DESCRIPTION: A whirling tube makes musical notes demonstrating the Bernoulli Theorem.

TOPIC: Air Properties

DESCRIPTION: A whirling tube makes musical notes demonstrating the Bernoulli Theorem.

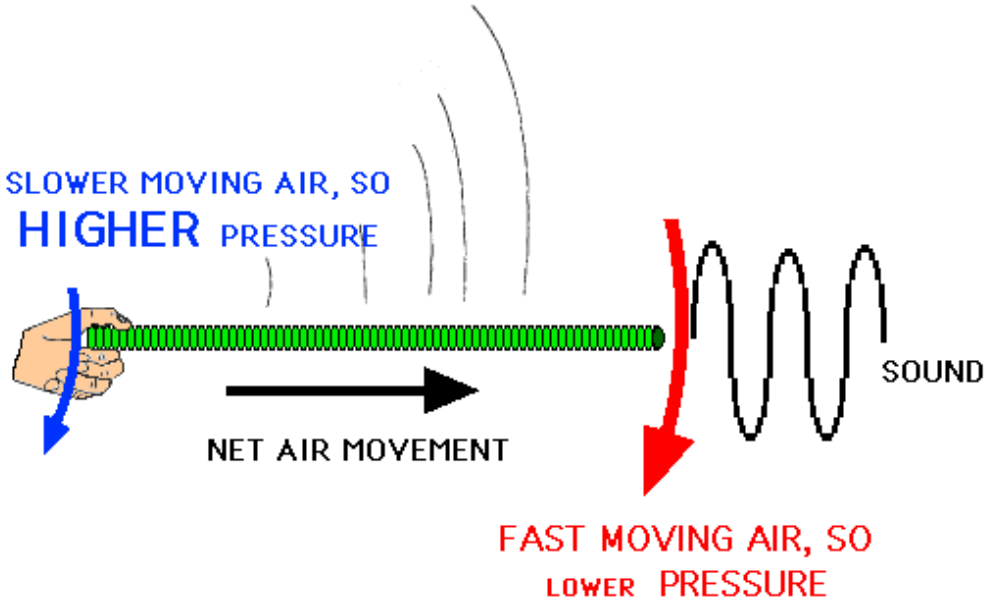
CONTRIBUTED BY: Gregory Vogt, OSU

EDITED BY: Roger Storm, NASA Glenn Research Center

MATERIALS: Corrugated flexible plastic tube (Corrugated tubing is available from swimming pool supply stores. Ask for a piece about 1 meter long. Tubing is also available from toy stores under names such as Whirl-A-Tune ™

PROCEDURE:

1. Hold the tube at one end and twirl the other end rapidly through the air. Make sure not to hit anything with the whirling end. A musical note will be produced.



2. Whirl the tube at different speeds. What happens to the pitch? Why do you think this happens?

3. Plug the end of the tube in your hand with a cloth and spin the tube. Is a sound produced? Why or why not?

DISCUSSION:

The musical tube provides an audible demonstration of the Bernoulli Theorem. The free end of the tube moves through the air much more rapidly than the end in your hand. Consequently, the velocity of the air around the free end is much greater than the velocity around the end in your hand.

Bernoulli's Theorem, in general terms, describes the relationship in a fluid between pressure and velocity. Where the velocity is greater, the pressure is smaller and vice versa. The velocity of the air around the moving end of the tube is greater and therefore the air pressure there is smaller than at the slowly moving end. Inside the tube, the air is relatively stationary. However, a pressure differential is created between the two ends and air flows from the slowly moving end to the fast moving end where it spills out. The tube's corrugations cause the air to vibrate as it travels from one end of the tube to the other. The vibration produces the musical note. When the tube is moving faster, the vibration frequency increases raising the pitch. When the tube is plugged, no air flows and the sound is stopped.

The musical tube can be used to demonstrate the same pressure changes that also take place around an airplane’s wing. By making air flow faster over the top of a wing than below it, a major share of aerodynamic lift is produced because the pressure on the bottom of the wing where the air is moving slower is greater than the pressure on the top of the wing where the air is moving faster. Thus the wing is pushed upwards by the difference in pressure. This is lift.