AIR-TO-AIR MODES

The radar provides five basic air-to-air submodes for target detection, acquisition, and tracking. The five submodes available are RWS, LRS, ACM, VSR, and TWS. Single-target track (STT) is accomplished directly from any of these modes. Multiple target track (MTT) (up to 10 targets) can be accomplished from the TWS mode. Situation awareness mode (SAM) is available in RWS and LRS. Radar data for these modes is presented on the MFD with additional information provided on the HUD.

Combined Radar Mode (CRM)

CRM combines the air-to-air radar submodes into a single mode consisting of RWS, LRS, VSR, and TWS submodes. CRM is divided into two modes of operation: search and multiple-target track (MTT). The search mode rotary consists of RWS, LRS, and VSR, while the MTT mode is TWS.

MFD Symbology

MFD symbology for air-to-air radar modes is described in the following paragraphs.

TARGET SYMBOLOGY

Radar search targets are displayed as small, solid squares. After a target is designated, it is represented as an open triangle with a circle around it. In TWS/MTT, up to ten open triangles are displayed representing track targets with only one target being circled denoting it as the priority target.

The tracked target symbol provides additional data. The symbol rotates in 22.5-degree increments indicating target aspect angle (figure 1-80). The displayed aspect angle is a truncated value (e.g., 40 degrees track crossing angle is displayed as 22.5 degrees). A line extending from the nose of the symbol increases in length as absolute target velocity increases. Target altitude is displayed digitally in thousands of feet beneath the symbol. A tail extends from the symbol when an AIM-120B has been launched at the target. The target symbol flashes for 5 seconds before the radar breaks lock on the target in TWS. In SAM, the target symbol flashes after one missed update and will flash until next update. If the target is again not detected, the track is broken and the previously selected search mode is reentered. If the update does detect the target, the symbol stops flashing and SAM track is maintained.

AIM-120B missile launch track target symbology has been modified in A-A missile master modes. A tail appears on the target symbol when an AIM-120B launch is performed. The tail flashes when time-until-active has expired. When time-until-impact expires, an X is placed over the target symbol. The X will flash 8 seconds after being displayed. If the missile impacts the target, the radar track should degrade causing the target symbol to flash at approximately the same time as the flashing X. If, however, the AIM-120B is determined to have missed the target, the bugged target with tail is displayed with the mnemonic LOSE below it.

RANGE SCALE

Target range can be determined by observing the target symbol position along the MFD range scale. Each of the three tic marks positioned along the right edge of the display represents one-fourth of the selected scale. Range scale options are available as an increment/decrement function adjacent to OSB's 19 and 20. The range scale is selected from a rotary containing 160 (RWS and VSR only), 80, 40, 20, and 10 nautical mile ranges. Depressing either the increment or decrement OSB will step through the rotary to the range desired.

The range scale can also be changed hands-on while in search, SAM, and TWS via the cursor controller function of the cursor/enable switch. If the radar cursor is slewed to a position of either less than 5 percent or greater than 95 percent of the selected range scale, the next lower or higher scale will be selected and the radar cursor will be positioned to approximately 50 percent in range of the selected scale and at the same azimuth as the previous scale. The range scale change will not occur in SAM or TWS if it would place the target outside the new range scale.

Automatic range scale switching is in effect in SAM, TWS, and STT to keep the tracked target symbol positioned near the center of the MFD. The range scale increases automatically when the target is at a range greater than 90 percent of the selected range. In TWS, the range scale decreases automatically when the target of interest range is less than 45 percent of the selected range. In STT, the range scale decreases when target range is less than 40 percent.

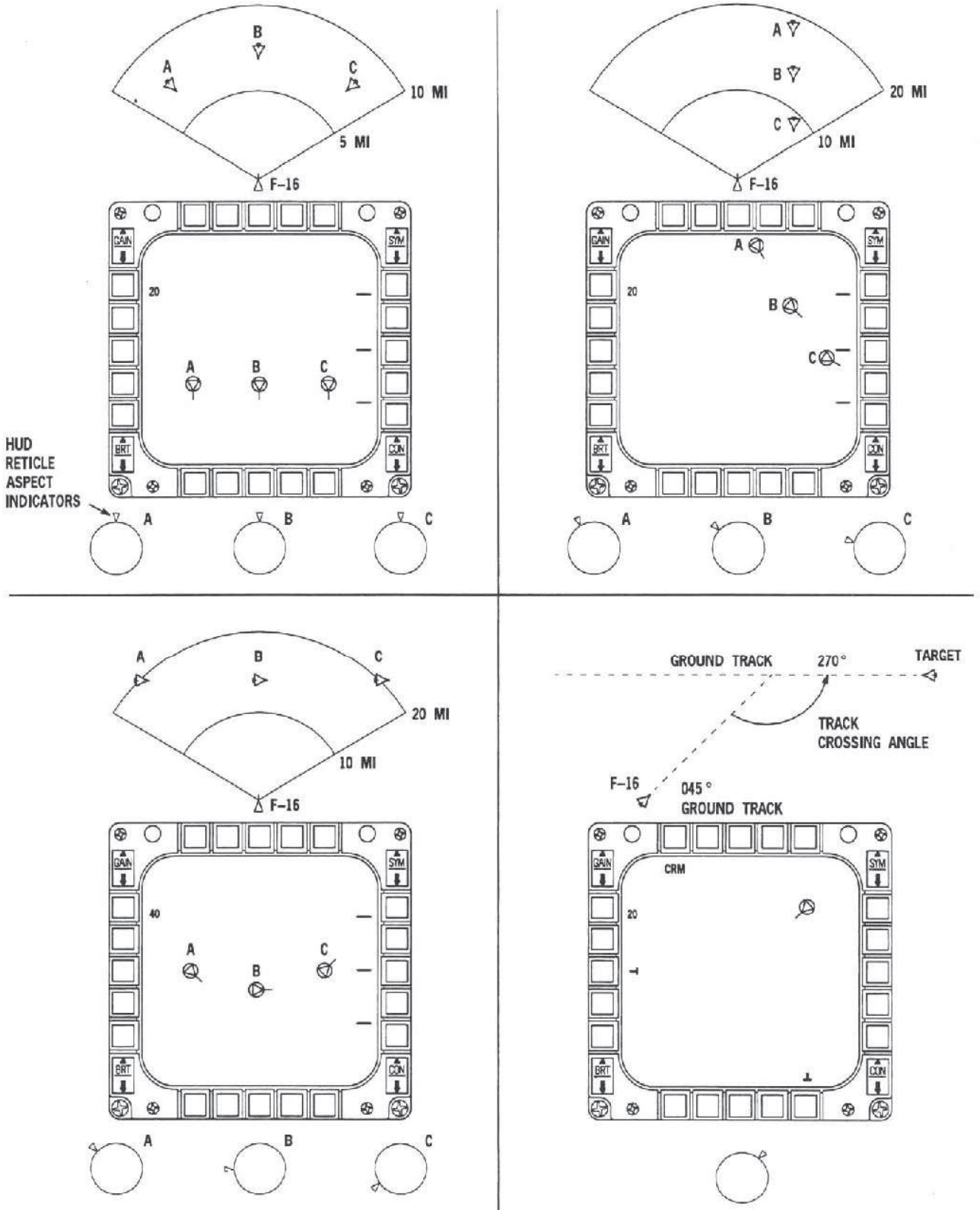


Figure 1-80. Tracked Target Symbol Presentations

ACQUISITION CURSOR

The radar acquisition cursor symbol displayed during search consists of two parallel vertical lines. Search targets are locked on by slewing the acquisition cursor over the search target symbol via the cursor controller function of the cursor/enable switch and momentarily positioning the TMS up (designate).

REACQUISITION ELEVATION SYMBOL

The reacquisition elevation symbol is displayed on the left side of the MFD for 10 seconds after track is lost. The position of the marker on the antenna elevation scale indicates the antenna elevation angle at loss of track. Antenna elevation can then be quickly set to the last tracked target elevation by rotating the antenna elevation knob on the throttle until the antenna elevation matches the last tracked target elevation.

STEERPOINT SYMBOL

The pyramid-shaped steerpoint symbol is displayed at the computed ground range and relative bearing from the F-16 to the selected steerpoint.

BULLSEYE SYMBOL

The bullseye symbol is displayed at the computed ground range and relative bearing from the aircraft to the bullseye steerpoint when the bullseye option is mode selected via the UFC. If the bullseye option is not mode selected, the bullseye defaults to the currently selected navigation steerpoint, the bullseye symbol is blanked, and the steerpoint symbol is displayed. If the bullseye option is mode selected, and happens to be the same steerpoint as the currently selected steerpoint, the bullseye symbol and the steerpoint symbols merge (see figure 1-81). There is a 1-pixel halo occlusion about the bullseye symbol.

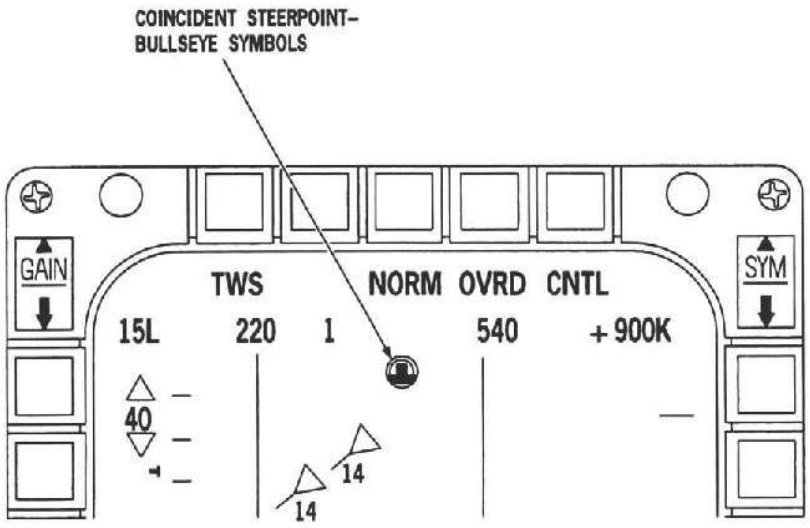


Figure 1-81. Merged Bullseye and Steerpoint Symbols

SPOTLIGHT SCAN

For RWS, TWS (except EXP) and LRS modes, holding the TMS to designate for longer than 1 second commands the radar to spotlight a small rectangular volume centered about the cursor azimuth and antenna elevation setting. The spotlight scan covers four bars and ±10 degrees in azimuth. The center of the scan may be slewed to the target for acquisition. Releasing the TMS commands the radar to track the target beneath the cursor.

ALTITUDE LINE TRACKER/BLANKER

For RWS, ACM, LRS or TWS, the altitude line tracker/blanker will blank all targets which are detected at the range of the altitude line. With the tracker/blanker on, the range being blanked is indicated by the position of the horizontal Y-symbol along the range scale. If the tracker/blanker is not selected, the symbol will not be displayed. If the altitude line return is not available, the symbol will be displayed at a fixed position near the top of the range scale.

ANTENNA AZIMUTH

Antenna azimuth is indicated by the position of the T-shaped antenna azimuth marker along the bottom of the MFD, where the left edge of the radar video represents –60 degrees, the center of the video represents 0 degrees, and the right edge represents +60 degrees. The antenna azimuth marker is space referenced in RWS. Seven tics are fixed in the center of the scale. The tics represent ±10 degree increments up to ±30 degrees either side of the center tic. Two vertical scan lines are displayed in search, TWS, and SAM to indicate minimum and maximum azimuth scan limits. The vertical scan lines are not available with the expand option selected or in STT. The lines are blanked as they approach the edge of the MFD.

The 60-degree azimuth scan width is the initial selection on the FCR format unless otherwise programmed by the DTC. Depressing OSB 18 (A and the selected scan width mnemonics) selects one of the following scan width options in the rotary from wide to narrow:

6 – ±60 degrees scan width centered about the nose

3 – ±30 degrees scan width centered about the acquisition cursor (not available in TWS)

2 – ±25 degrees scan width centered about the acquisition cursor (TWS only)

1 – ±10 degrees scan width centered about the acquisition cursor.

Hands-on selection of the azimuth scan width is accomplished by slewing the acquisition cursor to the left or right edge of the MFD (except in TWS). If the selected azimuth scan width is ±10 degrees, the hands-on control selects 30 degrees on the first change and toggles between ±30 and ±60 degree scan widths with subsequent changes. After a scan width change, the acquisition cursor symbol is positioned in the center of the display.

In SAM, the maximum scan width is selectable via the MFD azimuth controls. Actual scan coverage is determined automatically by the radar based on target range, target maneuvers, track quality, offset between the search volume and the SAM target, and the selected scan width. For example, a target at 3 nautical miles would allow a maximum scan width of 24 degrees, a target at 15 nautical miles would allow 44 degrees, and a target at 30 nautical miles would allow 60 degrees. If the scan width were set to be less than the maximum, then the scan would be the selected value.

ANTENNA ELEVATION

Antenna elevation is indicated by the position of the horizontal T-shaped antenna elevation caret along the left edge of the MFD. The range is space referenced and runs from +60 degrees at the top of the MFD to –60 degrees at the bottom. Seven tics are fixed in the center of the range; the upper tic represents +30 degrees, the center tic 0 degrees, and the lower tic –30 degrees. The number of elevation bars that the radar scans is controlled via OSB 17 adjacent to the B-mnemonic and one of the elevation bar mnemonics (1, 2, 3 (TWS only), or 4).

TARGET CALIBRATED AIRSPEED

Target calibrated airspeed is displayed in 10-knot increments below the OVRD mnemonic.

TARGET MINIMUM/MAXIMUM ALTITUDES

Minimum and maximum search altitudes at cursor range are displayed digitally in thousands of feet to the right of the acquisition cursor during search, TWS, SAM, and ACM slewable; the maximum search altitude readout is displayed at the upper right of the cursor; the minimum search altitude readout is displayed at the lower right.

TARGET CLOSURE RATE

Target closure rate is displayed in knots (–9999 to +9999) at the upper right of the MFD and in tens of knots (–990 to +990) next to the target range cue, along the dynamic launch zone. These displays have the sign right justified with no leading zeros.

When the target is in main beam clutter, where the target's doppler frequency falls within the band of frequencies occupied by the clutter, then closure rate is ambiguous. In this case, the closure rates are replaced with the mnemonic COAST and COAS at the upper right of the MFD and next to the target range cue, respectively.

TARGET ASPECT ANGLE

Target aspect angle is displayed in tens of degrees for the tracked target at the upper left corner of the MFD and is defined as the angle between the target longitudinal axis and the line of sight from the F-16 to the target. When the angle is at 0 degrees, the F-16 is on the tail of the target, and at 180 degrees, the F-16 is approaching the target head-on; thus, aspect angles from 0 degrees to 90 degrees indicate a departing target, and aspect angles from 90 degrees to 180 degrees indicate an approaching target. The L- or R-mnemonic displayed next to the aspect angle readout indicates the target wing closest to the F-16.

TARGET MAGNETIC GROUND TRACK

Target magnetic ground track is displayed in 10-degree increments immediately to the right of the target aspect angle at the upper left of the MFD.

TARGET INTERCEPT STEERING SYMBOL

The target intercept steering symbol provides horizontal steering to the tracked target and is displayed at target range.

The intercept steering symbol is not displayed when the collision angle exceeds 60 degrees. To keep the tracked target symbol positioned near the center of the MFD, the range scale is switched automatically when the target is at a range of less than 40 percent or greater than 90 percent of the selected range scale.

Situation Awareness Mode (SAM)

The situation awareness mode (SAM) (figure 1-82) provides the capability to simultaneously track a single target and search a controlled volume of space centered about the acquisition cursor while in RWS or LRS. The search volume is controlled via the hands-on antenna controls and MFD-selected parameters but may be reduced in azimuth (or even suspended) in order to maintain track on the target of interest.

The azimuth and elevation of the SAM target are indicated by the position of the outer horizontal T-symbol and inverted T-shaped symbols on the left and bottom edges of the MFD.

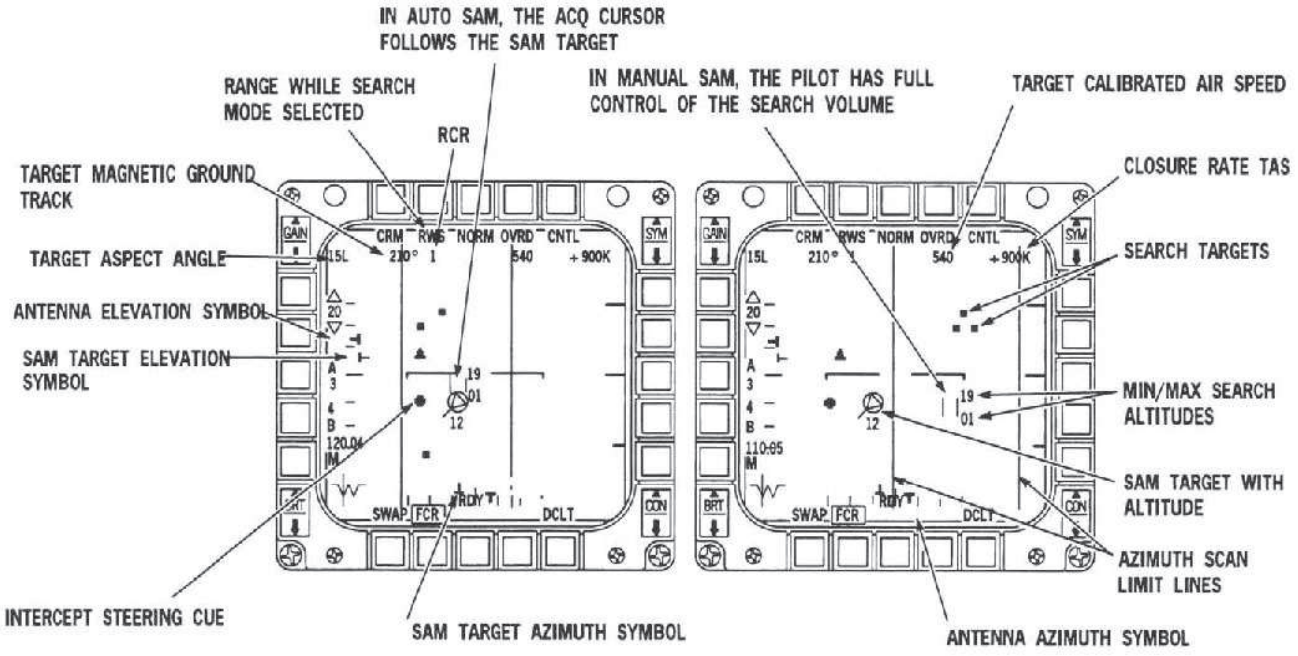


Figure 1-82. Situation Awareness Mode

SAM TRANSITIONS

The SAM submode is entered and exited using the designate and return-to-search commands. SAM may be entered one of the following ways:

Designate over a search target while in RWS or LRS mode (i.e., not STT).

Mode transition from TWS (single- or multiple-target track) to RWS or LRS with a bugged target. The bugged target becomes the SAM target, and other TWS track files are extrapolated for 13 seconds.

Transition to RWS or LRS from ACM or VSR single-target track or a return to search from RWS or LRS single-target track. The STT target becomes the SAM target.

Release designate while spotlighting with the cursor over a search target in RWS or LRS.

All of these conditions cause the radar to enter AUTO SAM with the search volume being centered about the SAM target azimuth and elevation. The cursors are placed on top of the SAM target in AUTO SAM. Slewing the cursors in azimuth and changing the antenna tilt cause the search volume to be independent of the bugged target and centered about the cursors. SAM may be exited one of the following ways:

Transition to single-target track by either designating with the cursor over the SAM target or changing the mode to ACM or VSR. The SAM target then becomes the STT target.

Mode transition to TWS. The SAM target becomes the bugged target in TWS. If SAM was originally entered from TWS multiple-target track and the extrapolated files have not expired, they are restored as system targets.

Return to search while in SAM.

Select any A-G mode. This causes SAM to halt and the radar to enter the commanded mode.

Single-target track may be entered directly by double designating; that is, pressing the designate switch twice in rapid succession with the cursors over a search target in RWS or LRS. A double return to search from single-target track in RWS or LRS causes a direct transition to the selected search mode. Designating with the cursor over a search target in SAM causes that search target to become the SAM target and the current SAM target to be dropped.

Some track conditions on the SAM target, such as jamming or target fade, may cause a transfer from SAM to STT. In this case, the radar does not return to SAM when the conditions are no longer present. Instead it remains in STT.

Other cases, such as target range inside 3 miles, COAST, and expanded data, cause the radar to automatically suspend the search portion of SAM. In this case, the azimuth limits are removed and FCR cursors replace the MFD cursors and are placed above the SAM target. As soon as this condition is removed, the radar will automatically reenter AUTO SAM.

SEARCH ALTITUDE DISPLAY (SAD)

While in RWS, TWS (except EXP) or LRS and SAM, placing the cursors over a search target causes that target altitude to be displayed digitally below the target symbol. The display remains as long as the cursors are placed over the search return.

Single Target Track (STT)

The radar can acquire and track a target starting from any of the search modes. In the VSR mode, the acquisition symbol is manually slewed over the search target and then the TMS is positioned to up (or designate) and released to command STT. In TWS, the acquisition symbol is manually slewed over the bugged target and then the TMS is positioned to up (or designate) and released to command STT. In SAM, the acquisition symbol is placed over the SAM target and then the TMS is positioned to designate and released to command STT. In ACM, acquisition is automatic.

When the target is acquired in RWS, LRS, and VSR, the target symbol changes from a small square (search target symbol) to an open triangle enclosed in a circle (tracked target symbol). When the target is acquired in TWS, the target symbol remains the same, and all other targets displayed (if any) are blanked from the MFD display and extrapolated by the radar software for a maximum of 13 seconds from the last time each target was updated. In ACM, the target acquired will appear as an open triangle enclosed in a circle. In the missile modes, this symbol will also have a tail if an AIM-120B has been launched at the target. The target range is indicated by comparing the position of the symbol to the range marks on the right edge of the display. The lateral position of the symbol represents azimuth.

Several features are available to aid in visually locating, intercepting, and evaluating the target including:

A target designator box or locator line is displayed on the HUD.

An intercept steering symbol is displayed on the radar format.

Target data is displayed digitally on the radar format and, to a lesser extent, on the HUD.

The radar range scale is switched automatically to keep the target symbol in the central area of the MFD.

A steerpoint symbol is positioned on the radar format at the range and bearing to the selected steerpoint.

To aid in visually acquiring the target, the HUD positions either a large target designator box (target within HUD field of view) or a target locator line (target outside HUD field of view) based on target position data from the radar. The target designator box (or locator line) is solid if the radar is tracking the target or dashed if the radar has entered the coast mode (figure 1-83). The air-to-air target designator box is not corrected for canopy distortions, but the target should fall within the box. Anytime the target is outside the HUD field of view, the target designator box is replaced by a target locator line and angle.

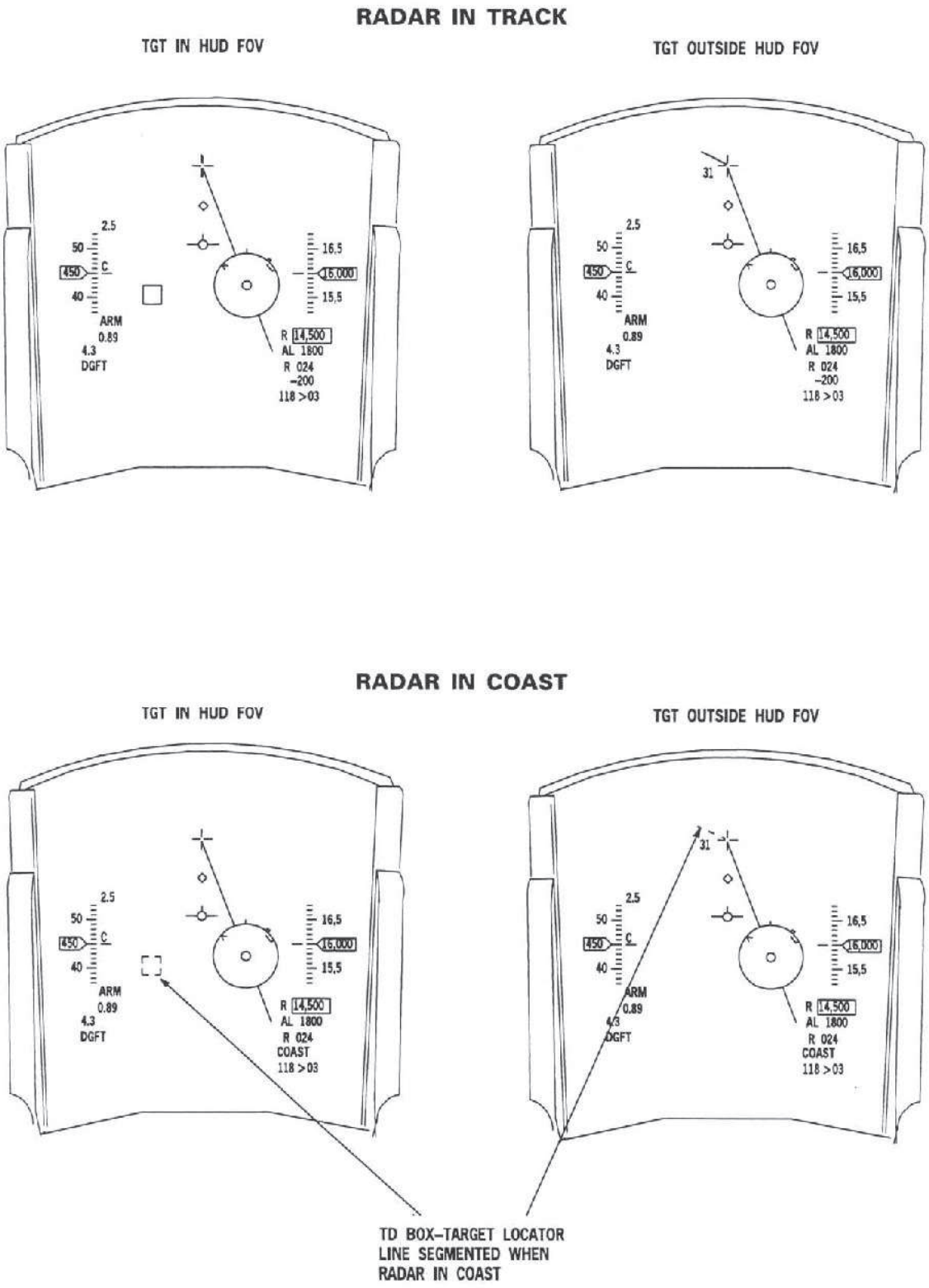


Figure 1-83. Radar Coast Indicator

The radar system uses a filter to remove ground clutter and enable lookdown operation. The filter is centered in velocity at the F-16 groundspeed and covers a band of velocities. The velocities which are filtered out constitute the doppler notch. When a target being tracked maneuvers so its closure rate on the F-16 is within this velocity band, it is said to have entered the notch. When this occurs, the radar may not see the target, as those signals in the notch are filtered out and rejected and the radar initiates a memory track operation called coast. However, if the target is determined to be able to compete against the clutter, the main beam clutter notch is shifted in frequency and the target is tracked normally (track through the notch). If the target cannot compete against the clutter, the radar will enter coast. In coast, target position is extrapolated from the last known information. The radar remains in coast for 4 seconds or less. If the target is reacquired during this time period, normal track will resume.

The target locator line is positioned from the HUD boresight cross and extends in the direction of the target. Target angle, representing the angle from HUD boresight to the target, is displayed to the left of the borecross to the nearest degree.

During STT, a small thick cross is displayed on the radar format at target range to aid in performing various intercept maneuvers (figure 1-84). By comparing the position of the symbol versus the centerline of the MFD, the pilot can fly collision, pursuit, or lead steering. This intercept steering symbol provides horizontal steering only, not vertical. If the collision angle exceeds ±60 degrees, the intercept steering symbol disappears off the edge of the MFD.

Most data regarding the bugged target is displayed on the MFD and HUD. The target symbol indicates target aspect angle, velocity, and altitude by its rotation, length of the leading line, and the digital altitude value, respectively. The position of the target symbol on the MFD indicates the range and azimuth. Digital readouts are provided for calibrated airspeed, aspect angle, ground track, and closure rate.

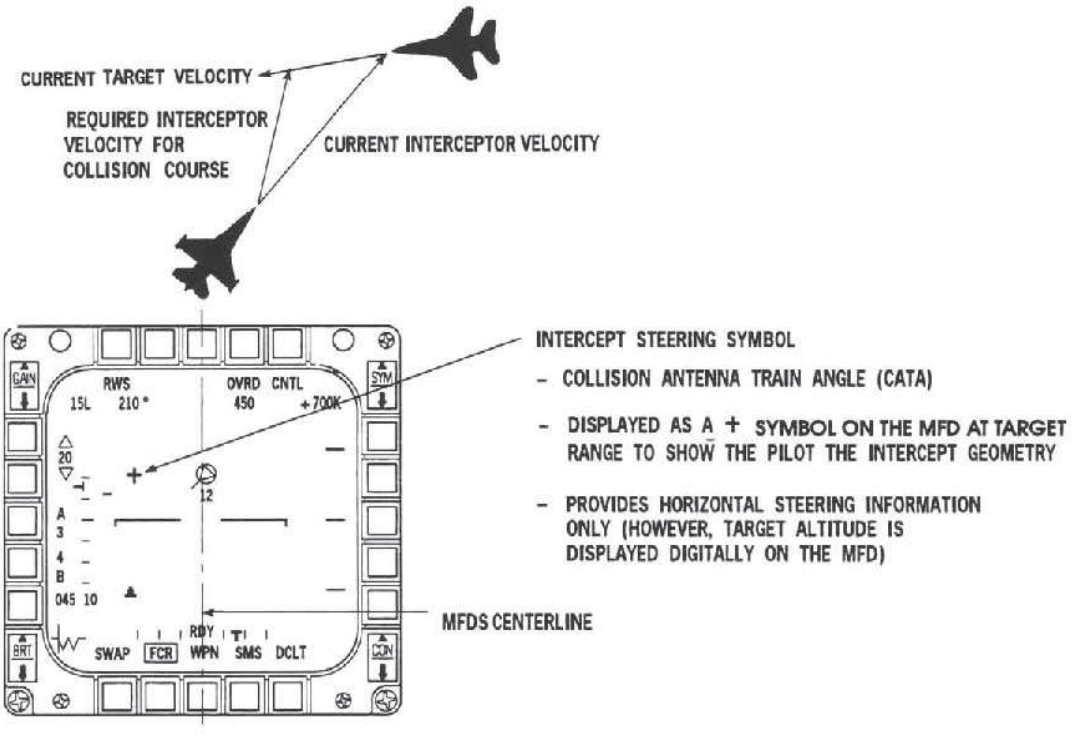


Figure 1-84. Intercept Steering Symbol

Although target ground track is measured to the nearest degree, the display will only change in 10-degree increments. The last digit will always be zero. Target calibrated airspeed is also displayed in 10-knot increments. The two-digit aspect angle (tens of degrees) is followed by either an L or an R.

Target closure rate is displayed on the HUD to the nearest 10 (KTAS) knots, with a positive number indicating the aircraft is closing on the target. Target range is also displayed in the lower right window of the HUD. Aspect angle is also displayed on the HUD in the air-to-air missile and missile override modes.

In the STT mode, the radar range scale is automatically switched in order to keep the target symbol in the upper region of the MFD. If the tracked target is less than 40 percent or greater than 95 percent of the displayed range scale, the range scale will automatically switch to the next lower or higher scale, respectively.

Range-While-Search (RWS)

The RWS format on the MFD is a B-scan presentation. Targets during search are represented by small squares. The search targets are presented with an option of up to three target histories in addition to present target position.

In the range-while-search (RWS) mode (figure 1-85), the radar searches a selectable volume of space and displays the position of any detected targets on the MFD. No track data (target range, velocity, angle, and ground track) are available on these detected targets. A specific target is placed into track by slewing the acquisition cursor over the synthetic target symbol and depressing and releasing the designate position of the TMS. This causes entry into SAM as previously described.

The size of the radar search volume is selected via the controls on the base page. Selections are provided for number of elevation bars (1, 2, or 4) and for the azimuth coverage (±10, ±30, or ±60 degrees) (figure 1-86). The search volume is centered about either the acquisition cursor (±10 or ±30 degrees sweep) or the aircraft fuselage reference line (±60 degrees sweep). Azimuth scan limit lines are displayed on the MFD for ±10 and ±30 degrees scan widths.

Depressing and holding the TMS to the designate (up) position will command the radar to spotlight search (±10 degrees azimuth by 4 bars elevation). Spotlight search is centered about the acquisition cursor and antenna elevation knob setting and can be slewed. A small (SAM) acquisition window is used. The radar attempts to acquire and track the target within the acquisition cursor at release of the designate position of the TMS.

When a target has been acquired, it is represented by an open triangular symbol enclosed in a circle.

The acquisition cursor is used not only for acquisition but also to change the radar range scale. If the acquisition cursor is slewed to less than 5 percent or greater than 95 percent of the displayed range scale, the range scale will automatically switch to the next lower or higher scale, respectively. After switching scales, the acquisition cursor is repositioned in range to approximately 50 percent of the new range scale.

Long Range Search (LRS)

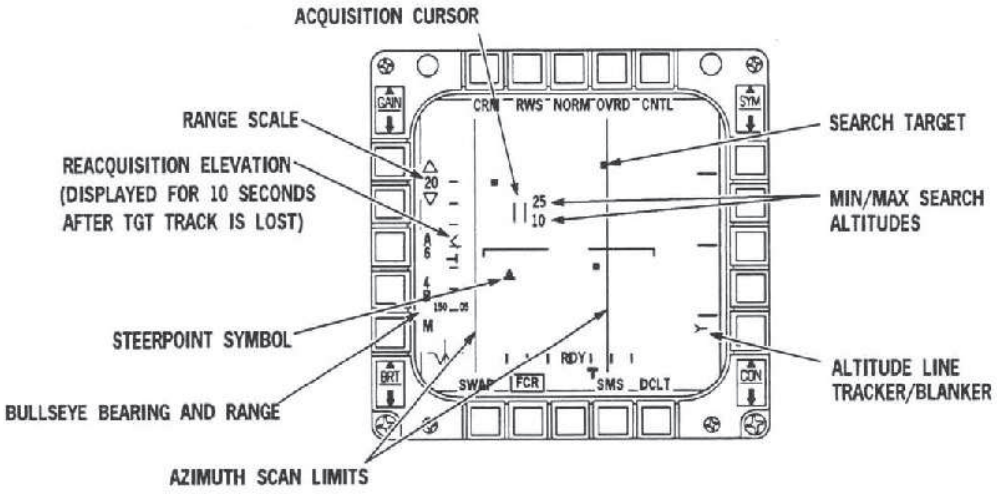
LRS provides the same display and control for air-to-air target detection, SAM, and STT as RWS but is optimized for long range target detection (figure 1-87).

Air Combat Mode (ACM)

The ACM mode can be entered by positioning the DOGFIGHT/missile override switch on the throttle to DOGFIGHT or through the radar menus selectable through the MFD.

ACM displays on the MFD are identical to RWS displays, except maximum acquisition range is automatically selected to 10 nm, no acquisition symbol is displayed, and, prior to lock-on, there will be no target symbols displayed.

SEARCH



SINGLE TARGET TRACK

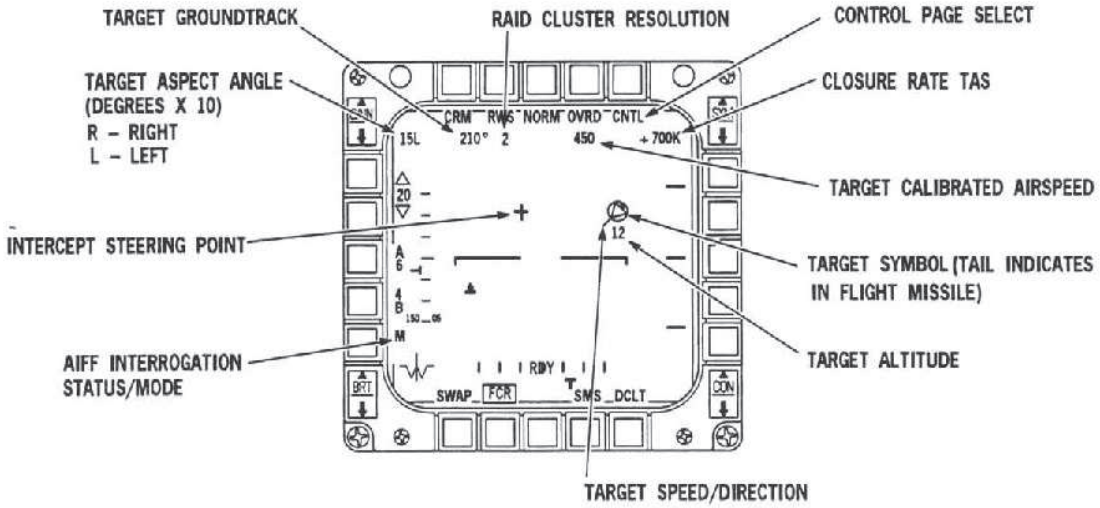
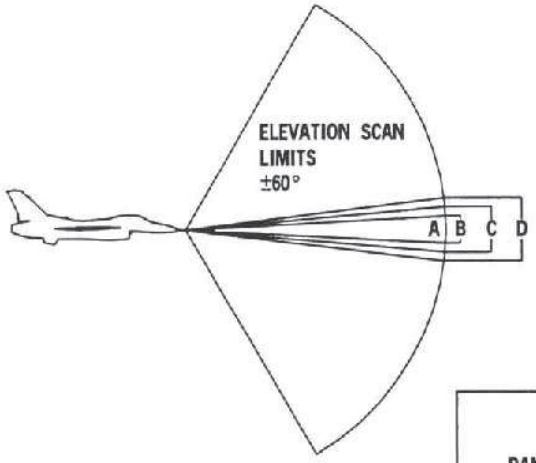


Figure 1-85. Range-While-Search Displays

ELEVATION COVERAGE IN THOUSANDS OF FEET

RANGE	ELEVATION SCAN				
	1 BAR	2 BAR	3 BAR (TWS)	4 BAR	4 BAR (TWS)
10 nm	5	10	12	20	15
20 nm	10	14	24	24	30
40 nm	20	28	48	48	60
80 nm	40	56	96	96	120
160 nm	80	112	N/A	192	N/A



ELEVATION SCAN OPTIONS

1 BAR VERTICAL COVERAGE (A)

2 BAR VERTICAL COVERAGE (B)

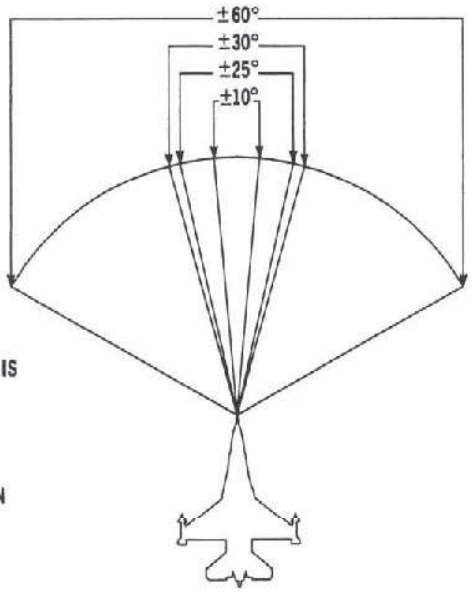
3 BAR VERTICAL COVERAGE (C)
(AVAILABLE IN TWS ONLY)

4 BAR VERTICAL COVERAGE (D)
MANUAL POSITIONING WITHIN SCAN LIMITS

AZIMUTH COVERAGE IN NAUTICAL MILES

RANGE	AZIMUTH SCAN			
	±10°	±25°	±30°	±60°
10 nm	3.5	8.8	10.2	17.3
20 nm	7.0	17.5	20.0	34.6
40 nm	13.9	34.8	40.0	69.3
80 nm	27.8	69.5	80.0	138.6
* 160 nm	55.6	139.0	160.0	272.2

NOTE: * SUPPORTED IN RWS AND LRS ONLY.



AZIMUTH SCAN OPTIONS

MANUAL SELECTION

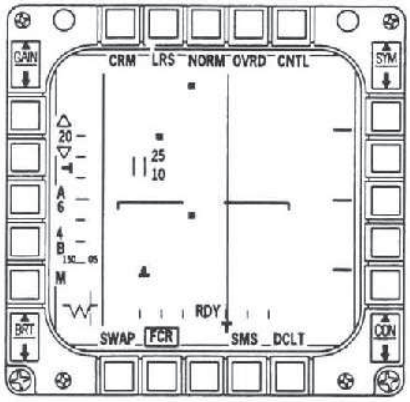
±10° } CENTER OF THESE SCANS IS
±30° } POSITIONABLE ANYWHERE
WITHIN GIMBAL LIMITS

±25° AVAILABLE IN TWS ONLY

±60° MAXIMUM AVAILABLE AZ SCAN

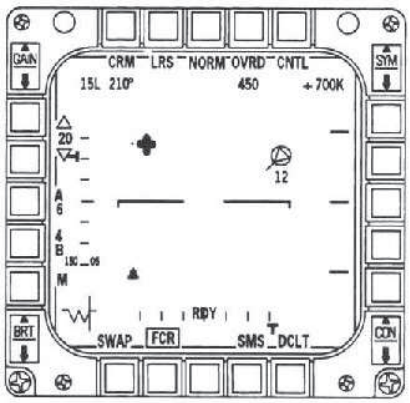
Figure 1-86. RWS/TWS Search Patterns, Elevations, and Azimuth Deflections

SEARCH



OTHER CONTROLS/DISPLAYS
SAME AS RWS MODE

TRACK



OTHER CONTROLS/DISPLAYS
SAME AS RWS MODE

Figure 1-87. Long Range Search Displays

ACM provides automatic search, acquisition, and track of the first target detected within the 10 nm range. Four selectable radar antenna scan patterns are provided in ACM: 30 by 20 degrees (HUD field of view), 10 by 60 degrees, boresight, and 60 by 20 degrees (slewable) as denoted by the mnemonics 20, 60, BORE, and SLEW on the MFDS. All patterns search out to 10 nm. Refer to figure 1-88 for azimuth and elevation coverage and HUD symbology for each pattern.

When ACM is initially selected, the 30 by 20 degree scan pattern is the submode entered, but with the FCR nonradiating. Radiation commences upon selection of one of the scan patterns. The system will lock on to the first target detected and display the target on the MFD. Upon target lock-on, the VMU provides a recorded advisory (LOCK-LOCK) through the pilot's headset.

NOTE

If more than one target is detected within the same beam width, the radar system will select the closest target in range.

A typical ACM lock-on display is presented in figure 1-89. Should target range exceed 90 percent of the current range scale after lock-on, the range is automatically commanded to the next higher range scale. If target range is less than 40 percent of the current range scale after lock-on, the range is automatically commanded to the next lower range scale. This allows the radar system to provide tracking and display of targets maneuvering in and out of the 10 nm range area. If the pilot desires, another scan pattern may be selected from search or track. Refer to figure 1-90 for ACM search pattern switchology.

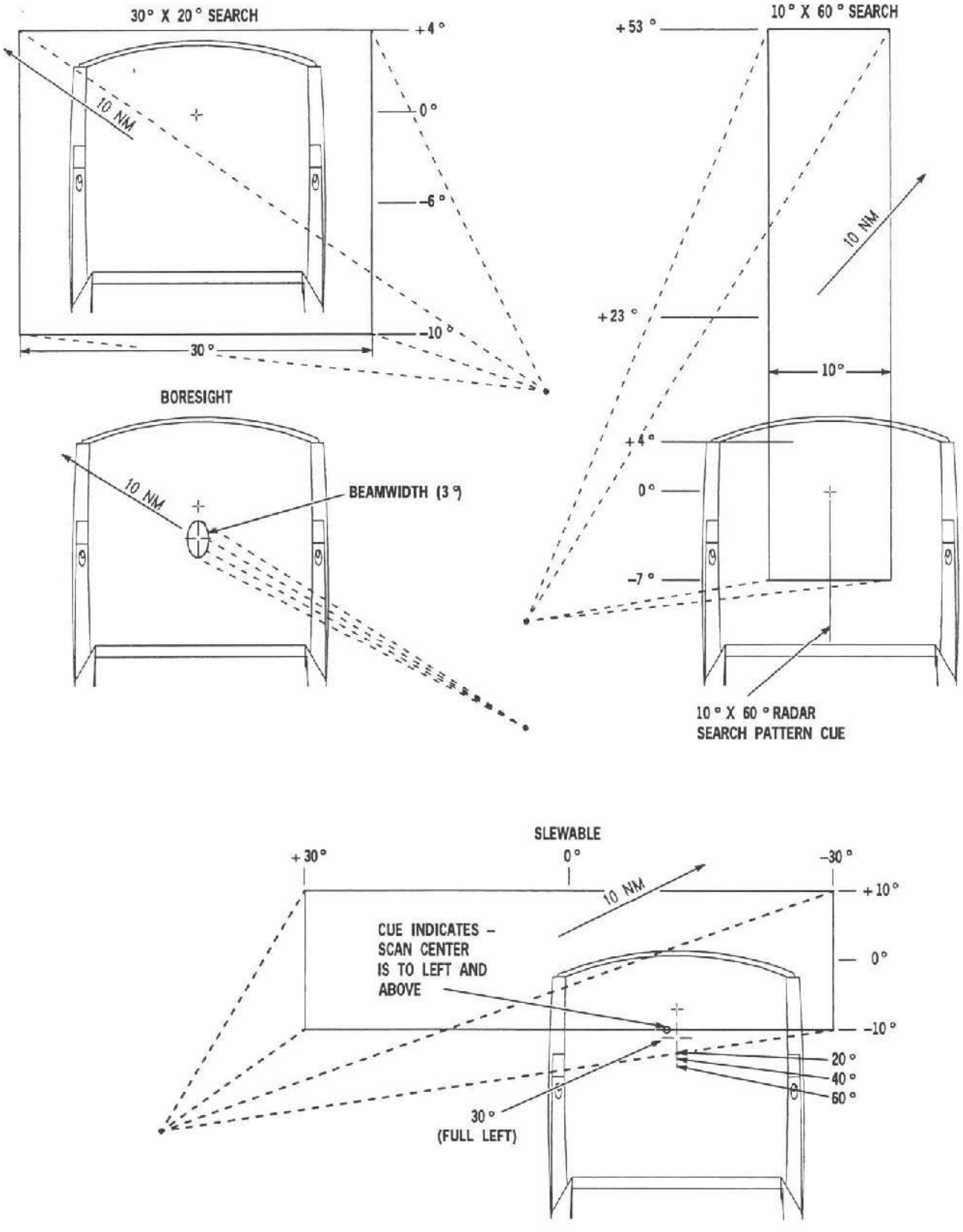


Figure 1-88. ACM Search Patterns, Elevations, and Azimuth Deflections

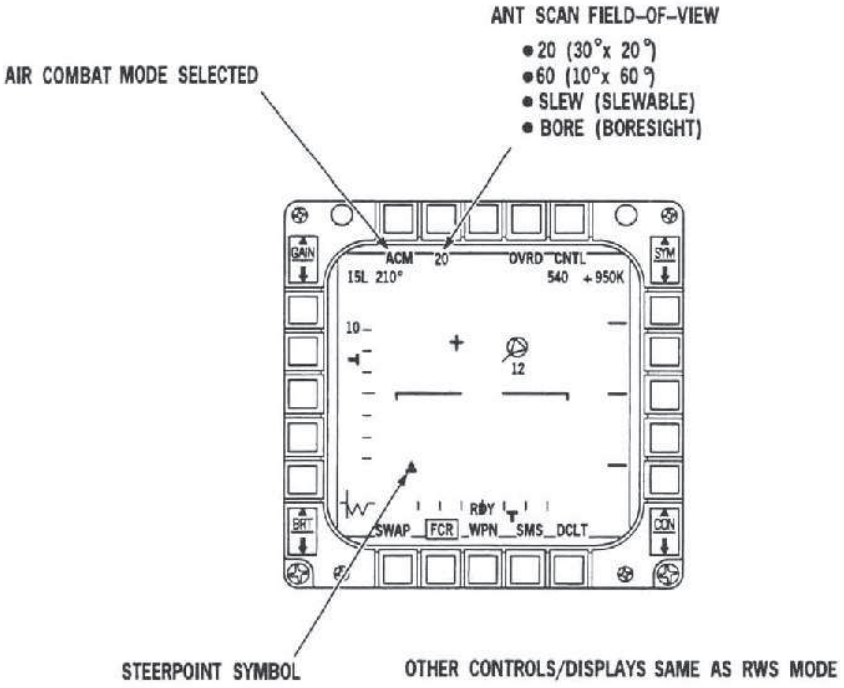


Figure 1-89. Air Combat Mode Symbology

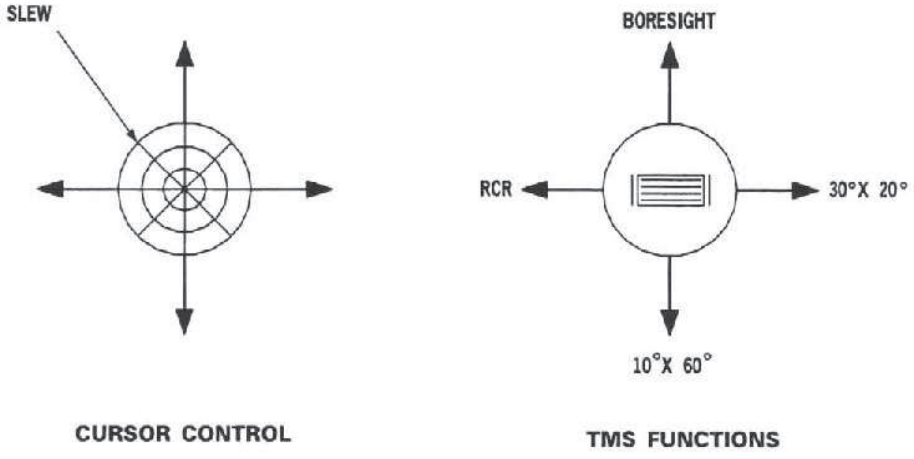


Figure 1-90. Hands-On Radar ACM Switchology

The 10 by 60 degree scan pattern can be entered directly from the 30 by 20 degree pattern, boresight, or slewable as shown in figure 1-90. A cue indicating the 10 by 60 degree scan will be presented on the HUD in the form of a vertical line from the gun borecross down to the bottom of the HUD field of view. To exit the 10 by 60 degree scan pattern, select any other ACM scan pattern.

The boresight mode can be entered from any scan pattern by depressing the TMS switch forward on the stick. The boresight is the width of the beam out to 10 nm. The cue displayed for boresight mode on the HUD is a large cross positioned 3 degrees down from the gun borecross (figure 1-88). Target acquisition is inhibited while the TMS switch is held forward to allow the pilot to maneuver the aircraft to position the target visually in the HUD reticle, which is the center of the boresight search. To exit boresight, select 30 by 20, 10 by 60, or slewable ACM scan pattern.

Slewable scan can be entered from any scan pattern by deflecting the CURSOR/ENABLE switch along the X-Y axis. This scan provides a roll and pitch stabilized radar antenna, a body-stabilized MFD (figure 1-91), and a HUD display.

When slewable scan is selected, the center of the search pattern is zero degrees in azimuth and on the horizon. The search pattern is ±30 degrees in azimuth and ±10 degrees in elevation. The pilot can use the CURSOR/ENABLE switch to slew the center of the search pattern within an azimuth limit of ±30 degrees and ±45 degrees in elevation in search of targets. A target within the antenna scan coverage and range will be automatically acquired the same as with the 30 by 20 degree scan. Cues for slewable scan are provided on the MFD in the form of an iron cross and on the HUD as an 8-milliradian circle. The iron cross on the MFD is oriented to the aircraft centerline (body stabilized).

The 8-milliradian circle on the HUD is body stabilized. While the aircraft is straight and level, slewing the antenna will move both cues in the same direction.

MIN/MAX search altitudes are displayed for slewable ACM based on a search range of 5 nm at the center of the MFD. To exit the slewable search pattern, select any other ACM scan pattern.

In all ACM search patterns, the radar will automatically acquire and lock on to the first target encountered within the search pattern out to 10 nm. When a lock-on is established, the pilot may reject the target (break lock) by reselecting the same scan pattern or selecting another scan pattern. If the same scan pattern is selected, the radar will automatically resume search in the selected pattern in use prior to the lock-on and lock on to the next target encountered (skipping the previous tracked target during the first frame). If a different scan pattern is selected, the previous tracked target may not be skipped. This procedure may be repeated as many times as required.

Velocity Search with Ranging (VSR)

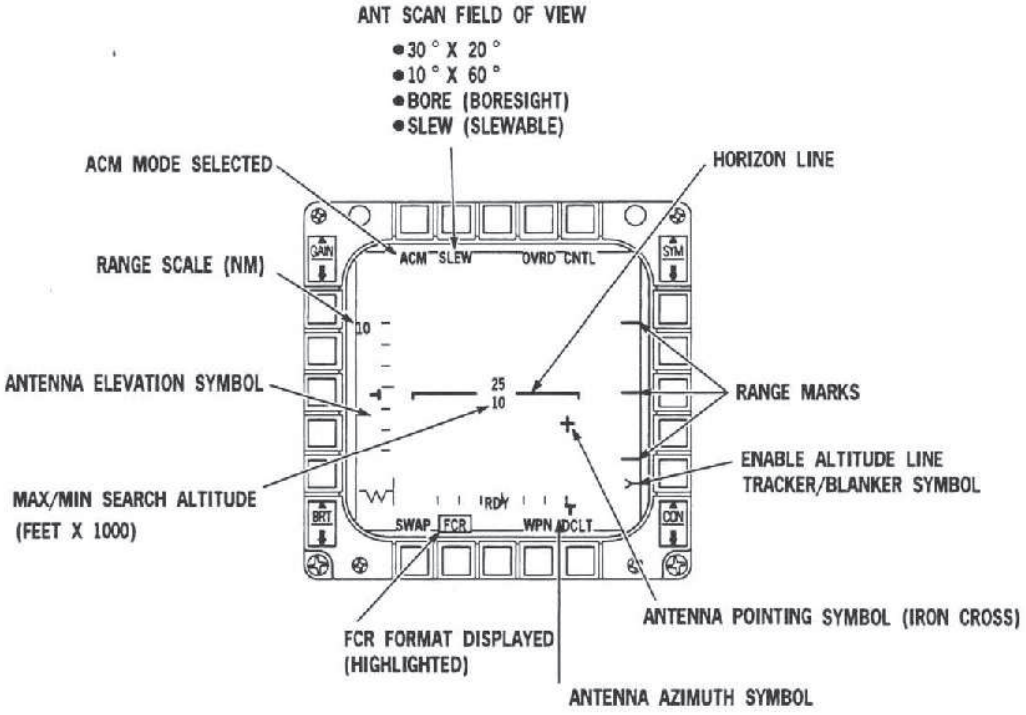
The VSR mode provides air-to-air search and single-target track on a range versus azimuth scale similar to RWS (figure 1-92).

VSR interleaves a high PRF mode with a medium PRF mode to extend the ranging capability of the radar beyond that of the medium PRF mode and to provide a lower false alarm rate than is currently available with high PRF modes.

VSR is designed to detect and display head-on targets only; therefore, VSR does not support SAM. Target acquisition can be accomplished by placing the cursors over the target and designating.

Target detection and display in VSR is a two step process consisting of a high PRF scan followed by a medium PRF scan. The first scan utilizing the high PRF is called the Alert scan during which the target is first detected and its angle and velocity are stored. Immediately after the Alert scan where a target has been detected, a medium PRF scan, called the Confirm scan, is performed during which the range of the detected target is determined. After being detected in both the Alert and Confirm scans, the target will be displayed as a search target. No new search targets will ever be displayed during an alert scan.

In VSR, an elevation bar is defined as either a single Alert scan when no targets are detected or a combination Alert scan/Confirm scan when targets are detected. As a result, it can take one or two scans to complete an elevation bar. Therefore, when a multiple bar scan pattern is being utilized, the radar will move to a new elevation bar at the beginning of each Alert scan. Any changes to elevation bar scan patterns will be immediately displayed, but will not take effect until the next Alert scan.



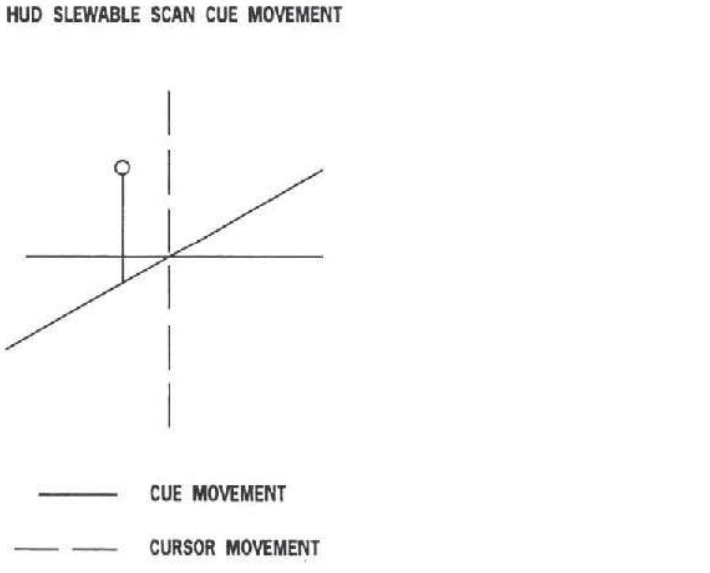


Figure 1-91. ACM Search Slewable

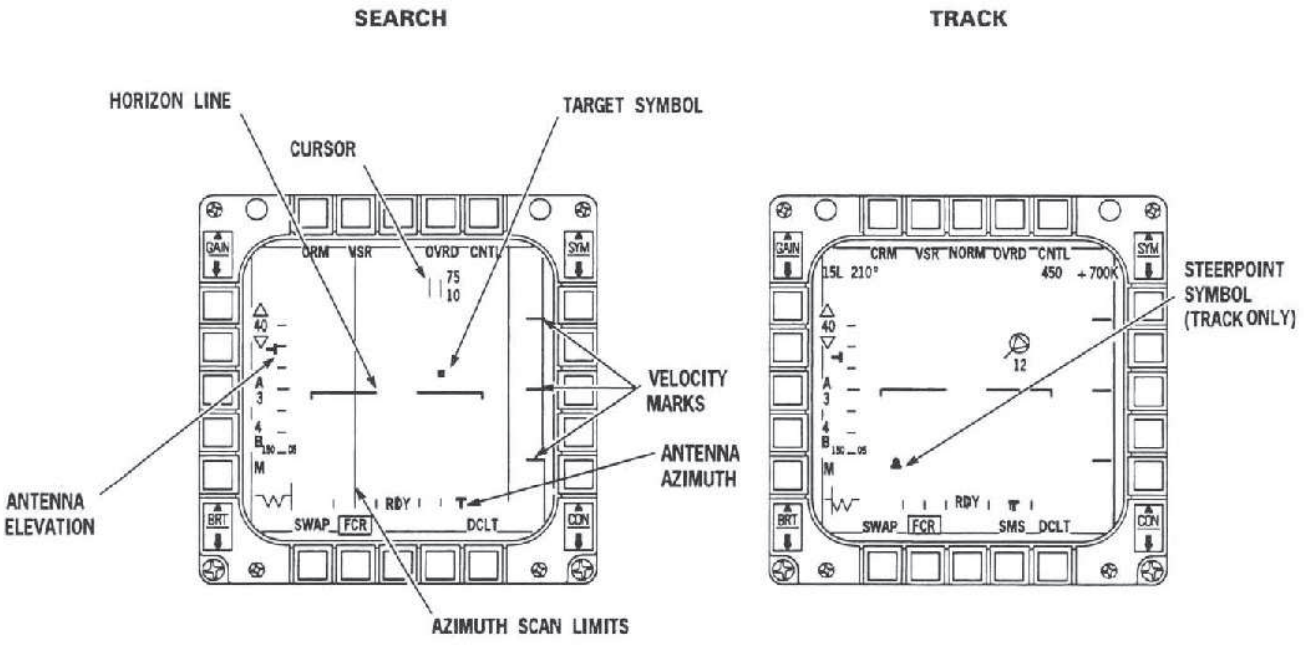


Figure 1-92. Velocity Search with Ranging Displays

It should be noted that the scan rate during the Alert scan is 45 degrees per second while the scan rate during the Confirm scan varies from 24 to 100 degrees per second based on the number and position of targets detected during the Alert scan.

During VSR, no Altitude Line Tracker/Blanker option is available as the altitude line return is automatically blanked by specialized VSR processing.

Track-While-Scan (TWS)

In TWS, the radar searches continually and automatically establishes track files on targets (up to 10) that it has detected at least twice within 6.5 seconds (figure 1-93).

The following TWS parameter selections differ from those available in other air-to-air search modes:

Range Scale – Initialized at 40 nm (unless otherwise selected by DTC); 10 nm, 20 nm, 40 nm, or 80 nm is manually selectable from the TWS basic page.

Scan options available in TWS and associated mnemonics are:

Azimuth Scan	OSB 18	Elevation	OSB 17
±10 degrees	1	4 bars	4
±25 degrees	2	3 bars	3
±60 degrees (no TOI)	6	2 bars	2

NOTE

These patterns are selectable hands-on by bumping the cursors against the edge of the MFD.

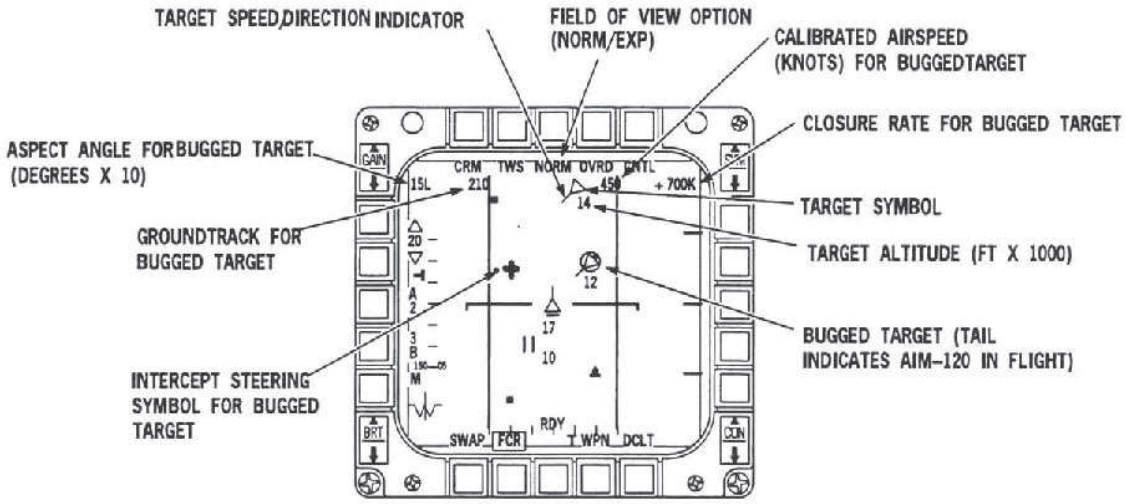


Figure 1-93. Track-While-Scan Display

Hands-on selection of the azimuth scan width is accomplished by slewing the acquisition cursor to the left or right edge of the MFD when a TOI has not been established. If a TOI has been established, the ±60 degrees option is not available.

These scan patterns are also selected by depressing OSB 18 for the desired azimuth scan or OSB 17 for the desired elevation bar option on the TWS basic page. Depressing either OSB automatically selects the corresponding elevation bar or azimuth scan width option for the selected scan pattern.

The azimuth center of the TWS scan pattern is automatically positioned to insure that the highest priority (bugged) target will fall within the scan volume. If there are no priority targets, the scan is centered in azimuth at the acquisition cursor. Moving the acquisition cursor in azimuth is allowed, but only to the extent that no priority targets will be lost by the repositioning. With AIM-120B missiles in flight with time until active remaining, azimuth and elevation will first be positioned to maintain track on the bugged target, then they will be positioned on any secondary priority targets which have AIM-120B's in flight to them, and finally they will be positioned on the acquisition cursor.

The pilot will receive an indication that the target is about to break radar lock; the target symbol begins to flash when it has not been updated for 8 seconds and will continue to flash until either the target is again detected or the target track is broken after 13 seconds of extrapolation.

The elevation center of the TWS scan is centered on the highest priority target, if one exists. If no priority target exists, the scan is centered at the manually controlled antenna elevation thumbwheel position which means that no elevation biasing is allowed when priority targets are present.

In the TWS mode, an expanded display is available to aid in discerning targets whose symbols are close together. In this display, the priority target remains in the same location as in the unexpanded display and a 4:1 expansion of the area around it is displayed. Either the pinky switch on the stick or OSB 3 above the NORM/EXP mnemonic can be used to select/deselect the expanded field of view. No search target symbols are displayed in expanded TWS; however, new track targets will be displayed.

If the EXP option is selected, the mnemonic will flash until deselected; a square box covering 2 miles in range will be centered about the bugged target (figure 1-94). In EXP, the bugged target remains at the true range and

azimuth position on the display with all other target positions expanded about the bugged target. Upon selection of the EXP option, the cursors are centered on the radar display.

The selected range scale will increment when the bugged target exceeds 95 percent of the current scale. The range scale will be automatically decremented in TWS when the bugged target position is less than 45 percent of the range scale or the cursors are positioned less than 5 percent of the range scale.

STT is available in TWS by slewing the acquisition cursor over the bugged target and positioning the TMS to designate. Once single-target track is selected, all other targets are blanked and memory pertaining to those targets is purged after 13 seconds. The pilot may also designate with the cursors over a search return to build a track file. The radar will enter an STT acquisition about the search target azimuth, elevation, and range position. If the acquisition is successful, the target becomes an open triangle. If the acquisition is unsuccessful, the radar will return to multiple-target track with all valid track files intact. In either case, track files that are extrapolated during the acquisition may be lost during the 4-5 second delay. If ten track files already exist when attempting to acquire a new track file, the lowest priority track file will be dropped and replaced by the new track file upon successful acquisition. If the acquisition is unsuccessful, the dropped track file will be lost.

When a transition is made to another air-to-air radar mode from TWS, the bugged target in TWS becomes the STT bugged target in the new mode and all other system track files are extrapolated for 13 seconds. If RWS or LRS is entered, the radar enters AUTO SAM on the bugged target. If TWS is selected while in the STT submode or another radar mode, the radar enters TWS multiple-target track with the locked-on target as the bugged target.

Raid cluster resolution (RCR) is a submode of STT, TWS, and SAM and is implemented to determine the number of targets within a given target resolution cell. RCR mode accomplishes this operation by employing high resolution doppler processing to resolve small radial velocity differences between targets. The target count is then displayed to the right of the target ground track display (figure 1-94).

RCR submode is entered while in STT, TWS, or SAM by positioning the TMS switch left to the expanded data position. This starts a 6-second timer in the MFD which controls the radar expanded data processing time. Positioning the TMS to the expanded data position for more than 6 seconds will extend the radar RCR processing time until the TMS is released or the radar determines the target count, whichever occurs first. If another target of interest is desired while RCR information is being displayed, positioning of the TMS right to the next target (TWS) position discontinues RCR information, zeroes the timer, and causes the FCC to step the bug to the next lower priority target. RCR mode can then be reentered by positioning of the TMS left to the expanded data position. Refer to T.O. GR1F-16CJ-34-1-1-1 (Secret) for discussion of RCR symbology.

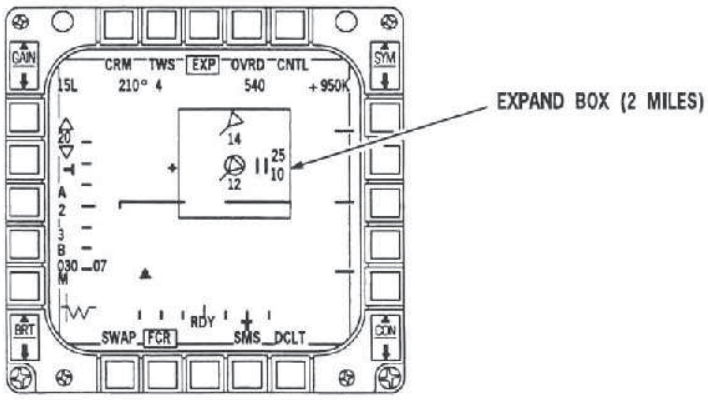


Figure 1-94. 4:1 Expand Option Display