


# Justifying *the Cost of* **Palletized Systems**



*Even small job shops are moving into palletized machining center and flexible manufacturing systems. Can your shop afford one?*

**Russ Olexa**, Senior Editor

**P**alletized machining center systems, also known as flexible manufacturing systems (FMS), offer tremendous benefits for manufacturing parts. But they are expensive, and for many small-to-medium job shops they are out of reach. However, lately even small machine shops are purchasing this equipment. So how do they justify the purchase?

At Prattville Machine (Peabody, MA) a three-machine palletized system using Hitachi Seiki HG 400 III HMCs with 172 tools per machine has helped reduce labor and inventory and let the company better meet customer requirements says General Manager Vincent Spinali.

Prattville Machine is a 50-man shop that produces parts for semiconductor equipment manufacturers, military, medical, and fluid-power producers. They do both one-offs and high production. "This was definitely the way for us to go," Spinali says. "It was a big investment for us to spend \$1.5 million on three machines and the pallet system, because we aren't a huge shop. But we couldn't keep

up with our customer's demands for just-in-time delivery and fluctuating business cycles. Before we bought the pallet system, we originally decided to treat the HMCs in our old building as cells, and we only machined on a JIT basis. We carried this mental-

ity into the pallet system, where it became obvious it was the right choice for us, if we were going to continue doing JIT production," he remarks. Now they have one operator running three HMCs in the pallet system instead of one operator per machine. Within three months of the initial pallet system purchase, they were running the system in untended mode for five hours.

To make their system work for them, Spinali says, "I don't typically look at part lot sizes, instead I look at repeatability. It doesn't bother me if the part has only a quantity of two or three per month as long as it comes back on a regular basis." This allows them to take advan-

tage of the permanent setups on the palletized machines. Spinali added that he probably wouldn't use the FMS for a one-off, non-repeating part. However, in some cases they have, because the tooling is already on the HMCs. Rather than going to a stand-alone machine where the tools are not available, they found it faster to do a setup on the palletized machine, because all the tools are loaded. It takes time to find all the necessary toolholders, load the tools, and set them up properly.

Previous to the palletized system, Prattville used stand-alone HMCs. They had HMCs for 15 years, but what was missing for the company was linking them together and being able to permanently leave the part setups on them. A new building allowed them to add the pallet system.

"I think palletized HMCs are the wave of the future. I know it's a big investment, and shops are slow to catch on, even to HMCs. I also think it's hard for smaller companies to see the advantage of a pallet system right away, but you have to think about how to reduce setup time and inventories," he adds.

Advice that Spinali offers to any shop interested in a pallet system is to be patient with it, because it takes time to use it effectively. He adds that well-trained personnel are required to set up the system. "It takes a huge commitment by both management and the machinist to make it run right. You need a few qualified and dedicated operators. It takes a while to see the payback. Also, purchase as much tool storage per machine as possible," he remarks.

Spinali said that the palletized system also opened doors to add new customers. Prattville Machine was a lot more competitive with the FMS, because it didn't have to amortize the setup every time a job was run. The

setup is there permanently.

Spinali also decided not to "nickel and dime" the FMS when he purchased it. They ordered two setup stations for the operator. Originally, they were thinking of getting only one, but Hitachi suggested two. "That was good advice, because there are many times that we need the extra station. When you're producing a lot of parts untended overnight, they must be unloaded in the morning, and one station would be overloaded, holding up the system for almost an hour when parts are being unloaded. Also, CNC memory is very important in these systems. Get as much as possible so programs can remain resident in the CNC," he adds.

Kobelco (Elkhart, IN) manufactures screw compressors for gas and refrigeration applications as well as superchargers for top-fuel drag racers. Before purchasing their single-HMC Mitsui Seiki 15-pallet system, they were using three two-pallet HMCs.

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"It was time to update our equipment," says President Kevin O'Neill. "We sent one HMC out for rebuilding, and it was a disaster. Japan (their company is a subsidiary of a Japanese company) had some influence on our decision and said to research a multi-pallet FMS system. We were just looking at another two-pallet HMC originally. We reviewed how much money to spend and which machines hold up well. We used a lot of differ-

ent criteria like machine gross weight. We found that our HMCs float too much, if they are too light. The columns on the machines are too weak for the parts that we produce. However, our biggest point was focused on setup time, because there's a lot of setup for our parts."

Kobelco did cost justification studies and calculated the setup expense for the parts. The company produces approximately 642 parts per year on their Mitsui. According to General Foreman Merle Buck and QA Supervisor Bob Laack, the parts are made from cast iron and require complex machining. Some take from one to 4.5 hours to machine with up to a three-hour inspection time for first-piece examination. Running the same parts, they average about 32 setups per year with their old HMCs.

Now, with 15 pallets available for part setups, and parts on pallets offline of the system, they can dramatically reduce this time. Also, instead of running excess inventory, they produce parts on a JIT basis. "Now we don't have to increase our inventory. Before we had the pallet system, we would run 20 or 30 parts while only needing two, and we're talking about parts that cost about \$3000. The others would go on the shelf. We're paying taxes on these inventoried parts and have material and labor in them. Some of these products would be on the shelf for a year or more. With the pallet system, we're saving about \$60,000 per year compared to a two-pallet HMC," O'Neill adds.

For Bill Seyferth, president/owner of Westech Corp. (Muskegon, MI), buying a two-machine FMS system was a stretch financially. The company has two Mori Seiki SH 503 models with a total of 18 pallets and one load/unload station. They manufacture aftermarket automotive and truck suspension parts, and compo-



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nents for industrial-hoists, agricultural products, and water-pump shafts. Their lot sizes range from 25 to thousands. Each machine has a 120 tool-storage capability.

"I justified the purchase of this system by looking at the work that we had at the beginning of 2000. I had been looking at systems since August 1999. I visited various installations and saw three different types of machines and three different manufacturers. I looked at the productivity of the machines and talked to the operators. The production an FMS offers is incredible. We took a job from an old machine that gave us about 40 parts a shift and moved it to the pallet system. With the productivity of this machine and the technology employed, we doubled the number of parts the very first time we ran the job, and we didn't have to adjust the machine for over two weeks though we adjusted the old one daily," Seyferth says.

Another benefit the FMS gave Seyferth was labor savings. He said

keeping one job on the machine for any length of time," Seyferth adds.

Royal Oak Boring (Lake Orion, MI) uses a single-HMC Toyoda FA 630 with a space-saving, two-level pallet pool of 10 pallets and 120-tool storage. The system is used to produce parts such as special engine heads for the heavy truck industry in medium-sized lots.

Manufacturing Manager Dale Zarzycki said they were able to justify the equipment purchase because "part setup time was virtually thrown out the window. Jobs effectively become continuously running ones, because they're put in the mix and the machine time is split up amongst

that the company is always training younger operators, but after training, they would stay awhile and then leave. The FMS allowed them to automate many jobs and reduce the labor needed.

"High repeat jobs are also easier on the FMS. They are always set up on pallets for shuttling to the machine. We don't lose setup time. It gives us flexibility so we aren't locked into

all the different work. With most of the parts sharing common machined features, they also share the tools in the changer and programs."

The palletized system gave them flexibility to run jobs when they needed them, without leaving the machine sitting idle, waiting for a part. Also, because of the machine's flexibility, they no longer waited for enough orders for a batch run. Zarzycki adds that it reduced their labor costs, and the amount of rework and scrap. "You can also eliminate first piece/good piece, because there is no setup involved after the initial fixture is built and proven," he added.

A new owner and a market shift in products helped Apex Precision Technologies, (Cambry, IN) move into a FMS system. The company once made products for the aerospace industry, but the work died in 1993. Now they produce parts for off-highway equipment, medical devices, and the military, says Vice President Timothy Lamb.

Three Makino HMCs, two A77s and one A88, make up a 20-pallet FMS. It operates 21 hr/day. Lamb says a "palletized system allows them to compete globally for their types of products. Good engineering makes it work and profitable. It lets us ride out



**A typical load/unload station on a palletized system serving two HMC machining centers.**

costs and then pass the cost savings onto the customer.”

Manufacturing Engineer Daniel Seacat says they bought the FMS because “we run a large mix of parts with an ever-changing schedule. The system allows us to change from one part to another in a matter of minutes.”

President Scott Little of Little Enterprises Inc. (Ipswich, MA) says that “today, with only 40 employees, we have dramatically increased our profits compared to 1997-98 when we had 52 employees, because of palletized systems.”

Many of the parts they manufacture are components for robots used as material handlers for silicon chips. Some parts are extremely complex and often one-of-a-kind prototypes. Faced with a tight labor market and simultaneously striving to meet the increased demands of a booming semiconductor industry, Little had to change the way he produced these parts.

Little invested in two Mazak palletized systems: one has four FH-4800 HMCs with 36 pallets and the other has two FH 5800s with 32 pallets stacked in two tiers and a 332-tool-storage beehive system. At first, one machine was purchased then the others were added later for increased capacity.

“We’re in the semiconductor business, which is a very difficult business because of its cyclical nature. The last industry downturn left me with over \$1 million in inventoried parts. During the next slowdown, we’ll have no large inventory to worry about because of the palletized systems.”

Little said the FMS allowed them to be competitive in a different way. “We have increased our production capability. Not because of the increase in the number of spindles running, but because we virtually eliminated setup time for loading and unloading parts for each machine. At the same time, we ran every machine longer due to untended machining. We currently have spindle utilization approaching 85 to 90%. We can handle volume production and a lot size of one, or we can easily mix and vary our production runs.” Little acknowledges that a palletized system was a large investment for a shop of his size. But because of its modularity (adding machines only when they are needed), he can make it grow as needed.

Other manufacturers of HMCs that can be expanded

beyond two-pallet capabilities are Niigata (Schaumburg, IL), Giddings & Lewis (Fond du Lac, WI), Kitamura, and Kiwa, which is distributed by CNC Systems Inc. (Kennebunk, ME).

Niigata offers HMCs using either linear guide or box-way models. The company’s two-pallet HMCs can be field-retrofit or expanded with a multipallet system offering from six to 200 pallets with one to eight machines. They also have a single-level or five-level stacker, as well as a rotary pallet system where one machine can become a flexible cell with 6, 8, 10, or 12 pallets.

Giddings & Lewis has eight models in its family of HMCs that offer pallet sizes ranging from 500 to 1600 mm. For the 630 × 500 mm through 1250 × 1000-mm pallet members of the HMC family, the 60-hp (44.7-kW) spindle drive coupled with a 6000, 10,000, or 12,000-rpm spindle maximizes metal removal capabilities. Rapid traverse rates up to 1417 ipm (36 m/min) and tool changes as fast as 4.8-sec chip-to-chip reduce cycle times.

A rigid cast-iron design provides a solid foundation for the machining centers’ four sigma accuracy of 0.0003" (0.007-mm) positioning and 0.00015" (0.004-mm) repeatability. The 100-tool magazine is a flexible design using two 50-tool cartridges. Additional capacity may be added in 50 tool increments, up to 200 tools.

Kiwa’s KNH-400x, is a field-expandable 400-mm HMC. It can be expanded from a two-pallet, 64-tool machine to six pallets and 120 tools. The expansion takes two days or less. Pallet size is 400 × 400 mm with an optional 500 × 500 mm. The X, Y, and Z-axis travels are 600, 610, and 665-mm respectively. Rapid traverse is 60 m/min with a 1.2-sec tool-change time. Three spindles are available with the standard providing 35 hp (26 kW) and 12,000 rpm. Optional spindles produce 15,000 and 20,000 rpm.

Kitamura has three machining centers that can be developed into a FMS: Mycenter H300, H400, and H500. As many as 120 pallets can be placed in a system. Additional machine axes can be ordered to give these HMCs contouring capabilities. Tool monitoring, automatic spare-tool selection, cutter-breakage detection, and a tool-gaging system are all available as options. ■