The Plant the Team Built: *The Betty Machine Company Story*

How a small company moved their operation and improved their flows.

Carl Davis

Everyone has moved at one time or another in their life and it is easy to recognize the time, expense, and effort involved but few ever face the challenge of moving a 56-year old manufacturing facility that has grown in the same location since its inception. That was the challenge Betty Machine Company faced in 1997.

The Betty Machine Company, a manufacturer of precision machined components, had been located in an industrial sector in the shadows of downtown Nashville since 1942. We had grown over the years to occupy four buildings and employ 130 people. With a full complement of single and multiple spindle screw machines, CNC machining centers, and a vast array of finishing and support equipment, we quickly recognized the size of the task at hand.

Betty Machine Company, Inc.

Founded: 1942

Employees: 130

Square feet: 75,000

Products: Screw machine parts, CNC Machining, Hydromat rotary transfer, centerless grinding and full secondary operations, value added assemblies

Annual sales: $10,000,000

The company's customers include a major gas pump manufacturer, automotive, air power tools, aerospace, industrial valves, and firearms manufacturers.

30 percent of the company stock is owned by the employees through an Employee Stock Ownership Plan.

In August of 1995, the Houston Oilers football team announced its intention to relocate the team to Nashville. Despite the public perception that several sites were being considered for a new stadium, most people recognized that the downtown location, home to Betty and other industries, was the area of choice.

Nashville had long been a city without a major league sports franchise and public sentiment from the majority of the population was positive but a vocal minority coupled with a few aspiring politicians chose to fight the deal and eventually forced a public referendum on the matter. In late 1995, the referendum date was set for May 1996.

The problem, from Betty's perspective, was that waiting to see the outcome of the vote would reduce the time available to relocate to 14 months. With economic growth very strong in Nashville, we decided a move was imminent and we knew we had to move forward.

Forming the Team

Most companies would form an executive management team to search for a site, interface with architects, design facilities, and plan a move. The team-oriented approach to business at Betty Machine, however, took us in a different direction: CEO Ben Betty announced that the people closest to the process — the shop floor employees—would design the plant and plan the move. He formed a team of five people who were chosen to represent every area of the manufacturing operation. Betty

served as the team facilitator.

The team developed the goals for the move:

- minimal loss of employees
- no disruption of customer service
- maximum productive workspace
- operational improvements to exceed a ten percent increase in efficiency
- a state of the art facility that the employees would be proud of.

Site Selection

Site selection was the first task to complete. Armed with a demographic survey of the workforce showing that 75 percent lived north of downtown, the team knew which direction to look. Believing it would be to everyone's benefit, the team tried to find a site close to the old facility but initial possibilities did not work out. It was then that team member Bill Hendrix suggested looking to Hendersonville, a suburban city approximately 15 miles northeast of downtown Nashville.

Betty instructed the team to meet with their departments and determine how much opposition there would be to moving that far. The report back the next week was that the teams wanted to take advantage of Hendersonville and estimated $300,000 savings on the land. They said, "Let's take that money and make ourselves a nicer plant."

By choosing Hendersonville, the company was moving to another county. The company initially had concerns that, given the short time frame in which to accomplish the move, dealing with a new city government in another locale could cause delays. After meeting with Hendersonville Mayor Hank Thompson, those concerns were put aside. Thompson sent a clear message that Hendersonville wanted the company and subsequently the city gave full cooperation during the construction and relocation.

In team-based companies, decisions often surprise management and the site choice served as a prime example. Frequently, policy decisions placed in the hands of employees result in much different results than management would choose. Facing an extreme move to one side of town, the issue of relocation assistance in some form came up (from management). The team decided there was probably no equitable way to accomplish this, so it was dismissed.

"I never would have believed we could move that far and not lose a lot of people," Betty said. Only one person out of the 130 left the company because of the move.

Plant Design

The team then embarked on the design of the new facility. Needing a visual image of what was possible, Betty flew the team to Chicago where they toured two recently-constructed facilities of fellow member companies in the Precision Machined Parts Association (PMPA). The team heard first hand what went right and what these companies would have done differently. Underestimating future growth, inadequate allocation of training space, and second floor/elevator accessibility issues were dealt with in the eventual design of the Betty Machine facility. However, the issue that became the most debated and researched item was the manufacturing floor: Every company visited or contacted had things they would change about their floor.

Since all machinery in this type of environment has to have a vibration-free base to sit on and also has to be level to a very close tolerance, the floor was of much concern. Sealing the floor to prevent oil from penetrating the concrete and yet not be slick was a challenge.

The team eventually contacted a company in Milwaukee that had put an addition on in the last two years. They were extremely pleased with the sealant and shared that information. Upon further investigation, it was learned that General Motors Saturn plant in Spring Hill, TN had used this product as well. The team decided to use this Ashford formula.

After much discussion with the architect and contractor, it was discovered that the floor could be poured with a laser screed and be extremely level. A premium was paid to have the floor poured this way using high-strength concrete.

The premium was recovered in the time it took to level the machines during the move and proof of this is

A Valuable Source of Outside Help

In addition to the tours of fellow machining operations, the team found an invaluable source of help in evaluating and planning the relocation effort.

The University of Tennessee's Center for Industrial Services offered the services of one of their consultants, Al Cash, who had relocated an International Harvester plant from Chicago to Memphis.

Once the team completed their relocation plan, Cash gave it a critical review and offered several observations for the team to reevaluate. Cash advised the team that the time required to move was probably 15 percent greater than anticipated.The points he offered were a definite asset in developing the move plan.

Figure 1. *The "Move" Team: (l-r) Joel Pace, Kevin Driver, Wendell Ladd, Rick Dalton, Ben Betty, Bill Hendrix, and Steve Geldrich.*

easy to document. The company has for many years used cedar roof shakes to level machinery. It was agreed by the team, based on much experience, that it would take eight bundles of shakes. However, during the relocation only two bundles wound up being used.

Another prime example of the team effort is evident in the floor. All computer controlled equipment must be grounded. This had always been done by driving ground rods into the ground through the concrete. Such an approach at the new facility presented a problem, as the new site was being constructed on a solid rock foundation.

After discussing this with the electrical engineer and electrical contractor, the team found a solution. A copper grid was designed to be put under the floor and attached to each column. The entire structure became the ground. Not only did this give easy access to a ground, it also saved on the insurance rate.

By working together and not giving up until a satisfactory solution was agreed upon, the team took all of the problems associated to the floor and converted them to a major asset in the new plant.

Meanwhile, Over in Operations

As our company focused on the tasks of 1997, we recognized that our charge was twofold: 1) plan and move a company and 2) remain focused on continuing operations.

The method by which the team managed the plant project allowed management to remain focused on growth, improvement of normal business processes, and also team support.

In addition to the sales and profit growth, the company migrated the entire operating system to a new computer network two months before the move. The workforce was increased by 30 percent in 1997. The year yielded the most successful overall results in close to a decade.

"The key was that everyone knew what their role was during this critical time period. We were focused,"according to Carl Davis, executive vice president.

The trip solidified most of the eventual design features incorporated into the new plant. They established several goals, some while sitting in O'Hare airport waiting for the return flight home (see Figure 1).

Relocation Planning

Early on, the team decided that a move of this size would likely require a two-week shutdown. Planning for the move began in late 1995, some 20 months before the actual relocation. Substantial planning and documentation was necessary not only to accommodate the relocation, but also to complete negotiations with the Nashville Metropolitan Government on the condemnation settlement.

As the plant neared completion and the time for the move rapidly approached, the team never lost its focus that the customer had to be served. The team met weekly to plan the move of over 125 pieces of equipment and countless skids of setups, tooling, and inventory. Many pieces of equipment would require recalibration upon arrival at the new facility and in some cases factory technicians had to be scheduled in.

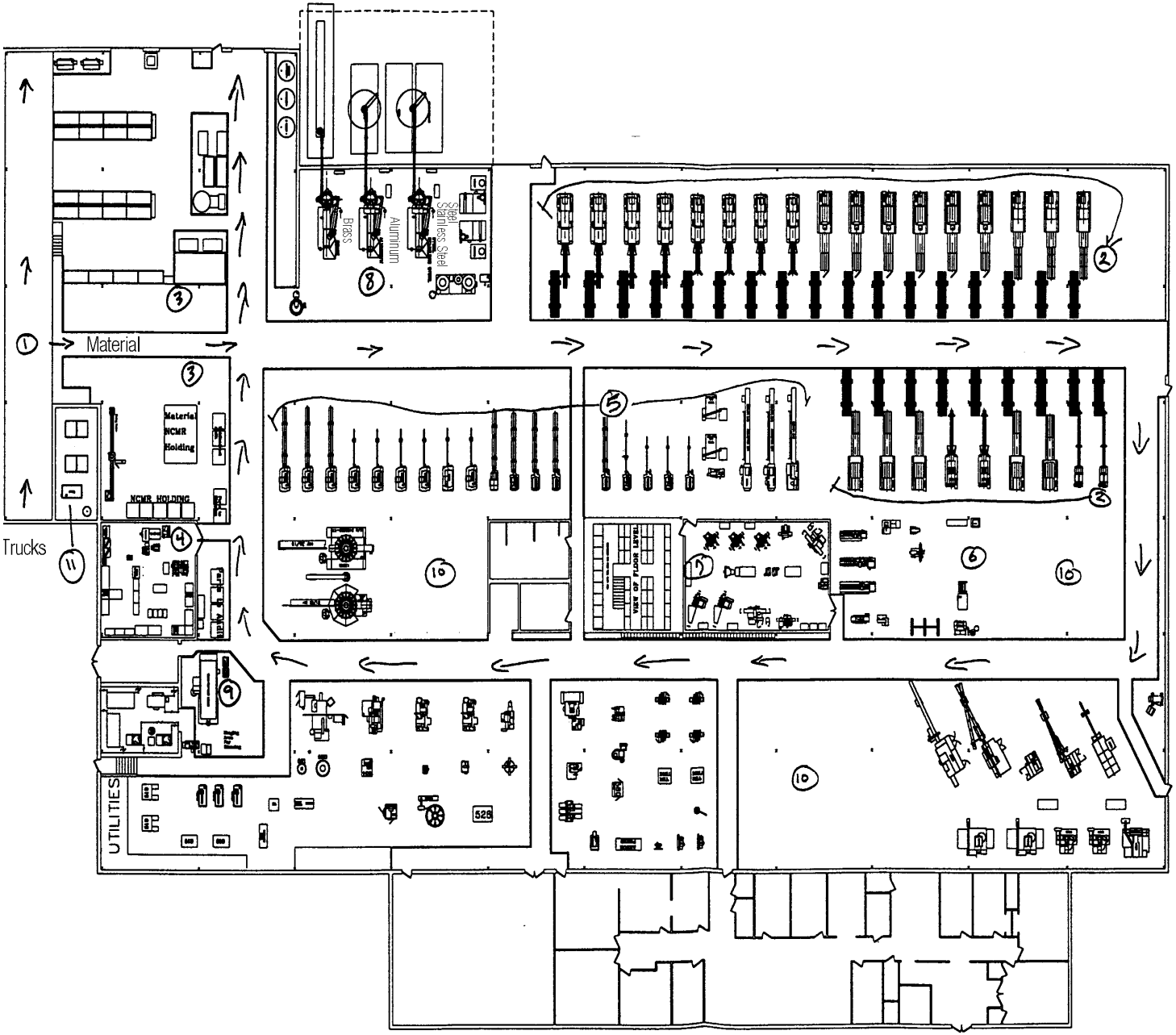
The rigging company agreed to work ten to 11 hours per day. The team began to identify how many trucks, boxes, wire pallets, fork trucks, etc. that were needed. Each team representative was responsible to identify the needs for their area and the information was reviewed and agreed to in the meetings.

It was clear how the machinery would be moved, but the difficult and time-consuming issue became the small items: tools, setups, repair parts, and miscellaneous items. The team decided the most efficient way would be to shrink wrap everything. A wrap machine was purchased and pallets were wrapped as they were filled. File cabinets, storage cabinets, desks, were all shrink wrapped: no time to unload and box the items. The decision was a good one: nothing was damaged.

The team broke the move down by department. It was further broken down into 30-minute increments. Involving the rigger in this precise planning process, 140 increments were identified, bringing the move to seven working days. The night shift would have primary responsibility for getting machines ready. Therefore, a machine could be in production until midnight, dismantled, moved and reassembled the next day and back in production that night. Several key machines were back in operation within 24 hours.

The day shift had primary responsibility to move

Revised Plant Layout



1. Drive through truck bay eliminates time consumed by backing in truck. Overhead crane spans from truck bay to other end of building. Allows material to be brought directly to the machine. Areas 2 and 5 use 90% of all bar stock.
2. Area 2 is multi spindle screw machines. Spacing between machines allows insertion of small secondary equipment to do miniature cell type work.
3. The positioning of the QA lab (#4) close to Receiving (#3) allows all incoming inspection to occur in close proximity.
4. Quality assurance — positioned after parts cleaning (#9) and before shipping (#3).
5. Single spindle and CNC Swiss machines — noted in #1 as a major user of bar stock.
6. Located maintenance next to tool room to allow sharing of equipment.
7. Tool room/tool crib together allows more efficient preparation of tools for jobs. Positioned in center to serve all areas.
8. Automated Mayfran chip processing lines used to process scrap generated by areas 2 and 5. Uses only 3-4 man hours per day; previous facility used 3 people full time.
9. Vapor degreaser for parts cleaning prior to final inspection. Efficiency of system calls for only 3-4 man hours. Previously cleaned parts on both shifts, 12-14 hours per day.
10. Expansion areas for future machines and large cellular activities.
11. Compressor room designed to vent hot air out side in summer; inside to truck bay in winter.

The "best" results of the overall flow are:

A. The raw material/scrap handing flow as out lined in #1 and #8. Has reduced labor by 75%.

B. The flow once parts are completed going 9-4-3 (clean-audit-pack). Move time and distance are minimal. Labor reduced here as well.

Figure 2.

Team Goals

Goal	Design Feature	Result
Improve material handling/decrease inventory	Drive-through truck bay and overhead crane. Trucks delivering material drive straight into the building, unload, and drive straight out.	JIT material delivery straight to the machine. 50 percent decrease in material handling time, 67 percent decrease in raw material inventory in 1997.
Improved material flow	Circular flow from start to finish. Support areas in center of plant.	One-way transfer of material from one process to the next.
Improved lighting for better work quality/ part evaluation	Raised ceiling 8 feet. Used clear globes to disperse light and use ceiling for additional reflection.	Year to date initial quality as of August 1998 has improved 25 percent.
Better air quality	Mist collection systems ducted to every machine in plant with return lines for condensed oil.	No oil mist in the air. Improved housekeeping and air quality.
Reduce manual labor in scrap metal spinning and recycling	Installation of triple line of Mayfran chip processing systems.	All scrap generated during the workday processed in less than four hours per day; previously used three-four people full time.
Improved tool management and organized setup kits.	Centralized, restricted access tool crib with computerized inventory. Staffed full time on both shifts.	Staffing and computerized access to inventory allow more efficient control and distribution. Single sourcing of most items reduces need to carry large inventory. Organized kits reduce setup time.
Cafeteria facility equal to quality of office environment.	Employee lunchroom situated in the front of the plant alongside offices. Cabinetry and furnishings equivalent to the CEO's office.	Well lit, carpeted area with big-screen TV provides a pleasant environment for lunch and breaks. Room also doubles as a meeting and training facility.

Figure 3.

the small items. As the riggers loaded and moved machines in a department, the people of that department packed, loaded, and moved the small items.

To say the least, the planning and time table were aggressive. At ten hours a day, 20 increments had to be scheduled for each day. The move began Monday morning, July 28 and at 5:00 p.m. on Tuesday, 60 increments had been moved. At 7:00 a.m. the next morning, the team decided to reduce the schedule to five days.

Figure 4. *Receiving leadman Greg Fuller unloads bar stock from a truck in the enclosed drive through bay while the truck driver (left) and Betty Machine employee Fred Fleming look on. The material is moved directly to production via overhead crane.*

Backlog Grows

Despite all the early planning, the team faced a new reality approximately six months before the move — the company's near-term sales backlog for 1997 surged 150 percent (and later grew to nearly 200 percent just prior to the move). A two-week shutdown was no longer a consideration; operations simply had to continue. The schedule was changed to accomplish a two-week move without ceasing production.

The team broke down department by department, who and what to move first and what should wait until the end. The most critical jobs were identified and in these cases production equipment dismantled in Nashville on day one was running in the new plant on day two. Shipping and finished inventory were the last areas moved. Quality Assurance operated in both the old and new facility the week of the move.

Results

The results of the move were staggering, even to those involved. All of the equipment was moved in only five days, releasing the rigging company well ahead of schedule. The rental trucks used by company employees were turned in three days ahead of schedule. The company achieved 40 percent productive hours the week of the move.

The most critical measure of all is customer service. While on-time shipments dropped to 65 percent during the move, average days late dropped by 18 percent in the two months after the move. Averaging four days late (on late shipments only) in the three months prior to the move, the company averaged 3.3 days late during the months of August and September. The company at any one time has up to 200 jobs on the floor and there was only one crisis that cropped up during the move. As team member Wendell Ladd told the CEO during the move, "I thought all this time we spent planning this was a waste, but I guess I was wrong."

Lessons Learned: Communication is the Key to Effective Teams

Once the move was complete and things were back to normal, the relocation team had a meeting to put closure on the process and use the data to improve teamwork in the future. The results of that meeting yielded no

major items that would have been done differently with respect to the facility. The only item noted was an issue common to teams: communication.

It is imperative that team members, particularly representing broad areas of a workforce, communicate to and from their groups well. All the cards must be put on the table, reviewed, and decisions made and communicated. If there was any one area where things could have gone better, it was in the area of proactive communication during the design phase. Once plans are drawn and construction begins, changes are very expensive.

The company probably should have organized a group outing to visit the site during construction a time or two. While many employees drove by to monitor progress, many others never did. Another "thought" not acted upon.

The Results

In that same post-move evaluation, the team cited one aspect important for all companies to take note of: management support. The team felt they had 100 percent support of management at all times and received everything they asked for promptly.

The events of 1997 set a new benchmark of performance for Betty Machine Company. Sales grew 28 percent and profits were at record levels. The company also formed an Employee Stock Ownership Plan (ESOP) and the employees now own 30 percent of the business. Formed in April of 1997, the ESOP gave the employees an ownership stake in the business and some extra impetus for success in this critical time.

Figure 5. *Buyer Cathy Reed of Gilbarco looked at a CNC Swiss machine during the company open house.*

The relocation was so successful that the company paid a four percent bonus on top of the incentives earned through the traditional profit sharing plan. As Betty told the employees both privately and publicly during last fall's open house, "I've been proud of this team many times over the years, but never have I been as proud as I am right now."

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A Customer's Viewpoint

From a customer's point of view, just the idea of having your top supplier relocate their business is enough to turn your hair gray; especially when the components they supply are used in some of the most critical applications of your end product.

When Betty Machine first informed Gilbarco of their intent to build a new facility and relocate to another town, I immediately wanted to know all the details of their game plan, even if the actual event wasn't due to take place for another year. For the next 12 months Betty representatives were very thorough in communicating plans, problems, concerns, and schedules about the move to the new plant in Hendersonville, TN. During this same time, we were compiling our list of questions relative to issues like, "What if something goes wrong with your plan and your production startup is delayed?"

My account representative, Terri Chambliss, and myself really started buckling down on communications the last four-six months prior to the move, looking at future requirements and making sure that should there be a sudden influx of "un-forecasted" spare parts or re-manufacturing orders that Betty would be able to respond within an acceptable time period.

MRP was reviewed weekly, making adjustments and additions as needed, and confirming delivery dates. Looking back at the whole relocation process, it still amazes me that a company the size of Betty Machine successfully and very efficiently disassembled, moved, reassembled, and set up some 125 pieces of equipment, and resumed production in less than one week! All of which was accomplished due to the determination and team effort of the employees. It's quite obvious that Betty Machine is a company that is committed to providing quality parts, service, and on-time delivery to its customers; a commitment that breeds partnership.

Cathy Reed, Gilbarco (a Betty Machine customer)