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.

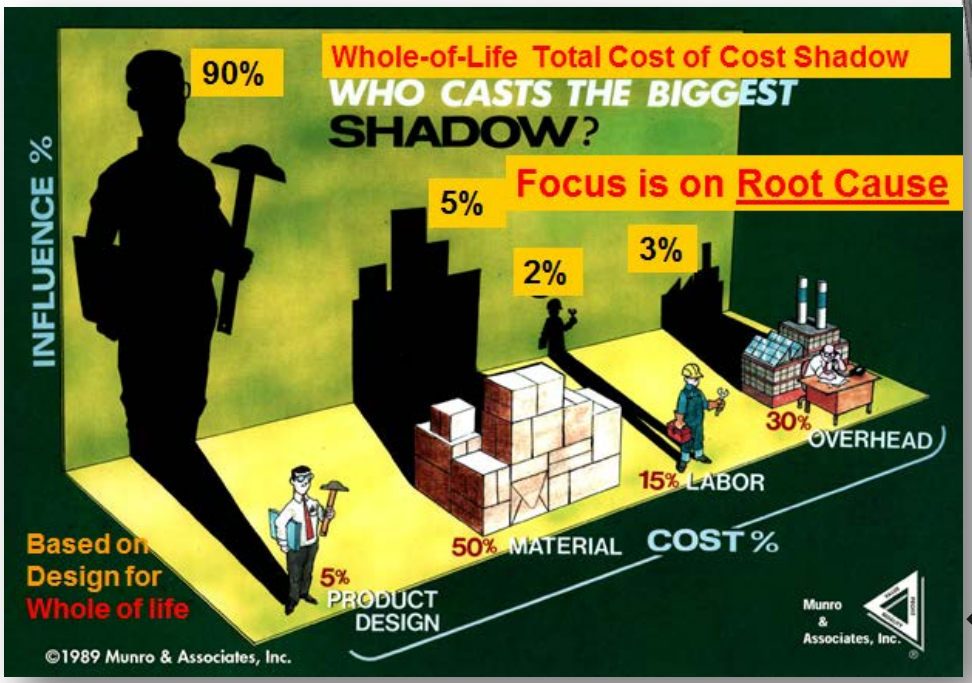
- **DFM / DFX, VE, VSM**
- **Lean Design® (reduce complexity)**
- **DP Cost of Quality™ (ensure robustness by design)**
- **Workshops**
  - **Bringing people together – rapid results**
- **Benchmarking and Teardown (technology infusion)**
- **The Wall Process® (stakeholder collaboration)**
- **Design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

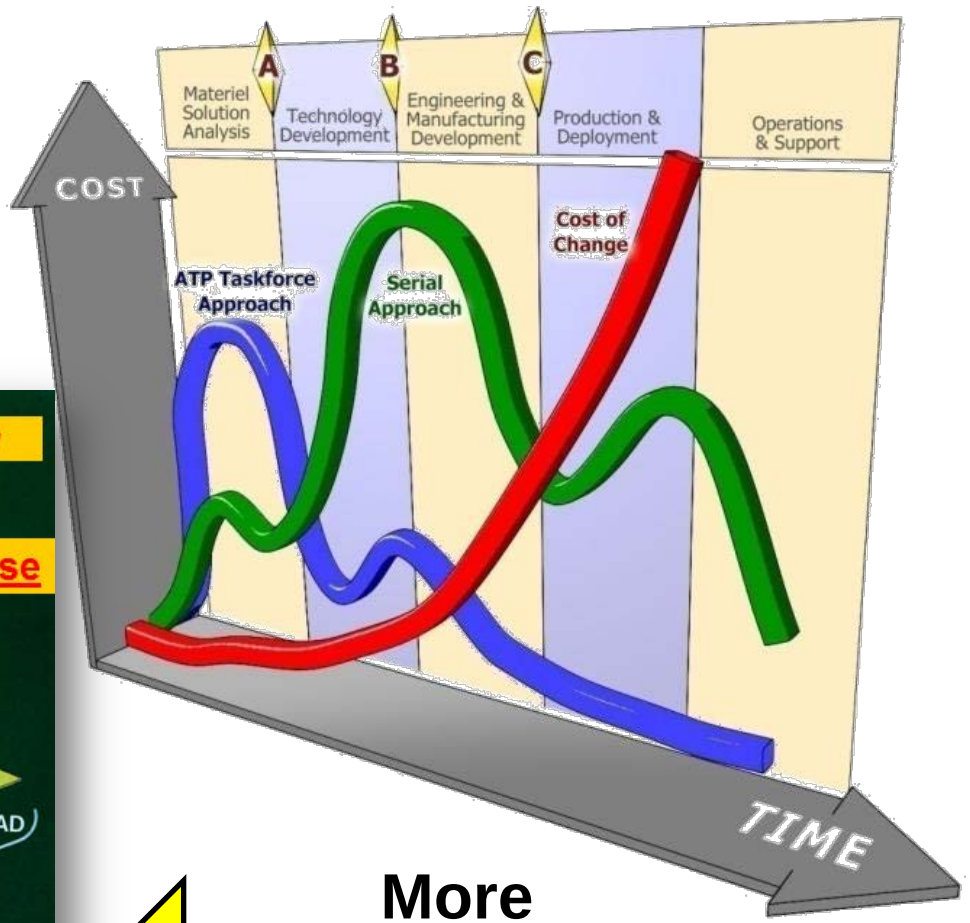
Design Profit® integrates these methodologies in a single integrated platform that provides a powerful collaborative AoA tradespace.

ERS
Engineered Resilient Systems

5000.02 Approach

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





More

Knowledge

Up Front

Integrated Lifecycle Engineering

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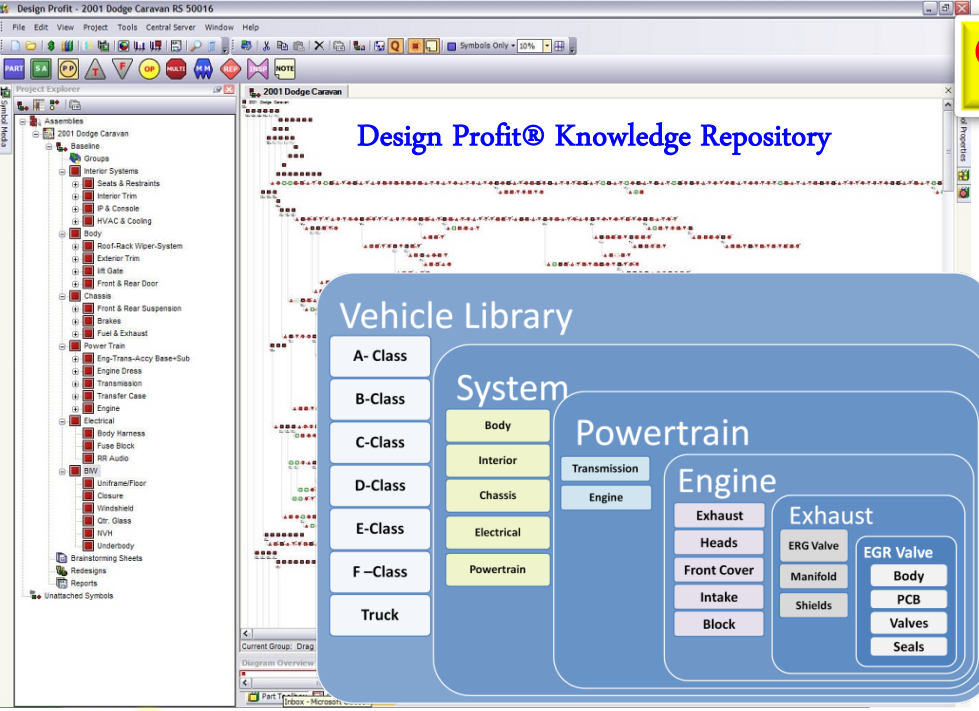
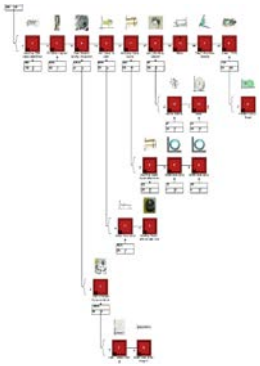
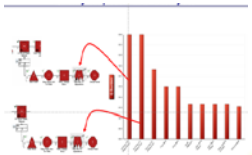
OPTIMIZED "Should Cost" Analysis



Lean Design® Analysis



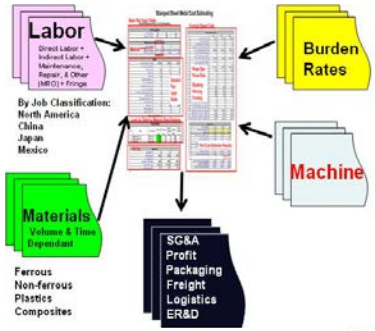
Quality Report Card® Analysis



Design Profit® Total Should Cost Analysis

Technology Analysis

Costing Databases

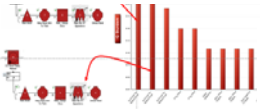


Ideation

Design Profit® Total Target Cost Analysis

Design Optimization Financial Summary

Quality Report Card



Manufacturing Analysis

Trade Studies

Down-select

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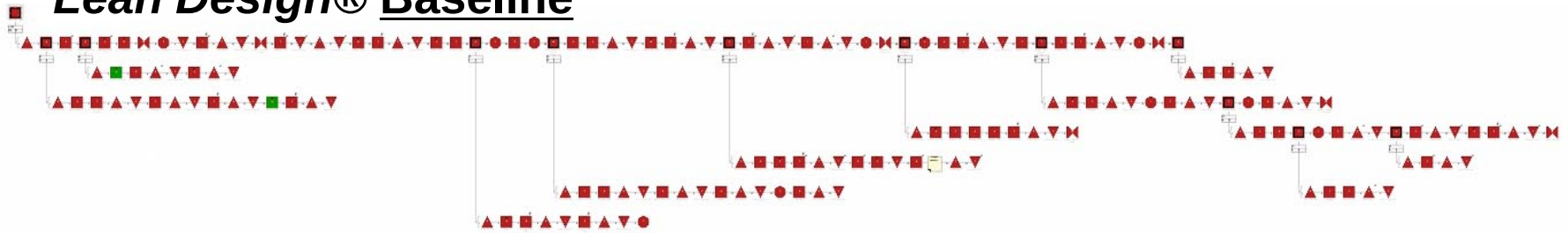
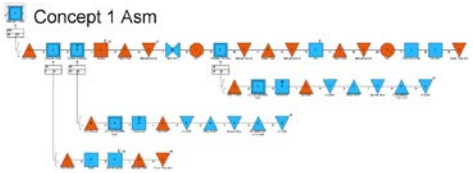
Lean Design® provides rapid generation and quantification of alternatives.

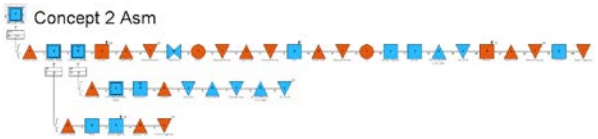
Lean Design® Baseline



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%

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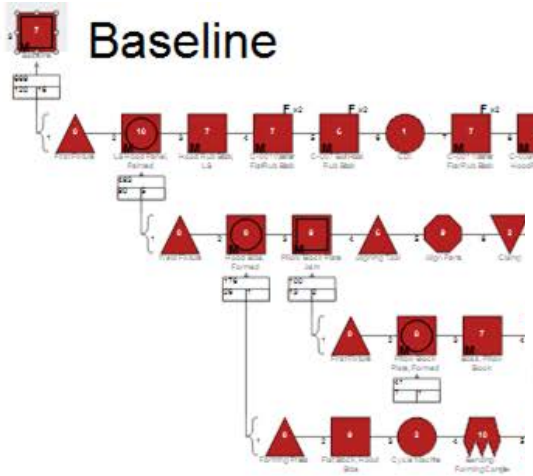

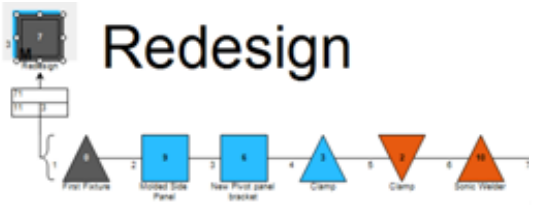

Design Profit® **EXECUTIVE SUMMARY**

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
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

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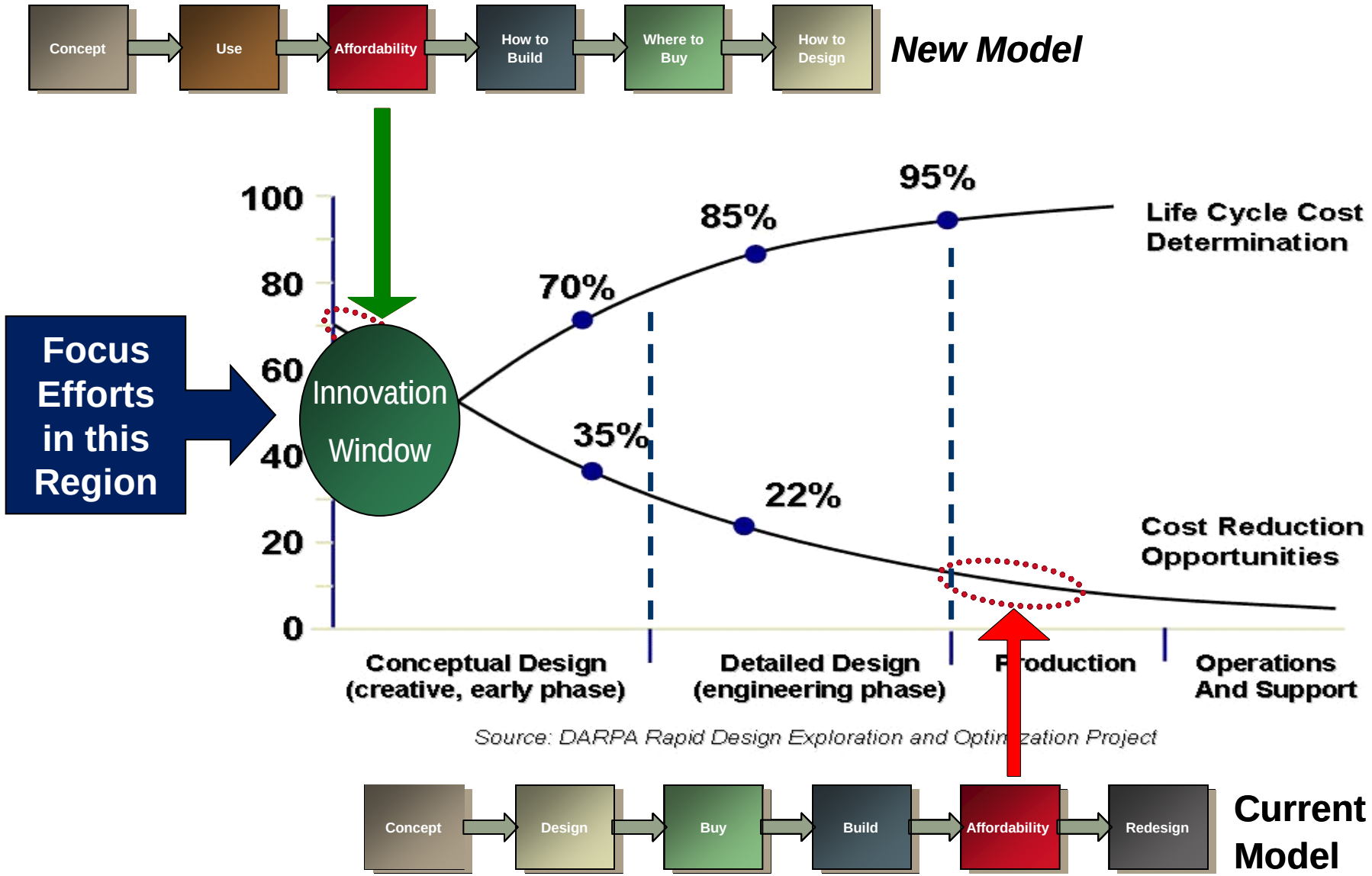
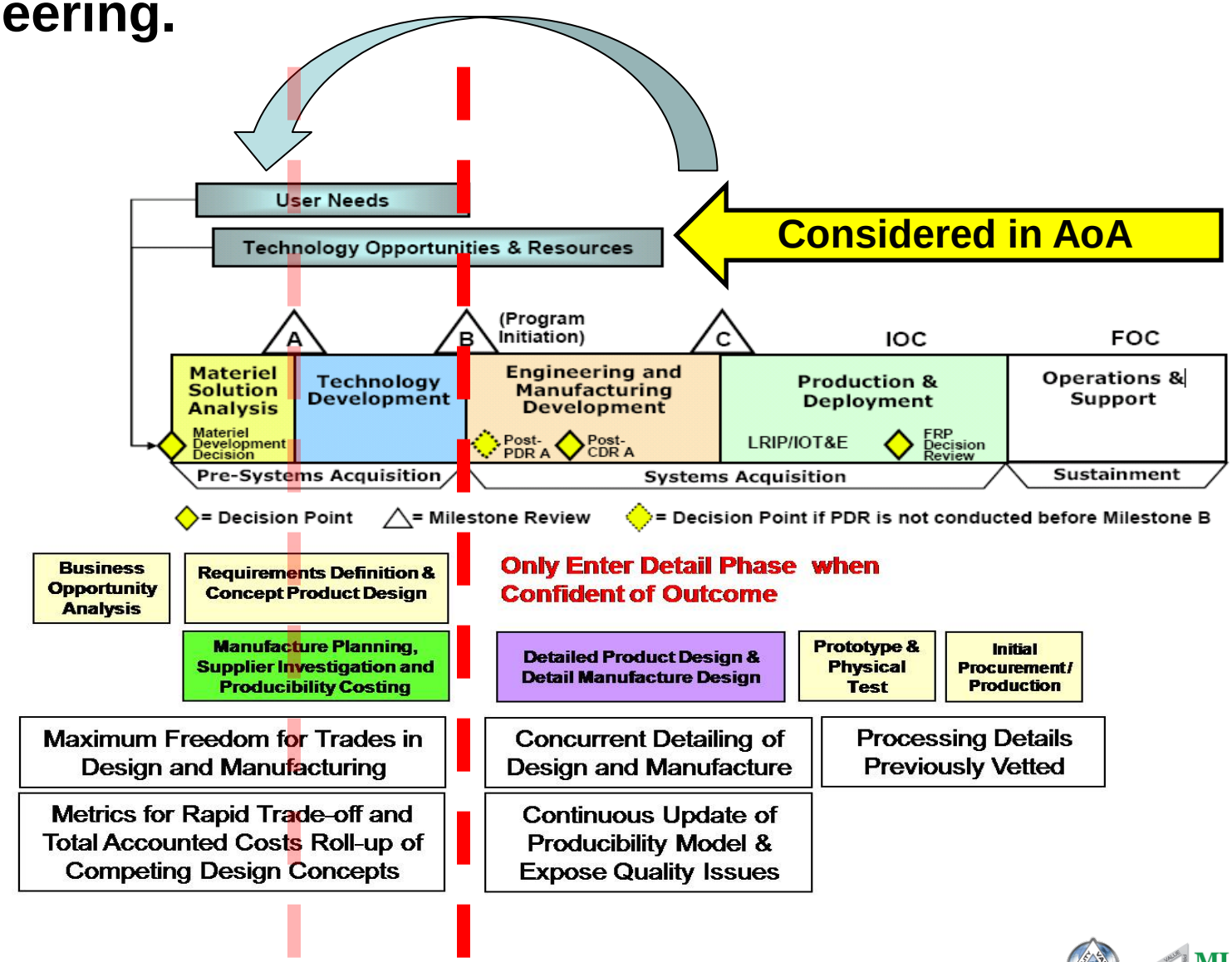
Shift Product Realization for Maximum Flexibility

Raytheon



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



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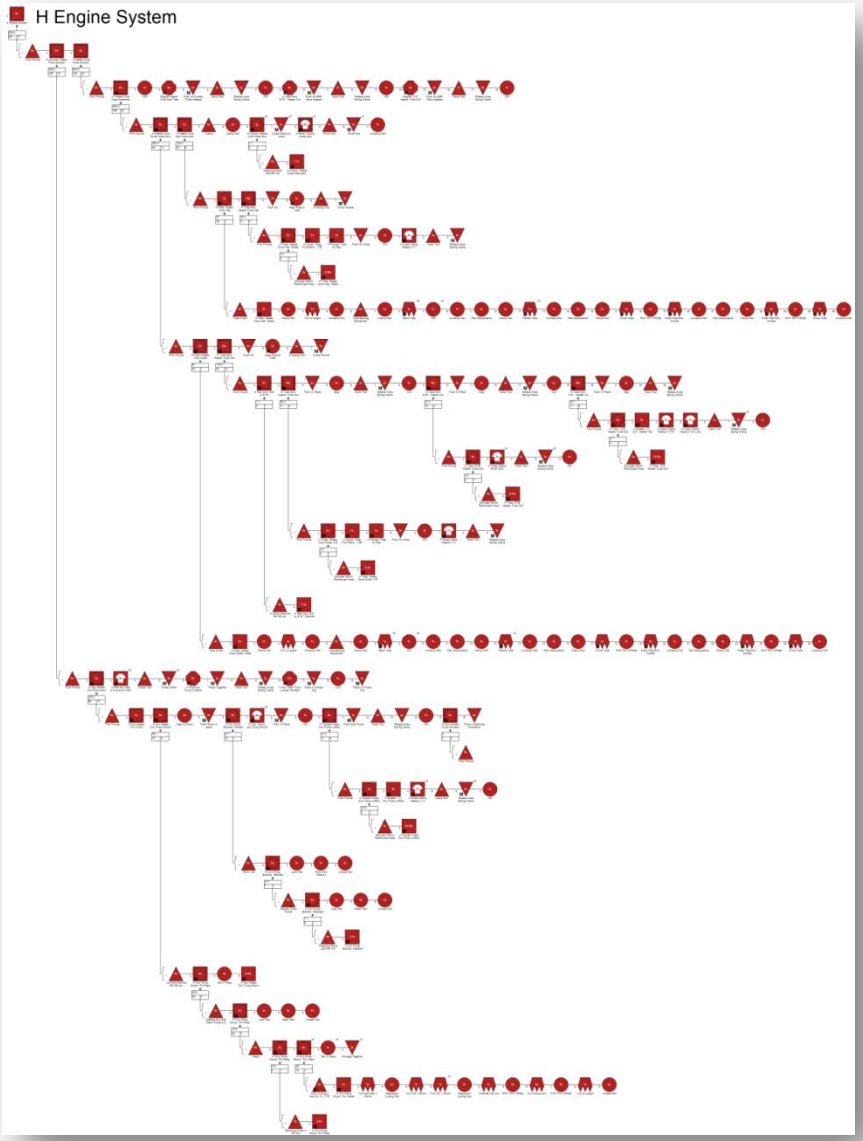
Questions



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.

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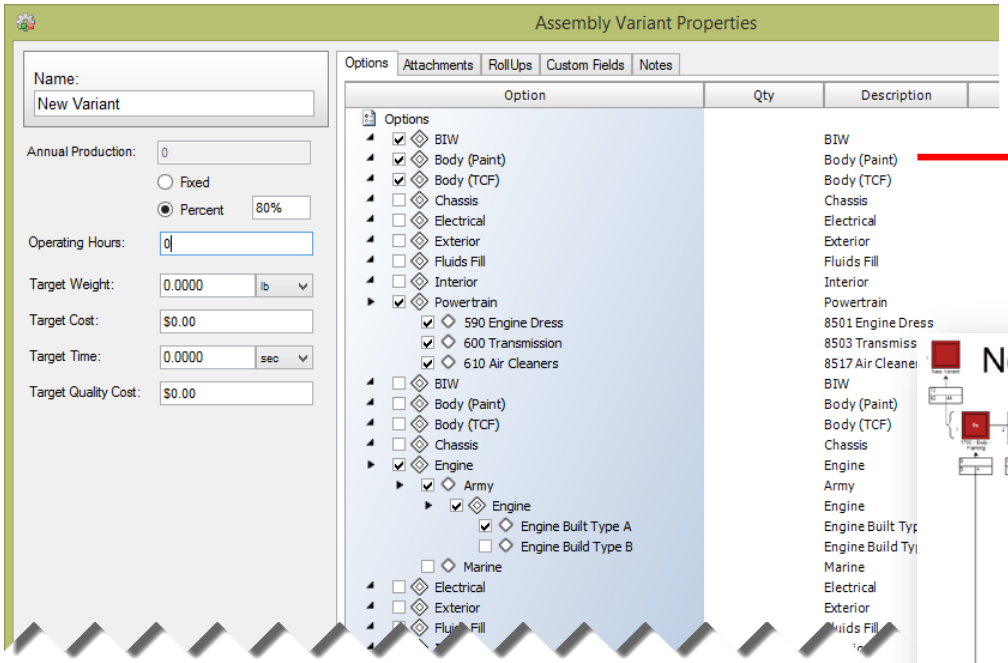
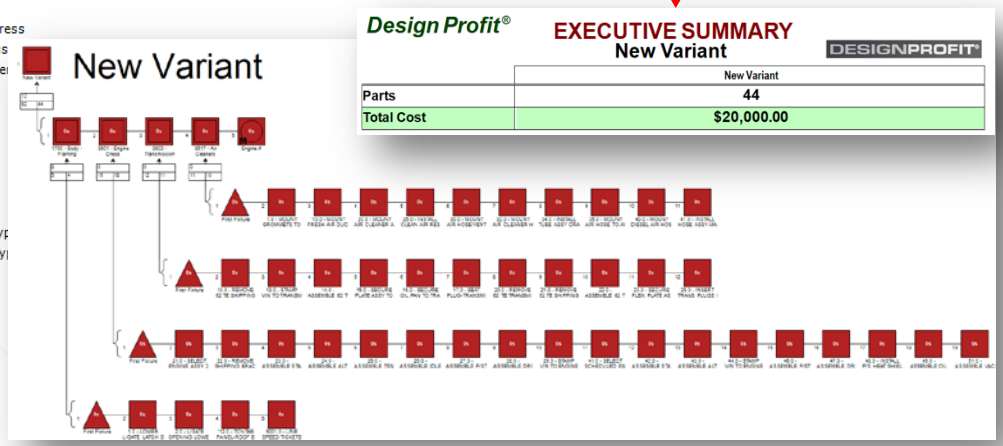


A life cycle cost model is generated based on your requirements.



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.

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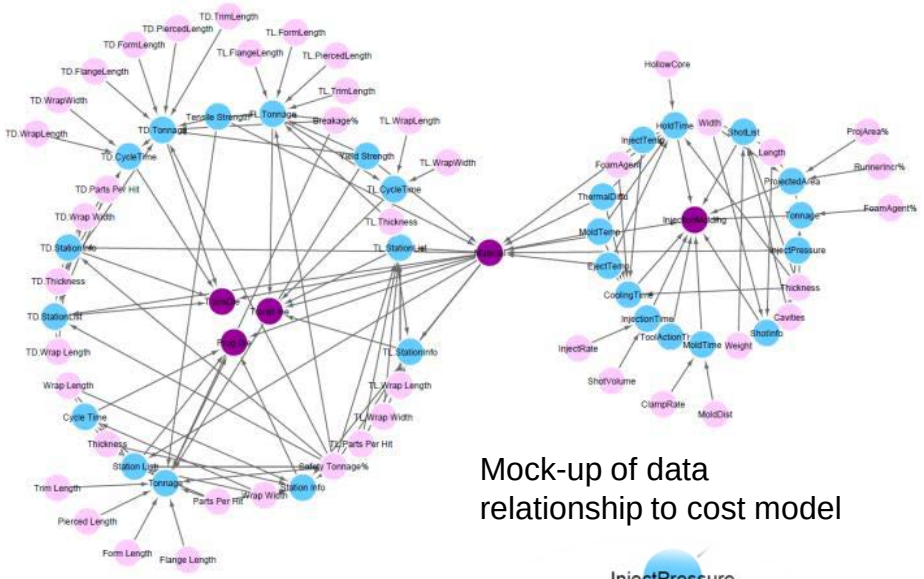
Topology
Proposed

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

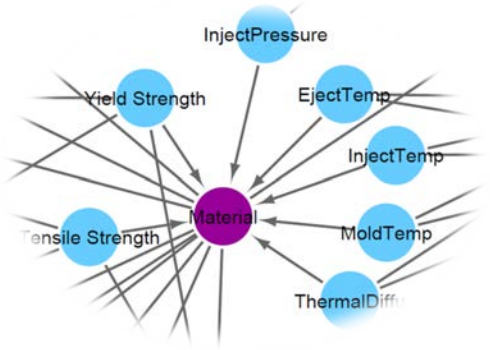
The Phase 1 approach is to display the data relationship in a topology.

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.



Mock-up of data relationship to cost model



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