2.4. AIR-TO-GROUND RADAR TEST TECHNIQUES

2.4.1. Scan Rate

2.4.1.1. Purpose

The purpose of this test is to determine the average radar scan rate and its effect upon the utility of the radar presentation.

2.4.1.2. General

Most air-to-ground radars operate in a single bar, raster scan format. The rate at which the antenna moves from side to side determines the scan rate. Since the antenna must stop at each side and since the moving parts have some inertia, the actual scan rate varies through the scan and as the scan angle limits are changed. The important characteristic for the air-to-ground radar is how often the target and the map display is updated and so an average scan rate over a number of scans in each scan angle limit setting will be used.[7]

Scan rate can affect several radar performance factors. A quick scan rate is desired to provide a rapid update of the target position and the radar navigation display. If the update is too slow, the airplane's position on the radar map presentation will change between scans requiring mental integration. In addition, during very low level flying, the radar presentation may change drastically between scans. A very rapid display update alleviates these problems. The update rate must also be rapid enough to provide quick and accurate position updates of the target during the final seconds of the attack. This requirement will vary depending upon the accuracy of the navigation system used (drift), the accuracy requirements of the weapons used, and the accuracy with which the radar can designate a target at longer ranges. Unfortunately, there are limits to the scan rate that can be used. The limiting factor is usually the number of radar hits required to build a consistent radar display. Too few hits results in an inconsistent and washed out display. Once the requirement for adequate mapping quality is obtained, the scan rate should be left at the highest possible rate to update the display as frequently as possible. Mapping quality and consistency tests will be discussed later.

2.4.1.3. Instrumentation

A stop watch and data cards are required for this test. A voice recorder is optional.

2.4.1.4. Data Required

Measure the time for ten complete radar scans (one side to the other and back) at each scan angle limit setting. Record qualitative comments concerning the effects of the display update rate upon the mapping display utility and the target display during mission relatable attacks.

2.4.1.5. Procedure

While on the ground, use a stop watch to measure the time for the sweep to move from one side of the display and back for ten full sweeps. Perform the test at all scan angle limit settings and repeat for one setting while airborne to confirm the ground test. If a discrepancy occurs between the ground and airborne data, repeat for all scan angle limits. While performing attacks at mission relatable speeds, evaluate the effect the update rate has upon the utility of the display for radar navigation. During the final phases of the attack, note the effect the update rate has upon the operator's ability to accurately maintain the designator or cursors over the target position.

2.4.1.6. Data Analysis and Presentation

The scan rate is calculated using the following relationship:

$$Scan\ Rate = \frac{(Scan\ Angle\ Limit\ in\ deg\ )(20)}{(Time\ for\ 10\ Sweeps)} \qquad (19)$$

The mapping quality and consistency test to be discussed later will evaluate whether the scan rate is slow enough to provide a consistent mapping display. The test discussed in this section is designed to evaluate whether the rate is quick enough to provide an update rate of the display adequate for all mission relatable scan angle limit selections and attack profiles. Relate the update rate to the necessity for near real-time

[7] In the context used here, the scan rate and update rate are the same.

navigation and target positioning data during high speed, low level ingress to the target when the radar horizon is very short and to the necessity to perform terminal target updates before delivering ordnance.

2.4.1.7. Data Cards

A sample data card is presented as card 24.

CARD NUMBER ___ TIME ___ PRIORITY L/M/H

AIR-TO-GROUND SCAN RATE

[RECORD TIME FOR 10 COMPLETE SCANS.]

RADAR MODE	SCAN ANGLE LIMIT	TIME FOR 10 SWEEPS

[RECORD QUALITATIVE COMMENTS ON THE MAP UPDATE RATE AND TARGET POSITION UPDATE RATE.]

TEST AIRPLANE SPEED____

TEST AIRPLANE ALTITUDE_____

SCAN ANGLE LIMIT____

RADAR MODE_____

TYPE ATTACK FLOWN_____

EFFECTS:

Card 24: Air-to-Ground Scan Rate Data Card