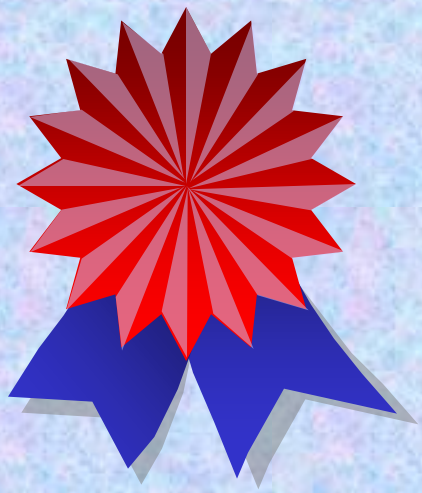
Texas State University- San Marcos
Ingram School of Engineering

2009 Best Product Development Contest Award

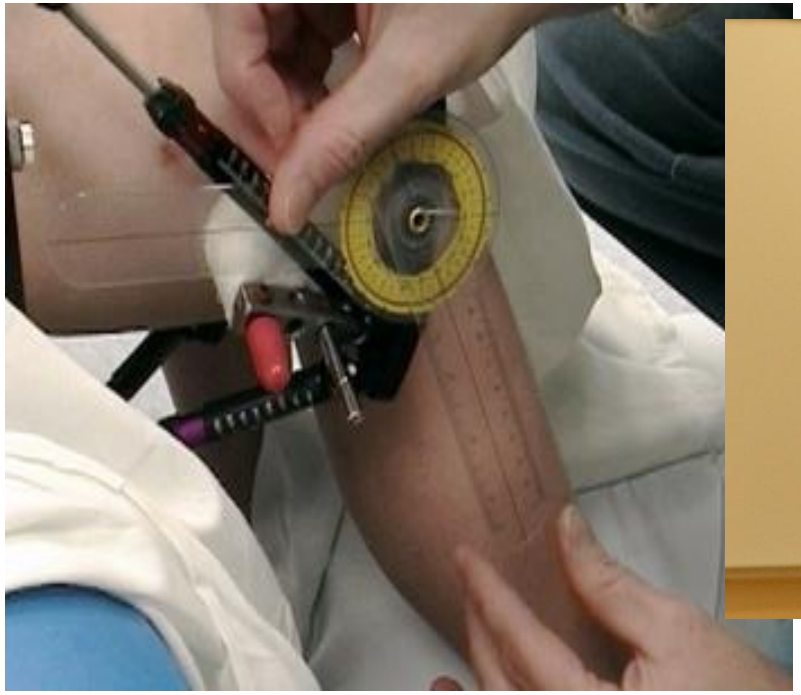


2009 Best Team: Digital Goniometer

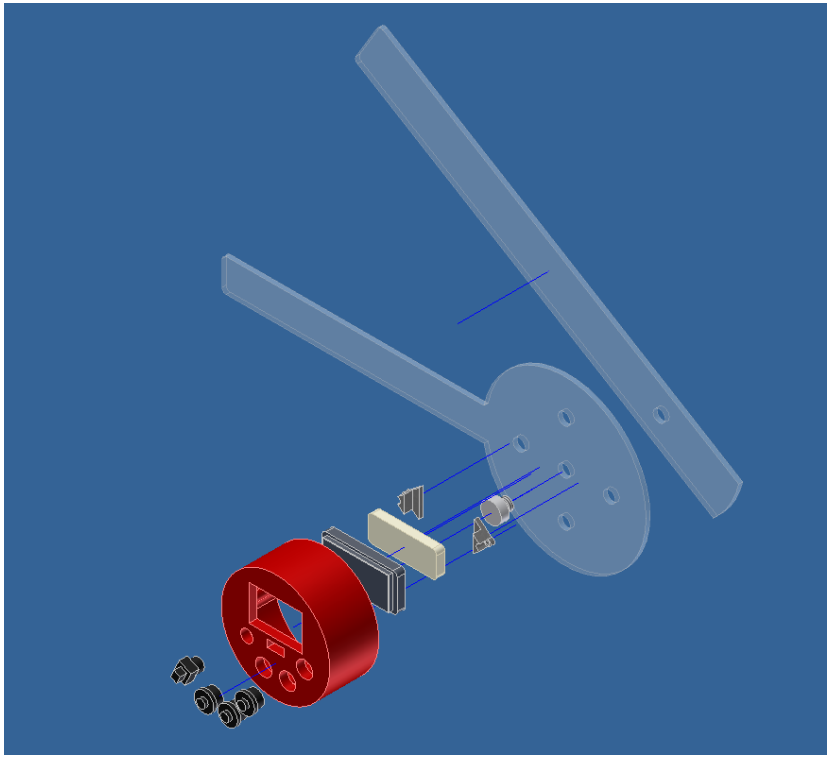
Thomas Randall
Dustin Schaefer
Colby Thomas
Andrew Roskey

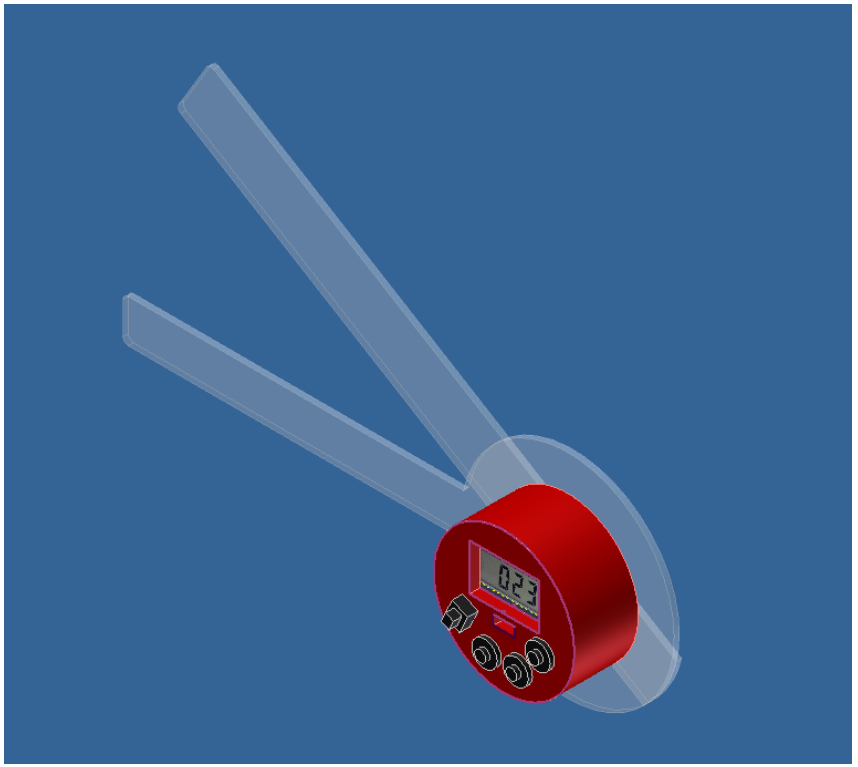
Goniometer Applications?

- A Medical Device
- Measures the angle of joint movement on therapy patients to record progress.
- Allows an object to be rotated to a precise angular position.

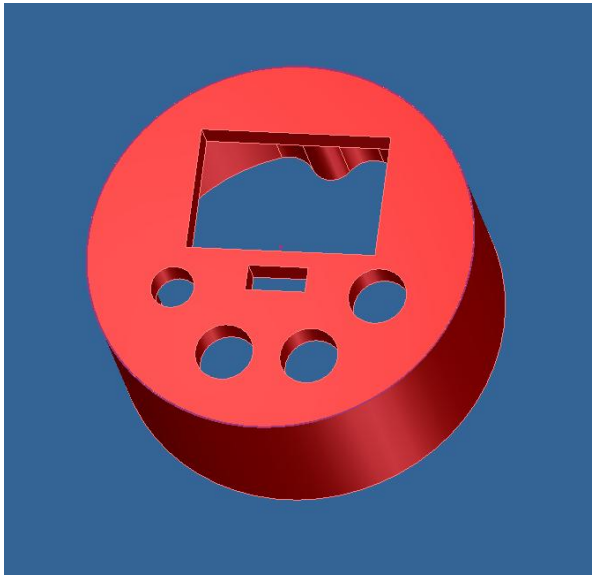


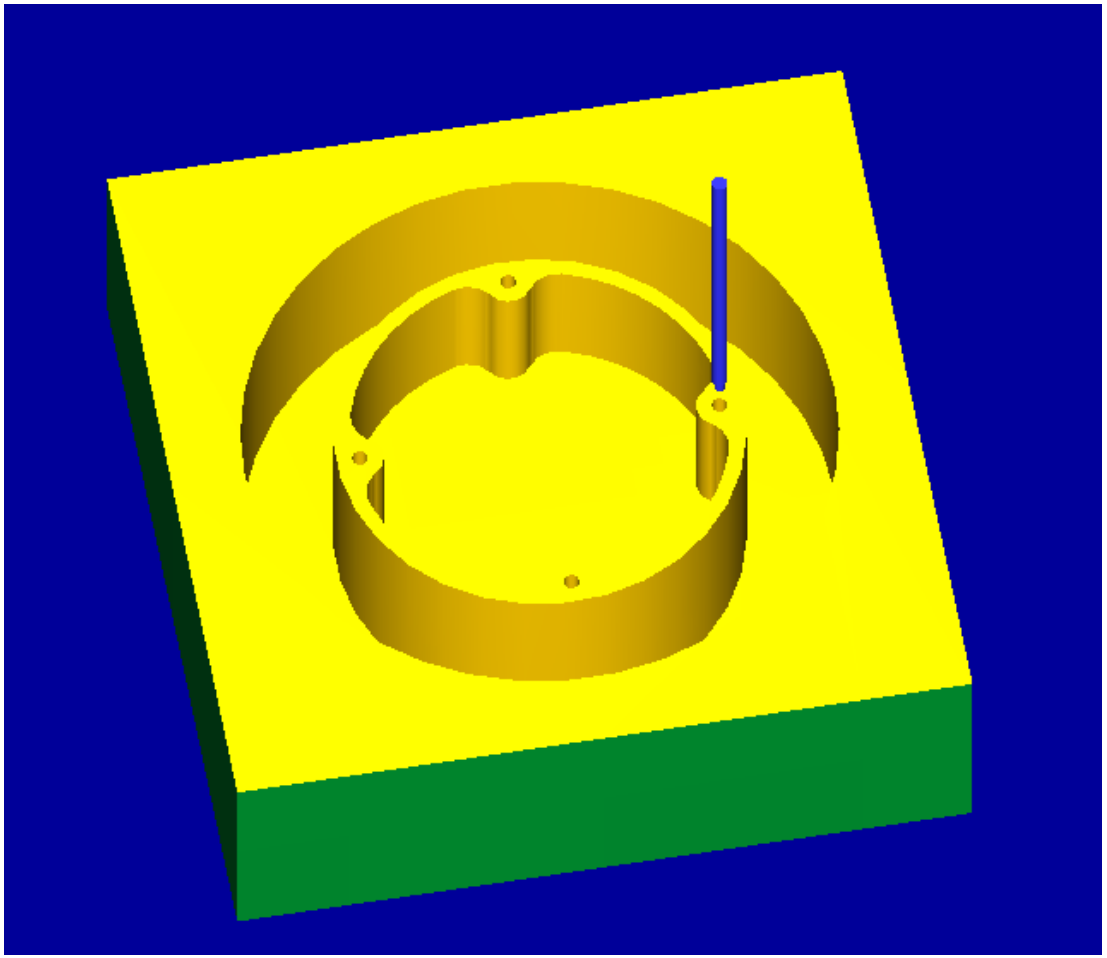
Finalized Design



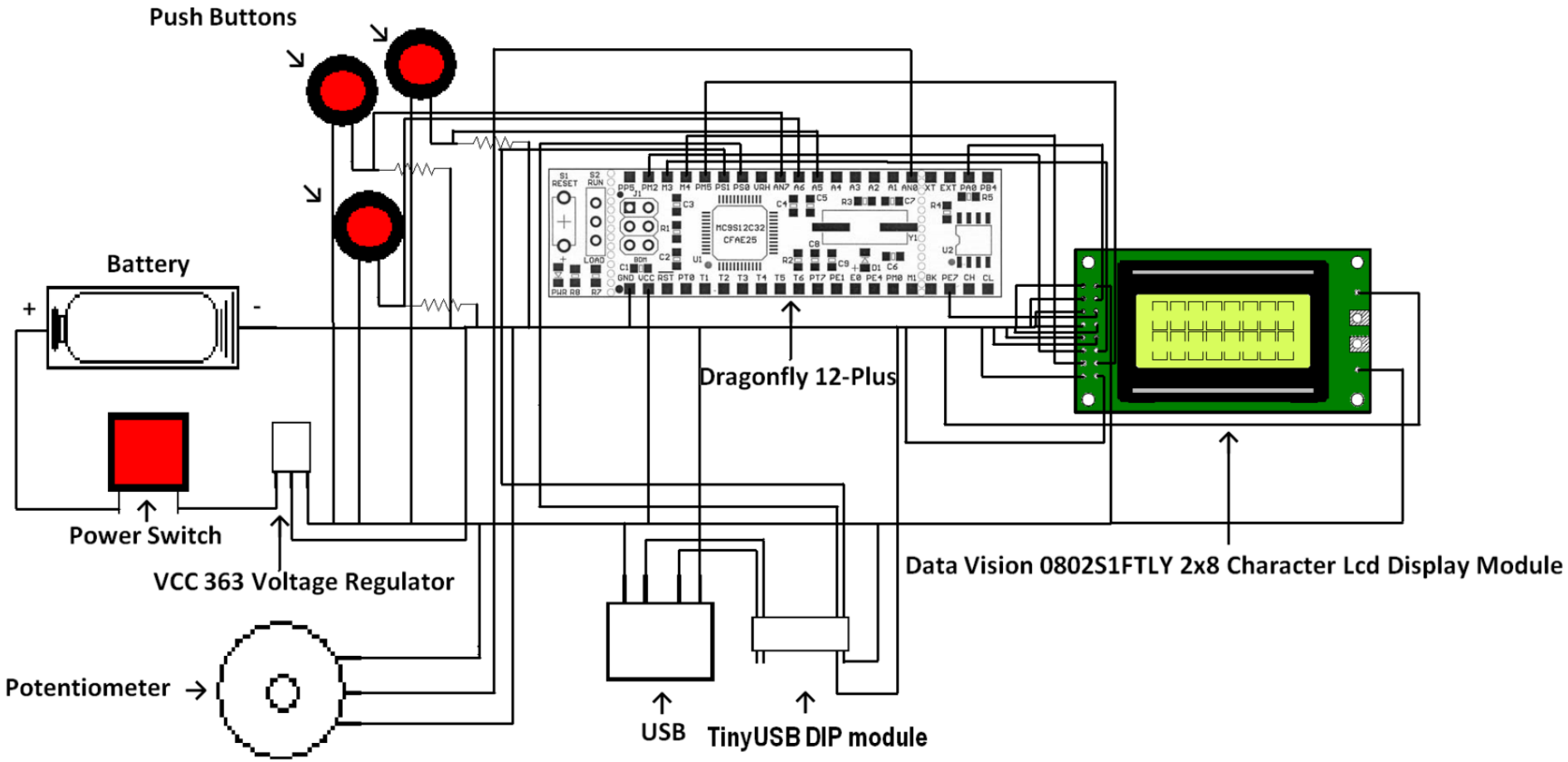


Tool Path for Housing

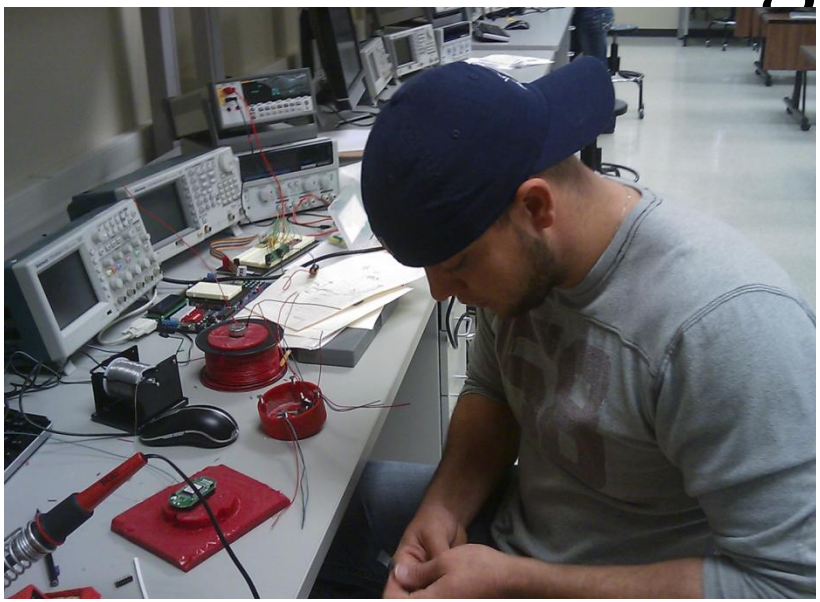


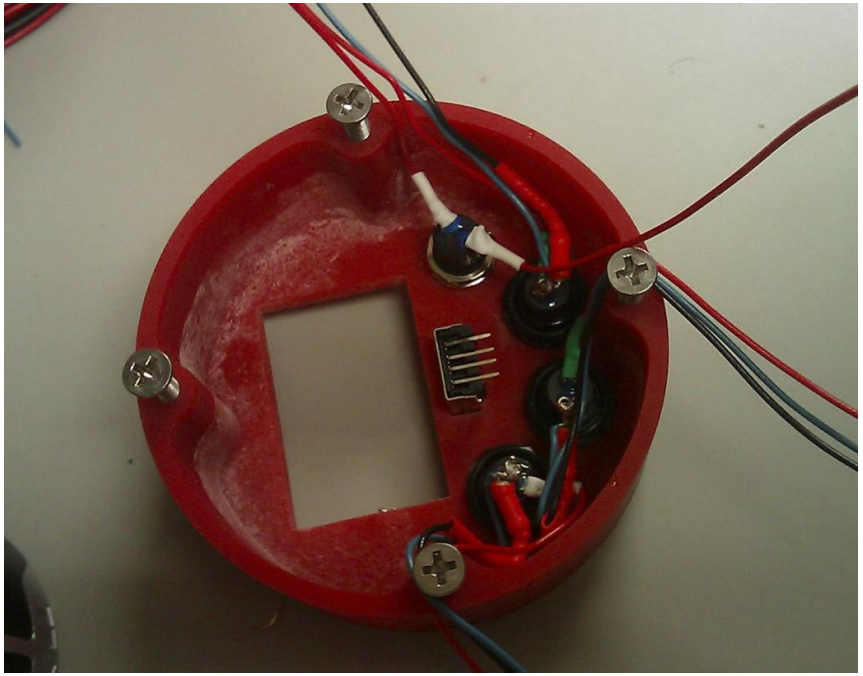


Schematic

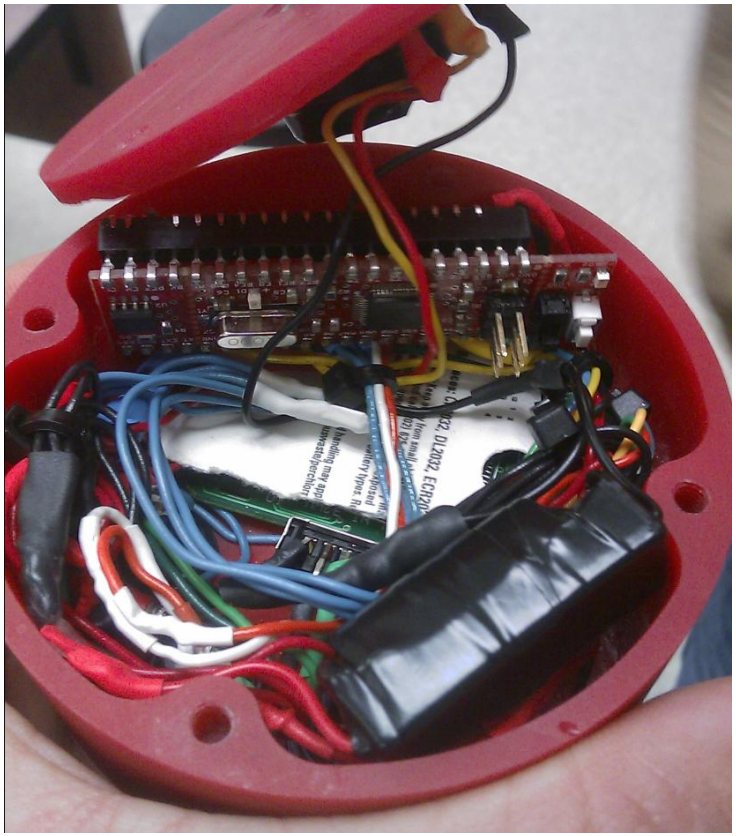

Push Buttons
Battery
+
-
Power Switch
VCC 363 Voltage Regulator
Potentiometer
Dragonfly 12-Plus
USB
TinyUSB DIP module
Data Vision 0802S1FTLY 2x8 Character Lcd Display Module

Soldering and Wiring





Final Product



Daniel Velez

Nick Ondrusek

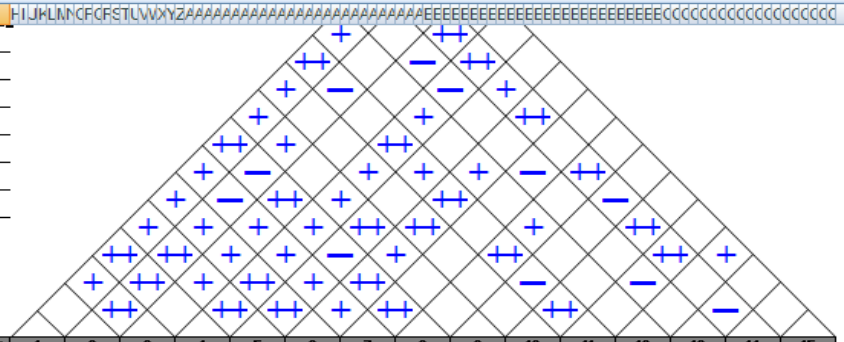
Gino Trevino

Zach Ayres

Hotwheels

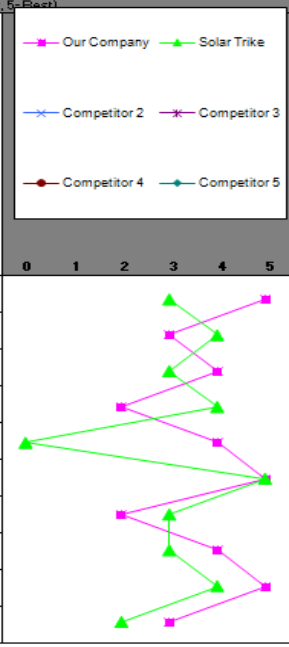
HOQ

what kind of things they would like on their own solar power car.



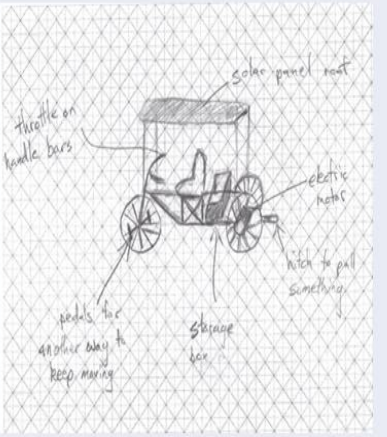
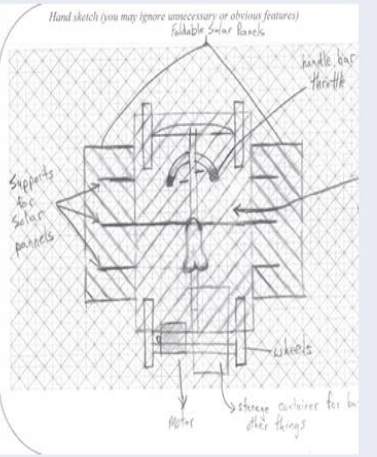
Strong Positive Correlation
Positive Correlation
Negative Correlation
Strong Negative Correlation
Objective Is To Minimize
Objective Is To Maximize
Objective Is To Hit Target

Row #	Max Relationship Value in Row	Relative Weight	Weight / Importance	Quality Characteristics (a.k.a. "Functional Requirements" or "Hows") / Demanded Quality (a.k.a. "Customer Requirements" or "Whats")	cost (dollars)	Weight (lbs)	Time (hours)	Power (Horsepower)	Capacity (Number of People)	Electric Power (Watts and amps)	Distance (Miles)	Battery life (mins)	Space (cubic inch)	Sexiness (yes or no)	Acceleration (m/s^2)	Toughness (in|bf/in3)	Friction (Newtons)	Velocity (mph)	Safety (yes or no)	Our Company	Solar Trike	Competitor 2	Competitor 3	Competitor 4	Competitor 5
				Column #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	**Competitive Analysis** (0=Worst, 5=Best)					
				Direction of Improvement: Minimize (▼), Maximize (▲), or Target (x)																					
1	9	18.8	18.2	Low cost	⊖			○		○	⊖	○	▲	⊖	⊖	⊖		⊖	○	5	3				
2	9	17.0	16.4	Light weight	▲	⊖		○			○	○	○		⊖	▲		⊖	▲	3	4				
3	9	13.1	12.7	To work at any time of the day or night	⊖		⊖				○	⊖							⊖	4	3				
4	9	3.3	3.2	Attractivness	⊖	○		○	⊖	▲		○	⊖	⊖	⊖	○		○	⊖	2	4				
5	9	8.2	7.9	To have storage space	⊖	⊖		▲	⊖				⊖	⊖	▲	⊖		▲	⊖	4	0				
6	9	7.6	7.3	For it to travel a fair distance	⊖	⊖	⊖	○	▲	⊖	⊖	⊖			○	▲	⊖	○	▲	5	5				
7	9	1.9	1.8	Number of passengers	⊖	⊖		⊖	⊖	○			⊖	▲		⊖			⊖	2	3				
8	9	15.0	14.5	For it to have a long battery life	⊖	⊖	⊖			⊖	○	⊖			○		▲	○		4	3				
9	9	5.7	5.5	For it to go fast	⊖	⊖	▲	⊖	▲	⊖	▲	⊖		▲	⊖		○	⊖	○	5	4				
10	9	9.4	9.1	For it to be safe	⊖	▲		○	○	▲		▲		○	▲	⊖	▲	▲	⊖	3	2				
				Target or Limit Value	under $2000.00	under 500 lb including driver	12 hours	5 hp	driver and passenger	12 Watts	20 miles or more	2 hours	300000 cubic inch	Yes, Please	1 m/s^2	to hold together	Minimual	30 mph	seat belt, helmet, lights						
				Difficulty (0=Easy to Accomplish, 10=Extremely Difficult)	0	5	10	0	0	10	8	0	0	7	10	3	4	9	0						
				Max Relationship Value in Column	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9						
				Weight / Importance	764.2	516.9	327.1	244.5	161.7	329.2	378.7	499.5	190.0	308.8	488.7	379.2	109.5	468.8	421.4						
				Relative Weight	13.7	9.2	5.9	4.4	2.9	5.9	6.8	8.9	3.4	5.5	8.7	6.8	2.0	8.4	7.5						

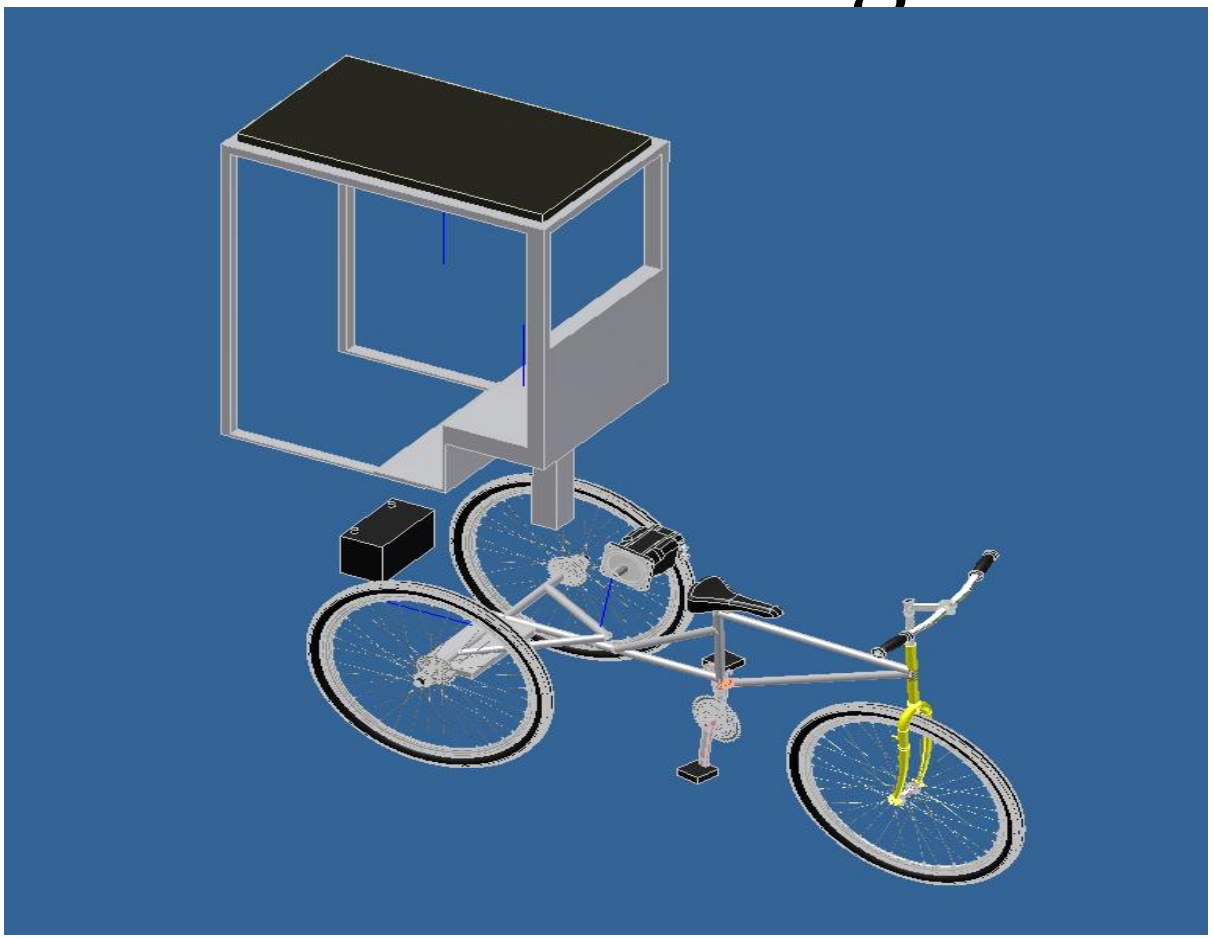


Powered by QFD Online (http://www.QFDOnline.com)

Concept Scoring

		B - Four Wheels, One Man		D - Three Wheels with Pedals		E - Collapsible Panels	
							
Selection Criteria	Weight	Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score
Ease of Handling	15%	3	0.45	4	0.6	3	0.45
Light Weight	20%	3	0.6	4	0.8	2	0.4
Roof	15%	4	0.6	4	0.6	5	0.75
Seats more than one person	5%	1	0.05	5	0.25	2	0.1
Safety Features	10%	5	0.5	4	0.4	3	0.3
Back up System	20%	2	0.4	4	0.8	2	0.4
Aesthetics	15%	4	0.6	4	0.6	5	0.75
	Total Score	3.2		4.05		3.15	
	Rank	2		1		3	
	Continue?	No		Develop		No	

CAD Drawing



Bike Assembly

Final Product

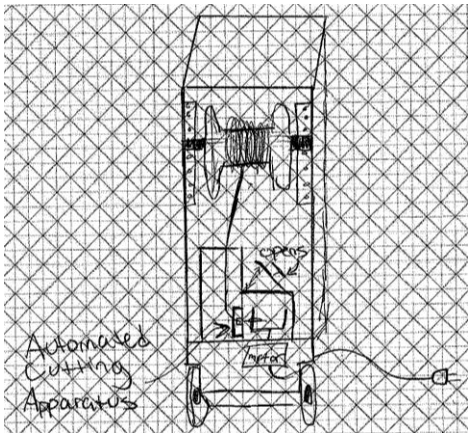
Wire Wrapping Machine

Bryant Bamburg
Brandi Barrier
Gabriela Garza
Erik Larson

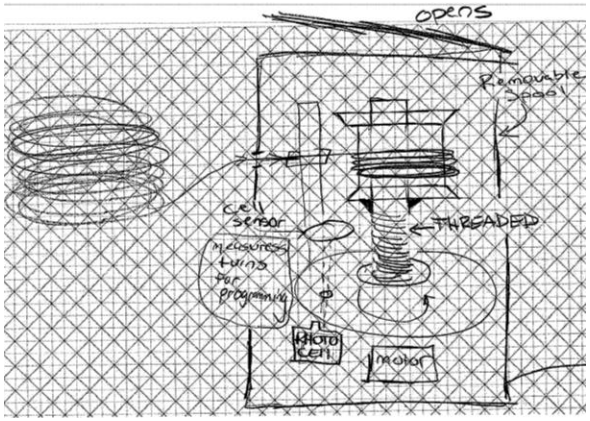
Current Design

initials

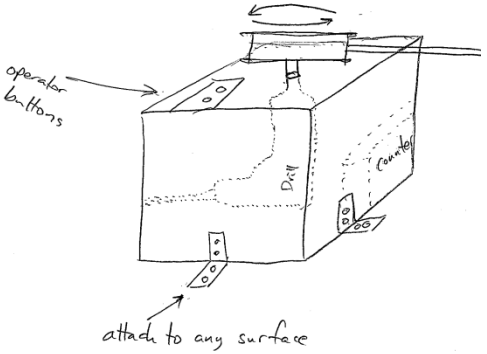
Concept Sketches



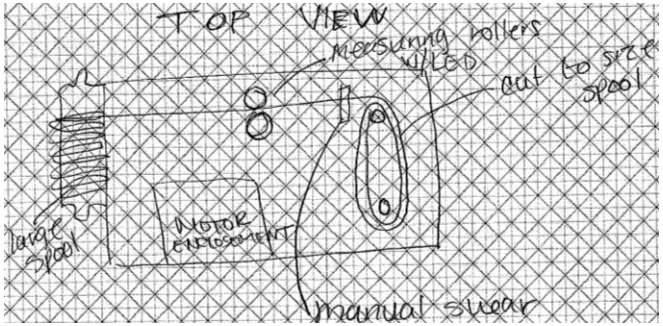
Portable Wrapper
- Customer Needs Answered
  - Portable, Wire Wrapped, Wire Cutter
- Drawbacks or Challenges
  - Programming



Photocell Power
- Customer Needs Answered
  - Wire Wrapped on Coil
- Drawbacks or Challenges
  - Spool Position
  - Programming



Box Design
- Customers Needs Answered
  - Programmable, semi-portable, self-contained
- Challenges or Drawbacks
  - Sharp corners, bulky, unstable when not attached

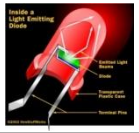


Boxed Measuring Device
- Customer Needs Answered
  - Mechanical, Easy to use, simple layout
- Challenges or Drawbacks
  - Non Portable

initials

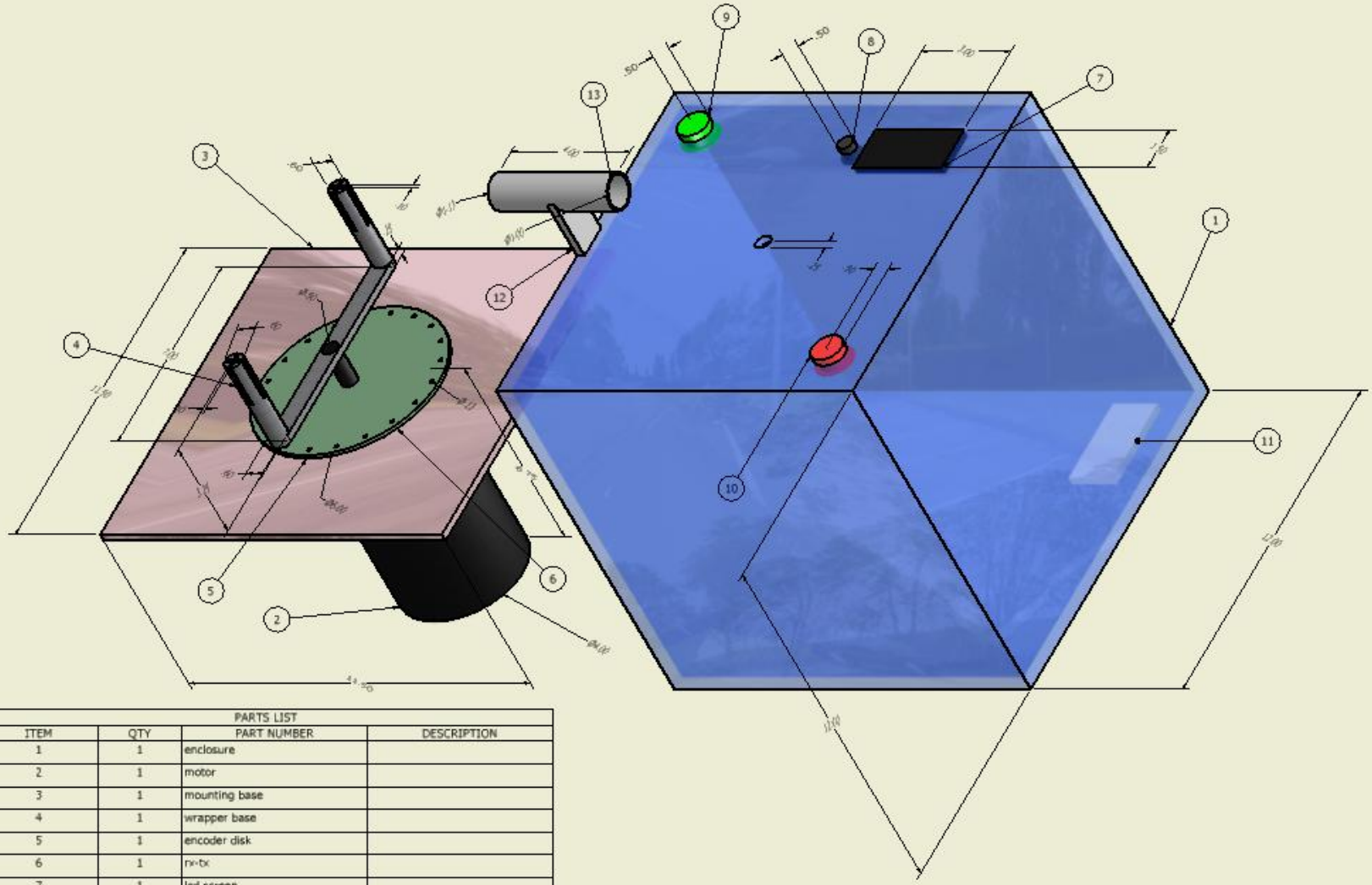
Concept Selection Matrix

		Hoist Motor		Drill motor		Winch motor	
Selection Criteria	Weight	Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score
Long lasting	60%	5	3	5	3	2	1.2
Electric Power	30%	5	1.5	4	1.2	5	1.5
Close tolerance	5%	4	0.2	2	0.1	3	0.15
Safety guarded	5%	4	0.2	2	0.1	2	0.1
	Total Score	4.9		4.4		2.95	
	Rank	1		2		3	
	Continue?	Yes		No		No	



		LED		Photocell power		Pinch Roller	
Selection Criteria	Weight	Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score
Long lasting	10%	3	0.3	2	0.2	2	0.2
Electric Power	30%	5	1.5	4	1.2	2	0.6
Close tolerance	60%	5	3	2	1.2	3	1.8
	Total Score	4.8		2.6		2.6	
	Rank	1		2		3	
	Continue?	Yes		No		No	

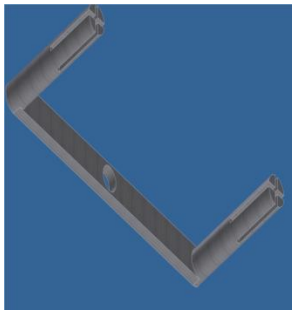
initials

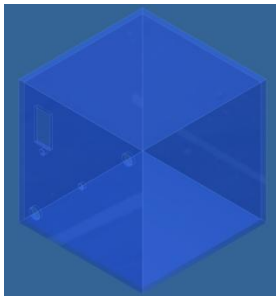


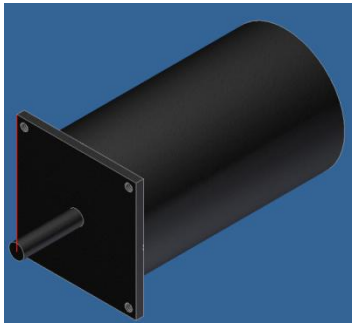
PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	enclosure	
2	1	motor	
3	1	mounting base	
4	1	wrapper base	
5	1	encoder disk	
6	1	rx+tx	
7	1	lcd screen	
8	1	lcd button	
9	1	go button	
10	1	stop button	
11	1	microchip	
12	1	guide base	
13	1	guide tube	

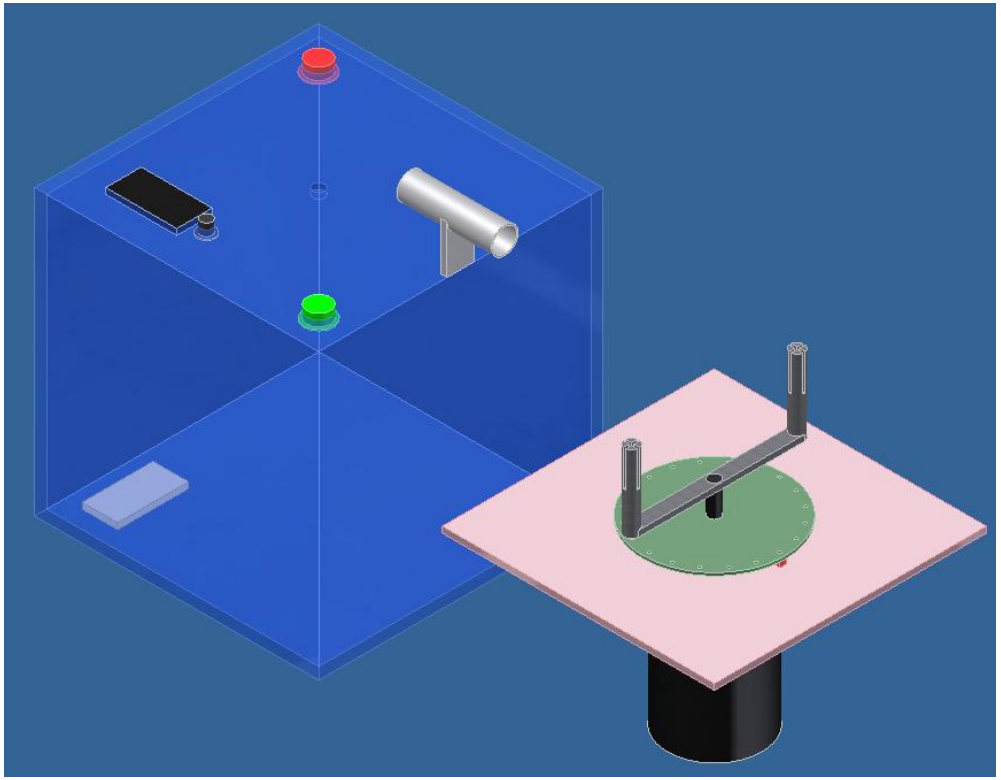
DRAWN bb1309	10/23/2009	
CHECKED		TITLE: Bill of Materials
QA		
MFG		
APPROVED		
		SIZE C / DWG NO BOM / REV
		SCALE / SHEET 1 OF 1

Inventor Drawings



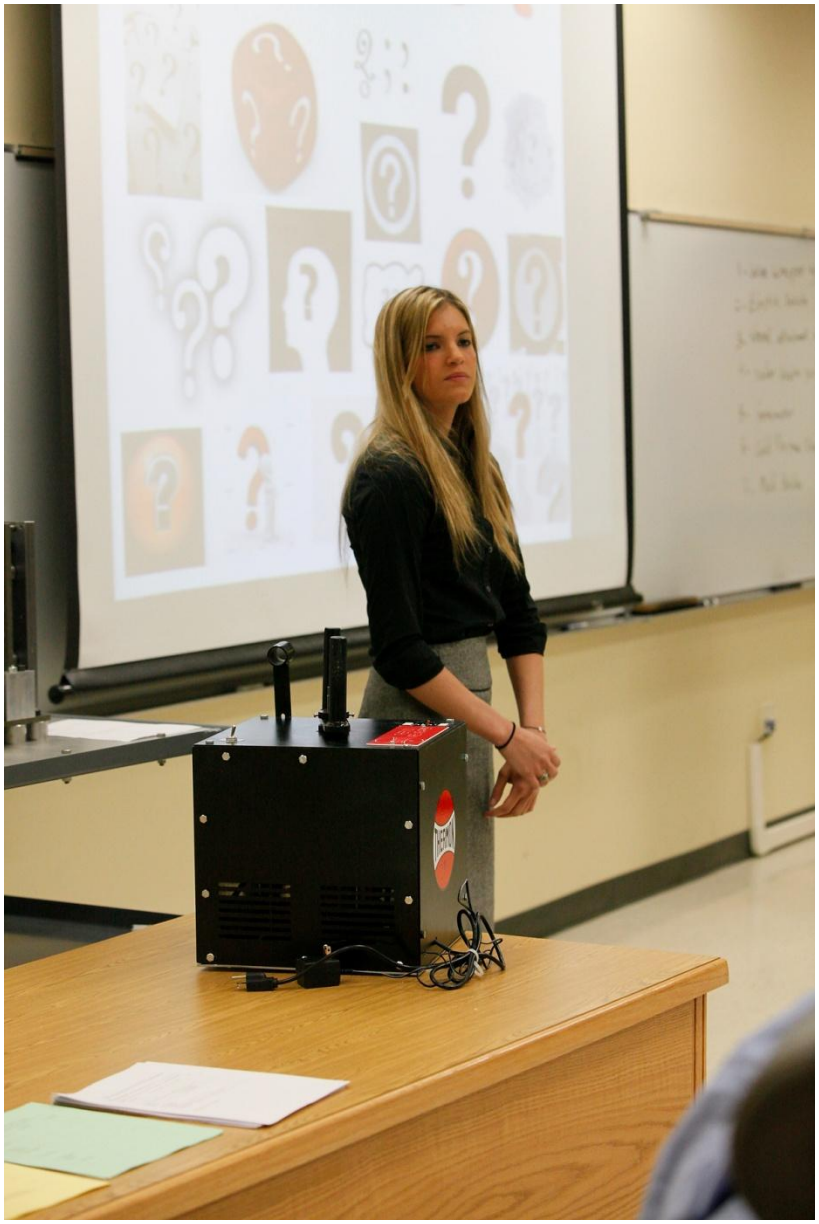






Wiring Rods Assembly

Final Product

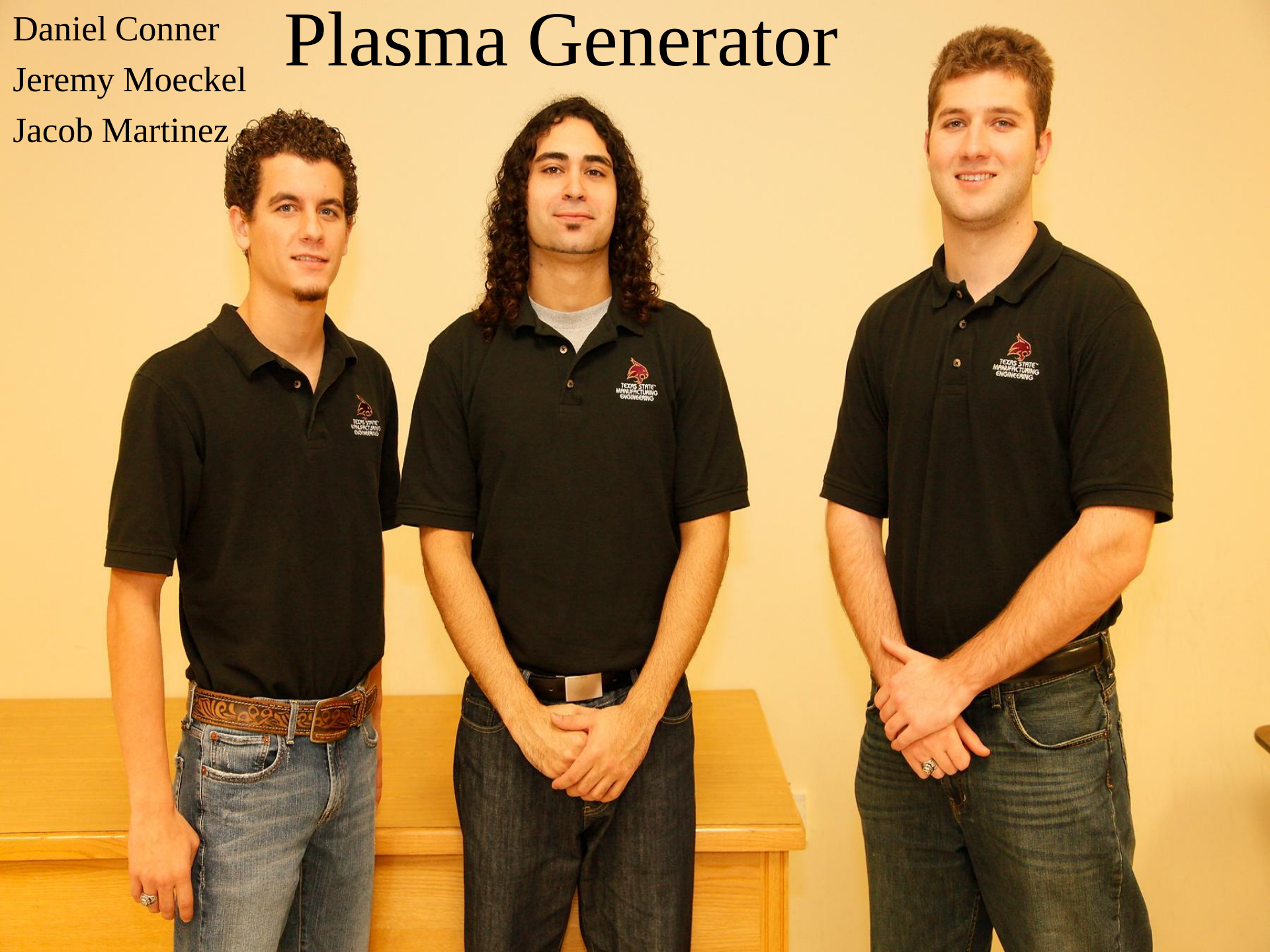


Daniel Conner

Jeremy Moeckel

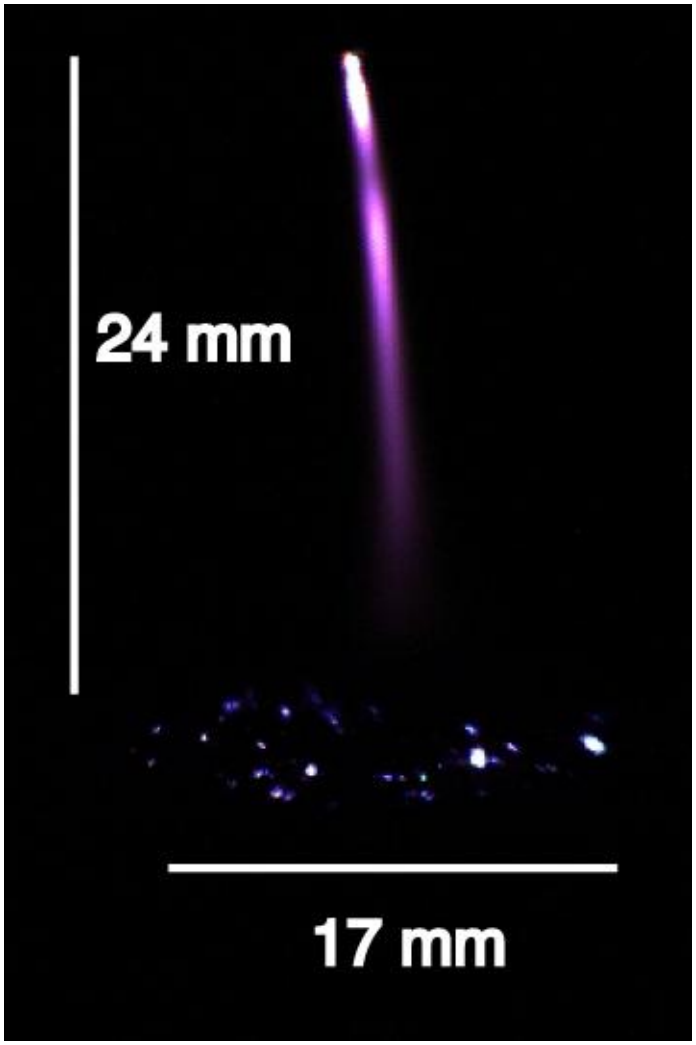
Jacob Martinez

Plasma Generator

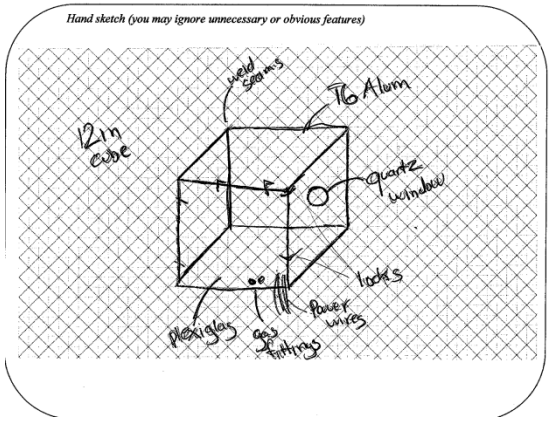


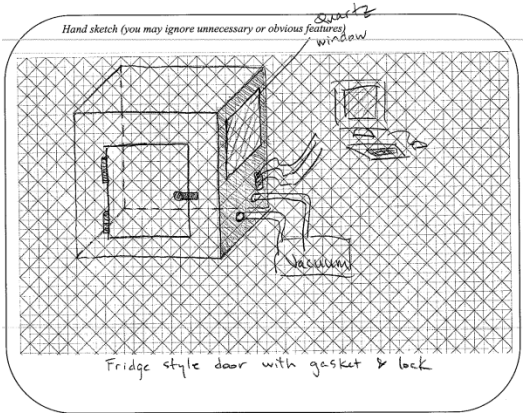
What is a glow discharge chamber?

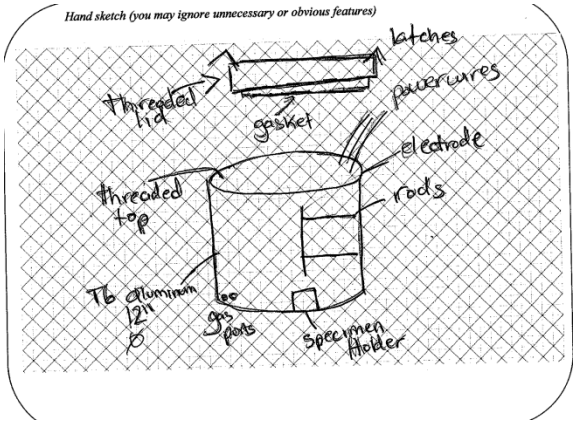
- Uses high voltage passed from an electrode to a grounded specimen
- Generates plasma on the grounded specimen
- Used to create non-thermal plasma by an electrical field
- Non-thermal plasma is much cheaper than thermal & more practical in manufacturing purposes

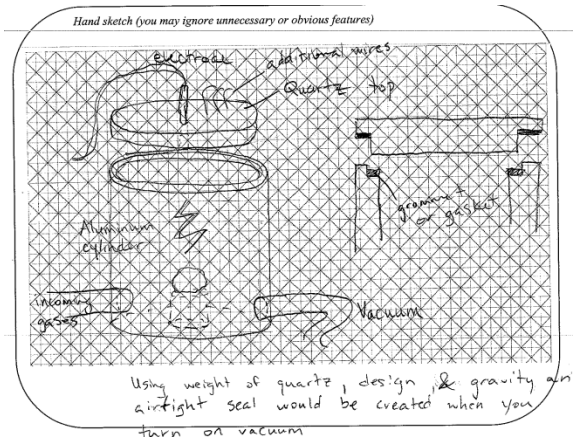


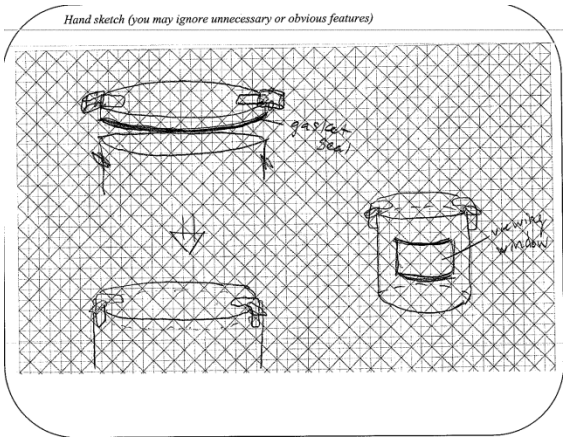
Concept Generation







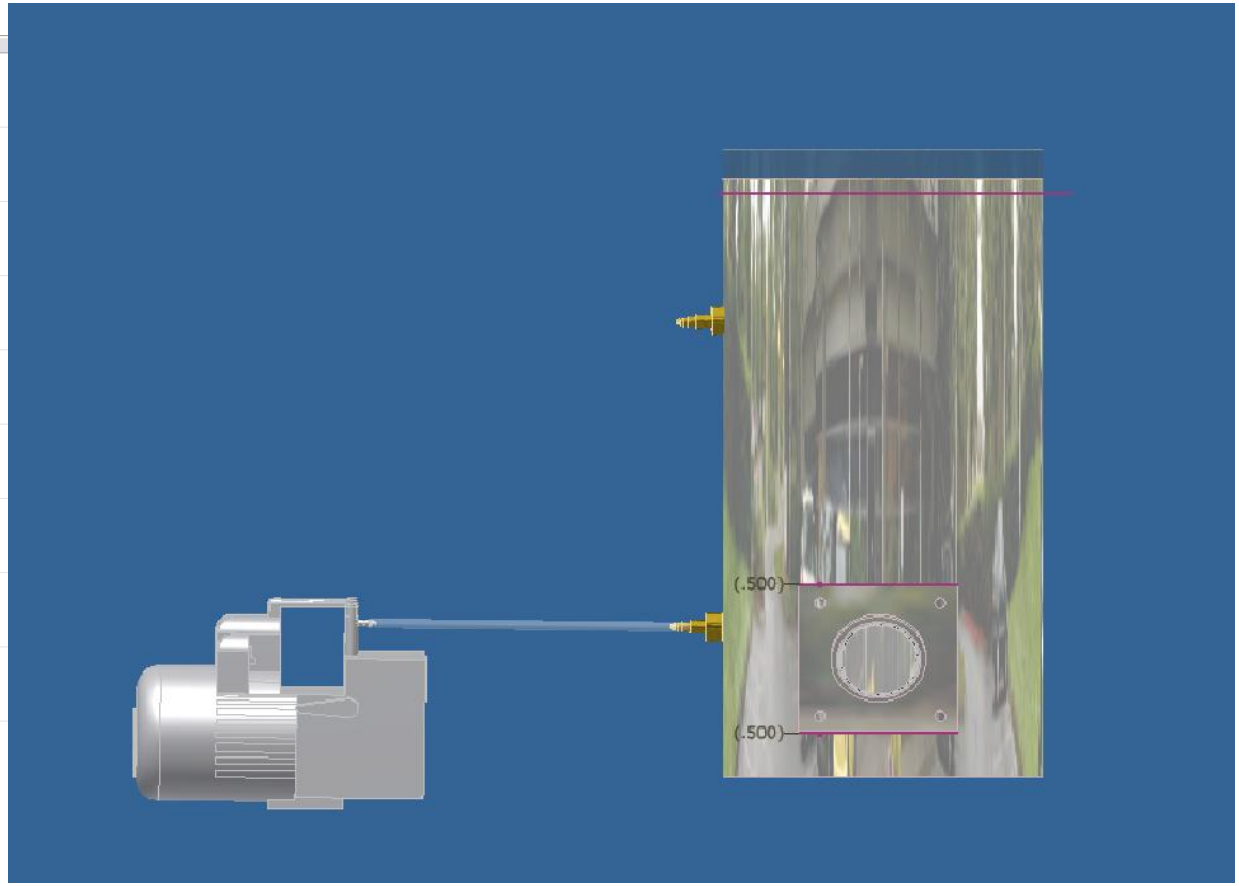




CAD file

Chamber Concept

Part Number	Thumbnail	BOM Structure	Unit QTY	QTY
cyclinder		Normal	Each	1
window2		Normal	Each	1
tube hose		Normal	Each	1
top gasket		Normal	Each	1
lid		Normal	Each	1
eye gasket		Normal	Each	2
vaccccuuuuum		Normal	Each	1
flange		Normal	Each	2
air valve		Normal	Each	2



FMEA

Core Team

FAILURES OF GLOW DISCHARGE

Design Item or Process Function Requirements	Potential Failure Mode	Potential Effect(s) of Failure	Sev	Class	Potential Cause(s) / Mechanism(s) of Failure	Occ	Current Design or ProcessControls	Det	RPN	Recommended Actions	Responsibility & Target Completion Date	Actions Taken	Sev	Occ	Det	RPN
Vacuum Sealing	Not adquately sealed	Box leaks	6	A	Incorrect welding	6	Use silicon	4	144	Minimze welds	10/19/2009	Use pre-formed square	5	2	4	40
					Poor sealant application		Self-pressure design			Adequate weld overlap		tig weld edges				
												RTV silicon				
Safety Interclocks	Not triggered	Electricution	9	A	Bad wiring	2	Plexiglas	3	54	Professional wiring	11/19/09	2 gauge wire	9	2	5	90
					Not insulated		4gauge wire			0 gauge wire		PLC devices				
					Pass through plexiglas							check-valves				
glow discharge	Not firing	System fails	10	A	Bad electrode	1	Hand-positioning	2	20	10 gauge wire	11/1/09	Micrometer screw	10	4	2	80
					Bad electrode placement		14 gauge wire			Micrometer positioning		12 gauge wire				
					Bad wiring											
Pressurization	Over-pressurized	Chamber explode	4	B	weak welds	5	T6 aluminum	3	60	Gauges	12/1/09	Gauges	4	3	3	36
					Bad check valves		Check valve			Prior material testing		Water testing				
					Bad safeyty interlocks											
					Material fracture											

Final product and test

Shovel Adaptor

Kelly Kincaid
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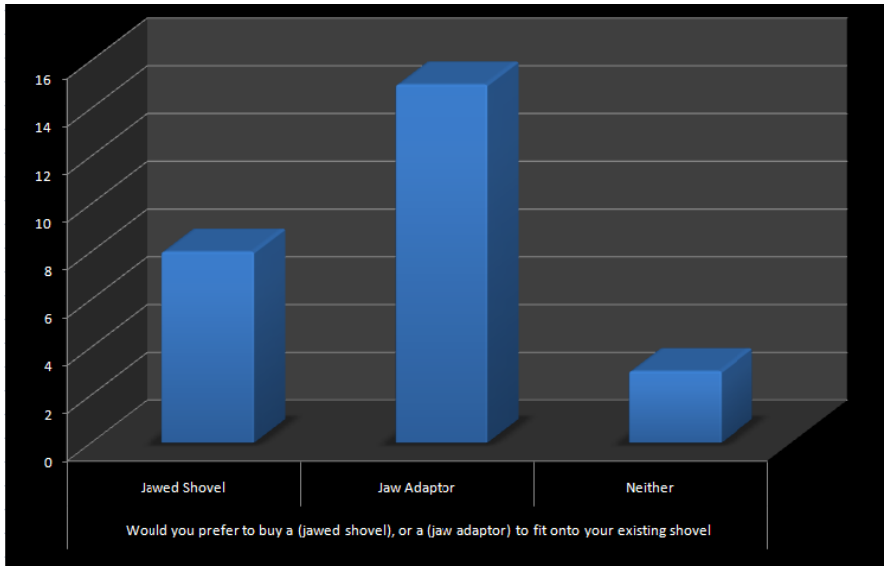
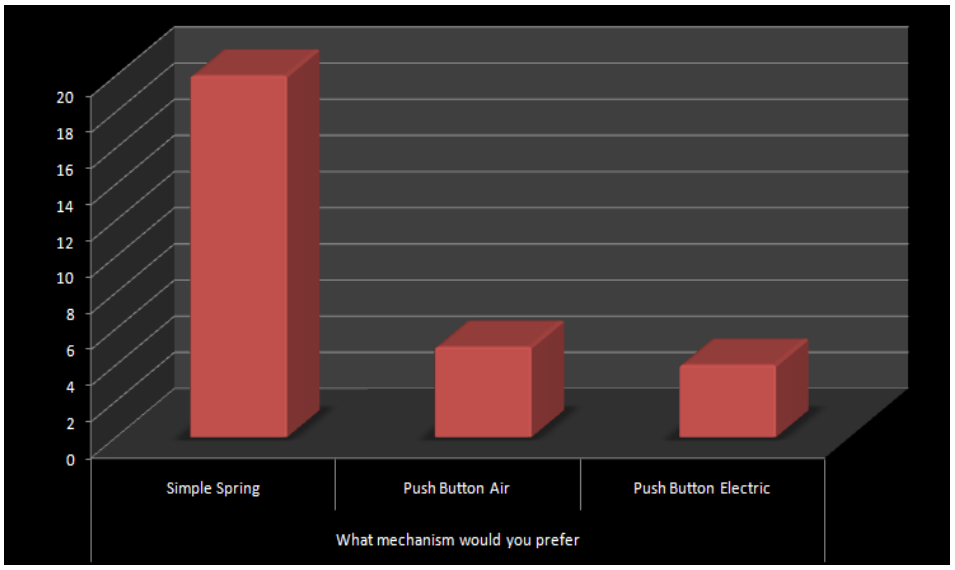
Sponsor and Problem

- Csar Ornelas
  - Contractor
- Problems with Debris Clean up
  - Lengthy process
  - By hand or with hand tools
  - Hand tools are difficult to handle the debris
- Desired Solution
  - A way to secure debris to a shovel in order to greatly decrease clean up time

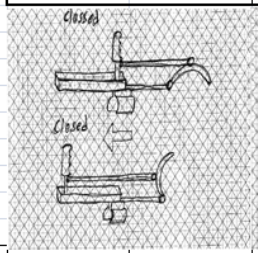
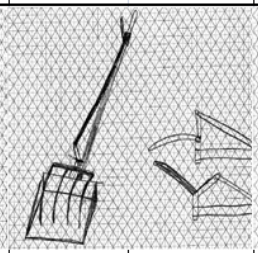
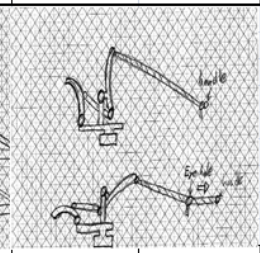
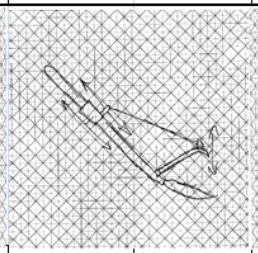
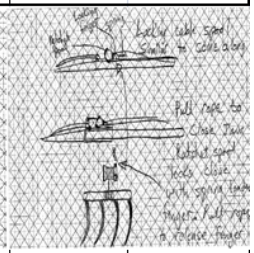
Survey Results



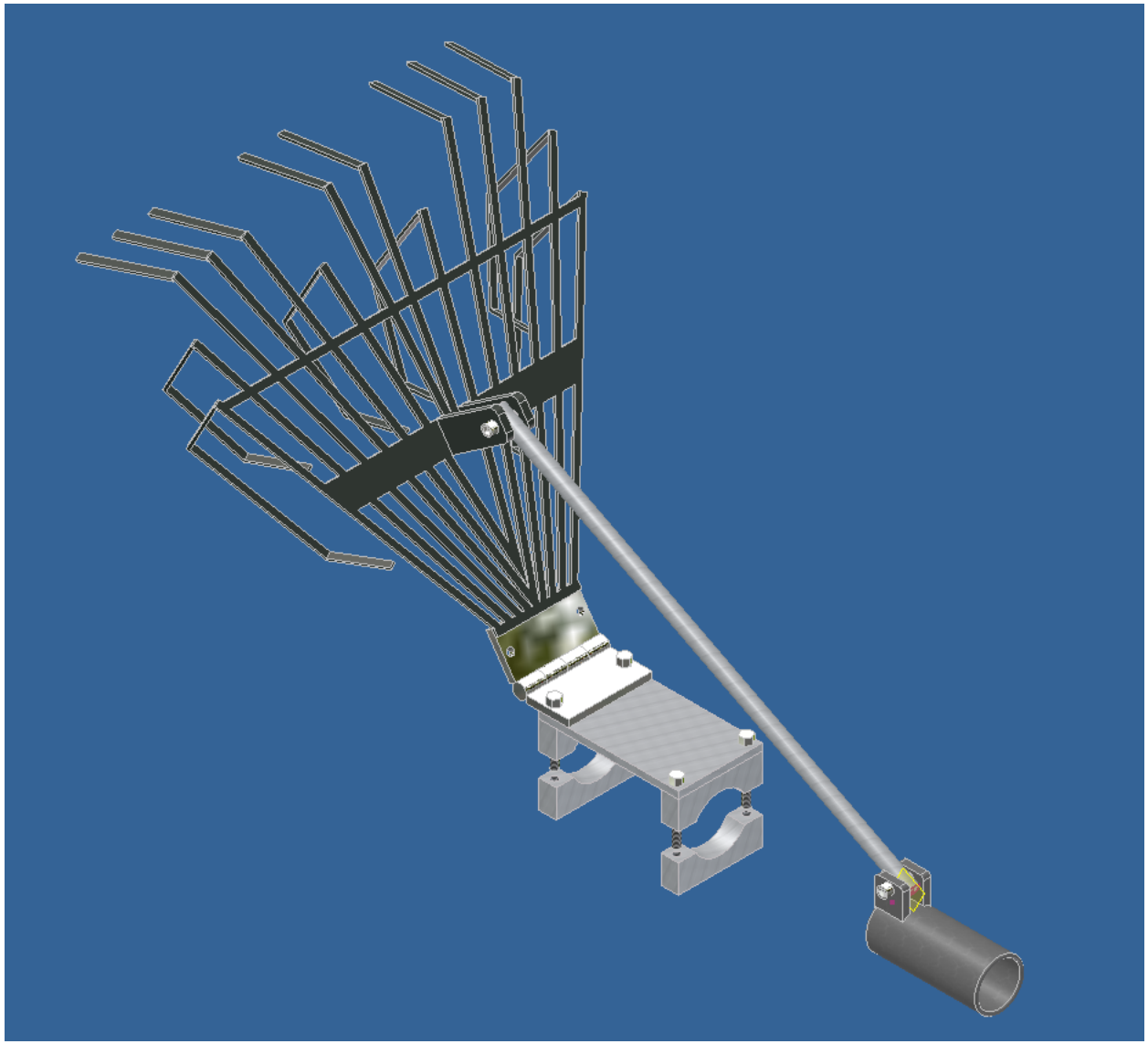


The survey has answered some of our design questions so that we are now able to start some simple sketches. We will be desig a universal adapter with a simple mechanism to fit on many different shovels.

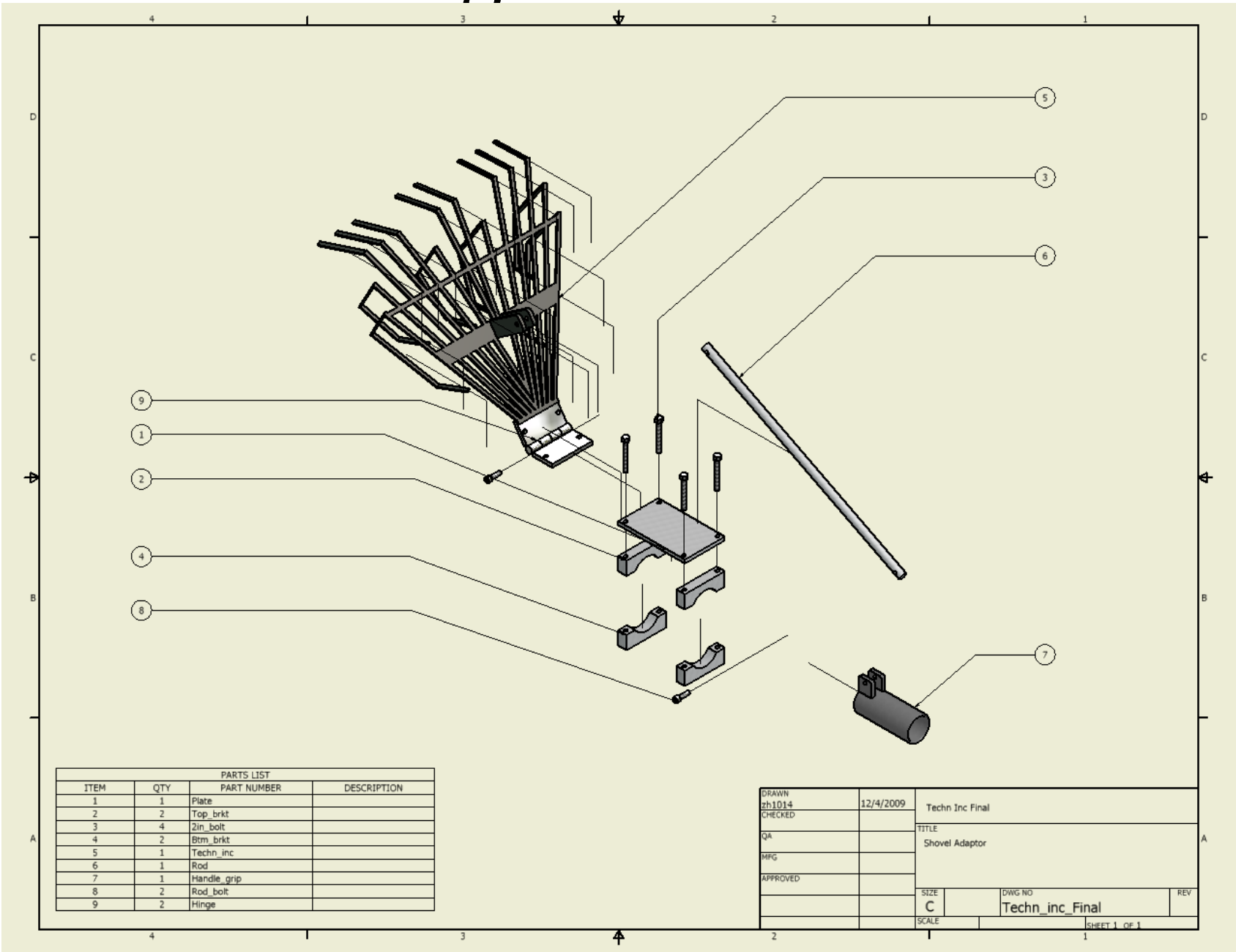
Concept Selection

		Concepts									
		A		B		C		D		E	
											
Selection Criteria	**Weight**	Rating	Score	Rating	Score	Rating	Score	Rating	Score	Rating	Score
Light weight	16%	3.25	0.52	3.5	0.56	2.75	0.44	4.25	0.68	2.5	0.4
Easy to operate	13%	3.5	0.455	3.5	0.455	2.75	0.3575	4	0.52	2.75	0.3575
Low cost	10%	2.75	0.275	3.75	0.375	3.25	0.325	3.75	0.375	2.25	0.225
Safe to operate/own	10%	3.75	0.375	4	0.4	3.75	0.375	3.75	0.375	3	0.3
Easy to remove/attach	12%	3.75	0.45	3.5	0.42	2.75	0.33	3	0.36	3.5	0.42
Demonstrates the advantages of the closing jaw	19%	3	0.57	3	0.57	3.25	0.6175	3.25	0.6175	3.25	0.6175
Must maintain a sufficient life cycle	10%	3	0.3	3.5	0.35	3.25	0.325	3.5	0.35	3	0.3
Simple self contained mechanism	10%	3.25	0.325	3.25	0.325	2.75	0.275	3.25	0.325	3.25	0.325
Overall Score			3.27		3.455		3.045		3.6025		2.945
Rank			**3**		**2**		**4**		**1**		**5**
Continue?			Develop		Develop		No		Develop		No

CAD drawing



CAD drawing and Bill of Material



PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	Plate	
2	2	Top_brkt	
3	4	2in_bolt	
4	2	Btm_brkt	
5	1	Techn_inc	
6	1	Rod	
7	1	Handle_grip	
8	2	Rod_bolt	
9	2	Hinge	

DRAWN zh1014	12/4/2009	Techn Inc Final
CHECKED		TITLE: Shovel Adaptor
QA		
MFG		
APPROVED		
SIZE C	DWG NO Techn_inc_Final	REV
SCALE	SHEET 1 OF 1	

Bringing the Design to Life

Drilling Holes for Bolts

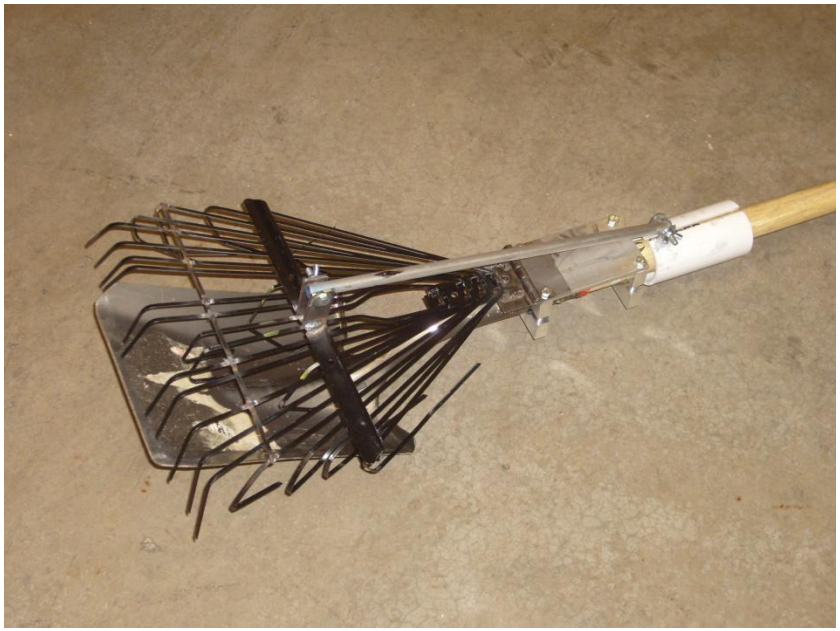
Cutting Stock for Machining

Smoothing Rough Edges

Tapping Holes

Final Design Comparison

Weight of 1st Design =
5.34 lbs.



Weight of 2nd Design =
3.44 lbs.

Save the Planet Clean Water

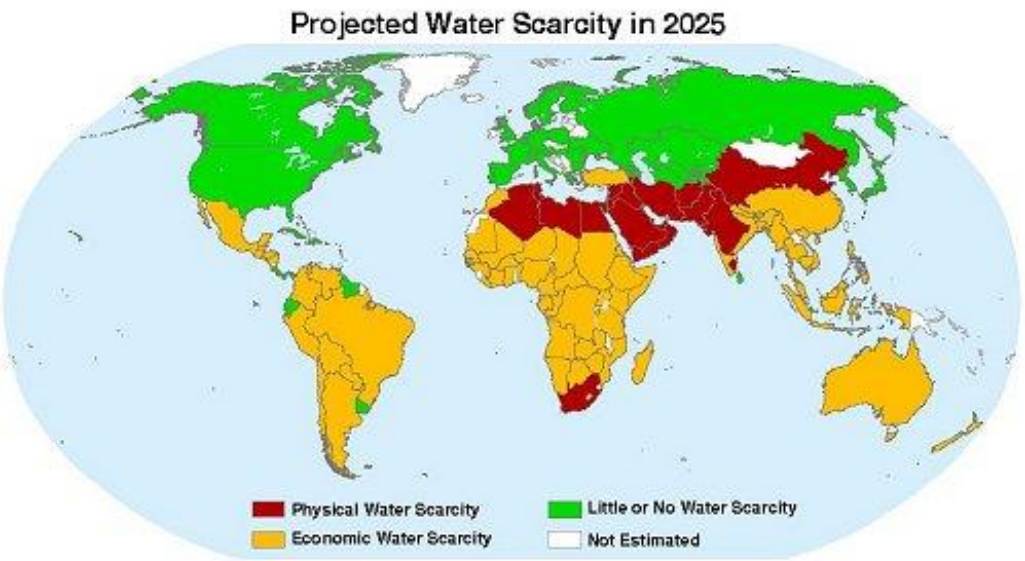
Travis Hilbig
Ben Butler
David Doughty
Eduardo Martinez

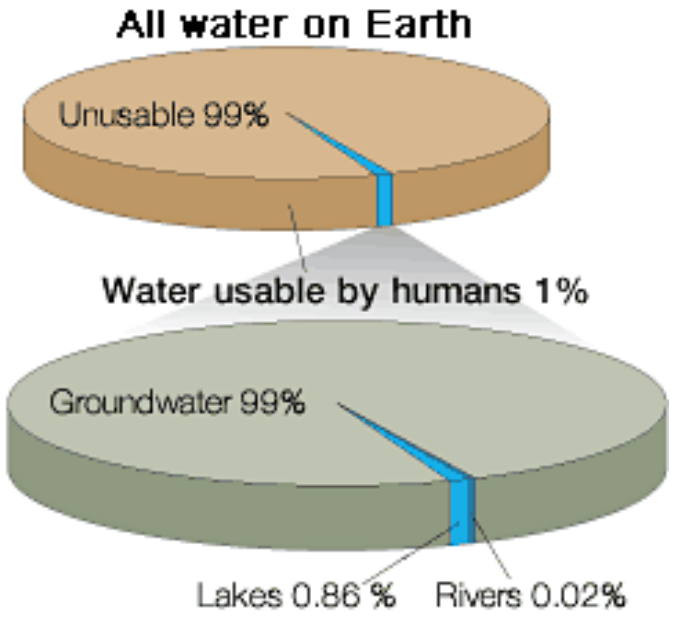
Problem

- Drinkable clean water is a limited resource
- **4000** children die each and every day from consuming contaminated water
- **1.6 billion** people live without electricity
- **1 billion** do not have access to potable water
- **5 million** die every year due to drinking non-potable water and becoming sick

Problem

- Not enough water to go around

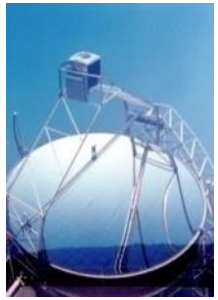




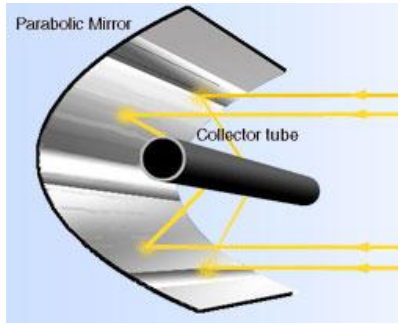
A Few Ways to go About It

Heat Focusing Designs:

Dish Design:



Parabola:



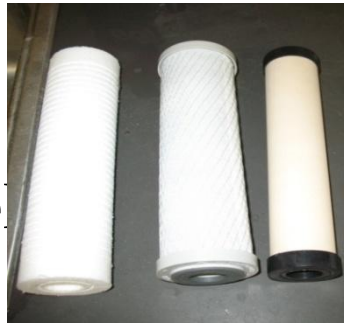
Filters:

Carbon Black

Sand and Gravel

Ceramic

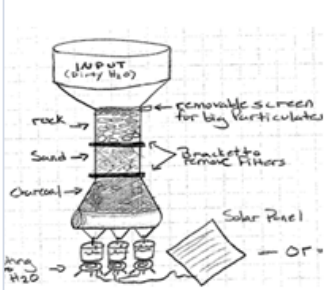
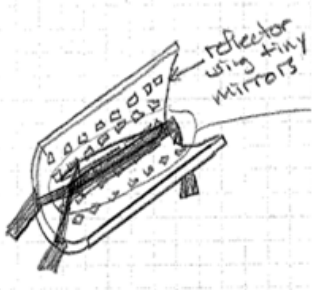
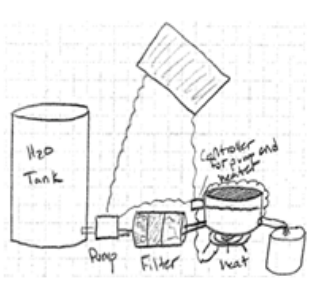
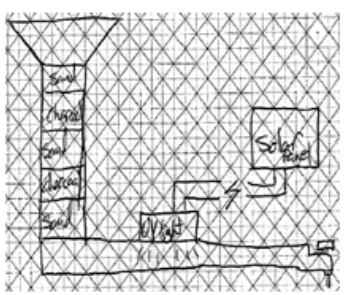
Osmosis



UV Purifier:

Chemicals:

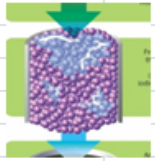
Concept Screening

Team Clean Green Machine		 Filter and Boil		 Evaporate and Collect		 Continuous Pump and Filter		 Gravity filter with UV light	
Selection Criteria	Weight	Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score
Heats Water to 212	5%	4	0.2	2	0.1	5	0.25	1	0.05
Low Energy Consum	15%	1	0.15	5	0.75	1	0.15	5	0.75
Can be turned on/of	5%	3	0.15	1	0.05	5	0.25	4	0.2
Light Weight	10%	2	0.2	2	0.2	2	0.2	2	0.2
Portable	10%	3	0.3	3	0.3	2	0.2	3	0.3
Easy to use	5%	4	0.2	4	0.2	4	0.2	5	0.25
Durable	10%	2	0.2	2	0.2	3	0.3	2	0.2
Safe	5%	2	0.1	4	0.2	5	0.25	5	0.25
High water throughp	10%	2	0.2	1	0.1	5	0.5	5	0.5
Continuous	5%	3	0.15	2	0.1	4	0.2	4	0.2
Can purify any wate	20%	3	0.6	5	1	3	0.6	5	1
	Total Score		1.5		2		1.8		3.9
	Rank	4		2		3		1	
	Continue?	no		no		no		yes	

Filters with the UV light is decided to be the best option
we later discover that gravity fed is not an option with the filters, so we Modify the design to have a hand pump

Which Filters to Use

Filter Selection Matrix

		UV filter		Carbon Black		Ceramic		Iodine Saturate		Screens	
											
Selection Criteria	**Weight**	**Rating**	**Score**	**Rating**	**Score**	**Rating**	**Score**	**Rating**	**Score**	**Rating**	**Score**
Inexpensive	0.10	2	0.2	3	0.3	3	0.3	2	0.2	5	0.5
Maintance	0.15	3	0.45	2	0.3	3	0.45	0	0	5	0.75
Long Lasting	0.20	4	0.8	2	0.4	3	0.6	0	0	5	1
Remove Particulates	0.15	0	0	4	0.6	5	0.75	2	0.3	5	0.75
Remove Microbes	0.30	4	1.2	5	1.5	4	1.2	4	1.2	0	0
Energy Use	0.10	0	0	5	0.5	5	0.5	5	0.5	5	0.5
Total Score	1		2.65		3.6		3.8		2.2		3.5
Rank			4		2		1		5		3
Continue?			Maybe		Develop		Develop		No		Develop

The UV purifier, Activated carbon and Ceramic filters will be used, along with some screens

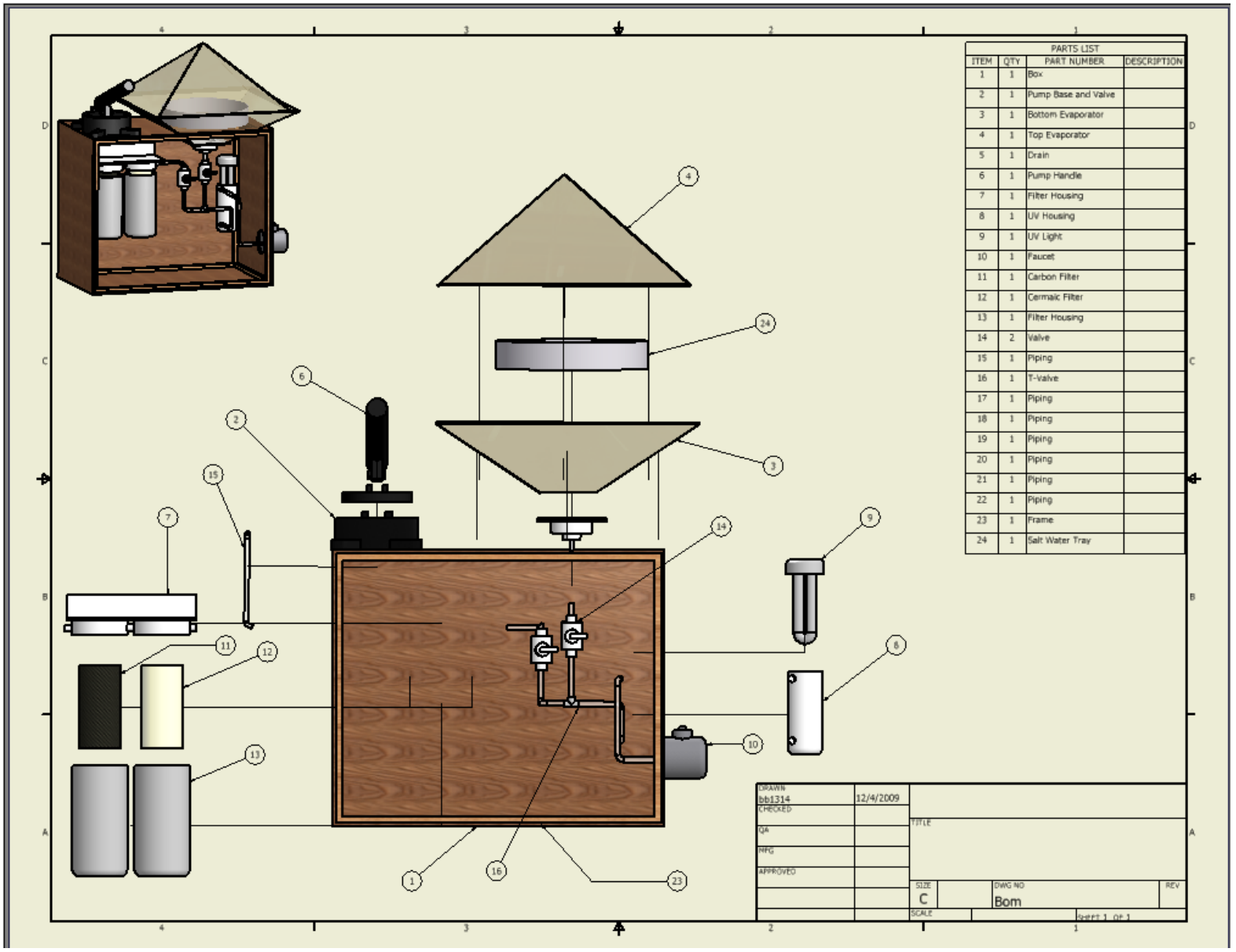
Pumping?

		Electric Pump		Hand Pump		Manual moving	
Selection Criteria	**Weight**	**Rating**	**Weighted Score**	**Rating**	**Weighted Score**	**Rating**	**Weighted Score**
Cost	0.1	1	0.1	4	0.4	5	0.5
Water throughput	0.25	5	1.25	4	1	3	0.75
Electricity use	0.2	1	0.2	5	1	5	1
Potential electricity generation	0.05	5	0.25	4	0.2	4	0.2
Ease of use	0.15	3	0.45	4	0.6	1	0.15
Maintanence	0.1	3	0.3	3	0.3	5	0.5
Longevity	0.15	2	0.3	3	0.45	5	0.75
	Total		**2.85**		**3.95**		**3.85**
	Rank		**3**		**1**		**2**
	Continue?		**No**		**Develop**		**Develop**

- We decide to not use an electric pump

Design

- Evaporator for Salt desalinization
- Four Filters design to remove microbes and bacteria's
- Will use plumbing to connect filters and drain into container to prevent growth of bacteria
- Manual Pump later added to design


PARTS LIST
ITEM | QTY | PART NUMBER | DESCRIPTION
1 | 1 | Box
2 | 1 | Pump Base and Valve
3 | 1 | Bottom Evaporator
4 | 1 | Top Evaporator
5 | 1 | Drain
6 | 1 | Pump Handle
7 | 1 | Filter Housing
8 | 1 | UV Housing
9 | 1 | UV Light
10 | 1 | Faucet
11 | 1 | Carbon Filter
12 | 1 | Cermaic Filter
13 | 1 | Filter Housing
14 | 2 | Valve
15 | 1 | Piping
16 | 1 | T-Valve
17 | 1 | Piping
18 | 1 | Piping
19 | 1 | Piping
20 | 1 | Piping
21 | 1 | Piping
22 | 1 | Piping
23 | 1 | Frame
24 | 1 | Salt Water Tray
DRAWN bb1314 12/4/2009
CHECKED
QA
MFG
APPROVED
TITLE
SIZE C
DWG NO Bom
REV
SCALE
SHEET 1 OF 1

Working Hard

Final Prototype

- Pump to push water through filters
- Evaporator connects to UV purifier
- Faucet give us fresh and clean water!

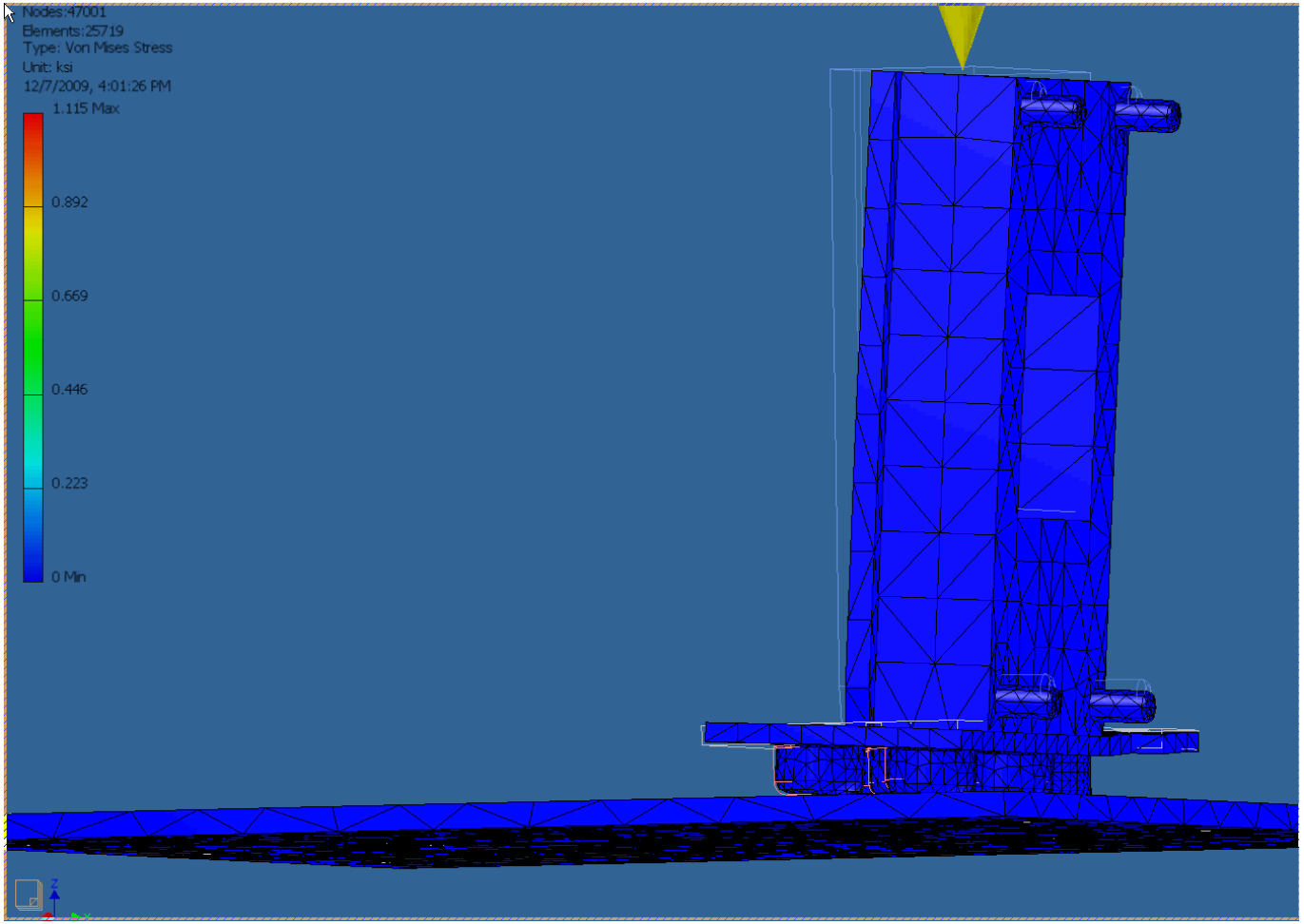
Edward Mendez
Davis Carlberg

Injection Mold Display Table

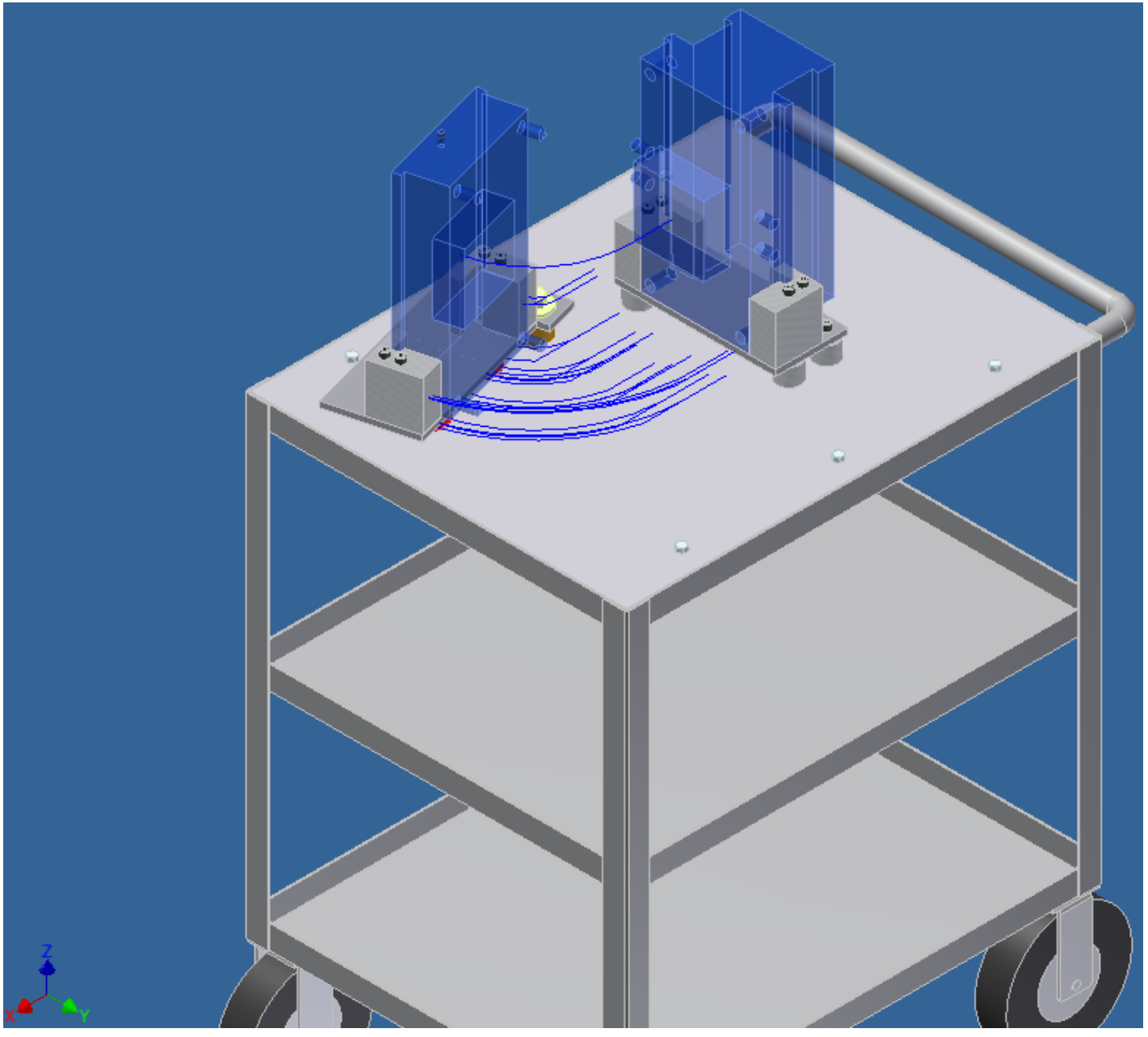
Description of Project

- The main goal of project is to create a fully mobile display unit that holds our injection molding parts in place, safely. The goal is to provide the professor with an easy way to show how the injection molding process works while letting the audience to view all components and parts.

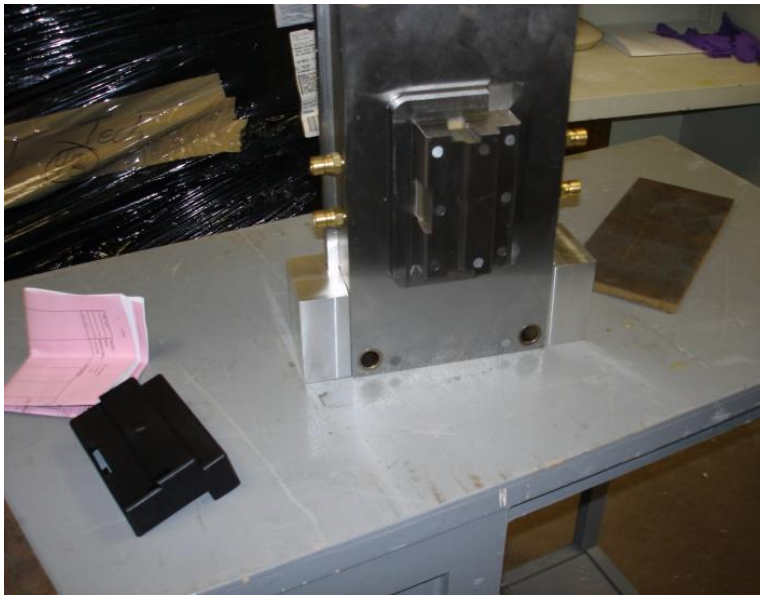
FEA


Nodes:47001
Elements:25719
Type: Von Mises Stress
Unit: ksi
12/7/2009, 4:01:26 PM
1.115 Max
0.892
0.669
0.446
0.223
0 Min

Final Assembly



Part Manufacturing



Final Product

Audience

Audience

Panel of Experts

And the best 2009 team is….