Global Presence
Since 1988

- Software Generation
  Lansing, MI
- Lean Design Center
  Windsor Ontario
- Leamington Spa, England
- Seoul Korea
- Tokyo Japan
- Shenzhen, Shanghai
  & Beijing China
- Melbourne Australia

Benchmark Innovation Center
Auburn Hills, MI
Customers Served

Aerospace
Aerojet
Astronix Corp
BAE Systems
Bell and Howard
BF Goodrich Aerospace
Boeing Commercial Aviation
Boeing Helicopter Systems
Boeing Satellite Systems
Cirrus
deHavilland
Drager Aerospace
Indian Government
JAMCO
Lucas Aerospace
Martin Marietta
Martin-Baker Aircraft Co
McDonnell Douglas
MISATS
Monogram Systems
NASA - Langley Research Center
NASA - Johnson Space Center
NCAM
Piper
Primex
Rolls Royce Aero Eng
Schukra
Sikorsky
Spar
Teague
Agriculture
DICCY-john
Automotive
Air International
Ancra
Auto Latina
Automotive International
Bentley Motors Limited
Bosch
BorgWarner
Brose
DaimlerChrysler
Champion Laboratories
Davco
Delphi
Denso
Donnex/Donnelly
Ford
GM
Humphrey Products
Intier
ITT Automotive
Johnson Electric
Johan A. Krause
Land Rover
Lectron Products
MG Rover
MTM Pty. Ltd. Australia
Navistar
PBR
Roll Royce
Rover
Rover Group / BMW
Scherfaeker
Sumitomo
Tata Motors
Textron Systems
Thyssen Krupp - Budd
Toyota
TRW
Volkswagen

Consumer Goods
Bose Corp
Brazeway
Fountain Head
Fuji Film
Hamilton Beach
Hunter Douglas
Mattel
Whirlpool

Defense
Alliant Techsystems
AlliedSignal
Boeing Integrated Defense Systems
Bofors
Brashear
Coleman Research
ComDev
Computing Devices
DARPA
Diehl
DRS
EC Marconi
General Dynamics
Hamilton Sunstrand
Honeywell
Kaman
KDI
L3 Communications
Litton Guidance Control
Litton Laser
Lockheed Martin
Northrop Grumman
Picatinny Arsenal
Raytheon
Sandia Labs
TACOM
Texas Instruments
Textron Defense Systems
Vickers
Westinghouse

Electronics
AB Dick
Advantest - Japan
Compaq Computers
EMC
Hewlett Packard
IBM
Intel
Motorola
Nikon
Novellus
Pitney Bowes
Siecor
Spartanics
Tektronics
Xerox

Furniture
Herman Miller

Homeland Security
AS&E

Industrial
ADIC
Advance Transformer
A.O. Smith
Ballard
Beacon Power Corp
Bowie Bell & Howell
Carrier Air Conditioners
Cymer
Dresser
Dupont
ElectroCom
Fluid Management
Graco
Ingersoll-Rand
International Fuel Cell
Jervis Webb
Muncie Power Products
National Cranes
Norcold
Nordyne
NTC Products
Oldenberg
Otis Elevators
Samsung
Spectra Precision
Stihl
Syspal
ThermoKing
Trane
TSI
Von Duprin
Wagner Spray Tech
Wallace & Tiernan
Xomox

Medical
Abbott Labs
Alaris Medical Systems
Becton Dickinsen
Cardinal Health
Cobe Cardiovascular
Despatch
Dynacom
Ethicon Endosurgery
Guidant
Hill-Rom
Medtronic
Nanodrop
Rela
Respironics
SciCam
SenDx
Siemens
Stryker Medical
UMM - United Medical Manufacturing Co.

Off Highway
Case
Caterpillar
CNH
FMC
Grove Crane
JCB
Yanmar

Oil
Baker Oil Tools
General Electric
Ingersoll-Rand

Recreational
Vehicle
Club Car
Harley Davidson
Polaris

Robotics
RPT

Ships
Atlantic Marine
Bath Iron Works
Electric Boat
NASSCO
Tenix

Transportation
Alexander Dennis
BlueBird
Cummins Engine
Freightliner
Kentworth
Luminator
Onan
Ricon
Design Profit® is our foundational tool to assist in:

- Producing objective and quantitative data on product designs
- Identifying waste and poor quality drivers
- Thinking differently - Challenging the value of every part in the design

**Change the Rules**
**The Part Value Challenge**

1. Does the Part to *have* move?

2. Does the part *have* to be a different material?

*When in doubt, Throw it out!!*
Success Road Map

Optimize the Design

Eliminate the Waste:
- poor quality driver
- non-value added parts & operations

Interject New Technology
- Reduce cost
- Satisfy new requirement

Predict:
- Cost, Weight, Quality

Informed Decisions
Business Case

Goal:
Efficient, Elegant Design that is Cost Effective with Higher Quality
A key success factor is timing. Early mapping or modeling of the product exposes hidden cost drivers, raises flags, forces early consideration and tracks resolution.

This isn’t working at all... I should warn others not to put their cart before the horse.

You want to put the all the work up front where it makes the most difference.
Elimination of Waste Through Front-Loading

Source: [http://manufacturingwisdom.com](http://manufacturingwisdom.com), How-a-traditional-japanese-meal-can-accelerate-new-product-introduction, Sept. 9, 2009 (Modified by Munro)

The design phase provides the best opportunity to reduce total program cost.
Significant or breakthrough innovation is only attainable in the early stages of design where product transformation is unrestricted and unhampered by existing drawings and tooling.
Ripple Effect
Ripple Effect
Ripple Effect
Ripple Effect
Ripple Effect
Cascading Effect of Design
The Best Design?

"... the simplest one that works."
-Albert Einstein

"The first design is never the simplest."
-Munro & Associates, Inc.
We Model so We can Improve

Appropriate Data at the Appropriate Time

Fidelity of the data is appropriate to support timely decision making through all phases of the program

- Coarse models at the program outset are needed to make decisions on requirements fulfillment criteria and architecture.
- Modeling exposes hidden cost drivers, raises flags, forces early consideration and tracks resolution.
- Model fidelity increases as knowledge increases.
- Data bases and templates facilitate rapid modeling.
Design Profit® is a tool and a thought process that methodically challenges the design status-quo.

But We’ve ALWAYS Done It This Way!

Design Profit

If it ain’t broke...
Our vendor won’t support that.
We tried that before.
Great idea, but not for us.
"It isn’t my responsibility."
Do you realize the paper work it will create.
I’ll get back to you.
"Let’s stick with what works."

No!
It will NEVER Work.

Tradition is admirable, but complacency can lead to collapse.
<table>
<thead>
<tr>
<th>The Business</th>
<th>The Mission</th>
<th>The Method</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>In The Business of INNOVATION &amp; Risk Mitigation</em></td>
<td><em>Helping Customers consistently maximize product Value, Quality &amp; Profit</em></td>
<td><em>Do It Right The First Time! Up Front! In The Design Phase!</em></td>
</tr>
<tr>
<td>The Goal</td>
<td>The Objective</td>
<td>Focus – Producibility</td>
</tr>
<tr>
<td><strong>Make Money For Share Holders</strong></td>
<td><strong>Optimized Program</strong></td>
<td><strong>Ensure RFT production</strong></td>
</tr>
<tr>
<td><img src="image" alt="Money Symbol" /></td>
<td><img src="image" alt="Cost, Performance, Quality, Manufacturability" /></td>
<td><strong>Guardian for cost, weight and Quality</strong></td>
</tr>
</tbody>
</table>
Fast forward to 21st century automania

Travel through time to the year 2096 as auto industry professionals answer the question, “What will the car look like 100 years from now?” Keep in mind that the 1996 reading of their forecasts may come true after another generation of engineers, designers, researchers, and scientists unlock discovery doors to the future.

Warning: the following opinions may be hazardous to readers without a sense of humor or creative visions.

One hundred years from now the colorant on the outside of a vehicle may be very different from today. The exterior coating will be resistant to damage, possibly a plastic film that can be custom designed. Automakers may offer a wider color range for some vehicles, possibly signature designs or personalized color combinations. Cars buyers could even order their selection using a personal computer. In 1980, its inherent flexo effect will likely be commonplace. As today, the marketplace will determine what colors and designs are in vogue. You will potentially see plastic, polka dots, or unique signatures for every style and shape. Expect the move toward individuality of style to become even stronger.

A personal opinion—All vehicles, including buses and heavy-duty trucks, will have electric drive systems and electronic control modules, probably in each wheel, with different combinations of onboard electrical energy storage and electrical power generation capability. The idea of burning fossil fuels in reciprocating heat engines will be reflected upon as having been a very primitive approach. The majority of automobiles will be sold as pure EVs with different driving ranges and passenger carrying capabilities, series hybrid-electric vehicles will provide unlimited driving range capability for four or more people with high fuel economy and low emissions. Heat engines will be small gas turbines with advanced ceramic materials, and will be fueled by natural gas or alcohol. Buses will be either pure electric or series hybrid-electric, heavy-duty trucks will be hybrid-electric with small pure EV range capability (like diesel-electric railroad locomotives today but with gas turbine heat engines). Medium-duty trucks will be both pure electric and series hybrid-electric. Fuels of choice will be natural gas or alcohol. Fuel cells may make it unceremonious to technology cars of vehicles as an alternative to gas turbine-driven APA’s and series hybrids, but for the most part, fossil-based fuel cells will be used to generate electricity as part of a distributed electric power generation system with very low emissions compared to the large central fossil-fueled power generation stations of today.

Plastic composite materials will replace sheet and aluminum in automobiles. What is thought of today as high volume modular/flexible production techniques will be replaced by what is thought of today as low-volume production techniques—with much greater flexibility at both low and high volumes. Automobile manufacturers will become a hybrid of what the consumer electronics and aerospace industries are today. Highly functional products will incorporate high technology. Vehicle design focus will be on systems engineering and tailoring the product to functional demands which will be reflected upon as having been a very primitive practice. The majority of automobiles will be sold as pure EVs with different driving ranges and passenger carrying capabilities, series hybrid-electric vehicles will provide unlimited driving range capability for four or more people with high fuel economy and low emissions. Heat engines will be small gas turbines with advanced ceramic materials, and will be fueled by natural gas or alcohol. Buses will be either pure electric or series hybrid-electric, heavy-duty trucks will be hybrid-electric with small pure EV range capability (like diesel-electric railroad locomotives today but with gas turbine heat engines). Medium-duty trucks will be both pure electric and series hybrid-electric. Fuels of choice will be natural gas or alcohol. Fuel cells may make it unceremonious to technology cars of vehicles as an alternative to gas turbine-driven APA’s and series hybrids, but for the most part, fossil-based fuel cells will be used to generate electricity as part of a distributed electric power generation system with very low emissions compared to the large central fossil-fueled power generation stations of today.

The Porsche 911 will be made of 100% recyclable materials, but will be recognizable as a 911. It will likely be powered by some form of solar energy, not by fossil fuels or batteries.

My guess off the cuff answer is: If you knew what the design would look like, we’d try to do that now. If you go back 100 years, the concept of autonomous vehicles was almost unheard of, as personal mobility was how we got around. But the idea of personal mobility will be with us in 100 years and longer. As for technology, four wheels are still a good way to get around. There’s a 50/50 chance that the car in 2046 will be a four passenger vehicle on four wheels. However, for all we know, in 100 years travel could be a personal energy package that enables a person to get around ways we don’t even know about. In 1996, we were on the verge of flying, but the only way was by hot air balloons. It’s really difficult to predict what automobiles will be like in 100 years although it’s likely that the basic look won’t change all that much in the next 30 years. After that generation, though, things get fuzzy.

Only God knows.

Bill Mason, Chief Engineer, Vista Manufacturing & Concept Center in Cupertino, CA

Financial support from Art Center College of Design. Design by Toby Gillies.

Future concept from Art Center College of Design. Design by Toby Gillies.

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