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Virtual Environment Technology Centre - just the beginning ...
Ahamed, S. S.

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Integrated Manufacturing Technologies Institute

Virtual Environment Technology Centre



Just the beginning...

May 17th, 2001

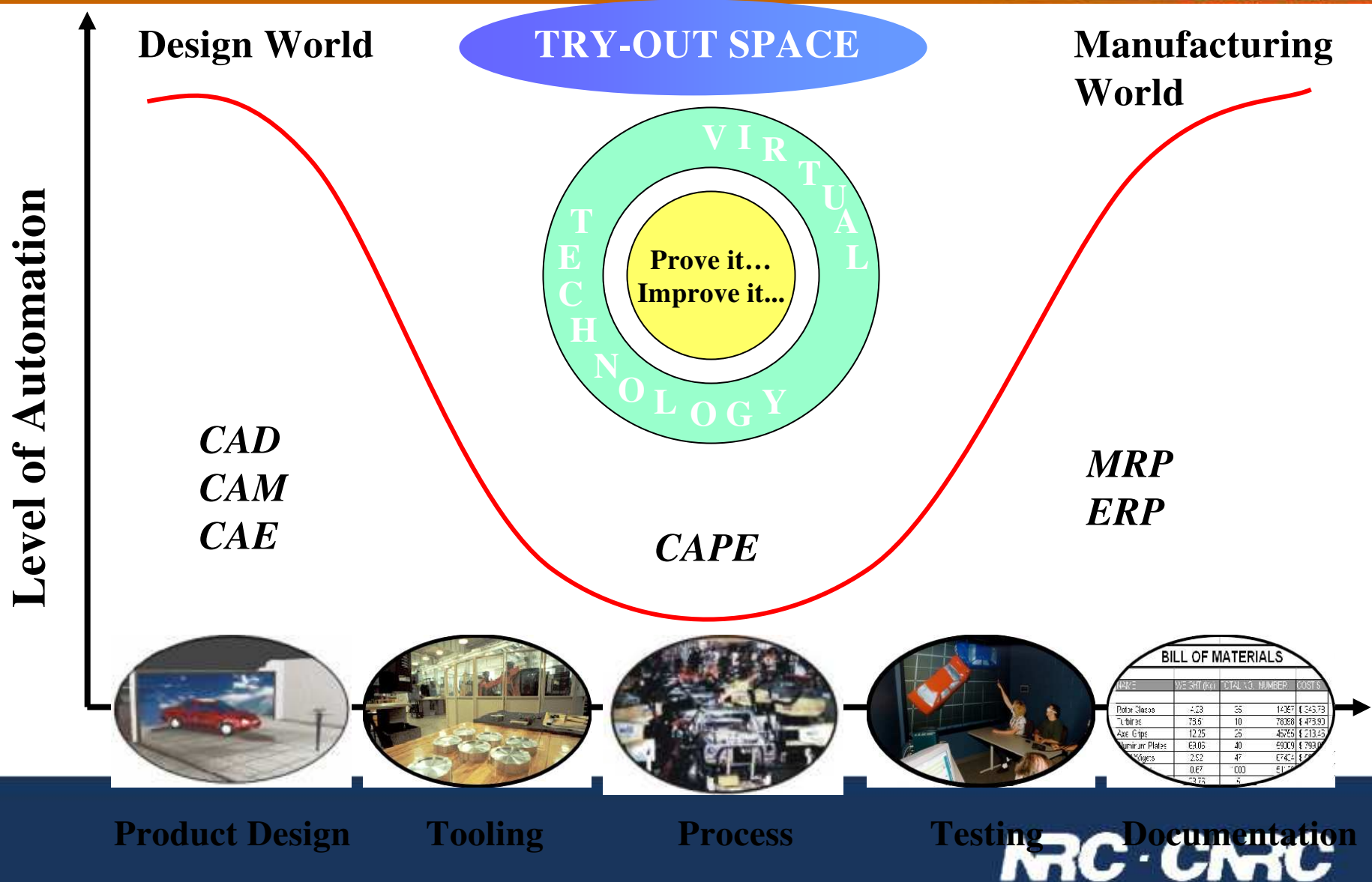


National Research
Council Canada

Conseil national
de recherches Canada

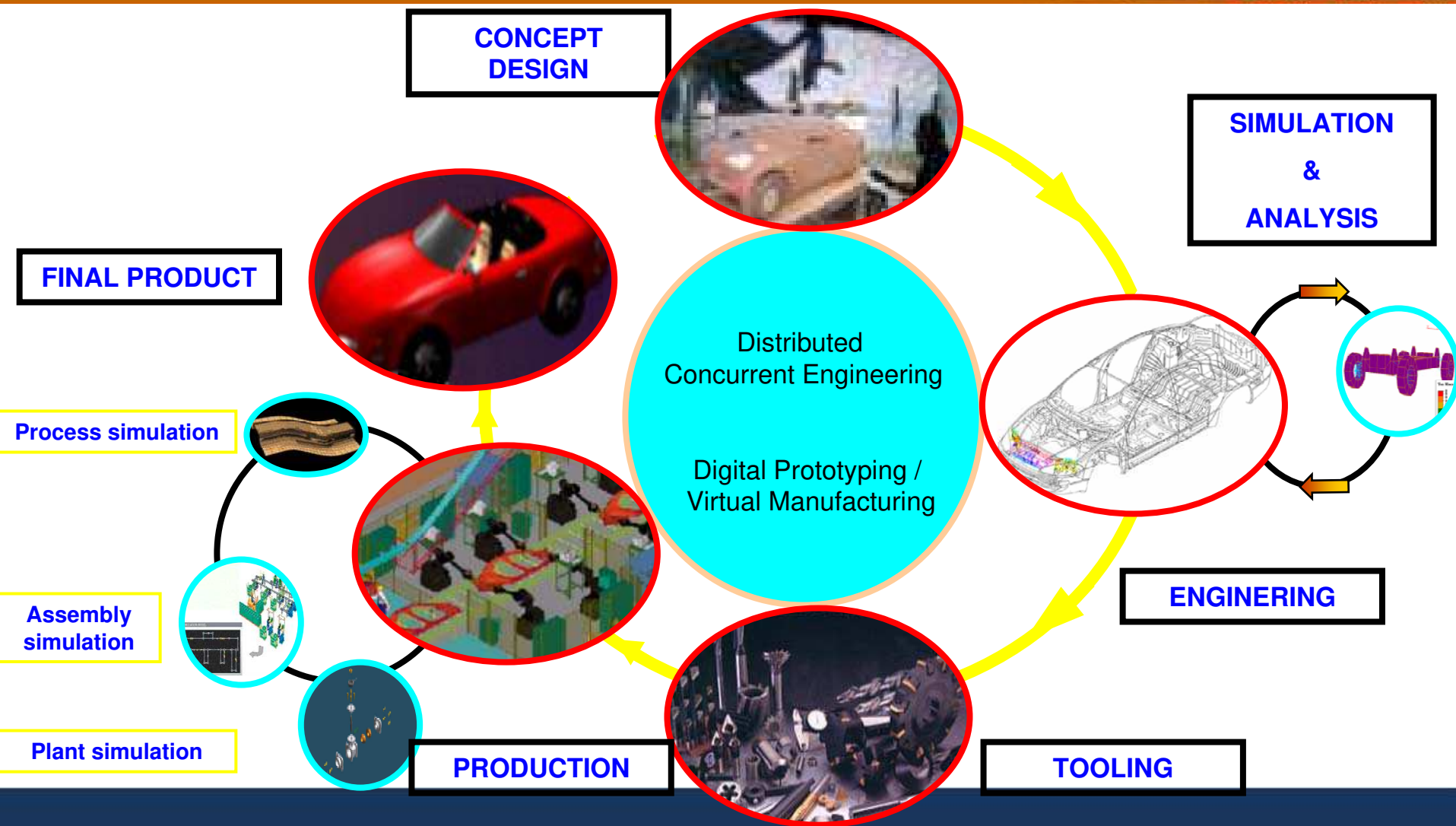
Canada

Design and Manufacturing gap

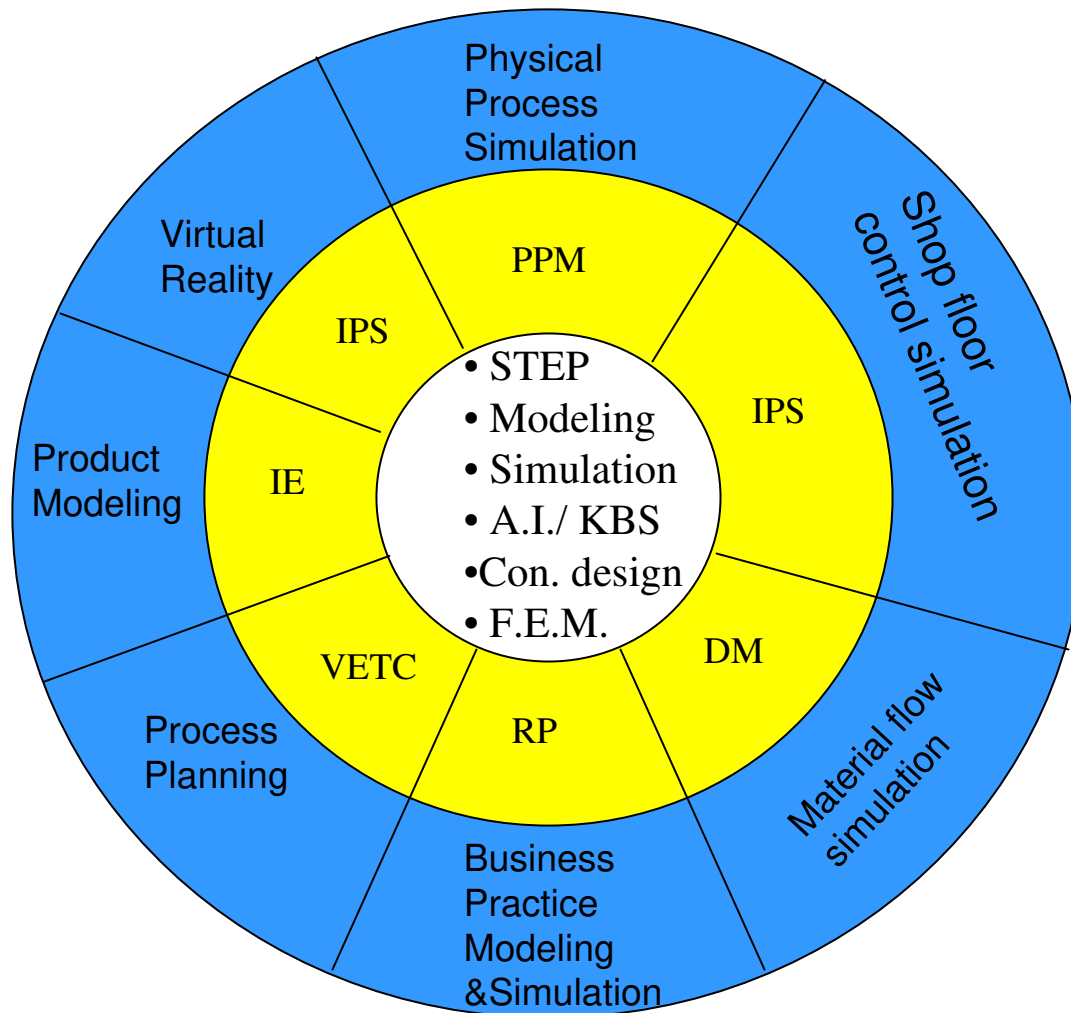


Art to Part in the Digital World

- from concept through production

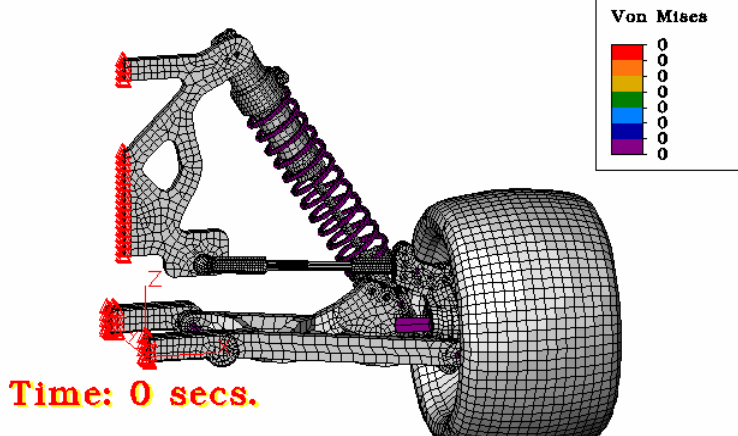


Virtual Manufacturing @IMTI

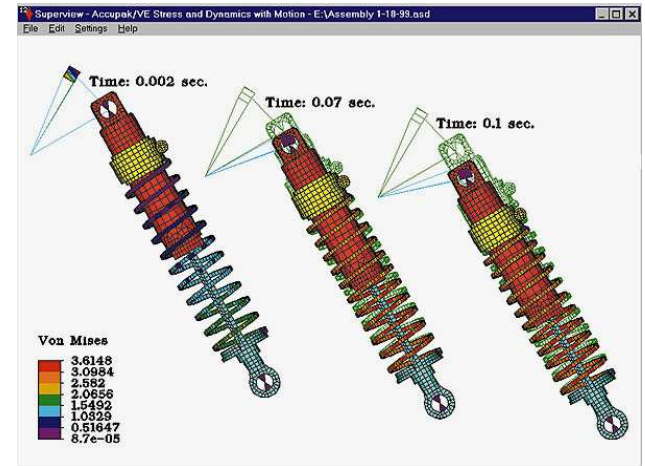


Design decisions based on simulation

MOTION

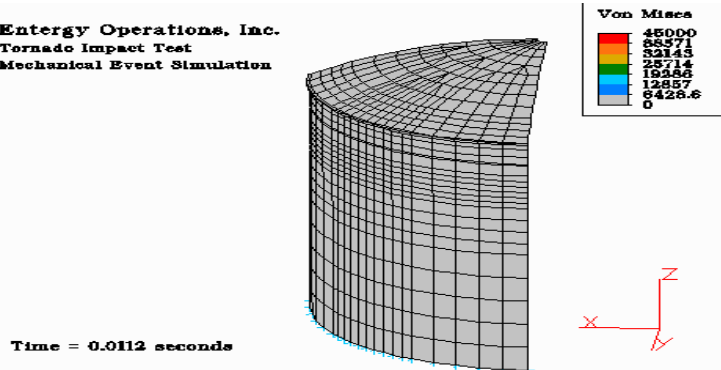


Source: Algor Inc

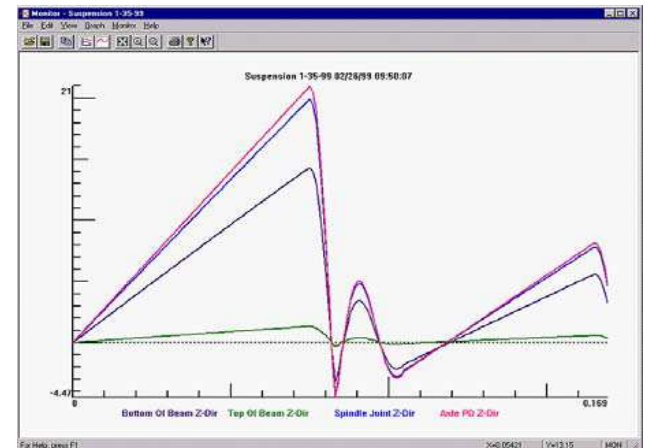


IMPACT

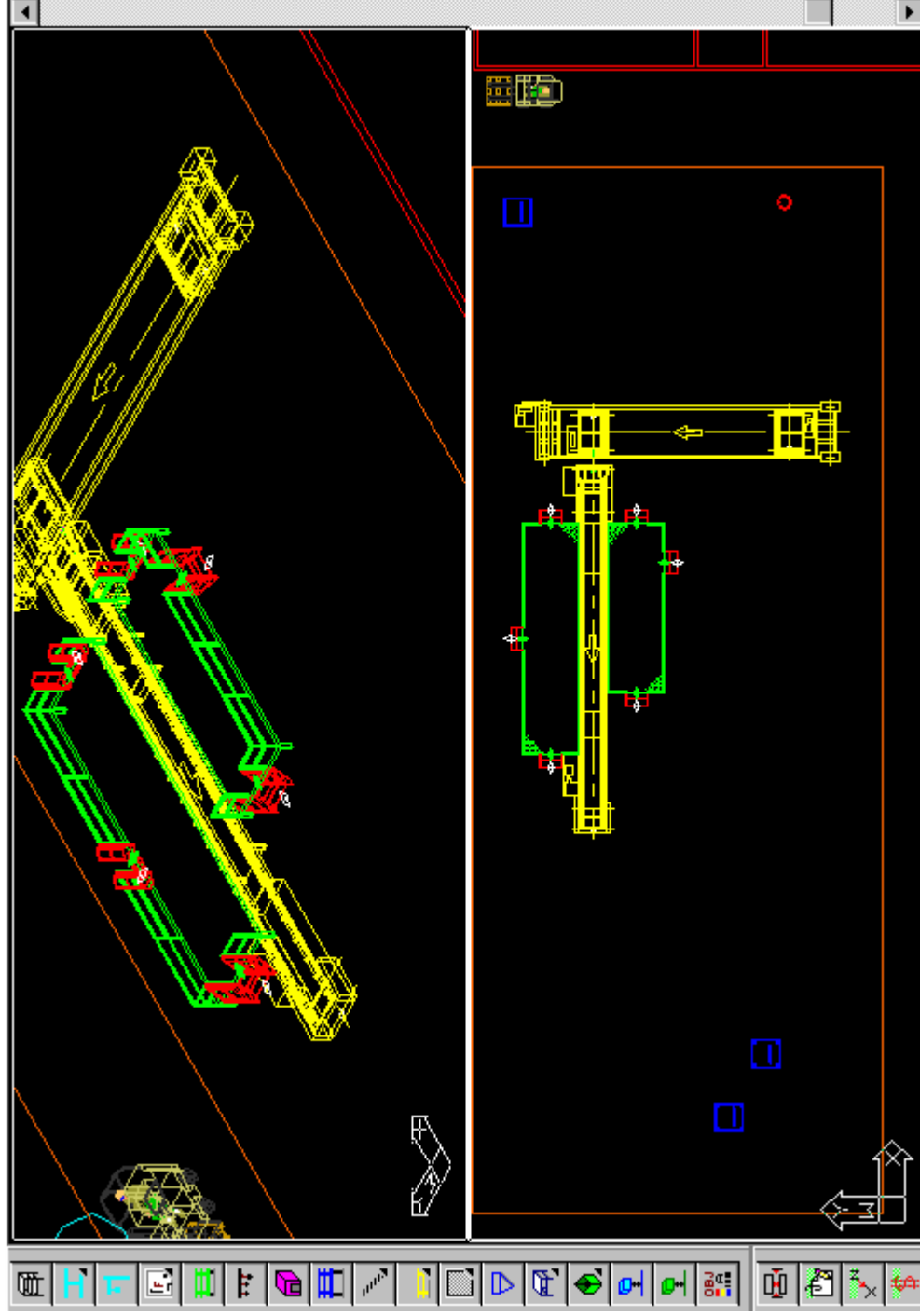
Entergy Operations, Inc.
Tornado Impact Test
Mechanical Event Simulation



Source: Algor Inc

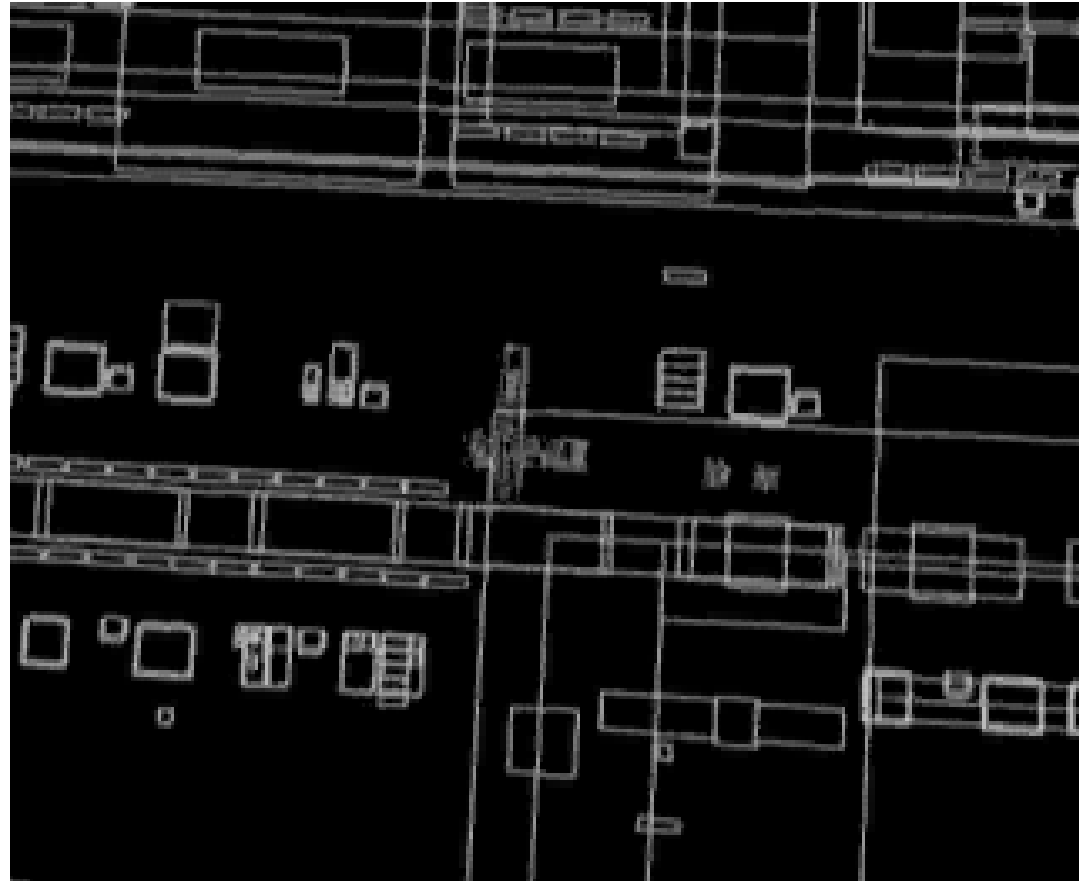


Operational Analysis



Plant Design and Layout

- ▶ Design and verify before implementation
 - Plant layouts
 - Plant processes
- ▶ Reduce design time
- ▶ Reduce design cost
- ▶ Improve production efficiency





Benefits of an effective plant layout:

- Efficient material handling
- Less space
- Optimum flow of material
- Less WIP area



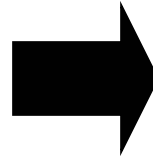
Symptoms of an ineffective plant layout:

- Bottleneck
- High Inventory
- Accidents
- Huge overtime
- Low utilization
- Late deliverables
- High scrap



Plant layouts for Lean Manufacturing:

Lean manufacturing
is a process to
eliminate non-value
added operations



- < Cycle time of product
- < Inventory
- < labour
- < Overtime
- > productivity
- > Capacity
- > Flexibility

Plant Design and Layout



Value added tasks:

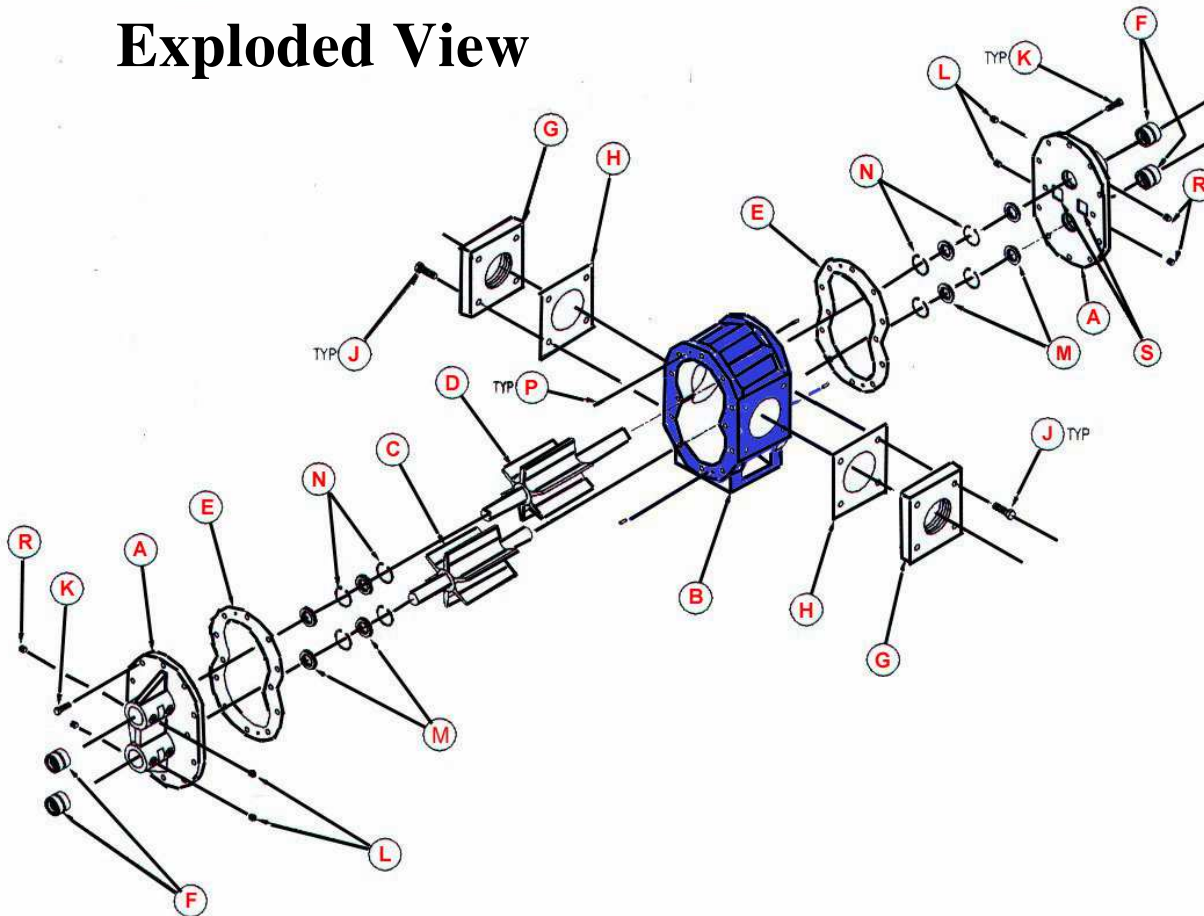
- Material that becomes product
- Inspection process

Non-value added tasks:

- Waiting time
- Unwanted/improper process
- Improper tools and machines

Plant Design and Layout

Exploded View



B.O.M

Symbol	Part Number	Description	Quantity
A	01B*	End Case	2
B	03	Center Plate	1
C	04B	Idler Gear w/SS Shaft #	1
D	05B	Drive Gear w/SS Shaft #	1
E	06*	Pump Case Gasket	5
F	08*	Bearings	4
G	10	Adapter Flanges	2
H	11	Flange Gaskets	2
J	12	Flange Bolts	8
K	14*	End Plate Bolt	24
L	15*	Grease Fitting	8
M	17*	Seals	8
N	21*	Snap Rings	8
P	19*	Alignment Pins	4
R	24*	Set Screws	4

Plant Design and Layout

Process Plan:
Product Name: Pump
No. of Subassemblies: 6

Company: Prime Pumps Inc.

No.	Description/Operation	Qty	Material	Notes
<i>Sub-assembly No. 1: NAME: Vale body casting</i>				
1.	Acquire material	1	CI 205-349	Seasoned > 6 months
2.	Load on Machining centre			Use Jig No. 1045A
3.	Face bore and tap 2 ends			Tools T125 & M32
4.	Work in Process			
5.	To mill			dimensions in drawing
6.	Broach flats			Use power broach
7.	To plating			Acid clean before
8.	Work in progress			
9.	To Galvanize			Salt water spray before
10.	To storage			
<i>Sub-assembly No. 2: NAME: Gland Cap Hex bar</i>				
1.	Acquire material	2	PR 423 -432-A	
2.	To press			Straighten the bar
3.	Form the material			Use allowances
4.	To inspection			
5.	Clean and protect			
6.	Work in progress			
7.	Inspect before use			
<i>Sub-assembly No. 3: NAME: Gland Body casting</i>				
1.	Acquire material from storage	1	CI 205-349	
2.	Turret lathe			Use 8 station
				no change setup till finish
3.	Face turn, bore and tread			TAP - 204
4.	Work in progress			
5.	To Broach			
6.	Broach flats			
7.	To plating			
8.	Galvanize part			
9.	Inspect			
	Work in progress			

No.	Description/Operation	Qty	Material	Notes
<i>Sub-assembly No. 4: NAME: Disk ring</i>				
1.	Acquire material from storage	4	CR 202-43	
2.	Machining center			Use soft jaw
3.	Complete periphery machining			Use soft clamps
4.	To inspection			
5.	Work in progress			
<i>Sub-assembly No. 5: NAME: Disk casting</i>				
1.	Acquire material from storage	1	CI 205-349	
2.	Turret lathe			
3.	Turn and thread			
4.	To inspect			
5.	Work in progress			
<i>Sub-assembly No. 6: NAME: Stem bar stock</i>				
1.	Acquire material from storage	1	MA 89-22C	
2.	Turret lathe			
3.	Turn, thread and cutoff			
4.	To machine center			
5.	Mill ends			
6.	Inspect			
7.	Work in progress			
<i>Assembly: No. 1 NAME: Pump</i>				
1.	Acquire materials			from storage for items 1 - 6
2.	Assemble			
3.	Inspection			
4.	Package			
5.	To warehouse			

Plant Design and Layout

AFFINITY CHART

	Description	1	2	3	4	5	6	7	8	9	10	11	12	13
1	RECEIVING													
2	SHIPPING	O1												
3	PRESS	U	U											
4	MILL	O1	O1	O1										
5	MACHINECEN	E1	O1	O1	E1									
6	PLATING	U	O1	I1	I1	O1								
7	TURRET	E1	O1	O1	O1	I3	O1							
8	INSPECTION	O1	O1	O1	I1	E1	I12	O1						
9	BROACH	O12	O2	I2	I12	E12	O1	E12	O1					
10	ASSEMBLY	I3	I3	O3	O1	U	U	O1	E1	O2				
11	MAINTENANCE	O2	O2	O2	O2	O2	U	O2	U	O2	U			
12	TOOLCRIB	U	U	I1	E1	E1	U	E1	U	O2	U	O2		
13	WAREHOUSE	I1	U	I1	I1	E1	U	I1	O1	O1	O1	U	U	
14	PACKAGING	O1	A12	O1	O1	O1	O1	O1	A1	O1	E1	O1	O1	O1

RANK	DESCRIPTION
A	Absolute necessary
E	Significant
I	Important
O	Ordinary
U	Un-important

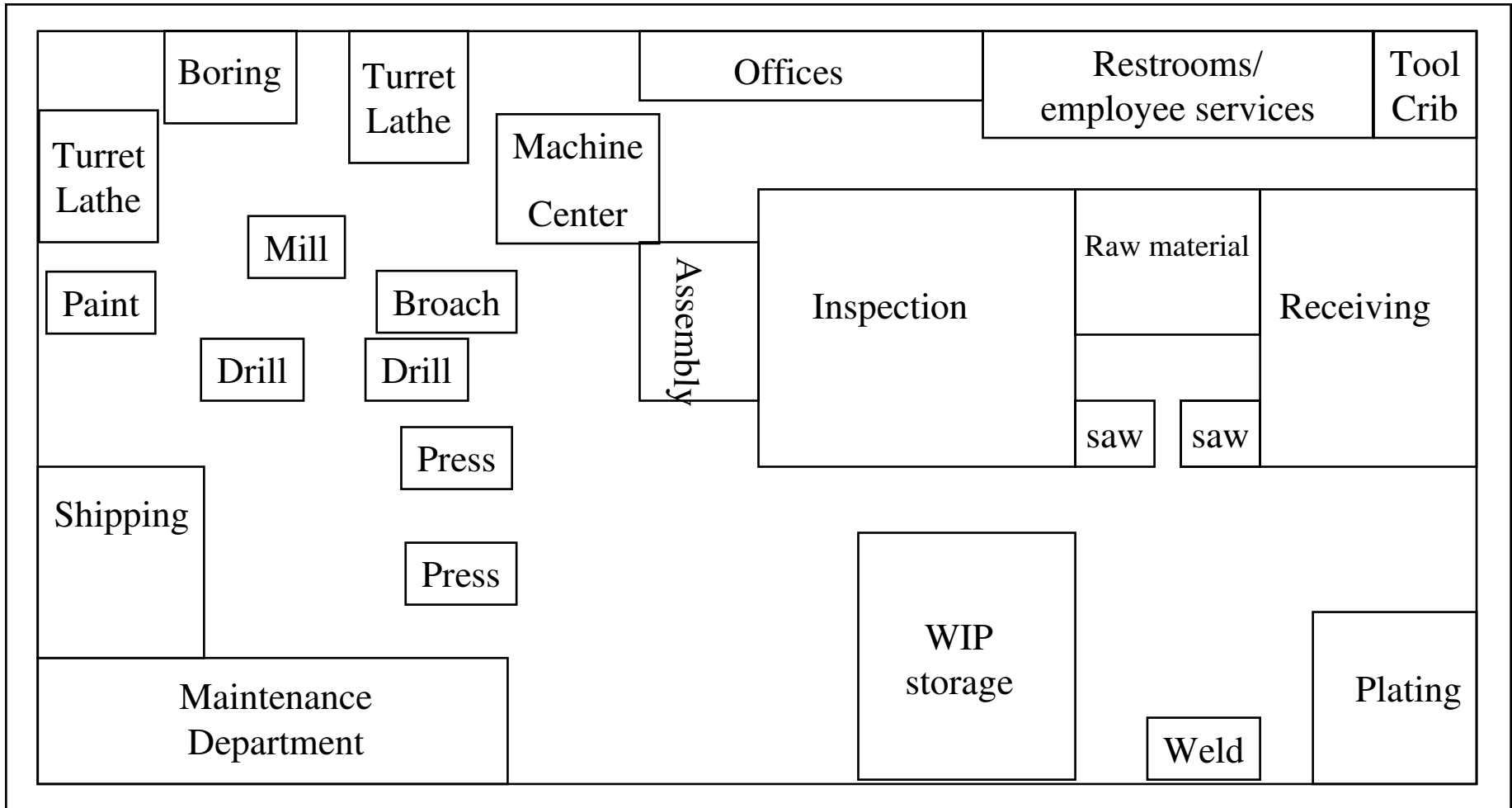
#	REASON
1	Material flow
2	People flow - - - -
3	Share equipment
4	Noise
5	Share people

Plant Design and Layout

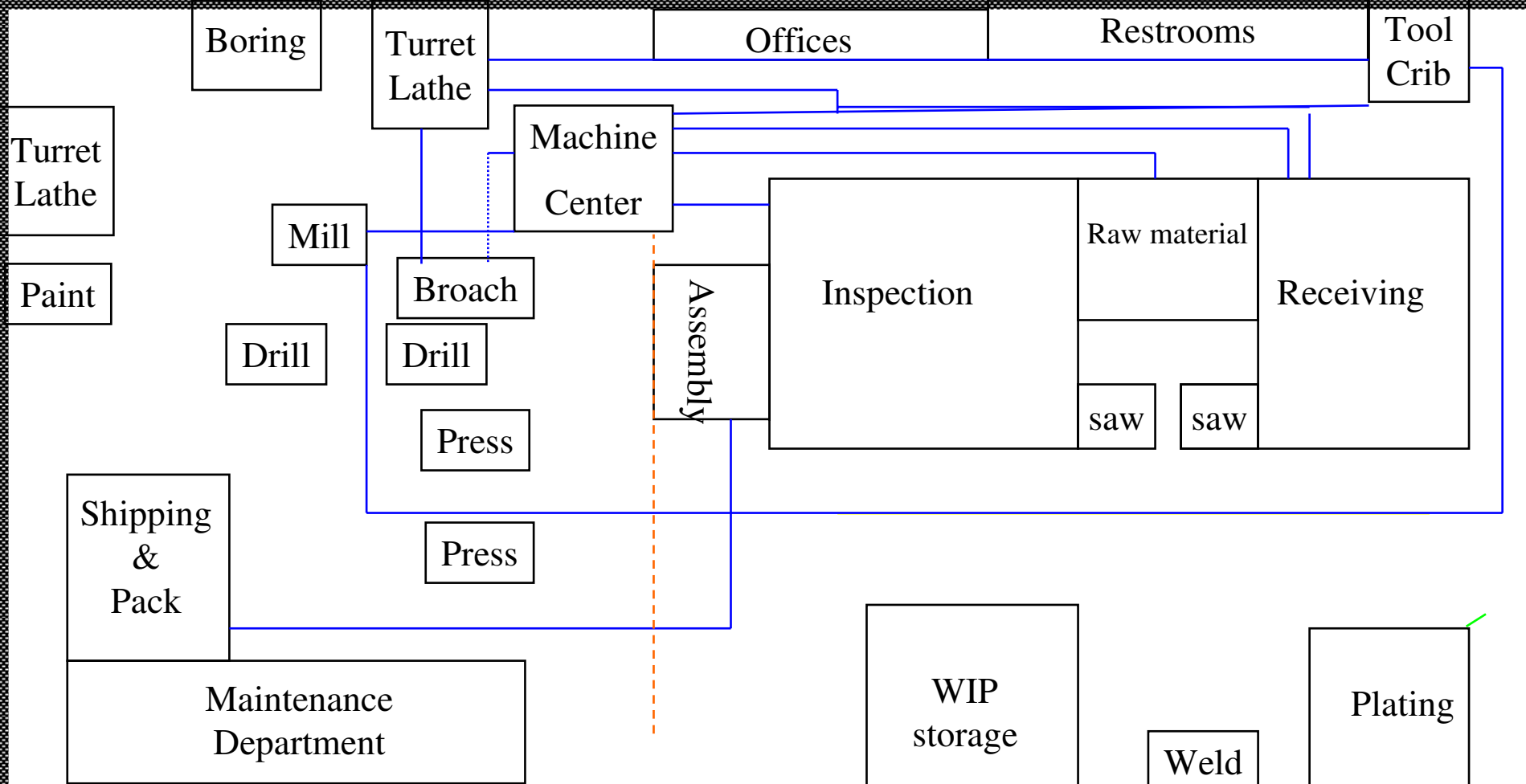


Flow analysis
with
existing layout

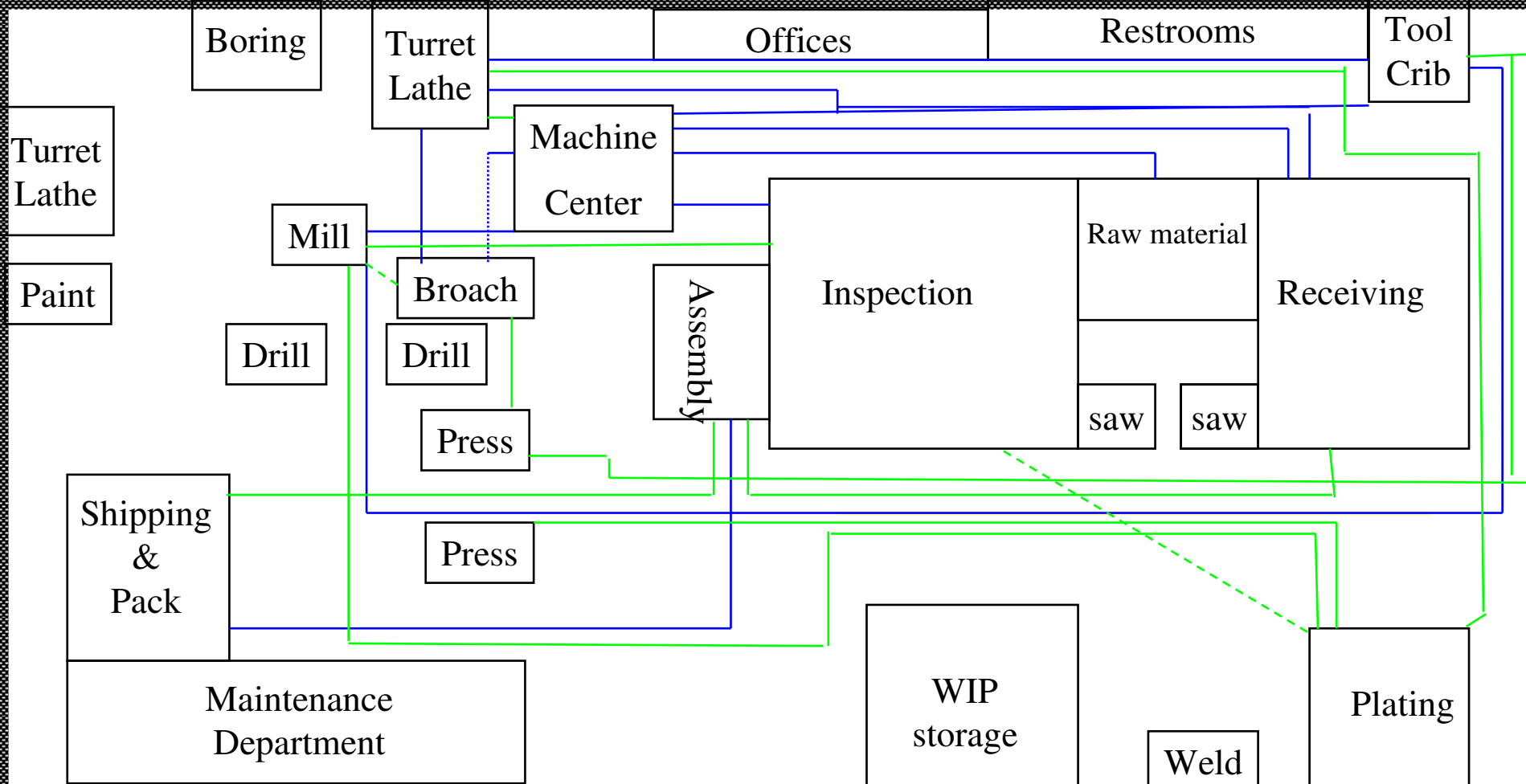
Plant Design and Layout



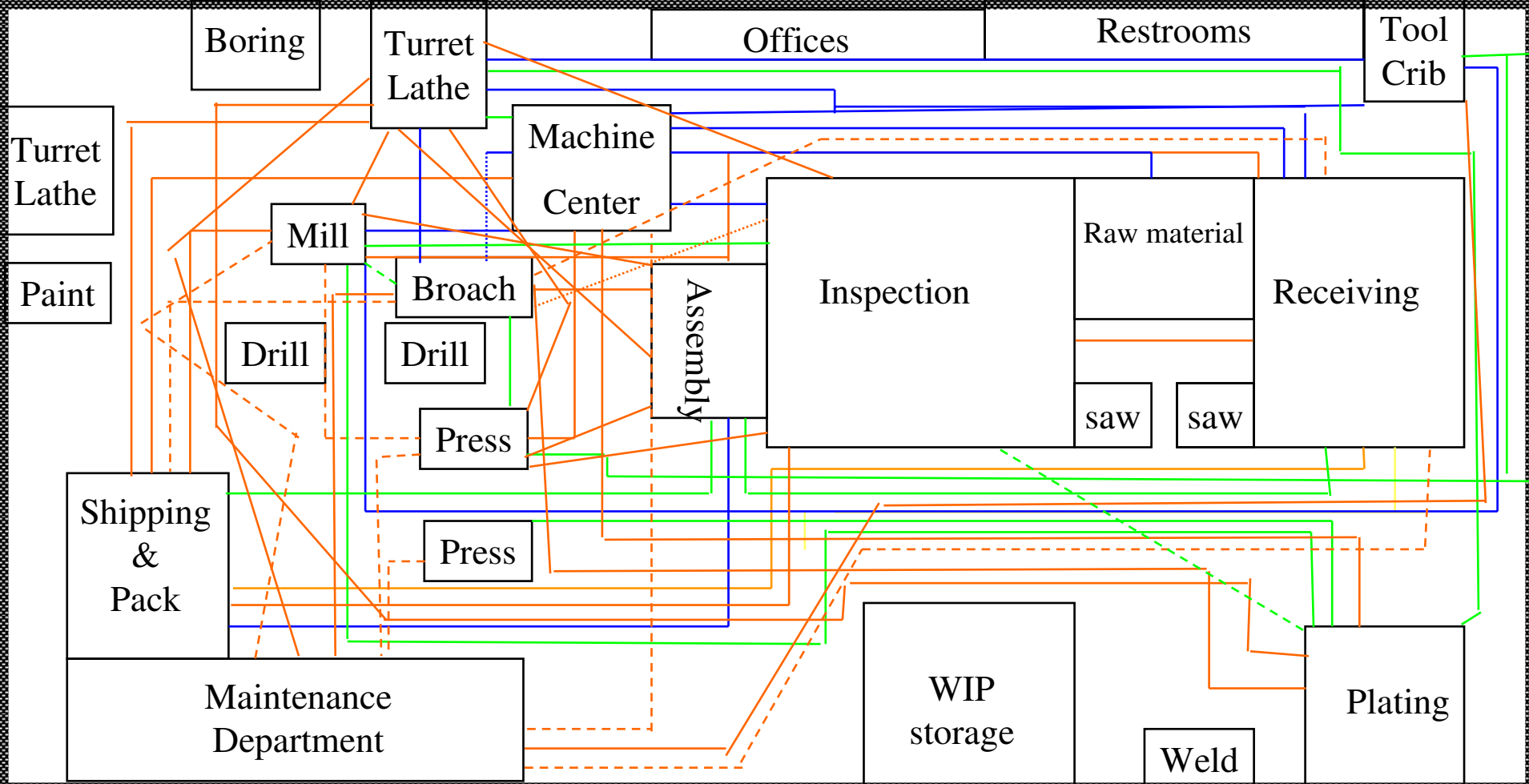
Plant Design and Layout



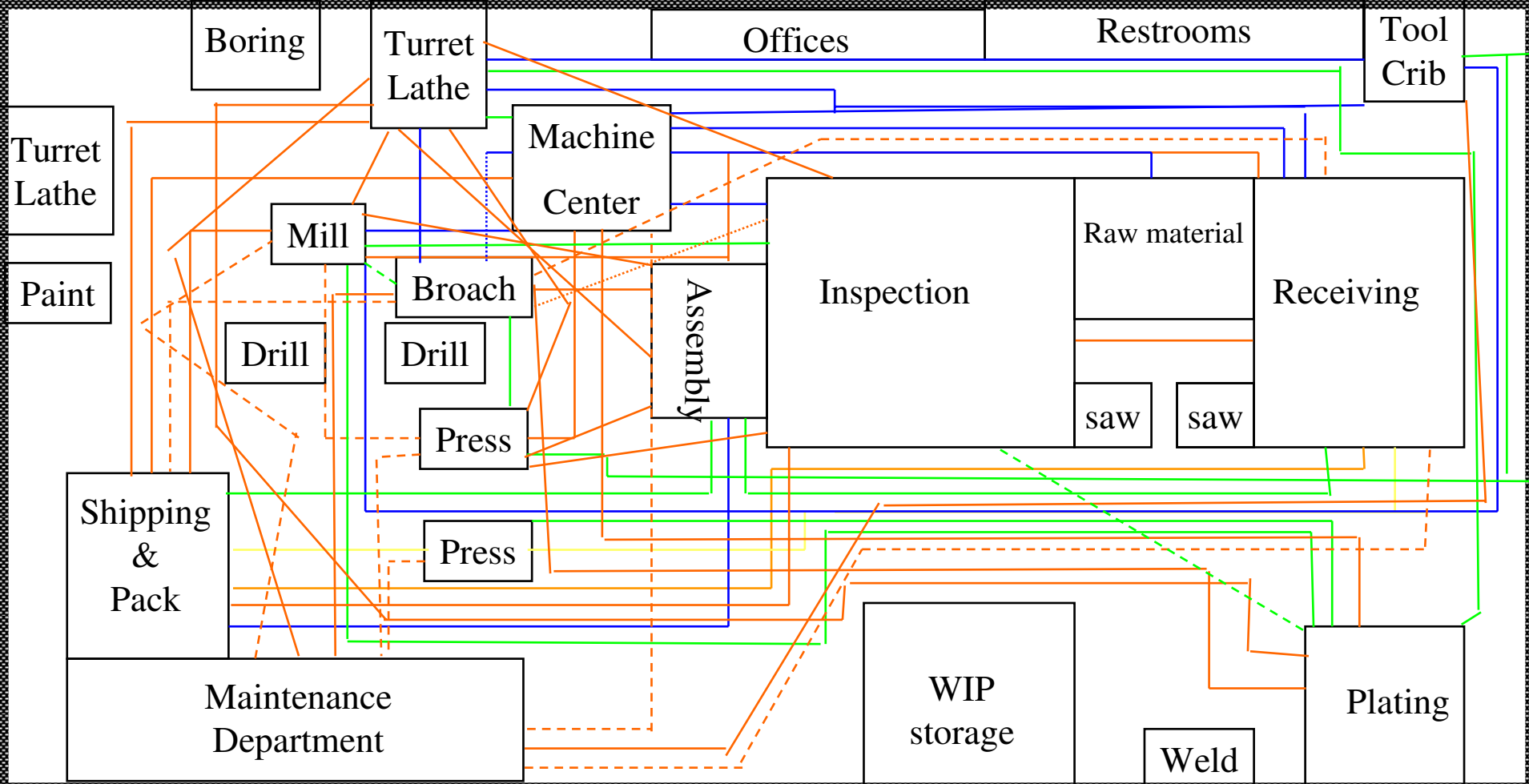
Plant Design and Layout



Plant Design and Layout



Plant Design and Layout



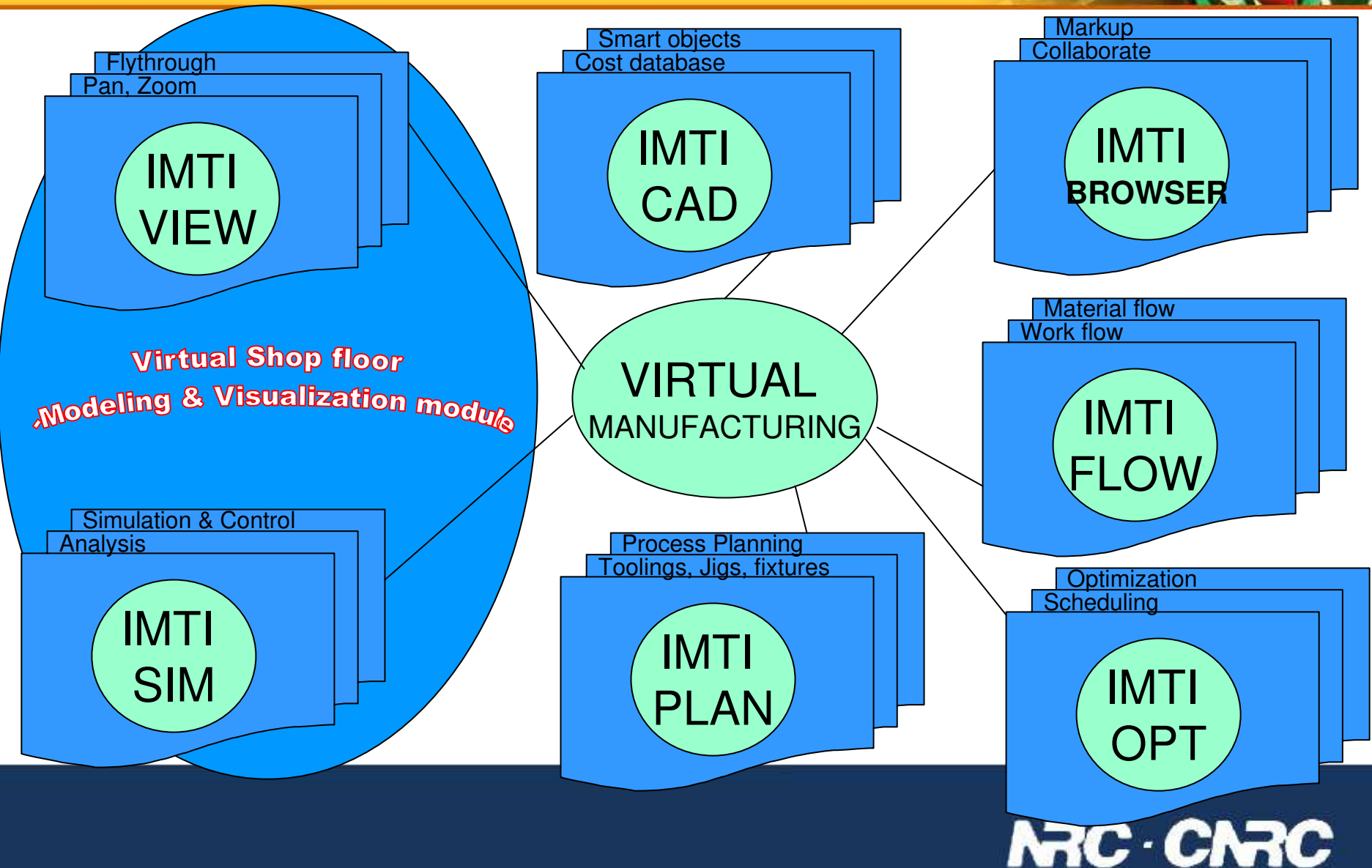
Virtual Shop Floor



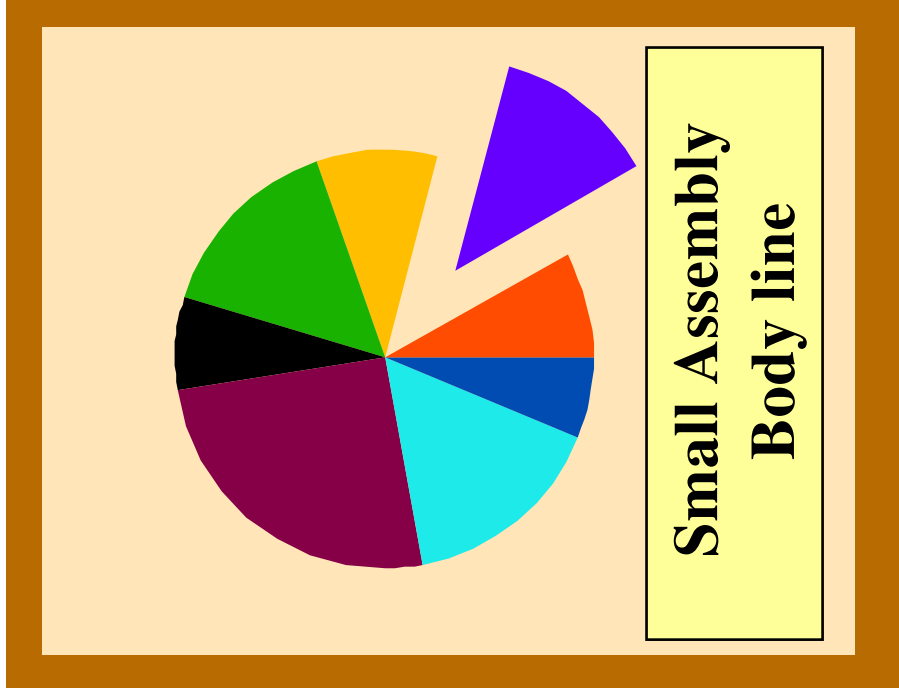
Objectives:

- Digital prototype of human and machine motion
- Track/Capture motion in VR Environments
- Simulate & Measure Productivity
- Integrate ergo analysis and Bio-medical
- Platform for research ideas

Virtual Shop Floor



Virtual Shop Floor



Production cost/time



Maintaince cost/time



Scrap cost

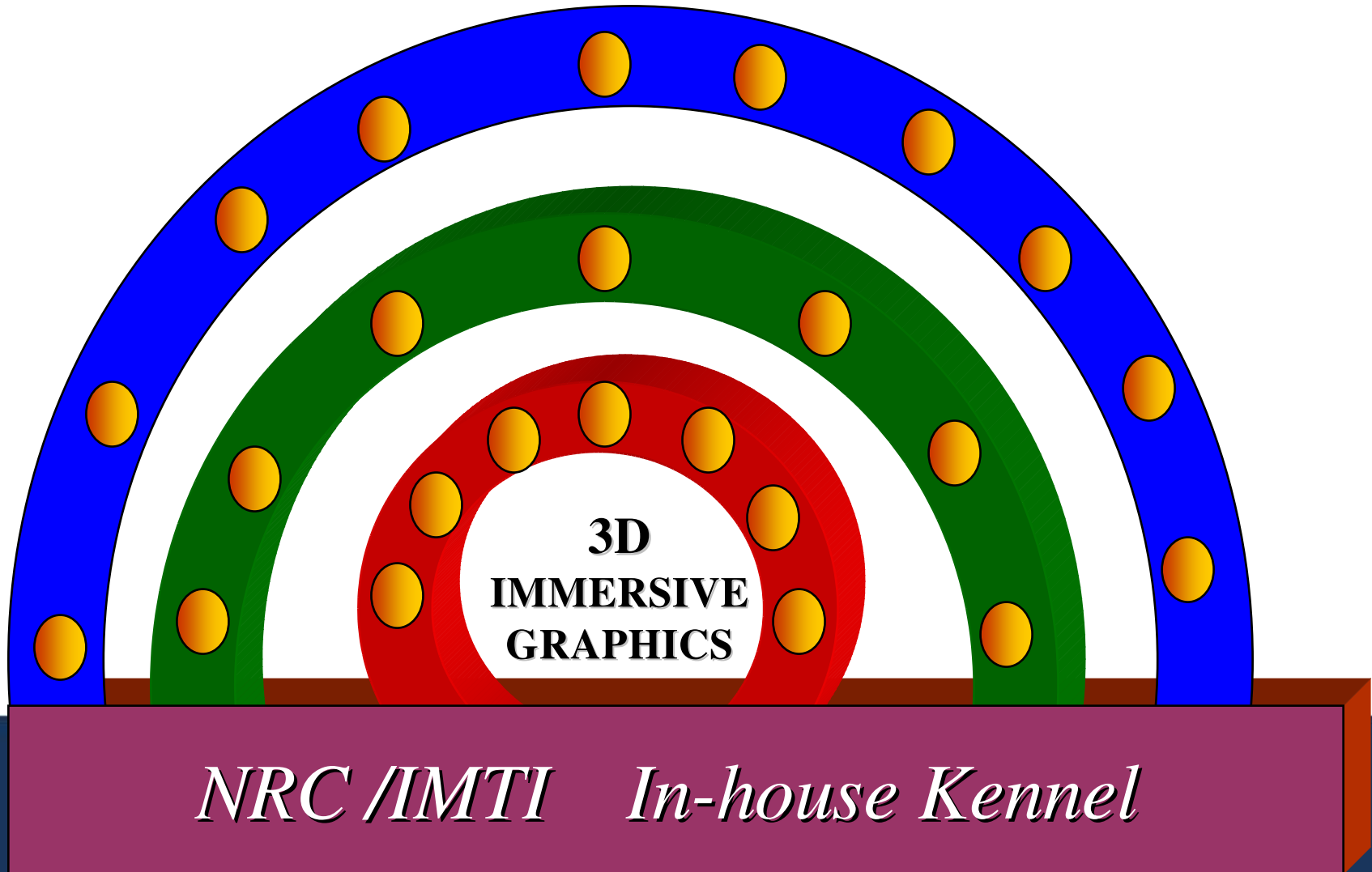


Idle cost/time

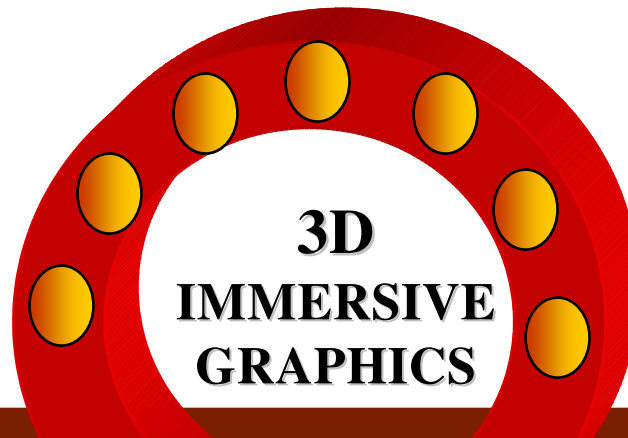


Profit/Time saved

Virtual Shop Floor - Structure



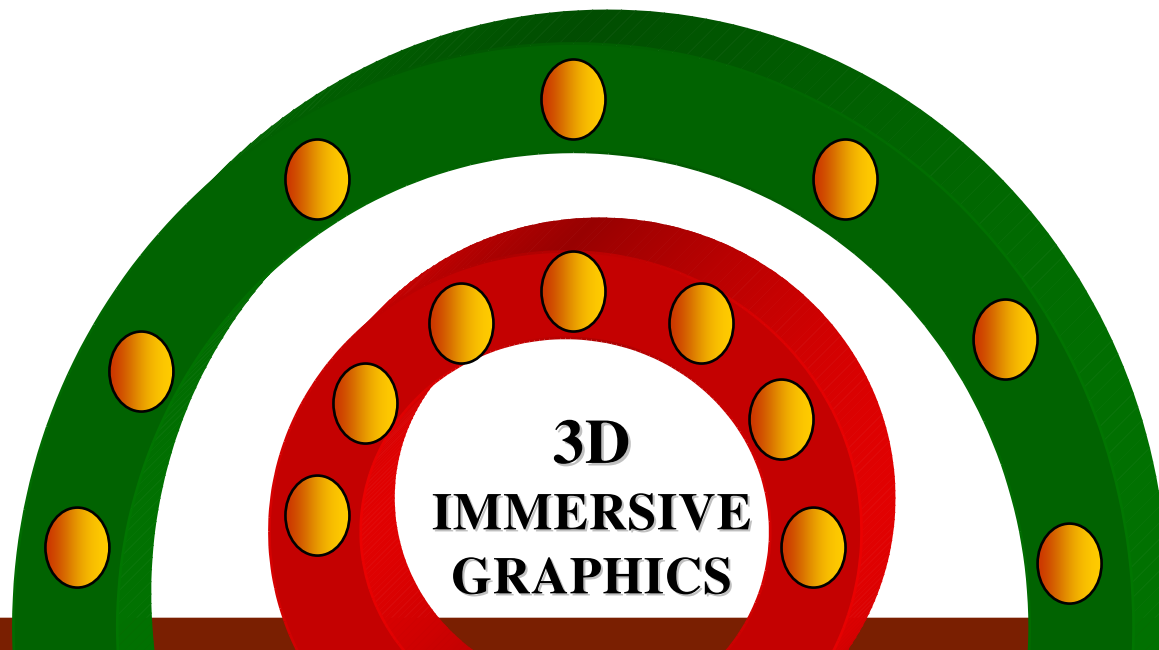
Virtual Shop Floor - Structure



NRC /IMTI In-house Kennel

NRC

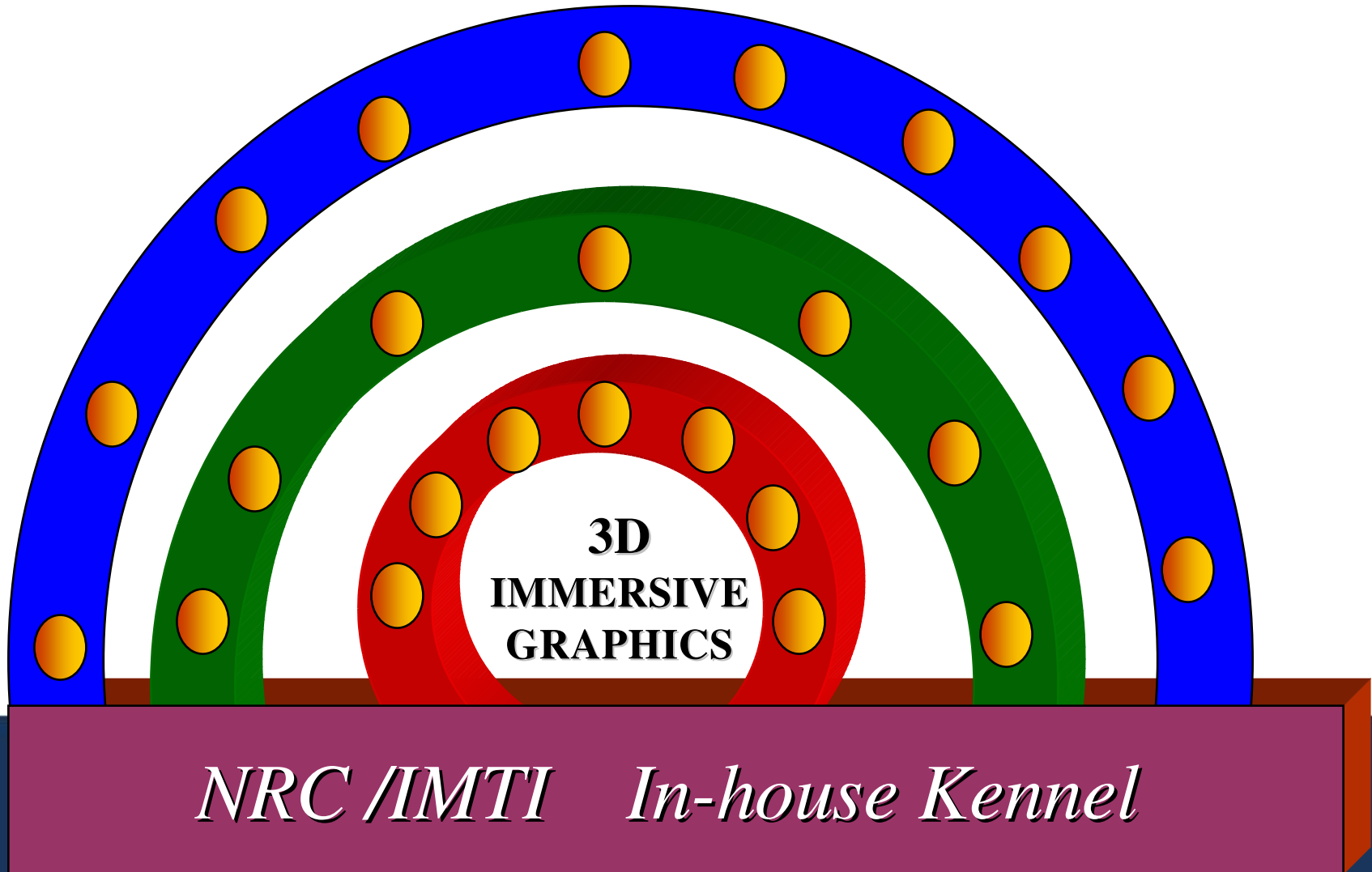
Virtual Shop Floor - Structure



NRC /IMTI In-house Kennel

NRC

Virtual Shop Floor - Structure



Virtual Shop Floor

- Modeling and Visualization module

