



Beyond Innovation, LLC



Group Number 6
Midterm 1

Group 6

Stow-Away Pool Table

*Sponsors: Alexander York,
College of Engineering (Dr. Mike Devine)
Advisor: Dr. Chiang Shih
Instructors: Dr. Scott Helzer, Dr. Nikhil Gupta*

Travis Jarboe, Joel Manahan, Matthew McHugh, Thomas Silva
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Background

- Successful proof of concept
- Redundant sensors
- Developed without structural analysis
- Not designed to meet tournament specs



Image credit: Team 6.



Scope

- High emphasis on marketability, quality and supply chain.
- Improvement of leveling system performance.
- Verification of compliance with structural/safety requirements.
- Table must meet expectations of tournament players.

Stow Designs 1, 2 and 3



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Stow Design Decision Matrix

TEAM AVERAGE								
		Criteria						
		Safety	Low Cost	Ease of Manufacturing	Visual Appeal	Familiarity	Low complexity	Total
	Weights	3	1	2	3	2	1	12
Design 1		2.75	1.75	1.75	2.5	3	1.5	28.5
Design 2		1.5	2.75	2.75	1.5	2.5	2.75	25
Design 3		2	2.5	1.75	2.25	2.25	2	25.25

The Sponsor, Alex York was emphatic that the table should hide completely in a housing rather than simply rotate and be pushed to the side to reduce its footprint.

➔ Scaled Down Model



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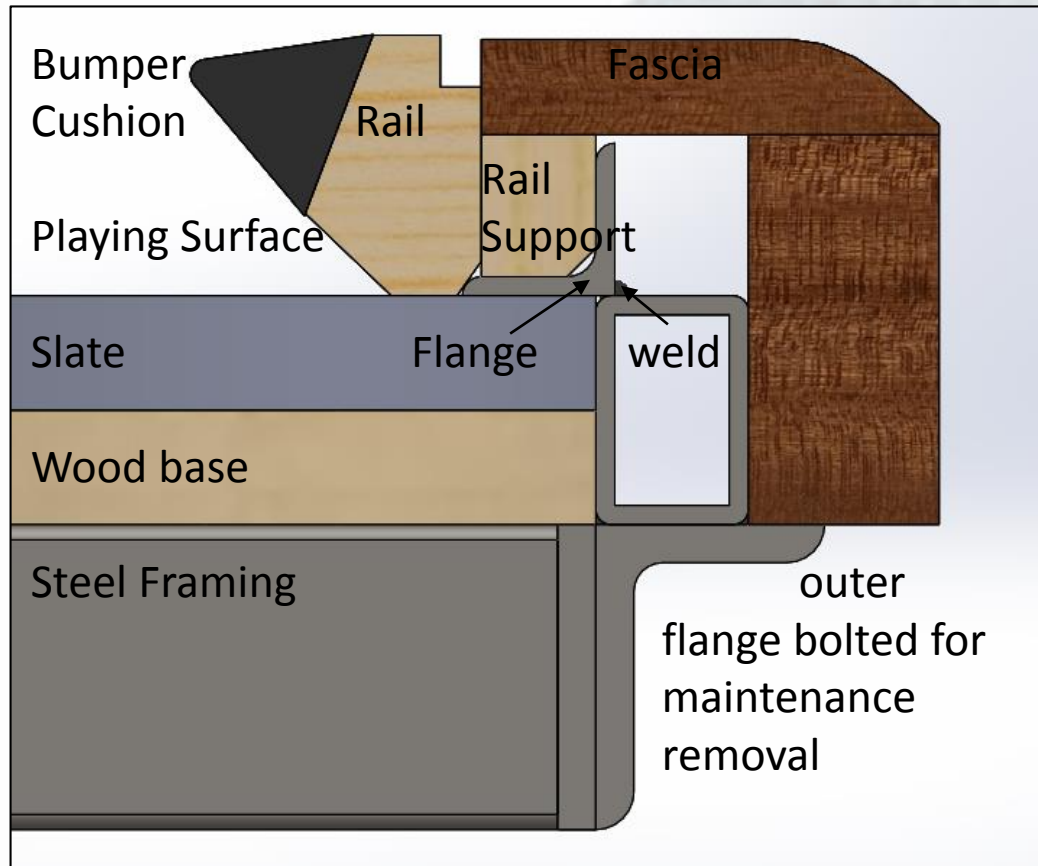
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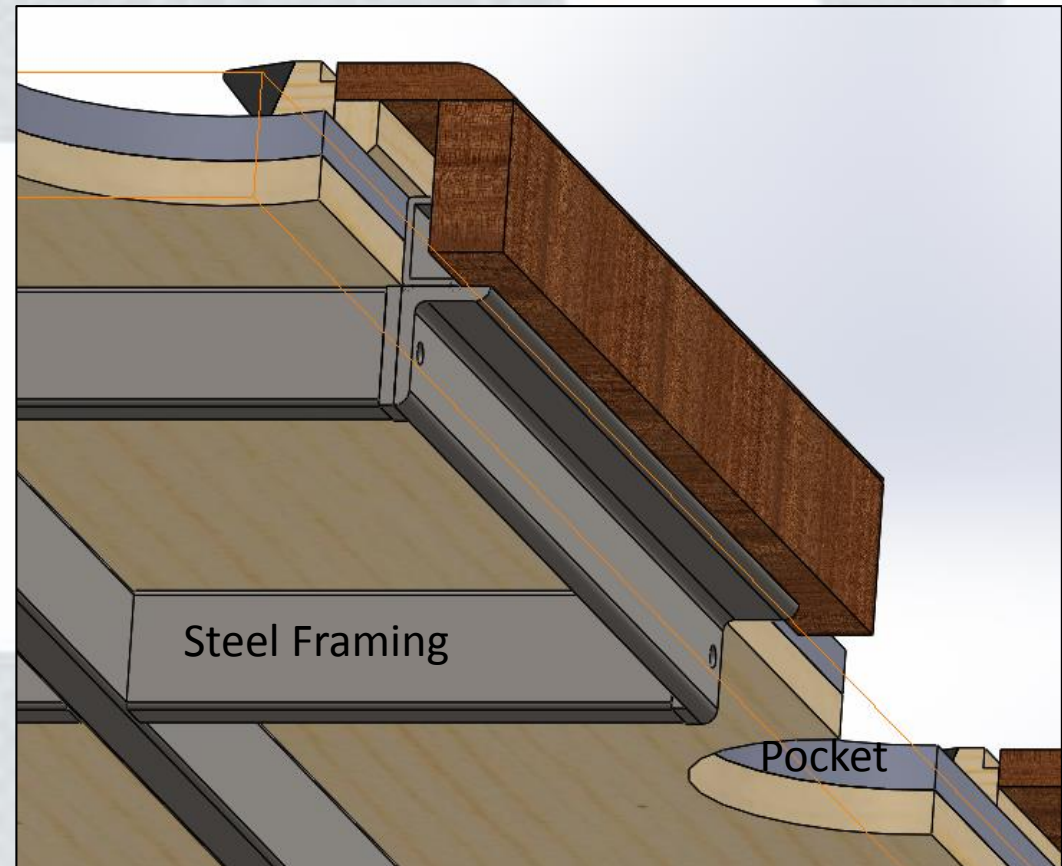
Materials Updated

Pool Table Materials						
Component	Item	Unit Cost	Qty	Shipping	Total Cost	Supplier
Pool Table Construction	Table Cloth	\$ 93.00	1	\$ -	\$ 93.00	Ozonebilliards.com
	Slate	\$ -	1	\$ -	\$ -	Sponsor (Alex York)
	Subrail (set of 6)	\$ 14.95	1			Mueller
	Feather strips (set of 6)	\$ 7.95	1			Mueller
	Leg Hinges	\$ 4.11	4	\$ 7.95	\$ 24.39	thehardwarehut.com
	Leather Pockets w/ shield (Set of 6)	\$139.99	1	\$ -	\$ 139.99	Ozonebilliards.com
	U23 Rubber Bumpers (Set of 6)	\$ 35.95	1	\$ -	\$ 35.95	Ozonebilliards.com
	Wood	TBD		\$ -		
	Northern Red Oak Table Legs	\$105.00	4	\$ 7.00	\$ 427.00	USAcarvings.com
Frame Construction	Screws, Nuts, Bolts, etc.	TBD		\$ -		
	Swivel & Locking Caster Wheels	\$ 20.00	4	\$ -	\$ 80.00	Uline
	Aluminum 6061 for Frame	\$132.00	4	\$ -	\$ 528.00	McMaster-Carr

Frame Updated

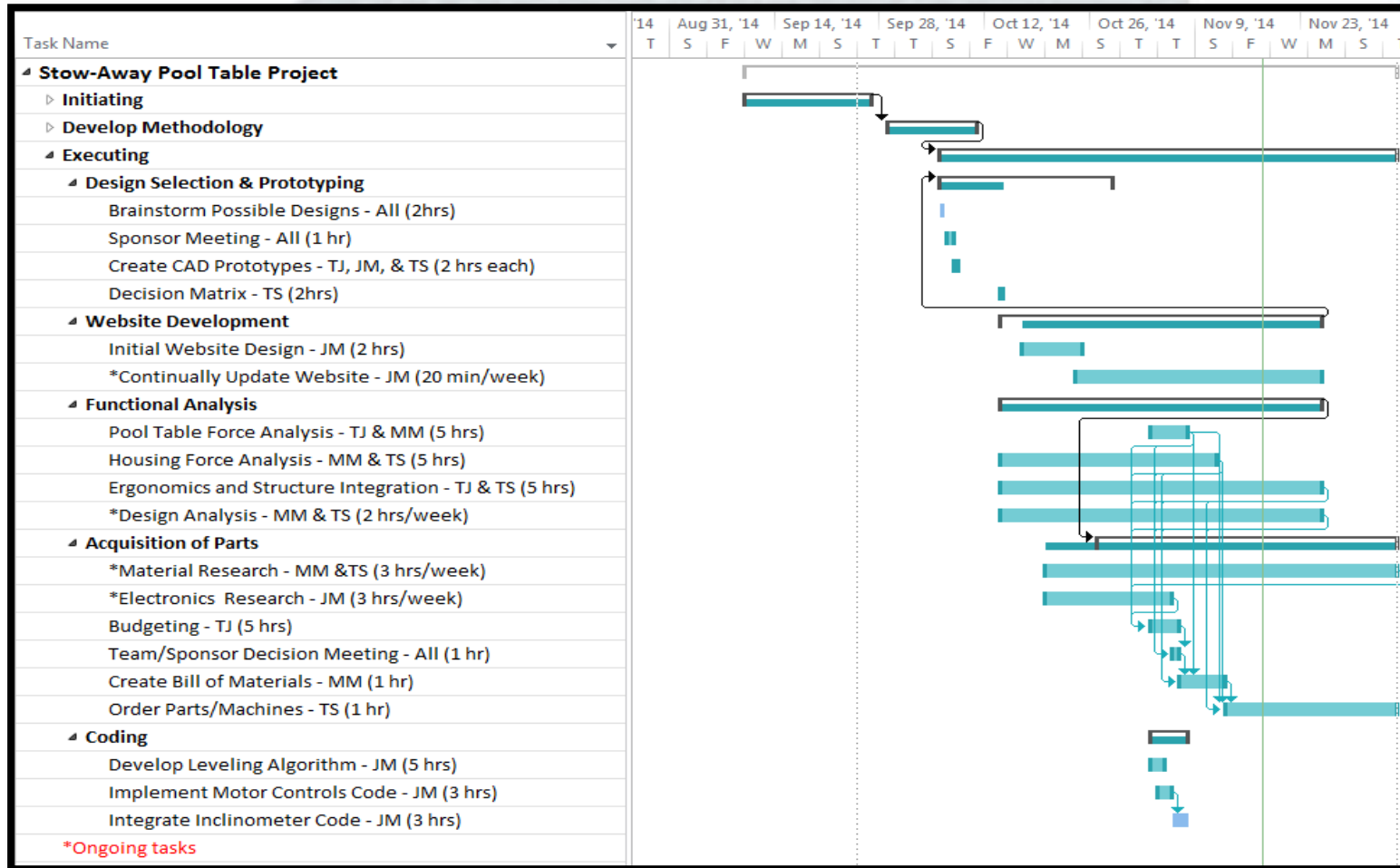


Cross section of table



Auxiliary view

Gantt Chart

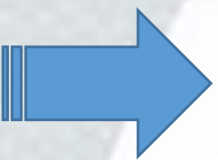


Leveling System (Mechanical)

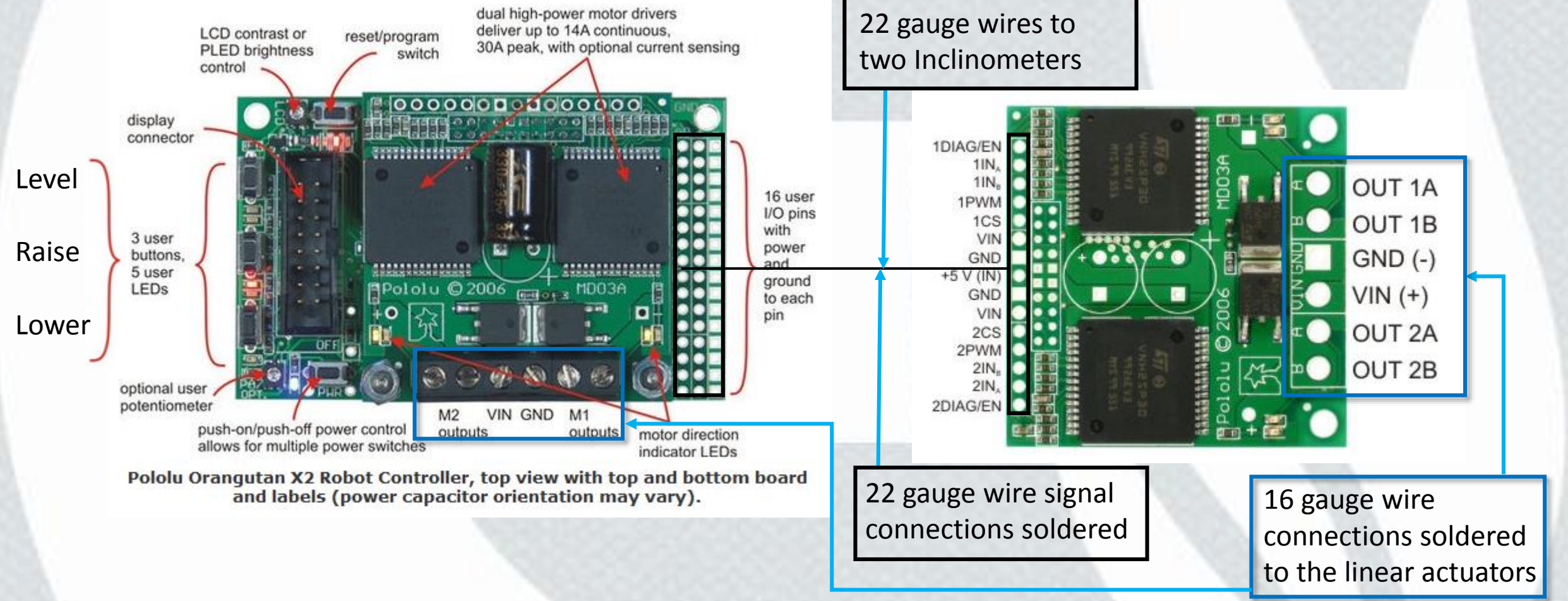
TEAM AVERAGE							
Criteria							
	Low Cost	Easy Implementation	No Wasted parts	Size	Lifting Capacity	Higher Quality	Total
Weights	4	5	2	3	2	4	20
Modify Trailer Jack	4	3.25	2.25	2.3	2.25	2.5	58
Linear Actuator	4.25	4.25	4	2.8	3.5	4	77.5
Linear Actuator	2.75	4.25	4	3.8	3.25	3.75	73
Linear Actuator	1.5	4	4.25	3.8	3	4.75	70.75
Build from Scratch	2.5	1.5	1.25	4.5	4.25	2.25	51
Less Favorable 1, 2, 3, 4, 5 More Favorable							

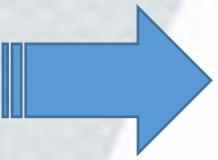
MA1527 / MA3507 Multipurpose Actuators (12 VDC)				
Part Number	Capacity N (lb)	Stroke mm (in)	Travel Speed mm/sec (in/min)	Retracted (A) mm (in)
MA1527B1115	1500 (337)	153 (6.0)	27 (64)	410 (16.1)
MA1527B1130	1500 (337)	305 (12.0)	27 (64)	613 (24.1)
MA1527B1145	1500 (337)	457 (18.0)	27 (64)	765 (30.1)
MA3507B1115	3500 (787)	153 (6.0)	7 (17)	410 (16.1)
MA3507B1130	3500 (787)	305 (12.0)	7 (17)	613 (24.1)
MA3507B1145	3500 (787)	457 (18.0)	7 (17)	765 (30.1)





Leveling System (Electrical)

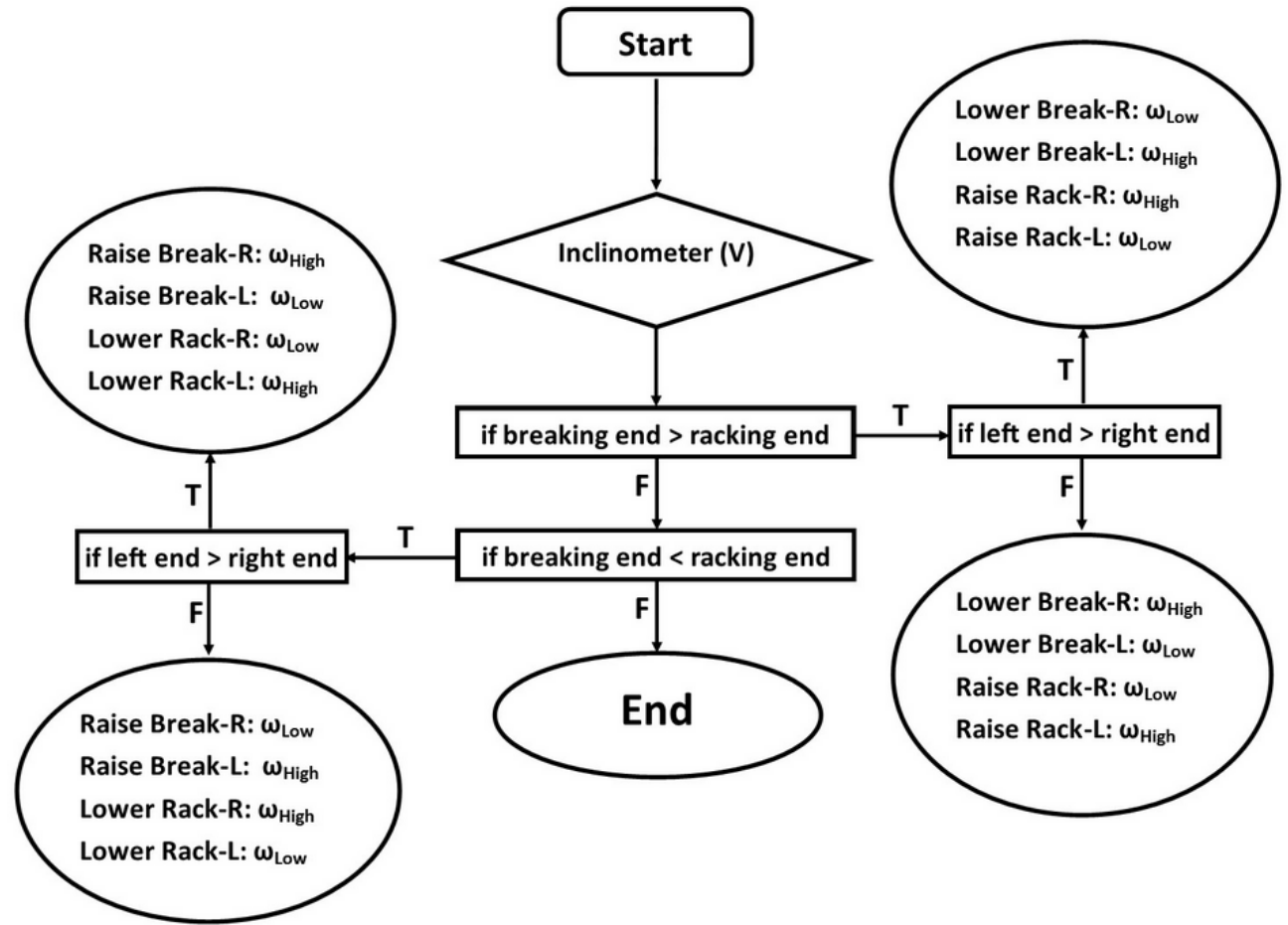
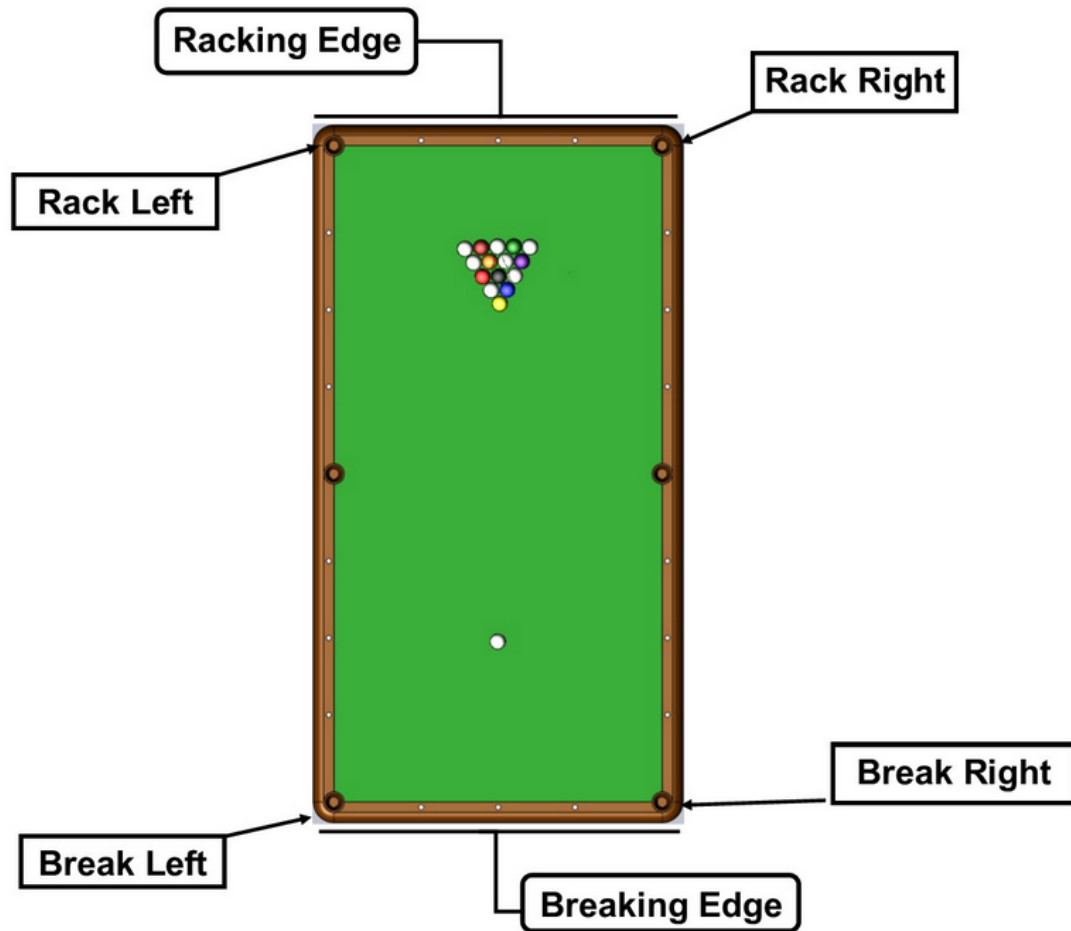




Leveling System (Tolerances)

	Tolerances		Level At			
Longitudinal Height Diff.	± 0.04 in	Inclinometer output	250.0 ± 5.5 mV			
Latitudinal Height Diff.	± 0.02 in					
Longitudinal Angle	± 0.0273 deg					
Latitudinal Angle	± 0.0273 deg					
Inclinometer Output	± 5.45 mV					
Digitization Error (12-bit)	± 2.44 mV	12-bit ADC with a voltage range of 0-5 V				
Powerscrew Precision	± 28.8 deg	Assuming major screw diameter of 2 in and pitch diameter of 1.875 in				
Motor Precision	± 144 deg	Assuming 5:1 gear ratio between motor and powerscrew				

Leveling System (Logic)





What's ahead

- Ordering Parts
- Continued Computer modeling and simulation.
- Structural analysis of stow away mechanism and fold up legs.
- Development and testing of leveling algorithm.



Planning for success

- Review Electronics with Dr. Gupta
- Talk to Dr. Devine about marketability
- Fully design and analyze all parts before fabrication
- Seek peer and mentor reviews of structural drawings
- Hardware and electronics will be tested before implementation



A Brief Recap

- Change of Original Design Idea
- Design 1 Selected
- Linear Actuators Selected
- Processor and Motor Controller Selected
- Programming Logic Begun
- Revision of Plans & Gantt Chart Updated