

Map & Compass Training



**Upper Valley Wilderness
Response Team**

Supporting the SAR Needs of NH and VT



General Map Reading Skills

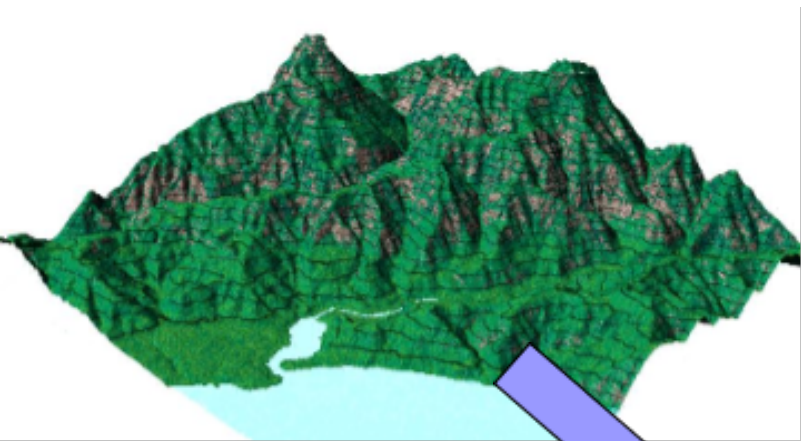
- Contour Lines & Topographic Features
- UTM Coordinate System & Scale
- Reading Coordinates
- Declination



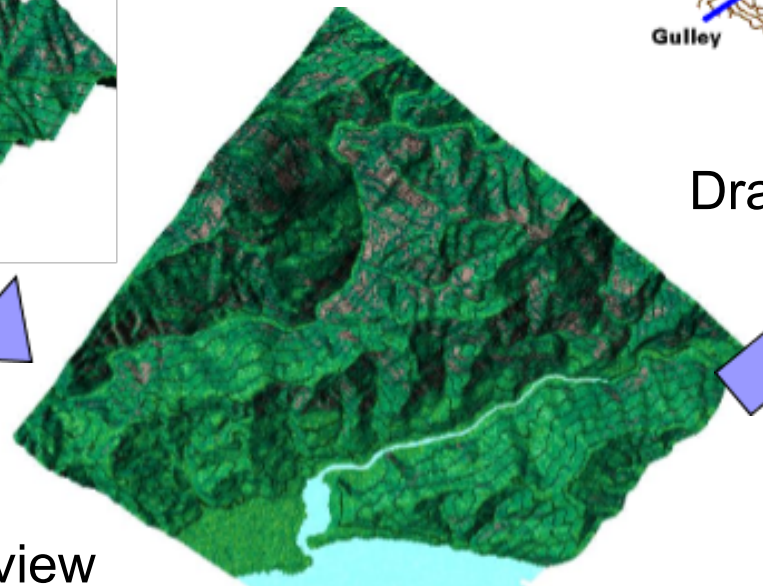
What are contour lines?

- **Contour Lines:**

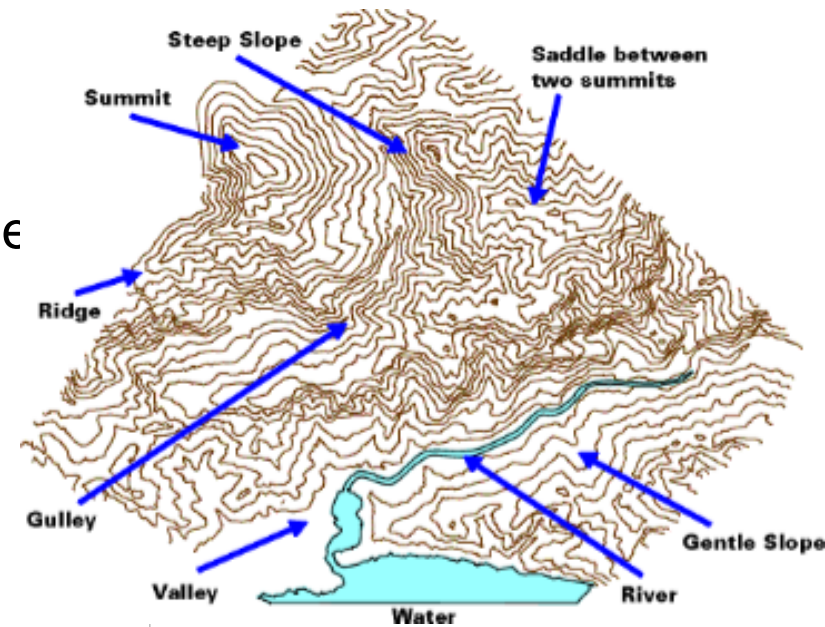
- Convert 3-D info into 2-D plane.
- Each contour line signifies specific altitude



3-D view



Overhead 3-D view

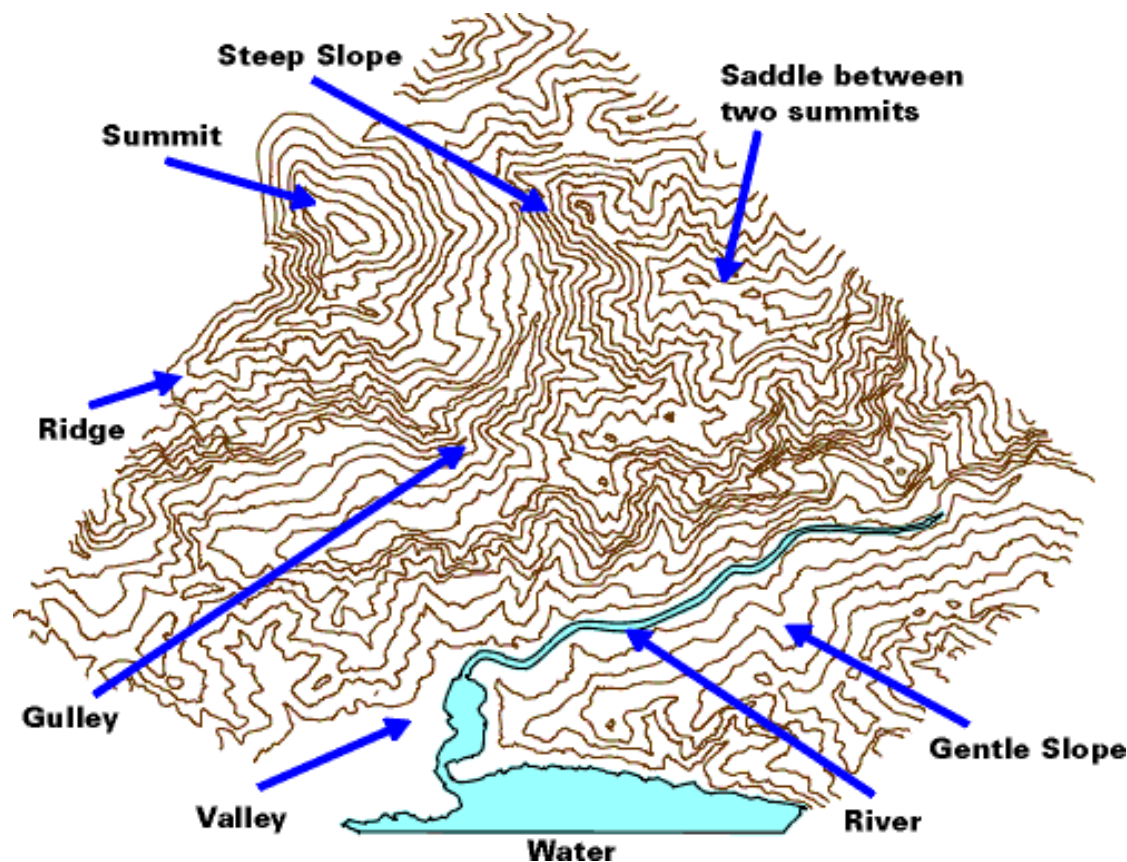


Drawn Contour Lines



Identifying Topo Features:

- Slopes:
 - Tighter Spacing > Steep Slope
 - Wider Spacing > Gentle Slope
- Summit:
 - Concentric Circles
 - (Higher Altitude / Marker)
- Ridge / Gulleys:
 - Ridge
 - “V” points away from summit
 - Gully / Stream
 - “V” points towards summit
- Saddles:
 - Elevated terrain between summits



General Map Reading Skills

- Coordinates:

- Standard on USGS Maps & Aircraft

- Lat/Long: (___° degrees , ___' hours , ___." min)

- e.g Team Room:

- 43° 42' 29.32" N

- 72° 17' 10.65" W

- BUT we use the **UTM Coordinate System**

- (Universal Transverse Mercator)



UTM Coordinate System

- Universal Transverse Mercator
 - 60 North-South Zones around globe
 - NH & VT are in ZONES 18 & 19

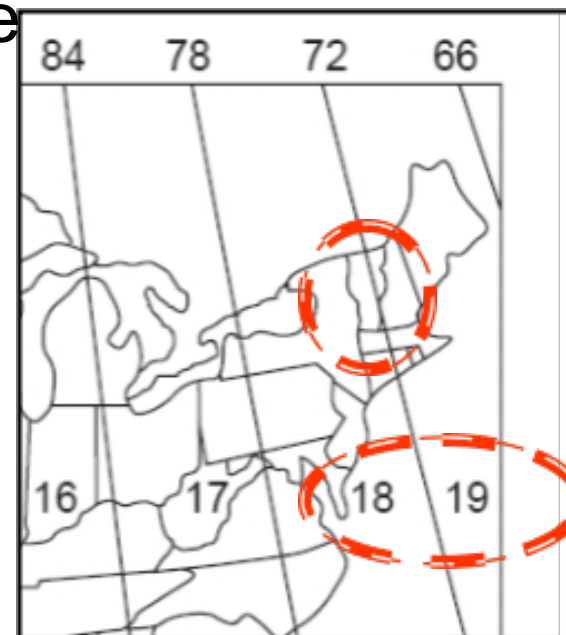
- Three Coordinate Values

- “Zone”
- “Easting”
- “Northing”

- Team Room:

“Zone 18” “07 18 642 E”

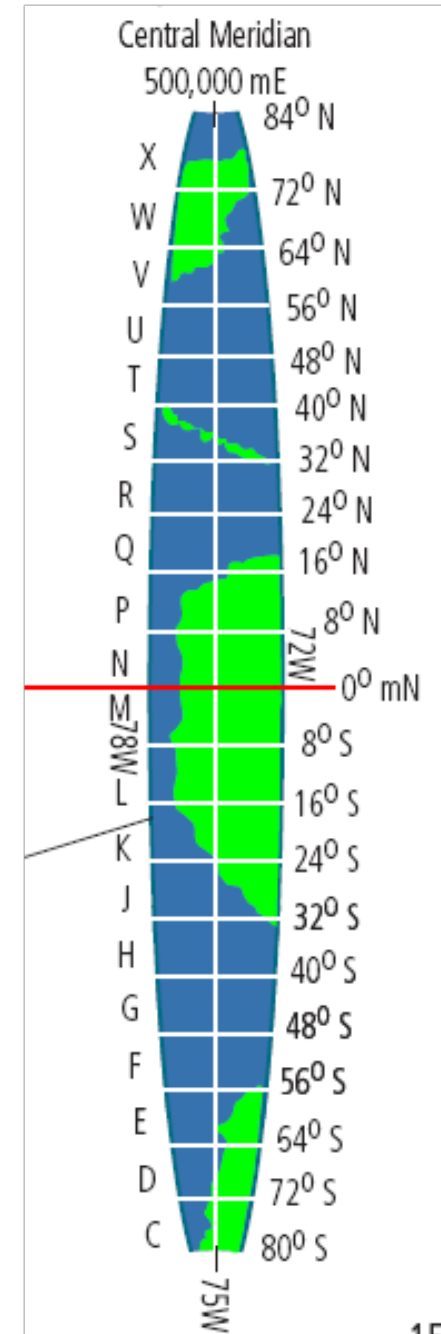
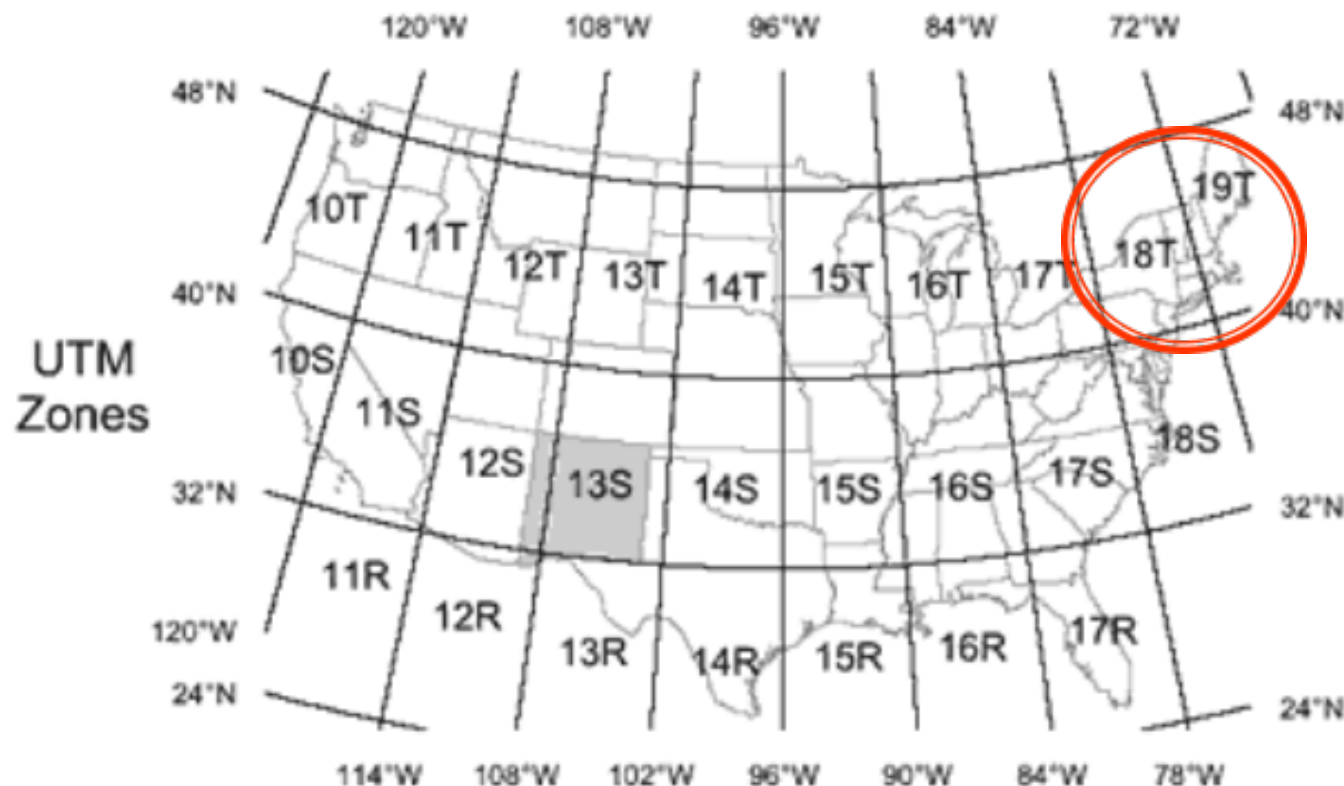
“48 42 821 N”



UTM Latitudinal Divisions

(Sometimes Used)

- Letters C-X
 - We're in Zones 18T or 19T



UTM Coordinate Details

- Easting

- East of what? Where's Zero?

- Zero Easting

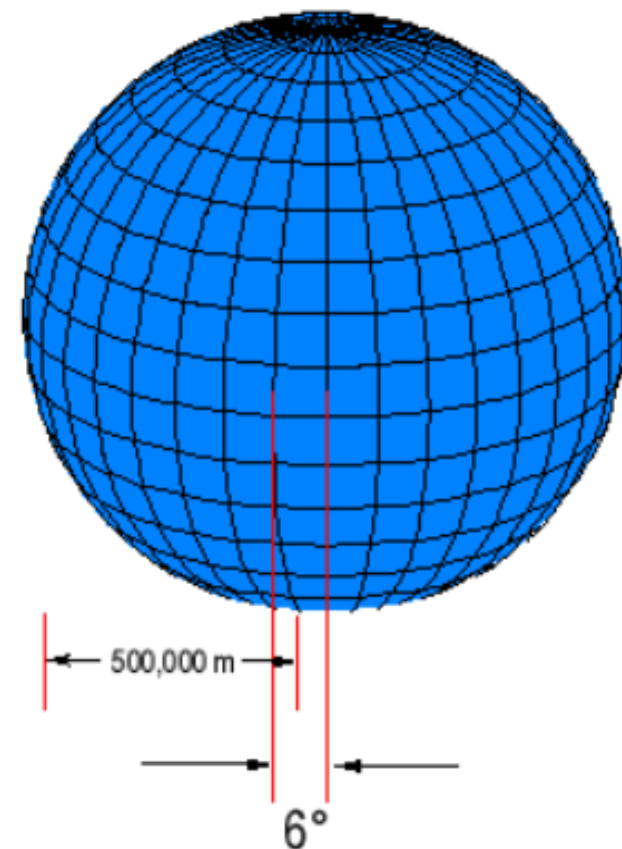
- Does not really exist

- 500,000m West of
each zone's center-line

- Northing

- North of What?

- Meters North of Equator,



UTM Maps

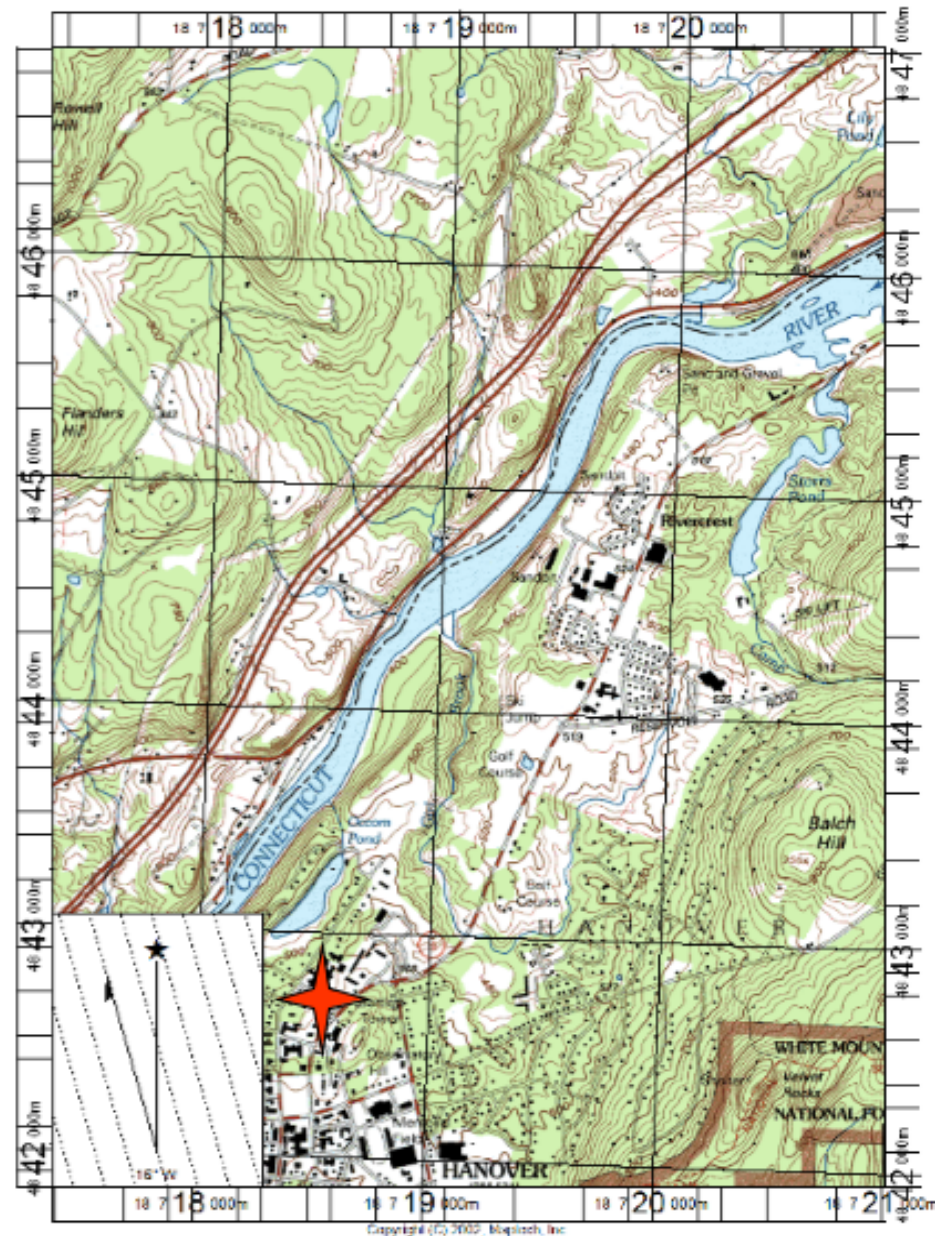
- Reading Scale of Printouts
(What we get at a search)

1 BOX = 10 ticks = 1km

1 tick = 100m

1 mile = 16 ticks

The scale doesn't quite match up when viewed in google. Take a look at the map on the next slide to see what the 'ticks' would actually look like.



Team
Room

What are the Team Room Coordinates?

Reading Complete Coordinates off a UTM map:

“Zone __ , __ __ __ Easting”

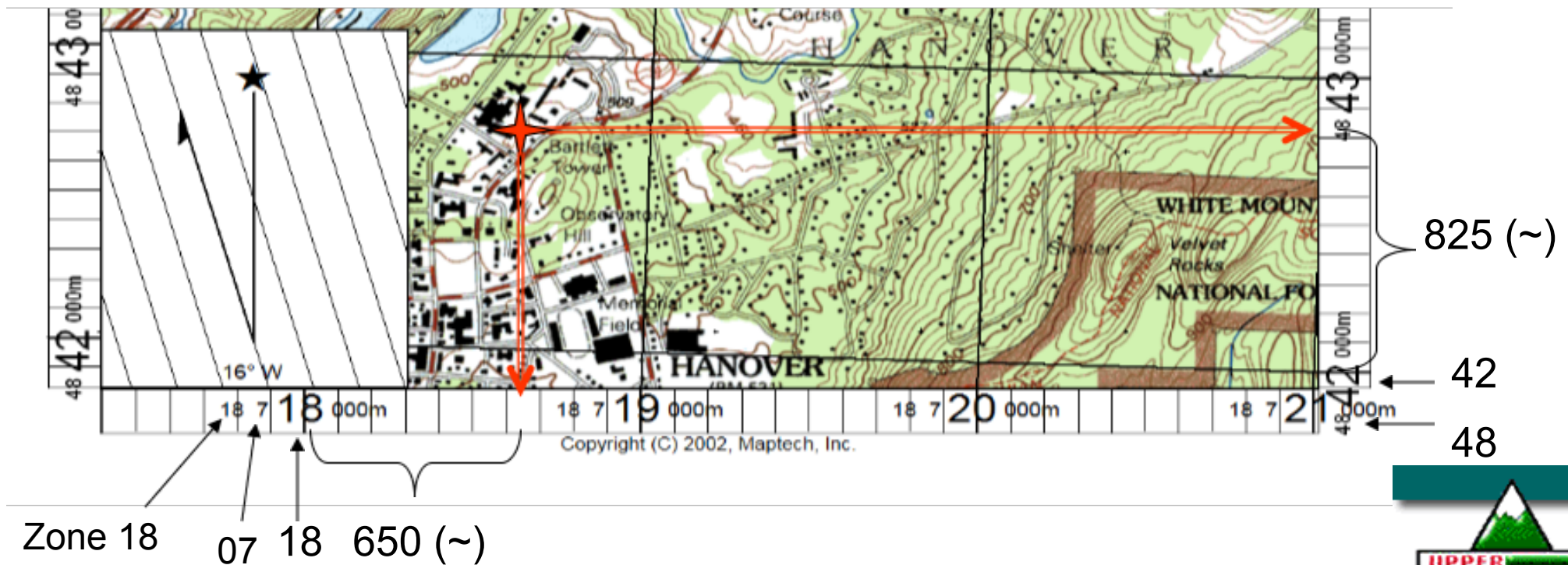
“__ __ __ Northing”



UTM Coordinates of the Team Room

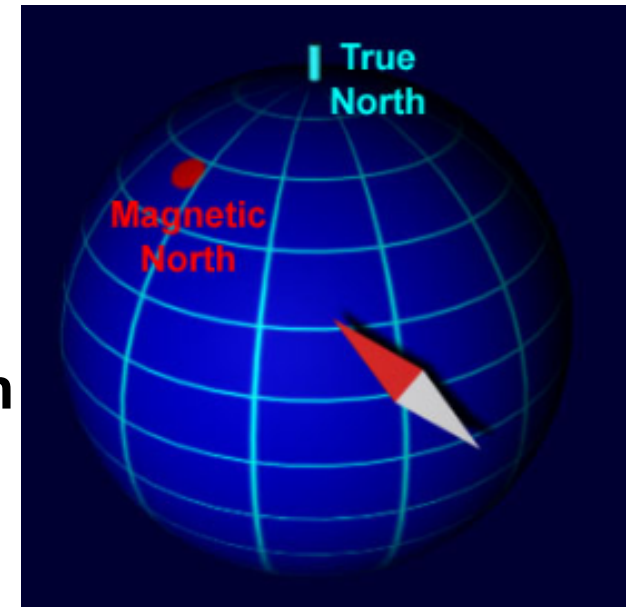
Zone 18, 07 18 642 Easting

48 42 821 Northing



Declination

- Magnetic North is **NOT EQUAL** to True North

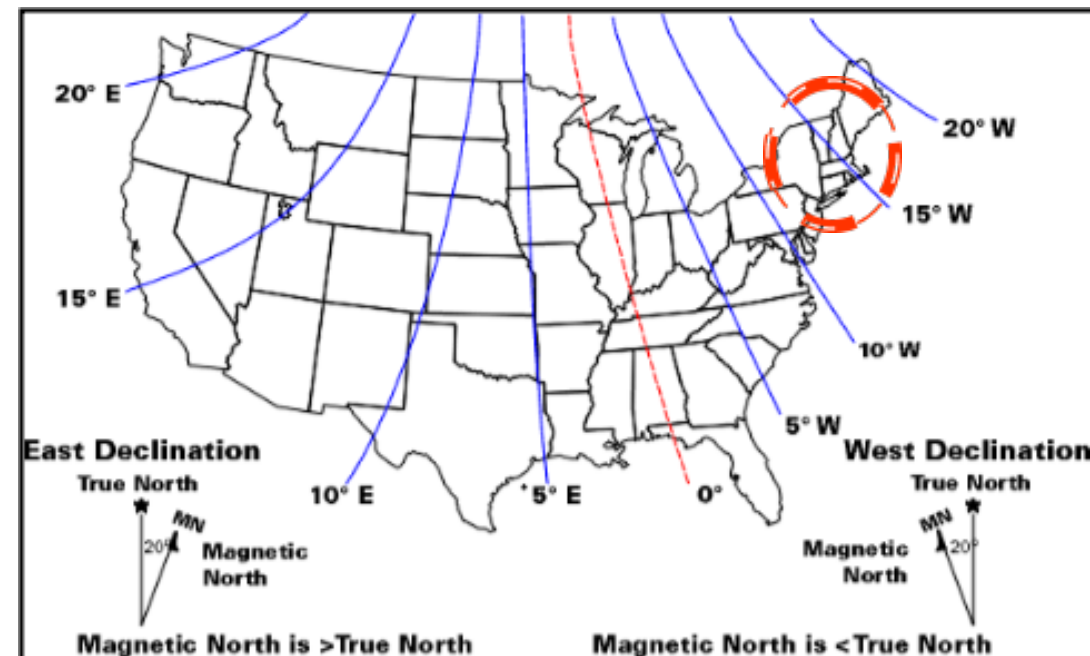


- Magnetic North
 - Iron ore deposit in Hudson Bay

- True North
 - Exact North Pole of Earth

- Declination

Angular difference
between True & Magnetic

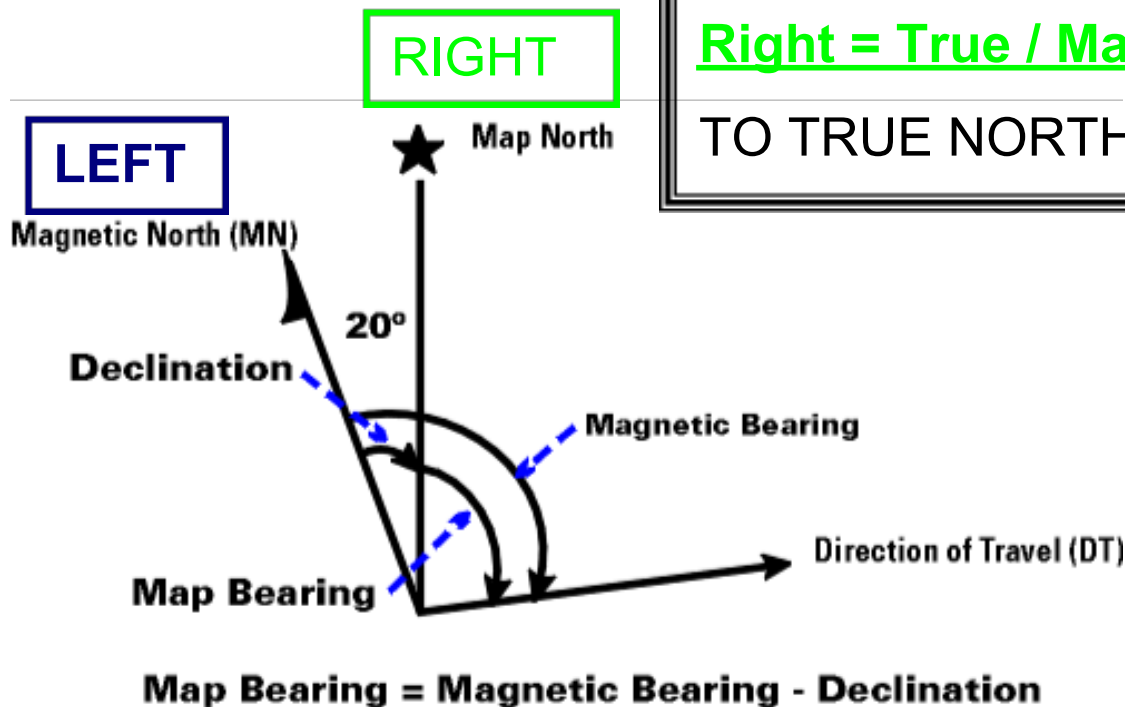


Converting between Magnetic North and True/Map/Grid North

L.A.R.S. = Left Add, Right Subtract

Left = Magnetic, so, converting True North
TO MAGNETIC, **ADD** DECLINATION

Right = True / Map North, so converting Magn. North
TO TRUE NORTH, **SUBTRACT** DECLINATION



Another Rhyme:

Grid to **Mag.**, Add

Mag. to **Grid**, Get Rid

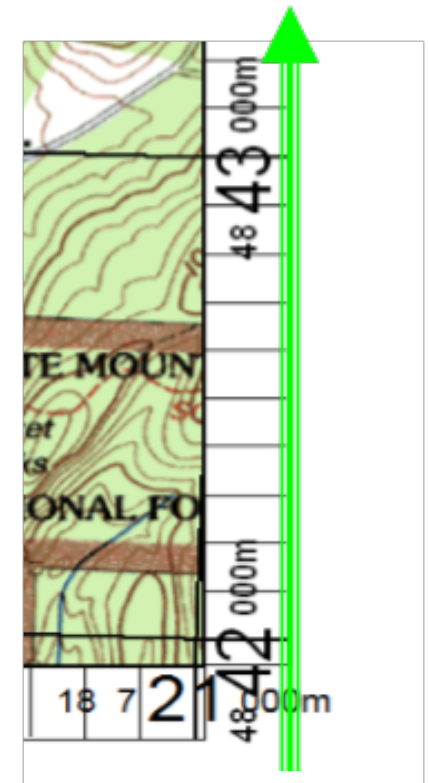
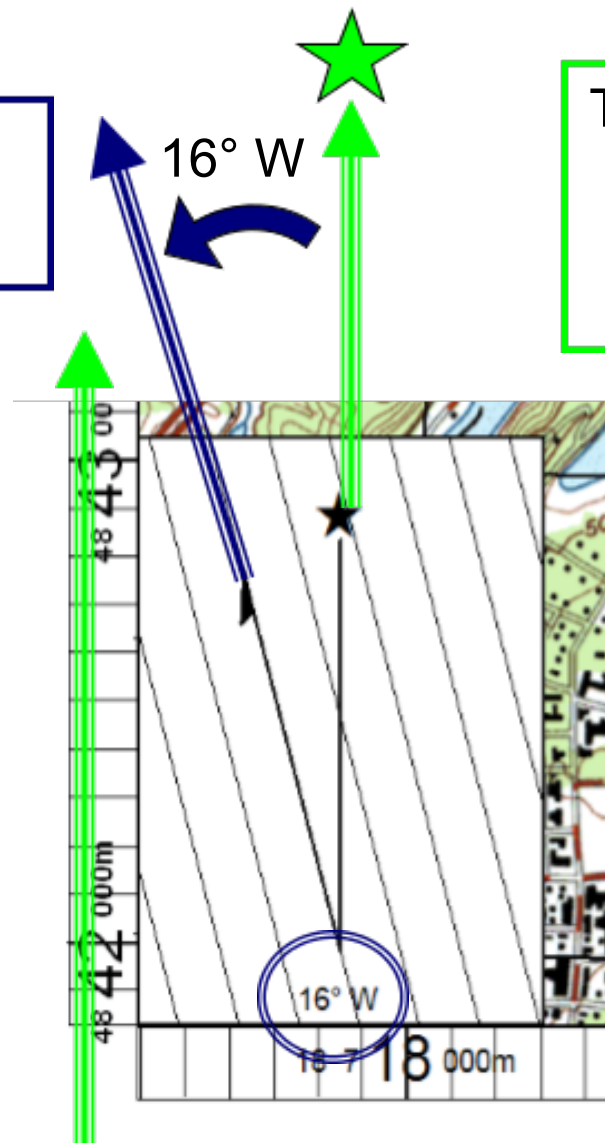
Declination on Map Printouts

MAGNETIC NORTH
(True North) — 16°

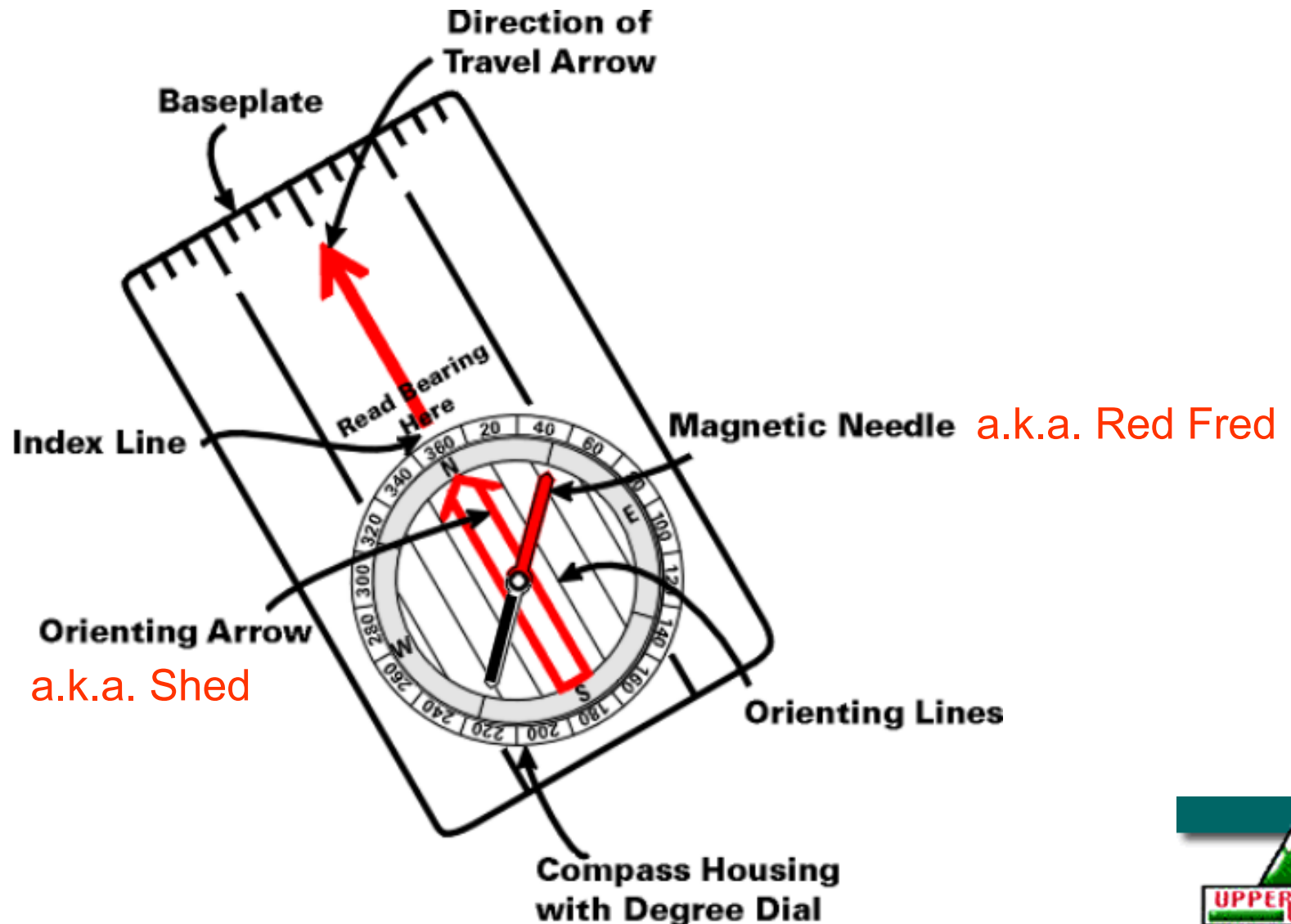
NH & VT Decl.
 $15^\circ\text{W} - 17^\circ\text{W}$

TRUE NORTH

- Parallel with **PAGE EDGE**
- NOT parallel with **GRID EDGE**



Parts of a compass



Using a Compass

- TWO FUNCTIONS
- Protractor (Magnetic Needle *not* used)
- Navigation Aid (Magnetic Needle used)

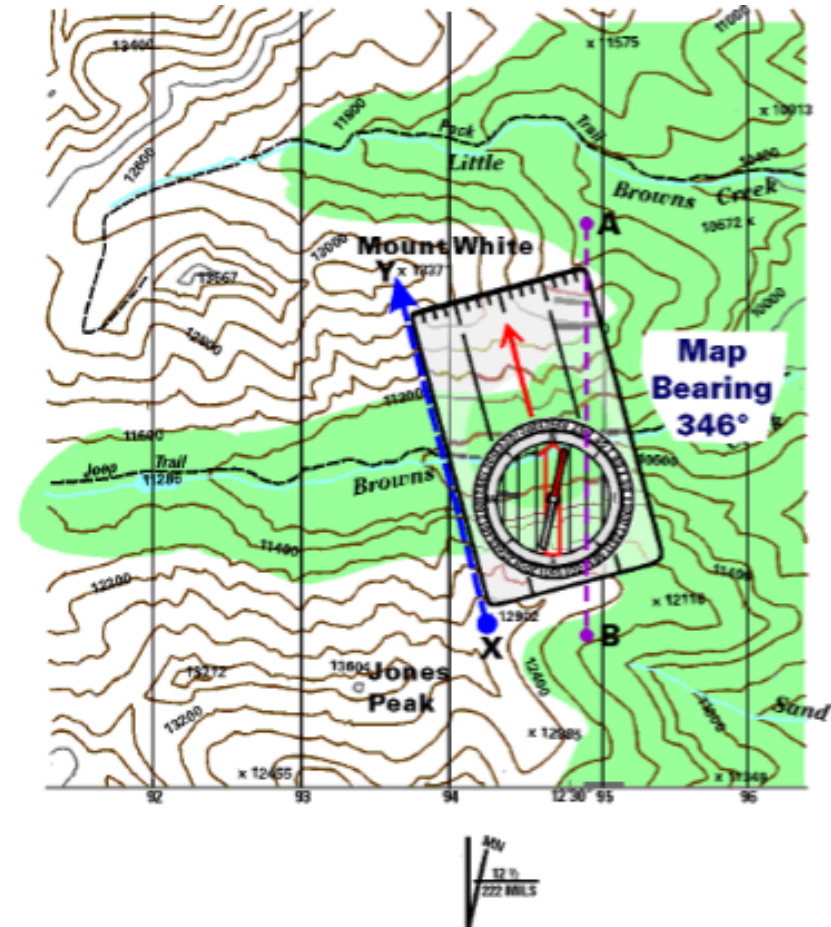


Protractor: True Bearings

TRUE Bearing taken off Map

(NO NEEDLE)

1. Draw bearing (Pt. X to Pt. Y)
1. Align base-plate with bearing
1. Align orienting lines with drawn
 1. True North lines



2. Read value on dial at Index Line

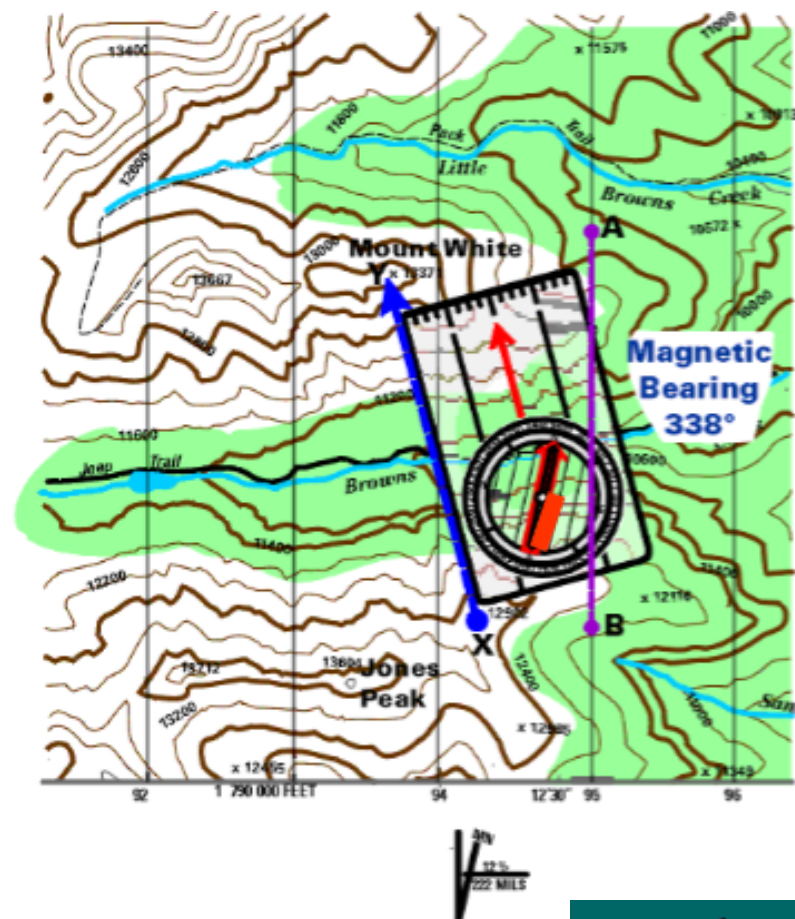


(Noting Bearing as "True")

Protractor: Magnetic Bearings

MAGNETIC Bearing taken off Map

1. Draw bearing (Pt. X to Pt. Y)
1. Align base-plate with bearing
1. Align orienting lines with drawn
 1. Magnetic North lines OR
 2. Keep “Red Fred in Shed”
2. Read value on dial at Index Line



Protractor: Magnetic Bearings

MAGNETIC Bearing taken off Map

1. Draw bearing (Pt. X to Pt. Y)

1. Align base-plate with

Would it be a good idea to use the
“Red Fred in Shed” method at a
search on top of the hood of a car?

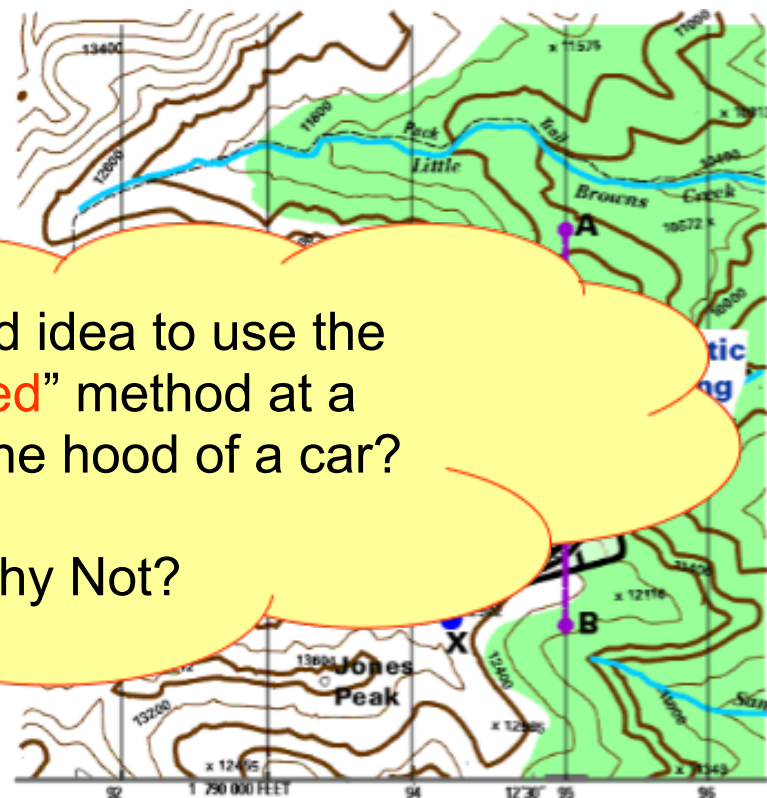
Why / Why Not?

1. Align orienting lines with draw

1. Magnetic North lines OR

2. Keep “Red Fred in Shed”

2. Read value on dial at Index Line



Compass as Navigation Aid

- Walking a bearing
 - Obtain Magnetic Bearing
 - Convert True Bearing to Magnetic if necessary
 - Rotate Compass Dial to Mag. Bearing
 - Rotate YOUR BODY until “Red Fred in Shed”
 - Hold compass straight in front
 - Rotate Your Body, not compass



-
- Back bearings (Bearing $\pm 180^\circ$)

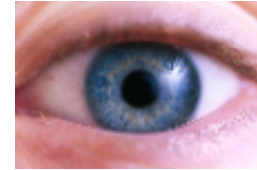
- “Red Fred To “

How would this method save time if the team is “Grid Searching”?



SIGHTING a bearing (accurately)

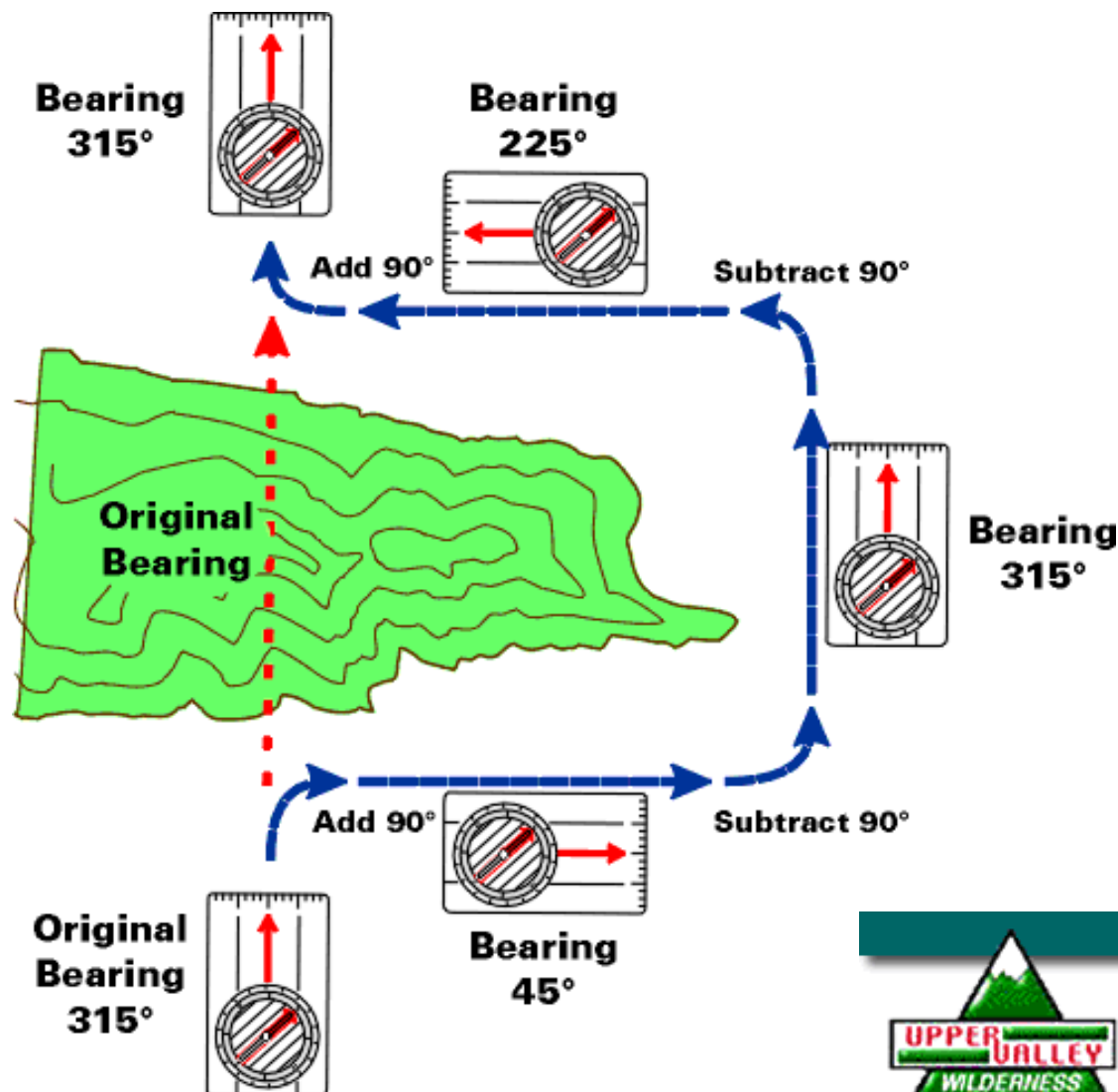
- Bring compass to eye level
- Sight a distant object or tree
- Two-Person Navigating
 - Great for Nighttime / Poor Visibility
 - “Leap Frog” Navigating



Navigation Problems:

OBSTACLE IN THE WAY:

- Add 90°
 - Pace Off-course Distance
- Subtract 90°
 - Original Course Distance
- Subtract 90°
 - Pace back to original course.
- Add 90°



Navigation Scenario

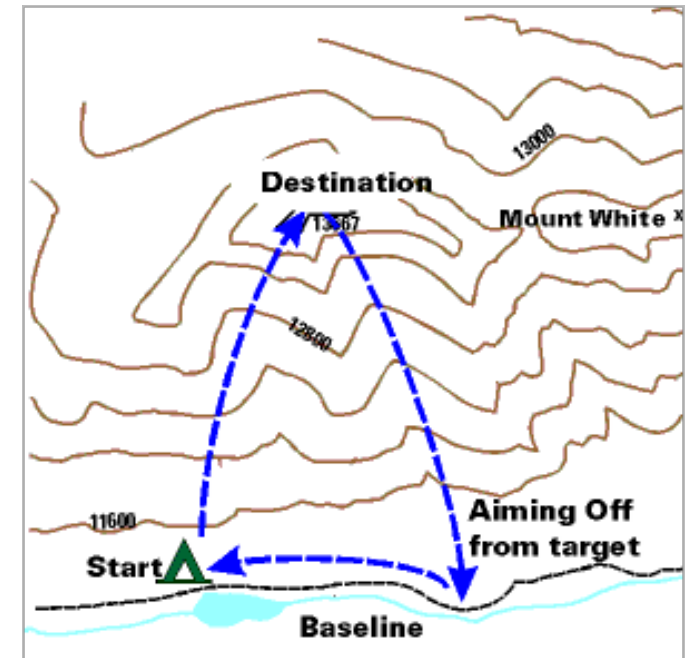
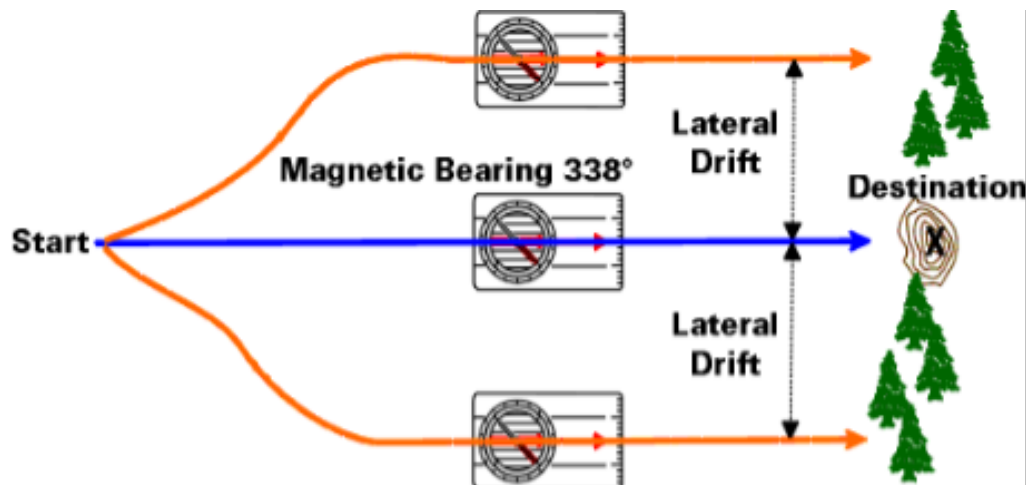
- Scenario:
- You're navigating on a 338°M bearing in poor visibility.
- You have counted 400 paces of your 400m bearing.
- You don't see your target...

WHICH WAY DO YOU TURN?
LEFT OR RIGHT?



Lateral Drift / Aiming-off

1. Aim to one side of target ($338^{\circ}\text{M} \rightarrow 330^{\circ}\text{M}$)
2. Estimate distance with pacing / landmark (400M)
3. Turn towards target. (Turn Right)





Navigation Scenario

(Remember this one!)

- You hear a shout far in the distance.
- Another team hears the same shout.
- How do you locate the origin of the shout?
- How do you tell base where the shout was?

Bearings & Triangulation

- **Taking a Bearing in the Field**

1. Immediately turn body towards shout
2. Align Direction of Travel arrow with shout
3. Rotate compass dial until “Red Fred in Shed”
4. Read Magnetic Bearing at index line.

- **Triangulating Bearings**

1. Plot bearings on map.
2. Mark intersection of bearings.



Does declination really make a difference?

Declination or Degrees Off Course	Error Off Target after Walking 10 Miles
1°	920 feet (280meters)
5°	4,600 feet (1,402 meters)
10°	9,170 feet (2,795 meters)
16° (Declination)	14,690 feet (4477)



Relaying Coordinates with NEK-9

- On a search, everyone has same map.
- To limit radio air-time, ONLY RELAY:
 - *LAST 5 DIGITS* OF EASTING
 - *LAST 5 DIGITS* OF NORTHING
- You: "Ready to copy coordinates"
- Base: "Go ahead"
- You: "Transmitting first set of coordinates, 18 642 Easting"
- Base: (*repeats*) "18 642 Easting"
- You: "Transmitting second set of coordinates, 42 821 Northing "
- Base: (*repeats*) "42 821 Northing "
- You: "Affirmative"

