

MCP CASE STUDY - WIRES



Sivaco: Sivaco leverages Preactor to improve its production operations

Located in Marieville, Quebec, Canada, Sivaco started operations in 1950 as a nail manufacturing plant which soon transitioned to wire production. Today, at the forefront of wire production in North America, Sivaco designs, manufactures and delivers the highest quality wire products for a wide range of applications. Many of Sivaco's customers take advantage of Sivaco's unique make-to-order manufacturing capabilities. Their technical expertise and strong client partnerships enable them to develop customer-specific, value-added wire solutions.



Sivaco's customers use these products to manufacture bedsprings, garage springs, rivets, cables for the forestry industry, galvanized wires as armour for telecommunication lines, screws, miscellaneous automotive parts and recently "Umbilical Wire" used in off shore oil and gas wells.

THE PRODUCTION PROCESS AND CONSTRAINTS

The customer's order wire in terms of either weight or length. All recipes are developed based on very specific customer requirements in a way to ensure consistency. An order is typically translated in a number of rod coils to meet the weight or length requirements. These coils will go through different manufacturing process steps to obtain the desired diameter, finishing and ductility.

The major manufacturing process steps are:

Pickling: Pickling is the process of cleaning the raw material wire by submersing coils in large baths of acid and moving them progressively from one stage to the next in an automated line. This is accomplished with the help of computer controlled cranes which are directed by recipes linked to each wire type and customer order. The line has a maximum capacity of coils which can be cleaned at one time with the objective to maximize throughput and prioritize accordingly each order to feed the other subsequent processes in production.

Wire Drawing: Wire Drawing is the biggest department in production at Sivaco and includes more than 40 machines. It is the process of reducing a wire rod to the proper diameter by passing it through different matrices in order to obtain the right metallurgical and mechanical

Company and product

Sivaco is at the forefront of wire production with a wide range of applications.

Key challenges

- There are hundreds of different manufacturing processes across multiple orders that need to be put in line to balance the number of setups which could be significant with customer delivery date compliance.
- Minimize overall setup times and meet due dates
- Maintain sufficient workload for the subsequent steps in order to avoid a line stoppage

Key Benefits

- Heuristic method allowed to minimize a number of setups and maximize of due date compliance at the same time.
- WIP minimizing rule was added to calibrate the amount of WIP between different departments.
- No dependency to personal experience to establish a schedule

System architecture

internally developed ERP system programmed by Sivaco

properties. Each machine has its own capabilities and multiple alternates are possible in order to fulfil a particular order. This is the main bottleneck department in the plant and the objective is to select the best machine for each in order to:

- Meet Due Dates
- Minimize overall setup times which could be up to several hours depending on several factors like changes in the input-output diameters and spools required to hold the wire.
- Maintain sufficient workload for the subsequent steps in order to avoid a line stoppage.

Galvanization: Galvanization is the process of applying a protective zinc coating to the wires in order to prevent rusting. This is accomplished by hot-dipping the wires into a bath of molten zinc. The process has its own characteristics which allow different wire types to be handled.

Annealing -Normalization: This annealing process normalizes the structure of steel wires and is accomplished by heating the strands of wires in an oven and then in a lead bath. It is used primarily for wires with high carbon content.

Annealing - Heat Treatment: This annealing process heats spools of raw material wires in ovens causing changes to their properties such as hardness and ductility in order to facilitate subsequent wire drawing steps. The annealing process is done by batches, grouping spools of wire requiring similar heat treatment profiles together which could vary from 7 to 62 hours.

Other steps include: Recoiling / Rewinding: The process of transferring wires, typically from one type of spool to another, for shipping or other purposes.

Shipping: Orders are grouped together for shipping based on destination and ideally a full truck load in order to minimize shipping charges.

The simplest wire would be pickled to remove the mill scale, drawn to the desired diameter and then shipped with the customer's preferred carrier. The most complex wire would go through different processing steps to change the physical properties to meet customer need, including the type of surface. They could be pickled, annealed, pickled a second time, galvanized, drawn to the desired diameter, annealed and finally put on spools. There are hundreds of different manufacturing processes across multiple orders that need to be put in line in such a way as to balance the number of setups which could be

significant with customer delivery date compliance. The scheduling process focuses primarily on the main operation, the wire drawing: The drawing operations are scheduled, "pulling" the upstream operations such as pickling or annealing, and "pushing" the downstream operations.

SPECIFIC PLANNING AND SCHEDULING DIFFICULTIES

The challenge at Sivaco was to balance production capacity with Due Dates commitments that are impacted by preventive maintenance, equipment repairs and staffing constraints such as vacation time or absenteeism. Essentially, one of the main difficulties is the ability to provide customers a realistic date and to meet it with the high level of quality the customer deserves. Because Sivaco manufacture to order, the forecasting, planning and scheduling processes are critical: When an order is scheduled, the raw material must be in inventory when the job starts. In the past an order was sometimes scheduled to start before the raw material arrived in the plant which caused several inefficiencies. The manual solution then was to choose alternate raw materials, hoping this would not result in a "domino effect" of other issues. One of the goals for Preactor was to schedule the order only when the material would be in stock, which provided better inventory visibility. Also, the wire market has changed significantly in the recent years with demand for smaller orders and faster turn-around. This meant Sivaco must be able to minimize numerous setups when possible on key equipment to meet customer due dates.

In the past, scheduling was done in a module of an internally developed ERP system programmed by Sivaco that could not properly represent all the complexity of the manufacturing operations as the process was primarily manual. In order to properly schedule the plant, only a very experienced scheduler with knowledge of all of the different rules could do it and often had difficulties keeping up with the demand.

PREACTOR APS P400 AS THE SOLUTION

In 2002 when Sivaco was looking for a new scheduling program, they created a CD that contained an ACCESS database with samples of manufacturing orders, customers and inventory records. For several scheduling software vendors, they requested a mini scheduling proof-of-concept using this data. In the CD was also a brochure explaining the nature of the industry. The volume was not big, but represented most of the challenges Sivaco faced. Companies that were not able to show a scheduling model were not considered as they demonstrated a lack of

understanding of the challenges at Sivaco. There were two finalists including Preactor. Both provided a good scheduling model, proving they understood the challenges. However, Preactor was chosen due to its similar approach but more effective pricing. Pascal Breuleux, Director of IT commented:

"The decision proved us right, since the other vendor did not last".

The decision was taken to procure a Preactor APS P400 license in order to allow raw material constraints check and the usage of advanced scheduling heuristics to solve the scheduling puzzle Sivaco was facing.

By installing Preactor, the primary goals were:

- Eliminate non-value-added tasks and streamline the scheduling process
- Provide a central repository of knowledge and rules for scheduling
- Improve inventory visibility and enable material constraints to start a job
- Create a realistic production schedule that considers all major constraints in the production process
- Reduce setup-up time while maintaining high due date compliance
- Have the ability to simulate impact on order insertions and due date changes

THE IMPLEMENTATION PROCESS

Sivaco decided to pursue configuration and implementation on its own with initial training and ad-hoc guidance provided by Preactor partner West Monroe Partners (WMP).

Sivaco had programmed the scheduling logic for its ERP, so was familiar with the concept of detailed scheduling. As a result they chose to undertake the configuration and implementation of Preactor themselves.

In general, it worked fine, but Sivaco faced two major obstacles:

- The original scheduling rule was taking too long to run so Sivaco requested that West Monroe rewrite the rules in a more efficient way using their experience and best practices.
- Secondly, Sivaco underestimated the complexity of the rules, the focus being too much on high level expertise and less on groundwork. They changed their approach and in the redesign relied more on the master scheduler's day-to-day work, translating experience and exceptions encountered into scheduling rules.

In the redesign process, the WMP consultant used a 4-step approach to solve the issues and the complexities identified along with the client. During the first step, they identified the root causes of the poor performance of the scheduling engine. After an investigation, it was discovered that the bad performance was due to a poor memory allocation associated with the setup matrix of the wire drawing process where the number of permutations were very high. The implemented solution involved developing custom setup calculation logic that allowed a reduction of the required amount of ram by 75%.

During the second phase of the project, WMP designed a rule-based engine to minimize the setups at the drawing machine department. The role of the engine was to create dynamic clusters of operations based on hierarchical product similarities, current load of the drawing machines, costs of setup and machine preferences. During the scheduling process, the agent dynamically identifies the best candidates to schedule. This heuristic method allows minimization of the number of setups and maximizes the due date compliance at the same time.

During the third phase of the project, WMP added a bin packing engine to schedule operations at the department of ovens. The role of that agent is to schedule operations that share the same annealing technical specifications by respecting the due date, arrival dates of the spools in front of the oven department, and the capacity of the oven in terms of volume.

Finally, a WIP minimizing rule was added to calibrate the amount of WIP between different departments.



Yanick Thibault from WMP comments:

“The key success factor in the redesign resided in the right balance between advanced tailored scheduling heuristics, the incorporation of “Sivaco’s Know How”,

and an adequate training of key users.

Pascal Breuleux comments on the process:

“The result was spectacular: We went from one hour of processing to less than five minutes (and many rules added in the system since then)”.

Overall The implementation of Preactor took a lot more time than expected, due to an incorrect initial evaluation of the scope; Sivaco had never identified a true “champion” on the user side who could translate the undocumented production rules that were surfacing as we were progressing.”

“We were very quick in implementing the 80% part of the solution. The 20% remaining was the toughest part”

THE RESULTS AND THE FUTURE

Preactor has been live at Sivaco for nearly 5 years. Pascal Breuleux comments:

“The schedule time for the drawing department (core business) has been reduced by half, and Sivaco does not depend anymore on personal experience to establish its schedule. If the scheduler is absent for one day for instance, Preactor can issue a schedule that can be put in production with no manipulation. The setup times have also been reduced, although it is difficult to evaluate the gain precisely as we have not measured it. We also now have a better control on raw material inventory availability when launching a new job on the shop floor”.

“The result was spectacular: We went from one hour of processing to less than five minutes (and many rules added in the system since then).”

Pascal Breuleux, Director of IT

Sivaco dealt with West Monroe Partners specifically for training and the reprogramming of the scheduling engine, and we received excellent service. We expect to involve them more for the implementation of the other departments that are not yet implemented. But before doing so, Sivaco will identify a “champion” who will take full ownership of the project”

Planned steps for 2013 include:

- Upgrade to the latest version V12
- Deploy to the other departments
- Streamline the ERP orders import process from within the sequencer screen
- Activate WIP constraints on specific resources
- Develop new KPI tracking

Key Benefit

The schedule time for the drawing department (core business) has been reduced by half, and Sivaco does not depend anymore on personal experience to establish its schedule

Key Benefit

Reduction of setup times and a better control on raw material inventory availability when launching a new job on the shop floor)

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