A comprehensive

INTRODUCTION TO MACHINE SHOP SCHEDULING

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Introduction

What this Ebook is about and who should read it.

If you are reading this Ebook, chances are you're either a production scheduling professional or a machine/ job shop owner who understands the importance of proper scheduling.

Most likely, you have experienced the pain of late deliveries. Of course, this did not happen on purpose. It is just, that you have too much stuff going on at the same time. Means: too many changes to existing orders, too many rush orders and too little insight into what exactly happens on your shop floor.

You came to the conclusion that software might be a bit of help for you. However, "typical" advanced scheduling software programs seem to be too heavy-weight and seem to be made for large-volume producers, but not for machine shops like yours. Likewise, you sense that a homegrown Microsoft Excel-based system will fall short of your requirements.

This Ebook is meant to provide an introduction into the specifics of machine shop scheduling, best practices and also the must-haves of any software system that is supposed to help machine shops with an easy time and resource scheduling.

About the author of this Ebook

Martin is Managing Director of NETRONIC - The Gantt Solutions Company. He is passionate of the idea making the Gantt chart a key enabler of operational agility. **just plan it** is his most recent "baby". Both with conventional NETRONIC products and with **just plan it**, he has helped numerous SMB shops gain transparency of their time and resource-oriented planning data.

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Chapter One

WHAT IS MACHINE SHOP SCHEDULING?

What is machine shop scheduling?

In recent years, the ability to combine software technology with lean ideals has transformed the way large manufacturers orchestrate their supply chain, resources, and production runs. As result, we today know a plethora of sophisticated production scheduling and planning systems, which come with powerful optimization algorithms. These algorithms though depend on being fed with highly specialized and always current data. Consequently, these enterprise-class scheduling systems fall short when applied in an SMB manufacturing environment such as is the case for most make-to-order job shops. This blog post outlines characteristics why SMB machine shop scheduling is specific, and why it differs from production scheduling in large enterprises.

Constant change as the only constant

Here is what makes a small machine shop really unique - and also "interesting" from a scheduling point of view: any machine shop can be characterized by the phenomenon of "constant change". Typically, the machine shop's scope is a high variety of products to be manufactured in very small batch sizes. Predictability is low as new jobs often are won short term with the customer requesting a quick delivery. As change is the one constant in a job shop's day-to-day business, also the schedule must get changed constantly.

Controlled chaos

For that, you need to successfully coordinate your orders and inventory with your resources (manpower and machinery), while simultaneously adjusting to fluctuating variables like change orders, deadline alterations, and logically dependent jobs.

Even if you are using an enterprise resource planning system (ERP), your daily production schedule probably depends on immense whiteboards or Excel-based “systems” that do not adequately deal with the constant changes and resources conflicts you experience. When a customer requests a rush order, there’s no way to easily see the impact it will have, or to modify your shop schedule in order to minimize the effect. So, rather than be able to support lean methods enabling your "close to batch size 1" type of business, you spend most of your time in a reactive mode, scrambling to maintain production targets so that you can meet shipment deadlines. This type of controlled chaos makes it difficult to ensure happy customers. Without the benefits and efficiency gains that can be orchestrated through mass production, you must ensure that the quality and timeliness of your throughput builds your reputation; but that is very difficult to orchestrate manually.

Common Scheduling Issues

Both ERP systems and Excel-based scheduling "systems" can’t effectively address the scheduling factors that you need to juggle in make-to-order (custom fabrication) operation, which include:

- **Delivery Times and Commitments**—managing numerous small batch orders with the ability to integrate continual additions, rush orders, and changes to existing orders in an on-going production schedule. The problem with most traditional methods is that you don’t have any ability to observe the consequences these changes create on the floor.
- **Finite Capacity Scheduling**—optimizing machine utilization so that inactivity and overlapping are minimized. This is especially important in machine shops with orders that consist of a number of logically dependent operations. With whiteboards or Excel, the sequential movement requires an excessively manual approach, so your scheduler is basically running the floor, desperately trying to coordinate tasks.
- **Inventory and Materials Availability**—your own materials inventory also effects scheduling your shop floor operations. If you’re operating with a JIT (just in time) or ASAP (as soon as possible) system, unforeseen interruptions in deliveries means rearranging your shop schedule to ensure that production continues despite the lack.
- **Labor and Resource Management**—your schedule must adapt to fluctuations in labor and machine operation parameters that include unplanned work absences, machine breakdowns and normal PM schedules.

All of these conditions are also subject to your particular order priorities and machine run-times. Your mission critical goal of delivering high quality parts and components to your customers on time means that you must establish a system that eliminates obscurity. Machine shop scheduling software delivers exactly that.

Machine Shop Scheduling 101

Lean manufacturing practices can be created in a make-to-order environment. Specialized software that employs visual machine shop Gantt charts substantially increases your visibility into floor activity and offers a comprehensive, yet alterable production schedule that integrates all of the volatile factors you deal with each day. And an effective scheduling system will make actionable provisions, including:

- When rush orders are placed, shop scheduling software produces instant “what if” analyses so that you can confidently project completion times and provide accurate delivery dates to your customers.
- For orders that require a variety of temporal movements, shop scheduling software delivers a visually integrated alternative, which allows you to instantly comprehend production dependencies to optimize machine usage and production time.
- If the shop scheduling software is cloud-based software it does not require extensive, costly, or difficult infrastructure changes. You won’t need to spend time training your staff or make investments in additional IT personnel. Keep the attention on maintaining quality and timely deliveries, rather than introducing complicated new systems.

Basically, effective machine shop scheduling software makes it easy for you to manage your production schedule without headaches or lost revenue from missed deadlines. It provides you with the ability to easily adapt to the myriad changes you face each day in order to maximize your productivity, reduce wastes, and build your reputation for dependable quality and service.

Chapter Two

WHY A MACHINE SHOP SCHEDULE IS IMPORTANT

Why a machine shop schedule is important

Machine shops are defined - and often define themselves - by uncertainty and uniqueness. They typically produce highly customized products in low volumes, and their product mix varies constantly. Hence, machines are reconfigured over and over again, staff is required to learn and unlearn new procedures, new equipment and tool, and jobs have to be rescheduled with the ever changing customer specifications and deadlines. In such an environment, many machine shop owners decide to operate on an ad-hoc basis and to tolerate efficiency issues which never would be accepted in a high-volume shop. This blog post provides thoughts why even (or especially!) in this very volatile machine shop world, proper scheduling is a must do.

The giant impact of infinite vs. finite capacities

When you operate with unlimited resources, whether it involves manpower, machinery, or materials, there's not a big effort required to orchestrate production operations. Literally spoken: You simply need to arrange your processes and press "go." Indeed, with an infinite resource capacity there are no operational limits, any resource may be apportioned to any number of operations simultaneously. And, rather than focusing on effective ways to control wastes and lessen the constraints on your throughput metrics and run times, the emphasis is placed on developing efficient sales funneling techniques and marketing procedures. Hence, in a shop with infinite resources, the rallying cry should be "sell, sell, sell".

However, when you conduct machine shop operations in a make-to-order setting, that type of freedom is unattainable. The inflexible delivery constraints that you deal with are subject to a variety of finite production capacities. Equipment and labor limitations, change-overs and waiting times, and multiple production dependencies conspire to generate a 'situation-normal' atmosphere on the floor which resembles thinly veiled bedlam. Which is exactly why some type of machine shop scheduling or planning system is required to organize your production tasks. Means, as soon as your resources are constraint, your rallying cry should be "schedule, schedule, schedule".

Scheduling as the definitive solution to limited capacity

Even if you've somehow managed to orchestrate a tenuous production schedule, delivery times usually don't equal the sum of your production times. Trying to accurately deliver on-time, small batch orders to your various clients using mammoth white boards or an advanced Excel program is difficult. The lack of visibility and "what-if" scenarios presents daily challenges.

For example, what happens when:

- Some, or all of your key shift operators fail to show up?
- Your machinery experiences a malfunction and requires immediate repairs?
- Your inventories are inaccurate and an out-of-stock situation halts production?
- Materials deliveries aren't made on time?
- Your biggest client requests a rush order for an intricate component?
- A current order requires a change in specifications or batch quantity?

And, these are just a few of the factors that can negatively hinder your delivery times.

Balancing production time with resources

Ongoing efforts are required to balance your production intricacies with continuous changes. Working from white boards or Excel 'systems' simply can't cope with such excessive unpredictability. You need an effective method for managing your various constraints (like necessary waits) to organize floor activity and maintain on-time deliveries. Your business reputation depends on it.

With manual scheduling, you're basically compelled to conduct operations from a reactionary standpoint and often you find yourself being driven by your schedule (although we all agree that it should be the other way round). Consequently, there's no proactive way to optimize your resources using this style of management.

Moreover, the lean principles which have proven so effective in large manufacturing assemblies break down when applied in a job shop setting because of the "custom" nature of the orders. This is exactly why introducing a dedicated machine shop schedule is so crucial.

A machine shop schedule provides solid answers

Essentially, everything boils down to intricate time management. Your customers need specific parts and components to maintain their production line activity, which means that any delayed shipments have a ripple effect; and you can't afford to lose the confidence of your buyers.

By orchestrating a series of "what if" considerations, a machine shop schedule allows you to examine the impact new orders will have on your floor operations, and outlines possible avenues of optimization that improve your overall performance. For example:

You need to understand the impact a new order (or a change of order) will have on your current production.

- What are the related dependencies and waiting times?
- How will those dependencies influence current orders?
- Will the inclusion negatively affect completion times on another important batch?
- If so, which tasks can be rescheduled to ensure that both are completed on time?

You also need to incorporate your specific resource parameters.

- Will scheduled manpower be adequate to meet the new requirements?
- If not, how can you work around it?
- Are preventative maintenance tasks arranged to create the least amount of downtime?
- What if one of your materials deliveries is late?

> *"Whatever the jargon, sources agree that job shop schedules must account for the causes and effects of unexpected schedule changes (from products received late from other suppliers, for instance) and juggle myriad conflicting elements."*
>
> **Tim Heston, THE FABRICATOR, September 2011**

Running a machine shop without a schedule is like flying blind

Trying to deal with these types of (typical) unexpected changes manually becomes more difficult as your business grows. For SMB's, your total production time is what affects your profitability; and without accurate planning capabilities, you're basically operating blind.

However, developing an efficient machine shop schedule solves your time management dilemmas and eliminates operational obscurity. By generating comprehensive production transparency, it gives you the tools to increase your management proficiency, and improve your overall output. With highly visual "what if" situations, it accurately analyzes and portrays the production time constraints that influence your operation so that you can immediately comprehend the impact.

A machine shop schedule is important because it improves floor productivity, helps reduce wastes, and allows you to focus on your most important task—fulfilling your commitments to your customers on time, every time.

Chapter Three

10 MACHINE SHOP SCHEDULING BEST PRACTICES

10 machine shop scheduling best practices

Unlike large process and discrete manufacturing, SMB job shop operations often rely on a labor-intensive scheduling process. However, because of dynamic arrival patterns, frequent order changes, and random sequencing on almost every small batch, finding effective ways to optimize your resources and reduce “makespan” times typically takes a back seat to the pressing urgency of simply arranging your daily production tasks.

Since many of your customers already utilize lean strategies to organize their own inventory and production runs, experiencing sporadic or unreliable order completion negatively effects your reputation as a vendor, and your revenues.

A Dynamic Production Environment Demands a Dynamic Scheduling Solution

By recognizing the factors that will make your scheduling process easier, you can incorporate machine shop scheduling best practices that improve your ability to deliver quality parts and components on time, while simultaneously improving your floor efficiency metrics.

The biggest challenge faced by SMB job shops is volatility. Therefore, machine shop scheduling best practices focus on developing an actionable strategy that addresses two core certainties: delivering accurate information regarding what needs done, and when; and the ability to easily view the impact and implications of specific job tasks.

The following top 10 machine shop scheduling best practices center on developing an active planning process, unobstructed visualization, clear understanding, and ways to take immediate action.

#1. Facilitate a seamless connection with current resource management systems.

Your production planning/scheduling tool needs to work together with your other resource management systems to ensure maximum productivity. A smooth integration of production load information, along with labor and machine capabilities allows your scheduling tool to expand together with your total software landscape.

#2. High-level planning logic integration.

Schedulers must arrange jobs according to finite capabilities, so your scheduling engine needs to automatically integrate the most important aspects of the job in relation to capacity. Moreover, necessary constraints like warm-up and wait times for machines must be accounted for, along with variables priorities, earliest due date, etc. A dedicated scheduling engine provides for these type of limits and dependencies automatically.

#3. Automatic prioritization for specific dispatch of rush orders and creating “what if” scenarios.

You schedulers need actionable information concerning the inclusion of rush orders or changes to existing jobs. A detailed “what if” scenario provides quick, accurate implications so that the schedule can be adjusted for optimum productivity.

#4. Offer clear, visual language.

Your scheduling tool needs to provide, clear, visual language that is easy to understand, and that highlights any potential conflicts. Speaking colors (like red warnings) and recognizable symbols must be included to instantly show bottlenecks and convey the impact new order additions make to the current production plan.

#5. Deliver a multi-dimensional outlook.

Your job shop deals with more variables than can be addressed by a one dimensional, visual system alone. A truly comprehensive view incorporates both your resource parameters (capacity) and your job details, with all their explicit and implicit dependencies.
Instead of viewing data in simple rows, columns, and cells, you should have 3-dimensional access to:

- Job view
- Machine (resource) view
- Calendar view—particularly in relation to work and non-work times.

#6. Embrace proactive support of the planning activities.

Machine shop scheduling best practices must deliver proactive scheduling support, which means that alterations must trigger scheduling conflicts immediately. The visual system allows your schedulers to instantly see where any conflicts will occur with resources, so that they can better understand subtle implications to the schedule.

#7. A clear delineation of order alterations and the impact they have on your operating production.

Successors and predecessors must be automatically altered when an operation is changed, in order to allow for easy interpretation the fluctuations you face each day, making order impacts and dependencies obvious. This type of superior presentation provides actionable intelligence for your schedulers.

#8. The power to manually alter the schedule.

The ability to alter your schedule to meet changing demands provides you with the tools and intelligence to ensure that you're optimizing your operations. Change your machine allocation, dates, and times using a drag and drop technique that continues to adjust the schedule as you work.

#9. The ability to swiftly change capacity.

Your schedulers also need to be able to quickly alter your capacities, such as inserting extra shifts and additional labor, or accounting for absent personnel.

#10. An actionable method for developing scenarios and production strategies.

You also need to be able to switch back and forth between production strategies (like ASAP and JIT) to ensure that delivery dates are met. This best practice offers flexibility that allows you to optimize your floor operations.

Machine shop scheduling best practices deliver the ability to alter your schedule to meet changing demands, and provide you with the tools and intelligence to improve your most important business metric: ensuring timely deliveries to your customers.

Chapter Four

5 REQUIREMENTS FOR AN EFFECTIVE MACHINE SHOP SCHEDULING SOFTWARE

5 requirements for an effective machine shop scheduling software

Trying to orchestrate well-organized, effectual production in a machine shop, using a manual scheduling system is extremely challenging. Although advanced algorithms and lean practices are very effective for improving productivity metrics in discrete operations, in a machine shop, the number of variables you face creates a volatile scheduling environment. This chapter discusses five requirements for an effective machine shop scheduling software which can cope with this volatility.

Machine shops: A volatile and demanding environment for scheduling software

Your own inventories, processing times, and logical dependencies, combined with frequent order alterations, fluctuating resource constraints, and customer “rush” requests generate a situation fraught with unpredictability. And, the typical result of gargantuan white boards and Excel sheets is a lot of frenzied activity, frustration, and late deliveries.

To effectively control floor productivity in a machine shop environment, many businesses adopt some type of scheduling software. The idea being, that additional technology will somehow produce the best practices that will drive production results. However, often the “solution” generates even more confusion by omitting critical information, or because of a lack of interoperability.

In today’s “time-based” competitive market, you simply can’t afford the revenue losses that accompany late shipments. Since your customers are depending timely deliveries, your machine shop scheduling software must facilitate the orderly execution of your shop floor activity, support user communication, and ensure the achievement of production best practices. **As such, a proper scheduling system becomes the clockwork of your shop floor operations**.

The following five requirements outline the software factors necessary for introducing the planning, visualization, comprehension, and agility you need to achieve “five nines” (99.999%) delivery metrics – and to make your scheduling software work like your shop floor’s clock work.

#1. Intuitive, Visual Planning Directives

Machine shop scheduling software must offer clear, easy to understand planning parameters in a quick to learn format. Your schedulers shouldn’t need extensive training to operate it. The best option is a highly visible Gantt chart system that features an intuitive, yet comprehensive approach, allowing for quick action and enhancing operational agility.

Visual planning allows you to view all of your resource capacities (machinery and employees) and job details, giving immediate warnings when and where any conflicts or wastes (idle gaps) occur. Moreover, by allowing the user to build plans based on common strategies like JIT and ASAP, and the ability to selectively prioritize jobs, you facilitate timely order completion.

The user should be the focal point from which all scheduling data is targeted. By providing your scheduler with simplified planning parameters and job insertion (minimal clicks, “drag and drop” functions), your machine shop scheduling software will institute best practices that will streamline:

- Dynamic arrival patterns
- Customer changes to quantity, date, or order specifications
- Rush order insertion

#2. Visual Planning Logic Integration

Your machine shop scheduling software must flawlessly integrate all of the finite capabilities of your shop. The total number of jobs must be coordinated according to volatile, moving constraints, and the software must provide a visual aspect of the logical dependencies of operations, comprehensively. This means that the individual predecessor-successor-relations of your jobs are considered automatically, every time you work on your schedule.

This inevitable Integration of existing dependencies minimizes the planning efforts in comparison to hand made solutions like Microsoft Excel and improves your operational agility tremendously.

#3. Automatic, Interactive Scheduling Tools

Because your scheduling process essentially consists of repeated re-scheduling, your scheduling software should offer automatic tools that instantly deliver actionable information. For example, to ensure operation efficiency in the face of rush order and alteration requests, your schedulers need to know exactly what impact the changes will create.

Likewise, in the event of an unexpected break-down, you need to be able to allocate another machine to fill the gap, without influencing other processes. Look for the ability to create “what if’ scenarios.

By providing a clear delineation of all successors and predecessors, relative dependencies, and other influences, along with the power to manually alter the current schedule, you gain an interactive system that eliminates backlogs and inaccuracies.

#4. Seamless Interoperability

Scheduling software for your machine shop must be able to function with your current enterprise resource planning system (ERP) and other business software applications to ensure maximum productivity throughout your business.

Naturally, your scheduling software should easily integrate your inventory data, but interoperability with other systems like CRM and vendor management programs create an effective way to monitor mission critical metrics and identify possible liabilities. For example, the ability to connect with management software, helps track vendor quality and delivery performances, and smoothly transfers all of your Excel information.

This ability allows your scheduling software to evolve and grow sustainably together with your total software landscape.

#5. User Friendly Set-up and Implementation

This requirement is really a must have in today's business environment. Out-of-the-box software that functions with cloud technology removes the implementation hassle. You should not have to spend days (or even weeks) operating at a minimum capacity to initiate the program. In fact, cloud computing solutions offer enhanced security and uptime.

No need to worry about costly upgrades, increasing your infrastructure and hardware, or adding additional IT personnel. Cloud based delivery eliminates the hassle of adopting state-of-the-art scheduling software for your machine shop.

The right tool will engender necessary best practices, while increasing floor communication and productivity.

This inevitable Integration of existing dependencies minimizes the planning efforts in comparison to hand made solutions like Microsoft Excel and improves your operational agility tremendously.

In today's "time-based" competitive market, you simply can't afford the revenue losses that accompany late shipments. Since your customers are depending timely deliveries, your machine shop scheduling software must facilitate the orderly execution of your shop floor activity.

TAKE 2 MINUTES AND GIVE IT A TRY

just plan it is a software that is made to help machine shops with easy time and resource scheduling. You can try it out with now further obligations.

LET'S TRY IT.