



MUNRO
& ASSOCIATES, INC.



Engineered Resilient Systems
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Since 1988, Munro has been a leader in delivering solutions to hundreds of customers around the world, helping them to achieve higher product quality with lower cost, resulting in better product value and higher company profits.

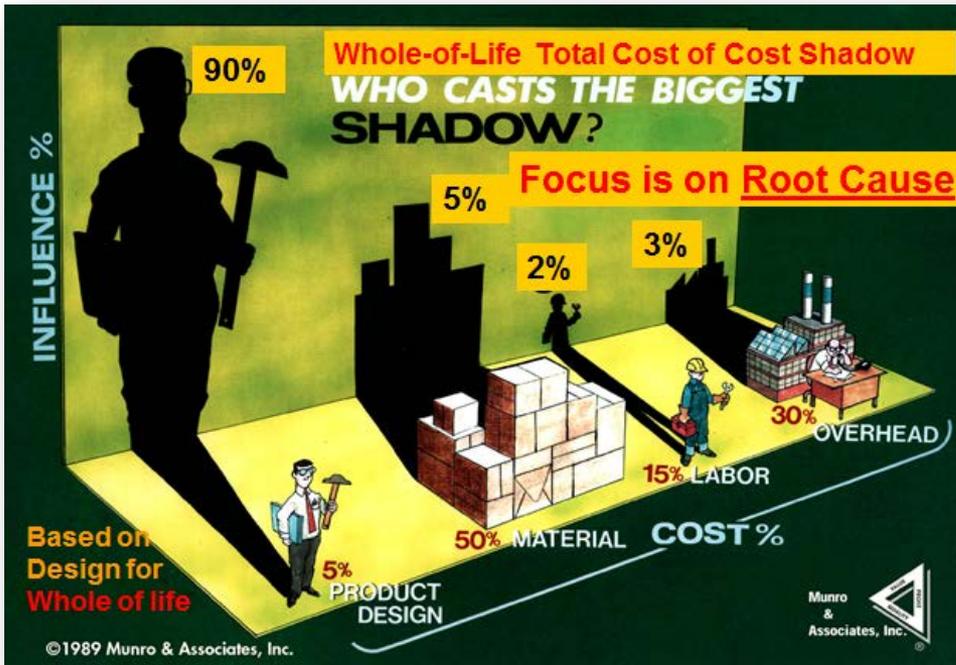
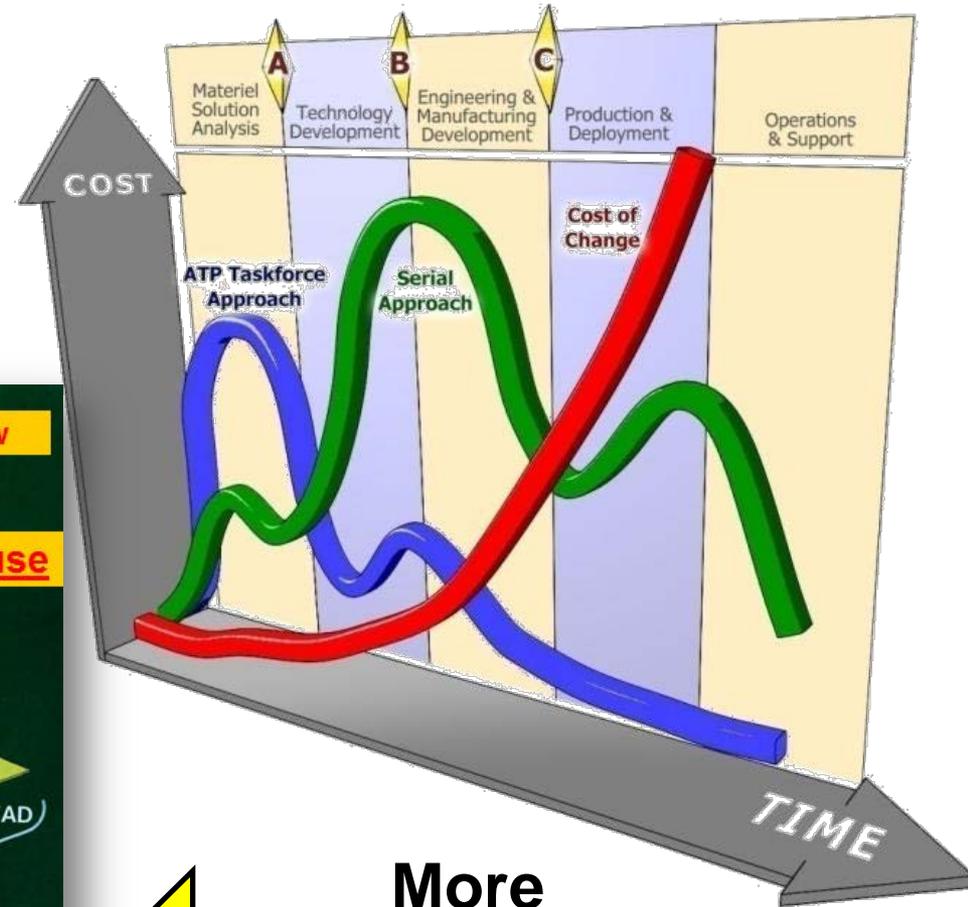
Munro understands the effects that design and other variables have on total life costs and has developed a unique suite of tools for managing cost and product complexity.



- DFM / DFX, VE, VSM
- Lean Design[®] (reduce complexity)
- DP Cost of Quality[™] (ensure robustness by design)
- Workshops
 - Bringing people together – rapid results
- Benchmarking and Teardown (technology infusion)
- The Wall Process[®] (stakeholder collaboration)
- Design for Manufacturing[®]
- Cost Estimating
- MRL Software, Training, and Assessments (risk & readiness)

Design Profit[®] integrates these methodologies in a single integrated platform that provides a powerful collaborative AoA tradespace.

The majority of life cycle costs are fixed early in the concept stage.



More
Knowledge
Up Front

Integrated Lifecycle Engineering

Design Profit® Knowledge Repository

Vehicle Library

- A-Class
- B-Class
- C-Class
- D-Class
- E-Class
- F-Class
- Truck

System

- Body
- Interior
- Chassis
- Electrical
- Powertrain

Powertrain

- Transmission
- Engine

Engine

- Exhaust
- Heads
- Front Cover
- Intake
- Block

Exhaust

- ERG Valve
- Manifold
- Shields

EGR Valve

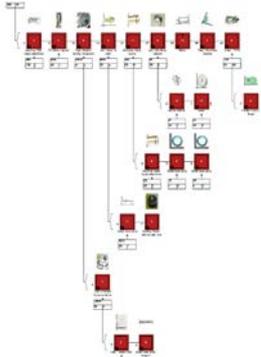
- Body
- PCB
- Valves
- Seals

OPTIMIZED "Should Cost" Analysis

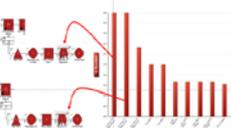
Lean Design® Analysis



Design Profit® Total Should Cost Analysis



Quality Report Card® Analysis



EGR Valve	
Parts	47
Total Part Numbers	36
Features	7
Steps	383
Actual Time	6.50sec
Parts Value Issues	1
Total Weight	3.85 lb
Prime Cost	\$17,107
Total Labor Cost	\$12,770
Total Cost	\$29,877
Investment Cost	\$397,488
Annual Production	375000

Technology Analysis

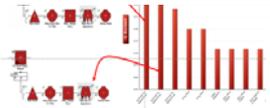


Design Profit® Total Target Cost Analysis

Design Profit® EXECUTIVE SUMMARY (Delta)

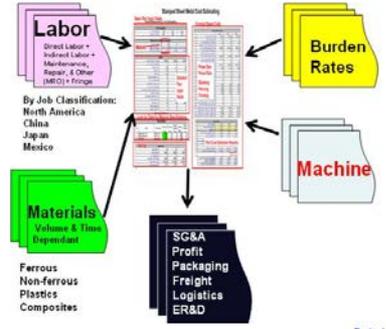
Item	2001	2002
Parts	385	390
Part Numbers	292	181
Features	292	0
Steps	2200	480
Time	6,350	1,522
Weight	328	34
Material	186	16
Headlines	56	5
Headlines	7	6
Part Numbers	20	18
Part Numbers	348,631 B	4,231 B
Part Numbers	116,536	88,138
Part Numbers	157,38	82,348
Part Numbers		878,312

Quality Report Card



Design Optimization Financial Summary

Costing Databases



Manufacturing Analysis

Revision	Issue description	Weight	Volume	Material	Material	Material	Year
107	Reduce length of rubber seal and reworking in large assembly area	NA	16,303	32,000	30,000	30,000	2001

Redesign #1 Description & Photos



Trade Studies



Ideation

Measure Success

EXECUTIVE SUMMARY

Item	2001	2002
Parts	385	390
Part Numbers	292	181
Features	292	0
Steps	2200	480
Time	6,350	1,522
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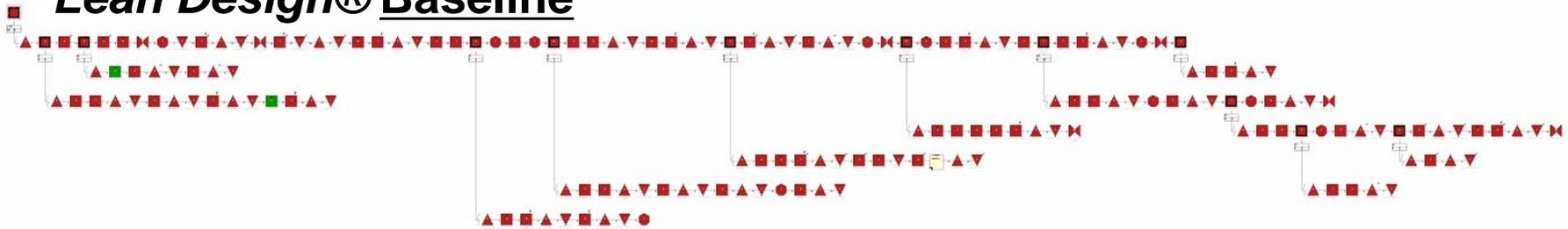
Design Profit®

Down-select

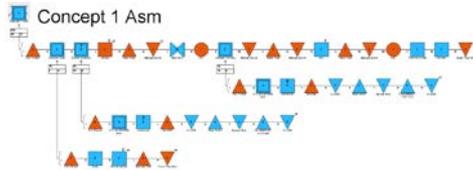


Lean Design® provides rapid generation and quantification of alternatives.

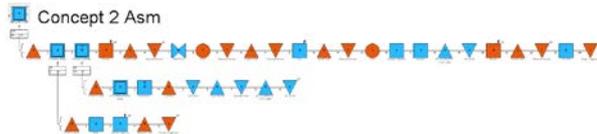
Lean Design® Baseline



Lean Design® Redesign 1



Lean Design® Redesign 2



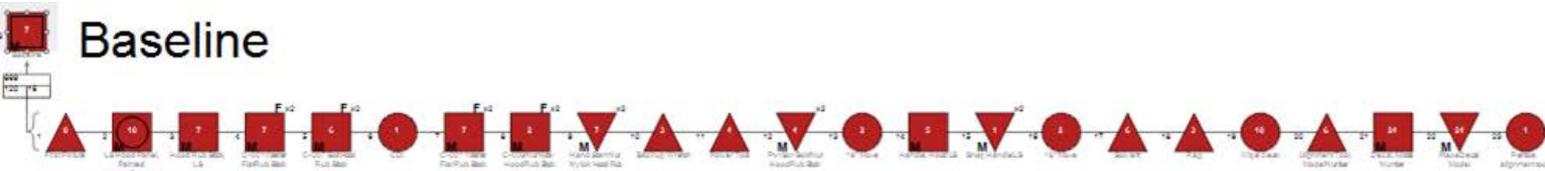
Lean Design® Redesign 3



Design Metrics	Baseline	Redesign 1	Redesign 2	Redesign 3
Parts	876	532 28%	467 30%	455 32%
Steps	1,289	1148 15%	1004 19%	988 20%
Score	4,578	2879 54%	2423 56%	2279 54%
Weight	35.78 lb	27.35 lb 15%	22.55 lb 15%	18.78 lb 17%
Fasteners	523	326 35%	310 38%	306 39%
Fastening Operations	672	572 23%	555 29%	522 30%
Poka Yoke	4	2 50%	2 50%	2 50%
Right First Time	90.57%	93.5% 2%	94.58% 2%	95.68% 2%
Sigma	5.03	5.12 11%	5.22 11%	5.42 12%
Piece Cost	\$390.10	\$248.23 22%	\$228.23 22%	\$198.22 25%
Supplier Labor Cost	\$30.00	\$2.00 3%		
Total Labor Cost	\$14.12	\$8.87 58%	\$8.27 58%	\$7.97 60%
Q Burden	\$3.67	\$1.58 55%	\$1.28 57%	\$1.18 58%
Total Cost	\$407.89	\$351.68 14%	\$331.73 15%	\$291.18 18%
Total Annual Savings	N/A	5,621,000 14%	5,881,000 15%	6,121,000 18%

Lean Design[®] provides rapid generation and quantification of alternatives.

Baseline



Design Profit[®] EXECUTIVE SUMMARY

DoDI 5000.02 Analysis of Alternatives (AoA)

	Pre-Concept	AoA - Design 1	AoA - Design 2	AoA - Design 3
TRL	4	4	5	2
MRL	3	3	3	2
Parts	142	94	104	85
Steps	930	748	818	680
Actual Time (min)	397.87	339.96	361.08	231.60
No. of Operators	77.861	66.723	69.539	44.641
Fasteners	51	33	39	26
Ergo Dangers	77	63	57	62
Poka Yoke Issues	68	44	34	46
Total Weight	1.89 lb	1.77 lb	1.80 lb	0.90 lb

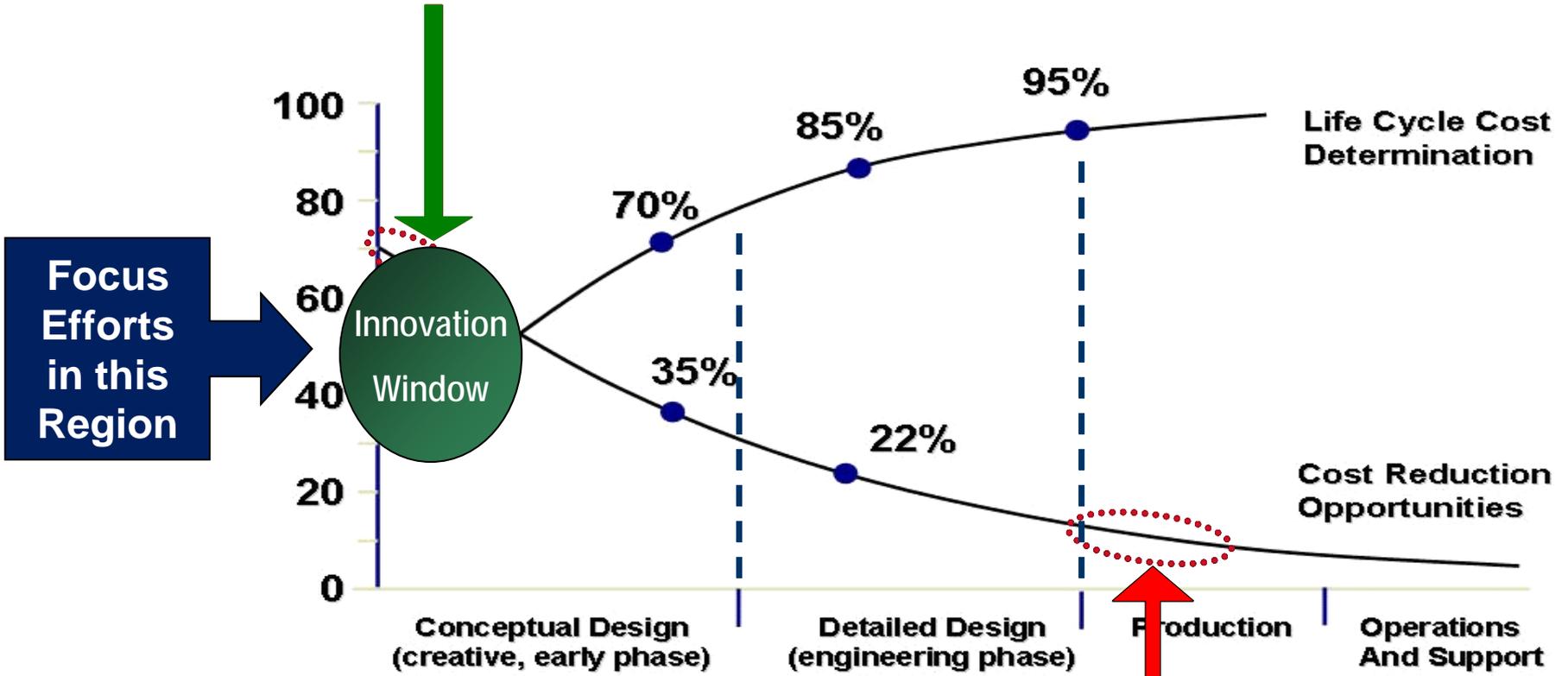
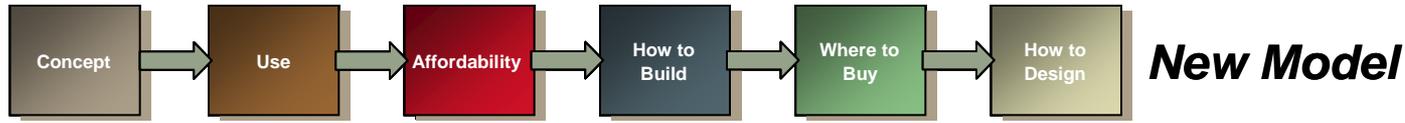
Redesign



Piece Cost	\$5,098.22	\$4,974.24	\$4,781.98	\$3,488.29
Total Labor Cost	\$551.06	\$479.00	\$505.47	\$329.38
Q Burden	\$1,066.69	\$1,066.69	\$1,057.84	\$883.15
Total Cost	\$6,715.97	\$6,519.92	\$6,345.29	\$4,700.83
Investment Cost	\$83,925	\$56,000	\$70,925	\$120,500
Annual Savings	N/A	\$4,705,054	\$8,896,231	\$48,363,432

AoA and Decision Visualization

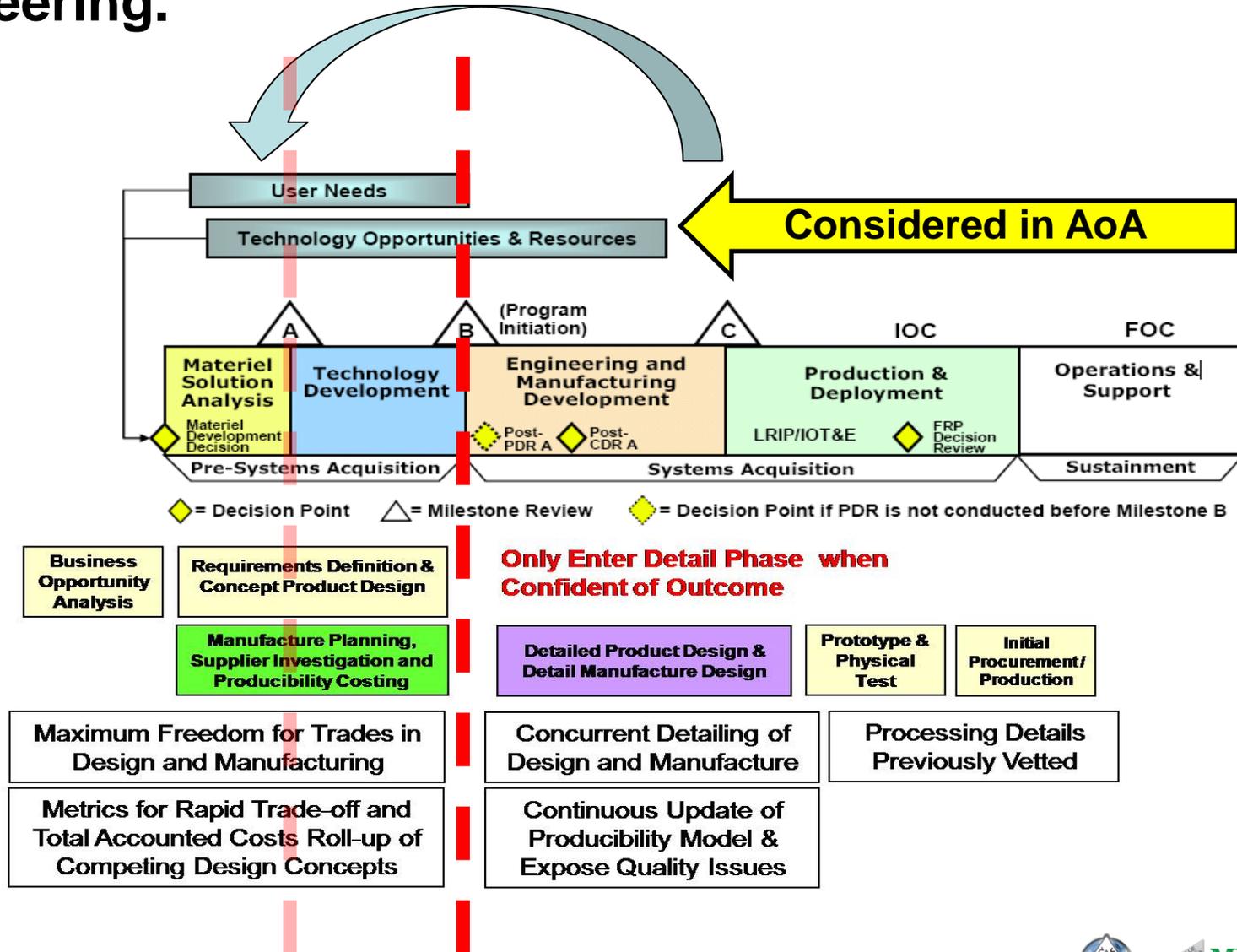
Shift Product Realization for Maximum Flexibility



Source: DARPA Rapid Design Exploration and Optimization Project



Design Profit[®] provides data and history needed to perform total life cycle trade studies to minimize risk before engineering.

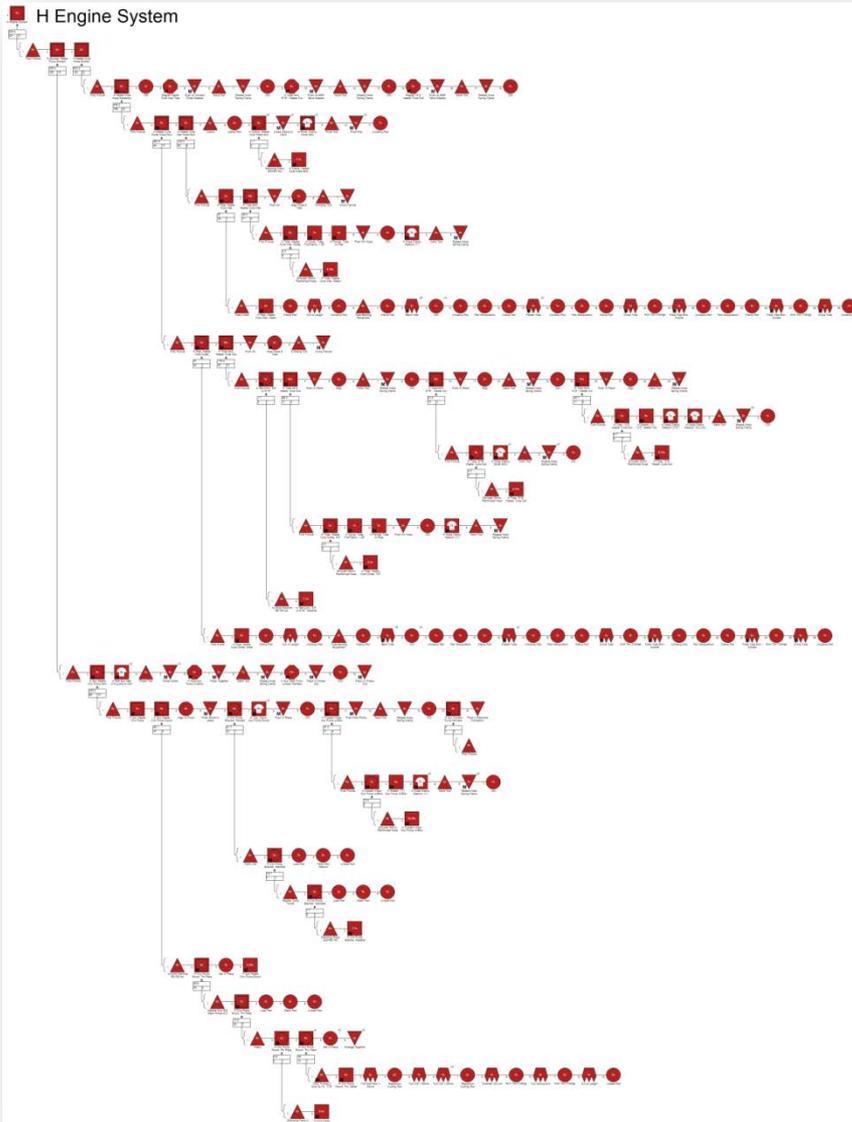




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Questions





Model Integration and Knowledge Manager

Design Profit[®] provides a systematic approach to translate requirements into total life cycle costs through conceptual modeling.

This provides the platform for effective decision-making considering all relevant metrics.

The baseline model consolidates and allocates data at the symbol level.

- Unit \$
- Program \$
- Quality \$
- Labor \$
- Machine \$
- Overhead \$
- Investment \$
- MRL
- Maintainability
- Producibility
- Sustainability
- Supplier
- Lead Time
- etc.

Assembly Variant Properties

Name: New Variant

Annual Production: 0

Operating Hours: 0

Target Weight: 0.0000 lb

Target Cost: \$0.00

Target Time: 0.0000 sec

Target Quality Cost: \$0.00

Options

- Options
- BIW
- Body (Paint)
- Body (TCF)
- Chassis
- Electrical
- Exterior
- Fluids Fill
- Interior
- Powertrain
 - 590 Engine Dress
 - 600 Transmission
 - 610 Air Cleaners
- Engine
 - Army
 - Engine Built Type A
 - Engine Built Type B
 - Marine
- Electrical
- Exterior
- Fluids Fill

Option Qty Description

BIW

Body (Paint)

Body (TCF)

Chassis

Electrical

Exterior

Fluids Fill

Interior

Powertrain

8501 Engine Dress

8503 Transmiss

8517 Air Cleaner

BIW

Body (Paint)

Body (TCF)

Chassis

Engine

Army

Engine

Engine Built Ty

Engine Build Ty

Marine

Electrical

Exterior

Fluids Fill

A life cycle cost model is generated based on your requirements.

Design Profit® EXECUTIVE SUMMARY
New Variant

New Variant	
Parts	44
Total Cost	\$20,000.00

New Variant

Currently, the definition of a product requires a person to build the variant (Model X).

We propose to identify requirements and construct a model based on the requirements. The model will identify associated costs to the requirement. Putting costs against requirements can improve program definition.

Modeling is capturing knowledge, and this knowledge can be used to easily generate designs. Multiple options can be proposed based on factors such as cost, weight, and timing requirements.

Early intensive data mining is needed.

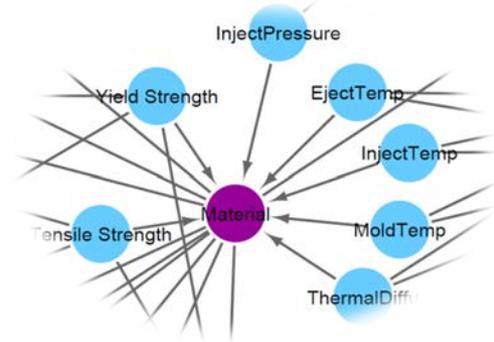
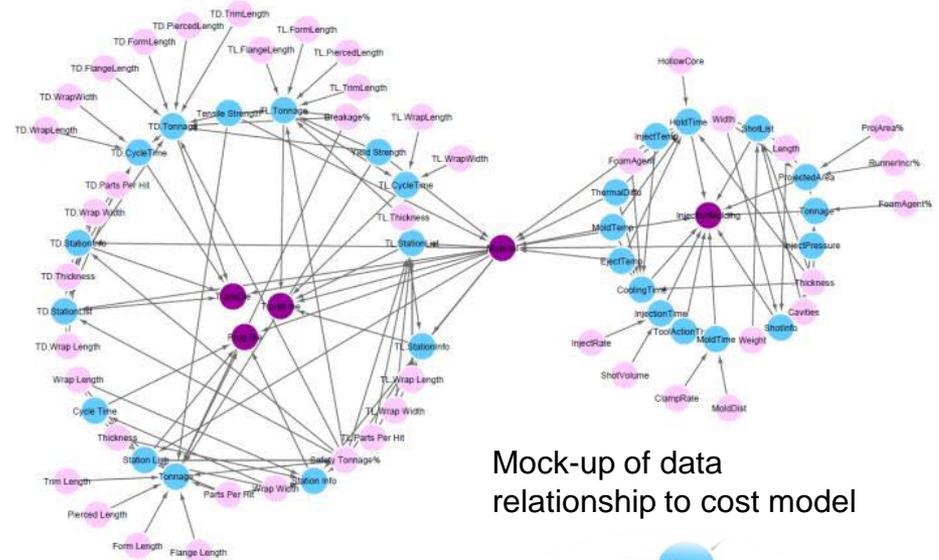
Topology Proposed

From either the Design Profit® process model or a BOM import, Design Profit will generate a topology that will visualize the data relationship.

The Phase 1 approach is to display the data relationship in a topology.

The next logical development will be utilizing advanced calculations to understand the relationship to specific design/performance characteristics.

For example, if we change the weight of a system how does it effect COG, MPH, etc., and what other systems does it effect.



Modeling is not limited to Design, but can be used for operations, service, energy requirement's, etc.