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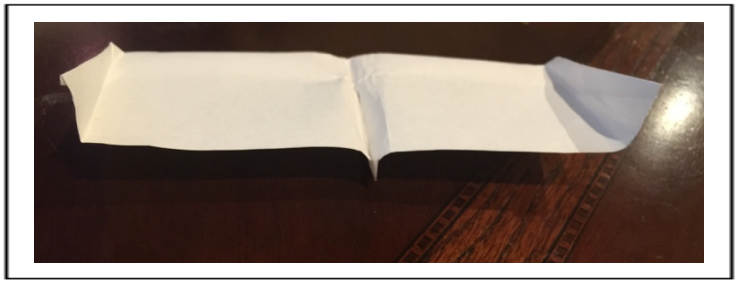
USC Paper Airplane Competition

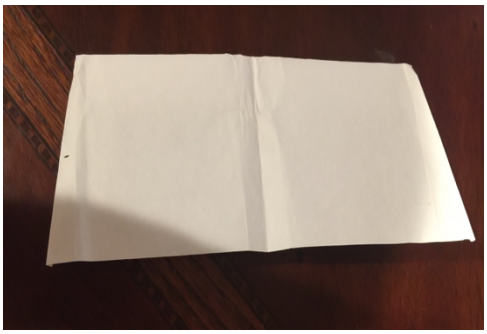


AirGlide 247

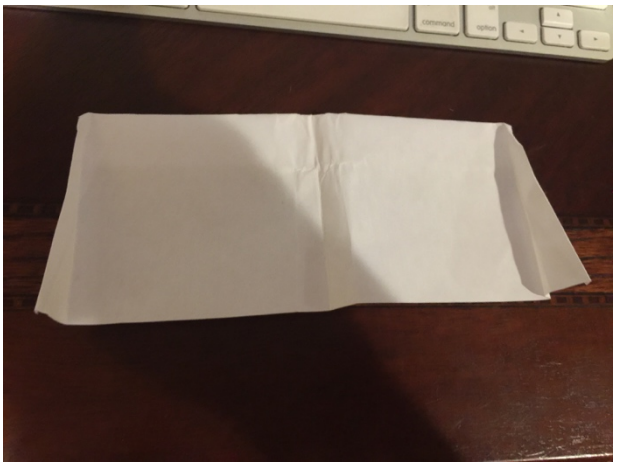
Goal:
The aim of this paper airplane design was to build a paper airplane that would fly for a long time. The goal was not necessarily want to build an airplane that would fly the furthest. A smooth gliding flight was of the upmost importance. The paper airplane needed to glide well on its way to the ground to maximize its time in the air. This, coupled with a high release point, would ensure that the paper airplane had a long flight time. In addition, a symmetrical design was created to ensure that the paper airplane flew straight and avoided any unforeseen deviations in its path that could decrease tis flight time. The lift created by the paper airplane must equal its drag to avoid nosedives.

Background:
There are four forces acting on a regular aircraft: thrust, lift, drag, and weight. In the case of a paper airplane, there is no continued thrust. The initial thrust comes from the force of the launch. Additionally, the actual weight of the airplane itself is minimal and the downward force comes primarily from gravity. Thus, the two forces that are most relevant to this experiment are lift and drag. Drag can be ignored because the primary focus of this experiment is to maximize flight time, not distance. Lift is the force that I am most concerned with. Ideally, the paper airplane would generate enough lift to exactly neutralize the force of gravity. Due to the practical limitations of building a paper airplane, constructing wings in the shape of airfoils is not able to be done. However, I believe that maximizing the wing area would produce the greatest lift for a paper airplane. This design produces a low aspect ratio, generating more drag. However, this is moot since drag is irrelevant to the goal of generating the longest flight time. If too much lift is generated, however, the paper airplane will pitch up. This pitching up movement will cause a lot of wing area to be perpendicular to the airflow, causing the airplane to stop producing lift altogether and nosedive suddenly. Thus, the paper airplane must generate just enough lift to counteract the force of gravity and yet not generate too much lift in order to keep the airplane parallel to the ground and avoid pitching upwards.

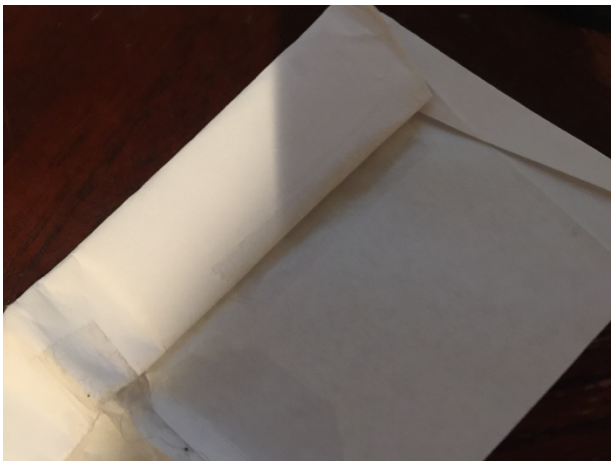
Design:
My airplane will have a large platform parallel to the ground on the sides of the aircraft. This aspect of the design is geared towards maximizing the lift of the aircraft. Additionally, my airplane design incorporates a central part that hangs outward and allows me to grip the aircraft in order to launch it. My initial design also includes wings in the shape of rectangles in order to maximize the airflow underneath these large wings. My aspect ratio of these wings is extremely small, but drag is unimportant in this airplane design.



Testing and Redesign:
After initial design, the first problem I noticed was that my aircraft had a tendency to veer off towards the right, significantly decreasing its flight time. Upon further examination, it occurred to me that left wing had a marginally greater wing area, producing more lift and causing the airplane to veer off to the right. I added a flap to both wings in order to minimize any discrepancies in wing area (and thus lift) between both sides of my aircraft. The addition of these flaps also keeps the airplane more immune to any unexpected wind on the day of the test.



After further testing, I noticed that the part of the airplane that I gripped kept opening up upon flight. Thus, I added a small bit of tape to ensure that the airplane keeps its shape. Although the opening of this middle portion theoretically adds to the wing area of the airplane, in reality it creates asymmetry in the airplane and causes it to veer off to a side. So, I taped together the center of the airplane in order to prevent this part from opening up during flight.



Estimated Results:
My paper airplane can be expected to fly for about 4-7 seconds for a distance of about 4-6 meters Its greatest recorded flying time was 7.68 seconds. Its greatest recorded distance was 5.78 meters.

The most obvious limitation of this airplane design is the great amount of drag generated by this design. While this drag does limit the distance the aircraft can travel, it does little to interfere with its time in the air. This aircraft can be improved by generating more precise folds and measures to increase its symmetry. If both sides are kept symmetric and all folds are crisp, the aircraft will fly straighter, and thus, longer. Additionally, at times, this aircraft generates too much lift due to the large amount of wing area. It is important that the aircraft is launched at a completely horizontal angle so that it does not nosedive.