FIELD MANUAL

AIR DEFENSE

ARTILLERY ENGAGEMENT SIMULATOR;

GUIDED MISSILE SYSTEM

RADAR-SIGNAL

SIMULATOR STATION AN/MPQ-T1

(NIKE HERCULES)

HEADQUARTERS, DEPARTMENT OF THE ARMY
JUNE 1971

AIR DEFENSE ARTILLERY ENGAGEMENT SIMULATOR: GUIDED MISSILE SYSTEM RADAR-SIGNAL SIMULATOR STATION AN/MPQ-T1 (NIKE HERCULES)

CHAPTER 1
INTRODUCTION

Section I. GENERAL

– 1. Purpose and Scope

a. This manual provides information pertaining to the guided missile system radar-signal-simulator station AN/MPQ – T1, referred to hereafter in this manual as the Nike Hercules engagement simulator or simulator. The manual is a guide for Nike Hercules officers and enlisted personnel of the battalion operations and intelligence section and electronics maintenance section to assist them in training, developing, and evaluating fire control operators as individuals or as an integral part of the fire control platoon. The simulator station and its capabilities are described in sufficient detail to provide programmers, simulator operators, scores, and evaluators with the methods and techniques of programming, applying programs, scoring, and evaluating.
b. The material contained herein is applicable to both nuclear and nonnuclear warfare.

1 – 2. Recommended Changes and Comments

Users are encouraged to recommend changes and provide comments to improve this manual. Comments should be keyed to the specific page, paragraph, and line of the text in which the change is recommended. Reasons will be provided for each comment to insure understanding and complete evaluation. Comments should be prepared, using DA Form 2028 (Recommended Changes to Publications) and forwarded direct to Commandant, U.S. Army Air Defense School, ATTN: ATSAD-DL, Fort Bliss, Texas 79916.

1 – 3. References

References listed in appendix A should be consulted for details beyond the scope of this manual**.**

Section II. SAFETY PRECAUTIONS

1 – 4. General

The safety precautions that must be observed by personnel when operating or working in proximity with the simulator are described in paragraphs 1-5 and1-6. Careless or improper handling of simulator components may result in injury or death to personnel or possible damage to the equipment.

1 – 5. Radiofrequency Radiation Hazard

a. Radiofrequency (RF) radiations from radar antennas can present a potential hazard to battery personnel. The effect of RF radiation is not cumulative; however, AR 40-583 and TB MED 270 specify the maximum permissible exposure level for personnel subjected to RF radiation. Personnel should not be permitted to enter areas where they may be exposed to RF power levels above **0.01 watt** per square centimeter.
b. A power intensity of **0.01** watt per square centimeter exists along the axis of the transmitted beam of the Nike Hercules radars at distances shown in table 1-1.

Table 1 – 1. Safe Distances from Nike Hercules Radar Antennas

High-power acquisition radar (nonscanning)	430 feet (131 meters)
High-power acquisition radar (scanning)	33 feet (10 meters)
[1]Alternate battery acquisition radar (AN/FPS-69 or AN/FPS-71)	280 feet (85 meters)
[2]Low-power acquisition radar Missile tracking radar (NIKE Ajax mode)	225 feet (78 meters)
Target tracking radar (long pulse mode)	355 feet (108 meters)
High-power acquisition radar with AJD	60 feet (21 meters)

1 – 6 Electrical Hazards

Dangerous voltages are present when the simulator is energized. While every practical safety feature is incorporated, it is still necessary to exercise caution when working within any simulator chassis. Safety rules should be strictly observed by both operator and maintenance personnel.

a. Always turn power off at the source before making installations or repairs.
b. When power is off, discharge all high-voltage capacitors with a suitably insulated shorting or grounding rod.
c. Unless absolutely necessary, do not override or otherwise disable any interlock switches within a cabinet, compartment, or component.
d. When necessary to service energized equipment, use only one hand and be careful not to touch any grounded equipment with the other hand.
e. When removing or replacing fuses, be sure that the power is turned off.
f. Be certain that the floor and personal clothing are absolutely dry at all times.
g. Do not rely completely on interlock switches to remove all power inside the electrical equipment cabinets. Interlock switches normally remove any high voltages present, but do not remove filament or ac voltages present at convenience outlets and blower motors.
h. Insure that all schematic diagram and theory changes are properly recorded in the manuals provided.
i. Before applying the primary source of power, insure that the simulator is properly grounded.

[1] Stationary antenna only, stationary antenna radiates only when a malfunction of an antenna relay occurs. No hazard exists when antenna is scanning.
[2] Stationary antenna only; antenna will be stationary when antenna disable switch at the pedestal is set at OFF, or if the ANT/RPM switch in the director station trailer is set at OFF. No hazard exists when antenna is scanning.

2 – 1. General

The simulator is a training device for use with the Nike Hercules and Improved Nike Hercules fire control systems. When connected to either system, it provides a complete and realistic radar environment for

CHAPTER 2

MAJOR SIMULATOR COMPONENTS

Section I. DESCRIPTION AND FUNCTION

2 – 1. General

a. The simulator is a training device for use with the Nike Hercules and Improved Nike Hercules fire control systems. When connected to either system, it provides a complete and realistic radar environment for training fire control operators and battery control officers. The simulator is inclosed in a modified semitrailer M348-A2H as shown in figures 2-1 and 2-2. A signal distribution panel (fig. 2-1) provides for cable connections between the Nike Hercules system and the simulator.

b. The simulator consists of six major components; operators console (fig. 2-3); power supply cabinet, auxiliary cabinet, and passive interference cabinet (fig. 2-4); ECM cabinet (fig. 2-5); and chaff cabinet (fig 2-6).

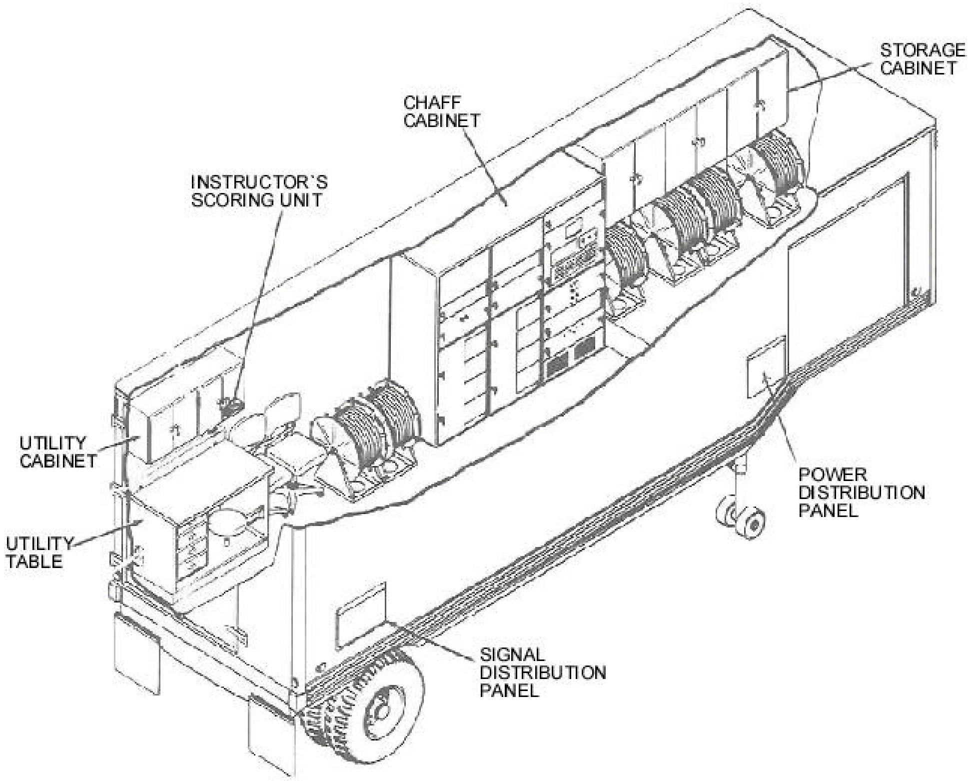

Figure 2 – 1. Nike Hercules engagement simulator, left side (cutaway view).

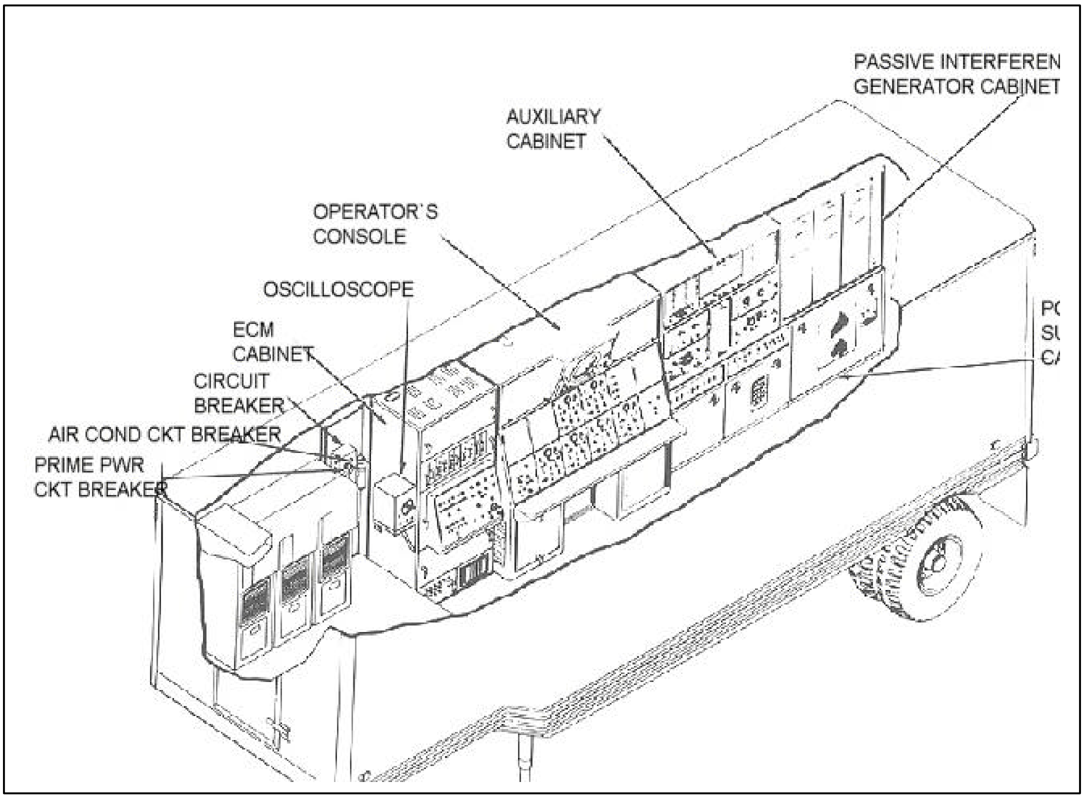

Figure 2 – 2. Nike Hercules engagement simulator, right side (cutaway view).

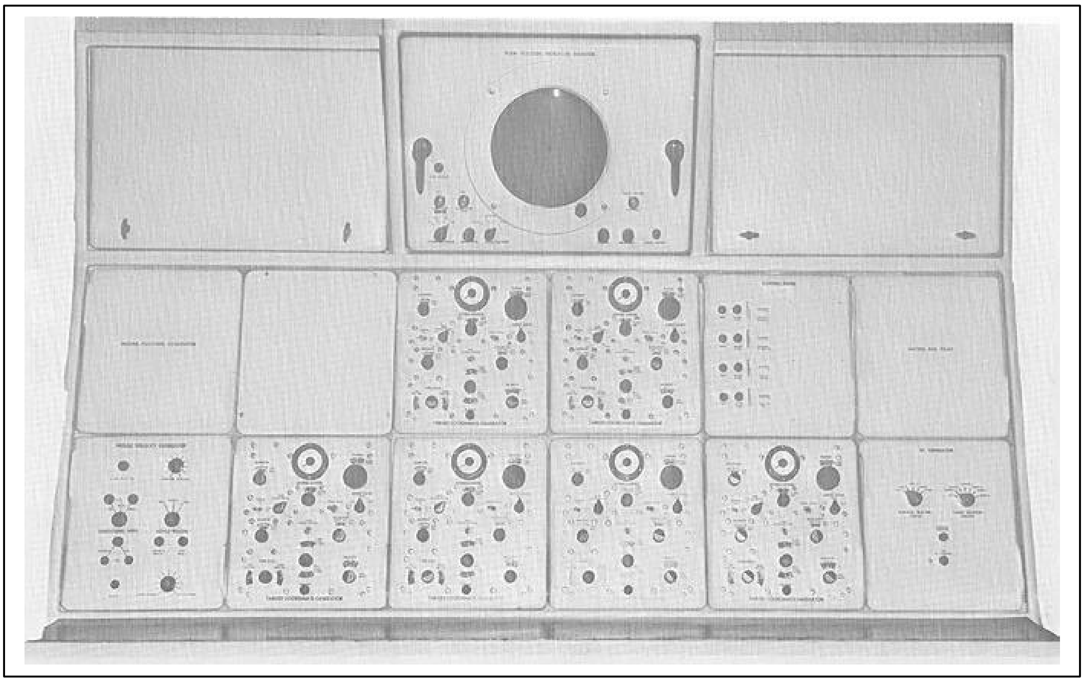

Figure 2 – 3. Operators console

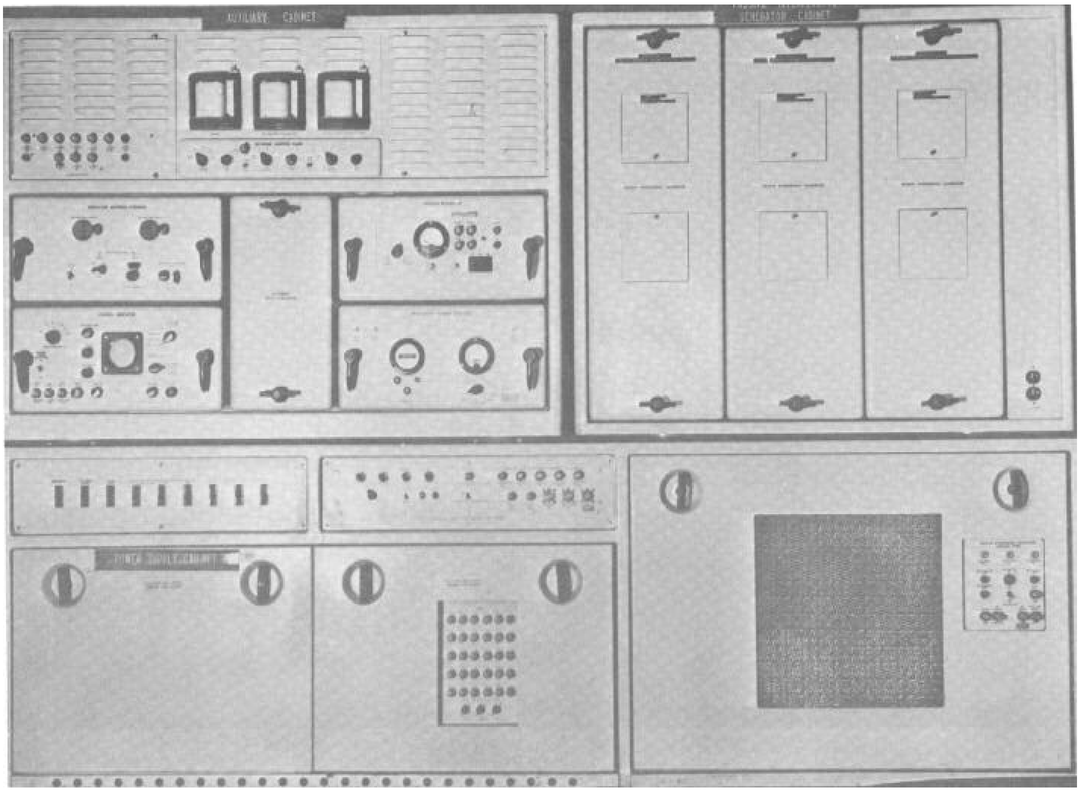

Figure 2 – 4. Power supply cabinet, auxiliary cabinet, and interference generator cabinet.

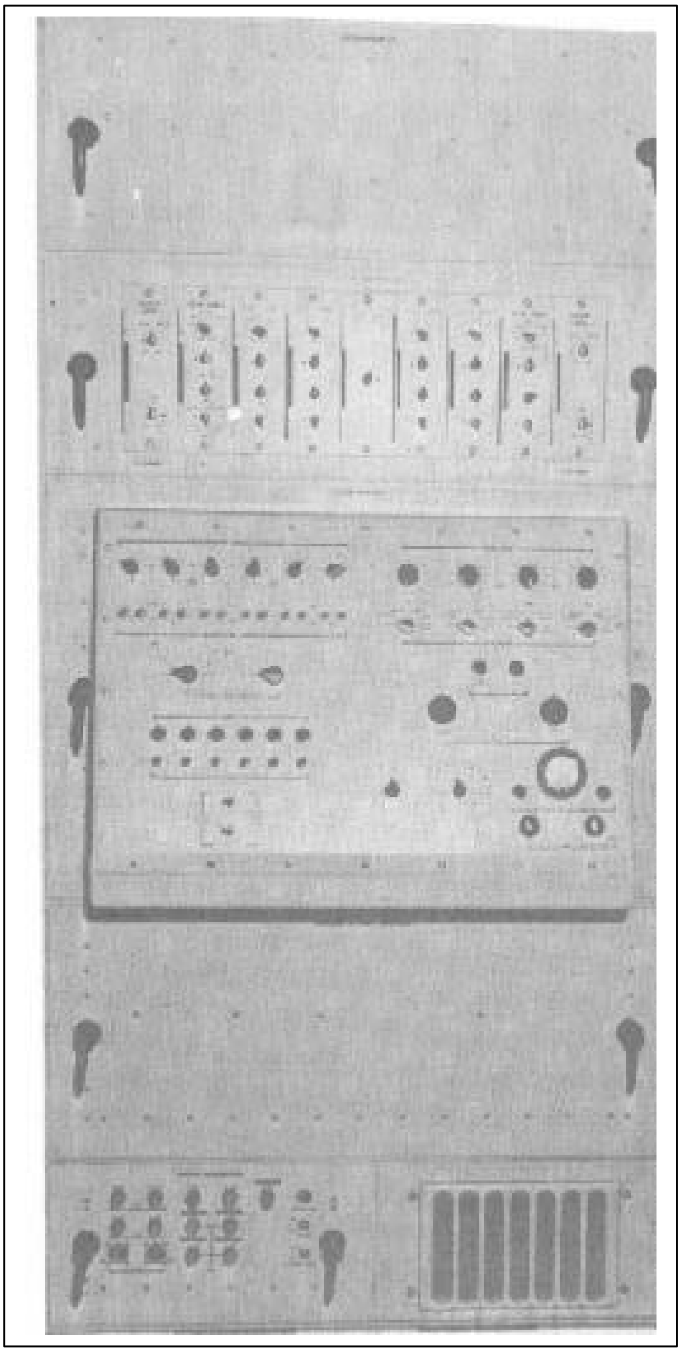

Figure 2 – 5. ECM cabinet.

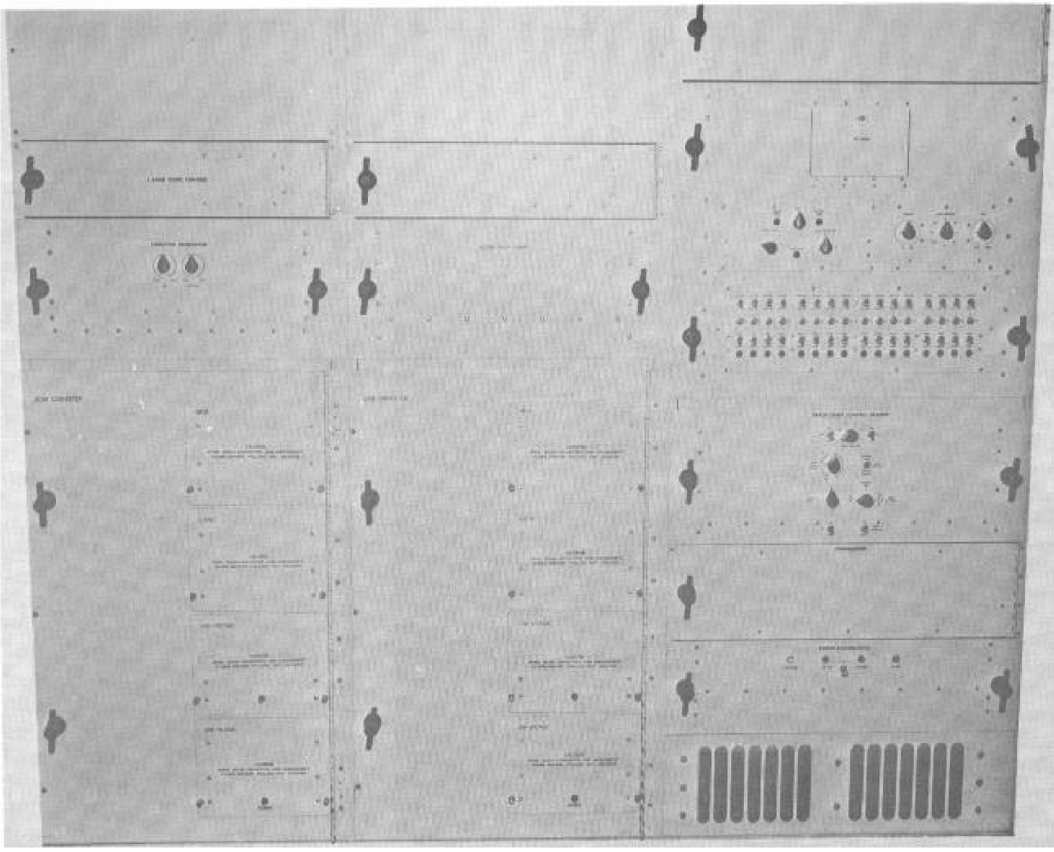

Figure 2 –6. Chaff cabinet.

2 – 2. Operators Console

a. The operators console (fig. 2 – 3) consists of a plan position indicator (PPI) monitor; six target coordinate generators; a scoring panel; an identification, friend or foe (IFF), generator; missile velocity generator; two telephone jacks with associated ring buttons; and a telephone control switch. The gating and relay drawer and the missile position generator have no operator controls. Their functions and operations are covered in detail in TM 9-1430-268-12/1.

b. The PPI monitor (figs. 2-3 and 2-7) displays either simulator or acquisition radar video. The setting of the four-position VIDEO SELECTION rotary switch determines the PPI display. When the switch is turned to LOCAL, DETECTED F[1] or DETECTED D, the PPI displays simulated video. When turned to RADAR, the PPI displays video from the acquisition radar that has been selected at the control console of the Nike Hercules director station. Other controls and indicators on the PPI monitor are as follows:

(1) The AAR RADAR indicator lamp glows with a blue light when the alternate acquisition radar (HIPAR or AAR) is in use instead of the low-power acquisition radar (LOPAR).

(2) The H.V. and FIL lamps will glow with a clear light when either the H.V. or FIL fuse is defective.

(3) The four-position RANGE (X1000YDS) rotary switch is used to select 60 000, 120 000, 200 000, or 350 000 yards of range for presentation on the PPI monitor.

(4) The VIDEO LEVEL rotary knob adjusted controls the intensity of video appearing on the PPI monitor.

(5) The IF GAIN rotary knob adjustment is used to decrease or increase the strength of the intermediate frequency (IF) signal. Adjustment of this control will affect the PPI monitor presentation only when the VIDEO SELECTION switch is turned to F or D.

(6) The BRIGHTNESS rotary knob adjustment is used to control the intensity of the radial sweep on the PPI monitor.

(7) The SWEEP FAILURE indicator lamp will glow when PPI sweep circuits fail or when an input to the circuits is lacking.

(8) The SERVO MOTOR lamp will glow with a clear light when the servomotor circuit fuse is defective.

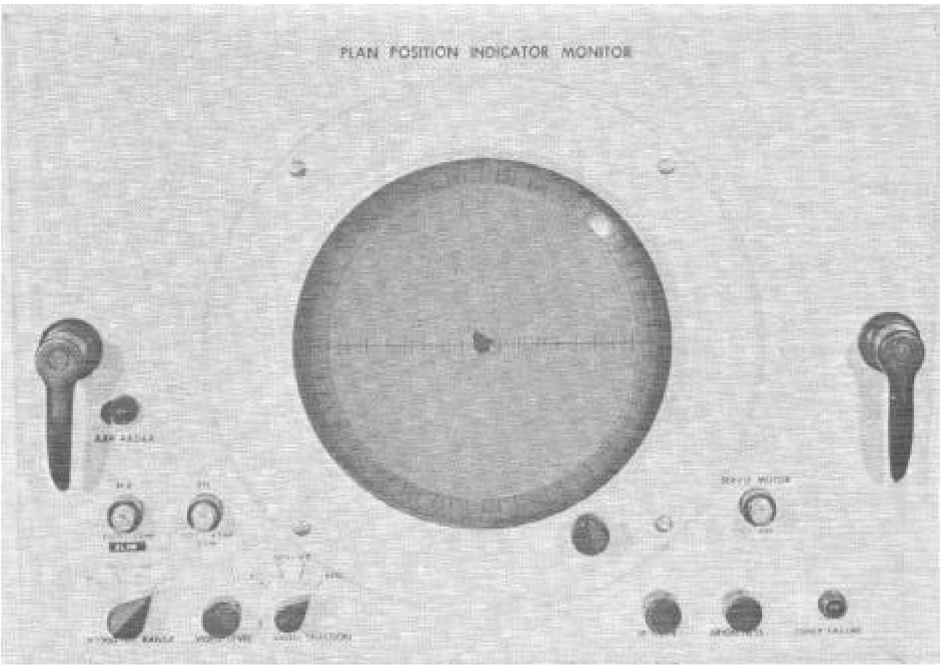

Figure 2-7. Plan position indicator monitor.

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[1] See appendix D.

c. The six target coordinate generators (TCG) (fig. 2-3) provides voltage for positioning and moving the simulated target. The controls and indicators on the generators are identical and the generators are interchangeable. The generator controls and indicators, as shown in figure 2-8, are described below.

Note. Each TCG will automatically indicate an increase in target size and aspect ratio as the simulated target approaches a Nike Hercules site. As the simulated target recedes, the target size becomes smaller and its aspect ratio decreases.

(1) The DESIRED ALTITUDE meter indicates the altitude of the simulated target from 0 to 150 000 feet in increments of 2 000 feet.

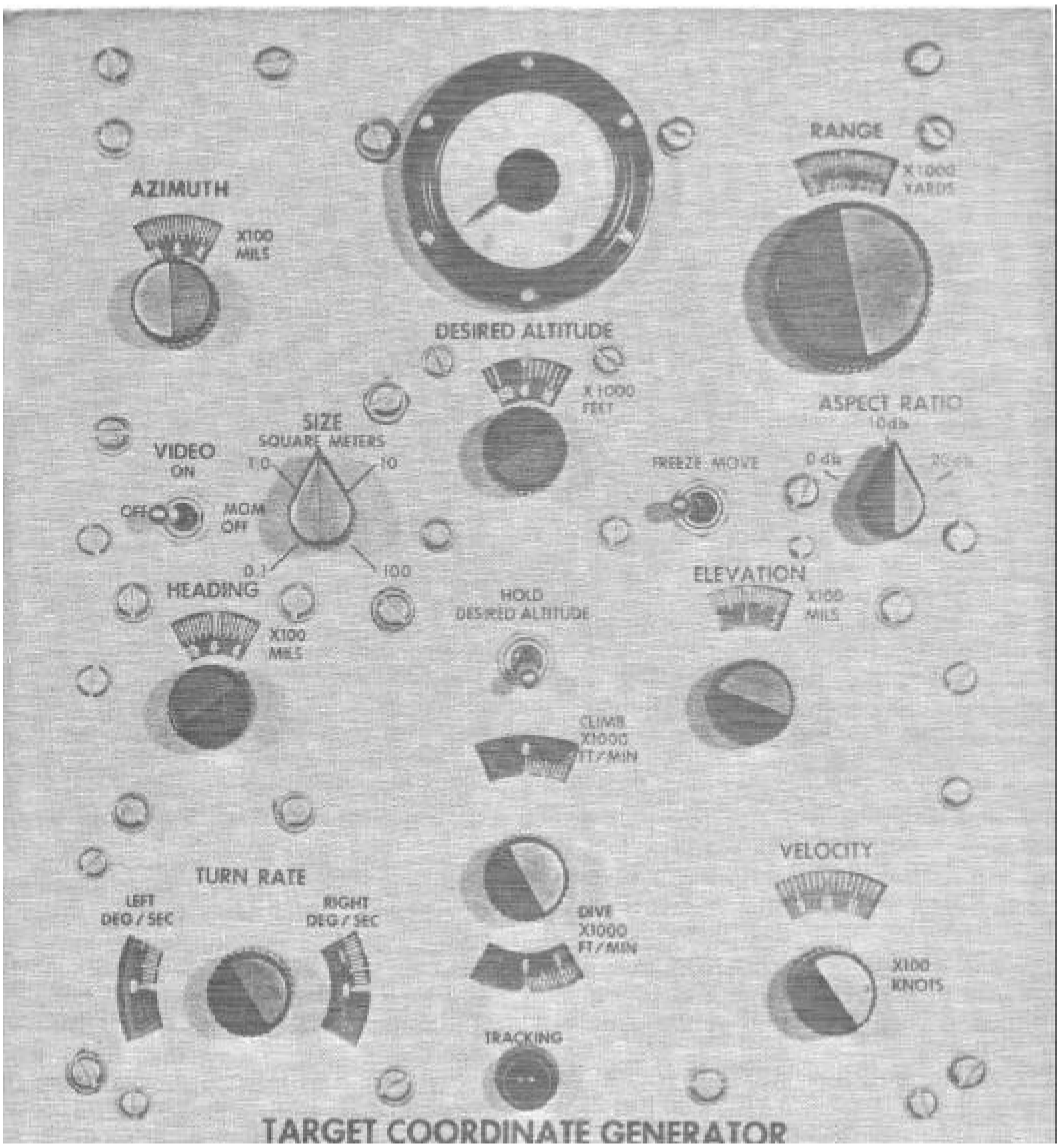


Figure 2-8. Target coordinate generator.

(2) The RANGE X1000 YARDS knob and dial are used to set the slant range of the simulated target from 0 to 400 000 yards in increments of 2 000 yards.

(3) The three-position ASPECT RATIO rotary switch provides for a 0 – 10 – 20 decibel (db) change in simulated target size based on the targets reflective area exposed to the Nike Hercules radar.

(4) The two-position FREEZE / MOVE toggle switch causes the simulated target to remain stationary or to

move as desired.

(2) The ELEVATION X100 MILS knob is used to set the desired elevation angle of the simulated target on the associated dial. The setting may be from –30 to 1 600 mils in increments of 10 mils.

(3) The two-position HOLT DESIRED ALTITUDE toggle switch, when set at the up position, will remove the effects of the climb and dive control; the simulated target will maintain the altitude indicated on the desired altitude dial.

(4) The DESIRED ALTITUDE X1000 FEET rotary knob is used to set a desired altitude of the simulated target on the associated dial. The altitude may be set from 0 to 150 000 feet in increments of 2 000 feet.

(5) The CLIMB X1000 FT/MIN and DIVE X1000 FT/MIN indicator dials have a rotary knob located between them. A clockwise movement of the knob sets in a dive rate in increments of 500 feet per minute; turning the knob counterclockwise sets in a climb rate in increments of 500 feet per minute.

(6) The red TRACKING indicator lamp, when lighted, shows that radar tracking data is within the specified tolerance of the simulated target position.

(7) The TURN RATE rotary knob is used to set in a turn rate for the simulated target of 0° to 20° per second. The turn rate is indicated on the LEFT DEG/SEC and RIGHT DEG/SEC dials. The dial is rotated clockwise for a right turn and counterclockwise for a left turn.

(8) The HEADING X100 MILS knob is used to set the heading of the simulated target on the associated indicator. The heading may be set from 0 to 6 400 mils in increments of 50 mils. (The heading of the simulated target is its direction of approach to the defended area.)

(9) The SIZE SQUARE METERS rotary knob is used to set the size of the simulated target from 0.1 to 100 square meters (e.g., a fighter-bomber may present a size of 2 square meters; a medium bomber may present a size of 10 square meters).

(10) The three-position VIDEO toggle switch, when set at OFF, prevents application of video to the Nike Hercules system. When the VIDEO SELECTION switch on the PPI monitor is turned to LOCAL, video will appear on the PPI monitor. When the VIDEO switch is set to ON, simulated target video appears on the PPI monitor and on the Nike Hercules system consoles. When held at MOM OFF, target video is removed from all indicators until the switch is released whereupon video reappears on all indicators.

(11) The AZIMUTH X1000 MILS knob is used to set the simulated target azimuth on the associated indicator. The azimuth may be set from 0 to 6400 mils in increments of 50 mils. (Azimuth is the direction of approach to the defended area as seen from the defended area.)

(12) The VELOCITY Y1000 KNOTS rotary knob is used to set the velocity of the simulated target from 0 to 2 000 knots in increments of 100 knots on the associated dial.

a. The scoring panel (fig. 2-9) is electrically connected to the instructors scoring unit (fig. 2-10) in the director station or tracking station trailer. To use the scoring panel, the simulator operator must set the controls and indicators as stated below prior to the start of a training exercise.

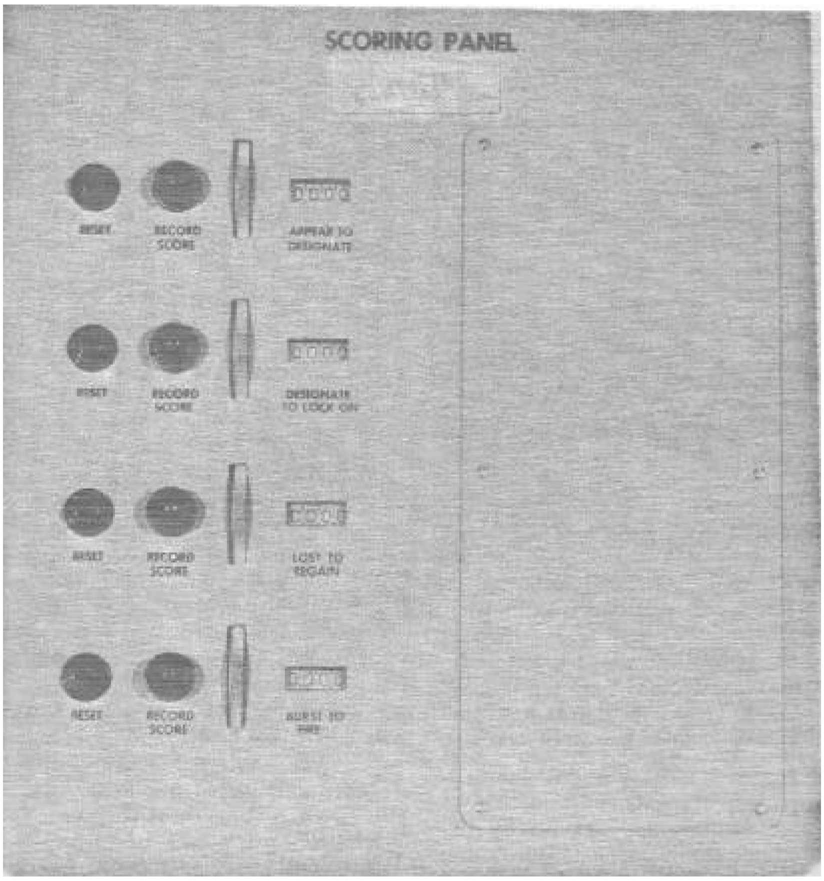


Figure 2-9. Scoring panel.

(1) Press the four RESET pushbuttons to cause the four RECORD SCORE green indicator lamps to go out.
(2) Set the APPEAR TO DESIGNATE; DESIGNATE TO LOCK ON; LOST TO REGAIN; and BURST TO FIRE counters to indicate 0000, using the associated thumbwheels.

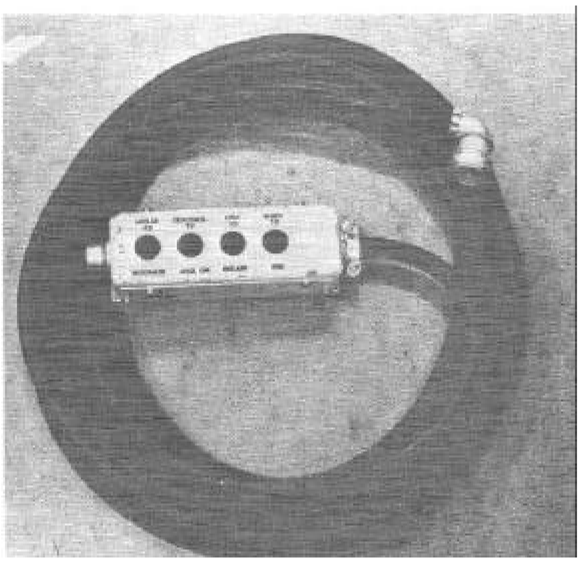


Figure 2- 10. Instructors scoring unit.

b. The IFF (fig. 2-11) develops five simulated IFF response signals, three friendly tactical replies (designated as code 1; code 2; the IFF code, designated as the personal identification (PI) code; code 3, the flight leader identification (FLI) code); a bogus reply; and a spoof reply. The purpose and function of the IFF generator controls and indicators are explained in (1) through (4) below.

(1) The rotary five-position RESPONSE SELECTOR SWITCH is used to determine the desired reply for the target selected by the TARGET SELECTOR SWITCH:

(2) The rotary seven-position TARGET SELECTOR SWITCH is used to determine which target, if any, will present the reply indicated on the RESPONSE SELECTOR SWITCH:

(3) The green CHALLENGE INDICATOR lamp will light when any of the six targets are challenged by the battery control officer in the director station trailer.

(4) The spring-loaded TEST IFF CHALLENGE pushbutton provides a test challenge signal for checking the operation of the IFF generator.

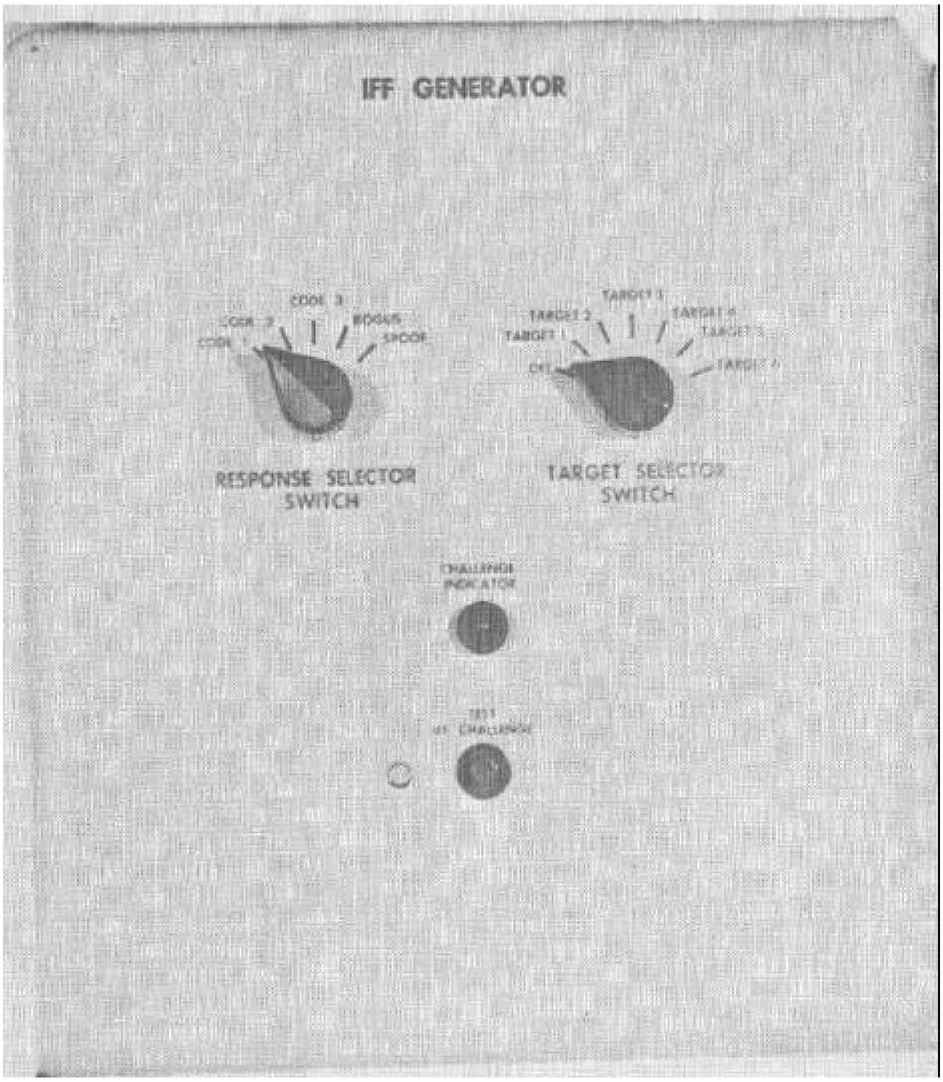


Figure 2-11. IFF generator.

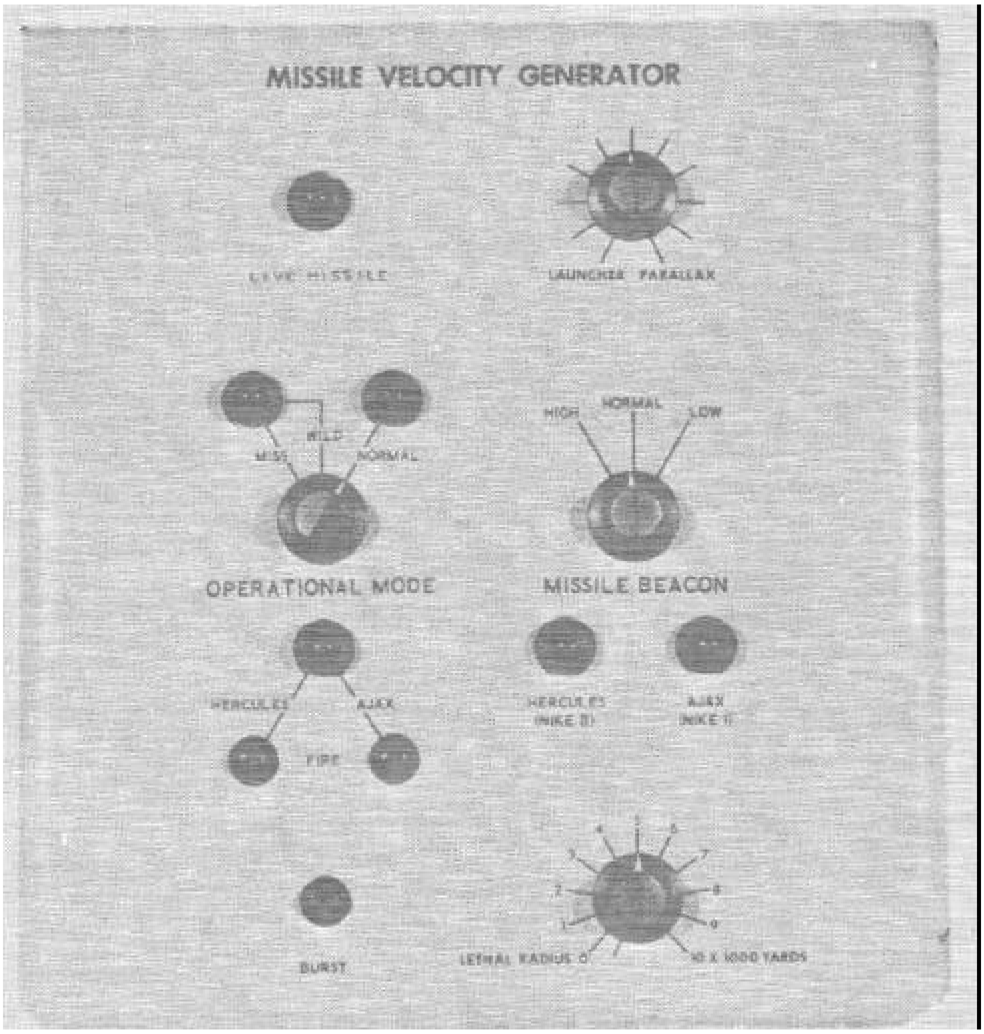


Figure 2-12. Missile velocity generator.

c. The missile velocity generator (fig. 2-12) provides the velocity to simulate a missile trajectory. The controls of the missile velocity generators are described in (1) through (9) below.

(1) The LAUNCHER PARALLAX rotary knob is used to arbitrarily adjust the range from the launcher to the missile tracking radar (MTR).

(2) The three-position MISSILE BEACON rotary switch is used to set the signal strength of the beacon response to HIGH, NORMAL, or LOW.

(3) The two amber indicator lamps HERCULES (NIKE B) and AJAX (NIKE I), when lighted, indicate the simulated missile that has been selected to be fired.

(4) The LETHAL RADIUS X1000 YARDS control knob is used to select the killing radius of the simulated missile. Any simulated target within this setting will disintegrate whether or not in the range gate.

(5) The BURST pushbutton, when pressed, will simulate a burst command to the missile for its destruction. The missile may also be destroyed by permitting the missile time of flight to continue for the maximum time (150 seconds for Nike Ajax, 350 seconds for Nike Hercules).

(6) The two FIRE pushbuttons, HERCULES or AJAX, are used for test purposes to simulate the firing of either type missile.

(7) The red FIRE indicator lamp will light when a simulated missile has been fired.

(8) The three-position OPERATIONAL MODE switch may be turned to MISS, WILD, or NORMAL and affects the simulated missile that has been fired. When turned to MISS, the MISS/WILD red lamp lights, and the burst command from the computer is disabled. When turned to WILD, the MISS/WILD red lamp lights, and the simulated missile trajectory is erratic and will cause the computer to overload and lose control of the missile. No kill effects are possible when the switch is turned to MISS or WILD. When the switch is turned to NORMAL, the NORMAL green lamp lights and a controlled missile flight is provided.

(9) The red LIVE MISSILE indicator lamp, when lighted, indicates that a live missile instead of a

simulated missile has been selected for firing.

d. Located below the top of the writing desk at the operators console, and on each side of it, are two telephone connectors, each of which has an associated PHONE RING pushbutton (figs. 2-13 and 2-14). The PHONE CONTROL switch, located on the right side of the desk, is a two-position toggle switch. When the switch is set at RDR NETWORK, the simulator station operators telephone is connected to the Nike Hercules switchboard and to the instructors telephone in the director station trailer and tracking station trailer. When the switch is set at secure, the simulator operators telephone is connected only to the instructors telephone in the director station trailer or tracking station trailer.

2-3. Power Supply Cabinet

a. The power supply cabinet (figs. 2-2) and 2-4), located below the auxiliary cabinet and passive interference generator cabinet, consists of a circuit breaker panel (fig. 2 – 15), an indicator panel and fuse panel (fig. 2 – 16), a high-voltage power supply (fig. 2–17), and a passive interference generator control panel (fig. 2-18) for the three passive interference generators.

b. The main power supply, located behind the panels shown in figures 2-15 and 2-16, provides the unregulated dc voltages for the simulator. The circuit breaker panel is also shown in figure 2-15. When the switches on this panel are set at the up position, ac power is supplied to the simulator.

c. The indicator panel (fig. 2-16) controls the distribution of both dc regulated and unregulated voltages.

d. The passive interference generator high-voltage power supply and control panel is shown in figure 2-17. The control panel has a toggle switch and four red lamps for the operators use. These are:

(1) HIGH VOLTAGE – ON/OFF and the associated HIGH VOLTAGE ON lamp.

(2) SWEEP FAILURE D ACQ lamp, SWEEP FAILURE F ACQ lamp, and SWEEP FAILURE TRACK lamp.

e. When the high-voltage lamp fails to light or one or more of the sweep failure lamps light, a serious deficiency is indicated and the operator will immediately notify organizational maintenance personnel.

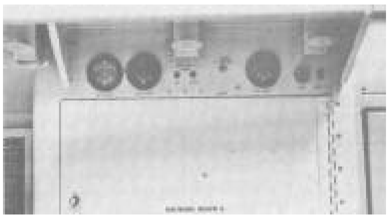


Figure 2 –13. Telephone connector (right side)

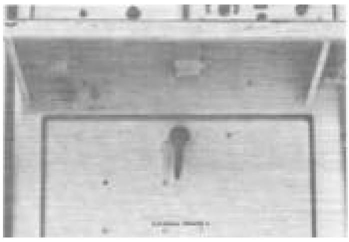


Figure 2 –14. Telephone connector (left side)

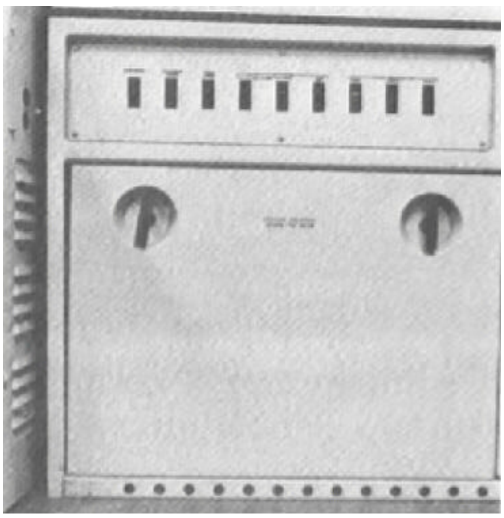
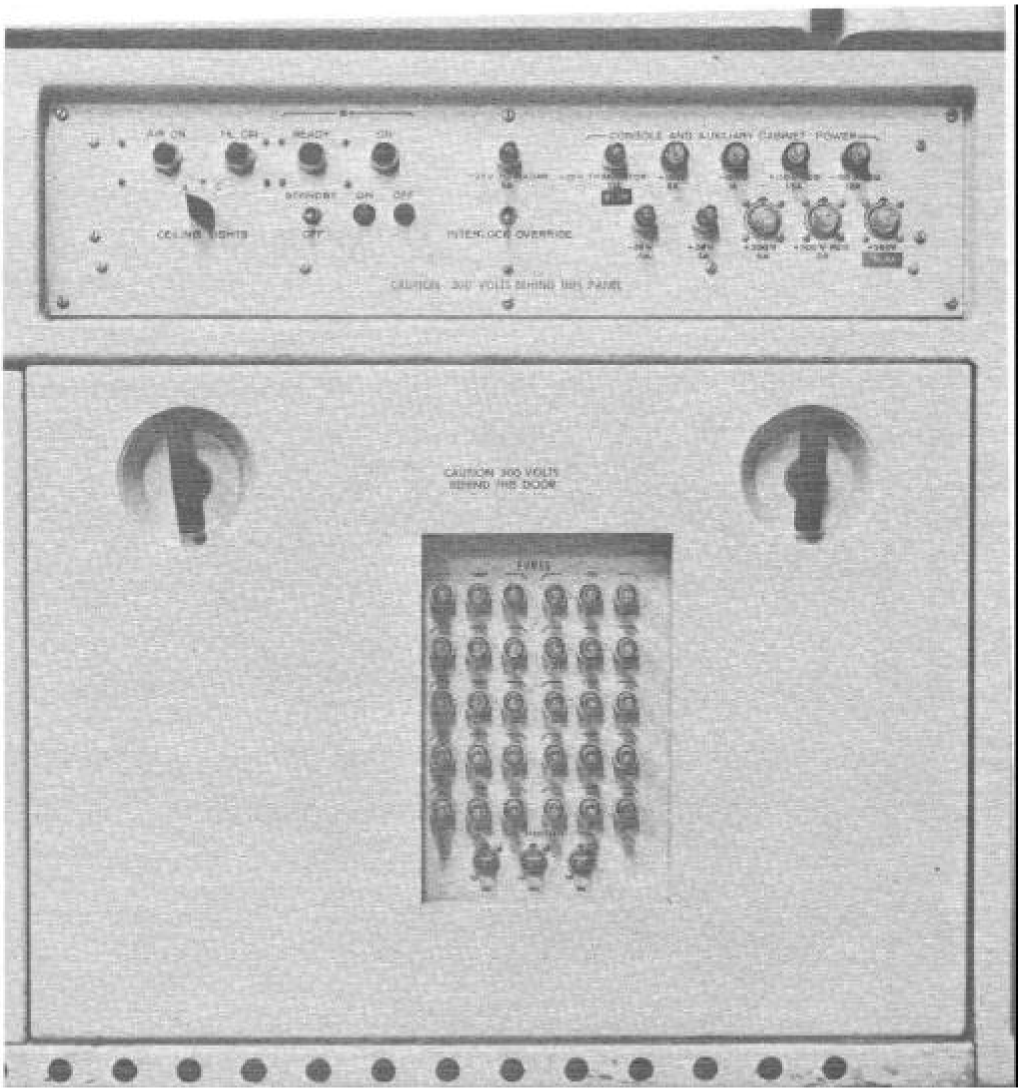


Figure 2 – 15. Main power supply and circuit breaker panel.



2 – 4. Auxiliary Cabinet

a. The auxiliary cabinet (fig. 2 – 4) provides voltage regulation, simulated sync pulses, antenna positioning data, error recording facilities, and a target pulse monitoring oscilloscope.

b. The voltage regulator (fig. 2-19) has the following controls and indicators:

(1) The six-position LINE VOLTAGE/REGULATED VOLTAGE rotary switch is used to check the input and output voltages for phases A, B, and C on the associated voltmeter.

(2) The INCREASE SENSITIVITY and INCREASE OUTPUT VOLTAGE screwdriver adjustments are used to adjust the sensitivity of the regulator and to set the level of the regulated output voltage.

(3) The four fuse indicator lamps will light when the associated fuse has blown.

(4) The two-position CONTROL - ON/OFF toggle switch, when set at ON permits a screwdriver adjustment of the INCREASE OUTPUT VOLTAGE and INCREASE SENSITIVITY potentiometers. The CONTROL lamp will light when the switch is set at ON.

(5) The two-position, three-gang, LINE toggle switch, when set to ON, will light the LINE indicator lamp and apply line voltage to the regulator.

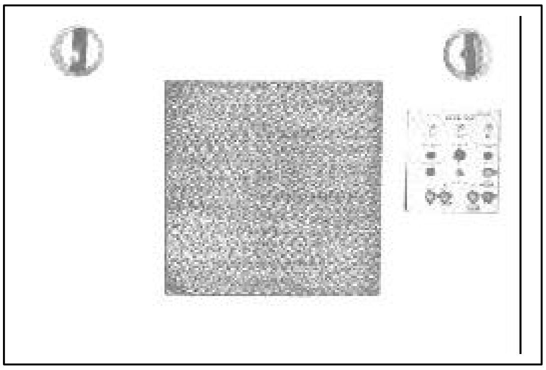


Figure 2 – 17. Passive interference generator high-voltage power supply and control panel.

c. The regulated power supplies (fig. 2 – 20) have the following controls and indicators:

(1) The two screwdriver adjustments, -150 REG OUTPUT VOLTAGE and + 150 REG OUTPUT VOLTAGE, are used to set the level of the –150 and +150 voltages on the DC VOLTMETER when the DC VOLTMETER RANGE switch is turned to –150 REG (x3) and +150 REG (x3), respectively. The voltages are checked daily. Adjustments are made by organizational maintenance personnel.

(2) The screwdriver adjustment, +300 REG OUTPUT VOLTAGE, is used to set the level of the +300 voltage on the DC VOLTMETER RANGE when the DC VOLTMETER RANGE switch is turned to +300 REG (x6). This adjustment is also made by organizational maintenance personnel.

(3) Three fuse indicator lamps, -150 REG, +150 REG, and +300 REG, will light when the associated fuse is blown.

(4) The LINE FREQUENCY meter indicates the frequency of the input power in hertz.

(5) The DC VOLTMETER indicates the voltage level for the required simulator voltages as determined by the setting of the DC VOLTMETER RANGE switch.

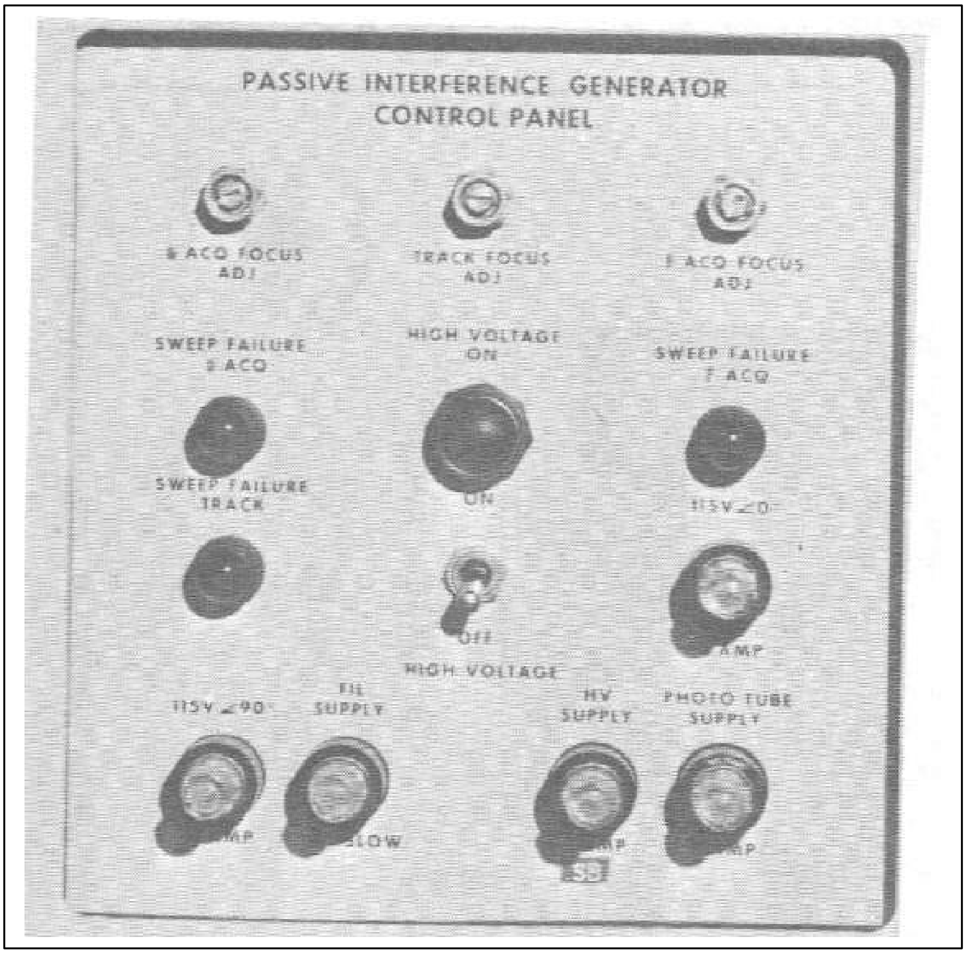


Figure 2 – 18. Passive interference generator control panel.

d. The front panel controls and indicators on the simulator antenna position chassis (fig. 2 – 4) are not within the scope of the simulator operators duties.

e. The control-indicator (fig. 2 – 21) provides an A-scope to monitor either the TTR or TRR displays as determined by setting of the RADAR VIDEO SELECTOR and FUNCTION SELECTOR switches. The purpose of the controls and indicators is as follows:

(1) The four-position FUNCTION SELECTOR switch will be turned to RADAR VIDEO when either associated TTR or TRR video is to be observed. When the switch is turned to SIMULATOR VIDEO, the track video generated within the simulator will appear on the A-scope. The ZERO ADJUST and MONOPULS positions are used the positions of the presentations on the A-scope.

(2) The three-position MONOPULSE switch provides standard A-scope operation on the indicator when turned to OPERATE. The other two positions are used during simulator alinement

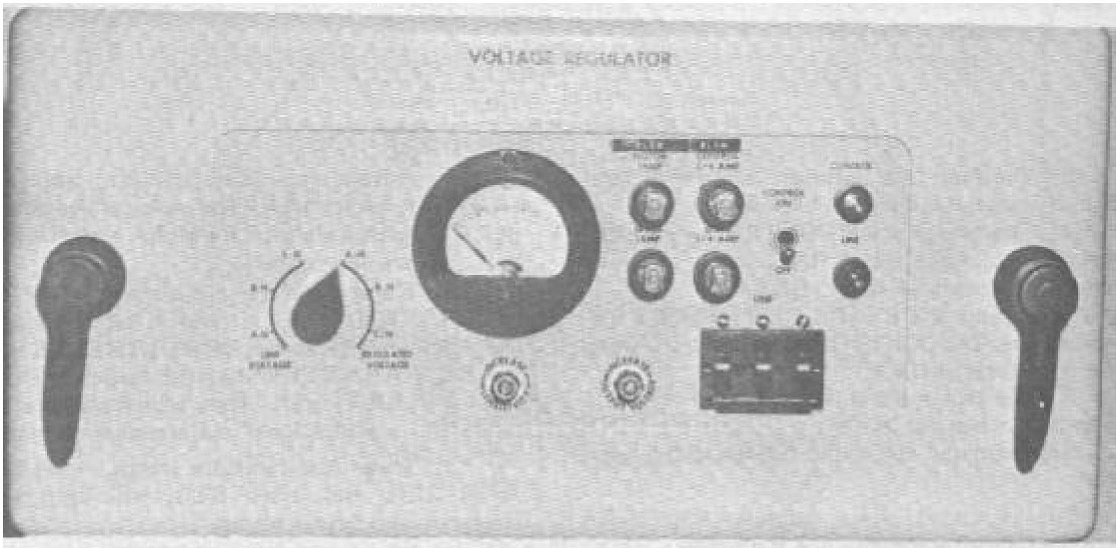


Figure 2 – 19. Voltage regulator.

(3) The three knob adjustments, ASTIGMATISM, FOCUS, and INTENSITY, are used to obtain the proper presentation of video on the indicator.

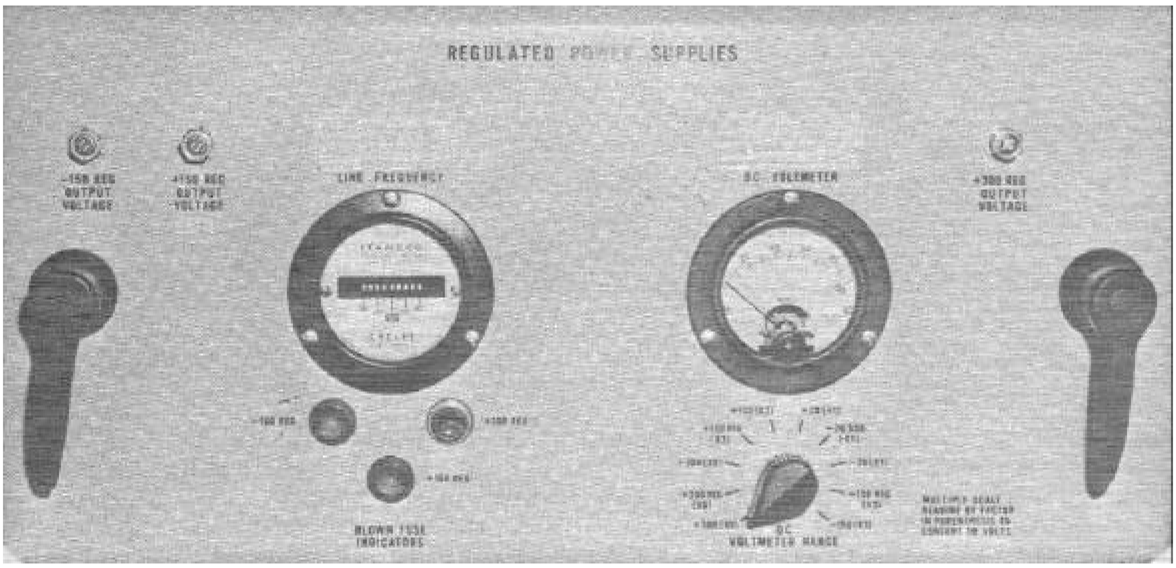


Figure 2 – 20. Regulator power supplies.

(4) The HORIZONTAL POSITION knob adjustment is used to center the position of the horizontal sweep on the scope.
(5) The HORIZONTAL GAIN knob adjustment is used to increase or decrease the length of sweep.
(6) The VERTICAL POSITION knob adjustment is used to raise or lower the position of the horizontal sweep on the scope.

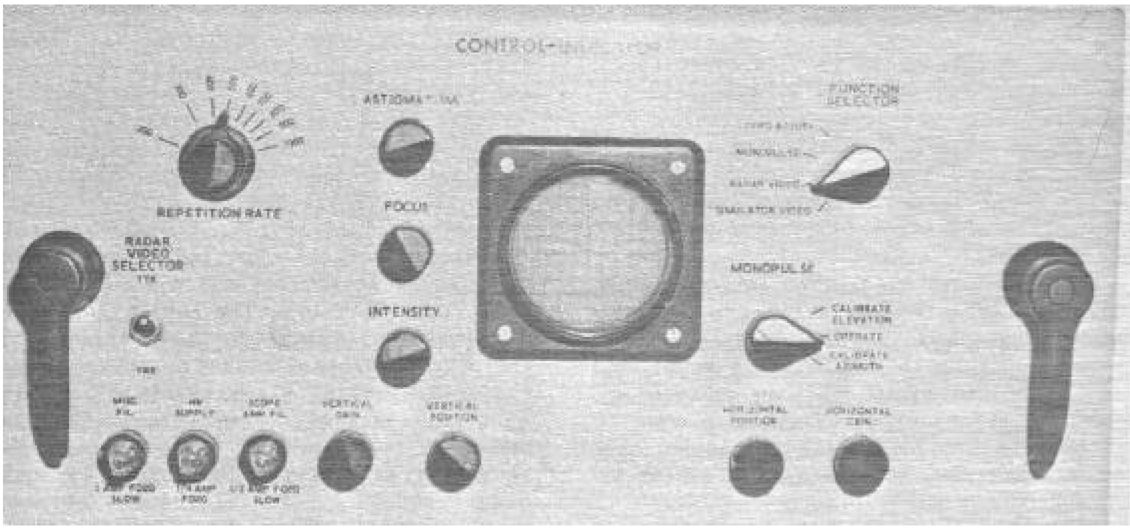


Figure 2 –21. Control-indicator

(7) The VERTICAL GAIN knob adjustment is used to increase or decrease the signal amplitude in the vertical plane.
(8) The three-indicator lamps, MISC FIL, HV SUPPLY, and SCOPE AMP FIL, will light when the associated fuse has blown.
(9) The two-position RADAR VIDEO SELECTOR-TTR/TRR toggle switch is used to present video from either the TTR or TRR on the control-indicator scope.
(10) The REPETITION RATE control is used to set pulse repetition frequency (PRF) during simulator alinement only.
f. The recorder control panel, associated error recorders, and fuse panel (fig. 2-22) record tracking errors, missile fin commands, and the TTR or LOPAR magnetron tuning. Below the three error recorders is the control panel used to zero-set and adjust the sensitivity of the recorders. Description and purpose of the controls are as follows:
(1) The three five-position rotary controls, one for each error recorder, are used to determine the deflection sensitivity for each error recorder, measured in volts (50, 25, 10, or 5 volts), and when turned to ZERO SET the controls are used to adjust for zero pen defection.
(2) The three ZERO SET knob adjustments, one for each recorder, are used to adjust for zero deflection in each error recorder.
(3) The POWER/OFF toggle switch is used to apply power to the error recorders.
(4) The PAPER DRIVE / OFF toggle switch is used to apply power to the paper drive motors.
(5) The 1 AMP FO2G SLOW indicator lamp will light when its associated fuse has blown.
(6) To the left of the error recorder panel are 10 indicator lamps that will length when the associated fuse are blown. Two of the indicator lights are the press-to-test type.

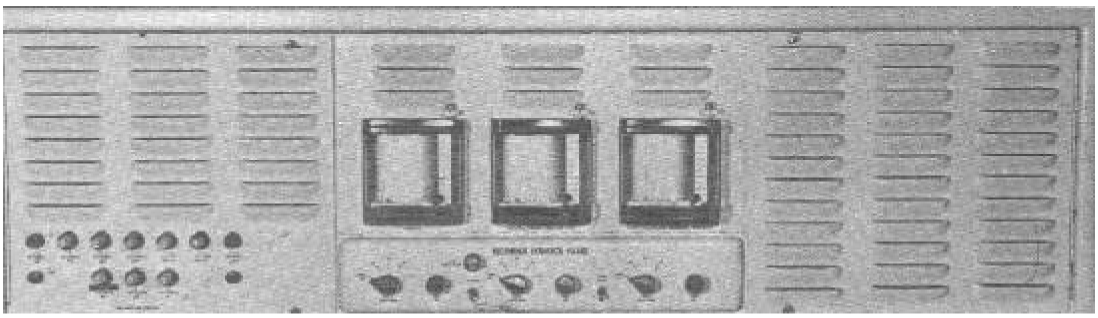


Figure 2 – 22. Recorder control panel, associated error recorders, and fuse panel.

2 – 5. Passive Interference Generator Cabinet

a. The passive interference generator cabinet (figs. 2-4 and 2-23) contains three passive interference generators. The generators simulate the effects of clutter and masking in the area scanned by the system radars. The left generator is used with the D-Band acquisition radar. The center generator is used with the tracking radars, and the right generator is used with the F-band acquisition radar. There are no external controls on these generators.

b. The effects of ground clutter and terrain features are produced in the passive interference generator by means of two translucent slides for each generator. One slide represents the masking of the radar by terrain features, the other slide represents the clutter that will be seen on the radar scope. When a simulated target is hidden from a radar by hills or mountains, target video is removed from the radar indicators. Emission of ECM and chaff drops also will be eliminated from radar indicators. The clutter slide represents radiations reflected by the surrounding terrain that return to the radar as echoes. Ground clutter and masking may be simulated to a maximum range of 200 000 yards. Because the slides are made from specially treated photographic plates, they are not normally produced locally by using personnel. Special request and equipment are usually required to produce the slides.

2 – 6. ECM Cabinet

a. Simulated ECM provides four types of jamming and the capability of varying the pulse repetition frequency and pulse width of the jamming. Types of ECM include noise, pulse, square-wave, and continuos wave (CW) that may be applied to any one or to all six simulated targets. Jamming from an external source may also be used. The modes of jamming (i.e., normal (spot), barrage, sweep, FM CW, and FM noise) are applied to all targets in any individual frequency band. That is, if three simulated targets are being generated in the F-band, all three will have the same mode of jamming. This will also apply to simulated targets generated by the D-band radars as well as by the TTR and TRR.

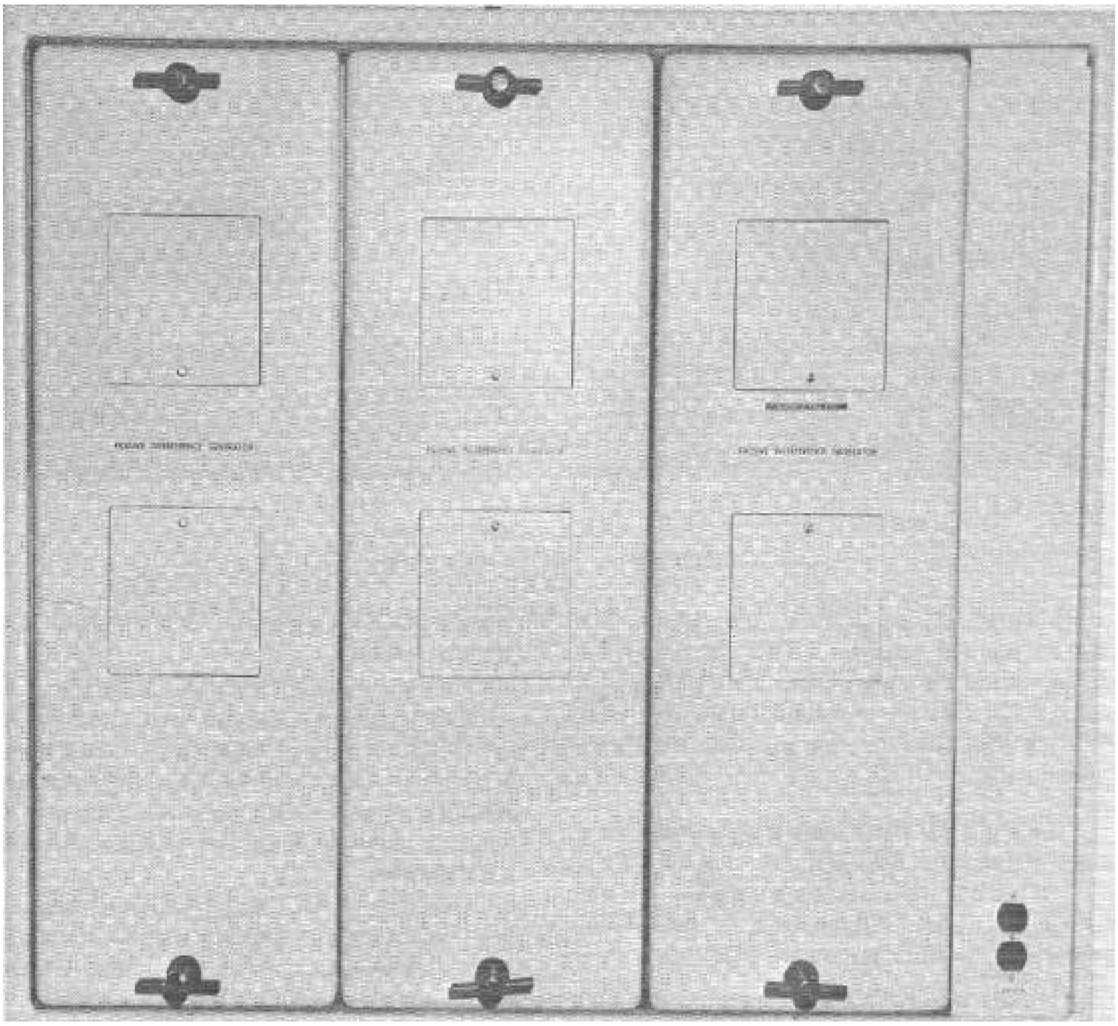


Figure 2 –23. Passive interference generator cabinet.

a. The ECM generator drawer (fig. 2 –24) contains six generators, two spoof generators (one F-band and one D-band), and one variable pulse repetition frequency generator. The controls of the ECM generators are as follows:

(1) The FUNCTION switch is a five-position rotary switch used to select EXT, NOISE, PULSE, SQUARE, or CW jamming. The EXT position enables the operator to apply the modulation from an external source; the other switch positions are self-explanatory.

(2) The PRF KC control is used to vary the jamming PRF from 2 kilohertz to 60 kilohertz.

(3) The PULSE WIDTH USEC control is a rotary knob used to vary the jamming pulse width from 0.7 to 5 microseconds.

(4) The SYNC selector switch is a four-position rotary switch which permits the selection of the desired sync pulse for jamming application. The four switch positions are F-Band, D-Band, TRACK, and VARIABLE. The F-Band position provides a PRF of 500 pulses per second (PRF of the LOPAR). The D-BAND position provides a PRF of 400 pulses per second (PRF of the HIPAR and AAR). The TRACK position provides a PRF of 500 pulses per second (TTR and TRR). The VARIABLE position provides an adjustable sync frequency which is controlled by the variable PRF generator.

b. The F-BAND spoof generator provides false target pulses for the LOPAR. The D-BAND spoof generator provides false targets for the HIPAR and AAR. The controls of both spoof generators, described below, are identical.

(1) The GATE WIDTH control is a rotary knob used to vary gate width from 60 to 700 microseconds. The resulting visual indication on the radar scope is an increase in spacing between false target pulses.

(2) The PRF control is a rotary knob used to vary the pulse repetition frequency from 10 000 to 45 000 pulses per second (PPS). The resulting visual indication on the radar scope is an increased number of fake target pulses.

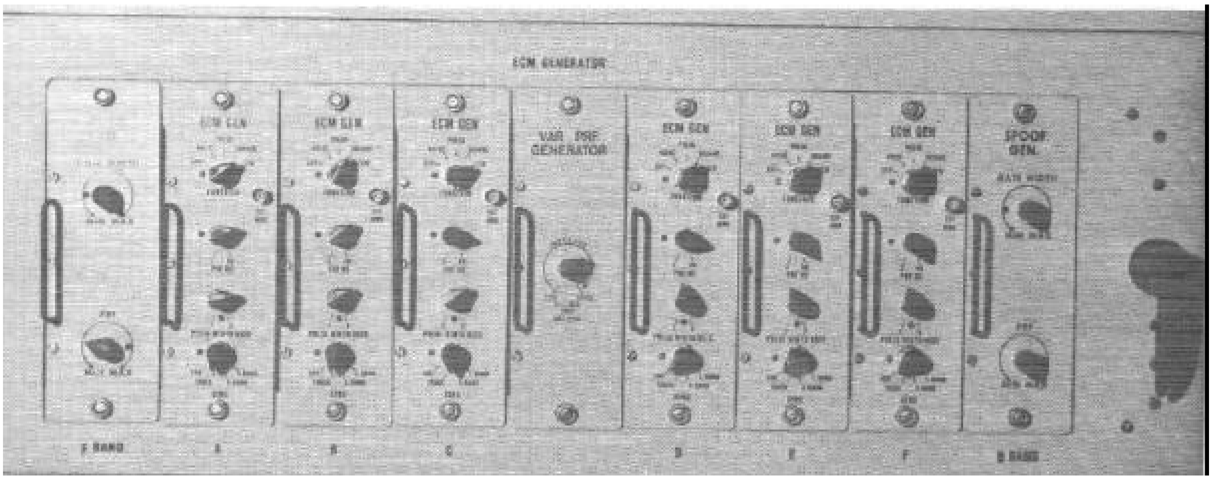


Figure 2-24. ECM generator drawer.

c. The ECM control drawer (fig. 2 – 25) comprises the lower portion of the ECM cabinet. The external controls enable the simulator operator to assign ECM signals to various targets and select the radar to receive the ECM display.

(1) The six-position rotary ECM GENERATOR TARGET ASSIGNMENT switches are used to select targets for ECM generators A through F, one for each ECM generator. When TARGET ASSIGNMENT switch A is set to a specific target number (1 through 6), ECM video from ECM generator A is assigned to that specific target.

(2) The ACQUISITION JAMMING two-position toggle switches are used to select either the D-band or F-band radar for targets 1 through 6. There is one pair of switches for each target. When the F or D switch for target 1 is set at ON, target 1 jamming is applied to either F-Band or D-band video.

(3) The ACQUISITION SPOOFING seven-position rotary switches are used to select either F-band or D-band spoofing for targets 1 through 6. The seventh position is the OFF position.

(4) The TARGET BEEING TRACKED indicator lamps light to indicate that the target is being tracked by the radar.

(5) The push-type TRACK JAMMING switches are used to select the target to receive the jamming signals.

(6) The TTR and TRR two-position toggle switches are used to select either ECM VIDEO or RANGE GATE STEAL pulses for the selected radar.

(7) The POWER LEVEL controls are rotary knobs used to adjust the power of the jamming signal. Each control can be adjusted on a scale from 0.1 to 100 watts per megahertz. There is one control each for F-band and D-band radars, TTR, and TRR.

(8) The ECM MODE six-position rotary switches are used to select NORMAL (SPOT), BARRAGE, SWEEP, FM CW, or FM NOISE modes of jamming. There is one switch each for the F-band and D-band radars, TTR, and TRR.

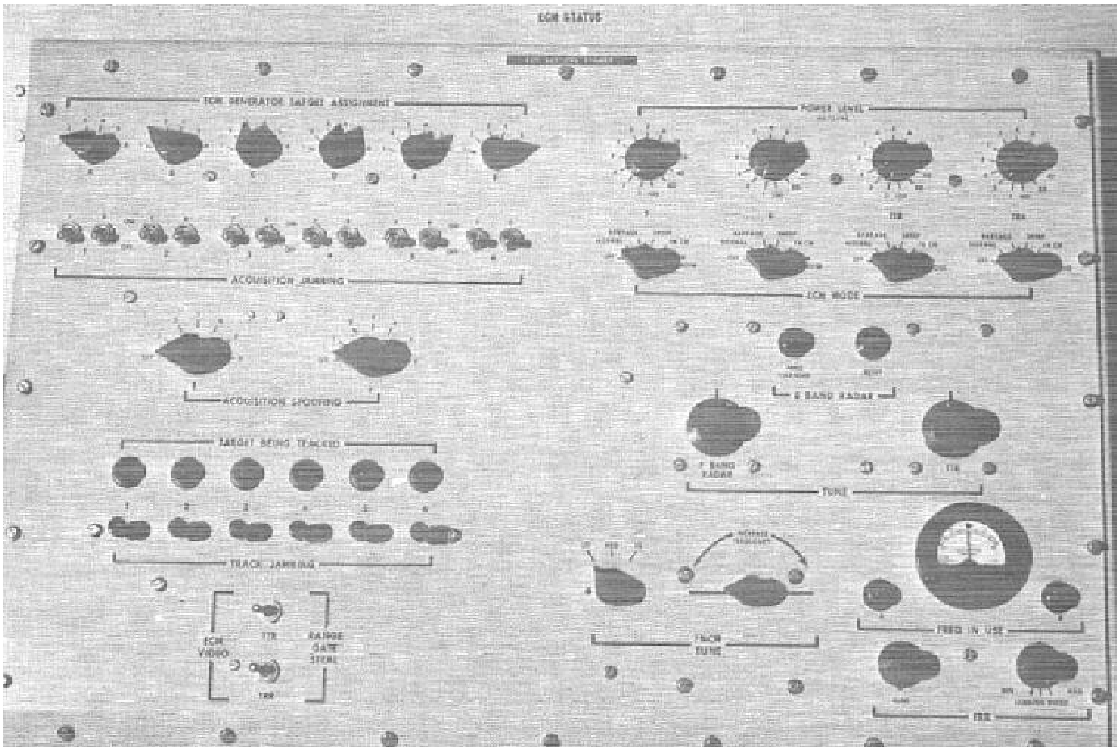


Figure 2 - 25. ECM control drawer.

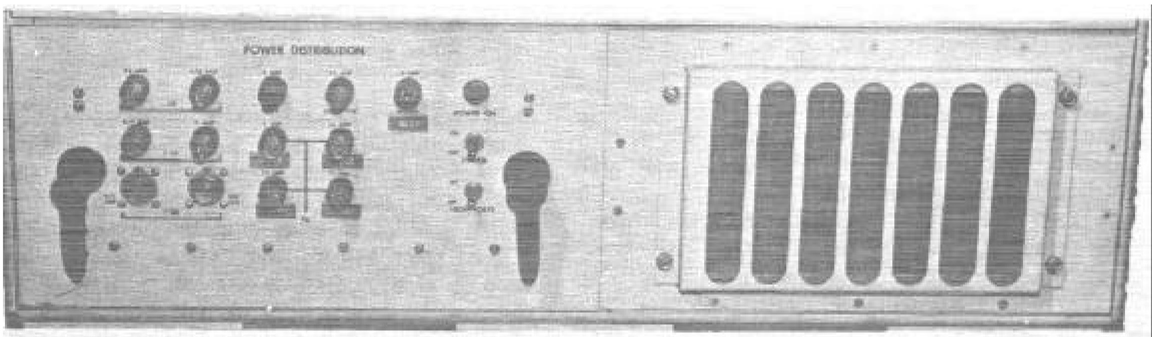


Figure 2 – 26. Power distribution panel (ECM cabinet)

(9) The D – BAND RADAR – FREQ CHANGED lamp will light when the frequency of the D-band radar is changed. The RESET switch, associated with the FREQ CHANGED lamp is pushbutton-type. When pressed, it returns the jamming signal to the frequency of the D-band radar.

(10) The FM CW TUNE controls are two rotary knobs. One knob selects LO, MED, or HI jamming range; the other is used to vary the FM CW jamming frequency.

(11) The FREQ IN USE meter indicates the difference and direction between the TRR frequency and the jamming frequency.

(12) The TRR – TUNE control is used to tune the panoramic receiver simulator radar frequency. The TTR – JAMMING WIDTH control is used to vary the width of the jamming to encompass the radar frequency.

d. The power distribution panel (ECM cabinet) (fig. 2 – 26) has controls for applying power to the ECM cabinet. The simulator operator will use the POWER – ON/OFF and HIGH VOLTS – ON/OFF switches and the POWER ON lamp which lights when power is applied to the ECM cabinet.

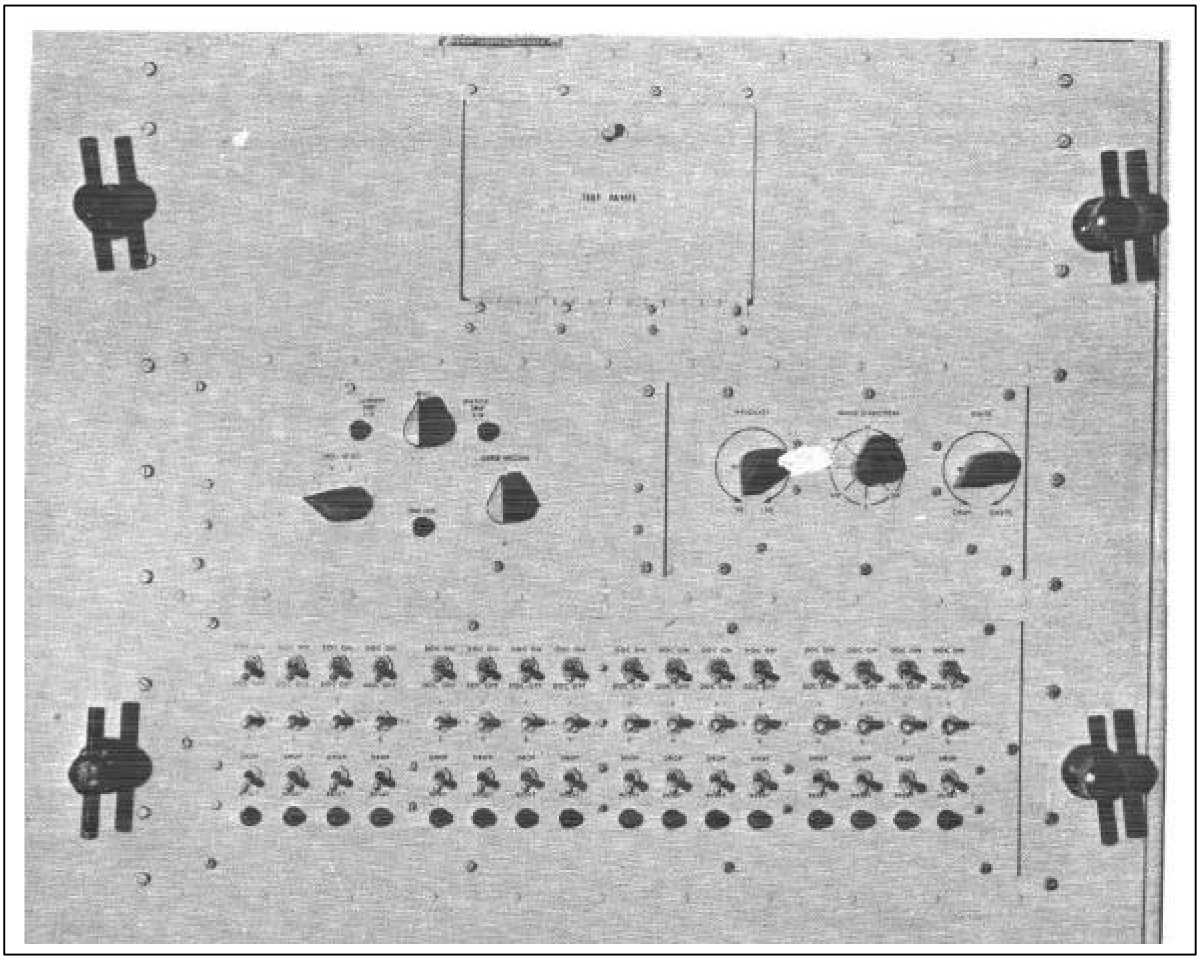


Figure 2-25. ECM control drawer

2 – 7. Chaff Cabinet

a. Simulated chaff is provided by the chaff cabinet (figs. 2-6, 2-27, 2-28, and 2-29). Chaff modes that can be applied include single drops, multiple drops, or corridor drops for the LOPAR, HIPAR, or AAR. For the TTR and TRR, a single drop or a corridor drop are the only two modes that can be selected. The purpose and functions of the operator controls and the techniques of presenting chaff are described below.

b. The function generator (fig. 2-29) dispense chaff for D- and F-band radar presentation. The generator has two controls, SIZE and INTENSITY, that may be varied from minimum (MIN) to maximum (MAX). The setting of these controls will determine the size and intensity of the chaff drops.

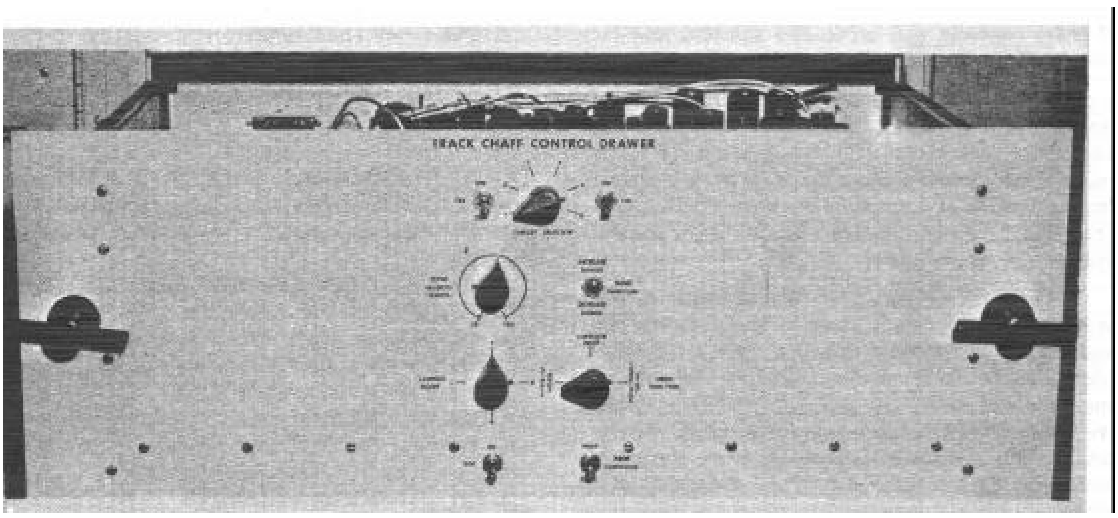


Figure 2-28. Track chaff control drawer.

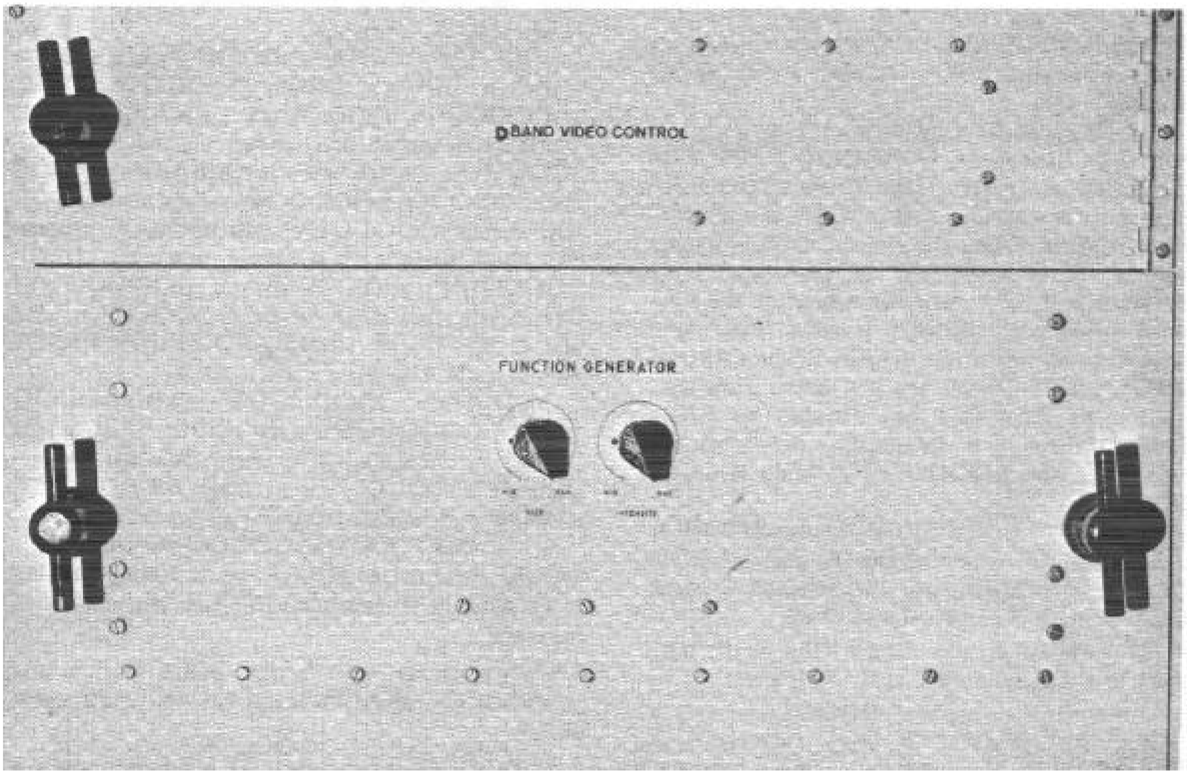


Figure 2 –29. Function generator.

c. The drop control drawer (fig. 2-27) also functions for D- and F- band chaff presentations. The drop control drawer can present 16 individual chaff drops, a corridor drop, or a multiple drop. Corridor and multiple drops are called programmed modes. The controls on the drop control drawer are as follows:

(1) Three banks of 16 toggle switches are provided at the bottom panel of the drawer. The top row of 16 switches are DOC ON/OFF OFF (delayed operating chaff) switches. When any one or all of the DOC ON/DOC OFF switches are set at DOC ON, each individual chaff drop is delayed 60 seconds after initiation of the drop command. The center row of 16 switches, placard F/F&D/D, are used to select the radar to which chaff will be presented. The lower row of 16 switches are placarded DROP/RESET. Single chaff drops are initiated by setting the DROP/RESET switches at DROP. This setting also causes the indicator lamp associated with the switch to light. Chaff is removed from radar indicators when the DROP/RESET switch is set at RESET.

(2) The RESET control knob may be set at either of two positions, CORRIDOR DROP 9 – 16 or MULTIPLE DROP 9 – 16. These settings are used to initiate corridor and multiple drops (programmed modes). When the control knob is moved to one of the two settings, the associated indicator lamp will light, showing which of the programmed drops is in progress, single drop switches (DROP/RESET) 9 through 16 are not used. However, single drops may still be initiated by using switches 1 through 8. Programmed drops are removed when the RESET control knob is set at RESET.

(3) The TARGET SELECT control knob is used to determine which of the six possible simulated targets will dispense the selected F-band, D-band, or both F- and D-band chaff.

(4) The launch direction of the chaff, with respect to the simulated targets, is determined by the setting of the LAUNCH DIRECTION rotary switch. The direction may be F (forward), L (left), R (right), or A (aft).

(5) Wind conditions that affect chaff after it has been dispensed are set by the VELOCITY (10-100 knots), WIND DIRECTION (N, NE, E, SE, S, SW, W, NW), and STATE (CALM to GUSTY) controls.

d. The track chaff control drawer (fig. 2-28) is used to dispense chaff for the selected TTR, TRR, or both simultaneously. The controls on the track chaff control drawer are employed as described below.

(1) The TARGET SELECTOR switch determines which of the six possible simulated targets will dispense chaff for the selected radar or radars.

(2) The TTR-ON/OFF and TRR – ON/OFF toggle switches select the tracking radar that will display chaff. When both switches are set at ON, both radars will display chaff.

(3) The WIND FUNCTION – INCREASE RANGE / DECREASE RANGE toggle switch is used to cause the chaff to drift out (increase) in range or drift in (decrease) in range.

(4) The WIND VELOCITY (KNOTS) CONTROL, which may be set from 10 to 100 knots, affects the rate of drift of the chaff.
(5) The LAUNCH MODE switches determines the launch direction of the chaff. The switch may be turned to F (forward), L (left), R (right), or A (aft).
(6) The DROP FUNCTION switch may be turned to SINGLE DROP, CORRIDOR DROP, or CORRIDOR STOP. When turned to SINGLE DROP, the target determined by the TARGET SELECTOR switch will initiate a single chaff drop. When the switch is turned to CORRIDOR DROP, the selected target will initiate a continuous chaff drop and continue until the DROP FUNCTION switch is turned to CORRIDOR STOP. All chaff drops occur in conjunction with use of the DROP COMMAND – DROP/RESET switch ((7) below).
(7) The DROP COMMAND – DROP/RESET two-position toggle switch, when set at DROP, initiates the drop mode selected by the DROP FUNCTION switch. When set at RESET, the chaff will vanish from the radar scopes.
(8) The DOC - ON/OFF two-position toggle switch, when set at ON, causes the chaff display to be delayed 60 seconds after the drop has been initiated.
e. The power distribution panel (fig. 2-30) furnishes operating voltages for the chaff cabinet.
f. Two scan converters control chaff drop size and intensity. Each scan converter has two red indicator lamps on the high-voltage panel, when lit, show that high voltage is applied to each scan converter. Those on the low-voltage panel, when lit, indicate that power is applied to the low-voltage power supply.

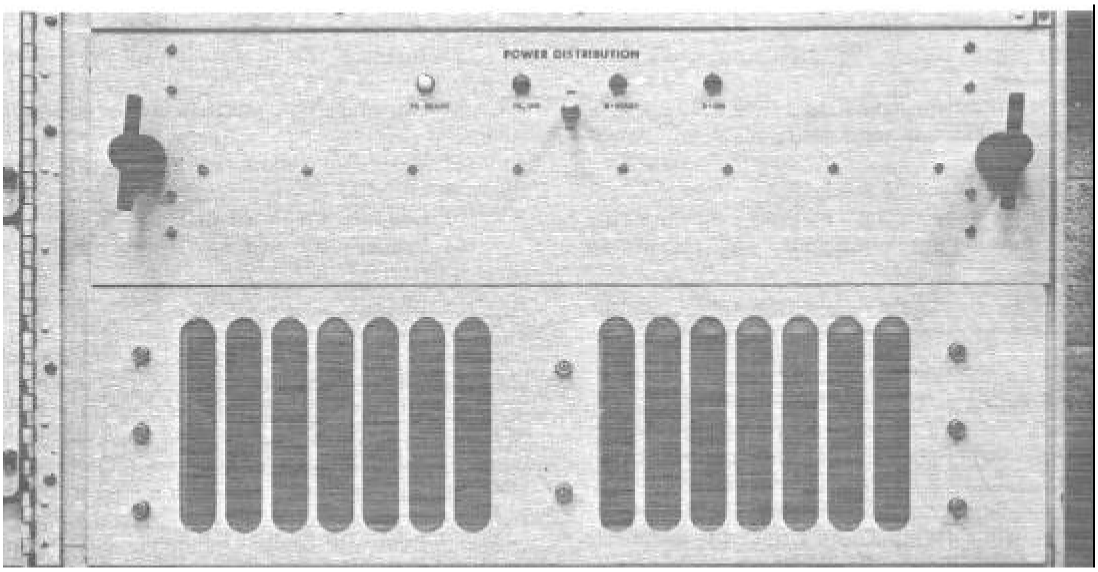


Figure 2 – 30. Power panel (chaff cabinet).

Section II. PURPOSE OF SIMULATOR

2 – 8. General

a. The sole purpose of the simulator is to provide simulated air defense situation with or without ECM for training and testing fire control crews and battery control officers. The simulator is capable of operating with all radars of the Nike Hercules and Improved Nike Hercules systems except the AN/FPS-69. The simulated targets ECM power output and radar cross-section area are automatically controlled with respect to their range from the Nike Hercules site. The simulated targets can be detected, identified, tracked, and destroyed by either simulated or live missiles. The simulated includes circuits for self-testing, monitors showing video presentation on Nike Hercules PPI`s and A-scopes, recorders for analyzing tracking errors, and a scoring facility to determine radar crew proficiency.

b. The simulator can present:

(1) Six targets to associated radars.
(2) Targets at a maximum range of 400 000 yards and a minimum range of 1 000 yards.
(3) Targets at an altitude of 0 to 150 000 feet.
(4) Target speeds from 200 to 2 000 knots.
(5) Target dive rate from 0 to 80 000 ft/min.
(6) Target climb rate from 0 to 40 000 ft/min.
(7) Target turn rate from 0° to 20° per second.
(8) Target size from 0.1 to 100 square meters.
(9) Target aspect ratio at 0, 10, or 20 dB, side-to-front.
(10) Target course headings from 0 to 6 400 mils.
(11) Types of ECM to include noise, pulse, square wave, continuous wave, or jamming from an external source.
(12) Modes of ECM to include normal (spot jamming), barrage, sweep, frequency-modulated continuous wave (FM CW), and frequency-modulated (FM) noise.
(13) Spoofing targets for both D- and F- band radars.
(14) Range gate steal for both TTR and TRR.
(15) Chaff presentation for acquisition radars include single drop, multiple drop, and chaff corridor. (For tracking radars, single drop and chaff corridor only.)
(16) Chaff launch direction and wind scattering effects.
(17) Target identification (IFF).
(18) Target kill radius from 0 to 10 000 yards.
(19) Crew-scoring methods.
(20) Error-recording methods for tracking errors, missile fire commands, and magnetron tuning.

2 – 9. Use of Simulator for Training

a. The simulator can present practical, realistic, and authentic training for Nike Hercules fire control crews and battery control officers. It can also provide the air defense commander with an overall evaluation of the capabilities of fire control crews and keep him abreast of the state of training of his organization. Use of the simulator should be based on carefully prepared programs which have been rehearsed and refined by the simulator crew. On-site simulator programs can furnish more realistic and productive training when they are based on the local tactical SOP.

b. Individual operator and collective crew performance can be evaluated from data obtained from the scoring panel and the error recorders.

c. The simulator can be used effectively for the following training activities in a Nike Hercules battery or air defense complex to:

(1) Familiarize newly assigned fire control operators and battery control officers with their duties, unit equipment, and tactical SOP.
(2) Increase the proficiency of fire control crews.
(3) Introduce new aircraft tactics and maneuvers.
(4) Train fire control crews to operate effectively in an ECM environment.
(5) Conduct simulated firings.
(6) Prepare for and participate in annual service practice.

2 – 10. Types of Training

a. Newly assigned fire control operators and battery officers can be exposed to an air defense environment without relying on targets of opportunity for acquisition and tracking training. The simulator can provide training for ECCM console operators, acquisition and tracking radar operators, and battery control officers, either individually or as a complete fire control team. The complete team can be trained in acquisition, tracking, missile launch, and burst phases.

b. Maintaining the proficiency of assigned fire control personnel requires continuous training in all phases of the operation. The simulator should be programmed to provide realistic aircraft tactics and reports, electronic warfare /EW) documents, and the tactical SOP can furnish information useful in realistic programing. When information from classified sources is used, security requirements must be observed.

CHAPTER 3

OPERATIONAL REQUIREMENTS

Section I. CREW COMPOSITION AND DUTIES

3 - 1. General

The simulator crew in TOE 44—536 is part of the electronic maintenance section; in TOE 44-546 the crew is part of the operations and maintenance section. TOE 44—536 is for headquarters and headquarters battery, air defense artillery battalion, Nike Hercules (field army), and TOE 44-546 is for headquarters and headquarters battery, air defense artillery battalion, Nike Hercules (CONIJS).

3 - 2. Crew Composition

a. Supervision of simulator operation and maintenance is the responsibility of the fire control technician, MOS 222BO, in both TOE 44 - 536 and TOE 44-546.

b. Under TOE 44 - 536 (field army), personnel provided in the electronic maintenance section are:

(1) One simulator mechanic, MOS 24Q30 (E - 6).

(2) One simulator operator, MOS 16G20 (E-4).

(3) One heavy vehicle driver, MOS 64B20 (E - 4).

c. Under TOE 44-546, the operations and maintenance section has a fire control mechanic, MOS 24Q30(E - 6), in addition to the fire control technician. This does not represent an increase in personnel but rather a change in duty assignment.

d. Field army battalions will usually require the use of a portable 45-kw generator to furnish simulator power. Operation and maintenance of the generator will be accomplished by the simulator operator or a heavy-vehicle driver.

e. Battalions organized under TOE 44-546 will normally use commercial power. However, when portable generator power is required, both the generator operator and generator will be furnished by the unit using the simulator.

3 - 3. Duties of Crew

a. The four-man simulator crew is part of the
electronic maintenance section of headquarters and headquarters battery, air defense artillery battalion, Nike Hercules (field army).

b. The fire control technician supervises maintenance and operation, and selects the site for the simulator.

a. The chief simulator mechanic is responsible to the section supervisor for the following:

(1) Organizational maintenance and materiel readiness of the simulator.

(2) March order, travel, and emplacement of the simulator and generator.

(3) Scoring training exercises (para 3 - 13).

(4) Insuring that the appropriate simulator exercise programs are available, checked out, and properly employed.

(5) Providing assistance and information during critique of training exercises.

b. The simulator operator is responsible for the following:

c.

(1) Operator maintenance and assistance in readying the simulator for training exercises.

(1) Providing assistance in preparing for march order, during travel, and in the emplacement of the simulator.

(3) Operating the ECM and chaff cabinets and applying ECM and chaff as required by the program sheet.

(4) Operation and preventive maintenance services for the assigned generator when necessary.

a. The heavy vehicle driver is responsible for the following:

(1) Providing assistance during march order, travel, and emplacement of the simulator.

(2) Operation and preventive maintenance service for the generator when required.

a. For units organized under TOE 44 - 546, the duties of the fire control technician and fire control mechanic are the same as those shown in b and c above. The unit employing the simulator will provide personnel to assist during march order, travel, emplacement, and operation of training exercises.

Section II. ENERGIZING AND DEENERGIZING

3 – 4 General

Energizing and deenergizing procedures for the simulator require certain preliminary procedures and equipment adjustments when the simulator is connected to any Nike Hercules system. These procedures, as well as daily, monthly, and non-periodic checks and adjustments, whether connected to a Nike Hercules system or not, are covered in detail in TM 9 – 1430 – 268 - 12/1. The unclassified preliminary procedures and operations are included in this section.

3 - 5. Preliminary Procedures

a. The simulator trailer should be located on level ground within 110 feet of the Nike Hercules system components to which it is to be connected. If the terrain within the prescribed distance of the Nike Hercules components is not level, the simulator trailer may be parked on an incline, with the right side (curb side) of the trailer lower than the left side (roadside). The ground slope should not exceed 89 mils (5°).

b. The 45-kw generator also should be located on level ground and within 100 feet of the simulator trailer. The three power cables, used to connect the generator and simulator, are 126 feet long.

e. When the simulator trailer and generator are properly emplaced, the three power cables are removed from the trailer and connected to the power distribution panel on the forward right side of the simulator trailer and to the 45-kw generator. The power provided is 208-volt, 3-phase, 400-hertz.

d. Three signal distribution cables also are stored in
the simulator station trailer. These cables are used to connect the simulator signal distribution panel and the radars of the Nike Hercules system. The instructor’s scoring unit is connected to either the director station trailer or tracking station trailer.

3 - 6. Application of Power

a. The generator operator makes the prescribed preoperational checks and starts the generator. After the prescribed warmup time, the main circuit breaker is set at ON.

b. The two trailer ceiling lights may now be turned on by means of the convenience light switch near the trailer door at the rear of the trailer.
e. The controls on the simulator trailer cabinets are checked and placed in the positions prescribed in TM 9-1430-268-12/1 table 63.

3 - 7. Energizing

The simulator station is energized.

3 - 8. Preoperational Checks

Dynamic daily checks and adjustments are performed prior to the start of any training exercise.

3 - 9. Deenergizing

The simulator station is deenergized by placing all controls in the positions prescribed in TM 9 – 1430 – 268 - 12/1 (table 63) and by reversing the procedure described in table 66 of that technical manual.

Section III. OPERATION OF SIMULATOR

3 - 10. General

The procedures described in this section are used for the operation of the simulator during a training exercise. The training exercise is for the purpose of providing training for Nike Hercules fire control crews and battery control officers. Training exercises can vary from an exercise involving a single simulated target flying a straight and level

course at a specific altitude to an exercise involving multiple targets performing programmed maneuvers in an ECM environment. The difficulty and complexity of the training programs applied will depend on the state of training and proficiency of the fire control crew involved.

3 - 11. Operational Procedures

Programs for training exercises are usually prepared by the battalion operations section and furnished to the simulator section chief. The battery commander of the unit to perform the exercise usually will determine which programs are to be used. Prior to the start of a training exercise, the battery officer or instructor and the simulator section chief are required to perform specified preliminary procedures.

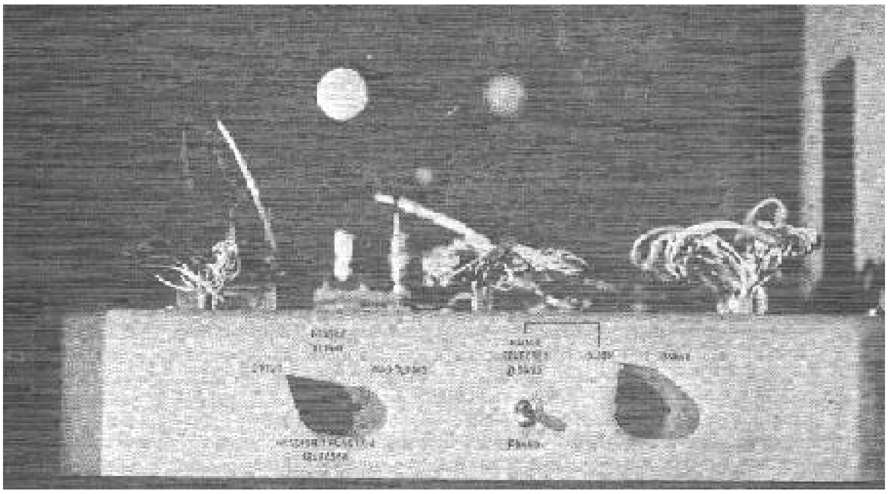


Figure 3 – 1. Auxiliary cabinet switching chassis.

a. Preliminary Procedures

Battery Officer or Instructor. The battery officer or instructor insures that the simulator section chief can identify the sequence of the programs to be used for the exercise. Prior to assuming his position for conducting, observing, and scoring the training, the battery officer or instructor performs the operations listed below:

Note. The type of training being conducted usually determines whether the instructor’s position will be in the director station trailer or tracking station trailer.

(1) Connects the instructor’s scoring unit (fig. 2-10) with headset attached to the appropriate connector at the selected station.
(2) Checks communications with the simulator station.
(3) Requests the simulator section chief to set the PHONE CONTROL switch at RDR NETWORK.
(4) Requests the simulator section chief to zero all counters on the simulator scoring panel.
(5) Checks the synchronization of the counters and lamps on the instructor’s scoring unit and the simulator scoring panel as follows:

(a) Presses APPEAR TO DESIGNATE pushbutton on instructor’s scoring unit. The APPEAR TO DESIGNATE counter on the simulator scoring panel will revolve.

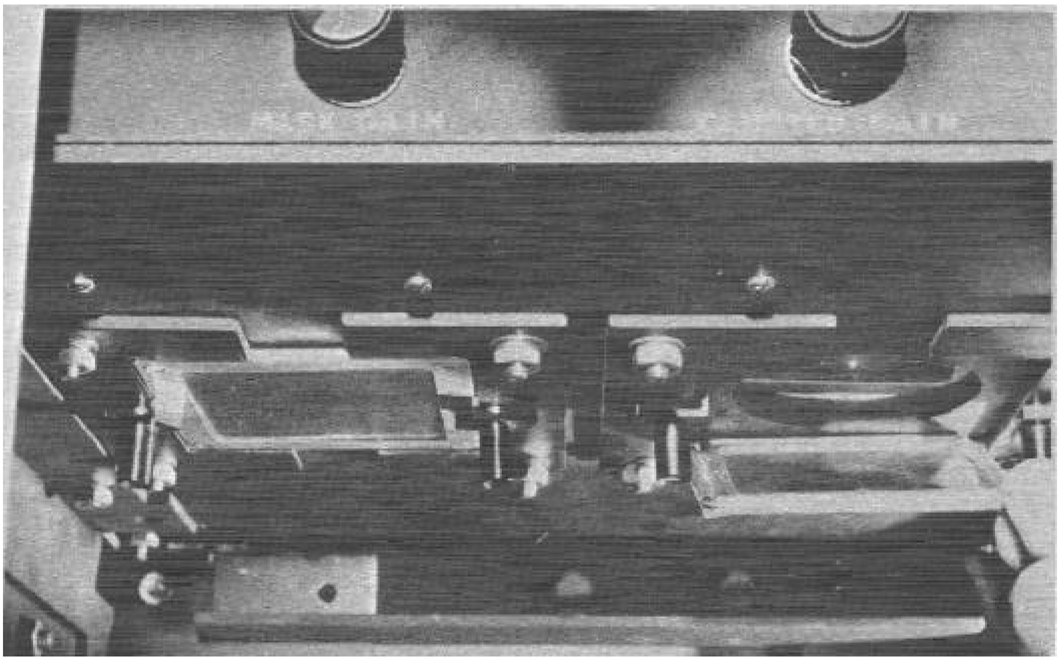


Figure 3 – 2. Slots for insertion of clutter and masking slides.

(b) Presses APPEAR TO DESIGNATE pushbutton on instructor's scoring unit a second time. The APPEAR TO DESIGNATE counter on the scoring panel will stop and the RECORD SCORE indicator lamp on the scoring panel will light.
(c) Requests the simulator section chief to press the RESET pushbutton on the simulator scoring panel so that the RECORD SCORE indicator lamp will go out.
(d) Repeats the steps in (a) through (c) above for DESIGNATE TO LOCK ON, LOST TO REGAIN, and BURST TO FIRE operations.

b. Preliminary Procedures-Simulator Section Chief. After performing the required checks with the instructor, the simulator section chief checks the exercise programs and their sequence of events. He provides the ECM cabinet operator with the ECM and chaff programs to be applied during the exercises and then performs the following operations:
the auxiliary cabinet switching chassis (fig. 3 - 1) to RADAR.
(2) Turns the VIDEO SELECTION switch on the PPI monitor to RADAR and observes both real and simulated target video from the associated acquisition radar; turns the VIDEO SELECTION switch to DETECTED F or DETECTED D and observes simulated target position, chaff, clutter, or ECM for each target generated by the simulator. When only observation of simulated targets is desired, turns the VIDEO SELECTION switch to LOCAL.
(3) Insures that the clutter and masking slides for the HIPAR or AAR, LOPAR, and TTR are inserted in the proper slots of the correct passive interference generator (fig. 3 - 2).
(4) Positions controls on one or more target coordinate generators as determined by the number of targets programmed on DA Form 3062-R (Target Program Sheet) (fig. 3-3).

c. Preliminary Procedures-ECM Operator. The ECM operator makes the initial switch and dial settings for the targets selected to emit ECM and chaff as indicated on DA Form 3061 - R,

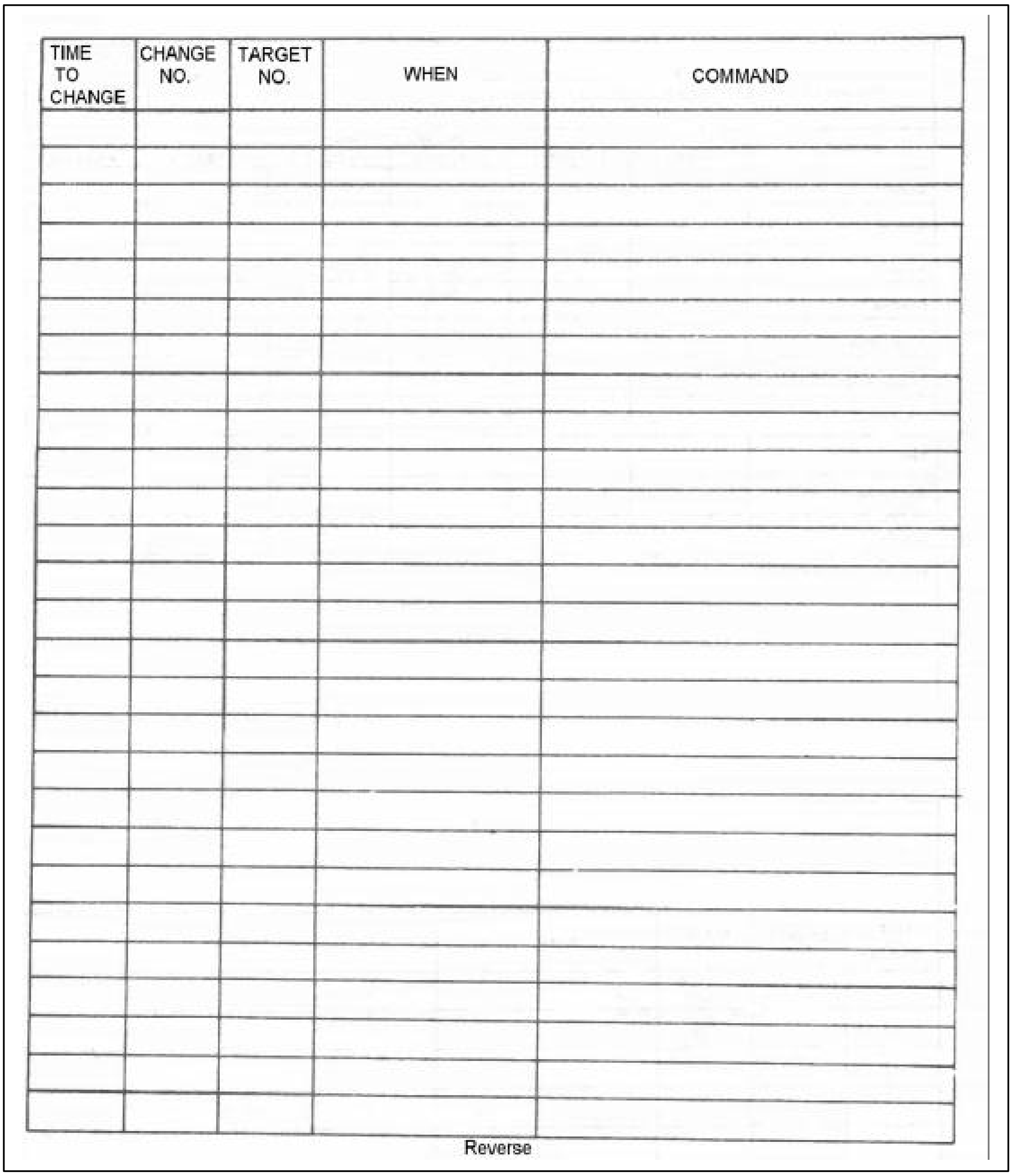
TARGET PROGRAM SHEET For use of this form, see FM 44-97; the proponent agency is the USCCNARC.						PROGRAM NO.
	INITIAL SETTING					
CONTROL	Target 1	Target 2	Target 3	Target 4	Target 5	Target 6
Range						
Altitude						
Azimuth						
Heading						
Target Size						
Aspect Ratio						
Climb/Dive						
Turn						
Air Speed						
IFF/SIF						

TIME TO CHANGE	CHANGE NO.	TARGET NO.	WHEN	COMMAND

DA FORM 3062–R, 1 Jun 71 Replaces DA Form 3062–R, 1 May 68, which is obsolete.

Front

Figure 3 –3. DA Form 3062-R (Target Program Sheet).



TIME TO CHANGE	CHANGE NO.	TARGET NO.	WHEN	COMMAND

Reverse

Figure 3 – 3 – Continued.

Electronic Countermeasures (ECM) and Chaff Program Sheet (fig. 3 - 41. The dial settings are made on the ECM generator drawer, ECM status panel, and chaff cabinet. DA Forms 8061 - R and 3062-R may be reproduced locally on 8- x 10 - inch paper.

3 - 12. Target Maneuvers and ECM

a. Target maneuvers are preplanned and are shown on the target program sheet. Maneuvers that may be applied to simulated targets consist of turns, climbs, or dives, and variations in speed. The programmed maneuvers are applied to each target by the simulator section chief or the console operator at the target coordinate generator (TCG) which generates the target. Commands may be applied separately or simultaneously as described below:

(1) The target is caused to turn by positioning the
TURN RATE control to LEFT— DEC/SEC for a left turn at the rate, in degrees per second, shown in the COMMAND column of the target program sheet. The control is set to RIGHT—DEC/SEC for a right turn at the rate specified on the target program sheet. When the simulated target has attained the new heading specified on the target program sheet, the console operator will zero the TURN RATE dial and the turn is completed.

(2) Climbs or dives are accomplished by
positioning the CLIMB X1000 FT/MIN or DIVE X1000 FT/MIN control to the positions shown in the COMMAND column of the target program sheet. The HOLD DESIRED ALTITUDE switch must be set at off (down) to initiate a climb or a dive. When the simulated target has reached the new altitude shown on the target program sheet, the climb or dive control is zeroed and the dive or climb is completed. When the HOLD DESIRED ALTITUDE switch is set at on (up), it removes a climb or dive command and causes the simulated target to continue at a constant altitude.

(3) Speed (velocity) changes are accomplished by positioning the VELOCITY—X100 KNOTS control to initiate a change in simulated target speed. Speed change requirements are also found in the COMMAND column of the target program sheet.

b. The application of simulated ECM is the result of carefully prepared, valid, comprehensive, and realistic program planning. Prior to providing ECM training, fire control crews should be instructed on the effects of ECM on Nike Hercules radar scopes. After adequate instruction, practical training with programmed ECM exercises should be conducted with individual radars in the system. ECM against the acquisition and tracking radars should be separate and progressive so as to enable the fire control crews and battery control officer to become proficient in the application of electronic counter-countermeasures (ECCM) for each particular radar. After this training has produced the desired level of proficiency, ECM programs may then be planned to involve the fully trained fire control crew and should include target acquisition, tracking, and simulated or live firing. ECM programs should be prepared, using the best applied techniques, to include:

(1) Intermittent jamming.
(2) Jamming from one direction and target approach from a different direction.
(3) Stand-off jamming and target approach through the area covered by the jamming.
(4) Chaff corridors or individual chaff drops to hide approaching targets.

c. To provide simulated acquisition chaff for the LOPAR, HIPAR/AAR, or both, the ECM operator will refer to the chaff program sheet (fig. 3-4). The program sheet provides the ECM operator with the switch settings required to be made on the drop control drawer prior to initiating the chaff drop on cue from the console operator. The functions of the chaff cabinet controls are covered in detail in paragraph 2 - 7.

ELECTRONIC COUNTERMEASURES (ECM) AND CHAFF PROGRAM SHEET

For use of this form, see FM 44–97; the proponent agency is USCONARC.

PROGRAM NO.

ECM PROGRAM

CUE NO:	MODE	POWER LEVEL	ECM GEN	FUNCTION	PRF KC	SYNC	SPOOF RANGE GATE STEAL	JAM ON	NOTES

DA FORM 3061–R, 1 Jun 71 Replaces DA Form 3061–R, 1 May 68, which is obsolete.

Front

Figure 3 – 4. DA Form 3061-R, Electronic Countermeasures (ECM) and Chaff Program Sheet.

CHAFF PROGRAM							PROGRAM NO.
CUE NO.	RADAR SELECT	TARGET	WIND	LAUNCH	DOC	SINGLE OR PROGRAMED	NOTES

Reverse

Figure 3 – 4 – Continued.

3 - 13. Scoring Functions

a. Scoring a training exercise involves an instructor, an assistant instructor, and the battery commander or his designated representative. The instructor and his scoring unit may be in either the director station trailer or tracking station trailer to permit observation of either the acquisition or tracking phases of training. The instructor's assistant is usually stationed at the scoring panel on the operator's console of the simulator. The battery commander, or his representative, will usually be stationed at the same location as the instructor's scoring unit.

b. During a scoring exercise, the instructor and his assistant perform the activities and functions described below:

(1) The assistant insures that all counters on the scoring panel are set at zero.

(2) The instructor observes the PPI in his station for the target to appear. When it appears, he presses the APPEAR TO DESIGNATE pushbutton on the instructor's scoring unit. The APPEAR TO DESIGNATE counter on the scoring panel will start. When the acquisition radar operator designates the target to the TTR, the instructor again presses the APPEAR TO DESIGNATE pushbutton. At the scoring panel the APPEAR TO DESIGNATE counter will stop and the associated RECORD SCORE lamp will light. The reading on the counter is recorded by the instructor's assistant.

(3) When the instructor presses the APPEAR TO DESIGNATE pushbutton on the instructor's scoring unit the second time, he also presses the DESIGNATE TO LOCK ON push button to start the DESIGNATE TO LOCK ON counter on the scoring panel. When the TTR is locked on the target, the instructor again presses the DESIGNATE TO LOCK ON pushbutton to stop the associated counter. When the DESIGNATE TO LOCK ON counter stops, the associated RECORD SCORE lamp will light and the reading on the counter is recorded by the assistant.

(4) To check the ability of the tracking crew to regain a target after it has been lost, the instructor will notify the simulator console operator to hold the VIDEO—ON/OFF/MOM OFF switch on the appropriate target coordinate generator at MOM OFF (momentarily off) for a few seconds. This will remove target video from the TTR while the target continues on its course. The instructor causes the target to reappear by having the console operator release the MOM OFF switch. At the same time, the instructor will press the LOST TO REGAIN pushbutton on the scoring unit. The LOST TO REGAIN counter on the scoring panel starts. When the tracking crew is again locked on the target, the instructor again presses the LOST TO REGAIN pushbutton to stop the LOST TO REGAIN counter. When the counter stops, the associated RECORD SCORE lamp will light. The assistant records the indication on the counter.

(5) When more than one missile is to be launched, the BURST TO FIRE pushbutton on the scoring unit and the BURST TO FIRE counter on the scoring panel are used. The BURST TO FIRE score is the time from the simulated burst of the first missile until a second simulated missile is launched. When the first burst occurs, the instructor presses the BURST TO FIRE pushbutton and starts the BURST TO FIRE counter on the scoring panel. When the second missile is launched, the instructor presses the BURST TO FIRE pushbutton to stop the counter and light the associated RECORD SCORE lamp. The score on the counter is recorded by the assistant.

c. A training analysis of fire control operators is more complete and accurate when records of tracking errors and magnetron tuning are included. A record of missile steering orders may help in the consideration of tracking errors. To furnish this information, the error recorders are prepared by the simulator console operator prior to the start of the exercise. Their preparation is described below:

(1) When tracking errors are to be recorded, the RECORDER FUNCTION SELECTOR switch (on the auxiliary cabinet switching chassis) is turned to ERROR. The controls on the recorder control panel are adjusted as follows:

(a) The pens on the three error recorders are zeroed by turning the proper VOLTS EACH SIDE switch (one for each recorder) to ZERO SET and adjusting the ZERO SET control to set each pen at zero.

(b) The three VOLTS EACH SIDE switches are turned to 50, 25, 10, or 5, depending on the sensitivity desired. The setting at 5 provides maximum sensitivity.

(c) When the assistant instructor is directed to record tracking errors, he sets the POWER/OFF switch at POWER and the PAPER DRIVE/OFF switch at PAPER DRIVE.

(d) When the instructor informs the assistant that the recording of this phase is complete, the latter sets the PAPER DRIVE/OFF switch at OFF and the POWER/OFF switch at OFF. The assistant then removes that portion of the paper that contains the error recordings and identifies them as to range, azimuth, elevation, unit, date, time, and course number, and exposes fresh paper for further use of the recorders.

(2) When magnetron tuning for the TTR and LOPAR is to be accomplished, the assistant is directed to turn the RECORDER FUNCTION SELECTOR switch on the auxiliary cabinet switching chassis to MAG TUNING and follows the procedure described in (1) above.

(3) When missile steering orders are to be recorded

after a simulated missile is launched, the assistant turns the RECORDER FUNCTION SELECTOR switch to MISSILE FLIGHT and follows the procedure described in (1) above.

CHAPTER 4

PROGRAMING

Section I. AIRCRAFT TACTICS AND MANEUVERS

4-1. General

The value of training for Nike Hercules fire control operators and battery control officers is dependent to a large extent on the realism of the simulated engagements presented for training. Programs will depend on the status of training of fire control crews, aircraft tactics employed, and ECM and chaff combined with tactics and maneuvers to create a realistic air defense environment. The basis of crew training is a local problem that will vary from unit to unit and from time to time within a unit. Training problems will be solved at the time and, based on the conditions that exist, when the exercises are programmed. ECM and chaff simulation has been explained. This section will describe aircraft tactics and maneuvers that can be used with or without ECM. and chaff to produce effective exercises.

(5)Distance from defended area when executing maneuvers.

a. An example of a basic aircraft tactic is furnished in figure 4-1. The low-altitude tactics illustrated can be employed by one or more aircraft with none emitting ECM or chaff, or one or more emitting ECM and/or chaff. Other tactics are illustrated in figure 4—2. Tactics used in simulator programing will be limited only by the knowledge and imagination of the individual preparing the programs and the capabilities of the simulator and aircraft.

4-2. Aircraft Tactics

a. The most advanced training programs are based on the tactical SOP of the unit and on enemy aircraft tactics taken from classified sources. The information contained in this manual will make it possible for a programmer to use material from the sources mentioned and produce the advanced training exercises needed to bring well-trained fire control crews and battery control officers to an even higher state of training and operational proficiency.

b. Aircraft tactics that may be used against a defended area, which will be effective in programing training exercises, involve the following elements:

(1) Approach altitude.
(2) Approach speed (table 4-1).
(3) Attack altitude.
(1) Attack angle.

Table 4—1. Attacking Aircraft Speed Data

Mach	Knots	Nautical miles/minutes	km/min	ft/sec	Minutes to cover 50 Nautical miles
0.9	**600**	**10.0**	**18.5**	**1 020**	**5**
1.2	**800**	**13.3**	**24.7**	**1 350**	**4**
2.1	**1 400**	**23.3**	**43.2**	**2 360**	**2**

Note. 0.75 mach = 500 knots at sea level.

4-3. Maneuvers and Methods of Attack

a. Low-angle attacks are usually a low-angle strafe, rocket run, or dive-bombing run.

(1) The low-angle strafe (fig. 4-3) is an attack made by an aircraft that approaches the defended area at an altitude of 30 to 100 feet and a speed of 400 to 500 knots. At approximately 2 miles from the target, the aircraft climbs at about a 30° angle to an altitude of 500 to 800 feet. From this altitude the aircraft will maneuver and strafe the target at a 5° to 6° angle and a speed of approximately 400 knots.

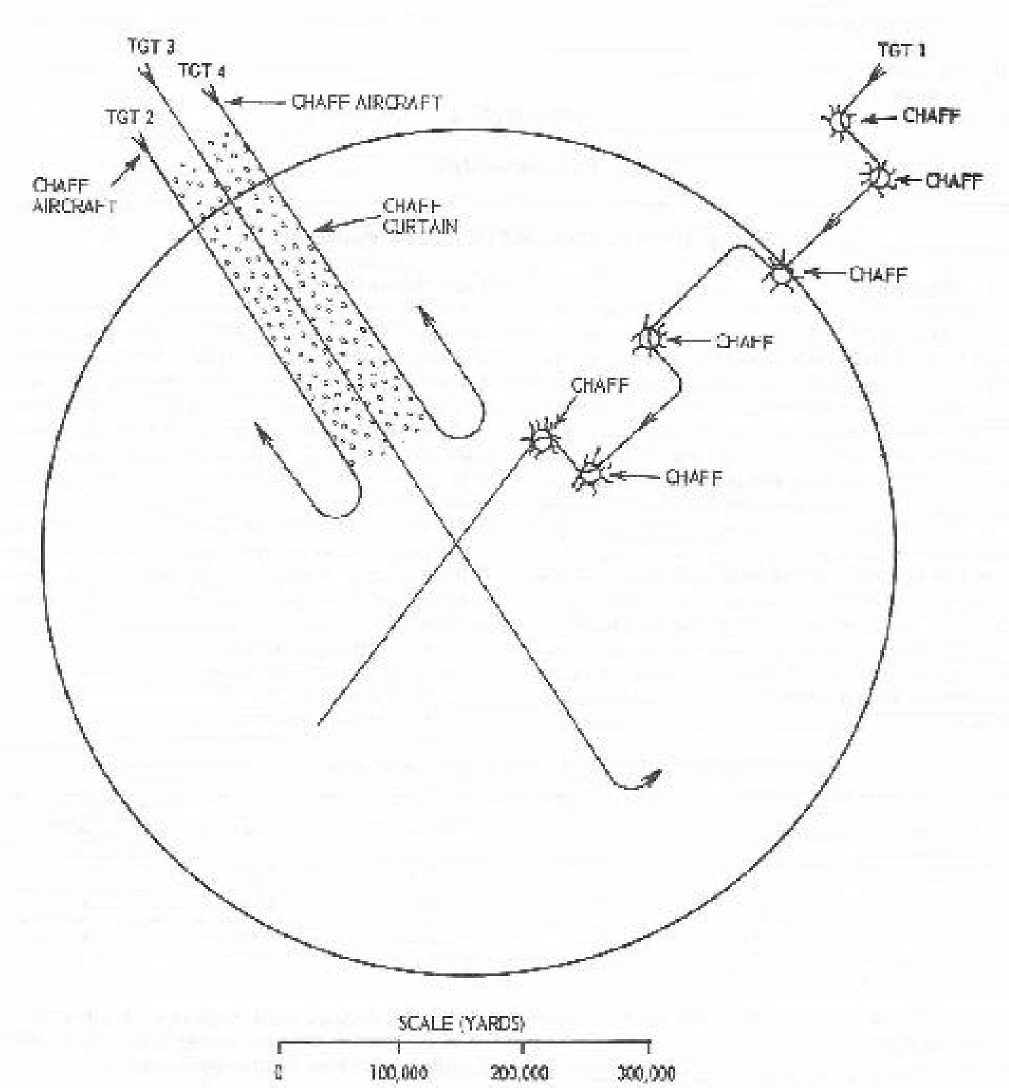


Figure 4 – 1. Probable zigzag pattern and chaff corridor.

(2) In the rocket run (fig. 4-4) the *aircraft* approaches the target at an altitude of 30 to 100 feet and a speed of 400 to 500 knots. When approximately 3 miles from the target, the aircraft climbs at about a 30° angle to an altitude of 5,000 to 7,000 feet. The aircraft fires its rockets at the target while diving toward it at an angle of about 30° and a speed of about 400 knots.

(3) The dive-bombing aircraft (fig. 4-5) also approaches the target at an altitude of 30 to 100 feet. When the aircraft is 2 to 2 1/2 miles from the target, it climbs abruptly at an angle of 40° to 45° to an altitude of 9,000 to 10,000 feet. The aircraft maneuvers toward the target at this altitude and then dives toward the target and

releases the bomb at a speed of approximately 400 knots. Just before the aircraft starts its dive, its speed is about 250 knots.

b. Usually fighter aircraft methods of attack are high-altitude, dive-bombing, dive-toss, low-altitude bombing system (LABS), and lay-down (fig. 4-6).

(1) When the high-altitude method is used, the fighter aircraft approaches the target at an altitude of 80,000 to 50,000 feet and a speed of approximately 800 knots. At release the bomb or bombs fall as a result of gravity only.

(2) The dive-bombing method is initiated also from an altitude of 30,000 to 50,000 feet but at a speed of about 700 knots. The aircraft dives toward the target and releases its bomb or bombs.

(3) The dive-toss method is initiated from an approach altitude of 80,000 to 60,000 feet and a speed of approximately 700 knots. The aircraft dives toward the target at an angle of 30° to 45° if terrain permits, and abruptly pulls up before reaching the target and releases the bomb or bombs at the moment of pull up. In effect, the pull up tosses the ordnance toward the target.

(4) When an aircraft employs the low-altitude bombing system (LABS), it approaches the target at an altitude of 100 to 1,000 feet at

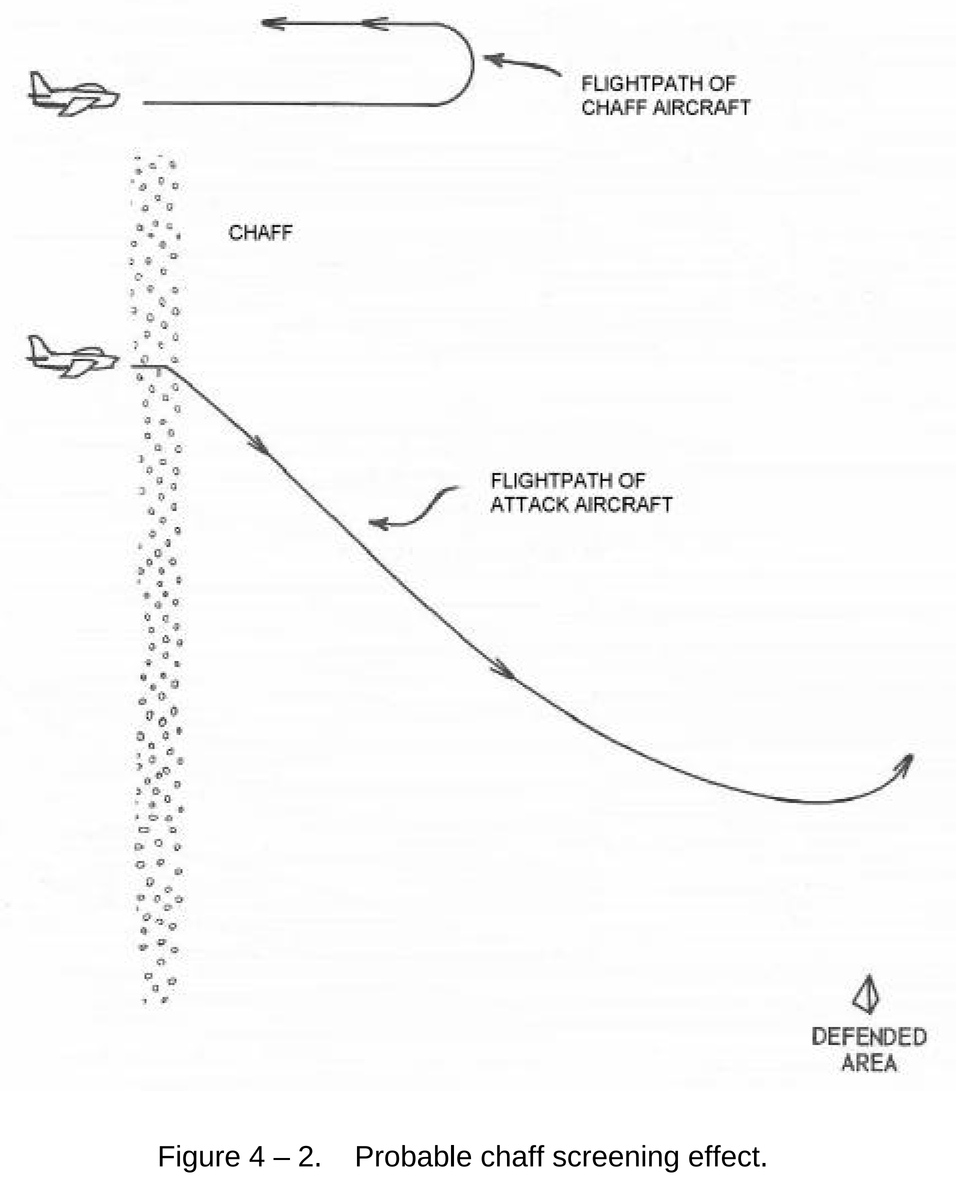


Figure 4 – 2. Probable chaff screening effect.

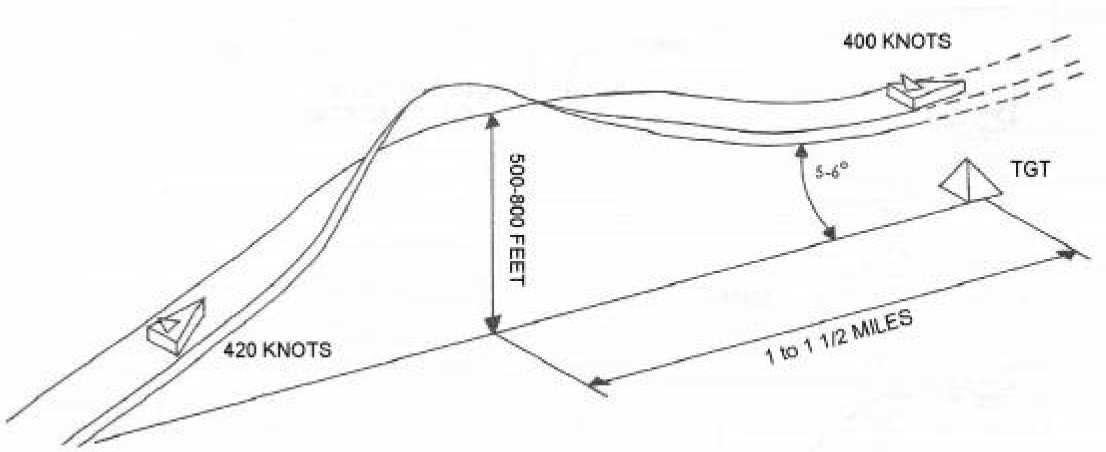


FIGURE 4-3. Low-angle strafe

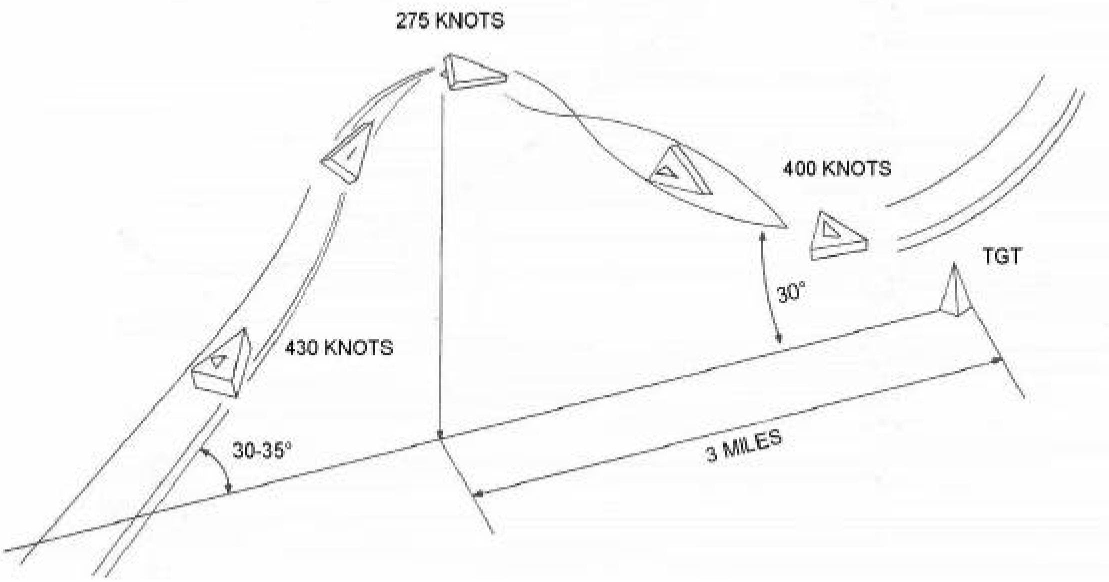


Figure 4 – 3 & 4. Rocket run.

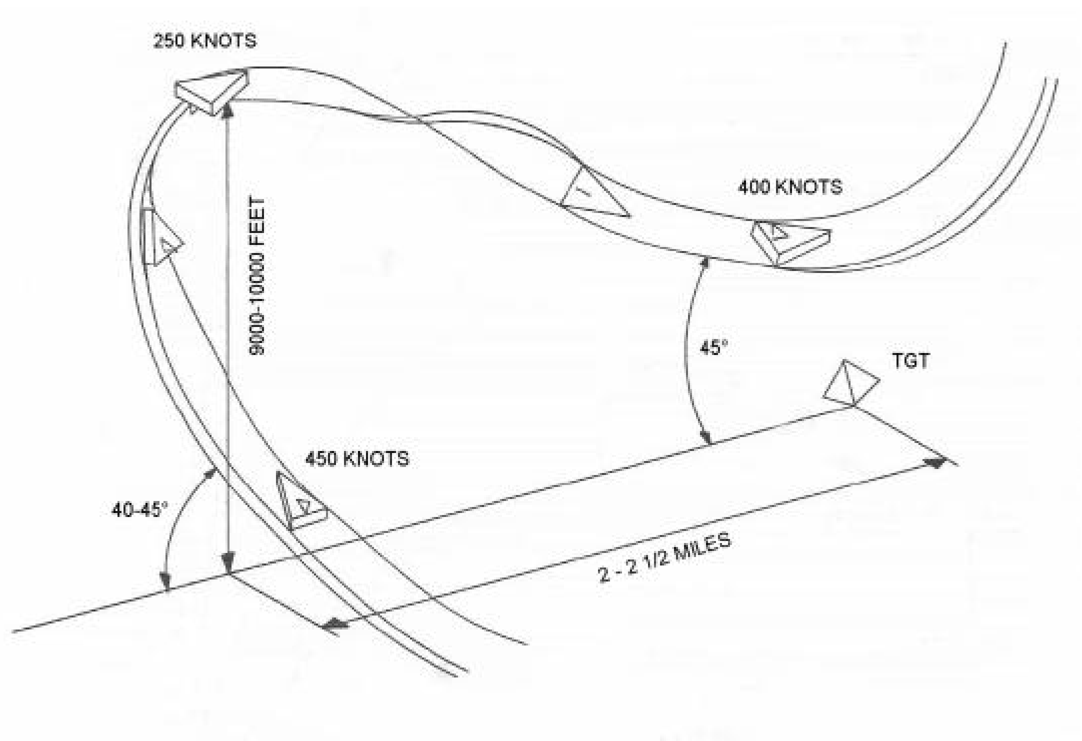


Figure 4 – 5. Dive-bombing run.

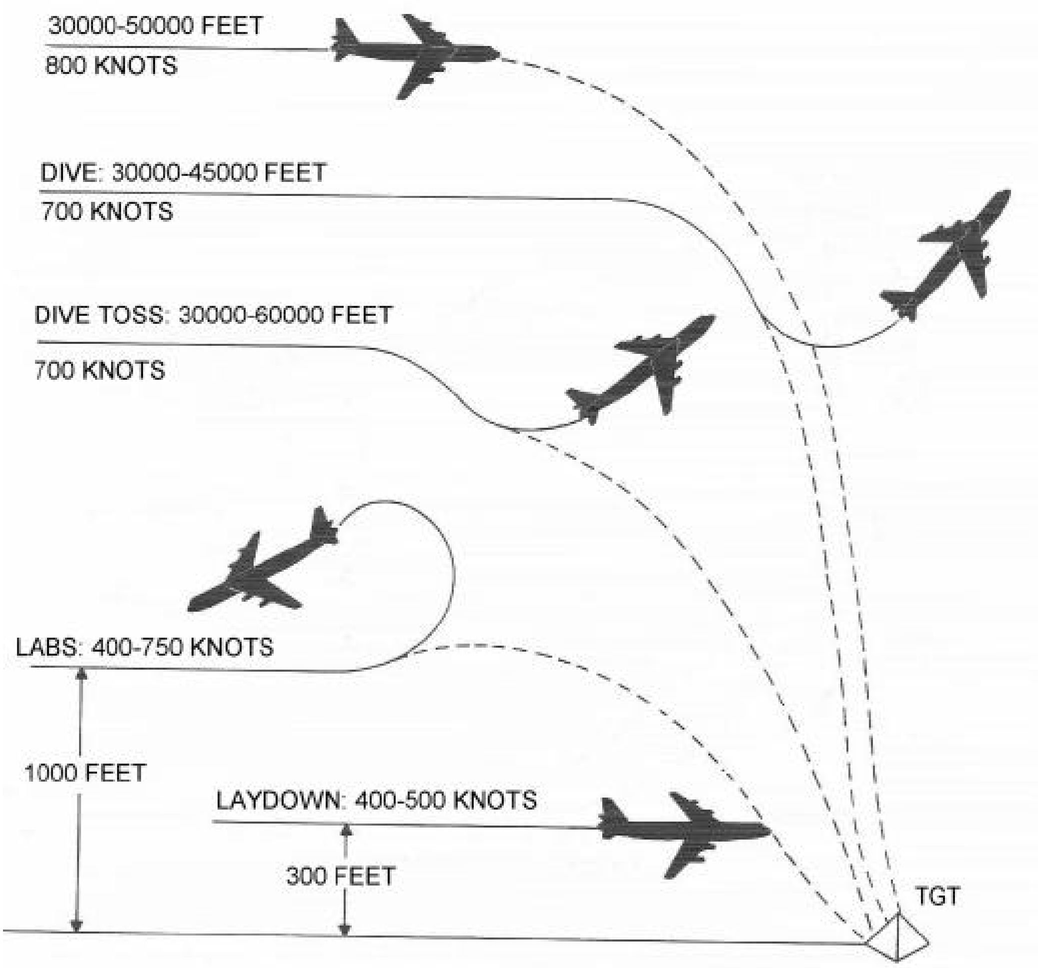


Figure 4 – 6.   Fighter delivery methods.

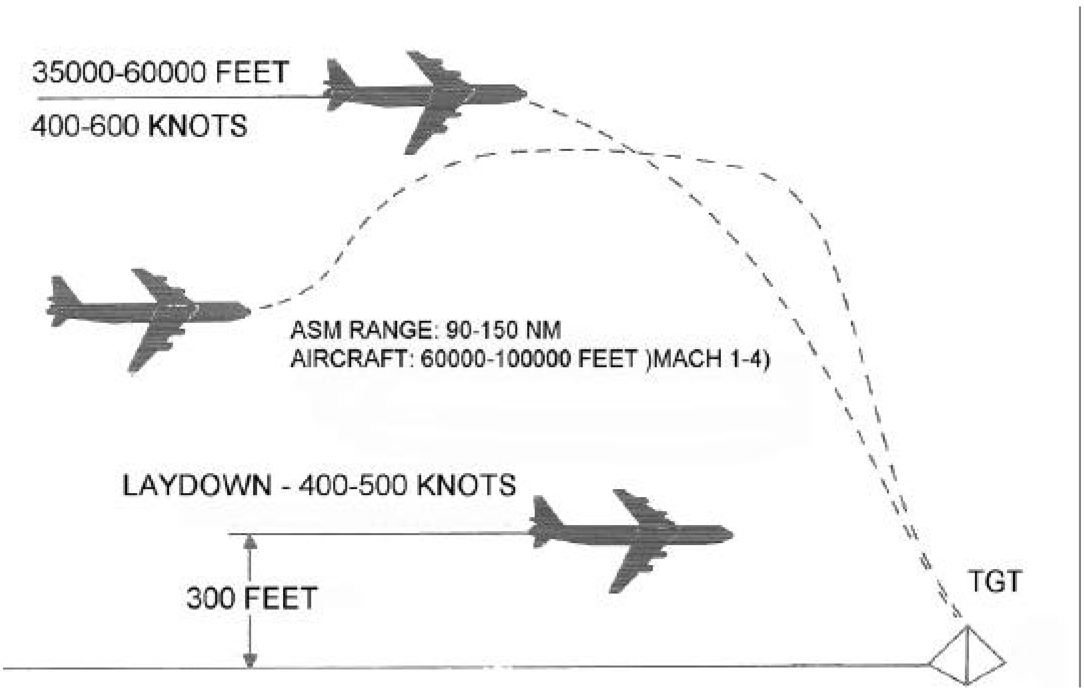


Figure 4 – 7. Bomber delivery methods.

a speed of 400 to 750 knots. At a predetermined point the aircraft pulls up abruptly, releases its ordnance, and reverses its direction.

(5) The lay-down method is employed when the aircraft approaches the target at an altitude of approximately 300 feet and a speed of 400 to 500 knots. At the proper time the ordnance is released without a change in altitude.

c. Bomber aircraft delivery methods are high-altitude, air-to-surface missile (ASM), and lay-down (fig. 4-7). These methods are described as follows:

(1) When using the high-altitude method, the aircraft flies at an altitude of 35,000 to 60,000 feet and a speed of 400 to 600 knots. When the ordnance is released, it falls free as a result of gravity only.

(2) Air-to-surface missiles (ASM) carried by bomber aircraft have ranges from 90 to 150 nautical miles. Bombers delivering ASM may release the missiles from a point well beyond the range of the defense.

(3) Bomber aircraft employ the lay-down method in the same manner as fighters (b (5) above).

a. The various methods used by fighter and bomber aircraft may be performed in an ECM environment. Fighter or bomber aircraft may be screened by other aircraft emitting ECM and/or chaff.

Section II. PROGRAMING TECHNIQUES

4-4. General

a. Programing is necessary for all exercises to be employed by the simulator and becomes more important as simulated engagements become more complex. It is a waste of time and an imposition on unit personnel to attempt to "play a program by ear." The program planner must carefully consider and skillfully blend all of the factors listed below:

(1) Type of aircraft.
(2) Type of attack.
(3) Routes of approach for attacking aircraft.
(4) Approach altitudes.
(5) Aircraft speeds.
(6) Clutter and masking.
(7) Acquisition range.
(8) Attack variations.
(9) ECM and chaff tactics to be employed.

b. The most skillfully planned programs should always be tested before being used as a training exercise. The most careful and experienced programmer can produce a program that may not progress as calculated when placed in the simulator. Much time can be saved if the program is tested prior to use for training.

c. Material that will aid the programmer and make the job less time-consuming and more accurate is listed below:
(1) Cross-section graph paper for plotting flight paths.
(2) DA Form 3062—R (Target Program Sheet) (fig. 3—3) to provide the simulator chief or console operator with the data to be applied to the simulator.
(3) DA Form 3061—R (Electronic Countermeasures (ECM) and Chaff Program Sheet) (fig. 3-4) to provide the ECM operator with all necessary data for ECM and chaff simulation.
(4) Compass (dividers) and protractor.
(5) Nomograms and tables as described and explained in paragraph 4-5.

4-5. Use of Nomograms and Tables

Nomograms to determine the time required for the sitni4ated aircraft to travel a certain distance, make a turn, and dive or climb assist the programmer. Table 4—2 provides aircraft performance characteristics. Other tables on ground range/slant range conversion, turn rate (degrees/ second), and mils/degrees conversion are employed in program planning.

Table 4-2. Aircraft Performance Characteristics

Type	Maximum speed (knots)	Maximum altitude (feet)	Maximum climb rate (ft/min)	Maximum dive rate (ft/min)	Maximum turn rate (°/sec)	ECM capability	Radar Reflectivity (m2)
Heavy Bomber	550	54 000	5 100	6 900	4	All	15-25
Medium Bomber	800	48 000	4 500	6 600	6	All	8
Fighter	1 100	51 000	36 000	45 000	8	None	2-3

Note. Figures in the above table do not necessarily show true performance characteristics of potential hostile aircraft. The table does provide data for programing courses for training purposes.

a. The time required for an aircraft to travel a certain distance is the distance to be traveled (ground range) divided by aircraft speed. The time required for an aircraft to travel a specified distance can be easily determined by using the aircraft speed/ground range/time nomograms (figs. 4-S and 4-9). The nomogram is used by placing a straightedge on an indicated aircraft speed shown in the left column and the ground range traveled in yards shown in the right column. The time in seconds or minutes can be read where the straightedge crosses the diagonal of the nomogram. As an example, assume an aircraft speed of 600 knots and a distance of 100,000 yards to be traveled. With the straightedge accurately on 600 in the left column and 100 (100,000 yd) in the right column, the reading where it crosses the diagonal is 5 minutes. The time required for an aircraft to travel 100,-000 yards at a speed of 600 knots is 5 minutes.

b. The time required for the simulated aircraft to make a turn may be determined by use of the turn rate/degrees/time nomogram shown in figure 4-10. By placing a straightedge on the left column of the nomogram (turn rate in degrees per second), and on the number of degrees of the turn angle (fight column), the time the simulated aircraft will require to complete a given turn can be read where the straightedge crosses the diagonal of the nomogram. For example, assume a turn rate for a simulated aircraft of 50 per second and a required turn of 750**,** Place the straightedge on 5° in the left column and on 75° in the right column. The straightedge crosses the diagonal at 15. Therefore, it takes 15 seconds for the simulated target to make a 750 turn at a turn rate of 5° per second. The turn rate in degrees per second is determined from table 4-3 and the degrees of the turn angle are determined by using the procedure explained in *e* below.

c. C. The time required for a simulated target to dive or climb a specified distance may be determined by using the dive or climb velocity/ altitude/time nomogram shown in figure 4-11. By placing a straightedge at a desired value in the left column (vertical velocity, either dive or climb), and at another desired value in the right column (change in altitude in feet), the time the simulated aircraft requires to dive or climb a specific distance can be determined by reading the figure where the straightedge crosses the diagonal. For example, assume a dive velocity of 20,000 feet a minute and a total change in altitude of 50,000 feet; place the straightedge on the left column at 20K and on the right column at 50K. The straightedge crosses the diagonal at 150 seconds or 2 minutes, 30 seconds. At a dive rate of 20,000 feet per minute, it will take a simulated aircraft 2 minutes, 30 seconds, to dive 50,000 feet.

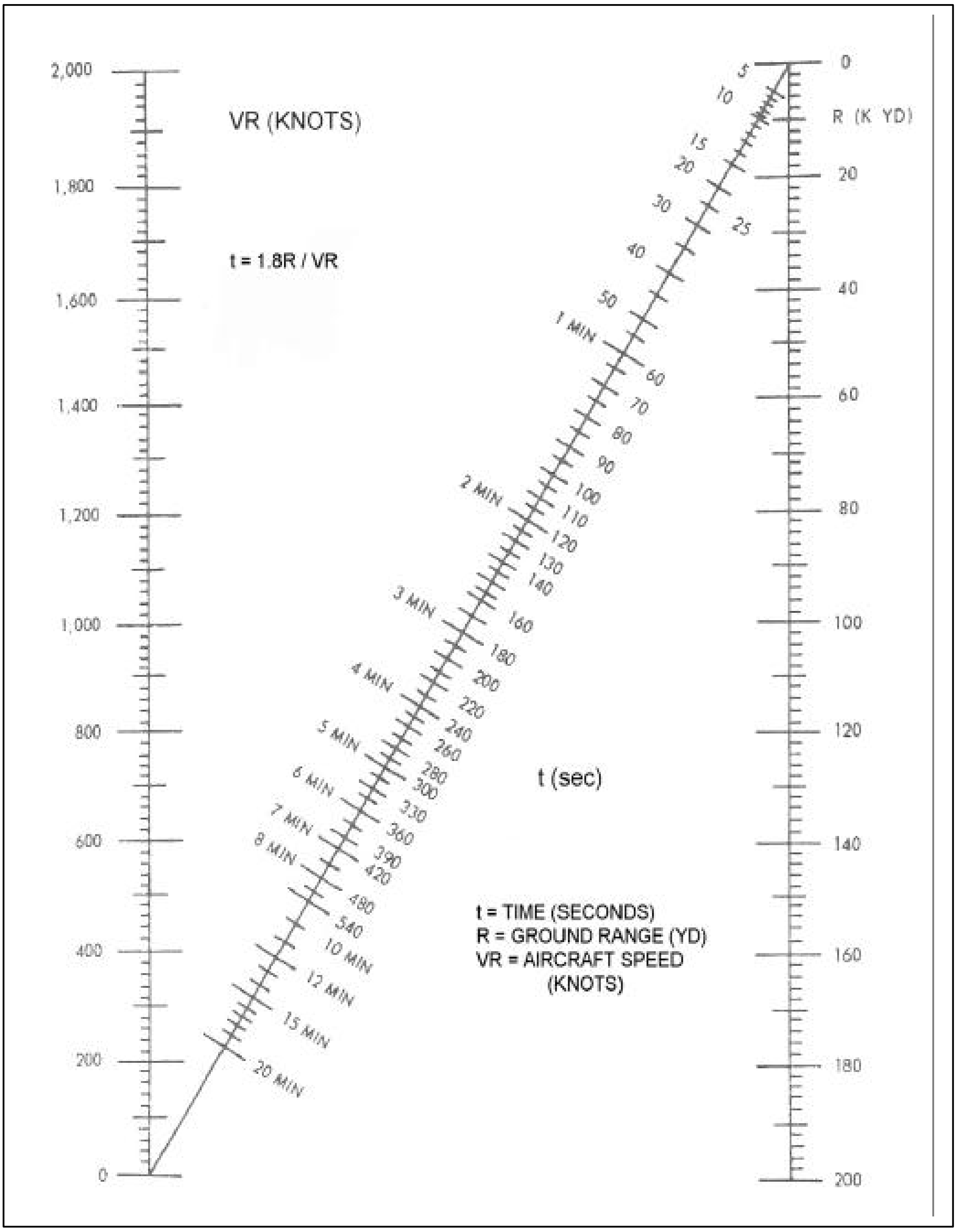


Figure 4-8. Aircraft speed / ground range / time nomogram (0-200 000 yards).

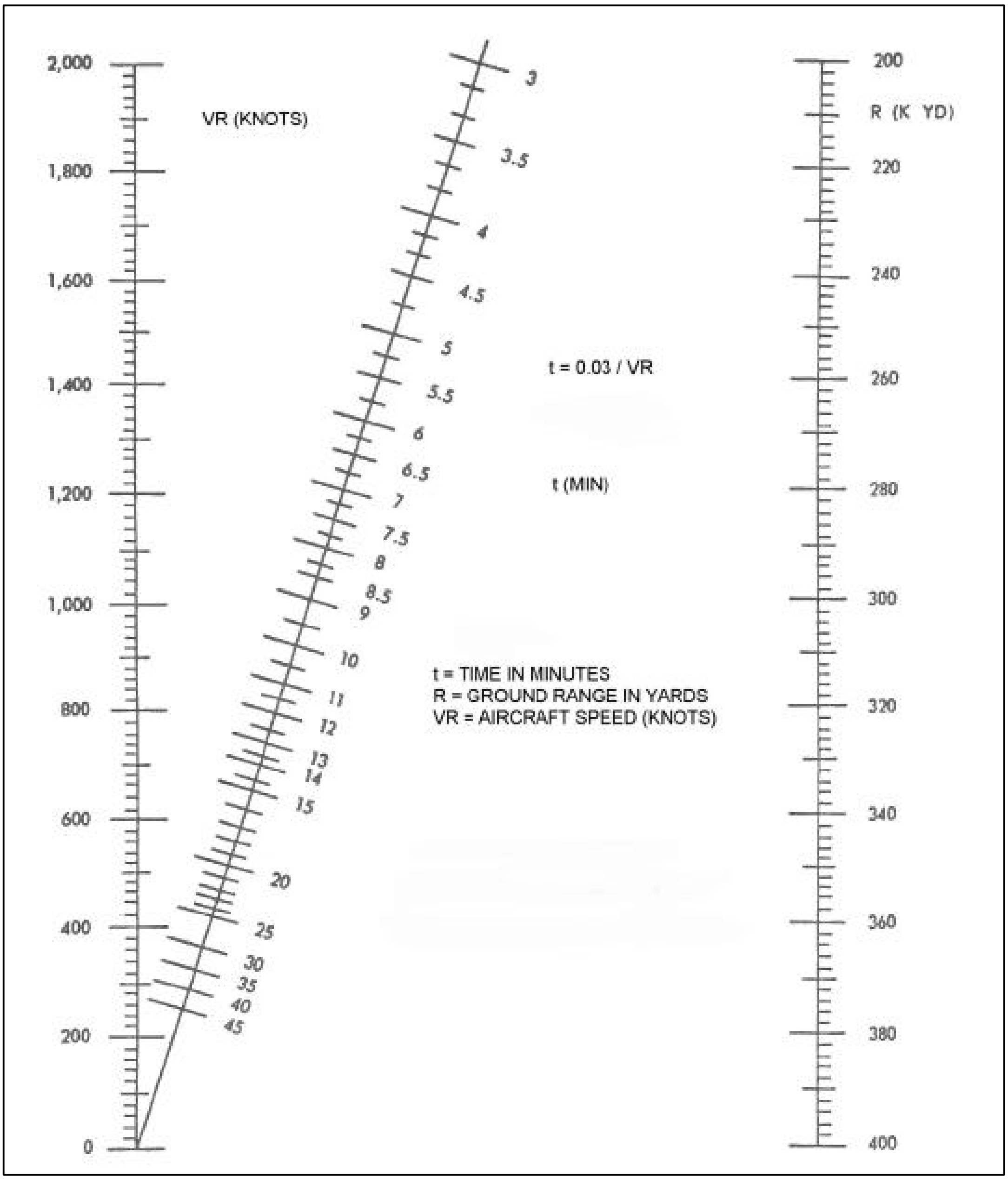


Figure 4-9. Aircraft speed / ground range / time nomogram (200 000-400 000 yards).

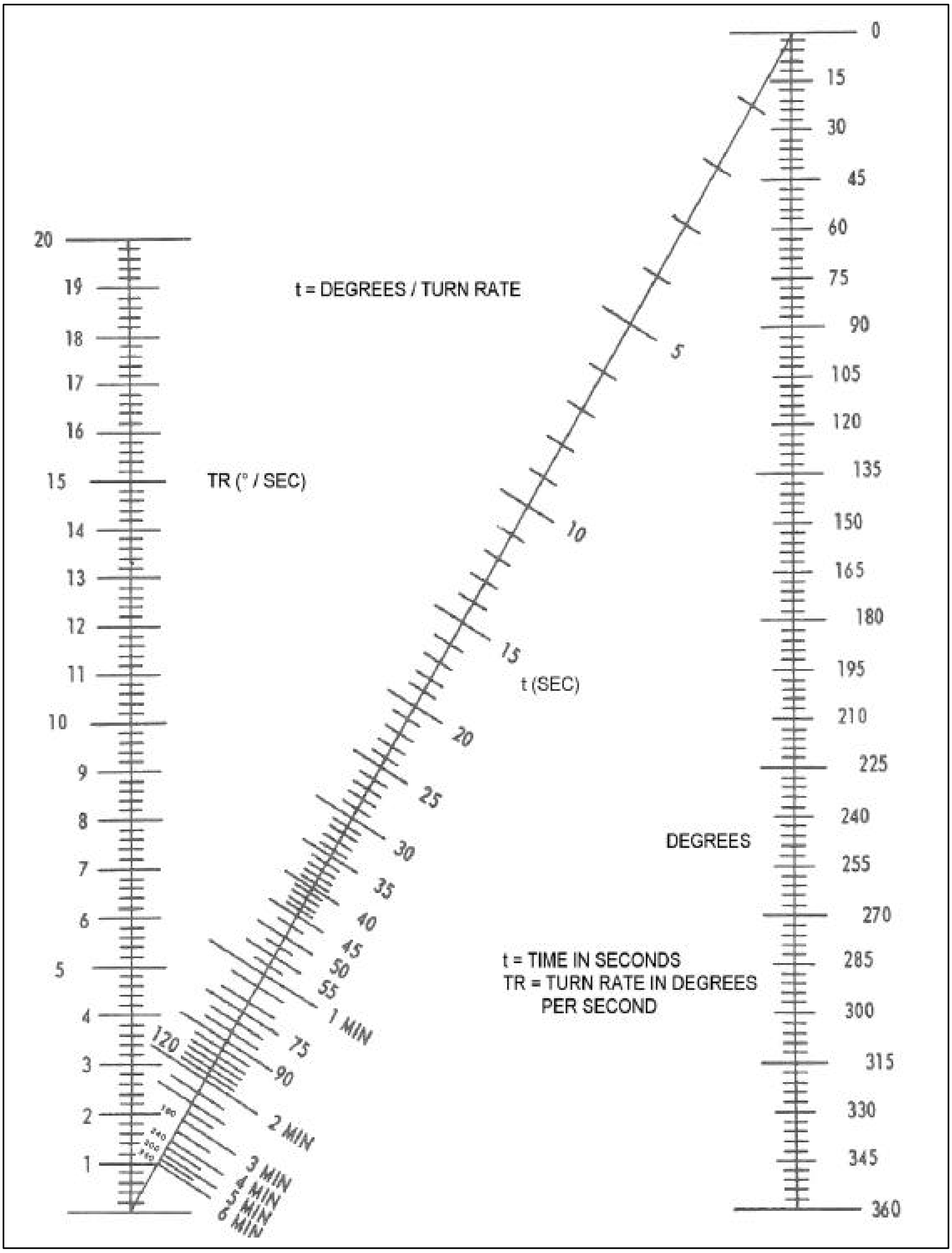


Figure 4-10. Turn rate / degrees / time nomogram.

RADIUS (R) (IN THOUSANDS OF YARDS)	100	200	300	400	500	600	700	800	900	1,000	1,100	1,200	1,300	1,400	1,500	1,600	1,700	1,800	1,900	2,000
49	.07	.13	.20	.26	.33	.40	.46	.52	.59	.65	.72	.78	.85	.91	.98	1.0	1.1	1.2	1.2	1.3
48	.07	.13	.20	.27	.33	.40	.47	.53	.60	.67	.73	.80	.86	.93	1.0	1.1	1.1	1.2	1.3	1.3
47	.07	.14	.20	.27	.34	.41	.48	.54	.61	.68	.75	.81	.88	.95	1.0	1.1	1.2	1.2	1.3	1.4
46	.07	.14	.21	.28	.35	.42	.49	.55	.64	.69	.76	.83	.90	.97	1.0	1.1	1.2	1.3	1.3	1.4
45	.07	.14	.21	.28	.35	.43	.50	.57	.64	.71	.78	.85	.92	.99	1.1	1.1	1.2	1.3	1.4	1.4
44	.07	.15	.22	.30	.36	.43	.51	.58	.65	.72	.80	.87	.94	1.0	1.1	1.2	1.2	1.3	1.4	1.5
43	.07	.15	.22	.30	.37	.44	.52	.59	.67	.74	.81	.89	.96	1.0	1.1	1.2	1.3	1.3	1.4	1.5
42	.08	.15	.23	.30	.38	.46	.53	.61	.68	.76	.84	.91	.99	1.1	1.1	1.2	1.3	1.4	1.4	1.5
41	.08	.16	.23	.31	.39	.47	.54	.62	.70	.78	.86	.93	1.0	1.1	1.2	1.2	1.3	1.4	1.5	1.6
40	.08	.16	.24	.32	.40	.48	.56	.64	.72	.80	.88	1.0	1.0	1.1	1.2	1.3	1.4	1.4	1.5	1.6
39	.08	.16	.25	.33	.41	.49	.57	.65	.74	.82	.90	.98	1.1	1.1	1.2	1.3	1.4	1.5	1.6	1.6
38	.08	.17	.25	.34	.42	.50	.59	.67	.75	.84	.92	1.0	1.1	1.2	1.3	1.3	1.4	1.5	1.6	1.7
37	.09	.17	.26	.34	.43	.52	.60	.69	.78	.86	.95	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.6	1.7
36	.09	.18	.27	.35	.44	.53	.62	.71	.80	.86	.97	1.1	1.2	1.2	1.3	1.4	1.5	1.6	1.7	1.8
35	.09	.18	.27	.36	.46	.55	.64	.73	.82	.91	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.6	1.7	1.8
34	.09	.19	.28	.38	.47	.56	.66	.75	.84	.94	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9
33	.10	.19	.30	.39	.48	.58	.68	.77	.87	.97	1.1	1.2	1.3	1.4	1.5	1.5	1.6	1.7	1.8	1.9
32	.10	.20	.30	.40	.50	.59	.69	.79	.89	.99	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
31	.10	.20	.31	.41	.51	.61	.72	.82	.92	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
30	.11	.21	.32	.43	.53	.64	.74	.85	.96	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1
29	.11	.22	.33	.44	.56	.67	.77	.88	.99	1.1	1.2	1.3	1.4	1.5	1.7	1.8	1.9	2.0	2.1	2.2
28	.11	.23	.34	.46	.57	.68	.80	.91	1.0	1.1	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.1	2.2	2.3
27	.12	.23	.35	.46	.58	.69	.81	.92	1.0	1.2	1.3	1.4	1.5	1.6	1.7	1.8	2.0	2.1	2.2	2.3
26	.12	.25	.37	.49	.61	.74	.86	.98	1.1	1.2	1.4	1.5	1.6	1.7	1.8	2.0	2.1	2.2	[illegible]	2.5
25	.13	.26	.38	.51	.64	.76	.89	1.0	1.2	1.3	1.4	1.5	1.7	1.8	1.9	2.0	2.2	2.3	2.4	2.6
24	.13	.27	.40	.53	.66	.80	.93	1.1	1.2	1.3	1.5	1.6	1.7	1.9	2.0	2.1	2.3	2.4	2.5	2.7
23	.14	.28	.42	.55	.69	.83	.97	1.1	1.3	1.4	1.5	1.7	1.8	1.9	2.1	2.2	2.4	2.5	2.6	2.8
22	.14	.29	.43	.58	.72	.87	1.0	1.2	1.3	1.5	1.6	1.7	1.9	2.0	2.2	2.3	2.5	2.6	2.8	2.9
21	.15	.30	.46	.61	.76	.91	1.1	1.2	1.4	1.5	1.7	1.8	2.0	2.1	2.3	2.4	2.6	2.7	2.9	3.0
20	.16	.32	.48	.64	.80	.96	1.1	1.3	1.4	1.6	1.8	1.9	2.1	2.2	2.4	2.6	2.7	2.9	3.0	3.2
19	.17	.34	.50	.67	.84	1.0	1.2	1.3	1.5	1.7	1.8	2.0	2.2	2.3	2.5	2.7	2.9	3.0	3.2	3.4
18	.18	.35	.53	.71	.89	1.1	1.2	1.4	1.6	1.8	2.0	2.1	2.3	2.5	2.7	2.8	3.0	3.2	3.4	3.5
17	.19	.38	.56	.75	.94	1.1	1.3	1.5	1.7	1.9	2.1	2.3	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8
16	.20	.40	.60	.80	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0
15	.21	.43	.64	.90	1.1	1.3	1.5	1.7	1.9	2.1	2.3	2.5	2.8	3.0	3.2	3.4	3.6	3.8	4.0	4.3
14	.23	.46	.68	.91	1.1	1.4	1.6	1.8	2.1	2.3	2.5	2.7	3.0	3.2	3.4	3.6	3.9	4.1	4.3	4.6
13	.25	.50	.74	.98	1.2	1.5	1.7	2.0	2.2	2.5	2.7	2.9	3.2	3.4	3.7	3.9	4.2	4.4	4.7	5.0
12	.27	.53	.80	1.1	1.3	1.6	1.9	2.1	2.4	2.7	2.9	3.2	3.5	3.7	4.0	4.3	4.5	4.8	5.0	5.3
11	.29	.58	.87	1.2	1.5	1.7	2.0	2.3	2.6	2.9	3.2	3.5	3.8	4.1	4.3	4.6	4.9	5.2	6.0	6.0
10	.32	.64	.96	1.3	1.6	1.9	2.2	2.6	2.9	3.2	3.5	3.8	4.1	4.5	4.8	5.1	5.4	5.7	6.1	6.4
9	.35	.71	1.1	1.4	1.8	2.1	2.5	2.8	3.2	3.5	3.9	4.3	4.6	5.0	5.3	5.7	6.0	6.4	6.7	7.1
8	.40	.80	1.2	1.6	2.0	2.4	2.8	3.2	3.6	4.0	4.4	4.8	5.2	5.6	6.0	6.4	6.8	7.2	7.6	8.0
7	.50	.91	1.4	1.8	2.3	2.7	3.2	3.6	4.1	4.6	5.0	5.5	5.9	6.4	6.8	7.3	7.7	8.2	8.7	9.1
6	.53	1.1	1.6	2.1	2.7	3.2	3.7	4.3	4.8	5.3	5.8	6.4	7.0	7.4	8.0	8.5	9.0	9.6	10	11
5	.64	1.3	2.0	2.6	3.2	3.8	4.5	5.1	5.7	6.4	7.0	7.7	8.0	9.0	9.6	10	11	12	12	13
4	.80	1.6	2.4	3.2	4.0	4.8	5.6	6.4	7.2	8.0	8.8	9.6	10	11	12	13	14	14	15	16
3	1.1	2.1	3.2	4.3	5.3	6.4	7.4	8.5	9.6	11	12	13	14	15	16	17	18	19	20	
2	1.6	3.2	4.8	6.4	8.0	10	11	13	14	16	17	19								
1	3.2	6.4	10	13	16	19														

VELOCITY (V) IN KNOTS

Turn rate (degrees/second) = $\frac{32V}{R}$

Table 4-3. Turn Rate (Degrees / Second)

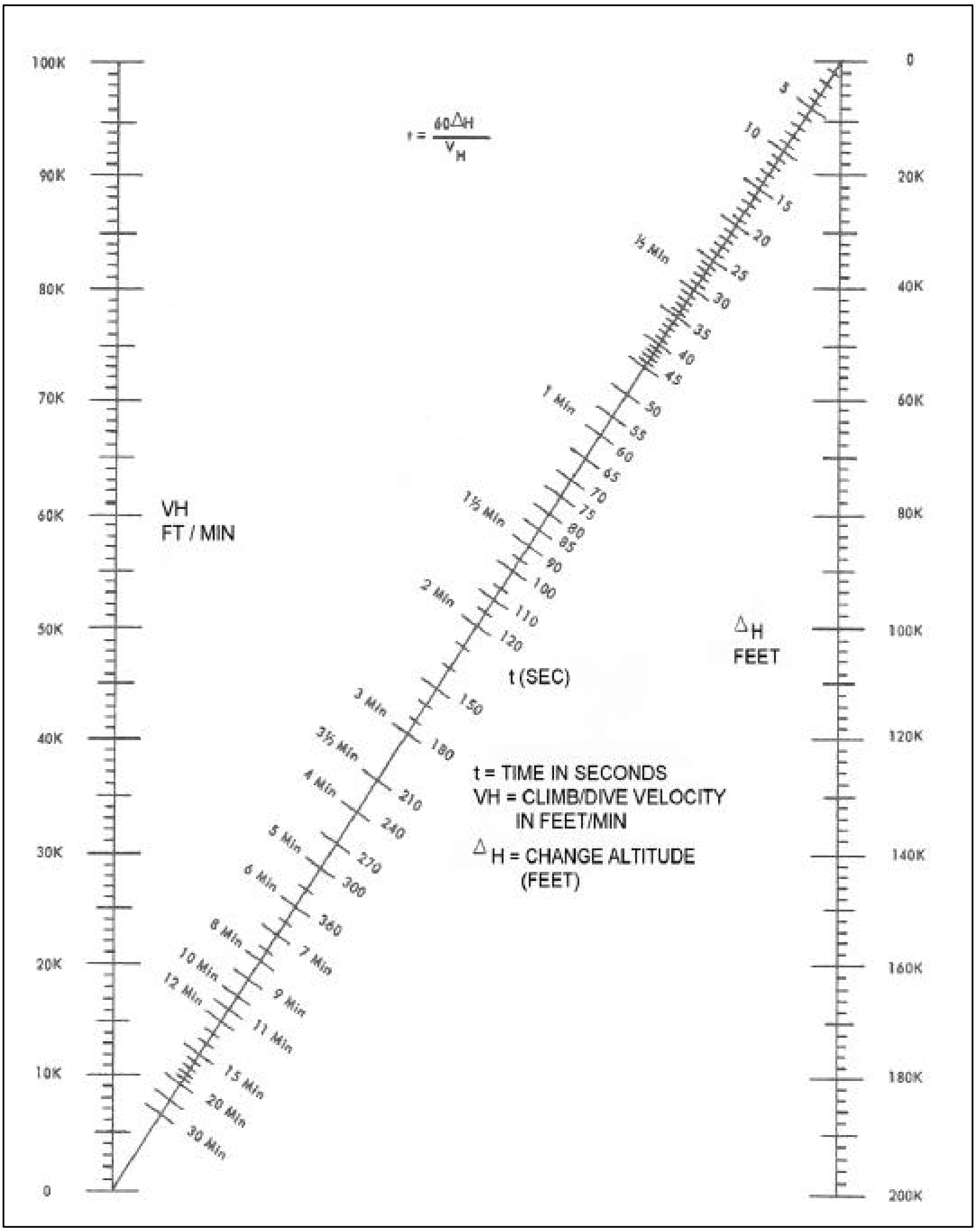


Figure 4-11. Dive-climb velocity / altitude / time nomogram.

d. Simulated targets that are programmed at high altitudes or short ranges must have their ground range converted to slant range so that time of flight, using the aircraft speed/ground range/time nomogram, can be determined. The conversion of ground range to slant range, using table 4—4, is accomplished as follows:
(1) Locate the programmed altitude of the simulated target in the vertical column at the left of the table.
(2) Locate the programmed slant range in the horizontal row across the top of the table.
(3) The ground range of the simulated target will be shown at the intersection of the programmed altitude and slant range; e.g., a simulated target at a programmed altitude of 50,000 feet and a programmed slant range of 50,000 yards will have a ground range of 47.1K yards (47,100 yards). The difference between ground range and slant range makes a difference in time of flight of the simulated target. Time of flight must be shown in the TIME TO CHANGE column of DA Form 3062—R and inaccuracies will cause errors in the program that make it useless for training.

ALTITUDE (ft)	SLANT RANGE (yd)																			
	10,000	20,000	30,000	40,000	50,000	60,000	70,000	80,000	90,000	100,000	110,000	120,000	130,000	140,000	150,000	160,000	170,000	180,000	190,000	200,000
10,000	9.4	19.7	29.8	39.9	49.9	59.9	69.9	79.9	89.9	99.9	109.9	120.0	130.0	140.0	150.0	160.0	170.0	180.0	190.0	200.0
20,000	7.5	18.9	29.2	39.4	49.6	59.6	69.7	79.7	89.8	99.8	109.8	119.8	129.8	139.8	149.9	159.9	169.9	179.9	189.9	199.9
30,000		17.3	28.3	38.7	49.0	59.2	69.3	79.4	89.4	99.5*	109.5	119.6	129.6	139.6	149.7	159.7	169.7	179.7	189.7	199.7
40,000		14.9	26.9	37.7	48.2	58.5	68.7	78.9	89.0	99.1	109.2	119.3	129.3	139.4	149.4	159.4	169.5	179.5	189.5	199.6
50,000		11.1	24.9	36.4	47.1	57.6	68.0	78.2	88.4	98.6	108.7	118.8	128.9	139.0	149.1	159.1	169.2	179.2	189.3	199.3
60,000			22.4	34.6	45.8	56.6	67.1	77.5	87.7	98.0	108.2	118.3	128.5	138.6	148.7	158.7	168.8	178.9	188.9	199.0
70,000			18.9	32.5	44.2	55.3	66.0	76.5	86.9	97.2	107.5	117.7	127.9	138.0	148.2	158.3	168.4	178.5	188.6	198.6
80,000			13.7	29.8	42.3	53.7	64.7	75.4	86.0	96.4	106.7	117.0	127.2	137.4	147.6	157.8	167.9	178.0	188.1	198.2
90,000				26.5	40.0	52.0	63.2	74.2	84.9	95.4	105.8	116.2	126.5	136.7	147.0	157.2	167.3	177.5	187.6	197.7
100,000				22.1	37.3	49.9	61.6	72.7	83.6	94.3	104.8	115.3	125.7	136.0	146.2	156.5	166.7	176.9	187.1	197.2
110,000				16.0	34.0	47.5	59.6	71.1	82.2	93.0	103.7	114.3	124.7	135.1	145.4	155.7	166.0	176.2	186.4	196.6
120,000					30.0	44.7	57.4	69.3	80.6	91.7	102.5	113.1	123.7	134.2	144.6	154.9	165.2	175.5	185.7	196.0
130,000					24.9	41.5	55.0	67.2	78.9	90.1	101.1	111.9	122.6	133.1	143.6	154.0	164.4	174.7	185.0	195.3
140,000					18.0	37.7	52.2	65.0	77.0	88.4	99.6	110.6	121.3	132.0	142.6	153.0	163.5	173.8	184.2	194.5
150,000						33.2	49.0	62.4	74.8	86.6	98.0	109.1	120.0	130.8	141.4	152.0	162.5	172.9	183.3	193.6

ALTITUDE	210,000	220,000	230,000	240,000	250,000	260,000	270,000	280,000	290,000	300,000	310,000	320,000	330,000	340,000	350,000	360,000	370,000	380,000	390,000	400,000
10,000	210.0	220.0	230.0	240.0	250.0	260.0	270.0	280.0	290.0	300.0	310.0	320.0	330.0	340.0	350.0	360.0	370.0	380.0	390.0	400.0
20,000	209.9	219.9	229.9	239.9	249.9	259.9	269.9	279.9	289.9	299.9	309.9	319.9	329.9	339.9	349.9	359.9	369.9	379.9	389.9	399.9
30,000	209.8	219.8	229.8	239.8	249.8	259.8	269.8	279.8	289.8	299.8	309.8	319.8	329.8	339.9	349.9	359.9	369.9	379.9	389.9	399.9
40,000	209.6	219.6	229.6	239.6	249.6	259.7	269.7	279.7	289.7	299.7	309.7	319.7	329.7	339.7	349.7	359.8	369.8	379.8	389.8	399.8
50,000	209.3	219.4	229.4	239.4	249.4	259.5	269.5	279.5	289.5	299.5	309.6	319.6	329.6	339.6	349.6	359.6	369.6	379.6	389.6	399.7
60,000	209.0	219.1	229.1	239.2	249.2	259.2	269.3	279.3	289.3	299.3	309.4	319.4	329.4	339.4	349.4	359.4	369.5	379.5	389.5	399.5
70,000	208.7	218.8	228.8	238.9	248.9	259.0	269.0	279.0	289.1	299.1	309.1	319.1	329.2	339.2	349.2	359.2	369.3	379.3	389.3	399.3
80,000	208.3	218.4	228.4	238.5	248.6	258.6	268.7	278.7	288.8	298.8	308.9	318.9	328.9	339.0	349.0	359.0	369.0	379.1	389.1	399.1
90,000	207.8	217.9	228.0	238.1	248.2	258.3	268.3	278.4	288.4	298.5	308.5	318.6	328.6	338.7	348.7	358.7	368.8	378.8	388.8	398.9
100,000	207.3	217.5	227.6	237.7	247.8	257.9	267.9	278.0	288.1	298.1	308.2	318.3	328.3	338.4	348.4	358.5	368.5	378.5	388.6	398.6
110,000	206.8	216.9	227.1	237.2	247.3	257.4	267.5	277.6	287.7	297.8	307.8	317.9	328.0	338.0	348.1	358.1	368.2	378.2	388.3	398.3
120,000	206.2	216.3	226.5	236.6	246.8	256.9	267.0	277.1	287.2	297.3	307.4	317.5	327.6	337.6	347.7	357.8	367.8	377.9	387.9	398.0
130,000	205.5	215.7	225.9	236.1	246.2	256.4	266.5	276.6	286.7	296.9	307.0	317.1	327.1	337.2	347.3	357.4	367.5	377.5	387.6	397.6
140,000	204.7	215.0	225.2	235.4	245.6	255.8	265.9	276.1	286.2	296.3	306.5	316.6	326.7	336.8	346.9	357.0	367.0	377.1	387.2	397.3
150,000	204.0	214.7	224.5	234.7	244.9	255.1	265.3	275.5	285.7	295.8	305.9	316.1	326.2	336.3	346.4	356.5	366.6	376.7	386.8	396.9

Table 4 – 4. Ground Range/Slant Range Conversion

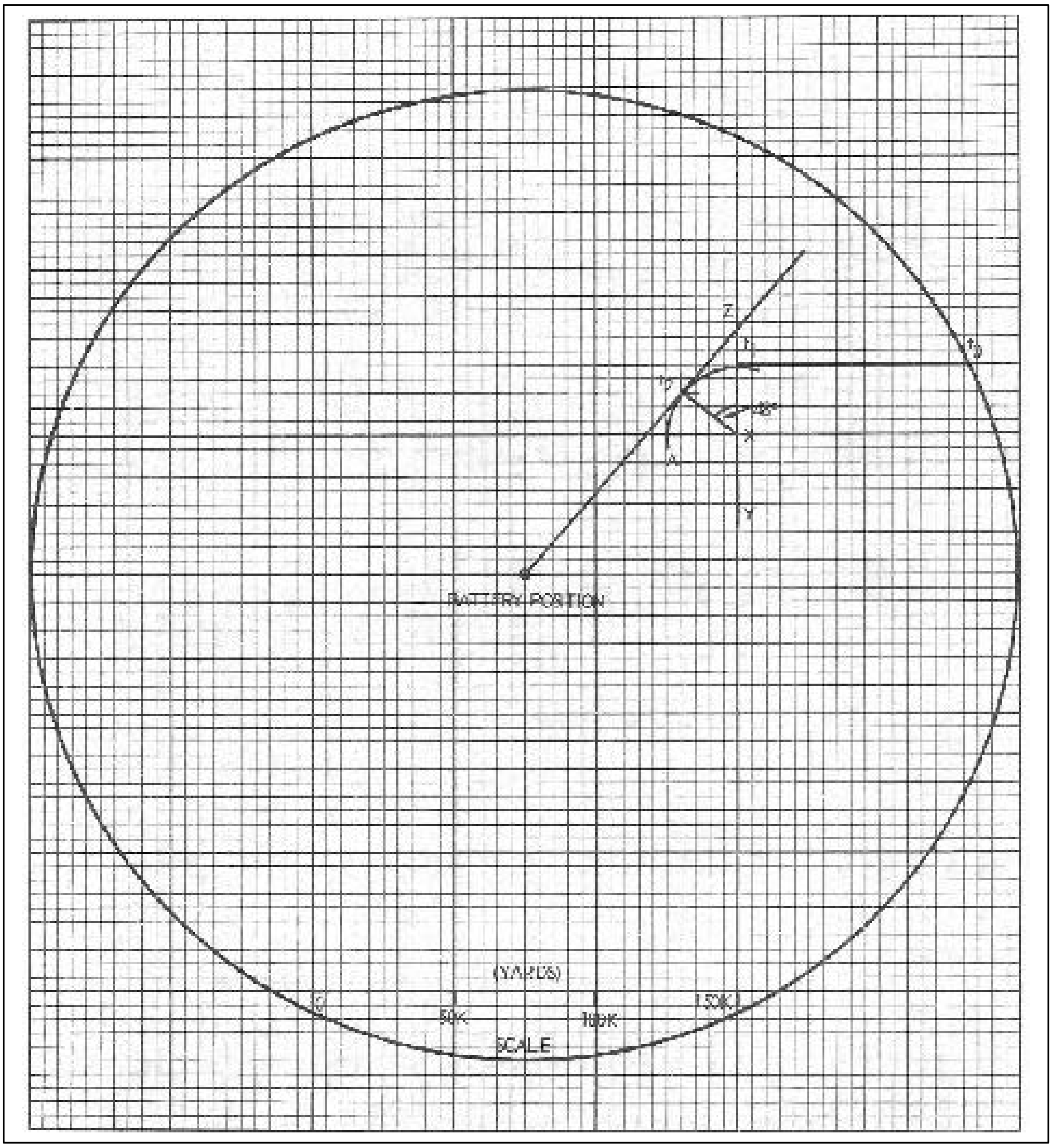


Figure 4-12. Plotting graph (sample).

d. To use the turn rate/degrees/time nomogram explained in b above, the radius of the turn in yards and the speed of the simulated target are required. The turn radius and turn angle in degrees are solved as follows:

(1) The programmed turn rate, based on data provided in table 4-2, and the speed of the simulated target are used to determine the turn radius in yards, using table 4—3 in the following manner:

(a) Locate the programmed speed of the simulated target in the horizontal row at the bottom of the table.

b) Read upward in the vertical column corresponding to the programmed aircraft speed to the turn rate indicated in degrees per'second (derived from the COMMAND column of the target program sheet).

(c) Move to the left along this horizontal row to the extreme left column (radius R in thousands of yards) and read the radius of the turn in thousands of yards.

(2)The turn angle, in degrees, is determined on a plotting graph (fig. 4-12), using a protractor and dividers (or compass), as follows:

(a) At t_1 (fig. 4—12), the point where the simulated target starts to make a left turn, draw the line YZ perpendicular to the line (extend the line beyond the point t_1).

(b) Assuming a turn radius of 25,000 yards (table 4—3, 800-knot speed, 1.00 turn rate per second, 25,000-yard turn radius), set the dividers to represent this radius, using the scale on the plotting graph and with as the center, locate point X on line YZ.

Table 4–5. Mils/Degrees Conversion

DEGREES		0	1	2	3	4	5	6	7	8	9
	MILS										
1	18										
2	36										
3	53								658	676	693
4	71	711	729	747	764	782	800	818	836	853	871
5	89	889	907	924	942	960	978	996	1,013	1,031	1,049
6	107	1,067	1,084	1,102	1,120	1,138	1,156	1,173	1,191	1,209	1,227
7	124	1,244	1,262	1,280	1,298	1,316	1,333	1,351	1,369	1,387	1,404
8	142	1,422	1,440	1,458	1,476	1,493	1,511	1,529	1,547	1,564	1,582
9	160	1,600	1,618	1,636	1,653	1,671	1,689	1,707	1,724	1,742	1,760
10	178	1,778	1,796	1,813	1,831	1,849	1,867	1,884	1,902	1,920	1,938
11	196	1,956	1,973	1,991	2,009	2,027	2,044	2,062	2,080	2,098	2,160
12	213	2,133	2,151	2,169	2,187	2,204	2,222	2,240	2,258	2,276	2,293
13	231	2,311	2,329	2,347	2,364	2,382	2,400	2,418	2,436	2,453	2,471
14	249	2,489	2,507	2,524	2,542	2,560	2,578	2,596	2,613	2,631	2,649
15	267	2,667	2,684	2,702	2,720	2,738	2,756	2,773	2,791	2,809	2,827
16	284	2,844	2,862	2,880	2,898	2,916	2,933	2,951	2,969	2,987	3,004
17	302	3,022	3,040	3,058	3,076	3,093	3,111	3,129	3,147	3,164	3,182
18	320	3,200	3,218	3,236	3,253	3,271	3,289	3,307	3,324	3,342	3,360
19	338	3,378	3,396	3,413	3,431	3,439	3,467	3,484	3,502	3,520	3,538
20	356	3,556	3,573	3,591	3,609	3,627	3,644	3,662	3,680	3,698	3,716
21	373	3,733	3,751	3,769	3,787	3,804	3,822	3,840	3,858	3,876	3,893
22	391	3,911	3,929	3,947	3,964	3,982	4,000	4,018	4,036	4,053	4,071
23	409	4,089	4,107	4,124	4,142	4,160	4,178	4,196	4,213	4,231	4,249
24	427	4,267	4,284	4,302	4,320	4,338	4,356	4,373	4,391	4,409	4,427
25	444	4,444	4,462	4,480	4,498	4,516	4,533	4,551	4,569	4,589	4,604
26	462	4,622	4,640	4,658	4,676	4,693	4,711	4,729	4,747	4,764	4,782
27	480	4,800	4,818	4,836	4,853	4,871	4,889	4,907	4,924	4,942	4,960
28	498	4,978	4,996	5,013	5,031	5,049	5,067	5,084	5,102	5,120	5,138
29	516	5,156	5,173	5,191	5,209	5,227	5,244	5,262	5,280	5,298	5,316
30	533	5,333	5,351	5,369	5,387	5,404	5,422	5,440	5,458	5,476	5,493
31	551	5,511	5,529	5,547	5,564	5,582	5,600	5,618	5,636	5,653	5,671
32	569	5,689	5,707	5,724	5,742	5,760	5,778	5,796	5,813	5,831	5,849
33	587	5,867	5,884	5,902	5,920	5,938	5,956	5,973	5,991	6,009	6,027
34	604	6,044	6,062	6,080	6,098	6,116	6,133	6,151	6,169	6,187	6,204
35	422	6,222	6,240	6,258	6,276	6,293	6,311	6,329	6,347	6,364	6,382
36	640	6,400									

CONVERSION FACTOR–1° = 17.77778 MILS

Table 4-5. Mils / Degrees Conversion.

CONVERSIO4 FACTOR – 1° = 17.77775 MILS

NOTE. This TABLE SHOWS MIL/DEGREE AND DEGREE/MIL VALUES. VALUES ARE ROUNDED OFF TO THE NEAREST WHOLE NUMBER WHICH IS SUFFICIENT IN ACCURACY FOR THE PREPARATION OF FLIGHT LAYOUTS. ENTER THE LEFT-HAND COLUMN OF THE TABLE WITH THE VALUE IN DEGREES UP TO 36 AND READ THE CORRE SPONDING VALUE IN THE FIRST ADJACENT COLUMN. TO READ HIGHER VALUES, USE THE SUCCEEDING COLUMNS STARTING WITH ZERO; FOR EXAMPLE, W IS FOUND IN THE FIRST COLUMN TO BE 533 MILS; 300° IN THE COLUMN UNDER 0 15 5,333; 30P UNDER 9 IS 5.493 MILSJ AND 319 IN THE COLUMN UNDER 0 AFTER 31 IS 5,511 MILS.

c) With the dividers set to a 25,000-yard radius and point X as the center, use the dividers to describe an arc (t_1 to A) from t_1 which will represent the simulated target course in the turn.

(d) Draw a line from the battery position tangent to the arc (point t_2).

(e) From the point t_2, draw a perpendicular to point X which will form angle ZXt_2.

(f) Using the protractor, measure angle ZXt_2 (it should measure 48°), which will be the number of degrees used for the right column of the nomogram (fig. 4-10).

(g) When using a protractor graduated in mils only, convert the mils to degrees by using the mils/degrees conversion table (table 4-5).

4-6. Planning a Simple Program

a. When plotting simulated flights, graph paper containing 10 by 10 subdivisions to the inch is usually employed. Any convenient scale can be used (1 inch equals 50,000 yards, for instance). When plotting flight paths, the programmer must consider the terrain features, routes of approach, and altitudes based on the features and characteristics of the site. Thus a program planned for a particular site or firing range may be entirely unsuitable for other sites.

b. Each program is assigned a number, and this identifying number is entered on DA Form 3062-R, allowing the training officer to call for specific programs to fill specific requirements. The initial settings to be applied to the target coordinate generator are entered in the CONTROL section of the target program sheet under columns TARGET 1 through TARGET 6 as determined by the number of targets used for the exercise. For example, the initial settings for a simple program (program 1), using only one target, shows the following data entered in the TARGET 1 column of the target program sheet:

Range	315,000 yards
Altitude	19,500 feet
Azimuth	1,190 mils
Heading	4890 mils
Target Size	10m2
Aspect Ratio	- 10 db
Climb/Dive	Climb 5,000 ft/min
Aircraft Speed	500 knots
IFF/SIF	none

b. The simple course provides one simulated target performing an "S" maneuver, climbing and diving during its bomb release.

(1) The initial data is as noted in b above.

(2) The starting point for the simulated flight, indicated as to on the plotting graph (fig. 4—13), is at an azimuth of 1,190 mils and a range of 315,000 yards from the site. The heading of the simulated target is 4,390 mils and its flight path is plotted as follows:

(a) Place the center of a protractor over t_0 with its horizontal axis parallel to the vertical lines of the plotting graph. Place a tick mark at 4,390 mils.

(b) Connect to, with the tick mark at 4,390 mils. This is the initial flight path.

(b) After flying along the initial course for 7,000 yards, the simulated target will make a right turn. Using the dividers, make a tick mark on the initial flight path at 7,000 yards from t_0 and mark this point t_1.

1. The time required for the initial change (use the formula shown in figure 4-8) would be:

$$t = \frac{7,000 \times 1.8}{500} = 25 \text{ seconds}$$

This 25 seconds is entered in the TIME TO CHANGE column of DA Form 3062-fl (fig. 4-14). This data also may be determined by using the aircraft speed/ground range/time nomogram.

2. The figure "1" is written in the CHANGE NO. and TARGET NO. columns (fig. 4—14) because this is the first change for target No. 1. The figures entered in the CHANGE NO. column will be in sequence, whereas the entries in the TARGET NO. column are determined by the number of the target to which the change is to be applied. In this exercise only one target is programmed.

3. The WHEN column will indicate the position of the target when the change is to be applied. In this case, after the target has moved 7,000 yards along the flight path, or at a range of 308,000 yards from the site (315,000 — 7,000), the WHEN column will show RANGE 808,000 yards. Data entered in the WHEN column should always be the greatest change that has occurred. This data may be the range of the target with respect to the site, the azimuth of the target with respect to the site, or the altitude of the target upon completion of a climb or dive.

4. The COMMAND column of the target program sheet will show the action the target is to perform. In this case, the target will perform a right turn at a turn rate of 1.1° per second. The length of time required to make this turn is determined by first finding the turn radius for a target flying at a speed of 500 knots. Using table 4-3, the turn radius for a 1.1°/sec turn at a speed of 500 knots is found to be 15,000 yards. This turn is plotted as explained in (3) below.

(3) At point t1 on the graph draw a perpendicular to the initial flight path in the direction of the turn (toward the top of the graph). Using the graph scale, mark off a distance on the perpendicular that represents 15,000 yards

(three squares), which is the radius of the turn, and make a tick mark. With this tick mark as the center, describe an arc with the dividers from t1 that will represent the turning course of the target. The extent of the arc (turn) is determined by the future flight path (heading) desired. The time to zero the turn, which will be CHANGE NO. 2, is determined by the number of degrees in the turn angle. Using the formula in figure 4—10, the time would be:

$$t = \frac{72°}{1.1°/\text{sec}} = 65.4 \text{ seconds.}$$

The 72° is the angle from t_1 to t_2 and represents the angle required to change the heading from 4,390 mils to 5,670 mils. The time of 65.4 seconds is rounded off to 65 seconds. Therefore, 25 seconds, CHANGE NO. 1, plus 65 seconds gives 1 minute 30 seconds. This is the TIME TO CHANGE entry made for CHANGE NO. 2.

Table 4—6 shows the procedure for the required calculations to determine the time between changes and the cumulative times for Program No. 1. The completion of Program 1 is shown in figures 4—14 and 4—15.

4—7. Planning Dives and Climbs

The program involving the planning of dives and climbs (figs. 4—16, 4—17, and 4—18) will present a Nike Hercules defended area to be attacked by two medium bombers employing air-to-surface (ASM) missiles. The two simulated targets will be detected initially at long range and high altitude. Both targets will dive to a low altitude, will then climb to a proper altitude to release their missiles, and then depart the attacked area. Specific details to be considered in plotting these courses, in addition to the procedures already explained, are as follows:

a. Using data shown in tables 4-1 and 4-2, enter the figures on the target program sheet (fig. 4-17) that are to be used for the two simulated aircraft (target 1 and target 2).

b. Determine the distance between the two simulated aircraft and local terrain features (mountains or hills) that they must avoid or fly around. Then determine the appropriate times to dive and climb, and the distance from the area to be attacked for the release of the ASM.

c. Each target course is then plotted individually as explained in paragraph 4-6 and as illustrated in figure 4-16.

d. On DA Form 3062-R (figs. 4-17 and 4-18), enter the data for TIME TO CHANGE, CHANGE NO., TARGET NO., WHEN, and COMMAND in the proper column for each target in sequence, insuring that each change occurs as shown on the plotting graph (fig. 4-16).

4-8. Planning a Program With Chaff

A sample program involving chaff is illustrated in figures 4—19, 4—20, 4—21, and 4-22. The program presents a Nike Hercules defended area under attack by two medium bombers whose approach is blanketed by another aircraft dispensing chaff. The chaff-dispensing aircraft is programmed to sow a chaff corridor. Programing is accomplished as follows:

a. Individual simulated target courses are plotted as explained in paragraph 4-6 and as illustrated in figure 4-19. Again enter the initial data taken from tables 4-1 and 4-2 (for medium bombers) on DA Form 3062-R (figs. 4-20 and 4-21).

b. The chaff-dispensing aircraft will appear first (target No. 2, fig. 4-20) at the time shown on the target program sheet.

c. Chaff cue 1 (fig. 4-22) is based on the radar to be affected by the chaff, the target that is to emit the chaff, wind direction aloft, direction of the chaff launch with respect to the emitting aircraft, use of delay operating chaff (DO C), type of chaff drop (single or programmed), and notes, such as size and intensity, change in wind direction, and other information not shown elsewhere on the program sheet.

d. Planning of all other chaff cues is based on the location of the dispensing aircraft with respect to the two attacking aircraft.

e. The change data for all three targets are entered in sequence with respect to time to insure that each chaff drop and target maneuver occurs as shown on the plotting graph (fig. 4—19).

4-9. Planning a Complex Program With ECM

a. This program illustrates the application of ECM, both electronic jamming and chaff. The program involves two targets, one a bomber transmitting ECM and emitting chaff to form a chaff corridor; the other a fighter without ECM devices that is programmed to attack a Nike Hercules defended area. Initial data for targets Nos. 1 and 2 are taken from tables 4-1 and 4-2 and are entered on the target program sheet (figs. 4-23 and 4-24). ECM and chaff for the program are planned and entered on DA Form 3061— R (figs. 4—25 and 4-26). The program is then plotted (fig. 4—27) as previously explained with the data on DA Form 3061—R included on the plots as shown. It is important that the ECM and chaff cabinet operator receive and execute the ECM and chaff cues at the times indicated on the target program sheet (figs. 4—23 and 4-24).

b. The ECM program sheet is unclassified unless it is programmed for a specific tactical site. The ECM program sheet prepared for a specific tactical site is classified CONFIDENTIAL.

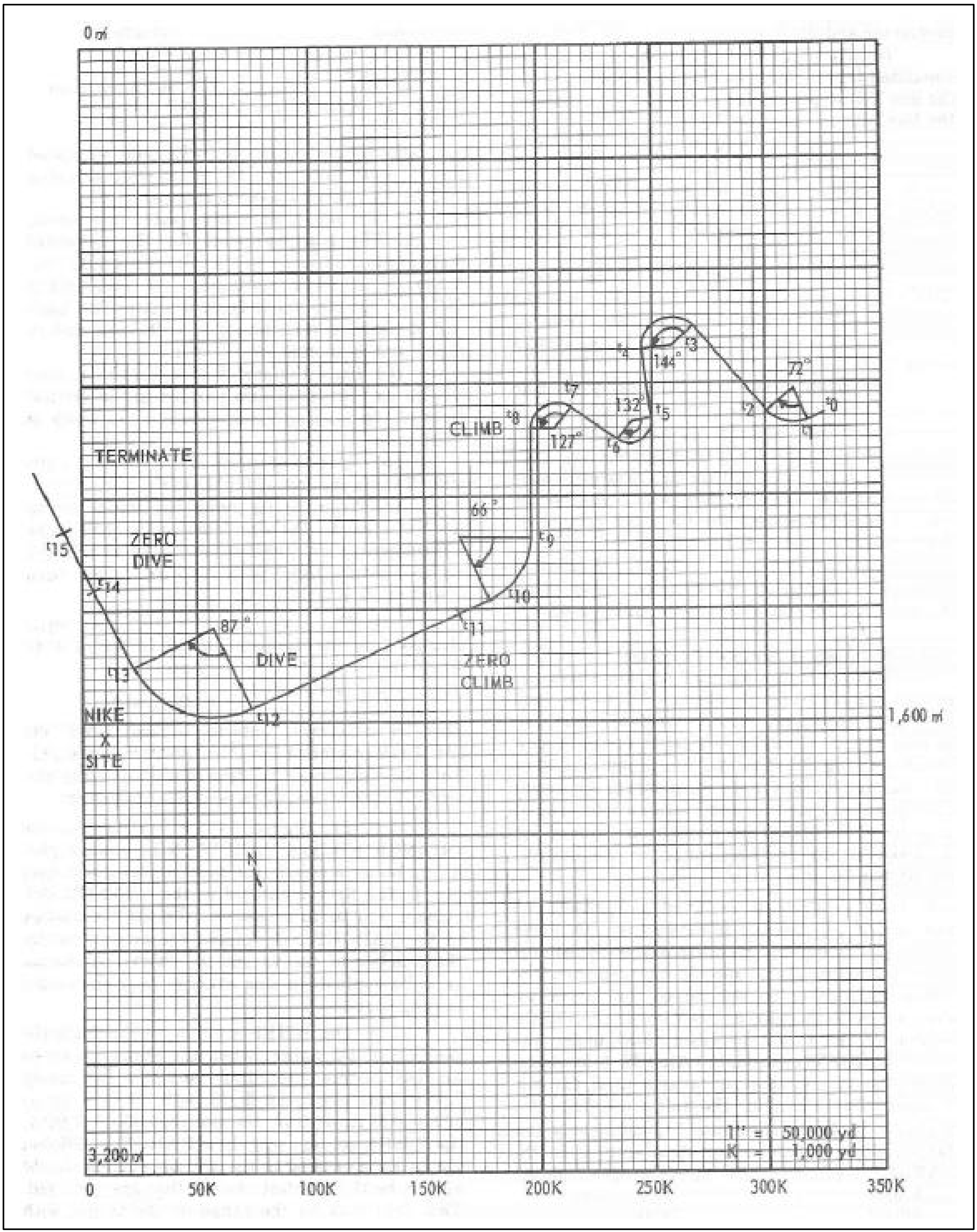


Figure 4 – 13. Plotting graph for Program 1.

TARGET PROGRAM SHEET For use of this form, see FM 44–97; the proponent agency is USCONARC.	PROGRAM NO. 1

CONTROL	INITIAL SETTING					
	TARGET 1	TARGET 2	TARGET 3	TARGET 4	TARGET 5	TARGET 6
Range	315K yd					
Altitude	19,500 ft					
Azimuth	1,190 ₥					
Heading	4,390 ₥					
Target Size	10 m^2					
Aspect Ratio	10 db					
Climb/Dive	Climb 5,000ft/min					
Turn	–					
Air Speed	500 knots					
IFF/SIF	None					

SPECIAL INSTRUCTIONS

The HOLD DESIRED ALTITUDE switch will be in the up position until CHANGE NO. 8.

TIME TO CHANGE	CHANGE NO.	TARGET NO.	WHEN	COMMAND
25"	1	1	Rn = 308,000 yd	Turn right 1.1°/sec
1' 30"	2	1	Hdg = 5,670 ₥	Zero turn
4' 30"	3	1	Az = 1,000 ₥	Turn left 1.25°/sec
6' 20"	4	1	Hdg = 3,110 ₥	Zero turn
8' 08"	5	1	Az = 1,080 ₥	Turn right 1.6°/sec
9'31"	6	1	Hdg = 5,460 ₥	Zero turn

DA FORM 3062–R, 1 Jun 71 Replaces DA Form 3062-R, 1 May 68, which is obsolete.

Figure 4 – 14. DA Form 3062-R, Target Program Sheet (front), Program 1.

TIME TO CHANGE	CHANGE NO.	TARGET NO.	WHEN	COMMAND
10' 50"	7	1	Az = 1, 000 ₥	Turn left 1.25°/sec
12' 33"	8	1	Hdg = 3, 200 ₥	Zero turn Climb to 49 K ft at 5, 000 ft/min
15' 33"	9	1	Az = 1, 190 ₥	Turn right 0.53°/sec
17' 37"	10	1	Hdg = 4, 370 ₥	Zero turn
18' 27"	11	1	Alt = 49, 000 ft	Zero climb
24' 31"	12	1	Rn = 68, 000 yd	Turn right 0.40°/sec; dive to 7K ft. 6, 000 ft/min
28' 09"	13	1	Hdg = 5, 920 ₥	Zero turn
31' 31"	14	1	Alt = 7, 000 ft	Zero dive
31' 57"	15	1	Az = 6, 230 ₥	Terminate mission

Entries on this form are sample entries only.

Figure 4 – 15. DA Form 3062-R, Target Program Sheet (reverse), Program 1.

Target Positions	Target Distances Traveled	Formulas Used	Calculations	Time for Required	Cumulative Time
$t_0 - t_1$	7,000 yd	$t = \frac{1.8R}{V_R}$	$\frac{(1.8)(7,000)}{500} =$	25 sec	
$t_1 - t_2$	18,500 yd	$t = \frac{\text{degrees of turn}}{\text{turn rate}}$	$\frac{72^\circ}{1.1^\circ/\text{sec}} =$	65 sec	1'30"
$t_2 - t_3$	50,000 yd	$t = \frac{1.8R}{V_R}$	$(1.8)(50,000) =$	180 sec	4'30"
$t_3 - t_4$	30,500 yd	$t = \frac{\text{degrees of turn}}{\text{turn rate}}$	$\frac{144^\circ}{1.3^\circ/\text{sec}} =$	110 sec	6'20"
$t_4 - t_5$	30,000 yd	$t = \frac{1.8R}{V_R}$	$\frac{(1.8)(30,000)}{500} =$	108 sec	8'08"
$t_5 - t_6$	23,400 yd	$t = \frac{\text{degrees of turn}}{\text{turn rate}}$	$\frac{132^\circ}{1.6^\circ/\text{sec}} =$	83 sec	9'31"
$t_6 - t_7$	22,000 yd	$t = \frac{1.8R}{V_R}$	$\frac{(1.8)(22,000)}{500} =$	79 sec	10'50"
$t_7 - t_8$	28,000 yd	$t = \frac{\text{degrees of turn}}{\text{turn rate}}$	$\frac{127^\circ}{1.25^\circ/\text{sec}} =$	102 sec	12'33"
$t_8 - t_9$	50,000 yd	$t = \frac{1.8R}{V_R}$	$\frac{(1.8)(50,000)}{500} =$	180 sec	15'33"
$t_9 - t_{10}$	34,500 yd	$t = \frac{\text{degrees of turn}}{\text{turn rate}}$	$\frac{66^\circ}{0.53^\circ/\text{sec}} =$	124 sec	17'37"
$t_{10} - t_{11}$	14,000 yd	$t = \frac{1.8R}{V_R}$	$\frac{(1.8)(14,00)}{500} =$	50 sec	18'27"
$t_8 - t_{11}$	98,000 yd	$t = \frac{60H}{V_H \text{ (climb velocity)(ft/min)}}$	$\frac{(60)(29,500)}{5,000} =$	354 sec or 12'33" + 5'54"	18'27"
$t_{11} - t_{12}$	101,000 yd	$t = \frac{1.8R}{V_R}$	$\frac{(1.8)(101,000)}{500} =$	254 sec	24'31"
$t_{12} - t_{13}$	72,500 yd	$t = \frac{\text{degrees of turn}}{\text{turn rate}}$	$\frac{87^\circ}{0.40^\circ/\text{sec}} =$	218 sec	28'09"
$t_{13} - t_{14}$	39,600 yd	$t = \frac{1.8R}{V_R}$	$\frac{(1.8)(39,000)}{500} =$	142 sec	31'31"
$t_{12} - t_{14}$	116,500 yd	$t = \frac{60H}{V_H \text{ (dive velocity(ft/min)}}$	$\frac{42,000}{6,000} =$	420 sec or 24'31" + 7'	31'31"
$t_{14} - t_{15}$	30,000 yd	$t = \frac{1.8R}{V_R}$	$\frac{(1.8)(30,000)}{500} =$	108 sec	33'19"

Table 4 – 6. Data and Calculations for Program 1.

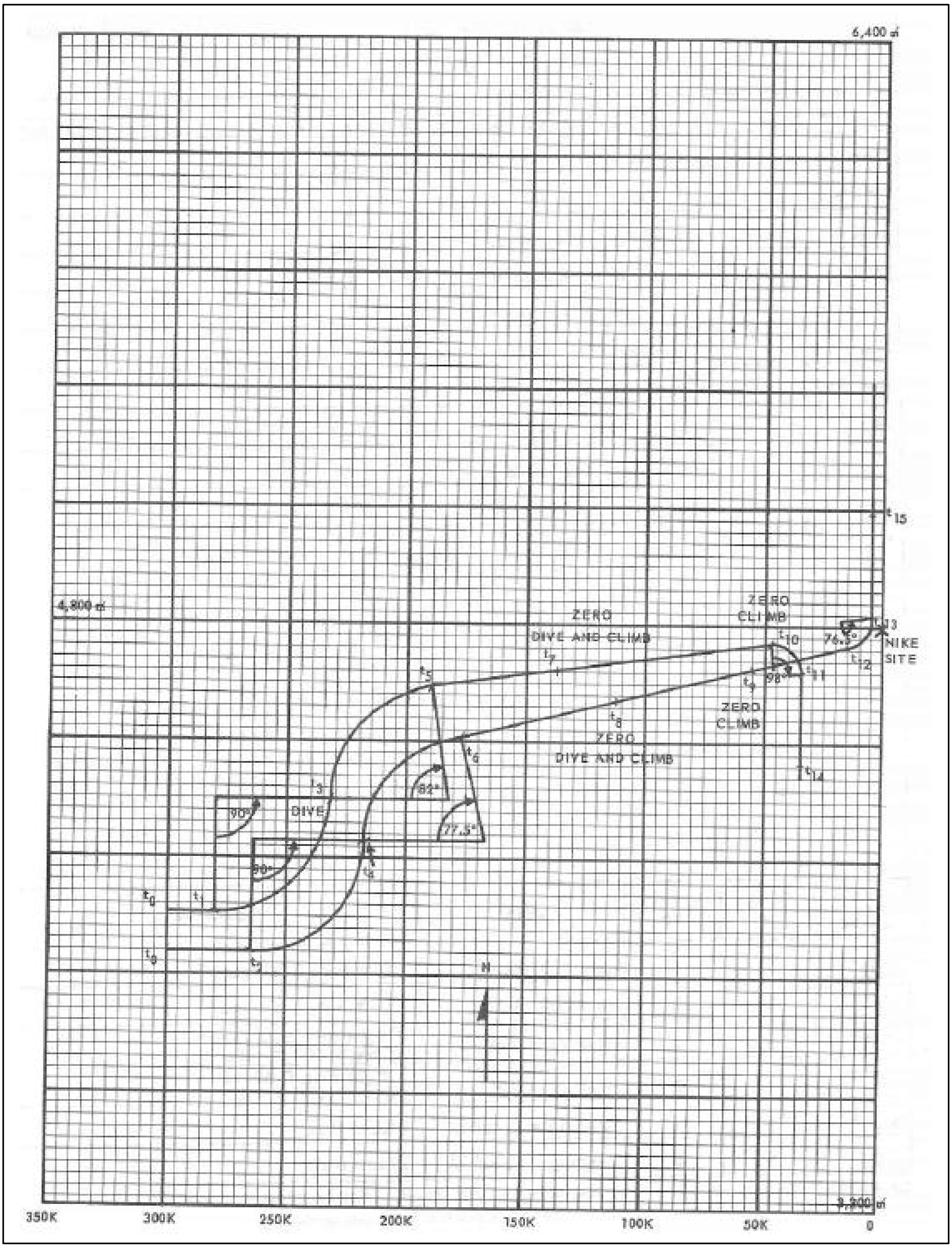


Figure 4 – 16, Plotting graph for Program 2.

TARGET PROGRAM SHEET For use of this form, see FM 44–97; the proponent agency is USCONARC.	PROGRAM NO. 2

CONTROL	INITIAL SETTING					
	TARGET 1	TARGET 2	TARGET 3	TARGET 4	TARGET 5	TARGET 6
Range	325,000'yd	330,000 yd				
Altitude	45,000 ft	40,000 ft				
Azimuth	4,400 m̸	4,350 m̸				
Heading	1,600 m̸	1,600 m̸				
Target Size	$1m^2$	$1m^2$				
Aspect Ratio	10db	10db				
Climb/Dive	Dive 6,600 ft/min	Dive 6,600 ft/min				
Turn	——	——				
Air Speed	600 knots	600 knots				
IFF/SIF	BOGUS	BOGUS				

SPECIAL INSTRUCTIONS

TIME TO CHANGE	CHANGE NO.	TARGET NO.	WHEN	COMMAND
1'00"	1	1	Rn = 305,000 yd	Left turn 0.52/sec
1'42"	2	2	Rn = 300,000 yd	Left turn 0.52/sec
3'53"	3	1	Heading = 0 m̸	Right turn 0.52/sec Dive 6,600 ft/min
4'35"	4	2	Heading = 0 m̸	Right turn 0.52/sec Dive 6,600 ft/min
6'31"	5	1	Heading = 1,460 m̸	Zero turn
7'04"	6	2	Heading = 1,360 m̸	Zero turn

DA FORM 3062–R, 1 Jun 71 **Replaces DA Form 3062-R, 1 May 68, which is obsolete.**

Entries on this form are sample entries only.

Figure 4 –17. DA Form 3062-R, Target Program Sheet (front), Program 2.

TIME TO CHANGE	CHANGE NO.	TARGET NO.	WHEN	COMMAND
10'24"	7	1	Alt = 2,000 ft	Zero dive-climb 4500'/min
10'29"	8	2	Alt = 1,000 ft	Zero dive-climb 3000'/min
13'29"	9	2	Alt = 10,000 ft	Zero climb
14'24"	10	1	Alt = 20,000 ft	Zero climb-turn right 1.9°/sec
15'16"	11	1	Heading = 3,200 ₥	Zero turn
15'20"	12	2	Rn = 16,000 yd	Turn left 1.9°/sec
16'00"	13	2	Heading = 0 ₥	Zero turn
17'16"	14	1	Rn = 55,000 yd	Terminate
18'09"	15	2	Rn = 50,000 yd	Terminate

Entries on this form are sample entries only

Figure 4 – 18. DA Form 3062-R, Target Program Sheet (reverse), Program 2.

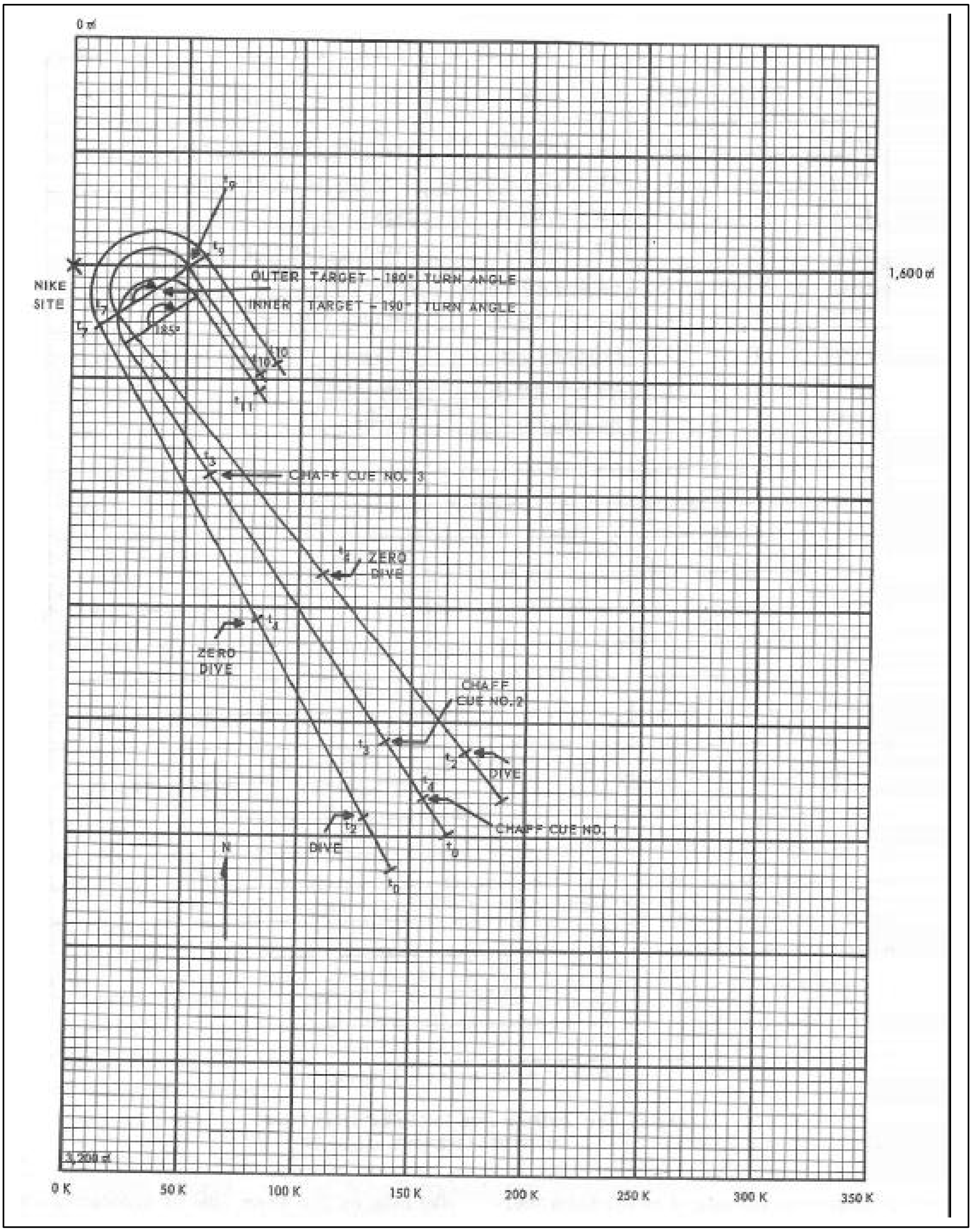


Figure 4 – 19. Plotting graph for Program 3.

TARGET PROGRAM SHEET For use of this form, see FM 44–97; the proponent agency is USCONARC.						PROGRAM NO. 3
CONTROL	INITIAL SETTING					
	TARGET 1	TARGET 2	TARGET 3	TARGET 4	TARGET 5	TARGET 6
Range	300, 000 yd	300, 000 yd	300, 000 yd			
Altitude	38, 000 ft	10, 000 ft	38, 000 ft			
Azimuth	2, 500 ₥	2, 600 ₥	2, 700 ₥			
Heading	5, 700 ₥	5, 800 ₥	5, 900 ₥			
Target Size	1 m^2	5 m^2	1 m^2			
Aspect Ratio	10 db	10 db	10 db			
Climb/Dive	Dive 6, 000 ft/min	-	Dive 6, 000 ft/min			
Turn	-	-	-			
Air Speed	500 knots	600 knots	500 knots			
IFF/SIF	Bogus	Spoof	Bogus			

SPECIAL INSTRUCTIONS

TIME TO CHANGE	CHANGE NO.	TARGET NO.	WHEN	COMMAND
1' 00"	1	2	RN = 280, 000 yd	Chaff cue No. 1.
1' 30"	2	1 & 3	RN = 275, 000 yd	Dive 6, 000 ft/min (6 min)
2' 30"	3	2	RN = 250, 000 yd	Chaff cue No. 2.
7' 30"	4	1 & 3	ALT = 2, 000 ft	Zero dive; increase speed to 900 knots
8' 00"	5	2	RN = 110, 000 yd	Chaff cue No. 3.
11' 30"	6	2	RN = 40, 000 yd	Turn right 1.0°/sec

DA Form 3062–R, 1 Jun 71 Replaces DA Form 3062-R, 1 May 68, which is obsolete.

Entries on this form are sample entries only.

Figure 4 – 20. DA Form 3062-R, Target Program Sheet (front), Program 3.

TIME TO CHANGE	CHANGE NO.	TARGET NO.	WHEN	COMMAND
12' 30"	7	1 & 3	RN = 25, 000 yd	Right turn 1.4°/sec; increase speed target 3 to 1, 000 knots
14' 35"	8	2	Heading = 2, 700 ₥	Execute chaff cue No. 4 Zero turn; increase speed to 900 knots
14' 39"	9	1 & 3	Heading = 2, 700 ₥	Zero turn; decrease speed target 3 to 900 knots
16' 15"	10	2	RN = 109, 000 yd	Terminate
16' 45"	11	1 & 3	RN = Tgt 1 = 98,000 yd RN = Tgt 3 = 101,000 yd	Terminate

Entries on this form are sample entries only.

Figure 4 – 21. DA Form 3062-R, Target Program Sheet (reverse), Program 3.

CHAFF PROGRAM							PROGRAM NO. 3
CUE NO.	RADAR SELECT	TARGET	WIND	LAUNCH	DOC	SINGLE OR PROGRAMED	NOTES
1	D&F	2	50 SW Gusty	Aft	Off	Corridor	Size & Intensity at Max
2	TTR	2	50 Dec Rng	Aft	On	Corridor	–
3	TRR	2	30 Dec Rng	Left	On	Corridor	–
4		Terminate	chaff				

Entries on this form are sample entries only.

Figure 4 – 22. DA Form 3061-R, Electronic Countermeasures (ECM) and Chaff Program Sheet (reverse), Program 3.

TARGET PROGRAM SHEET For use of this form, see FM 44–97; the proponent agency is the USCONARC.	PROGRAM NO. 4

CONTROL	INITIAL SETTING					
	TARGET 1	TARGET 2	TARGET 3	TARGET 4	TARGET 5	TARGET 6
Range	300, 000 yd	300, 000 yd				
Altitude	30, 000 ft	48, 000 ft				
Azimuth	1, 600 m̸	1, 700 m̸				
Heading	4, 800 m̸	4, 900 m̸				
Target Size	10 m^2	1 m^2				
Aspect Ratio	10 db	10 db				
Climb/Dive	-	5, 000 ft/min				
Turn	-	-				
Air Speed	500 knots	800 knots				
IFF/SIF	None	Bogus				

SPECIAL INSTRUCTIONS

Target No. 1. The HOLD DESIRED ALTITUDE (HDA) switch will remain in the up position for the entire flight; ECM will be emitted and chaff dispensed as noted in the COMMAND column.

Target No. 2. This target will appear at Change No. 2.

TIME TO CHANGE	CHANGE NO.	TARGET NO.	WHEN	COMMAND
36"	1	1	Rn = 290, 000 yd	Execute ECM cues No. 1 and No. 2 Execute Chaff cue No. 1
4' 12"	2	1	Rn = 230, 000 yd	Execute ECM cues No. 3 and No. 4 Execute Chaff cue No. 2
7' 12"	3	2	Rn = 220, 000 yd	Dive 6, 000 ft/min to 2, 000 ft
15' 00"	4	1	Rn = 50, 000 yd	Turn right 1.1°/sec Execute ECM cue No. 5
15' 52"	5	2	Alt = 2, 000 ft	Zero dive; turn right 1.7°/sec; climb 5, 000 ft/min to 25, 000 ft
16' 49"	6	1	Az = 1, 150 m̸	Zero turn Execute chaff cue No. 3

DA Form 3062–R, 1 Jun 71 Replaces DA Form 3062-R, 1 May 68, which is obsolete.

Entries on this form are sample entries only.

Figure 4 – 23. DA Form 3062-R, Target Program Sheet (front) Program 4.

TIME TO CHANGE	CHANGE NO.	TARGET NO.	WHEN	COMMAND
16'59"	7	2	Az = 530 m̸	Zero turn
20'29"	8	2	Alt = 25,000 ft	Zero climb - terminate
21'04"	9	1	Rn = 120,000 yd	Execute chaff cue No. 4 Terminate

Entries on this form are sample entries only

Figure 4 – 24. DA Form 3062-R, Target Program Sheet (reverse) Program 4.

ELECTRONIC COUNTERMEASURES (ECM) AND CHAFF PROGRAM SHEET

For use of this form, see FM 44–97; the proponent agency is USCONARC.

ECM PROGRAM

PROGRAM NO. 1

CUE NO.	MODE	POWER LEVEL	ECM GEN	FUNCTION	PRF	SYNC	SPOOF OR RANGE GATE STEAL	JAM ON	NOTES
1	F Barrage	80	A-1	CW	-	F	-	Tgt 1	
2	D Barrage	60	B-1	Noise	-	D	-	Tgt 1	
3	TTR Barrage	60	C-1	Noise	-	Track	-	Tgt 1	
4	TTR Barrage	80	D-1	Noise	-	Track	-	Tgt 1	
5	Terminate	jamming							

DA FORM 3061–R, 1 Jun 71 Replaces DA Form 3061–R, 1 May 68, which is obsolete.

Figure 4 – 25. DA Form 3061-R, Electronic-Countermeasure (ECM) and chaff Program Sheet (front) Program 4.

CHAFF PROGRAM							PROGRAM NO. 1
CUE NO.	RADAR SELECT	TARGET	WIND	LAUNCH	DOC	SINGLE OR PROGRAMED	NOTES
1	F and D	1	25NE	F Forward	-	Corridor	
2	TTR TTR	1	10NE	F Forward	-	Corridor	
3	TTR TTR	1	10NE	R (Rear)	-	Corridor	
4		Cease chaff dispensing					

Entries on this form are sample entries only

Figure 4 – 26. DA Form 3061-R, Electronic Countermeasures (ECM) and Chaff Program Sheet (reverse) Program 4.

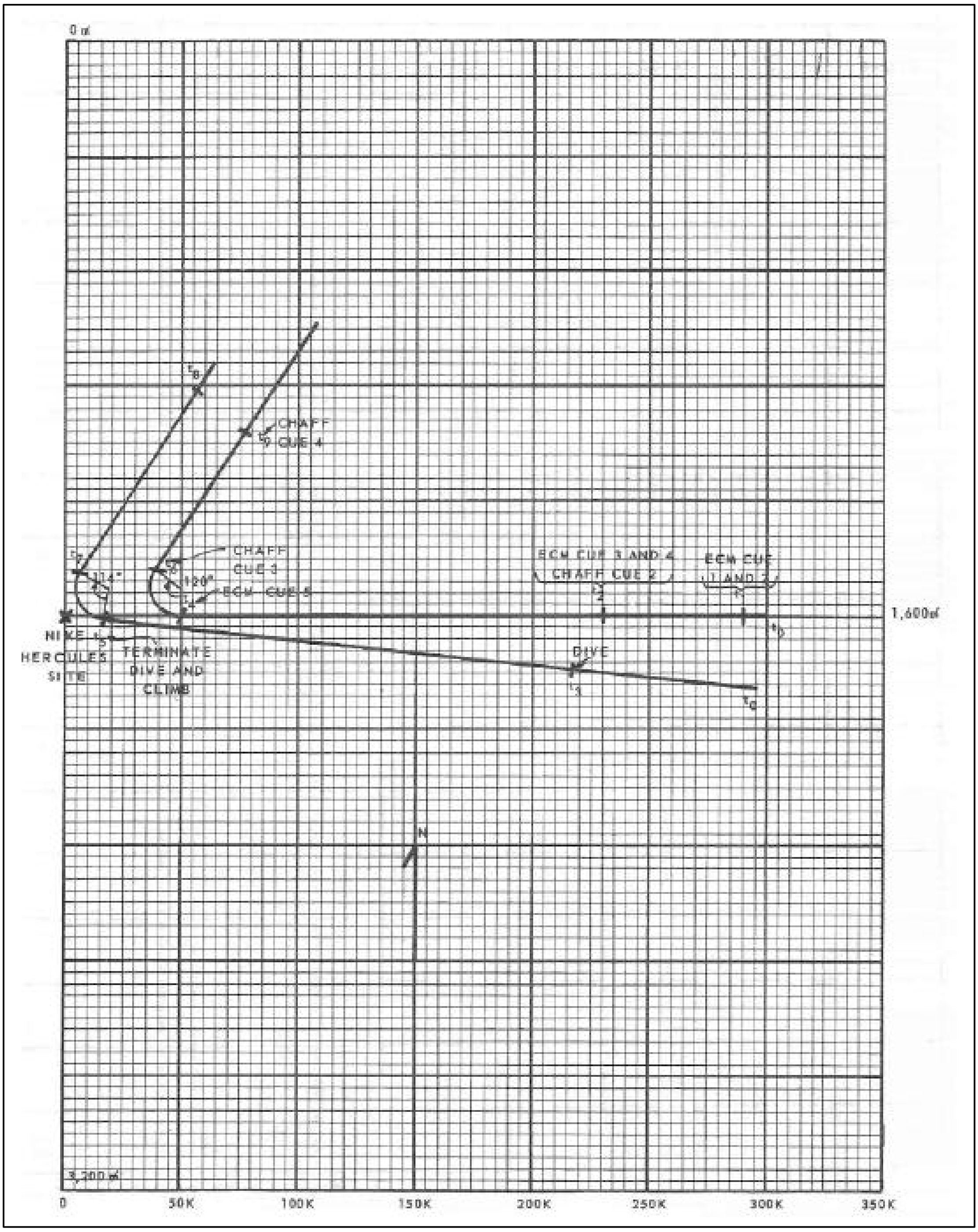


Figure 4 – 27. Plotting graph for ECM program, Program 4.