Cycle Time Reduction in the General Motors Service Parts Operation

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Original Equipment Manufacturer (OEM) distribution systems are increasingly pressured to provide quicker and more accurate processing of parts orders. The problem, put simply, is how can more parts be picked faster while reducing the costs to ship the parts and ensuring that the correct parts are picked. Many distribution systems have turned to high levels of automation within the warehouse and others have refined the processes to reduce cycle time and provide better service. General Motors has recently altered their approach to how this process works. The result is increased parts picked and shipped at a lower cost. At the core of the changes are strategically located smaller parts distribution centers (PDCs), workplace organization, fair and equal work assignments, and lean and common warehouse templates. Each of these areas is addressed in this article as well as a discussion of the results associated with implementation of the new approach at a specific PDC facility.

Peter Piper picked a peck of pickled peppers. The question is how quickly did Peter Piper pick the pickled peppers, what was his cost to pick them and did he pick the right amount of peppers. This tongue twister helps to illustrate the fundamental questions that have changed the way General Motors and their Service Parts Operation (SPO) are stocking and shipping parts to their dealers.

Customers are becoming increasingly demanding. As a result, the demand for service becomes even more prevalent when their vehicle is in need of repair. Customers are not willing to wait days for a part to arrive in order for their vehicle to be repaired. In a world where packages are shipped across the globe overnight and expectation levels for service are higher than ever, systems and processes need to be effective and efficient to ensure the quick delivery of a vast number of auto parts to dealers across the country.

Cycle time reduction in the handling of the parts at the warehouse is the key to improved performance. The emphasis at the warehouse was to reduce the amount of time walking and increase the amount of time spent picking parts (Meeting, May 4, 2000). As well, all efforts were made to prevent non-value-added work by reduced excess handling. The concept is similar to time management at a desk. All work has a place, therefore you touch the work once and do not waste time shuffling through papers numerous times. Those who have good time management skills will tell you it took repetition and discipline to build the habit. The same is true of parts picking. There is a method to the processes implemented to reduce non-value-added work and it takes time to build the habits involved in efficient part picking. While on the surface this may look like a simple problem with a simple answer, there are several changes that had to be implemented to reduce the cycle time involved in picking.

General Motors used a modified version of
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“Toyota Production System” and state of the art computer systems to guide the work of a Competitive Warehousing Team (Arndt, 1999). The foundation for the changes at the Parts Distribution Center (PDCs) is as follows:

- Workplace organization
- Fair and equal work assignments
- Process control boards
- Manpower planning
- Continuous improvement
- Quality improvements
- Smooth work flow
- Small batch work assignments
- Problem solving
- Inventory control
- Parts management
- Real time updates
- Directed activities
- Employee performance reporting
- Quality reporting
- Inventory cycle counting
- Labor standards

Three measures were used to benchmark the performance at General Motors and to aid in cycle time improvement effort (Meyer, 2000). These were:

- Lines picked (a single part order, whether it is one or more of the same part)
- Structural cost to pick those parts and ship them to the end customer
- Errors in parts picked and quantities picked

The result of General Motors’ efforts is a template for its other parts warehouses that addresses the tongue twister, reduces order processing cycle time and satisfies the customer. The purpose of this paper is to describe the problems associated with the parts picking process at General Motors and discuss the cycle time initiative used to solve the problem.

The Original Parts Picking Process

SPO at General Motors needed to identify the problems with their processes and systems in order to improve their performance. The Competitive Warehousing Team used the “Toyota Production System” elements as both a problem identifier and a solution to the problem when the root cause was found (Arndt, 1999). All of the elements are used in the lean and common warehouse, but workplace organization and fair and equal work assignments impact the changes in processes the most. Below is a discussion of the problems in the parts picking process that retarded performance against the three benchmarks mentioned earlier.

Workplace Organization

Workplace organization concerns were separated out and identified as an area for improvement. Parts were scattered and not necessarily in fixed storage areas that could be readily identified for easy picking. While the placement may seem fundamental, it is important to remember that different parts are introduced and taken out of the system all the time due to obsolescence and seasonal changes (Meeting, May 5, 2000). The changeover in parts stocked causes placement issues and confusion as to where to go to pick the part.

The work at the Parts Distribution Center (PDC) is separated into inbound (receiving) and outbound (shipping) (Meeting, May 5, 2000). Poorly defined storage areas impact both. Inbound must be able to put the part away quickly and in the correct storage area. Outbound must be able to pick the part quickly and also identify if the part includes eight pieces or one piece. For example, if you are asked to pick part #123456789 and you find the bin quickly but are unsure of the correct part quantity (e.g., one spark plug or eight spark plugs), you might pick the wrong quantity of parts. It is important to note that the outbound is significantly impacted by the
job performed by inbound (Meeting, May 5, 2000). If parts are put away correctly and made easy to pick by inbound, then outbound performance should improve.

Fast moving and bulky parts were not placed in areas that allowed quick picking. Many bulky parts were damaged while loading and unloading or due to long transits within the PDC (Meyer, 2000). High volume parts were not necessarily placed near the floor and near the shipping doors. Each PDC determined where to store parts on their own (Meeting, May 5, 2000). This meant it was difficult to share best practices between the PDCs.

**Work Assignments**

Work assignments were not fairly distributed for inbound or outbound personnel. The inbound parts were placed on carts and made ready to put away. This was not necessarily done in a manner that either leveled work assignments or adhered to first-in-first-out (FIFO) inventory management. The employee was expected to organize the work for an efficient walk through the warehouse, which might take different times for different assigned work due to the variety and amount of parts (Meeting, May 5, 2000). Expectations were not managed and many times an employee was given a work assignment and would not be seen until hours later. Management would not know they had a problem until they were several hours into the shift. Manpower was moved from various areas of the warehouse to make-up for lost time. This reassignment reduced the PDCs ability to provide a smooth workflow.

These problems had a significant negative impact on the cycle time required to get parts to dealers. As a result, GM set out to create a common template for all PDCs to use to improve the picking process cycle time.

**The New Parts Picking Process**

Improving the performance of the PDCs against the previously listed benchmarks, lines picked, structural cost, and reduction in errors of parts and quantities picked drove the changes the Competitive Warehousing Team made. A template was devised for a “Lean and Common” warehouse that includes the size and shape of the building itself and the processes used within the PDCs. The template implemented common processes for the warehouse as well as lean process improvements. The result is a warehouse that encloses 352,000 square feet, stocks 65,000 parts, picks an average of 19,300 lines per day and services some 530 dealers. Thirty-six routes are run each day, arriving and leaving at specific times during the day. The template facility employs 20 salaried personnel and 119 hourly workers (Meeting, May 5, 2000).

**Reorganization of the Workplace**

The first change in the cycle time reduction initiative was workplace organization. The design and placement of parts within the warehouse can have a dramatic effect on costs and efficiency. High volume items were placed near the shipping and receiving docks while low volume items were placed in the rear of the warehouse. High volume parts were also placed on the lower bins, within reach of an average adult. The new layout made it possible for 87.6 percent of the bin trips to be placed in the front half of the warehouse (Meyer, 2000). These items include fast bulk (doors and engines), semi-fast bulk (batteries and cases of oil filters), and overpack (switches and spark plugs). In addition, template facilities are designed with shipping and...
receiving docks on the same side of the building. This arrangement allows for efficient stocking and picking of parts due to their proximity.

Because each facility follows the established template, the Competitive Warehousing Team is responsible for establishing placement of all parts in the facilities (Meeting, May 5, 2000). This aids completion of process audits and helps in sharing best practices. From the descriptions you can determine that heavy and bulky items were placed near shipping doors as well. This was done to reduce the amount of transit large and bulky items incurred. This placement reduced damage as well as traffic time for both the inbound and outbound processes. The rear of the warehouse was allocated to slow and smaller parts that account for 22.4 percent of the picking trips (see Figure 1). It requires less time to retrieve the high volume parts because of their placement and reduces the damage done to parts that are hard to handle. Figure 1 presents the layout template for the new placement of parts.

**Fair and Equal Work Assignments**

State of the art computer hardware and software were introduced to aid in inventory control and parts management. The software helps to solve many of the problems identified earlier. Work assignments are established by the software and fairly distribute the work into twenty minute directed activities (Meeting, May 5, 2000). During the inbound process, carts are stocked with the aid of the software. The work is scanned into the computer with a handheld device. The route the employee walks to most efficiently put the parts away is established and read out to the employee through the handheld device. It tells him where and what part to put away next. If the route is properly done it should take the employee twenty minutes to complete the route.

All items are scanned when they are put away.
Reports are available to show individual picker performance in terms of both speed and accuracy. The small batch work assignments also alert management to problems earlier in the day rather than when the work shift is half over. Manpower planning and adjustments can be made to complete the necessary work to smooth the workflow.

Fixed Storage
To avoid the confusion due to change over in parts, a fixed storage approach was established and is maintained throughout the year. All parts have a place and all parts are in their place. To accomplish this task, bins needed to be flexible in their design and allow adaptation for different sized parts (Meeting, May 5, 2000). For example, during summer months larger numbers of air conditioner compressors need to be stocked while during the winter when the number of accidents increases, larger quantities of sheet metal panels are carried. The sheet metal and compressors are not be stored in the same container but the size adaptation of the bins allows this to be accomplished.

A unique approach has been adopted when an employee runs into a problem. Sometimes a part will not fit in a bin or an employee cannot find the bin that the part should be placed into during an inbound shift. Employees have been trained to avoid wasting time if the part will not fit the designated bin or if they are unable to locate the designated bin for the part. The part is to be returned to a designated area called “The Twilight Zone” (TWI). Management can easily see when a part is placed in TWI and use root cause analysis to fix the cause of the problem (Meeting, May 5, 2000). Abandonment of the part has been avoided because the part now has a place in the system at TWI. The non-value-added time the employee spends wandering around looking for a resolution has been minimized and the problem can be identified and corrected. The correction might be training necessary for the employee or correcting a fault in the system.

Visual Controls
To aid further efficiency, visual controls are used to manage the outbound process in the warehouse. Because small batch work assignments are used to fairly distribute the workload across pickers, not all the parts for an order may be picked by the same person. As the parts make their way to the shipping area a means was necessary to gather all the parts for a specific order. A simple answer was found and implemented. Easily identified symbols are printed on a ticket and identify it as part of an order (Meeting, May 5, 2000). For example, a star might be printed on one order while another has a rabbit. When the pickers return from their directed route all star tickets are identified and placed together while the rabbits are gathered to ready the order. This is referred to as “process at a glance” and helps to simplify a possible confusing period in the outbound process (Meeting, May 5, 2000). What looks like mass confusion is actually a well orchestrated dance in part due to the discipline in processes.

“Process at a glance” is present in many other forms throughout the warehouse. All areas where work is being performed are labeled from above and below. Signs hang from the ceiling to describe what the area is used for and what part of the process they are in. The area is also marked on the floor to reserve space. By using the markings and designated areas, processes are followed and excess handling is avoided. As well, when a shift change occurs, workers can quickly understand what work needs to be performed next for orders that have not been completed.

Once the Competitive Warehousing Team determined the process and procedures to change, they were charged with implementing these changes into the day to day operations of the Service Parts Operation facilities and making it work. The result is a template facility that establishes the future of General Motors parts distribution. Below is a look at the implementation of the template at GM’s Jacksonville PDC facility.
GM Service Parts Operation Template—The Jacksonville PDC

General Motors and SPO have been able to make significant improvements in their parts picking performance by focusing on cycle time issues and processes inside the warehouse. Fundamental approaches to the way business was completed and the results expected were changed to meet the demands of customers. The intent is to curtail the transit time inside the warehouse by organizing the storage of parts, reduce excess handling by using “process at a glance,” and use manpower planning to level the workflow while maintaining FIFO inventory management. The result is a facility that provides consistent and world-class order fulfillment. The following is a discussion of the improvement the Jacksonville PDC facility made during their first months of operation using the new order processing template. The benchmarks established and discussed earlier in the paper, orders shipped, structural cost and quality in terms of correct parts picked and quantity of parts picked, provide an understanding of the dramatic improvement cycle time can provide.

Orders Shipped per Employee

In just eleven months the Jacksonville PDC posted an impressive 18.92 orders shipped per employee per day (see Figure 2). This compares with the industry leader, at 22.2. Jacksonville’s performance was more than eight orders per employee better than other GM facilities and puts them ahead of other major auto manufacturers (Presentation, May 1998).

This dramatic improvement is a direct result of the processes the Competitive Warehousing Team is instituting as part of the cycle time reduction initiative. Workplace organization reduces transit time and pulls non-valued-added effort out of the system and puts it back to work. Computer systems guide the work, assist in controlling the 20 minute directed activities and

![Figure 2. Jacksonville PDC](image-url)
minimize wasted steps. The Twilight Zone identifies problematic parts and identifies the need for a resolution. “Process at a glance” helps ensure communication and reduces replication of work. At the end of the day more parts have been shipped and fewer employees have been required to complete the task.

Structural Cost

Companies around the world are looking to improve the performance of their core operations. It goes without saying then, if more is done with less you have accomplished this goal. The structural cost per order shipped at the Jacksonville Template PDC is an impressive $3.90 per order shipped. To put this in perspective the average cost of a like sized non-template (medium) PDC is $5.65 per order shipped (see Figure 3). You might ask, what does $1.75 mean in the big scheme of things. A dollar and seventy-five cents multiplied by 19,300 orders shipped on an average day from the Jacksonville PDC is an impressive savings of $33,775 per day. When you carry this out over a year and across the many facilities General Motors Service Parts Operation manages, the results are impressive.

Quality

Historically, quality errors surfaced in two ways. Either the wrong part is picked or the wrong quantities of parts are picked. Lack of quality control impacts both numbers of orders shipped and the cost to complete the job.

With the new template in place, more parts are being picked, the cost to pick them is going down, and the quality of the job is moving upward. Manpower planning assists managers in scheduling the work and reduces drastic measures that force people to rush to get the job done. Twenty-minute directed activities increase the involvement of all personnel and gain managed expectations which increase quality. This element of the cycle time reduction initiative is impressive. The errors per 1,000 orders picked dropped from a high of 6.61 errors in May 1998 to a low of 3.51 errors just 10 short months later (see Figure 4). Ultimately the improvement means that more dealers and their customers are...
completely satisfied with the performance Service Parts Operation has provided and more General Motors vehicles are repaired in a shorter time.

**Keys to Success**

To be successful, it was determined that the process had to be simplified, order fulfillment cycle time needed to be improved, customer service was paramount, and costs associated with each order had to be reduced.

There were several keys to the success of this cycle time reduction initiative at General Motors:

- Time-boxing the parts picking process
- Standardizing the placement of parts in the PDC
- Simplifying the parts picking process

Time-boxing the parts picking process — General Motors realized that there was a problem with work assignments in the original order picking process. It was not uncommon for work assignments to vary widely from employee to employee. In this scenario, if a problem were to arise, management might not become aware of it for several hours.

The cycle time reduction initiative ensured fair and equal work assignments through the implementation of computer-based inventory control and parts management. The result was equal work assignments of twenty minutes. This allowed for better control of the parts picking process and facilitated much more expedient problem management.

Standardizing the placement of parts in the PDC — Prior to the initiative, it was not uncommon for parts to be scattered randomly about the PDC. This problem was further complicated when parts became obsolete or there was a seasonal change. To make matters worse, every PDC was arranged differently. Standardizing workplace organization played a large part in reducing the parts picking process. This PDC standardization
reduced picking cycle time, reduced damaged parts, and allowed employees to be more productive.

Simplifying the parts picking process — A key to success of the cycle time reduction initiative was simplification of the parts picking process. Given the twenty minute picking limit, it was not uncommon for an order to be picked by more than one person. The orders then had to be consolidated. The use of easy to identify visual symbols was used to relate a part to a specific order. This “process at a glance” approach not only simplified the order picking process but significantly reduced errors.

Conclusions

In an effort to increase customer satisfaction, lower costs, and reduce errors in the parts picking process, many organizations are beginning to examine the way their PDC’s operate. One such company is General Motors.

The original parts picking process at General Motors was unorganized, slow, and prone to error. As a result, the process was expensive. It was not uncommon for dealers to complain that their parts orders were late, incomplete, or incorrect altogether.

By reorganizing the way that parts orders were filled, General Motors turned their parts order process into a process that better met the needs of customers by reducing the order processing cycle time. This new parts picking process lowered structural costs, increased operating efficiency, and made the PDC’s more profitable. As a result, General Motors used the new process as a template to implement organization wide.

References

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