Flight and Rocketry

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About **Flight and Rocketry**

DeltaScienceModules, THIRD EDITION

Students explore the fundamentals of flight by assembling and experimenting with a hangar full of flying machines. Before they "take off," students investigate the properties of air, especially that air exerts pressure. Then they build parachutes, kites, and hot-air balloons to demonstrate air resistance, wind speed and angle, and lighter-than-air flight. Paper airplane trials prove that shape determines flight path and duration. Next, students discover how the airfoil design of both fixed wings and helicopter rotors creates lift. They construct propeller-driven and simulated jet vehicles to explore plane power, and they learn to control flight by adding ailerons, elevators, and rudders to gliders. Students cap off the unit by building and launching fuel-powered model rockets.

In the Delta Science Reader *Flight and Rocketry,* students read about the two types of flight—gliding flight and true flight. They learn about both lighter-than-air flight and heavier-than-air flight and about different types of flying machines, from parachutes and airships to jets and spacecraft. They find out about the forces at work in flight and how Bernoulli's principle explains lift. They are also introduced to the Wright brothers, who made the airplane that flew the first powered, controlled flight. Finally, students learn about milestones in the history of flight.

Overview Chart for Hands-on Activities

Hands-on Activity	Student Objectives
1 **Properties of Air** *page 13*	• demonstrate that air takes up space and has weight • learn that air is made up of molecules that move around in all directions • discover that the molecules that make up air exert pressure on the surfaces they bump into
2 **Parachutes** *page 23*	• define gravity as a force that pulls objects downward, toward Earth • observe the effects of air resistance on falling objects • build and launch parachutes • compare the rate of descent of different-size parachutes
3 **Hot-Air Balloons** *page 33*	• test different objects to see if they float in water • relate an object's ability to float to its density • discover that warm air is less dense than cool air • launch a solar-heated hot-air balloon
4 **Kites** *page 45*	• explore the role of wind in keeping a kite aloft • observe how the angle of attack contributes to lift • build and fly their own kites
5 **Airplane Design** *page 55*	• build and fly two different types of paper airplanes • observe how the shape of the paper airplane affects its flight performance • identify the parts of a real airplane • discover that streamlining reduces drag in flight
6 **Bernoulli's Principle** *page 65*	• observe that air flowing around objects may cause the objects to behave in unexpected ways • blow across a strip of paper to demonstrate the pressure drop in a fast-moving stream of air • discover why the pressure exerted by moving air decreases the faster it flows
7 **Airfoils** *page 73*	• identify the curved shape of airplane wings • construct model wings and observe the effect of moving air on each model • relate their observations to Bernoulli's Principle
8 **Propeller Planes** *page 81*	• relate the shape of a propeller blade to an airfoil • assemble a model propeller plane • observe how spinning propellers produce thrust • conclude that an increase in power results in an increase in thrust
9 **Jet Planes** *page 91*	• assemble and experiment with a balloon-powered jet craft • discover the principles of jet propulsion • relate an increase in power to an increase in thrust
10 **Controlling a Plane** *page 99*	• identify the control surfaces of an airplane • investigate how changing the position of the control surfaces changes the flight path of the plane
11 **Helicopters** *page 111*	• name the parts of a helicopter • relate the shape of the rotor blades to an airfoil • observe how spinning rotor blades produce lift • discover how tilting the spinning rotor produces thrust in any direction
12 **Rockets** *page 121*	• distinguish between a rocket engine and a jet engine • build a model rocket complete with an internal fuel source • observe how a rocket engine provides the thrust needed to launch a spacecraft into orbit • discuss the importance of streamlining in rockets
Assessment *page 131*	• See page 131.

Process Skills	Vocabulary	Delta Science Reader
predict, observe, infer	**air pressure, molecule**	pages 2–3, 7
observe, define based on observations, hypothesize, experiment, use variables, compare	**air resistance, canopy, gravity, surface area**	page 4
experiment, use variables, infer, make and use models	**density, envelope, lift**	page 5
observe, make and use models	**angle of attack**	page 4
observe, compare, use numbers, define based on observations	**drag, fuselage, streamlined, tail assembly, wings**	pages 6, 7
observe, predict, hypothesize, experiment	**Bernoulli's principle**	pages 2–3
make and use models, observe, compare	**airfoil**	pages 2–3, 8
compare, make and use models, observe, measure, infer	**blade, hub, propeller, thrust**	page 7
experiment, use variables, measure, define based on observations	**jet engine**	pages 10–11
experiment, use variables, observe	**ailerons, control surfaces, elevators, rudder**	page 9
make and use models, compare, predict, observe	**rotor**	page 12
compare, make and use models, observe, communicate	**rocket, rocket engine**	page 13

See the following page for the Delta Science Reader Overview Chart.

Overview Chart for Delta Science Reader
Flight and Rocketry

Selections	Vocabulary	Related Activity
Think About...		
What Is Flight? *page 2*	airfoil, Bernoulli's principle, gliding flight, lift, parachute, pressure, propulsion, thrust, true flight	Activities 1, 6, 7
Trying to Fly *page 4*	drag, friction, gravity	Activities 2, 4
Lighter-Than-Air Flight *page 5*	airship, hot-air balloon	Activity 3
Heavier-Than-Air Flight *page 6*	glider	Activity 5
Forces in Flight *page 7*	aerodynamics, propeller, weight	Activities 1, 5, 8
Structure of Airplanes *page 8*	aeronautics, stability	Activity 7
Controlling an Airplane *page 9*	controls	Activity 10
Jet Aircraft *page 10*	jet engine	Activity 9
Helicopters *page 12*	helicopter, rotor	Activity 11
Rockets *page 13*	rocket, rocketry	Activity 12
People in Science		
• **The Wright Brothers** *page 14*		
Did You Know?		
• **About the History of Flight** *page 15*		

See pages 139–148 for teaching suggestions for the Delta Science Reader.

MATERIALS LIST

Flight and Rocketry

Quantity	Description
8	bags, plastic, dry-cleaning
20	balloons, long
30	balloons, round*
1	ball, table tennis
8	bases, for balance
50	beads, plastic
8	beams, for balance
8	bottles, plastic
16	bowls, plastic
1	clay, modeling, 0.25 lb*
32	clothespins, wooden
1	cup, plastic, 10-oz
1	Dart Design
1	fishing line, 250 m*
1	funnel
20	gliders, foam*
1	index cards, p/100*
1	jar, plastic, with lid
1	Kite Tail Pattern
1	marble, glass
1	marble, wooden
1	paper clips, large, p/100*
1	paper clips, small, p/100*
8	pins, for balance
1	pipe cleaners, p/50*
20	rubber bands
1	seltzer tablets, p/36*
1	Slider Design
1	solar balloon
4	sticky notes, p/100*
1	straws, plastic, p/150*
6	string, kite, 180 m
1	tape, masking*
3	tape, transparent*
1	Tips for Safe Kite Flight
50	tongue depressors*
8	vials, with caps
16	whirligigs

Quantity	Description
1	Wing Templates
9	Wingless Wonder packets
1	**Teacher's Guide**
8	**Delta Science Readers**

TEACHER-PROVIDED ITEMS

Quantity	Description
16	chairs
–	crayons, red and blue
1	fan, electric, small
–	glue
1	hair dryer, hand-held
1	ice, 5 lb
103	paper, plain
–	paper towels
32	pencils
1	penny
–	pictures of airplanes
–	pictures of hot-air balloons
–	pictures of parachutes and skydivers
–	pictures of space shuttle
1	pitcher
1	rock, heavy
16	rulers, metric
32	safety goggles
33	scissors
–	water, tap

* = consumable item

† = in separate box

ACTIVITY SUMMARY

In this *Delta Science Module*, students are introduced to the fundamentals of flight.

ACTIVITY 1 Students learn that air takes up space, has weight, and because it is made up of molecules that move around in all directions, exerts pressure on the surfaces it bumps into. Understanding the properties of air is necessary in order to understand how aircraft fly.

ACTIVITY 2 Students examine parachutes and learn that gravity is the force that pulls all objects down, toward Earth. Then they make simple parachutes to demonstrate how air resistance can counteract the effects of gravity by slowing the rate at which an object falls.

ACTIVITY 3 Students experiment with a hot-air balloon, a lighter-than-air craft that achieves lift by floating. Through simple trials, students discover that an object will float when it is less dense than the medium around it. Later in the activity, students launch a solar-heated balloon and apply what they have learned about density to explain how it floats.

ACTIVITY 4 Students build and fly their own paper kites—the oldest and simplest type of heavier-than-air craft. They learn that heavier-than-air craft achieve lift by the movement of air against and around their surfaces. Students explore the role of wind in keeping a kite aloft, and the importance of the kite's angle to the wind.

ACTIVITY 5 Students learn about basic airplane design. By building and flying two different types of paper airplanes, students discover how the shape of the craft affects its performance.

ACTIVITY 6 Students discover how lift is achieved in fixed-wing aircraft. They are introduced to Bernoulli's Principle, which states that increasing the velocity of a fluid lowers its pressure. By blowing across a strip of paper and watching it rise, students demonstrate how a pressure differential can cause an object to move.

ACTIVITY 7 Students learn how the airfoil shape of an airplane's wings creates a pressure differential above and below the wing, which lifts the airplane into the air.

ACTIVITY 8 Students learn how the airfoil shape of propeller blades produces the thrust that moves the plane forward. Then they build their own propeller-driven craft and launch it down a fishing-line runway.

ACTIVITY 9 Students continue to examine power sources in airplanes, in particular, jet engines. Students learn that jet engines produce thrust by the explosive movement of gases through the engine unit. Then they build their own balloon-powered jet craft and launch it down a fishing-line runway.

ACTIVITY 10 Students find out how an airplane is steered by adjusting the control surfaces on a toy glider. Students learn how to alter the orientation and direction of motion of an airplane in flight.

ACTIVITY 11 Students are introduced to rotary-wing aircraft: helicopters. Students learn how the airfoil-shaped rotors provide lift, and how tilting the rotors produces thrust in any direction. Students then launch a whirligig to demonstrate how helicopters can move straight up, forward, backward, and to either side.

ACTIVITY 12 Students build a model that uses both solid and liquid "fuel" and launch it outdoors. Students learn about rocket propulsion and solid-fuel and liquid-fuel rocket engines.