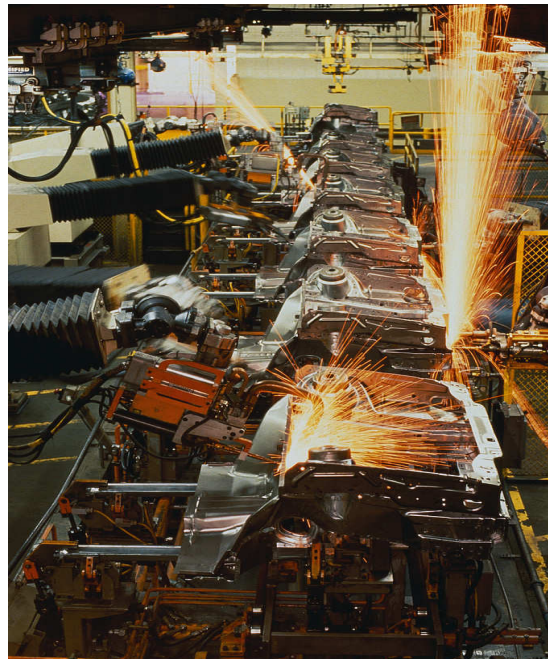
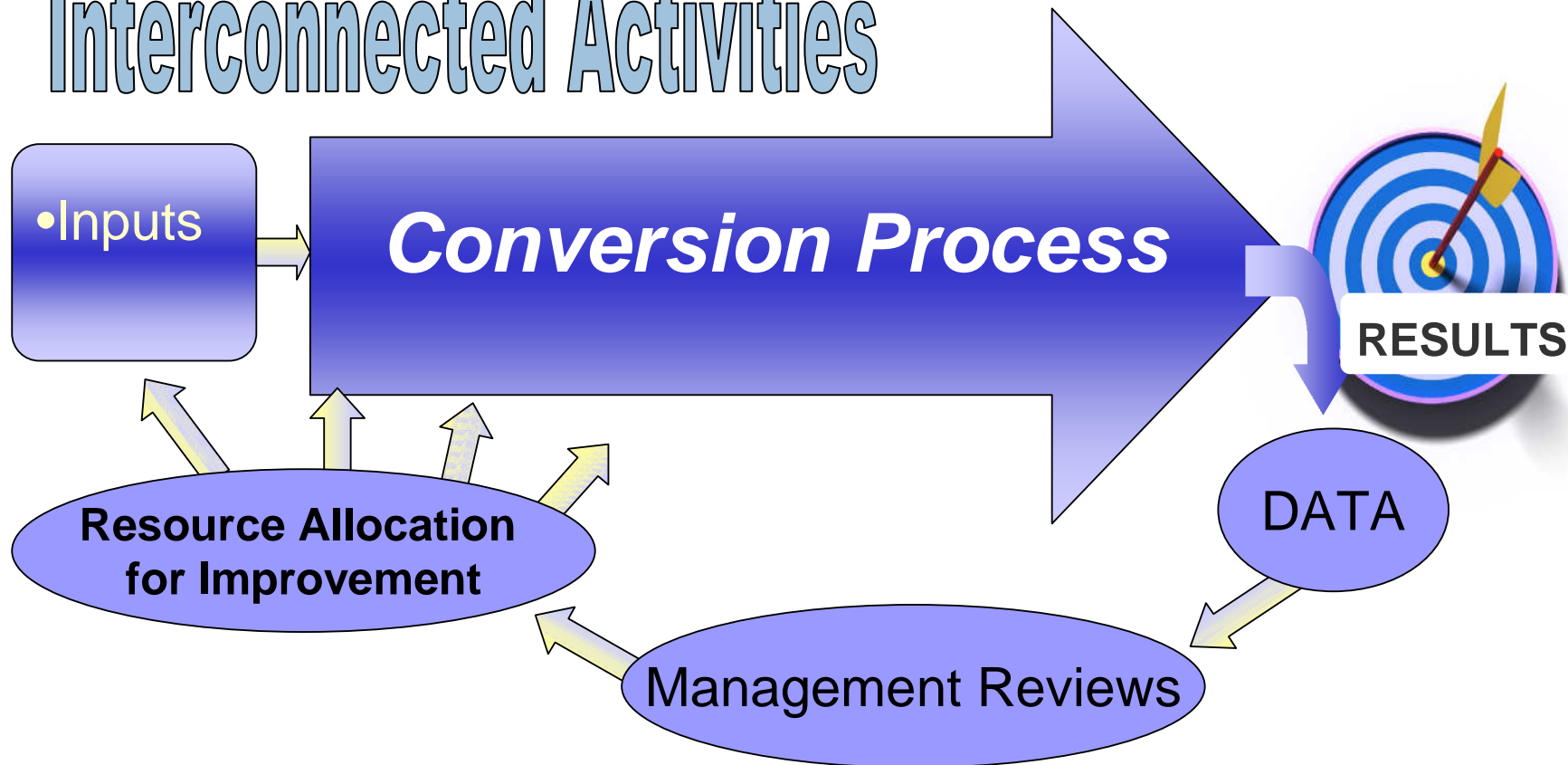


# ELEMENTS OF MANUFACTURING BASICS



## Basic System Model

### Interconnected Activities



# MANUFACTURING BASICS

CATEGORY	PEOPLE	QUALITY	SUPPLY	COST
<b>OBJECTIVE</b>	The right people trained and safe	1) Provide products that conform to Chrysler requirements 2) Protecting customers from Nonconforming material	1) Volume to Schedule & traceability 2) Throughput Efficiencies 3) Visual Mgt	Progress to budget
<b>EXAMPLE METRICS</b>	Safety incidents  Absenteeism  % Trained	- Process Capability & First Time Quality - Customer Concerns - Warranty - Sub Tier performance	OEE  Hourly Production vs. Schedule  Downtime by Operation	Scrap  Operating Cost to Budget
<b>SUPPORT MECHANISMS</b>	- Training programs - Problem solving expertise and tracking	- Pareto Top Rejects - Control of NCM - SPC program - TS 16949 cert. - Parts Inspection system	-Material Flow --Pareto Downtime issues -Effective Maintenance System (Equip & tool) -Back up IT & Power -Container management -Engineering Change Mgt	- Continuous improvement/ Lean Manufacturing - Layered Process Audits

# PEOPLE

## Objective:

A process that ensures the appropriate number of employees are hired, trained, and competent at the required time prior to launch.

## Example Metrics:

- Safety Incidents recorded
- Absenteeism tracked
- Percent of workforce trained

## Support Mechanisms:

- A timely selection process for qualified candidates
- Provide training that represents the manufacturing environment, performed by qualified employees or outside trainers
- Document job descriptions, qualifications, safety procedures, and assignments
- Monitor Safety Metrics and respond accordingly
- Track employee qualification approval/recertification requirements
- Provide training in problem solving and monitor resolution progress
- Monitor absenteeism and provide a strategy for retaining employees

## Employee Training:

- - Qualified Candidates
  - - Document Procedures
- - Schedule Reviews



# QUALITY

## 1) Objective:

Provide products that conform to Chrysler requirements

### Example Metrics:

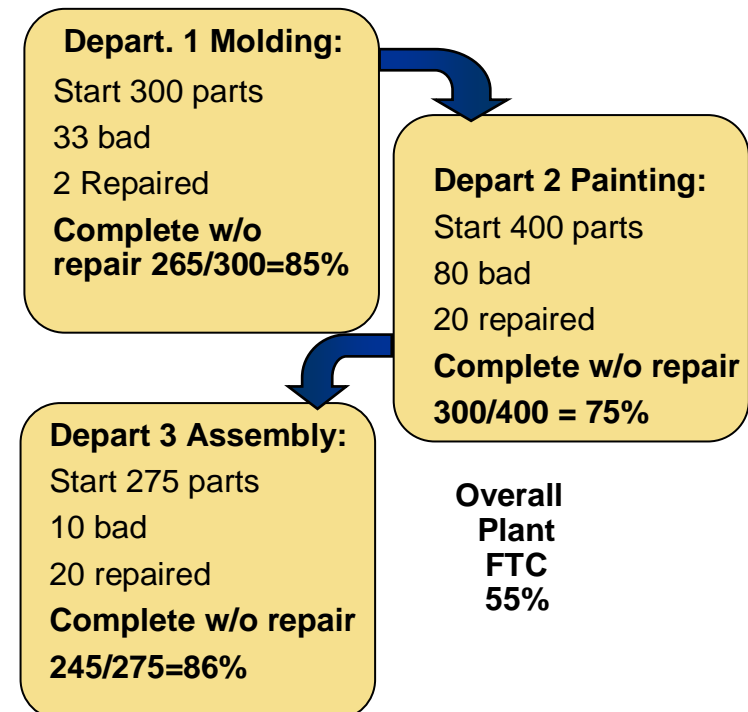
- First Time Quality
- Process Capability

### Support Mechanisms:

- Actively track and analyze Top Rejects (Pareto) and drive continuous improvements
- Use of statistical methods to control in-process quality including SPC, and capability studies
- Obtain TS16949 Certification and maintain an internal auditing program
- Established Part Inspection System with containment
- Continuous improvement program for process capability
- Use of the Forever Requirements that includes customer notification of process or product changes prior to change implementation

**First Time Quality/Capability (FTC):** A measure of the effectiveness of a process to produce 100% quality parts with no rework of any kind. On a cell basis it is measured as the percent of good parts ready to ship right off the process.

**FTC Formula:** # Finished w/o rework ÷ # Started



**Overall Plant FTC:**

$$\text{Dept. 1} \times \text{Dept. 2} \times \text{Dept. 3} = .85 \times .86 \times .75 = 54.82\%$$

# QUALITY

## 2) Objective:

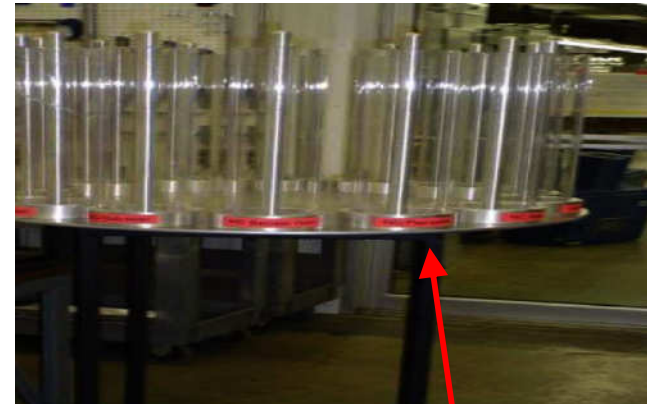
Protecting customers from nonconforming material.

### Example Metrics:

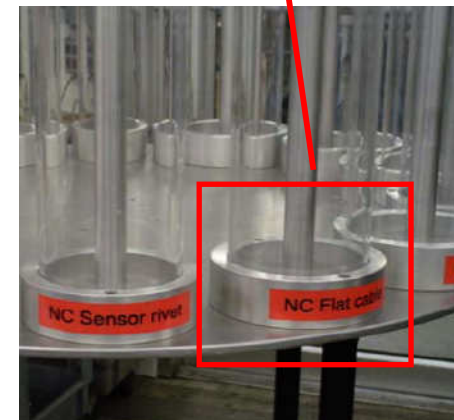
- Customer Concerns (Yardholds, NCT, eCIMS)
- Warranty data
- Sub Tier performance

### Support Mechanisms:

- Proactive customer protection - performance-based trigger points for self-imposed containment
- Control nonconforming material in a distinct location in a controlled, highly visible area
- Data board for trend charting and corrective actions
- Effective method for disposition of nonconforming product from work area within one production day
- Internal performance monitoring with feedback to Tiered Suppliers
- Warranty reduction program that includes issue management tracking, return analysis, and resolution



**Identify  
and  
segregate  
suspect  
material**



# SUPPLY

## 1) Objective:

A system that controls delivery, storage, traceability and movement of materials to meet schedule

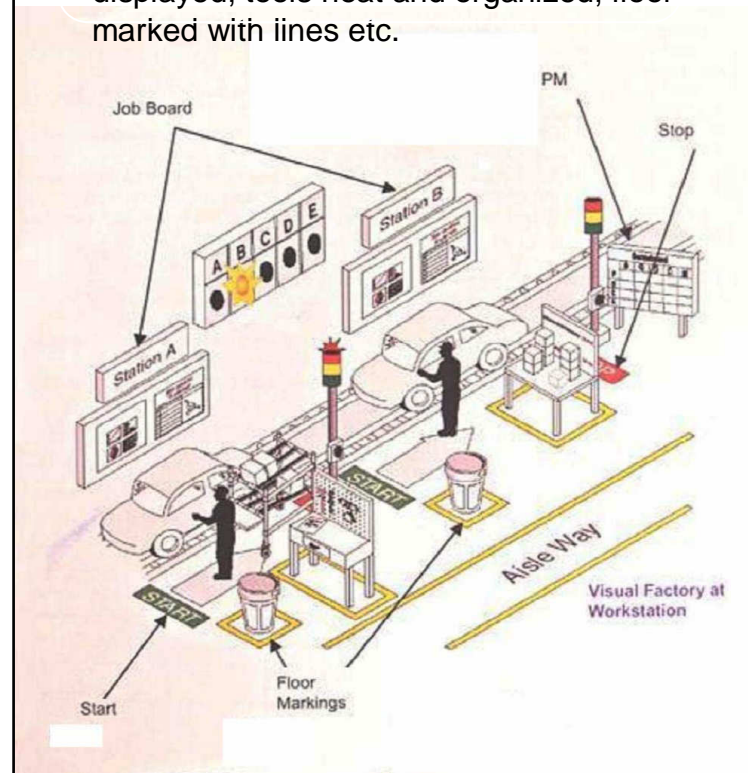
### Metric:

- Certified Line Shortage/Certified Line Delivery occurrences (CLS/CLD)
- Advanced Shipping Notice compliance (ASN)
- Premium Freight

## Support Mechanisms:

- Product identification at each step of process
- Visual plant layout showing material locations for inventory, work in progress, finished goods, scrap, and nonconforming material location
- Contingency plans that include IT and power backups
- Inventory control process for dunnage (returnable and expendable)
- A means to receive an order and break it down into the Bill of Material
- A method to assure rotation of material (FIFO) and traceability
- Structured Engineering Change Management
- A traceability system for inventory, including raw material

**Workstation:** Outlined racks, trash cans, start and stop positions, standardized work displayed, tools neat and organized, floor marked with lines etc.



# SUPPLY

## 2) Objective:

A system to assure the supplier can meet the production volume throughout the life of the program

### . Example Metrics:

- Operating Equipment Efficiency (OEE)
- Hourly Production (actual) vs. Scheduled Production
- Downtime tracked by Operation and/or cause

### Support Mechanism:

- A scheduling and issue resolution method for tiered suppliers
- An inventory management system for consumption and loss
- Pareto of downtime issues with appropriate corrective actions
- A process that ensures a tooling / fixture preventive maintenance program
- Obvious communication (hourly) of daily production vs. schedule
- Active tracking of production capacity and trends
- A contingency plan that includes a trigger for escalating issues to management for countermeasures

**Is the right part in  
the right place at  
the right time?**



# SUPPLY Operating Equipment Efficiency (Throughput)

Measuring production to plan, example of scheduled production: 1,000 Parts

Machine down: Less 100 parts  
**Availability = 900/1000 = 90%**

Machine running slow:  
 Less 100 parts **Performance Efficiency = 800/900 = 89%**

Parts scrapped or Reworked:  
 Less 100 parts  
**Quality Rate = 700/800 = 88%**

**Note: Include down time in the OEE Equation but not in Supplier Yield**



Shift one total losses: 300 parts  
 OEE = Availability (90%)  
 x  
 Performance Efficiency (89%)  
 x  
 Quality rate (FTC) (88%)  
**Finish Production: 700 good parts**  
**OEE=700/1000 = 70%**

**OEE Equation:**

$$OEE = \{ (Parts Planned) - \left[ \begin{array}{c} \text{Quality Losses} \\ + \\ \text{Downtime Losses} \\ + \\ \text{Quality Rate Losses} \end{array} \right] \} \div \text{Parts Planned}$$

# SUPPLY

## Visual Management

### Objective:

Make the production process status obvious at a glance

### Support Mechanisms:

- Scoreboard displayed at each process
- Visible and easily understood data is displayed
- Specific details defining how each control is implemented
- Color coding used to denote differences in processes
- Safety equipment and instructions are displayed
- Operation start and finish marks are clearly defined
- Container contents are clearly marked
- Appropriate boundary samples are displayed at work stations
- Preventative maintenance documents are posted
- Identify weaknesses that require corrective actions



# COST

## Objective:

Effective cost management

## Example Metrics:

- Cost of Quality
- Current operating costs compared to budget

## Support Mechanisms:

- Understand the elements of actual production costs to quoted costs
- Benchmarking to identify best methods and or materials
- Program to support continuous improvement through lean principles
- Regular Management reviews of cost vs. budget that includes Chrysler metrics
- Perform Layered Process Audits to assure effective deployment of resources

