Meet an Engineer:
Cindy Camp
Aerophysics Department

United Launch Alliance

Cindy started her career working in aerodynamics for the Titan series of launch vehicles and aerodynamic and fluid flow problems for both the Atlas V and Delta IV rockets. Some of her past work involved the development of lift and drag aerodynamic coefficients on the rocket, which help define the way the vehicle flies.

One of the highlights of Cindy's career was the work she did for the Cassini mission. The Cassini spacecraft is currently studying Saturn and its moons and sending home amazing pictures of that world. The analysis she completed studied the flow from the prelaunch air-conditioning system and how it interacted with Cassini.

Cindy's desire to work in the aerospace industry grew from her love of the stars, and wanting to follow her father's footsteps. The two ideas became one dream to be an astronaut, and later turned into a dream to be an Aerospace engineer to help build and design the vehicles that take astronauts to the stars.

Cindy is very active with the Arapahoe County 4-H program, both as a youth (11 years) and now on Arapahoe County 4-H Foundation after graduating from the University of Colorado with a Bachelors of Science Degree in Aerospace Engineering. She believes that the opportunities she was given through 4-H made a huge difference in her life, providing her with the tools needed to be a successful engineer and welcomes any opportunity to pay it forward.

4-H Projects:
Aerodynamic design
Robotics
Model Rocketry

STEM Connections

Colorado State University Extension

Dr. Barbara J. Shaw

Connecting Science, Technology, Engineering, and Math concepts to our everyday lives.

Aerodynamic Design

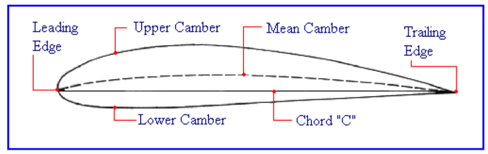
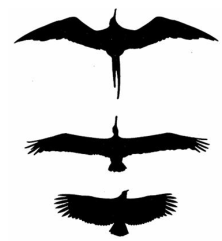


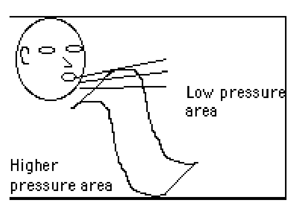
Figure 3-1 Cross section of an airfoil

EXPLORE IT - DESIGN IT - DO IT

In this series on engineering design, we have examined shapes in 2D and 3D. This activity introduces building a 3D aerodynamic design. Airplanes lift and thrust are necessary to counter gravity and drag (air resistance) in order to fly. Aerodynamic means having a shape that reduces the drag from air moving past. Thrust is provided by the engine spinning the propeller. Lift is provided by the airfoil of the wing. Different wing designs provide different attributes to flight. For example, a frigate bird (top silhouette) flies long distances from land everyday to feed, snatching fish from the surface of the ocean. The New World vulture (bottom silhouette), on the other hand, flies slowly, finding raising currents of hot air to lift the bird into the sky. The shape of the wing, therefore, determines the way the bird flies. The middle silhouette is a pelican; how do you think they fly? The long, thin, pointed wings are fast, whereas the wide, short, blunt wings are slow with great maneuverability. Scientists refer to this with an aspect ratio number, which is the wingspan divided by the chord (see above). High aspect ratio is like the frigate bird and low aspect ratio is like the vulture.



An airfoil is the shape pictured above. Notice that the top half of the wing is larger than the bottom half, and generally will have more of a curve, The bottom half of the wing can be fairly straight. This shape, as the plane or bird moves through the air, forces wind to move faster over the top half of the wing. The difference velocities change the air pressure around the wing. The air pressure is lower on top, and higher on the bottom of the wing. The higher pressure under the wing pushes up, causing lift. You can try this out for yourself. Hold a sheet of paper as pictured. What do you think will happen when you gently blow across the top of the paper? Try it. Are you surprised at what happened to the paper? Daniel Bernoulli lived in the 1700s, and he was the first to describe how the air pressure difference causes lift.

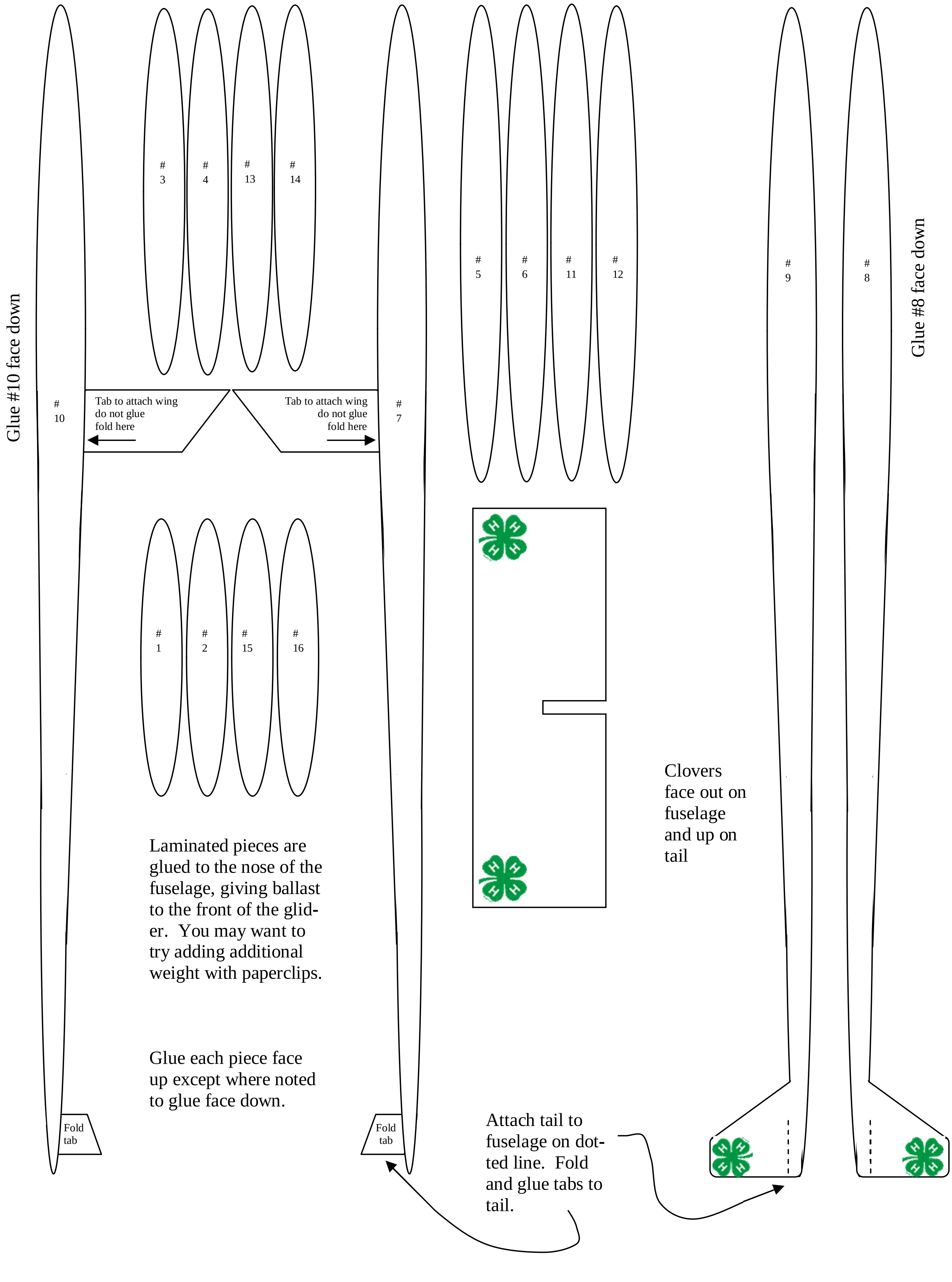


Using this information, we are going to build a laminated glider. You will be able to modify the wings of your glider to improve the distance and speed. Be ready to spend some time in your initial development phase. After you build your fuselage, you can test out different wing designs for one that glides the furthest or soars the highest! Remember, symmetry is key to building a successful glider.

Materials:
- Scissors
- Heavy card stock.
- White school glue
- Wax paper
- Stack of books
- Template on back
- 5/8" paperclips (mini)

Directions:
- Cut out the fuselage template and trace on the card stock.
- Cut out the card stock template.
- Glue piece 2 to piece 1, glue piece 3 to piece 2, etc., until you have everything glued together, and the largest pieces will be in the center.
- Fold fuselage inside a piece of wax paper, weigh down with books, and allow to dry overnight.
- Trace the tail onto the cardstock, and cut out the tail. Insert the tail on the end of the fuselage and glue.
- Remember symmetry. Design your wings. Start with something simple, for example a rectangle 4 times longer than wide (4" by 1" or 8" by 2"). Attach with several paperclips to test. Try molding the wings into airfoils or experiment with different aspect ratio wings.

- http://www.allstar.fiu.edu/aero/wing31.htm
- http://www-scf.usc.edu/~tchklovs/Proposal.htm
- http://www.physics.umn.edu/outreach/pforce/circus/Bernoulli.html



Laminated pieces are glued to the nose of the fuselage, giving ballast to the front of the glider. You may want to try adding additional weight with paperclips.

Glue each piece face up except where noted to glue face down.

Clovers face out on fuselage and up on tail

Attach tail to fuselage on dotted line. Fold and glue tabs to tail.