

## Shedding Light on Lights Out Machining

Jumping into this competitive strategy without a plan could be disastrous. But by following the due diligence being discussed here, your business could not only grow, it could thrive.

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Whether you call it lights-out, lights-off, factory automation or some other term, the idea of expensive capital equipment manufacturing parts without expensive human operators on the floor is very appealing, particularly in these challenging economic times. The theory makes perfect sense: if you can keep a machine running through a second or third shift without adding manpower, your profitability should increase.

Yet as anyone who has looked into this seriously knows, lights-out manufacturing is not as simple as setting up a job and letting it run. It requires careful planning, the right equipment, experienced operators, a good support organization, and a real commitment to the lights-out methodology to maximize the benefits.

While these may sound like considerations only very large manufacturers and job shops can afford, the fact is that lights-out manufacturing is well within the reach of small and mid-size shops too. Yes, it does require some up-front investment - at a level some manufacturers may not be used to - but the potential for an effective payback is there, providing the shop has more work than it can produce during existing shifts with typical lights-on methods.

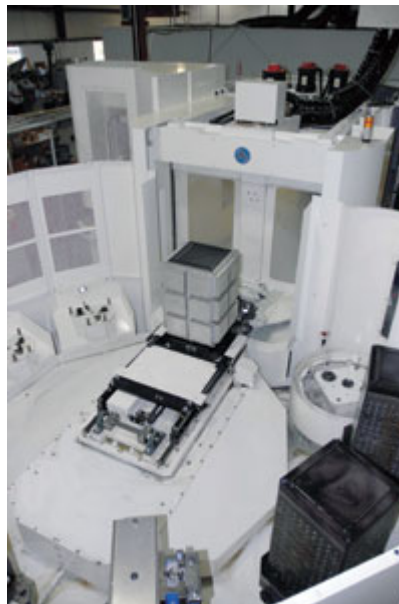
So how do you determine if lights-out manufacturing makes sense for your shop? Here are some core considerations to launching a successful lights-out operation.

### UNDERSTANDING LIGHTS-OUT VS. AUTOMATION

The term "lights-out" has two essential uses in manufacturing. One is factory automation that is designed to use robots in place of human labor for high-volume, repetitive production of a single part or assembly. This is often used in the automotive industry, either to produce component parts or, more commonly, to build portions of a vehicle on an assembly line.

In a machining environment, lights-out more commonly refers to adding multi-pallet systems or other equipment to a machining center to make it possible for that machine to run unattended after human operators are gone for the day or weekend. A shop can typically produce five, ten, twelve or more unrelated workpieces in one continuous run without operator intervention. In some cases the job may also involve the use of robotics, particularly if many of the workpieces have short cycle times, but it's not essential to most jobs.

While the amount of work that can be produced varies, a good rule of thumb is that a two-pallet system can run unattended for three hours; an eight-pallet system can run for eight to twelve hours; and a 40-pallet system can run from Friday night to Monday morning. That's a lot of work that wasn't being performed before!



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## **ADVANTAGES OF LIGHTS-OUT**

This type of automated production mode offers several advantages, the most obvious being added productivity with minimal impact on labor costs. For example, suppose you have ten different parts to run that normally have to be scheduled between other jobs over a period of 30 days. By moving to a lights-out mode for those parts, you may be able to complete the run in three days - simultaneously freeing the machine to take on other, more complex work during the day.

This certainly attracted Bill Casey, president of KC Precision Machining, Inc. (Ipswich, MA), a 20-year veteran of the machining industry. "We liked that we could get so many more hours of machining in," says Casey. "We'd leave the shop at 6:00 pm. When we'd return at 6:00 the next morning the job would just be finishing up. We used this method on two long-term jobs and it fit them perfectly. Lights-out definitely helped us increase capacity and use our machines more efficiently."

Many shops express concern over the current shortage of qualified set-up people. In a typical manufacturing environment where the operator is tied to one or two machines and must stop to reset them for each run, waiting for a qualified set-up person to become available means a loss of productivity. When the machine is not productive, the company is less productive and detracts from the bottom line.

But in a lights-out environment a single operator can set up one or more runs while another is already in process, reducing the amount of labor required to keep machines operating. This minimizes downtime due to a lack of available set-up people and allows the shop to increase its production schedule without increasing labor costs, or having to find and train new people. This also focuses highly-skilled (and highly paid) workers on using their skills rather than spending too much time loading/unloading workpieces or doing other unskilled labor tasks.

Lots of time can be wasted if you must interrupt one job with a long set-up time in order to meet a sudden customer request on another. "Most of the jobs we do are short runs of very complex parts," says Otto J. Schultes, president of Schultes Precision Manufacturing (Buffalo Grove, IL). "Some of them take as long as three days to set up. Sometimes we'd be 15 parts into an 80-part run and have to stop because another customer needed us to run a short-notice job on the same machine. Our set-up guys would look at us like we were nuts because that's a lot of wasted effort. Now, with an automated pallet changer, we run that same job and finish it overnight, or over a few nights, while leaving the machine free for other work during the day. We've increased our efficiency while serving our customers better."

Then there are energy considerations - which are particularly significant in the current climate. Some power companies offer lower rates for off-peak (read: nighttime) power usage. Machines that turn during these times, literally with the lights-out and the thermostat set at minimal levels, help reduce overhead costs and deliver additional profitability to the bottom line.

Finally, lights-out manufacturing makes an operation more efficient. In most cases, the actual run times between your shop and your competitors' are not much different. But if you can continue to run while they're stopped to change set-ups, you've reduce the overall run time for all jobs. This increases your efficiency and gives you a distinct competitive edge that only increases over time. You can then choose to take the additional profit or use the added efficiency to lower your price if required to win more business.

## **REQUIREMENTS AND CONSIDERATIONS**

Now that you're sold on the concept, the next logical question becomes how do you get into lights-out manufacturing? What are the requirements for a successful operation? What are some factors you should consider?

Without question having the right machining center is critical. Lights-out manufacturing is about expanding your business and increasing long-term payout. By choosing anything other than a high quality machine tool to incorporate into your system or cell, you stand the chance to lose any of the flexibility and efficiency that a multi-pallet system is designed to maximize. In fact, not choosing the right machining center for your lights-out application (system) will likely cost you more in terms of wasted time, increased rejects, and customer dissatisfaction than if you'd just run the stand-alone machine.

Of course, if you are used to purchasing machines for \$200,000, a \$700,000 system with a one-time payment will look like a significant upgrade. But, depending on specific requirements, future considerations and the number of machines needed, that may still not be enough. Because of the level of precision and reliability required in a lights-out environment, overall costs can run as high as \$1 million or more.

Although this is the case, those willing to make the jump often see the system pay for itself sooner than anticipated with the added benefits of a lights-out concept. Often times they also see their facilities transition into a better structure and method of organization built around the lights-out method of manufacturing - making them work and think "leaner".

What's so special about a high-quality machining center? Think of it in terms of choosing a car. On the top of the checklist, you make sure you have enough power for the everyday drive as well as special circumstances. The base model of many vehicles comes with a small engine that is powerful enough to move the car around in normal city driving, but it doesn't have much pickup. On the highway at higher speeds, that engine runs close to maximum, exerting a great deal of strain that causes it to wear out faster.

The same concept relates to machining centers in terms regarding cutting capability. A machine that strains itself when making heavy cuts, or running at higher speeds over an extended period of time, should not be considered when evaluating potential systems to fit the "lights-out" model. If the job proves to be too much for the machine, your investment diminishes with each cut. Incorporate a high-quality machining center that can handle heavy cuts with strong low end torque as well higher rpm for high speed machining of conventional material. You'll have the flexibility necessary to run a variety of work much more easily and comfortably over a long period of time.

This is also true for a lack of leeway in the tolerance. If the job calls for a tolerance of 0.0004 in and you can only run 0.0004 in accuracies on a particular machine, any deviation will be a problem. But if a job calls for 0.0004 in and you can set it for 0.0001 in, you have much more room before a cause for concern appears - most likely enough to avoid problems even over extended lights-out runs.

Another major consideration is the automated pallet changer system itself. An ongoing debate in the industry is whether having the machine tool and the APC all come from one manufacturer is better than a "best of breed" approach. When you think about it, however, the answer is fairly obvious.

The key to any machining operation is the machining center itself. The APC is simply a way of moving work into place, a method of material handling. The multi-pallet system itself does not make the parts, it only carries them from one location to another. Compromising on the machine tool in order to get it all from one manufacturer is like choosing which car to purchase based on who made the cup holders.

The multi-pallet system should be considered an accessory - albeit an important one - but the machine tool is the heart of the operation. Base your choice on the machine tool first and you'll find far greater success. Other factors to keep in mind when considering lights-out manufacturing:

- Make sure the machine has a high quality chip removal system. Lights-out manufacturing creates a lot of chips over time, with no one to watch over them. A good chip removal system keeps the job running smoothly.
- Assure a large tool magazine is available. This was one of the lessons learned by Schultes: "You must be sure you can stockpile the tools and have them available, especially on a longer run. If you can't afford or don't need to start with one, be sure you can upgrade in the field (as he did) when needs change as your lights-out business grows."
- Use only water-based coolants. Under the right circumstances, oil-based coolants can catch fire. If no one is there to sound the alarm, you could lose more than that job. Water-based coolants are far safer - and more environmentally friendly. For extra safety, consider adding a fire extinguisher.
- Factor in ambient temperature considerations. Machines running 24/7 generate much more heat than machines running for eight or ten hours. This not only has an effect on machine performance and life but also on jobs. Remember that for every degree Fahrenheit the temperature increases, metal expands. For example, iron and steel will expand 0.0023 in every three feet with a 10 deg temperature increase - enough to throw off the specs of the job. Determine whether your shop will require additional cooling - and be sure to space machines to allow adequate air circulation.
- Look into expandability. Can two machines share the same APC system? Can you add on or expand the system down the road? According to Schultes, having more pallets means you can leave certain complex jobs set up permanently to run on-demand rather than having to reset them for every run.
- Look at the manufacturer's track record for retrofits. Don't purchase a machine based on today's needs only to find you've painted yourself into a corner. Check to see if you will need to change the current machine configuration by adding pallets or additional tools. This will give you an idea as to whether you should consider a dedicated or a more flexible machining option.

Also check to see whether the system you are considering will allow easy compatibility between old and new if you need to swap out the machine for any reason or change out pallets. Whether you change your machines every few years or buy them with a plan to run them forever, be sure you're thinking long-term when thinking lights-out.

- Assure that customer support and replacement parts are readily available. If a problem occurs configuring a particular job, you want to know someone is available to help you. The same goes for replacement parts: the longer you wait, the more time that machine sits on the floor doing nothing. You're going lights-out for efficiency. Be sure you get that same efficiency for your machines themselves in the form of proper service support after the sale.

## **SEE THE LIGHT**

The final word of caution before jumping into lights-out machining is to make sure you have a plan. Know what jobs (or types of jobs) you're going to run, what volume of work you anticipate, how it will affect the shop's configuration, and when you expect to hit break even. If you don't, there's a big likelihood you won't derive the value, you'll see more rejects as time goes on, your machines will require more service, and ultimately the project will fail.

If you do perform your due diligence, however, lights-out machining can shed a whole new light on profitability and help your business not only grow, but thrive. Lights-out will put you in a better competitive position and help you maximize your machining center investment over both the short- and long-term.

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