



Aerodynamics Index

Here is a list of all the topics available from the Beginner's Guide to Aerodynamics (BGA) site. Clicking on the title will deliver a page with a slide and a scientific explanation of the contents. Click on the word "Animated" for the animated version of selected pages. If the number and variety of pages seems too intimidating, consider taking one of our [Guided Tours](#) through the web site.

Another method for reaching students, teachers and lifelong learners is the use of **Distance Learning**. While preparing presentations for students, many [Power Point files](#) have been developed for the [Digital Learning Network](#) using information from the BGA. [Another group](#) of Power Point presentations has been prepared concerning the exploration of space. Students and teachers are encouraged to copy the Power Point files to their own computers and to modify them as desired for their own presentations. We have also created a home page for all of our [movies](#) featuring Wilbur and Orville Wright.

* Animation files can be large (average 350K bytes)

** Java Applet

<div style="border: 1px solid black; padding: 5px; text-align: center; color: red; font-weight: bold;">STUDENT ACTIVITIES</div> <p>NASA Glenn History and Missions Activities FoilSim Activities Basic Aerodynamics Activities Aerospace Lesson Plans Cross-Word Puzzle Activity Airplane Gallery</p>	<div style="border: 1px solid black; padding: 5px; text-align: center; color: blue; font-weight: bold;">AIRPLANE PARTS</div> <p>Airplane Parts Definitions Fuselage Turbine Engines Wing Geometry Definitions .Interactive** Winglets Elevator .Movie..Interactive** Aileron .Movie..Interactive** Rudder .Movie..Interactive** Spoilers .Interactive** Flaps and Slats .Interactive** Stabilator .Interactive** Pitot-Static Tube - Speedometer</p>
<div style="border: 1px solid black; padding: 5px; text-align: center; color: red; font-weight: bold;">SCIENCE FUNDAMENTALS</div> <p>Three Phases of Matter Newton's Laws of Motion Movie Newton's First Law - Inertia Newton's Second Law - Force Newton's Third Law - Action & Reaction Torques (Moments) Forces and Torques Equilibrium - 2 Forces Equilibrium - 3 Forces Equilibrium - 2 Torques</p>	<div style="border: 1px solid black; padding: 5px; text-align: center; color: green; font-weight: bold;">AIRCRAFT FORCES</div> <p>Four Forces on an Airplane .Movie What is Weight? .Movie What is Lift? .Movie What is Drag? .Movie What is Thrust? .Movie Lift to Drag Ratio Thrust to Weight Ratio Excess Thrust (Thrust - Drag) Forces in a Climb Vectored Thrust Airplane Cruise - Balanced Forces Trimmed Aircraft Momentum Effects Density Effects .Interactive** Velocity Effects .Interactive**</p>
<div style="border: 1px solid black; padding: 5px; text-align: center; color: blue; font-weight: bold;">MATH FUNDAMENTALS</div> <p>Functions Rectangular and Polar Coordinates Area Volume Displacement, Velocity, Acceleration Angular Displacement, Velocity, Acceleration Scalars and Vectors Comparing Two Scalars - Ratio</p>	<div style="border: 1px solid black; padding: 5px; text-align: center; color: red; font-weight: bold;">AERODYNAMICS</div> <p>Aerodynamic Forces</p>

Comparing Two Vectors Vector
 Addition
 Vector Components Trigonometry
 Sine-Cosine-Tangent Ratios in
 Triangles
 Pythagorean Theorem *Interactive***

ANALYSIS

Conservation of Mass Conservation of
 Momentum Conservation of Energy
 Euler Equations
 Bernoulli's Equation Navier-Stokes
 Equations
 Lift of Rotating Cylinder *Interactive***
 Ideal Lift on Spinning Ball *Interactive***
 Ideal Flow Around Spinning
 Ball *Interactive***
 Conformal Mapping... *Interactive***

STATIC GASES

Animated Gas Lab...*Animated* Gas Properties
 Definitions Equation of State (Ideal Gas)
 Specific Heats - cp and cv Boyle's
 Law...*Animated*
 Charles and Gay-Lussac's Law...*Animated*
 Specific Volume
 Kinetic Theory of Gases

THE ATMOSPHERE

Interactive Atmosphere Simulator The Atmosphere
 Air Properties Definitions Air Pressure
 Air Temperature Air Density
 Air Viscosity *Interactive*** Earth Model - Imperial Units
 Earth Model - Metric Units Mars Model - Imperial Units
 Mars Model - Metric Units
 Relative Velocity - Ground Reference .. *Interactive***
 Relative Velocity - Aircraft Reference Cross Winds
 Updrafts and Downdrafts Lightning Strike

SPEED REGIMES

SoundWave Interactive Simulator
 Dynamic Pressure
 Center of Pressure - cp
 Aerodynamic Center
 Similarity Parameters *Interactive***
 Reynolds Number *Interactive***

Boundary Layer
 Mass Flow Rate
 Definition of Streamlines

THRUST

Beginner's Guide to Propulsion
EngineSim Interactive Simulator
 Thrust Equation

HEIGHT

Determining Aircraft Weight
 Center of Gravity - cg *Movie*
 Aircraft Center of Gravity - cg
 Weight Equation *Movie*

LIFT

FoilSim III Interactive Simulator
 Bernoulli and Newton
 Objects with Lift *Interactive***
 Lift from Flow Turning *Interactive***
 Shed Vorticity
 Equal Transit Theory *Interactive***
 Skipping Stone Theory *Interactive***
 Half Venturi Theory *Interactive***
 Factors That Affect Lift
 Shape Effects on Lift *Interactive***
 Size Effects on Lift *Interactive***
 Inclination Effects on Lift *Interactive***
 Downwash Effects on Lift
 Lift Equation *Movie*
 Lift Coefficient

DRAG

Factors That Affect Drag Shape
 Effects on Drag
 Drag on a Sphere...*Animated* Size Effects on
 Drag Inclination Effects on Drag Drag
 Measurement
 Induced Drag Coefficient Drag
 Equation *Movie* Drag Coefficient

GLIDERS

Gliders
 Paper Airplanes...*Plans*



Compressible Aerodynamics
 Mach Number..Interactive**
 Speed of Sound ..Interactive**
 Subsonic
 Transonic
 Supersonic
 High Supersonic
 Hypersonic
 Re-Entry
 Mach Calculator

OBJECT MOTION

DropSim Interactive Simulator
 Basic Object Motion
 Object Motion Due to a Side Force
 Ballistic Flight..Interactive**
 Falling Objects - Newton's First Law
 Motion of Free Falling Object
 Free Fall without Air Resistance
 Falling Object with Air Resistance
 Terminal Velocity..Interactive**
 Flight with Drag..Interactive**
 Ballistic Flight Calculator

AIRCRAFT MOTION

RangeGames Interactive Simulator
 Simplified Aircraft Motion
 Aircraft Motion - Newton's First Law
 Aircraft Motion - Newton's Second Law
 Aircraft Translations
 Aircraft Rotations
 Roll..Movie..Animated
 Pitch..Movie..Animated
 Yaw..Movie..Animated
 Banking Turns
 Range - Constant Velocity
 Maximum Flight Time
 Range Summary

Fun with Gliders
 Space Shuttle as a Glider
 Three Forces on a Glider
 Glide Angle
 Vector Balance of Forces - Glider
 Glider Trajectory Problem

MODEL ROCKETS

Beginner's Guide to Model Rockets
 RocketModeler Interactive Simulator

KITES

Beginner's Guide to Kites KiteModeler Interactive Simulator

WIND TUNNELS

Beginner's Guide to Wind Tunnels
 TunnelSim Interactive Simulator

SPORTS

Baseball Home Page
 HitModeler Interactive Simulator
 HitModeler Weather Interactive Simulator
 CurveBall Student Interactive Simulator
 CurveBall Expert Interactive Simulator
 Soccer Home Page
 SoccerNASA Interactive Simulator

MISCELLANEOUS

Wright Brothers Aircraft
 Let's be Specific
 Venus Airfoil

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