Airfoil project – research paper 3316

Engineering

Every day, across the world, thousands of planes take off from airports and travel great distances in short amounts of time, saving time and money for many people and businesses. We use planes to sit mail, packages, luggage, and people. Without flight, the world's transportation would be a lot slower than it is now. But what are those massive planes made of and how do they lift themselves into the sky? How do they fly great distances without falling out of the sky?

The reason planes don't tumble out of the sky is because there are four forces acting on airplanes while they are in flight that keep it in flight. There are other forces, but these are the ones that control its flight path. The first of these forces is lift. Lift is what it sounds like, it's the force that keeps the plane in the air. This force pushes the plane upwards and usually keeps planes in flight.

The force opposite to lift is gravity. Gravity pulls against lift and brings the plane down. Since planes are designed to fly and defy gravity, we need more lift than gravity. To get lift, we usually need high speeds, which is known as thrust. Thrust is the speed of the plane as it goes forward. But while you soar through the skies, there's a lot of wind resistance to a large object traveling at great speeds, so the wind resistance is known as drag. Drag pulls planes backwards and tries to slow them down.

The way they usually act together is like this. The jet engines or propellers power the airplane forward, which is its thrust. As the plane moves faster, air travels over the wing of the airplane, and the wing is shaped especially to provide lift. The top of the wing is curved so that the air moves over it faster.

The faster the air moves over the top of the wing compared to the bottom, the lower the pressure on the top of the wing, therefore the higher pressure air on the bottom of the wing wants to fill the lower pressure gap above the wing, so the high pressure air pushes up, and since the wing is in the way, it pushes on the wing and provides an upward force for the plane. This is lift. But enough lift must be generated to overcome gravity and take gigantic airplanes off the ground.

The way the pressure system works with the wing is known as Bernoulli's Principle. That states that the faster a fluid is traveling, the lower a pressure it is. When he refers to fluids, he refers to anything that is not a solid. That means that if there is a river, and the river has a ford, the slow moving water has a higher pressure than the waterfalls downstream. With air, it works the same. The air on top of the wing has to move faster to get around the curve of the wing, and so its speed is greater than that of the air on the bottom of the wing. The higher pressure area on the bottom of the wing wants both areas to have equal pressure, so it tries to move to the low pressure area which is on top of the wing to replace some pressure, but the wing is in the way, so as the high pressure moves upward, it pushes on the wing of the airplane and uses lift, using Bernoulli's Principle.

The way lift is measured is by the amount of lift that occurs on a piece of an airplane wing, known as an airfoil. You can measure lift by pounds per square foot, and that is the industry's standard of measuring lift. Some airplanes need a lot of lift to fly and gather 33 pounds per square foot of lift, which sums up to be a lot of lift on the whole wing of the airplane. Military

stealth planes even get 75 pounds per square foot of lift, and stealth planes have specially designed wings just so they can be stealthy.

Well. That's how airplanes fly, with the four forces of aviation. There's lift, which pushes up, gravity, which pushes down, thrust, which is given by the engines of the airplane and pushes forward, and there's drag, which is also air resistance.