

The Ninety-Nines, Inc.,® International Organization of Women Pilots®

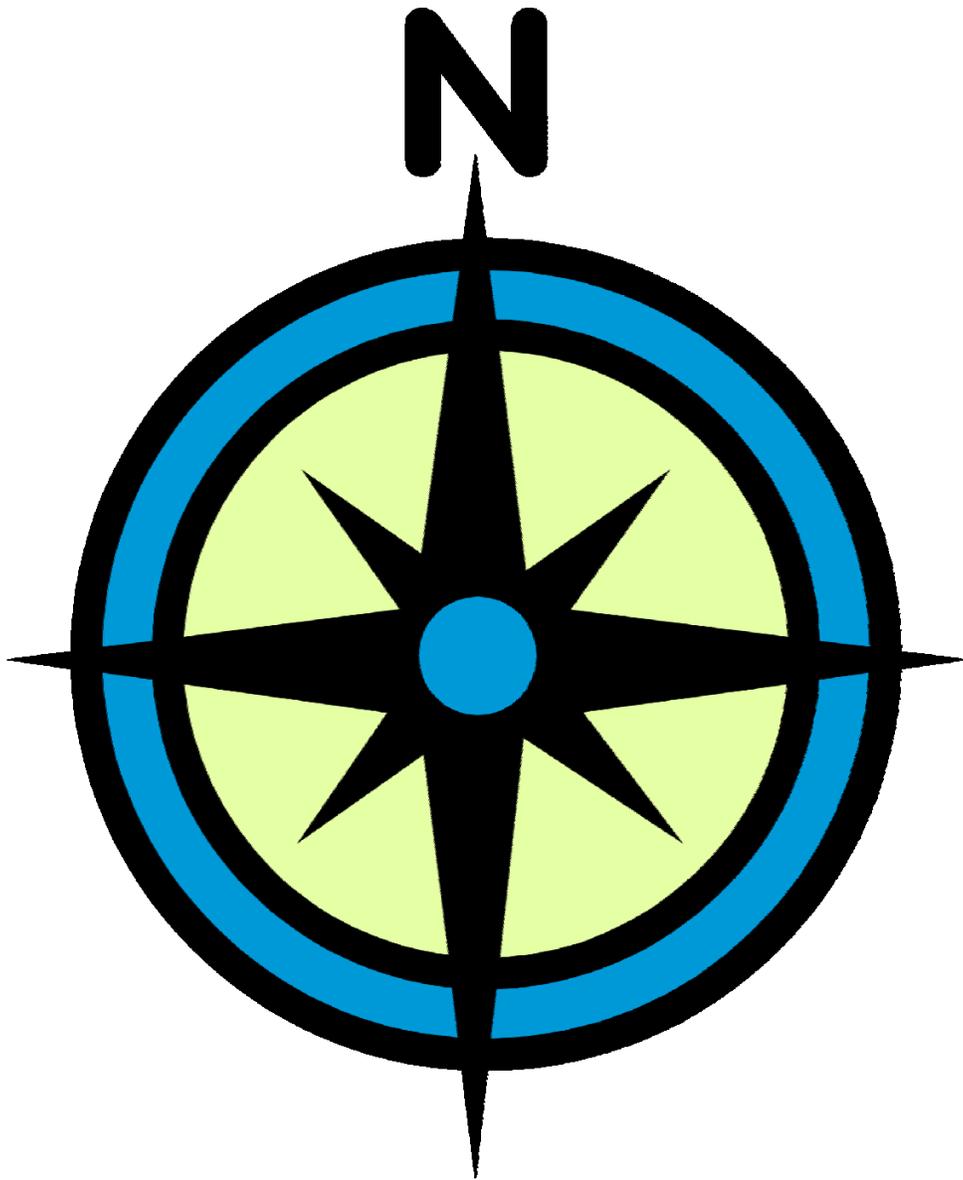
Aviation Adventure Guide

Module 4 - Navigation & the Compass



Module 4

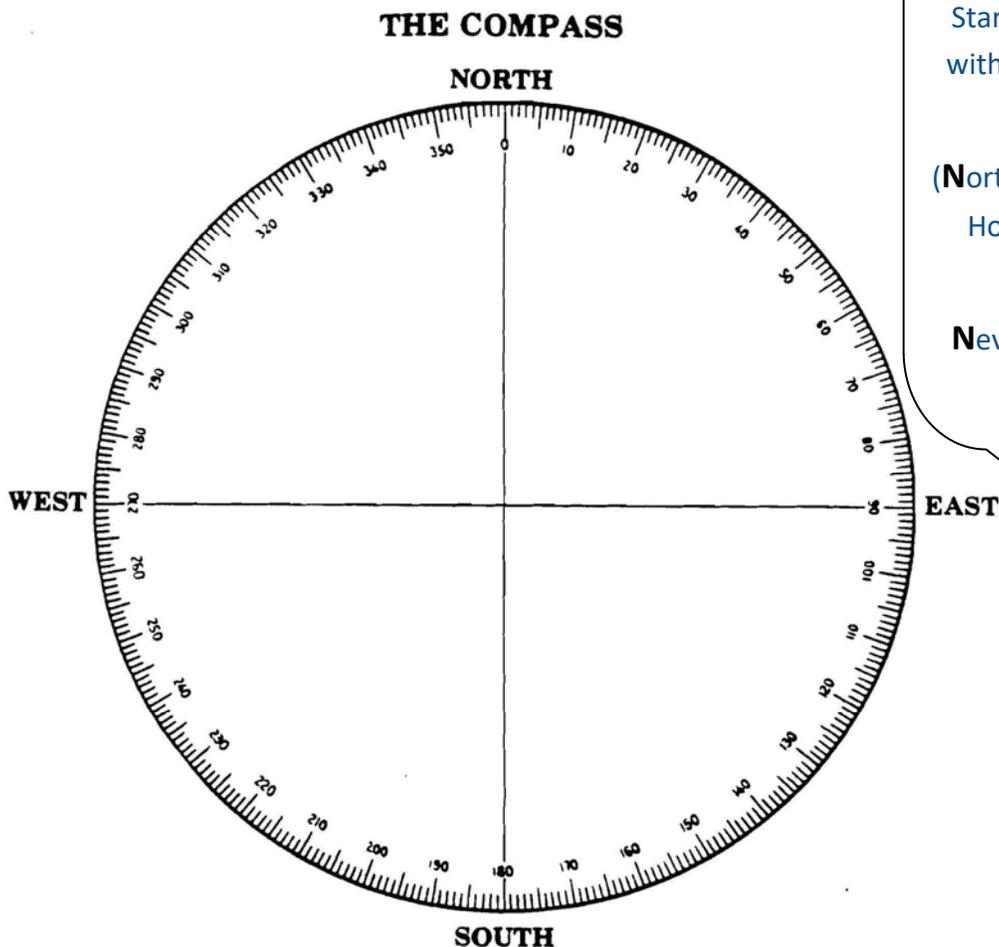
Navigation & the Compass



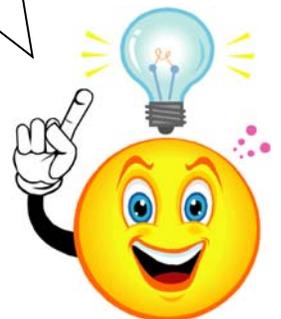
History of the Compass and Compass Measurement: A circle is one of the basic geometric shapes. A compass has the shape of a circle. A compass is a device used for many purposes including surveying and navigation. A ship at sea or an airplane in the air needs a way to determine direction. A magnetic compass is designed in such a way that the needle points to magnetic north. The other directions are known in relation to magnetic north.

In order for a compass to be a useful instrument, it must measure in any direction. The ancient Babylonians measured the movement of the earth in relation to certain stars. It was thought that it took 360 days for the earth to make one complete revolution around the sun until the star was visible in the same position again. The Babylonian calendar, therefore, had 360 days.

The circle was divided into 360 equal parts by the Babylonians and each part is today called a “degree”. The modern compass has 360 degrees. A degree is designated by the symbol °.



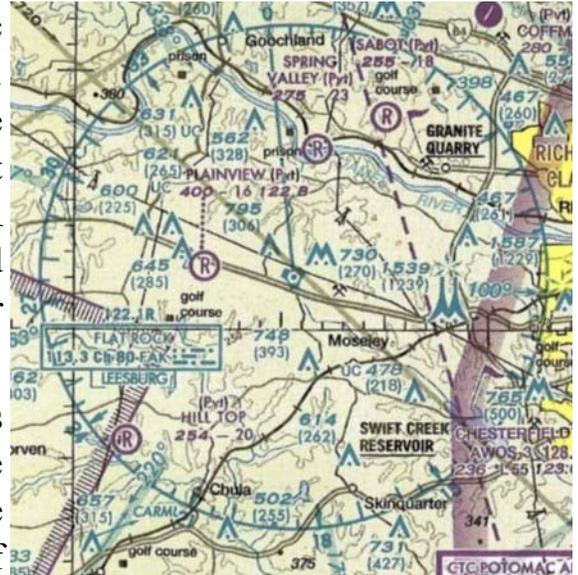
Here is a useful memory aid
for the compass directions.
Start at the top of the compass
with north and rotate clockwise
around the compass
(**N**orth to **E**ast to **S**outh to **W**est).
How can you remember the
order? Just think:
Never Eat Sour Watermelons!



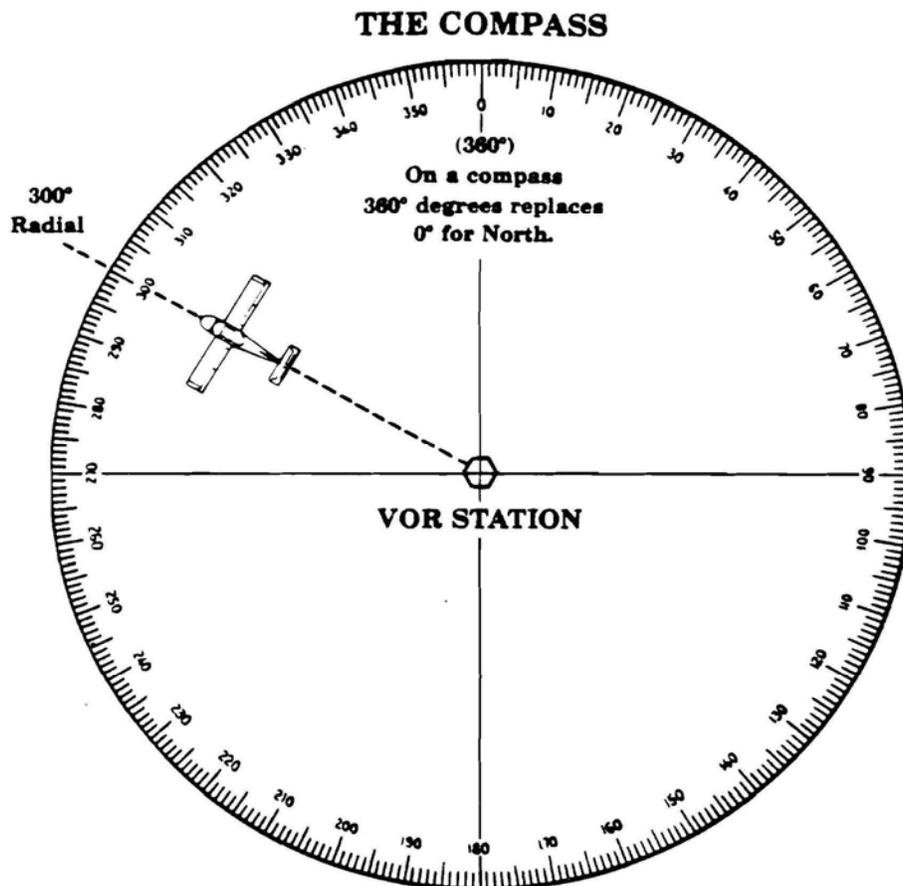
Compass Navigation: For many decades airplanes and ships have relied on the compass for directional information called “headings”. However, most airplanes today use either modern GPS (Global Positioning System) or older ground based radio transmitters which are designed to aid in air navigation. These transmitters are called VOR stations. On an aerial navigation chart, these stations are marked by a small hexagon (6 sided shape) with a compass rose around it. VOR stands for Very High Frequency Omni Range which is the technical, electronic description of the transmitter.

The pilot of an airplane may choose the magnetic heading that she wishes to fly to or from a VOR station. This heading is now called a “course” because it will be along a specific path over the ground. The exact magnetic direction which is flown away from a VOR station is called a “radial”. The term “radial” is used because the signal is being radiated out from the center of the VOR station in a specific magnetic direction.

In the example below, the airplane’s course or heading is on the 300° radial away from the VOR station. If the airplane were in the same place but headed in the opposite direction it would still be on the 300° radial of the VOR but the course or heading would be 120°.

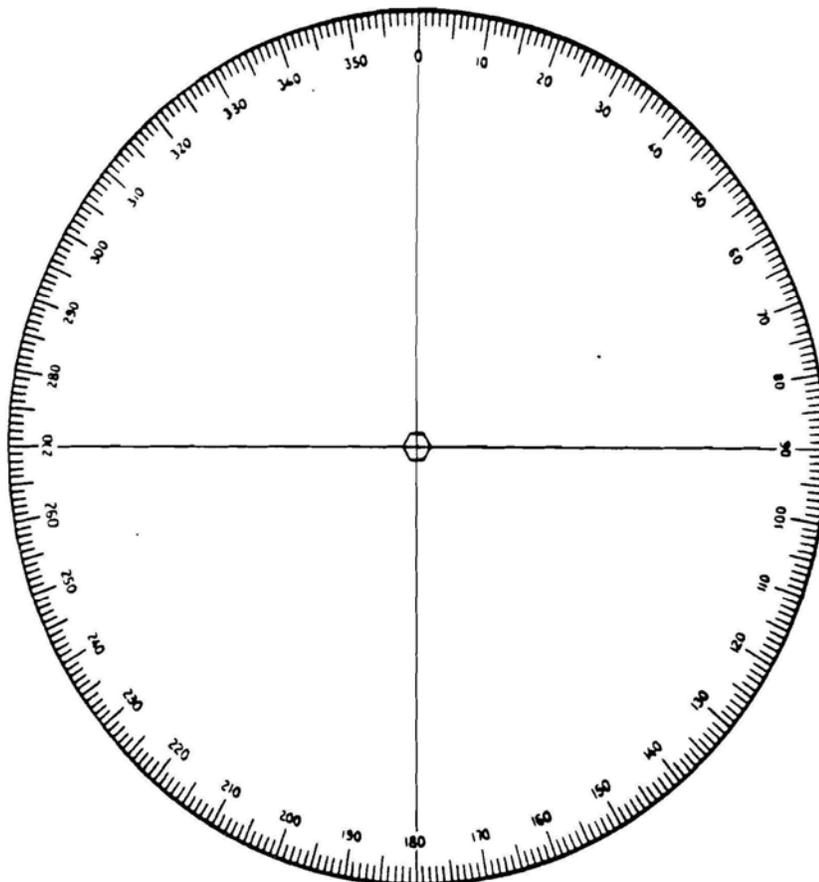


VOR depicted on a Sectional Chart

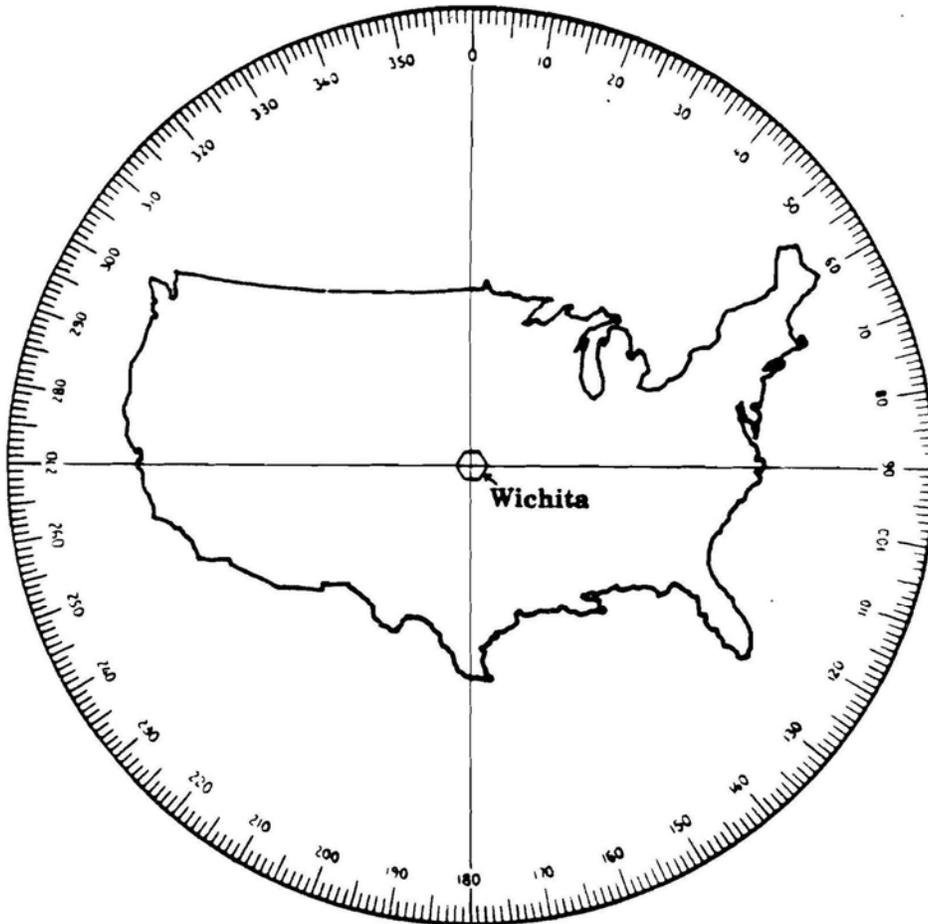


Activity - the Compass: Use the compass below for the following activities.

1. The CARDINAL points on the compass are north (N), south (S), east (E) and west (W).
 - A. Label each of these on the compass.
 - B. North corresponds to the _____° radial.
 - C. South corresponds to the _____° radial.
 - D. East corresponds to the _____° radial.
 - E. West corresponds to the _____° radial.
2. INTERCARDINAL points are points between the cardinal points.
 - A. Label NW, NE, SE and SW on the compass.
 - B. Northwest corresponds to the _____° radial.
 - C. Northeast corresponds to the _____° radial.
 - D. Southwest corresponds to the _____° radial.
 - E. Southeast corresponds to the _____° radial.
3. The distance between lines on a compass is called a _____.
4. There are _____ degrees on a compass.



THE COMPASS



Activity - Compass Navigation: Use the compass above to answer the following questions.

1. If you took a trip FROM Florida TO Wichita, KS which direction would you fly? _____
Draw your course on the compass above. What is your approximate heading? _____°
2. The direction FROM Wichita TO the Great Lakes is _____.
3. If you took a trip along the 235° radial from Wichita, what part of the United States would you be seeing? _____.
4. To get TO Canada FROM Wichita, which direction would you fly? _____
5. Plot a course TO Seattle, WA FROM Wichita on the compass above. Which direction have you chosen to fly? _____
6. If you were in Maine and wanted to go to Wichita, which direction would you fly? _____
Draw your course on the compass above. Along which radial do you travel? _____°

THE COMPASS



Activity - Navigation: You are in San Angelo at the VOR station. Find your approximate heading to fly to each of the following cities:

- | | |
|-------------------|-----------------------|
| Fort Worth _____° | Houston _____° |
| El Paso _____° | Lubbock _____° |
| Dallas _____° | Corpus Christi _____° |
| Laredo _____° | Beaumont _____° |
| Austin _____° | Wichita Falls _____° |
| Midland _____° | Amarillo _____° |
| Abilene _____° | Waco _____° |

COMPASS ROSE: A diagram, called a **compass rose**, shows the directions north, south, east, and west as abbreviated initials marked on the compass. When the compass is used, the rose can be aligned with the corresponding geographic directions, so, for example, the "N" mark on the rose really points to the north. Frequently, markings in degrees are shown on the compass. The symbol for degrees is $^{\circ}$. North corresponds to 0° or 360° , and the angles increase clockwise, so east is 90° , south is 180° , and west is 270° .

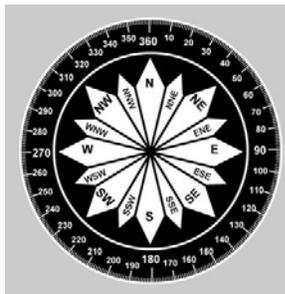
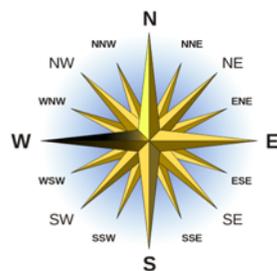
The compass rose first appeared on ships' navigational charts around the year 1300. "Rose" comes from the fact that the design looks like rose petals. The now standard 32-point compass rose with the fleur-de-lis indicating north and the cross indicating east evolved around the time of Christopher Columbus in 1492. The compass rose on a map or navigational chart provides directional information. A compass rose is often painted on the apron at many general aviation airports and is often a part of the airport's 'Air Marking' program. An airport compass rose is used to calibrate the aircraft magnetic compass in a procedure called "swinging the compass". It can also be a unique airfield identifier, due its placement, design or incorporation of the airport name or identifier.

Ninety-Nines and Air Marking: A program of identifying airports to pilots was started as the National Air Marking Program. This program was the first U.S. government program conceived, planned and directed by a woman with an all-woman staff. The program was a part of the Bureau of Air Commerce.



Fairhope, AL compass rose painted by Emerald Angels of the Gulf Coast Chapter 99s, EAA and volunteers from the Boys & Girls Club of South AL "No Limits" Girls Aviation Club.

In 1933, Phoebe F. Omlie was appointed Special Assistant for Air Intelligence of the National Advisory Committee for Aeronautics - NACA (forerunner of the National Aeronautics and Space Administration - NASA.) Under the program, a state was divided into sections of 20 square miles. Where possible, at each 15-mile interval a marker with the name of the nearest town was painted on the roof of the most prominent building. If the towns were far apart, white painted ground markers, such as rocks and bricks, were used. At the time that the program was established, few pilots were flying on established airways or had the benefit of radios. With the aid of markers, even the most inexperienced pilots could determine where they were. Today, local 99's chapters volunteer to paint compass roses for airports as community service projects.



Activity - Compass Rose: Go to the computer and do a search for “compass rose images”. Look at all of the many designs for a compass rose. Use the circle below to design, draw and color your own compass rose. Include all of the directions (N, S, E, W, etc.) and all of the headings that correspond with the directions (360°, 90°, 180°, 270°, etc.).

N

