How to test the aerodynamics of a plane or aircraft before flying?

Aerodynamicists use wind tunnels to test models of aircraft. In the tunnel, the engineer can carefully control the flow conditions which affect forces on the aircraft. By making careful measurements of the forces on the model, the engineer can predict the forces on the full scale aircraft. And by using special diagnostic techniques, the engineer can better understand and improve the performance of the aircraft.

NASA recently tested a full-sized tail from a 757 commercial aircraft that was modified and equipped with tiny jets called "sweeping jet actuators" to blow air across the rudder surfaces.

The test vertical tail is an actual 757 tail that came out of an aircraft bone yard in Arizona and was refurbished into a wind tunnel model.

The tunnel hosted the 26-foot 757 tail for a series of tests of an innovative Active Flow Control system that one day might allow airplane builders to design smaller tails, which would reduce weight and drag, and help improve fuel efficiency. The “flow control” comes from the actuators, which are devices that essentially blow air in a sweeping motion along the span of the tail and manipulate that flow of air.

The image was taken inside the National Full-Scale Aerodynamic Complex, a massive wind tunnel located at NASA’s Ames Research Center in Moffett, Ca. In the image, an engineer braces himself against the strong winds in the tunnel as he holds a wand emitting a stream of smoke that’s used to visualize “in flight” air flow across the tail.

Actuator technology will be installed for flight tests on the tail of Boeing’s ecoDemonstrator program 757 flight test aircraft in early 2015 as part of an agreement with NASA.

NASA Now: Engineering Design: Wind Tunnel Testing

5 min

Great Planes Boeing 747 and 777 National Geographic Documentary

Great Planes Boeing 747 and 777 National Geographic documentary

https://www.youtube.com/watch?v=KU5GjyOCr6c

More videos on youtube under"great planes"

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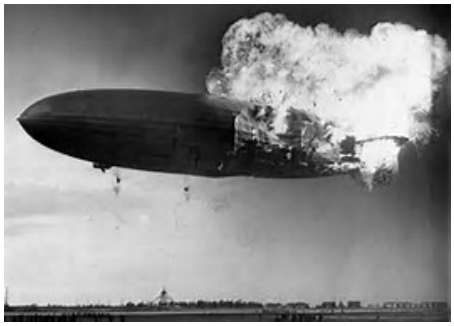
Lighter-Than-Air (Airships)

In the early 1900's people found that if you filled balloons with special gases that were lighter than air, the balloon would rise. A gas call hydrogen was used at first but hydrogen explodes if it comes in contact with a spark or a flame. In 1937, a large airship filled with hydrogen called the Hindenburg burned, killing 36 people.



The most common gas used today is helium which does not burn ans is much safer than hydrogen. (Heliun is a gas used in weather balloons and the birthday balloons). Balloons like this are sometimes given metal frames for support and adding a propeller hels them travel around. Lighter-than-air balloons can carry very heavy loads if they are large enough, but today, their main purpose is for advertising. The "Goodyear Blimp" is a famous example of a modern lighter-than-air balloon.

Molecules in Motion

The gas molecules in air are always moving, but when they are heated they become even more active and move farther apart. Since the same number of molecules takes up more space, the warmer air becomes less dense and rises. Then as it cools down, the molecules move closer.

More about airships

http://www.airships.net/

https://www.bing.com/videos/search?q=hindenburg+flying&&view=detail&mid=4781233C72DD29DADBCC4781233C72DD29DADBCC&&FORM=VRDGAR

https://www.youtube.com/watch?v=LyaYaFzSPac

The Propeller Explained

24 min

How Do Propellers Work? (Mr. Wizard)

3 min 47 se

Propellers

by Chris Woodford. *Last updated: June 30, 2016.*

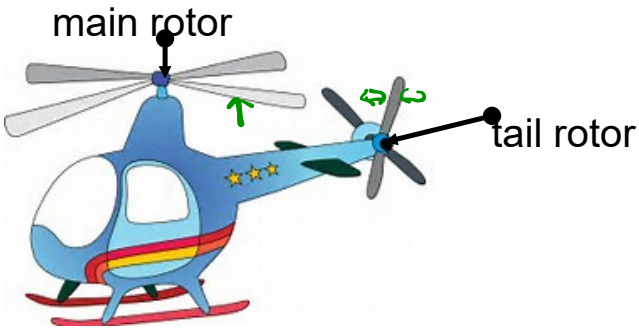
If you want to move forward, you need to push backward; that fundamental law of physics was first described in the 18th century by Sir Isaac Newton and still holds true today. Newton's third law of motion (sometimes called "action and reaction") is not always obvious, but it's the essence of anything that moves us through the world. When you're walking down the street, your feet push back against the sidewalk to move you forward. In a car, it's the wheels that do something similar as their tires kick back against the road. But what about ships and planes powered by propellers? They too use Newton's third law, because a propeller pulls or pushes you forward by hurling a mass of air or water behind you. How exactly does it work? Why is it such a funny shape? Let's take a closer look!

Newton's 3rd Law → "for every action there is an opposite but equal reaction" Ex) Push your foot back to get to move forward

A propeller is a machine that moves you forward through a fluid (a liquid or gas) when you turn it. Though it works the same way as a screw, it looks a bit different: usually it has two, three, or four twisted blades (sometimes more) poking out at angles from a central hub spun around by an engine or motor. The twists and the angles are really important.

Helicopters

Helicopters can fly but they have no wings. Instead, a helicopter gets lift from spinning blades called "rotors" that are attached to the top of the helicopter. A second, smaller rotor called the tail rotor helps to keep the helicopter from spinning out of control.



Actually, if a person cut the rotor in half, you would see the same shape as a wing which is how the helicopter flies. This main rotor allows a helicopter to life straight up in the air without using a runway and to 'hover', remaining in the same place in the air without moving.

Know definition

Being able to fly slow, hover and take off from a small place has made the helicopter useful for many jobs that airplanes cannot do. These include things like reporting on traffic conditions in big cities, lifting skiers to high mountain tops, uses in the logging industry, fighting forest fires and lifting heavy objects.