O-2022

DEMONSTRATE SCANNING PATTERNS AND LOCATE TARGETS

CONDITIONS

You are a Mission Scanner trainee and must use scanning patterns to locate targets.

OBJECTIVES

Use proper scanning patterns to locate an object and a person on the ground.

TRAINING AND EVALUATION

Training Outline

1. As a Mission Scanner trainee, the ability to use proper scanning patterns to locate objects on the ground is essential. Scanning is the process of investigating, examining, or checking by systematic search. In search and rescue operations, the scanner visually searches for distress signals or accident indications by using a systematic eye movement pattern. Refer to Chapter 5 of the MART for figures.

2. Vision. The brain actively senses and is aware of everything from the point outward to form a circle of 10 degrees (visual acuity outside of this cone of vision is only ten percent of that inside the cone). This is central vision, produced by special cells in the fovea portion of the eye's retina. Whatever is outside the central vision circle also is "picked up" by the eyes and conveyed to the brain, but it is not perceived clearly. This larger area is called peripheral vision; cells less sensitive than those in the fovea produce it. For example, an object that is visible one mile away using central vision would only be visible 500 feet away using peripheral vision. However, objects within the peripheral vision area can be recognized if mental attention is directed to them.

Note that peripheral vision is very important at night, and is also important in picking up structures such as towers.

3. Fixation area. The fixation area is the area in which "concentrated" looking takes place. If the search objective happens to come within this fixation area, you probably will recognize it. For central vision to be effective, the eye must be focused properly. This focusing process takes place each time the eyes, or head and eyes, are moved. When you are not actively focusing while looking outside the aircraft, your focal point will be a point about 30 feet out. Thus, daydreaming or thinking about other things while you are supposed to be looking for the target will guarantee you will not see the target even if your eyes are pointed right at it!

4. Fixation points and lines of scan. When you wish to scan a large area, your eyes must move from one point to another, stopping at each point long enough to focus clearly. Each of these points is a fixation point. When the fixation points are close enough the central vision areas will touch or overlap slightly. Spacing of fixation points should be 3 or 4 degrees apart to ensure the coverage will be complete. Consciously moving the fixation points along an imaginary straight line produces a band of effective "seeing."

5. Fixation area. The goal of scanning techniques is to thoroughly cover an assigned search area. Reaching this goal on a single overflight is not possible for a number of reasons. First, the eye’s fixation area is a circle and the search area surface (ground) is flat. Coverage of a flat surface with circles requires much overlapping of the circles. This overlapping is not possible on a search mission because of the aircraft’s motion. Also, the surface area covered by the eye’s fixation area is less for the area near the airplane and increases with distance from the airplane. The net result is relatively large gaps in coverage near the airplane and some overlap as distance from the airplane increases. Angular displacement is the angle formed from a point almost beneath the airplane outward to the scanning range, or beyond. By this definition, the horizon would be at 90 degrees

displacement. Although the fixation area may be a constant 10-degree diameter circle, the effectiveness of sighting the objective decreases with an increase in this angular displacement. Said another way, your ability to see detail will be excellent at a point near the aircraft, but will decrease as the angular displacement increases. At the scanning range, at which the angular displacement may be as much as 45 degrees, the resolution of detail area probably will have shrunk to a 4-degree diameter circle. This is why having scanners looking out both sides of the aircraft is optimal. With track spacing (explained later) proper for the given search visibility, each scanner will look at roughly the same area (i.e., double coverage).

6. Field of scan. The area that you will search with your eyes in lines of scan is called the field of scan. The upper limit of this field is the line that forms the scanning range. The lower limit is the lower edge of the aircraft window, while the aft (back) limit is usually established by the vertical edge of the aircraft window. The forward (front) limit for a field of scan will vary. It might be established by a part of the airplane (such as a wing strut). Or, when two scanners are working from the same side of the airplane it might be limited by an agreed-upon point dividing the field of scan.

7. Scanning range. We are using the term “scanning range” to describe the distance from an aircraft to an imaginary line parallel to the aircraft’s ground track (track over the ground.) This line is the maximum range at which a scanner is considered to have a good chance at sighting the search objective.

Scanning range sometimes may be confused with search visibility range. Search visibility range is that distance at which an object the size of an automobile can be seen and recognized. Aircraft debris may not be as large as an automobile and may not be immediately recognizable as aircraft debris, particularly when the aircraft is flying at 100 mph. Therefore, scanning range may be less than but never greater than the search visibility (in CAP searches, we rarely credit a search visibility of greater than three or four nautical miles).

If your pilot states that the search altitude will be 500 feet above the ground level (AGL), you can expect your scanning range to be ¼ to ½ mile. If the search altitude is 1,000 feet AGL, you can expect a scanning range of between ½ and 1 mile. Even so, there are many variables that affect both the effective scanning range and your probability of detecting the search objective. These issues are discussed later.

8. Scanning patterns. To cover the field of scan adequately requires that a set pattern of scan lines be used. Research into scanning techniques has shown that there are two basic patterns that provide the best coverage. These are called the *diagonal pattern* and the *vertical pattern.* The diagonal pattern is the better of the two.

The diagonal pattern begins with the first fixation point slightly forward of the aircraft's position, and the scanner moves her fixation points sequentially back toward the aircraft. The next scan line should be parallel to the first, and so on. Each succeeding scan line is started as quickly as possible after completing the previous one. Remember, the duration of each fixation point along a scan line is about 1/3 second: how long it takes to complete one scan line depends on the distance at which the scanning range has been established. Also, the time required to begin a new scan line has a significant influence on how well the area nearest the airplane is scanned. In other words, more time between starting scan lines means more space between fixation points near the airplane.

The vertical pattern is somewhat less effective. You should use this pattern only from a rear seat position, and the first fixation point should be as near to underneath the airplane as you can see. Subsequent fixation points for this first scan line should progress outward to the scanning range and back. This scanning pattern traces a "sawtooth" shape on the surface.

Note: If there are two scanners on the same side of the airplane, it is good practice to combine the diagonal and vertical patterns. As agreed between scanners, one would use the diagonal pattern and the other the vertical pattern. However, the scanner using the vertical pattern *would not* scan to the scanning range. Some distance

short of the scanning range would be selected as the vertical pattern limit. This technique provides good coverage of the surface area near the search aircraft.

Additional Information

More detailed information and pictures on this topic are available in Chapter 5 of the MART.

Evaluation Preparation

Setup: Provide the student with an aircraft and aircrew (scanning techniques may be simulated on the ground).

Place a target (preferably to simulate aircraft wreckage) in the search area, and have a person (or mannequin) in the same general area. Fly the search area at 1000' AGL and 90-100 knots.

Brief Student: You are a Scanner trainee asked to demonstrate scanning patterns and locate targets in a search area.

Evaluation

Performance measures	Results	
1. Define "scanning" and "fixation," and describe how aircraft motion effects scanning.	P	F
2. Demonstrate knowledge of central and peripheral vision, and describe where your focal point is when your eyes are relaxed.	P	F
3. Demonstrate knowledge of fixation points and lines of scan, and define "scanning range."	P	F
4. Demonstrate diagonal and vertical scanning patterns.	P	F
5. Locate a target in a search area.	P	F
6. Locate a person in a search area.	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.