



Decision Tree for Selecting and Implementing Direct to Part Decorating Processes

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Reasons to Implement New Decorating Processes

Required to meet new business opportunities

Upgrade of current processes to meet performance or customer requirements

To meet regulatory requirements

To improve process yields and financials



With Plastic Decorating There are Many Technical Solutions

- Paint and Coatings
 - Decorative Coatings (Paint and Ink)
 - Functional Coatings (Hard coat)
- In-Mold
 - In-Mold Labeling
 - In-Mold Decorating (Ink Transfer)
 - In-Mold Materials
- Physical Vapor Deposition
- Plating (Galvanic Process)
- Pad Printing
- Hydrographics
- Thermal Transfers
- Hot Stamping
- Gravure Printing
- Flexographic Printing
- Digital Printing (Ink Jet)
- Dye Sublimation
- Screen Printing
- Flocking
- Laser Texturing
- Laser Ablation
- Laser Marking
- Applied Materials
 - Applied Metal
 - Leather Wrap
 - Three Dimensional Overlay
- Direct Dispense
- Combined Processes
- Associated Technologies
 - Surface Preparation
 - Measurement and Testing



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Decorated Plastic is Used Across Many Industries and Applications

- **Automotive**
- **Transportation (Other)**
 - Heavy Duty Truck
 - Agriculture
 - Recreational Vehicles
- **Aerospace**
- **Appliance**
- **Decorative Packaging**
 - Cosmetics Packaging
 - Containers
- **Telecommunications**
- **Medical**
- **Consumer Products**
- **Finance & Security**
 - Credit / Gift Cards
 - Identification Badging
- **Information Technology**
- **Toy**
- **Advertising**
- **Construction**
- **Electronics**

Each Decision Tree will be Unique



What are the first steps in setting up a decision tree

What do you want to accomplish ?

What are the requirements?

defined by the market

defined by design and application

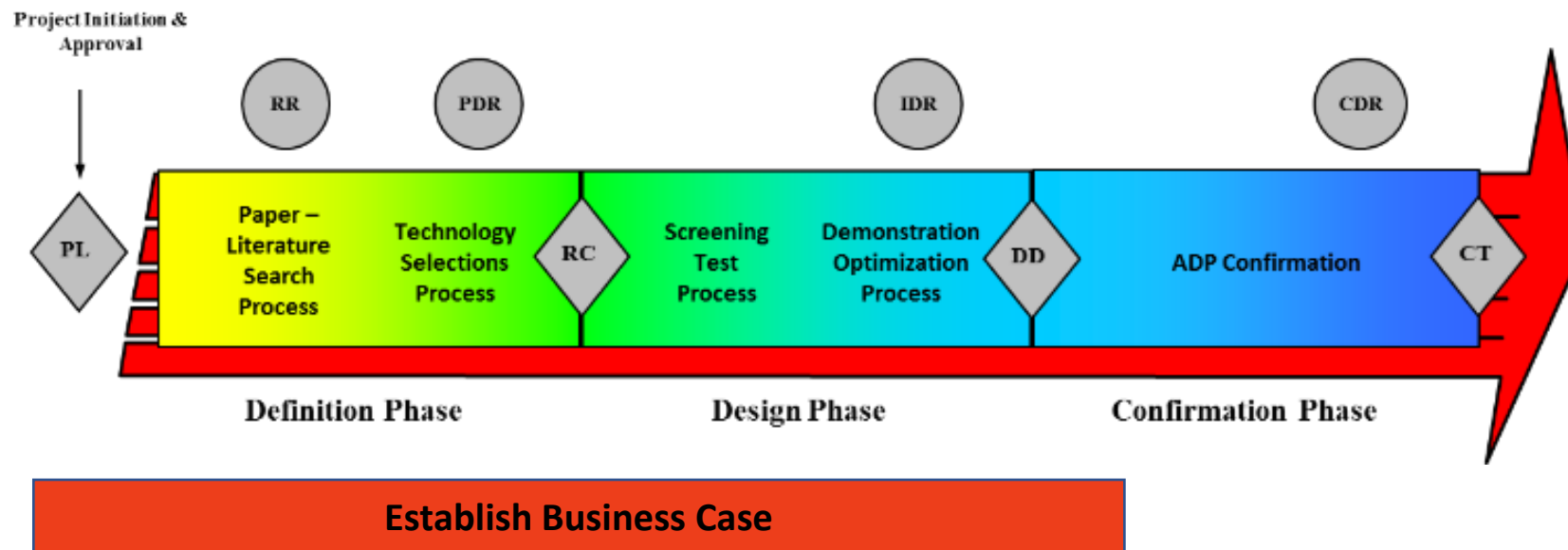
defined by regulation

Select processes to investigate that meet the requirements

Identify the process capabilities and limits

Create a plan to evaluate and implement

Start with a Plan



A structured process which provides a manufacturing ready process



Identify the Deliverables

Bill of Process

Equipment and Tooling SOW
 Recommended Equipment
 Spare Parts and PM

Requirements

Operator Training Documentation
 Material Selection and Validation
 Color Matching

Process Design and Documentation

PFMEA
 Process Specification
 Workmanship Standards

Process Control

MSE and Test Requirements

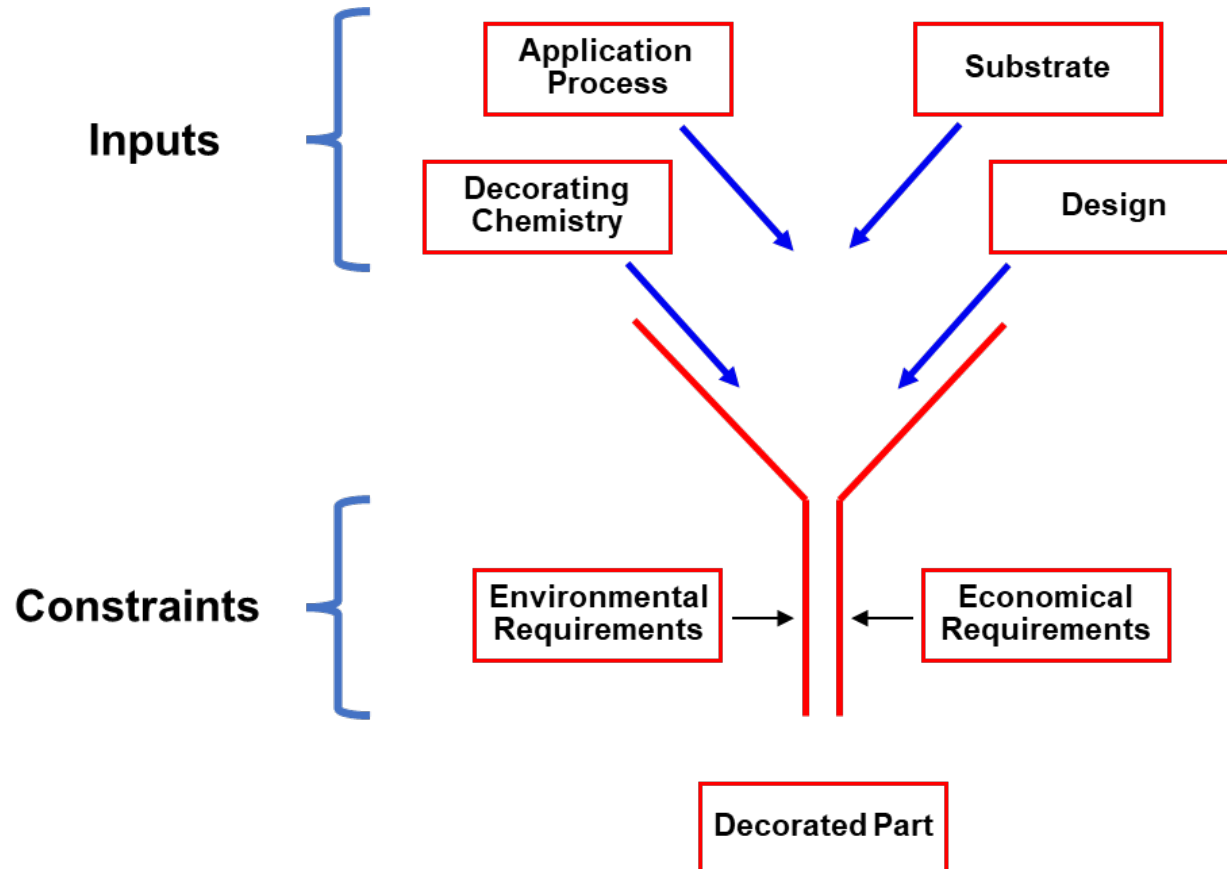
Safety and Environmental Compliance

Deliverables - 6 M's Job Aid

Project Name:
 ADP Project #:

Last Update:		Deliverable	Ref Doc	Phase/NA	Status	Comments/Justification/Action Items	Link to Deliverable Document
Man		Operator Training					
		Maintenance Training					
		Engineering Training					
		Final Report					
Machine		Cost & Lead Time Estimate		RC			
		Specifications (SOW)	LNK	DD			
		Recommended Supplier(s)	LNK	RC			
		PM Schedule		CT			
		Troubleshooting		DD			
		Spare Parts List		CT			
		Buyoff Checklist	MFGE 209.01	DD			
		Changeover Time Estimate		DD			
		Design Requirements/Drawings					
Tooling		Recommended Supplier(s)	LNK				
		Cost & Lead Time Estimate	LNK				
		Changeover Time Estimate					
		PM Schedule					
Materials		MSDS	LNK				
		Materials Documentation	DE W/ 208.04.01 DE W/ FOR 208.04.01A				
		Supplier Selection	LNK				
		Critical Interactions					
		Capability/Limitations					
		Storage/Handling Reqs					
		Cost & Lead Time					
		C-Specs/Q1000 Specs	GES				
		SFPOO TMAP	LNK				
		Control Methods/Plan	LNK				
		System Integration Reqs					
		Process Map	LNK				
	Cycle Time						
Method		Reliability Characterization					
		Process Parameter Spec Limits					
		Error Proofing Methods/Plan	DE 204.80.1 Process Error Proofing				
		Containment Methods/Plan	LNK				
		DFM Analysis	(DE 204.78) Process FMEA http://img.plmcentral.com/bpc/legis/fin/3df/plmapp				
		Baseline PFMEA	DE 204.78 Process FMEA				
		DRBFM	MSE Design Review to Control Mode				
		Raw ork Process					
		KPCs and KOCs	DE 204.08				
		FIS	LNK				
		Workmanship Standards	DE FOR 1102.01G Workmanship Standards Verification Checklist				
Measurement		Design Standards	LNK				
		Required Practices					
		Preliminary Work Instructions					
		Calibration Schedules					
		Equipment/Tooling Software					
		Test Software	MFGE 210.01				
		Preliminary Process Specification	MFGE 205.01				
		Capability/Limitations Results (Cpk>2.0 or PPK>3.4)	(MFGE 211.01) MSA				
		MSA/MSE - Critical Inputs	(MFGE REF 211.01A) (SR) (MFGE REF 211.01B) (Res see above)				
		MSA/MSE - Critical Outputs					
Mother Natur		Safety/Ergonomics Compliance	LNK				
		Facilities/Utilities	LNK				
		Environmental, Health and Safety	LNK				
	ESD Requirements	DE 1106.01					

Key Factors in Decorating Plastics



The foundation is defining a set of materials for the decoration and substrate that work in the application.

Then consider the product design, application process, and production volume.



Where to Learn About Decorating Technologies

Professional Societies and Associations

You get out what you put in

Conferences

Webinars are a poor substitute

Trade and Professional Publications

Include those in adjoining fields

Market Research Organizations

Internet Searches

Can be misleading

Sales and Marketing Organizations

Supplier visits and webinars

Benchmarking



Additional Places to Look

- **OEM Consumers**
 - **Quote Packages and Technology Wish Lists**
- **Industry Trends**
- **Adjacent Market Technology Trends**
- **Standards Activities**
- **Government Regulations and Legislation**
- **Government Initiatives / Programs**
- **University Research**
- **Supplier Roadmaps**
- **Open Literature**
- **Patent Activity**
- **Competitive Trends**
- **End Consumers**



Benchmarking

Visit plants whenever you have the opportunity

There is something to learn in every manufacturing facility

List what you want to learn before you start

It is too easy to miss important learning opportunities

Look to surrounding industries

Industries desiring similar outcomes

Supplier Evaluation Visits

Technology, desire and capability to support the project

Do teardowns of complete parts (and unrelated parts)

Anything in production is a rearview mirror



The Foundation is Knowing the Requirements

**Unfortunately Even With the Best Plans New Processes
Sometimes Fail to Meet Exceptions**

**Usually Due to a Failure to Capture or Understand
Requirements and Constraints**



Capturing Requirements

Regulations

- Health and Safety
- Environmental
- Permissible Materials

Customer Specifications

- Material / Performance Specifications 

 - Approved Supplier Lists

- Process Specifications

 - Specific Cleaning Instructions

 - Continuous vs Batch Processes

- Product Specific Requirements

 - Differ within a given end customer 

- Communication to Tier 2 and 3 suppliers



Capturing Requirements (2)

Machine Requirements

Utilities

Electrical, Air, Cooling Water

Stack Permits

Machine Footprint



Adequate Accessibility for PM, Material and People Movement

Process / Material Requirements

Material, People, and Waste Flow

Mapped and Understood

Changeover and Setup Process

Required Pretreatment

Cleanliness

Parts, Air



Time Between Process Steps

Environmental Requirements

Temperature, Humidity



Acceptable Rework



Other Things to Consider

System type

Turnkey?

Level of Automation

Leadtime

Process Maturity

Including supplier experience

Supply base stability

Spare Parts

Service Contracts

Warranty

Operational Availability

Uptime

Required change over time

Maintenance time



Measure and Communicate the Requirements

Requirements by Importance

Requirements New Process Rev Date		UGLUM CONSULTING									
Technical Requirements	Verification	Relative Importance	Meets Defined Target	Meets Approved Budget and Business Plan	Can be grouped but list separately	Can be grouped but list separately	Defined Measurement Method	Cross Hatch - Tape Pull Test Per ASTM D3330M using TESA 4657	No Material Removed	Visual Match to Standard	Or Defined Instrumental Method with acceptable tolerance
Cost	2		X								
Regulatory Requirements	3										
Customer Requirements	4										
Position Accuracy	5					X					
Adhesion	6						X				
Color	7							X			
Abrasion - Wear	8										
List Additional Requirements	9										
	10										
	11										

Verification Method

Identify All:

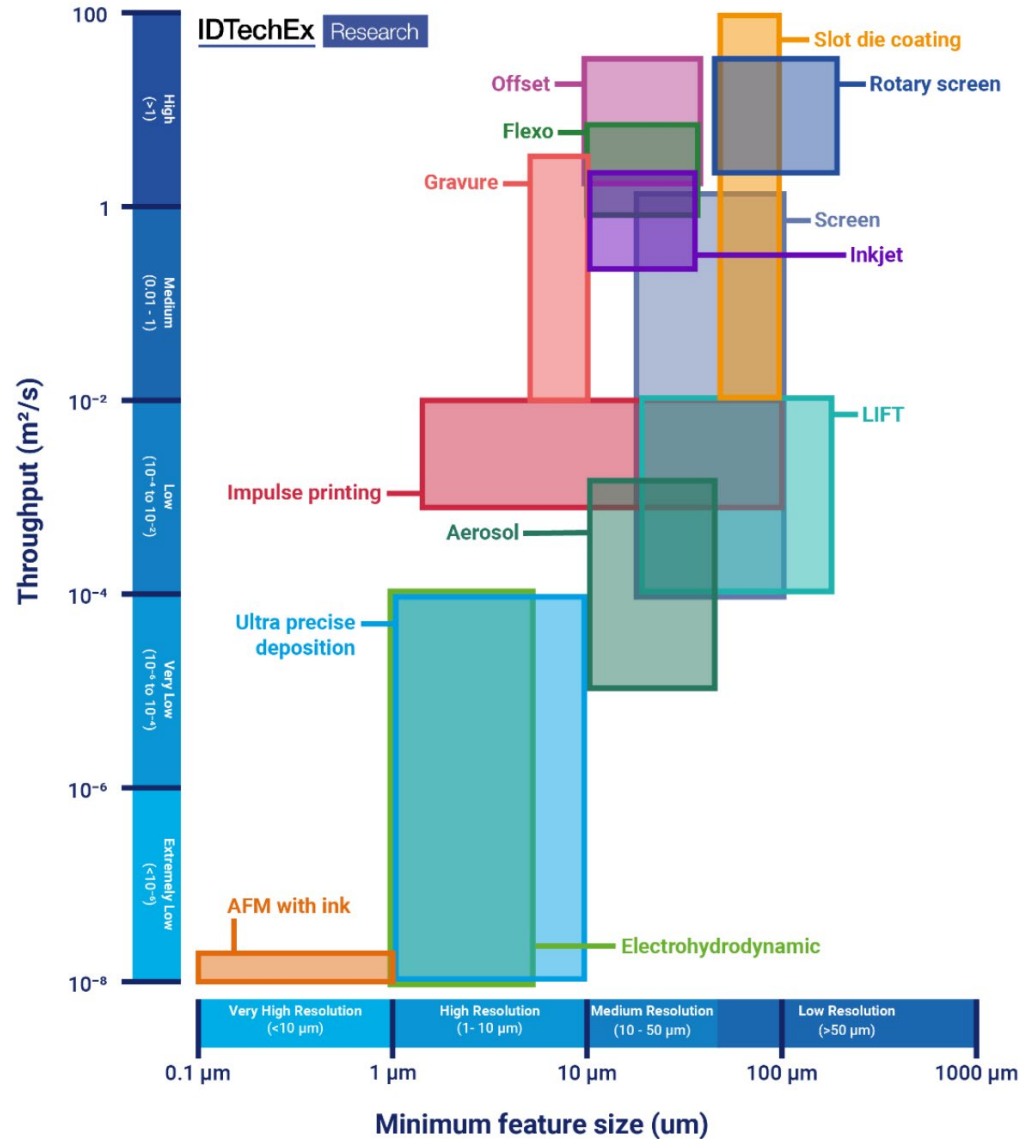
- Business Objectives
- Regulatory Requirements
- Customer Requirements
- Equipment Requirements
- Performance Requirements
- Operating Environment

Establish:

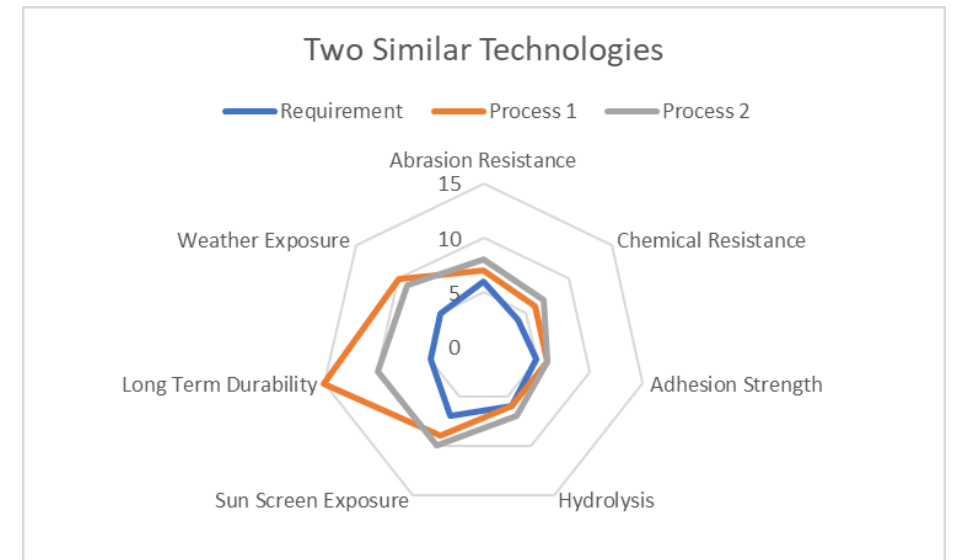
Verification Methods



Compare the Critical Characteristics of the Potential Options



Create a structure to evaluate the relative performance of the possible processes vs the desired characteristics.





What is the Technology Maturity?

Lab-Like

Factory- Like



Proof of Science



Proof of Technology

Demonstration of critical structure feasibility



Demonstration and integration of critical structure

One of a kind working



Repeatability, scalability, Six Sigma methodologies

Extending Science



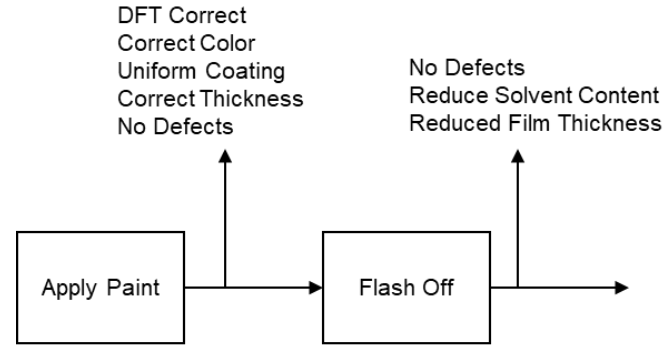
Technology roadblocks related to applications

Motorola Model



Map the Process

P Map



Other Important Maps

Identify Part Flow

Identify People Movement

Identify Waste Flow

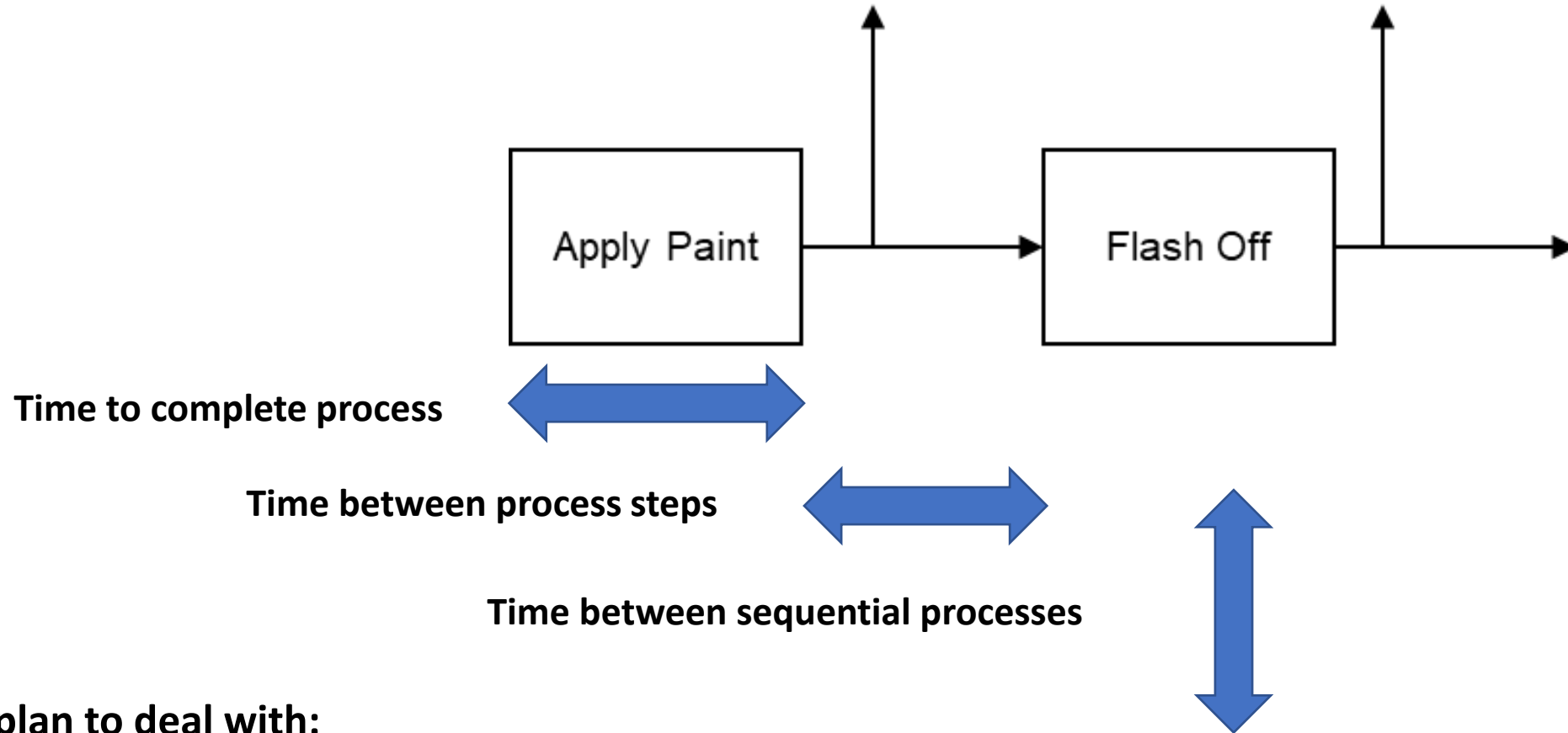
Work Instructions **S**
Settings
Atomization Pressure
CR
Flow Rate **CR**
Fan Pattern **C,S,N**
Spray Gun **C,S**
Type **CR**
Tip **N**
Distance/Angle **S**
Rotation Speed **S**
PM (clean) **S,N**
Environment **C,N,S**
Temperature
Humidity
Air (clean & pressure)
Conveyor Speed **C,S**
Air Lines **N**

Air Temperature **C,S**
Part Temperature **C**
Conveyor Speed **C,S**
Humidity **N**
Air Flow Rate **N**

Measurement Tools
Visual Inspection **S,N**
Spectrophotometer **S**
Laser gage **S**



Time During and Between Process Step



Have a plan to deal with:

- Machine Shutdowns due to scheduled breaks
- Power Outages or Machine Failure
- Multi Process Constructions



Lessons Learned

Are you buying a pony

Total cost of ownership



Toddlers

Process Maturity – New Processes means new defect modes

Risk of the unknown



Oil and Water

Including how it will interface with the plant and other processes

Conflicting needs

Wernher von Braun (over the wall)

This includes the plant, suppliers and design engineers

Identify the “why” behind instructions for machine operators





Actions for Success

Have a clearly defined process for introducing a new technology

Clearly Defined Deliverables

Responsibility for each step

Choose the right Team Members

Understand both the technology and the tools

Take time to understand the process

Including how it will interface with the plant and other processes

Understand and document all requirements

Clear methods for determining if the requirements are met

Communicate requirements with all participants

This includes the plant, suppliers and design engineers

Identify the “why” behind instructions for machine operators



Contact Information



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Backup



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		Deliverable	Ref Doc
Machine	Man	Operator Training	
		Maintenance Training	
		Engineering Training	
		Final Report	
	Equipment	Cost & Lead Time Estimate	
		Specifications (SOW)	LINK
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Method	SIPOC/ TMAP	LINK
	Control Methods/Plan	LINK
	System Integration Reqs	
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	Process Parameter Spec Limits	
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	Baseline PFMEA	(DE 204.78) Process FMEA MFG Design
	DRBFM	Review by Failure Mode
	Rework Process	
	KPCs and KCCs	DE 204.08
	FIS	LINK
	Workmanship Standards	DE FOR 1102.01G Workmanship Standards Verification Checklist
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