Forces of Flight

Gliding

Your hand controls the angle of the pterosaur’s wings—called the *angle of attack*.

*Weight arrow beneath pterosaur*

WEIGHT pulls the pterosaur down.

*Weight arrow beneath pterosaur, and Lift arrow above*

LIFT counteracts WEIGHT. Rotate your hand. A steeper angle of attack gives you more LIFT.

*Boundary layer graphics*

A layer of air rushes over the top of the wing. The wing’s shape pulls this boundary layer down, lifting the pterosaur up.

*Ability to stall at critical angle of attack*

But what happens when the angle of attack is too steep? Find out.

*Stall graphics*

When the boundary layer breaks away from the wing there is no more LIFT. The pterosaur *stalls*...and starts to sink.

Flapping

*pterosaur on screen, with ability to flap*

Move your hand up and down to flap.

*Drag arrow behind pterosaur*

DRAG pushes back against the pterosaur when flying.

*Thrust arrow ahead of pterosaur*

THRUST counteracts DRAG. Pterosaurs must create THRUST—but how?

*diagonal downstroke lines from wings*

Pterosaurs generate THRUST by flapping. On a downstroke, the wings cut diagonally through the air.

*show lift arrow moving forward, transitioning to thrust*

LIFT is always perpendicular to the movement of air over a wing. The diagonal wing movement tilts LIFT forward. THRUST is the forward part of LIFT.