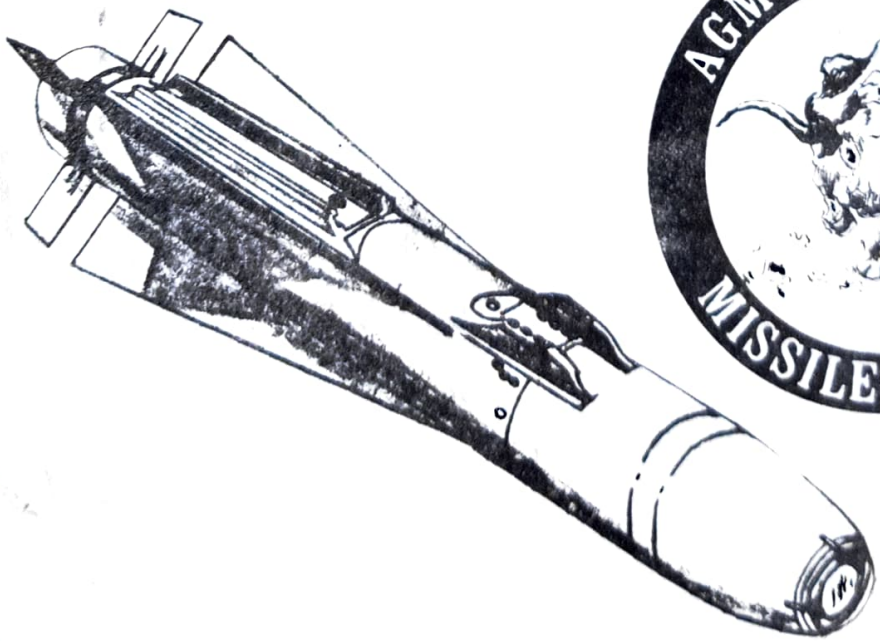
STANK

347 TFW DOW

NEW INFORMATION PAMPHLET #17

AGM-65 MAVERICK



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SECTION I

AGM-65 MAVERICK (GENERAL)

1. The AGM-65 is a very accurate, lightweight, air to ground missile with a high single-round probability of kill against small to medium size tactical targets. The missile is effective against prebriefed targets or targets of opportunity, either moving or stationary, such as armored vehicles, hangarettes, POL areas, SAM sites, bunkers, etc. The high probability of kill is made possible by the combination of a boost-sustained solid fuel rocket motor, and electro-optical (TV) automatic homing guidance system and a lethal forward firing shaped charge and explosive blast warhead. Two clusters, each holding up to three AGM-65's, may be carried on the F-4 aircraft. Since the Maverick is rocket powered, the missile has impressive launch flexibility. To a Soviet tank crew the Maverick is like being trapped in a bread box on the tracks inside a railroad tunnel with a 100 mph freight train bearing down. Whooh! Whooooh! "CLEAR THE TRACKS, IVAN, I'M COMIN' THRU!"

2. References:

   a. FWS Texts TG Weapons Vol I (C), Vol II (S), Vol III (U) (See NIP #16)

   b. TAB 76-4 (S)

   c. TO 1F-4E-34-1-1

   d. TO 1F-4E-34-1-1-1 (C)

   e. TO 1F-4E-1

   f. AFM 3-1 (S)

   g. TACM 3-1 (S)

   h. MAFBR 51-1, Attachment 3, Section E, 347TFW Maverick Training Program

   I. Maverick Operations Supplement by Hughes Aircraft Company

   j. Air Force System Command, Security Classification Guide, AGM-65 Missile System (Maverick)

You will not be "spoon fed" during your Maverick upgrade. The responsibility for getting into the books lies squarely on each aircrewmember's shoulders. You must understand the system before you fly it. Consult MAFBR 51-1 for the 347TFW Maverick Training Program. You must be completely familiar with FWS Text TG Weapons, Vol I (C). Questions surrounding security classification can be answered by consulting Ref. j (above).

3. Physical Characteristics:

Body Diameter	12 inches
Wing Span	28.5 inches
Wing Arrangement	Cruciform Delta
Length	97.7 inches
Weight	463 lbs
Warhead Weight	125 lbs
Kill Mechanism	Shaped Charge

4. Airplane Loading (Stations 2 and 8).

   a. Inboard pylon and LAU 88/A Launcher (See figure 1):

LAU-88/A LAUNCHER

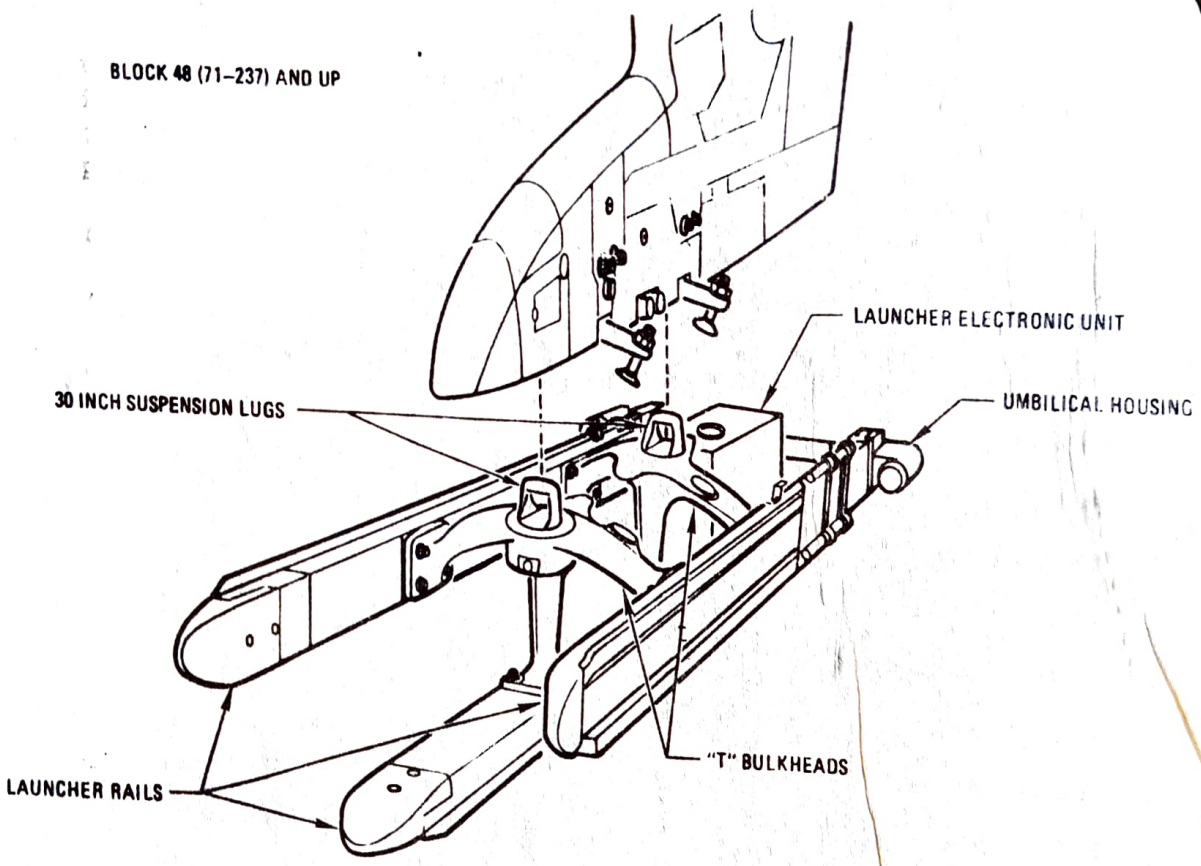


Figure 1

The jettisonable, LAU-88/A launcher (figure 1) provides a mechanical and electrical means of carrying and launching three AGM-65 missiles. The launcher is mounted on the inboard armament pylon by means of standard lugs spaced 30 inches apart. The launcher consists of three track-rail assemblies attached to a central structure which contains the launcher electronics unit (LEU). The electronics unit provides the electrical interface between the aircraft and the missiles, and controls the launch and jettison sequence. The missiles are attached to the rails by two suspension assemblies and are held in place by a shear pin. Missile launch occurs after the rocket motor thrust has reached the required level to shear the pin.

(1) Weight per station 740 lbs

(2) Drag per station 13.7

(3) Stability index number 21.5

b. AGM-65 Missile:

(1) Weight per store 463 lbs

(2) Drag per store 2.8

(3) Unit stability number

(a) 17.6 single mounted

(b) 23.5 cluster mounted

c. Carriage:

(1) Airspeed - Aircraft Limits

(2) +6.0 to -3.0 G's sym.

(3) +4.8 to 0.0 G's unsym.

d. Jettison - 175-550 knots.

e. Remarks (Ref. 1F-4E-1):

(1) If gross weight is over 37,500 lbs refer to Acceleration Limitations Chart.

(2) Speed brakes must be retracted when launching from stations 2 and 8.

(3) Shoulder-mounted AIM-9 missiles are not cleared for carriage with AGM-65 missiles.

(4) CG position could become critical.

(5) A mixed load of AGM-65 missiles and TGM-65 trainers is not authorized.

(6) No other TGM-65 will be installed on the same launcher when one is equipped with recorder.

(7) All partial load configurations are authorized without restrictions for AGM-65 and TGM-65.

5. Ground Checks:

a. Don't do ground checks with live missiles.

b. For TGM's - Set your switches after start to get the Maverick seeker head gyro up to speed (3 minutes) prior to attempting ground checks. Set your switches for Maverick video.

(1) Take slew of the seeker head - move it around.

(2) Check for good lock-on with black-on-white and white-on-black contrast settings

(3) Check that the TGM will cage.

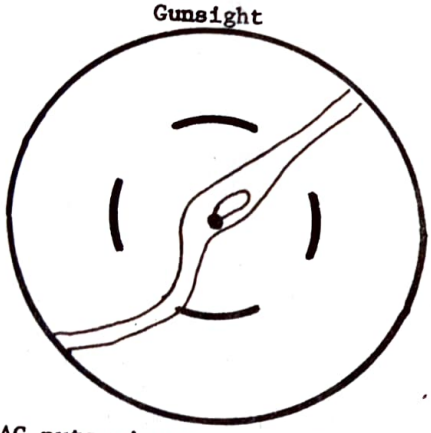
NOTE: You are expending film while performing the check on recorder equipped TGM's, so do the check quickly.

CAUTION: Cage the TGM before rounding sharp corners if performing the check while taxiing.

6. Airborne Boresight (see also page 32):

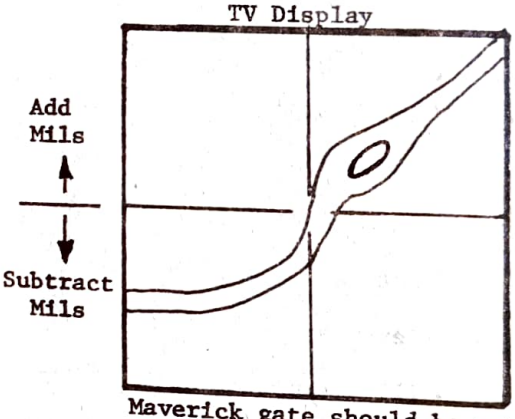
45 mils
A/G
Direct
TV
Station select
Blow dome cover
Video present both cockpits

Gunsight



AC puts pipper on prominent reference point

TV Display



Maverick gate should be on same reference if correctly boresighted.
--WSO would say, "Add 5 mils and aim 5 mils right".

7. Local flying areas best suited for Maverick training on tactical targets include:

a. MOA-2 (low altitude) is one of our best potential Maverick training areas. It is close to Moody, has many types of targets, and has acceptable size for tactics.

b. Eglin Range C-52 - good availability of tactical targets. Good for tactics.

c. Low Level routes (targets of opportunity).

d. Eglin Range C-62 has some tactical targets.

e. Pinecastle has some tactical targets.

8. Poinsett, Lake George, Rodman, and Stevens Lake lack tactical targets and are too small for multi-ship tactics.

9. Film assessment charts for Maverick are available in your Squadron Weapons Shop.

10. You should consider the use of cassette tape recorders during EO upgrade missions. Tapes are a valuable aid in debriefing the mission and in critiquing crew coordination.

SECTION II

MAVERICK TRAINING PROGRAM

The following Maverick Mission Outlines are included for your convenience (see also MAFBR 51-1, Attachment 3, Section E). The scenarios are general in nature. Units should continue to develop and refine scenarios in order to improve training.

1. EO-1: Maverick Proficiency.

   a. Aircraft requirements: One (may be flown as two ship).

   b. EO Instructor requirements: One in each aircraft.

   c. Objectives: System Orientation and Operation.

      (1) Weapon preflight and film procedures.

      (2) Weapon system ground checkout.

      (3) Weapon boresight, employment, switchology, crew coordination, tracking and lock-on techniques.

      (4) Practice lock-on from both cockpits.

      (5) Lock-on with each contrast setting.

      (6) Mil/target size relationship.

      (7) Effects of sun angles and shadow development.

      (8) Pop-up attacks.

         (a) Maximum range launches.

         (b) Minimum time lock-on (4-6 sec from tracking to pickle).

         (c) Multiple launch passes.

   d. Mission Planning: Mission planning for EO-1 should center on thorough familiarization with the TGM-65, preflight, switchology, and crew coordination.

   e. Briefing: Maverick students will brief missile preflight, boresight and switchology. EO Instructors will brief systems operation, system techniques, and crew coordination procedures.

   f. Mission Overview: After the airborne boresight, the range/area work should begin with "Kiddy Car" and "Snake" patterns to perform varied low angle and level deliveries. Initial passes should have considerable time on final to allow the upgrader practice in tracking, locking-on, launching, and crew coordination. Demonstrate lock-ons on large and small targets and with improper contrast settings. As the upgrader's proficiency increases, the attacks should be made at higher airspeeds and with less time on final. Attack headings will be random in order to demonstrate sun angle, target angle and shadow effects on lock-ons. The mission will also demonstrate maximum range launches. The crewmember will practice minimum time lock-ons (4-6 sec tracking to pickle). Multiple launch passes and pop-up attacks will be practiced.

g. Documentation:

(1) EO Instructor completes Maverick Grade Sheet.

(2) Instructor and student review and assess film.

h. Safety: ATTACKS AGAINST OFF-RANGE TARGETS OR NON-TARGET STRUCTURES ON RANGE WILL NOT BE MADE WHEN THE M-61 CANNON HAS BEEN ARMED!!

2. EO-2: Maverick Proficiency and Tactics Orientation.

a. Aircraft requirements: Two

b. EO Instructor requirements: One EOI in the flight if one of the crewmembers in the other aircraft is Maverick qualified. One EOI in each aircraft if upgraders fill the other cockpits.

c. Objectives: System proficiency and tactics orientation.

(1) Maverick proficiency. Demonstrates proficiency and knowledge in:

(a) Weapon preflight.

(b) Weapon system boresight.

(c) Crew coordination, tracking, and lock-on.

(d) Pilot lock-on from front cockpit.

(2) Tactics Orientation.

(a) Maverick planning considerations.

(b) Low altitude tactical formation and mutual support responsibilities.

(c) Limited communication maneuvering and tactics.

(d) Preplanned target attacks (Hi Threat).

(e) Crew coordination/visual look-out/mutual support procedures and techniques for the high threat close air support environment.

d. Mission Planning: Extensive planning is required for this mission. Pick several targets and plan low-level tactics and pop-up deliveries. Use limited comm tactics. Consider the effect of the sun on dive-angle and run-in. Pops should be only high enough to establish line of sight. The instructor should help the students plan the mission. Some suggestions for the attacks are the tactical split, the line abreast attack and the B'NAI attack.

e. Briefing: Students will brief as in EO-1 and may aid in the briefing of Maverick tactics portions of the mission. The instructor will designate specific briefing items to upgraders. Random attack considerations will be briefed if random attacks are to be flown.

f. Mission Overview:

(1) Low level, limited comm ingress to a minimum exposure pop-up attack against tactical target(s) in a high threat environment. Exit the target area low level, re-establishing mutual support/visual lookout. Continue the mission with different types of preplanned attacks on different targets and attempt some multiple launch attacks.

(2) The mission may end with random Maverick attacks on targets of opportunity utilizing Maverick tactics. The EO Instructor will insure that the students are aware of problems associated with bad or dangerous attacks.

g. Documentation:

(1) EO Instructor completes Maverick Grade Sheet.

(2) Instructor and student review and assess film.

h. Safety: ATTACKS AGAINST OFF-RANGE TARGETS OR NON-TARGET STRUCTURES ON RANGE WILL NOT BE MADE WHEN THE M-61 CANNON HAS BEEN ARMED!!

3. EO-3:

a. Aircraft requirements: Minimum of two.

b. EO Instructor requirements: One EOI in the flight.

c. Objectives: System and tactics proficiency.

(1) Students will demonstrate proficiency in the system by briefing the system preflight, switchology, system operation, crew coordination, and the first attack.

(2) Students will plan and lead an attack during a tactical Maverick mission in a high threat environment. Students will demonstrate proficiency in Maverick tactics planning.

(3) After the preplanned attacks, random attacks will be made on targets of opportunity.

d. Mission Planning: Students will plan a tactical delivery on a predetermined target. A high threat, comm-out scenario will be simulated.

e. Briefing: Students will brief the system and the first attack. The instructor will brief considerations for attacking targets of opportunity in a hi-threat environment. Targets of opportunity require good crew coordination to insure that the correct target is locked-on. The instructor should also cover techniques for attacks on roads, railroads, and bridges.

f. Mission Details: Fly a comm-out, low level ingress to the preplanned attack in a simulated high threat environment. Then work on targets of opportunity in a hi-threat environment. Acceptable targets may be found along low level routes. If FAC or SCAR is available, obtain FAC/SCAR-directed pop-up attacks. Working with a FAC or SCAR will require good pre-mission coordination to insure the FAC is able to properly plan a Maverick attack. The EO Instructor will insure that the students are aware of problems associated with bad or dangerous attacks.

g. Documentation:

(1) EO Instructor completes Maverick Grade Sheet.

(2) Instructor and student review and assess film.

h. Safety: ATTACKS AGAINST OFF-RANGE TARGETS OR NON-TARGET STRUCTURES ON RANGE WILL NOT BE MADE WHEN THE M-61 CANNON HAS BEEN ARMED!!

4. Continuation Training:

a. Aircraft requirements: Two or more aircraft.

b. Aircrew requirements: Qualified aircrews.

c. Objectives: System and tactics proficiency.

(1) Demonstrate proficiency in the system.

(2) Practice low altitude, limited comm tactics, in a simulated high threat environment.

(3) Work with a FAC or SCAR if available.

(4) Plan Maverick deliveries on predetermined targets.

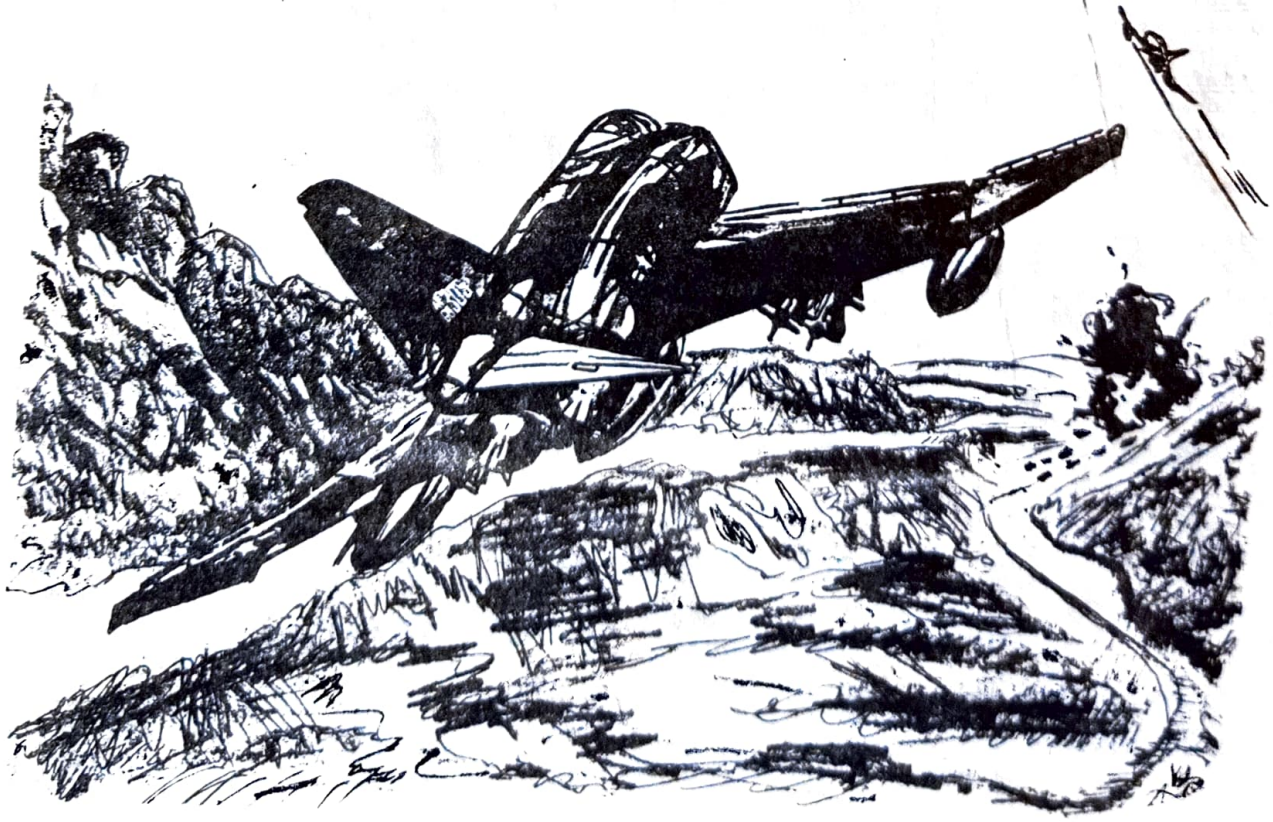
(5) Practice attacking targets of opportunity using Armed Reconnaissance tactics.

d. Mission Planning: Plan tactical deliveries on known targets in a high threat environment and/or plan to work with a FAC or SCAR, and/or plan for employment on an Armed Reconnaissance mission.

e. Briefing: Emphasize system capabilities and limitations as related to the planned mission. Thoroughly discuss tactical considerations, delivery techniques, crew coordination and flight responsibilities/mutual support. Emphasize low altitude safety and abort parameters.

f. Mission: An EO-3 profile or SAT profile will be flown.

5. Effectiveness Criteria: A Maverick mission (IQT and CT) is effective when the objectives of the mission have been achieved and a fully operational Maverick trainer (TGM) is loaded on the aircraft.



SECTION III

AGM-65 MISSILE

PREFLIGHT

INTERIOR INSPECTION (BEFORE ELECTRICAL POWER)

1. Weapon selector - B or C (out of TV)

CAUTION

To prevent gyro damage, do not apply power to the AGM-65 weapon during ground operations.

INFLIGHT

1. Optical sight - SET
   a. Sight mode - A/G
   b. Reticle depression - 45 MILS

NOTE

The 45 milliradian setting is an average setting which will vary with individual aircraft.

2. Weapon selector knob - TV (3-min timer start)

NOTE

Refer to TO 1F-4E-34-1-1-1 for AGM-65 missile power ON limitations.

3. Delivery mode - DIRECT
4. Station select button(s) - DEPRESS
   a. Station green light(s) - ON
5. (WSO) DSCG scope power - TV (or ON as desired)
6. (WSO) Video select button - WEAPON
7. (P) Weapon video - ON
   a. Block 31 thru 48 (71-236), scope display switch (pedestal panel) - TV

NOTE

If a missile check is not necessary, proceed to missile launch.

MISSILE CHECK (IF NECESSARY)

1. Master arm switch - ARM, then SAFE

   a. Check station ARM light(s) ON (momentarily) indicating 3-minute timer complete.

CAUTION

Failure to allow 3 minutes for the seeker head gyro to spin up to operating speed (indicated by amber station ARM light) may result in severe damage to the guidance unit.

NOTE

When both left and right inboard stations are selected, the RI ARM light illuminates the instant master arm switch is positioned to ARM and the LI ARM light comes on after the 3-minute time out. Both RI and LI missiles are timing out simultaneously when both are selected.

To launch the RI station, the LI station must be empty or deselected.

2. (P or WSO) Trigger switch - SQUEEZE and RELEASE

   a. Video - ON (missile centerline)

   b. Bright/contrast controls - SET

   c. Tracking gate aligned (approx) with sight pipper

   d. Perform any additional sight adjustment

3. (P) AGM slew/lockon - CHECK

   a. Contrast switch (WHT/BLK) - SET (for random tgt)

   b. ARR button - DEPRESS and HOLD

   c. Move seeker head control and observe seeker slew in proper directions; position gate on target

   d. ARR button - RELEASE (lockon)

   e. Tracking gate - STEADY (good lockon)

NOTE

The WSO may perform step 3 using action switch HA, the antenna hand control, and the trigger. If a malfunction exists, or if the pilot wishes to check the next missile(s) in sequence, select MSL REJ and perform steps 1 through 3. Do not reject or deselect a missile if its sun shutter is closed unless it is certain that closure was due to malfunction.

4. Trigger switch - SQUEEZE and RELEASE

   a. Missile seeker - MISSILE CENTERLINE

5. (P) Station select button (if necessary) - OFF then ON

   a. Video - OFF

   b. Seeker returns to mechanical cage

   c. Sequence returns to first missile

MISSILE LAUNCH

1. Master arm switch - ARM

   a. Head-up ARM light - ON

   b. Station ARM light - ON (3-min timer)

2. Trigger - SQUEEZE and RELEASE

   a. Missile video/tracking gate - ON

3. Contrast switch - SET

   Observe target and select proper track contrast

4. Position pipper on target/aimpoint

5. Locate target in video display and initiate lockon

   a. (P) Front cockpit lockon procedure:

      (1) ARR button - DEPRESS and HOLD

      (2) Use seeker control to position target in tracking gate

      (3) ARR button - RELEASE

      (4) Verify lockon

   b. (WSO) Rear cockpit lockon procedure:

      (1) Action switch - HA

      (2) Use antenna hand control and position target in tracking gate

      (3) Action switch - RELEASE or FULL ACTION

      (4) Verify lockon

6. (P or WSO) Bomb button - DEPRESS and HOLD

   a. Verify release - WPN VIDEO BLANK

7. For next missile, repeat steps 2 through 6

AFTER LAUNCH (WITH MISSILES REMAINING)

1. AGM station select button - OFF

2. Weapon selector - B or C (out of TV)

   a. Allow an approx. 5-min gyro run-down time before landing

AGM-65A/B DELIVERY

The AGM-65 missile is a TV-guided, rocket-propelled air-to-surface missile. Primary targets are tanks, armored personnel carriers, field fortifications, reinforced buildings etc., which the aircrew must visually acquire before proceeding with missile launch preparations. In all cases, missile video acquisition must be accomplished prior to missile launch. With all cockpit controls properly set, the television display (scope video in both cockpits) shows a TV picture which is provided by the television camera in the weapons.

The missiles are suspended from the LAU-88/A launcher, which is suspended directly from the MAU-12 rack in the inboard armament pylon.

The AGM-65 missile system becomes available in block 31 thru 48 (71-236) after MOD 2851 is accomplished. These aircraft are equipped with the Digital Scan Converter Group (DSCG) which is the same radar scope system installed in block 60 and up aircraft. The seeker head control handle is installed on the engine control panel and a three position target contrast switch is provided outboard of the seeker head control. A three position scope select switch is provided on the pedestal panel (figure 2). In the rear cockpit the target contrast switch is installed under the main instrument panel along with gun camera switch (figure 3).

With the DSCG components, the display of electro-optical (EO) weapon and radar video displays are more adequately presented to the aircrew. With more than one sensor system in operation, the displays are selectable and each crewmember may select the desired display. For an EO (TV) guided weapon, the radar set may be in any operational mode; the weapon video is transmitted directly to the radar scopes. The TV position on the radar set control is used only with the MSDG aircraft during BIT checks.

With all controls properly set, depressing and releasing either trigger switch removes (jettisons) the protective dome cover on the first missile, mechanically uncages the seeker head, and electrically aligns the seeker head to the radar boresight line (RBL). Also, the tracking gates (crosshairs) appear on the video display. With the seeker aligned, the TV display should approximately coincide with the view which appears in optical sight. (The optical sight is manually depressed 45 mils to align with RBL. On individual aircraft, the sight depression angle will probably vary.) The aircrew can separately adjust the TV display on each of the radar scopes for contrast and brightness. The pilot may select the tracking mode so that the seeker tracks a black-on-white target, a white-on-black target, or the switch may be left in the automatic mode. This effects the target tracking characteristics of the missile, but has no effect on the video display. After a sufficient check of the video is performed, the missile can be returned to a mechanical cage condition by de-selecting and then re-selecting the station; the scope goes blank and remains in the condition until the trigger is actuated again.

Operating in a DIRECT delivery mode the pilot flys the aircraft to place the optical sight pipper on target. When the target is identified on the scope video, the pilot depresses and holds the ARR button. Depressing the ARR button enables the seeker control, (the AGM-12 control handle) on the left console. Using the seeker control, the pilot positions the video so that the target image is centered in the gate crosshairs. If the target image is too small, the pilot must close with the target. With the target centered in the crosshairs, the pilot initiates lockon by releasing the ARR button. The instant

that lockon is accomplished may not be discernible. However, lockon is determined by observing how the target remains centered in the gate crosshairs, and by observing the gate area expand as range decreases. The WSO has the same control of the seeker head by initiating half action and using the antenna hand control to center the target in the gate. Lockon is accomplished by releasing the half action, or by initiating full action.

When target lockon is confirmed, the missile is launched by depressing either bomb button. An approximate 0.5-second time delay occurs between the bomb button signal and missile launch. During this time the missile internal power supply is activated and the rocket motor is ignited. After the missile is launched, the radar scope goes blank and the next missile on that station is selected.

LAUNCH SEQUENCE

With both stations selected, all missiles on the left station are fired (outboard to inboard) before the launch sequence is transferred to the right station. To transfer the release signal to the right station while a missile is present on the left station, the left inboard station must be deselected. The missile reject (manual sequence) switch on the pedestal may be used to deselect a missile and select the next missile on the release sequence on that station. This switch, however, does not sequence from one wing station to another. In order to reselect a missile after having been deselected through the sequence switch, the station select button must be cycled.

It is possible, though contrary to proper procedure, for the aircrew to launch an AGM-65 before the ready light (amber station ARM light) comes ON since the light circuit is a timing device only and not a launch interlock. Activating the missile (pressing the trigger switch) prior to completion of gyro warmup may result in severe damage to the guidance unit. If the gyro is not up to speed on activation, the display will probably jiggle and target identification may be difficult. This situation is precluded by ensuring that the amber station ARM light is ON before activating the missile, assuming no malfunction of the guidance or video systems.

AGM-65A CONTROLS

The controls necessary for missile prelaunch and launch operations are shown in figures 2 and 3. As soon as the aircraft bus system is energized, environmental power is available to vidicon heaters in all missiles aboard. The environmental conditioning is continuous with no control action necessary from the cockpit. The missiles should remain in this state for at least 10 minutes before beginning any missile control functions.

Delivery Mode Selector

Only the DIRECT release mode is used for the AGM-65 missile. This places the bomb button directly in the release relay network, and closes a portion of the station ARM (amber) light circuit.

Weapon Selector Knob

The TV position of the weapon selector applies power to the station select circuits and places the trigger switch in the TV weapon network. To get trigger transfer, the CAGE signal must not be present. Weapon select voltage is also applied to the TGT/MSL reject switch. In each launcher, the missile gyro power supplies are energized which initiates seeker gyro run-up in all missiles aboard. A 3 minute period must be observed for gyro run-up before video and uncaging signals are applied. A timer in the launcher signals the completion of the 3 minute period by closing the station select ARM (amber) light circuit.

CAUTION

Weapon seeker gyro damage can occur if the weapon selector TV position is selected during ground operation.

Failure to allow 3 minutes for the seeker head gyro to spin up to operating speed (indicated by amber station ARM light) may result in severe damage to the guidance unit.

NOTE

Refer to TO 1F-4E-34-1-1-1 for AGM-65 missile power ON time limit requirements.

Station Select Buttons

The station select buttons (LI or RI) energize the station select relays for the missile station to be fired. The station green light illuminates immediately as the button is depressed. Actuating either trigger switch will now provide weapon video. With DIRECT selected, the pilot may momentarily select master ARM and observe the station ARM light illumination indicating the 3-minute timer has completed. Even though the missile video may be energized through the trigger with master arm in SAFE, the ARM position should be selected momentarily to check the timer-complete indication of the station ARM light.

Trigger Switch

Prior to depressing the trigger switch, the seeker head is mechanically caged with a protective dome covering the seeker head. With the weapon selected and the station selected, depressing the forward or rear trigger switch removes (jettisons) the protective dome on the seeker head of the first missile in the release sequence, removes mechanical cage, electrically aligns the seeker head to RBL, and energizes the vidicon. As the trigger switch is released, the tracking gate appears on the video and the seeker head remains aligned along RBL.

TV Display

In block 31 thru 48 (71-236) after MOD 2851, the TV display is energized by placing the scope display select switch (on the pedestal panel) to TV. The RADAR position is used to select a radar display for viewing and the OFF position deenergizes the front scope. In the rear cockpit, placing the DSCG sensor select switch to TV energizes the TV display. WEAPON must be selected (illuminated) on the Video Select Button in the rear cockpit.

AGM-65 Hangfire

Approximately 1/2 second is required to fire the missile battery and initiate the logic sequence. If the pilot releases the bomb release button earlier (quick pickle), the missile battery will fire but launch will not occur. The missile battery temperature may reach 1000°F.

If the missile battery fires but no rocket motor ignition, allow 15 minutes for the battery to cool before landing. Have wingman check missile.

If missile hangfire occurs (rocket motor ignites or partially ignites), jettison the LAU-88 launcher with the AGM-65 missile attached.

1. Deselect other station

2. Selective jettison knob - STORES

3. Selective jettison button - PUSH TO JETT

If LAU-88 does not separate from the aircraft:

4. External stores emergency release button - PUSH

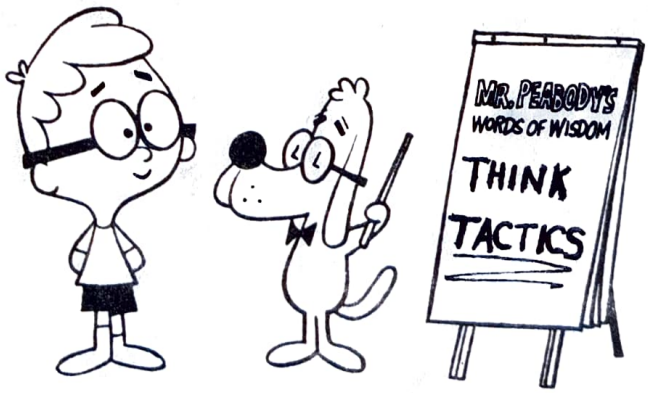
If the LAU-88 does not separate from the aircraft, attempt to jettison through the DCU-94/A.

AGM-65 Misfire

1. Step to the next missile

NOTE

Do not reselect the bad missile to preclude possible inadvertent launch.



AGM-65A CONTROLS

F-4E-31 (66-284) THRU -48 (71-236)

FRONT COCKPIT

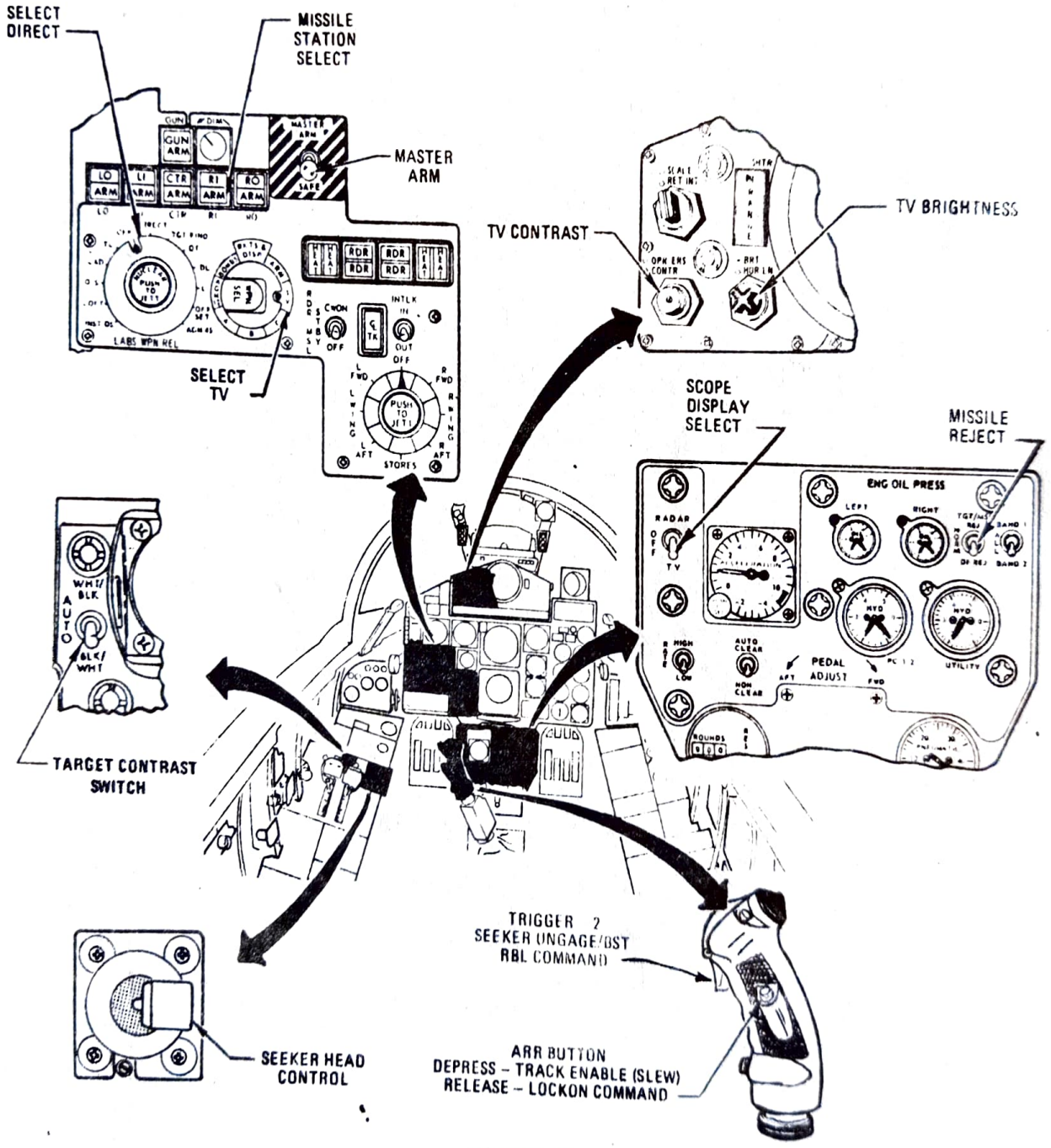


Figure 2

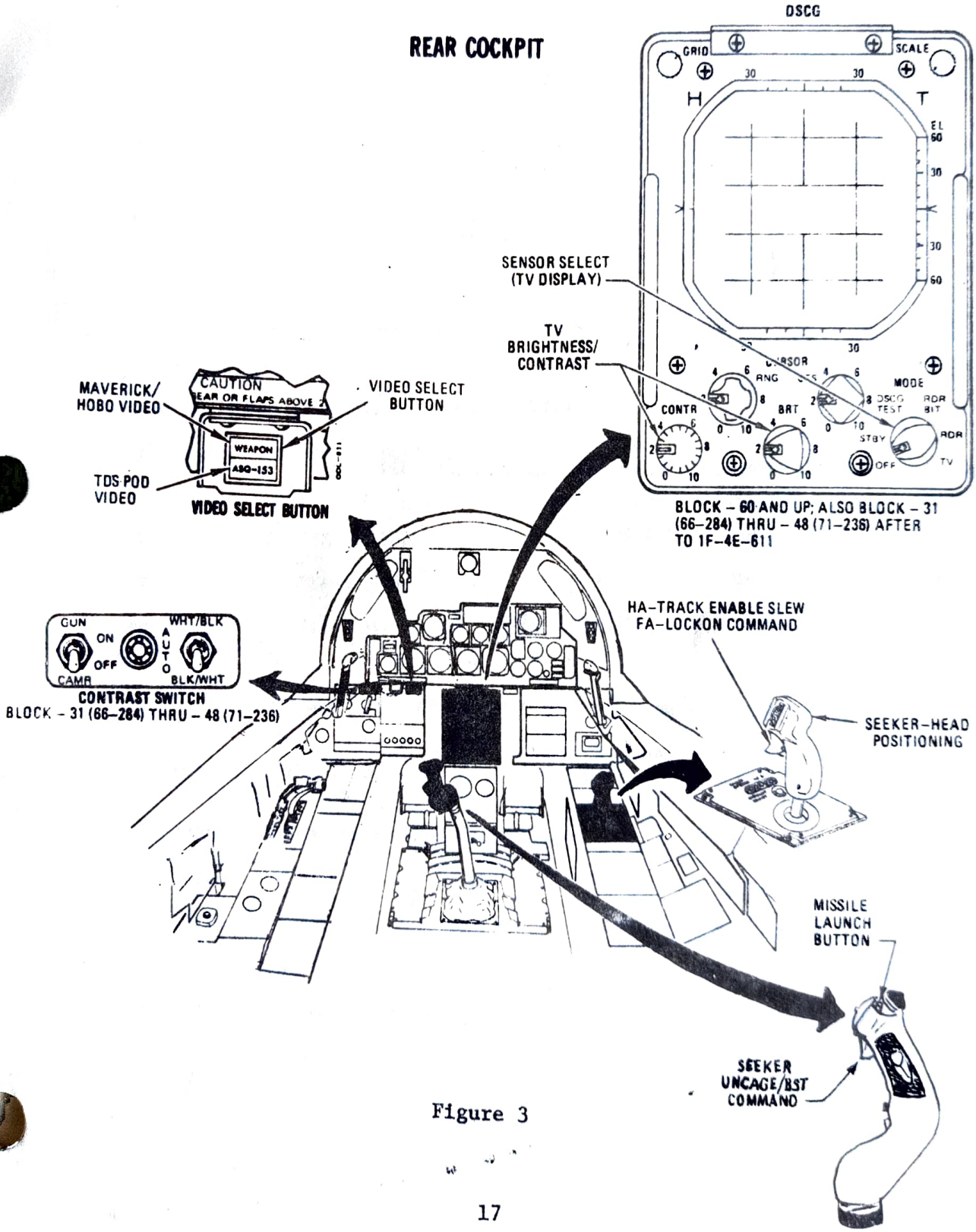

REAR COCKPIT
DSCG
GRID
SCALE
H
T
SENSOR SELECT (TV DISPLAY)
TV BRIGHTNESS/ CONTRAST
MODE
CONTR
BRT
STBY
OFF
TV
BLOCK – 60 AND UP; ALSO BLOCK – 31 (66–284) THRU – 48 (71–236) AFTER TO 1F–4E–611
MAVERICK/ HOBO VIDEO
VIDEO SELECT BUTTON
TDS POD VIDEO
CAUTION
WEAPON
ASQ-153
VIDEO SELECT BUTTON
GUN
ON
OFF
CAMR
WHT/BLK
AUTO
BLK/WHT
CONTRAST SWITCH
BLOCK – 31 (66–284) THRU – 48 (71–236)
HA–TRACK ENABLE SLEW FA–LOCKON COMMAND
SEEKER–HEAD POSITIONING
MISSILE LAUNCH BUTTON
SEEKER UNCAGE/BST COMMAND

Figure 3

SECTION IV

TGM-65 TRAINING MISSILE

PREFLIGHT

INTERIOR INSPECTION (WITH ELECTRICAL POWER)

CAUTION

Do not operate TGM on the ground if the dome cover is installed. Flying glass from jettisoned cover could result in FOD or injury to ground personnel.

Missile Check

1. Optical sight - SET
   a. Sight mode - A/G
   b. Reticle depression - 45 MILS

NOTE

The 45 milliradian setting is an average setting which will vary with individual aircraft.

2. All armament switches - OFF/SAFE
3. Armament safety override - DEPRESS
4. Weapon selector knob - TV (3-min timer start)
5. Delivery mode - DIRECT

   The DIRECT selection is necessary for station ARM light functions.

6. Station select button (TGM station only) - DEPRESS
   a. Station green light - ON

      Select only the TGM station, especially if other munitions are aboard.

7. (WSO) DSCG scope power - TV (or ON as desired)
8. (WSO) Video select button - WEAPON
9. (P) Weapon video - ON
   a. Block 31 thru 48 (71-236), scope display switch (pedestal panel) - TV

10. Master arm switch - ARM, then SAFE

    a. Check TGM station ARM light ON (momentarily) indicating 3-minute timer complete

CAUTION

Failure to allow 3 minutes for the seeker head gyro to spin up to operating speed (indicated by amber station ARM light) may result in severe damage to the guidance unit.

11. (P or WSO) Trigger switch - SQUEEZE and RELEASE

    a. Video - ON (missile centerline)

    b. Bright/contrast controls - SET

    c. Tracking gate aligned (approx) with sight pipper

    d. Perform any additional sight adjustment

    e. TGM recorder is operational; film is expended

12. (P) TGM slew/lockon - CHECK

    a. Contrast switch (WHT/BLK) - SET (for random tgt)

    b. ARR button - DEPRESS and HOLD

    c. Move seeker head control; observe seeker slew in proper directions

    d. ARR button - RELEASE (lockon)

    e. Tracking gate - STEADY (good lockon)

    f. Repeat a thru e with contrast switch in other positions and check good lockon (BLK/WHT, AUTO)

NOTE

The WSO may accomplish step 11 by using the action switch (for ARR functions) and antenna hand control to position the seeker.

13. Trigger switch - SEQUEEZE and RELEASE

    a. TGM seeker - RBL

14. Station select button - OFF

    a. TGM video - OFF

15. Weapon selector - B or C

    a. If taxi operations follow immediately, avoid rapid turns while seeker gyro is running down

16. Delivery mode knob - OFF (if required)

17. (WSO) Armament safety override - RESET (if required)

a. Momentarily pull Arm. Bus Cont. CB on No. 3 panel (zone C9)

CAUTION

The TGM shall not be maintained in the full power mode (electrical alignment, slew, track) in excess of 30 minutes on any single mission, and the sum of the TV mode period (weapon select TV and gyros running) and the full power mode period on any single mission shall not exceed 40 minutes. No single simulated attack (start to stop of camera operation) with the TGM shall be in excess of 3 minutes.

Do not fly within 20° of the sun when the TGM is uncaged. This will prevent vidicon scarring.

INFLIGHT

1. Delivery mode - DIRECT
2. Weapon selector - TV (3-min timer start)
3. TGM station select button - DEPRESS
   a. Station green light - ON
4. Master arm switch - ARM
   a. Station ARM light - ON (3-min timer complete)
   b. Head-up ARM light - ON
5. Trigger - SQUEEZE and RELEASE
   a. Video/tracking gate - ON (missile centerline)
   b. TGM recorder is functioning
6. Target contrast switch - SET
7. Position pipper on target/aimpoint
8. Locate target in video display and initiate lockon
   a. (P) Front cockpit lockon procedure:
      (1) AAR button - DEPRESS AND HOLD
      (2) Use seeker control to position target in tracking gate
      (3) ARR button - RELEASE
      (4) Verify lockon
   b. (WSO) Rear cockpit lockon procedure:
      (1) Action switch - HA
      (2) Use antenna hand control and position target in tracking gate

(3) Action switch - RELEASE or FULL ACTION

(4) Verify lockon

9. (P or WSO) Bomb button - DEPRESS and HOLD

a. Verify release signal - WPN VIDEO BLANK

CAUTION

The bomb button or trigger must be actuated prior to pulling off the target during a simulated missile attack. This will cage the vidicon and operate the sun shutter to preclude damage to bumper rings, vidicon cables, and vidicon tubes.

10. Trigger - SQUEEZE and RELEASE

a. TGM video - ON

11. For next run, repeat steps 6 thru 9

After last run

12. TGM station select button - OFF

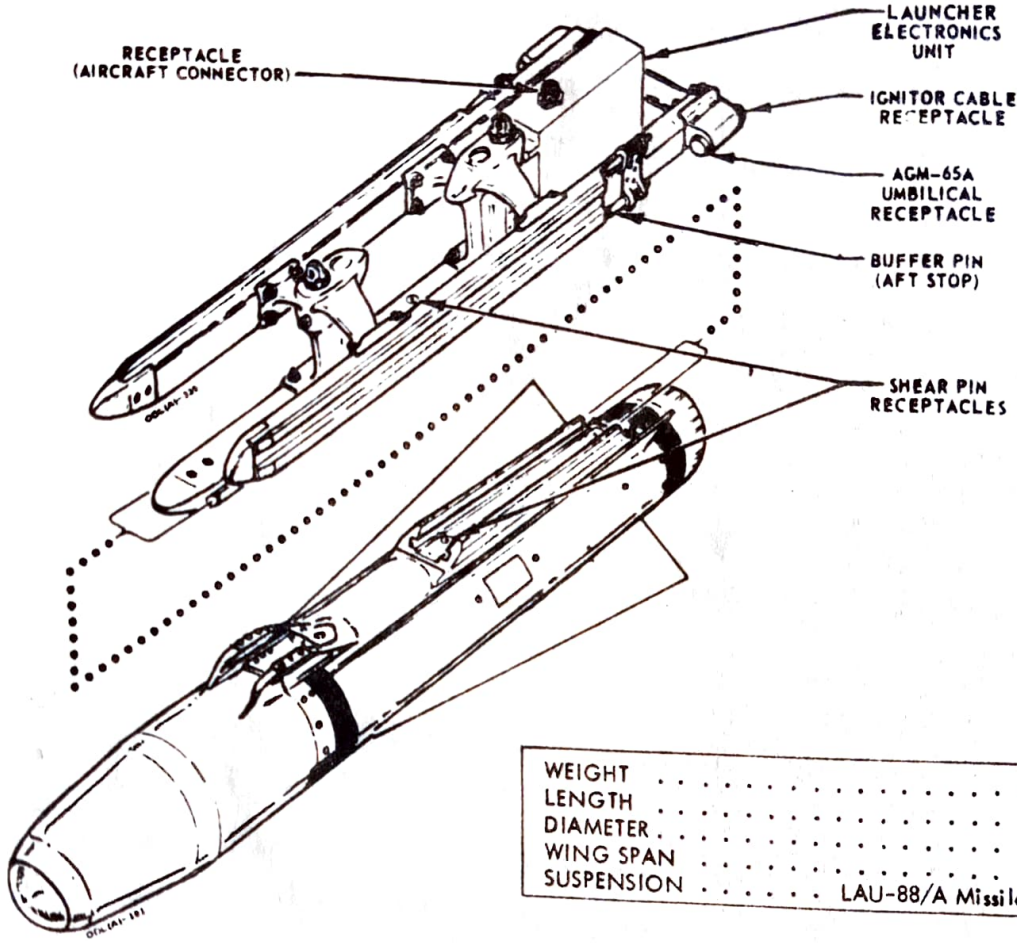
a. Video - OFF

13. Weapon selector B or C (out of TV)

a. Deselect TV (out of TV) at least 5 minutes before landing

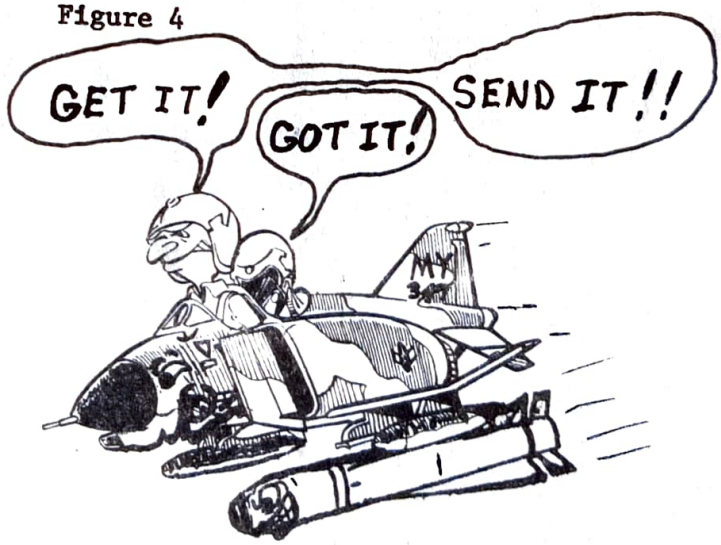
TGM A/A 37A-T1 & LAU-88/A LAUNCHER

TGM-65 TRAINING MISSILE



WEIGHT	445 Pounds
LENGTH	98 Inches
DIAMETER	12 Inches
WING SPAN	29 Inches
SUSPENSION	LAU-88/A Missile Launcher

Figure 4



MAVERICK TRAINING GUIDED MISSILE INFORMATION

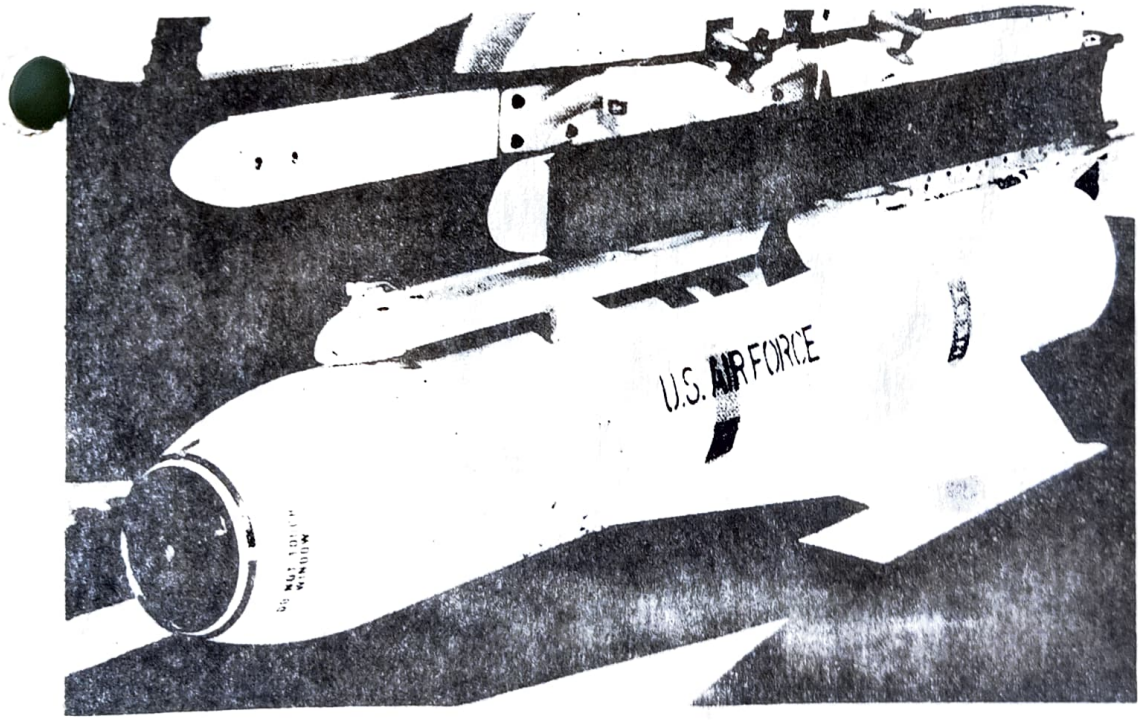
"The A/A37A-TI Training Guided Missile"

This information is for training use only and does not supplant existing Air Force Technical Orders.

General Description:

The A/A37A-TI Training Guided Missile (TGM) is designed to train aircrews in the use of the AGM-65A Missile. The TGM gives you the same cockpit control response as the operational missile except that it does not launch. Launch is simulated by blanking out the TV display one second after you press the launch (pickle) button.

Figure 5 shows a picture of the TGM. Note that it looks like the tactical missile except for the absence of control surfaces. The TGM is carried on the LAU-88/A launcher and except for the dome cover unit, is completely inert in that it contains no warhead, rocket motor, hydraulic actuation system or battery. Also, the TGM has approximately the same weight, aerodynamic characteristics and carry configuration as the tactical missile.



A/A37A-TI Training Guided Missile

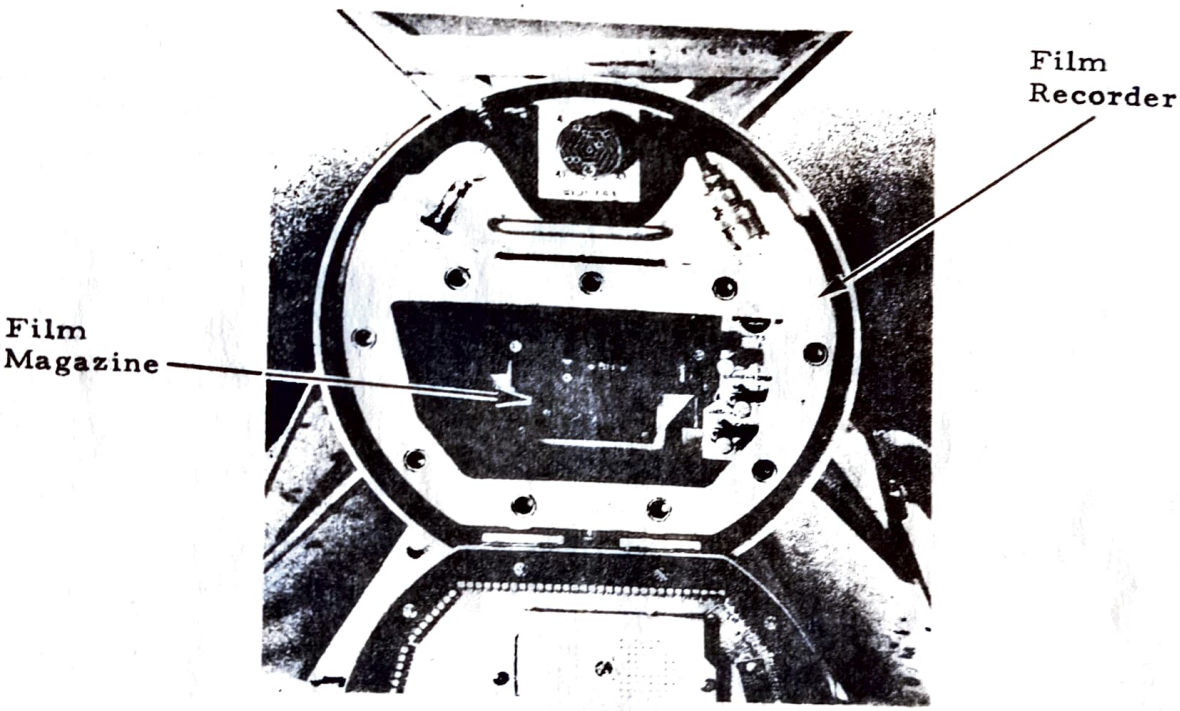
Figure 5

Use:

You can use the TGM to develop your target acquisition and lock-on technique since it provides the identical TV display, lock-on characteristics and tracking ability as the operational missile. Additionally, some TGMs contain a camera which records simulated attacks on* 16 mm film for post flight evaluation. The film, when processed, will show everything you can see on your TV display plus markers which may be used to evaluate your performance during the runs.

Figure 6 is a picture of the film magazine and aft end of the TGM. Normally the magazine, which is similar to the one used in the gun camera, will be marked with your name and training mission number prior to being installed in the TGM Recorder Unit.

*Kodak 2498 RAR (FSN: 6750-00-157-0830)



Aft End of TGM

Figure 6

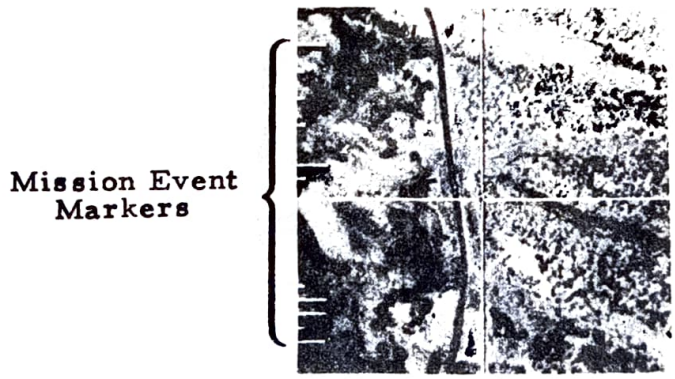
The film recorder is set prior to flight to record either 30 minutes of video at 3.75 frames per second or 15 minutes of video at 7.5 frames per second. The latter is most commonly utilized. One important thing to remember is that the camera starts recording when you squeeze the trigger and doesn't stop until you press the launch button. This means that in order to conserve film you should press the pickle button during each simulated launch sequence. In addition to saving film this properly completes the simulated launch sequence and resets the system to record the next pass or launch. This is most important because this action also recages the TGM gyro.

WARNING

It has been determined that
failure to recage the TGM gyro
prior to pullup may be dangerous
to its health.

Event Marker Interpretation:

After the flight the filmed record of your training mission can be processed for viewing on a 16 mm stop-frame projector. Figure 7 shows one frame from a typical TGM recorded mission. Notice the eleven black and white bars on the left side of the picture.



TGM Film Frame

Figure 7

The length (long or short) of the first four bars from top to bottom is coded to show what mode you are in and if you have exceeded the launch angle limit or not. The next two bars tell what contrast polarity is selected and the remaining five bars indicate the pass number.

Mode Event Markers:

Interpreting the event markers is easy if you know how. The next series of four film frames will show you how to identify ALIGN, SLEW, TRACK and LAUNCH modes.

Mode Event Interpretation:

Align Mode

(You squeeze the trigger)
Markers 1, 2 and 3 are short.

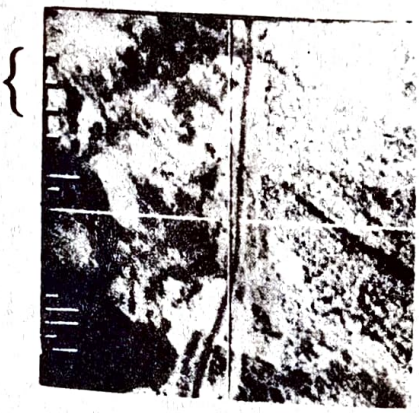


Figure 8

Slew Mode

(You press the ARR Button)
Marker 1 goes long.

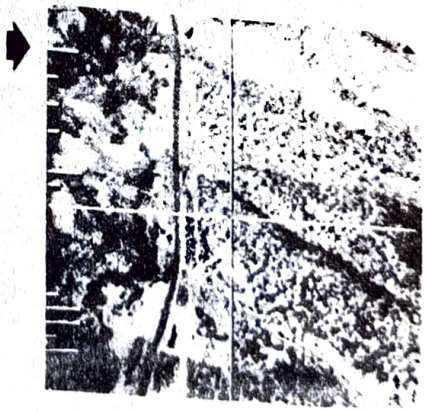


Figure 9

Mode Event Interpretation: (Continued)

Track Mode

(You get a lock-on)
Marker 1 goes short, marker 2 goes long.

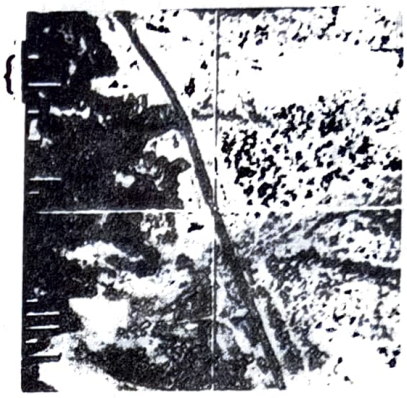


Figure 10

Launch Mode
(You pickle)
Marker 3 goes long.

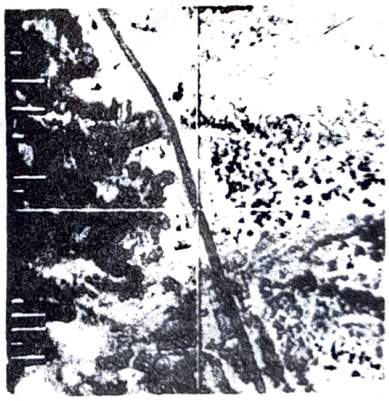


Figure 11

Measuring Time Between Events:

It is possible to measure the elapsed time between events by dividing the number of film frames recorded between events by the rate of recording.

For Example: If it takes 31 frames to get from slew to launch, the elapsed time is 4 seconds.

$$\frac{31 \text{ Frames}}{7.5 \text{ Frames/Sec}} = 4.2 \text{ Seconds}$$

Launch Angle Limit Marker:

The short number 4 marker seen on the previous four film frames indicates that the launch angle limit was not exceeded during the pass. If you exceed the limit, the bar will go long and stay long for the remainder of the pass.

Contrast Polarity Markers:

The film frames in Figure 12 and 13 show how the 5th and 6th marker indicate what contrast polarity was selected during the run.

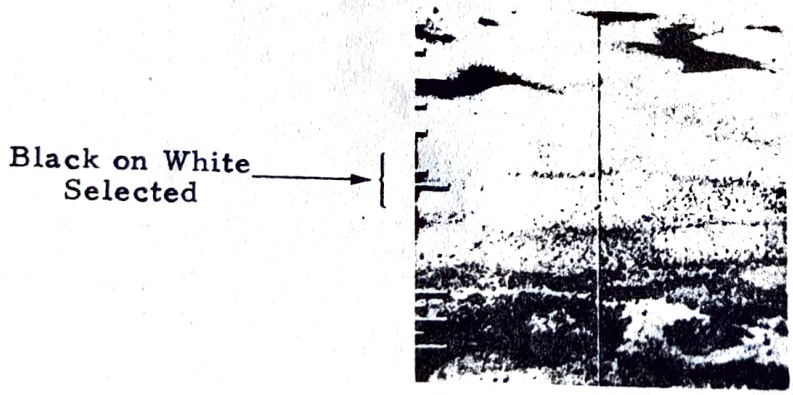


Figure 12

Contrast Polarity Markers: (Cont'd.)

White on Black Selected

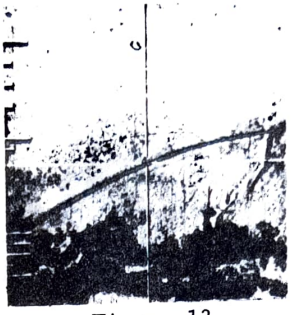


Figure 13

Note: If you select AUTOMATIC position on your contrast switch markers 5 and 6 go short.

Pass Number Markers:

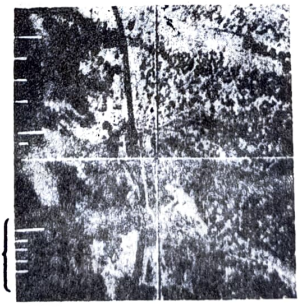
The last five markers shown in the TGM film frames can be interpreted to tell what the number of your pass is. If you want to learn how it is done - read on.

The 7th, 8th, 9th, 10th and 11th markers are weighted 1, 2, 4, 8 and 16 respectively when they are long. They have zero value when they are short. Totaling up the value of the long bars will give you the pass number. Up to 32 pass numbers can be counted.

For Example: Pass number 1 looks like this.

Value of Long Bars

1
0
0
0
0



Total Value of Long Bars = 1

Figure 14

Pass Number Markers: (Cont'd.)

Pass number 21 looks like this.

Value of Long Bars

1
0
4
0
16

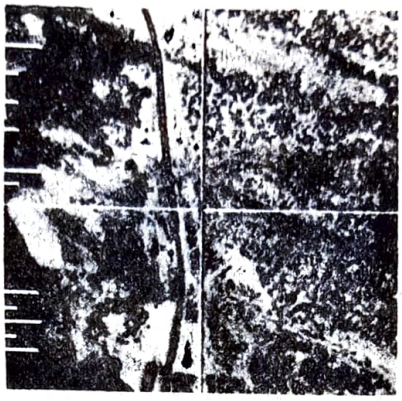


Figure 15

Total Value of Long Bars

1 + 4 + 16 = 21

Pass number 31 looks like this.

Value of Long Bars

1
2
4
8
16

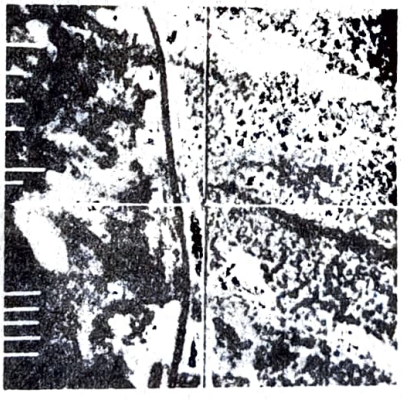


Figure 16

Total Value of Long Bars

1 + 2 + 4 + 8 + 16 = 31

Pass number 32 is identified by all 5 bars being short.

If you'd like to try this yourself, see if you get 22 as the pass number for the film frames shown in Figures 7 through 11.

Summary:

In summary, the TGM will do everything the tactical missile will do except launch. Thus, it is valuable tool for sharpening up your target acquisition and lock-on technique. Additionally, you get a film record with event markers that can be used as a debriefing or training evaluation aid.

Remember:

To avoid damaging the TGM it is essential that the gyro be recaged prior to pullup. Therefore, don't forget to pickle before pullup. Best TGM performance will be obtained if you properly complete each simulated launch by pressing the pickle button.

AGM-65 Video Displays

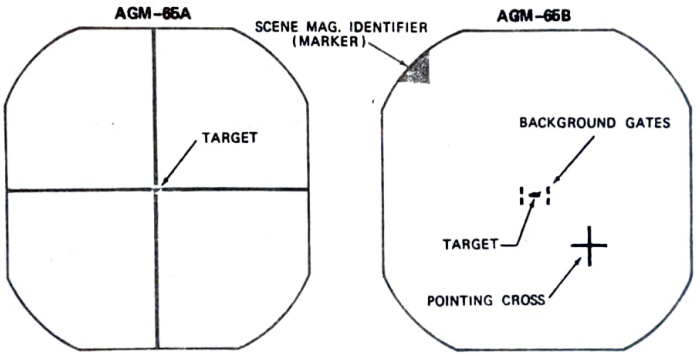


Figure 17

Good Lock-on Indications:

AGM-65A solid lock-on indication - steady crosshairs, smallest target dimension fills one-half of crosshair gap or greater.

AGM-65B solid lock-on indication - pointing cross and marker not flashing.

SECTION V

F-4E/MAVERICK INTERFACE

1. This is a simplified explanation of the interrelationships of various switches and controls in the cockpit of the F-4E concerned with the operation and delivery of the AGM-65A or B (Maverick) missile.

2. After engine start, and aircraft main buses are switched to internal power, all AGM-65's loaded aboard the aircraft are provided with environmental power. This power is used by the vidicon faceplate heaters to maintain the temperature of the light sensitive element of the vidicon above 58°F. Heater power is also applied to the three rate gyros (roll, pitch, and yaw) in each missile to maintain them in a state of readiness. These gyros will be powered upon missile activation and will come up to operating speed in 3.5 to 5.0 seconds. Nothing other than generator switches on is required to provide environmental power.

3. After takeoff the aircrew may elect to perform an airborne alignment (boresight) of one or more of the missiles. To accomplish this the seeker head gyros of the missiles must be brought up to operating speed, the seeker head aligned to the radar boresight line (RBL) and the video system activated. Placing the weapon select (WPN SEL) switch in TV position provides the power to spin the seeker head gyros of all the missiles aboard. No other switching is required for gyro spin power. The WPN SEL switch should not be maintained in the TV position for more than 30 minutes out of any 2.5 hour period.

4. From a dead start the seeker head gyros will come up to operating revolutions per minute (rpm) in 3 minutes. To obtain an indication in the cockpit that the gyros are up to speed, the Maverick launching circuits must be fully armed. This indication is the illumination of the amber light (ARM) portion of the left inboard (LI) or right inboard (RI) station select buttons. To provide continuity for the power to these lights it can be seen that the delivery mode switch must be in DIRECT, the MASTER ARM switch must be in ARM, the appropriate station must be selected, and finally the 3 minute delay relay in the launcher electronic unit (LEU) must have timed out. It can also be seen that the station ARM light is not an interlock to the AGM-65A activate and launch circuits. It is possible to launch a missile before its seeker head gyro is fully up to speed. This could result in erratic tracking and a possible miss.

5. The DIRECT position of the delivery mode switch, in addition to completing a step in the continuity of power to the station ARM light, also enables the AGM-65A or B launch function of the bomb release button on the control stick in both cockpits. The TV position of the WPN SEL switch, in addition to supplying power to spin the seeker head gyros, applies power to the station select buttons, and activates the trigger transfer relay. This relay transfers the trigger switch out of it normal guns/missiles firing function into the AGM-65 active function. The missiles referred to in this case are heat seeking or radar guided air-to-air missiles.

6. With gyro warm up complete the aircrew is ready to perform airborne alignment. The AC first disables the Maverick launch circuits by placing the MASTER ARM switch in SAFE. While this removes power from the bomb release button circuit it does not disable the AGM-65 activate function of the trigger switch. The AC next selects air-to-ground (A/G) on his optical sight MODE knob and sets 45 mils in the reticle depression (RETICLE DEPR) window. He then selects a target on which to align the pipper projected on the optical sight combining glass. Either aircrewman may then press his trigger to activate the first missile in the normal selection sequence. At this time a number of things happen. A 60 ms pulse is applied to a detonating device in the missile dome cover actuator, which fires and drives a piston against the edge of the dome cover, causing it to disintegrate. A signal is applied to release a mechanical brake on the gyro torque motors and the seeker head is electrically aligned to the RBL. Finally, the television circuits of the selected

missile are activated. If the AC has TV selected on his Scope Display Select switch (pedestal panel), and if the WSO has TV selected on his DSCG scope control panel and has WEAPON selected (illuminated) on his Video Select button (located next to Air-to-Air button above left knee), then both crewmembers will have displayed on their radar scopes a television image of the area within the FOV of the lens of the AGM-65 vidicon camera.

7. The AC will then fly the aircraft to place the selected target within the video tracking gate (the break in the horizontal and vertical crosshairs being displayed on the radar scopes). At this time his optical sight pipper should also be on the target or very near it. He makes elevation corrections to the pipper by adjusting reticle depression. Azimuth errors between the tracking gate of the missile video and the sight pipper cannot be corrected. The AC must make note of where, azimuth wise, his pipper lies in relation to the target when the target is properly centered in the tracking gate. This completes airborne alignment. The final action at this time should be to rotate the WPN SEL switch out of the TV posotion. Spin power is thus removed from the seeker head gyros and mechanical cage is once more applied. It is recommended that the airborne boresight be conducted on the rear cockpit scope, since most launches from the F-4 will be by the WSO, while the AC is avoiding threats, terrain, and visually acquiring targets. (See diagram on page 4)

8. It is feasible to perform airborne alignment on one missile on each station. As the dome cover is jettisoned during this procedure, alignment of more than one missile per launch may result in damage to the guidance unit window of the previously activated missile. Only failure of the video presentation of the first missile would dictate attempting a second missile alignment on the same launcher. The rails of each launcher are assembled so as to be in alignment with one another to a very close degree of tolerance.

9. On approaching the target area the AC will again rotate the WPN SEL switch to TV, bearing in mind the 3 minute period required to spin the seeker head gyros up to speed. He will select the ARM position of the MASTER ARM switch and await the illumination of the station ARM light. Selecting a target he will fly the aircraft to place his optical sight pipper in the best relation to it as determined by the airborne alignment. Either aircrewman may then activate the selected missile by pressing his trigger switch, uncaging the torquer motors, aligning the seeker head with the RBL, and activating the missile video. When missile video appears on the radar scope the selected target should appear within or very close to the tracking gate.

10. The trigger switch in the front cockpit closes a circuit providing power to the air refueling release (ARR) button on the control stick. Pressing the ARR button activates the SLEW ENABLE relay closing a set of contacts to provide plus and minus 15 volts direct current (VDC) to the AGM-65 Seeker Head Control. The AC then may make fine position corrections to the seeker head by movement of the control while holding down the ARR button. Fore and aft motions of the control drive the seeker head up and down respectively in pitch. Right and left motions of the control drive the seeker head right and left respectively in azimuth. The control is proportional; i.e., the further the control is displaced the faster the seeker head will be slewed.

11. In addition to providing power to the seeker head control, the SLEW ENABLE relay closes a TRACK COMMAND ENABLE switch which then provides its own hold down. The TRACK COMMAND signal is not sent to the laucher at this time, however, as the SLEW ENABLE relay holds open the normally closed SLEW (not slew) switch. When the ARR button is released the SLEW switch closes sending the TRACK COMMAND signal to the LEU, closing a set of relay contacts to provide a path for the launch command.

12. The half-action (HA), first detent, of the radar control handle powers the SLEW ENABLE relay providing plus and minus 15 VDC to the positioning circuits of the hand control. After manually slewing the seeker head to position the tracking gate over the target the WSO either releases the action switch or goes to full action. Either condition will allow the track command to be sent to the LEU. If both crewman press their

trigger switch at the same time the ACs trigger takes precedence. The antenna hand control is not spring loaded to the null position. Therefore, the WSO should position the control as carefully as possible to the null position before activating the action switch in order to preclude a large initial surge of power to the torquer motors. Failure to find the null may cause loss of the target from the TV field of view when the vidicon jumps to the position commanded by the radar control handle.

13. If there is sufficient contrast between the target and its background, and if the aircrew has properly selected target contrast (black on white or white on black), the seeker head will now follow the target as long as it remains within the limits of the seeker head gimbal system. Pressing either bomb release button will initiate the launch sequence providing that gear and flaps are up. A 60-ms pulse is formed and sent to fire the squib in the missile battery. The squib ignites heating materials which melt the electrolyte crystals permitting ions to flow, bring the battery up to its rated power. When this is achieved a signal is sent to the safety, arming and fuzing (SAF) unit unlocking a safety solenoid. Another signal from the battery activates the hydraulic actuation system (HAS) by firing an electro-explosive device which blows a metal cap off a high pressure helium reservoir. The first action of the HAS is to pull retaining pins which have held the missile control surfaces in a locked up condition. Still another signal from the battery is sent to the LEU to activate a relay enabling the rocket motor ignition pulse forming circuit. As will be noted, this signal has been delayed by a 500-ms delay relay which began timing down at the same instant the 60-ms pulse was sent to the battery squib. Upon termination of the 500-ms delay, and, providing the missile battery has come up to a specified percentage of its rated power, another 60-ms pulse is generated to ensure firing of the rocket motor squibs. The bomb release button must be held down (approximately 0.75 seconds) through all these delays to ensure a successful launch.

14. The rocket motor is ignited by the squibs and generates enough thrust to break the shear pin holding the missile in place on the launcher rails and propel the missile from the launcher. Separation of the umbilical connection activates relays within the missile to allow the battery to provide the missile electrical power requirements. Steering commands, which have been generated by the guidance unit, are applied to the HAS starting 0.23 to 0.7 seconds after umbilical separation, depending upon the magnitude of acceleration forces being experienced by the missile. The steering commands result from the efforts by the seeker head to follow the target. The seeker head gyro is caused to precess by the torquer motors in response to positioning error signals from the video tracking circuits. Induction potentiometers on the torquer motor shafts sense the angular displacement and generate signals which, properly processed and amplified, become the steering commands. The HAS responds by positioning the control surfaces to alter the flight path of the missile on a proportional navigation collision course with the target. The acceleration force caused by rocket motor thrust drives a ratchet mechanism which turns a rotor in the SAF to electrically arm the fuzing device. The delaying action of the ratchet device ensures a safe separation from the aircraft before the missile becomes fully armed.

15. On impact, a set of contacts in the nose of the missile are crushed together providing a path for electrical current which fires an initiator, which in turn detonates the booster in the SAF unit. The booster detonates the warhead. In the event of electrical failure a firing pin device is driven into the booster charge by the force of impact, ensuring detonation of the warhead.

16. Missile Selection.

a. The AGM-65 is carried on the LAU-88A launcher which has three rail positions. The normal sequence of firing from the launcher is outboard, bottom, and inboard. This sequence is determined by a stepping relay in the LEU. Separation of an umbilical connection advances this relay one step. Of the two armament stations capable of carrying Maverick missiles, LI and RI, the left station has priority. This means that if both stations have been selected, the first missile will be launched from the left station. On F-4 aircraft,

firing sequence does not advance automatically to the right wing until the LI station is empty or deselected.

b. To obtain alternate left and right station missile selection the AC need only deselect LI station after the first and third launches, and reselect LI after the second and fourth launches, as shown below:

Both Stations Selected	1st Launch, Left Outboard Missile
Deselect LI	2nd Launch, Right Outboard Missile
Reselect LI	3rd Launch, Left Bottom Missile
Deselect LI	4th Launch, Right Bottom Missile
Reselect LI	5th Launch, LI Missile
Left Station Empty, Right Station Selected Automatically	6th Launch, RI Missile

c. Because the outboard missile on the right wing is on the right whereas the outboard missile on the left wing is on the left, there must be some means of informing the LEU which wing the launcher is mounted on. This is accomplished by a signal, starboard ident, provided by the carrying aircraft to the right wing armament pylon, thence to the LEU mounted on that wing.

d. To manually advance the selection sequence to any desired rail position, the AC may activate the TGT/MSL REJECT switch on the pedestal panel. This overrides the automatic sequencing circuit in the LEU, causing it to advance one step. The switch is spring loaded to the null, or off, position, and it is necessary to activate it once for each desired advance in the stepping sequence. To reselect a missile once it has been rejected, it is necessary to first deselect then reselect the station.

17. Missile/Launcher Jettison.

a. If it is desired to jettison a single missile, the AC must rotate the selective jettison knob on the multiple weapons release panel to the appropriate station, L WING and R WING, and press the PUSH TO JETT button. As can be seen from the schematic, this sends a signal directly to the rocket motor squibs. No other switch positions affect the procedures. Only gear and flaps up interlocks remain in effect.

b. Let us examine the condition of the missile being jettisoned. First of all, there will be no 500-ms delay to the rocket motor squibs, only the 60-ms pulse to ensure squib firing. The missile battery is not activated and therefore, the locking solenoid in the SAF unit is not unlocked. This prevents rotation of the rotor so that the electrical firing circuit will not be completed. The same rotor lock prevents the mechanical firing pin from reaching the booster charge. The missile therefore impacts with the warhead in an unarmed condition. Also, because the battery was not activated, no HAS activation signal was generated. The locking pins remain in position locking the control surfaces so that the flight path of the missile is unguided.

c. The AC may jettison all three missiles from the selected wing by merely pressing the PUSH TO JETT button three times. The TGT/MSL REJECT switch may be used to manually advance the stepping sequence to any desired missile, but as there is no cockpit indication as to which missile has been selected, the AC must make mental note of his actions which result in either automatic or manual sequencing advance.

d. The LAU-88/A launcher may be jettisoned, along with any missiles remaining on the

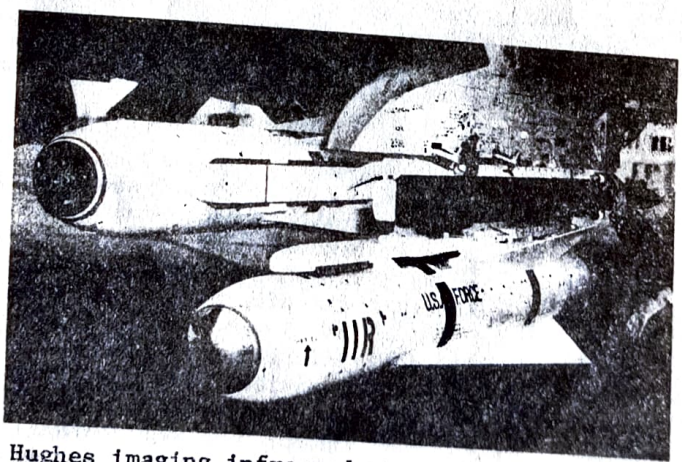
rails, by selecting the appropriate station on the station select button panel, rotating the selective jettison knob to STORES position, and pressing the PUSH TO JETT button. If both LI and RI are selected, both launchers will be jettisoned simultaneously. Note that gear and flaps up interlocks are not in effect. Launcher jettison is accomplished by initiating the cartridges in the MAU-12A bomb rack by which the launcher is secured to the armament pylon.

18. Air-to-Ground/Air-to-Air Switching.

a. A feature has been added to F-4E aircraft, Block 48 and up, by which the AC may, with activation of a single control, switch the armament select and firing function from air-to-ground to air-to-air weapons (guns or air-to-air missiles). This control is the CAGE button on the right throttle assembly. Pressing this button interrupts power from WPN SEL, TV position, to the trigger transfer relays, causing them to return to the normally closed position in the GUNS/MISSILES firing circuits. The GUNS/MISSILES SELECT/REJECT switch on the left throttle assembly then determines which air-to-air weapon will be fired on activation of the trigger switch. This provides instant air-to-air capability in the event of being attacked by hostile aircraft during an air-to-ground mission.

b. Return to air-to-ground (AGM-65) functions may be accomplished by either the AC or the WSO. The AC does this by rotating the WPN SEL switch to B position then back to TV. The WSO accomplishes the same purpose by pushing the AIR-TO-AIR button located on his main instrument panel. This button is illuminated whenever the CAGE signal is present. Either action interrupts power to the CAGE holding relay, allowing power from the TV position of the WPN SEL switch to once again activate trigger transfer relays.

AGM-65D



Flight tests of the Hughes imaging infra-red Maverick air-to-surface missile, according to the manufacturer, have shown stand-off range acquisition of smoke-obscured battlefield targets such as tanks at night and in daylight, and acquisition of larger targets such as power stations at extremely long ranges. A number of European countries are currently showing much increased interest particularly in the IIR Maverick. According to program office manager Col Paul Good, "The imaging IR Maverick maintains effectiveness in the European winter environment, where long nights and low visibility significantly limit conventional TV guidance systems. We have demonstrated the performance and reliability of the imaging IR seeker through extensive captive flight test against a wide spectrum of tactical targets, in various environments, and in three operational aircraft types - F-4, A-7 and A-10. The seeker has achieved a success rate, under severely low visibility conditions, which no alternative weapon system could match, and this was achieved by squadron pilots who had only a few training flights to learn the IR system."

SECTION VI

DEFINITION OF TERMS

1. BORESIGHTING: AGM-65--aligning the aircraft gunsight with the television presentation.

2. CAPTURE: Terminology used by WSO when target has been identified and is being tracked on the TV presentation.

3. GATING OUT: Reducing the area seen by the EO tracking gate in order to eliminate undesirable points of contrast prior to locking on.

4. LOCKED: Used by WSO to alert AC of optical lock on.

5. NOISE: Display of any signal not normally associated with the TV display.

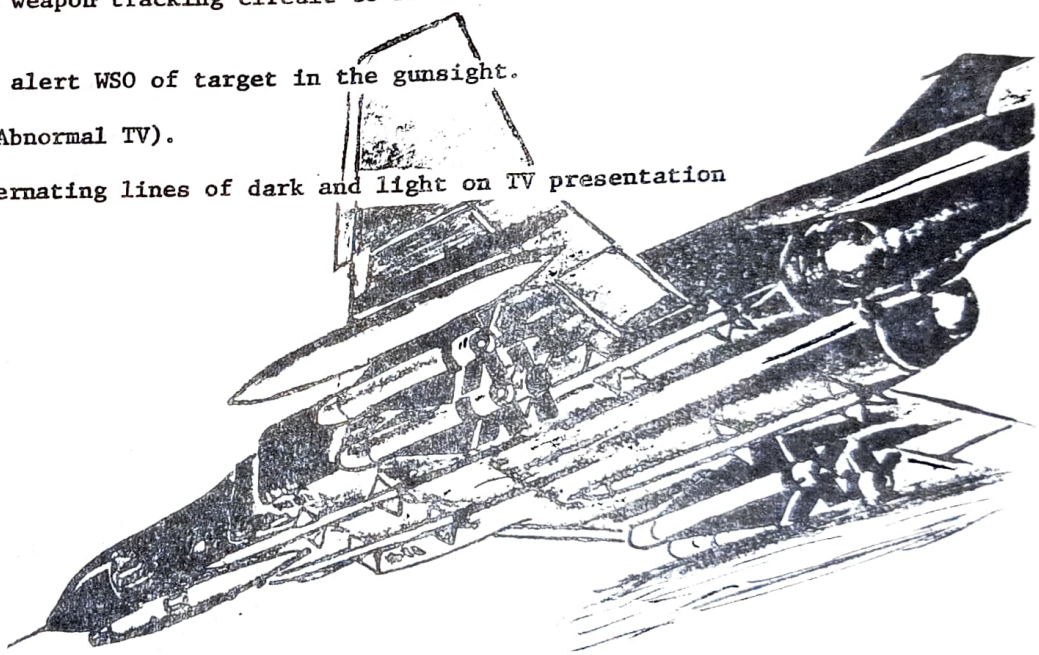
6. REFERENCE HEADING: Used by the flight leader to alert wingman of desired heading.

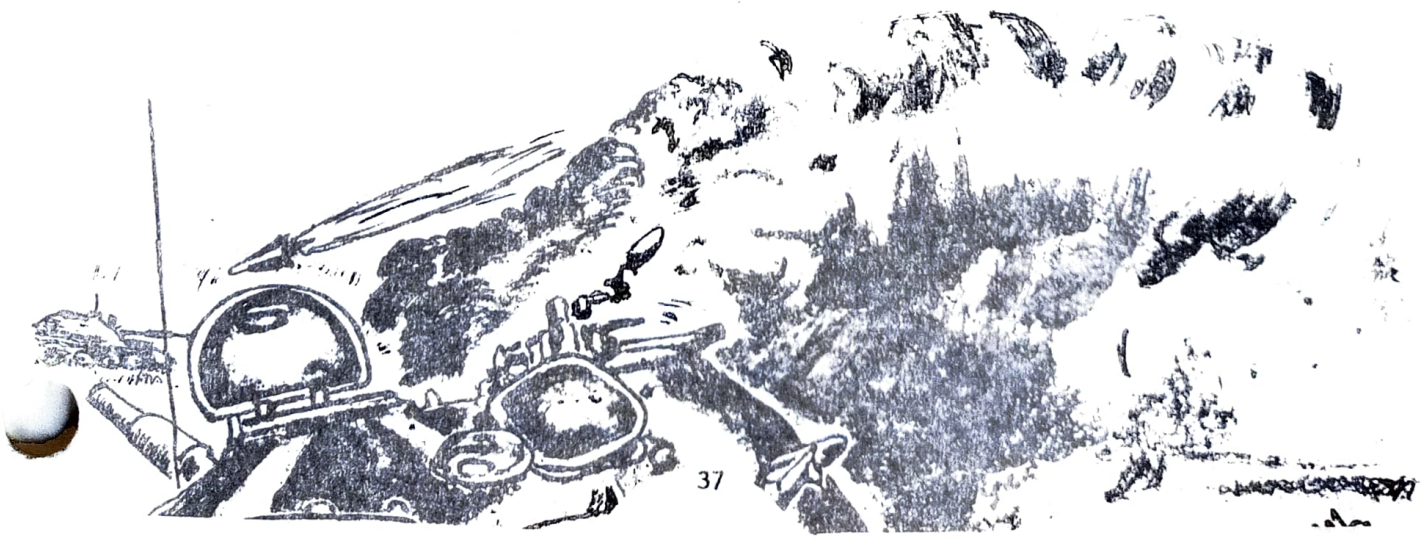
7. SLIP LOCK: Inability of weapon tracking circuit to maintain optical lock-on to aim point.

8. TRACKING: Used by AC to alert WSO of target in the gunsight.

9. TEARING: Jagged Video (Abnormal TV).

10. VENETIAN BLINDING: Alternating lines of dark and light on TV presentation (Abnormal TV).



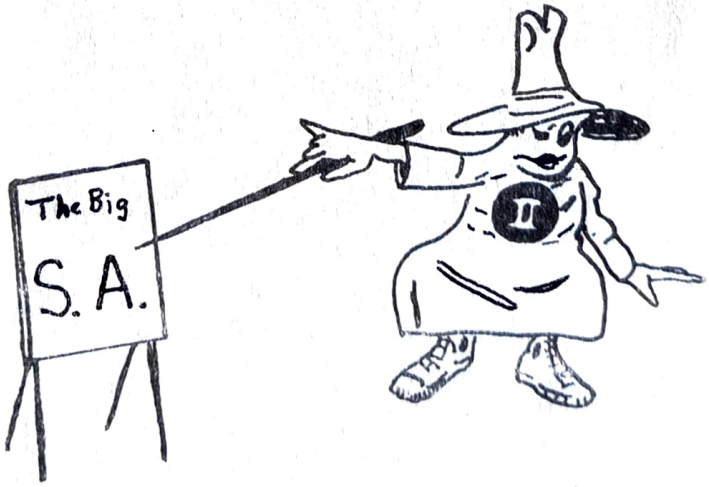


SECTION VII

COMMON ERRORS

Common errors made by crews unfamiliar with the Maverick system are:

1. Swinging the aircraft boarding ladder into the optical dome.
2. Flying with no dust covers on non-loaded stations.
3. Trying to slew before the gyros are up to speed.
4. Trying to change BST mils with mode select in OFF.
5. Pilot flying gate instead of slewing with the Bullpup handle.
6. Trying to launch with master arm in SAFE.
7. Trying to fan lock.
8. Using wrong contrast setting.
9. WSO trying to cage the Maverick with the paddle switch.
10. Not caging the TGM before pull off.
11. Flying through heavy rain/hail.
12. WSO trying to lock-on before aircraft commander (AC) calls "tracking".
13. Attacking from extended slant ranges.
14. "Quick pickle".



SECTION VIII

MAVERICK EXPANDED BRIEFING GUIDE

The following is a guide of items you may wish to brief for Maverick missions. There may be other items you wish to brief. Also, depending on aircrew experience level, some items may not have to be covered in detail.

1. AGM/TGM-65 Expanded Preflight (see also TO 1F-4E-34-1-1CL-1)

    a. Dome clean

    b. Dome cover secure (AGM)

    c. Dome actuator pin (AGM)

    d. Vidicon

    e. Humidity sensor

    f. Weapon security

    g. "White black box" (LEU) on LAU-88, no damage

    h. Control surfaces (AGM) no damage, locked

    i. Shear pin

    j. Ground pin

    k. Umbilical connection

    l. Missile electrical connector--installed--no red visible

    m. Stinger cable (AGM [Rx Motor Ignitor])--not connected

    n. Dust caps--on all unloaded LAU-88 umbilical connections

    o. 16mm camera pack (TGM)--secure, if installed

2. BIT Checks

3. Switchology (review use; as required by aircrew proficiency)

    a. Front cockpit

        (1) Armament override

        (2) Sight shutter

        (3) Sight mode select

        (4) Mils (45)

        (5) Reticle intensity (gunsight)

        (6) DSCG contrast - use of brightness/contrast adjustments

        (7) TV selected on scope display select switch (pedestal panel)

(8) TV - WPN SEL switch

(9) Master arm

(10) Direct

(11) Station select (after 3 minutes)

(12) Jettison selector

(13) Contrast switch

(14) MSL reject switch

(15) Trigger

(16) ARR button

(17) Bullpup handle

(18) Pickle button

b. Rear Cockpit

(1) Radar - power

(2) DSCG - TV

(3) DSCG brightness/contrast knobs

(4) Radar hand control

(5) Contrast switch

(6) Video select button - WEAPON illuminated

(7) Stick trigger

(8) Pickle button

4. TGM-65 Ground Check Procedures

5. Airborne Systems checks including - Airborne Maverick Boresight

6. Crew Coordination and Responsibilities

7. Maverick Systems Operation

a. Tracking and lock-on techniques (FCP and RCP)

(1) No fan lock

(2) Pilot don't fly gate - fly airplane

8. Target Considerations

a. Effects of WX/Vis/ceilings

b. Effects of sun angle and shadow development

c. Target contrast

9. Maritime Operation Considerations (when applicable)

10. Maverick Tactics

a. Low altitude comm out maneuvering

(1) Mutual support

(2) Single plane maneuvering

(3) Formation

(4) Delayed turns

(5) In-place turns

(6) Low altitude awareness

b. Pop-up deliveries

(1) Comm out signal

(2) Preplanned vs random attacks

(a) Minimum exposure

(b) Multiple launches

c. Attacks

(1) Split

(2) Line abreast

(3) In-trail

(4) Level

d. Random attacks

(1) Procedures and techniques

(2) Range estimation

(3) Low altitude awareness

11. Weapon Limits

a. Carriage

b. Jettison

c. Quick pickle

12. Maverick Live Fire - Contact DOW

a. Collect data for TAFSWAT - contact DOW

b. If RTB with live AGM-65

(1) Insure switches SAFE

(2) Avoid populated areas

(3) Fly straight in approach

(4) Notify SOF during RTB (if possible) and approach control or tower

13. Special Subjects

a. No fly through heavy precipitation at high airspeed

b. Sun scarring of vidicon

c. Recage TGM off of target, if no launch was attempted

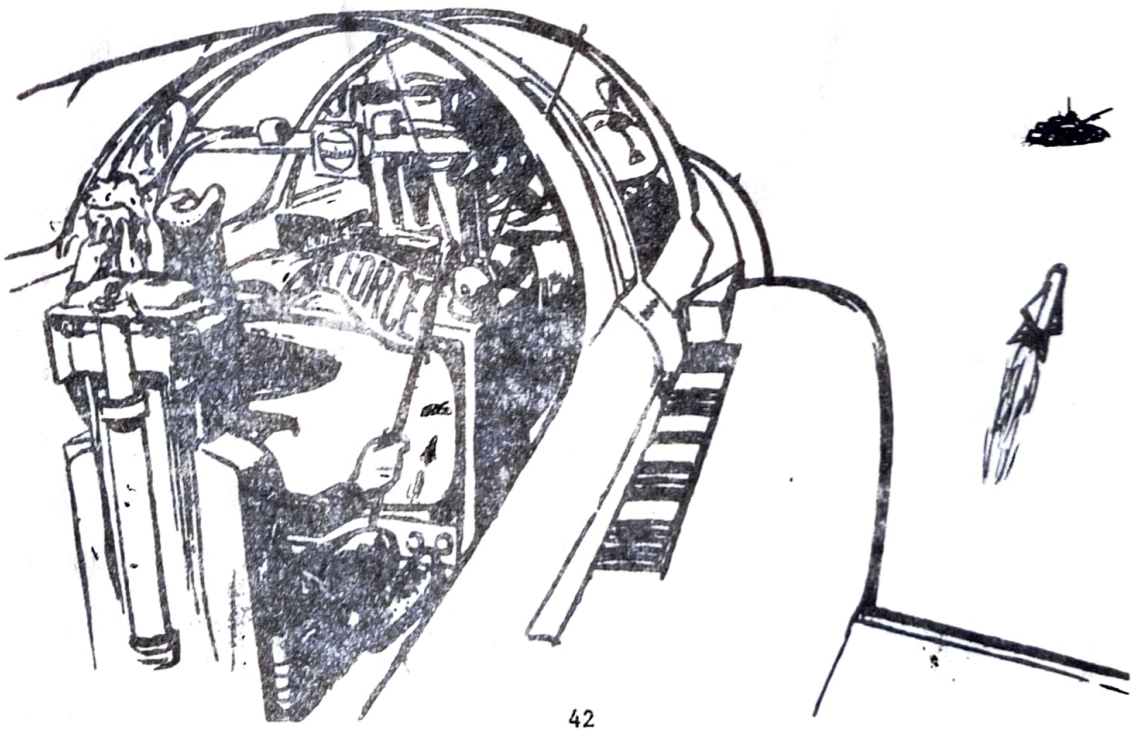
d. Do not operate the TGM in excess of 40 minutes in TV mode (WPN SEL switch in TV or ARM) or in excess of 30 minutes in the full power mode (video present). No single TGM attack should exceed 3 minutes. Do not operate a TGM in excess of 15 minutes during ground operation; i.e., WPN SEL switch in TV or ARM.

e. Attacks against off range targets or non-target structures on range will not be made when the M-61 cannon has been armed.

f. Beware of TV target fixation at low altitude. The - "Gee look at that picture", syndrome could be hazardous to your health.

g. He who is not slewing and locking is heads up and out.

h. CG position considerations.



SECTION IX

347TFW AIRCREW STUDY GUIDE
MAVERICK (AGM-65)

This guide should be used by aircrews as an aid in their Maverick upgrade and qualification.

1. EO Theory (see NIP #16)

   a. Describe the operation of an edge gate tracker.

   b. Describe the operation of a centroid gate tracker.

   c. What are advantages and disadvantages of edge and centroid trackers.

   d. List five limitations common to all current EO weapons.

2. AGM-65A and AGM-65B (see FWS Text TG Wpns, Vol (C) and other references) - The page numbers identify a starting point for study. However, a comprehensive response may require additional review of interrelated material contained in the text and other sources. After self study and academics, the aircrew will be able to:

   a. Describe the physical characteristics of the AGM-65. (p 2-2)

   b. Explain the purpose and operation of the following AGM-65 components:

      (1) Dome cover (p 2-4)

      (2) Optics

         (a) Dome window (p 2-7)

         (b) Lens assembly (p 2-7)

      (3) Gimbal limits (p 2-7) FOV 5° /60°

      (4) Tracking function

         (a) Video (p 2-7)

         (b) Sun shutter (p 2-9)

         (c) Faceplate heater (p 2-9)

         (d) Vidicon (p 2-9)

         (e) Video processor (p 2-10)

         (f) Gated video tracker (p 2-10)

         (g) Tracker display (p 2-11)

         (h) Tracking gate geometry (p 2-13)

         (i) Window gate tracking (p 2-14)

         (j) Gate size (p 2-15)

         (k) Edge tracking (p 2-15)

(l) Image motion (p 2-15)

(m) Last rate memory (p 2-17)

(5) Flight controls (p 2-17)

(6) Hydraulic actuation system (p 2-17)

(7) Lethality of the warhead (p 2-19)

(8) Arming function (p 2-22)

(9) Battery (p 2-23)

(10) Rocket motor (p 2-33) Discuss boost and sustain functions.

c. Describe G bias and its tactical application (p 2-65)

d. List four options available after "quick pickle".

e. Discuss battery life and its relationship to a "quick pickle".

f. Describe sequence of events with the tracking gate during lock-on and the function of the contrast switch. (p 2-33)

g. Describe what factors determine the following points on the AGM-65 performance envelope:

(1) Minimum range (p 2-42)

(2) Maximum range (p 2-42)

(3) Minimum altitude (p 2-43)

(4) Maximum altitude (p 2-43)

(5) Maximum dive angle (p 2-43)

h. List the standard crew coordination steps. (p 2-65)

i. List the lock-on techniques of the pilot and WSO. (p 2-66, and 2-67)

j. Describe the major differences of the AGM-65A and AGM-65B.

k. Describe the characteristics of the "good lock" indication of the AGM-65B. (p 2-31)

l. Describe sun shadow and attack axis consideration for single and multiple launcher. (p 2-42, 2-43 and 2-63)

m. Diagram a typical AGM-65A single ship, single launch attack. (p 2-42)

n. Define crew duties, attack range, effects of spacing and defense reactions of the following attacks (TACM/PACAFM/USAFEM 3-1):

(1) In-trail

(2) Split

(3) Level

(4) Random

o. Describe use and application of sun locus charts. (p 3-2-1)

p. Discuss advantages and disadvantages of multiple launches on a single pass.

3. AGM-65 Maverick: The aircrew will be able to:

a. Perform preflight requirements of the following items

(1) Dome cover

(2) Dome

(3) Humidity indicator

(4) LAU-88 (and LEU - the white "black box")

(5) Shear pin

(6) Grounding pin

(7) Electrical connections

(8) Stinger cable

(9) Dust caps

b. Perform ground checks of TGM-65.

c. Perform switchology procedures relative to front/rear cockpit functions of the F-4E and know the functions of each switch:

(1) Front cockpit

(a) Select optical sight

(b) Scope display select switch (pedestal panel)

(c) Weapons select knob

(d) Station select buttons

(e) Delivery mode selector

(f) Master arm switch

(g) Contrast switch

(h) Target/missile reject switch

(i) Jettison controls

(j) Stick trigger

(k) ARR button

(l) Bullpup handle

(m) Pickle button

(2) Rear Cockpit

(a) Radar power

(b) DSCG - TV

(c) DSCG - Brightness/contrast knobs

(d) Video select switch - WEAPON

(e) Contrast switch

(f) Stick trigger

(g) Radar control handle

(h) Pickle button

d. Describe the steps in the boresight process of a TGM-65; also a full load of AGM-65.

e. Discuss and list warnings and cautions from T.O. 1F-4E-34-1-1-1 (C) concerning AGM-65 operations.

f. List carriage and launch airspeeds and G limits.

g. Be able to discuss considerations for use of the Maverick against bridges, railroads, and ships.

h. Be able to discuss pros and cons of carrying a full load of Mavericks (six) into a high threat combat arena.