The following is some additional information on Mixed Model Scheduling. Instead of writing something on the subject ourselves, we decided to provide you with a couple of articles that I found to be very helpful when describing what it takes to create an effective flow using Mixed Model Scheduling. One of the better consultants in the area of Lean, from our perspective, is company called, “The Lean Advisors”, who originated the following articles. They have a treasure trove of Lean Manufacturing resources on their website, which is www.leanadvisors.com.

Have fun!

Derril

Mixed Model Scheduling

What is Mixed Model?

Mixed Model flow is a somewhat common occurrence in Lean. They are parts of your value stream that produce multiple products - not one product - within a given time period.

Lean implementation can be more straightforward in dedicated parts of your value stream - those places where only one product is made and where one-piece flow cells are appropriate.

But what if your value stream produces more than one product? What if it produces many products in any given month, or week or hour? Mixed Model flow is the solution you may have been looking for.

What is Mixed-Model flow? Mixed-Model flow is making value flow by taking out the waste in your value stream so that multiple products are made in each time period.
This is accomplished by making the Mixed-Model flow part perform as if it were a dedicated asset. Each product "flows" at the rate of customer demand, even though multiple products are made there.

Business Definition

First, you must understand what kind of business you're in. The basic question here is are you in a MTS (Make To Stock) or a MTO (Make to Order) business? Make To Stock means you will have some sort of Finished Goods Inventory (FGI) at the end of your Mixed-Model flow. Make To Order means your product will dovetail directly into a "customer process" at the end of your Mixed-Model flow line.

Product Families

Second, you need to spend time understanding (really understanding) your product families. A product family is a combination of products that share similar processes. In your Mixed-Model flow value stream there are most likely a number of products. For example, some Circuit Card Assembly operations have as many as 250-1500 different products. But this doesn't mean they will have that many product families. Generally speaking, when you look closely at your products and the common processes they travel through, you'll end up with a small set of product families.

Takt Time

Third, you start getting a bit more technical. You have to figure out what the takt time is for the product family. What is the average rate of customer demand for the family of products? This takt time becomes important in setting up and in staffing the Mixed Model flow line.

The Customer

Fourth, you will need to begin defining value for each product family from the customers' perspective. What are their expectations? Where is the value being created in your current flow? Where is the non-value added cost being incurred (the waste)? Also included here is the work of creating a current state Value Stream Map of your Mixed-Model flow. What does it look like? How does it work? What are the outcomes in terms of VAT (Value Added Time) and Lead Time?

One Piece Flow

Fifth, where in your Mixed-Model flow can you achieve one-piece flow for each product family? This is where you can create cells in your Mixed-Model flow.

Pull Systems

Sixth, where you can't flow, where will you install pull systems? Where will you put supermarkets and FIFO lanes? These are essentially inventory buffers between the shared resource part and the 1-piece flow parts of your Mixed Model flow value stream. There's quite a bit of hard work required here, since supermarkets will have to be sized appropriately, located in the right spots, kanban cards (withdrawal and production) created, procedures changes, etc. in order to make this happen. The same for FIFO Lanes.

At this point you're ready to tie this thinking together on your future state value stream map. You can "flow where you can" and "pull where you can't flow" on a future state map. Of course, this doesn't mean you've physically accomplished "flow and pull" yet, but at least you have the concept on paper of where and how it'll be achieved in the future.

Heijunka Box

Seventh, you need to determine how often you want to make each product family. What is the "mix" of products going to be in each product family? How frequently will you make this product family? This will be your production interval. This is important because it determines how you will produce your product family mix, your lot sizes and the frequency of changeovers

in your Mixed Model flow value stream. Normally, we use a concept called the Heijunka box. The Heijunka box is a visual scheduling system and allows the product family team to see how well they are doing against takt time (customer demand) as the day progresses. It also indicates the work to be done by each team in the selected time frames. The Heijunka box becomes the production controller for the operation both in manufacturing and in administrative environments.

Quick Changeover

Eighth, you will want to be working on SMED / Quick Changeover in your Mixed Model flow (almost always necessary. This is where you build the capability to rapidly and efficiently switch between one running product and the next running product to achieve true Mixed Model flow.

Standard Work

Ninth, you need to balance the operator work in the Mixed Model flow. When completed, this becomes the Standard Work based on actual customer demand for the products in each Family. You also need to check machine capacity compared to this customer demand to be sure you have adequate capability to meet the demand in the interval you've chosen.

Scheduling

Tenth, you will have to figure out where to schedule the Mixed Model flow. The key is one point and only one point in the whole Value Stream is to be scheduled. Once that point is selected, you "pull" up to that point and "fast flow" from that point to the customer. Typically this schedule point is found immediately after the shared resource asset in your Mixed Model Value Stream.

Fine Tuning

Eleventh, you are now ready to "go live" with your Mixed Model Value Stream and basically test and debug it's operation. There will be a number of fine tuning elements to make it work, but this is normal.

Continuous Improvement

Twelfth, once up and running in your Mixed Model flow, you now have the opportunity (continuous opportunities) to improve its operation.

The only advice we can give you is to be bold and get started with your Mixed Model flow. Following the process described above will insure you are successful. Virtually all of the Lean Tools are available for use in Mixed Model flows. And the results beat the old "batch & queue, push scheduling system" that's in place today for your shared resources.

By James Myers, Senior Advisor
Lean Advisors Inc.

SMED Lives In The Factory And Beyond

Single Minute Exchange of Die or SMED is a method for rapidly and efficiently converting a process from running the current product to running the next product. It is also often referred to as Quick Changeover. The SMED method can, and often is, used in starting up a process and rapidly getting it to running condition with minimum waste.

SMED or Single Minute Exchange of Die is a concept that says all changeovers (and startups) can and should take less than 10 minutes ... hence the phrase Single Minute. Closely associated is an advanced concept of OTED (One-Touch Exchange of Die), which says changeovers can and should take less than 100 seconds.

Think of a racecar pit stop and you've got the idea with SMED! We have worked with a number of companies who have reduced their setups and changeovers from several hours to 30 minutes or less on the first try using SMED. It works perfectly!

SMED (Single Minute Exchange of Die) originated with Shigeo Shingo and has evolved and spread around the world over the years. The term refers to the theory and techniques for performing set up operations in under 10 minutes i.e. a number of minutes expressed in a single digit. SMED or QCO (Quick Changeover) as it is often called, had its birth and growth in factories where metal stamping dies, plastic injection molds, and extrusion dies had to be changed, or taken out of the machine, and a different one installed in order to produce the next scheduled part. The time for the changeover covers the period from the last old part being made until the first good new part is produced. If adjustment or fine tuning is required to make a good part, the changeover is not complete.

You may ask why is it necessary to get a changeover done quickly. The answer comes from the need to be lean and eliminate waste from the process. With value added work being any activity transforming the part, product, or service that a Customer is willing to "pay" for constituting only 5 to 10% of a non-lean company's activity, any reduction in non value added waste drops right through to the bottom line as a cost saving. That is understood by even non - lean "Bean Counters".

The focus on waste reduction leads to what constitutes the 9 types of waste defined by lean practices. They are the waste of overproduction, inventory, waiting, transportation, motion, processing, defects, re-prioritization, and people skills. By training people in SMED, all of these wastes can be minimized. This is achieved through the utilization of SMED to externalize elements of the changeover that can be done while the machine is operating. The remaining internal elements are then streamlined to decrease the time the machine is stopped. The many streamlining techniques include using functional fixtures and jigs, as well as eliminating adjustments, and creating parallel steps which are completed at the same time. A high degree of refinement of SMED morphs into OTED (One Touch Exchange of Die) which is the concept that says all setups should and can take less than 100 seconds!

It should be noted that while it is not mandatory that everyone achieve changeovers of less than 10 minutes, it is imperative that changeovers be reduced and the first priority is to get them to a level that puts your group closer to the Future State as dictated by your Implementation Plan. Some companies spend years and hundreds of thousands of dollars to improve changeovers only to find the rest of the process can't keep up. What has happened is that a point improvement has jammed up the system with a resultant cost increase and deterioration in the SMED improvement. SMED is to be part of the overall "Lean journey", not a "flavor of the day".

Remember that SMED is a cost reduction principle. Traditionally management took the cost of a product and added on a profit to arrive at a selling price. This is no longer the case in the modern economy where the customer/market place dictates the selling price and to increase or even maintain the profit level, the producer has to cut costs.

Thus cost + profit = selling price is replaced with selling price - costs = profit.

SMED exists and thrives outside the factory. The next time you see a race car do a pit stop, notice that many of the "changeover" operations are carried out in parallel, rather than sequentially as the home mechanic might do. Part of the externalizing of the activities, that may not be obvious, is that the lug nuts for the wheels are glued onto the wheel rim with a dab of crazy glue. This ensures there is no fumbling around trying to find a nut that has been taken off and then inserting it into the nut driver of a pneumatic wrench to install and tighten it. Seconds count!

Similarly, in a medical setting where patients queue for an MRI, if the patients change from street clothes to hospital garb ahead of their machine time, the changeover from one patient to the next is decreased. SMED is a critical tool and like all tools, it is important to apply it properly. It can be applied in the office, in healthcare, in manufacturing, or anywhere where there are different products or services being produced or developed with similar machines. When applied 'right', SMED can make the difference between profit and loss, and being able to meet the changing demands of your customer. It may be your competitive edge.

Heijunka

The act of leveling the variety and/or volume of items produced at a process over a period of time. It is used to avoid excessive batching of product types and/or volume fluctuations, especially at a pacemaker process.