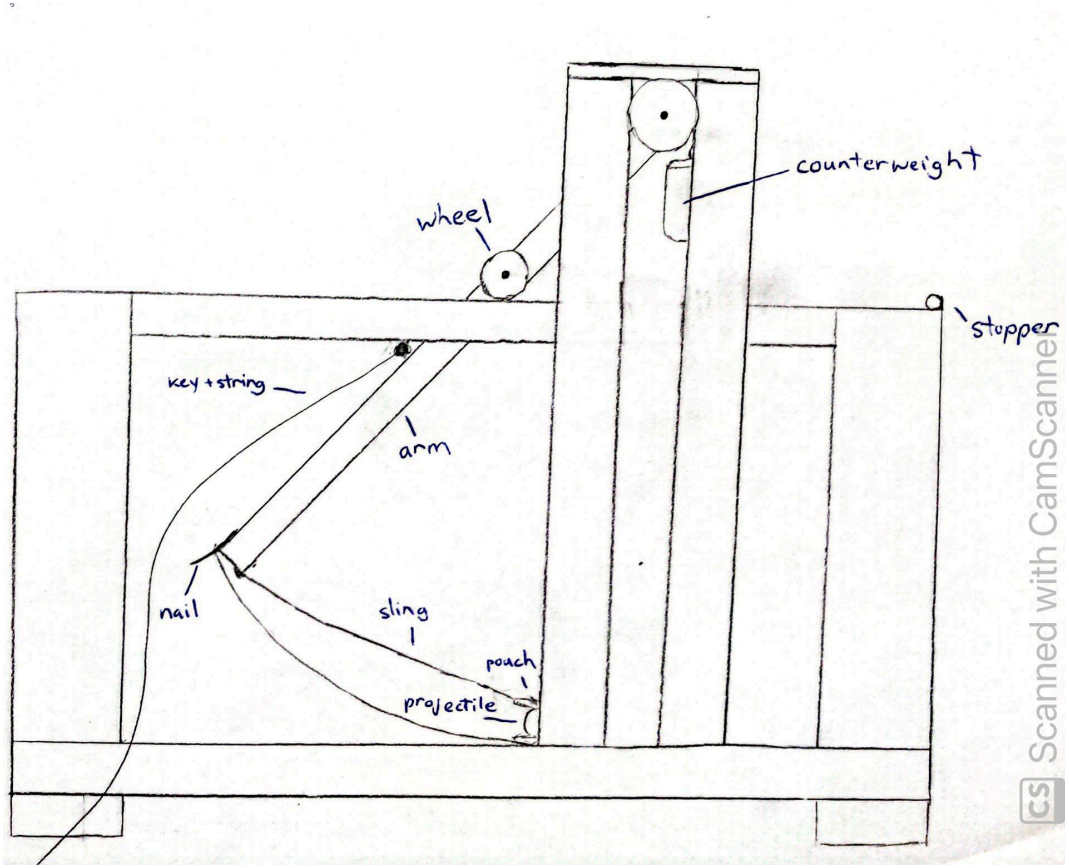
Storm the Castle Design Log - Beachwood Team A

How it works: The counterweight is hooked on to a screw eye in the middle, attached to the end of the floating arm. When the key is pulled out, the counterweight will drop down and the arm will get propelled forward because of the wheel. When the arm reaches a certain angle, the sling opens and the projectile is released. The key holds the arm in place in ready-to-launch position.



Components

- Wheel- allows the arm to be rotate forward and swing
- Arm- Floating arm is not attached to anything. Includes the wheel and the counterweight is hooked on to a screw eye at the end of the arm. At the other end is the sling.
- Key+string- activation device for the trebuchet. The key is an aluminum rod that prevents the arm from swinging up. Once it is pulled out by the string, the device activates.
- Nail- the nail is what the other side of the sling hooks on to. Once the arm reaches a certain angle when it is swinging, the sling will slip off the nail and release.
- Sling & Pouch- the sling and pouch hold the projectile and releases it at a certain point.
- Projectile- the projectile is the racquetball or the tennis ball
- Counterweight- The counterweight provides the gravitational potential energy. When it drops, the arm is propelled forward to throw the projectile.

1.5kg Counterweight & Tennis Ball Arm Length				
Date-Test#	Counterweight/Projectile	Target Distance (m)	Arm Length from wheels up (cm)	Distance From Target (cm) 'IN' means in bucket
01/12/22-1	Heavy	3.5	50	10
01/12/22-2	Heavy	3.5	50	0
01/12/22-3	Heavy	3.5	50	0 (IN)
01/13/22-4	Heavy	3.5	45	0
01/13/22-5	Heavy	3.5	45	13
01/13/22-6	Heavy	3.5	45	0
01/14/22-7	Heavy	3.5	40	0
01/14/22-8	Heavy	4.0	40	0
01/14/22-9	Heavy	4.0	40	0
01/14/22-10	Heavy	4.0	35	119
01/14/22-11	Heavy	5.0	35	31
01/14/22-12	Heavy	5.0	35	9
01/14/22-13	Heavy	5.5	35	19
01/14/22-14	Heavy	5.5	35	11
01/14/22-15	Heavy	5.5	35	18
01/14/22-16	Heavy	5.5	35	44
01/14/22-17	Heavy	5.0	35	0
01/14/22-18	Heavy	5.0	35	10
01/14/22-19	Heavy	5.0	35	12
01/14/22-20	Heavy	5.0	35	0 (IN)

1.5kg Counterweight & Tennis Ball Sling Length				
Date-Test#	Sling Length from mask to arm (cm)	Target Distance (m)	Distance from target (cm) 'IN' means in bucket	Vertical distance from target (cm)
01/18/22-21	24	5.0	0	0
01/18/22-22	24	5.0	25	3
01/18/22-23	24	5.0	10	0
01/18/22-24	24	5.0	11	8
01/20/22-25	24	5.0	5	5
01/20/22-26	20	5.0	60	53
01/20/22-27	23	5.0	0	0
01/20/22-28	23	5.0	36	28
01/20/22-29	23	5.0	15	5
01/20/22-30	23	5.0	14	7
01/20/22-31	23	5.0	33	29
01/20/22-32	23	5.0	27	25
01/20/22-33	24	5.0	7	7
01/21/22-34	24	5.0	10	10
01/21/22-35	25	5.0	0	0
01/21/22-36	25	5.0	19	18
01/21/22-37	25.5	5.0	13	11
01/21/22-38	25.5	5.0	7	5
01/21/22-39	25.5	5.0	0 (IN)	0
01/21/22-40	25.5	5.0	0	0

0.5kg Counterweight & Racquetball				
Date-Test#	Arm Length from wheels up (cm)	Target Distance (m)	Distance From Target (cm) 'IN' means in bucket	Vertical distance from target (cm)
01/21/22-41	50	1.0	0	0
01/21/22-42	50	1.0	0	0
01/21/22-43	50	1.0	0	0
01/21/22-44	45	1.0	11	11
01/21/22-45	45	1.0	0	0
01/21/22-46	45	1.0	15	15
01/28/22-53	40	1.5	0	0
01/28/22-54	40	1.5	0	0
01/28/22-55	40	1.5	0	0
01/21/22-47	35	1.5	19	19
01/21/22-48	35	1.0	0 (IN)	0
01/21/22-49	35	1.0	7	0
01/21/22-50	35	1.0	0	0
01/21/22-51	35	1.0	5	0
01/21/22-52	35	1.0	0	0
01/28/22-56	35	1.0	11	4
01/28/22-57	35	1.0	0 (IN)	0
01/28/22-58	35	1.0	12	7
01/28/22-59	35	1.0	7	0
01/28/22-60	35	1.0	0 (IN)	0

Launch Device Position (angle)					
Date-Test#	Counterweight/Projectile	Launch Device Position (angle) (marked on device)	Target Distance (m)	Distance From Target (cm). 'IN' means in bucket	Horizontal distance from target (cm)
2/5/22-61	Light	0	1.0	10	10
2/5/22-62	Light	1	1.0	8	7
2/5/22-63	Light	2	1.0	4	4
2/5/22-64	Light	3	1.0	0 (IN)	0
2/5/22-65	Light	3	1.0	0	0
2/5/22-66	Light	4	1.0	0	0
2/5/22-67	Light	3	1.0	0 (IN)	0
2/5/22-68	Heavy	0	5.5	23	18
2/5/22-69	Heavy	1	5.5	16	13
2/5/22-70	Heavy	2	5.5	12	12
2/5/22-71	Heavy	3	5.5	31	15
2/5/22-72	Heavy	4	5.5	0	0
2/5/22-73	Heavy	5	5.5	8	3
2/5/22-74	Heavy	5	5.5	14	12
2/5/22-75	Heavy	4	5.0	0 (IN)	0
2/5/22-76	Heavy	4	5.0	7	5
2/5/22-77	Heavy	4	5.0	9	9
2/5/22-78	Heavy	5	5.0	6	6
2/5/22-79	Heavy	5	5.0	0 (IN)	0
2/5/22-80	Heavy	5	5.0	5	0

Calculations						
Type of Test/ Counterweight (kg)	Best Device Position (angle), Target Distance (cm)	Best Device Position = (Target Distance+500)/200 (found using rise/run and point-slope formula)	New Device Position, New Target Distance	Best Arm Length (cm), Target Distance (cm)	Best Arm Length = (Target Distance-3300)/-80 (found using rise/run and point-slope formula)	New Arm Length, New Target Distance
Light/0.5	3, 100		3.25, 150	40, 100		39.375, 150
Heavy/1.5	5, 500		4.75, 450	35, 500		35.625 ,450
Type of Test	Best Target Distance for 0.5kg and 1.5kg tests (cm)	Ratio of Counterweight (kg)/ Target Distance (cm) (using the ratio of distance/counterweight to find new distance given a weight)	New Counterweight, New Target Distance	Best Device Position (angle), Target Distance (cm)	Best Device Position = (Target Distance+500)/200 (found using rise/run and point-slope formula)	New Device Position, New Target Distance
Light	100	0.5/100	1/200	3, 100		3.5, 200
Heavy	500	1.5/500	2/667	5, 500		6, 700