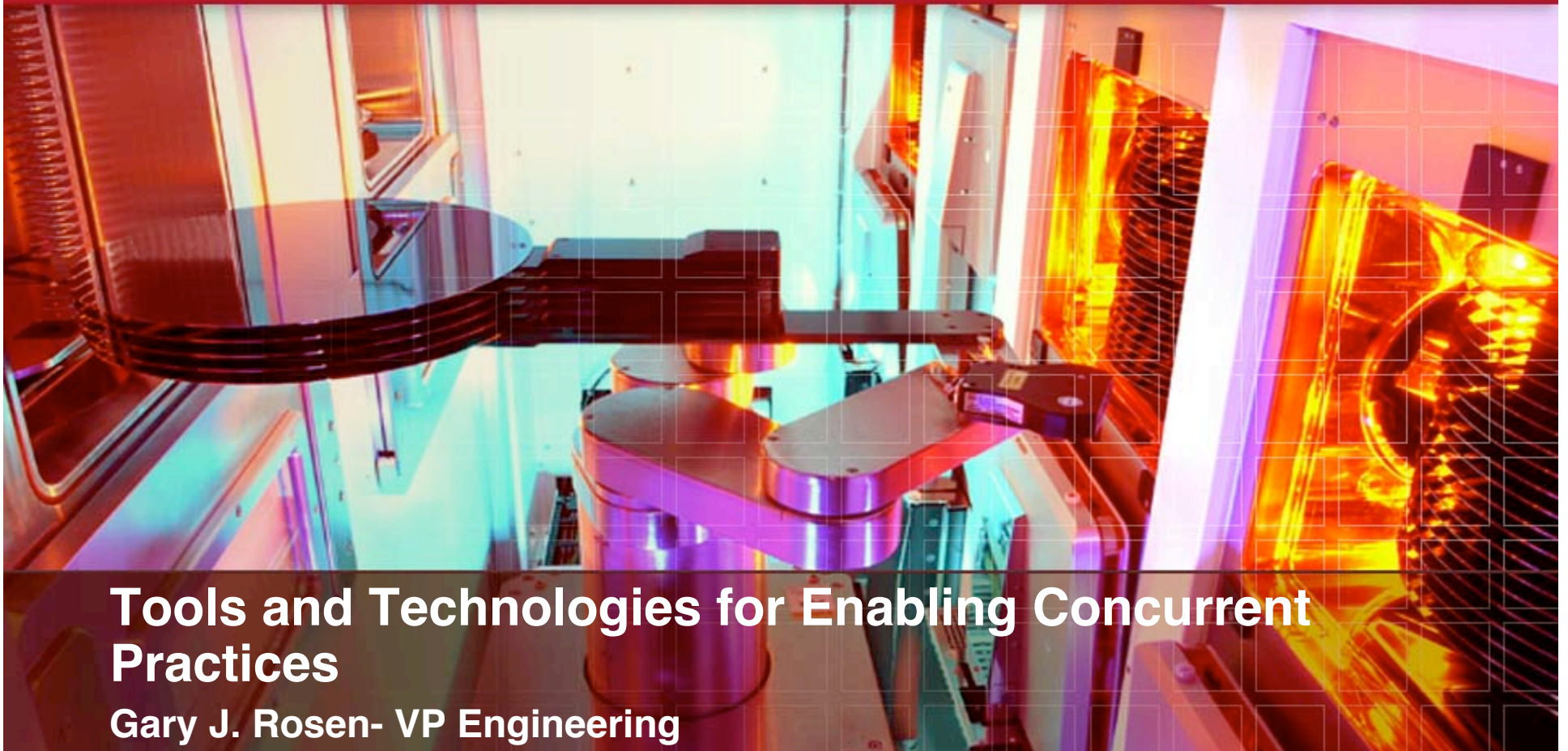




The Leaders in Ion Implant



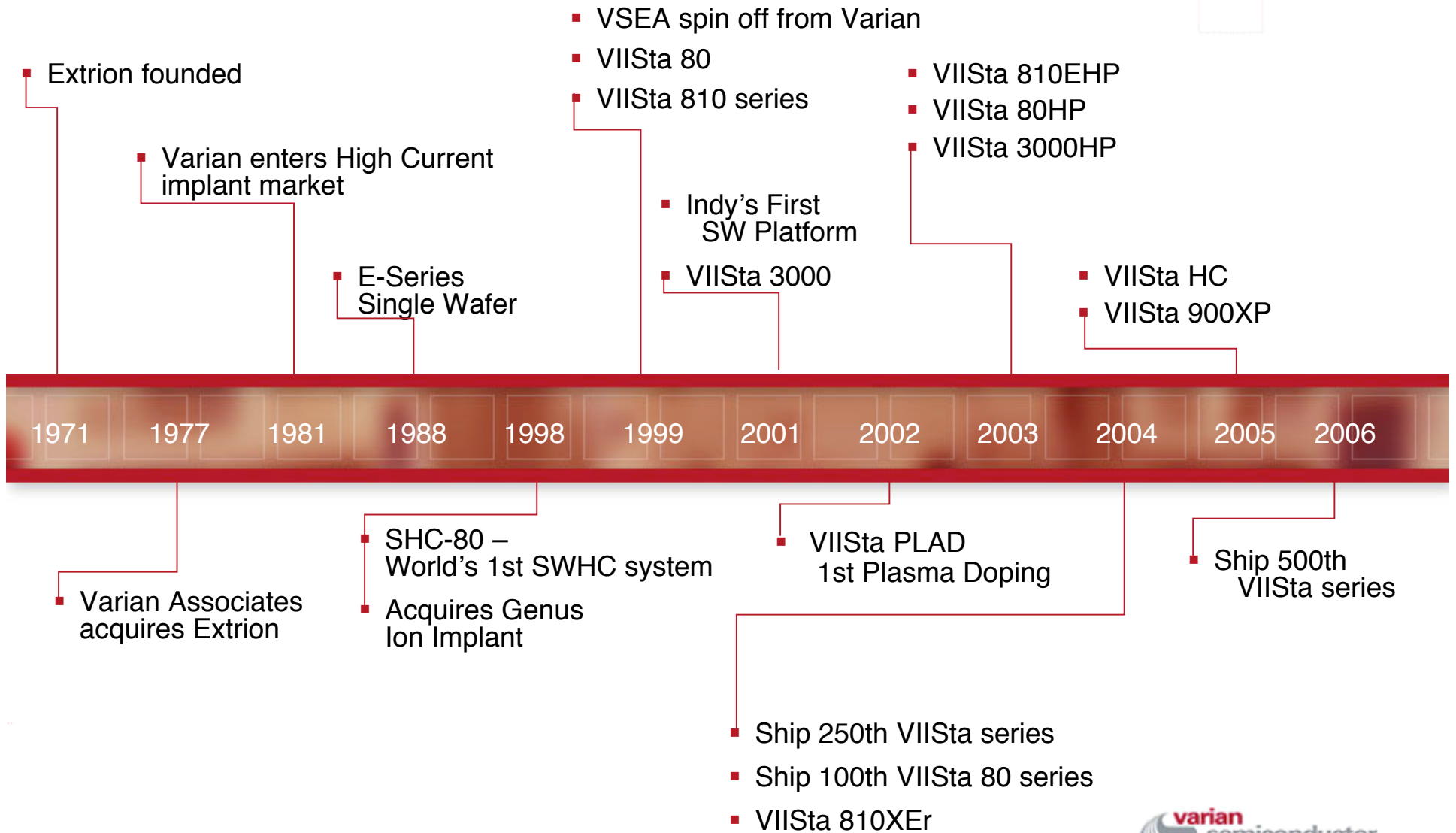
## Tools and Technologies for Enabling Concurrent Practices

Gary J. Rosen- VP Engineering

# Outline

- Varian
- Challenges
- Approach
- Product Development Process
- Learning Organization for Concurrent Product Development
- Design for (DFx) Focus
- Unifying program management tool

# Varian Semiconductor History



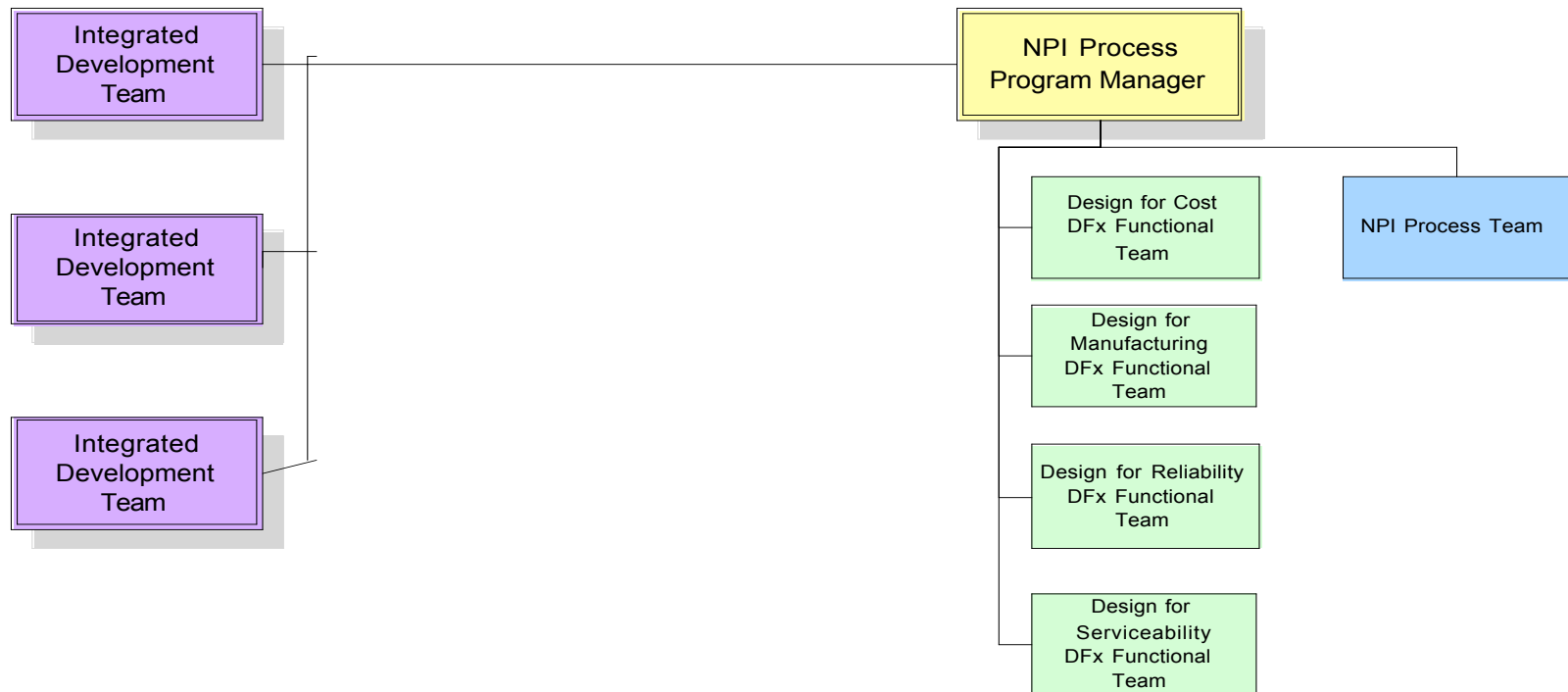
# Challenges

- Culture
  - 35 years of serial product development
- Developing easy-to-use enabling tools
  - Drive cultural change
  - Drive concurrency
- Avoid creating bureaucracy
- Building learning processes and organizations
- Establishing metrics that prove value of concurrency

# Approach

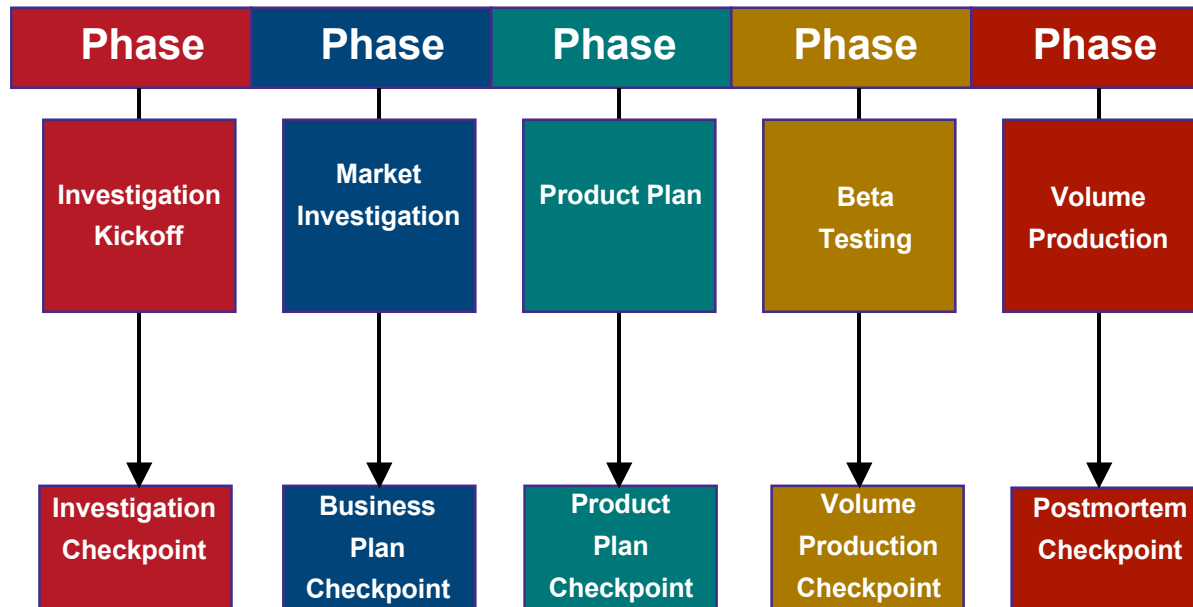
- Grass roots level
  - Add “How To” to the product development process
  - Develop DFX templates, metrics and scorecards
  
- Executive level
  - Create and support an organization around NPI
  - Provide resources for education and tools
  - Attend review meetings, enforce phase gates
  
- Automate after above is established

# NPI Organization



Process Team takes learning from the IDT's and incorporates it into the next NPI process revision

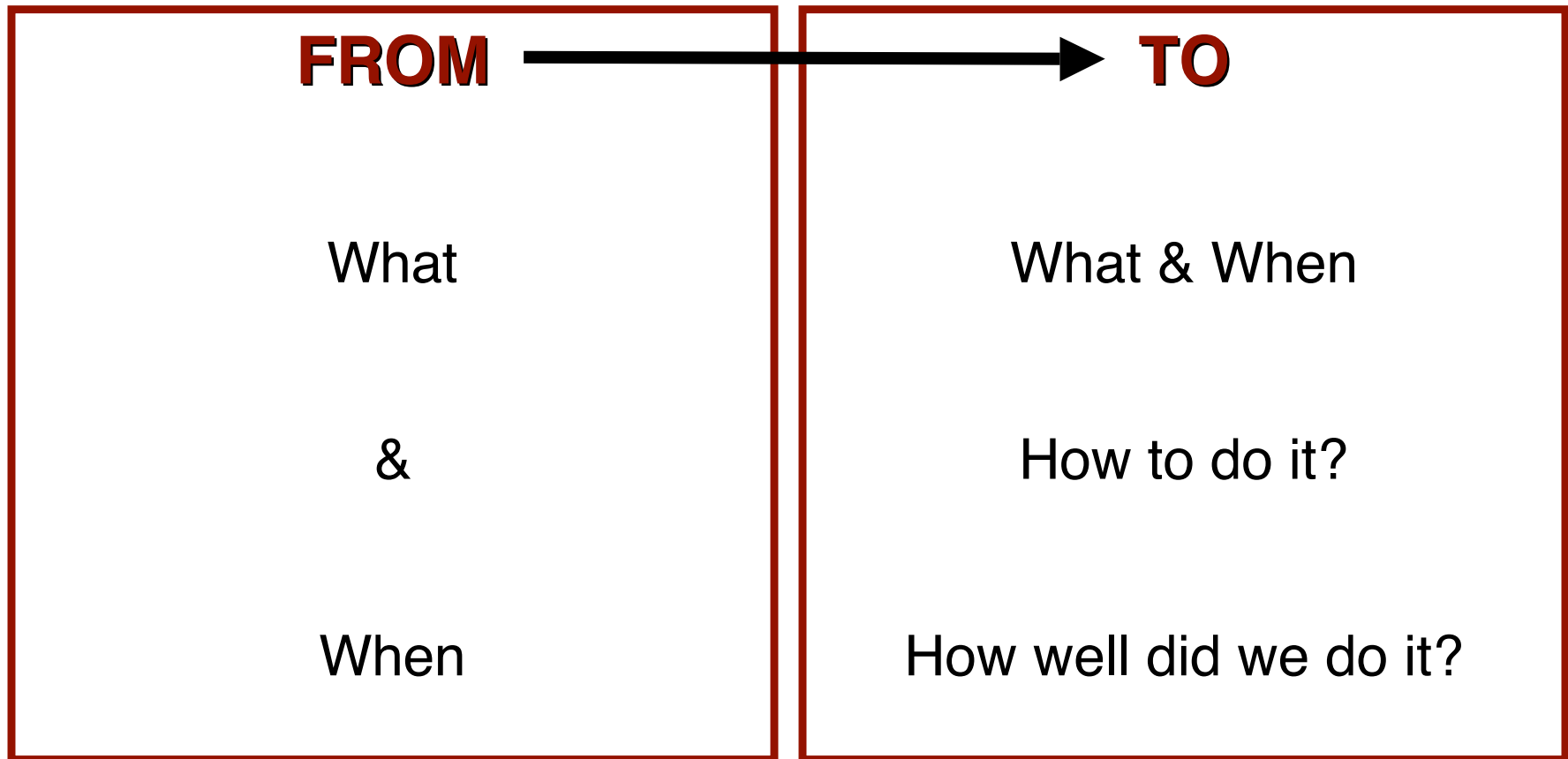
# New Product Introduction Process



What and when

# NPI at Varian

## What Changed?

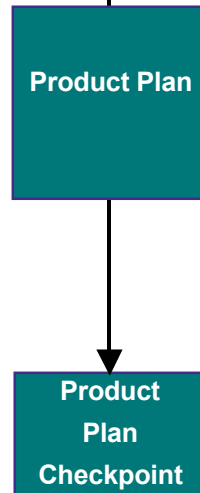


# New Product Introduction Process



## Guidelines / BKM's / DFX:

Incorporate guidelines/BKM's and DFX initiatives into design through the IDT concepts meetings



## Deliverables:

- Staffing plan complete using capacity analysis and manufacturing support ready for Alpha
- Develop a preliminary flowline layout including build/buy strategy – required to develop the family tree structure
- Identify facilities and test stand requirements for engineering to deliver
- Confirm guideline/BKM and DFX initiative integration -- Identify and document gaps for review
- For a new tool: Start preliminary build procedure and identify % of completion.  
For a new phase of an existing tool: Identify procedures that require change based on new designs.
- Start scorecards for DFX integration and satisfaction

## Metrics:

- Define MFG cycle time, labor hour, rework targets

What, when and how



# NPI Process

- DfX added to Market Requirements Document
  
- NPI Phase Gate Checklist
  - Drives concurrent development
  - Drives complete product requirements
  - Identifies and links DF(x) deliverables
  - DF(x) deliverables are supported by
    - Guidelines
    - BKM's
    - Templates
    - Examples
  - Post Mortem – a required gate exit deliverable
  
- Scorecards developed to create leverage for DfX functions

# MRD DFX Input

MRD DFX Input			
DFX Team	Objective	Requirement / Metric	
Installation	Identify and develop plan to correct current product top 10 Installation failure and material issues	Plan to correct all Installation Failure items as listed in the 12 Month and 3 Month Installation Parts Pareto	
	Installation Cycle Time Reduction	Build - x Days (< xx Hours)	
	Minimize tooling required to support installation	No additional Installation Tooling	
	Eliminate the need to return material required for shipping	Shipping Skids and related shipping hardware disposable	
Cost		<b>Launch Jan '06</b>	<b>End End FY '06</b>
	Net System Price	xx	xx
	Cost to Manufacture	xx	xx
	Install	xx	xx
	Warranty	xx	xx
	OCS	<u>xx</u>	<u>xx</u>
	Total Cost	xx	xx
	<b>Gross Profit</b>	<b>xx</b>	<b>xx</b>
<b>Gross Margin</b>	<b>xx</b>	<b>xx</b>	
Manufacturing	Manufacturing Cycle Time - Design assemblies and modules to the highest level (HLA) for outsourcing.	<xx days (Current average is xx days.)	
	Build Hours - Eliminate the need for mechanical alignments. Include bulkheads between modules.	<xx hours (Current average is xx hours.)	
	Pack & Ship Hours - Design modules to be shipped without the need for additional tooling and fixtures.	<xx hours (Current average is xx.)	
	Test Hours - Design for higher level flowline test to lower or eliminate the need for final test.	<xx hours (Presently at xx hours. A more robust mod test could eliminate final test in some cases.)	
	Reduce the number of modules. Adhere to all semi and shipping/transportation specs.	<x crate minimum (The existing design requires a minimum of xx and up to xx crates/skids.)	



# Best Known Method

BKM's and Guidelines for DFX	
Manufacturing, Service, and Supply Chain	
BKM #	Requirement
MOD 1	Design shipping capability into the module, eliminating the need for tooling and fixtures.
MOD 2	Limit the number of parts removed from tool at shipping – the goal should be zero
MOD 3	Design the minimum number of modules using semi and shipping/transportation specs.
MOD 4	Design designated harness and facilities routing paths within the frame throughout the module
MOD 5	Minimize fastening hardware and material count using the DFx "Part Count Design Techniques".
MOD 6	Develop and identify Poke -Yoke features – all assemblies.
MOD 7	Identify, resolve, and close all QN's relative to the new/changing design.
MOD 8	Use solid pipe for vacuum connections – if bellows must be used, minimize length and keep straight within 10%.
MOD 9	Use industry standard chassis sizes. SEMI Standard - E72-0600
MOD 10	Eliminate mechanical alignments when possible.
MOD 11	Maintain one central connection point for facilities through bottom or top to interface with customer fab for clean, simple, and quick on site connection with the ability to pre-ship and install. Include standard facilities template or mylar
MOD 12	Define footprint relative to tool size and customer/industry requirements.
MOD 13	Identify functionality, rigidity, manufacturability, serviceability, aesthetics, sourcing level, modularity (frame and panels as part of module), and/or drop ship & pre-installation capability of enclosures.
MOD 14	Design with the ability to build in 1 shift (20 man hours), drop ship or design as part of module (not to be removed at shipment) if technically and cost feasible.
MOD 15	Eliminate Plastic water fittings
CAB 1	Define tie points for cable installation.
CAB 2	Minimize harness exposure while allowing easy access, i.e. covered channels as part of the frame.
CAB 3	Design in associated mechanical cable supports. (brackets, retractors) as needed for serviceability.
CAB 4	All cables designed with breakpoints and bulkheads between modules for quick disconnect ability between modules for shipment.
CAB 5	Build future expansion into harnesses (ie: options/selects/specials). Predefine the options, look at current options available that will be supported -- design in plug-and-play capability.
CAB 6	Utilize common connectors/pins where applicable (minimize connector/pin types).
CAB 7	Separated power, ground, and signal harnesses.



# Scorecard Example

Manufacturing DFX Initiatives Satisfaction Scorecard				
Assembly name		Scoring		
INSERT PICTURE		Weight Factor		
		1 - Low		
		2 - Medium		
		3 - High		
		Manufacturability Rating		
		2 - Acceptable: Meets requirements		
		1 - Design needs improvement		
		0 - Unacceptable: Does not meet requirements		
Action Items	BKM #	Weight 1 3	Design Evaluation 2	Comments for Closure
<b>Manufacturability</b>				
Design shipping capability into module, eliminating the need for tooling/fixturing	MOD 1	3	2	Great improvement from the first concept. The manufacturing team believes this concept has the potential to meet everyone's DFX requirements. Thank you for your hard work, we know a lot of effort went into this redesign.
Limit number of parts removed at shipping	MOD 2	3	2	Great improvement from the first concept. The manufacturing team believes this concept has the potential to meet everyone's DFX requirements. Thank you for your hard work, we know a lot of effort went into this redesign.
Limit number of modules. Use semi and shipping/transport specs.	MOD 3	3	2	Great improvement from the first concept. The manufacturing team believes this concept has the potential to meet everyone's DFX requirements. Thank you for your hard work, we know a lot of effort went into this redesign.
Design harness routing paths	MOD 4	2		?
Minimize fastening hardware	MOD 5	1		?
Develop Poke-Yoke features for connections	MOD 6	2		?
Resolve open QN's with new design	MOD 7	3		?
Use solid pipe vacuum connections.	MOD 8	2		?
Use industry standard chassis sizes	MOD 9	2		?
Eliminate mechanical alignment issues	MOD 10	3	1	
Maintain one central facilities connection point	MOD 11	3		?
Define footprint to meet customer/industry std.	MOD 12	3	2	
Define Manufacturability of enclosures	MOD 13			?
Design with ability to build in 1 shift	MOD 14	3	1	Improvement from first concept
Eliminate plastic water fittings on tool	MOD 15	2		?
Define tie points for cable installation	CAB 1	2		?
Minimize harness exposure	CAB 2	2		?
Design in mechanical cable supports	CAB 3	2		?
Design harnesses with break points and bulkheads	CAB 4	2		?
Build in future expansion	CAB 5	2		?
Use common connectors	CAB 6	2		?
Separate power, ground, and signal harness	CAB 7	2		?
Minimize number of connections to be broken at shipment	CAB 8	3		?
Identify requirements for supplier testing SPC	TST 1	2		?
Define self teach and self test features	TST 2	2		?
Define Auto-calibration features	TST 3	2		?
Define Auto- alignment features	TST 4	2		?
Mfg, Service, & Cost score based on 100:				25.00

- Method for driving design changes at an early stage
- Creates leverage for supporting functions to impact the design



# Manufacturing – Metrics & Deliverables

		<b>Phase M1: METRICS</b> – Establish cost reduction curve based on product targets and alpha results for (CT, labor hours, rework)
<b>M8</b>		Alpha tool to be built by MFG
<b>M9</b>		Confirm build/buy strategy is incorporated into family tree
<b>M10</b>		Identify percent complete of Mfg procedures in Lotus Notes
<b>M11</b>		Validate final acceptance test and document changes
<b>M12</b>		Preliminary BOM accuracy complete, gaps identified by QN system, and necessary corrections documented
<b>M13</b>		Validate and start implementation of flow line model with preliminary lean initiatives
<b>M14</b>		Validate BKM and DFX initiatives and document gaps for closure
<b>M27</b>		Continue the scorecard process
		<b>Phase M2: METRICS</b> – Cost reduction curves in process, gaps identified, and plan in place to meet targets for: Cycle time, Labor hours, and Rework
<b>M15</b>		Manufacturing processes fully implemented <ul style="list-style-type: none"> <li>• Tool review process</li> <li>• QN review and root cause analysis</li> <li>• MFG rework analysis</li> <li>• Continue Lean initiatives</li> </ul>



# NPI Checklist

NPI PHASE REVIEW		Completed	In-Process	Schedule Delay	Owner	Original Date	Last Date	Current Date	DFx Deliverable
<b>INTRO - Investigation Kickoff</b>									
<b>INTRO - Manufacturing</b>									
	Evaluate manufacturing BKM's and guidelines - ensure BKM's from previous programs (lessons learned) have been incorporated into the master BKM's and scorecards.								Manufacturing - M1
	Identify specific design concerns from the previous generation tool that should be considered for modification or redesign.								Manufacturing - M2
<b>M0 Manufacturing</b>									
	Define product targets for MFG cycle time and labor hours with build/ship design requirements for the MRD.								Manufacturing - M3
	Start to develop DFX scorecards for all new product designs.								Manufacturing - M4
	Identify project staffing plan to support Alpha/Beta build using the MFG capacity analysis.								Manufacturing - M5
<b>MK Manufacturing</b>									
	Identify new MFG facilities requirements for mod build and the cleanroom.								Manufacturing - M6
	Confirm DFX scorecards are complete. Identify and document gaps for review with plan for closure.								Manufacturing - M7
	Define high level build/buy strategy required to develop family tree structure.								Manufacturing - M8
	Manufacturing to review test engineering assembly test stand requirements.								Manufacturing - M9
	Based on new designs, quantify the procedures that need to be updated and/or written.								Manufacturing - M10
	Staffing plan complete using capacity analysis and manufacturing support ready for Alpha.								Manufacturing - M12



# Unifying Program Management Tool

- Drive a common process across all programs
- Enterprise wide visibility
- Quantifies and measures
- Drives efficiency
- Quickly drive lessons learned back into the process
- Grow a culture of concurrent engineering

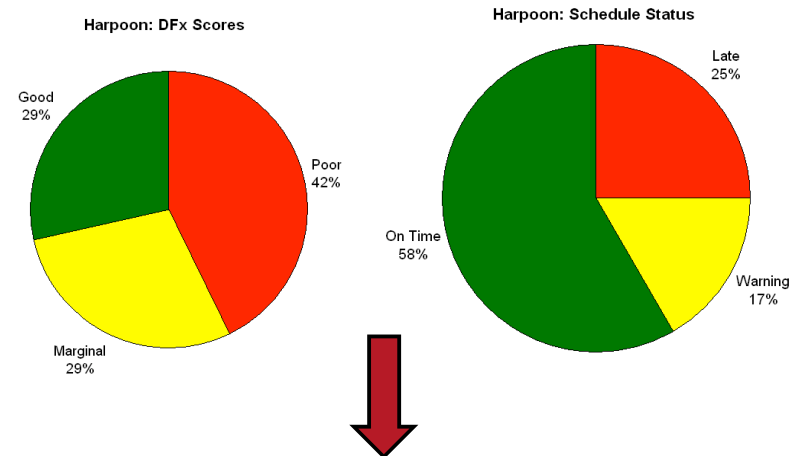


# Approach to Integration

- Manage all development programs on a single platform
  - NPI and design process
- Create dashboards to provide real-time program visibility
  - Get ahead of issues instead of reacting to surprises
- Create metrics to measure the process
  - Track progress and deficiencies over time
- Deploy a highly flexible system
  - Allows fast integration of lessons learned

# Increased Program Visibility

- High level metrics give a quick snap shot on program status
- Drill down to different levels of detail as needed – from NPI to program plans
- Quickly highlight issues – get ahead of the problem

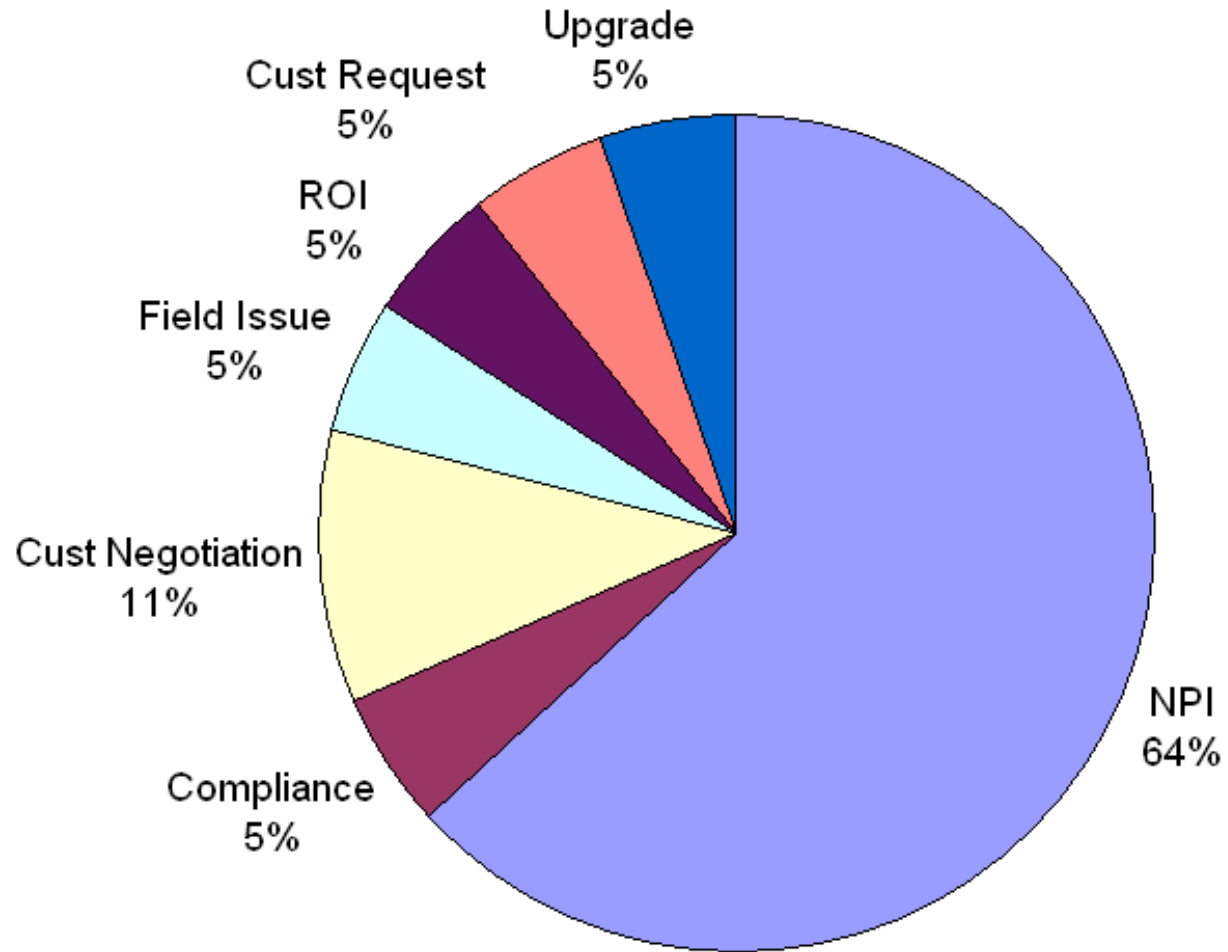


Harpoon Projects	Project Type	ECO Date	Schedule	DFx
<a href="#">Wide chamber</a>	Cust Negotiation	9/12/2006	Green	Red
<a href="#">PFG Modifications</a>	Field Issue	10/30/2006	Red	Red
<a href="#">Chamber liners</a>	ROI	6/30/2006	Yellow	Red
<a href="#">Cryo manifolds</a>	Cust Request	7/27/2006	Yellow	Red
<a href="#">Source flange</a>	QN	6/23/2006	Green	White

Program	Process level	Project Type	Milestones						DFx Summary Scores						
			Project Start	Reqs Defined	Concept Review	Verify Complete	Design Review	ECO Date	Mfg	Service	SC	Cost	Install	Reliability	Bus Dev
Wide chamber	Full	Cust Negotiation	Pass	pass	5/31/2006	6/30/2006	8/15/2006	9/12/2006	70	65	46	62	75	80	32
PFG Modification	Full	Field Issue	pass	5/17/2006	6/12/2006	9/5/2006	10/8/2006	10/30/2006	63	21	77	80	90	11	71
Chamber liners	Full	ROI	pass	pass	pass	5/29/2006	6/18/2006	6/30/2006	50	45	32	70	39	70	43
Cryo manifolds	Full	Cust Request	pass	pass	6/15/2006	6/30/2006	7/10/2006	7/27/2006	39	50	39	23	80	73	23
Source flange	Fast	QN	Pass	Pass	Pass	N/A	N/A	6/23/2006	N/A	N/A	N/A	N/A	N/A	N/A	N/A

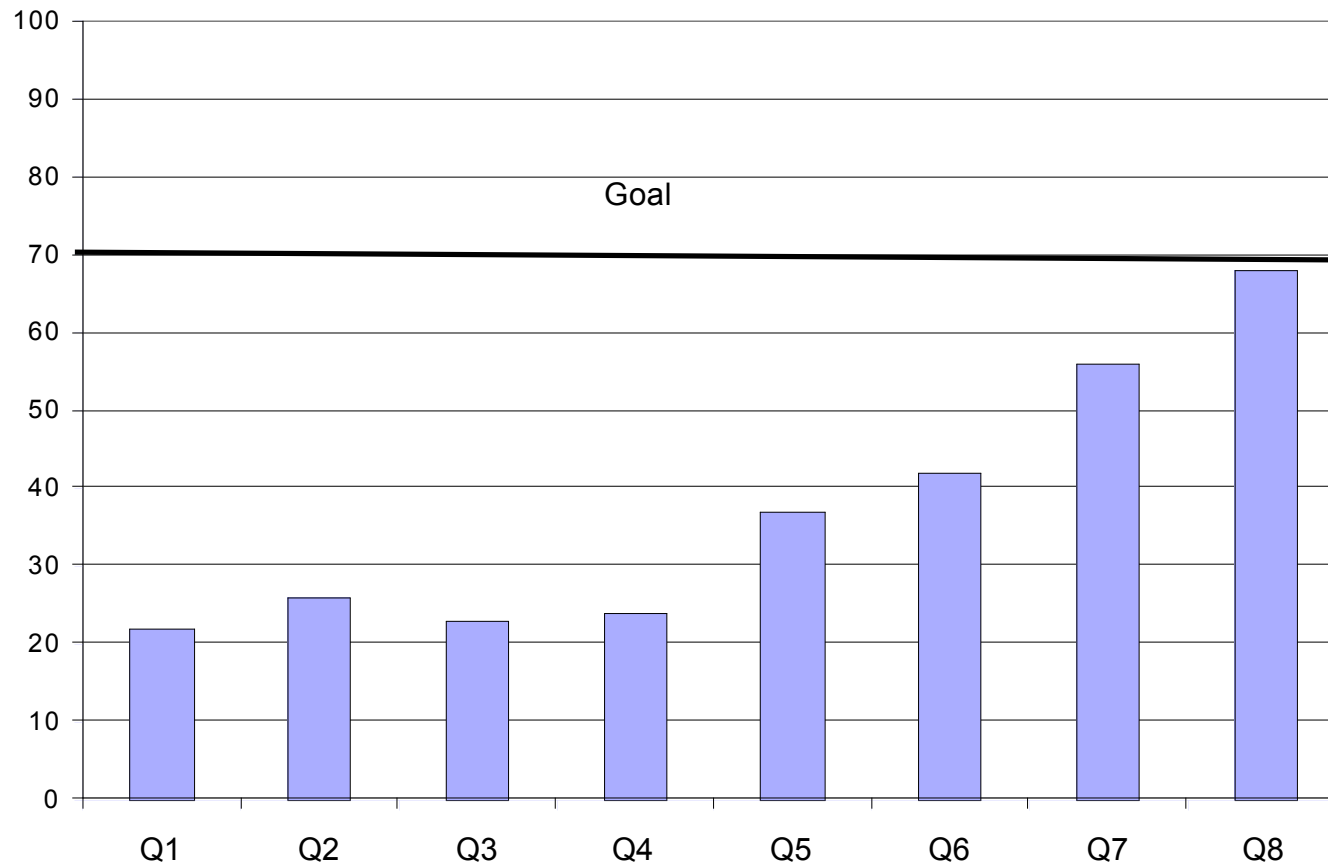


# Budget Management



# DFx Metrics

All Programs - Design for Service Scores



# Data and Document Retention

- All program data and documents are contained in a central vault
- Template document data can be read/written by the system
  - Example:
    - Excel DFX Template document updated and vaulted into the system
    - DFX scores read by the system- stored live
    - User retrieves design review powerpoint file – system updates DFX scores in it automatically
- Everyone is working with the latest data – increases efficiency
- Data and documents stored with the system associated with the project – Ease of document retrieval => reuse of documentation
- Metrics: Data can be analyzed to spot trends

# Summary

- Learning organization
- What, when and how product development process
  - Scorecards used to drive design changes before prototype built
  - Provides leverage for DfX teams to impact design before prototype
- After organization and process established PM tool unifies and drives efficiencies