



# Virginia 4-H **MAKING** the Future

\*18 U.S.C. 707

## The Science of Flight

### The Science Behind it . . .

#### **How do airplanes fly?**

There are four forces that impact a plane's flight: Thrust, Lift, Gravity, and Drag. Planes can fly long and fast when all four of these forces are in balance. Lift is the force that gets the plane in the air; thrust is the force that keeps it moving forward. Drag is the force that slows it down, and gravity is the force that tries to bring it back down to the ground. Thrust and lift are the two forces that keep an airplane flying; drag and gravity are the two forces that work to shorten an airplane's flight.

#### **Thrust** - The force that pushes an airplane forward.

An airplane's thrust is a mechanical force generated by its engine or propeller. In a paper airplane, the thrust is generated by someone's arm throwing it.

#### **Lift** - The force that pushes an airplane up.

An airplane has specially designed wings called airfoils that move the air on the top of the wing faster than the air below the wing, creating higher pressure under the wing. Energy flows from higher to lower energy levels; the difference in pressures above and below the wing causes the upward force called lift.

#### **Gravity** - The force that pulls an airplane down.

Gravity is the force that pulls everything toward the center of the earth. The more massive an object is, the greater the force of gravity. Airplanes that are lighter will need less thrust and lift to go up and stay in the air. Adding weight at the rear of a plane will move the center of gravity aftward. (Note: As youth experiment it is important to know that the addition of paperclips may initially improve flight performance, but with enough paperclips, it will eventually make flight unstable.)

#### **Drag** - The force that pushes against an object.

Airplanes are designed long and skinny, with a pointed nose so that they can move through the air with reduced resistance, or drag. If an airplane had a wider surface it would have to push more air out of the way, requiring more energy, to move forward.

#### **Materials**

- ⇒ 8 ½" x 11 paper (1 per youth)
- ⇒ Paperclips (4-5 per youth)

#### **Optional**

- ⇒ Colored pencils/markers/crayons (to share)
- ⇒ Scissors (to share)
- ⇒ Stickers

#### **Sources**

- ⇒ National Aeronautics and Space Administration: [www.grc.nasa.gov/www/k-12/UEET/StudentSite/dynamicsofflight.html](http://www.grc.nasa.gov/www/k-12/UEET/StudentSite/dynamicsofflight.html)
- ⇒ National Museum of the U.S. Air Force: [www.nationalmuseum.af.mil/Education/ForEducators.aspx](http://www.nationalmuseum.af.mil/Education/ForEducators.aspx)
- ⇒ Virginia 4-H, Planes in Flight: <http://it.cals.vt.edu/ProjectPortfolio/InstructionalModules/multimedia/PlanesInFlight-multimedia.html>

[www.ext.vt.edu/topics/4h-youth/makers](http://www.ext.vt.edu/topics/4h-youth/makers)

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#### **Making and Exploring Further**

Make activities encourage problem solving through trial and error, allowing for individual creativity and experimentation. Youth will ignite their curiosity and expand their critical thinking skills as they move from the planned and guided activity to an open exploration of different materials and methods.

- ⇒ Encourage youth to make airplanes that are different designs and sizes.
- ⇒ Encourage youth to test and compare flights with other household items such as paper towel or toilet paper rolls, paper plates, disposable pie tins, straws, or plastic lids.