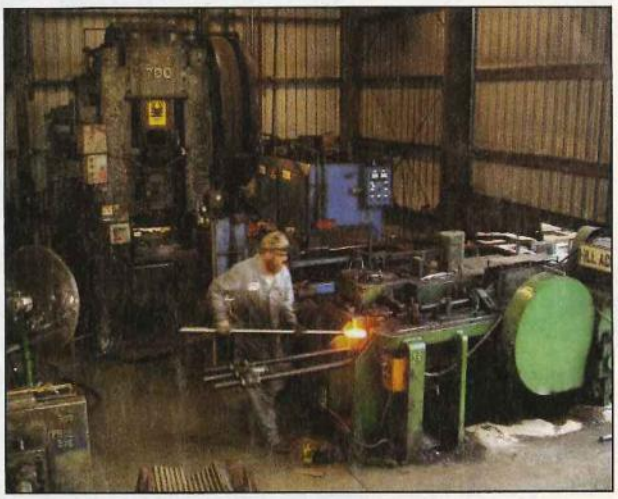
Ulven Forging Succeeds with Jobshop Lean

At the recent FDMC Jobshop Lean Workshop in Cleveland, Andy Ulven detailed how his company has benefited by implementing several recommendations from Jobshop Lean and its analytical software, PFAST.



A 1.5-in. upsetter acquired as a result of the PFAST analysis has speeded up production through the 700-ton press in the background.

By Wallace D. Huskonen, Contributing Editor

Ulven Forging Inc. is the latest forger to report successes with Jobshop Lean, the program under development at Ohio State University to provide techniques for applying the principles of lean manufacturing to custom or job shop forging.

At the recent Jobshop Lean Workshop (see p. 30 for a report on Jobshop Lean, PFAST, and the workshop), Andrew Ulven, told attendees that his company's experience indicates that Jobshop Lean and PFAST do work for a custom forger. This article is based on an interview with Ulven after the workshop. Ulven is founder and president of the Hubbard, OR, forger.

Jobshop Lean helped Ulven Forging reduce lead times, improve throughputs, influence plant layout, and guide capital equipment purchases. "Using these tools had a positive impact on our business," Andy Ulven said.

Ulven acknowledged the contributions of Ohio State University where Jobshop Lean and PFAST are under development and of Prof. Shahrukh Irani and his graduate students who are involved in their development and implementation.

"Ulven Forging also acknowledges the support provided by the Defense Logistics Agency and the Forging Defense Manufacturing Consortium for support through their PRO-FAST Program," Ulven said. "Without their support, none of what we have realized would have been possible, and none of what you will see today would have happened for the U.S. forging industry as we support the soldiers, sailors, and airmen of our nation."

Ulven Forging overview

Ulven Forging was founded in 1971. The company began with open die forging, then gradually added closed die hammer forging, press forging, and upset forging. Today, officials claim that Ulven Forging is one of the most versatile forge shops in the U.S.

The forging operation is one of six companies in the Ulven group. The other companies include a steel foundry, a CNC machining facility, and three companies with proprietary product lines for construction and related industries. (For more details on the companies in the group, see *Forging*, No. 1, 1998, p. 35).

Ulven uses open die forging to produce larger-size products, as well as prototypes and short-run quantities.

Closed-die hammers are used to produce longer runs of forgings ranging in weight from 0.5 to 100 lb. Ulven's closed die business first exceeded its open die volume in 1996.

Press forging is used for medium- to high-volume production runs, and is set up with automatic bar feed systems and induction heating.

Upset forging is used for both low- to high-volume runs. In Ulven's practice, parts are forged in a horizontal position where the work piece is gripped between two grooved dies and deformed by a heading die that exerts force to the end of the stock Examples of upset forgings include axles, rod ends, eye bolts, and shafts.

Ulven's CNC division offers both lathe and mill CNC operations and manual machining.

Jobshop Lean assessment process

As noted, Prof. Shahrukh Irani is

Typical assembled products at Ulven Forging.

Examples of product after CNC machining.

in the final stages of developing Jobshop Lean at Ohio State University with support from the Forging Defense Manufacturing Consortium and the Defense Logistics Agency. Prof. Irani puts graduate students at OSU through an intense training program to equip them with the knowledge to conduct on-site Jobshop Lean reviews.

Ulven Forging decided to proceed with a Jobshop Lean assessment in the fall of 2001. Because it was early in the development of Jobshop Lean and PFAST, Prof. Irani visited Ulven Forging to collect routing data for the 530 forgings that the company produces, as well as gather information on the 57 pieces of equipment that

Ulven Forging has offered open-die forging from its founding in 1971.

Ulven uses in producing and finishing forgings.

Several types of data were collected for each forging, including product identification number and description, annual production quantity, routing through the manufacturing steps, and annual sales, profit, and revenue.

The equipment was rated on whether or not it could be moved or duplicated.

The next step was entering the data into PFAST at the university. PFAST is short for Production Flow Analysis Simplification Toolkit, an integrated library of algorithms derived from Graph Theory, Pattern Recognition, Multivariate Statistics, and Artificial Intelligence. PFAST runs on a single Pentium PC desktop or laptop, and uses standard MS Office tools and MS Visual C++ to provide a comprehensive material flow analysis for any job shop.

For Ulven Forging, the PFAST Analysis produced before and after process flow diagrams and generated several recommendations or "solutions":

- Improve product flow throughout the facility.
- Purchase and install tables and a crane near one Rotoblaster.
- Move and setup/install 440-ton presses.
- Install an overhead crane at a 5,000-lb hammer.
- Purchase and install a portable hacksaw.
- Purchase and install a 1.5-in. capacity bar shear.
- Purchase and install a magnetic particle inspection machine.
- Increase and modernize in-house tooling capabilities.
- Evaluate storage around closed die production area.

Working with Prof. Irani, Ulven personnel reviewed the recommendations and ranked them on the basis of reasonableness, their affordability and ease of implementation, and the cost and timesavings that would result from each.

Projects implemented

Following are some of the projects that have been implemented along with the results that were achieved:

Process Flow —To improve process flow, Ulven installed an additional processing area in the drop hammer building, consisting of two heavy-duty inspection and finishing tables. Also, selected packaging and shipping now is handled from this area.

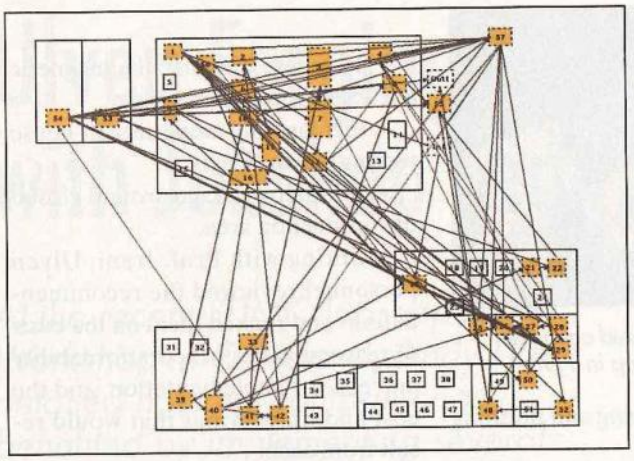
Andy Ulven says that this has worked out really well in reducing cycle time and increasing throughput.

Install a 440-ton trim press—A 5,000-lb hammer was equipped with a 158-ton trim press, but when it was used to produce larger forgings, they had to be moved elsewhere for trimming and straightening. A 440-ton trim press was installed in place of the smaller trimmer. Shortly after this was installed, it was used for a brand-new order, the largest part in a particular customer's product line. Without the press, Ulven Forging wouldn't have been able to produce this job.

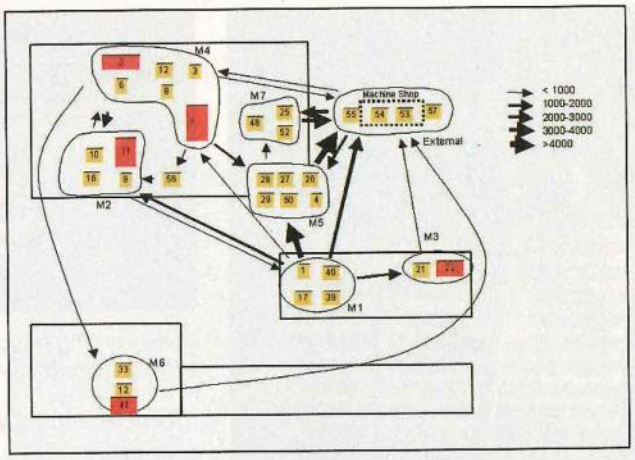
Crane installed at a 5,000-lb hammer—The installation of an overhead crane at a 5,000-lb hammer facilitates product movement. It also reduces piston change-out time and die key tightening time.

Portable hacksaw—Ulven acquired a portable Marvel hacksaw and a 1.5-in. bar shear.

Add Magnaflux capability—The company purchased and installed a



Schematic shows factory flows at Ulven Forging before Jobshop Lean.



Factory flows recommended for Ulven Forging by PFAST Analysis.

Magnaflux test machine. This eliminates costs and reduces lead times associated with outside testing. According to Andy Ulven, "That's worked very well."

Add in-house tooling capabilities—Ulven installed a CNC mill dedicated to producing its own die sets. Also, the company moved its EDM machine into the same area. This has reduced outside costs and lead times. "If we have the die material on hand, we can control when the tooling is available to us," Ulven reports.

Install an additional induction heater—A 350 KW induction heater and conveyor was installed next to a 3,000-lb hammer. "This has really improved throughput," Ulven says.

Install a 2.5-in. upsetter—Purchased new 2.5" upsetting machine and positioned it next to a 3000-lb hammer to form an upset/forging cell. The benefits include a reduction in part travel distance and increased throughput through the hammer.

Install a 1.5-in. upsetter—An existing 1.5-in. upsetter was replaced by a faster 1.5-in. upsetter. This is used next to a 700-ton press to form an upsetting/forging cell. This particular implementation, with the faster upsetting operating cycle, has drastically reduced cycle time and increased throughput through the 700-ton press.

Overall results

Based on the projects that have been implemented to date, Ulven Forging has achieved the following overall results:

- The cost of one group of upset-and-forged parts was reduced by 10-15%.
- Savings in handling, finishing, and shipping are estimated at 10-12%. More significant savings are expected as a result of future projects to set up manufacturing cells.
- Several jobs now require less time in the plant due to speed of handling, processing, and finishing. Cycle times are faster in many cases, netting the company more open production time for additional jobs.

What's next?

We asked Andy Ulven what comes next and he had a ready answer: "No.1, we want to take care of some additional implementation. No. 2, we want to refine our measurement of results. And No. 3, we want to develop more recommendations from inside the plant, and outside as well."

He goes on to explain why measuring the results needs to be improved. "We don't have a full-time person to review cost sheets, output rates, and how long a job ties up a piece of equipment. So measuring results is difficult for us. At the same time, we're certainly able to sit back and say this one really paid off. Or that Project B works well-maybe not quite as good as Project A, but it certainly was worthwhile."

The 440-ton trim press at right replaced a smaller trim press in a 5,000-lb hammer cell. This eliminated the need to move the largest forgings produced by the hammer in the background to a distant 350-ton trim press.

Ulven continues, "We want to take advantage of the Ohio State University graduate student assistance program."

Finally, Andy Ulven envisions applying lean manufacturing to the administrative area. "Lean manufacturing at the manufacturing level really makes you focus on what are you doing in your plant; what are you doing to better satisfy the customer and to increase your efficiency within your plant. We're always looking for ways to improve administrative operations, but we want to use 'lean' to better focus our attention on this area."

FORGING

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Wringing Out Waste

A growing number of forgers have utilized PFAST and Jobshop Lean to wring the waste from their operations.

So much interest was shown in Forging Defense Manufacturing Consortium's free workshop on Jobshop Lean in February that the organizers decided to schedule a second day-long session *(see p. 30 for a report)*. Now, the FDMC is scheduling two more Jobshop Lean workshops to be held later this year, probably in the Chicago area and on the West Coast.

What's all the fuss about? Many manufacturing industries have adopted lean manufacturing as a way of life. They are identifying and eliminating waste in their manufacturing processes. "Waste" is defined as any step in the manufacturing system that does not provide value to the customer.

These manufacturers produce thousands, even millions, of parts, with little part variety, in what is termed low-mix, high-volume (LMHV) manufacturing.

Ohio State University's Prof. Shahrukh Irani has become a guru on applying lean manufacturing to custom forgers and other types of job shops. Typically forgers produce only short runs of forgings in any given job. Such job shop manufacturing is known as high-mix, low volume (HMLV) manufacturing.

According to Prof. Irani, many of the tools, technologies, and processes designed for accomplishing "lean" with LMHV manufacturing are not well-suited to achieving lean manufacturing in job shops. He has developed the Production Flow Analysis Simplification Toolkit (PFAST), an integrated library of algorithms that can provide a unique, comprehensive material flow analysis for custom forgers. PFAST runs on a Pentium PC desktop or laptop, requiring only off-the-shelf software. A growing number of forgers have used PFAST and Jobshop Lean to wring waste from their operations. TECT Manufacturing (see "Thinking Lean at TECT Cleveland," *Forging*, Jan.-Feb. 2003, p. 16) is one.

The latest forging company to detail its successes with lean manufacturing in a job shop environment is Ulven Forging Inc., Hubbard, OR. Andrew Ulven, president, revealed several positive outcomes in a presentation at the Cleveland workshop. The report beginning on p. 26 of this issue covers many of these favorable results.

The development effort for Jobshop Lean is funded by the Defense Logistics Agency through the FDMC. For details on the next two Jobshop Lean workshops planned for the Midwest and West Coast, check the FDMC website at http://fdmc.aticorp.org. In case you were wondering, the DLA supports the Jobshop Lean effort because it is responsible for purchasing forgings needed for replacement parts for the nation's weapons systems.

If you want to wring waste from your forging job shop operations, you need to become familiar with Jobshop Lean. The upcoming FDMC workshops are a perfect opportunity.

WALLACE D. HUSKONEN, Contributing Editor

Jobshop Lean Workshop is a Winner

Applying the concepts of lean manufacturing is a way of life in many industries, and especially among suppliers to the automotive industry. These manufacturers produce thousands, even millions, of parts with little part variety. This is known as low-mix, high-volume (LMHV) manufacturing.

The "lean" is the identification and elimination of waste in any and all manufacturing processes, in any production system. Waste is defined as those elements of the system that do not provide value to the customer.

According to Prof. Shahrukh Irani of Ohio State University, the workshop's main lecturer, many of the tools, technologies, and processes designed to achieve "lean" with low-mix, high-volumemanufacturing are not well-suited to achieving lean manufacturing in forging job shops. That's because they typically produce limited quantities of many different jobs in what is known as high-mix, low-volume (HMLV) manufacturing.

This is an important distinction for the Defense Logistics Agency (DLA), which supplies the U.S. military and several civilian agencies with critical resources to accomplish their missions. Among its responsibilities, the DLA acquires forgings for replacement parts for aging weapon systems.

To develop ways to shorten the lead times required to produce HMLV forgings, and to lower their costs, the DLA joined with the Forging Industry Assn. to form the Forging Defense Manufacturing Consortium (FDMC). The Advanced Technology Institute, a private, nonprofit consortia-management company, administers activities of the FDMC.

Since early in 2001, the DLA, the FDMC, Ohio State University, and several forges have worked to develop and deploy Jobshop Lean, an approach to lean manufacturing that identifies and uses tools, technologies, and processes suited for custom forge shops, taking into account their fixed equipment installations and batch-oriented process layouts.

For front-line managers

The February 11 Jobshop Lean Workshop in Cleveland was designed to educate front-line managers about what can be achieved when the lean approach is properly applied. Registration was free, and all seats were quickly filled. To accommodate a second presentation was arranged (on Feb. 10) and that, too, was well attended.

Andrew Ulven, CEO of Ulven Forging, Hubbard, OR, gave the keynote presentation and discussed his company's success with Jobshop Lean and its analysis software, PFAST (*see p. 19.*)

Prof. Irani reviewed the science of lean manufacturing for LMHV manufacturing and discussed why many of its precepts are not directly applicable to jobshop HMLV manufacturing. His answer to that problem: Jobshop Lean.

At the core of Jobshop Lean is PFAST — short for Production Flow Analysis Simplification Toolkit, an integrated library of algorithms derived from Graph Theory, Pattern Recognition, Multivariate Statistics, and Artificial Intelligence. This suite of algorithms provides a comprehensive material-flow analysis for any high-mix, low-volume jobshop.

Using input about the products, equipment, and processes of an HMLV facility, PFAST generates an analysis that provides a roadmap to implementing Jobshop Lean best practices, such as manufacturing cells, process standardization, process razing, flexible machine tools, etc. Built in to the analysis is the fact that some equipment in forges, such as presses or hammers, can't be moved.

A contingent of nine people from Meadville Forging Co., Meadville, PA, attended the first workshop in Cleveland. Gary Hatton, plant manager, explains: "We have engaged in some lean manufacturing projects with the product for one particular customer. It was customer driven, and we have seen some pretty appreciable advantages in cost savings. This particular product is a high-volume product to which we could apply the standard concepts of lean. The concept of a job shop lean approach was what attracted us to this workshop."

Another attendee was Richard Rookery, operations process manager for Green Bay Drop Forging, Green Bay, WI. He said, "The lure of the workshop was to find out how I can make lean manufacturing work with our immovable forging hammers and presses. I think Dr. Irani was very successful in accomplishing that, at least to the point where I could go back and start to apply concepts to my forging shop."

Repeat performances

Dr. Irani will be involved in two additional Jobshop Lean Workshops. "I feel that the next two workshops can be improved, based on the evaluations we got from the first one," he told *Forging*. "I am a firm believer in continuous improvement."

Visit the FDMC website (http://fdmc.aticorp.org/) and check the calendar to read what is planned for the upcoming workshops, and to register your interest in receiving further information about workshop dates and

Doug Brown, Director of Forging Sales, Inductotherm Group, and president, Alpha 1 Induction Service Center, and Jon Tirpak, executive director, FDMC, contributed to this report.