Map & Compass Training
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.
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
  - Gulley / 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 = 1 km
  1 tick = 100 m
  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°

TRUE NORTH
- Parallel with PAGE EDGE
- NOT parallel with GRID EDGE

NH & VT Decl.
15°W - 17°W
Parts of a compass

- Baseplate
- Index Line
- Orienting Arrow
- Magnetic Needle
- Compass Housing with Degree Dial
- Direction of Travel Arrow
- Read Bearing Here

a.k.a. Red Fred
a.k.a. Shed
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)*

2. 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 bearing

1. Align orienting lines with drawn Magnetic North lines OR

2. Keep “Red Fred in Shed”

2. Read value on dial at Index Line

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?
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°M → 330°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?

<table>
<thead>
<tr>
<th>Declination or Degrees Off Course</th>
<th>Error Off Target after Walking 10 Miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>1°</td>
<td>920 feet (280 meters)</td>
</tr>
<tr>
<td>5°</td>
<td>4,600 feet (1,402 meters)</td>
</tr>
<tr>
<td>10°</td>
<td>9,170 feet (2,795 meters)</td>
</tr>
<tr>
<td>16° (Declination)</td>
<td>14,690 feet (4477)</td>
</tr>
</tbody>
</table>
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”