Map Systems

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Handout by Brandon Rogers and Chris Clarke - 2001

By the end of this class, you should be able to:

(1) Use different map systems to determine the coordinates for any given point.
(2) Understand the different systems so you can communicate effectively with other organizations that use them.
(3) Get information from maps.

Topographic Maps (we say "topos")

Topos are those neat maps we always give you with all the curvy lines on them. The maps we give you are taken from larger versions that are 7.5′ (7.5 minutes) wide and 7.5′ tall. These 7.5′ maps, called quadrangles, are chock full of info for the anxious SAR resource. You can find minute size, declination, the year the map was made, contour intervals, and the name of the quadrangle all along the edges.

Another important piece of information on only BRMRG maps is the map file system designator, which is usually a number and a letter, such as 94-C. Each 7.5′ map is one of four quarters of a section of the state of Virginia. Each quarter has a letter (A,B,C,D), and each section has a number. The BRMRG map filing system is based on this designator, where each folder in the filing system is a whole sector (4 7.5′ maps) the key to the section numbers is posted above the filing cabinet in the Locker. The sections are broken down in the format below:

Section 1

So map 1-A would be the upper right quarter of this section.

B	A
C	D

ASRC Grid System

ASRC Grid overlays are designed to be used with 7.5′ topos to provide additional information to ASRC resources. Every map has a declination, indicator letter (use phonetic alphabet) for distinguishing between different maps of the area, and crosshairs. The larger crosshairs are 1000 meters apart, the smaller ones are 500 meters. All of the crosshairs and edges are oriented to TRUE North.

The benefits of this system include:

- Easy to use and figure out distances
- Security (people outside a search cannot determine locations)
- Usable with any map (the scale will change though)
- Fits on a standard sized sheet of paper (good for making copies)

The Gazetteer

One page in the Gazetteer is equal to 4 folders from the Locker which is equal to 16 7.5′ topo maps (4 across and 4 down). There is a key to the whole Gazetteer on the back and the inside front cover. We use these mainly for giving directions to searches. They are great for driving, but not for land navigation on foot.

Latitude/Longitude (Lat/Long)

Latitude and Longitude are measured in degrees. Each degree can be broken down into 60 minutes, and each minute can be broken down into 60 seconds. Degrees are represented by a (°), minutes are represented by a (′), and seconds are represented by a (″). A 7.5-minute topo is 7.5′ of Lat. from one side to the other and 7.5′ of Long. from top to bottom. This system is on the USGS topos (look in the corners of the map). Maps properly using Lat/Long get narrower as you get farther away from the equator.

1 second of Latitude = 1 nautical mile = 1.15 statute miles

This system is the stepping stone to Loran-C.

Loran-C

Loran-C uses the same measuring system as Lat/Long except minutes and seconds are combined into a decimal form of minutes. This system is used with some GPS units and by the Civil Air Patrol (CAP).

To convert from Lat/Long to Loran-C:
Take the seconds from Lat/Long and divide by 60. Add this decimal number to the number of minutes from Lat/Long. This is the minutes measurement for Loran-C.

150° 20′ 30″ = 150° 20.5′ 28° 15′ 20″ = 28° 15.33′

<u>Decimal Degrees</u>

Decimal Degrees is the same as Loran-C except degrees, minutes, and seconds are represented as a decimal form of degrees. This system is used mainly in computer mapping and also some GPS units.

To convert from Loran-C to Decimal Degrees:
Take the minutes from Loran-C and divide by 60. Add this decimal number to the number of degrees from Loran-C. This is the degrees measurement for Decimal Degrees.

150° 20.5′ = 150.342° 28° 15.33′ = 28.256°

<u>Universal Transverse Mercator (we say "UTM")</u>

The UTM system is another map system that is found on USGS topos. It divides the Earth into sections called Zones. We are in Zone 17. Each Zone has its own "North", meaning each is oriented a different way in relation to true North. Each Zone also has its own origin where measurement begins (0 meters). A Zone is measured by meters with the same precision as the ASRC Grid system, but over a much larger area. This system is used by the military and some GPS units. We will primarily come across it when communicating with the National Guard or the Military Reserves.

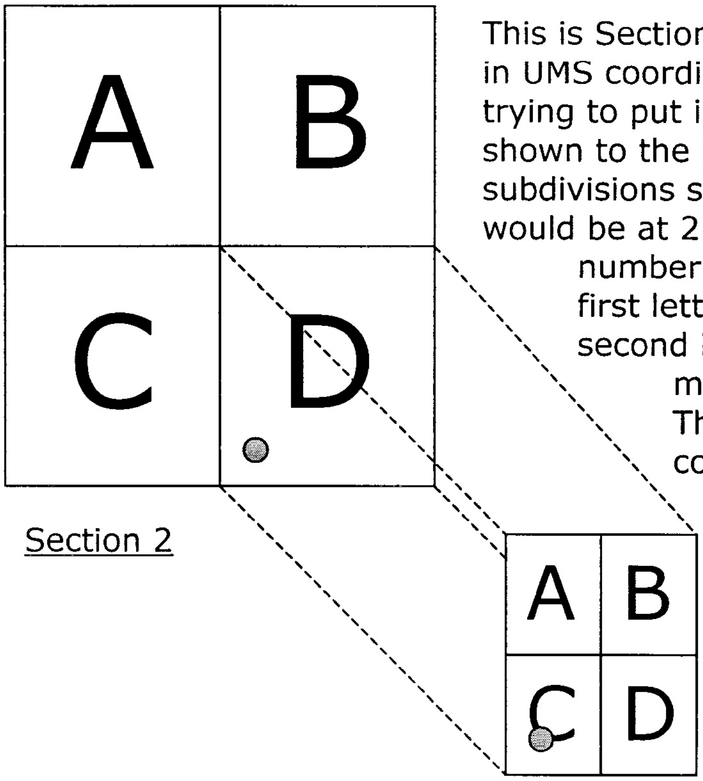
The UTM system is on any USGS 7.5′ topo in the margins. Newer versions of any topo will have a black grid on the actual map for UTM coordinates. Look for the series of numbers along the sides that contains both big and small digits. It will look something like this:

$^{42}18$ This is read in meters and as if there were 3 more zeroes on the end (4,218,000 meters). If you're reading these numbers from top to bottom on a topo then you would say "4,218,000 meters North" in Zone 17.

UMS System

The UMS System is a block system used on the CAP's road maps. UMS is very similar to the BRMRG filing system, but there are a few important differences. The basic idea is that you have a point located in a certain section on the map. You can narrow down the size of the section by continually subdividing it into four quadrants and specifying which quadrant the point is in. This system can be as precise as necessary. It is primarily used by organizations like the CAP to roughly indicate where a moving aircraft is located at any given time. The maps have roads and other good reference points that are visible from the air so pilots can communicate their position to someone else. However, aeronautical maps are more accurate and better for directing a plane to a single point on a map.

To indicate the coordinates of a point in UMS, first you must find the number of the section that the point is in. This number is found on a Virginia State Map, and it is subdivided much like the BRMRG filing system, but the numbering is different. Each numbered section is equal to 1 BRMRG map folder which has 4 7.5' USGS topos in it. Once you have the right numbered section, you can begin subdividing it into lettered quadrants using the following method:



Section 2

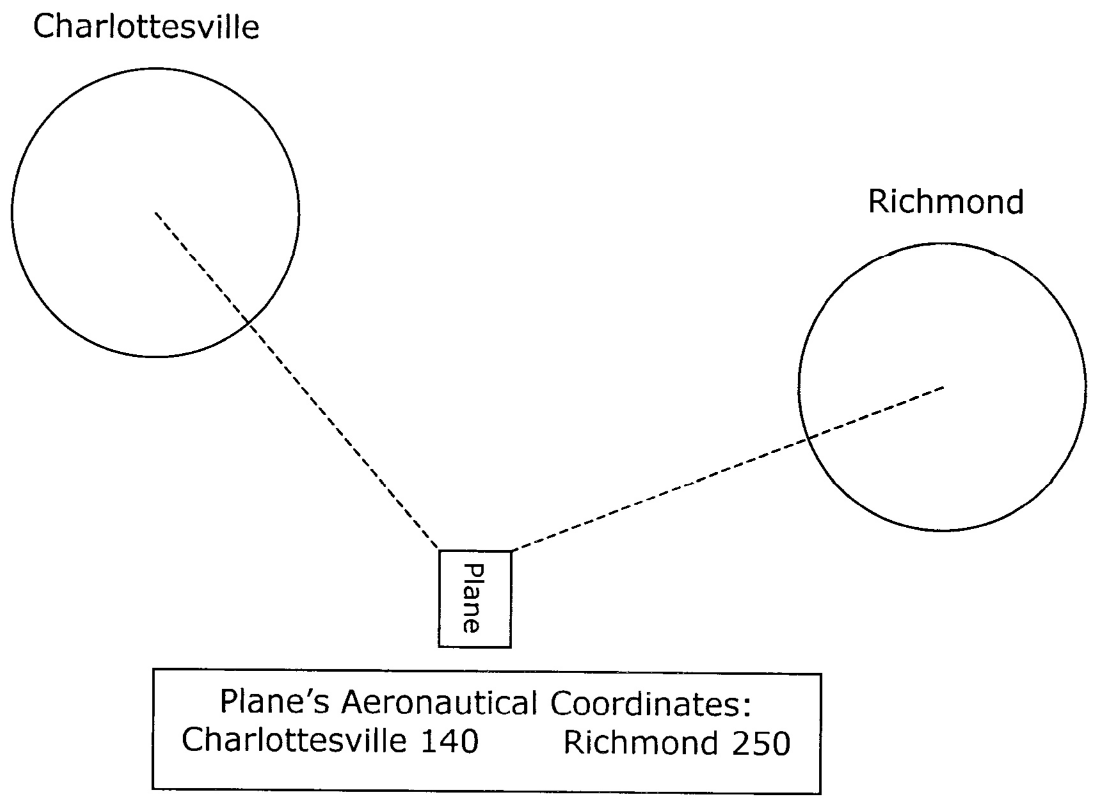
This is Section 2 of the State of Virginia in UMS coordinates. The point we are trying to put in UMS coordinates is shown to the left. Based on the subdivisions shown here, this point would be at 2DC in UMS. The first number is the section number. The first letter is the first quadrant, the second is the next quadrant at a more specific level. This specification can continue as necessary.

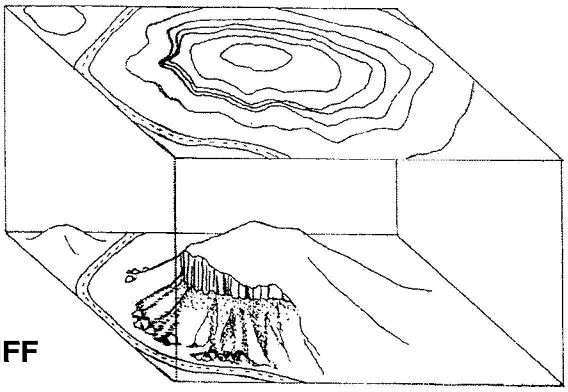
NOTE: The ABCD form is different from the BRMRG filing system BACD form.

Aeronautical Charts

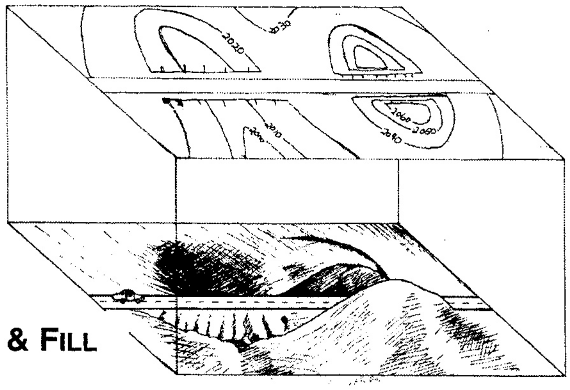
Aeronautical Charts use VORs (VHF Omnidirectional Range) at different locations to give the coordinates for a certain point. Each VOR uses a signal similar to radar and sweeps the sky in a circle. When the signal hits something (like a plane), it communicates to the plane a compass bearing from that VOR. For example, a plane due West of Richmond would receive the signal that it was at the aeronautical coordinate "Richmond 270". This system is more accurate than UMS for directing people or planes to specific points.

To communicate a specific point for a pilot to fly to, or for base to send a ground team, 2 or 3 aeronautical coordinates are necessary. A pilot could receive multiple signals from different VORs and tell base his exact location, or base could use an Aeronautical Chart and the nearby VORs to give a pilot aeronautical coordinates to fly to.

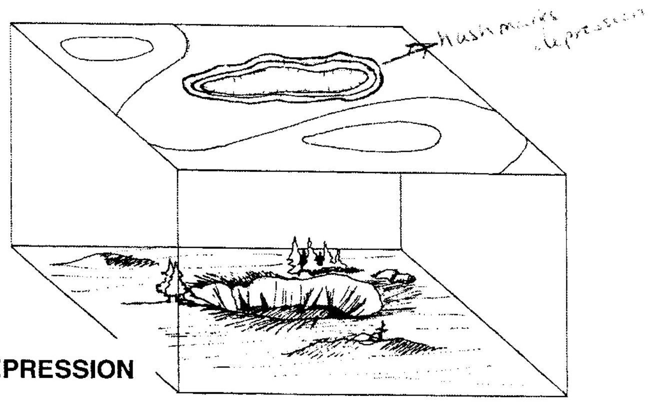




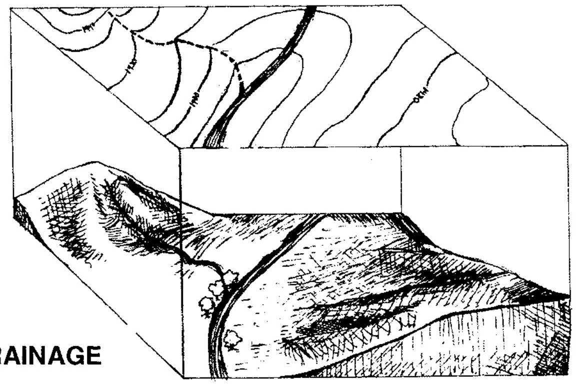
CLIFF



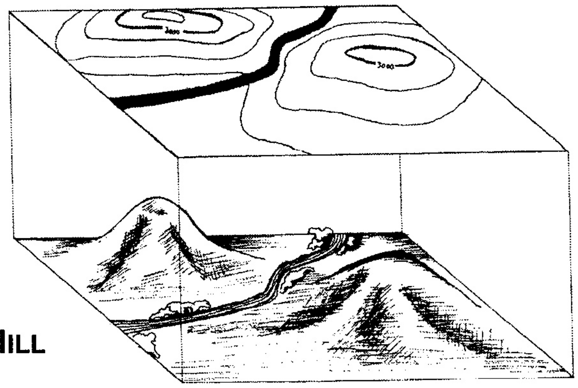
CUT & FILL



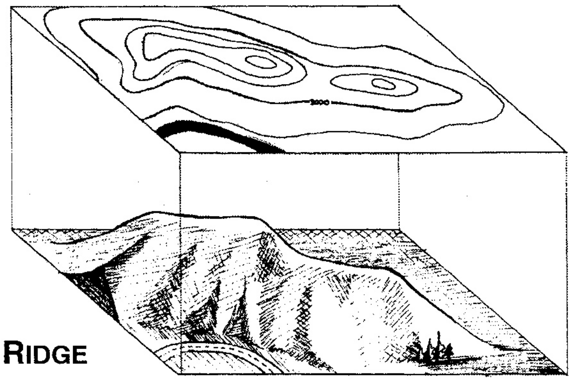
DEPRESSION



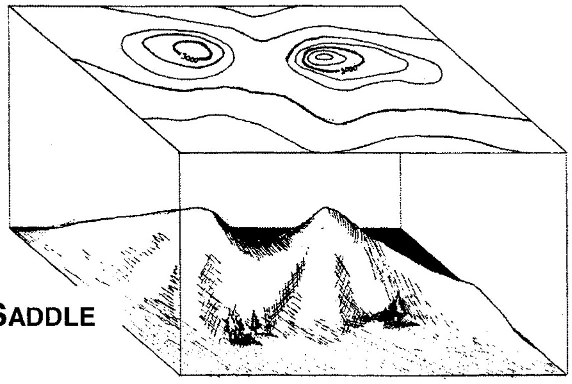
DRAINAGE



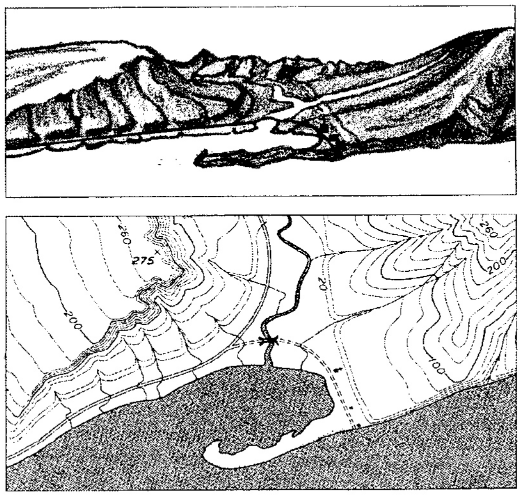
HILL



RIDGE



SADDLE



GENERAL EXAMPLE

Compass Parts