

CORE SUBJECTS: EARTH SCIENCE, ATMOSPHERIC SCIENCE

## ALTITUDE, ATTITUDE, AND SPEED

are just a few of the things pilots monitor during every flight. Pilots initially learn to control the airplane by looking out the window and using the horizon as reference. Most airplanes, however, have an array of gauges and indicators, known as flight instruments, in a panel similar to the dashboard of a car. The panel of flight instruments provides the pilot with critical information about his or her airplane while flying. You can use the basic gauges of an aircraft to introduce your students to the concepts of airspeed, altitude, attitude or position, as well as how to use a compass.

### SIX INSTRUMENTS COMMON TO MOST GENERAL AVIATION AIRCRAFT:

#### AIRSPPEED INDICATOR



A gauge that displays the airplane's speed through the air, based on the difference between ambient air pressure

and ram air pressure. Typically shows airspeed in knots (nautical miles per hour) or in miles per hour.

#### ATTITUDE INDICATOR OR ARTIFICIAL HORIZON



An indicator that shows whether the airplane is pitched up or down, or banked (tilted) left or right. Here the orange bars indicate

wing position relative to the ground as shown by the white line.

**ALTIMETER**



**3** A highly sensitive barometer that shows an airplane's altitude above sea level by measuring ambient pressure. The large numbers mark hundreds (long hand) or thousands (short hand) of feet.

**TURN COORDINATOR**



**4** A gyro-based instrument that shows the tilt of the wings. The position of the ball indicates if the airplane is in a coordinated turn. A turn is "coordinated" if the rate of turn is appropriate for the amount of bank angle.

**HEADING INDICATOR OR DIRECTIONAL GYRO**



**5** An indicator that displays aircraft heading, based on the 360-degree compass rose. The pilot sets the heading indicator based on the aircraft's magnetic compass prior to taking off, and checks it against the compass in flight to ensure it stays accurate.

**VERTICAL SPEED INDICATOR**



**6** An instrument sensitive to changes in ambient air pressure. It takes the rate of change and displays it as rate of climb or descent. Reads in hundreds of feet per minute.

**DEFINITIONS**

**Ambient air pressure:** The pressure of the air that is around you and the aircraft. Air pressure decreases as altitude increases, so the changes in ambient air pressure affect the aircraft's altimeter.

**Ram air pressure:** The pressure of air as it is forced into a forward facing inlet. In general aviation, when the airplane moves forward, air is forced into an instrument called a pitot tube that is

affixed to the wing. This ram pressure is compared against the undisturbed air in a static port to determine the airspeed of the aircraft.

## ACTIVITY: Panel decoder



Photocopy this activity for classroom use.  
Go to [www.aopa.org/path](http://www.aopa.org/path) for student worksheets.

### TEACHERS:

From this activity, students will learn how to read the instruments and establish relationships between the indications on the instruments and the airplane's flight path.

TAKE A LOOK AT THE FOLLOWING PANEL AND SEE IF YOU CAN FIGURE OUT WHAT THE INSTRUMENTS ARE TELLING YOU.



Numbers in photo refer to instrument descriptions in the opening pages of this module

### QUESTIONS:

1. What is the airplane's indicated airspeed?
2. At what altitude is the airplane?
3. Is the airplane in a turn? What two instruments can you look at in order to know?
4. Is the airplane climbing or descending? What instrument(s) are you looking at in order to make this conclusion?
5. What direction is the airplane headed at this moment?
6. Based on your answer to Question #3, is the airplane's heading changing or staying the same?
7. If power has remained constant, based on your answer to Question #4, do you think the airspeed is increasing, decreasing, or remaining constant?
8. How long will it take the airplane to descend 1,000 feet?