FIRST DIVISION MUSEUM
at CANTIGNY

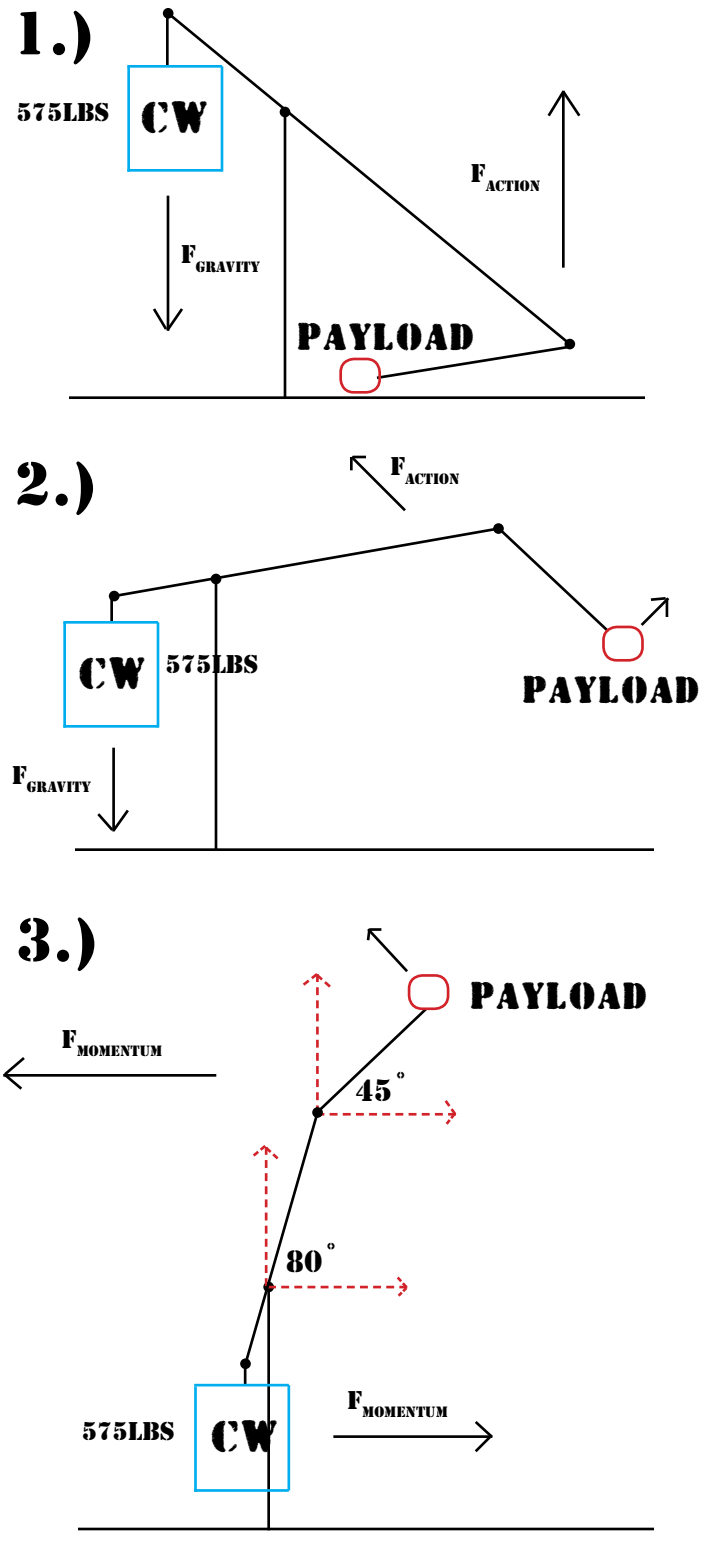
FDM CATAPULT

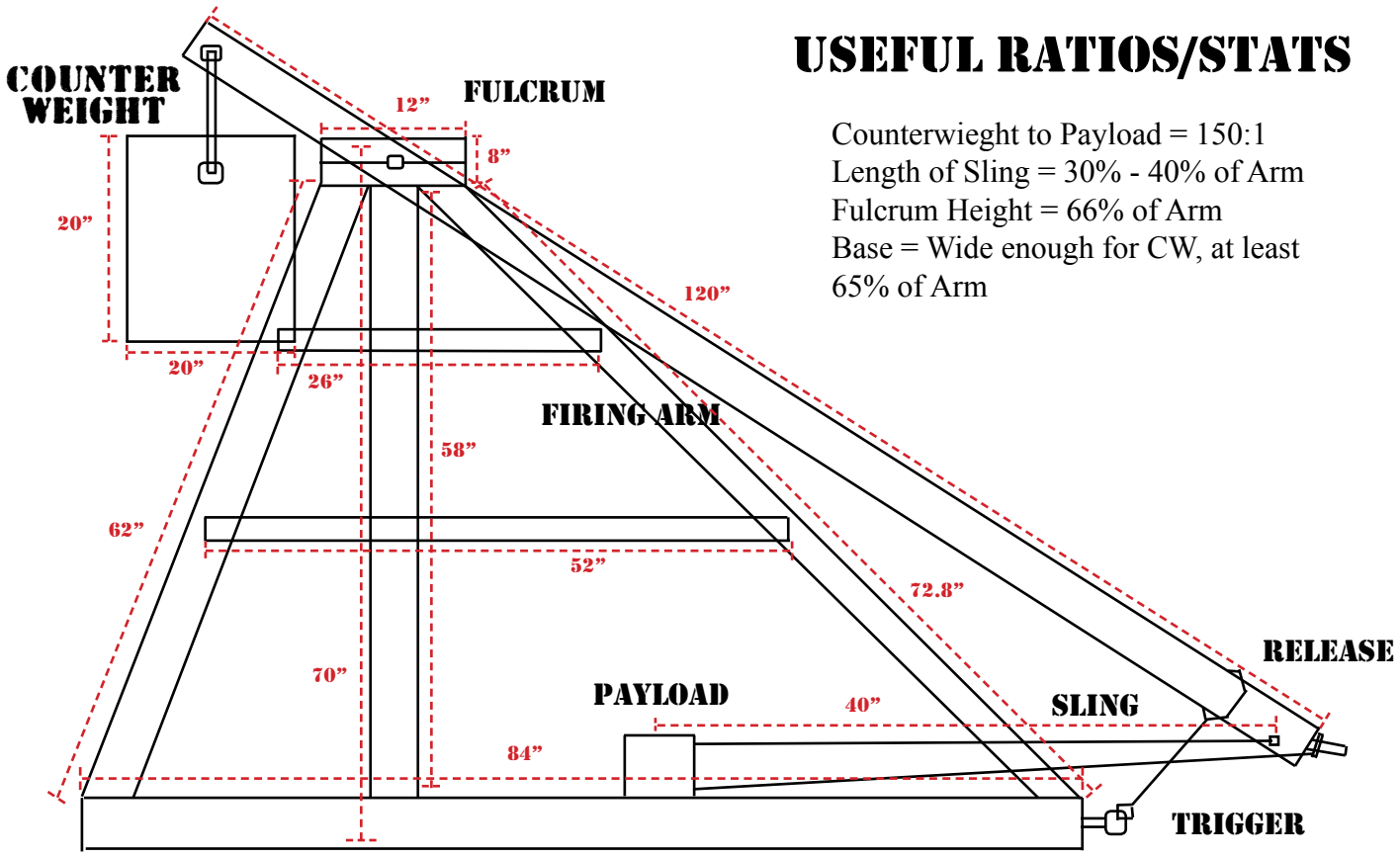
CHOSEN WEAPON STYLE - TREBUCHET

The trebuchet made its first appearance on the battlefield during the middle ages, between 800 and 1400 AD. They soon became a staple of siege warfare due to their ability to send heavy objects long distances, very effective for bombarding a fortified city. The actual mechanics are extremely simple and based upon the first type of ranged weapon, the sling. The trebuchet itself simply takes the idea of a sling, whirling a stone around your head quickly in a pouch then letting go to fire, and makes it very very large. Think of the counterweight as your muscles, the firing beam as your arm, and the catapult pouch as a personal sling.

THE PHYSICS BEHIND THE SHOT

The science behind a **Trebuchet** is fairly simple, all the machine does is harness the power of gravity and converts it into **Force (**F) exerted on the payload, thus sending it on its way. The mass of the **Counterweight** (CW) directly effects distance fired, sling length, payload mass, and release angle because the force generated isn't just the weight, its multiplied by gravitational acceleration which means hieght is a factor as well. When the CW is released, it pulls the firing beam on a pivot which rotates the opposing half, which holds the **Sling** and **Payload**. As the payload end of the beam begins to rise and accelerate, the sling is pulled out from beneath the body of the trebuchet and follows a larger arc at the end of the beam. This is important, becasue the sling trails, the release point for the payload is actually behind the end of the beam. So in order to get a perfect release of **45 degrees** on the payload, the beam will need to travel as far as **80 degrees**. When the trebuchet reaches that point, the force is enough to separate the end of the sling firing the payload.





USEFUL RATIOS/STATS

Counterwieght to Payload = 150:1
Length of Sling = 30% - 40% of Arm
Fulcrum Height = 66% of Arm
Base = Wide enough for CW, at least 65% of Arm

BUILDING MATERIALS & CONSTRUCTION

Lumber = A-Frame (x2), Base, Arm
- (4x4) = 84” x2, 28” x4, 62” x2, 58” x2, 72.8” x2, 12” x2
- (2x4) = 120” x1, 52” x2, 28” x2

Lumber = Counterweight Box
- Plywood (3/4”) = 20x20 (x4), 21.5x21.5 (x1)

Hardware = Screws, Knuts, Bolts, Etc
- 6” Lag Screws (for 4x4’s), 3” Lag Screws (for 2x4’s), 4x4 Post Anchors (x4), 6” Bolt, 1/2” Cable, 3/4” Cable Clamps (x4), 1” Shackle (all for CW assembly), 4” I-Bolts (x2), various wachers, knuts

Miscellanious Materials
- 20” Chain (CW assembly), Climb Rope (Sling), 1 yd^2 Canvas (Pouch), 40” Steel Bar 1 1/2” Diameter (Fulcrum)_

Construction begins with the base assembly, 6” lag screws driven between the two 84” and four 28” pieces. The **A-Frames** are consturcted separetely and attached to the base as individual components. Each frame has a 62”, 58”, and 72.8” piece attached to the fulcrum block (two 12” pieces attached with lag screws) with the 6” screws. The 3” screws are used to attach the 2x4’s to the frames as cross member supports. Using the post anchors, the vertical 58” pieces were attached to base and firing block first, with the rest following. Next, the 120” piece is drilled, along with the fulcrum block to accept the 40” steel bar. The **Counterweight** is built and attached by drilling the end of the arm, thread a bolt through with chain attached, then suspending the CW with shackle and cable threaded through the box. Measure and cut the rope for the **Sling**, using a sewing kit create a pouch with the canvas and attach the rope ends to the arm and a circular washer. Drive a bolt into the end of the arm at a 30 deg. angle then cut off the end w/ a hack saw. Take the washer end of the sling and palce it on the release bolt. The **Trigger System** is created with I-bolts driven into the base with a bar threaded through those and a cable extending from the arm to secure it in place. Use a rope to pull free.