Texas State University- San Marcos
Ingram School of Engineering

2012 Best Product Development Contest Award

2012 Best Team: Toyota Paint Shield Design

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Toyota Motor Manufacturing—Texas

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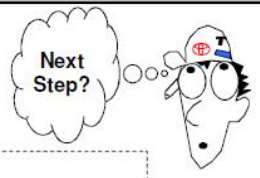
Project Introduction

[2] Problem Breakdown

Prioritize Problem:
- Current study of cleaning process

Reduce Annual Cleaning Cost of $72,000



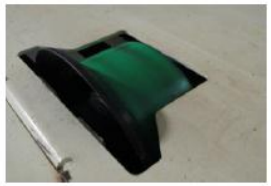
- Primer Cleaning Cost $30,000
- A-Booth Cleaning Cost $21,000
- B-Booth Cleaning Cost $21,000
- Roller Scrapping $24,000
- Debris Pick & Sweep $6,000

*Vehicle Traversing on roller equipment

*Roller must be free of paint debris

Genchi Genbutsu (Go and See):
- Study scrapping method and develop tool to eliminate.

*Clean Roller with no interference

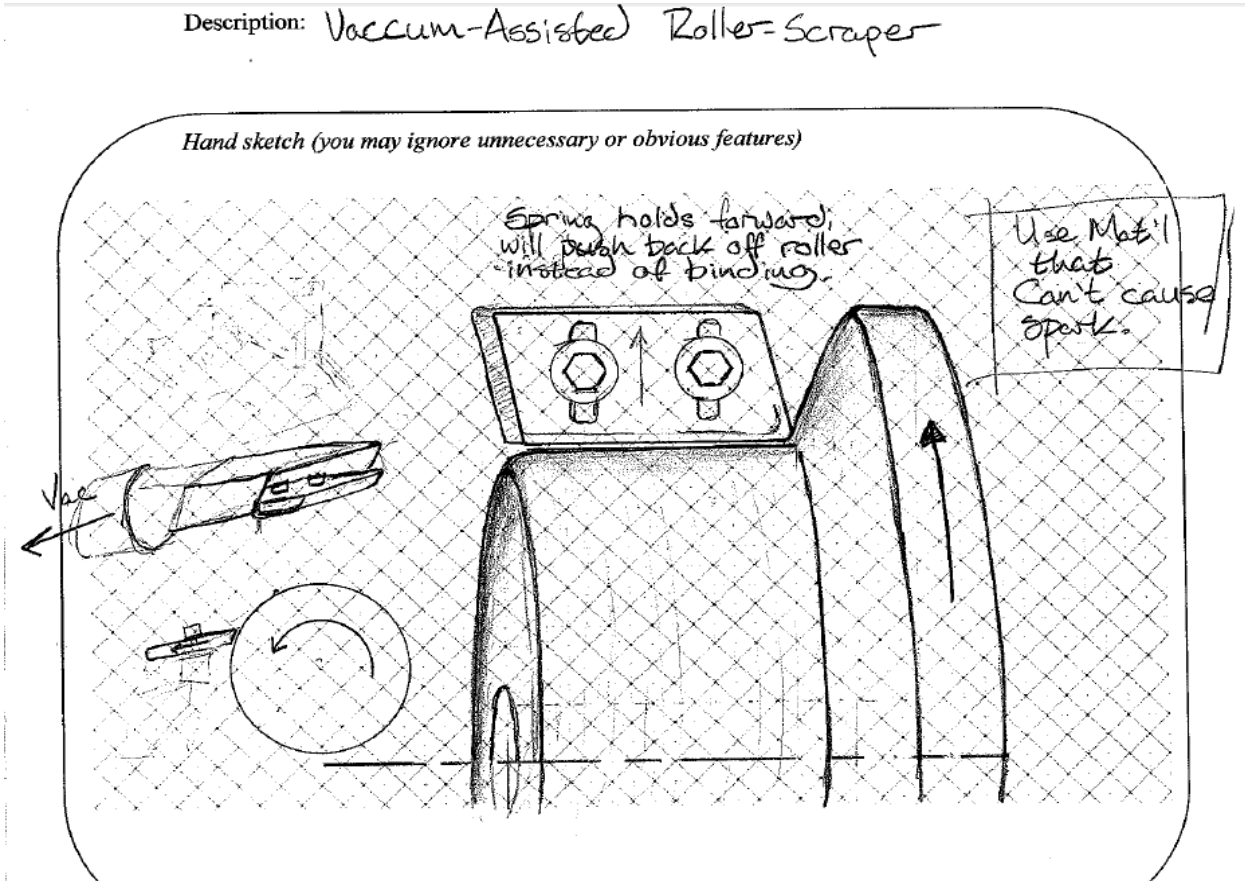


Customer Needs & Desires

	Criteria	Importance
The Solution:	Has no impact on production schedule	5
	Is safe for users and maintenance	4
	Prevents build-up of paint debris on rollers	5
	Is economically advantageous over current methods	3
	Reduces manual cleaning time by 100%	5
	Desirables	**Importance**
The Solution:	Is durable	5
	Is easy to maintain	3
	Is easy to install and uninstall	4
	Withstands chemical and environmental exposure	4

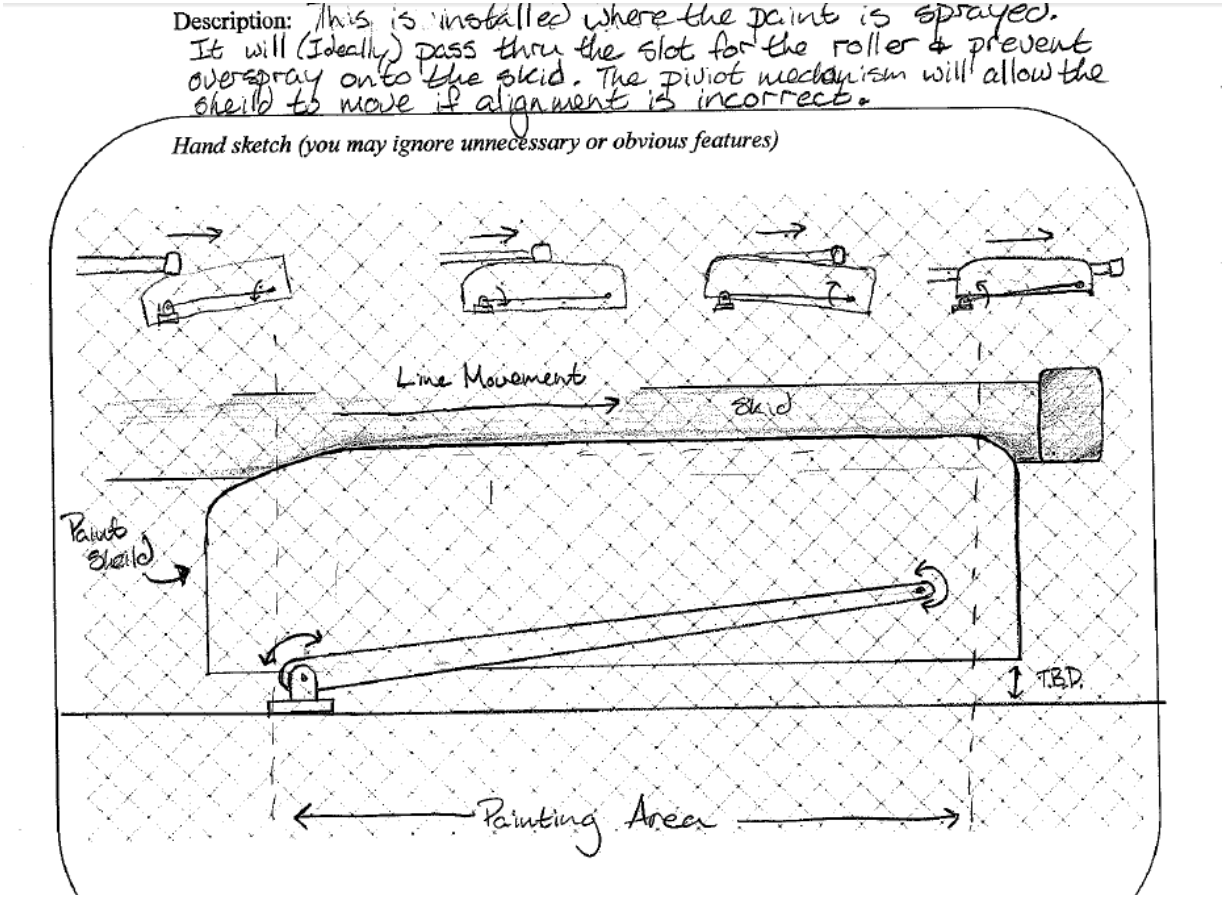
TOYOTA Motor Manufacturing Texas

Root Cause Analysis/ Concept Generation



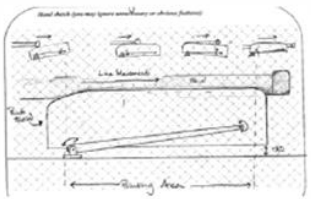
- Root Cause Analysis: Cleaning Rollers
  - Would need cleaning system for each rollers (approximately 30 rollers)
  - Has potential to create airborne debris
  - Class 1/Division 1 area would require expensive materials
  - Cleaning effectiveness is predicted to be relatively low

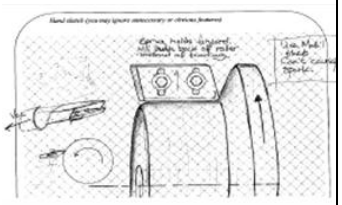
Root Cause Analysis/ Concept Generation

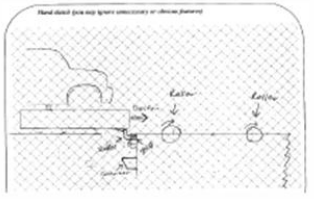


- Root Cause Analysis: Protecting Skids
  - \+ Addressing the problem before it starts will be the most effective solution
  - \+ Unlikely to interfere with production line movement
  - – Requires multiple mechanisms in each critical area

Concept Selection







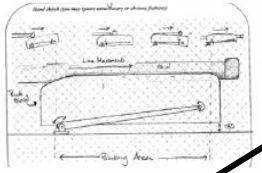
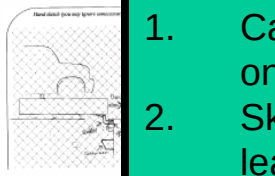
		Adaptive Paint Shield		Roller Scraper		Courter Blade	
Selection Criteria	*Weight*	*Rating*	*Weighted Score*	*Rating*	*Weighted Score*	*Rating*	*Weighted Score*
Automation	10%	**3**	**0.3**	**4**	**0.4**	**4**	**0.4**
Easy to install	5%	**2**	**0.1**	**3**	**0.15**	**3**	**0.15**
Low cost in design and implementation	20%	**4**	**0.8**	**2**	**0.4**	**4**	**0.8**
Nondisruptive to production	7%	**3**	**0.21**	**3**	**0.21**	**3**	**0.21**
Longevity	10%	**4**	**0.4**	**2**	**0.2**	**3**	**0.3**
Safety	15%	**4**	**0.6**	**3**	**0.45**	**3**	**0.45**
Reduces labor cost	25%	**3**	**0.75**	**4**	**1**	**3**	**0.75**
Low maintenance	8%	**3**	**0.24**	**3**	**0.24**	**3**	**0.24**
	Total Score		**3.4**		**3.05**		**3.3**
	Rank		**1**		**3**		**2**
	Continue?		**YES**		**NO**		**OPTION B**

Concept Evaluation

Concept – Evaluation Matrix

Julio Mata– Paint Engineering

- ○ (4): No Impact
- ◬ (3): Low Impact, Need Improvement
- △ (2): Impact, Required Improvement
- × (1): Major Impact

#	Concept	Picture	Safety	Quality	Productivity	Cost	Outlook
1	Adaptive Paint Shield		△ When cleaning the shield, pinch points will need to be addressed	△ 1. Cam affect may sling paint onto vehicle. 2. Skid scraping shield may leave paint onto skid.	△ 1. Since shield moves up and down, if shield jams under skid, how do we remove quickly? 2. How to clean rotation parts without disassembling shield?	○ Low cost increase, easy retrofit	◬ 10
2	Scraper		△ ound scraper, rom sharp edges	△ Make sure scraping path of debris is away from vehicle.	◬ No impact	× 1. High cost if each unit is custom for location. 2. Will require a higher variation of parts.	◬ 8
5	Counter Blade			from ve			

When cleaning the shield, pinch points will need to be addressed

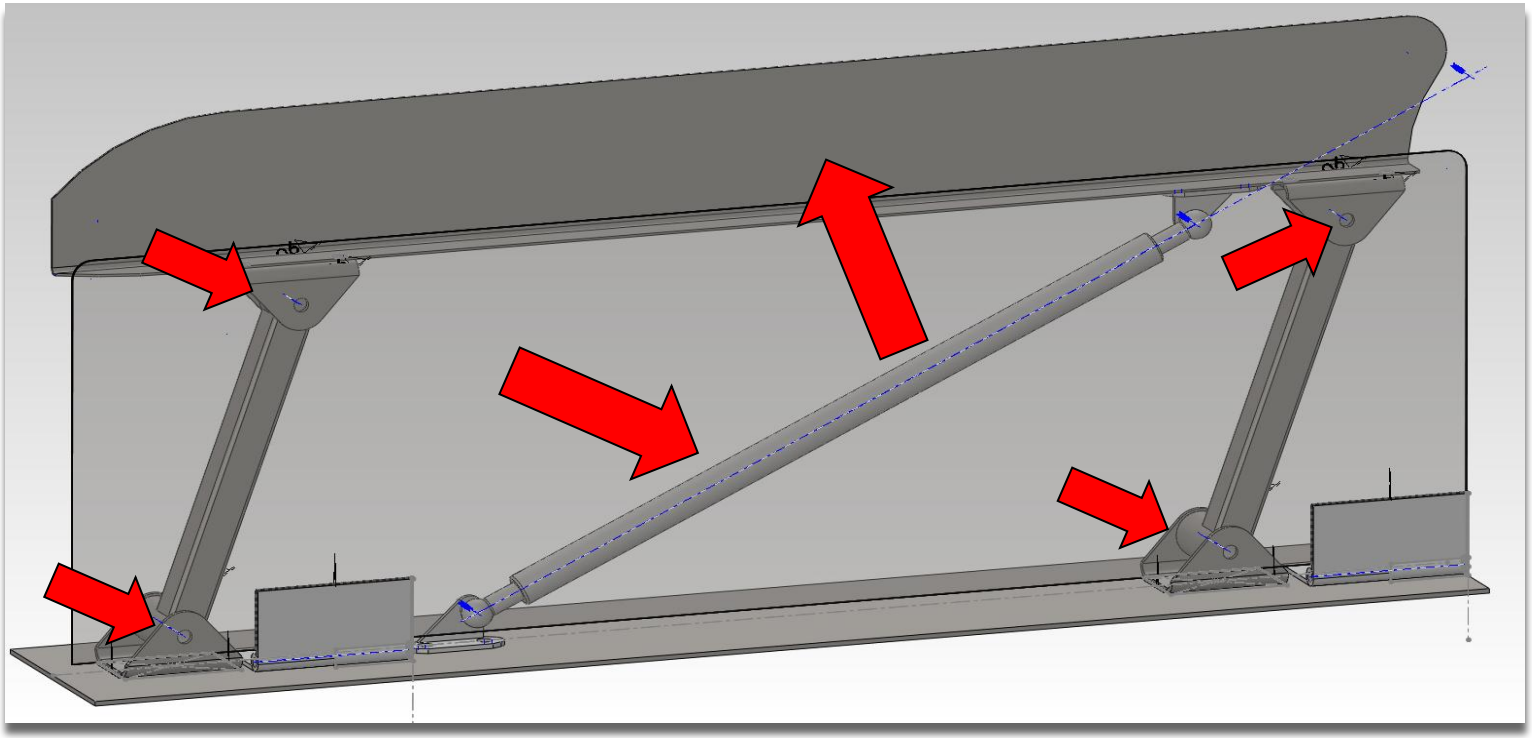
1. Cam affect may sling paint onto vehicle
2. Skid scraping shield may leave paint onto skid

1. If shield jams under skid, how do we remove quickly?
2. How to clean moving parts without disassembling shield?

Failure Mode and Effect Analysis

Design Item	Potential Failure Mode	Potential Effect(s) of Failure	Sev	Potential Cause(s) / Mechanism(s) of Failure	Occ	Current Design or ProcessControls	Det	RPN	Recommended Actions
Adaptive Paint Shield	Vertical movement of shield fails	Lost of efficiency	3	Paint gathered on drive mechanism	4	Fixed--no movement on shield	1	12	Clean the rotation mechanism
	Paint slings	Quality defect on vehicle	8	Speed of vertical movement of shield	3	Fixed--no movement on shield	5	120	Control the resistivity of the spring
	Lever arm breaks	Interrupt production	9	Repeated action	1	None	1	9	Preventive maintenance

Adaptive Paint Shield (1st Iteration)



Material: 304 Stainless Steel

- ✓ Resistance to corrosion and its ability to withstand the chemicals being used in the painting process.

Paint Shield

- ✓ Protects the skid from overspray

Sealed Bearings

- ✓ Provide smooth, accurate motion in harsh conditions

Close-Assist Gas Spring

- ✓ Return Shield to original position without “slinging” any material onto the vehicle.

Design Considerations (Design for X)

Design for Maintence:

✓ Lift-off hinges

✓Quick-Release gas springs

Design for Assembly:

✓ Symmetrical components

✓Only two sizes of fasteners are used in the entire mechanism

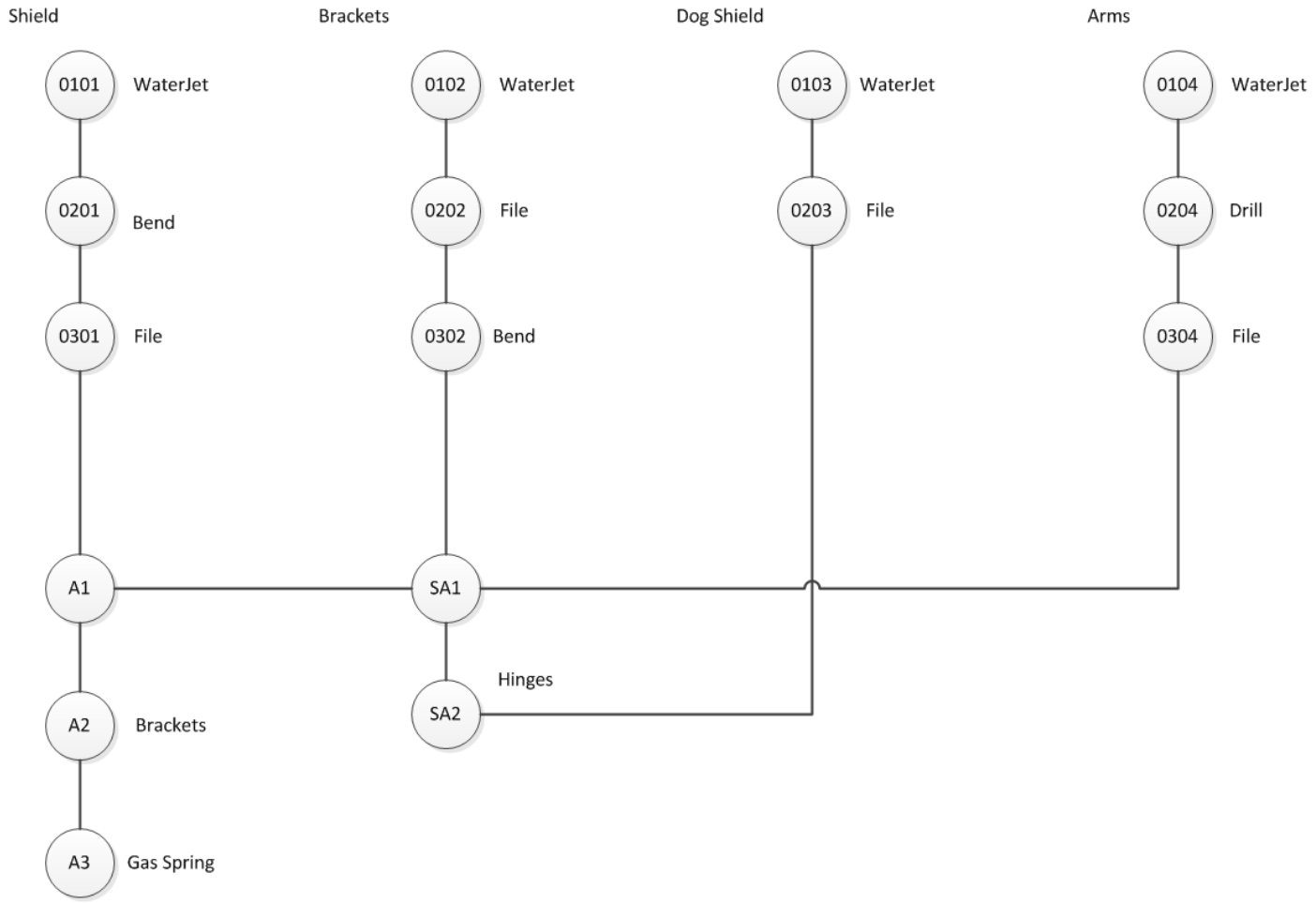
✓All assembly can be done with a couple standard tools

Design for Manufacturing:

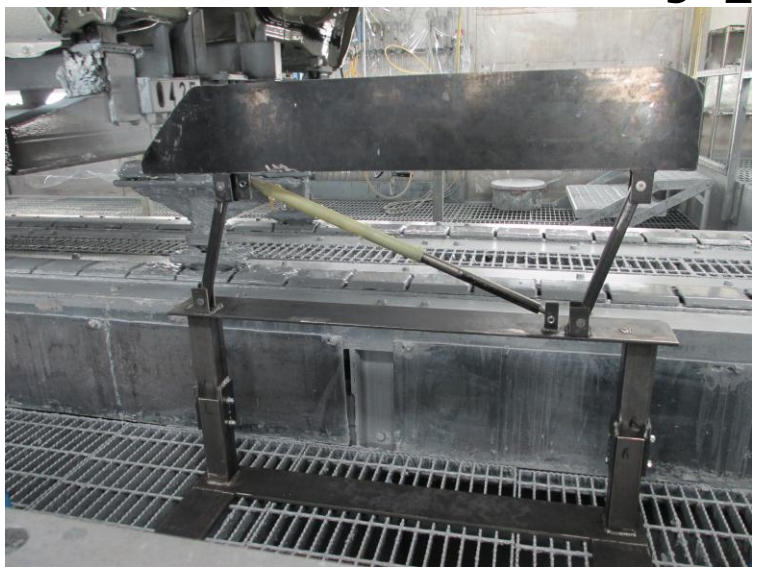
✓Taking into consideration our available manufacturing capabilities and their associated operational costs, each component's design was optimized for production/cost efficiency without sacrificing product quality.

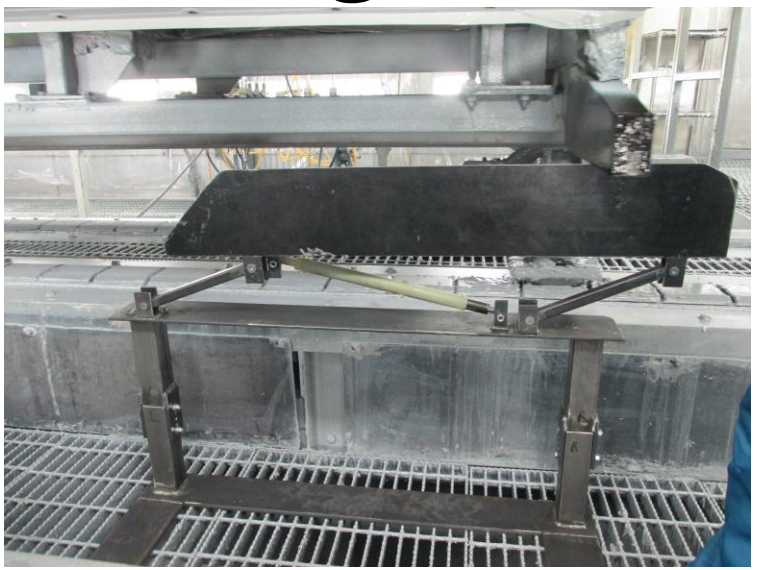
✓Standardized construction materials

Operational Chart



Prototype Testing

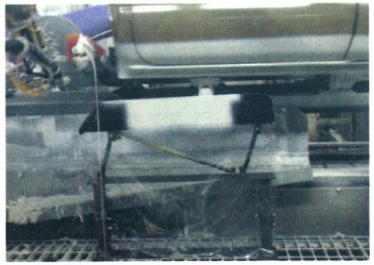




Toyota evaluation:

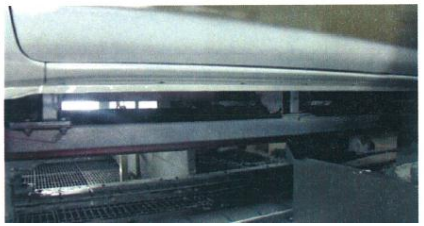
2. Trial Activity (cont)

	Trial	S	Q	P	C	Outlook
3	Shield mounted next to conveyor (2" higher, 11" wider)	○	△	△	△	△



–idea is to capture more overspray by moving shield up and wider to avoid interference with other skid cross members

RH Side



Control or evaluation
Overspray on 75% of skid lower on RH side of skid

Rating Legend	
○	Meets or exceeds target
△	Acceptable, slight improvement needed
△	Significant improvement needed
X	Unacceptable

Results

- Product meets customer's criteria:

	Criteria	
The Solution:	Has no impact on production schedule	✓
	Is safe for users and maintenance	✓
	Prevents build-up of paint debris on rollers	✓
	Is economically advantageous over current methods	✓
	Reduces manual cleaning time	✓
	Desirables	
The Solution:	Is durable	✓
	Is easy to maintain	✓
	Is easy to install and uninstall	✓
	Withstands chemical and environmental exposure	✓


VISITOR
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VISITOR


Prototype Testing

Toyota -Tundra Tailgate Jig-

Anthony Ahrens
Jared Horne
Jamie Humble
Mario Pozos

Safety Is Our Commitment

- Texas State Safety Commitment contract
- Toyota safety operation standards

- Personal Protective Equipment (PPE)
  - Hard Hats
  - Protective eye wear
  - Ear Plugs
  - Steel toed shoes
  - Gloves
  - Welding shields/hoods

Problem

- During cleaning process
  - •Zinc shot and paint buildup between coils
- During painting process
  - •Debris effects quality of paint job

Customer Needs

Category	#	Customer Needs	Imp
Must-Have	1	Apply proper resistance to the tailgate force	5
Must-Have	2	Compatible with Painting process	5
Must-Have	3	Easily Cleaned	5
Must-Have	4	Utilized by one operator	5
Must-Have	5	Heat resistant	4
Must-Have	6	Material must be Impact resistant	4
Must-Have	7	Simple installation	4
Must-Have	8	Size of product must fit within the desired confinements	4
Must-Have	9	Easy to handle	3
Desirable	10	Must be Ergonomically Acceptable	3

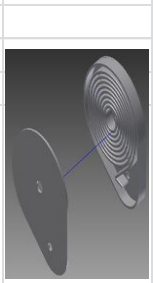
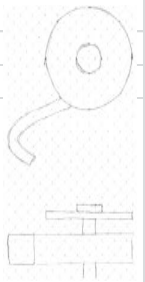
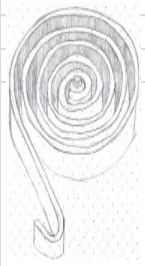
Customer Needs: Metrics

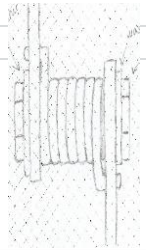
#	Customer Needs	Imp	Torque lb*ft	Distance from bed (in)	OD (in)	Gap btwn Coils (in)	Weight (lb)	Heat Resistant (F)	Hardness
1	Apply proper resistance to the tailgate	5	9			9			3
2	Compatible with Painting process	5		9	9			3	
3	Easily Cleaned	5			3	9	3		9
4	Utilized by one operator	5	3	3			9		
5	Heat resistant	4						9	
6	Material must be Impact resistant	4							9
7	Simple installation	4		3	3		9		
8	Size of product must fit within the desired confinements	4		9	9	3			
9	Easy to handle	3	3	3	3		9		
10	Must be Ergonomically Acceptable	3	3	3			3		

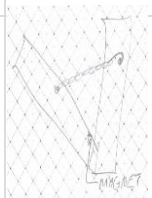
LOCATION OF SPRING (RE-CENTERING COIL)

- -Current location of the spring produces higher constraints on the upper half than the lower half resulting in multiple pinch points for zinc to be wedged in
- -By re-centering the spring we can produce equal amounts of coil spacing throughout the entire spring therefore decreasing the possibility of zinc being wedged into the coil

Concept Screening

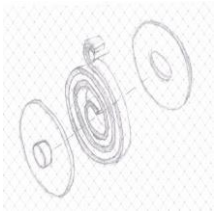
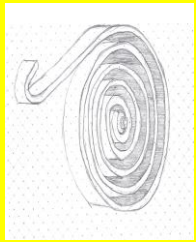
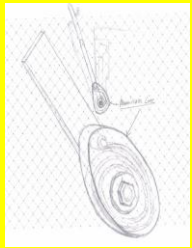
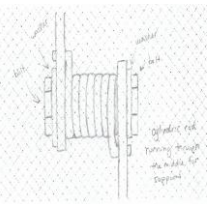









		Concept Variants								
		A	B	C	D	E	F	G	H	
	Selection Criteria	Coil Case	Cap & Washer	Expanded Coil	Triangular coil	Torsion Coil	Fewer Coils	Retention Chain	Recenter Spring	Ref.
1	Proper Torque	5	5	4	2	3	4	1	5	5
2	Compatible with Painting process	4	4	4	4	4	5	3	5	5
3	Easily Cleaned	4	3	5	3	3	4	2	5	3
4	Utilized by one operator	5	5	5	5	5	5	5	5	5
5	Impact Resistant	5	5	5	4	4	5	3	5	5
6	Easy Part replacement	1	2	2	2	4	2	3	2	1
7	Low Investment Cost	2	2	3	1	4	3	4	2	3
8	Size of product must fit within the desired confinements	5	4	3	5	5	5	1	4	5
9	Easy to handle	4	4	4	3	4	4	2	4	4
10	Reduce # of Wedged Zinc Pellets	4	3	4	3	3	3	4	3	1
11	Heat resistant	5	5	5	4	4	5	3	5	5
12	Simple installation	4	5	4	4	4	5	3	4	5
13	Must be Ergonomically Acceptable	5	5	5	5	5	5	3	5	5
	SUM	53	52	53	45	52	55	37	54	52
	RANK	3	6	4	7	5	2	8	1	
	CONTINUE?	Yes	Yes	Yes	No	Yes	Yes	No	Yes	

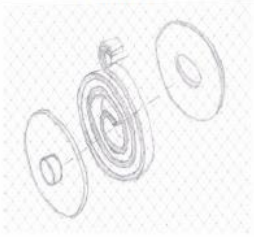
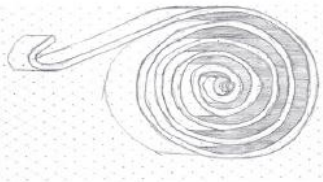
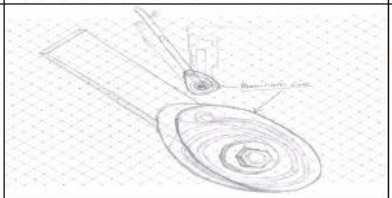
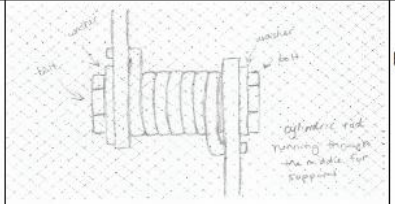
Concept Scoring

		Concepts									
		Cap & Washer		Expanded Spacing Spring		Total Case Covering		Torsion Spring		Re-centering Coil	
											
Selection Criteria	Weight	Rating	Weight Scored	Rating	Weight Scored	Rating	Weight Score	Rating	Weight Scored	Rating	Weight Scored
Proper Torque	10.0%	5	0.5	4	0.4	5	0.5	3	0.3	5	0.5
Compatible with Painting process	10.0%	4	0.4	5	0.5	4	0.4	4	0.4	5	0.5
Easily Cleaned	10.0%	3	0.3	4	0.4	4	0.4	3	0.3	5	0.5
Utilized by one operator	10.0%	5	0.5	5	0.5	5	0.5	5	0.5	5	0.5
Impact Resistant	8.0%	5	0.4	5	0.4	5	0.4	4	0.32	5	0.4
Low Investment Cost	8.0%	2	0.16	3	0.24	2	0.16	4	0.32	2	0.16
Size of product must fit within the desired confinements	8.0%	4	0.32	5	0.4	5	0.4	5	0.4	4	0.32
Easy Part replacement	7.0%	2	0.14	2	0.14	1	0.07	4	0.28	2	0.14
Easy to handle	7.0%	4	0.28	4	0.28	4	0.28	4	0.28	4	0.28
Reduce # of Wedged Zinc Pellets	7.0%	3	0.21	3	0.21	4	0.28	3	0.21	3	0.21
Heat resistant	7.0%	5	0.35	5	0.35	5	0.35	4	0.28	5	0.35
Simple installation	5.0%	5	0.25	5	0.25	4	0.2	4	0.2	4	0.2
Must be Ergonomically Acceptable	3.0%	5	0.15	5	0.15	5	0.15	5	0.15	5	0.15
	Total Score	**3.21**		**3.47**		**3.39**		**3.31**		**3.51**	
	Rank	**5**		**2**		**3**		**4**		**1**	
	Continue?	**No**		**Yes**		**Yes**		**No**		**Yes**	

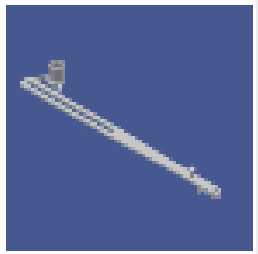
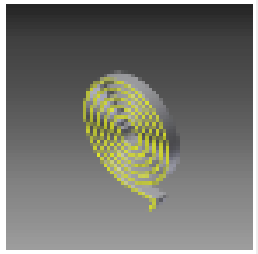
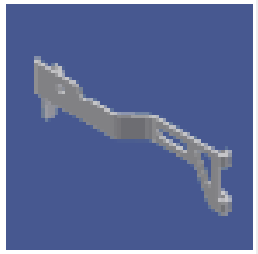
Sponsor Scoring

Concept – Evaluation Matrix

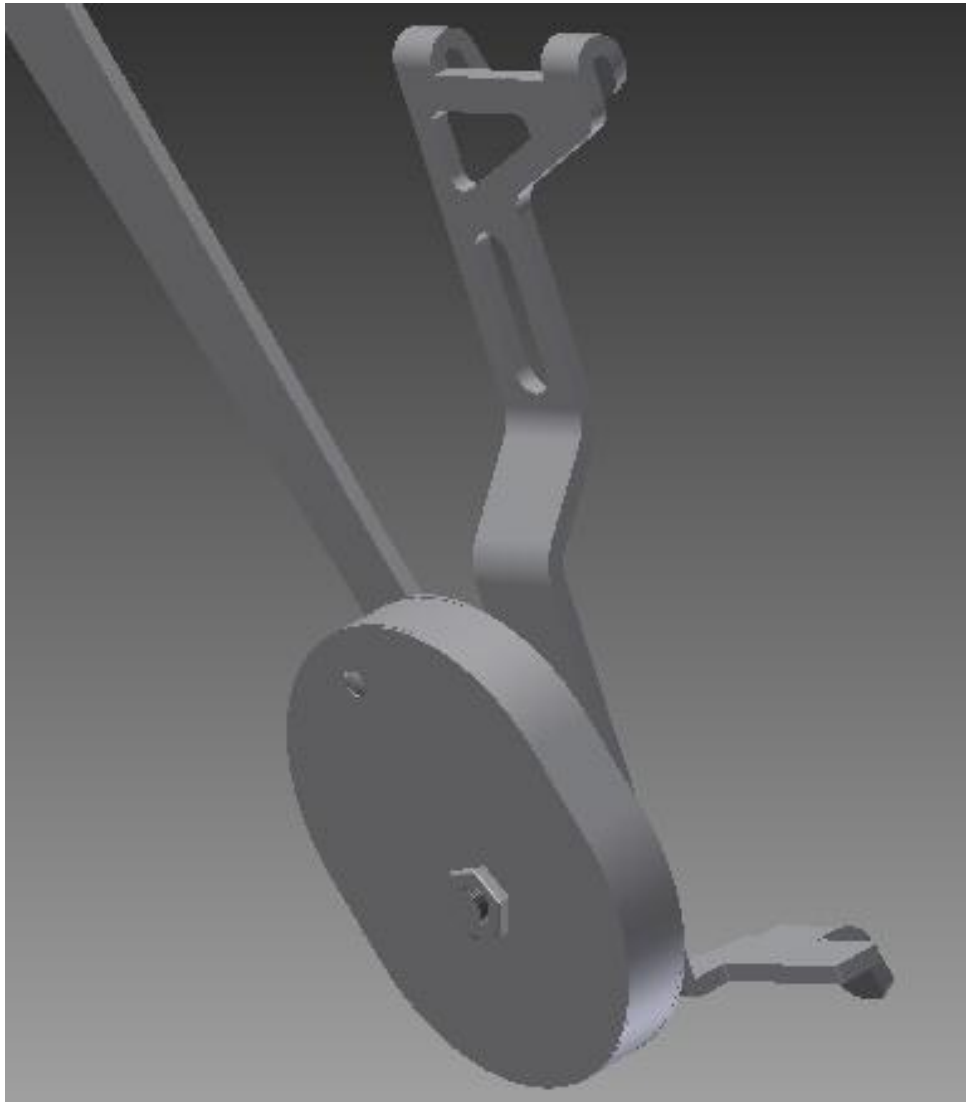
- ◯ (4): No Impact
- ⓓ (3): Low Impact, Need Improvement
- △ (2): Impact, Required Improvement
- × (1): Major Impact

#	Concept	Picture	Safety	Quality	Productivity	Cost	Outlook
1	Cap & Washer		◯ No impact	△ 1. will cap interfere with painting 2. Will it trap zinc	× 1. if item must be removed for cleaning, we must add work 2. how to secure after removal 3. added weight	× 1. cost increase 2. must have spare parts in case parts lost (if removable for cleaning)	△ 8
2	Expanded Spacing Spring		ⓓ must watch for TM putting fingers near coil opening	ⓓ 1. what other area will trap zinc	ⓓ confirm fit with current jig space	ⓓ will require investment, but will improve quality	ⓓ 12
3	Total Case Covering		◯ No impact	△ 1. what is wear on aluminum and will it leave a different defect 2. will zinc be trapped inside of case	△ 1. how to remove if spring is damaged 2. may add work to repair operator	× 1. cost increase 2. must have spare parts in case parts lost (if removable for cleaning)	△ 9
4	Torsion Spring		◯ No impact	△ 1. will zinc be trapped inside coil	△ 1. will current cleaning process remove paint from coil 2. must confirm installation clearance	ⓓ will require investment, but will improve quality	ⓓ 11
5	Re-centering Coil		◯ No impact	ⓓ 1. what other area will trap zinc	ⓓ 1. same as current	ⓓ will require investment, but will improve quality	ⓓ 13

Expanded Spacing Spring: BOM

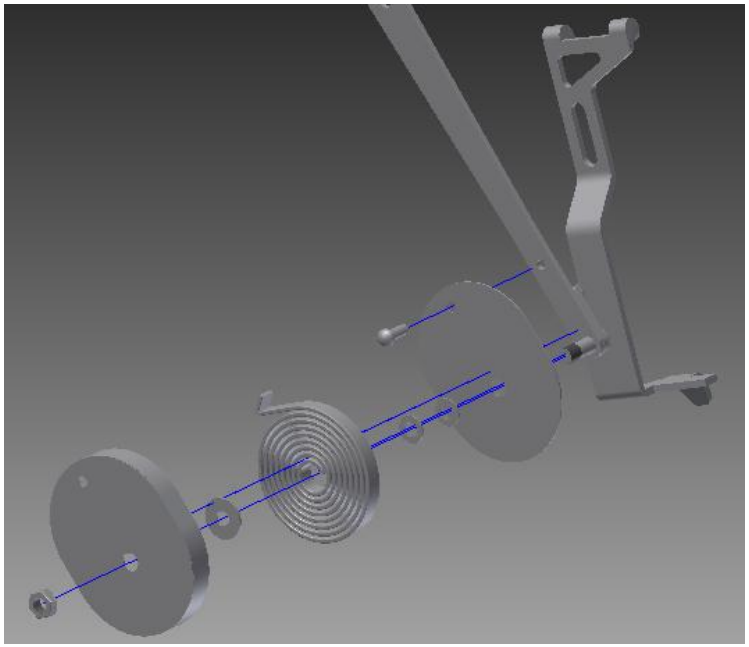
Part Number	Thumbnail	BOM Structure	Unit QTY	QTY
Assembly 1		Normal	Each	1
Expanded +Clock +Spring		Normal	Each	1
Part9-R		Normal	Each	1

Permanent Case



Operation Process Chart

Permanent Case



Face Plate x 2

101

Water Jet

102

103

Jig

Plate to Jig

2A 01

Curved Exterior x2

201

Water Jet

202

Formed

Exterior Case Assembly

1A 01

Welded Exteriors

1A 02

Welded Exteriors to Plate

Spring to Jig

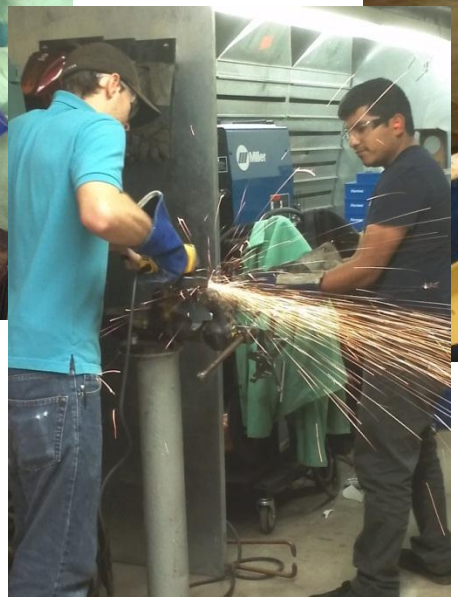
2A 02

Exterior Case to Jig

2A 03

Making The Prototypes

- Metal grinding/cutting
- Tapping holes
- Water-jet
- Welding
- Turning (Lathe)

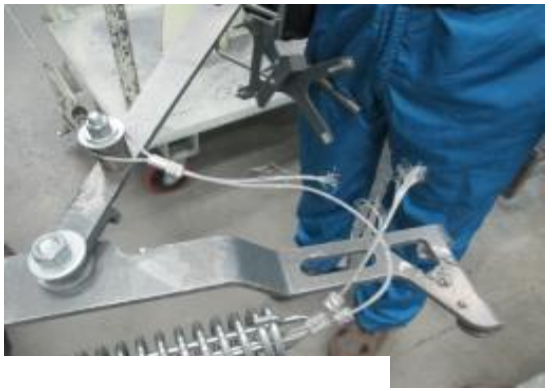


Tests & Modifications

- **Drawbar**

Cleaning Test

Sponsor Feedback



Add an enclosure to coil spring to reduce zinc shot debris

Rating Legend	
◎	Meets or exceeds target
◎	Acceptable, slight improvement needed
△	Significant improvement needed
X	Unacceptable

4. Evaluation Result

	Jig	S	Q	P	C	Outlook
1	Torsion Spring	△	×	◎	◎	×
2	Enclosure	△	◎	◎	△	◎
3	Draw Spring	△	△	△	△	△

5. Summary

Jig	Concerns and provisions
2	Confirm enclosure and debris entrapment

Team Final Product

- Video

Business Plan

- Used Business Plan Pro to create our own company using our project experience

•Core Business

- SR Springs – Spring and Custom Jig Manufacturing
- SR Springs will use experience and knowledge of springs to customize springs to customer specifications.
- The company caters mainly to those who are looking for experimental prototypes and customized parts.
- Products consist of torsion springs, clock springs and custom jigs used in the automotive industry, doors, and devices such as lift assists.

Thermon: Panel lift assist

Chance Justice
Zack Fennell
Isaac Nuti

The company

- Thermon is a company that offers “solutions for all your heat tracing needs”(www.thermon.com)
- Since 1954, Thermon has placed its focus on heat tracing exclusively(www.thermon.com)
- Located at 4105 Hunter Rd. Ste 19 in San Marcos

Identified Needs

#	NEED	Imp
1	Safe for worker to use	4
2	Stability when holding the panel	5
3	Easy to use when needed	4
4	Build for durability	3
5	Customizable for varying width and heights	5
6	Adaptable for varying cabinets sizes	5
7	Avoid harming electrical installations	4
8	Affordable to the shop's needs	2

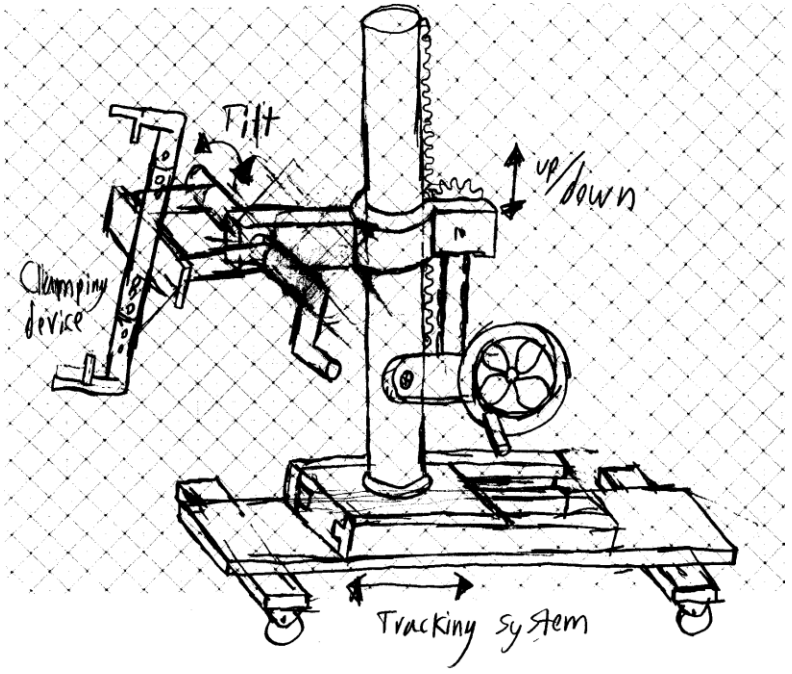
Metrics of design

Metric #	Needs #	Metric	Imp	Units
1	8	Cost effective product	2	US$
2	2, 4	Build for maximum weight	5	Lbs.
3	1,3,6	Reasonable volume size to fit in work area	2	in^3
4	5,6,7	Build for maximum Size	5	in^2
5	5,6,7	Build for minimum Size	5	in^2
6	5,6,7	Clearance on the edges of the panels	4	in.
7	7	Amount of electrical components protrude out	4	in.
8	1,2, 3	Time it takes to mounting on and off	3	sec.
9	1,2,3	Manageable weight	2	Lbs.

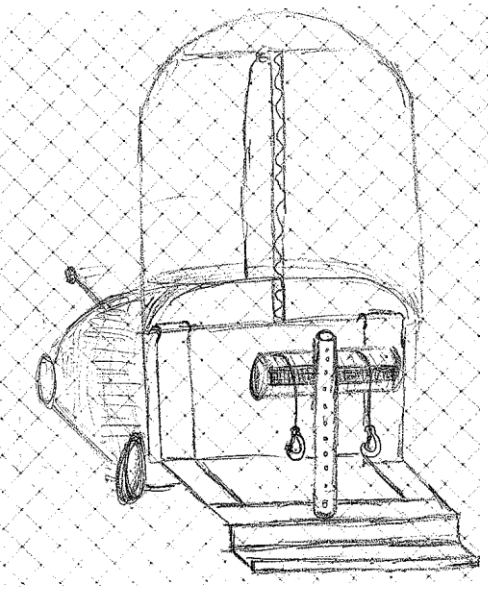
concept generation

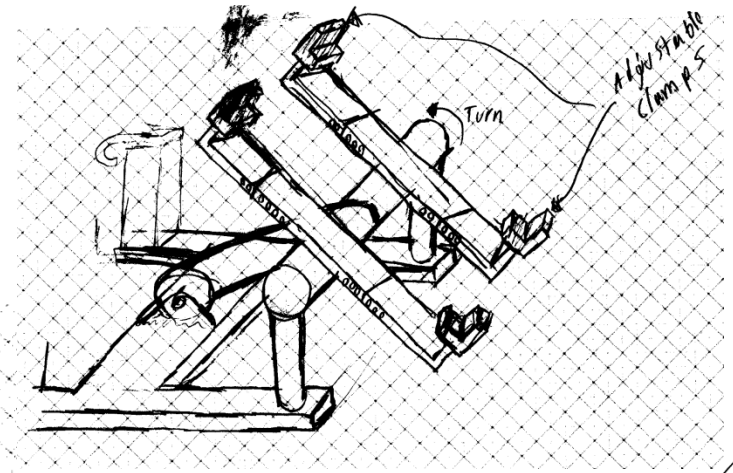
Subsystems Identified:

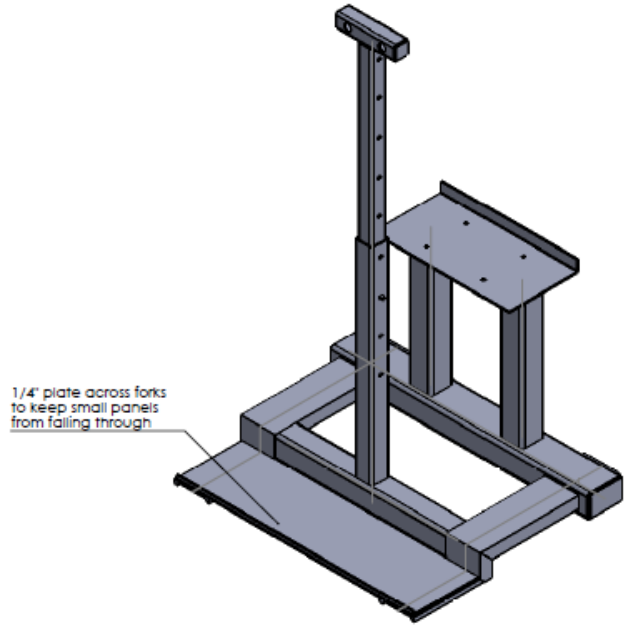
- Rotation/Tilting motions
- Lifting (up/down motions)
- Horizontal movements
- Clamping/Grasping/Holding system

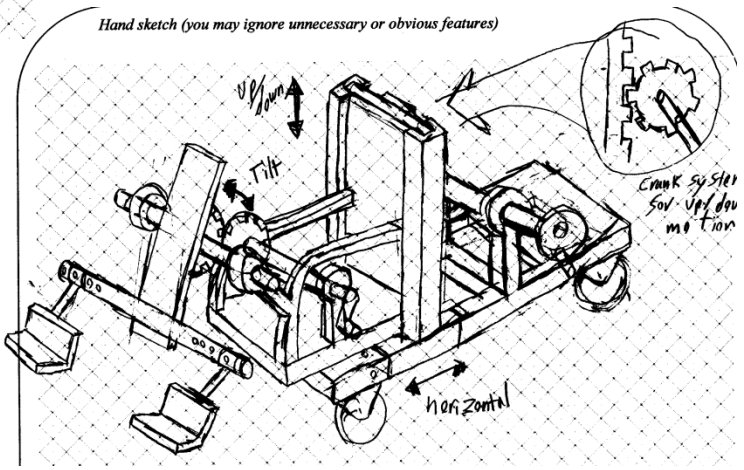


Sketches



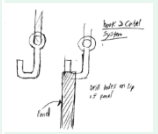

Turn

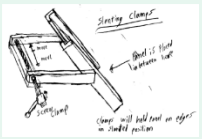

1/4" plate across forks
to keep small panels
from falling through

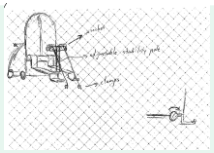

Hand sketch (you may ignore unnecessary or obvious features)
Up/Down
Tilt
horizontal

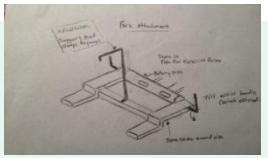
Scoring Subsystems

Clamping System



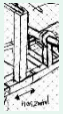


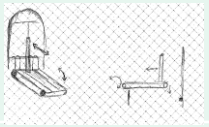




Selection Criteria	Weight	Hook (or pin) and cabel system (must drill holes on panel top lip) Rating	Weighted Score	Slanted side clamping system Rating	Weighted Score	Bent Fork Rating	Weighted Score	Adjustable support rod for clamping Rating	Weighted Score
Durability	7%	2	0.14	3	0.21	3	0.21	3	0.21
adaptability for panel sizes	14%	5	0.7	3	0.42	3	0.42	3	0.42
reapeatability of use	14%	3	0.42	4	0.56	4	0.56	4	0.56
Stability of holding panel	15%	3	0.45	4	0.6	4	0.6	3	0.45
Ease of use	10%	4	0.4	3	0.3	3	0.3	4	0.4
Safety	8%	3	0.24	4	0.32	4	0.32	3	0.24
ease of manufacturing	7%	5	0.35	3	0.21	3	0.21	3	0.21
Not obstructing the placing panel in box	10%	4	0.4	4	0.4	4	0.4	4	0.4
Compatibility with other system	15%	5	0.75	3	0.45	3	0.45	4	0.6
Total Score:			3.85		3.47		3.02		3.49
Rank:			1		3		4		2

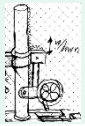
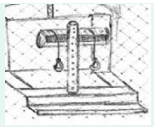
Moving System

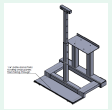
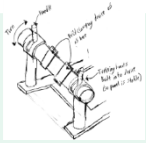
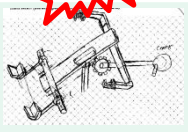




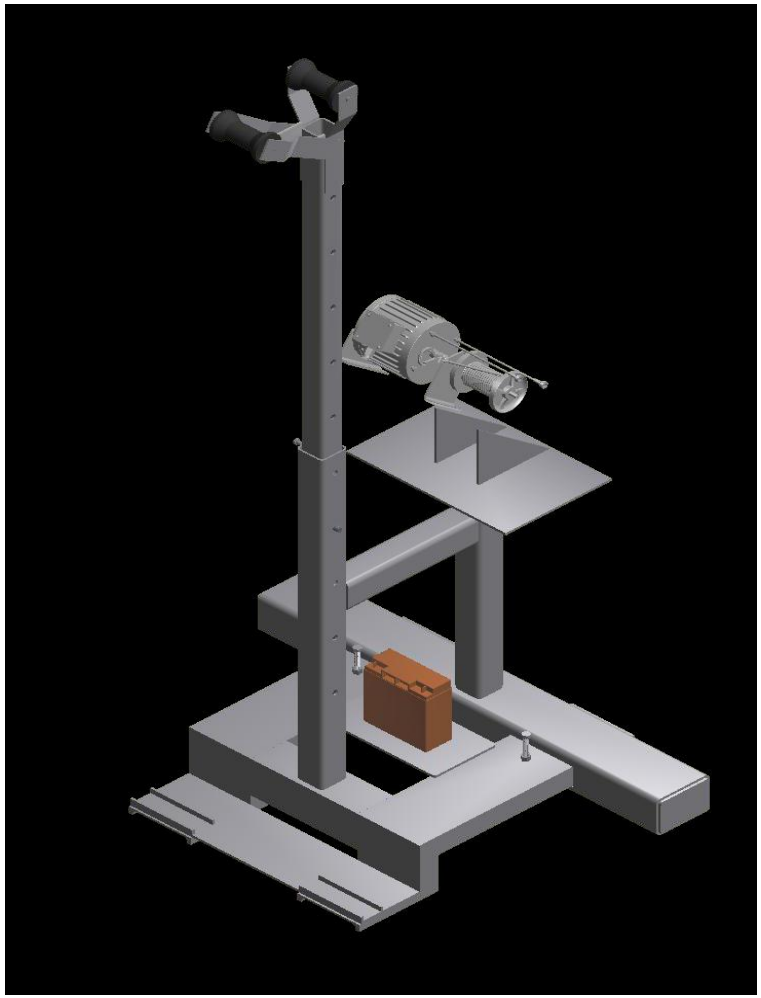
Selection Criteria	Weight	Presto counter weight forklift (already owned by sponsors) Rating	Weighted Score	Overlapping square tubing that will slide the panel (build on moving plane) Rating	Weighted Score	conveyor belt moves panel to its location Rating	Weighted Score
			0.8				0.6
Ease of moving panel around	20%	5	1	4		3	
Safety	7%	2	0.14	4	0.28	3	0.21
Repeatability of use	10%	4	0.4	4	0.4	3	0.3
load handling	12%	4	0.48	4	0.48	4	0.48
Room it takes up	13%	4	0.52	3	0.39	3	0.39
ease of manufacturing	10%	5	0.5	4	0.4	1	0.1
Not obstructing the placing panel in box	15%	3	0.45	4	0.6	2	0.3
portability	13%	5	0.65	3	0.39	2	0.26
Compatibilty with other systems	15%	5	0.75	3	0.45	2	0.3
Total Score:			4.89		4.19		2.94
Rank:			1		2		3

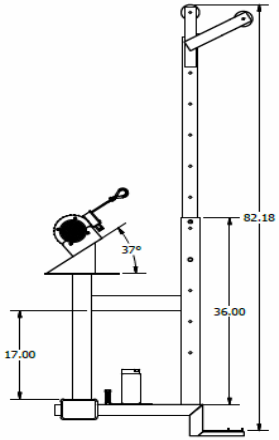
Scoring Subsystems (continued)

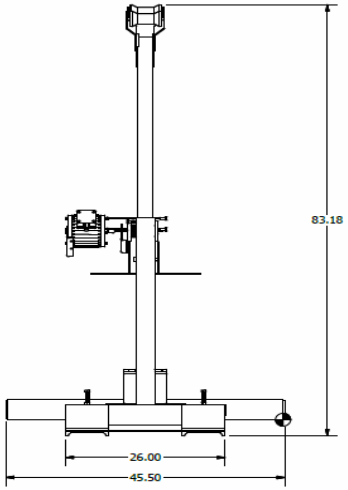
Lifting device				 			
		Gear system (involving bike chains, gears, cranks, etc)		Pancake Jack (hydraulic device)		Cabel system	
Selection Criteria	Weight	Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score
load handling	11%	4	0.44	4	0.44	3	0.33
Safety	10%	3	0.3	3	0.3	2	0.2
Ease of manufacturing	10%	3	0.3	4	0.4	4	0.4
Accuarcy/adaptibilty of lifting	14%	3	0.42	3	0.42	4	0.56
ranges that it can lift	13%	4	0.52	3	0.39	4	0.52
Not obstructing the placing panel in box	14%	4	0.56	4	0.56	4	0.56
ease of use	13%	4	0.52	4	0.52	4	0.52
compatibiltity with other sub systems	15%	3	0.45	3	0.45	5	0.75
Total Score:			3.51		3.48		3.84
Rank:			2		3		1

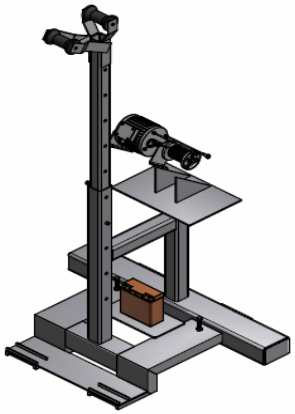
Rotation/Tilting							
		Cabel Cranking system		Pivoting around a cylinder/pipe		Pivoting gear system	
Selection Criteria	Weight	Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score
safety	11%	2	0.22	3	0.33	4	0.44
repeatability	12%	3	0.36	4	0.48	4	0.48
durability	12%	3	0.36	4	0.48	4	0.48
ease of use	10%	4	0.4	3	0.3	4	0.4
ease of manufacturing	14%	4	0.56	4	0.56	3	0.42
ability to adapt to condition (flexibility)	12%	4	0.48	3	0.36	3	0.36
Not obstructing the placing panel in box	14%	4	0.56	4	0.56	4	0.56
Compatibility with other subsystems	15%	5	0.75	4	0.6	3	0.45
Total Score:			3.69		3.67		3.59
Rank:			1		2		3

Final cad drawings(almost)

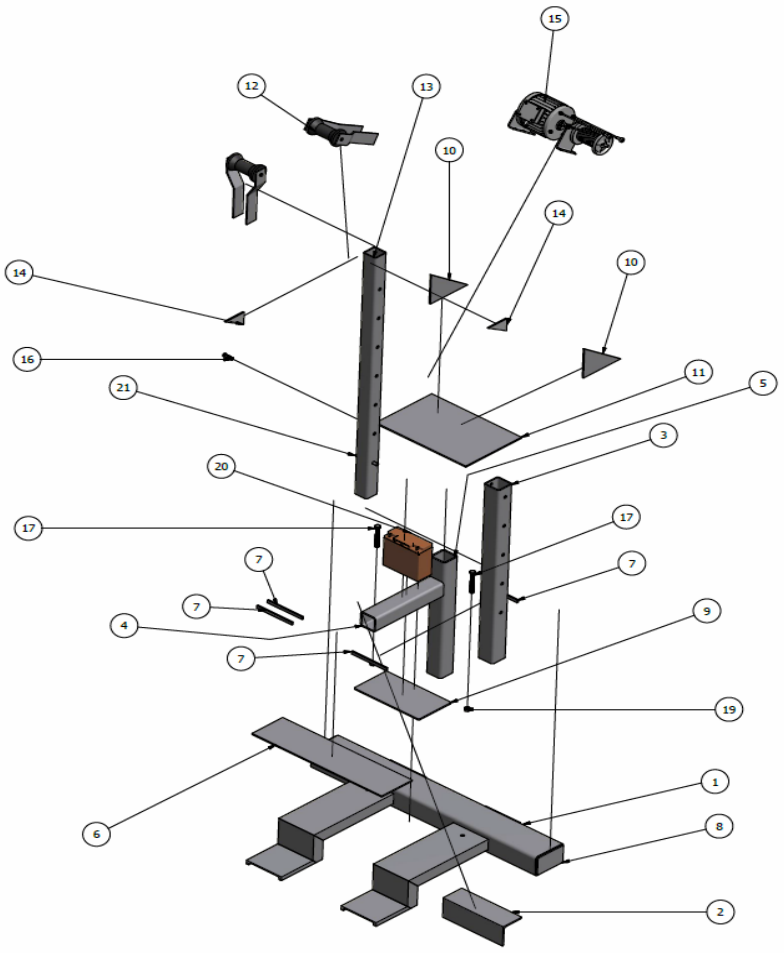






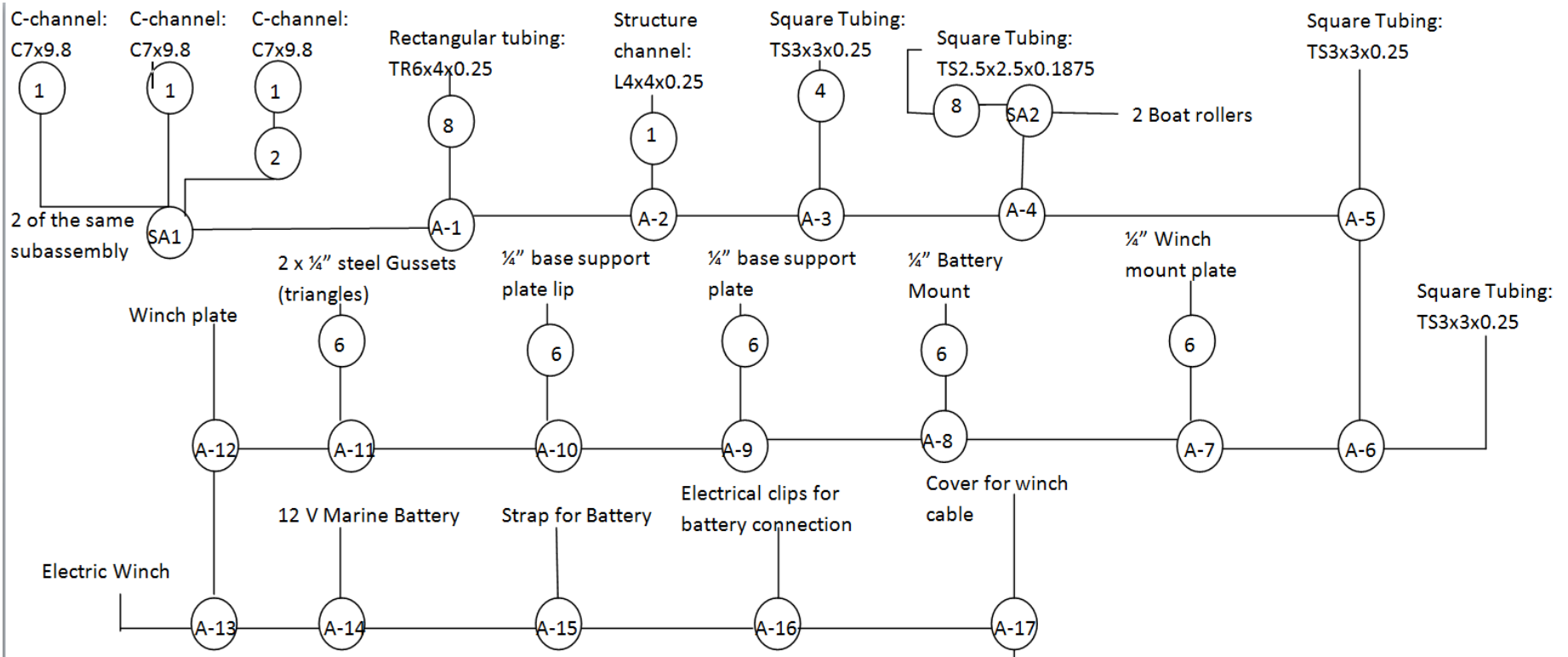


Exploded view--Bill of Materials



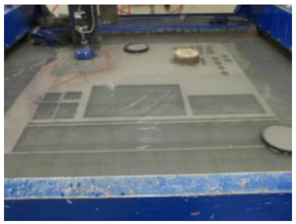
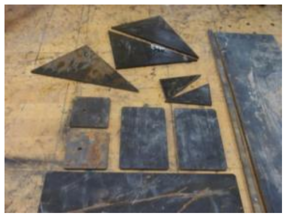
PARTS LIST				
ITEM	QTY	PART NUMBER	DESCRIPTION	LENGTH
1	1	MainFrame		
	1		C7.98	75.56"
	1		TR6x4x0.25	45.25"
2	1	Support Mount	L4x4x0.25	12"
3	1	Support Riser-1	TS3x3x0.1875	36"
4	1	Pole support	TS3x3x.25	14.71"
5	1	WinchMount Leg	TS3x3x0.25	24"
6	1	Panel Rest	16.79" x 26" 0.25" plate	
7	4	Panel Stop	0.5" x 7" 0.25" plate	
8	2	MainFrame Endcaps	5.5"X3.5" 0.25" plate	
9	1	BatteryMount	7" x 13" 0.25" Plate	
10	2	Winch Angle	6" x 8" 0.25" plate	
11	1	Winch Mount	12" x 18" 0.25" plate	
12	2	Anchor rollers		
13	1	Support Riser-2	TS2.5x2.5x0.1875	50"
14	2	Roller Gusset	6" x 10" 0.25" plate	
15	1	Electric Winch (Reference Only)		
16	1	Hex Cap Screw-1	3/8"-16 Thrd	
17	2	Hex Cap Screw-2	1/4"-20 Thrd, Fully Thrd	4"
18	1	Hex Nut-1	3/8"-16 Thrd	1.5"
19	2	Hex Nut-2	1/2"-20 Thrd	
20	1	12V Marine Battery (Reference Only)		
21	1	Forklift Pin		

Process Flow chart



Operation #	Operation
1	Bandsaw
2	Notcher
3	MIG welding
4	Drilling
5	MIG welding
6	Water-Jet
7	Grinding
8	Torch cutting

Production















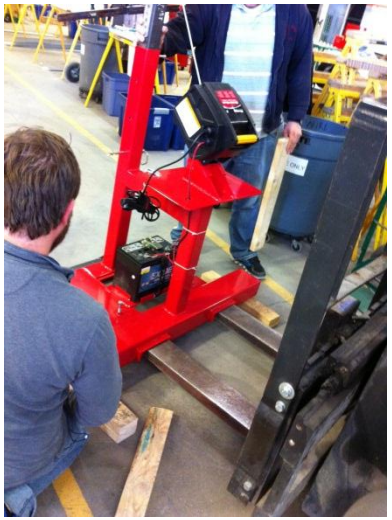


Modifications

- Adding a horizontal roller
- Extending panel rest
- Shortening riser
- Angled Winch
- New panel stop (Pivoting)

Test Runs

- Early test Run



- Early test Run

- Early test Run

Business Plan-SWOT Analysis

- **S**trengths
  - Connections
  - Experience
  - Customization

- **O**pportunities
  - Growth of manufacturing in the U.S.
  - Enlightened Growth

- **W**eaknesses
  - New compar
  - Patenting
  - Subcontracting
  - Capital

- **T**hreats
  - Economy
  - Competition

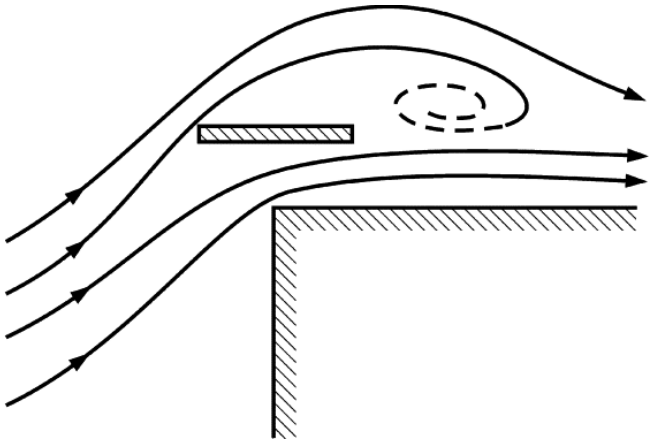
AGEG Horizontal Axle Wind Turbine

Alex Keary
Bryce Davis
Justin McNamAra
Spencer Stephens

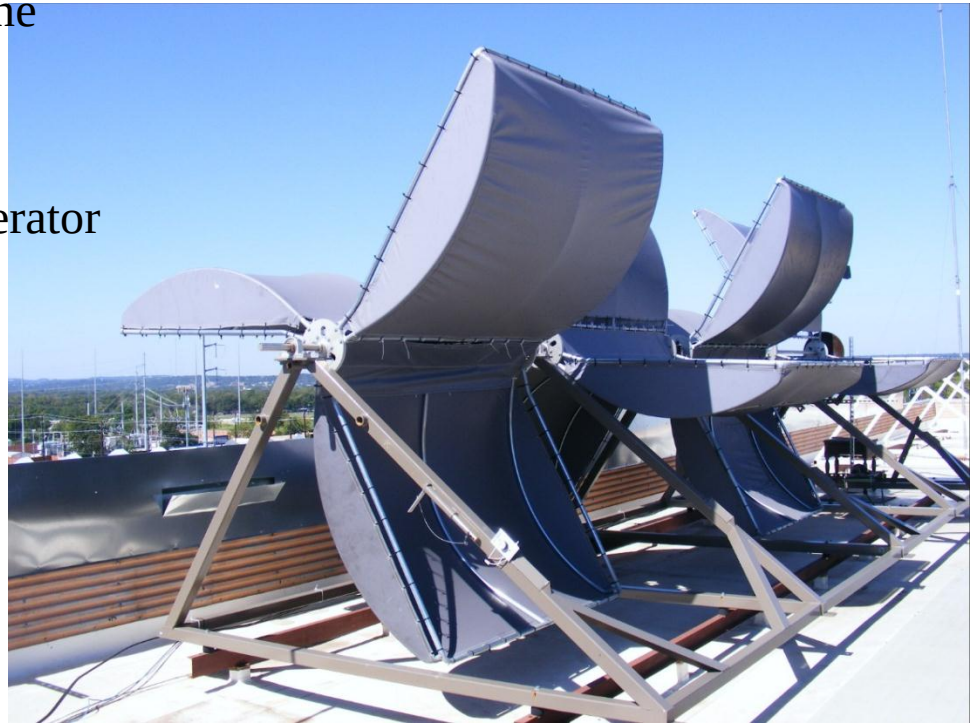
Sponsor

- Austin Green Energy Group
- Building Turbines, Inc.

Introduction

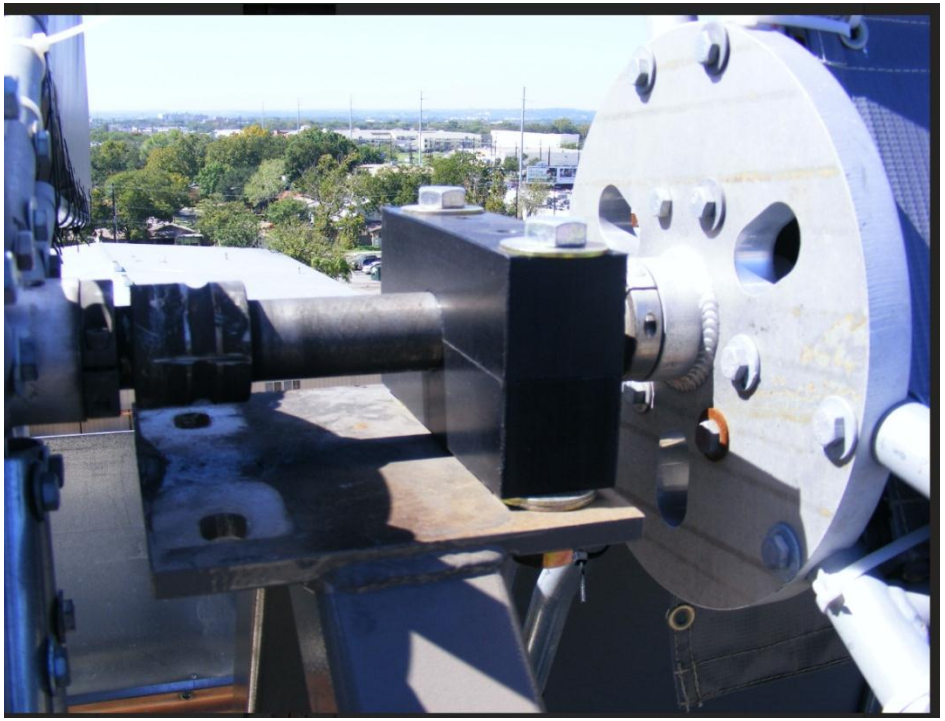


- Current model
  - Horizontal Axis Wind Turbine
  - Captures Parapet Vortex
  - Mounted on Rooftop
  - Connected to Electrical Generator



Problems/Tasks

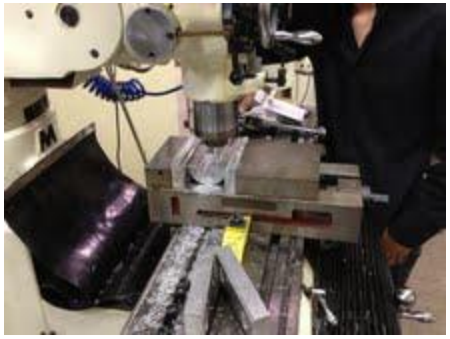
- Hub Failure
- Bearing Failure
- Difficulty in Maintenance
- No Braking System



Sub-Assemblies

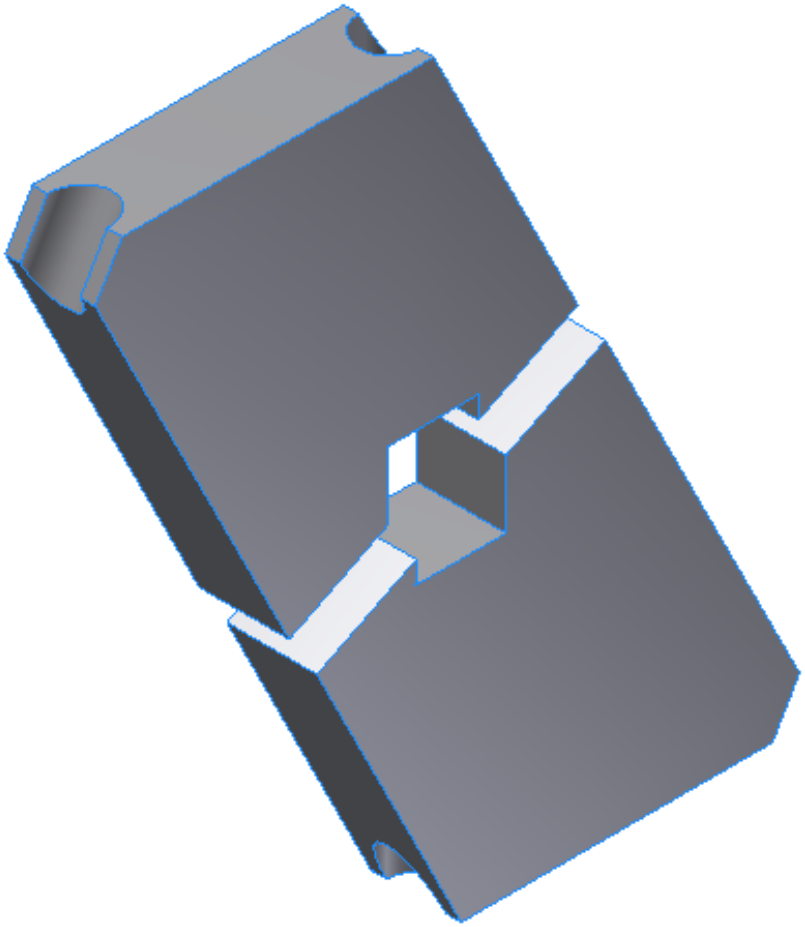
- Axle
- Plug
- Coupler
- Hub
- Blade Frames
- Brake

Coupler Processing

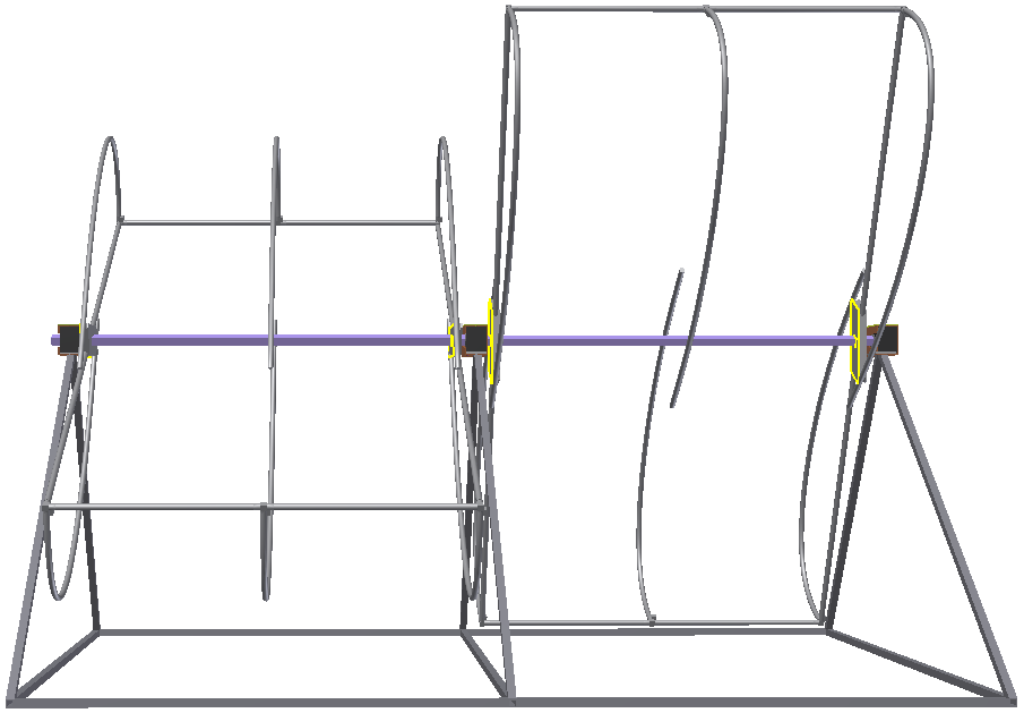


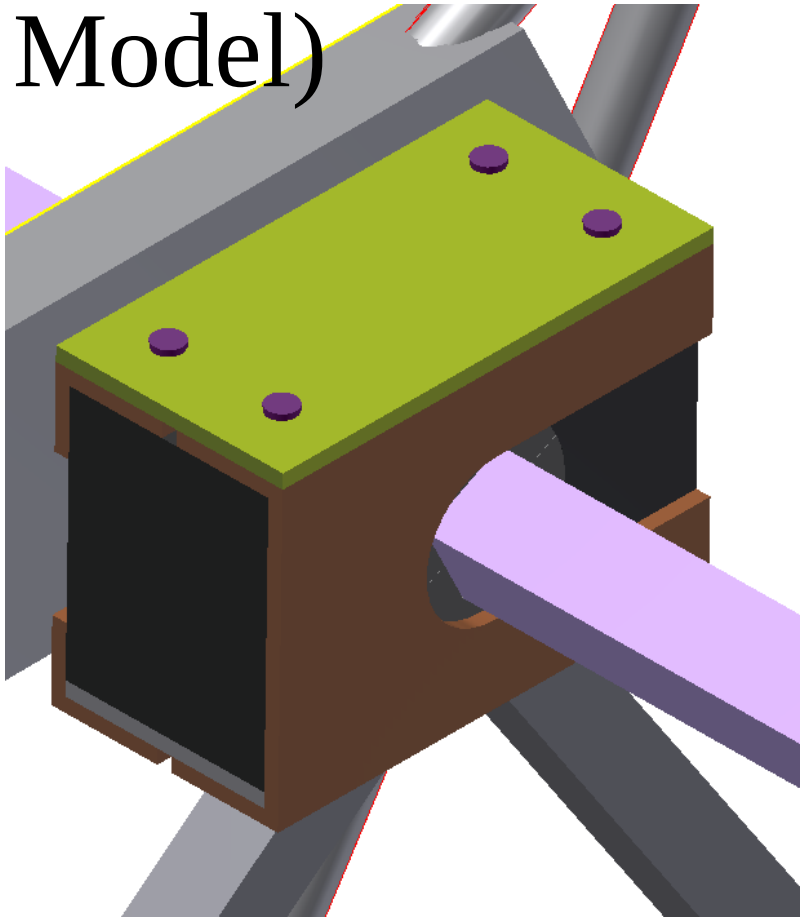
Hub

Final hub design easy to manufacture, strong, satisfies maintenance requirements.



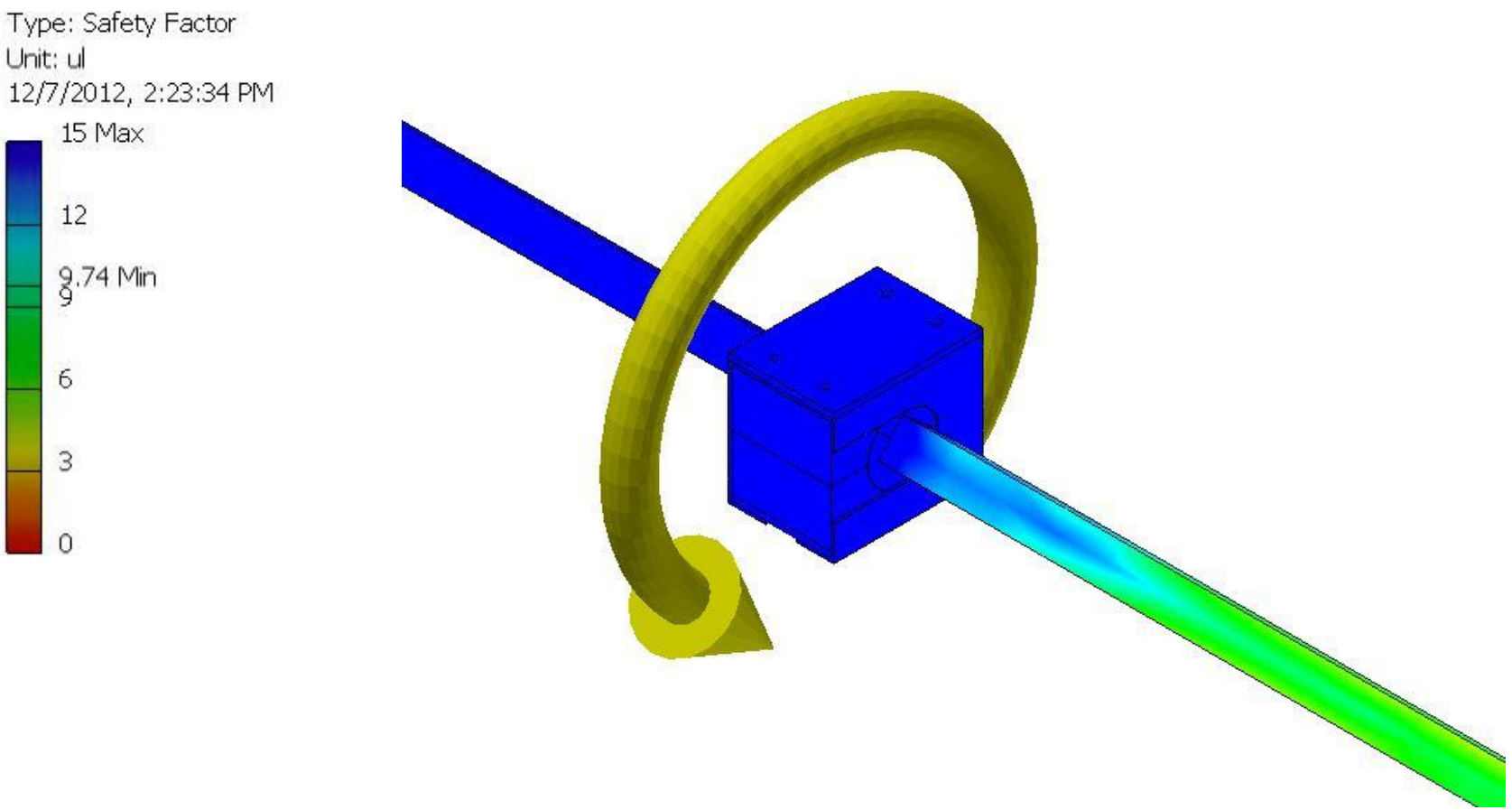
Final Design (3D Model)



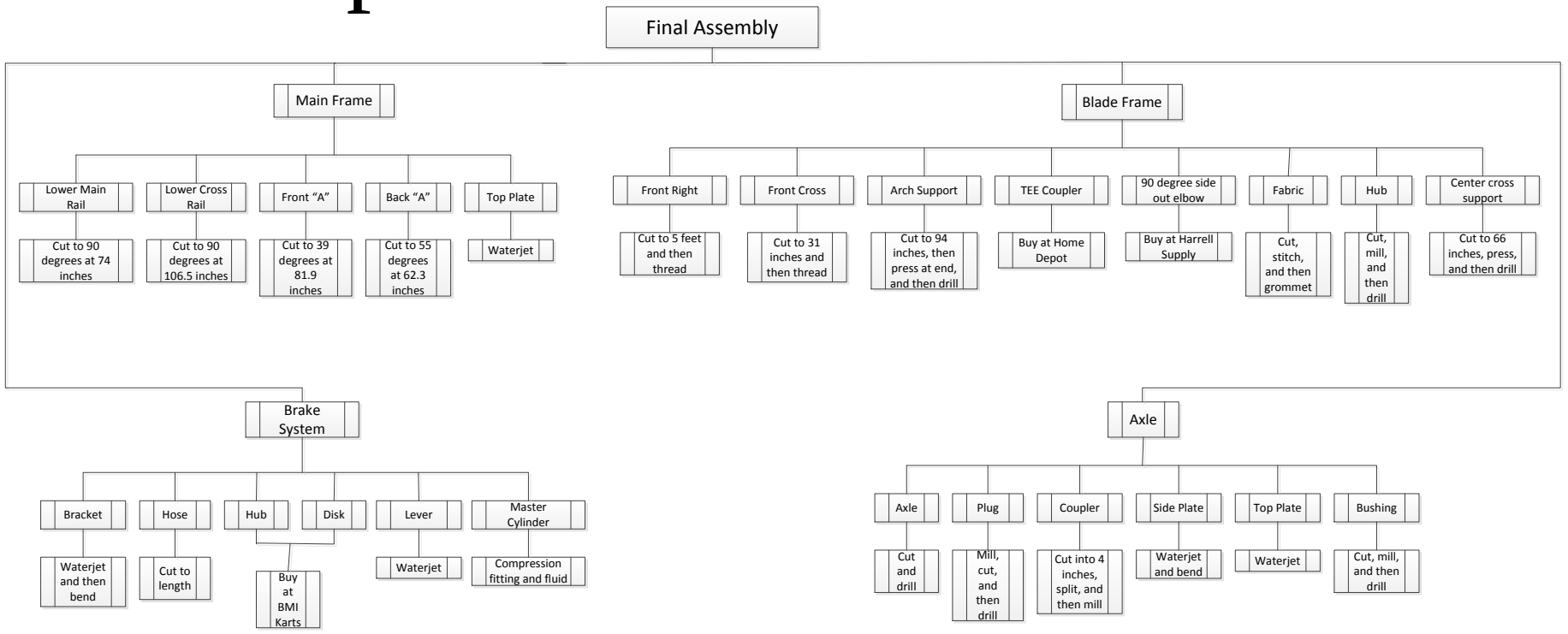


Assembly Video

Finite Element Method (F.E.M.)

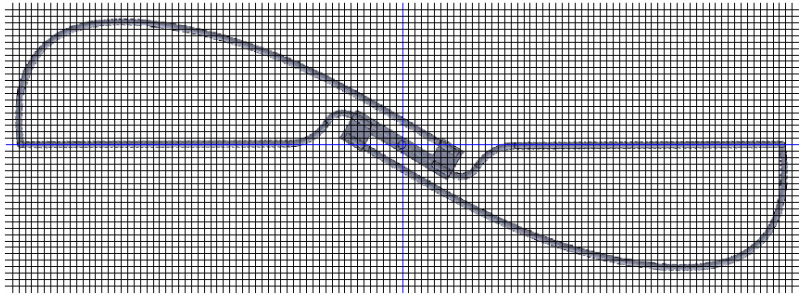


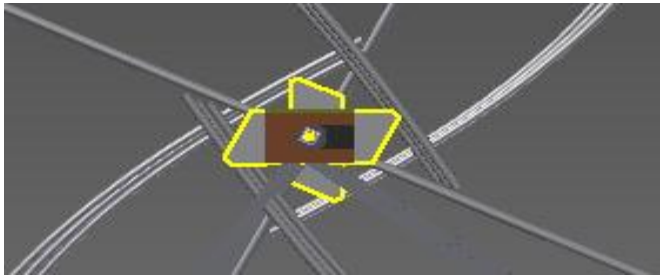
Operations Process Chart



Design for Manufacturing

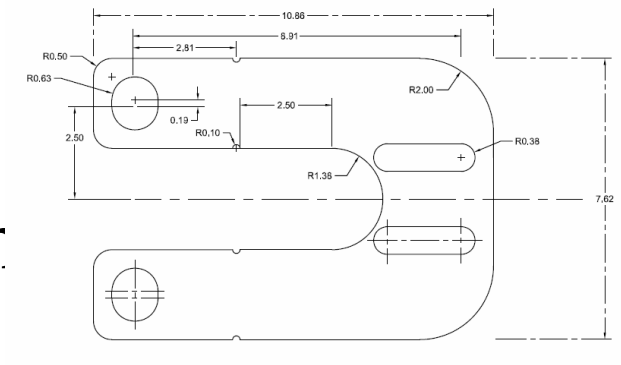
- Standardized hole diameters
- Standardized fasteners
- Simplified blade curvature
- Eliminated welds
- Eliminated manufacturing processes
- Used nominal sizing when possible



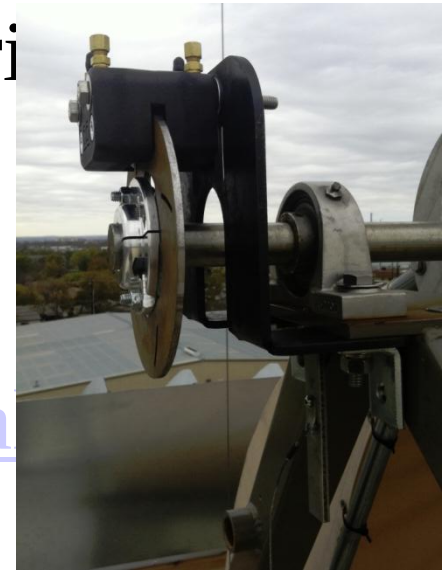


Brake

- Sketch

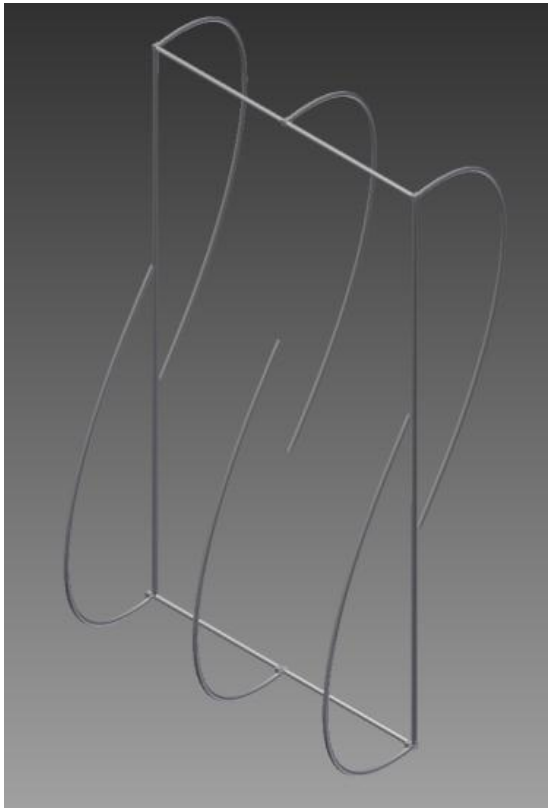


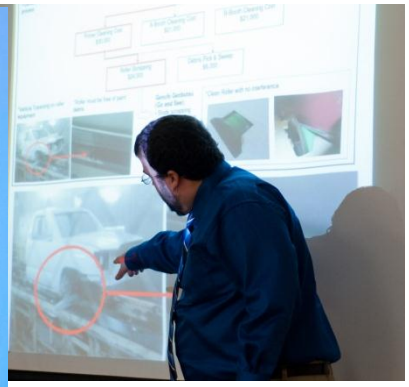
- Fabri



- Insta

Blade Frame





Presentations
Networking

Sponsors,
Panel of experts,
Technical consultants

And the best 2012 team is……