# Process Mapping (PMAP)

Manufacturing Excellence

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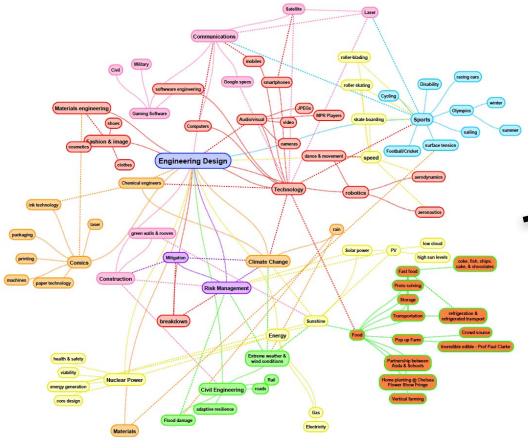
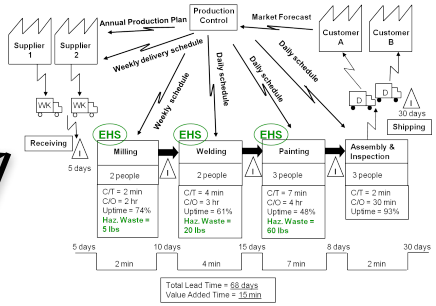
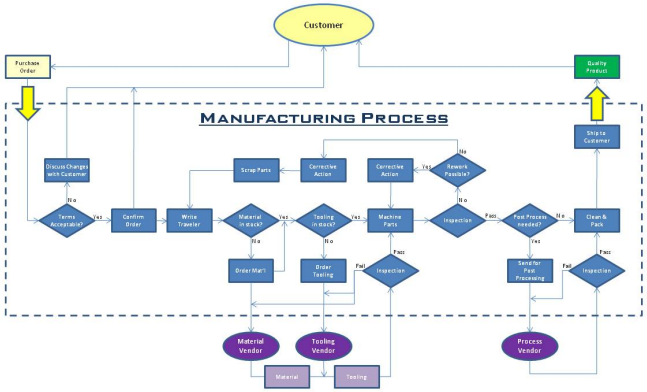
# Mapping Hierarchies




Thought Map (TMAP)




Value Stream Map (VSM)

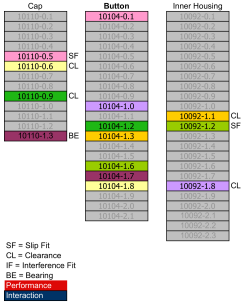


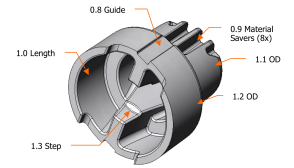

Process Map (PMAP)

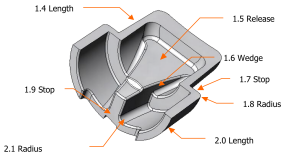
**Feature Function**

0.8 Guide ensures alignment during activation
0.9 Material savers to reduce sinks
1.0 Length of *Button* - stroke safety
1.1 OD of 1st shot defines inner ID of 2nd shot
1.2 OD that travels within the *Cap*
1.3 Wedge safety that when in the safe position the *Fingers* can not "jump" over

$$Y = f(x_1, x_2, \ldots, x_k)$$




Function Map (FMAP)

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# Why Do We Map Processes?

Process Mapping is the basis for all process improvements

A Process Map (PMAP):

- Shows the process in detail with inputs and outputs
- Graphically ‘describes’ the relationships for the areas we choose to study
- A PMAP reflects the reality that previous documentation often misses

Note: Multiple types of process maps are used to improve a process such as: Value Stream Map (VSM), Process Map (PMAP), Swim-lane Process Map, & Functional Process Map (FMAP)

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# Process Maps

- PMAP's are working documents that are to be updated during the life of the process
- In order to **improve** our processes we must be able to see them

- PMAP's can be used to:
  - Characterize the current process
  - Design a new process
  - Streamline an existing process
  - Assess weaknesses in the process

- PMAP's allow us to visualize:
  - Major activities
  - Input and output variables (e.g. specifications, tolerances, settings)
  - Rework loops
  - Supplier requirements
  - Customer expectations

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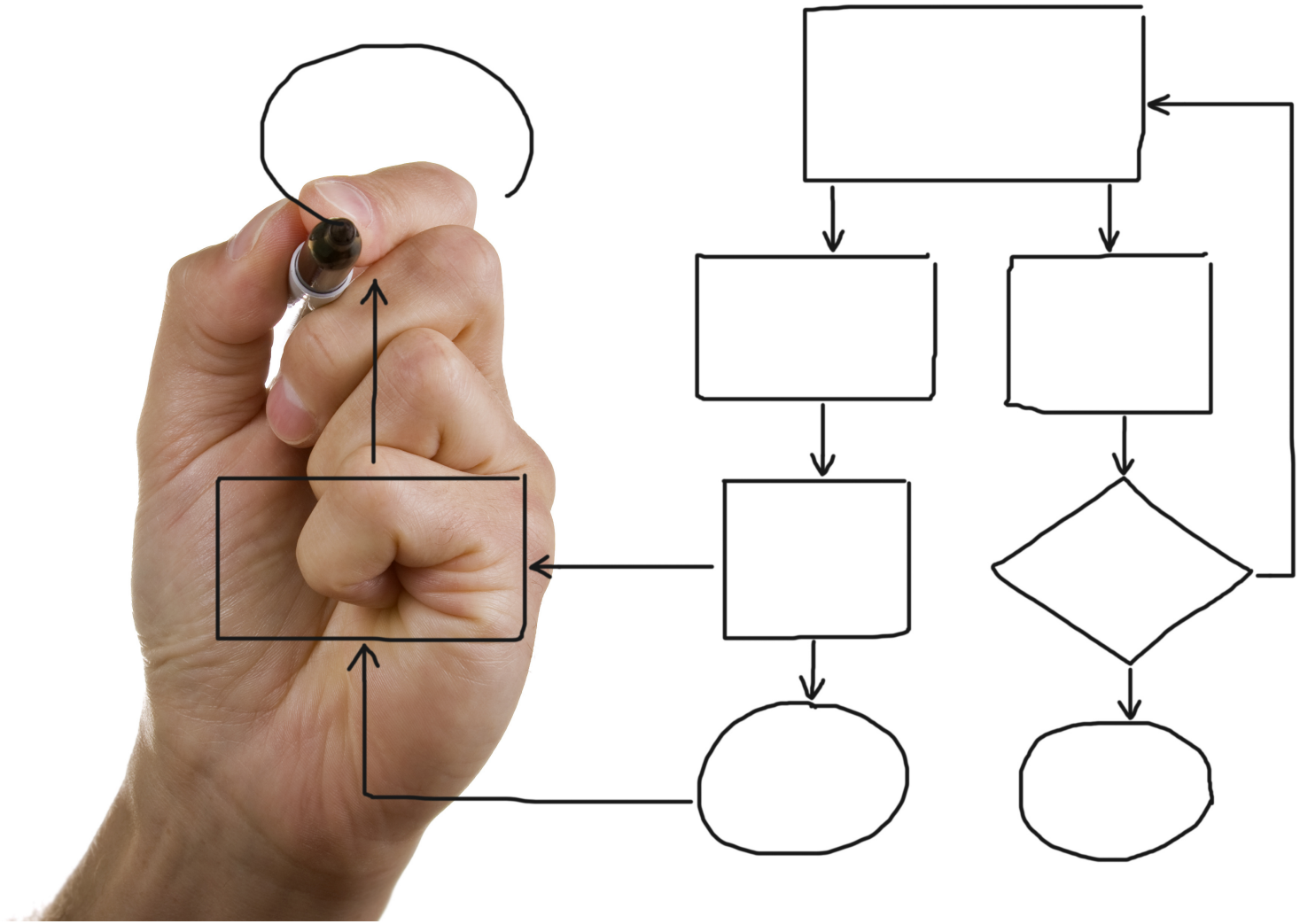
# What Is A Process?



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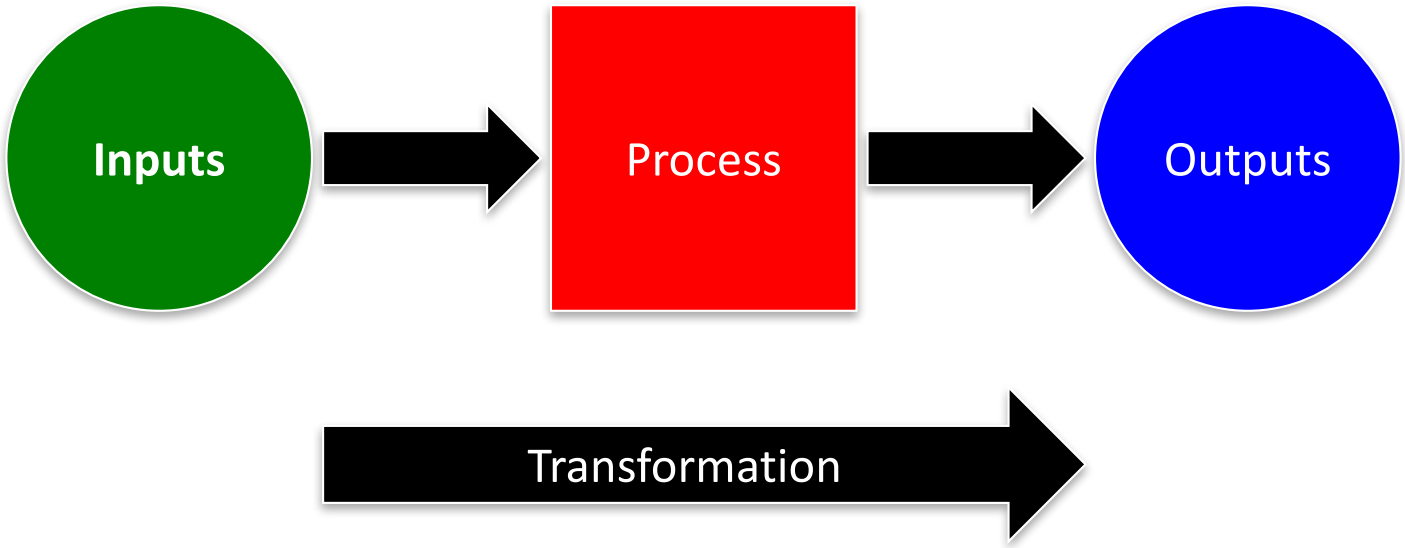
# Elements of a PMAP



# Elements of a PMAP


- Machine
- Material
- Technician
- Coolant

Transformation

Molded Part

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# Preparing to Map the Process

- Team Effort:
  - Cross Functional Process Owners
  - Customers
  - Suppliers
- If the process is existing, walk the process
- Inputs to process mapping:
  - Brainstorming
  - Operators Manuals
  - Specifications
  - Process Owners Experience
  - Fishbone Diagrams

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# PMAP Steps

1. Define process boundaries (e.g. from receipt of material to order shipped)
2. Identify all steps in the process
3. Display process outputs
4. List and classify process inputs
5. Add operating specifications and process targets to the controllable and critical inputs

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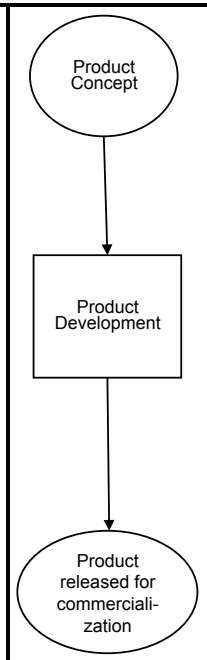
# PMAP Steps

## Step 1 – Define the boundaries

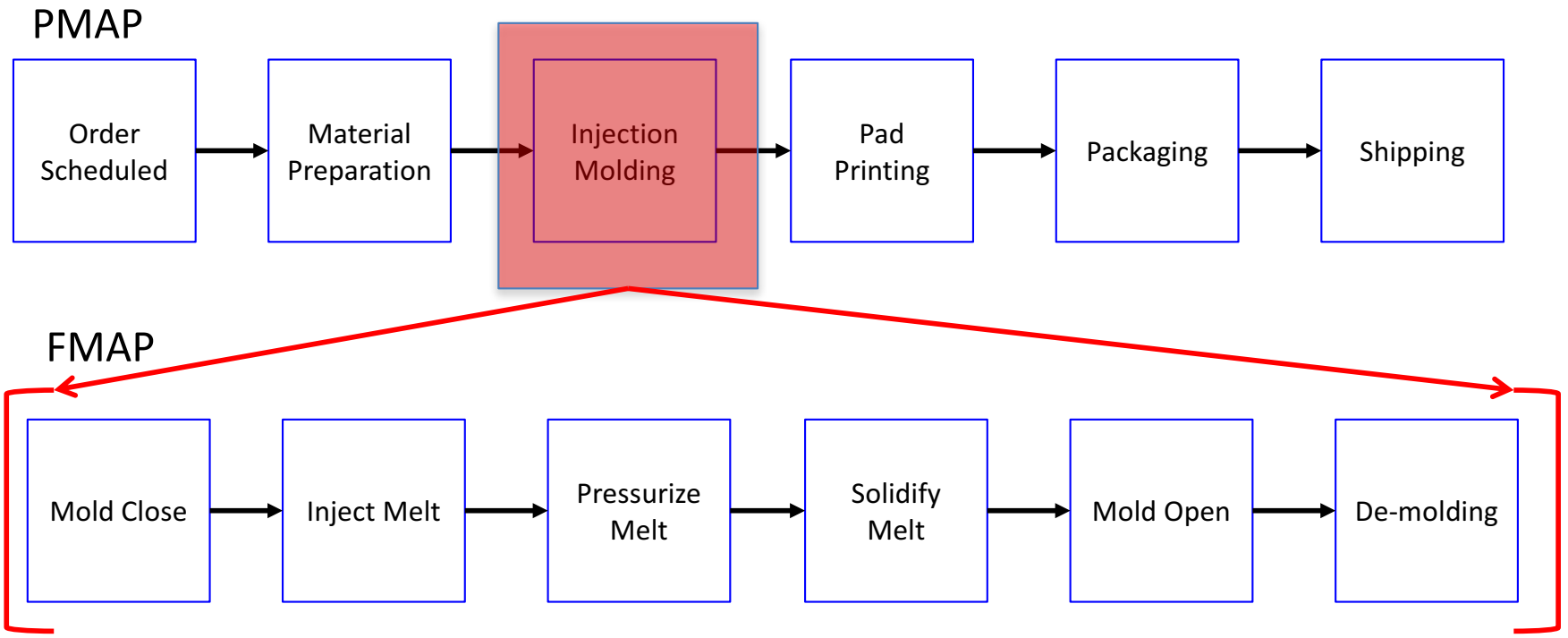
A ‘SIPOC’ (Suppliers-Inputs-Process-Outputs-Customers) is a common way to state the boundaries of a process or a project.  Like most tools that we’ve discussed, the SIPOC organizes your thoughts into a graphical representation of the ‘bigger’ picture.

| **Suppliers** (Providers of the required resources) | **Inputs** (Resources required by the process) | **Process** (Top level description of the activity) | | **Outputs** (Deliverables from the process) | **Customers** (Stakeholders who place the requirements on the outputs) | |
|---|---|---|---|---|---|---|
| | | **Requirements** |  | | **Requirements** | |

# PMAP Steps

Step 2 – Identify all steps in the process

This exercise can be complicated due to the fine line between a Process Map (PMAP) and a Function Map (FMAP). Think of a PMAP as the 'parent' of the FMAP.




Include value added and non-valued added steps (inspection points, rework, etc.)

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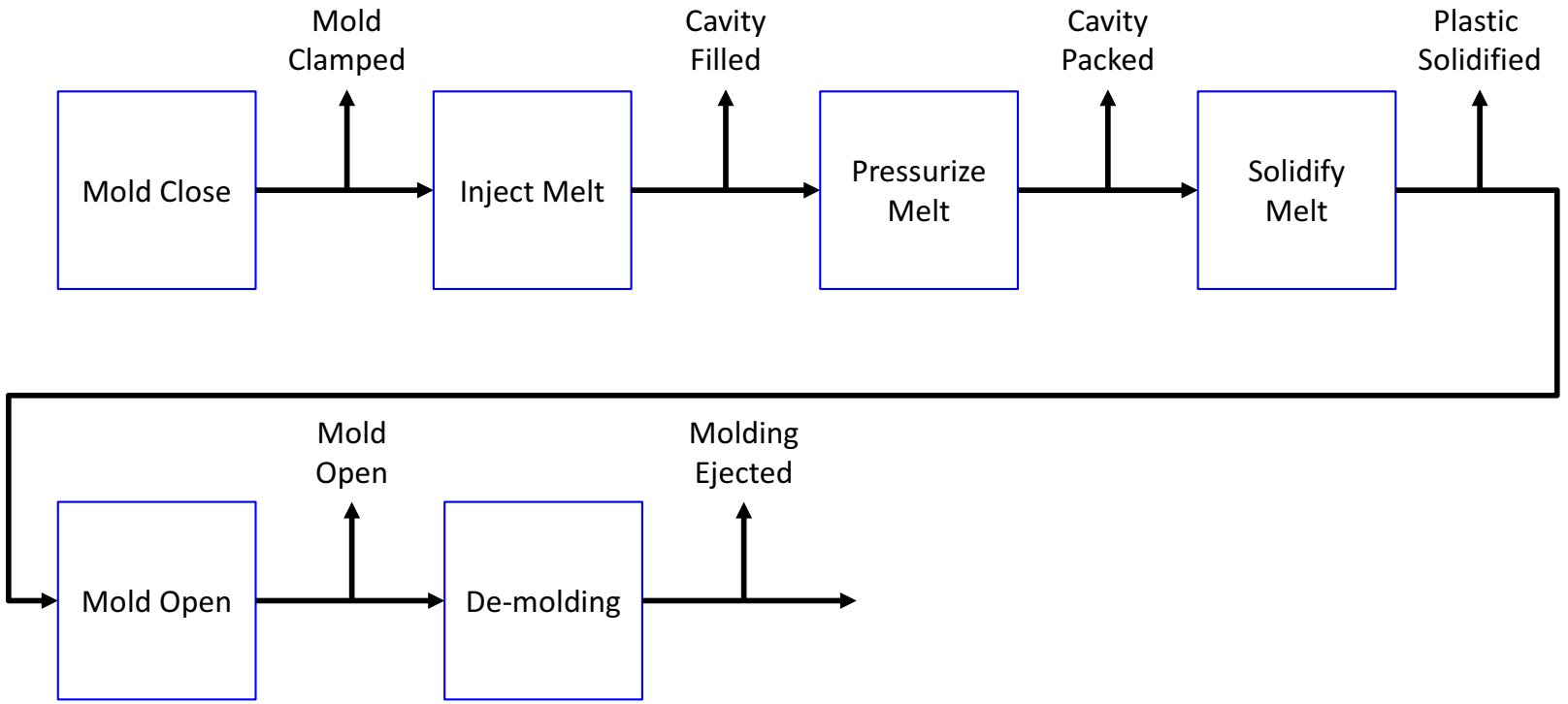
# PMAP Steps

Step 3 – Show outputs at each step

Outputs are those ‘things’ we expect to see at the completion of the step.




Some outputs become final process outputs, while others become inputs to the next process.

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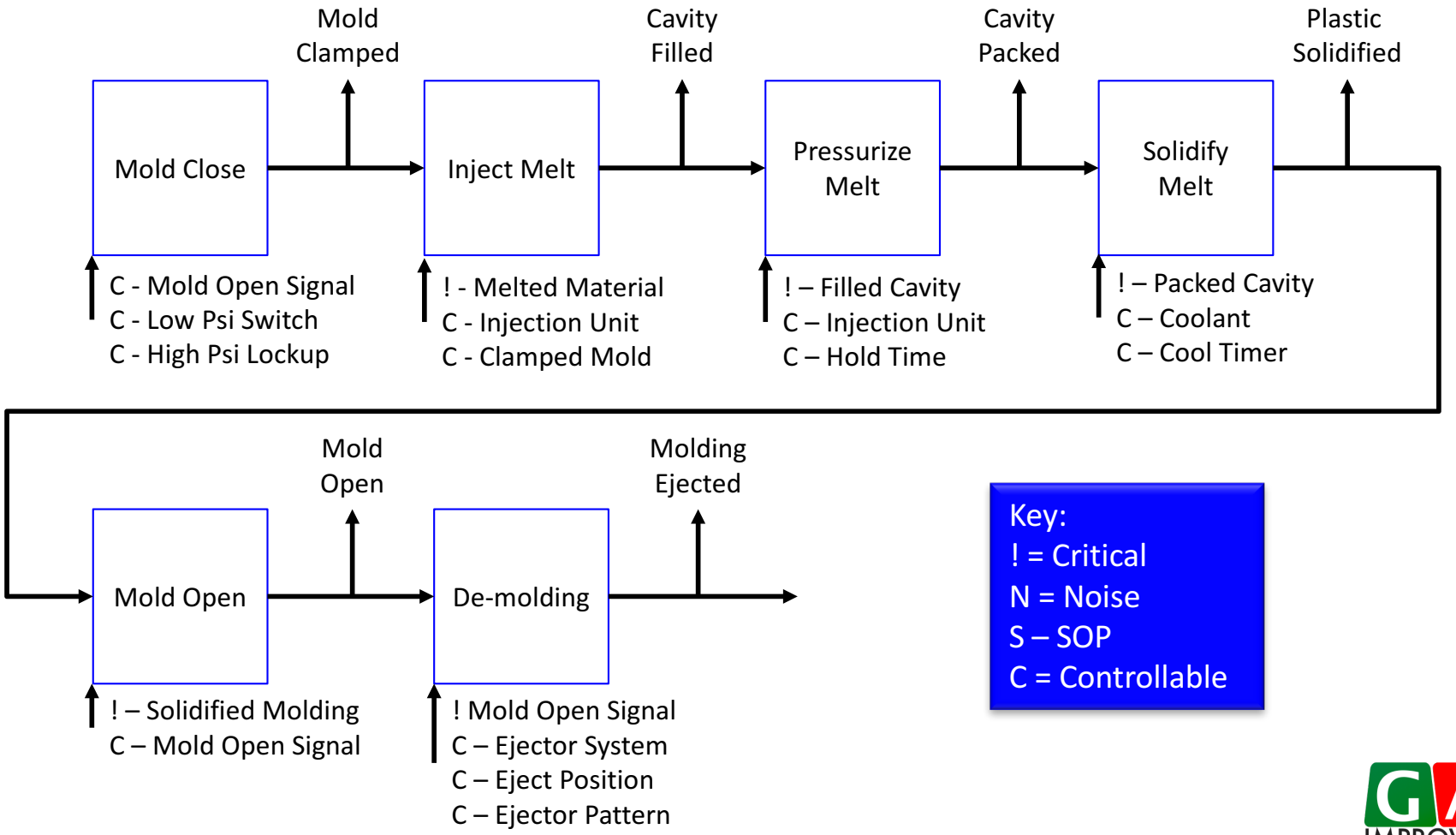
# PMAP Steps

Step 4 – List and classify process inputs

Outputs are those ‘things’ we expect to see at the completion of the step.



# PMAP Steps

Controllable Inputs: Input Variables (x's) that are being changed to see the effect on Process Output Variables (y's). Sometimes called "knob" variables.

Standard Operating Procedures: Documentation or information required for the process to run (i.e. procedures, SOP's, written or verbal instructions)

Noise Inputs: Input variables that impact the y's but are uncontrollable, difficult, or too costly to control. (e.g. environmental variables such as humidity, ambient temperature, etc.)

Critical Inputs: X's that have proven to have a major impact on the y's, proven by tools such as FMEA, DOE, SPC, etc. and significant process knowledge.

Any of the types of inputs can be critical

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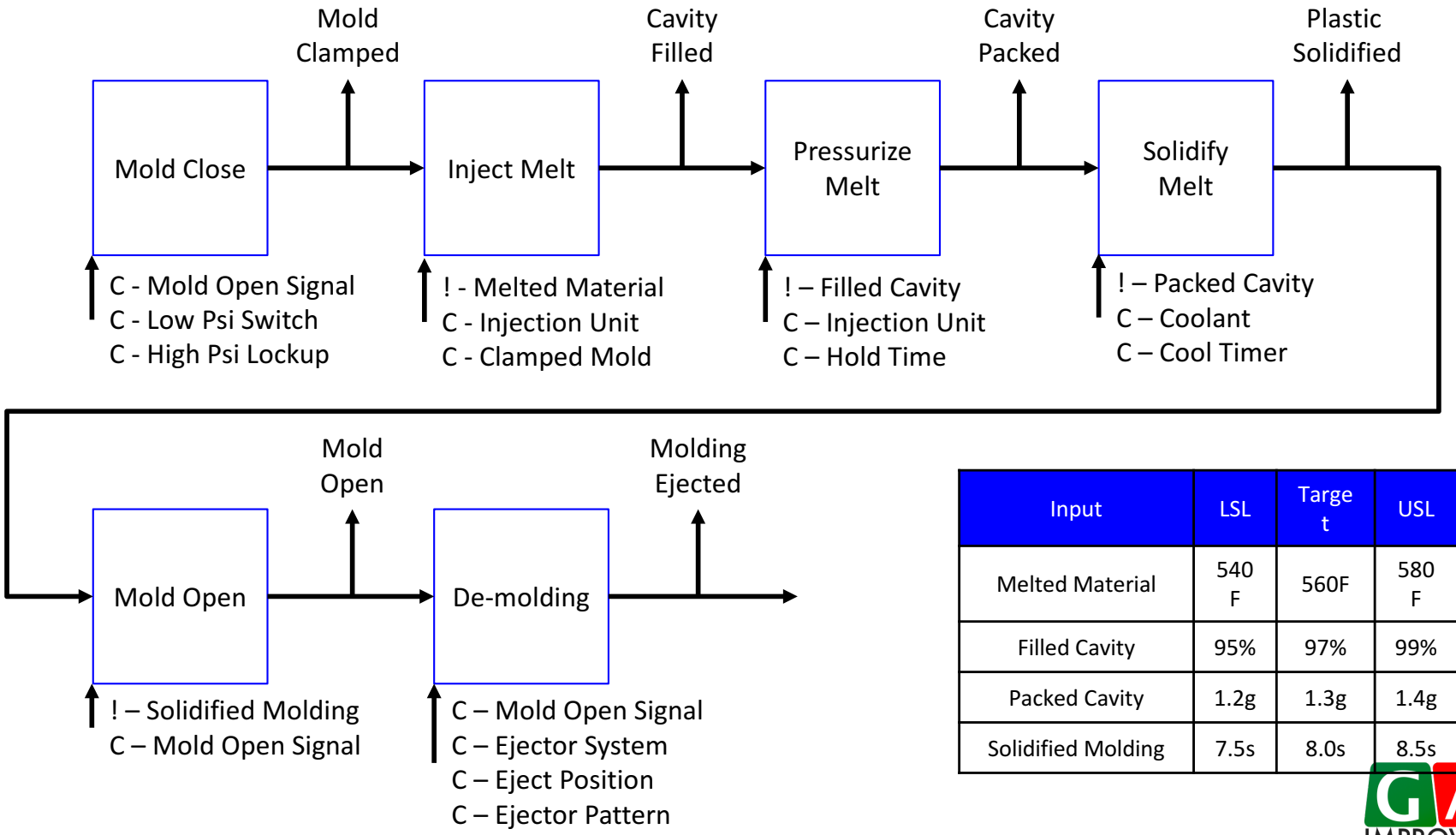
# PMAP Steps

Step 4 – Add operating specifications and process targets to the controllable and critical points




| Input | LSL | Target | USL |
|---|---|---|---|
| Melted Material | 540 F | 560F | 580 F |
| Filled Cavity | 95% | 97% | 99% |
| Packed Cavity | 1.2g | 1.3g | 1.4g |
| Solidified Molding | 7.5s | 8.0s | 8.5s |

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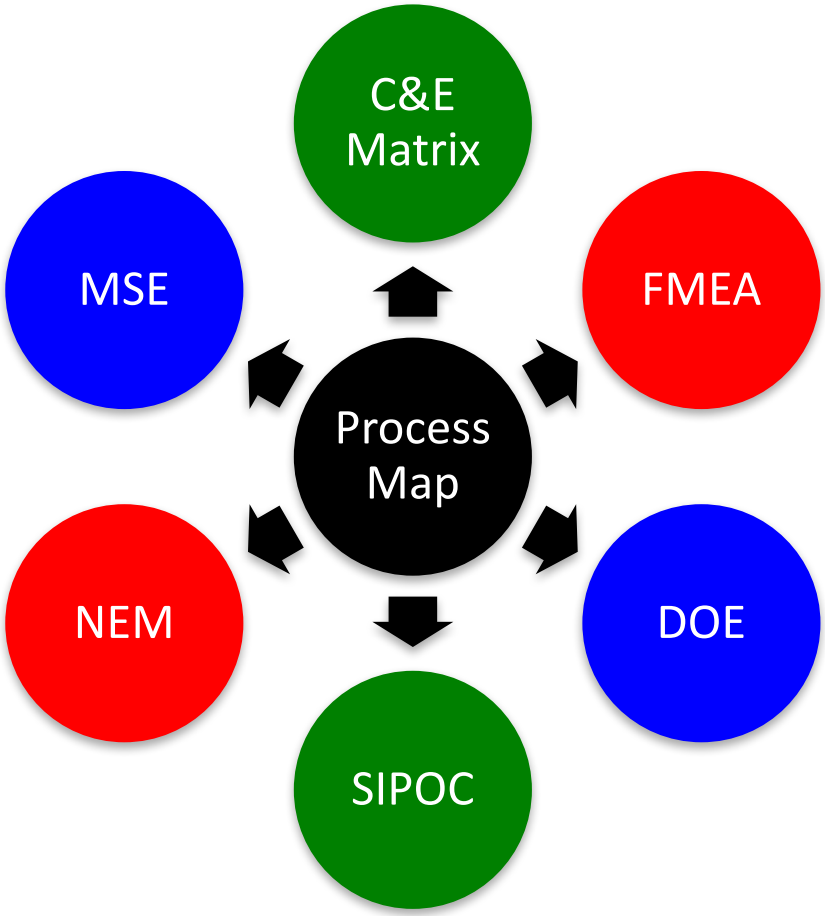
# PMAP




The process map is the foundation for continuous improvement

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# PMAP Exercise


A recently opened bakery has experienced negative customer feedback on the taste of their cakes. Your team has been selected to visit the store and identify the problem. The head baker feels that he has the problem under control and that your visit is a waste of time. How do you begin to resolve the problem?

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# PMAP Exercise

- Based on the problem statement, prepare a process map
- Things to keep in mind:
  - What are the boundaries of the process?
  - What is the big ‘Y’?
  - What are the intended process outputs at each step?
  - How can the process inputs be characterized?
  - Are there any specifications or operating parameters that can be added to the map?

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# PMAP Summary

- Walk the process with a cross functional team
- The process map provides a visual representation of the process
- The process map helps us begin to understand the Y=*f*(x) relationship
- The process map helps us understand the sources of variation that can potentially cause our outputs not to meet our customers requirements

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# Functional Process Maps (FMAP)

- What is a FMAP?
  - Describes what happens within the operational steps of the process
  - Captures the physics of the process
- Why consider a FMAP?
  - If your focus is on improving the function of a process, a FMAP captures the functional elements
  - Provides insight into inputs (x's) that might have otherwise been missed

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# How to Create a FMAP

- Start with a cross section, schematic, photograph or hardware for the product
- Build on known descriptions
- Take the “material” point of view, be the physics
  - For oil leaks, “be the oil”, mapping temperatures, pressures, etc. throughout the oils route
  - For injection mold, “be the material”, map the pressures, temperature, expansion, etc.
  - Think about the energy flow in the system

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# FMAP Summary

- Develop an understanding of the nature of transformations
- Describes what happens within the operational steps of the process
- Be the physics, take a material point of view
- Be the mechanics, take a part point of view
- Build upon known descriptions (schematics, blueprints, etc.)
- Provides insight into the x's that might have otherwise been missed

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# An Questions?

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