Wright-Patterson AFB Educational Outreach

K-12 STEM

WPAFBSTEM.com

DIY Air Force Activities:

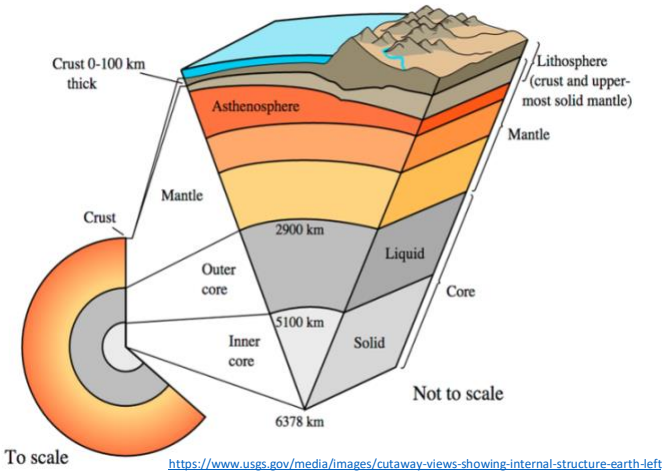
Seismograph Simulation

WOW DIY WIZARDS of WRIGHT

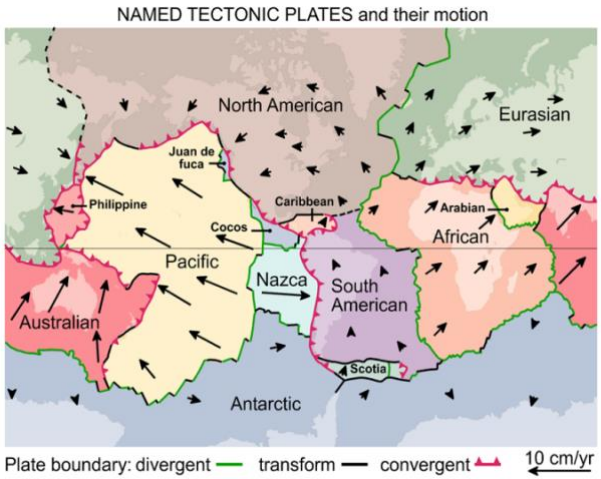
Materials:

- medium sized box (shoebox sized works great!)
- string or yarn
- marker
- paper or Styrofoam cup
- scissors or craft knife (*adult supervision suggested)
- tape
- paper

Geologists are scientists that study the earth. Through their studies we have learned that the Earth is made up of many layers, with a solid crust floating on top of a molten inner core (see image on right). Even the Earth's surface is not one solid piece, but composed of many plates that move and shift. Geologists use a theory called plate tectonics to describe this motion. The map on the left also shows the behavior of the plates at the boundaries between them. The surface of our planet shifts a little each year. This happens slowly, but can have huge consequences, like earthquakes!



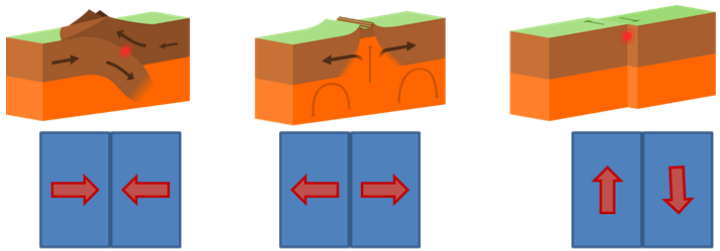
https://www.usgs.gov/media/images/cutaway-views-showing-internal-structure-earth-left



https://commons.wikimedia.org/wiki/File:Tectonic_plates_boundary_types_%26_movement.png

The image on the lower right illustrates the three different ways plates can move. First, the crust is destroyed as one plate is pushed under another at convergent boundaries. Second, the plates pull away from one another, and new crust is formed at divergent boundaries. Lastly, plates slide horizontally past each other and the crust is neither created nor destroyed at transform boundaries. The potential energy stored in the crust is released when the masses of rock slip and fracture at the boundaries, or fault lines. This energy radiates out in seismic waves that cause the earth to shake.

Geologists, use a tool called a seismograph to measure the waves resulting from earthquakes. When the earth shakes, a seismograph records the magnitude of the motion as well as the time period of the disturbance. During an earthquake there are primary (P) waves that travel faster than the secondary (S) waves. The difference between when a P wave and an S wave reach the seismograph helps geologists estimate how far away the earthquake occurred! Follow the instructions on the back of this page to ***build and test your own***



Air Force Associations:

The Albuquerque Seismological Laboratory (ASL) at Kirtland Air Force Base is a location where seismograph instruments are operated and tested. The sites location is remote, so tests can be run without any major disturbances from manmade noise sources. The ASL houses extremely low noise seismometer test facilities that are integral in evaluating and developing seismic instrumentation for the Global Seismic Network (GSN).

WIZARDS of WRIGHT LEADERS IN STEM EDUCATION

Seismographs used to be composed of a base with a pendulum attached to a pen hanging above a roll of paper. Modern seismographs are now digital.

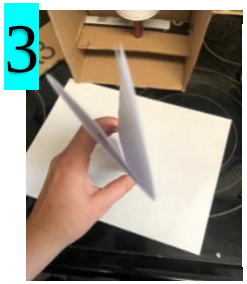
1

Step 1: Cut the flaps off of your box and set them aside. Take a long flap and cut it to the width of the box.

2

Step 2: Insert the cut flap as a shelf. It should fit snuggly, and not slide easily up or down. Use a piece of tape to secure it.

3

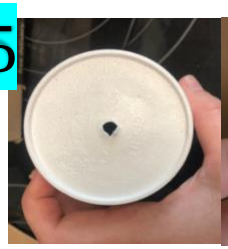


Step 3: Cut your paper in quarters lengthwise. You can tape the ends together to make a long strip!

4

Step 4: Cut a slit in the center of the sides of the box at the height of the shelf. It should be wide enough that the strips of paper can move easily through them across the shelf.

5



Step 5: Poke a hole in the center bottom of the cup so that your marker can fit snuggly inside and not fall through.

6

Step 6: Turn the cup on its side and poke two smaller holes along the rim directly across one another.

7

Step 7: Cut two pieces of string. They should be slightly shorter than the length of the box. Tie one end of each through the small holes on the sides of your cup.

8

Step 8: Poke two holes on the top of the box about a hands width apart (more if you have tiny hands!).

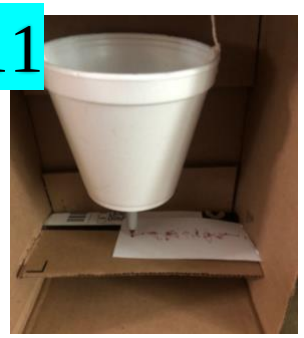
9

Step 9: Push the strings through the hole and secure with a single piece of tape. You should be able to pull on the strings to adjust the height of the now suspended cup and marker.

10

Step 10: Estimate the strings starting length by securing it at a point where the capped marker touches the stage.

11



Step 11: Now find a surface you want to test the stability of; this could be a table, chair, bed, or couch cushion. Push strip of paper through the holes. Uncap the marker and adjust the string so the maker barely touches the paper.

Now create an earthquake simulation! Vary the disturbance. Run, jump, or walk by the surface you are testing. You could even shake it directly. Observe what your seismograph records. Pull the paper through slowly to record fresh data. Repeat your activity either closer or further away. How does the data change as the distance of the event varies? What sites are most stable? You could layer some cardboard and slide it around to simulate tectonic plate movement! Earthquake science is fascinating and we have barely cracked the surface here. More information is just an internet search away! To learn more, research faults, Richter scale, and primary (P) and secondary (S) waves.