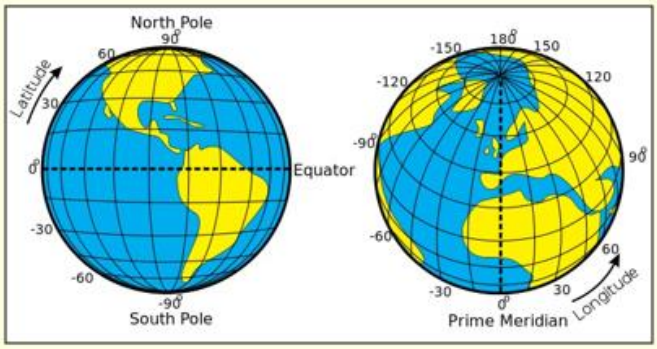
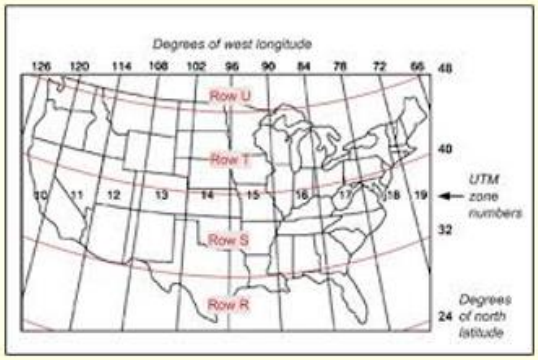
# Plotting A Point On A Map

- Latitude-Longitude
- UTM (Universal Transverse Mercator)




These are the two generally accepted methods for determining where a point on the map is.
Or, conversely, telling someone where you are.

# Map coordinates/Position format

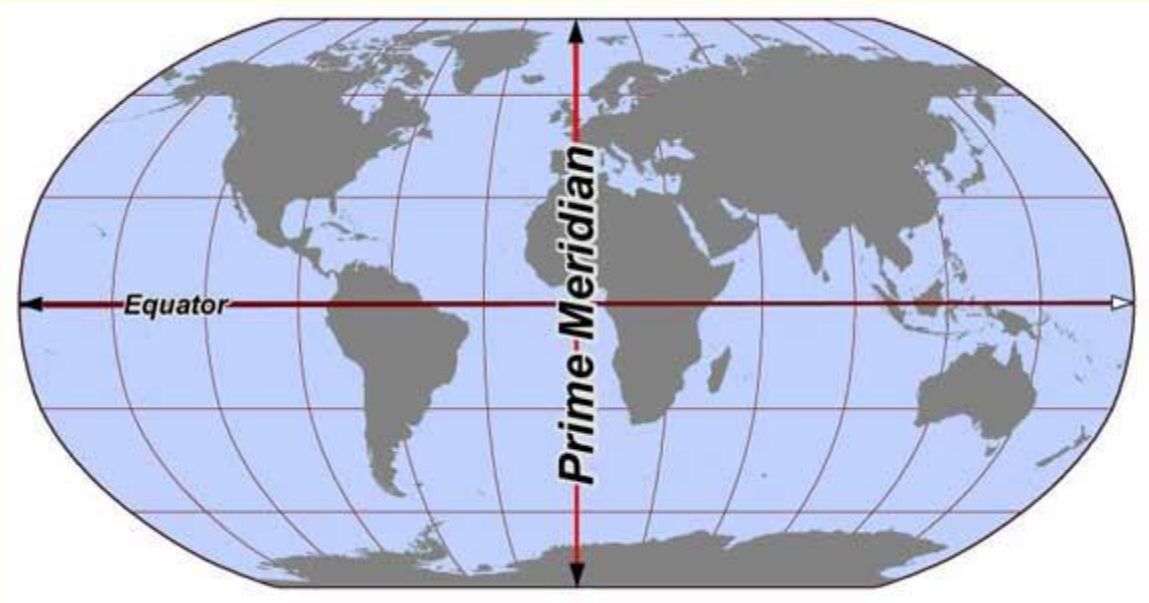
## LATITUDE/LONGITUDE METHOD

(Degrees North/South and East/West)

- North-South measurement (Latitude) given first and gets larger as they move away from the equator.
- East-West measurement (longitude) is given second and gets larger as they move away from the Prime Meridian.

The Latitude Longitude system, abbreviated as LAT/LONG measures the position on the face of the earth in degrees north or south of the equator AND east or west of a line drawn north and south from a point in England called the Prime Meridian.

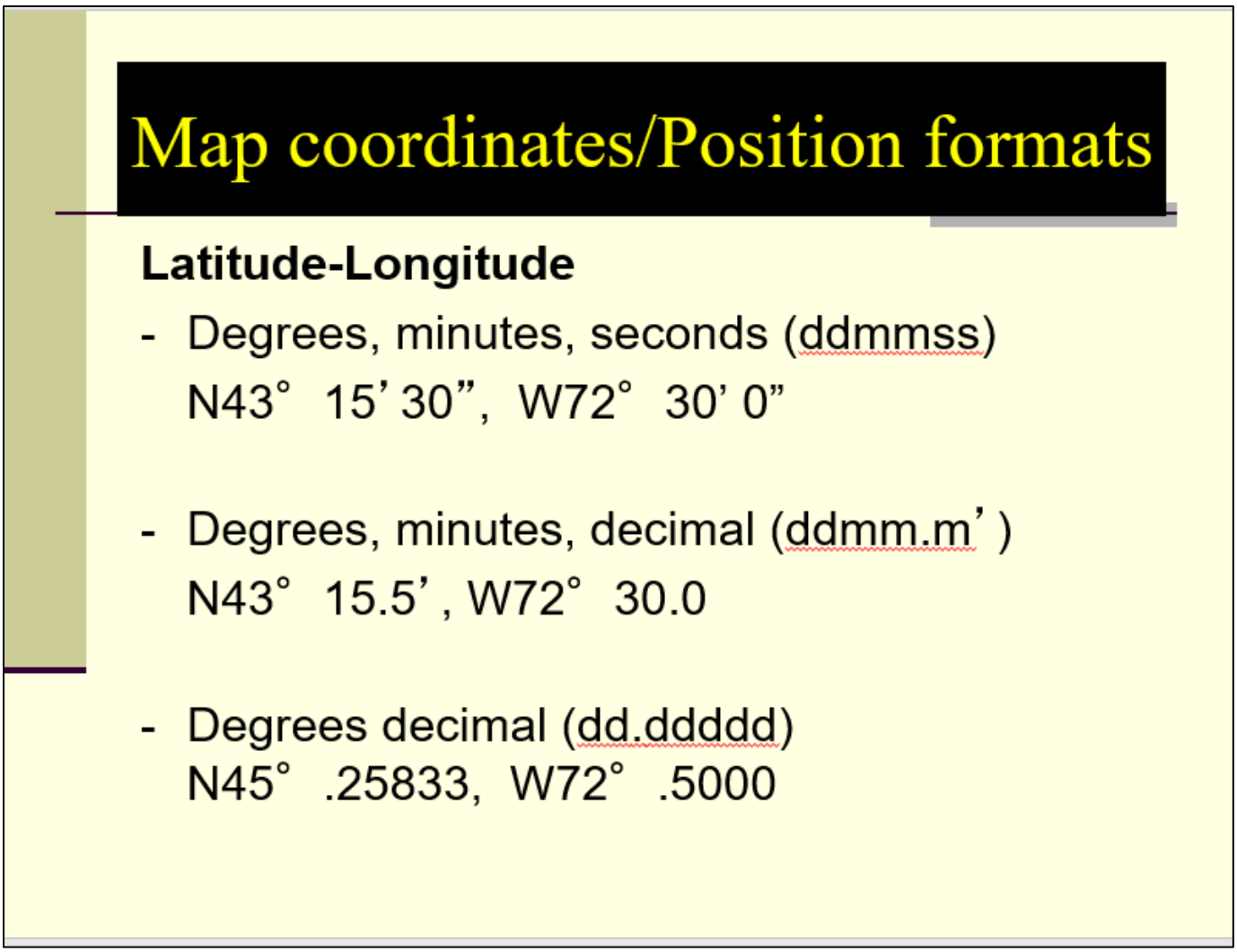
# LAT/LONG on the globe




The equator is roughly in the middle of the earth running around the center horizontally. The Prime Meridian is a line running from pole to pole and was arbitrarily set in England.

Longitude lines are those parallel to the Prime Meridian and go all the way around the world dividing it into 360 equal parts, or degrees. Latitude lines are those parallel to the equator and also go all the way around the world dividing it into 360 equal parts, or degrees.

Each degree is divided into 60 parts called minutes and each minute is divided into 60 seconds. This allows us to define a point on a map quite accurately.




LAT/LONG positions may be displayed any of 3 different formats.

Since we are always working in the northern hemisphere and west of the prime meridian the N and W designations are assumed and often not displayed.

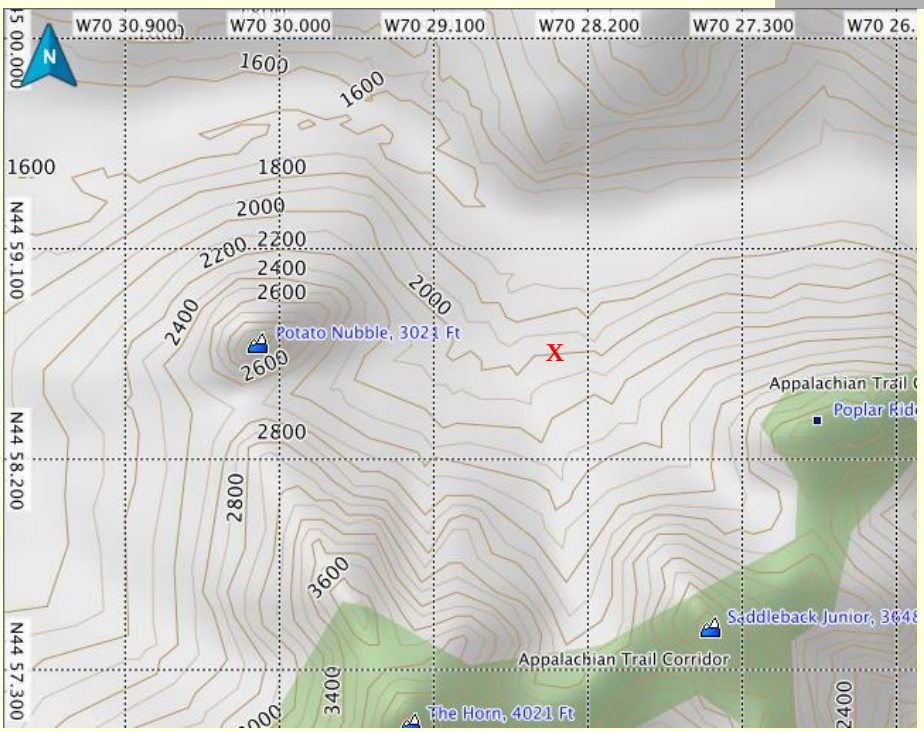
It's important that you are able to recognize which LAT/LONG format is being used.
*** Degrees, minutes, seconds** (ddmmss). Think of this just like a clock time format – 60 seconds in a minute, 60 minutes in a degree. This is what you will often see displayed on a map.
*** Degrees, minutes, decimal** (DD.MM.MMM) is the preferred method for aviation.
*** Decimal degrees (DD.DDDD)** is the format that coordinates from 911 calls are received in. It is very common to initially receive this format from dispatchers who take a call from a lost or injured party in the backcountry.

All of the coordinates in the slide above represent the same position, just in different formats.

For example 30 seconds is one-half of one minute, so using decimal format 30 seconds would be represented as '.5'
There are web and smartphone based tools for converting from one format to another.

It can't be stressed enough to be <u>really clear</u> in your communications as to which format is being used. It is very easy to get them confused when talking over the phone or the radio which can result in significant errors.

# Map coordinates/Position format

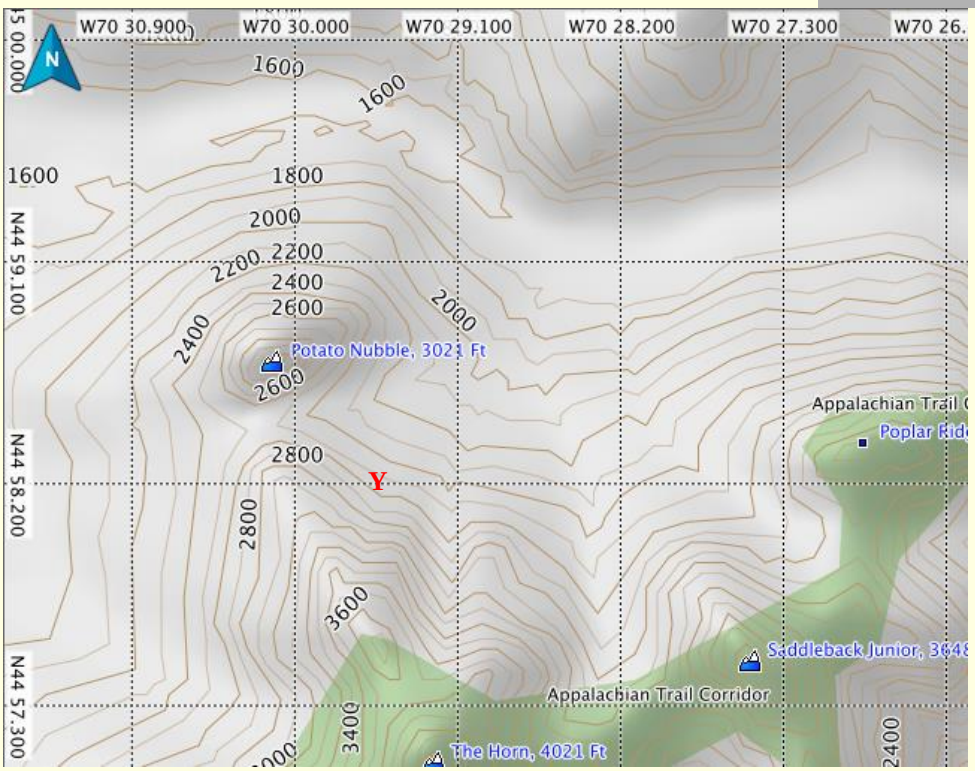



To determine the LAT/LONG of the **RED X** on the map look at the numbers on the left edge and note that it is about half way between N44 59.100 and N44 58.200 (remember that the .200 is a decimal portion of a minute). There are .900 between the two numbers, half of that is 450 which is added to the .200 putting it at N44 58.650.

Looking on the upper edge note that it is about 1/4 of the way beyond W70 28.200, again there are .900 between the numbers and ¼ of 900 is .225 which is added to the .200 putting it at W70 28.425.

The location of the RED X is N44 58.650 W70 28.425

# Map coordinates/Position format




To determine the LAT/LONG of the **RED Y** look at the number on the left edge and note that the Y is right on the line for N44 58.200 so the latitude is N44 58.200.

Looking on the upper edge note that it is about 1/2 of the way beyond W70 29.100, again there are .900 between the numbers and ½ of 900 is .450 which puts it at W70 29.550.

The location of the RED Y is N44 58.200  W70 29.550

# Map coordinates/Position format

UTM (Universal Transverse Mercator )

- Meters east and north of a reference
- East measurement given first
- Numbers get bigger going east and north

During WW I- the militaries learned the value of grid systems and each developed their own. By WW II it became clear that there were too many grid systems and there needed to be only one.

The UTM system was developed by the British and US Army Map Service from 1945 - 1949 and was originally very highly classified. The system has been adopted by NATO and is in use today by the military and SAR units.

Vermont State Police endorses the use of UTM during SAR operations in Vermont.

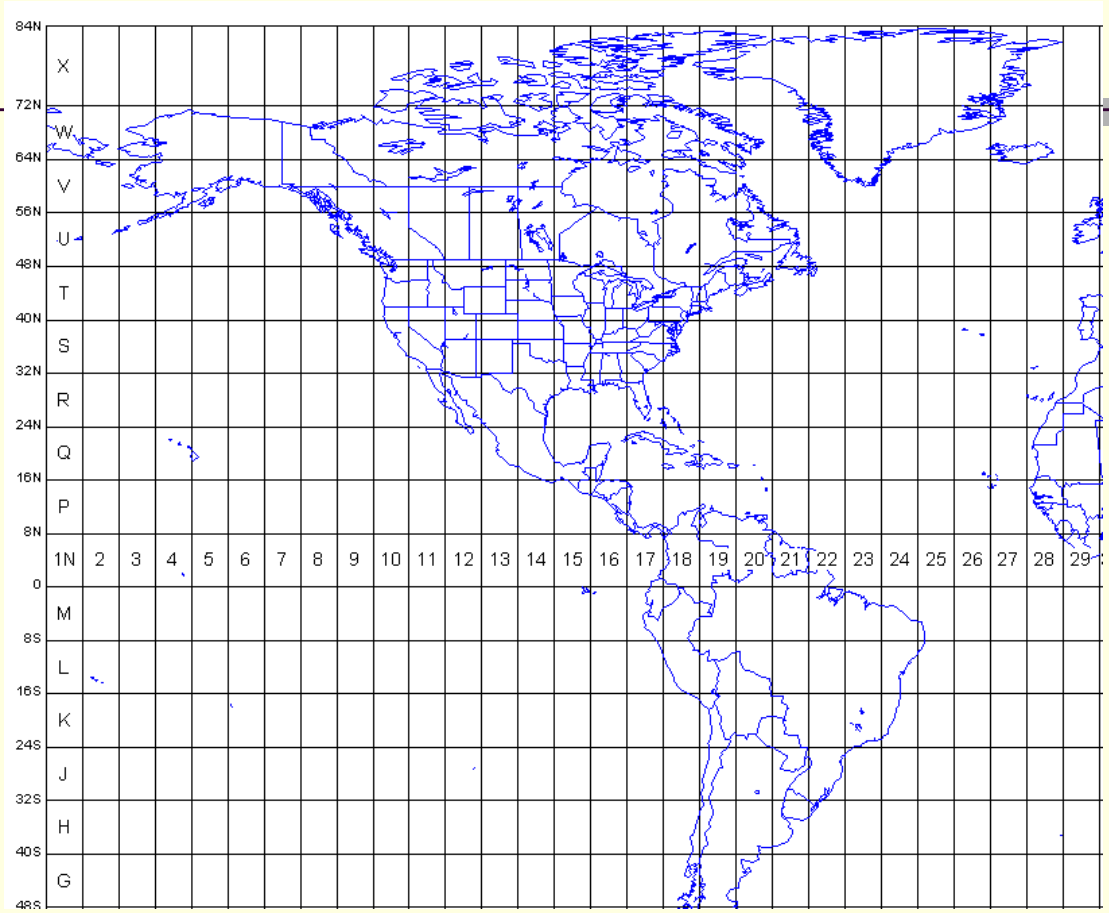
# Map coordinates/Position format

- **Advantages of UTM:**
- This is just like the X Y Cartesian coordinate system you learned in high school math class.
- Coordinates are decimal based.
- Newer maps are using UTM as the primary grid.

Since UTM grids are perpendicular to each other in consistently sized grids it makes it much easier than LAT/LONG to pinpoint a location on a map.

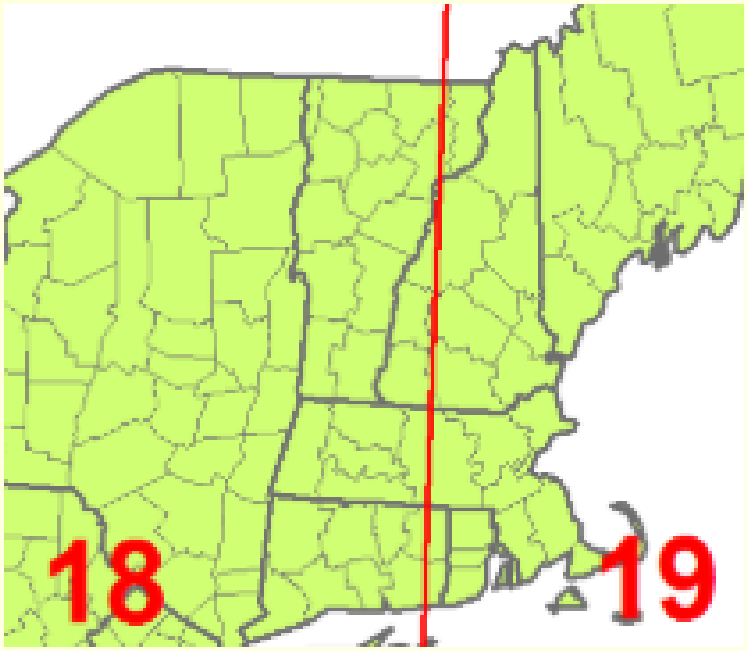
It also does away with potential confusion when communicating coordinates as was discussed in the LAT/LONG section.

# UTM grid




The world is divided into a series of squares that are numbered west– east and lettered south– north. This is part of the world wide UTM grid map.

# UTM grid



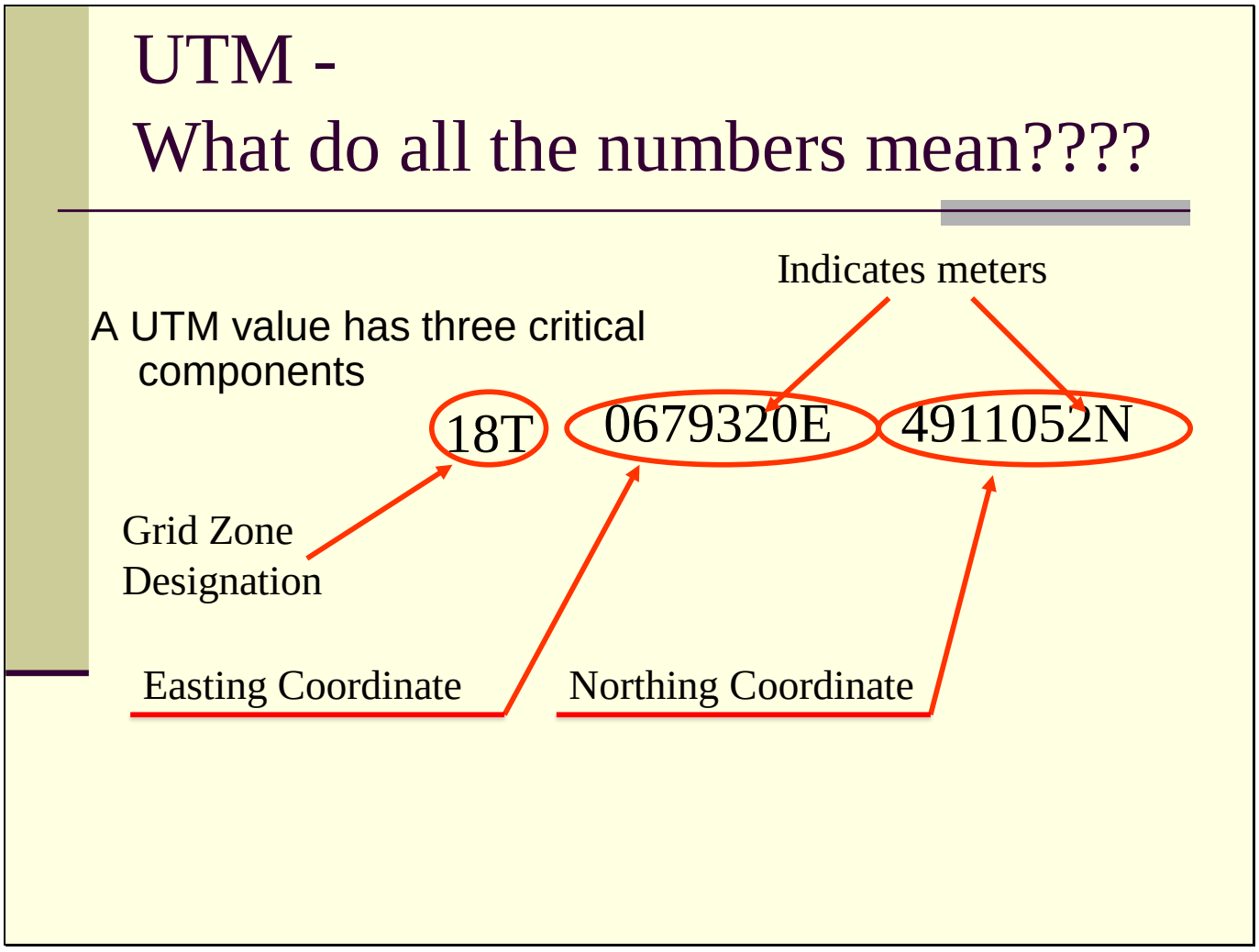

Here is a blown up section on the preceding slide showing just the northeast and making it easier to see Vermont.

Just the very northeast corner of the state is in Grid Zone 19 – the rest is 18T.

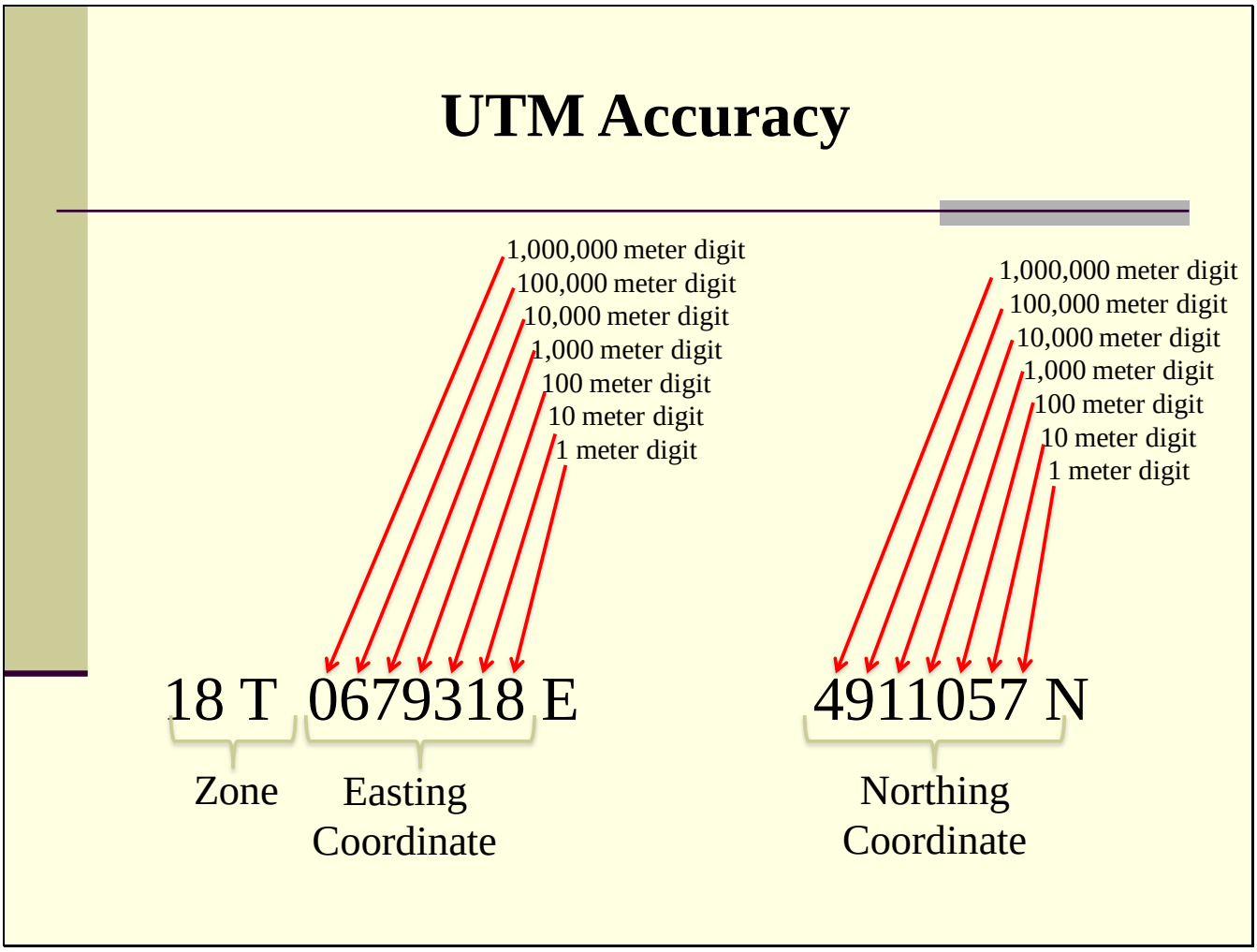
When defining a Vermont location on the map, the UTM coordinates will start with either 18T or 19T.

# Grid Reference Lines

- Easting measurements are measured in meters from the western boundary of the zone towards the east.
- Northing measurements are measured in meters from the southern boundary of the zone towards the north.




This shows the format used for UTM and explains how it is broken down.




The more digits you use, the more accurate you can make your location.

# UTM Coordinates

- In SAR we will typically omit the zone and often the first 2 digit coordinates when transmitting locations, as those typically don't change during a mission.

  18 T 0679318 E 4911057 N

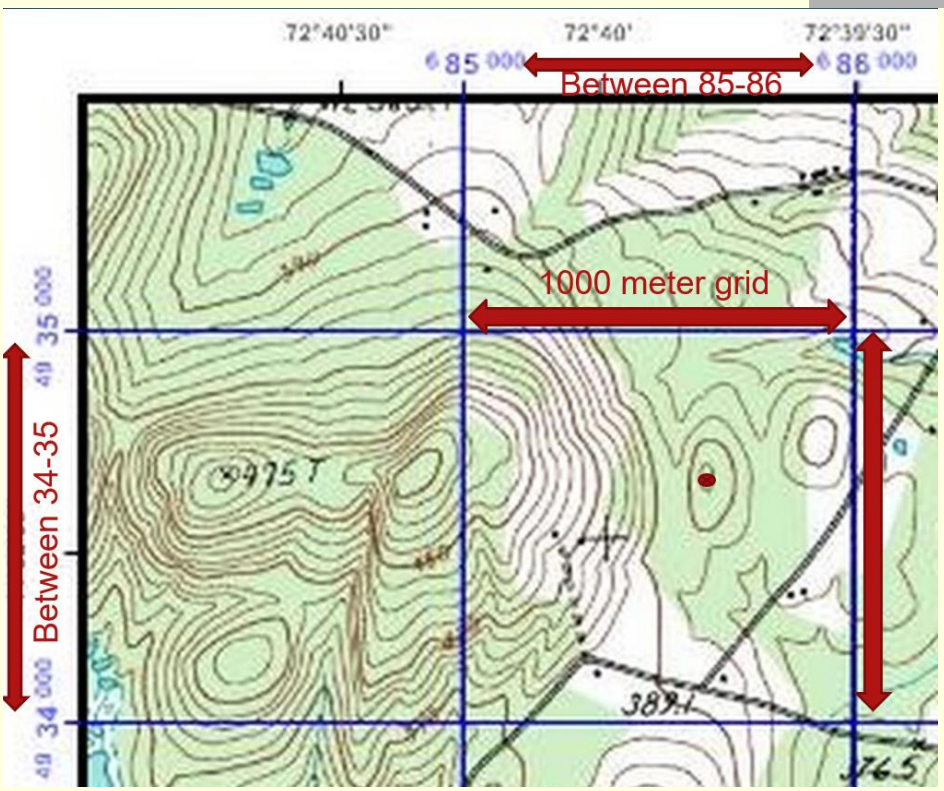
For brevity the above coordinates might be transmitted as "79318,11057"
(there is nothing wrong about including the '06' and '49' but those should be obvious)

This would be referred to as a 10 digit UTM location and defines a point on the earth that is 1 meter by 1 meter or the size of a small table.

The purpose of this is simply to save a bit of time when communicating between the field teams and search base – there is nothing wrong with reading the entire coordinate.

# Location UTM on a map

**18T 0685610 E  4934690 N**




Zone 18T is divided into 100 squares and the whole map above falls into the square 06 easting and 49 northing shown on map by the arrows.  Notice the 06 is shortened to just 6.

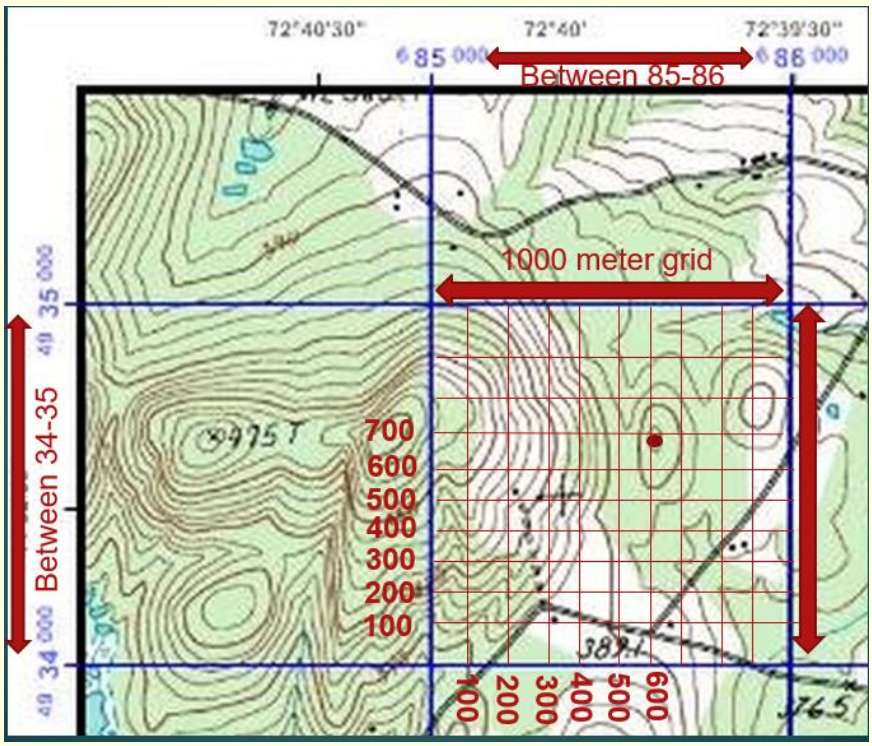
So to determine the location of the red dot on the map we already know that the entire map is in square 18T06 easting – 49 northing so the next step it to identify which square on the map it is in.

On the top of the map you see that the red dot is between 85 and 86 and looking on the left side it is between 34 and 35. We now know the location is in block 18T 0685 E and 4934 N.

The box we have now defined its location as 1000 meters by 1000 meters.

# Location UTM on a map

**18T 0685610 E  4934690 N**




Now our last step is to define where in that 1000M by 1000M box the dot is.
The easiest way to do this is by laying a transparent grid tool over the box, but there are other techniques you can use to estimate this to get 'close enough.'

You can see that the dot is between the 600 and 700 meter grid lines both N and E.

So that adds the next number to the location – we now have:
18T 06856 E and 49346 N which gets is in a 100M x 100M 'box'.

From a practical standpoint this is likely close enough to go locate something in the field, but the UTM grid goes down to 1M x 1M so we need two more numbers to complete the location.

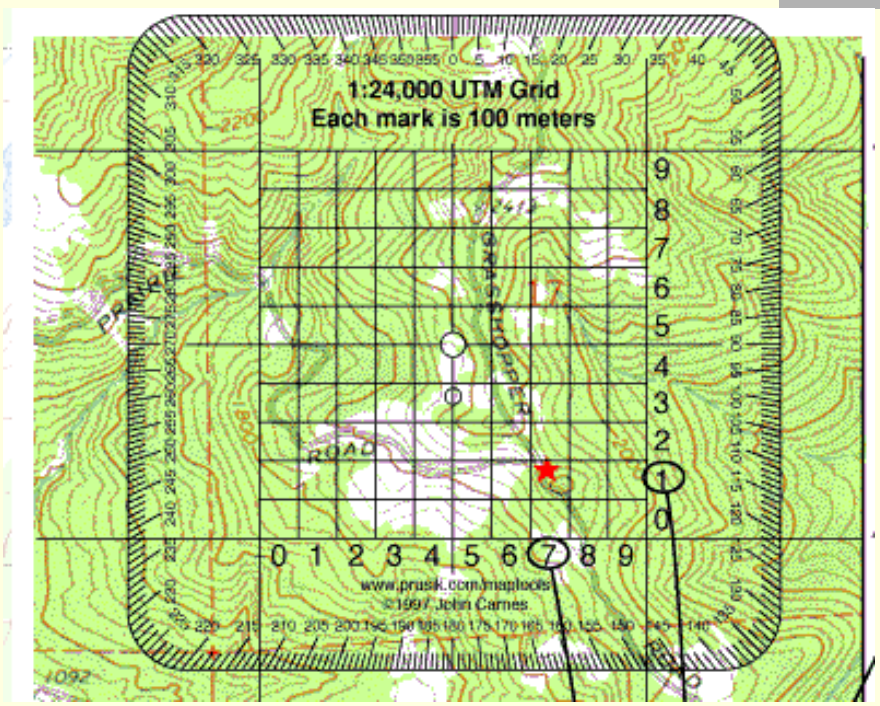
At this point you can just estimate to the closest 10M and call it good.

The dot is just barely past the 600M line E so we'll call that '1', and it's almost touching the 700M line N so we'll call that '9' (9/10 of the way to the 700 line).

We can't possibly get it down to 1M accuracy so we come up with:
**18T 0685610 E  4934690 N**

For UTM locations, always remember to read "right up".  Your easting gives you the "right" on the map, and your northing gives you the "up".

# UTM GRID TOOL



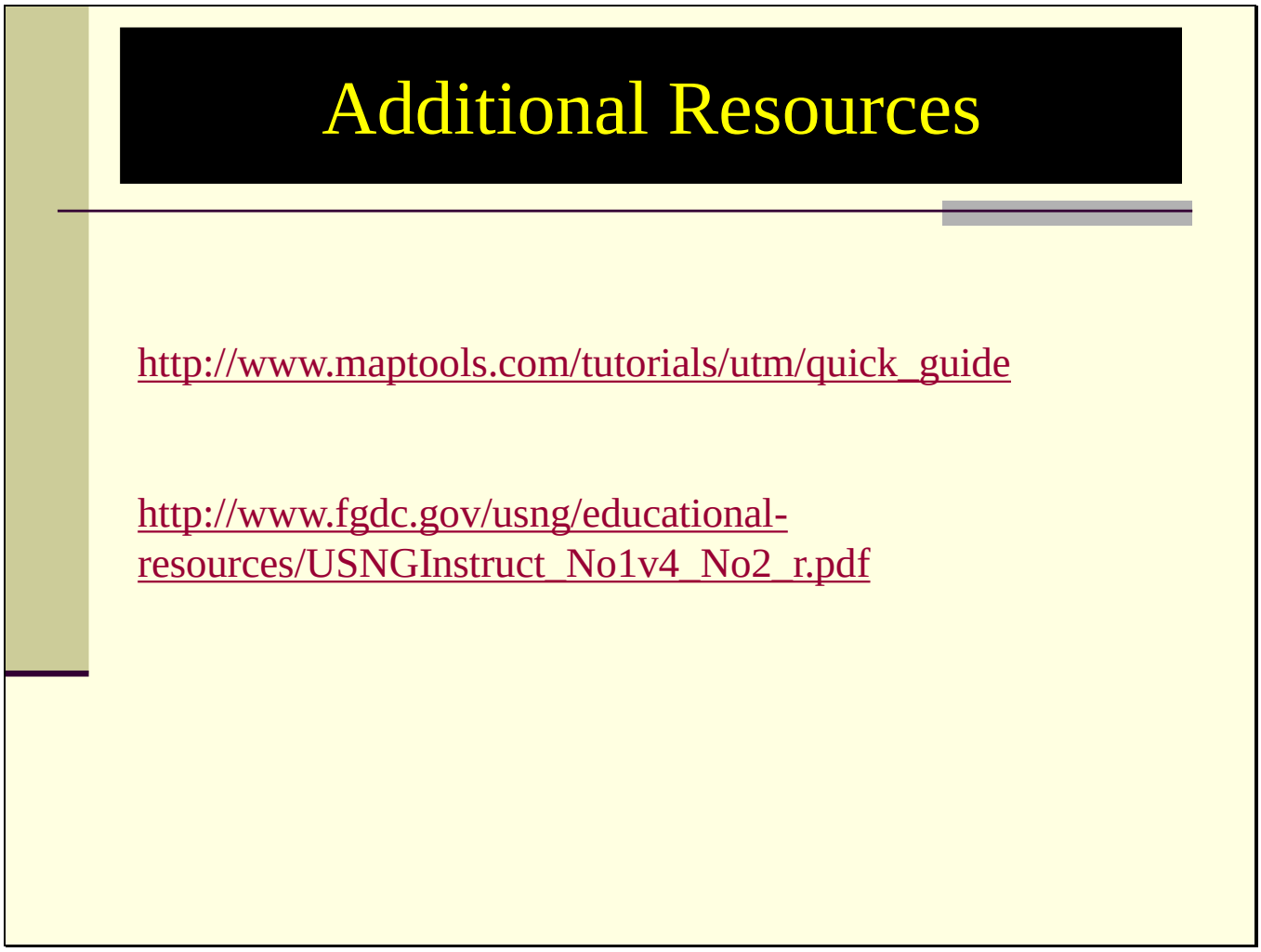

This is a grid overlay tool laid on top of a map. It is made for the 24000:1 scale maps and is see through plastic. The small blocks divide the 1000 meter square we worked with before into 100 meter square blocks leaving us to estimate only within the 100 meter square box giving much more accuracy. You see the Red Star covers about 30 by 30 meters so we don't even try to get it to 1M accuracy.

# UTM GRID TOOL


This compass has a number of different measuring tools at different scales.

The arrow is pointing to the 1:24,000 scale we most commonly use in SAR.

This can be a helpful feature to have on your compass as it facilitates calculating the UTM location on a map.




If you would like to get more information on UTM or USNG navigation, here are some resources.

http://www.maptools.com/tutorials/utm/quick_guide

http://www.fgdc.gov/usng/educational-resources/USNGInstruct_No1v4_No2_r.pdf

# You have finished part of this module

You may close this window to return to the main course and select another part of the Map And Compass module to complete.

Be sure you keep track on your course checklist so you know which modules you have completed.

Don’t forget to look at all the sections in this module.