Fly Rocket Fly: Rocket Report

Hammerhead X-134

Question:

How do you design and test a 2 liter bottle rocket to fly a maximum distance? What kind of things will help the rocket reach a maximum distance?

Background:

From lessons learned last rocket day the “Hammerhead x-134” was initially based off the rocket “The Stang” by Jeff Kline and Brendon Kondrat, hoping the information that was researched pays off. Initially “Hammerhead x-134” was a replica bottle referring to the cabin and fin design. With an identical nose cone and mass of “ The Stang”, knowledge of Brendon and Jeff’s rocket report severely enhanced the “Hammerhead x-134” results, the only change influenced on the rocket was, perfected weight and stability , which in return maximized optimal distance for the “Hammerhead x-134’s” design. After additional research on fin and total mass, the “Hammerhead x-134” went through fin repairs which increased launch distance by approximately 60%.

Rocket Design:

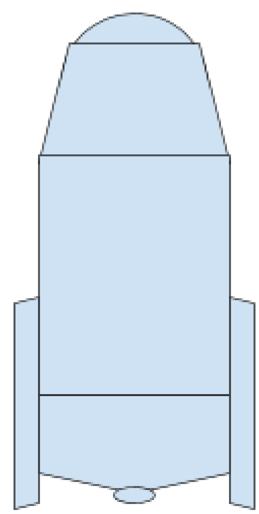


Figure 2

The original “Hammerhead x-134” had the similar rounded nose shape from the bouncy ball, Also had the small and flat wings made from house siding similar to the design of “The Stang”.

Fin Design:

After much research, and the process of elimination with a basis theory for compatibility and possibility of accomplishing the build of the new fins, the final option was a "clipped delta". This design had a completely different design and approach towards distance and relative output with horizontal distance or vertical distance.

The new fin design allows optimal control while in flight, With bigger fins compared to the original trapezoidal shape, While in flight the fins worked by cutting through the wind while increasing stability and decreasing drag similar to an actual rocket, From the Fins allowing a decrease in drag, it in return increased the distance horizontally substantially.

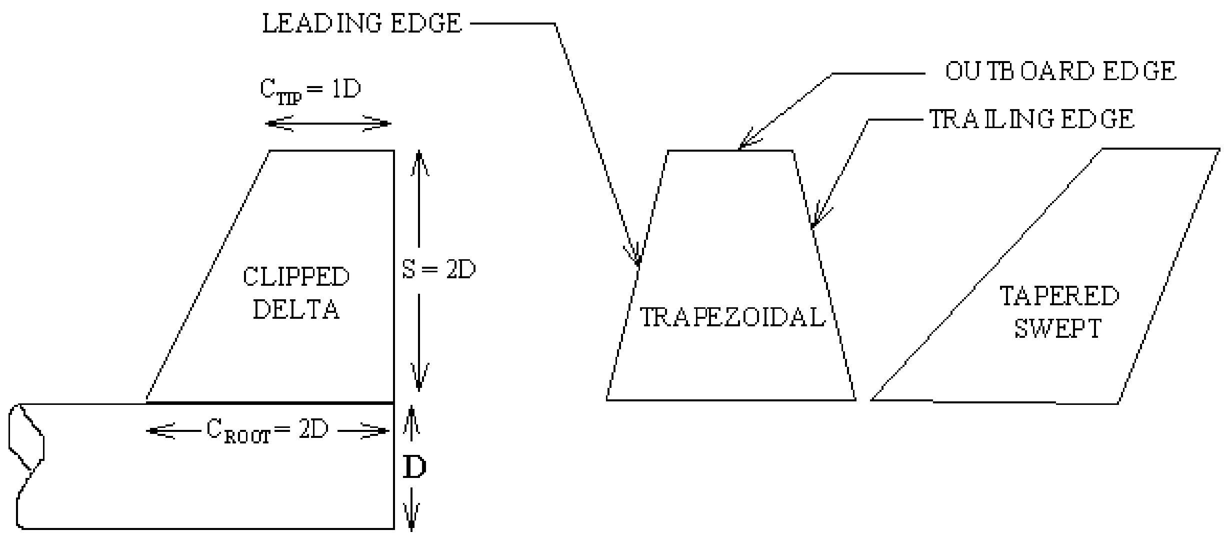
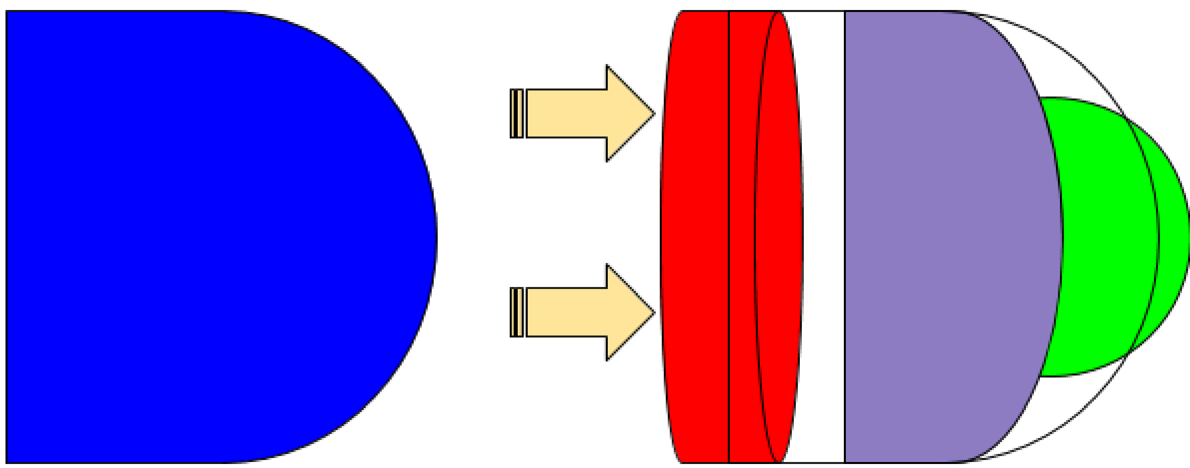


FIGURE 3 -- FIN PLANFORMS

http://www.nakka-rocketry.net/fins.html

Nose Cone Design:

Figure 4



Blue: end of pepsi soda bottle used to fit perfectly into nose cone

Red: a sealant that causes little to no drag, a single piece of small duct tape wrapped around once.

Purple: Plastimake, or the mold that adheres to the second nose cone (blue) as well as the nose cone itself and the green sphere or bouncy ball.

Green: indicates the bouncy ball used to help make the rocket more aerodynamic as well as allowing a soft cushion for durability on time of impact.

Results:

With this idea along with the cushion of impact related to the nose cone ball, this allowed the module to sustain more impacts and more launches, even after many launches, the

Hammerhead X-134 would out fly the previous mark which proves that the double nose cone CAN withstand the rising Psi with every launch.

Day 1 testing

Question:

How far will the rocket actually go?, will there be any stability or mass issues associated with a first time run. After the “Hammerhead x-134” launch will there be any outstanding concerns with the base model?

Background:

The “Hammerhead X-134” was based off of “The Stang” by Jeff Kline and Brendon Kondrat, with hopes that the information originally researched and the same fins, nose cone and mass, eventually match the same distance as “The Stang”.

Figure 5

Date	Test Number	Pressure (Psi)	Distance (Yards)	Changes made to rocket
9/22/15	1	60 Psi	72 Yds.	None
9/22/15	2	80 Psi	105 Yds.	None
9/22/15	3	100 Psi	113 yds.	None

Results:

The rocket was not stable at all, showed that the"Hammerhead x-134" needs improved weight and improved Fin stability. The arising question of fin change and increasing mass are options. With added weight could come complications of less distance, the perfect mass has yet to be found.

Day 2 testing:

Question:

Will the change in weight and the "re-taping" of the fins help with stability as well as a new nose cone and body. Pepsi bottle for both, the theory is the old module and nose cone were dented and scratched which could increase drag or assist instability issues.

Background:

The Hammerhead X-134 was a prodigy of " The Stang" after much research and the first test day it was observed that there were stability issues whether based off of module and nose cone damage, wing alignment and strength, or mass mis calculations.For the second testing day the Hammerhead x-134 will have a new pepsi bottle for the module and nose cone, kuak for a sealant and sturdiness for the fins, and finally a new mold for the mass issue called "Plastimake" which is located in the nose cone.

Figure 6

Date	Test	Pressure (Psi)	Distance (Yards)	Changes made
9/28/15	1	80 Psi	115 Yds.	module, nose cone, fin adhesive, mass
9/28/15	2	100 Psi	130 Yds.	module, nose cone, fin

				adhesive, mass
9/28/15	3	120 Psi	131 Yds.	

Results:

There was still some stability issues, more mass did make a difference as shown in the data, relying question is whether or not installing new fins to the rocket is a risk that should be taken. From the data shown in the table above, it can be concluded that the new mass did help affect the overall distance but if the Hammerhead X-134 does go through a fin change is it possible to double the number shown in the data table above? or does the Rocket need more tape for extra support on fins already being used.

Day 3 testing

Question:

Will covering Rocket in duck tape add sufficient durability or stability on the fins as well as not having a huge drag factor and evenly distributing the mass. If there is too much mass located in one area will the rocket have a faulty launch?

Background:

After much discussion and consideration the idea of completely covering the rocket in duck tape came from previous unsuccessful launches with durability and stability. After researching and seeking help from Mr.Darlington. He referred to the rocket built by Rebekah Reichard, which was nominated most durable, furthermore, Test day 3 is a trial run for a completely covered rocket.

Figure 7

Date	Test	Pressure (Psi)	Distance (Yards)	Changes made to the rocket
10/2/15	1	100 Psi	119 Yds.	Complete coverage with duck tape

10/2/15	2	238 Psi	125 Yds.	Complete coverage with duck tape

Results:

Duck tape caused a lot of drag, did not help what so ever, going to scratch the idea of "complete coverage" and start implementing ideas and designs for fins. With luck and success, the Hammerhead X-134 will undergo fin change and durability testing for the next Test day, number 4.

Day 4 testing

Question:

Will the new fin design prove to be successful compared to Hammerhead X-134 old fins. Will this fix stability problems, and will this increase or decrease distance vertically or horizontally?

Background:

After much research and testing, it was concluding that the fins being used originally were failing the Hammerhead X-134 from achieving maximum performance. From the research, it was decided to use a fin called a “Clipped Delta” with more of a trapezoidal shape compared to the previous fin.

Figure 8

Date	Test	Pressure (Psi)	Distance (Yards)	Changes
10/8/15	1	130 Psi	200 Yds.	New fins, less mass, new module(Pepsi)
10/8/15	2	130 Psi	195 Yds.	New fins, less mass, new module(Pepsi),

10/8/15	3	138 Psi	190 Yds.	New fins, less mass, new module(Pepsi),

Results:

It is concluded that the new fin design on the Hammerhead X-134 proved successful and and maintained control during times of periodic gusts of wind during flight, in return this allowed the rocket to remain stable and go further. From new data and research, the fins used in previous launches were to slim and allowed the wind to just pass over them which caused instability. The clipped delta fins are taller and stronger and cut through the air forcing the rocket into a certain direction.

Day 5 testing

Question:

Will Final changes to position of fins and mass prove successful when it comes to distance especially on windy days?

Background:

The mass was 200 grams, with the weather being very windy, it was theorized to have a minor gain in mass to counteract the forceful wind. In conclusion the final mass was 10 grams denser compared to the 190 gram rocket “The Stang”.

Figure 9

Date	Test	Pressure (Psi)	Distance(Yds.)	Changes
10/14/15	1	138 Psi	205 Yds.	alignment of fins, mass
10/14/15	2	138 Psi	127 Yds.	alignment of fins, mass

Results:

On the first launch the rocket flew, with the change of alignment on the fins, it dramatically changed the distance. The aerodynamics of the wings allowed the rocket to successfully break the air’s surface tension. The next challenge is discovering a successful and reliable tool for durability. The second launch did not achieve a distance as far because of durability issues afflicted from the first launch.

Day 6 testing

Question:

Will creating a type of “double nose cone” configuration allow the durability of our rocket to increase without interfering with the weight or drag issues as well as taking away damage from the fall on the module area of the rocket?

Background:

From Constant results of low durability, research of brendon and Jeff's rocket as well as Rebekah’s rocket, it was found that a way to increase durability but not drag was to, in a sense, have a double nose cone type configuration. This was a theory that if proven successful would allow consistent launches with similar distances, as well as no drag issues and no mass difference.

Figure 10

Date	Test	Pressure (Psi)	Distance (Yards)	Changes
10/20/15	1	139 Psi	215 Yds.	Double nose cone
10/20/15	2	139 Psi	206 Yds. (over fence)	Double nose cone launches.

Results:

On this launch day, the Hammerhead X-134 was successful, maintaining stability and durability. After the first launch hitting the new personal best for the Hammerhead X-134, it was proven a success. The path towards optimal distance was clear, with the second launch only being a few yards shy of the first, the durability was increased by the double nose cone. With no drag issues recorded and no mass differences the double nose cone was a big breakthrough.

Day 7 test

Question:

Will more weight to the rocket module and to the nose cone help break wind resistance and create a sort of wind tunnel where the rocket will streamline from start to finish, will the weight and velocity help breakthrough the resistance or is it in fact opposite and less weight is needed ?

Background:

After analysing Brendan and Jeff's rocket report and seeing they kept a consistent mass of 190 grams, and then analysing the article from Graham. Which stated 350-400 grams. It was decided to add a small amount of mass to the nose cone to help with wind resistance while still staying near "The Stang's" mass as well as testing out graham's mass theory.

Figure 11

Date	Test	Pressure (Psi)	Distance (Yards)	Changes
10/22/15	1	138 Psi	143 Yds.	increased the mass.
10/22/15	2	140 Psi	154 Yds.	increased the mass.
10/22/15	3	140 Psi	166 Yds.	increased the

				mass.

Results:

With more weight the rocket still remained stable but most definitely lacked distance. With the wind being a factor on the day of the launch (which was the hope), the added mass never seemed to counteract natures natural force. Wind. With the ability to compare distances from prior launches where all were 200 grams. It is concluded that the added mass in reality acted against the goal of maximum distance.

Day 8 test

Question:

Will taking mass out of the nose cone and adding it to the fins of the rocket located tail end of the rocket allow more stability and "Push" the rocket farther ?

Background:

Brendon and Jeff's rocket was severely light compared to mass of the Hammerhead X-134's last test run and most rockets built in general. The theory that was established was to make the Hammerhead X-134 light but not top heavy. Therefore the test is to evenly distribute the mass throughout the rocket.

Figure 12

Date	Test	Pressure (Psi)	Distance (Yards)	Changes
10/30/15	1	138 Psi	198 Yds.	Made nose cone lighter more mass to fins
10/30/15	2	138 Psi	----	Made nose cone lighter more mass to fins

Results:

The rocket did not go as far as previous launches, even though the first launch almost reached 200 Yds., the fins caused an issue. The second launch the Hammerhead X-134 was not able launch at all, to much drag was recorded from the first flight and it was concluded that the original mass and theory of wing placement, mass and nose cone mass were correct. No changes are needed.

Day 9 test

Question:

Is it possible to remake and amplify the original Hammerhead X-134 that got the best results, perfect it and make sure that there are no flooks or flaws with the design and building process?

Background:

From total research between, mass, fins, and durability, it has been found that the product of both “ The Stang” and Rebekah Reichard’s rocket is the Hammerhead X-134, with the maximum durability similar to Rebekah’s rocket, the perfect mass and nose cone design from “The Stang”, and the research that led to the fins for maximum distance, the Hammerhead X-134 is a rocket with all the right tools to be the record holder and winner or the 2015 “Rocket Day”

Figure 13

Date	Test	Pressure (Psi)	Distance (Yards)	Change
11/5/15	1	138 Psi	80	re taped everything and fixed damaged nose cone.
11/5/15	2	138 Psi	180	re taped

				everything and fixed damaged nose cone.

Result:

Nothing new was done to the rocket, with the right tail wind on rocket day the Hammerhead X-134 should pass prior distances that were previously launched. Next thing to do is completely rebuild the Hammerhead X-134 with all new materials and wait for Rocket Day.

Conclusion:

“For a rocket to fly a far distance, it needs to be three things. The rocket needs to be aerodynamic, it needs to be light, and it needs to use it’s propellent efficiently. There are multiple things that one can do to achieve these things.” - Bendon Kondrat

The Hammerhead X-134 had many different obstacles and trial to go through to be Rocket day ready. With a mix between two rockets the Hammerhead X-134 went through extensive trials, Three of the most important things that allow a rocket to out launch the previous launch, or out last previous trials, are Fins, mass, and durability. These three things were prominent in the building of Hammerhead X-134. The fins were by far one of the biggest factors for the rocket, with the addition of new fins, the Hammerhead X-134 was allowed to gain more distance and supply better stability. The second part to the rocket that was also highly important was the double nose cone idea which dramatically increased the durability of the Hammerhead X-134. The double nose cone was a big win win situation, it allowed the Hammerhead X-134 to reach maximum durability as well as not altering the mass or length of the rocket. The final important piece to the puzzle was finding the perfect mass for the Hammerhead X-134. “The Stang” was very similar to the Hammerhead X-134 but the mass was different for both rockets, the Hammerhead X-134 had a denser mass while “The Stang” had a lighter one. All three things were crucial to the Hammerhead X-134’s success. Without constant trial, analysis, research and calculations, the data collected and the final distance measured would not have been able to be achieved.

Setup:

1.) Gather materials

-Two pepsi bottles

-duck tape

-siding for fins

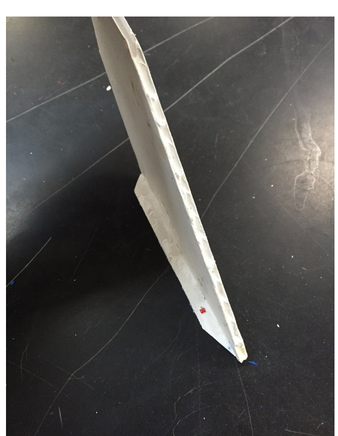
-plastimake (read directions)

-rubber ball

Build:

1.)

build three fins cut the bottom of the fins to create a “flap” type bottom to make it easier for the wings to adhere to the bottle, take a string and wrap it around the bottle and mark where the string comes back around and hit the string again. then measure the length, divide by three, and mark on the string the three even distances, put the sting back on the bottle mark where each mark is on the string on the bottle and then place fins on the mark.



2.) Create nose cone, take one of the bottles saw of the neck of the bottle (part that connects bottle to cap) then take and cute 2 inches back starting from the area of the sawed off neck.



3.) Take the same bottle and cut off the the bottle about 3 inches up from the bottom to create the double nose cone extension.


4.) take plastimake after melting it mold it into the actual nose cone with the ball already placed in nose cone so that the ball is popping out of the neck of the bottle.



5.) Attach the second nose cone and the original and take the one bottle that has been untouched and attach it all together.Once the module is fully connected attach the wins by following the instructions stated above in number one.


My Job:

In the start of the project the job assigned was called the voo voo zela. It was a large green horn that made a distinct loud sound that alerted the people down range that rockets were about to launch. It is an important job, it ensures safety and attention. Second job about halfway through the project was a “Marker”, as this person, the responsibility is to safely run down each rocket to the exact point at which it landed, by doing this it is then required to hold a huge sign on a pole that has a big red dot on it. When approaching the landing zone you will hold up the sign high and steady as the person in charge of marking the distance reads it clearly, preceding this bring the rocket to the runners and wait til the next rocket is launched and landed. Then repeat, dress warm!