

O-2024
USE SECTIONAL CHARTS

CONDITIONS

You are a Mission Scanner trainee and must discuss the information displayed on a sectional chart and determine heading and distance

OBJECTIVES

Discuss the information displayed on a sectional chart and to determine heading and distance.

TRAINING AND EVALUATION

Training Outline

1. As a Mission Scanner trainee, basic knowledge the information contained on a sectional chart and its use is essential. The most important tool you will use in both mission flight planning and execution is the chart. Highway road maps are usually not acceptable for air navigation, since most don't have detailed terrain depiction and also lack the superimposed reference system. Many aeronautical charts have such small scales that the makers are unable to show required levels of detail when trying to put a large area into a small chart space. The most useful chart that has been widely accepted for visual, low-altitude navigation is the *sectional aeronautical chart*, sometimes simply referred to as the "*sectional*".
2. Sectional chart. Sectionals use a scale of one to five hundred thousand, or 1:500,000, where all features are shown 1/500,000 of their actual size (1 inch = 6.86 nm). This allows accurate depiction of both natural and cultural features without significant clutter. Sectionals portray the following:
 - a. Physical, natural features of the land, including terrain contours or lines of equal elevation.
 - b. Man-made or cultural development, like cities, towns, towers, and racetracks.
 - c. Visual and radio aids to navigation, airways, and special-use airspace.
 - d. Airports and airport data, lines of magnetic variation, controlled airspace, obstructions and other important information.
 - e. VFR waypoints.
 - f. Obstructions to flight.
3. Legend. An often overlooked but vital part of the sectional is the 'Legend.' This is a written explanation of symbols, projections, and other features used on the chart. Other important areas of the chart are its title page or "panel", and the margins around the chart edges. The margins contain supplemental radio frequency information, details about military or *special use airspace*, and other applicable regulations. The title panel identifies the region of the country shown by the chart, indicates the scale used in drawing the chart, explains elevations and contour shading, and shows the expiration date of the chart and effective date of the next issue of that chart. *It is vitally important that you keep current charts in the aircraft at all times.*
4. Interpretation. A significant part of air navigation involves interpreting what one sees on the chart, then making comparisons outside the aircraft. Basic chart symbols can be grouped into cultural features, drainage features, and relief features.

Understanding *cultural features* is straightforward, and they usually require little explanation. Villages, towns, cities, railroads, highways, airports or landing strips, power transmission lines, towers, mines, and wells are all examples of cultural features. The chart legend explains the symbols used for most cultural features, but if no standard symbol exists for a feature of navigational significance, the cartographer frequently resorts to printing the name of the feature itself, such as *factory* or *prison*, on the chart.

Drainage features on charts include lakes, streams, canals, swamps, and other bodies of water. On sectional charts these features are represented by lightweight solid blue lines for rivers and streams; large areas of water, such as lakes and reservoirs, are shaded light blue with the edges defined by lightweight solid blue lines. Under most conditions, the drainage features on a map closely resemble the actual bodies of water. However, certain bodies of water may change shape with the season, or after heavy rains or drought. Where this shape change occurs with predictability, cartographers frequently illustrate the maximum size expected for a body of water with light-weight, blue, dashed lines. If you intend to use drainage features for navigation, you should consider recent rains or dry spells while planning and remember the body of water may not appear exactly as depicted on the chart.

Relief features indicate vertical topography of the land including mountains, valleys, hills, plains, and plateaus. Common methods of depicting relief features are contour lines, shading, color gradient tints, and spot elevations. Contour lines are the most common method of depicting vertical relief on charts. The lines do not represent topographical features themselves, but through careful study and interpretation, you can predict a feature's physical appearance without actually seeing it. Each contour line represents a continuous imaginary line on the ground on which all points have the same elevation above or below sea level, or the zero contours. Actual elevations above sea level of many contour lines are designated by a small break in the line, while others are not labeled. Contour interval, or vertical height between each line, is indicated on the title panel of sectionals. Contour lines are most useful in helping us to visualize vertical development of land features. Contour lines that are grouped very closely together indicate rapidly changing terrain, such as a cliff or mountain. More widely spaced lines indicate more gentle slopes. Absence of lines indicates flat terrain. Contour lines can also show changes in the slope of terrain.

Shading is added to sectional charts to help highlight and give contrast to the contour lines. These tiny gray dots are applied adjacent to selected contour lines and give the contours a three-dimensional appearance. This makes it easier to imagine the physical appearance of the shaded topographical feature. Gradient tints, the "background" colors on charts, indicate general areas of elevation. The height range assigned to each gradient color is indicated on the title panel of each sectional chart. Areas that are near sea level are pale green, while *high terrain is color-coded a deep red/brown*. Intermediate elevations are indicated by brighter shades of green, tan, or lighter shades of red/brown.

5. Aeronautical data. The aeronautical information on the sectional charts is for the most part self-explanatory. An explanation for most symbols used on aeronautical charts appears in the margin of the chart. Additional information appears at the bottom of the chart.

Information concerning very high frequency (VHF) radio facilities such as tower frequencies, omnidirectional radio ranges (VOR), and other VHF communications frequencies is shown in blue. A narrow band of blue tint is also used to indicate the centerlines of Victor Airways (VOR civil airways between omnirange stations). Low frequency-medium frequency (LF/MF) radio facilities are shown in magenta (purplish shade of red).

Runway patterns are shown for all airports having permanent hard surfaced runways. These patterns provide for positive identification as landmarks. All recognizable runways, including those that may be closed, are shown to aid in visual identification. Airports and information pertaining to airports having an airport traffic area (operating control tower) are shown in blue. All other airports and information pertaining to these airports are shown in magenta adjacent to the airport symbol that is also in magenta.

The symbol for obstructions is another important feature. The elevation of the top of obstructions above sea level is given in blue figures (without parentheses) adjacent to the obstruction symbol. Immediately below this set of figures is another set of lighter blue figures (enclosed in parentheses) that represent the height of the top of the obstruction above ground-level. Obstructions which extend less than 1,000 feet above the terrain are

shown by one type of symbol and those obstructions that extend 1,000 feet or higher above ground level are indicated by a different symbol (see sectional chart). Specific elevations of certain high points in terrain are shown on charts by dots accompanied by small black figures indicating the number of feet above sea level. The chart also contains larger bold face blue numbers that denote Maximum Elevation Figures (MEF). These figures are shown in quadrangles bounded by ticked lines of latitude and longitude, and are represented in thousands and hundreds of feet above mean sea level. The MEF is based on information available concerning the highest known feature in each quadrangle, including terrain and obstructions (e.g., trees, towers, and antennas). Since CAP aircraft regularly fly at or below 1000' AGL, aircrews should exercise extreme caution because of the numerous structures extending up as high as 1000' – 2000' AGL. Additionally, guy wires that are difficult to see even in clear weather support most truss-type structures; these wires can extend approximately 1500 feet horizontally from a structure. Therefore, all truss-type structures should be avoided by at least 2000 feet (horizontally and vertically).

6. Determining heading and distance. To determine a heading, locate the departure and destination points on the chart and lay the edge of a special protractor, or *plotter*, along a line connecting the two points. Read the true course for this leg by sliding the plotter left or right until the center point, or grommet, sits on top of a line of longitude. When the course is more to the north or south, you can measure it by centering the grommet on a parallel of latitude, then reading the course from the inner scale that's closer to the grommet. To determine distance, use the scale that's printed on the plotter's straight edge: one edge measures nautical miles and the other statute miles.

7. Grids. CAP has adopted a standard grid system built upon the matrix of parallels of latitude and meridians of longitude and the sectional aeronautical chart. Sectional charts cover a land area approximately seven degrees of longitude in width and four degrees of latitude in height. Information pertaining to gridding can be found in Attachment E of the *U.S. National SAR Supplement to the International Aeronautical and Maritime SAR Manual* (or Attachment 1 of the MART).

The sectional grid system used by Civil Air Patrol divides each sectional's area into 448 smaller squares. This process begins by dividing the whole area into 28 *1-degree* grids, using whole degrees of latitude and longitude. Then each 1-degree grid is divided into four *30-minute* grids, using the 30-minute latitude and longitude lines. Finally, each of the 30-minute grids is divided into four *15-minute* grids, using the 15- and 45-minute latitude and longitude lines.

When circumstances require, a 15-minute grid can be divided into four more quadrants using 7 1/2 degree increments of latitude and longitude, creating four equal size grids that are approximately 7 1/2 miles square. The quadrants are then identified alphabetically - A through D - starting with the northwest quadrant as A, northeast as B, southwest as C and southeast as D. [If needed, a 7 1/2 degree grid can be further subdivided into four quadrants using the same methodology: using the 7 1/2 degree grid 'A', the quadrants would be labeled AA, AB, AC and AD.]

Another means of designating a grid system is the *Standardized Latitude and Longitude Grid System*. It has an advantage over the sectional standardized grid in that it can be used on any kind of chart that has lines of latitude and longitude already marked. In this system, 1-degree blocks are identified by the intersection of whole numbers of latitude and longitude, such as 36-00N and 102-00W: these points are always designated with the latitude first, such as 36/102, and they identify the area north and west of the intersection of these two lines. Next, the 1-degree grid is divided into four quadrants using the 30-minute lines of latitude and longitude. Label each quadrant A through D; the northwest quadrant being 36/102A, the northeast 36/102B, the southwest 36/102C, and the southeast 36/102D. Each quadrant can also be divided into four sub-quadrants, labeled AA, AB, AC, and AD, again starting with the most northwest and proceeding clockwise.

Additional Information

More detailed information and pictures on this topic are available in Chapter 8 of the MART.

Evaluation Preparation

Setup: Provide the student with a sectional chart and a plotter.

Brief Student: You are a Scanner trainee asked to discuss the information displayed on a sectional chart, and to determine heading and distance.

Evaluation

Performance measures

Results

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|------------------------------------------------------------------------------|---|---|
| 1. Identify and discuss the following on an aeronautical sectional chart: | | |
| a. Physical features such as topographical details. | | |
| b. Towns, cities, highways, roads, and towers (MSL and AGL). | | |
| c. Airways, radio aids, airports and airport data. | | |
| d. Maximum Elevation Figures. | | |
| e. Legend and margin information. | P | F |
| 2. Given a sectional and plotter, determine a heading and measure distances. | P | F |
| 3. State the size of a full and one-quarter CAP and Standardized grids. | P | F |

Student must receive a pass on all performance measures to qualify in this task. If the individual fails any measure, show what was done wrong and how to do it correctly.