2.4.5. Minimum Range

2.4.5.1. Purpose

The purpose of this test is to determine the minimum range of the radar and its effects upon weapon delivery tactics.

2.4.5.2. General

The theoretical minimum radar range is discussed in the radar theory section. This is the absolute minimum range possible; however, the minimum range is usually something greater. The display is an important factor, as in the air-to-air minimum range. For a PPI display, the mapping video becomes very cluttered and often becomes a block of solid video close to the notch of the V from which a target cannot be resolved. Minimum range is critical in air-to-ground radars since highly accurate and frequent target position updates are required to place conventional ordnance on small tactical targets. The final target update is often the difference between a hit and a wide miss.

Note should be taken as to exactly what range is being measured while performing the minimum range test in order to properly interpret the results. The radar range is the line of sight from the radar to the target and can be envisioned as the hypotenuse of a triangle. One of the remaining sides of the triangle is then the altitude of the test airplane above the target. This implies that the minimum range measured can never be less than the altitude above the target. In addition, the lower antenna elevation angle fixes one of the adjacent angles in the line of sight, height, minimum range triangle so that the minimum range that can be measured becomes even greater than the test altitude above the target. For these reason, the test should be performed at as low an altitude as possible within the limitations of safety. 200 to 500 feet AGL are usually chosen for test purposes. Care must be taken to ensure that the effects of the lower elevation angle limits discussed earlier are not confused with the effects of the radar minimum range.

2.5.4.3. Instrumentation

Data cards and an optional voice recorder are required for this test.

2.5.4.4. Data Required

Record the altitude and airspeed of the test airplane, target elevation, antenna elevation at the time detection is lost on the radar display and the displayed radar range. Record the time between loss of detection and overflight of the target. Make qualitative comments concerning the effects that the minimum range has upon the final target position updates.

2.4.5.5. Procedure

Descend to the test altitude. Choose a target of known altitude and designate it using the radar cursors. Use geostable cursors if available. If not, adjust the antenna elevation angle to optimize the target display. Proceed inbound to the target at a constant altitude. Continue to observe the radar display of the target as it converges to the bottom of the display. Lower the range scale to the minimum possible to display the target if the radar does not downscale automatically. Just as radar contact is lost, start the stop watch, record the displayed range to the target, altitude, airspeed and antenna pointing angle. Mark the elapsed time as the target is overflown. During mission relatable attacks, assess the effects that the minimum range has upon the ability of the radar to provide accurate, final target updates.

2.4.5.6. Data Analysis and Presentation

Check the antenna pointing angle at the time detection was lost to determine if it was at an angle less than the lower antenna elevation limit. If it was at the limit then assume that the minimum range is limited by the lower antenna elevation angle. If it was not at the limit, use the displayed radar range as the minimum radar range. Use the airspeed and time to overflight to confirm the radar derived range. Relate the minimum range to the likelihood that the target position will change in the case of a moving target, or that the last measured position will drift due to navigational errors for stationary targets, causing a reduction in weapon delivery accuracy.

2.5.4.7. Data Cards

A sample data card is provided as card 28.

CARD NUMBER ___ TIME ___ PRIORITY L/M/H

AIR-TO-GROUND MINIMUM RANGE

[DESCEND TO ____ FEET AGL. SET ____ KIAS. DESIGNATE A KNOWN TARGET WITH THE GEOSTABLE CURSORS AND HEAD TOWARDS IT. WATCH FOR LOST DETECTION. RECORD THE DATA BELOW.]

TARGET_____

ALTITUDE OF TARGET (MSL)_____

ALTITUDE AT LOSS (MSL)_____

AIRSPEED AT LOSS_____

RADAR RANGE AT LOSS_____

ANTENNA ELEVATION_____

TIME FROM LOSS TO OVERFLIGHT_____

[QUALITATIVE COMMENTS CONCERNING THE EFFECTS OF THE MINIMUM RANGE UPON LAST SECOND TARGET POSITION UPDATES.]

TYPE DELIVERY_____

EFFECTS:

Card 28: Air-to-Ground Minimum Range Data Card