

Map & Compass Training



Supporting the SAR Needs of NH and VT

***Upper Valley Wilderness
Response Team***



General Map Reading Skills

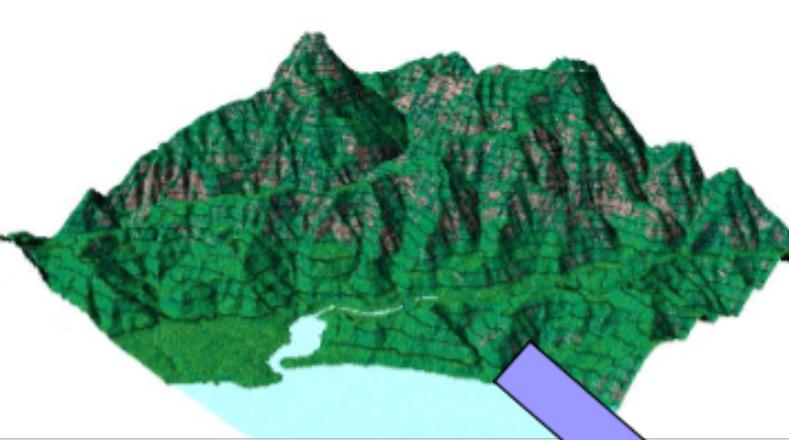
- Contour Lines & Topographic Features
- UTM Coordinate System & Scale
- Reading Coordinates
- Declination



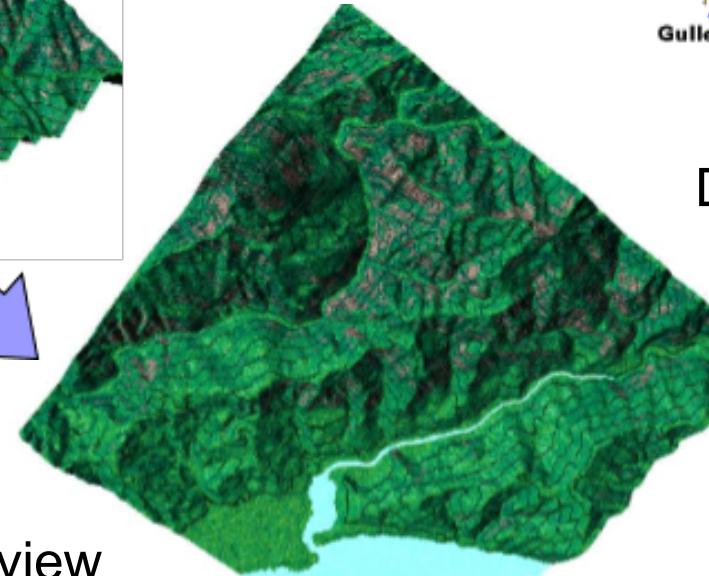
What are contour lines?

- **Contour Lines:**

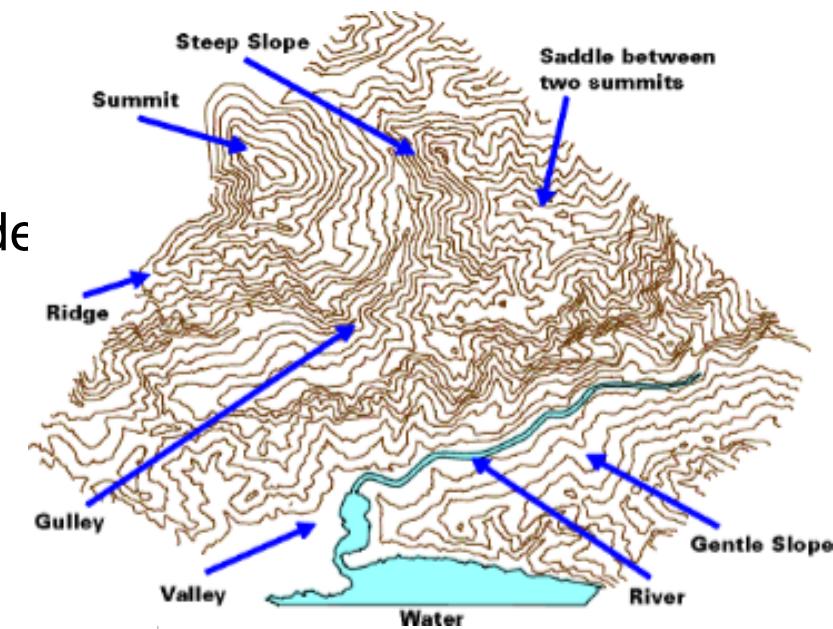
- Convert 3-D info into 2-D plane.
- Each contour line signifies specific altitude



3-D view



Overhead 3-D view

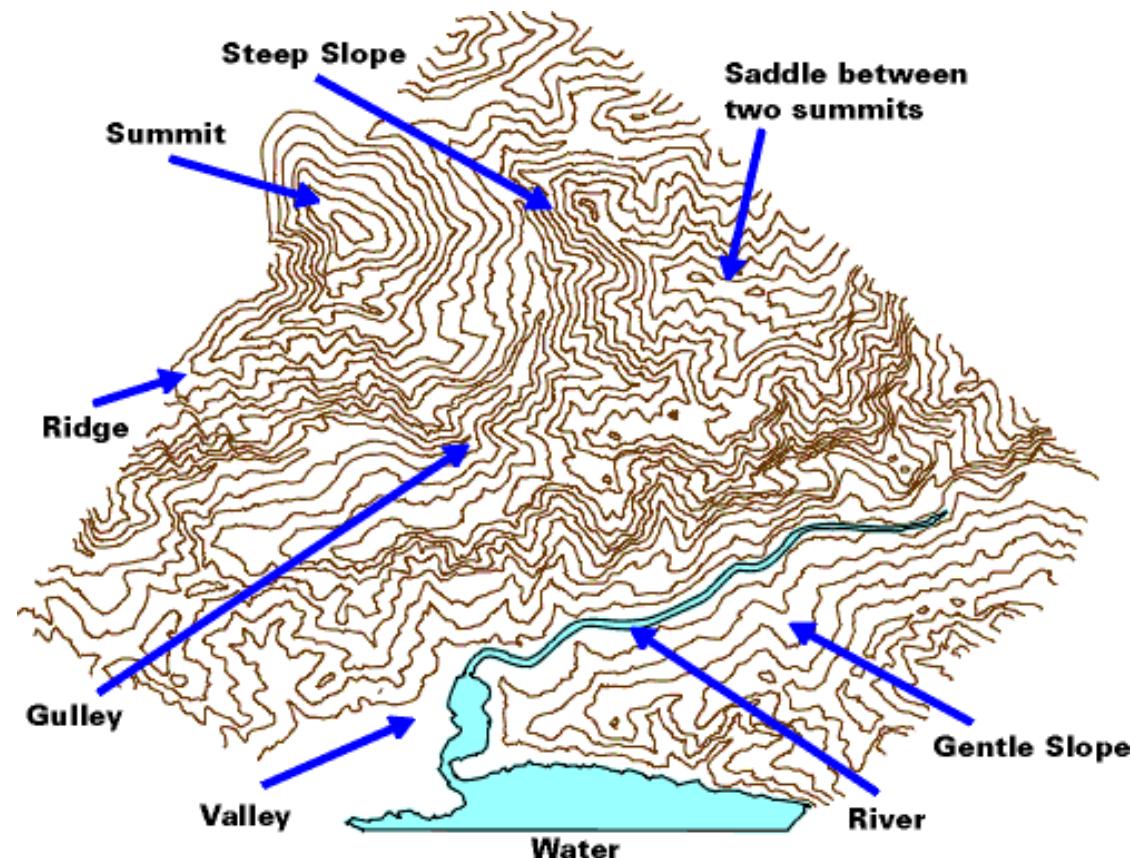


Drawn Contour Lines



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: ($_\circ$ degrees, $_\prime$ hours, $_\cdot_\cdot\prime\prime$ min)

- e.g Team Room:

- $43^\circ 42' 29.32''$ N

- $72^\circ 17' 10.65''$ W

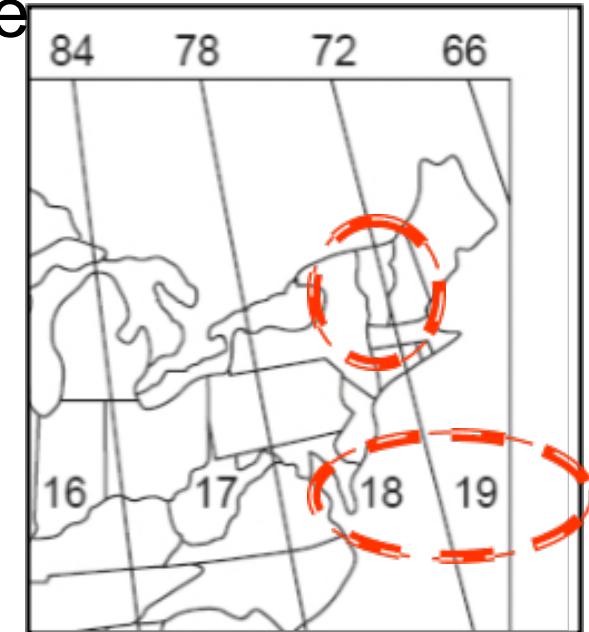
- BUT we use the **UTM Coordinate System**

- (Universal Transverse Mercator)



UTM Coordinate System

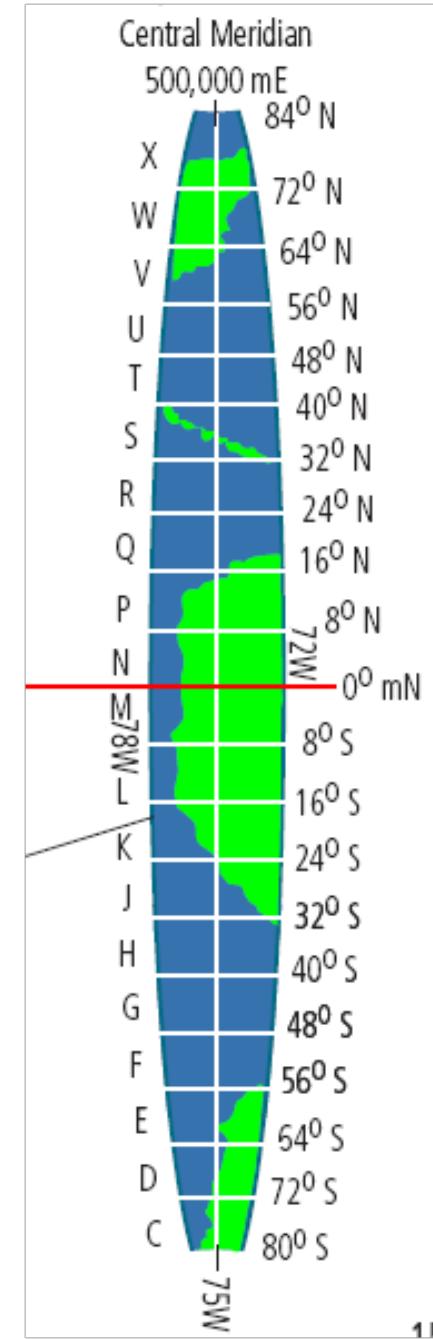
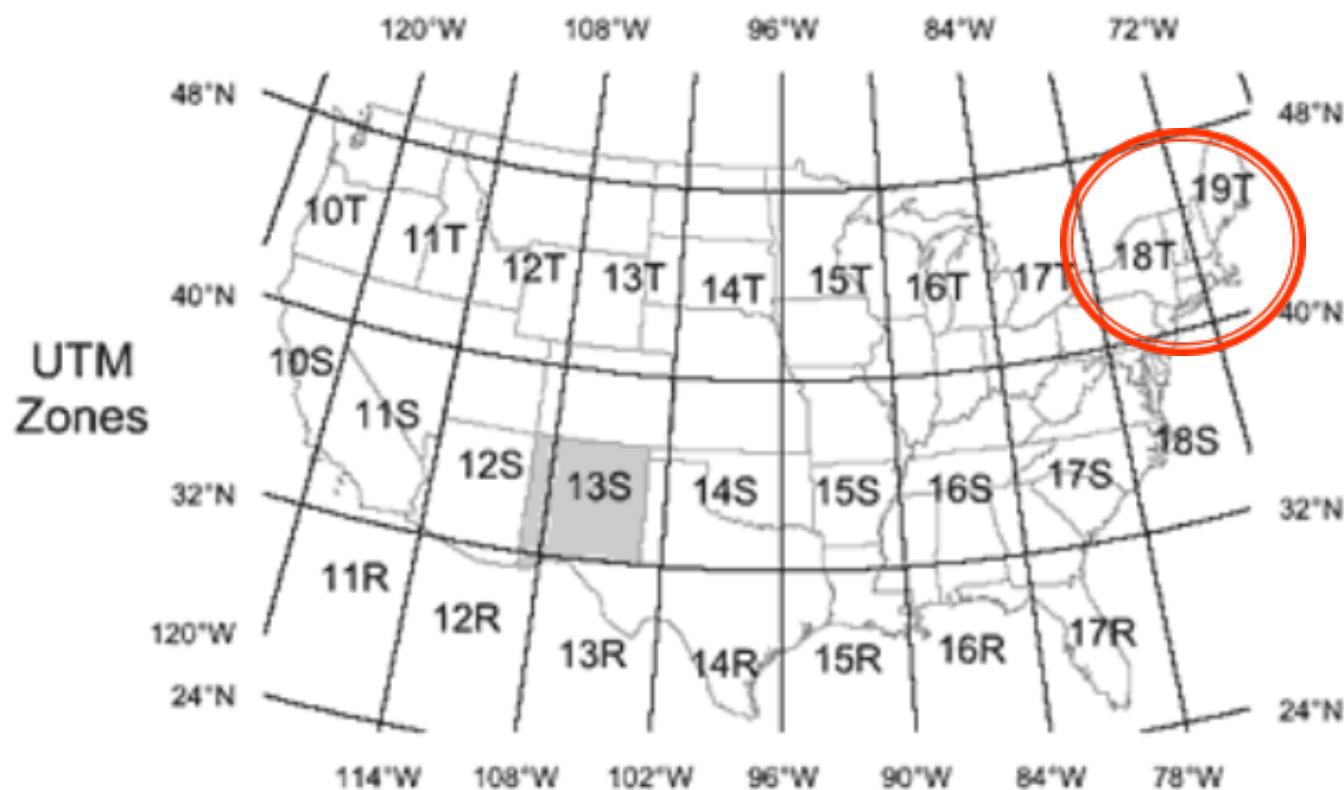
- Universal Transverse Mercator
 - 60 North-South Zones around globe
 - NH & VT are in ZONES 18 & 19
 - Three Coordinate Values
 - “Zone”
 - “Easting”
 - “Northing”
 - Team Room:
 - “Zone 18” “07 18 642 E”
 - “48 42 821 N”



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

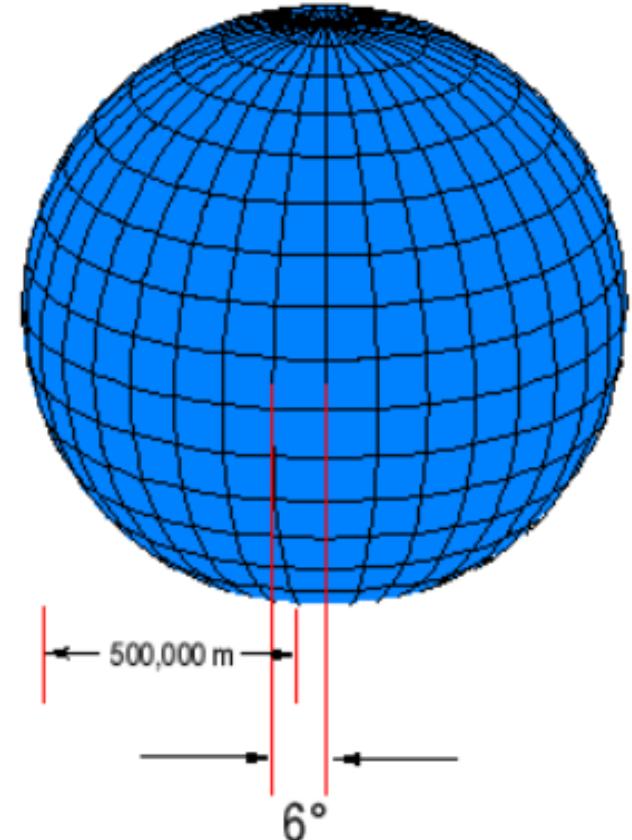
- 500,000m West of

- each zone's center-line

- **Northing**

- North of What?

- Meters North of Equator,



UTM Maps

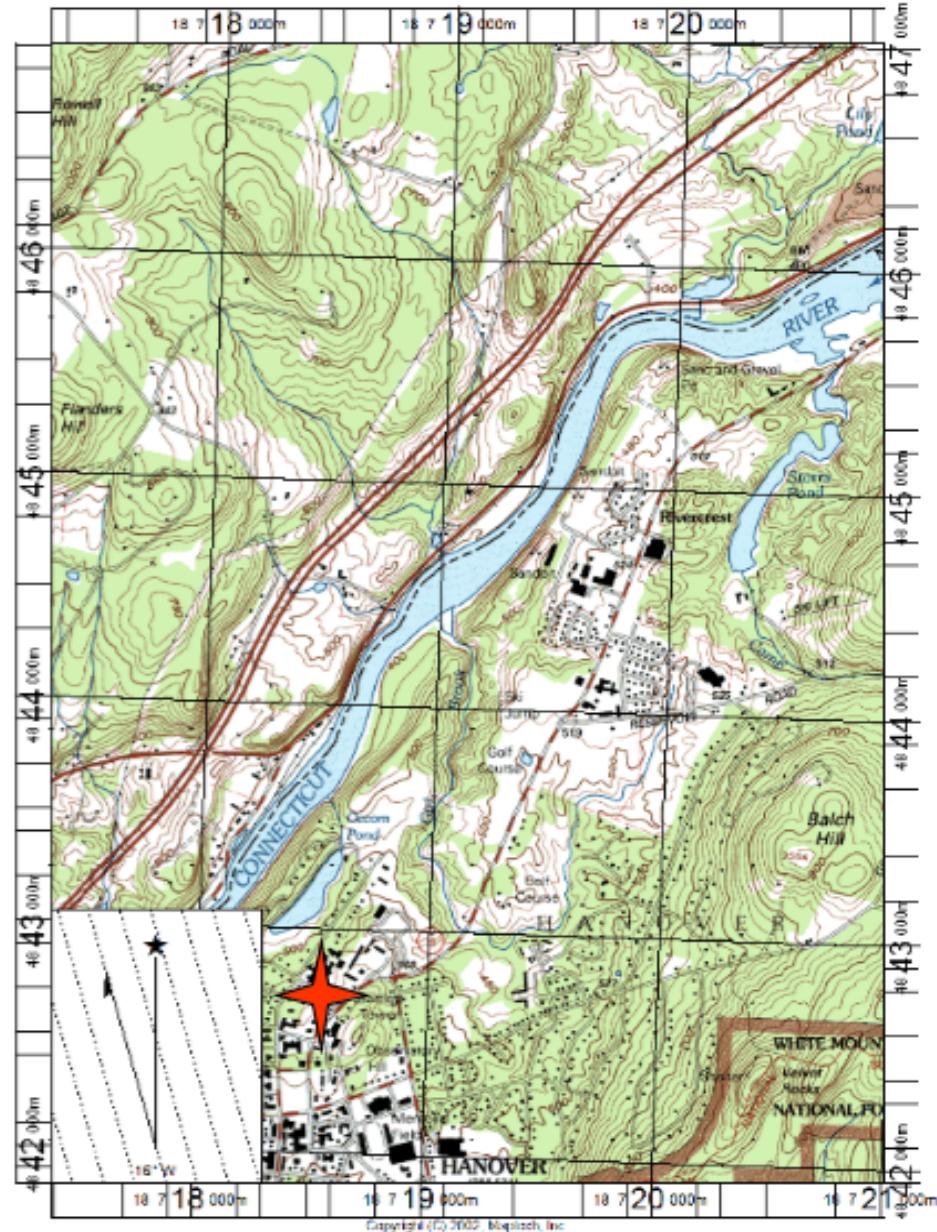
- Reading Scale of Printouts
(What we get at a search)

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.



What are the Team Room Coordinates?

Reading Complete Coordinates off a UTM map:

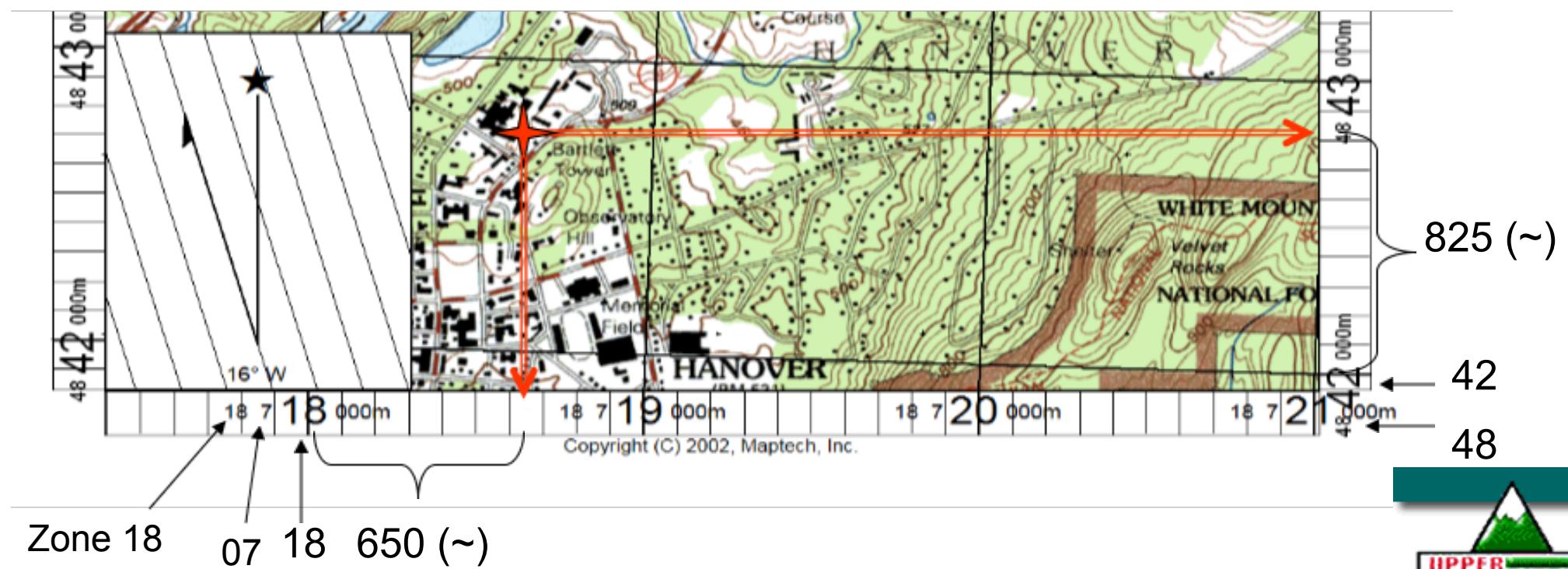
“Zone __, ____ Easting”

“____ Northing”



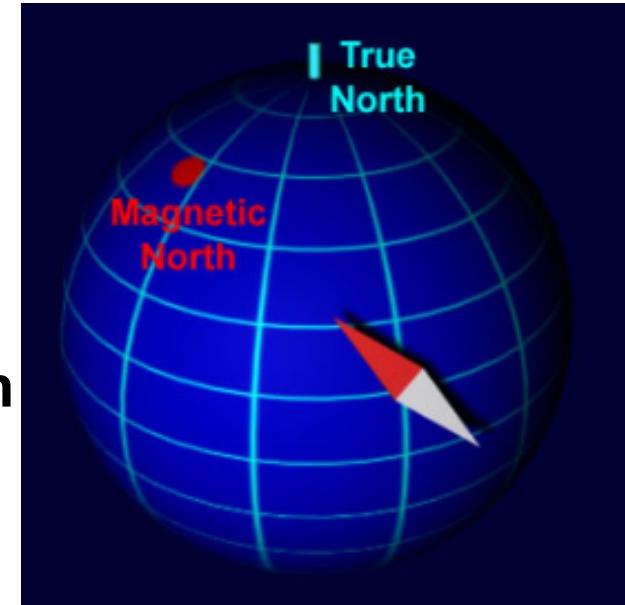
UTM Coordinates of the Team Room

Zone 18, 07 18 642 Easting
48 42 821 Northing



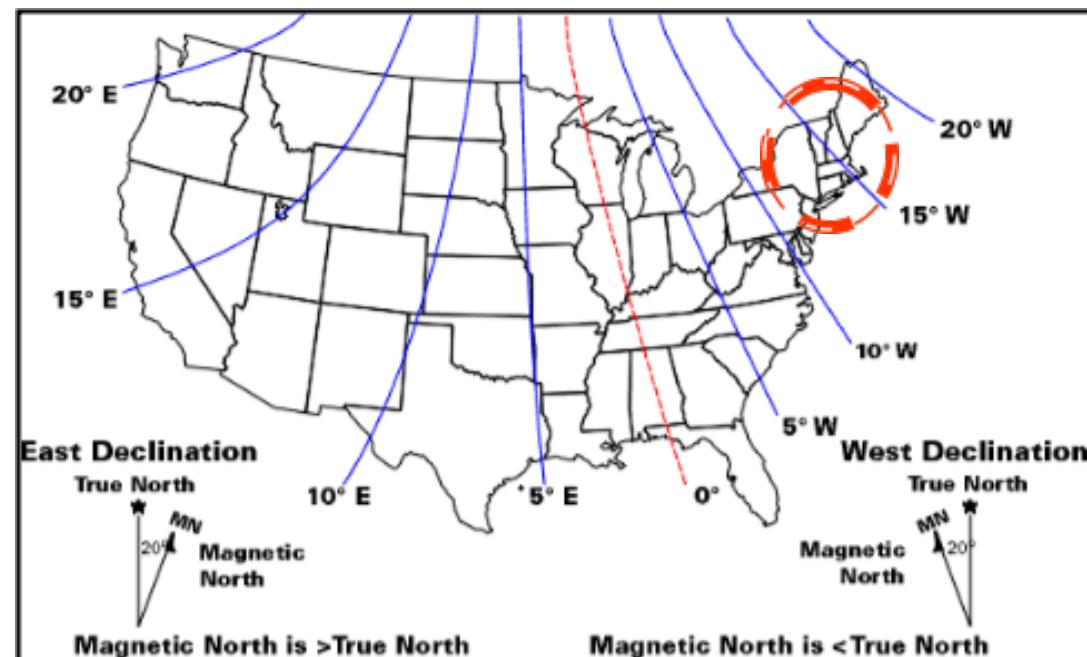
Declination

- 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

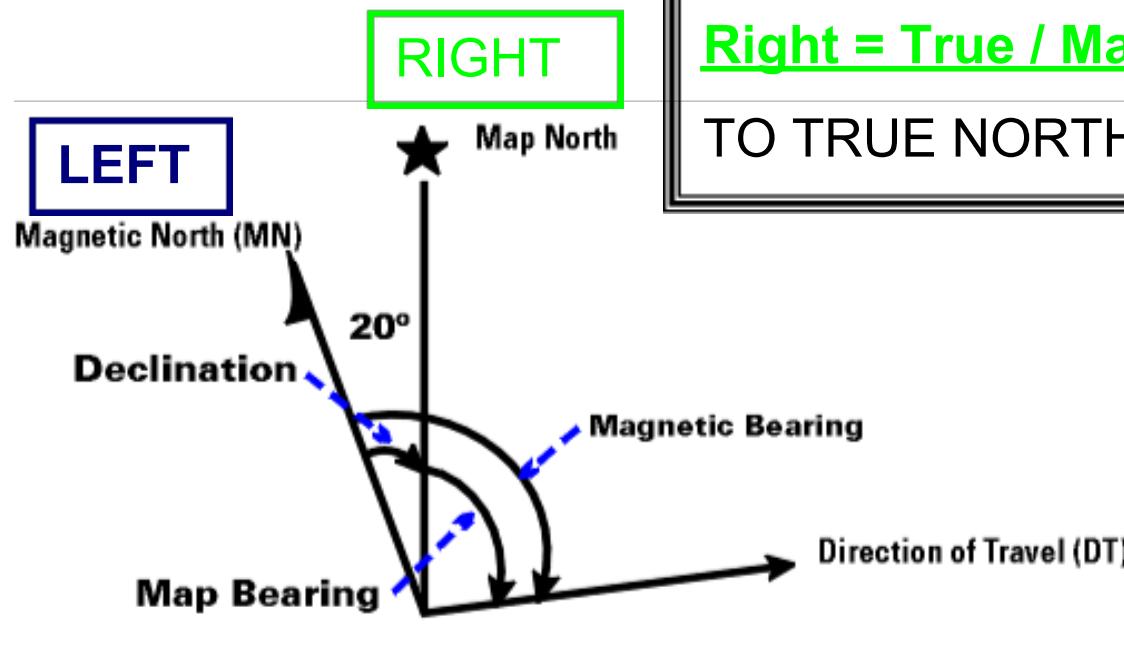
L.A.R.S. = *Left Add, Right Subtract*

Left = Magnetic, so, converting True North

TO MAGNETIC, **ADD DECLINATION**

Right = True / Map North, so converting Magn. North

TO TRUE NORTH, **SUBTRACT DECLINATION**



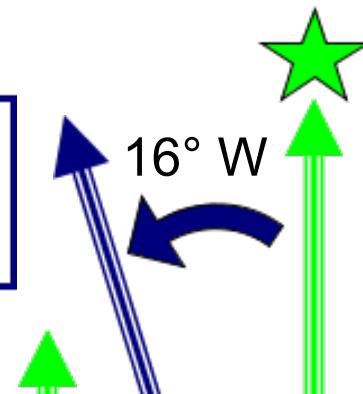
Another Rhyme:

Grid to Mag., Add

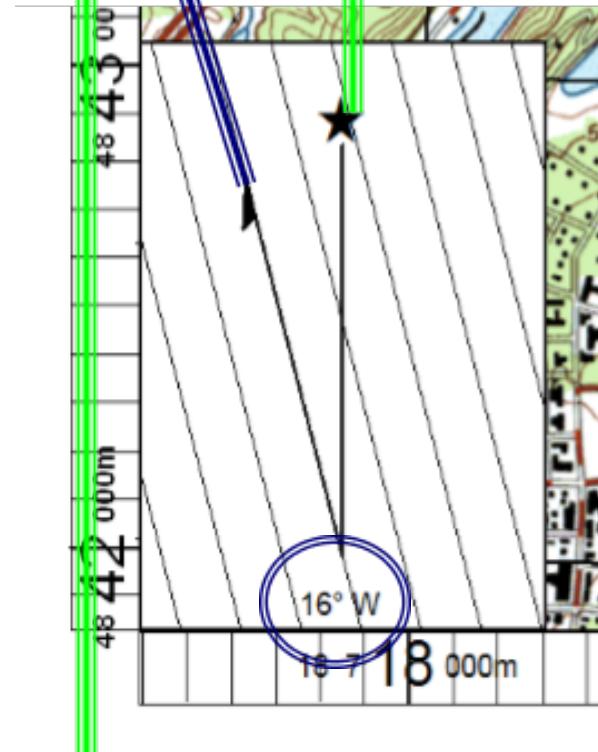
Mag. to Grid, Get Rid

Declination on Map Printouts

MAGNETIC NORTH
(True North) — 16°

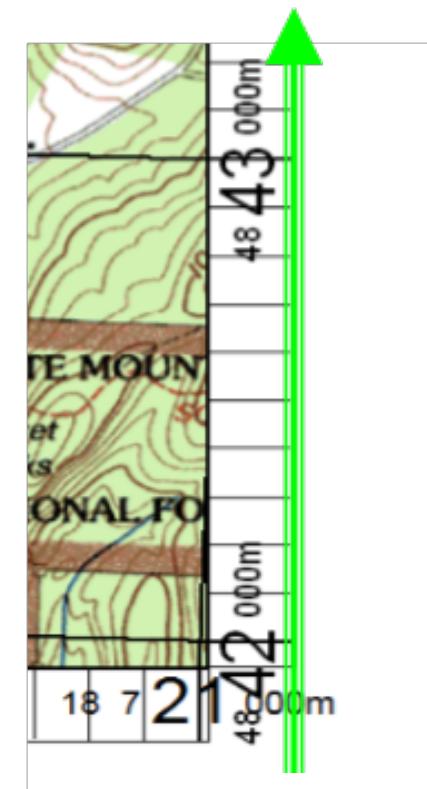
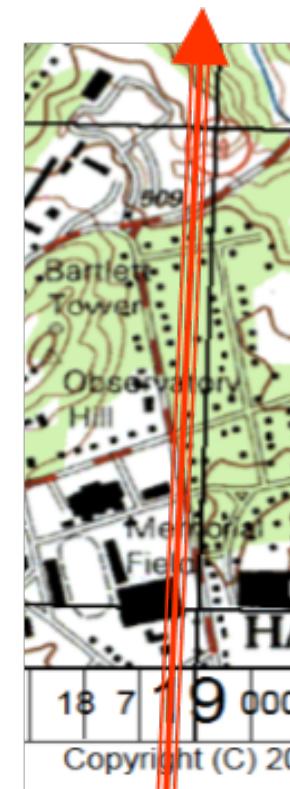


NH & VT Decl.
15°W - 17°W



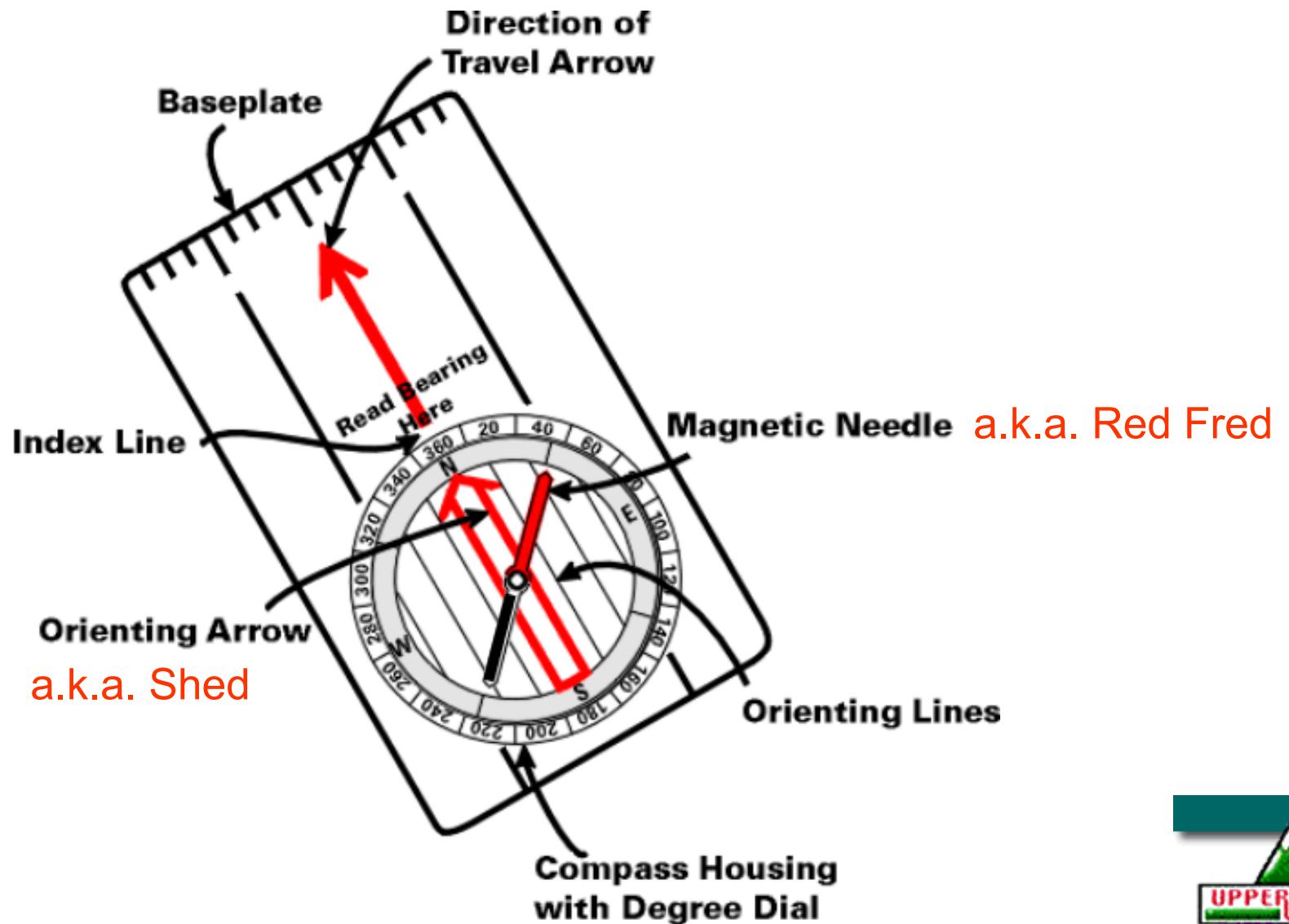
TRUE NORTH

- Parallel with PAGE EDGE
- NOT parallel with GRID EDGE



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Parts of a compass



Using a Compass

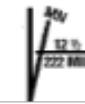
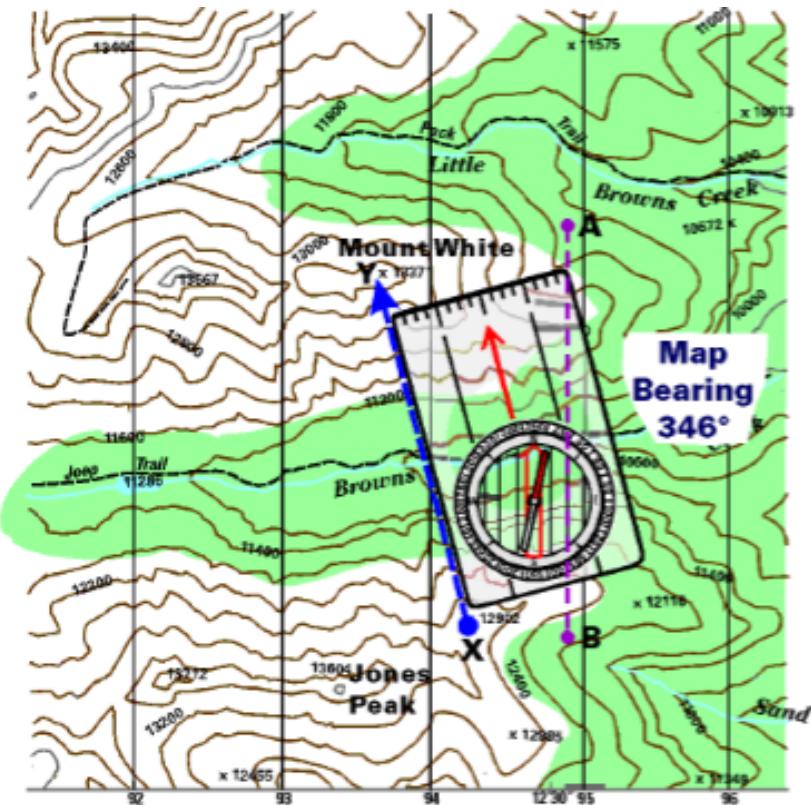
- TWO FUNCTIONS
- Protractor (Magnetic Needle not used)
- Navigation Aid (Magnetic Needle used)



Protractor: True Bearings

TRUE Bearing taken off Map (NO NEEDLE)

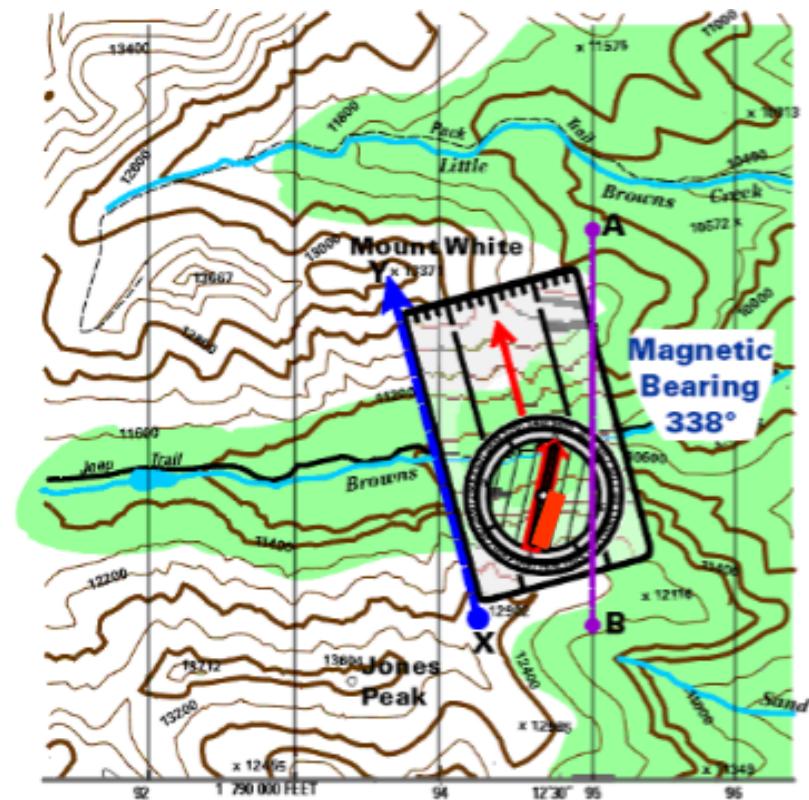
1. Draw bearing (Pt. X to Pt. Y)
1. Align base-plate with bearing
1. Align orienting lines with drawn
 1. True North lines
2. Read value on dial at Index Line
(Noting Bearing as "True")



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)

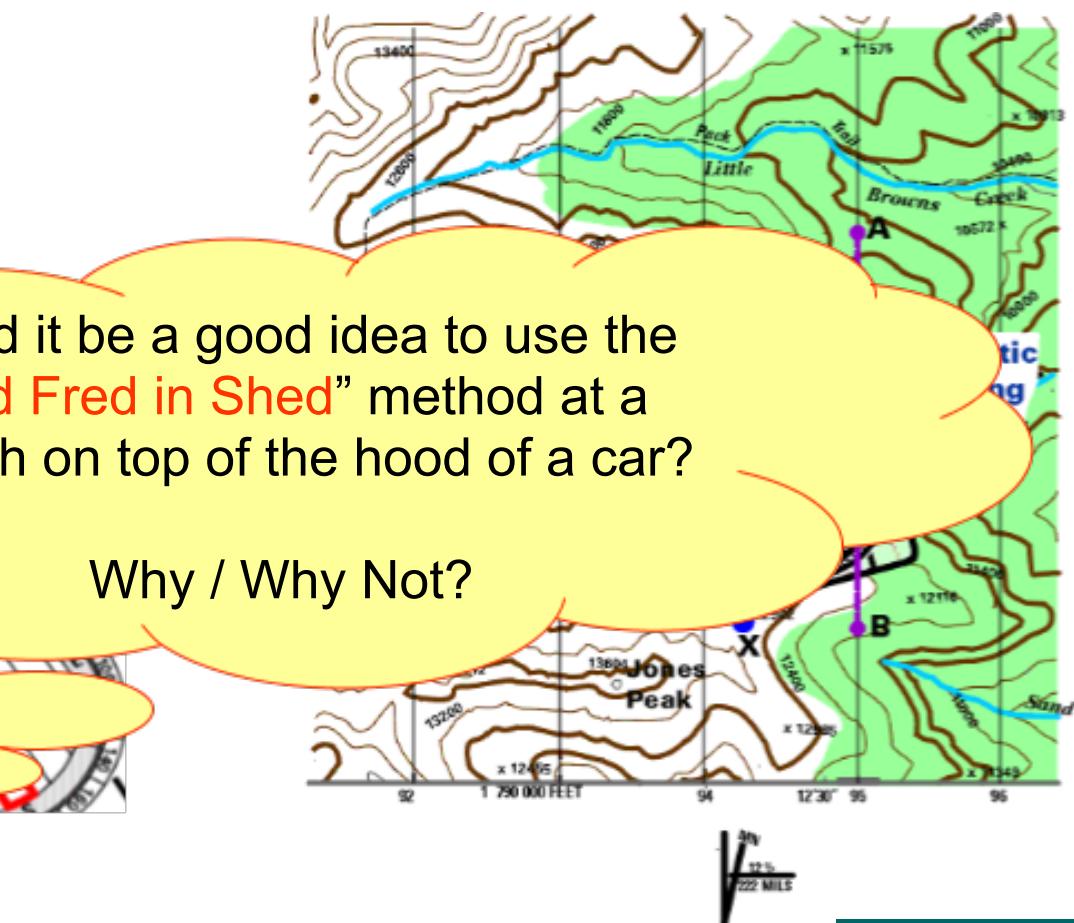
1. Align base-plate w

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 +/- 180°)

- “Red Fred To”

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



SIGHTING a bearing (accurately)

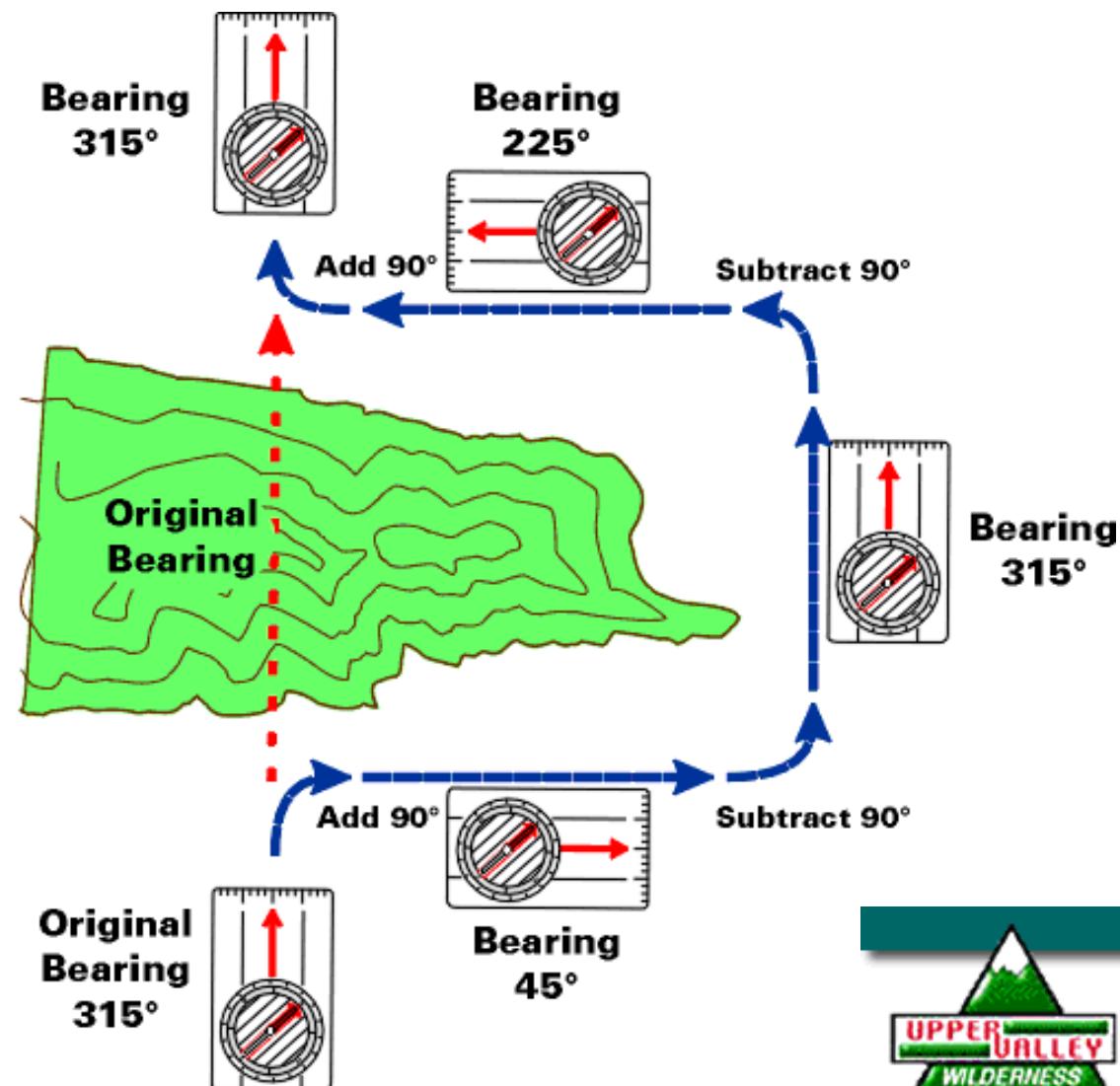
- Bring compass to eye level
- Sight a distant object or tree
- Two-Person Navigating
 - Great for Nighttime / Poor Visibility
 - “Leap Frog” Navigating



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

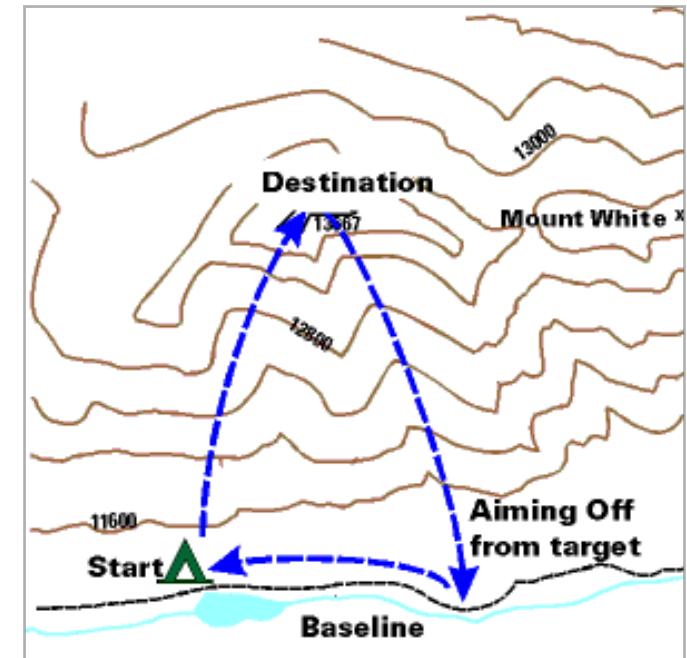
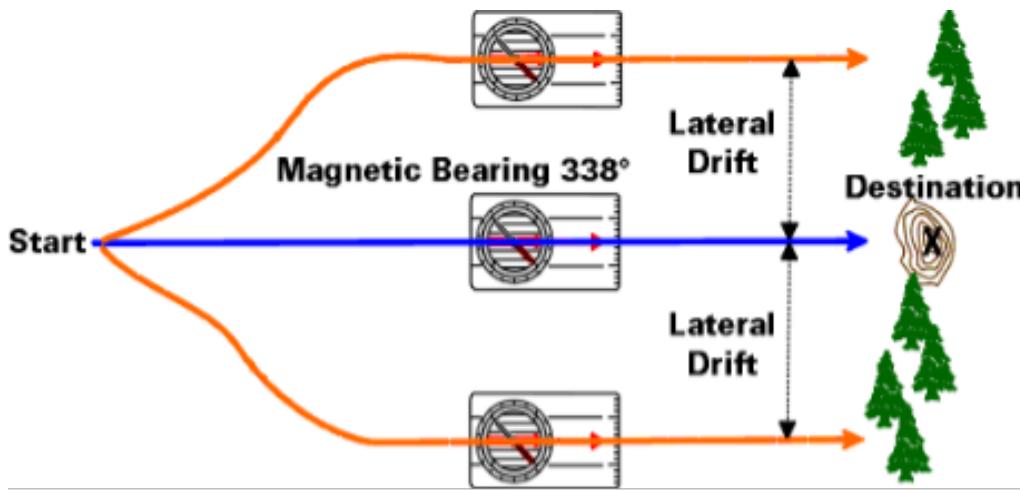
- Scenario:
- You're navigating on a 338°M bearing in poor visibility.
- You have counted 400 paces of your 400m bearing.
- You don't see your target...

**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 821Northing ”
- Base: (*repeats*) “42 821Northing ”
- You: “Affirmative”

