



FUN FACT #2: Triangulation / Shooting a Line

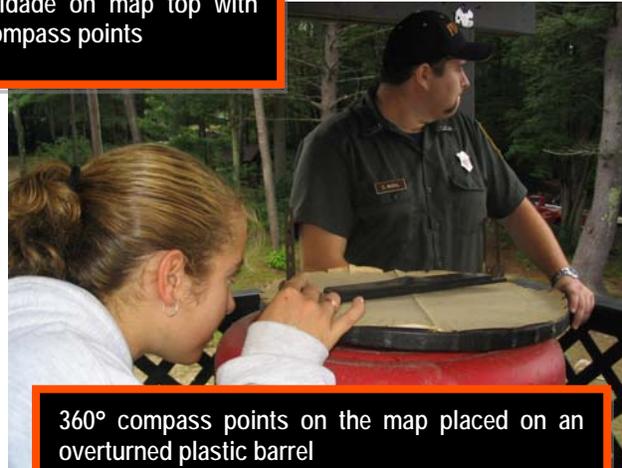
Target age group

- Grade 5 – High School
- Set-up and equipment assist from your state/provincial wildfire agency is highly recommended.

Some Wildfire Terminology

- Alidade: sighting device used by lookouts to determine the horizontal bearing and sometimes the vertical angle of a fire.
- Topographic map or contour map (topos for short): large scale maps that show a wide range of human and physical features of the earth; map having lines of equal elevation that represent the land's surface.
- Azimuth: horizontal angle or bearing of a point measured clockwise from true north.
- Back azimuth: angle or bearing 180 degrees opposite of azimuth.

Alidade on map top with compass points



360° compass points on the map placed on an overturned plastic barrel

Materials Needed

3 of each are required:

- ✓ Tower observation site (Highest elevation in your area - if no high spots, this exercise can be done as long as you have a clear visual view of your area – “towers” should be located as far apart as possible and best if in a triangular pattern.)
- ✓ Stapler or tape
- ✓ Alidade (see below to make your own)
- ✓ 360° compass markings printed out on a transparent sheet
- ✓ Compass
- ✓ Some type of table top (picnic table or overturned barrel)

- ✓ Communication equipment such as a handheld portable radio or truck radio.
- ✓ Topographic map of your immediate area
- ✓ Binoculars

1 of each is required:

- ✓ Your smoke (You can use either an easily identifiable item such as a camp flag or an actual campfire. If making your own fire you will need a stone enclosed campfire area, dry fuel ready to light such as pine boughs and matches. Safety equipment such as water in a pail, a filled pump can, a hose line and shovel should be at the site at all times.)
- ✓ Large area preferably with at least one hilltop (or manmade high spot) with a clear view.
- ✓ Instruction map (Large topographic map already set up for triangulation, with triangulating lines and compass points. Three or more towers should be on the map.)

Approximate Time Needed

- Set-up: 1+ hour
- Exercise: 30 minutes for explanation of all fire terms (shooting a line, white one, back azimuth, compass bearing points/marks, topographic map, cardinal points...), proper radio use, what you will accomplish during this exercise and Q & A. 10 minutes per group for shooting a line and finding the fire.

Set-Up

- Split students into 3 groups and send them to their respective fire towers. An instructor should be at each tower.
- Establish your fire observation sites; be sure your table top sits sturdy at each site.
- Use your compass to find north and place your transparency with the 360° compass points on top; be sure that the 0° and 180° are correctly positioned on your table top; secure with staples or tape. *** For more detail: a topographic map of the immediate area can be placed on the tabletop below your compass marking transparency. This too must be correctly lined up with the tower site on your map placed in the middle of the compass setting (works best when towers are located far apart and in different geographical points on the topographic map).
- Place binoculars and a handheld radio at each tower site.

- Build campfire or place chosen identifiable item. Do not disclose the location; allow students to find on their own while observing from their respective tower using their binoculars. If a firefighter is helping with the campfire, agree on the best moment to send smoke up beforehand.
- Students should switch from tower to tower to experience shooting a line from different areas.

Activity

- Explain that the 3 tower sites chosen for this exercise represent actual fire towers. Give an example of local towns in the area where they can be found.
- Instruct from the large map board explaining and demonstrating how it is used to coordinate or triangulate compass bearings from different towers.
- Explain that for this exercise students will be shooting a line, that is, communicating their own compass bearings with one another but not actually pinpointing the fire on the large map board (exception: unless map board and lines are available for all three tower instruction sites).
- Each tower should have its own name and students should be familiar with the approximate direction of each tower. For example naming your most northerly tower “North Tower” will enable students to get a better feel for sense of direction.
- Instruct them in the proper use of the radio. Allow for a radio check with the other 2 towers. If possible, pre-arrange to use a lesser used frequency and have students radio check with an agency dispatch center or actual fire HQ.
- Explain what triangulation is and how wildfire agencies use it to locate fires.
- Identify familiar areas.
- If using a topographic map, point out different symbols on the map which aid the spotter in identifying where the fire is (railroad crossings, churches, mines...)



- Point out the importance of these identifying symbols in telling the fire departments where the wildfire is located.
- Show the students where their school & other favorite local spots are located.
- Describe what forest fire smoke looks like.
- Compare it to dust from a gravel pit and structure fire colored smoke.
- Tell them what part of the smoke they should be ‘shooting’ to get the most accurate compass bearing.
- If you aren’t using a camp flag or other item for all 3 towers to shoot a line to, the person at the campfire (preferably a firefighter) can now place pine boughs on the fire to create white smoke.

Prevention Education Fire Tower Cabin set up with map board, alidade on map table, radio and portable telephone



- The tower observers will spot the white smoke and must note its compass point. If using a topographic map board, the coordination points from the 2 other towers will enable the observer to pinpoint the fire (works best over long areas).
- Explain that the observer would then call the respective fire department to report the fire.

How to make your own alidade

- Open a large sized paper clip until it becomes L shaped making a 90° angle.
- Secure a piece of string to the end of the paperclip; tie the opposite end of the string to a thumb tack.
- To use, insert thumb tack into the middle of the compass transparency on the map table top so that the 360° markings are equally distanced from the tack. When shooting a line, pull the string tight, keeping the tied paper clip side of the L flat on the table top. Be sure the inside of your L shaped paperclip is facing the tack. Look through the erect side of the clip and find your smoke. Note what compass degree bearing your string is over, using the exact opposite marking as your bearing mark (back azimuth) for triangulation with another tower.