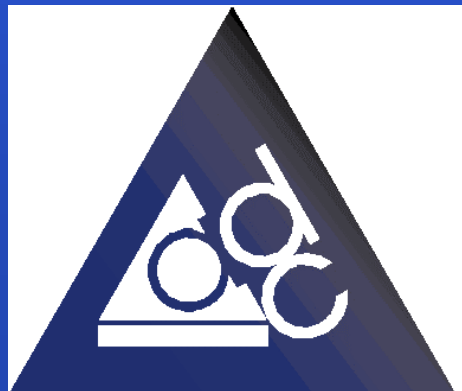


# ***The Role of Process Development in Automation***

**Tom Lawton**  
**President**  
**ADVENT DESIGN CORP.**

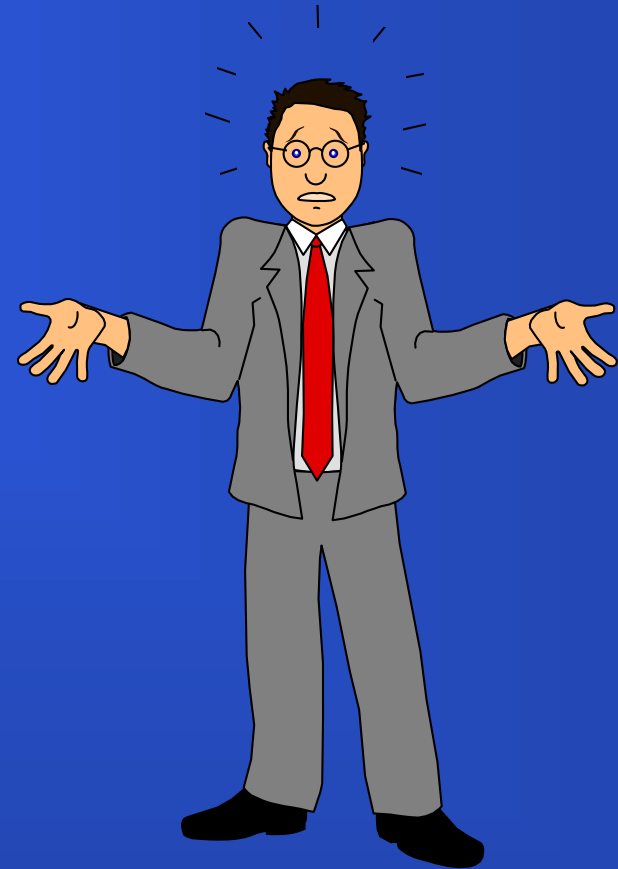


# ***Process Development***

## ***What is process development?***

The sequence of operations and parameters required for each operation to ensure that the manufacturing process produces a product within specifications.

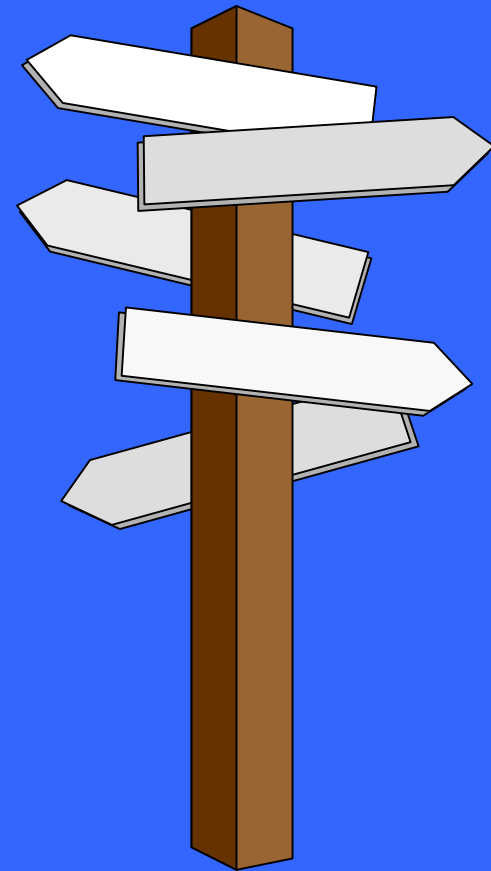
- ★ Define transformation requirements of each step of the manufacturing process
- ★ Define the sequence of steps



# ***Automation Will Change your Process***

***Why does the manufacturing process change?***

- ★ Tools used to transform the product will change
- ★ Sequence of steps may change
- ★ Absence of Human Element
  - ◆ Intellect
  - ◆ Dexterity
  - ◆ Adaptability



# *Identify Your Process*

- ★ Understand what's changing
- ★ Quantify Parameters
- ★ Repeatability
- ★ Evaluate manual processes carefully
- ★ Quality Requirements
- ★ Environmental Effects
- ★ Be willing to make product design changes



You will miss things during the identification process.

# *Qualify and Test Process Changes*

**Manufacturing Process Changes  
Product Design Changes**

- ★ **Whenever possible integrate process changes into the existing manufacturing process first**
- ★ **Every process change has unanticipated consequences**
- ★ **Understand the consequences before cutting metal**

## *Minimize Risk*

- ★ The more you change your product or process the higher the risk
- ★ The more processes you link together the greater your down time

$$99.9^{10} = 99\%$$

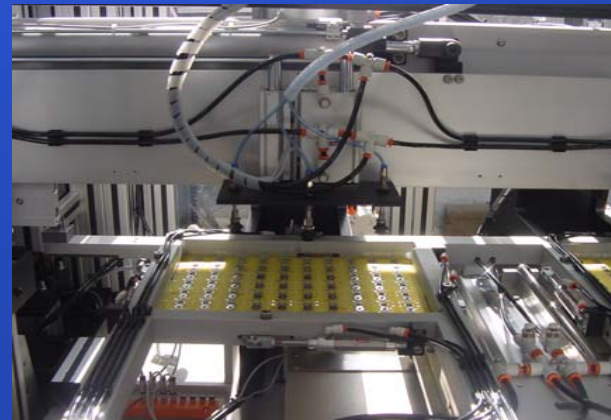
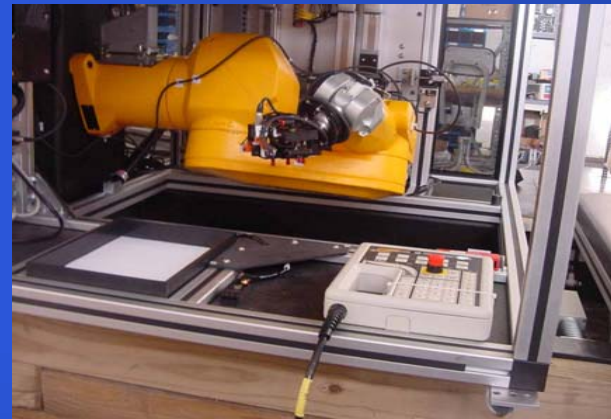
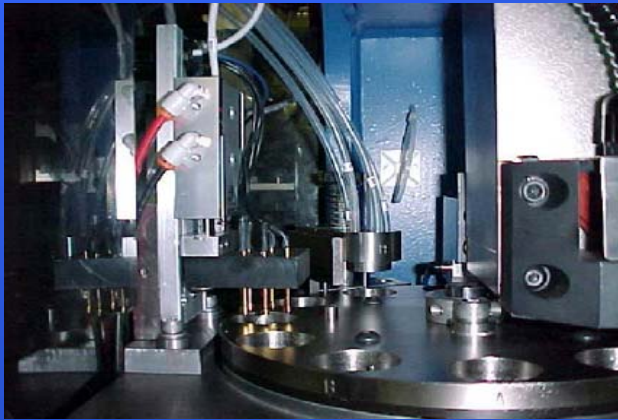
@ 100 parts/minute = down every minute

# *Common Pitfalls*

- ★ Underestimate the human element
- ★ Incoming parts not within specification
- ★ Development components not truly representative of production components
- ★ Process is not repeatable
- ★ Product Design changes

# *Machine Design*

Select a transport system based on the requirements of the process.



# *Robot*

## **Advantages**

- ★ Programmability
- ★ Easy to link processes with different cycle times
- ★ Ability to change operation
- ★ Based on sensor inputs

## **Disadvantages**

- ★ Sequential steps increase cycle time
- ★ Limits to part gripping because of single end-effector
- ★ changing end-effector further increases cycle time

# *Rotary (Dial Table)*

## **Advantages**

- ★ **Low Cost**
- ★ **Fast**
- ★ **Accurate**
- ★ **Size limits number of operations and associated risk**

## **Disadvantages**

- ★ **Size Limitations - large parts & high number of stations requires a large dial**
- ★ **Poor operator access**
- ★ **Difficult to maintain**

# *Synchronous Inline*

## **Advantages**

- ★ Mid-range cost
- ★ More flexibility with part size and number of stations
- ★ better work cell layout allows easy operator access

## **Disadvantages**

- ★ Slightly slower than rotary

# *Asynchronous Inline*

## **Advantages**

- ★ Best method when combining manual and automatic operations
- ★ Allows accumulation between stations

## **Disadvantages**

- ★ Very high cost when pallets required
- ★ Slower than synchronous

# *Walking Beam*

## **Advantages**

- ★ Very cost effective in no pallet required
- ★ Enables different part fixturing in each station

## **Disadvantages**

- ★ Hard to use if pallet required

# *Machine Design for Process Development*

## **Do**

- ★ use PLC or other programmable controller
- ★ oversize PLC
- ★ use Op Interface
- ★ include extra stations
- ★ use sensors - when in doubt include a sensor

## **Don't**

- ★ combine operations if at all possible
  - Linking operations limits flexibility because it affects the other processes
- ★ use mechanical cams or linkages

# *Machine Design for Process Development (Cont.)*

## **Do**

- ★ use pneumatic actuators where possible
- ★ use servo actuators when you need to control motion
- ★ use flexible framing (Bosch or other)
- ★ use off the shelf subsystems when possible

## **Don't**

- ★ directly connect electrical sensors or actuators - go through PLC

## *In Summary*

- ★ Understand your process thoroughly
- ★ Don't underestimate the human element
- ★ Test manufacturing process and product design changes
- ★ Minimize risk
- ★ Design to monitor and adjust process parameters