

The Story of Stomach Virus

Current World Champions in Youth Human Powered Division

by Dave Drummer, Teacher

Though I've always thought that trebuchets and other hurling machines were pretty neat, our first practical experience with them came in 2004, when there was a Science Olympiad event called "Storm the Castle". The objective was to build a machine powered entirely by a falling mass that would throw a small projectile as far, and as accurately as possible. A little research showed that a gravity powered hurling machine is a trebuchet, and an on-line search led us to Ron Toms' website, trebuchet.com. We decided to start by building a small trebuchet from a kit purchased from this site (sadly, no longer in operation).



First Science Olympiad FAT

After playing with the kit for a while, one of our students built a similar machine of his own. It was a floating arm trebuchet (FAT), an innovative Ron Toms adaptation of the traditional trebuchet. The FAT is a variation on a traditional trebuchet, in which the counterweight is forced to fall straight down through a slot between two vertical towers. Instead of a fixed pivot, the arm rotates about an axle with wheels that roll along a horizontal track.



First large FAT

A FAT is therefore capable of throwing greater distances with the same amount of counterweight. Our student built machine was able to throw a small projectile about the size of a golf ball nearly 40 meters with about 5 pounds of counterweight. It won a gold medal for our team in the PA state Science Olympiad competition that year.

Our first larger trebuchet (FAT) was built during the winter of 2009/10 by two Kutztown High School students. This scaled-up machine competed in a cantaloupe throwing competition called the Cantalobber at Kutztown University, winning with a best throw of 483 feet, achieved with a maximum counterweight of 320 pounds. The students' interest was piqued - they wanted to compete in the World Championship Punkin' Chunkin' in Delaware. Some research showed the world record in the youth trebuchet to be 852 feet, so we realized that some changes would be necessary if we were to be competitive at the Chunk.



First F2k Floating Arm Trebuchet

That Summer, the machine was converted into a F2k trebuchet, a more efficient floating arm design in which the pivot axle is raised above the horizontal tracks. It was also given the name Stomach Virus, and entered in the 2010 Punkin' Chunkin' in Bridgeville, DE. Our longest throw of 653 feet was good for 2nd place in the Youth Trebuchet division. However, the maximum counterweight of 410 pounds caused the weight bar to bend, so it was back to the drawing board.

Extensive modifications followed that Summer. The main change was a heavy duty counterweight assembly that rolled down between the towers on inline skate wheels. This assembly also increased the diameter of the bar from 1 inch to 2 inches. After countless hours of building it, breaking it, fixing it, and tuning, we achieved our goal of first place at the 2011 Punkin' Chunkin'. Our longest throw of 1143 feet was a new world record in Youth Trebuchet.



F2k Floating Arm Trebuchet with Extensive Modifications

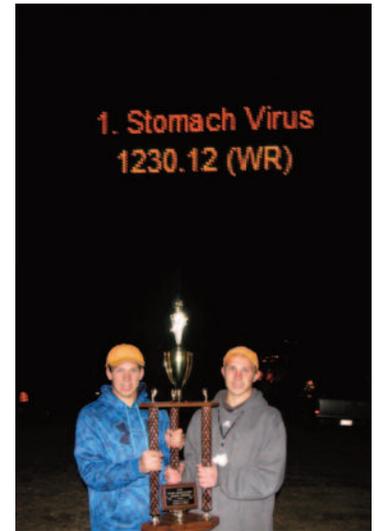
Here is a link to some video of our performance at the 2011 Chunk:
http://www.youtube.com/watch?v=PWUOr2L30_E

The 2012 throw was achieved with 730 pounds of counterweight, but the machine had a capacity of 910 pounds, so we returned to the Chunk in 2012 with a strengthened trailer and throwing arm, hoping to extend our distance beyond 1143 feet by using a heavier counterweight. This was not to be, however, as increasing the counterweight caused the throwing arm to hit the towers during the throw, with a final distance of only 1126 feet. This was still good for a second place finish in Youth Trebuchet.

So What Was Done For 2013?

The problem encountered at the 2012 Chunk was determined to be a warp in the wooden arm, so the team decided to build a new arm from metal tubing. The new arm proved to solve this problem, but our distances were significantly reduced. This taught the students a lesson in rotational inertia - the thick-walled metal tubing was too heavy, and although the metal arm was only a few pounds heavier than the wooden one it replaced, there was too much weight out on the throwing end that launches the pumpkin. We are currently in the process of replacing the end 4 feet of the arm with a piece of thin-walled tubing. Our next practice session will show how effective this is at increasing our distances.

The team also decided to switch from youth trebuchet to the youth human powered division for 2013. This change allowed us to compete at the Last Fling Pumpkin Sling in New Jersey 2 weeks before the Chunk as a practice event. (The Last Fling requires that all machines be human powered. <http://www.pumpkinsling.com/index.html>) We built a bicycle powered winch, which will allowed us to raise the counterweight with human power, and the team went on to win the competition with an event record throw of 1874 feet. Two weeks later, Stomach Virus became Punkin' Chunkin' world champions in the Youth Human Powered division with a world record throw of 1230 feet.



Post-2013 Stomach Virus

Though there was no Punkin' Chunkin' competition held in Delaware in either 2014 or 2015, our machine competed at the Cantalobber and the Last Fling Pumpkin Sling both years, winning all four competitions.

The 2015 LFPS was sanctioned by the World Championship Punkin' Chunkin' Association so that participating teams could designate some of their throws to be counted toward 2015 World Championship status and world record attempts. The Stomach Virus threw an official 4 pound pumpkin to 1378 feet, winning the 2015 Youth Human Powered championship, and increasing the world record in that category from the old distance of 1230 feet.

Where are they now?

The majority of the students involved in building these trebuchets have gone on to careers in Science or Technology related areas. The student who built our very first Science Olympiad machine is working for one of the commercial space launch companies. One of the students who built the first large trebuchet recently graduated from RPI with a BS and MS in mechanical engineering, and has just accepted a job with a robotics company in New Hampshire. His partner studied Manufacturing Engineering Technology at PA College of Technology, and currently has a job programming for computer aided design and manufacturing operations.