Unit 5. US Weapons Systems

KNOWING weapons systems, their capabilities, strengths and weaknesses is the foundation of being a true operations intelligence technician. This unit covers US, and Allied, Weapons systems, US munitions familiarization, and weapons of mass destruction. By no means does this unit go into all the weapons systems. However, keeping current on these systems is a continuous process with the rapid progression of technology; use your intelligence library and other classified resources available to you to stay up with the latest developments. Previously we talked about credibility with our peers and aircrew members. Knowledge of these weapon systems is a test of your credibility.

5–1. US and Allied Air, Naval, and Ground Systems

We'll begin with US and Allied ground, naval and aerospace weapons systems. These weapon systems are the backbone of our military. As an intelligence operations technician, your knowledge of aircraft, air-delivered weapons, as well as our forces on the ground and supporting us from the seas is essential for a successful career. Your knowledge of the assets from the other services are necessary to operate within an AOC, and to interact with our service counterparts. First, we will start off with US Army ground weapon systems influencing the ground war. After that, we will look at surface-to-air missiles and aircraft, and finally, the navy bringing up the rear.

221. Identify US and Allied Ground Weapon Systems

Up to now, you have learned about the various missions we support and the missions the Air Force is tasked to perform. Now let's move on to the weapons systems your aircrews may encounter in your different missions. Operations Intelligence personnel play an important role in the development of aircrew knowledge of ground weapon systems. Our aircrews are required to be familiar with these different weapons systems, the enemy's as well as our own. We are responsible for knowing the mission and capabilities of the different ground systems we work with and the threats these systems might encounter. Knowing your unit mission and its weapons systems not only aids you in accomplishing your duties, but also helps you to gain the respect of the aircrew members (very important) and your planning staff personnel.

Since it is not possible to cover every weapons system, refer to AFTTP 3–1, Vol. 2, *Threat Reference Guide and Countertactics* for further information.

Ground equipment

Let's start with the most visible armored ground equipment. We'll review some facts on tanks, armored personnel carriers (APCs), and infantry fighting vehicles (IFV).

Tanks

A tank's primary mission is to kill other tanks or anti-tank systems. Tanks provide the high speed, mobility, heavy striking power required for offensive operations and the ability to exploit breeches in the battlefield. The following is a listing of a few American and Allied tanks and their capabilities.

US Army Tanks

M–1A1 & 1A2 Abrams:

The US M–1A1/A2 Abrams, figure 5-1, is the primary main battle tank within the US inventory. The M–1 possesses nearly a 100 percent first round kill capability at a range of over 1.5 nautical miles. The Abrams can obtain a max speed of 45-mph. The M–1 is armed with a single 120mm smoothbore gun and can fire on the move. The M–1 is night capable with laser rangefinder and a passive thermal imaging sight. The Abrams utilizes depleted uranium armor for increased protection. M–1A2 has a number of performance-related improvements, to include an improved fire control system. The Abrams is protected against nuclear, biological, chemical (NBC) warfare.

Figure 5-1. M-1A2 Abrams MBT.

M–60 Series:

The M60, figure 5-2, is one of the world's most successful main battle tanks with over 15,000 produced and serving in 22 of the world's armies. The M–60A3 is the current production model and still in use within the US Army, Army Reserve and Army National Guard. The M–60A3 is capable of maximum cross-country speeds of 10–13 mph and a top road speed of 30 mph. The M60 series is either armed with a 105mm M68 rifled gun or a 120mm M256 smoothbore. The M–60 series has a laser range finder gun stabilization system, ballistic computer, and thermal imaging sight. The tank is also capable of operating within an NBC environment.

Figure 5-2. M-60 MBT.

British Army Main Battle Tank

Challenger 1, 2 & 2E:

The British Army's main battle tank is the Challenger shown in figure 5-3. The Challenger is armed with a 120mm rifled main gun. However, the Brits are considering an upgrade to a 120mm smoothbore main gun. The Challenger maintains a storage capacity for 50 120mm projectiles. The turret is protected with Chobham armor and has an improved fire control system. The Challenger is also protected to operate within an NBC environment.

Figure 5-3. Challenger MBT.

Israeli Defense Force Main Battle Tank

Merkava 4:

The Israeli Army's new and main battle tank is the Merkava 4 which is shown in figure 5-4. This tank entered into production in 2001 and began operational training in July 2003. The Merkava will begin operational deployment in 2004. Up to 400 Merkava tanks are expected to be produced. The Merkava 4 is an improved Merkava 3 tank. The Merkava is armed with a 120mm smooth bore and capable of carrying 48 rounds of ammunition. The tank boasts an electrically operated revolving magazine containing 10 ready-to-fire rounds. The tank includes a new fire control system capable of firing on the move at moving targets and has demonstrated an ability to fire against attack helicopters. The Merkava is capable of operating in a NBC environment.

Figure 5-4. Merkava MBT.

South Korean Main Battle Tank

K1/A1:

The South Korean K1A1, figure 5-5, is the newest of the main battle tanks within its inventory. The K1A1 completed operational tests in 1997 and is in production. The K1A1 is an upgraded version of the K1 MBT. The K1A1 is equipped with a 120mm M256 smoothbore gun, the same main gun employed on the US M–1A1 Abrams. The K1A1 is equipped with a new fire control system and a laser rangefinder. The K1A1 operates well in Korea's varied geographical features to include mountainous terrain, jungle, rice paddy fields and swamp.

Figure 5-5. K1/A1 MBT.

German Main Battle Tank

Leopard 2:

The German Leopard main battle tank, figure 5-6, is common throughout many countries in Europe. The German Leopard 2 is the successor to the German Leopard 1. The Leopard 2 was first introduced in 1979 and has gone through several upgrades and improvements. The German Army is currently upgrading 225 2A5 Leopard tanks to 2A6. The Leopard 2 is armed with a 120mm L55 smoothbore gun, an improved fire control system and a laser range finder.

Figure 5-6. Lepoard 2 MBT.

Infantry vehicles

Infantry vehicles can vary from general transport assets (such as trucks) to specially designed light armored fighting vehicles (LAFVs). Infantry LAFVs are generally classed as armored personnel carriers (APCs) or infantry fighting vehicles (IFVs). The lighter, less protected, and less lethal system of the two is the APC. It is intended to carry soldiers to the close combat zone, and then dismount them.

An IFV is designed to fight with soldiers onboard, to carry the soldiers forward without dismounting them if possible, and to support them with direct fire if they do dismount. Most countries export their infantry vehicles to many other nations, so we will focus mainly on a general overview of the most common US and Allied vehicles. Additionally, many of these vehicles can be configured to perform

reconnaissance missions, but we will concentrate on APCs and IFVs. The following is a brief listing of infantry vehicles of the US and its Allies.

US Army Infantry Vehicles

M2 & M3 Bradley Fighting Vehicle System:

The US Bradley Fighting Vehicle System (BFVS), figure 5-7, includes the M2 Infantry Fighting Vehicle (IFV) and the M3 Cavalry Fighting Vehicle (CFV). The M2A3/M3A3 Bradley is the first US fighting vehicle used for mounted mechanized operations. The M2 IFV transports infantry on the battlefield, provides fire support for dismounted infantry troops, and suppresses enemy tanks and fighting vehicles. The M2 carries three crew and six combat ready infantry soldiers. The M3 Bradley performs scout missions and carries a crew of three plus two scouts. The A3 upgrade includes improvements based on the Gulf War. The upgrades include an improved fire control system for BGM–71 TOW missiles, an improved thermal imager, and explosive reactive armor. The Bradley is armed with a “Bushmaster” 25-mm chain gun, a 7.62-mm coaxial machine gun, and twin TOW–2-missile launchers. The Bradley maximum ground speed is around 41 mph and is also amphibious capable.

Figure 5-7. M2/M3 Bradley Fighting Vehicle (BFVS).

Stryker Infantry Combat Vehicle:

The US eight-wheeled Stryker Infantry Combat Vehicle (IFV), figure 5-8, is the first new military vehicle to enter service into the Army since the Abrams tank in the 1980s. Delivery of the Stryker began in early 2002. It officially entered the inventory in November 2003. The US Army has ordered over 2,100 Strykers to add to its IFV inventory. The US Stryker is a family of eight-wheel drive combat vehicles, transportable in a C–130 aircraft. Stryker is based on the GDLS Canadian LAV III 8x8 light armored vehicle. The Stryker is a full time four-wheel drive, selectively eight-wheel drive ICV. The ICV can attain speeds of 62mph on roads and has a maximum range of 312 miles. The ICV provides armored protection for the two-man crew and a squad of nine infantry soldiers. The ICV provides protection against 14.5mm machine gun rounds, mortar and artillery fragments, as well as a limited capability against RPG–7 rounds. The Stryker ICV is armed with a .50 caliber M2 machine gun, MK19 40mm grenade launcher or a MK240 7.62mm machine gun.

Figure 5-8. Stryker Infantry Combat Vehicle (IFV).

M113 Armored Personnel Carrier:

The US M–113 Armored Personnel Carrier (APC), figure 5-9, entered the US Army in 1960. It is a proven platform used in Vietnam, and the recent combat actions in Iraq. The M–113 served the US Army and coalition forces during Operations DESERT SHIELD/DESERT STORM as an infantry and engineer squad carrier, a medical evacuation carrier, and a maintenance support vehicle. The M–113 provides the Army a highly mobile, survivable, and reliable tracked APC able to keep pace with the M–1 Abrams and the M–3 Bradley. The primary mission of the M–113 is a mechanized infantry troop transport. It accommodates 11 combat soldiers and two crewmembers. Other variations of the M–113 include an add-on dozer blade, a Vulcan weapon system (M163) for antiaircraft defense, a TOW launch assembly (M901), and a command-and-control vehicle (M577). The upgraded M113A3 has added span suppression liners, armored external fuel tanks, a more powerful engine and transmission, and mounting plates for the optional bolt-on aluminum armor. The M113 is armed with a 50-caliber (12.7mm) machine gun. Over 100 variations of the M113 have been produced in numerous countries, with 7.62mm machineguns, 40mm automatic grenade launchers, 90mm recoilless rifles, and turrets with 20 to 75mm cannons. With current upgrades ongoing, the M–113 is likely to remain in the US Army inventory for the foreseeable future.

Figure 5-9. M-113 Armored Personnel Carrier (APC).

British Infantry Fighting Vehicles

Warrior Infantry Fighting Vehicles:

The British Warrior Infantry Fighting Vehicle (IFV), figure 5-10, is one of the mainstays of the British Army. Over 700 Warriors have been produced since 1987, for the British Army. The Warrior has proven its wartime capabilities in the recent conflicts in Iraq and in Bosnia. The Warrior carries a crew of three and seven fully equipped soldiers. The Warrior also carries enough supplies and weapons for a 48-hours in a NBC environment. The Warrior is armed with a M242 chain gun, an M240 7.62mm machine gun, and TOW missile launchers mounted on each side of the turret. The vehicle has the capacity to carry four TOW missiles in the vehicle and two in the launchers. The Warrior adapts to a range of roles with weapon fits ranging from machine pistols to 90mm guns, mortars and missiles. The Warrior is in service in the following variants: infantry section vehicles, infantry command, repair vehicles, recovery vehicles, observation post vehicles, artillery command and anti-tank guided weapon carriers. The British Army has plans to upgrade its Warriors to extend their service life to 2025.

Figure 5-10. Warrior Infantry Fighting Vehicle (IFV).

Viking (BVS10) Amphibious Armored All-Terrain Vehicle:

The Viking BVS10 Amphibious Armored All-Terrain Vehicle (ATV), figure 5-11, entered the British Royal Marine inventory in 2003. The UK Ministry of Defense ordered 108 Vikings to be delivered for Royal Marine use. The Viking is a fully amphibious armored ATV, which consists of two tracked vehicle units. The Viking development is based on the Swedish Hagglunds Bv206. The Viking can be deployed for all Royal Marines landing craft and transported by C–130 and C–17 aircraft. Vikings are able to reach speeds of 48 mph on roads and speeds of over 10 mph on off-road situations. The Viking is armed with a 12.7mm Browning machine gun.

Figure 5-11. Viking (BVS10) Amphibious Armored All-Terrain Vehicle.

Saudi Arabian Armored Personnel Carrier

AF–40–8–1 Al Fahd Armored Personnel Carrier:

The Saudi Arabian Al Fahd Armored Personnel Carrier (APC), figure 5-12, is the first Saudi Arabian armored designed armored vehicle. The Al Fahd is an eight wheeled APC and available in two variants, the AF–40–8–1 APC and the AF–40–8–2 armored fighting reconnaissance vehicle (AFRV).The Al Fahd AFRV can be equipped with a 105mm low recoil and the APC with a 40mm gun. Maximum speed for the Al Fahd is over 50 mph on paved roads. The APC is capable of carrying 11 combat ready soldiers. The Al Fahd is also amphibious capable.

Figure 5-12. Al Fahd Armored Personnel Carrier (APC).

German Armored Personnel Carrier

Fuchs 2 Armored Personnel Carrier:

The German Fuchs 2 armored personnel carrier (APC), figure 5-13, is a new version of the Fuchs 1. The Fuchs can be armed with a 30mm cannon, 12.7 mm machine gun, or a 40mm grenade launcher. The Fuchs is also capable of operating in an NBC environment. The Fuchs is also fully amphibious capable.

Figure 5-13. Fuchs 2 Armored Personnel Carrier (APC).

Artillery

Historically, artillery has killed more soldiers on the battlefield than any other weapon. This stands true today. On the modern battlefield, artillery represents a formidable force, and consists of artillery reconnaissance, towed artillery systems, self-propelled artillery systems, and multiple rocket launchers. Due to the plethora of artillery systems throughout the world, we will only review some of US artillery systems.

US Artillery Systems

High Mobility Artillery Rocket System (HIMARS):

The HIMARS, figure 5-14, is the US Army's newest multiple rocket launcher system (MRLS). HIMARS is a highly mobile artillery system offering the firepower of MRLS on a wheeled chassis. In 2003, the US Army and US Marine Corps ordered 89 HIMARS. The system is scheduled to become operational in summer 2004. The HIMARS is to engage and defeat artillery, air defense concentrations, light armor and support troops. A crew of three operates the MRLS. The HIMARS

has a sophisticated fire control system and is self-loading. HIMARS is capable of firing Army Tactical Missile System (ATACMS) guided missiles capable of delivering 950 anti-personnel munitions exceeding ranges of 100 miles.

Figure 5-14 High Mobility Artillery Rocket System (HIMARS).

M270 Multiple Launch Rocket System (MLRS):

The US Army MLRS, figure 5-15, provides an all-weather, indirect, area fire weapon system to strike and counterfire, air defense, and armored formations. The MLRS accommodates the Army ATACMS. The MLRS is designed to complement, not replace, traditional field artillery.

Figure 5-15. M270 Multiple launch rocket system (MLRS).

M–109 Paladin:

The US M–109 Paladin self-propelled 155mm artillery system, figure 5-16, was first introduced into the Army inventory in the early 1960s. The M–109 has continuously been upgraded and is still the primary indirect fire support weapon for US Army armor and mechanized brigades, and infantry divisions. The M–109 is capable of firing three rounds per minute with a range of over 18,000 meters. The system is capable of traveling at speeds up to 35 mph and is operated by a crew of six. The M–109 is the most widely deployed self-propelled artillery system in the world.

Figure 5-16. M-109 Paladin.

M–110A2:

The M–110A2 self-propelled artillery howitzer, figure 5-17, is the US Army's largest available artillery piece in its inventory. The M–110A2 is deployed in division level artillery and in separate corps and Army level battalions. The M–110 A2 fires 203mm caliber shells at a rate of two rounds per minute. Its mission includes counter-battery fire, and suppression of enemy air defense systems. The M–110A2 is capable of reaching speeds of 35 mph and is operated by a crew of five.

Figure 5-17. M-110A2.

Ground aviation support

The helicopter is the US Army's primary aviation tool, capable of supporting a wide spectrum of ground and air support missions. Helicopters have proven to be a force multiplier on the battlefield able to engage and take out tanks, APCs and ground troops. Due to the large number of types and manufactors of helicopters for the world's armies, we will focus on US helicopters and their ground support mission to ground operations.

US Army Helicopters

AH–64 Apache A/D:

The US Army's is replacing the AH–1 Cobra with the AH–64 Apache, figure 5-18, as its primary attack helicopter. Currently, there are more than 800 AH–64s in the US Army's inventory. The Apache's primary mission is to destroy armored vehicles on the battlefield. The Apache is a twin

engine army attack helicopter that entered the US Army inventory in 1984. The Apache has been exported to several different countries throughout the world. The Apache was first used in combat in 1989 in Panama. It has since then been battle proven in Iraq, Bosnia, Kosovo and Afghanistan. The newest variant of the Apache is the AH–64D Longbow. The new Apache Longbow has an improved fire control system and new AGM–114D Longbow Hellfire anti-tank guided missiles. Other Apache armament consists of rockets, a 30mm M230 gun capable of firing 625 rounds per minute, and air-to-air missiles. The Longbow Apache carries the combination of armaments chosen for the particular mission. In the close air support role the Apache Longbow carries 16 Hellfire missiles on four 4-rail launchers and four air-to-air missiles.

Figure 5-18. AH-64 Apache.

AH–1W/AH–1Z Super Cobra:

The US Marine Corp's primary new attack helicopter is the AH–1W/AH–1Z Super Cobra, figure 5-19. In March 2003, the AH–1W Super Cobra deployed in support of Operation Iraqi Freedom. Its primary mission is to destroy armored vehicles. The Super Cobra was the first attack helicopter capable of carrying air-to-air missiles and Sidearm anti-radiation missiles. The Super Cobra can carry both TOW and Hellfire anti-tank guided missiles and is being outfitted to carry the Maverick missile. The AH–1 can also carry a wide range of rockets and is outfitted with a three-barrel 20mm Gatling gun. The AH–1 Super Cobra upgrade includes electronic countermeasures, radar-warning receivers, laser range finders, laser-warning receivers etc.

Figure 5-19. AH-1W Super Cobra.

UH–60 Blackhawk:

The US Army's primary utility helicopter is the UH–60 Blackhawk, figure 5-20. It entered the US Army's inventory in 1978 and there are over 2000 within the US military today. The Blackhawk has also been widely exported to multiple countries. The Blackhawk's primary mission a troop carrier and logistical support aircraft. The UH–60 also serves as a medevac, command and control, search and rescue, armed escort, and electronic warfare helicopter. It is a combat proven helo used in combat missions in Grenada, Panama, Operation RESTORE HOPE in Somalia, Bosnia and the recent operations in Afghanistan and Iraq. In Sept 2003, the upgrade of over 1,500 Blackhawks to UH–60M began extending the aircraft active service to 2025. The Blackhawk is capable of carrying 11 combat equipped soldiers and has an airlift capacity of 10,000 pounds. The Blackhawk can carry up to 16 Hellfire missiles. Armament, 2 x 7.62 mm machine guns.

Figure 5-20. UH-60 Blackhawk.

OH–58 Kiowa Warrior:

The OH–58 Kiowa Warrior, figure 5-21, is the US Army's primary scout attack helicopter. The Army has approximately 375 Kiowa in the inventory. The OH–58 is the first US helicopter to have an all glass cockpit. The Kiowa has supported operations in Haiti, Operation RESTORE HOPE in Somalia, Afghanistan and Iraq. The Kiowa can be used as a troop transport capable of moving six combat ready soldiers or carry up to 2,000 pounds of supplies. The Kiowa can be armed with two Hellfire missiles, seven Hydra 70 rockets, two air-to-air Stinger missiles or one .50 caliber machine gun. The Kiowa also has an infrared jammer, radar warning receiver, and a laser-warning detector. Two Kiowas can be transported in a C–130.

Figure 5-21. OH-58 Kiowa Warrior.

RAH–66 Comanche:

The RAH–66 Comanche helicopter, figure 5-22, is the US Army's newest reconnaissance/attack helicopter. The Army has placed a requirement for 650 Comanche helicopters to enter its inventory by 2009. The Comanche is designed to have a very low radar cross section due to its shaped fuselage and internal weapons configuration. The RAH–66 carries it weapons internally and has a weapons bay on each side of the fuselage. The Comanche can be armed with Stinger, Starstreak or Mistral air-to-air missles; TOW or Longbow Hellfire anti-tank guided missiles; or a variety of rockets. It is also equipped with an advanced laser warning receiver and infrared jammers. The Comanche is also protected from NBC agents.

Figure 5-22. RAH-66 Commanche.

CH–47D/MH–47E Chinook:

The US Army's only medium cargo lift helicopter with rear-load capability is the CH–47 Chinook, figure 5-23. The Chinook transports troops, artillery, supplies and equipment to the battlefield area. Some other roles of the Chinook are medvac, aircraft recovery, air assault and search and rescue. More than 480 Chinooks are presently in the Army's inventory and it is widely exported throughout the world. The Chinook has a crew of three, and is capable of transporting up to 33 combat ready soldiers. The Chinook has a triple hook system allowing for the transportation of large external loads such as 155mm howitzers. The Special Forces variant, the MH–47 Chinook has a multitude of electronic countermeasures and is air refuelable. 300 of the US Army CH–47D are being upgraded to CH–47F, which includes an improved cockpit area and new engines. Delivery of the new CH–47F will begin in 2004.

Figure 5-23. CH-47D.

222. Identify US and Allied Aerospace Surface-to-Air Defense Weapons Systems

US and Allied aerospace surface-to-air defense weapons systems

As a superpower, we keep our technological edge by constantly designing and deploying newer aerospace defense weapons systems. Most of the weapons systems in the US inventory are aircraft and surface-to-air missiles. These aerospace weapons systems are designed and employed to carry out one or more of our assigned air defense missions in an efficient and timely manner. We'll start with some of the primary surface-to-air missiles (SAM) in the US and allied inventories. This is not an all-inclusive listing due to the large number of SAMs throughout the allied inventory. If you need additional information on allied SAMs, a good source is Jane's Weapons Systems manuals.

US Surface-to-Air Missiles

Patriot (MIM–104)

The US Patriot, figure 5-24, is a long-range, all-weather, all-altitude surface-to-air missile to counter cruise missiles, tactical ballistic missiles and aircraft. The Patriot was extensively used throughout Desert Shield/Storm against Iraqi SCUD missiles and again during Operation IRAQI FREEDOM. The Patriot has been exported to several countries. The Patriot is equipped with a track-via-missile guidance system and has a range of 42 miles reaching to an altitude of over 100,000 feet. The Patriot utilizes a AN/MPQ–53 phased array radar capable of a range of 60 miles and able to track up to 100 targets and provide missile guidance for up to nine missiles. The new Patriot Advanced Capability (PAC–3) missile has an increased capability against tactical ballistic missiles and cruise missiles. Another major improvement of PAC–3 is its ability to have 16 PAC–3 missiles loaded on a launcher, vice four PAC–2 missiles.

Figure 5-24. Patriot (MIM-104).

LAV-AD

The USMC's Light Armored Vehicle – Air Defense (LAV-AD), figure 5-25, is a hybrid gun/surface-to-air missile defense system. It uses a combined GAU–12/U 25mm Gatling gun and two four-Stinger surface-to-air missile pods in defense of Light Armored Vehicle Battalions and ground forces. The Gau is very effective against pop-up helicopters. The LAV-AD 8x8 wheeled vehicle has an all-terrain and amphibious mobility capability.

Figure 5-25. LAV-AD.

Avenger

The US Army's Avenger, figure 5-26, Low Level Air Defense System was first introduced into the Army inventory in 1987. Since then, over 1,004 Avenger units have been ordered with over 800 currently in service. The Avenger turret with Stinger missiles is mounted on a 4x4 HMMWV (High Mobility Multi-purpose Wheeled Vehicle). It operates with a crew of three members. The Avenger is also used in the US Marine Corps and is in service in Taiwan and Egypt. The Avenger supported operations in Bosnia and Iraq during Operations DESERT SHIELD/DESERT STORM and IRAQI FREEDOM. The Avenger is equipped with two lauch pods able to handle four Stinger missiles each. The Avenger is equipped with a .50 caliber M3P machine gun to cover blind spots and to engage enemy ground forces. The Avenger utilizes an automated fire control system and has a Forward Looking Infared (FLIR) capability.

Figure 5-26. Avenger.

Bradley M6 Linebacker

The US Army's Bradley M6 Linebacker, figure 5-27, is a short-range (SHORAD) air defense system consisting of a standard vehicle mounted launcher for Stinger missiles mounted on the US Bradley Fighting Vehicle (BFV). The Bradley Linebacker first entered the Army inventory in 1997, with over 99 systems now in operation on BFV. The Bradley Linebacker is designed to provide SHORAD, capable of operating day or night, and in all weather while firing on the move. The Bradley Linebacker is capable of engaging fixed and rotary wing aircraft, cruise missiles and unmanned aerial vehicles (UAVs) within range of the Stinger missiles.

Figure 5-27. Bradley M6 Linebacker.

THAAD Theater High Altitude Area Defense Missile System

The Theater High Altitude Area Defense (THAAD) missile system, figure 5-28, is currently in a testing phase. The THAAD is scheduled to enter the Army inventory in 2007. The THAAD will be used against targets such as tactical and theatre ballistic missiles at ranges up to 120 miles and altitudes well above 100,000 feet. The THAAD will protect target areas such as airfields and population centers. The Army is expected to acquire between 80–100 THAAD launchers, 18 ground based radars, and over 1,400 missiles. The Army is to establish two future THAAD air defense battalions, each with four batteries. The THAAD battery will operate nine launch vehicles, each carrying eight missiles, two mobile tactical operations centers, and a ground based radar. The THAAD is intended to be jointly used with the Patriot.

Figure 5-28. THAAD.

British Surface-to-Air Missile System

Rapier

The Rapier Field Standard C (FSC), figure 5-29, is in service with the British Army and Royal Air Force and is their primary air defense system. Development of the Rapier began in 1992, with over 50 Rapier systems operational in two Royal Artillery air defense batteries and three Royal Air Force air defense squadrons. The Rapier provides defense against fixed and rotary wing aircraft, cruise missiles, and UAVs. The Rapier is easily transportable behind medium trucks or APCs. The system is also air transportable by helicopters or transport aircraft. The Rapier uses a Dagger target acquisition and surveillance radar with a three dimensional (3-D) resolution. The high resolution radar tracker provides the system with a dual engagement capability. The Rapier has eight ready-to-fire missiles and its own electro-optical surveillance and tracking system. The Rapier is also employed throughout several countries.

Figure 5-29. British Rapier.

Canadian Surface to Air Missle System

ADATS

The ADATS, figure 5-30, is a Canadian built low-level SHORAD system capable of engaging both air and ground targets. The Canadian ADATS system is mounted on a M113 armored vehicle, or can be mounted on a BFV. The system was first introduced into the Canadian inventory in 1988. The ADATS missile can engage low-level attack helicopters and aircraft out to six miles. The ADATS command and control system coordinates up to six ADATS spaced at distances up to 12 miles apart. ADATS can fire eight laser beamriding missiles at its targets.

Figure 5-30. Canadaian ADATS.

223. Identify US and Allied Aircraft Aerospace Systems

US and Allied Aircraft Aerospace Systems

US and Allied Aircraft

US F/A–22 Raptor

The US F/A–22 Raptor, figure 5-31, is the selected replacement aircraft for the F–15 Eagle for air superiority. The F–22 combines stealth design with the supersonic, highly maneuverable, dual engine, long-range requirements of an air-to-air fighter, and it also will have an inherent air-to-ground capability. The F/A–22 integrates avionics for a first-look, first-shot, first-kill capability that guarantees the US air domination for the next three decades. Raptor surpassed its 5,000-test flight hour in February 2004 and is expected to reach initial operational capability (IOC) in late December 2005. The first F–22 squadron will be stationed at Langley AFB.

Figure 5-31. F/A-22 Raptor.

F–15 Eagle

The US F–15 Eagle, figure 5-32, is the Air Force's primary air superiority fighter. The F–15 is an all-weather, extremely maneuverable, tactical fighter designed to gain and maintain air superiority in aerial combat. The F–15 possesses a pulse-Doppler radar able to look up or look down at targets. The Eagle can be armed with combinations of four different air-to-air weapons: AIM–7F/M Sparrow missiles or AIM–120 advanced medium range air-to-air missiles on its lower fuselage corners, AIM–9L/M Sidewinder or AIM–120 missiles on two pylons under the wings, and an internal 20mm Gatling gun in the right wing root. The F–15 low-drag, conformal fuel tanks were especially developed for the F–15C and D models. Conformal fuel tanks can be attached to the sides of the engine air intake trunks under each wing and are designed to the same load factors and airspeed limits as the basic aircraft. These tanks reduce the need for in-flight refueling on global missions and increase time in the combat area. The F–15E Strike Eagle is a two-seat, dual-role, totally integrated fighter for all-weather, air-to-air and deep interdiction missions. The rear cockpit is upgraded to include four multi-purpose CRT displays for aircraft systems and weapons management. The digital, triple-redundant Lear Siegler flight control system permits coupled automatic terrain following, enhanced by a ring-laser gyro inertial navigation system. For low-altitude, high-speed penetration and precision attack on tactical targets at night or in adverse weather, the F–15E carries a high-resolution APG–70 radar and low-altitude navigation and targeting infrared for night pods. The F–15 has been purchased by several different nations.

Figure 5-32. F-15 Eagle.

F–16 Fighting Falcon

The F–16 Fighting Falcon, figure 5-33, is a multi-role all-weather fighter aircraft proven in air-to-air combat and air-to-surface attack. The USAF F–16 deployed to the Persian Gulf in 1991 in support of Operation DESERT SHIELD/STORM and conducted more sorties than any other aircraft. The F–16 is armed with one M–61A1 20mm multi-barrel cannon, conventional air-to-air missiles, air-to-surface missiles and electronic countermeasure pods. The F–16 has been widely exported to many NATO countries.

Figure 5-33. F-16 Fighting Falcon.

A–10/OA–10 Thunderbolt II (WARTHOG)

The USAF's A/OA–10 Thunderbolt II, figure 5-34, is the first Air Force aircraft specially designed for close air support mission. The A–10 is an effective and survivable twin jet engine aircraft that can be used against all ground targets, including tanks and armored vehicles. The A–10 can loiter near battle areas for extended periods of time and operate under 1,000-foot ceilings with 1.5-mile visibility. Their wide combat radius and short takeoff and landing capability permit operations in and out of locations near front lines. Using night vision goggles, the A–10/ OA–10 pilots can conduct their missions during darkness. A–10 pilots are protected by titanium armor that also protects parts of the flight-control system. The aircraft can survive direct hits from armor-piercing and high explosive projectiles up to 23mm. The Thunderbolt II's 30mm GAU–8/A Gatling gun can fire 3,900 rounds a minute and can defeat an array of ground targets including tanks. In the Gulf War, A–10s flew 8,100 sorties and launched 90 percent of the AGM–65 Maverick missiles. The A–10 is armed with one 30 mm GAU–8/A seven-barrel Gatling gun; up to 16,000 pounds of mixed ordnance on eight under-wing and three under-fuselage pylon stations, including 500 pounds Mk–82 and 2,000 pounds Mk–84 series low/high drag bombs, incendiary cluster bombs, combined effects munitions, mine dispensing munitions, AGM–65 Maverick missiles and laser-guided/electro-optically guided bombs; infrared countermeasure flares; electronic countermeasure chaff; jammer pods; 2.75-inch rockets; illumination flares and AIM–9 Sidewinder missiles.

Figure 5-34. A-10 Warthog.

F–117A Nighthawk

The F–117A Nighthawk, figure 5-35, is the world's first operational aircraft designed to exploit low-observable stealth technology. The F–117 precision-strike aircraft penetrates high-threat airspace and uses laser-guided weapons against critical high value targets. The F–117A can employ a variety of weapons and is equipped with sophisticated navigation and attack systems integrated into a digital avionics. F–117 missions into highly defended target areas are accomplished by an automated mission planning system. During Operation Desert Storm, the F–117 flew approximately 1,300 sorties and scored direct hits on 1,600 high-value targets in Iraq. It was the only US or coalition aircraft to strike targets in downtown Baghdad. In 1999, 24 F–117A's deployed to Aviano Air Base, Italy, and Spangdahlem AB, Germany, to support NATO's Operation Allied Force. The aircraft led

the first Allied air strike against Yugoslavia on March 24, 1999. The F–117A carries its weapons within an internal bomb bay to keep its stealth capability. There are only 55 F–117s within the USAF's inventory.

Figure 5-35. F-117A Nighthawk.

B–52 Stratofortress

For over 40 years, the B–52 Stratofortresses, figure 5-36, has been the backbone of the strategic bomber force for the USAF. Current engineering analyses show the B–52's life span to extend beyond the year 2040. The bomber is capable of flying at high subsonic speeds at altitudes up to 50,000 feet. It can carry nuclear or precision guided conventional ordnance with worldwide precision navigation capability. In a conventional conflict, the B–52 can perform strategic attack, air interdiction, offensive counter-air and maritime operations. During Desert Storm, B–52s delivered 40 percent of all the weapons dropped by coalition forces. It is highly effective when used for ocean surveillance, and can assist the US Navy in anti-ship and mine-laying operations. The use of aerial refueling gives the B–52 a range limited only by crew endurance. The aircraft's flexibility was evident in Operation Desert Storm and again during Operations Allied Force. B–52s struck wide-area troop concentrations, fixed installations and bunkers, and decimated the morale of Iraq's Republican Guard. During Operation Allied Force, B–52s opened the conflict with conventional cruise missile attacks. B–52H model can carry up to 20 air-launched cruise missiles. The B–52 is capable of dropping or launching the widest array of weapons in the US inventory. The B–52 can deliver approximately 70,000 pounds of mixed ordnance—bombs, mines and missiles, or be modified to carry air-launched cruise missiles, Harpoon anti-ship and Have Nap missiles. Currently, the USAF has 85 operational B–52s.

Figure 5-36. B-52 Stratofortress.

B–2 Spirit

The B–2 Spirit, figure 5-37, is a multi-role bomber capable of delivering both conventional and nuclear munitions. A dramatic leap forward in technology, the bomber represents a major milestone in the US bomber modernization program. The B–2 brings massive firepower to bear, in a short time, anywhere on the globe through previously impenetrable defenses. Along with the B–52 and B–1B, the B–2 provides the penetrating flexibility and effectiveness inherent in manned bombers. Its low-observable, or "stealth," characteristics give it the unique ability to penetrate an enemy's most sophisticated defenses and threaten its most valued, and heavily defended, targets. The low-observable technologies, with high aerodynamic efficiency and large payload, give the B–2 important advantages over existing bombers. The B–2s unrefueled range is approximately 6,000 nautical miles.

The B–2's low observability is derived from a combination of reduced infrared, acoustic, electromagnetic, visual and radar signatures. The success of the B–2 was proved in Operation Allied Force, where it was responsible for destroying 33 percent of all Serbian targets in the first eight weeks. In support of Operation Enduring Freedom, the B–2 flew one of its longest missions to date from Whiteman AFB to Afghanistan and back. Whiteman AFB is the B–2's only operational base. There are only 21 B–2 Spirits within the USAF's inventory.

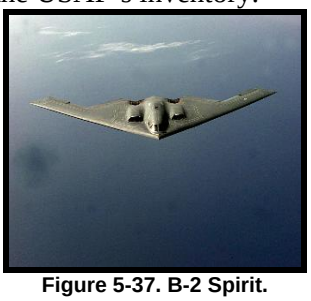

Figure 5-37. B-2 Spirit.

C–17 Globemaster III

The C–17 Globemaster III, figure 5-38, is the newest, most flexible cargo aircraft to enter the airlift force. The C–17 is capable of rapid strategic delivery of troops and all types of cargo to main operating bases or directly to forward bases in the deployment area. The aircraft is also capable of performing tactical airlift and airdrop missions when required. The inherent flexibility and performance of the C–17 improve the ability of the total airlift system to fulfill worldwide air mobility requirements. Maximum payload capacity of the C–17 is 170,900 pounds, and its maximum gross takeoff weight is 585,000 pounds. With a payload of 160,000 pounds and an initial cruise altitude of 28,000 feet, the C–17 has an unrefueled range of approximately 2,400 nautical miles. Its cruise speed is approximately 450 knots. The C–17 is designed to airdrop 102 paratroopers and equipment. The design of the aircraft allows it to operate through small, austere airfields. The C–17 can take off and land on runways as short as 3,000 feet. The Air Force originally programmed to buy a total of 120 C–17s, with the last one being delivered in November 2004. The fiscal 2000 budget funded another 14 C–17s for special operations duty.

Figure 5-38. C-17 Globemaster III.

FA–18 Hornet

The US FA–18 Hornet, figure 5-39, is the US Navy's and US Marine Corps' all-weather fighter and attack aircraft. The single-seat F/A–18 is the Navy's first strike-fighter. The Hornet was designed for interdiction and close air support without compromising its fighter capabilities. With its excellent fighter and self-defense capabilities, the F/A–18 increases its strike mission survivability and supplements the F–14 Tomcat in fleet air defense. The newest model, the Super Hornet, is a highly capable with missions of air superiority, fighter escort, reconnaissance, aerial refueling, close air support, air defense suppression and day/night precision strike. Compared to the original F/A–18 A through D models, Super Hornet has longer range, an aerial refueling capability, increased and improved carrier suitability. Super Hornet is designed to deliver precision-guided munitions: joint

direct attack munition (JDAM) (all variants) and joint stand off weapon (JSOW). In the future, joint air-to-surface stand off missile (JASSM). The F/A–18 demonstrated its capabilities and versatility during Operation Desert Storm, shooting down enemy fighters and subsequently bombing enemy targets with the same aircraft on the same mission, and breaking all records for tactical aircraft in availability, reliability, and maintainability. FA–18s took direct hits from surface-to-air missiles, recovering successfully, being repaired quickly, and flying again the next day proved the aircraft's survivability.

Figure 5-39. FA-18 Hornet.

F–14 Tomcat

The US Navy's F–14 Tomcat, figure 5-40, is a supersonic, twin-engine, variable sweep wing, two-place strike fighter. The multiple tasks of navigation, target acquisition, electronic counter measures (ECM), and weapons employment are divided between the pilot and the radar intercept officer (RIO). Primary missions for the F–14 include precision strike against ground targets, air superiority, and fleet air defense. As a Strike Fighter, the Tomcat is capable of deploying an assortment of air-to-ground ordnance (MK–80 series GP bombs, laser-guided bomb (LGBs) and JDAM) in various configurations, while simultaneously carrying the AIM–7, AIM–9 and AIM–54 air-to-air missiles. The F–14 also has the LANTIRN targeting system that allows delivery of various laser-guided bombs for precision strikes in air-to-ground combat missions and for battle damage assessment. With its Fast Tactical Imagery (FTI) system the F–14 can transmit and receive targeting/reconnaissance imagery in-flight to provide time sensitive strike capability. A number of F–14s also carry the Tactical Air Reconnaissance Pod System (TARPS) providing in-theater tactical reconnaissance. Current plan is to have F–14s in service until mid-FY07. F–14 squadrons have already started to transition to the F/A–18 E/F *Super Hornet* aircraft, and will continue to transition in a phased approach.

Figure 5-40. F-14 Tomcat.

224. Idenfify US Naval Systems

Naval Vessels

The Aircraft Carrier Mission

- To provide a credible, sustainable, independent **forward presence** and conventional deterrence in peacetime.
- To operate as the cornerstone of joint/allied maritime expeditionary forces in times of crisis.
- To operate and support aircraft attacks on enemies, protect friendly forces and engage in sustained independent operations in war.

Aircraft carriers are deployed worldwide in support of US interests and commitments. They can respond to global crises in ways ranging from peacetime presence to full-scale war. Together with their on-board air wings, the carriers have vital roles across the full spectrum of conflict.

The *Nimitz*-class carriers, eight operational and two under construction, are the largest warships in the world. *USS Nimitz* (CVN 68) was the first to undergo its initial refueling during a 33-month Refueling Complex Overhaul at Newport News Shipbuilding in Newport News, Va., in 1998. The next generation of carrier, CVN 21, the hull number will be CVN 78, is programmed to start construction in 2007 and is slated to be placed in commission in 2014 to replace *USS Enterprise* (CVN 65) which will be over its 50-year mark. CVN 79 is programmed to begin construction in 2012 and to be placed in commission in 2018, replacing *USS John F. Kennedy* (CV 67) in her 50th year.

Aircraft Carriers – Nimitz class aircraft carriers

The United States has become increasingly entwined in the business and security issues with the rest of the world. Our economy and security depends upon our protecting our overseas interests as well as encouraging peace and stability around the globe. Forward presence by US Navy aircraft carrier battle groups and amphibious ready groups helps us accomplish this. The carrier battle group, operating in international waters, does not need the permission of host countries for landing or overflight rights. Nor does it need to build or maintain bases in countries where our presence may cause political or other strains. Aircraft carriers are sovereign US territory that steam anywhere in international waters. This characteristic is not lost on our political decision-makers, who use Navy aircraft carriers as a powerful instrument of diplomacy, strengthening alliances or answering the fire bell of crisis. As former President Bill Clinton said during a visit to the aircraft carrier *USS Theodore Roosevelt*, figure 5-41, “When word of crisis breaks out in Washington, it’s no accident the first question that comes to everyone’s lips is; where is the nearest carrier?” Aircraft carriers provide a wide range of possible response for the National Command Authority.

Figure 5-41. US Nimitiz Class Aircraft Carrier – USS Theodore Roosevelt (CVN-71).

Cruisers - Ticonderoga Class

The US Navy's Ticonderoga class guided missile cruisers, figure 5-42, perform primarily in a battle force role. These ships are multi-mission (anti-air warfare (AAW), anti-submarine warfare (ASW), and anti-surface warfare (ASUW)) surface combatants capable of supporting carrier battle groups, amphibious forces, or of operating independently and as flagships of surface action groups. Due to their extensive combat capability, these ships have been designated as battle force capable (BFC) units. The cruisers are equipped with Tomahawk Cruise missiles giving them additional long-range strike mission capability.

Technological advances in the Tomahawk missile coupled with the Aegis Combat System in the Ticonderoga class cruisers have increased the AAW capability of surface combatants to pinpoint accuracy. The addition of *Tomahawk* in the CG–47 has vastly complicated unit target planning for any potential enemy and returned an offensive strike role to the surface forces that seemed to have been lost to air power at Pearl Harbor.

Figure 5-42. US42 Ticonderoga Class Guided Missile Cruiser-USS Lake Erie (CG-70).

Ships of the *USS Constellation* (CV 64) battle group steamed westward across the Pacific Ocean enroute to the Arabian Gulf to enforce no-fly zones and monitor shipping to and from the region. The ships, from foreground to back, are the Aegis cruisers *USS Lake Erie* (CG 70) and *USS Chosin* (CG 65), the ammunition ship *USS Mount Hood* (AE 29), and the fleet oiler *USS Cimarron* (AO 177).

Crew: 24 Officers, 340 Enlisted

Armament: MK26 missile launcher (CG 47 thru CG 51) (MR) or MK41 vertical launching system (CG 52 thru CG 73) (MR); Vertical Launch ASROC Missile; *Tomahawk* Cruise Missile; Six MK 46 torpedoes (from two triple mounts); Two Mk 45 5-inch/54 caliber lightweight guns; Two *Phalanx* close-in air defense weapons systems

Destroyers - Arleigh Burke *class*

The US Navy's Arleigh Burke class destroyers, figure 5-43, are the fast warships providing multi-mission offensive and defensive capabilities, and can operate independently or as part of carrier battle groups, surface action groups, amphibious ready groups, and underway replenishment groups. US destroyers and guided missile destroyers operate in support of carrier battle groups, surface action groups, amphibious groups and replenishment groups. Destroyers primarily perform anti-submarine warfare duty while guided missile destroyers are multi-mission (anti-air warfare (AAW), anti-submarine warfare (ASW), and anti-surface warfare (ASUW)) surface combatants. The addition of the Mk–41 Vertical Launch System or Tomahawk armored box launchers (ABLs) to many *Spruance*-class destroyers has greatly expanded the role of the destroyer in strike warfare.

Figure 5-43 USS John Paul Jones (DDG–53).

Technological advances have improved the capability of modern destroyers culminating in the Arleigh Burke (DDG 51) class. Named for the Navy's most famous destroyer squadron combat commander and three-time Chief of Naval Operations, the Arleigh Burke was commissioned July 4, 1991, and was the most powerful surface combatant ever put to sea. Like the larger Ticonderoga class cruisers, DDG 51's combat systems center around the Aegis combat system and the *SPY-lD*, multi-function phased array radar. The combination of Aegis, the Vertical Launching System, an advanced anti-submarine warfare system, advanced anti-aircraft missiles and Tomahawk, the *Burke* class continues the revolution at sea..

The DDG 51 class incorporates all-steel construction. In 1975, the cruiser *USS Belknap* (CG 26) collided with *USS John F. Kennedy* (CV 67). *Belknap* suffered severe damage and casualties because of her aluminum superstructure. On the basis of that event, the decision was made that all future surface combatants would return to a steel superstructure. And, like most modern US surface combatants, DDG 51 utilizes gas turbine propulsion. These ships replaced the older *Charles F. Adams* and *Farragut*-class guided missile destroyers.

Crew: 23 officers, 300 enlisted

Armament: Standard missiles; Harpoon; Vertical Launch ASROC (VLA*)* missiles; Tomahawk; six Mk–46 torpedoes (from two triple tube mounts); one 5"/54 caliber Mk–45 (lightweight gun); two 20mm Phalanx close-in air defense weapons system (CIWS).

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

221. Identify US and Allied ground weapon systems

1. What is the US's primary main battle tank?

2. What is the Israeli Army's new and main battle tank?

3. What is the first US fighting vehicle used for mounted mechanized operations?

4. What British amphibious armored ATV consists of two tracked vehicle units?

5. What is the US Army's only medium cargo lift helicopter with a rear-load capability?

6. What is the US Army's primary scout attack helicopter?

222. Identify US and Allied Aerospace Surface-To-Air Defense Weapons Systems

1. Which USMC light armored vehicle consists of a hybrid gun/surface-to-air missile defense system using a combined GAU–12/U 25mm Gatling gun and two four-Stinger surface-to-air missile pods?

2. What is the British Army and Royal Air Force's primary air defense system?

3. What US Army short-range (SHORAD) air defense system consisting of a standard vehicle mounted launcher for Stinger missiles is mounted on the US Bradley Fighting Vehicle (BFV)?

4. The US Patriot is a long-range, all-weather, all-altitude surface-to-air missile to counter cruise missiles, tactical ballistic missiles and aircraft?

223. Identify US and Allied aircraft aerospace systems

1. What is the aircraft selected to replace the F–15 Eagle for air superiority?

2. What USAF strategic bomber has been the backbone of the strategic bomber force?

224. Idenfify US Naval Systems

1. What US Navy class guided missile cruisers perform primarily in a battle force role?

2. What US Navy ship class primarily performs anti-submarine warfare duty?

5–2. US Munitions Familiarization

As an Operations Intelligence technician, you must have a vast knowledge of US munitions, both air-to-air and air-to-ground. You may find yourself working in an Air Operations Center planning an air campaign and selecting what targets will be destroyed, and with what weapons. You will be required to assist in the selection of munitions to degrade or destroy different types of targets. You may even find yourself in the squadron reviewing the air tasking order (ATO) and questioning the AOCs selection of weapon to attack a target. You will need to be familiar with munitions that can be utilized and deliver from certain air platforms. This section will cover the different types of US air-to-surface and air-to-air munitions.

225. Identify US air to surface munitions familiarization

The US air-to-surface inventory contains many different types of munitions. These weapons can vary from simple gravity bombs to sophisticated laser guided, tv-guided, and GPS capable bombs within the US inventory. You have to be familiar with US air-to-surface munitions, their effects on a target, and their limitations. In this section, we will review some of the common characteristics of these weapons.

General purpose bombs

General purpose (GP) bombs are free fall ordnance or sometimes referred to as dumb or gravity bombs. The bombs are dumb in the fact they are only as accurate as the pilot or platform delivering them. They come in a variety of sizes and weights ranging from 500 pounds for MK–82 (pronounced Mark), to 2,000 pounds for the MK–84. By adding special guidance kits to the MK series the bombs accuracy and performance are greatly enhanced. It is important to be familiar with GP warheads since they are often used as the core element of more advanced guided weapons. Approximately 45 percent of the GP bomb's weight is explosive materials. See figure 5-44.

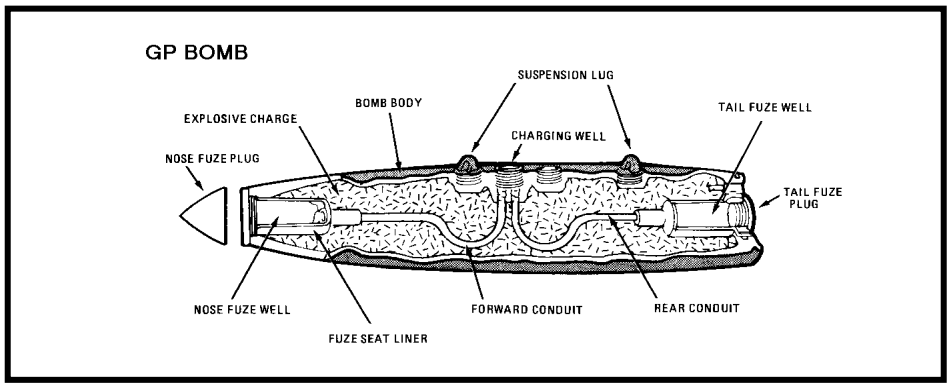

Figure 5-44. General Purpose Bomb.

Mk 80 series

Produces blast, fragmentation, fire, and deep cratering effects. Normally, GP bombs have both nose and tail fuze to increase functioning reliability. Mk series weapons can be employed against all target types except when a penetrating capability is needed. Examples: Radars, buildings, bridges, artillery, vehicles, troops, roadways, airfields, and SAMs, etc.

Mk 82

500 pound low-drag, general purpose bomb. The Mk–82 has a slender body with a long tapered nose. It has a mechanical or proximity fuze, or proximity sensor. The Mk 82 can be loaded on most fighter/attack aircraft in the USN, USAF, and USMC inventories.

- Total Weight: 500 lbs.
- Explosive Weight: 190 lbs.

- Case thickness: 0.4 inches.
- Variants:

  a. Mk–82 Slick - low drag.
  b. Mk–82Air - high drag.
  c. BLU–111 - USN and USMC. Has a thermal coating and PBXN explosive fill.

MK 83

1,000 pound low-drag, general purpose bomb. It has a mechanical, proximity fuze, or proximity sensor. The USN and USMC primarily use the Mk 83.

- Weapon weight: 1000 lbs
- Explosive weight: 400 lbs
- Case thickness: 0.5 inches
- Variants:

  a. Mk–83 Slick - low drag.
  b. Mk–83Air - high drag.
  c. BLU–110.

Mk 84

2,000 pound, low-drag, general purpose bomb. It has a mechanical or proximity fuze, or proximity sensor. The Mk 84 can be loaded on most fighter/attack aircraft in the USN, USAF, and USMC inventories.

- Weapon weight: 2,000 lbs
- Explosive weight: 945 lbs
- Case thickness: 0.6 inches
- Variants:

  a. Mk–84 Slick - low drag.
  b. Mk–84Air - high drag.

M–117

General purpose bomb is a 750-pound general purpose bomb, usually fitted with the M904 and M905 or FMU–54 (tail) fuze. The M-series bombs, also called demolition bombs, produce blast and fragmentation, but not deep cratering effects, because they have relatively thin casings.

- The basic M–117 dates from the Korean War and uses a low-drag tail fin for medium and high-altitude deliveries.
- The M–117R (Retarded) uses a special fin assembly providing either high drag or low drag release options. For low altitude deliveries, the tail assembly opens four large drag plates which rapidly slow the bomb and allow the aircraft to escape its blast. The M–117 series was used extensively during the Vietnam War, and B–52G aircraft dropped thousands of tons of M–117 and M–117R bombs during Operation Desert Storm.

General Purpose Bomb Weapons Characteristics

General purpose bombs have three sections. The bomb body is the casing containing the explosive material. The fuze section can be located in the nose and/or the rear of the bomb and determines the timing of the explosion. The tail section, or fins, determines how the bomb flies through the air.

- Operate in low and high-drag modes

- The low drag or slick-version fins are conical and provide only in-flight stability.
- High-Drag or Retarder Fins. The original retarder fins consist of four metal foils that unfold in free fall: they are called Snakeye fins. The other device is the air-inflatable retarder (AIR), which can be used in the retarded or unretarded mode. The AIR consists of a container on the aft end of the warhead that deploys a small parachute or ballute that expands by entrapping air. Either retarder slows the velocity of the weapon, the slower velocity allows for weapon delivery at lower altitudes because the delivery aircraft has enough time to leave the area to avoid fragmentation and blast damage. Retarding the weapon increases the impact angles at low delivery altitudes and decreases velocities. See figure 5-45.
- Cylindrical bodies are stabilized in flight by either fin or parachute assemblies. These assemblies attach to the rear section of the bomb and keep the bomb nose-down during its descent.
- Use nose and tail fuzes (dual fuzing) together to increase functional reliability.

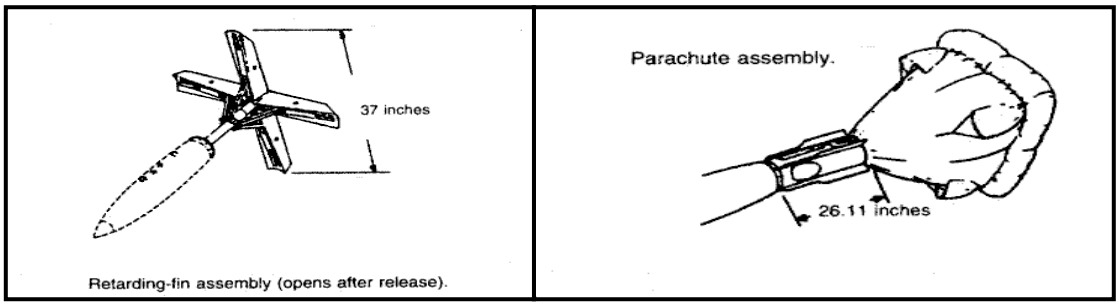

Figure 5-45. Fins and Ballutes.

Special unconventional weapons type

Massive Ordnance Air Burst (MOAB)

The MOAB, figure 5-46, is a GPS (Global Position Satellite) guided 21,500 lb bomb. After being pulled out of the cargo hold of the aircraft by a parachute, the parachute releases, and the GPS guides the bomb to the target destination. At a designated altitude, the MOAB sprays the area with a highly flammable mist, which is then ignited by a conventional explosive within the bomb. The results are a truly devastating explosion that can destroy tanks, buildings, and personnel in an area of several hundreds of yards.

Figure 5-46. Massive Ordnance Air Burst (MOAB).

BLU–109

Series 2,000-Pound Penetrator Bomb has a slender body with a long, tapered nose. The heavy-walled is made of modified alloy steel case that is a nominal 1.125 inches thick and provides the capability to penetrate 4 to 6 feet of steel reinforced concrete. The nose of this weapon is thick and solid with no provisions for nose fuzing. The BLU–109 is currently used only in guided configurations for electro-optically and laser-guided weapons. The BLU–109 is interchangeable with the Mk–84 warhead on guided weapons due to similarities in size and weight class. The BLU–109 uses the FMU–143, FMU–152, or FMU–157 tail fuzes. See figure 5-47.

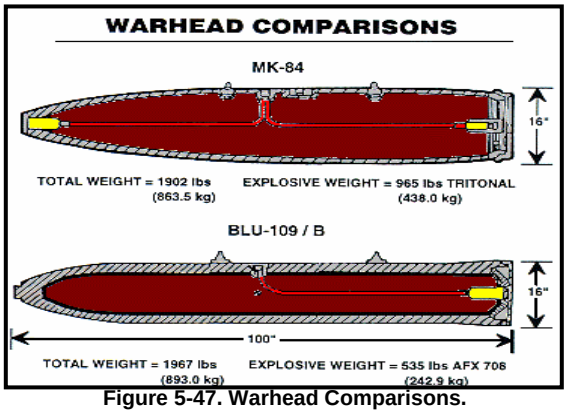

Figure 5-47. Warhead Comparisons.

- Warhead weight: 1957 lbs.
- Explosive weight: 535 lbs.
- Case thickness: 1.125 inches.
- Fuzes: FMU–143, FMU–152.

BLU–113B

5,000-pound penetrator warhead is based on the design of the BLU–109/B. It has a long, slender body with a tapered nose. The heavy-walled steel nose and case provide its penetration capabilities. The nose of this weapon is thick and solid. This weapon has not been tested to determine the full extent of its capabilities. During a sled test, the weapon perforated more than 20 feet of reinforced concrete. Currently the BLU–113/B is only loaded on the F–15E and the B–2. The BLU–113/B uses the FMU–143, FMU–152, or FMU–157 tail fuzes.

- Warhead weight: 5,000 lbs.
- Explosive weight: 670 lbs.
- Case thickness: 2.225 inches.
- Fuzes: FMU–143, FMU–152.

BLU–116A/B Advanced Unitary Penetrator (AUP)

The Advanced Unitary Penetrator (AUP), figure 5-48, is the next-generation, hard target penetrator munition that provides a lethal capability to penetrate and defeat extremely hard multilayer underground facilities. Sharing an external appearance and flight characteristics with the 2000 lb BLU–109, the AUP has an advanced heavy steel penetrator warhead penetrator that features an elongated narrow diameter case made of a tough nickel-cobalt steel alloy. The AUP can penetrate approx 11 feet of reinforced concrete. The AUP can make use of the BLU–109 proven family of guidance kits for precision delivery, including the GBU–10, 15, 24, 27, JDAM and AGM–130 kits.

Figure 5-48. AUP.

BLU–118B Thermobaric Weapon

The BLU–118B, figure 5.49, is a penetrating warhead filled with an advanced thermobaric explosive that, when detonated, generates higher sustained blast pressures in confined spaces such as tunnels and underground facilities. The BLU–118/B uses the same penetrator body as the standard BLU–109 weapon. The significant difference is the replacement of the high explosive fill with a new thermobaric explosive that provides increased lethality in confined spaces. The FMU–143 fuze has been modified with a new booster and a 120-milisecond delay. All weapon guidance systems and employment options currently used with the BLU–109 warhead are compatible with the new BLU–118/B warhead.

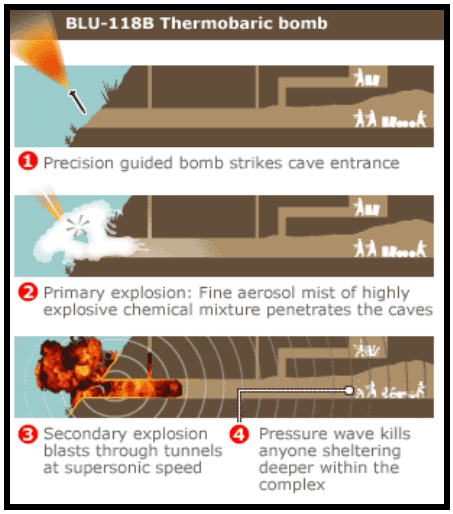

Figure 5-49. BLU–118B.

Precision guided munitions (PGM)

PGM's employ trajectory-altering guidance units to improve the probability of a hit on or near the aimpoint. Information from a source external to the weapon is received and evaluated to assess potential errors in the trajectory; the flight path of the weapon is altered through a control capability on the weapon.

There are two types of guidance used in these weapons; homing and command.

Homing guidance have a seeker within the weapon, since the seeker is in the weapon and the signal generally get stronger as the weapon gets closer to the target this method of guidance is accurate. If the weapon receives information about the target before launch as when the operator performs target

acquisition and identification and locks the weapon onto the target before launch, this method is called lock on before launch (LOBL). Other weapons such as the GBU–15 and GBU–24 may be launched from distances such that LOBL is not possible. The seeker must search, acquire, and identify the target or the appropriate signal; this method is called lock on after launch (LOAL). There are three types of homing guidance.

Guidance systems

Passive guidance systems use signals generated by the target or reflected by the target from natural sources. This method also used the contrast between the target and its environment to provide tracking, examples include the following:

- Electro-optical (EO). An example is the EO-guided Maverick missile, which locks onto the light contrast (reflected signal from a natural source) between a target and its environment. The launching aircraft performs target acquisition and identification while the weapon is locked onto the target before launch.
- Imaging infrared (IIR) seeker provides much the same capability using the signal or energy radiated by the target rather than reflected energy and thus the weapon will work when visible light is not available, examples include: Heat contrast; infrared (IR) guided Mavericks.
- Radio detection and ranging (RADAR). The weapon homes in on the radar signal of the target. These weapons are considered launch-and-leave systems because the weapon requires no further intervention from an operator after lock on, such as the Air to Ground High Speed Anti-Radiation Missile (AGM–88 HARM).

Semi-active guidance systems use reflected signals from an external source, the most prevalent being the laser designator from the aircraft. A designator in the launching aircraft, another aircraft, or on the ground provides the signal that illuminates or designates the target. The launch aircraft may be in the area and able to lock onto the signal prior to launch or the weapon may search and acquire the signal after launch. The laser signal may be coded so that multiple signals and weapons may be employed in the same area at the same time. The designator must remain on the target until the weapon impacts; therefore, the systems are not considered launch-and-leave though the delivery aircraft may leave after launch.

Active guidance has a signal that is generated by the weapon that illuminates the target and the weapon guides on the reflected signal: This method is used primarily in air-defense systems and has limited air-to-surface (AS) application at this time. There is only one active guidance AS weapon, the-AGM–84, Harpoon.

Command Guidance weapons receive corrections from an external source; the receiver may then send course correction information to the weapon. This system is very accurate because the target is increasingly clearer in the picture and guidance is increasingly more accurate. Some weapons receive commands through fine wires that physically connect the weapon with the launcher. Tracking of the weapon to impact may be totally visual or the weapon may provide data to the launcher, an example is the AGM–130.

Advantages of Precision Guided Munition (PGM)

- The accuracy is greater, requiring fewer sorties to achieve the objective.
- Improved combat assessment

Disadvantages of PGMs.

- Higher cost per munition. GBU–15 costs vary from to over $250,000.
- SomePGMs require a long loiter time for the aircraft.

AGM–65 Maverick

The following six major versions of Maverick missiles are: AGM–65A, B, D, E, F, and G. The AGM–65 series missiles are lightweight, aluminum, delta wing, air-to-ground weapons capable of launch-and-leave tactics, except for the E model. The primary targets are tanks, armored personnel carriers, field fortifications, and reinforced buildings. Figure 5-50 is an example of a maverick.

The Maverick family consists of the four major sections: guidance, warhead, propulsion, and control sections. The guidance may be EO, IIR, or laser guided. The warhead section consists of the WDU–20/B shaped-charged or the WDU–24/B alternate 300-pound penetrator/blast-fragmentation warhead. Flight propulsion is provided by a boost-sustain, solid-fuel rocket motor. The Maverick is shipped as a complete unit, only requiring a brief electrical check to determine proper operation. A 3-minute warm up period is required to ready the system for operation, after which missiles can be launched at less than 3.5 second intervals. The Maverick can be employed up to 33,000 feet and to a maximum range of 14 miles, tactical range are usually closer to less than 10 miles.

- The AGM–65A (EO), B (EO), and D (IR), with the WDU–20/B shaped charge warhead, are intended for use against tactical ground targets in close-air-support, interdiction, and counter air operations. The primary targets are tanks, armored personnel carriers, field fortifications, and reinforced buildings.
- The AGM–65E is being adopted as the Marine Corps laser Maverick weapon for use from Marine aircraft for use against fortified ground installations, armored vehicles and surface combatants. Used in conjunction with ground or airborne laser designators, the missile seeker, searches a sector of 7 miles across and over 10 miles ahead, if the missile loses laser spot it goes ballistic and flies up and over the target, the warhead does not explode, but becomes a dud.
- The AGM–65F and G, with the WDU–24/B penetrator/blast-fragmentation warhead, can be used against an expanded spectrum of targets including bunkers, revetments, armored vehicles, hangars, small bridges, artillery, and surface-to-air sites.

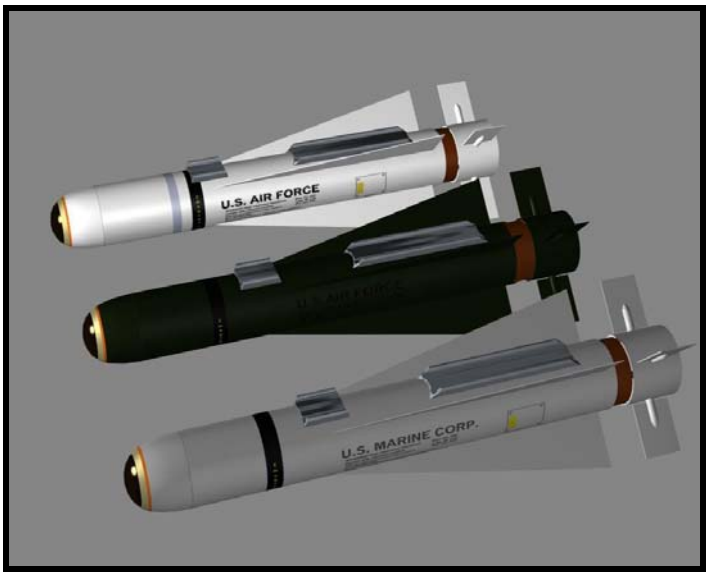

Figure 5-50. Mavericks.

GBU–15

The GBU–15 is an un-powered glide weapon used to destroy high value enemy targets (see figure 5-51). The GBU–15 provides the capability for accurate (automatic or manual) guided bomb at increased ranges. The weapon is remotely controlled by a datalink system, and the weapon systems operator locates the target area and the specific aimpoint by observing the video transmitted from the

weapon. The weapon's midcourse flight path can be adjusted either automatically or manually. Weapon's video is either electro-optical (TV camera) or infrared.

- Range: 15 NM
- Guidance: EO/IR via data link

Variants:

- GBU–15(v)1/B: Mk–84, EO guidance, "long-chord"
- GBU–15(v)1C/B: Mk–84, EO - INS/GPS guidance "short-chord"
- GBU–15(v)2/B: Mk–84, IR guidance, "long-chord"
- GBU–15(v)2C/B: Mk–84, IR and INS/GPS guidance "short-chord"
- GBU–15(v)31/B: BLU–109, EO guidance, "short-chord"
- GBU–15(v)31A/B: BLU–109, EO - INS/GPS guidance, "short-chord"
- GBU–15(v)32/B: BLU–109, IR guidance, "short-chord"
- GBU–15(v)32A/B: BLU–109, IR - INS/GPS guidance, "short-chord"

AGM–130

The AGM–130 is a powered air-to-surface missile designed for high-and low-altitude strikes at standoff ranges against a variety of targets. The GBU–15 uses a glide-boost-glide flight utilizing a nine-inch rocket motor mounted to the under-side of the weapon. The system can use the MK–84, BLU–109/B, or BLU–118B as warheads, employing either a TV or IR seeker. The weapon may be used in an autonomous mode after launch or have man-in-the-loop (MITL) control.

Figure 5-51 offers an example of a GBU-15 and AGM-130.

- Range: >40 NM.
- Guidance: EO/IIR via data link.

Variants:

- AGM–130A–9: Mk–84 warhead, EO guidance
- AGM–130A–10: Mk–84 warhead, IR guidance
- AGM–130A–11: Mk–84 warhead, EO – INS/GPS guidance
- AGM–130A–12: Mk–84 warhead, IR – INS/GPS guidance
- AGM–130AC–9: BLU–109 warhead, EO guidance
- AGM–130C–10: BLU–109 warhead, IR guidance
- AGM–130C–11: BLU–109 warhead, EO – INS/GPS guidance
- AGM–130C–12: BLU–109 warhead, IR – INS/GPS guidance
- AGM–130D: BLU–118B warhead

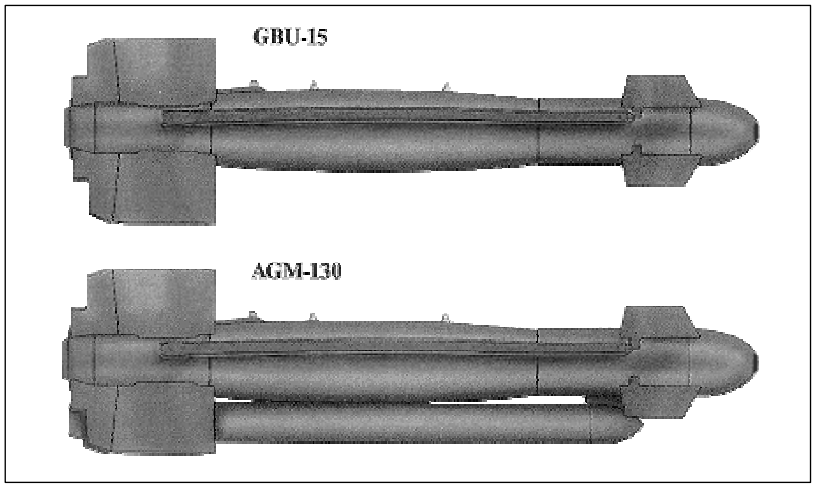

Figure 5–51. GBU–15/AGM–130.

Laser Guided Bombs (LGBs)

The development of laser-guided weapons has dramatically improved the accuracy of weapon guidance and delivery. With the assistance of build-up guidance kits, GP bombs are turned into laser-guided bombs (LGB's). The kits consists of a computer-control group (CCG), guidance canards attached to the front of the warhead to provide steering commands, and a wing assembly attached to the aft end to provide lift. LGB's are maneuverable, free-fall weapons requiring no electronic interconnect to the aircraft. They have an internal semi active guidance system that detects laser energy and guides the weapon to a target illuminated by an external source. The computer section transmits directional command signals to the appropriate pair(s) of canards. The guidance canards are attached to each quadrant of the control unit to change flighpath of the weapon. These weapons are all semi-active homing because the signal is external to the target and weapon. The following six guided-bomb units (GBU) and single air-to-ground missiles (AGM) are laser guided: Guided Bomb Unit–10/12/16/24/27/ 28 and AGM–65E.

Laser (light amplification by the stimulated emission of radiation) is one of the older methods of guiding weapons and is still the only air to surface method in which the radiation signal comes from a source external to the weapon and target. A thin laser beam is directed onto the target and the seeker guides on the reflected energy. The laser signal may be from the delivery aircraft, another aircraft or the ground. The accuracy of the system depends on the ability of the seeker to find the laser signal and the accuracy of the designator to keep the laser on the target. If the weapon loses the laser signal because of weapon malfunction or designator failure, it will continue on a ballistic trajectory and performs like an unguided weapon.

The weapon flight envelope permits standoff from the target, thus reducing hazards to the aircrew while improving bombing accuracy. After release, there is a short delay before the seeker detects and guides on the reflected laser signal. After detection by the seeker, course corrections are generated within the computer, and the guidance fins are deflected, fine deflections causes the weapon to guide to the target.

The effects of smoke, dust, and debris can impair the use of laser-guided munitions. The reflective scattering of laser light by smoke particles may present false targets. Rain, snow, fog, and low clouds can prevent effective use of laser-guided munitions. Heavy precipitation can limit the use of laser designators by affecting line-of-sight. Snow on the ground can produce a negative effect on laser-guided munition accuracy. Fog and low clouds will block the laser-guided munition seeker's field of view, which reduces the guidance time.

Paveway II and Paveway III with retractable wings are the Air Force designations for laser-guided bombs (LGBs). A guidance control unit is attached to the front of the bomb and a wing assembly is attached to the rear. Both generations are compatible with current Army, Navy, Marine and Air Force designators.

- Paveway II uses "***bang-bang guidance'*** due to the fact the guidance control fins have only three positions-all the way left, all the way right, or straight. This causes Paveway II weapons to bleed off energy as it guides to the target, resulting in what is called a negative bias (a tendency to hit short of the aim point). Delayed lasing minimizes this problem and allows the weapon to fly a normal trajectory for a longer period before the target is actually lased. In delayed lasing missions, the target is not lased until approximately 10 to 14 seconds before weapon impact. This method prevents weapon energy loss and minimizes the negative bias. The merits of the "bang-bang" system are extreme simplicity and reliability.
- Paveway III series guided munitions use ***proportional guidance***. This means that the guidance control fins move only as necessary to guide itself to the target. With proportional guidance, the weapon does not lose energy trying to maintain its flight path on a straight line to the reflected energy.

The GBU–10

The GBU-10, figure 5-52, utilizes the 2,000-pound Mk–84 general purpose or BLU–109 penetrating warhead. The operator illuminates a target with a laser designator and then the munition guides to a spot of laser energy reflected from the target. The munition was used during Operation Desert Storm, and hit 78 percent of its targets with a CEP of 7 meters.

- Range: 8nm.
- Guidance: PAVEWAY II (semi-active laser).

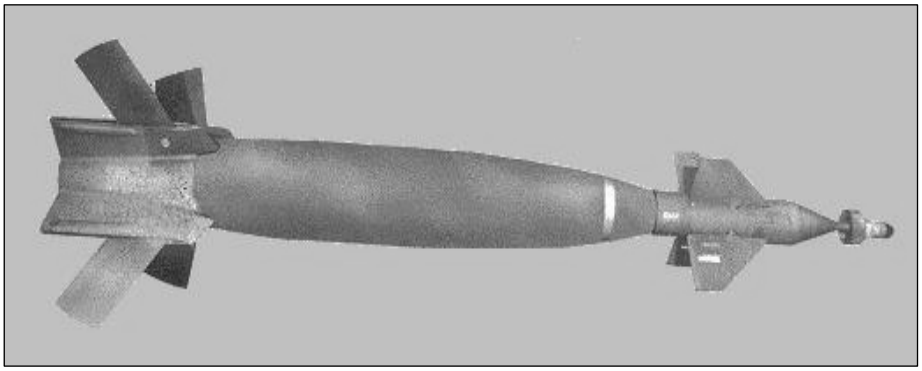

Figure 5-52. GBU–10 Paveway II.

Variants:

- GBU–10E/B: Mk–84 warhead.
- GBU–10H/B and J/B: BLU–109 warhead.

GBU–12

The GBU–12, figure 5-53, utilizes the Mk–82 500-pound general-purpose as its warhead. The operator illuminates a target with a laser designator and then the munition guides to a spot of laser energy reflected from the target. The munition was used during Operation Desert Storm, and,

according to the Air Force, hit 88 percent of its targets with a CEP of 9 meters.

- Range: 8nm.
- Guidance: PAVEWAY II (semi-active laser).
- Warhead: Mk–82 or BLU–111.

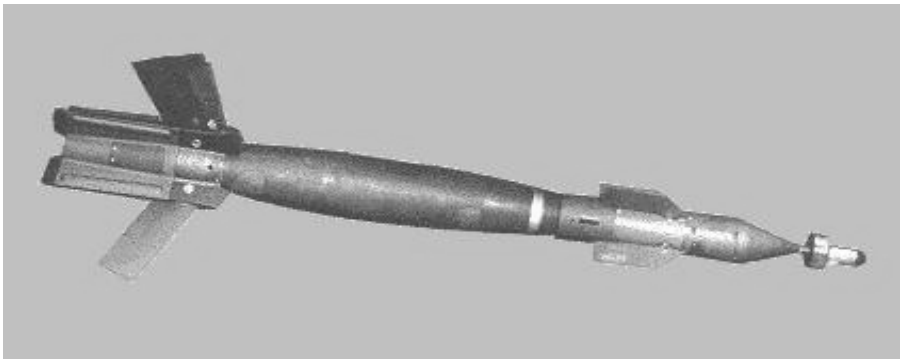

Figure 5-53. GBU–12 Paveway II.

GBU–16

The GBU–16 utilizes a 1000-pound general-purpose warhead. GBU–16 consists of a MK–83 with a common Paveway II laser guidance kit. During Desert Storm virtually all 219 GBU–16s were dropped by Navy A–6Es, which had the capability to lase the target themselves (self-designation).

- Range: 8nm
- Guidance: PAVEWAY II (semi-active laser)
- Warhead: Mk–83 or BLU–110

GBU–24

The GBU–24 low level laser guided bomb (LLLGB), figure 5-54, consists of either a 2,000-pound MK–84 or BLU–109 or BLU–116 penetrator bombs with a Paveway III low-level laser-guided bomb kit to add the proportional guidance in place of the bang-bang type used in the Paveway II. The weapon is designed for low altitude delivery and with a capability for improved standoff ranges to reduce exposure. Paveway III also has increased seeker sensitivity and a larger field of view.

- Range: >10nm.
- Guidance: PAVEWAY III (semi-active laser).

Variants

- GBU–24B: MK–84.
- GBU–24A/B: BLU–109 warhead (USAF).
- GBU–24B/B: BLU–109 warhead (USN).
- GBU–24C/B: BLU–116 warhead (USAF).
- GBU–24D/B: BLU–116 warhead (USN).
- GBU–24E/B: BLU–109 warhead and laser and INS/GPS guidance.

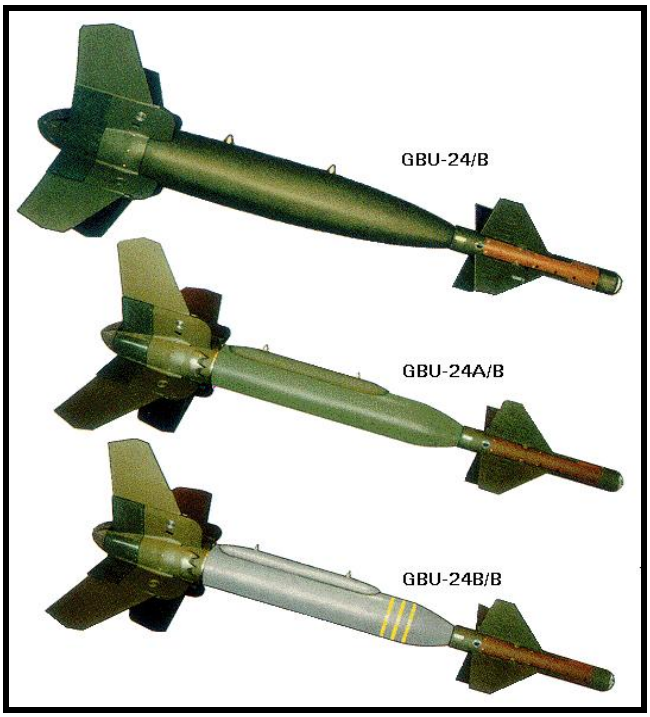

Figure 5-54. Variants of GBU–24 Paveway III.

GBU–27

The GBU–27, figure 5-55, was designed specifically for use by the F–117's advanced target acquisition/designator system. The GBU–27 uses a modified Paveway III guidance control unit, which provides "terminal trajectory shaping" for optimum impact angle against various target structures and a Paveway II tail assembly with folding wings.

- Range: >10nm.
- Guidance: PAVEWAY III (semi-active laser).

Variants

- GBU–27/B: BLU–109 warhead, laser guidance.
- GBU–27A/B: BLU–109 warhead, laser and INS/GPS guidance.

Figure 5-55 GBU–27.

GBU–28

The GBU–28, figure 5-56, is a special weapon developed for penetrating hardened Iraqi command centers located deep underground. The GBU–28 is a 5,000-pound class laser-guided conventional munition that uses a BLU 113 warhead. The bombs are modified Army artillery tubes14.5 inches in

diameter and are almost 19 feet long, weighing 4,637 pounds, and containing 630 pounds of high explosives. They are fitted with modified Paveway III kits. A sled test proved that the bomb could penetrate over 20 feet of concrete, while an earlier flight test had demonstrated the bomb's ability to penetrate more than 100 feet of earth.

- Range: >10nm.
- Guidance: PAVEWAY III (semi-active laser).

Variants

- GBU–28A/B: BLU–113A/B warhead, laser guidance.
- GBU–28B/B: BLU–113A/B warhead, laser and INS/GPS guidance.

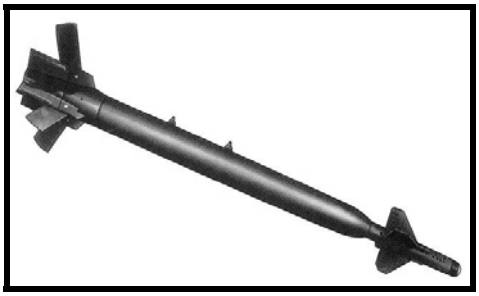

Figure 5–56. GBU–28.

Global Positioning System Munitions (GPS)

Joint Direct Attack Munition (JDAM)

JDAM is a precision-guided weapon using GPS aided INS guidance kits to convert standard MK–82, MK–83, MK–84, BLU–109, and BLU–110 bomb bodies, with appropriate fuzes, to accurate guided munitions (see figure 5-57). The JDAM is a bomb-on-coordinates (BOC) system; target coordinates are passed to the weapon through an interface from the aircraft. Figure 5-57 is an example of a JDAM. JDAM will upgrade the existing inventory of general purpose and penetrator unitary bombs, which can be launched from approximately 15 miles from the target and each is independently targeted. On release, autonomous guidance is initiated using inertial navigation system (INS) data only. After the JDAM GPS receiver acquires the GPS satellites, precision GPS position and velocity data are used to aid the INS. In its most accurate mode, the JDAM is designed to achieve a circular error probable (CEP) of 42 feet or less and each is independently targeted. The JDAM can be employed in all-weather and day/night situations.

- Range: 5–15 NM depending of altitude release.
- Guidance: INS aided with GPS.

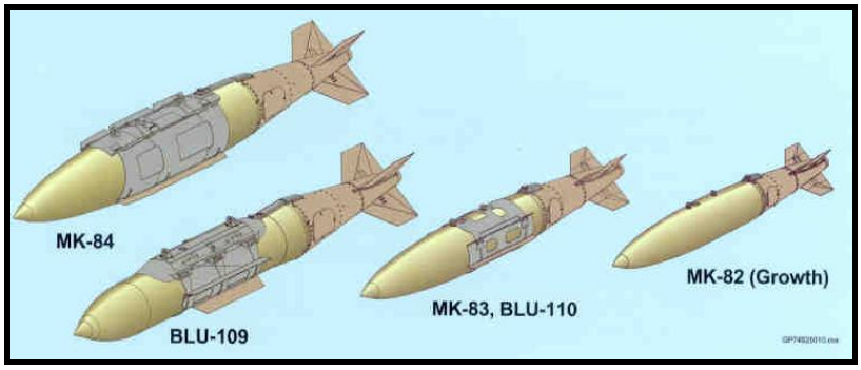

Figure 5-57. Joint Direct Attack Munitions (JDAM).

Variants:

GBU–31

- GBU–31(v)1/B: Mk–84 warhead (USAF).
- GBU–31(v)2/B: Mk–84 warhead (USN/USMC).
- GBU–31(v)3/B: BLU–109 warhead (USAF).
- GBU–31(v)4/B: BLU–109 warhead (USN/USMC).
- GBU–32(v)2/B: Mk–83 warhead (USN/USMC).
- GBU–35(v)4/B: BLU–110 warhead (USN/USMC).
- GBU–38/B: Mk–82 warhead.

GBU–37(v)1/B

Global Positioning System aided munition (GAM). The GBU–37 was developed as an interim precision munition for the B–2. GAM is a tail kit that fits on the BLU–113 penetrator. Unlike the JDAM the GAM only uses GPS to accurately guide to the target. This weapon is currently the only all-weather, near-precision BLU–113/B capability available.

- Range: >5nm.
- Guidance: GPS.
- Warhead: BLU–113.

Joint Stand Off Weapon (JSOW)

AGM–154A, figure 5-58, is an unpowered guided weapon using the INS/GPS and is capable of day/night and adverse weather operations. It is just over 13 feet in length and weights between 1000–1500 pounds. The JSOW uses inertial-aided GPS to achieve highly accurate bomb-on-coordinate performance; the weapon automatically provides a backup mode using only inertia guidance, when jamming of the GPS is encountered. Up to six preplanned waypoints can be incorporated into the flight-path.

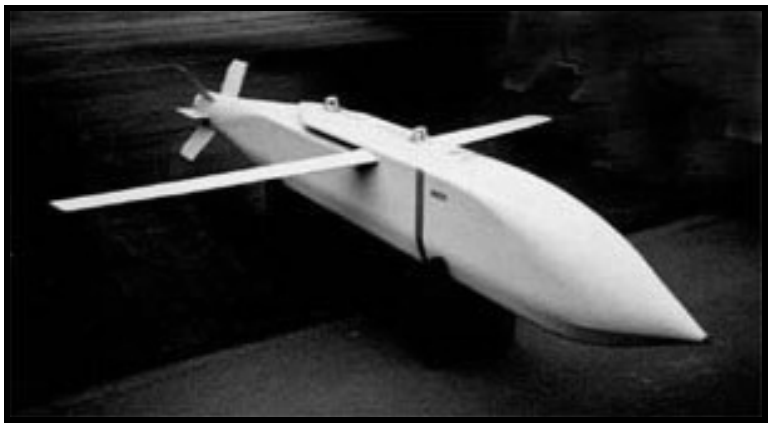

Figure 5-58. AGM–154 JSOW.

Range: 12–40 NM, depending on launch altitude.

Variants.

- AGM–154A: 145x BLU–97A/B combined effect submunitions.
- AGM–154B: 6x BLU–108 sensor fuzed submunitions.
- AGM–154C: BLU–111 warhead.

JASSM

JASSM (Joint Air to Surface Standoff Missile) is a precision cruise missile designed for launch from outside area defenses to kill hard, medium-hardened, soft, and area type targets An example is provided in figure 5-59. After launch, it will be able to fly autonomously over a low-level, circuitous route to the area of a target, where an autonomous terminal guidance system will guide the missile in for a direct hit

Figure 5-59. JASSM.

Cluster Bomb Units (CBUs)

These munitions are comprised of small submunitions (bomblets), figure 5-60, contained in a canister. They are small explosive filled or chemical filled items designed for saturation coverage of a large area. They may be antipersonnel (AP), anti material (AM), and antitank (AT). On the battlefield submunitions are widely used in both offensive and defensive missions. Submunitions are used to destroy an enemy in place or to slow or prevent enemy movement away from an area. The submunitions provide smaller weapons effects than bombs, but there are more of them. Like larger conventional warheads, sub-munitions produce blast, fragmentation, and fire, but can also have shaped charges. The submunitions provide extensive coverage on the ground, referred to as the pattern.

- They can cover different size areas or target types.
- Dispenser release.
- Weapon begins to spin and opens at selected revolutions per minute (RPM).
- Submunitions hit the air stream and begin to spread out.

Impact patterns vary with the functioning altitude and time, number of submunitions, and delivery conditions.

- Toroidal (donut) US Navy version.
- Rectangular USAF version.

APERS/AMAT submunitions.

Figure 5-60. Bomblets.

Wind Corrected Munitions Dispenser (WCMD)

This kit will reduce susceptibility to wind induced errors, not fully compensated for by aircraft avionics, by providing mid-course wind correction. The inexpensive tail kit uses INS without GPS to inertially steer the munition from a known release point to precise target coordinates while compensating for launch transients, winds aloft, surface winds and adverse weather.

Specific CBUs types.

Mk 20 Rockeye II

The Mk 20 Rockeye II is a free fall, unguided, antitank (AT) cluster munition with shaped-charge warheads. The system consists of a clamshell dispenser, time fuze, and 247 armor-piercing bomblets. The Rockeye is most efficiently used against area targets requiring penetration to kill.

CBU–87/CBU–103 Combined Effects Munitions (CEM)

The CEM is a 1,000-pound, combined effects munition (CEM) that employs 202 BLU–97B Anti-Personnel (AP) submunitions designed for attacking soft and armored target areas. It is an excellent weapon against armor, personnel and material. It contains a shaped charge, scored steel casing and zirconium ring for anti-armor, fragmentation and incendiary capability. The bomblet case is made of scored steel designed to break into approximately 300 preformed ingrain fragments for defeating light armor and personnel. The footprint for the CBU–87, figure 5-61, is approximately 200 meters by 400 meters. The dud rate for a standard cluster is approximately five percent. When paired with the WCMD, the weapon becomes the CBU–103.

Figure 5-61. CBU-87.

CBU–89B/CBU–104 "Gator mine"

The Gator Mine is a 1,000-pound cluster munition containing antitank and antipersonnel mines, consists of a SUU–64 tactical munitions dispenser with 72 BLU–91B anti-tank mines, 22 BLU–92B anti-personnel mines. Mine arming begins when the dispenser opens; detonation is initiated by target detection, mine disturbance, low battery voltage, and a self-destruct time-out. The antitank mine is a magnetic sensing submunitions effective against tanks and armored vehicles. The antipersonnel mine has a fragmenting case warhead triggered by trip wires. The Gator mine system provides a means to emplace minefields on the ground rapidly using high-speed tactical aircraft. The minefields are used for area denial, diversion of moving ground forces, or to immobilize targets to supplement other direct attack weapons. When paired with the WCMD, the weapon becomes the CBU–104.

CBU–94 "Blackout Bomb"

The CBU–94, figure 5-62, is a special-purpose munition that uses the BLU–114B submunitions for attacking electrical power infrastructure. The BLU–114/B detonates over its target and disperses huge numbers of fine carbon filaments. The filaments are only a few hundredths of an inch thick and can float in the air like a dense cloud. When the carbon fiber filaments dispensed from the BLU–114/B submunitions, contact transformers and other high voltage equipment, a short circuit occurs. The weapon is sometimes referred to as a "Soft Bomb" or Blackout Bomb" since its effects are largely confined to the targeted electrical power facility, with minimal risk of collateral damage.

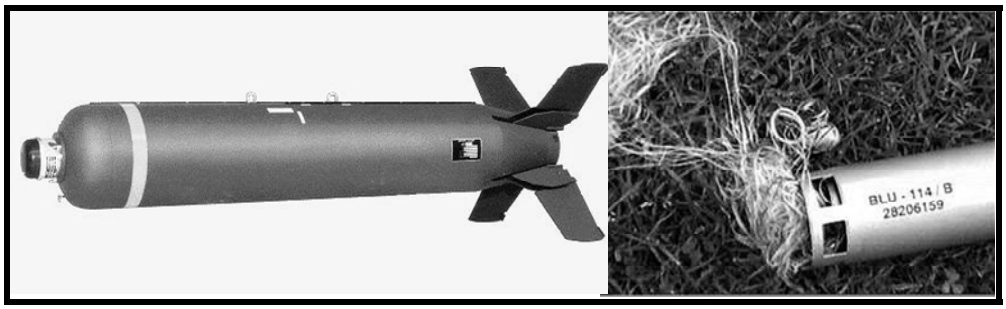

Figure 5-62. CBU-94.

CBU–97/CBU–105 Sensor Fuzed Weapon (SFW)

The SFW is a 1,000-pound class weapon containing sensor-fuzed submunitions for attacking armor . The CBU –97 dispenses ten BLU 108/B, figure 5-63, each with four warheads each. Each of the 10 BLU–108/B submunitions contains four armor-penetrating projectiles with infrared sensors to detect armored targets. The fuze sensors detect heat and will fire down at the engine of the armored vehicle. At a preset altitude sensed by a radar altimeter, a rocket motor fires to spin the submunition and initiate an ascent. The submunition then releases its four projectiles, which are lofted over the target area. The projectile's sensor detects a vehicle's infrared signature, and an explosively formed penetrator fires at the heat source. Each CBU–97/B can cover an area of about 500 feet by 1,200 feet. When paired with the WCMD, the weapon becomes the CBU 105.

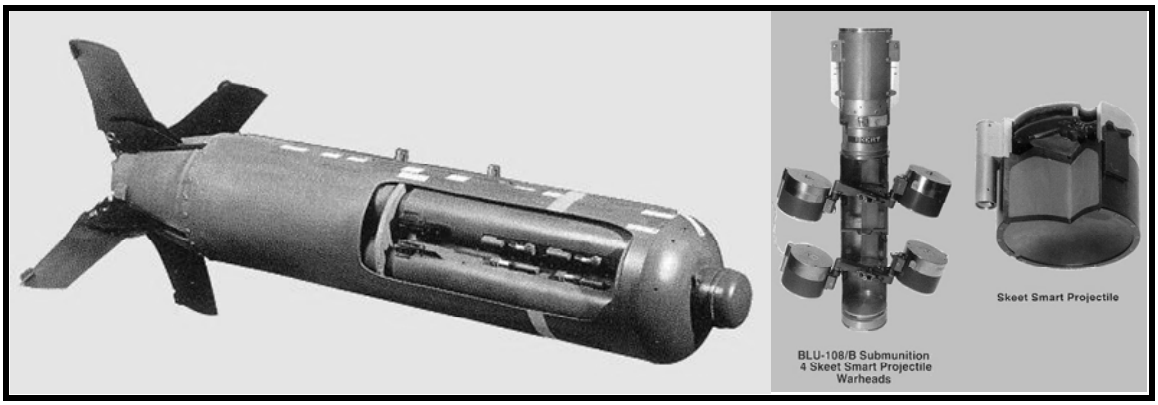

Figure 5–63. BLU–108 Submunition.

CBU–99 Rockeye II

The Rockeye II, figure 5-64, is a free-fall, unguided cluster anti-tank (AT) weapon designed to kill tanks and armored vehicles. The system consists of a clamshell dispenser and 247 dual-purpose armor-piercing shaped-charge Mk–118 bomblets. The bomblets weigh 1.32 pounds and have a 0.4-pound shaped-charge warhead of high explosives, which produces up to 250,000 psi at the point of impact, allowing penetration of approximately 7.5 inches of armor. Rockeye II is most efficiently used against area targets requiring penetration to kill.

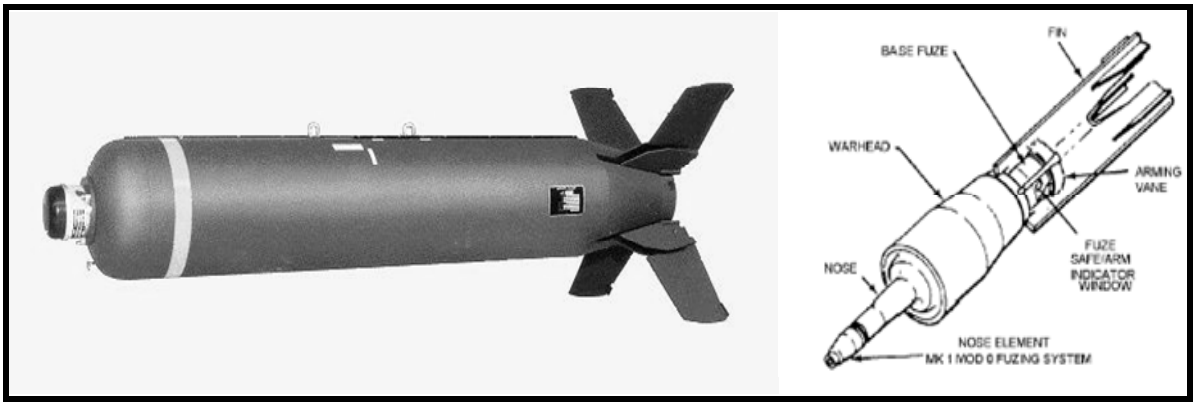

Figure 5–64. CBU–99 Rockeye II.

226. US Air to air munitions familiarization

US Air to air munitions

AIM–7M Sparrow

The AIM–7 Sparrow, figure 5-65, is a radar-guided, air-to-air missile with a high-explosive warhead (see figure 5-65). The AIM–7 is an all-weather, all-altitude operational capability and can attack high-performance fixed winged aircraft and helicopters. The AIM–7 is widely deployed throughout NATO. The AIM–7 has been in the US inventory since 1976, with the most current model being that of the AIM–7M. The AIM–7M is a 500 pound supersonic air-to-air missile carried by the F–16 and F–15. It is radar guided and can destroy targets more than 10 miles away during day, night, or in adverse weather. The AIM–7 has improved reliability and performance over earlier models at low altitudes and in electronic countermeasure environments. It also has a more significant warhead. In Desert Shield/Desert Storm, Air Force pilots using the AIM–7 Sparrow downed 22 Iraqi aircraft and three Iraqi helicopters.

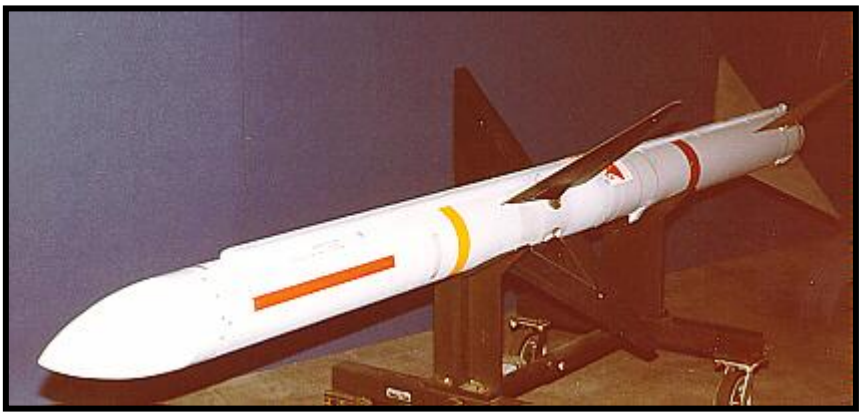

Figure 5-65. AIM-7M Sparrow.

AIM–9M Sidewinder

The AIM–9 Sidewinder, figure 5-66, is a 200 pound supersonic, heat-seeking, air-to-air missile carried by A–10, F–15, and F–16 aircraft (see figure 5-66). It is a "heat seeking" missile with a range of 1–2 miles and is generally used in day, clear weather conditions. The Sidewinder has been continually improved since entering service in the 1950 up to its present version of AIM–9M.

The AIM–9M, currently the only operational variant of the Sidewinder, has an all-aspect capability and provides all-around higher performance. The AIM–9M has improved defense against infrared countermeasures, enhanced background discrimination capability, and a reduced-smoke rocket motor. These modifications increase the ability of the AIM–9M to locate, and lock-on to a target and decrease the missile's chances of detection.

The newest variant of the Sidewinder is the AIM–9X. The AIM–9X major physical changes include fixed forward canards, and smaller fins designed to increase flight performance. The guidance section has been redesigned and features an imaging infrared seeker. The propulsion section now incorporates a jet-vane steering system for enhanced post-launch agility. The X-Model is also compatible with a Joint Helmet-Mounted Cueing System, which is designed for ease of target acquisition and decreased aircrew workload.

Figure 5-66. AIM-9M Sidewinder.

AIM–120 AMRAAM

The AIM–120 Advanced Medium Range Air-to-Air Missile (AMRAAM), figure 5-67, is an all-weather "fire-and-forget" weapon designed to replace the AIM–7 Sparrow. The AMRAAM program

improves the aerial combat capabilities of US and allied aircraft to meet current and future threat of enemy air-to-air weapons. The AIM–120 missile is faster, smaller and lighter, and has improved capabilities against low-altitude targets. It incorporates active radar with an inertial reference unit and microcomputer system, which makes the missile less dependent upon the fire-control system of the aircraft. Once the missile closes on a target, its active radar guides it to intercept. This enables the pilot to aim and fire several missiles simultaneously at multiple targets. AMRAAM has three variants, AIM–120A/B/C, all compatible with F–15 and F–16 aircraft.

The AMRAAM weighs 340 pounds and uses an advanced solid-fuel rocket motor to achieve a speed of Mach 4 and a range in excess of 30 miles. In long-range engagements AMRAAM heads for the target using inertial guidance and receives updated target information via data link from the launch aircraft. It transitions to a self-guiding terminal mode when the target is within range of its own monopulse radar set. The AIM–120 also has a “home-on-jam” guidance mode to counter electronic jamming. With its sophisticated avionics, high closing speed, and excellent end-game maneuverability, chances of escape from AMRAAM are minimal. Upon intercept an active-radar proximity fuze detonates the 40-pound high-explosive warhead to destroy the target. At closer ranges AMRAAM guides itself all the way using its own radar, freeing the launch aircraft to engage other targets. F–15 aircraft carried a small number of AMRAAMs during Operation Desert Storm, though none were used. The AIM–120 was redeployed to the Persian Gulf in 1992 for use on F–15 and F–16 fighters. In December 1992 an F–16 pilot fired the first AMRAAM in actual combat, shooting down a MiG–25 Foxbat during a confrontation over southern Iraq. The AIM–120A on display was restored and donated by the Hughes Aircraft Company and was received by the Museum in April 1993.

Figure 5-67. AIM-120 AMRAAM.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

225. Identify US Air to surface munitions familiarization

1. What munitions are considered free fall ordance, or sometimes referred to as dumb or gravity bombs?

2. A Mk 84 is consided a low-drag, _____ pound general-purpose bomb?

3. What bomb is a GPS (Global Position Satellite) guided 21,500 lb bomb?

4. What are the advantages of precision guided munitions (PGM)

5. What development has dramatically improved the accuracy of weapon guidance and delivery**?**

6. Name the munition specifically designed for use by the F–117's advanced target acquisition/designator system?

7. What is a precision cruise missile designed for launch from outside area defenses to kill hard, medium-hardened, soft, and area type targets?

8. What munitions are comprised of small submunitions (bomblets) contained in a canister which are small explosive filled or chemical filled items designed for saturation coverage of a large area?

9. What is a free-fall, unguided cluster anti-tank (AT) weapon designed to kill tanks and armored vehicles consisting of a clamshell dispenser and 247 dual-purpose armor-piercing shaped-charge Mk–118 bomblets?

226. US Air to air munitions familiarization

1. What US air-to-air missile is a 200 pound supersonic, heat-seeking, air-to-air missile carried by A–10, F–15, and F–16 aircraft?

2. What US air-to-air missile is an all-weather “fire-and-forget” weapon designed to replace the AIM–7 Sparrow?

5–3. Weapons of Mass Destruction

Following World War II, the Soviet Union represented the principal threat to US national security interests. Starting in the later years of the 1980s, the international security environment has undergone rapid, fundamental, and revolutionary changes. With the collapse of Soviet communism, the Soviet Union disintegrated as a viable economic and political system. The Warsaw Pact dissolved as a political and military entity. The Commonwealth of Independent States (CIS), dominated by the Russian Republic, replaced the central Soviet government. The ultimate outcome of these events in terms of US national security interests is unclear. However, a strategic nuclear and impressive conventional, biological, and chemical warfighting capabilities and threat still exists from these former Soviet nations.

From a global perspective, the economic power and influence of developing and newly industrialized nations continues to grow. Centers of power (global or regional) cannot be measured solely in military terms. Nation states pursuing their own political, ideological, and economic interests may become engaged in direct or indirect competition and conflict with the US. More nations have acquired significant numbers of modern, lethal, combat weapon systems; developed very capable armed forces; and become more assertive in international affairs. In the absence of a single, credible, coercive threat, old rivalries and long repressed territorial ambitions will resurface, causing increased tensions in many regions. Political, economic, and social instability and religious, cultural, and economic competition will continue to erode the influence of the US over the rest of the world. This erosion will also reduce the US influence of traditional regional powers over their neighbors. This environment will encourage the continued development, or acquisition, of modern armed forces and equipment by less influential nations; thus raising the potential for the use of NBC/RDD weapons during internal conflict and armed confrontations in developing regions of the world.

A third dimension to the threat is terrorist, rogue groups, and belligerents employing a number of chemical and biological agents and the possible use of toxic industrial material (TIM) to injure or kill US personnel. The actions may be isolated or may be imposed by groups of individuals. Most will have the financial backing of nations, large organizations, or groups that have the desire to cause harm and create public distrust in our government.

227. Identifying different agents of weapons of mass destruction

Different agents of weapons of mass destruction

With the recent events of 9/11, followed by our operations in Afghanistan and Iraq, the US and the free world have a concern for terrorist operations and the potential for the use of weapons of mass destruction. Weapons of mass destruction have been a concern throughout the Cold War with the threat from nuclear weapons being the primary concern. Today, the concern has gone to third world rogue nations obtaining nuclear weapons technology, to the threat of chemical and biological agents being delivered by these nations or by terrorist groups. As an Operations Intelligence Technician, you must be familiar with these different types of weapons, their delivery methods, and potential affects on airfield operations, as well as the population.

Chemical warfare

Since World War I, most western political and military leaders have publicly held chemical warfare (CW) in disrepute. However, evidence accumulated over the last 50 years does not support the position that public condemnation equates to limiting development or use of offensive CW agents. The reported use of chemical agents and biological toxins in Southeast Asia by Vietnamese forces;

the confirmed use of CW agents by Egypt against Yemen; and later by Iraq against Iranian forces; and the probable use of CW agents by the Soviets in Afghanistan indicate a heightened interest in CW as a force multiplier. Also, an offensive CW capability is developed as a deterrent to the military advantage of a potential adversary. For a list of countries known or suspected of having offensive chemical weapons, see figure 5-68.

The Russian Republic has the most extensive CW capability in Europe. Chemical strikes can be delivered with almost any type of conventional fire support weapon system (from mortars to long-range tactical missiles). Agents known to be available in the Russian inventory include nerve agents (O-ethyl methyl phosphonothiolate [VX], thickened VX, Sarin [GB], and thickened Soman [GD]); vesicants (thickened Lewisite[L] and mustard-Lewisite mixture[HL]); and choking agent (phosgene). Although not considered CW agents, riot control agents are also in the Russian inventory. Figure 5-69 represents a common listing of chemical agents.

The US is in the process of destroying its stockpiles of CW weapons. Many weapons have already been destroyed and the storage facilities have been rendered safe of all CW agent residues.

Known	**Suspected**
United States	People's Republic of China
Russia	North Korea
France	Egypt
Libya	Israel
Iran	Taiwan
Syria	Burma

Figure 5-68. Nations Known or Suspected of Possessing Chemical Weapons

Following the Persian Gulf war (1990–91), the United Nations (UN) began destroying CW munitions discovered during inspection visits to Iraq by UN Arms Control Inspectors. Included among the CW munitions were some 2,000 aerial bombs, and 6,200 artillery shells filled with never agents. Iraq also declared SCUD warheads filled with nerve agents.

NERVE	VESICANT	INCAPACITATING	CHOKING	BLOOD
TABUN (GA)	SULFUR MUSTARD (HD)	CNS DEPRESSANT (BZ)	PHOSGENE (CG)	HYDROGEN CYANIDE (AC)
SARIN (GB)	LEWISITE Mixture (HL)	CHLORINE (CL)	DIPHOSGENE (DP)	CYANOGEN CHLORIDE (CK)
SOMAN (GD)	LEWSITE (L)	CHLOROPICRIN (PS)		
GF	PHOSGENE OXIME (CX)	D-LYSERGIC ACID		
VX		DIETHYLAMIDE (LSD)		

Figure 5-69. Chemical warfare agents

Biological Warfare.

Biological warfare (BW) is defined by the US intelligence community as the intentional use of disease-causing organisms (pathogens), toxins, or other agents of biological origin (ABO) to incapacitate, injure, or kill humans and animals; to destroy crops; to weaken resistance to attack; and to reduce the will to fight. Historically, BW has primarily involved the use of pathogens in assassinations or as sabotage agents in food and water supplies to spread contagious disease among target populations.

Known or suspect BW agents can generally be categorized as naturally occurring, unmodified infectious agents (pathogens); toxins, venoms, and their biologically active fractions; modified infectious agents; and bioregulators. See figure 5-70 for examples of known or suspected BW threat agents.

Anthrax	Brucellosis
Plague	Cholera
Smallpox	Hemorrhagic Fevers

Figure 5-70. Examples of Pathogen Toxins

Nuclear Warfare

The principal physical effects of nuclear weapons are blast, thermal radiation (heat), and nuclear radiation. These effects are dependent upon the yield (or size) of the weapon expressed in kilotons (KT), the physical design of the weapon (such as conventional and enhanced), and the method of employment. Larger weapons are more destructive than smaller weapons, but the destructive effect is not linear. The distribution of energy from the detonation of a moderate-sized (3 to 10 KT) weapon is as follows:

- Fifty percent as blast.
- Thirty-five percent as thermal radiation; made up of a wide spectrum of electromagnetic radiation, including infrared, visible, and ultraviolet light and some soft x-ray radiation.
- Fourteen percent as nuclear radiation, 4 percent as initial ionizing radiation composed of neutrons and gamma rays emitted within the first minute after detonation, and 10 percent as residual nuclear radiation (fallout).
- One percent as electromagnetic pulse (EMP).

The altitude at which the weapon is detonated determines the blast, thermal, and nuclear radiation effects. Nuclear blasts are classified as air, surface, or subsurface bursts.

- An airburst is a detonation in air at an altitude below 30,000 meters, but high enough that the fireball does not touch the land or water surface. The altitude is varied to obtain the desired tactical effects. Initial radiation will be a significant hazard, but there is essentially no local fallout. However, the ground immediately below the airburst may have a small area of neutron-induced radioactivity. This may pose a hazard to troops passing through the area.
- A surface burst is a detonation in which the fireball actually touches and vaporizes the land or water surface. In this case, the area affected by blast, thermal radiation, and initial nuclear radiation will be smaller than for an airburst of comparable yield. However, in the region around ground zero, the destruction will be much greater and a crater is often produced. Additionally, all the material that was within the fireball becomes fallout and will be a hazard downwind. A surface burst is the most likely type of terrorist detonation.
- A subsurface burst is an explosion in which the detonation is below the surface of land or water. Cratering usually results. If the burst does not penetrate the surface, the only hazard is from the ground or water shock. If the burst penetrates the surface, blast, thermal, and initial

nuclear radiation will be present, though less than for a surface burst of comparable yield. Local fallout will be heavy over a small area.

- A high altitude burst occurs above 30,000 meters. Radiation and physical effects do not reach the ground and there is no local fallout. This is the only detonation where the effects of the EMP are significant. Nonhardened electronic equipment including many medical devices may become inoperative. The EMP damage is a moot point with other types of detonations, as its range is primarily limited to the area of intense physical destruction.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

227. Identify US Air to surface munitions familiarization

1. What are the known countries to possess chemical warfare weapons?

2. Name the nerve agents?

3. List examples of Pathogen Toxins?

4. What are the principal physical effects of nuclear weapons?

Answers to Self-Test Questions

221

1. M–1A1 & 1A2 Abrams.
2. Merkava 4.
3. M2A3/M3A3 Bradley.
4. Viking (BVS10) Amphibious Armored All-Terrain Vehicle.
5. CH–47D/MH–47E Chinook.
6. OH–58 Kiowa Warrior.

222

1. LAV-AD.
2 Rapier.
3. Bradley M6 Linebacker.
4. Patriot.

223

1. Raptor.
2. Stratofortresses.

224

1. Ticonderoga class guided missile cruiser.

2. Destroyers.

225

1. General Purpose Bombs.
2. 2000.
3. MOAB.
4. The accuracy is greater, requiring fewer sorties to achieve the objective and improved combat assessment.
5. Laser-guided weapons.
6. GBU–27.
7. JASSM (Joint Air to Surface Standoff Missile).
8. Cluster bomb units (CBUs).
9. CBU –99.

226

1. AIM–9 (Sidewinder).
2. AIM-120 (AAMRAM).

227

1. US, Russia, France, Libya, Iran, Syria.
2. Tabun, Sarin, Soman, GF, VX.
3. Anthrax, Pague, Smallpox, Cholera, Brucellosis, Hemorrhagic Fevers.
4. Bast, thermal radiation (heat), and nuclear radiation.