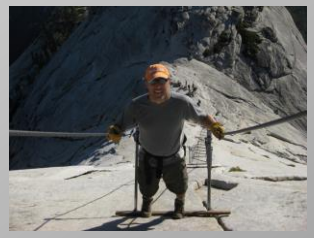
Rapid Product Development

in a Global & Competitive Economy

MSOE 12.2.2019

Mark Schaefer



- The acronyms: BS, MBA, PE
- 30 years of experience in product development & product refinement from concept to reality
  - Aerospace Medical Consumer Automotive
- 20+ patents
- Licensed to scuba dive and fly
- Endurance sports = problem solving and creative time
  - 2 Ironmans, 11 marathons, 5 Chequamegon Bike Races, 10 Birkebeiners X-Country Ski Races, etc.

ADC's Services

fully integrated engineering design and prototype development studio

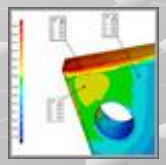

Training


Consulting


Rapid Prototyping


FEA


Mechanical Engineering


Inspection


Plastic Injection Molding


CNC Machining


Scanning / 3D Digitizing


Reverse Engineering

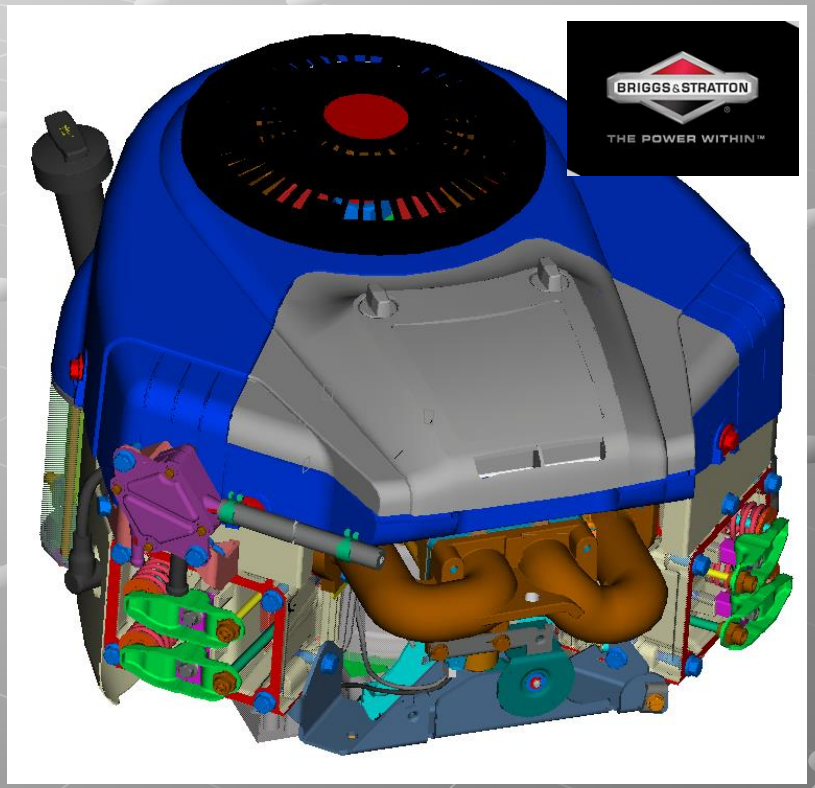
ADC Clients


FORCE America
LeTourneau Plastics, Inc.
COMP CAMS
omnilink now you know
MBE CYLINDER HEADS & MANIFOLDS
CAT CATERPILLAR
Triangle Tool Corporation
HARLEY-DAVIDSON MOTOR COMPANY
Applus
Millport
SIGNICAST INVESTMENT CASTINGS
Clinical MR Solutions Providing the Image of Health
ORBIS
LIGHTSHIPS
WEGNER AUTOMOTIVE
GEMINI
Milwaukee

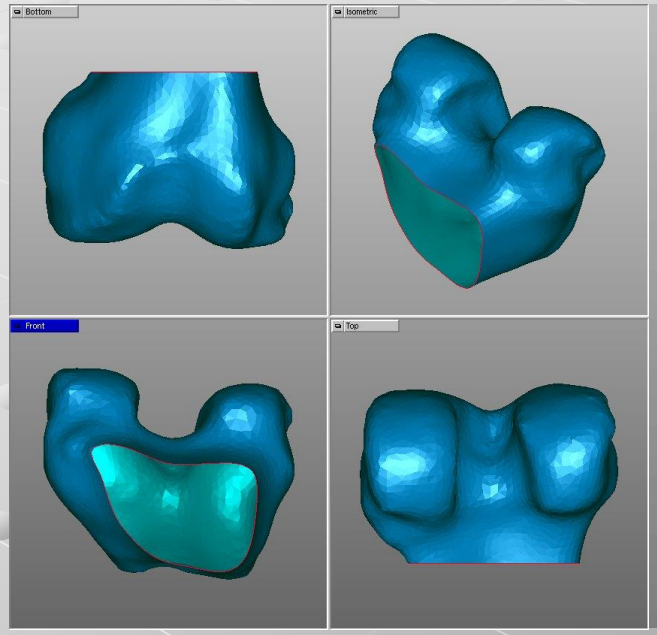
MECHANICAL ENGINEERING DESIGN

New product design and development is our primary focus. Our work has resulted in numerous **patents** for our clients.

Product Design & Refinement



Reverse Engineering



Scan Data

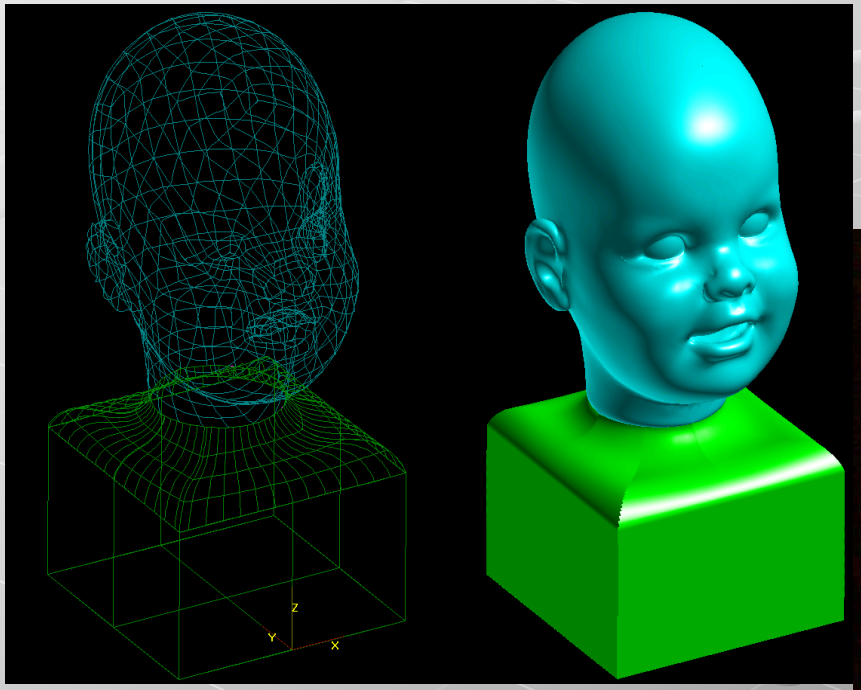
Point Cloud Data

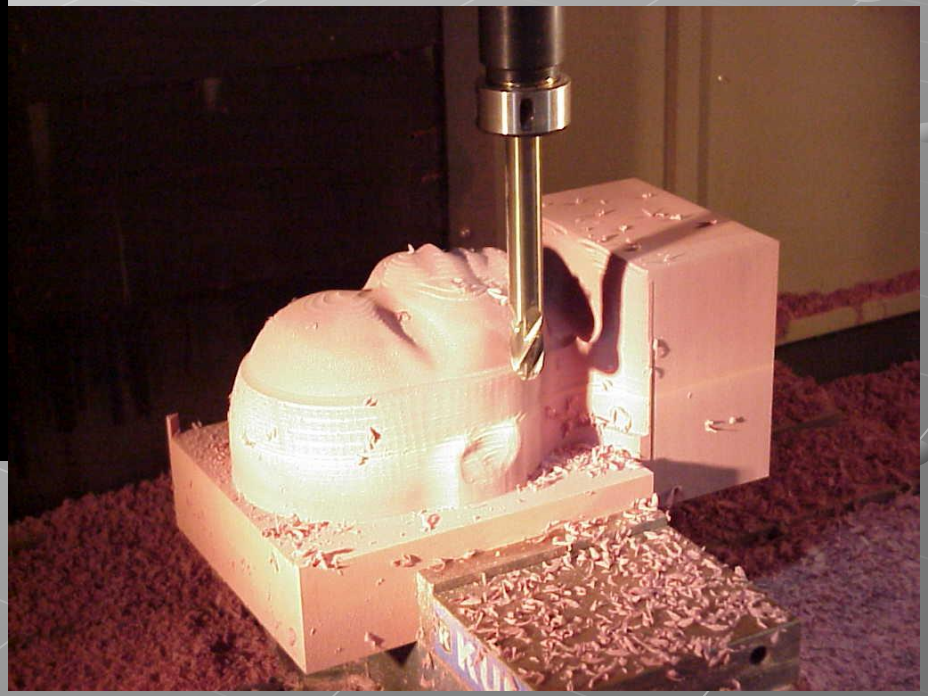
NURBS Model

Complete Assembly

Scanning Example

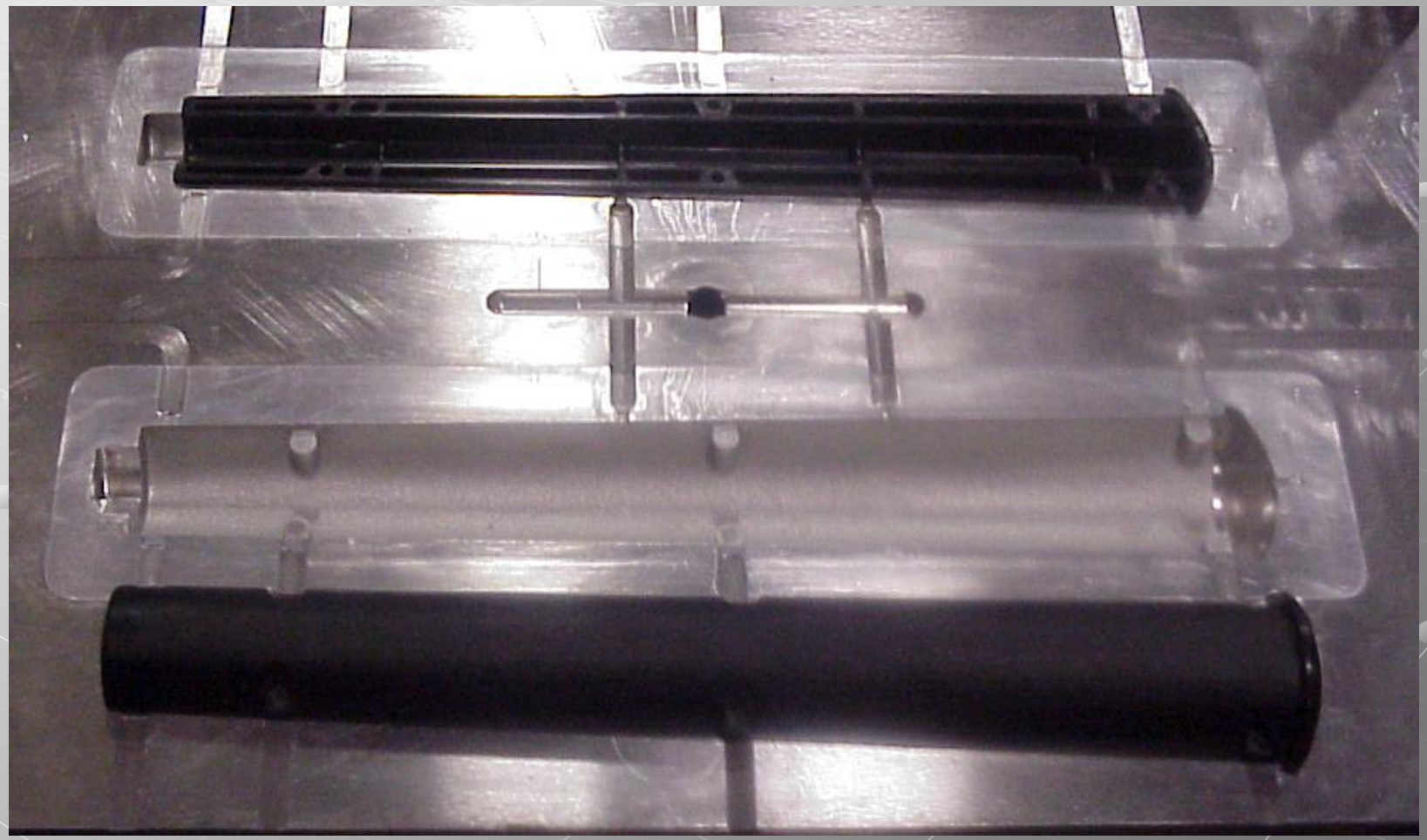
Scanning to CNC Machining



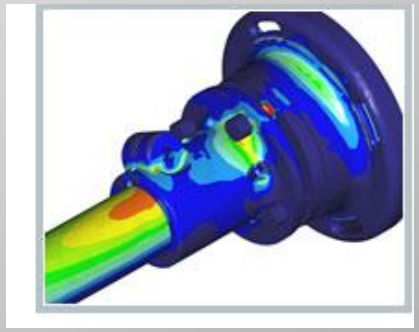


Rapid Prototyping

Plastic Injection Molding



FEA



ADC primarily uses Pro/MECHANICA analytical tools to verify that designs will withstand the necessary stress, deflection or motion requirements.

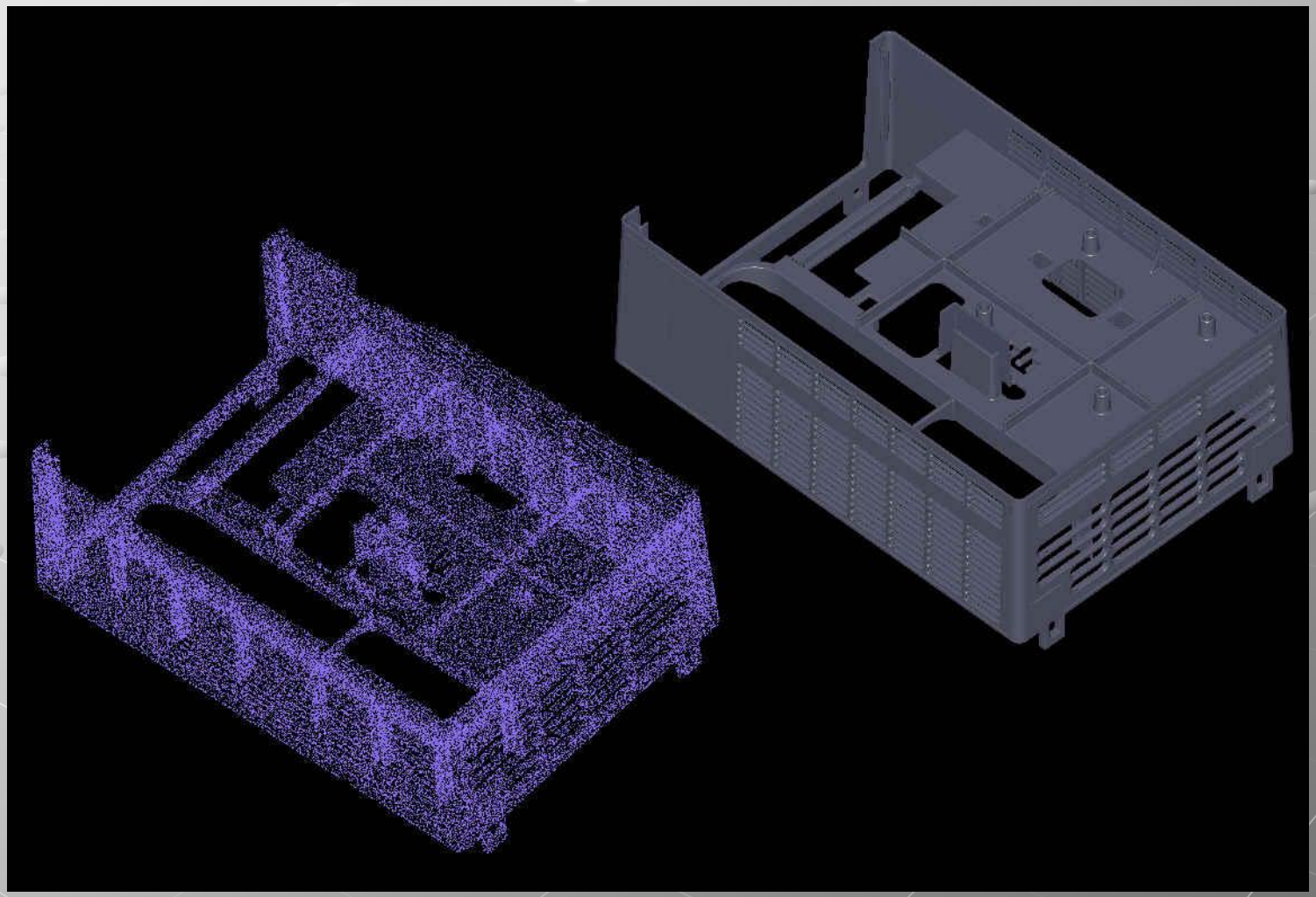
FEA Key Benefits:

- Supports the design of safer and more efficient products in a shorter time
- Enables you to verify a proposed design prior to manufacturing
- Allows you to evaluate the advantages of various design options

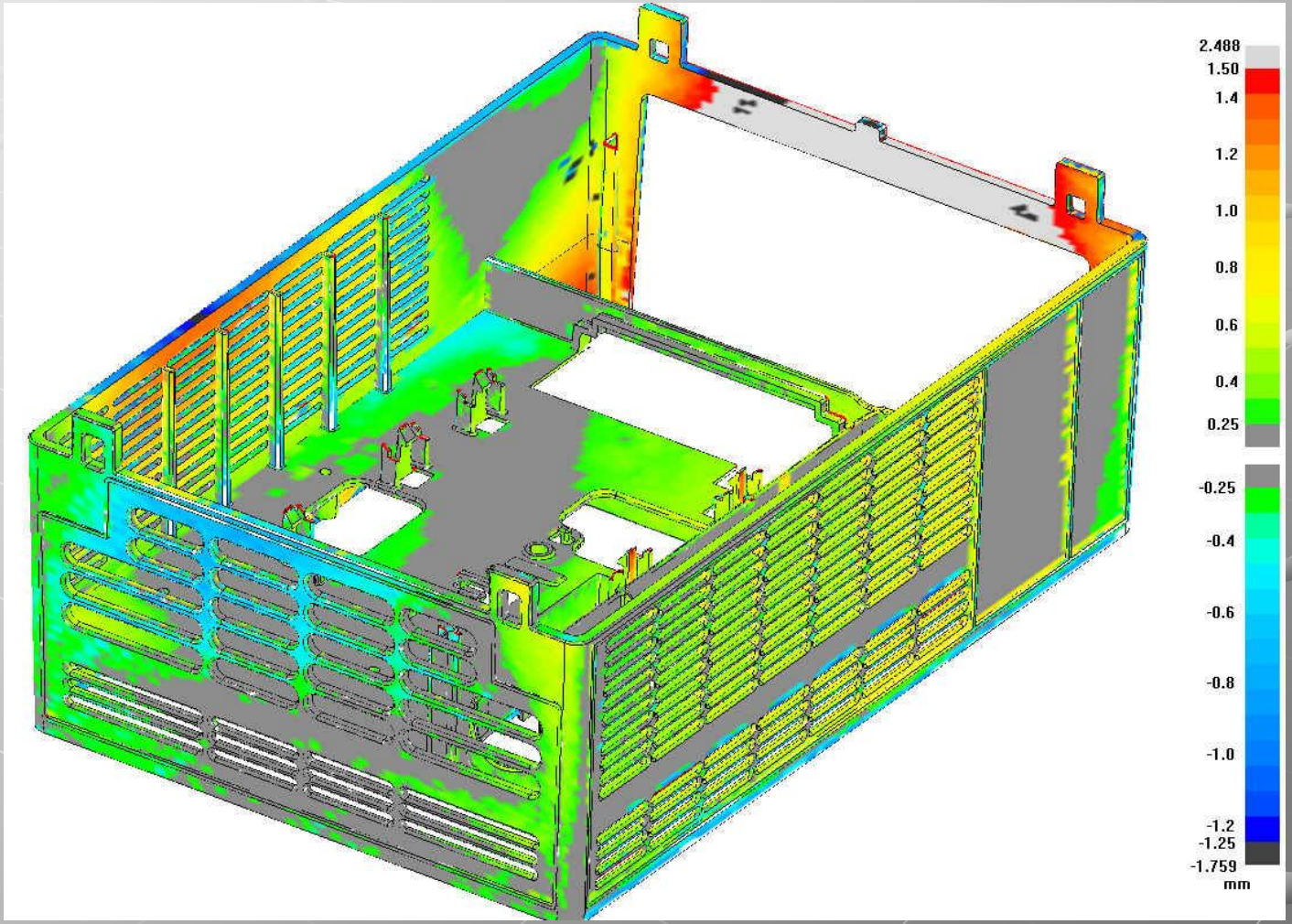
Inspection

Computer Aided Inspection (CAI) is a new technology that enables one to develop a comparison of a physical part to a 3D CAD model. This process is fast and accurate.

Inspection



Inspection



Our Design Model

Create designs that are based on:

- sound engineering principles
- the latest technology
- aiming for products that are intuitive in use
- attractive
- inexpensive to manufacture

ADC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DO YOU THINK YOUR EGO INFLUENCED THE DESIGN PROCESS?
BAH!
IT'S WAGGING.
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FUNCTION MEANS NOTHING. DESIGN IS EVERYTHING.
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QUALITY IS YESTERDAY'S NEWS. TODAY WE FOCUS ON THE EMOTIONAL IMPACT OF THE PRODUCT.
BUT IT STILL NEEDS QUALITY, RIGHT?
YOU ARE SO-O-O-O HARD TO LOOK AT.
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The Design Challenge

- Clients often desire designs that are:
  - Less expensive
  - Of good quality
  - And, they want them immediately!
- These attributes are often contradictory

6 Steps of the Process

1. Needs and Wants
2. Specification
3. Brainstorm/Prototype
4. Design/Iterate/Prototype
5. Manufacturing

The Design Process

Step #1

Assessment

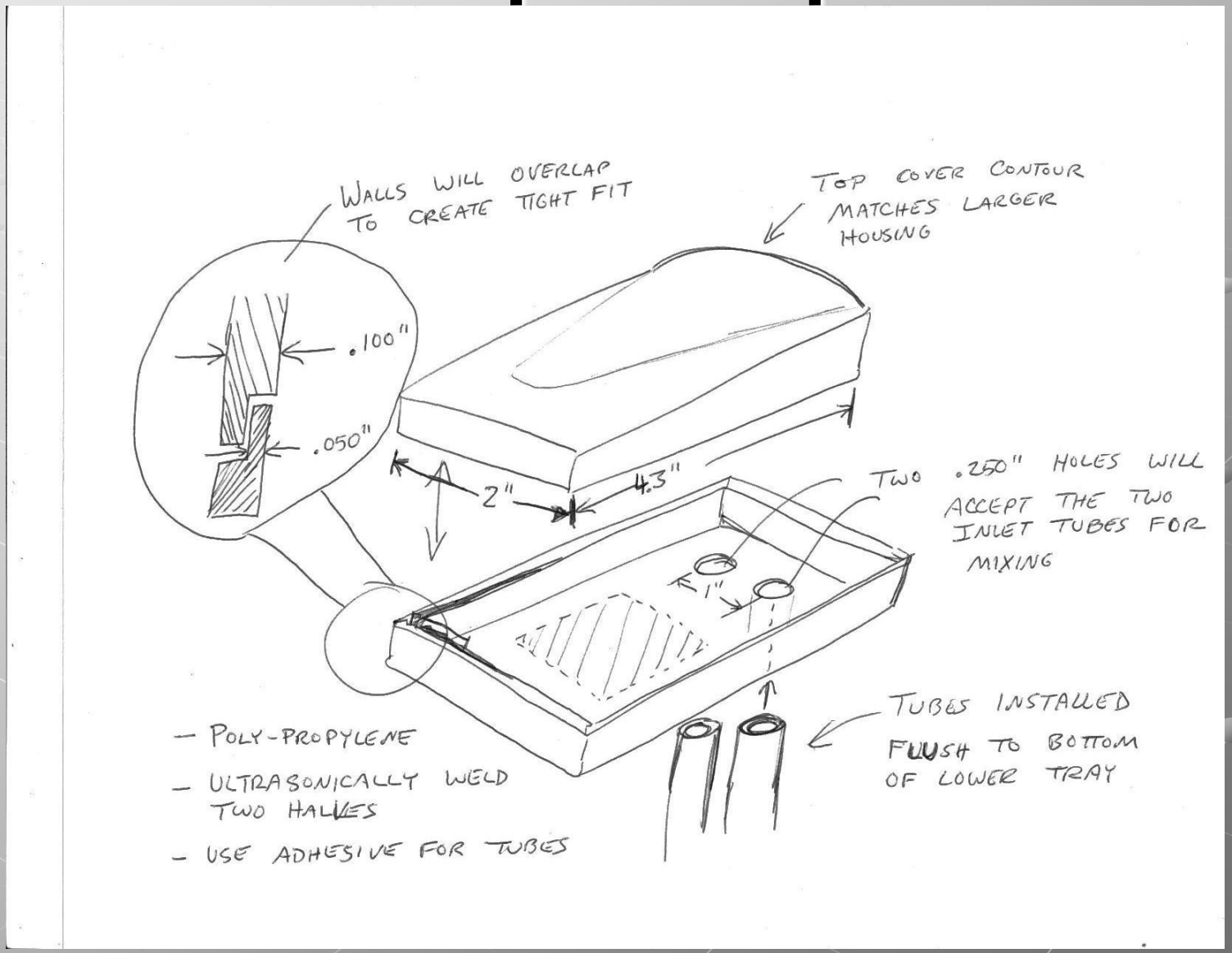
Identify customer needs and wants:

- Aesthetic design
- Performance requirements
- Anticipated manufacturing cost
- Expected quantities and lot size
- Service life expectations
- Service environment

The Design Process
Step #2
Design Specs

- Define a *specification*
- Develop a simple and specific document that addresses the needs identified in the assessment (step #1)
- Share with the customer to confirm everyone is on the "same page"

Sample Spec


WALLS WILL OVERLAP TO CREATE TIGHT FIT
TOP COVER CONTOUR MATCHES LARGER HOUSING
.100"
.050"
2"
4.3"
TWO .250" HOLES WILL ACCEPT THE TWO INLET TUBES FOR MIXING
1"
TUBES INSTALLED FLUSH TO BOTTOM OF LOWER TRAY
- POLY-PROPYLENE
- ULTRASONICALLY WELD TWO HALVES
- USE ADHESIVE FOR TUBES

Percentage Effort
in Product Development
Shipbuilding Production Stage

Company	Definition	Design	Redesign
British Company	17%	33%	50%
Japanese Company	66%	24%	10%

Source: Rapid Prototyping and Engineering Applications, by Frank W. Liou 2007

The Fun Phase: Brainstorming

Step #3 - Brainstorming

- Generate ideas & solutions to meet requirements
- 1 – 2 hours brainstorming with small team
- Summarize session: sketches and trade-off analysis
- Review with the customer. If satisfied proceed to the next step. If not, repeat with second session of brainstorming.
- You may discover that the requirements are impossible. The customer may want to build too small of a quantity for too small of a manufacturing cost.
- Create detailed sketches of the “proposed” design.
- Do not start using CAD until a concept is documented in sketch form.

Step #4
Initiate Design

- If the part is aesthetic, it may be quicker to build a clay prototype and scan back into CAD. We have been successful designing the inside of the product and then creating an RP of the minimal inside model. Additional clay for the exterior can lead to the correct aesthetics.
- Main design software: Pro/E family of products. We also use SolidWorks, Geomagic, Surfcam, and Powermill.
- Use the software to its fullest potential. Run:
  - Dynamic simulations
  - Clearance and interference checks
  - FEA
  - Moldflow
  - Draft analysis
  - Reflection analysis

Step #4
Complete Design

- Design for manufacturing. Either have designers that fully understand the process or have the manufacturing representative working with the designers to ensure the design is manufacturable.
- Check product cost.
- Prototype often and test as much as you can.
- Repeat this process until you have a satisfactory design.
- Build a final fully functional prototype. Test as much as you can. The materials may not be correct so some of the test results may be skewed.

Step #5 Manufacturing

- Initiate the manufacturing process
- CAD models should be the master
- Drawings should provide critical dimensions and materials
  - Scan to inspect the actual part to the CAD data.
  - Finalize any testing that was unable to complete in the prototype stage.

“When you make a thing, a thing that is new, it is so complicated to make it that it is bound to be ugly. But those that do it after you, they don't have to worry about making it. And they can make it pretty, and so everyone can like it, when the others make it after you.”

Picasso

Other Interesting Items

- https://prostock.vanceandhines.com/
- https://www.harley-davidson.com/us/en/motorcycles/fxdr-114.html
- https://mailchi.mp/fb15bd6ac393/adc-news-12060811
- http://www.ifitprosthetics.com/
- https://www.adcinc1.com/9-considerations-3d-scanning-services.html

Questions?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