



Lean Design[™] Overview
with
Armrest Example

The basis of what we do at Munro & Associates relies on our patented methodology called *Lean Design*[™].

What is *Lean Design*[™]?

Lean Design[™] encompasses a set of methods and principles which result in a product design that is elegantly simple: it looks good, performs well, and can be easily manufactured with quality at a profit.

To ensure this outcome, *Lean Design*[™] has four major parts:

Part 1) A baseline analysis of a product, including cost information. This baseline analysis involves mapping out each step it takes to make the product. This map, in turn, informs efforts at redesign by clearly pointing out where the best opportunities exist.

Part 2) Cross-functional Brainstorming for Redesign. This step in a *Lean Design*[™] event draws upon the experience, strategies, and support of cross functional teams to redesign the product.

Part 3) Prioritizing. The cross-functional teams prioritize the results of their brainstorming into three phases:

Redesign 1, which essentially involves no cost;

Redesign 2, which involves more cost, time, and engineering validation; and

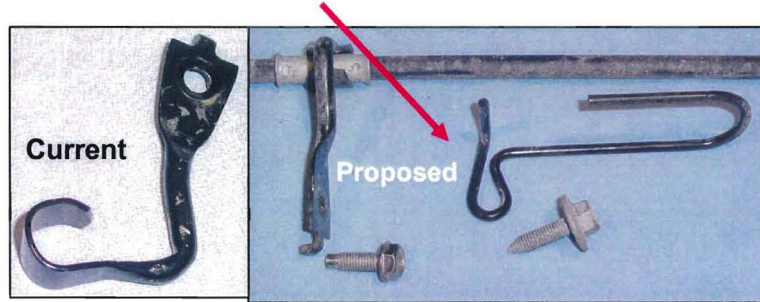
Redesign 3, which would involve substantial costs, including retooling.

When Munro & Associates conducts a *Lean Design*[™] event on behalf of our clients, we provide them with a hard copy report of every redesign idea, described pictorially.

Examples of the Reports that Result from Part 3 of a *Lean Design™* Event

PICTORIAL

Idea # 8 Use low cost wire form bracket for L-shaped bracket



EXCEL CHART
 Tracks Each Redesign Idea

Idea No.	Idea Description	Delta	\$ 80.00	\$ 50.00	Delta	\$11.50
		Weight (Lbs)	OEM Labor Savings	Supplier Labor Savings	Material Cost Savings	Total Idea Savings
1	Replace seven screws with snaps	3.80	\$2.60	\$4.20	\$4.70	\$1.05
3		0.05	\$0.15	\$0.80	\$0.10	\$1.05
5		0.70	\$0.25	\$0.30	\$2.00	\$2.55
6		0.20	\$0.20	\$0.60	\$0.40	\$1.20
7		0.40	\$0.40	\$0.70	\$0.70	\$1.80
11		1.45	\$0.70	\$0.90	\$0.10	\$1.70
13		0.80	\$0.70	\$0.20	\$1.20	\$2.10
		0.20	\$0.20	\$0.70	\$0.20	\$1.10

Part 4) Report Out. The overall results are graphed out in a *Lean Design™* Executive Summary, which includes potential cost savings.

Lean Design™ Executive Summary

Company:
 Product:
 Assembly:

	Baseline	Redesign 1	Redesign 2	Redesign 3
Number of Steps	452	420		
Number of Parts	135	118		
Number of Fasteners	62	56		
Munro Assembly Score	1,965	1,852		
Good Parts	20	20		
Ergonomic Problems	7	7		
Poka Yoke Problems	0	0		
Poor Quality Cost @ /defect				
System Weight Savings (lb)	-----	2.99		
OEM Labor Cost Savings	-----	\$0.34		
Supplier Labor Cost Savings	-----	\$0.33		
Material Cost Savings	-----	\$3.29		
Total Cost Savings	-----	\$3.96		

The methodology behind Lean Design stems from the knowledge that 70% of a product's costs tracks back to its design. To fully comprehend a product's design, *Lean Design*TM looks at how a product is put together by analyzing the following:

1. What does it take to pick up a part? (For example: one hand, two hands, or a crane?)
2. What is the part-to-operator interface? (For example: difficult, dirty, or dangerous?)
3. What is the part-to-part interface? (For example: does the operator have to fight gravity, use complex motions, or is his or her vision restricted?)
4. What tools are required? (For example: a hand tool, a power tool, or an arc welder?)
5. What operations are required? (For example: CDI, part inspection, or the use of a crane?)
6. What fasteners are involved and how many of each?

Along the way, *Lean Design*TM uses a series of symbols for each component and assembly step to clearly map out the process.

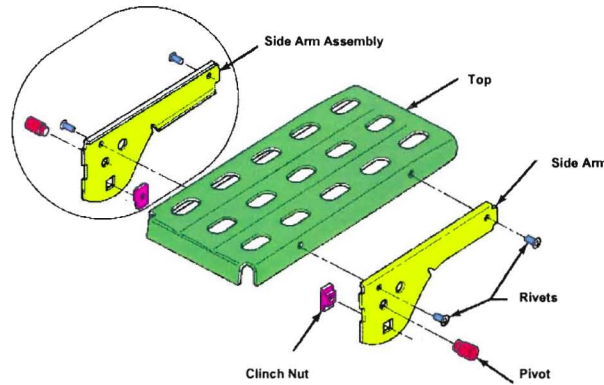
1. \triangle = Tooling Operation
2. ∇ = Fastening Operation
3. \square = Part
4. \circ = Operation
5. \blacksquare = Sub-Assembly
5. Color red = opportunity for redesign
6. Color green = good part

What is the difference between *Lean Design*TM and other DFM/DFA or VA/VE methods?

- 1) *Lean Design*TM goes beyond focusing on cost reduction of the individual parts that comprise a product: it tells you *which* parts you should eliminate and why.
- 2) *Lean Design*TM uses the assembly process to guide you through the product's whole design. This prevents subjective part selection common to other methodologies.
- 3) By using the assembly process to drive the evaluation, *Lean Design*TM guides you through an evaluation of your entire design architecture.
- 4) *Lean Design*TM considers the operator and what he or she needs to do to assemble the product. This reveals issues such as ergonomic concerns.
- 5) *Lean Design*TM looks to incorporate new technology into redesigns.

An example of *Lean Design*TM on an armrest would look like this:

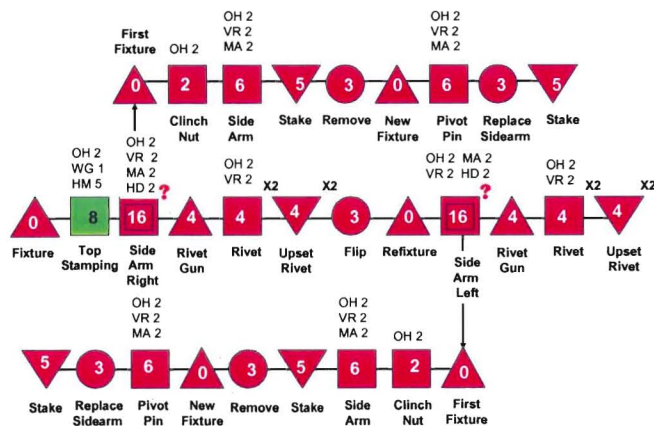
EXISTING ARMREST BRACKET ASSEMBLY
Piece Functional Linear Assembly



The above armrest bracket assembly employs a piece-functional-linear assembly design rationale. This means that each part exists because of assumptions about form and function that build one upon the other.

When we put this armrest bracket assembly through *Lean Design*TM analysis, the result is a flow chart of red steps (i.e., opportunities for redesign) and only one green part, (i.e., good part).

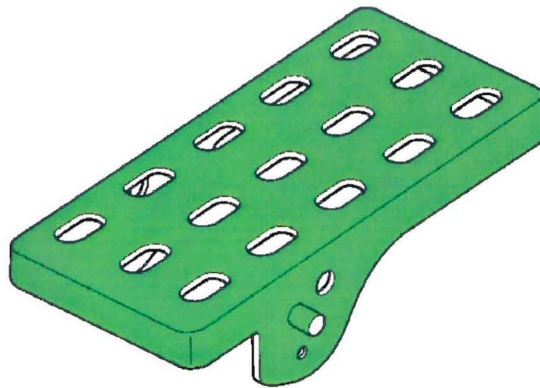
*Lean Design*TM Analysis
 of
EXISTING ARMREST BRACKET ASSEMBLY
Piece Functional Linear Assembly



The goal we strive for is product simplification. We know that the simpler the product, the higher the quality, because there is less opportunity for something to go wrong. The example below might be a reasonable redesign of the armrest, this time changing the material to a plastic injection molded part.

Undoubtedly, this is an improvement. In fact, our *Lean Design*[™] analysis would reveal that this part would result in a savings of approximately 50 % over the original.

Armrest Redesign 1



But another principle of *Lean Design*[™] is that the first design is never the simplest. Also, *Lean Design*[™] looks to incorporate new technology into redesigns.

From this perspective, Munro & Associates proposed an entirely new concept for the armrest, which fully integrated not only the original bracket and fittings, but also the cloth covering, padding, and everything needed to make a product that looked good, added value, performed well, and was easy to manufacture at a profit.

Munro Armrest Redesign Integrated Armrest Technology with Living Hinge



The total cost of this redesigned part was approximately \$1.80 per unit, there was a two pound weight reduction, and, in addition, the new product required no foam, cutting or sewing, transportation, or inventory, since it was produced at line speed 5 vehicles ahead. In contrast, the original armrest with bracket cost \$42.00 per unit.

Since its founding in 1988, Munro & Associates has had extensive experience with nearly every major automaker. In North America, our consultants have typically succeeded in generating more than \$1,000 in cost savings ideas per fully optioned vehicle, making the automotive industry among our biggest customers and the greatest believers in our methods. But it doesn't stop there. *Lean Design*[™] works, and has been used successfully by Munro & Associates on everything from Mattel's Barbi to NASA's Space Station.

For more information, contact Munro & Associates, Inc. at their headquarters in Troy, Michigan, at 248-362-5110.