



Overview

During 2003, the ZF Lemforder plant in Tuscaloosa, Ala., had a unique opportunity to make a transformation to Lean Production when preparing to launch of the front and rear axle system programs for three new Mercedes-Benz vehicles - the M-Class, R-Class, and GL-Class - began. A plant expansion of 39,000 square feet with two new assembly lines was constructed that allowed for new model preparation without interruption of current production.

Achievements

Quality

- **Customer PPM** reduced from 13 PPM in 2003 for the 163 axle program to 10 PPM. For the new 164/251 axle program, PPM was reduced from 254 at year end 2005 to 17 as of April 2007. The part mix and complexity more than doubled for the new Mercedes program.
- **Internal PPM** 2005 to 2007 YTD for the new 164/251 programs was reduced by 50% on the front axle to 17,923 PPM and 23% on the Rear axle to 27,890 PPM.
- **Supplier PPM** was reduced by 38.6% from year end 2005 to 2006 year end 2006 for the new 164/251 programs.

Delivery

- On-Time Delivery on the 163 Program increased from 93% to 99.7%
- On-Time Delivery of the new 164/251 axles year end 2006 was 98.8%. Monthly scores of 100% have been achieved through March 2007.

Productivity

- JPH improved 12% from year end 2005 to YTD 2007.
- Equipment Availability has improved 18% from 2005 to 2007 YTD. The front, rear line average is 90.8%.

Health Safety and Environmental

- The DuPont Stop Safety program was initiated in 2003 is a program involves of all plant leadership resulting in a decreased incidence rate and severity rates.

- Incident rates dropped 56% from 2000 to 2006. Lost workday cases dropped 44% from 2000 to year end 2006. An additional 24% was realized by April 2007.
- Ergonomics assessments were completed for all jobs and job rotation schedules with team members were established
- Environmental certification to ISO 14001 is current.

Cost

- Inventory turns increased by 68% from 29 in 2005 to 48.8 turns year-end 2006. Another 5.8% increase realized as of April 2007.
- Average overtime was decreased by 5% from mid 2005 to mid 2006 and continues to improve. Based upon 1st quarter results, a comparable reduction will be realized at year end 2007.
- Major kaizen activities are on going to further improve cost structure.

Supplier Support

Recognizing that ZF Tuscaloosa is only as strong as the weakest supplier ZFT resources have been working on-site with key suppliers since the SOP of the 164 and 251 Programs. The objective is to strengthen the supply stream by helping implement Lean Principles and Practices to improve Quality, Reduce Cost and achieve On-Time Delivery.

People

Employees are integral to meeting customer's requirements for a problem-free launch and to continually improve to create successes. Our goal is to obtain the next Mercedes-Benz program to ensure the future of both the employees and the plant.

In preparing for the new model launch in 2005 all employees received Lean Production training in one or more focused training sessions. A Lean sensei with Toyota experience on Mr. Fujio Cho's staff was contracted to support the lean transformation.

- Four-hour introductory sessions for all
- Two day plant staff Value Stream Mapping Training and preparation for kaizen events.
- Four Day Lean Training for all team members with focus on Workplace Organization/ 5S, standardized work, quality and productivity, and continuous improvement with two days problem solving



- Three-week over three-months Lean Transformation/Certification Training for all management staff and team members on the project launch team.
- Goal post manufacturing simulation (developed at NUMMI) offered to all employees and Stephen Covey's Seven Habits offered to all employees.
- Lean Production Training is offered to new employees on a regular basis.
- A number of our ZF Tuscaloosa team members assisted in the start-up of the ZF Chicago Axle Assembly Plant to understand potential start-up problems and to learn the new assembly-line design.

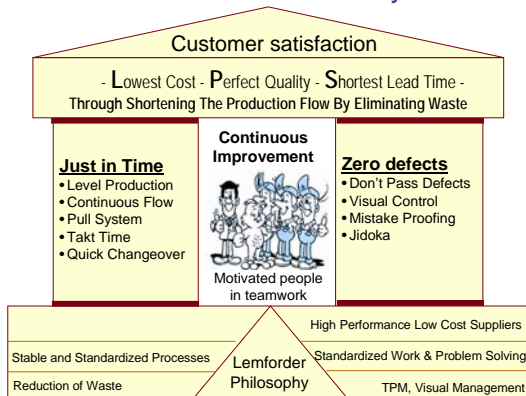
Lean is becoming the culture at ZFT with all employees taking responsibility for day-to-day improvement and problem solving.

Product

- The ZF Tuscaloosa site produces complete front and rear axle assemblies in broadcast sequence for Mercedes-Benz U.S. INC (MBUSI) in Vance, Ala., approximately 30 miles away. The plant has approximately four hours lead time after receipt of order to produce and ship the axle assemblies. The MBUSI vehicles are the only ones produced in the U.S. and are built for the North American and world markets.

Process

Tuscaloosa Production System



- ZF Tuscaloosa has transformed its operations from traditional manufacturing to the Tuscaloosa Production System that has its goals as perfect quality, lowest cost and shortest lead time while maintaining

on-time delivery. The goals are accomplished through shortening material flow.

- TPS is based on the Toyota Production System and continues to evolve as employees gain experience and drive continuous improvement. The LPS model is based on the system model that was developed by Toyota Managers at the Toyota's Georgetown, KY site.

Plant

The ZF Lemforder Tuscaloosa facility is part of the Car Chassis Technology division of ZF. There are seven plants and a technical center within North America dedicated to the division. Tuscaloosa is one of three axle systems facilities. The plant opened in 1997 with 115,000 square feet of manufacturing space on 46 acres as a dedicated facility, providing front and rear axle systems to Mercedes-Benz M-Class vehicles. A 39,000 square foot expansion in 2003 provided the backdrop for the second generation of the Mercedes-Benz M-Class, R-Class and GL-Class. Currently, there are 300 employees at the facility.

ZF Lemforder Corporation

ZF Lemforder Corporation is the car chassis division of ZF – one of the world's largest suppliers of driveline and chassis technology. The company employs approximately 58,000 at 120 locations in 25 countries, and totaled sales of \$16.4 billion in 2007. Within ZF Lemforder North America, there are five components manufacturing plants and three axle systems assembly plants.

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