On Cart ☐ Same as layout ☐ Order ☐ Diff Mach______	Cam:__________ On Mach ☐ Pos__ On Cart ☐ Same as layout ☐ Order ☐ Diff Mach______
Form Holder	H T On Cart ☐ ☐ On Mach ☐ ☐ Diff Mach ☐ ☐ Order ☐ ☐	H T On Cart ☐ ☐ On Mach ☐ ☐ Diff Mach ☐ ☐ Order ☐ ☐	H T On Cart ☐ ☐ On Mach ☐ ☐ Diff Mach ☐ ☐ Order ☐ ☐	H T On Cart ☐ ☐ On Mach ☐ ☐ Diff Mach ☐ ☐ Order ☐ ☐	H T On Cart ☐ ☐ On Mach ☐ ☐ Diff Mach ☐ ☐ Order ☐ ☐	H T On Cart ☐ ☐ On Mach ☐ ☐ Diff Mach ☐ ☐ Order ☐ ☐
Shave Holder			H T On Cart ☐ ☐ On Mach ☐ ☐ Diff Mach ☐ ☐ Order ☐ ☐	H T On Cart ☐ ☐ On Mach ☐ ☐ Diff Mach ☐ ☐ Order ☐ ☐	H T On Cart ☐ ☐ On Mach ☐ ☐ Diff Mach ☐ ☐ Order ☐ ☐	
Drill Holder, Collet, & Tool	H T C On Cart ☐ ☐☐ On Mach ☐ ☐☐ Diff Mach ☐ ☐☐ Order ☐ ☐☐ Bushing ☐ ☐	H T C On Cart ☐ ☐☐ On Mach ☐ ☐☐ Diff Mach ☐ ☐☐ Order ☐ ☐☐ Bushing ☐ ☐	H T C On Cart ☐ ☐☐ On Mach ☐ ☐☐ Diff Mach ☐ ☐☐ Order ☐ ☐☐ Bushing ☐ ☐	H T C On Cart ☐ ☐☐ On Mach ☐ ☐☐ Diff Mach ☐ ☐☐ Order ☐ ☐☐ Bushing ☐ ☐	H T C On Cart ☐ ☐☐ On Mach ☐ ☐☐ Diff Mach ☐ ☐☐ Order ☐ ☐☐ Bushing ☐ ☐	H T C On Cart ☐ ☐☐ On Mach ☐ ☐☐ Diff Mach ☐ ☐☐ Order ☐ ☐☐ Bushing ☐ ☐

Prep Guy: ______________________________ **Supervisor or Designate:** ______________________________

Recess Holder & Tool			H T On Cart ☐ ☐ On Mach ☐ ☐ Diff Mach ☐ ☐ Order ☐ ☐ Bushing ☐ ☐ Rod Mount ☐ ☐	H T On Cart ☐ ☐ On Mach ☐ ☐ Diff Mach ☐ ☐ Order ☐ ☐ Bushing ☐ ☐ Rod Mount ☐ ☐	H T On Cart ☐ ☐ On Mach ☐ ☐ Diff Mach ☐ ☐ Order ☐ ☐ Bushing ☐ ☐ Rod Mount ☐ ☐	
Tap Holder, Collet, & Tool				H T C On Cart ☐ ☐ ☐ On Mach ☐ ☐ ☐ Order ☐ ☐ ☐ Bushing ☐ ☐	H T C On Cart ☐ ☐ ☐ On Mach ☐ ☐ ☐ Order ☐ ☐ ☐ Bushing ☐ ☐	
Reamer Holder, Collet, & Tool	H T C On Cart ☐ ☐ ☐ On Mach ☐ ☐ ☐ Diff Mach ☐ ☐ ☐ Order ☐ ☐ ☐ Bushing ☐ ☐	H T C On Cart ☐ ☐ ☐ On Mach ☐ ☐ ☐ Diff Mach ☐ ☐ ☐ Order ☐ ☐ ☐ Bushing ☐ ☐	H T C On Cart ☐ ☐ ☐ On Mach ☐ ☐ ☐ Diff Mach ☐ ☐ ☐ Order ☐ ☐ ☐ Bushing ☐ ☐	H T C On Cart ☐ ☐ ☐ On Mach ☐ ☐ ☐ Diff Mach ☐ ☐ ☐ Order ☐ ☐ ☐ Bushing ☐ ☐	H T C On Cart ☐ ☐ ☐ On Mach ☐ ☐ ☐ Diff Mach ☐ ☐ ☐ Order ☐ ☐ ☐ Bushing ☐ ☐	H T C On Cart ☐ ☐ ☐ On Mach ☐ ☐ ☐ Diff Mach ☐ ☐ ☐ Order ☐ ☐ ☐ Bushing ☐ ☐
Face Off Holder & Tool	H T On Cart ☐ ☐ On Mach ☐ ☐ Diff Mach ☐ ☐ Order ☐ ☐	H T On Cart ☐ ☐ On Mach ☐ ☐ Diff Mach ☐ ☐ Order ☐ ☐	H T On Cart ☐ ☐ On Mach ☐ ☐ Diff Mach ☐ ☐ Order ☐ ☐	H T On Cart ☐ ☐ On Mach ☐ ☐ Diff Mach ☐ ☐ Order ☐ ☐	H T On Cart ☐ ☐ On Mach ☐ ☐ Diff Mach ☐ ☐ Order ☐ ☐	H T On Cart ☐ ☐ On Mach ☐ ☐ Diff Mach ☐ ☐ Order ☐ ☐
BD/CO Holder & Tool	H T On Cart ☐ ☐ On Mach ☐ ☐ Diff Mach ☐ ☐ Order ☐ ☐	H T On Cart ☐ ☐ On Mach ☐ ☐ Diff Mach ☐ ☐ Order ☐ ☐	H T On Cart ☐ ☐ On Mach ☐ ☐ Diff Mach ☐ ☐ Order ☐ ☐	H T On Cart ☐ ☐ On Mach ☐ ☐ Diff Mach ☐ ☐ Order ☐ ☐	H T On Cart ☐ ☐ On Mach ☐ ☐ Diff Mach ☐ ☐ Order ☐ ☐	H T On Cart ☐ ☐ On Mach ☐ ☐ Diff Mach ☐ ☐ Order ☐ ☐
Thread Roll Holder & Tool				H T On Cart ☐ ☐ On Mach ☐ ☐ Diff Mach ☐ ☐ Order ☐ ☐	H T On Cart ☐ ☐ On Mach ☐ ☐ Diff Mach ☐ ☐ Order ☐ ☐	
Knurl Holder & Tool	H T On Cart ☐ ☐ On Mach ☐ ☐ Diff Mach ☐ ☐ Order ☐ ☐	H T On Cart ☐ ☐ On Mach ☐ ☐ Diff Mach ☐ ☐ Order ☐ ☐	H T On Cart ☐ ☐ On Mach ☐ ☐ Diff Mach ☐ ☐ Order ☐ ☐	H T On Cart ☐ ☐ On Mach ☐ ☐ Diff Mach ☐ ☐ Order ☐ ☐	H T On Cart ☐ ☐ On Mach ☐ ☐ Diff Mach ☐ ☐ Order ☐ ☐	
Chaser Die Head & Tool				H T On Cart ☐ ☐ On Mach ☐ ☐ Diff Mach ☐ ☐ Order ☐ ☐	H T On Cart ☐ ☐ On Mach ☐ ☐ Diff Mach ☐ ☐ Order ☐ ☐	

Appendix B Setup Checklist