CHAPTER 3

AIR-LAUNCHED GUIDED MISSILES AND GUIDED MISSILE LAUNCHERS

Guided missiles are self-propelled objects. After launching, they automatically alter their direction of flight in response to signals received from outside sources. They usually carry high-explosive charges and are equipped with a means to explode them at or near a target. The majority of guided missiles used in the Navy are essentially rockets that are maneuvered while in flight.

AIR-LAUNCHED GUIDED MISSILES

LEARNING OBJECTIVE: *Recognize air-launched guided missile classifications. Match missiles with their range and speed. Identify air-launched guided missiles and recognize the methods used to designate them. Identify missile components to include guidance and control, armament, and propulsion systems. Identify the guided missiles used in the Navy today.*

The purpose of a guided missile is to reach and destroy or damage its target. The type of target involved influences the characteristics of the missile; however, each missile meets the following basic requirements:

- It must have sufficient speed to intercept or catch its target.
- It must be maneuverable in flight to correct its flight path as required to intercept the target.
- It must be capable of inflicting a satisfactory degree of damage to the target on intercept.
- It must have an acceptable operating envelope (range/altitude) within which it is effective.
- It must be capable of launching when required and at a satisfactory rate.
- The missile and its components must be safe to handle, store, and use.

In general, a typical guided missile has a long, cylindrical shape, with an oval or a hemispherical shaped nose. It is fitted with a series of stabilizing or maneuvering fins, wings, or canards around its outer surface.

MISSILE CLASSIFICATION

Guided missiles are classified according to their range, speed, and launch environment, mission, and vehicle type.

Range

Long-range guided missiles are usually capable of traveling a distance of at least 100 miles. Short-range guided missiles often do not exceed the range capabilities of long-range guns. The Navy has air-launched guided missiles that function within these ranges; they are medium-range or extended-range missiles.

Speed

The speed capability of guided missiles is expressed in Mach numbers. A Mach number is the ratio of the speed of an object to the speed of sound in the medium through which the object is moving. Under standard atmospheric conditions, sonic speed is about 766 miles per hour (Mach 1.0). Guided missiles are classified according to their speed as shown below:

- Subsonic—Up to Mach 0.8
- Transonic—Mach 0.8 to Mach 1.2
- Supersonic—Mach 1.2 to Mach 5.0
- Hypersonic—Above Mach 5.0

When considering the speed of an air-launched guided missile, the speed of the launching aircraft is added to the speed of the missile. For example, if a missile's speed is Mach 2.5 and the aircraft's speed, at the time of missile launch, is Mach 2.0, the missile's speed is Mach 4.5.

Types of Guided Missiles

Guided missiles are divided into two types—service missiles and nonservice missiles.

SERVICE MISSILES.—These missiles are generally referred to as tactical missiles. Service missiles are fully operational and fully explosive loaded rounds, designed for service use in combat.

NONSERVICE MISSILES.—These include all types of missiles other than service or tactical. They are subdivided as captive air training missiles (CATMs), dummy air training missiles (DATMs), special air training missiles (NATMs), and practice guided weapons (PGWs).

Some practice and training missiles are used for actual launching. They contain live propulsion and guidance systems with inert loaded warheads. They are fitted with pyrotechnic fuze indicator signals and/or tracking flares that give a visual indication of missile/target impact. These missiles can also be fitted with a telemetry-type warhead, which transmits electronic signals to a monitoring station. The monitoring station displays the missile's in-flight performance and missile/target hit. Some types of exercise missiles contain explosive-destruct charges so the missiles destroy themselves in flight. These explosive-destruct charges, when installed, are used as a safety measure so the missile does not travel beyond the established target range.

The CATMs are used for pilot training in aerial target acquisition and aircraft controls/displays. They have both tactical and training components.

The DATMs are ground training missiles used to train ground personnel in missile assembly/disassembly, uploading/downloading, and handling procedures.

The NATMs are used for pilot training during fleet weapon training exercises.

The PGWs are used for stowage procedures and techniques. All components are completely inert.

Service missiles are fired as practice or training missiles when approved by proper authority. Normally, approval is restricted to missiles that are obsolete or to missiles that have exceeded their normal service life.

Guided missiles used in naval aviation include air-to-air and air-to-surface missiles. Air-to-air guided missiles are fired by one aircraft against another aircraft. Air-to-surface guided missiles are fired from an aircraft against a target on the land or water surface.

For further information on the classification of guided missiles, you should refer to *United States Navy Ammunition Historical and Functional Data*, NAVSEA SWO10-AB-GTP-010, and *Identification of Ammunition*, NAVSEA SW010-AF-ORD-010.

MISSILE DESIGNATION

The Department of Defense established a missile and rocket designation sequence. The basic designation (table 3-1) of every guided missile are letters, which are in sequence. The sequence indicates the following:

1. The environment from which the vehicle is launched
2. The primary mission of the missile
3. The type of vehicle

Examples of guided missile designators common to the Aviation Ordnanceman are as follows:

Designator	Meaning
AGM	Air-launched, surface-attack, guided missile
AIM	Air-launched, intercept-aerial, guided missile
ATM	Air-launched, training guided missile
RIM	Ship-launched, intercept-aerial, guided missile

A design number follows the basic designator. In turn, the number may be followed by consecutive letters, which show a modification. For example, the designation of AGM-88C means the missile is an air-launched (A), surface-attack (G), missile (M), eighty-eighty missile design (88), third modification (C).

In addition, most guided missiles are given popular names, such as Sparrow, Sidewinder, and Harpoon. These names are retained regardless of subsequent modifications to the original missile.

MISSILE IDENTIFICATION

The external surfaces of all Navy guided missiles, except radome and antenna surfaces, are painted white. The color white has no identification color-coding significance when used on guided missiles.

There are three significant color codes used on guided missiles and their components—yellow, brown, and blue. These color codes indicate the explosive hazard in the missile component. If components are painted blue on a practice missile and have a yellow or brown band painted on them, the component has an explosive component that doesn't have a comparable part in a service missile.

Table 3-1.—Guided Missile and Rocket Designations

FIRST LETTER DESIGNATING LAUNCH ENVIRONMENT	DESCRIPTION
A Air	Air launched.
B Multiple	Capable of being launched from more than one environment.
C Coffin	Stored horizontally or at less than a 45-degree angle in a protective enclosure and launched from the ground.
F Individual	Carried and launched by one man.
M Mobile	Launched from a ground vehicle or movable platform.
P Soft Pad	Partially or non-protected in storage and launched from the ground.
U Underwater	Launched from a submarine or other underwater device.
R Ship	Launched from a surface vessel, such as a ship or barge.
SECOND LETTER DESIGNATING MISSION SYMBOL	DESCRIPTION
D Decoy	Vehicles designed or modified to confuse, deceive, or divert enemy defenses by simulating an attack vehicle.
E Special Electronic	Vehicles designed or modified with electronics equipment or communications, countermeasures, and electronic relay missions.
G Surface Attack	Vehicles designed to destroy enemy land or sea targets.
I Intercept-Aerial	Vehicles designed to intercept aerial targets in defensive roles.
Q Drone	Vehicles designed for target reconnaissance or surveillance.
T Training	Vehicles designed to be modified for training purposes.
U Underwater Attack	Vehicles designed to destroy enemy submarines or other underwater targets or to detonate underwater.
W Weather	Vehicles designed to observe, record, or relay data pertaining to meteorological phenomena.
THIRD LETTER DESIGNATING VEHICLE TYPE SYMBOL	DESCRIPTION
M Guided Missile	An unmanned, self-propelled vehicle with remote or internal trajectory guidance.
R Rocket	A self-propelled vehicle whose flight trajectory cannot be altered after launch.
N Probe	A non-orbital instrumented vehicle to monitor and transmit environmental information.
NOTE: The designations listed in the above table cover all the guided missiles and rockets used within the Department of Defense. Therefore, the Navy may not use all designations listed.	

Each component of the missile, besides being color coded, is identifiable by lettering stenciled on the exterior surface of the component. The lettering on a component gives information such as the Mark and Mod, type and weight of explosive filler, loading activity symbol and date of loading, temperature range restrictions, and unit serial number.

All missiles used in naval aviation are assigned missile serial numbers. These numbers are shipped with the missile's logbook. The missile serial number is normally the serial number of the leading component of the missile, such as the guidance and/or control components. The serial number is important because it is the number used to track the missile from assembly at a weapons station until it is fired or discontinued from service.

For further information concerning identification of guided missiles, refer to NAVSEA SW010-AF-ORD-010/NAVAIR 11-1-117, *Identification of Ammunition* (latest revision).

REVIEW NUMBER 1

Q1. The speed of a guided missile is given in terms of Mach numbers. If a guided missile is traveling at Mach 1, how fast is it going?

Q2. A missile traveling at Mach 3 is traveling at _______ speeds.

Q3. List the two types of guided missiles.

Q4. What two types of guided missiles are used in naval aviation?

Q5. The first letter of a missile designation describes the missile's ________.

Q6. Define the missile designation ATM.

Q7. Where would you find the serial number in an assembled missile?

Q8. What do the color codes identify on guided missiles?

MISSILE COMPONENTS

Guided missiles are made up of a series of subassemblies (figs. 3-1 and 3-2). The various subassemblies form a major section of the overall missile to operate a missile system, such as guidance, control, armament (warhead and fuzing), and propulsion. The major sections are carefully joined and connected to each other. They form the complete missile assembly. The arrangement of major sections in the missile assembly varies, depending on the missile type.

The guidance section is the brain of the missile. It directs its maneuvers and causes the maneuvers to be executed by the control section. The armament section carries the explosive charge of the missile, and the fuzing and firing system by which the charge is exploded. The propulsion section provides the force that propels the missile.

Guidance and Control Section

The complete missile guidance system includes the electronic sensing systems that initiate the guidance orders and the control system that carries them out. The elements for missile guidance and missile control can be housed in the same section of the missile, or they can be in separate sections.

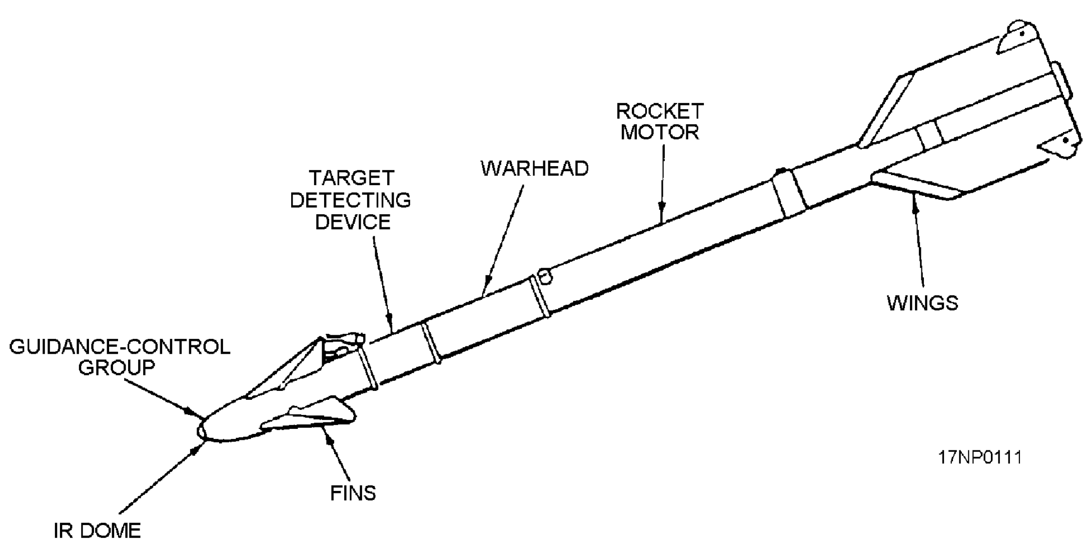

Figure 3-1.—Typical air-to-air guided missile.

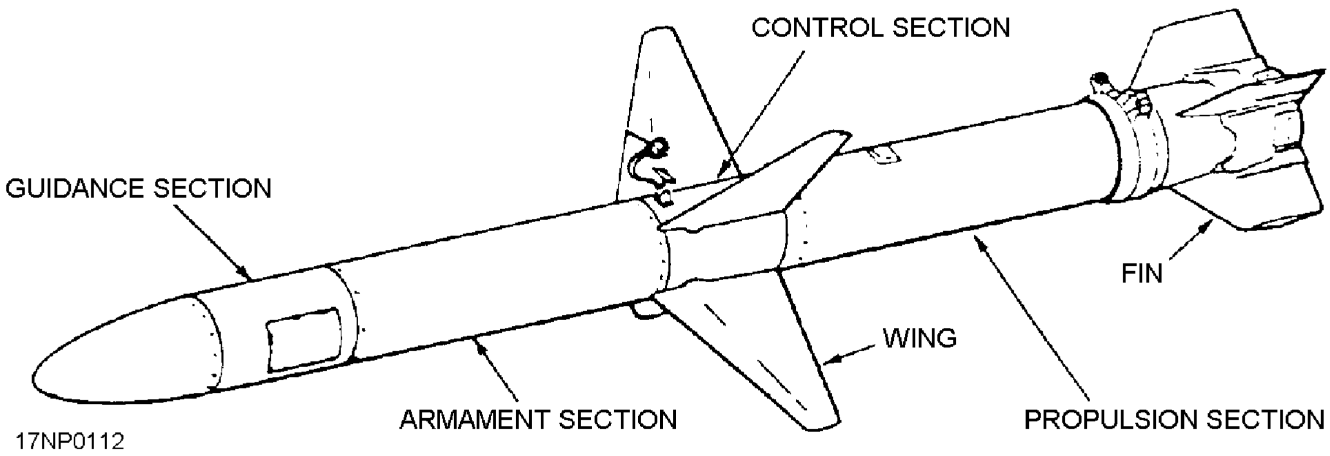

Figure 3-2.—Typical air-to-surface guided missile.

There are a number of basic guidance systems used in guided missiles. Homing-type, air-launched, guided missiles are currently used. They use radar or infrared homing systems.

A homing guidance system is one in which the missile seeks out the target, guided by some physical indication from the target itself. Radar reflections or thermal characteristics of targets are possible physical influences on which homing systems are based. Homing systems are classified as active, semiactive, and passive.

ACTIVE.—In the active homing system, target illumination is supplied by a component carried in the missile, such as a radar transmitter. The radar signals (fig. 3-3) transmitted from the missile are reflected off the target back to the receiver in the missile. These reflected signals give the missile information such as the target's distance and speed. This information lets the guidance section compute the correct angle of attack to intercept the target. The control section that receives electronic commands from the guidance section controls the missile’s angle of attack. Mechanically manipulated wings, fins, or canard control surfaces are mounted externally on the body of the weapon. They are actuated by hydraulic, electric, or gas generator power, or combinations of these to alter the missile's course.

SEMIACTIVE.—In the semiactive homing system (fig. 3-4), the missile gets its target illumination from an external source, such as a transmitter carried in the launching aircraft. The receiver in the missile receives the signals reflected off the target, computes the information, and sends electronic commands to the control section. The control section functions in the same manner as previously discussed.

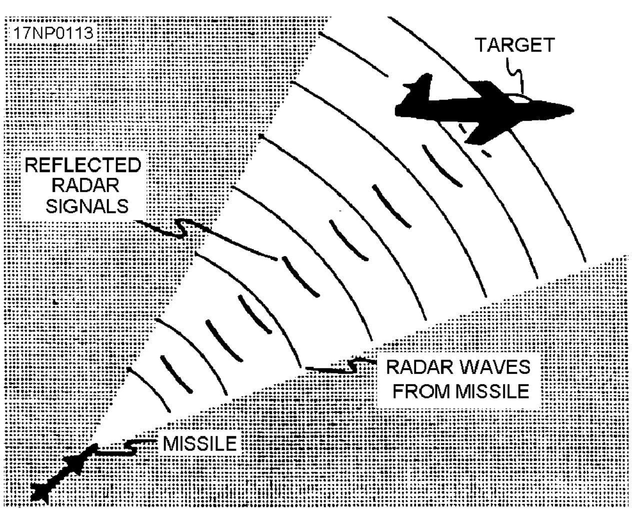

Figure 3-3.—Active homing system.

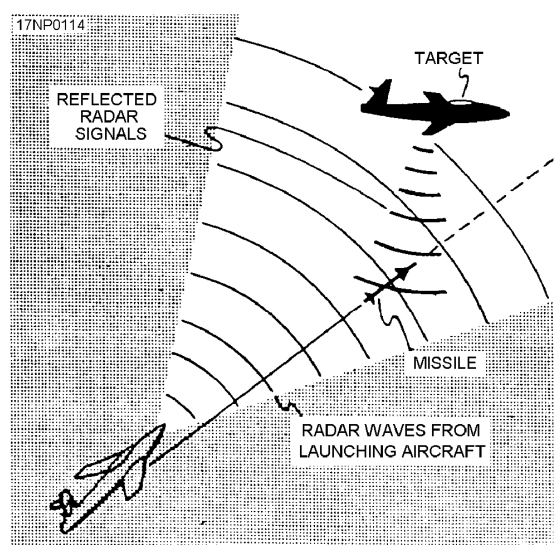

Figure 3-4.—Semiactive homing system.

PASSIVE.—In the passive homing system (fig. 3-5), the directing intelligence is received from the target. Examples of passive homing include homing on a source of infrared rays (such as the hot exhaust of jet aircraft) or radar signals (such as those transmitted by ground radar installations). Like active homing, passive homing is completely independent of the launching aircraft. The missile receiver receives signals generated by the target and then the missile control section functions in the same manner as previously discussed.

REVIEW NUMBER 1 ANSWERS

A1. If a guided missile is traveling at Mach 1, it is traveling at approximately 766 miles per hour.

A2. A missile traveling at Mach 3 is traveling at supersonic speeds.

A3. The two types of guided missiles are service and nonservice guided missiles.

A4. The two types of guided missiles used in naval aviation are air-to-air and air-to-surface guided missiles.

A5. The first letter of a missile designation describes the missile's launch environment.

A6. The missile designation ATM stands for an air-launched training guided missile.

A7. The serial number in an assembled missile is usually found on the leading component.

A8. The color codes on guided missiles identify the explosive hazard in the missile component.

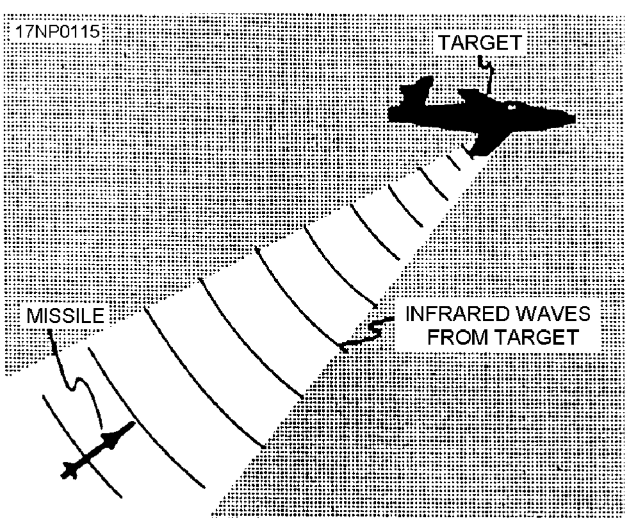

Figure 3-5.—Passive homing system.

Armament Section

The armament system contains the payload (explosives), fuzing, safety and arming (S&A) devices, and target-detecting devices (TDDs).

PAYLOAD.—The payload is the element or part of the missile that does what a particular missile is launched to do. The payload is usually considered the explosive charge, and is carried in the warhead of the missile. High-explosive warheads used in air-to-air guided missiles contain a rather small explosive charge, generally 10 to 18 pounds of H-6, HBX, or PBX high explosives. The payload contained in high-explosive warheads used in air-to-surface guided missiles varies widely, even within specific missile types, depending on the specific mission. Large payloads, ranging up to 450 pounds, are common. Comp B and H-6 are typical explosives used in a payload.

Most exercise warheads used with guided missiles are pyrotechnic signaling devices. They signal fuze functioning by a brilliant flash, by smoke, or both. Exercise warheads frequently contain high explosives, which vary from live fuzes and boosters to self-destruct charges that can contain as much as 5 pounds of high explosive.

FUZING.—The fuzing and firing system is normally located in or next to the missile's warhead section. It includes those devices and arrangements that cause the missile's payload to function in proper relation to the target. The system consists of a fuze, a safety and arming (S&A) device, a target-detecting device (TDD), or a combination of these devices.

There are two general types of fuzes used in guided missiles—proximity fuzes and contact fuzes. Acceleration forces upon missile launching arm both fuzes. Arming is usually delayed until the fuze is subjected to a given level of accelerating force for a specified amount of time. In the contact fuze, the force of impact closes a firing switch within the fuze to complete the firing circuit, detonating the warhead. Where proximity fuzing is used, the firing action is very similar to the action of proximity fuzes used with bombs and rockets.

SAFETY AND ARMING (S&A) DEVICES.—S&A devices are electromechanical, explosive control devices. They maintain the explosive train of a fuzing system in a safe (unaligned) condition until certain requirements of acceleration are met after the missile is fired.

TARGET-DETECTING DEVICES (TDD).—TDDs are electronic detecting devices similar to the detecting systems in VT fuzes. They detect the presence of a target and determine the moment of firing. When subjected to the proper target influence, both as to magnitude and change rate, the device sends an electrical impulse to trigger the firing systems. The firing systems then act to fire an associated S&A device to initiate detonation of the warhead.

Air-to-air guided missiles are normally fuzed for a proximity burst by using a TDD with an S&A device. In some cases, a contact fuze may be used as a backup. Air-to-surface guided missile fuzing consists of influence (proximity) and/or contact fuzes. Multifuzing is common in these missiles.

Propulsion Section

Guided missiles use some form of jet power for propulsion. There are two basic types of jet propulsion power plants used in missile propulsion systems—the atmospheric (air-breathing) jet and the thermal jet propulsion systems. The basic difference between the two systems is that the atmospheric jet engine depends on the atmosphere to supply the oxygen necessary to start and sustain burning of the fuel. The thermal jet engine operates independently of the atmosphere by starting and sustaining combustion with its own supply of oxygen contained within the missile.

ATMOSPHERIC JET PROPULSION SYSTEM.—There are three types of atmospheric jet propulsion systems—the turbojet, pulsejet, and ramjet engines. Of these three systems, only the turbojet engine is currently being used in Navy air-launched missiles. A typical turbojet engine includes an air intake, a mechanical compressor driven by a turbine, a combustion chamber, and an exhaust nozzle. The engine does not require boosting and can begin operation at zero acceleration.

THERMAL JET PROPULSION SYSTEM.—Thermal jets include solid propellant, liquid propellant, and combined propellant systems. As an AO, you come in contact with all three systems. The solid propellant and combined propellant systems are currently being used in some air-launched guided missiles.

The majority of air-launched guided missiles used by the Navy use the solid propellant rocket motor. They include the double base and multibase smokeless powder propellants as well as the composite mixtures. Grain configurations vary with the different missiles. Power characteristics and temperature limitations of the individual rocket motors also vary.

In some guided missiles, different thrust requirements exist during the boost phase as compared to those of the sustaining phase. The dual thrust rocket motor (DTRM) is a combined system that contains both of these elements in one motor. The DTRM contains a single propellant grain made of two types of solid propellant—boost and sustaining. The grain is configured so the propellant meeting the requirements for the boost phase burns at a faster rate than the propellant for the sustaining phase. After the boost phase propellant burns itself out, the sustaining propellant sustains the motor in flight over the designed burning time (range of the missile).

REVIEW NUMBER 2

Q1. List the major sections of guided missiles.

Q2. What section is considered the brains of the missile?

Q3. List the three types of homing systems.

Q4. If a missile gets its target illumination from the launching aircraft, what type of homing system does it have?

Q5. List the components of the armament section.

Q6. Describe the function of safety and arming (S&A) devices.

Q7. What are the two types of propulsion used with guided missiles?

Q8. Describe the basic difference between the two types of propulsion.

SERVICE GUIDED MISSILES

Missiles have been operational for several years. Still, research on missiles continuously produces changes in the missile field. The missiles discussed in this manual are presently operational.

Sparrow III Guided Missile

The AIM-7F/M missile (fig. 3-6) is a supersonic, air-to-air DTRM, guided missile. It is designed to be rail or ejection launched from an interceptor aircraft. The missile's tactical mission is to intercept and destroy enemy aircraft in all-weather environments. It is designed to be launched from the F-14 and F/A-18 aircraft.

REVIEW NUMBER 2 ANSWERS

A1. Guidance, control, armament, and propulsion are the major sections of guided missiles.

A2. The guidance section is considered the brains of the missile.

A3. The three types of homing systems are active, semiactive, and passive homing.

A4. If a missile gets its target illumination from the launching aircraft, it is semiactive homing.

A5. The armament section consists of the payload, fuzing, safety and arming (S&A) devices, and target-detecting devices (TDDs).

A6. Safety and arming devices maintain the explosive train of a fuzing system in a safe condition until the acceleration requirement is met after launch.

A7. The two types of propulsion used with guided missiles are atmospheric (air breathing) jet and thermal jet.

A8. The atmosphere jet depends on the atmosphere to supply the oxygen for proper fuel burning, and the thermal jet contains its own supply of oxygen and is independent from the atmosphere.

The AIM-7F/M missile is a semiactive missile. Missile guidance depends on RF energy radiated by the launching aircraft and reflected by the target. Excluding the radome, the missile body has four sectional tubular shells that house the major functional components. The four major functional components are the target seeker, flight control, warhead, and rocket motor. The overall length of the missile is approximately 142 inches with a diameter of 8 inches. It weighs approximately 510 pounds. The missile is issued to the fleet as an all-up-round (AUR). The only assembly required at fleet level is the installation of the wing and fin assemblies, which are shipped in separate shipping containers.

The radome is ceramic and forms the nosepiece of the missile. It does not obstruct RF energy. It covers the RF head assembly of the target seeker and provides protection against environmental damage.

The target seeker receives and interprets the radar energy reflected from the target. Then it produces signals that are sent to the flight control section to direct

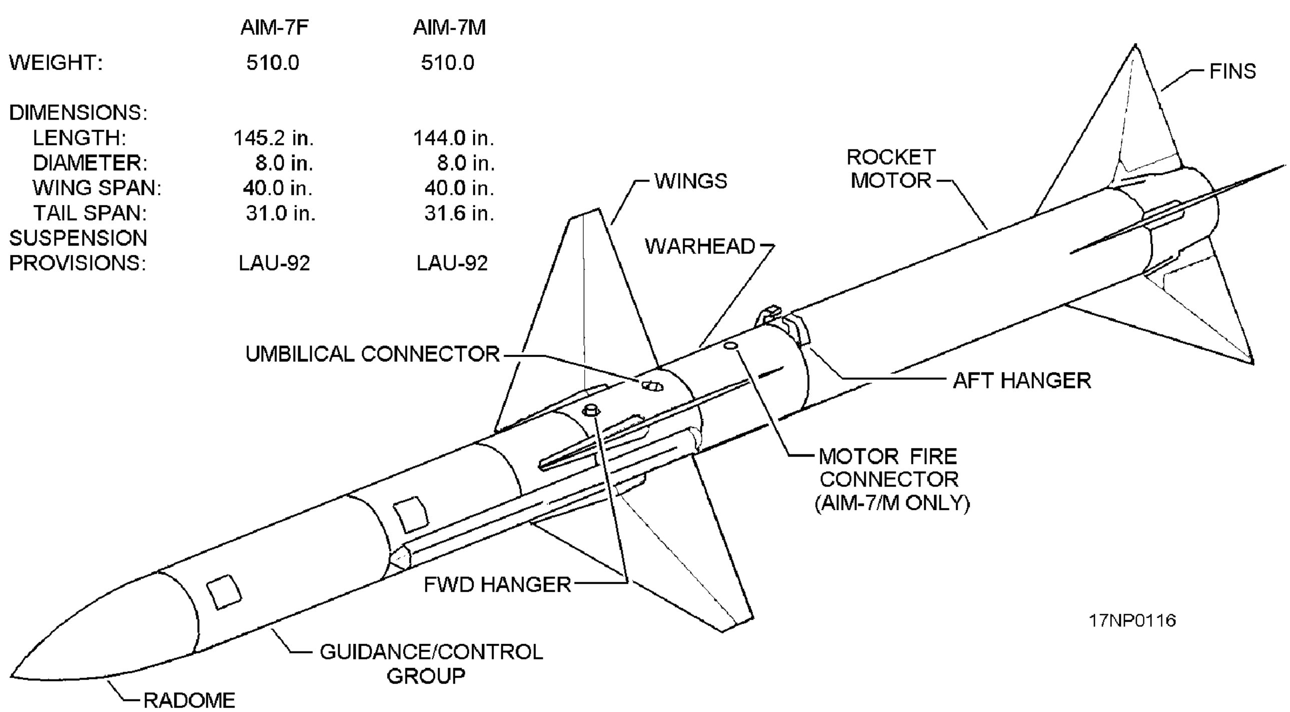

Figure 3-6.—AIM-7F/M Sparrow missile.

the missile to intercept the target or come within lethal range of it.

The flight control consists of the autopilot and the hydraulic group. These function to provide control signals and mechanical energy to move the external control surfaces that guide the missile toward the point of intercept, and to stabilize the missile in pitch, yaw, and roll.

The warhead is located between the target seeker and flight control section. The warhead is explosive-loaded, and it contains the fuze, fuze booster charge, and the safety and arming (S&A) device. It is a continuous-rod type of warhead. At detonation, the rod sections expand into a continuous ring. Target kill is accomplished by collision of the continuous ring with the target. Detonation is triggered either by a fuze pulse from the target seeker at the nearest point of intercept or a fuze pulse from the flight control upon impact with the target.

The DTRM attaches to the aft end of the missile flight control section. It is equipped with a SAFE/ARM igniter assembly that is manually locked in either the SAFE or ARMED position. This switch can only be repositioned with an arming key. When in the SAFE position, the arming key cannot be removed. This switch prevents accidental firing of the motor. It should not be moved to the ARMED position until immediately before aircraft launch.

The control surfaces consist of four delta-shaped wing and fin assemblies. The wings and fins are designed for quick attachment and release without the use of tools. The wing assemblies attach to the flight control section, which controls their rotary motion to produce the desired pitch, yaw, and roll. The tail fin assemblies attach to fittings on the rear of the rocket motor and provide stability to the missile.

Another series of the Sparrow III guided missile is the RIM-7E and RIM-7H. These missiles are surface-to-air guided missiles. They are used in some ships in the ship's Basic Point Defense Surface Missile System (BPDSMS) and Improved Point Defense Surface Missile System (IPDSMS), respectively. As an Aviation Ordnanceman, your responsibility for these missiles is in the area of handling and stowage only.

For further information concerning the Sparrow III (series) missiles, refer to publication *Organizational, Intermediate, and Depot Maintenance Instruction Manual with Illustrated Parts Breakdown*, NAVAIR 01-265GMAD-9-3 (series) and NAVAIR 11-140-6 Airborne Weapons Assembly Manual.

Harpoon Guided Missile

The Harpoon surface attack guided missile, AGM-84 series (AGM-84/C/D Tactical) air-launched missile (fig. 3-7), is an all-weather antiship attack weapon. The SLAM tactical missile (fig. 3-7), AGM-84E, is a standoff land attack missile. The Harpoon can be delivered from the F/A-18, P-3, and S-3 aircraft. Both missiles are AURs and require no assembly other than installation of the wing and control fin assemblies. The missile consists of the guidance section, warhead section, sustainer section, boattail section, wings, and control fins. The missile is approximately 151 inches in length and weighs approximately 1,144 pounds.

The Harpoon missile has a low-level cruise trajectory with over-the-horizon range that makes it less susceptible to radar detection. It uses active guidance and has counter-countermeasure capability.

The guidance section contains the seeker, radar altimeter, midcourse guidance unit, and power supply. A radome on the front of the guidance section provides the required aerodynamic shield to protect the internal components of the seeker. During ground handling, a radome protector cap protects the radome.

The warhead section contains a penetration blast type of explosive, the guided missile fuze, fuze booster, and the pressure probe assembly. It also provides internal routing of the interconnecting cable from the guidance section to other parts of the missile.

The sustainer section contains the fuel tank and fuel supply system, missile battery, pyrotechnic relay panel, and the turbojet engine. Three BSU-4/B missile wings and one BSU-43/B missile wing are attached to the sustainer section by quick-attach, clevis-type fittings. These wings are attached to the missile at the organizational level. They provide the aerodynamic lift required sustaining missile flight. They are made of a framed aluminum honeycomb construction and are nonfolding.

The boattail section contains four control actuators, which control the control fins. Four identical nonfolding missile control fins (BSU-44/B) provide directional control of the missile's airframe proportional to the input signal received from the guidance section. The control fins are one-piece aluminum castings, and are attached to the control fin actuators by means of an integral torque-limiting, screw-type device.

PHYSICAL CHARACTERISTICS

	AGM-84A HARPOON	AGM-84E SLAM	AGM-84F HARPOON-1D
WEIGHT:	1160 lb.	1250 lb.	1400 lb.
LENGTH:	151 in.	178 in.	175 in.
DIAMETER:	13.5 in.	13.5 in.	13.5 in.
SUSPENSIONS PROVISIONS:	30 in.	30 in	30 in.

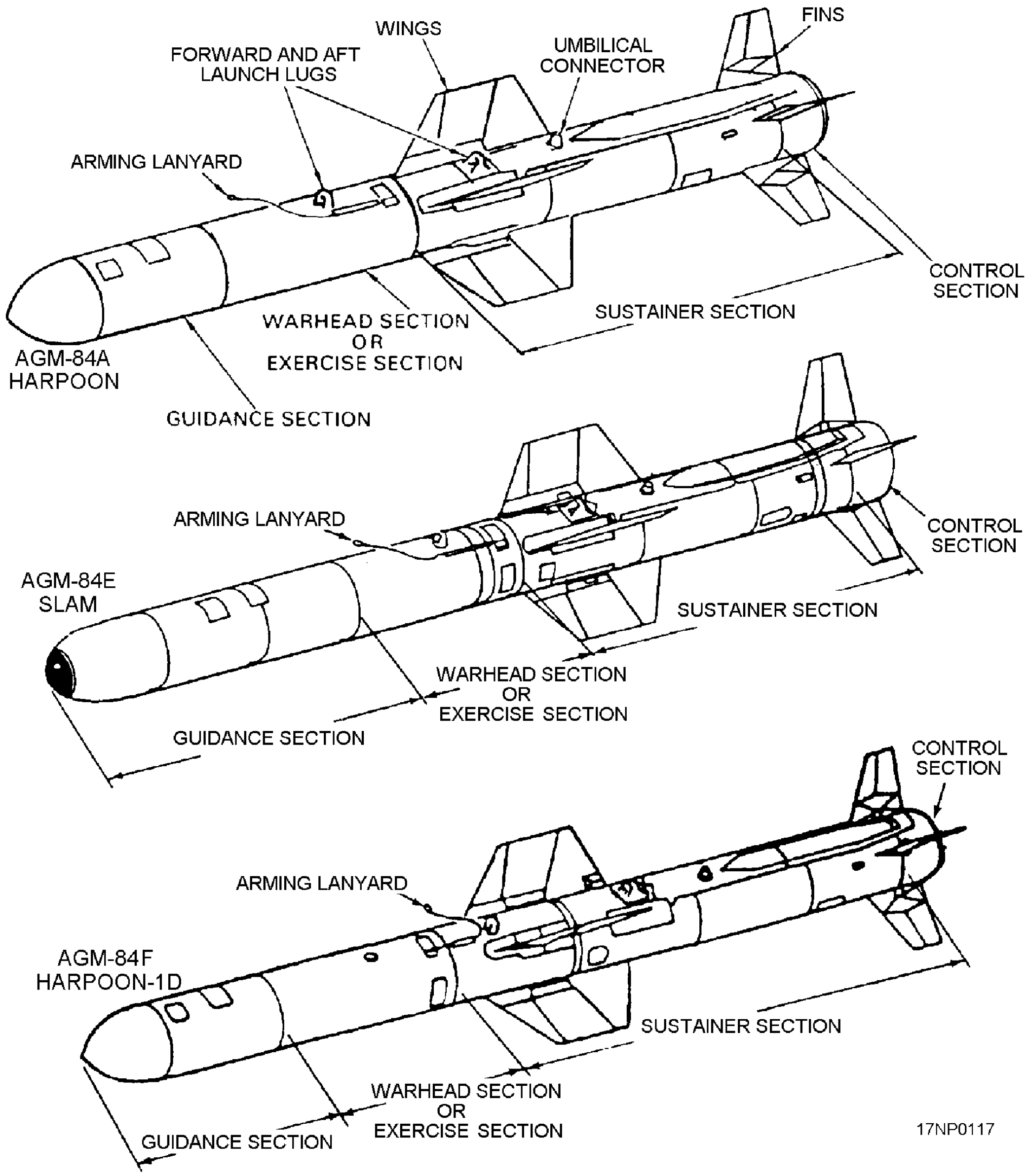

Figure 3-7.—AGM-84 series Harpoon/SLAM guided missile.

For further information concerning the air-launched AGM-84 (series) Harpoon guided missiles, refer to the publications *Airborne Weapons Assembly,* NAVAIR 11-140-6.2-4, and *Airborne Weapons Assembly, AGM-84/E,* NAVAIR 11-140-6.2-5.

Sidewinder Guided Missile

The Sidewinder guided missiles, AIM-9 series (fig. 3-8), are supersonic, air-to-air weapons with passive infrared target detection, proportional navigation guidance, and torque-balance control systems. They are capable of being launched from the F-14 and F/A-18 aircraft. The AIM-9 series missiles are issued to the fleet as AURs. The components of the ATM-9L-1 are identical to the AIM-9L/M except that a training warhead is substituted for the tactical warhead in the ATM-9L-1. The AIM-9L/M missile is used strictly for tactical purposes. The ATM-9L-1 missile is used for pilot training in target acquisition and missile firing.

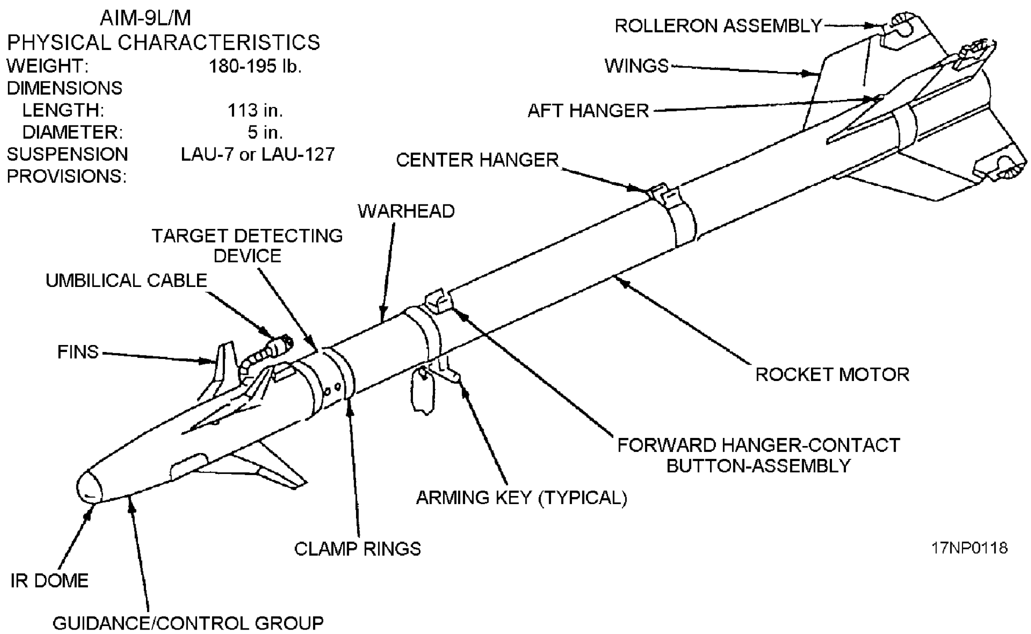

Figure 3-8.—AIM-9 series Sidewinder guided missile.

The Sidewinder guided missile is approximately 113 inches in length, 5 inches in diameter, weighs approximately 190 pounds, and consists of five major components. These components are the guidance and control section, the target detector section, the S&A device, the warhead section, and the rocket motor section (fig. 3-9).

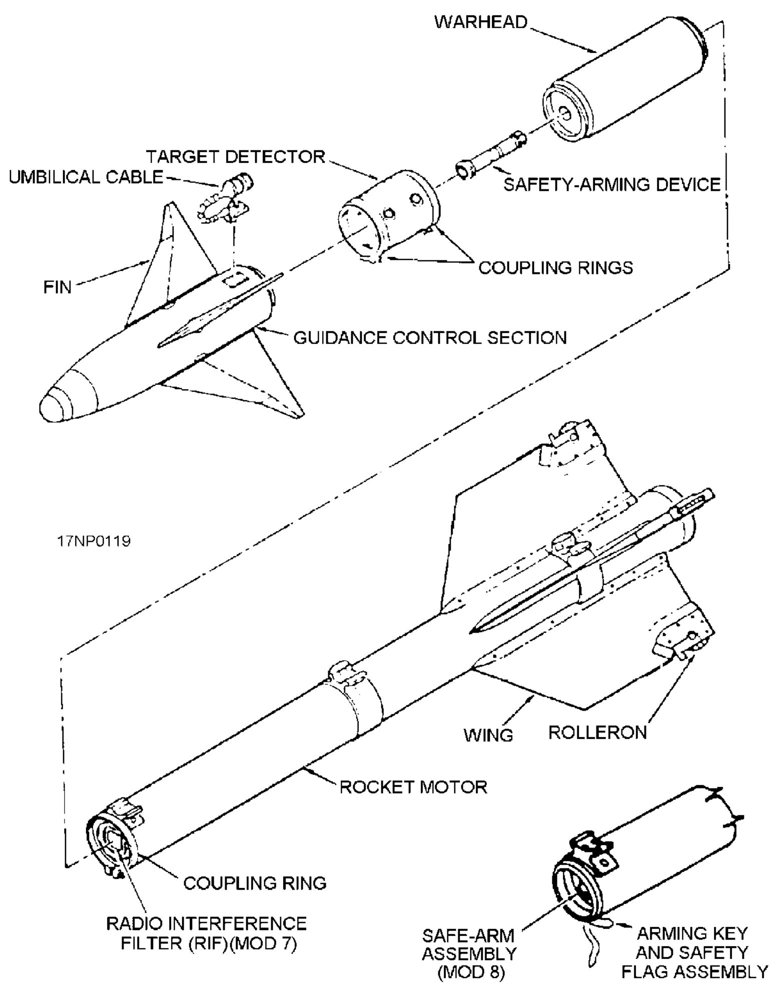

Figure 3-9.—AIM-9 series Sidewinder guided missile (exploded view).

The guidance and control section consists of the following three major assemblies:

1. An infrared seeker assembly, which is used for detecting the target.
2. An electronic assembly, which is used for converting detected target information to tracking and guidance command signals.
3. A gas servo assembly (which consists of a gas generator, manifold, pistons, rocker arms, electrical solenoids, and thermal battery), where the electrical guidance commands are converted to mechanical movement of the control fins.

Four BSU-32/B control fins are mounted on the guidance and control section to provide aerodynamic lift and course alterations to the missile during free flight. They are movable surfaces that are electrically controlled and pneumatically operated by the gas servo assembly. The missile's umbilical cable is also attached to the guidance and control section. A shorting cap/dust cover must be installed on the umbilical connector at all times when the missile is not electrically connected to the LAU-7 launcher. The umbilical cable provides the necessary path for the exchange of electronic signals between the missile and aircraft before missile launch. It also provides a connection to the launcher-mounted cooling gas supply, which prevents the electronic components of the guidance and control section from becoming overheated during operation before missile launch. The umbilical cable is sheared off at missile launch.

The target detector (TD) is a narrow-beam, active-optical, proximity fuze system. The purpose of the TD is to detect the presence of an air target within the burst range of the missile warhead and generate an electrical firing signal to the S&A device.

The S&A device attaches to the target detector and is located between the TD section and the warhead section. The S&A device contains an interrupted firing train that is aligned by an acceleration-arming device. It contains the necessary high explosives, switches, and circuits to initiate detonation of the warhead.

The WDU-17/B warhead (used in the AIM-9L configuration) is an annular blast fragmentation warhead that consists of a case assembly, two booster plates, an initiator, high explosive, and fragmentation rods. The explosive output from the S&A device is transferred through the initiator to the booster plates. The initiation is then transferred through the explosive-loaded channels of the booster plates to the booster pellets at each end of the warhead. Detonation of the booster pellets sets off the high explosive, causing warhead detonation.

The WDU-9A/B warhead (used in the ATM-9L-1 configuration) is mechanically interchangeable with the WDU-17/B tactical warhead. The WDU-9A/B contains a smoke-flash mix with CH-6 booster to provide visual observation of the missile/target hit.

The Mk 36 Mod 7 rocket motor uses a single-grain propellant. A nonpropulsive head closure located on the forward end of the motor tube, blows out if the motor is accidentally ignited without the warhead installed, making the motor nonpropulsive (a fire hazard vice a missile hazard). The Mk 36 Mod 8 rocket motor is basically identical to the Mod 7 motor except that the Mod 8 motor is equipped with a safe-arm ignition assembly. The purpose of this assembly is to prevent accidental or inadvertent rocket motor ignition. The safe-arm ignition assembly must be manually rotated to the armed position before flight. This is accomplished by the use of a hex-head T-handle.

Four Mk 1 Mod 0 or Mod 1 wings are attached to the aft end of the motor tube. They provide aerodynamic lift and stability during flight. Each wing has a rolleron assembly that provides pitch, yaw, and roll stabilization during free flight. When the missile is fired, the rolleron is uncaged by acceleration and is free to move through its longitudinal axis during flight. The rolleron wheel is designed so that the passing airstream causes it to spin at a very high speed, thus acting as a gyroscope, which helps to stabilize the missile and reduce roll during flight.

For further information about the AIM-9L/M and ATM-9L-1 Sidewinder guided missile, you should refer to the *Sidewinder Guided Missile AIM-9L and Training Missile*, NAVAIR 01-AIM9-2 and Airborne Weapons Assembly Manual NAVAIR 11-140-6.

Advanced Medium Range Air-to-Air Missile (AMRAAM)

The AMRAAM is an all-weather missile (fig. 3-10). Aircraft currently scheduled to carry the missile are the F-14 and F/A-18 aircraft. The AIM-120 is an AUR that consists of a guidance section, armament section, propulsion section, and control section.

The guidance section consist of a radome, seeker components, electronics unit, inertial reference unit, target detection device, batteries, power converter, and related harnesses and hardware.

The armament section includes a WDU-33/B fragmenting warhead, Mk-44 booster, and a FZU-49/B safe and arm fuze (SAF).

The propulsion section consists of a dual-thrust, solid propellant, low-smoke, rocket motor, a blast tube and exit cone, and an arm/fire device (AFD).

The control section includes four independently controlled electromechanical actuators, four thermal batteries, a data link assembly, and associated hardware. Gas pressure-operated mechanical locks during ground handling and captive carry lock the control surfaces in position. During launch, a pyrotechnic gas generator creates enough gas pressure to unlock the control surfaces.

REVIEW NUMBER 3

Q1. *Within the radome of the Sparrow III missile, what feature receives and interprets the radar energy reflected from the target?*

Q2. *What part of the Sparrow III missile provides control signals and mechanical energy to move external control surfaces that guide the missile?*

Q3. *To what part of the Sparrow missile is the DRTM attached?*

Q4. *Name the aircraft from which the Harpoon guided missile is launched.*

Q5. *The Harpoon missile is less susceptible to radar detection because*

Q6. *List the sections of the Harpoon missile.*

Q7. *Sidewinder missiles are equipped with ____________ target detection.*

Q8. *List the five major components of the Sidewinder missile.*

Q9. *By what means is the S&A device aligned?*

Q10. *What feature of the Sidewinder missile provides aerodynamic lift and stability during flight?*

PHYSICAL CHARACTERISTICS:	
WEIGHT:	327 lb.
DIMENSIONS	144 in.
LENGTH:	144 in.
DIAMETER:	7 in.
WING SPAN:	21 in.
FIN SPAN:	25 in.
SUSPENSION PROVISIONS:	LAU-127A/A or LAU-116A/A

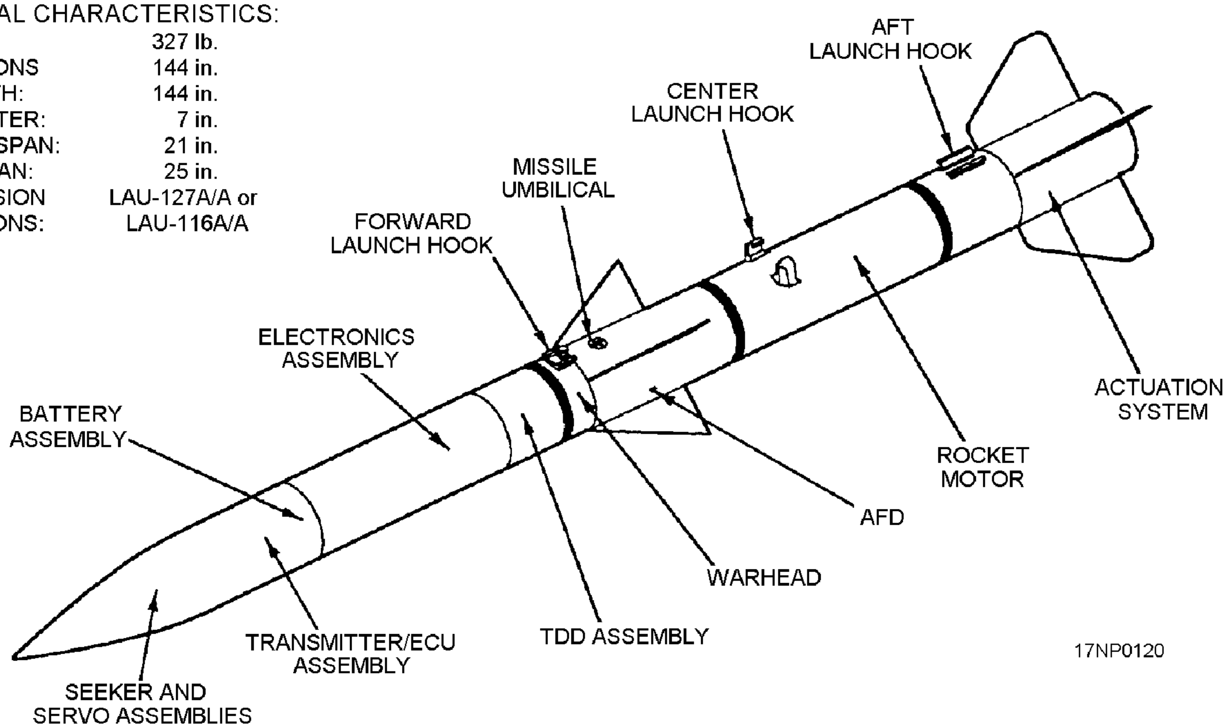

Figure 3-10.—AIM-120 AMRAAM guided missile.

Phoenix Missile

The tactical AIM-54C Phoenix (fig. 3-11) is an air-launched, air-to-air guided missile that employs active, semiactive, and passive homing capabilities. The AIM-54C is used as a long-range, air-intercept missile launched from the F-14 aircraft. It is equipped with the AWG-9 Airborne Missile Control System (AMCS). The missile can be launched in multiple missile attacks, as required, against hostile forces. A maximum of six AIM-54C Phoenix missiles can be launched from a single aircraft, with simultaneous guidance against widely separated targets. In addition, the missile has dogfight, electronic counter-countermeasures (ECCM), and anticruise missile capabilities.

The physical description of the Phoenix missile is extremely brief because it is classified as Secret. The overall length of the missile is 13 feet with a diameter of 15 inches. It weighs approximately 1,020 pounds. The missile consists of the guidance section, the armament section, the propulsion section, and the control section. The missile is an AUR. The wings and fins can be mounted or removed to facilitate handling.

Maverick Missile

The tactical AGM-65E Maverick (fig. 3-12) is a laser-guided, rocket-propelled, air-to-ground missile. It is used against fortified ground installations, armored vehicles, and surface combatants. Launch aircraft for the Maverick is the F/A-18

The AGM-65E missile has two major sections—the guidance and control section and the center/aft section. Four fixed wings are an integral part of the center/aft section, and four movable control surfaces (fins) are located at the aft section. These fins are installed or removed to aid in handling. The missile is issued to the fleet as an AUR. Installation of the fins is the only assembly required at the organizational maintenance level.

The AGM-65E missile system has all the laser missile features, including automatic terminal homing on laser energy reflected from the target, which is illuminated by a laser designator. The laser designator can be a ground device, either hand-held or tripod mounted. It can also be a stabilized airborne device, mounted either on a separate aircraft or on the launching aircraft. Additionally, the warhead provides kinetic penetration into earth-barricaded or concrete fortifications and ships. The fuzing system allows a selectable detonation delay to optimize kill capability.

For further information on the AGM-65E Maverick, you should refer to *Laser-Guided Missile AGM-65E (Maverick)*, NAVAIR 11-120-58.

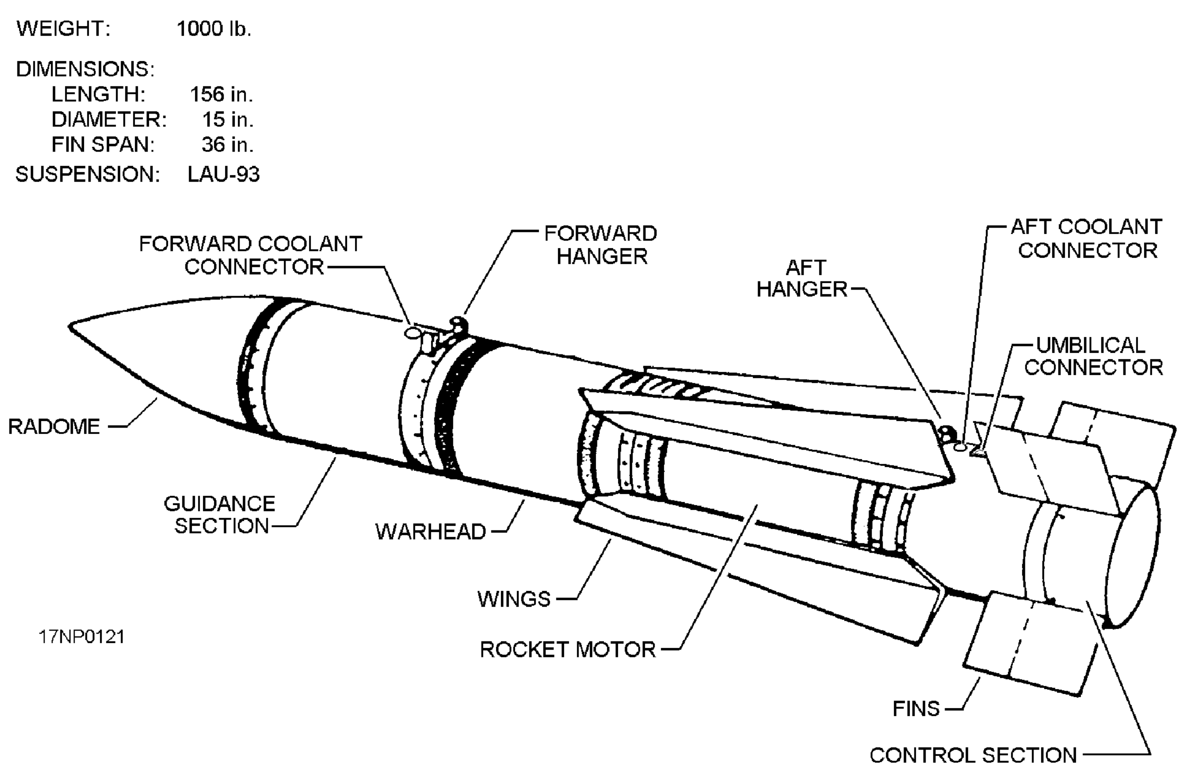

Figure 3-11.—AIM-54 Phoenix guided missile (typical).

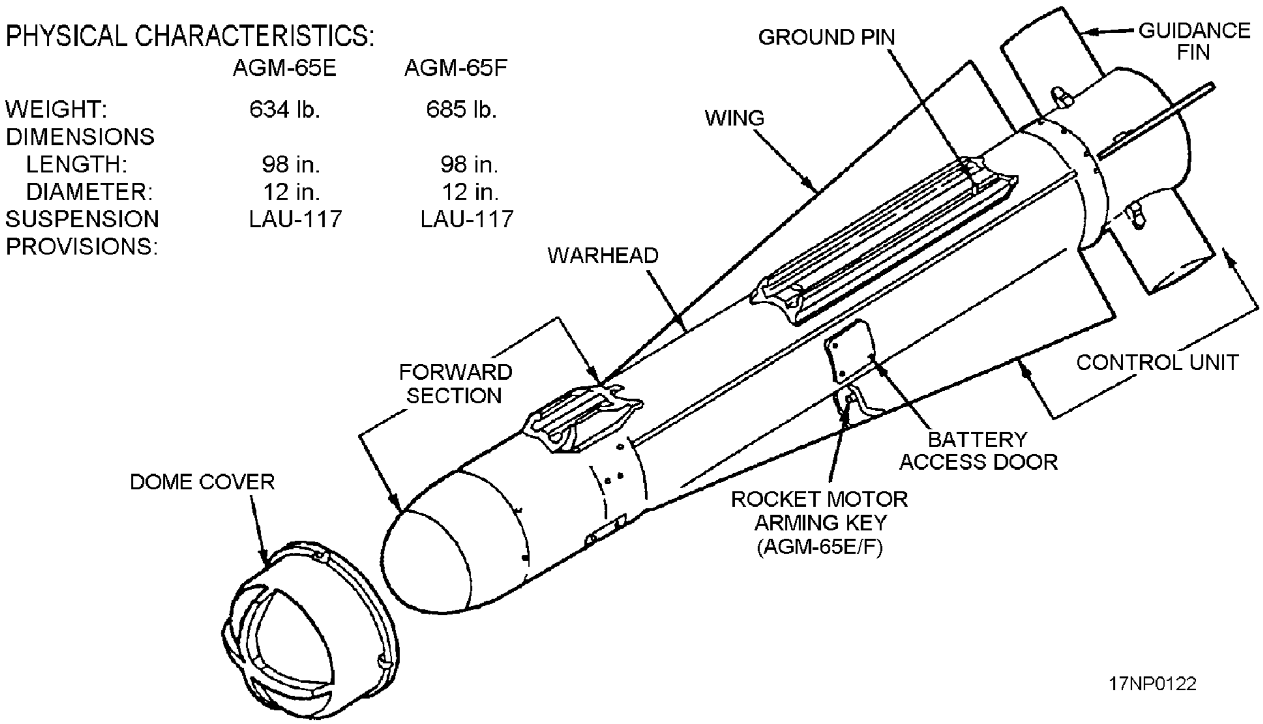

Figure 3-12.—AGM-65E Maverick missile.

HARM Missile

The AGM-88A high-speed antiradiation missile (HARM) (fig. 3-13) offers performance improvements over the existing Standard ARM missile when used for defense suppression and similar operations.

The HARM missile, in conjunction with the launching aircraft's avionics, detects, identifies, and locates enemy radar, displays threat information, and computes target parameters. The HARM missile is 10 inches in diameter, 194 inches long, and weighs 780 pounds. The missile operates in three basic modes:

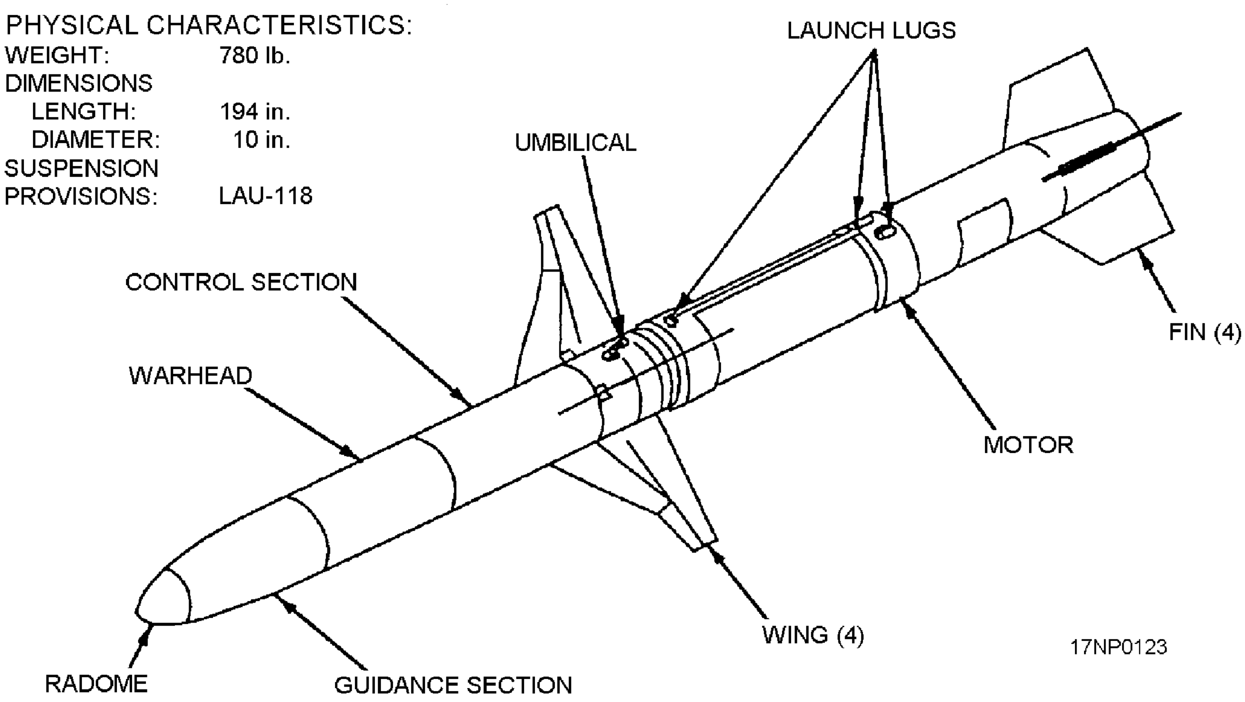

Figure 3-13.—AGM-88 HARM missile.

(1) self-protect (which attacks targets that pose immediate threat to the aircraft), (2) target of opportunity (which attacks discrete targets important to the tactical situation), and (3) prebrief (missile programmed to the vicinity of known or expected targets, and to attack when lock-on is achieved). Launch aircraft for the HARM are the EA-6B and F/A-18.

Penguin Missile

The AGM-119B (fig. 3-14) is a fire and forget, antisurface ship, all-up-round (AUR) missile. The missile uses inertial guidance and infrared (IR) homing. The AGM-119B is intended to be launched from the SH-60B LAMPS helicopter. It is the first helicopter-launched, air-surface, antiship missile system in the U.S. Navy inventory.

The missile launch assembly (MLA) contains the missile control system (MCS) and attaches to the wing pylon of the SH-60B LAMPS Mk III helicopter. It provides mechanical attachment points for the missile launch/release system (BRU-14 rack with two AERO-1A adapters, which provide a 30-inch suspension capability). The MLA, with BRU-14 attached, carries and launches the Penguin missile on command.

REVIEW NUMBER 3 ANSWERS

A1. *Within the radome of the Sparrow III missile, the target seeker receives and interprets the radar energy reflected from the target.*

A2. *The flight control section, which consists of the autopilot and hydraulic group, provides the Sparrow III missile with control signals and mechanical energy to move external control surfaces to guide the missile.*

A3. *The DRTM is attached to the aft end of the missile flight control section of the Sparrow missile.*

A4. *The Harpoon guided missile is launched from F/A-18, S3, and P-3 aircraft.*

A5. *The Harpoon missile is less susceptible to radar detection because of its low-level cruise trajectory with over-the-horizon range.*

A6. *The sections of the Harpoon missile include the guidance, warhead, sustainer, and boat-tail sections.*

A7. *Sidewinder missiles are equipped with passive infrared target detection.*

A8. *The five major components of the Sidewinder missile include the guidance and control*

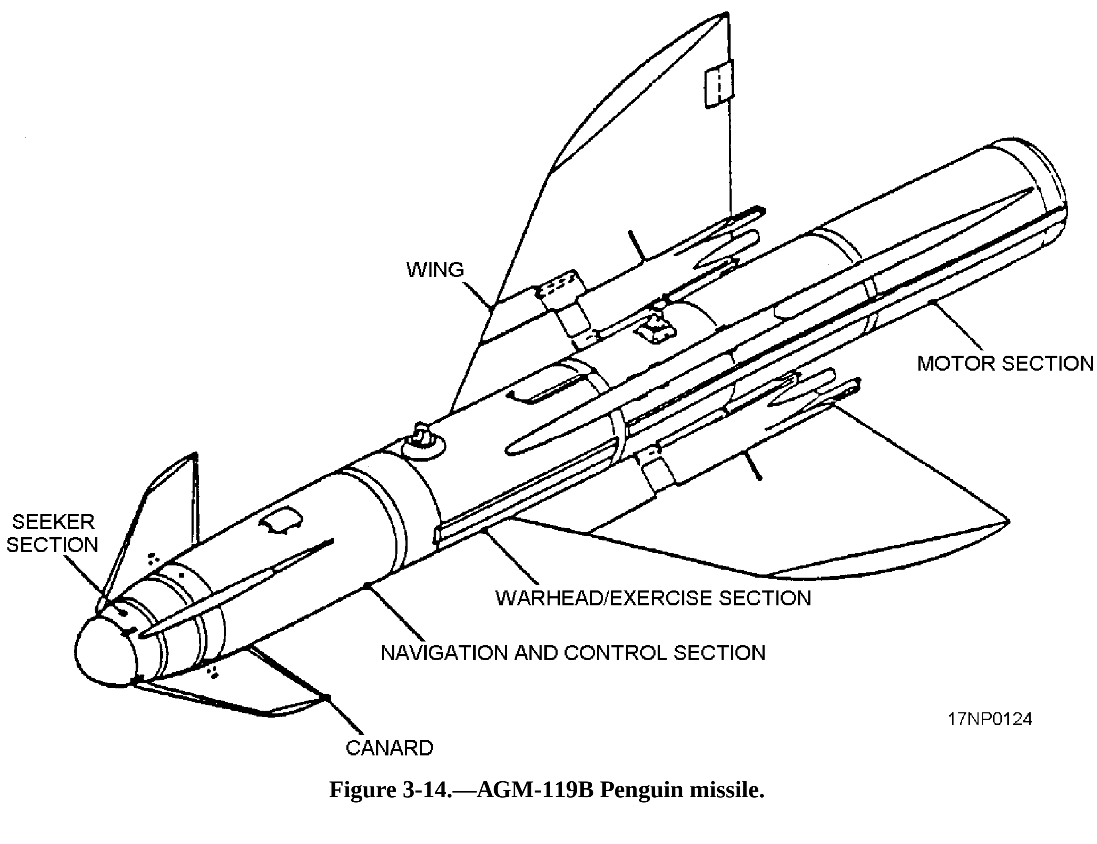

Figure 3-14.—AGM-119B Penguin missile.

section, target detector section, S&A device, warhead section, and rocket motor section.

A9. An interrupted firing train that is aligned by an acceleration-arming device aligns the S&A device.

A10. Four Mk 1 Mod 0 or Mod 1 wings attached to the aft end of the motor tube provide aerodynamic lift and stability to the Sidewinder missile during flight.

REVIEW NUMBER 4

Q1. List the homing capabilities incorporated into the Phoenix missile.

Q2. How many Phoenix missiles can be launched from a single aircraft?

Q3. List the sections of the Phoenix missile.

Q4. List the types of targets the Maverick missile is used against.

Q5. How does the laser guidance system work in the Maverick missile?

Q6. Name the three basic modes of HARM missile operation.

Walleye Guided Weapon

The Walleye guided weapon does not contain a propulsion system, as do guided missiles. It is included in this chapter because it contains a guidance system, a control system, externally mounted control surfaces, and is listed in the Air Launched Guided Missiles and Components section of *Navy Ammunition Logistic Code TW010-AA-ORD-010,* NAVAIR 11-1-116A.

The Walleye guided weapon system (fig. 3-15) is designed to deliver a self-guided, high explosive weapon from an attack aircraft to a surface target. The Walleye weapon is issued to the fleet as an AUR. The only assembly required at the organizational maintenance level is the installation of the wings and fins.

The weapons are grouped into four basic series—Walleye I (small scale), Walleye I extended range data link (ERDL), Walleye II (large scale), and Walleye II ERDL. Note that the Walleye II and Walleye II ERDL weapons are larger in diameter and length and weigh more than the Walleye I weapon. The Walleye II ERDL weapon also has larger wings. A Walleye weapon representative of each basic series is discussed in this chapter.

WALLEYE I.—The Mk 21 Walleye I tactical weapon consists of a guidance section, a warhead section (including the fuze and fuze booster), a control section, four wings, and four fins. The weapon has provisions for 14- and 30-inch suspensions, and an ejector foot pad that is used to adapt the weapons to various types of aircraft bomb racks. The Walleye I (series) weapons are in the 1,000-pound class weapon category.

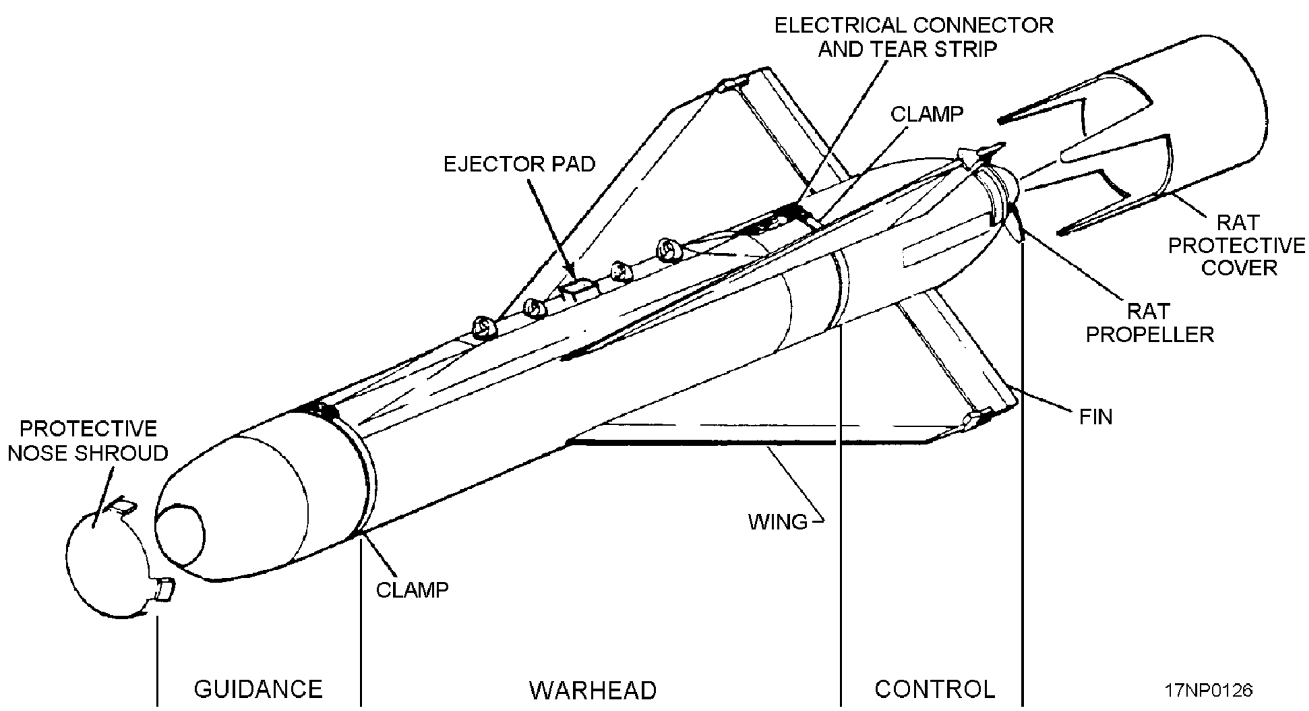

Figure 3-15.—Walleye guided weapon (typical).

To form a typical attack situation, the weapon, pilot, and aircraft must perform as a complete weapons system. The weapon uses aircraft electrical power (via an umbilical cable that connects the weapon to the aircraft) from the time electrical power is applied to the aircraft until the aircraft reaches a speed of approximately 180 knots. The automatic power changeover circuit in the weapon then switches the weapon to ram air turbine (RAT) generator power.

Basically, the guidance section of the weapon and the aircraft system form a closed-circuit television system. A television camera mounted in the nose of the guidance section provides a picture of the area forward of the aircraft and displays this information on a television monitor located in the cockpit of the aircraft. Additional circuits provide a cross-hair grid on the pilot's television monitor, which is a pair of vertical and a pair of horizontal lines. This intersection of horizontal and vertical cross hairs (the square in the middle) defines the tracking area. By looking at the video scene displayed on the television, the pilot is able to boresight the weapon and aircraft to acquire the target, initiate lock-on, and confirm weapon tracking.

After boresighting the weapon, selecting the proper fuze option, and achieving satisfactory lock-on, the pilot initiates release and escapes the target area. The weapon continues to track the target until it reaches the point of impact.

The Walleye I Mk 27 practice weapon is identical to the Mk 21 weapon except for the warhead and control sections. The warhead is entirely inert, does not contain a fuze or fuze booster, and has ballast to maintain weapon CG (center of gravity) compatibility with the Mk 21 weapon. This weapon is used for captive-flight pilot training and for aircraft loading and ground handling training purposes.

For further information concerning the Walleye I guided weapon, you should refer to the *Walleye I Guided Weapon*, NAVAIR 01-15MGA-1.

WALLEYE I ERDL.—The Walleye I extended range data link (ERDL) guided weapon consists of the same basic items as the Walleye I. These weapons are designed to be used in conjunction with the AN/AWW-13 data pod. They permit target information to be transmitted between the weapon and data pod before and after release of the weapon.

WALLEYE II.—The Mk 5 tactical Walleye II guided weapon consists of a guidance section, a fairing assembly, a warhead section (including the fuze and fuze booster), a control section, four wings, four fin adapters, and four fins. The weapon has provisions for 30-inch suspension only, and is in the 2,000-pound class weapon category. The Walleye II (series) weapons are essentially the same as the Walleye I weapons except they are physically larger in size and have improved electronics. Functional operations of the weapon and delivery tactics are basically the same as Walleye I.

For further information concerning the Walleye II (series) weapons, you should refer to the *Guided Weapon (Walleye II)*, NAVAIR 01-15MGB-2.2.

WALLEYE II ERDL.—The Walleye II extended range data link (ERDL) guided weapon Mk 23 Mods 0, 1, and 2 (frequency channels A, C, and E) consists of the same basic items as the Walleye II Mk 5 weapons. However, these assemblies include added data link functions and extended range capability. The addition of the larger wings enables the weapon to be launched with longer slant ranges to a target complex. The addition of the data-link pod (Guided Weapon Control-Monitor Set AN/AWW-9/13) and a joystick controller (guided weapon control group OK-293/AWW) on the aircraft allow the pilot to remotely steer the weapon to a specific target within the complex with pinpoint accuracy.

The Guided Weapon Control-Monitor Set AN/AWW-9/13, data-link pod (fig. 3-16) is the communications link between the pilot and the weapon. The pod is suspended from a standard Walleye-configured bomb rack. It can be jettisoned in an emergency. The pod contains the necessary electronics to allow the pilot to receive the transmitted video from the weapon and to transmit the command signals to the weapon. In addition, the pod contains a video tape recorder (VTR) that record the video transmitted by the weapon all the way to impact on the target. This allows low-cost weapon performance monitoring, which can be played back for mission evaluation or for training purposes.

REVIEW NUMBER 4 ANSWERS

A1. *The Phoenix missile use active, semiactive, and passive homing.*

A2. *Six Phoenix missiles can be launched from a single aircraft.*

A3. *The Phoenix missile consists of the guidance, armament, propulsion, and control sections.*

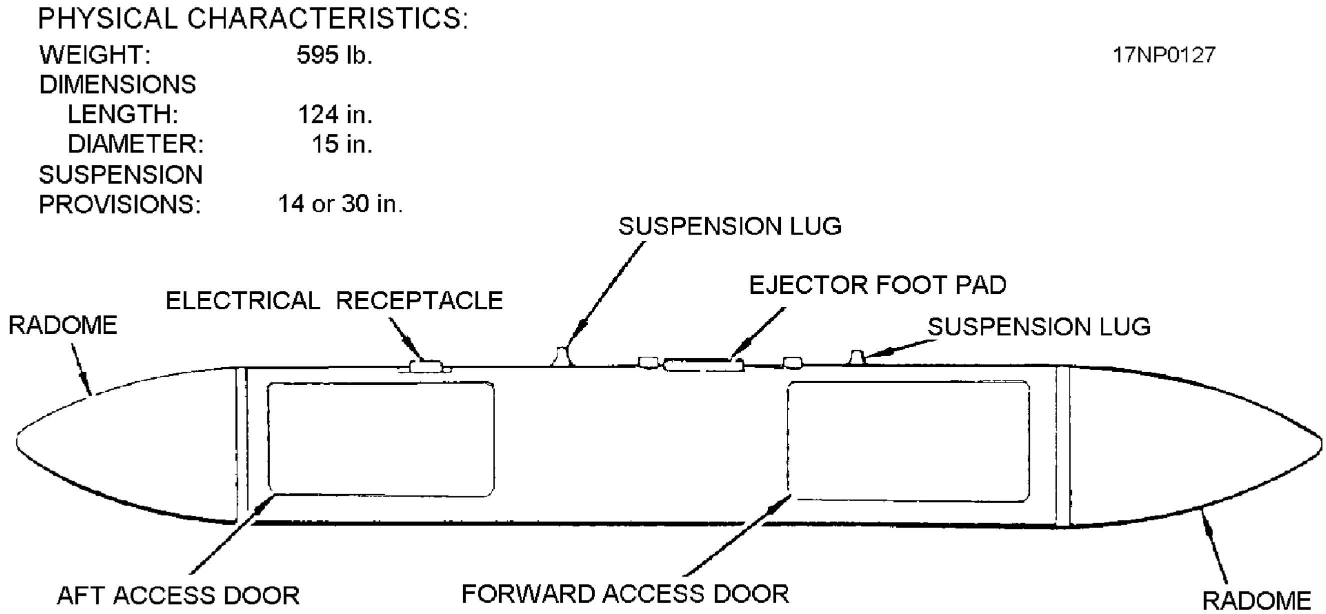

Figure 3-16.—AN/AWW-9/13 advanced data-link pod.

A4. The Maverick missile is used against fortified ground installations, armored vehicles, and surface combatants.

A5. The Maverick missile has automatic terminal homing on laser energy reflected from the target, which has been illuminated by a laser designator.

A6. The three basic modes of HARM missile operation are self-protect, target of opportunity, and prebrief.

The weapon system may be used in one- or two-aircraft operations. In a single aircraft operation, the aircraft carries both the weapon and the pod, and the aircraft perform both launch and control functions. In the two-aircraft operation, one aircraft carries the weapon and a second aircraft carries the pod. In this operation, both the launch aircraft and the pod aircraft receive a video picture of the target area from the weapon. After weapon launch, the pod aircraft monitors the flight of the weapon and can update the weapon aim point all the way to impact.

Tactically, the two-aircraft operation dominates because of the limited number of available pods. For example, a one-pod configured aircraft monitors the weapon control functions for several individual weapon launchings during one mission (not simultaneously). The three frequency channels (A, C, and E) are used to control the individual weapons launchings. The three channels prevent the control section of the weapon from responding to override (steering) commands from a pod that is not set to that weapon's specific frequency channel. Therefore, more than one weapon/pod operation can be conducted in the same area.

The Walleye II ERDL Mk 38 series (frequency channels A, C, and E) practice guided weapon is used for captive flight and data-link training for pilots of data link configured F/A-18 aircraft. The practice-guided weapon contains the same data link components as the tactical Walleye II ERDL Mk 23 weapon except that the warhead in the Mk 38 is filled with inert material.

REVIEW NUMBER 5

Q1. Name the four basic series of Walleye guided weapon systems.

Q2. List the sections of the Walleye I tactical weapon.

Q3. When the Walleye I is used, how is a typical attack situation formed?

Q4. What type of suspension does the Walleye II have?

Q5. What is the difference between the Walleye I and Walleye II weapons?

Q6. Name the functions the Walleye II ERDL have that the Walleye I and Walleye II don't have.

Q7. The data-link pod provides the ________________.

Q8. What prevents the control section of one weapon from responding to commands not set to its channel?

GUIDED MISSILE LAUNCHERS

LEARNING OBJECTIVE: *Describe the purpose and use of guided missile launchers. Identify the components of the LAU-7/A (series) guided missile launcher.*

Guided missile launchers provide the mechanical and electrical means of suspending and air-launching a guided missile from an aircraft. Because the physical, mechanical, and functional requirements vary for each particular missile-to-aircraft configuration (table 3-2), a brief description of each type of missile launcher is discussed in the following paragraphs.

LAU-7/A (SERIES) GUIDED MISSILE LAUNCHER

The LAU-7/A (series) guided missile launcher (fig. 3-17) is a reusable launcher that provides a complete launching system for use with the AIM-9 Sidewinder (series) missiles. The launcher (fig. 3-17) has four major assemblies—the housing assembly, nitrogen receiver assembly, mechanism assembly, and power supply.

Housing Assembly

The housing assembly is the main structural member of the launcher. It is an extruded, machined aluminum member that provides structural rigidity to the launcher and includes provisions for mounting all other assemblies. It also includes provisions for mounting the launcher to the aircraft.

Nitrogen Receiver Assembly

The nitrogen receiver assembly stores the high-pressure nitrogen (3,200 psig) used to cool the missile's IR detector in the guidance system. Two nitrogen receiver assemblies are available for use with the launcher. One is a cylindrical fiber glass container with a corrosion-resistant metal liner, and the other is a plain cylindrical steel container. The receiver mounts in the aft section of the housing assembly and screws into the aft end of the mechanism assembly. All receivers contain a charging valve (for refilling), relief valve, and a pressure indicator mounted in the aft end of the cylinder. The pressure indicator is color coded to ensure correct readings as follows:

- Red 0 to 2.2 psi
- Yellow 2.2 to 2.8 psi
- Green 2.8 to 3.5 psi
- White 3.5 to 5 psi

All readings listed must be multiplied by 1,000 psi.

Table 3-2.—Missile Launcher Application

LAU-7/A	AIM-9 SIDEWINDER	RAIL	F-14, F/A-18
LAU-92	AIM-7 SPARROW	EJECTOR	F-14
LAU-93	AIM-54A/C PHOENIX	EJECTOR	F-14
LAU-132	AIM-54C PHOENIX	EJECTOR	F-14D
LAU-115/A	AIM-7 SPARROW	RAIL	F/A-18
LAU-115A/A	AIM-120 AMRAAM	RAIL	F/A-18
LAU-116/A	AIM-7 SPARROW	EJECTOR	F/A-18
LAU-116A/A	AIM-120 AMRAAM	EJECTOR	F/A-18
LAU-117/A(V)2/A	AGM-65 MAVERICK	RAIL	F/A-18
LAU-118/A	AGM-88 HARM	RAIL	EA-6B, F/A-18
LAU-127	AIM-120 AMRAAM AIM-9 SIDEWINDER	RAIL	F/A-18
LAU-138	AIM-9 BOL CHAFF	RAIL	F-14D

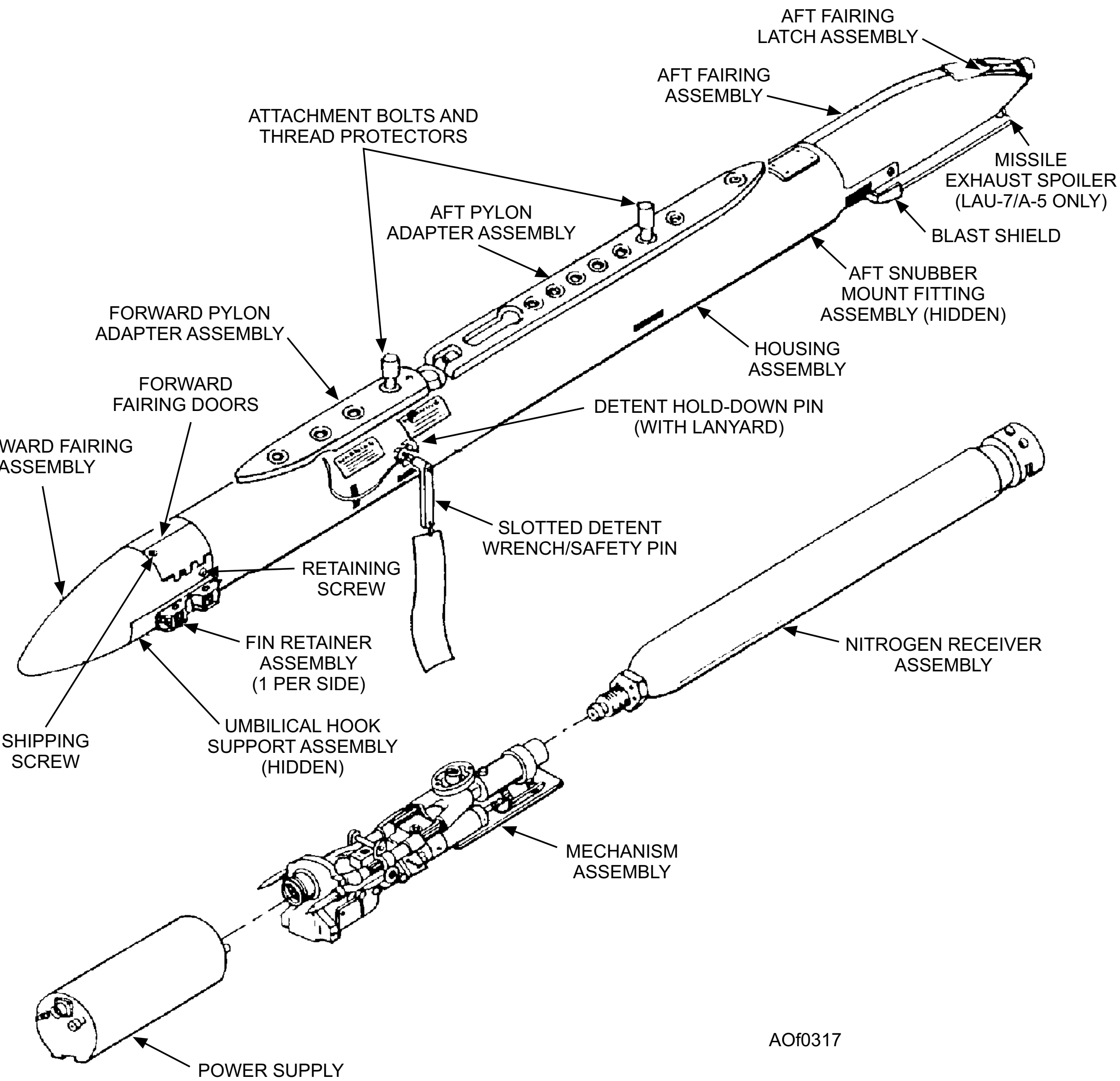

Figure 3-17.—LAU-7/A (series) guided missile launcher.

REVIEW NUMBER 5 ANSWERS

A1. The four basic series of Walleye guided weapon systems are the Walleye I, Walleye I EDRL, Walleye II, and Walleye II ERDL.

A2. The sections of the Walleye I tactical weapon include the guidance section, warhead section, control section, four wings, and four fins.

A3. When the Walleye I is used, a typical attack situation is formed by the weapon, pilot, and aircraft performing as a complete weapons system.

A4. The Walleye II has a 30-inch suspension.

A5. The Walleye I and Walleye II weapons are basically the same; however, the Walleye II is physically larger and has improved electronics.

A6. The Walleye II ERDL has added data link functions and extended range capability.

A7. The data-link pod provides the <u>communications link between the pilot and weapon</u>.

A8. Three frequency channels (A, C, and E) prevent the control section of one weapon from responding to commands not set to its channel.

Mechanism Assembly

The mechanism assembly is an electromechanical device that holds the missile for takeoffs and landings and releases the missile for launching. It mounts in the center of the housing assembly forward of the receiver assembly. The subassemblies of the mechanism assembly are discussed in the following paragraphs.

ELECTRICAL HARNESS ASSEMBLY.—The electrical harness assembly consists of the appropriate connectors and wiring to interconnect between the aircraft power and firing circuits and the launcher. Also, the nitrogen system supply tube is routed through the electrical wiring harness to the power supply.

DETENT, DETENT LOCK, DETENT-LOCK SOLENOID, AND SNUBBERS.—The detent, detent lock, detent-lock solenoid, and forward snubbers (fig. 3-18) make up an electromechanical system that restricts longitudinal and lateral motion of the mounted missile. This system prevents accidental launch or release during catapult takeoff or arrested landings. A slotted detent wrench/safety pin is installed through the mechanism assembly to prevent movement of the aft detent and to safe the launcher firing circuits. It is also used to raise the aft detent lug sufficiently to clear the missile hanger during loading. The slotted detent wrench/safety pin is removed before flight. When the detent is down (normal), the striker points make contact with the buttons (contacts) on the forward hanger of the missile. The forward striker point does not have a function for the missile; the aft striker point makes contact between the missile and the firing safety switch.

NITROGEN CONTROL VALVE.—The nitrogen control valve is a solenoid-operated shutoff valve that controls the flow of nitrogen from the receiver assembly to the missile. The pilot controls operation of the control valve from the cockpit.

Power Supply

One power supply is available for use in the launcher. Power supply PP-2581/A is a single-phase power supply. It is a self-contained unit with connectors on each end. The aft connector links the power supply and the mechanism assembly. The forward connector provides the connection to the missile's umbilical cable.

Forward Fairing Assembly

The forward fairing assembly is an aluminum casting that mounts to the forward end of the outer housing to provide an aerodynamic nose to the front of

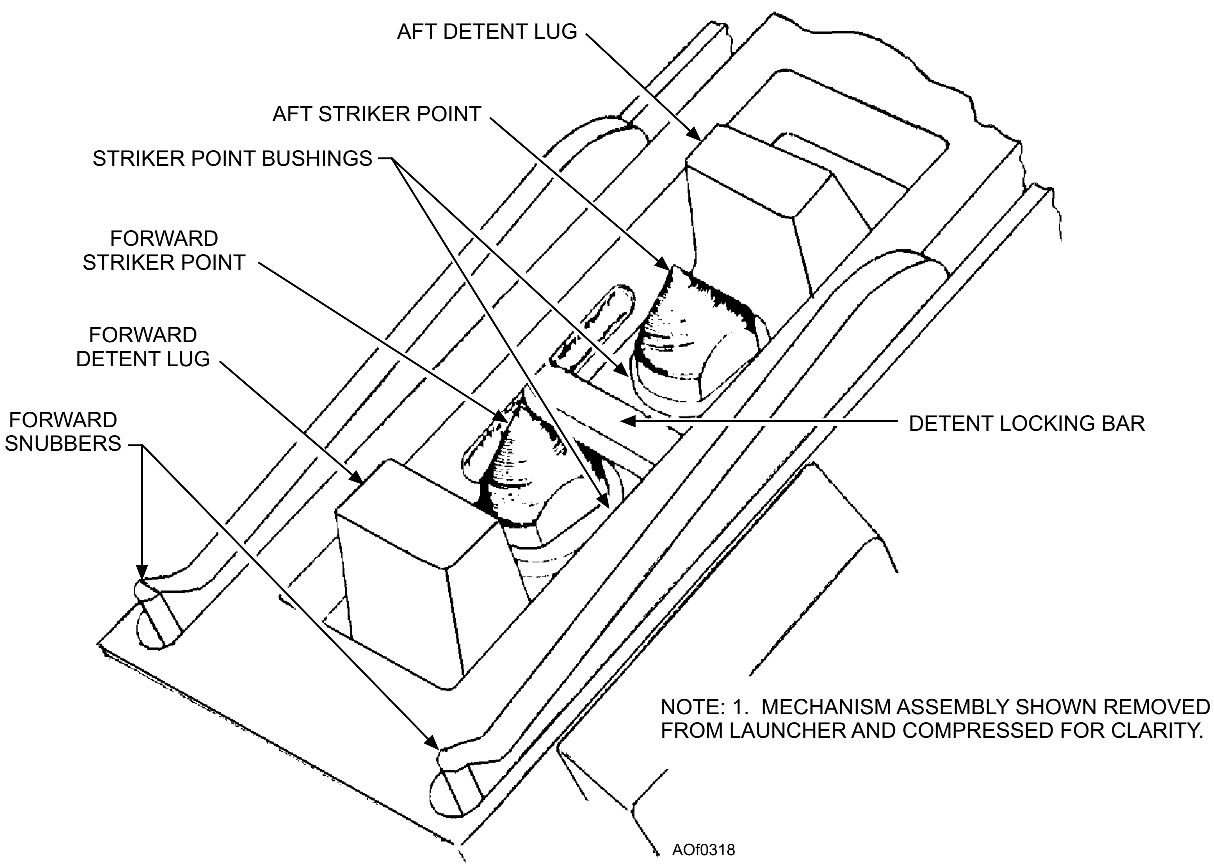

Figure 3-18.—Mechanism assembly detent and snubbers.

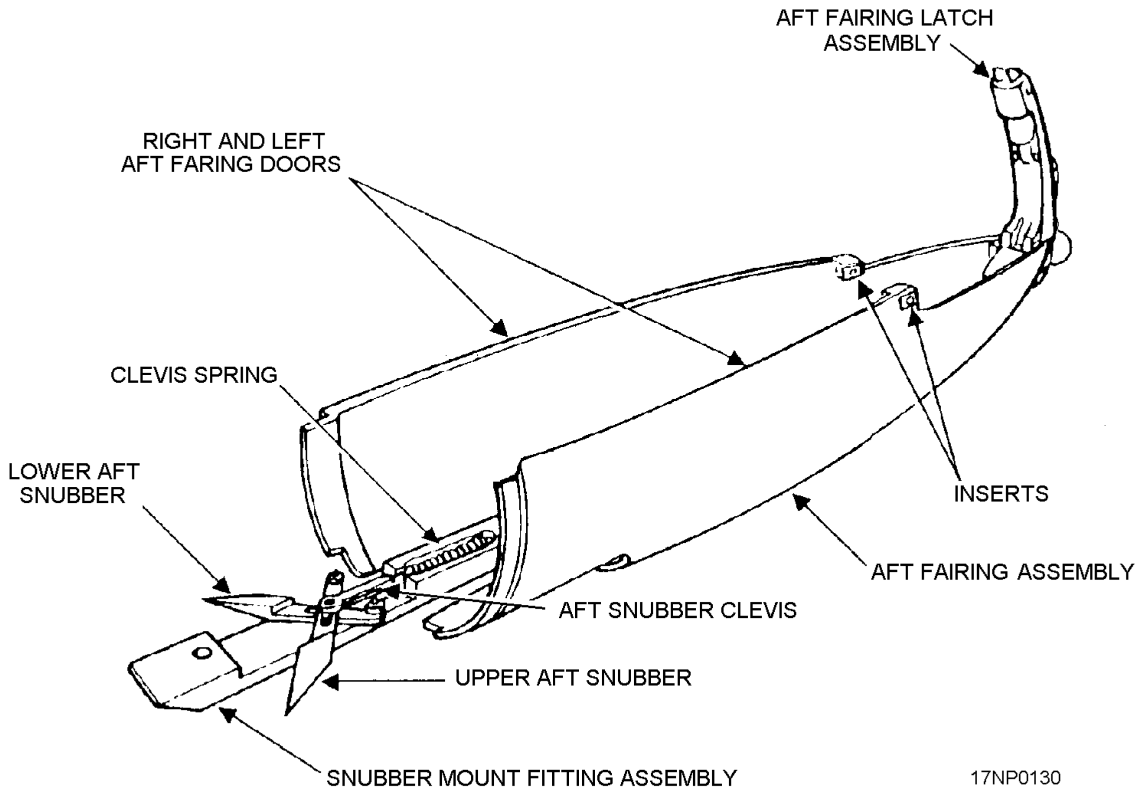

Figure 3-19.—Aft snubber mount fitting assembly, aft fairing assembly, and aft fairing latch assembly.

the launcher. It has two doors that are spring-loaded to open. These doors provide access to the umbilical hook support assembly.

Umbilical Hook Support Assembly

The umbilical hook support assembly mounts to the forward housing rails and, during missile loading, is connected to the missile umbilical shear block. At missile launch, the mechanism snaps up, retracting the sheared end of the umbilical cable into the launcher to prevent interference with the missile hangers.

Fin Retainer Assemblies

Two fin retainer assemblies are mounted to the forward end of the housing assembly beneath the forward fairing assembly. The fin retainer is a small, U-shaped bracket that contains two spring retainers that snap over the missile fins to prevent movement during captive flight.

Snubber Mount Fitting Assembly, Aft Fairing Latch Assembly, and Aft Fairing Assembly

The aft snubber mount fitting assembly, aft snubber assembly, and aft fairing latch (fig. 3-19) are assembled together as a group and mounted to the aft end of the housing assembly. When the aft fairing latch assembly (fig. 3-20) is in the open position, you can access the nitrogen receiver. It also releases the aft snubbers to allow missile loading. When in the closed position, it allows the snubbers to spring over the aft missile hanger, locking it in place.

For further information on the LAU-7/A (series) guided missile launcher, refer to *Guided Missile Launcher LAU-7/A*, NAVAIR 11-75A-54.

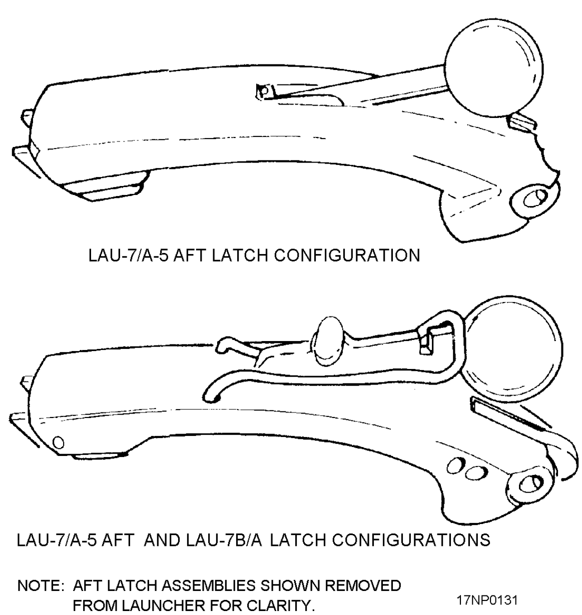

Figure 3-20.—Aft fairing latch assembly.

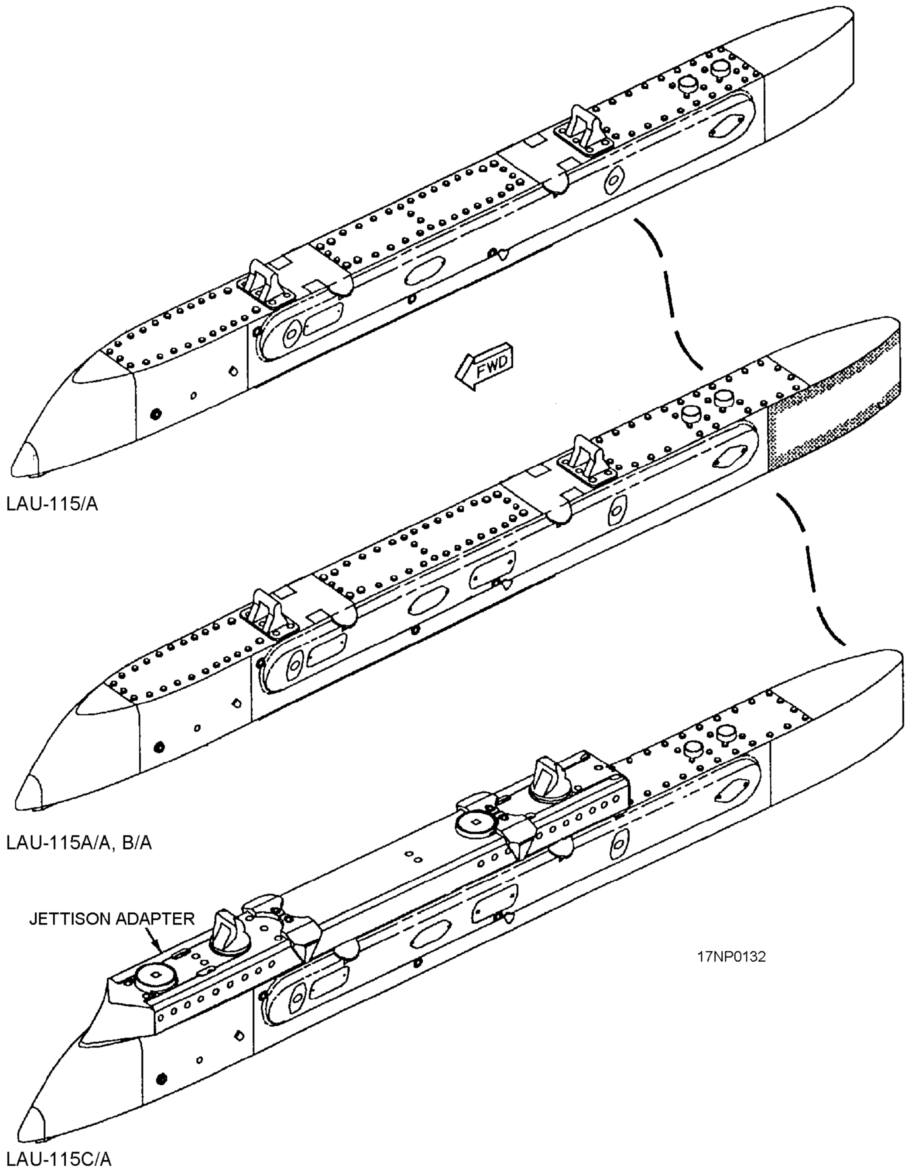

Figure 3-21.—LAU-115A/A, LAU-115B/A, and LAU-115C/A guided missile launchers.

REVIEW NUMBER 6

Q1. What missile launcher is used to carry and launch the Sidewinder missile?

Q2. List the four major assemblies of the LAU-7/A launcher.

Q3. What is the purpose of the nitrogen receiver assembly?

Q4. What is the purpose of the detent, detent lock, detent-lock solenoid, and snubber subassemblies of the mechanism assembly?

Q5. What does the LAU-7/A guided missile launcher provide?

LAU-115 SERIES GUIDED MISSILE LAUNCHER

The LAU-115 series guided missile launcher (fig. 3-21) is a reusable launcher. It completes the F/A-18 aircraft suspension and launching system for the AIM-7 Sparrow missile. The technical characteristics can be found in (table 3-3). The forward internal grooves of the rail provide a guide and support for the

Table 3-3.—LAU-115 Technical Characteristics

LAU-115/A	LAU-115A/A	LAU-115B/A	LAU-115C/A
Weight: 52 pounds	Weight: 59 pounds	Weight: 59 pounds	Weight: 120 pounds
Height: 7 inches	Height: 7 inches	Height: 7 inches	Height: 10 inches
Width: 7 inches	Width: 7 inches	Width: 7 inches	Width: 7 inches
Length: 78 inches	Length: 82 inches	Length: 82 inches	Length: 82 inches

forward missile-mounting button. The external rail flanges are a guide for the aft missile suspension lugs during firing. The aft section of the rail consists of a removable fitting that provides mounting for the aft missile suspension lugs.

REVIEW NUMBER 6 ANSWERS

A1. The LAU-7/A missile launcher is used to carry and launch the Sidewinder missile.

A2. The four major assemblies of the LAU-7/A launcher include the housing, nitrogen receiver, mechanism, and power supply assemblies.

A3. The nitrogen receiver assembly is used to store high-pressure nitrogen (3,200 psig) that is used to cool missile IR detector guidance systems.

A4. The detent, detent lock, detent-lock solenoid, and snubber subassemblies of the mechanism assembly are an electromechanical system that restricts longitudinal and lateral movement of mounted missiles. This prevents accidental launch or release during catapult takeoffs or arrested landings.

A5. The LAU-7/A guided missile launcher provides a complete system that lets the pilot monitor the condition of the missile during flight, control mode of operation of the missile guidance system, and initiate arming and launch sequence.

The latch mechanism is composed of a detent cam and keeper. The detent cam is spring-loaded down and acts as a stop during missile loading. The cam mechanism is constructed so the force created by the missile motor during normal missile firing overcomes the detent cam spring tension. This action lets the missile button push the detent cam up, actuating the missile-gone switch.

An electrically operated solenoid is used to assure that the missile is retained during sudden deceleration, such as an arrested landing. The keeper portion of the latch mechanism is spring-loaded to the down position and retains the missile during all periods of aircraft acceleration. The keeper mechanism has an indicator. When the keeper is in the down or latched position, the indicator is flush with the launcher skin. If, during missile loading, the missile button is not in its maximum forward position, the indicator extends beyond the upper launcher mold line. This indicates that the missile is not properly latched in place. During loading, the missile button can slide past the keeper, stopping when contact is made with the detent cam.

During the unloading of a missile, the indicator bell crank is supported in the launcher structure. Using a 3/8-inch square drive tool manually operates it. The square drive end of the bell crank is accessible from the side of the launcher. The launchers are suspended from BRU-32 bomb racks in the outboard pylons. Two LAU-7/A launchers can be attached for suspension of the AIM-9 missiles. For ground safety, an actuator-operated safety device prevents inadvertent loss of the AIM-7 missile.

LAU-116/A GUIDED MISSILE LAUNCHER

The LAU-116/A guided missile launcher (fig. 3-22) is a reusable launcher of the F/A-18 aircraft

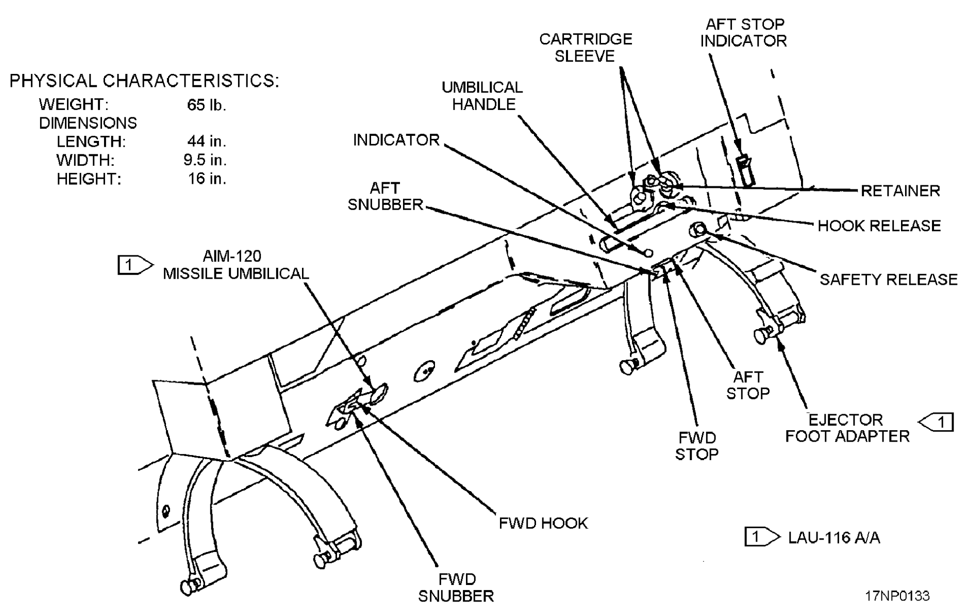

Figure 3-22.—LAU-116/A guided missile launcher.

suspension and launching system for the AIM-7 Sparrow missile. The launchers are mounted internally in the fuselage structure. They are self-contained, gas-operated mechanisms, capable of suspending and ejecting the AIM-7 Sparrow missile. Two CCU-45 impulse cartridges ignited by an electrical impulse applied by the missile-firing switch, supply ejection force. The rapidly expanding gases actuate the ejector pistons and release the missile from the launcher. Power is applied to the missile guidance control system through the umbilical plug. An actuator-operated safety device prevents inadvertent firing of launcher cartridges.

LAU-117/A GUIDED MISSILE LAUNCHER

The LAU-117/A guided missile launcher (fig. 3-23) is a reusable launcher that completes the F/A-18 aircraft suspension and launching system for the Maverick, AGM-65, air-to-ground missile. The mechanical structure of the launcher is built around a box-section channel or rail, which supports the missile. The missile hooks contact the rail surfaces or tracks, which are hard, anodized metal treated with a dry lubricant. Two lug fittings and lugs provide mechanical interface with the bomb rack. The two lug fittings provide smooth surfaces for the bomb rack sway braces. The missile restraint device is recessed into the rail channel between the lug fittings. A stop on one side of the rail track engages the missile aft hook to prevent damage to the umbilical connector during loading. The rear of the rail channel provides mounting for the launcher electronic assembly and the umbilical engaging assembly. The launcher electronic assembly houses all electronic circuitry. Fairings at the front of the rail and the rear of the launcher electronic assembly provide aerodynamic surfaces. Special brackets and bushings are provided for the Navy's single hoist ordnance loading system. The launcher can be suspended from the BRU-32 bomb rack on the inboard and outboard pylons. An electrically operated safety device prevents inadvertent loss of the missile.

LAU-118/A GUIDED MISSILE LAUNCHER

The LAU-118/A guided missile launcher (fig. 3-24) is a reusable launcher that completes the F/A-18 and EA6B aircraft suspension and launching system for the HARM, AGM-88, air-to-ground guided missile. The launcher consists of the launcher housing, forward and aft fairing assemblies, forward and aft launcher tracks, suspension lugs, insert plugs, and internal electrical components. The launcher is a structurally modified Aero 5B-1. The LAU-118/A is suspended from the BRU-32 bomb rack on the inboard and outboard pylons. An electrically operated retention mechanism prevents inadvertent loss of the missile.

LAU-92/A GUIDED MISSILE LAUNCHER

The LAU-92/A guided missile launcher (fig. 3-25) carries and launches the AIM-7 (series) Sparrow guided missile on the F-14 aircraft. The launcher is installed in semisubmerged fuselage stations 3, 4, 5,

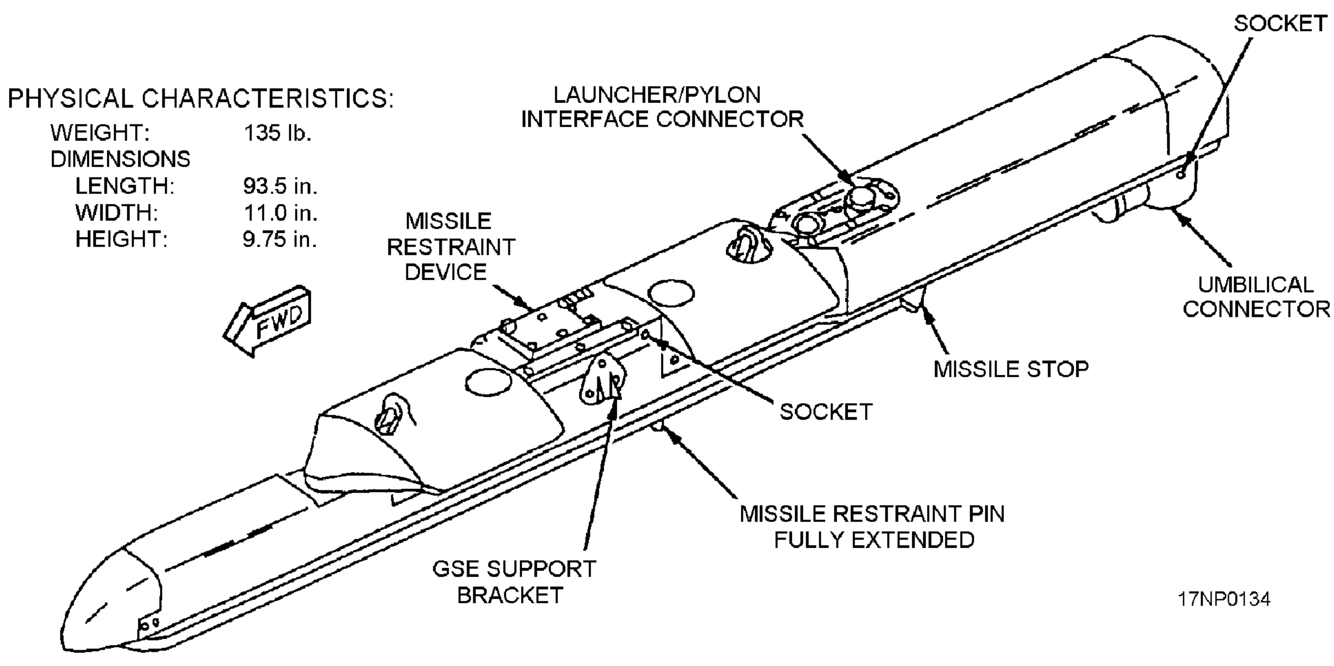

Figure 3-23.—LAU-117/A guided missile launcher.

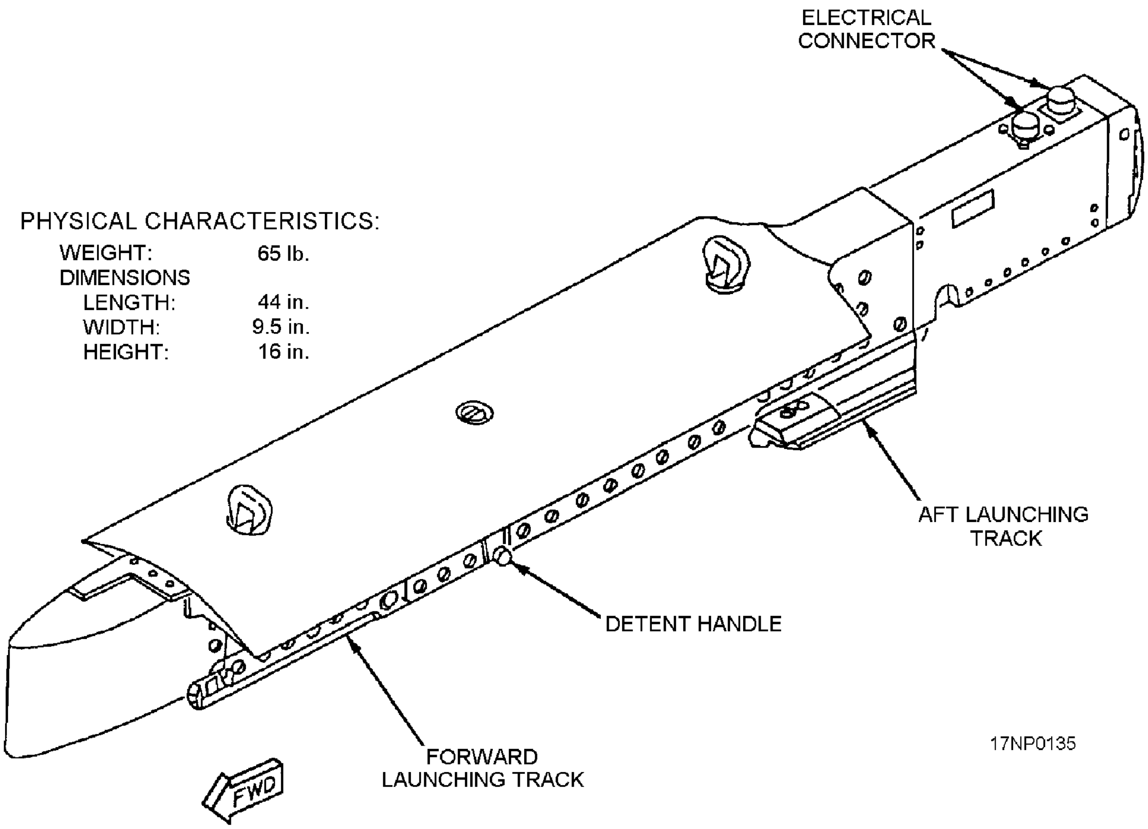

Figure 3-24.—LAU-118 guided missile launcher.

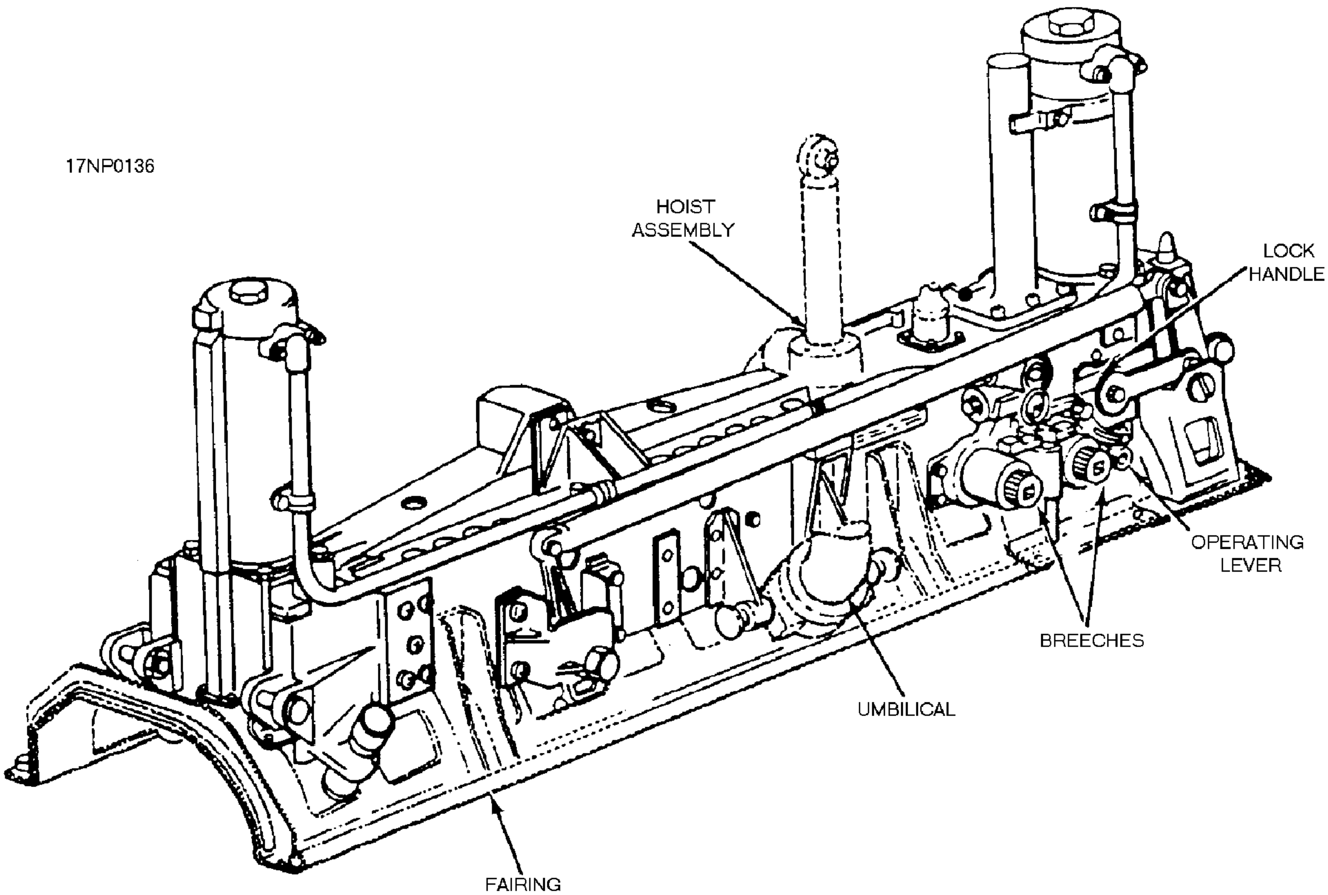

Figure 3-25.—LAU-92/A guided missile launcher.

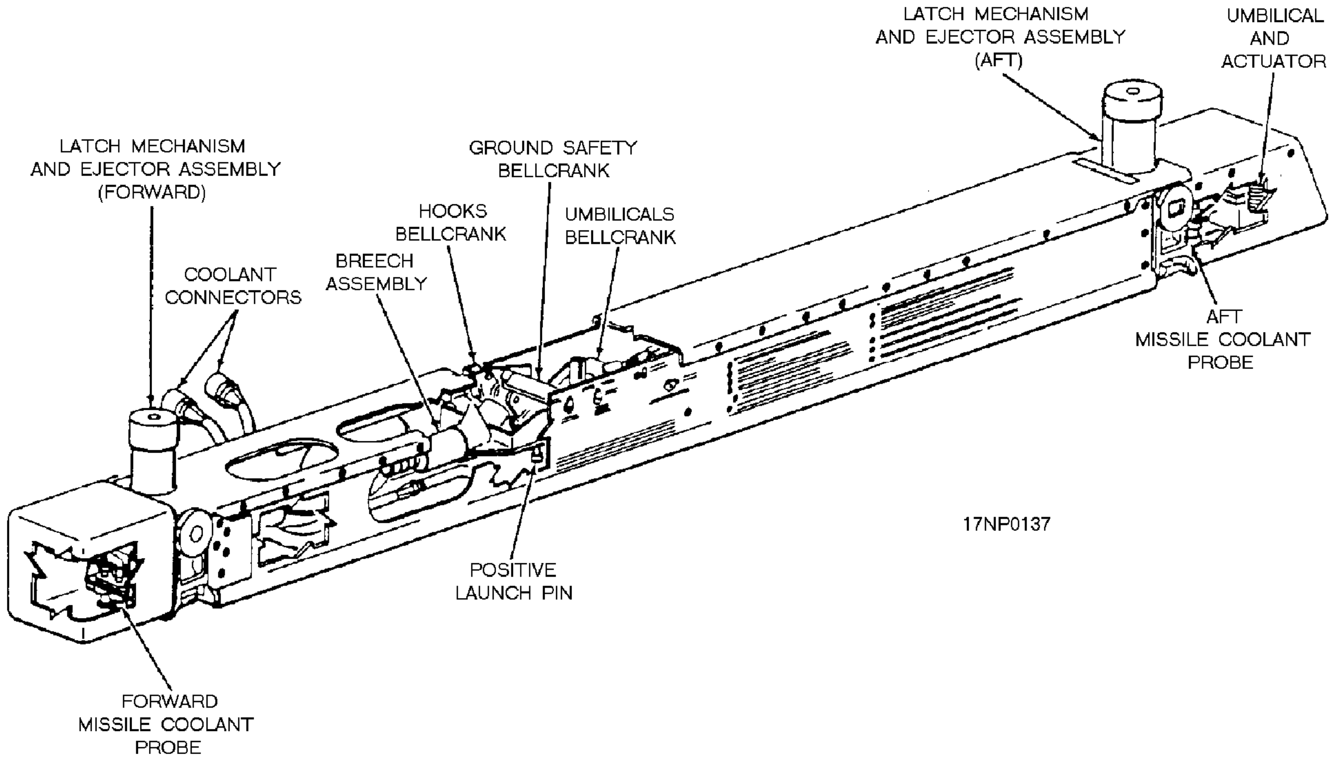

Figure 3-26.—LAU-93/A guided missile launcher.

and 6. It is retained on the weapons rail by means of four hooks, which are operated by a latch mechanism. The launcher can also be installed on the wing-mounted, multipurpose pylon by using an LAU-92/A adapter. The launcher components are accessible by means of a door in the adapter.

LAU-93/A GUIDED MISSILE LAUNCHER

The LAU-93/A guided missile launcher (fig. 3-26) carries and launches the AIM-54 Phoenix missile, and is installed on the weapons rail of the F-14 aircraft. The launcher provides electrical and coolant connections

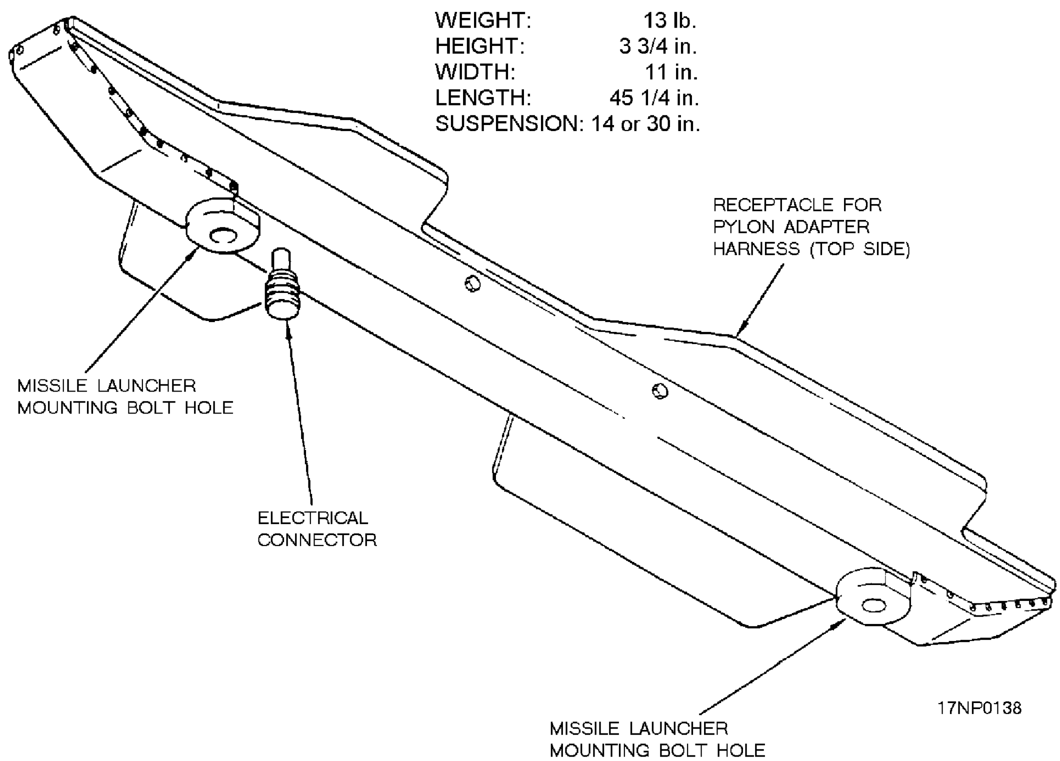

Figure 3-27.—ADU-299/E missile launcher adapter.

between the weapons rail and the missile. The mechanical components of the launcher consist of a gas-operated, hook-opening linkage and two ejectors, a ground safety lock and positive launch pin, coolant, and electrical umbilical. The launcher can also be installed on the wing-mounted, multipurpose pylon by using an LAU-93/A adapter.

ADU-299/E MISSILE LAUNCHER ADAPTER

The ADU-299/E missile launcher adapter (fig. 3-27) is used to adapt the LAU-7 missile launcher, providing Sidewinder missile capabilities. Mechanical attachment of the adapter to the ejector rack is provided by two suspension lugs on 30-inch centers. Mechanical attachment of the adapter to the LAU-7 launcher is provided by two swivel nuts positioned on 30-inch centers to mate with the launcher bolts. When the launcher and adapters are electrically connected and mechanically mated, an adapter harness from the wing pylon to the aft end of the adapter supplies electrical power.

LAU-127 GUIDED MISSILE LAUNCHER

The LAU-127 guided missile launcher (fig. 3-28) is designed to carry and launch the AIM-120 series

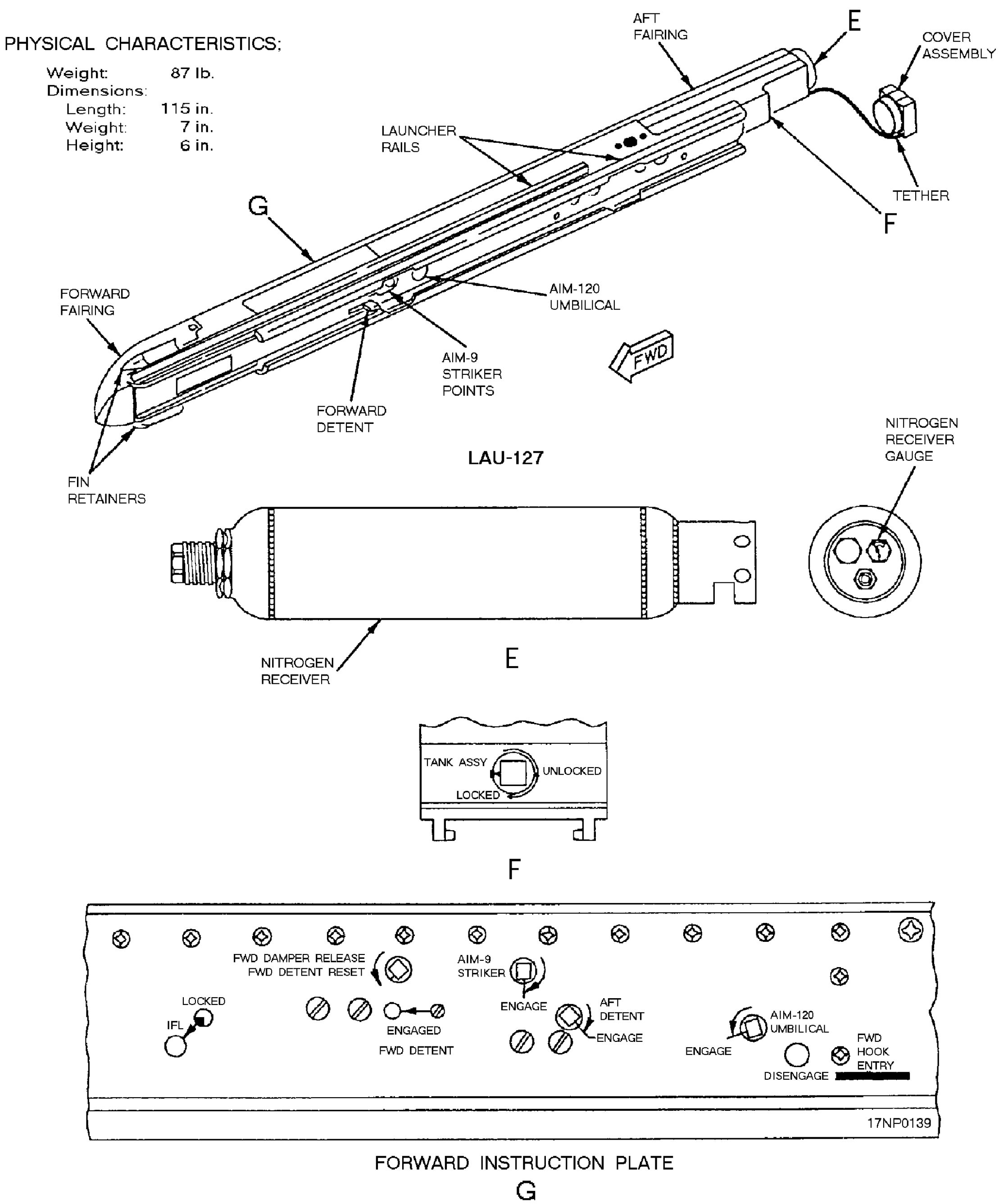

Figure 3-28.—LAU-127 guided missile launcher.

AMRAAM missile. The LAU-127 will also be capable of launching the AIM-9 series sidewinder missile.

LAU-132 GUIDED MISSILE LAUNCHER

The LAU-132 guided missile launcher is similar in appearance and operation to the LAU-93 launcher. The LAU-132 was developed for carriage and launch of the AIM-54C Phoenix missile on the F-14D aircraft.

REVIEW NUMBER 7

Q1. *What missile launcher is used to carry an AIM-7 Sparrow missile on the outboard pylon of an F/A-18 aircraft/*

Q2. *What guided missile launcher completes the F/A-18 aircraft suspension and launching system for the Maverick missile?*

Q3. *What missile is compatible with the LAU-118/A guided missile launcher?*

Q4. *What missile launcher is used to carry and launch the AIM-54 Phoenix missile on the F-14 aircraft?*

GUIDED MISSILE HANDLING

LEARNING OBJECTIVE: *Identify the methods used in guided missile handling afloat and ashore.*

The establishment of the all-up-round (AUR) concept simplified the handling of guided missiles at the user level. The AUR concept has improved the reliability, availability, and logistics support of current guided missiles used by fleet activities.

NAD/NWS/NAWMUs

The service life of an AUR missile begins at a naval ammunition depot (NAD) or a naval weapons station (NWS). The NAD or NWS receives the individual components of a missile from the manufacturer. The NAD or NWS assembles the components to make up a complete round, performing the required operational checks and tests. The AUR is then packed into a missile container and is stored as RFI (ready for issue). The missile logbook is also packed inside the missile container. The missile logbook is compiled from the operational records that are received with each component. This logbook remains with the missile until the missile is either expended (fired) or disassembled.

Naval Air Weapons Maintenance Unit (NAWMUs) is assigned to areas close to overseas operating forces. Generally, they are located at a naval air station (NAS) or a naval magazine station (NAVMAGSTA). The purpose of NAWMUs is to upgrade missiles from a non-RFI (not ready for issue) status to an RFI status. This prevents the time-consuming and costly procedure of shipping non-RFI missiles from overseas operating areas back to the United States for component replacement or scheduled checks and tests. This quick turnaround time increases missile availability to deployed operating units in the fleet.

AFLOAT

Under the AUR concept, missiles are received aboard ship in containers completely assembled except for the wings and fins. Depending upon the particular missile and the type of container involved the wings and fins may or may not be shipped in the same container as the missile. In most cases, the wings and fins are shipped in separate containers that contain either one complete set of wings and fins (4 wings and 4 fins) or two sets of wings and fins (8 wings and 8 fins).

When containerized missiles, wings, and fins are received aboard ship, the containers are inspected for any obvious damage. When the inspection reveals a damaged container, it must be sent to the decanning area to be opened for inspection of the missile or wings and fins. When a container, missile, or wings and fins do not meet the inspection criteria listed in the appropriate technical manual, they must be tagged non-RFI and kept separate from RFI material for later turn-in. Missiles, wings, and fins can be either deep stowed in magazines still in their sealed containers, or they can be decanned, inspected, and stowed in stanchions located in ready-service magazines or missile magazines. Missiles that are deep stowed in their sealed containers can be off-loaded as RFI. However, when the seal has been broken and/or the missiles, wings, or fins removed from the container, the missiles, wings, and fins must be tagged non-RFI and off-loaded to the appropriate NAD, NWS, or NAWMU.

When missiles are decanned for ready service, the missile logbooks are removed from the empty containers and turned in to the aviation ordnance control station (AOCS), where they are kept on file until the missile is fired (expended) or off-loaded. When the missile is fired, the missile logbook is mailed to the appropriate NAD or NWS. When the missile is to be off-loaded, the logbook must be placed in the missile container.

ASHORE

Guided missile handling functions for naval air stations or shore-based squadrons are the same as shipboard functions except for the obvious difference in working environments. Space limitations are not as critical ashore and allow for an increase in handling capability.

Other details of missile handling, such as MOAT (missile on aircraft test), supply procedures, missiles firing reports, quality deficiency reports, and loading procedures, are discussed in the appropriate chapters throughout this manual.

REVIEW NUMBER 8

Q1. What concept simplified the handling of guided missiles at the user level/

Q2. The responsibility for assembling individual missile components into complete RFI missiles rests with ____________________.

Q3. What is the purpose of a Naval Air Weapons Maintenance Unit (NAWMU)?

SAFETY PRECAUTIONS

LEARNING OBJECTIVE: *Recognize the safety precautions to follow when working with guided missiles*.

Safety precautions have been established for each particular type of missile. All missile handling must be carried out according to the approved local safety regulations of the ship, depot, or wherever the work is being done. All of the safety precautions cannot be discussed in this chapter. However, some of the general safety precautions are as follows:

- Observe detailed precautions. Follow specific instructions for each type of guided missile. You will find the specific instructions in the manual issued for each particular type of aircraft.
- Keep work areas clear of obstructions, loose cables, hoses, and any unneeded equipment during missile assembly and testing. Permit only assigned personnel engaged in the work in the area or vicinity of the missile.
- Use only the authorized handling equipment with any missile, or any missile section, component, or related parts, including shipping crates and containers.
- Make sure that all electrical equipment used in missile handling operations is adequately shielded and grounded. Also, avoid injury from sharp edges often present on nose assemblies, wings, and fins. After assembly, cover all sharp edges with protective covers.
- Use tools specified in the missile manual when uncrating missile components and for assembling missiles. Do not force any unit. If it does not fit or function properly, determine the cause and correct it before proceeding.
- Before connecting igniters in missile motors, check the firing leads for stray or induced voltages and for static charges.
- Before handling any piece of ordnance material, inspect the safety device to be sure that it is in a SAFE position. If not, the unit must be made safe by experienced personnel before further work is performed.
- The wing servo units in many missiles are supplied with primary power by means of an accumulator charged from gas bottles (or cylinders) containing compressed air or nitrogen; both of which contain pressure. Use extreme caution when charging accumulators and when handling the gas bottles or containers in which the gases are stowed.
- When testing for leaks in a gas container, use soapy water.
- When cleaning hydraulic units, use only the cleaning solvents or other materials specified in the particular missile publication.
- Keep your hands and other parts of your body clear of exhaust vents when working with test equipment that uses high pneumatic pressure.
- When any hydraulic unit is disassembled for inspection or repair, make sure that the workbench is thoroughly cleaned of dirt and metal filings.
- Missile ordnance materials, including rocket motors, igniters, fuzes, warheads, and in some cases boosters or auxiliary rockets, are potentially dangerous. Handle each unit according to the specific procedures authorized in the appropriate publication.

- Load forward-firing ordnance in authorized loading areas only, with aircraft facing uninhabited areas.
- When leading/handling forward-firing ord-nance, you should avoid working in front or behind the ordnance.

REVIEW NUMBER 9

Q1. What solution is used to leak test gas containers/

Q2. When handling forward-firing ordnance, what is the desired place you should work/

REVIEW NUMBER 7 ANSWERS

A1. The LAU-115/A series guided missile launcher is used to carry an AIM-7 Sparrow missile on the outboard pylon of an F/A-18 aircraft.

A2. The LAU-117/A guided missile launcher completes the F/A-18 aircraft suspension and launching system for the Maverick missile.

A3. The AGM-88 HARM missile is compatible with the LAU-118/A guided missile launcher.

A4. The LAU-93/A missile launcher is used to carry and launch the AIM-54 Phoenix missile on the F-14 aircraft.

REVIEW NUMBER 8 ANSWERS

A1. The handling of guided missiles at the user level was simplified by the introduction of the all-up-round (AUR) concept.

A2. The responsibility for assembling individual missile components into complete RFI missiles rests with <u>naval ammunition depot (NAD) or naval weapons station (NWS)</u>.

A3. The purpose of a Naval Air Weapons Maintenance Unit (NAWMU) is to upgrade missiles from a non-RFI to an RFI status.

REVIEW NUMBER 9 ANSWERS

A1. A soapy water solution is used to leak test gas containers.

A2. When handling forward-firing ordnance, you should work on the sides. Work in the front or rear of the ordnance should be kept to a minimum.