

CHAPTER III : THE ROLE OF TECHNOLOGY IN THE 1991 GULF WAR

3.1 INTRODUCTION

Operation Desert Storm (1991 Gulf War) marked the beginning of the first microchip war, a battle of high-tech weaponry that was frighteningly accurate. The start of the Persian Gulf War opened a new chapter in the history of warfare, a conflict marking the first widespread use of advanced technology “smart” weapons to destroy military targets from the air, sea and ground with minimum loss of casualties. The war also marked a watershed in the history of combat, a transition between the ages of the terrifying carpet bomb raid, although impersonal wizardly of the computer age. But no matter how high-tech the weapons, control of contested real estate remained the ultimate goal, with both sides girding early on for a down and dirty fray that promised to be the tank engagement of all time, what Saddam at one point called “the mother of all battles”.

In observing the role of technology, it can be argued that America’s trump card during the 1991 Gulf War was its high-technology weapons. Iraq’s air, industrial, nuclear and chemical military power was destroyed with America’s top of the line warplanes and missiles. It was the support for the allied forces over the air space. This led to the enemy’s ground forces being defenseless. A major factor in unaccountable lives being saved was the ability of the Patriot missiles to knock almost all Iraqi Scud missiles out of the sky.

This chapter will provide coverage on the role of technology by outlining some of the key weapons systems that were seen as a dominant and crucial during the 1991 Gulf War campaign. Among them include systems used by C3I, the Air Force, Navy and the Land forces. The special role of weapons used by the Allied Forces will also be covered and similarly, the Iraqi technological capability will also be looked at to provide a broader approach to the study of technology in the 1991 Gulf War.

Other sophisticated weapons that made a difference were the Joint Surveillance Target Attack Radar System (JSTARS) and the Army Tactical Missile System (ATACMS), which was a newly produced anti-armor missile system, which contributed to the success of the allied forces in the 1991 Gulf War. The Apache attack helicopter, the M-1 Abraham's, the Bradley infantry fighting vehicles and Maverick anti-tank missiles were also instrumental in the 1991 Gulf War success.

3.2 TECHNOLOGY IN THE 1991 GULF WAR

The Hero in Operation Desert Storm (1991 Gulf War) that performed so well has to be the Patriot missile system. It is an anti-aircraft missile system first deployed in Europe in 1984. The system consists of advanced phased-array radar for

tracking targets in flight, canisters containing the missiles themselves and a launch, or fire –control center.⁴⁴

However the Patriots were specially modified to shoot down missiles and not just aircraft, saw combat for the first time. Patriot batteries were able to deflect a five-missile barrage against the allied airbases in Saudi Arabia. This demonstrated the ability of the Patriot system to perform the technically difficult mission of intercepting several missiles simultaneously.

For the Navy, the silver bullet was the Tomahawk cruise missile. These unmanned projectiles were armed with conventional high explosive warheads, although they can carry nuclear warheads.⁴⁵ Military commanders typically fire cruise missiles at targets that are too well defended for manned bombers. Such targets include bunkers housing Iraqi political and military leaders. The first shot fired by U.S. in the 1991 Gulf War was a Tomahawk from the USS Louisville.⁴⁶

The Stealth technology was used by the Air Force designed to elude radar detection. The Stealth is equipped with a redundant computer-assisted “ fly-by-wire” flight control system and a sophisticated digital avionics system. The Stealth Bomber is thought to be capable of using location and velocity data from Global Positioning system navigation satellites for inertial navigation. Most operational

⁴⁴ Internet Website: *The Gulf War; Weapons*, <http://www.gulfwar.com>, October 7, 2000

⁴⁵ Internet Website: <http://www.pbs.org/wgbh/pages/frontline/gulf/weapons/stars.html>, October 7, 2000

details about the Stealth Bomber are still classified, but the aircraft is known to exhibit high subsonic performance. The Stealth's offensive and defensive systems are currently classified as of to date. During the 1991 Gulf War, the Stealth Bomber reportedly struck targets in Baghdad with great precision.⁴⁷

Joint Surveillance Target Radar Systems (JSTARS) is an advanced radar, computer and communications technologies combined to create surveillance, targeting and battle management system. The system detects fighting vehicles, helicopters, low-speed aircraft, and missile launchers, rotating antennas, ships/barges, tanks and other varied equipment with its sensors. The airborne JSTARS provided combat commanders with near real-time information on various targets, including moving targets, in all weather conditions. The Air Force and the Army benefited from the use of JSTARS in a number of operations. Also accompanying Joint Surveillance Target Attack Radar System (JSTARS) was the Army Tactical Missile Systems (ATCMS).⁴⁸

There were other high-powered weapons and instruments used in the 1991 Gulf War that provided the firepower needed for a quick and successful end to the war, which did not cause much causality to the allied forces. These technological weapons that were used by the allied forces were needed to curtail ground combat to

⁴⁶ Author; U.S. Army Reserve Officer Training Corp (ROTC); Alpha Company; Command Center, UofL, KY, USA, 1990-1992

⁴⁷ Interview with Major C. Douglas Dawson; United States Air Force, Deputy Chief, Security Assistance Office, U.S. Embassy, Kuala Lumpur, Malaysia, 8 September, 2003

⁴⁸ Internet Website: <http://www.pbs.org/wgbh/pages/frontline/gulf/weapons/stars.html>, October 7, 2000

reduce high fatal casualty rate. Hence the ability of the air, sea and ground technological weapons played a key role in the success of the 1991 Gulf War. These weapons were critical to the outcome of the war as it made a difference early and send a warning to the forces that invaded Kuwait. In the following, I will highlight some technological weapons that have made a significant difference in the 1991 Gulf War.

3.3 TECHNOLOGY AND WEAPONS SYSTEMS IN THE AERIAL WARFARE

The air war against Iraq was fought with the most diverse and one of the most deadly assortments of warplanes, smart systems and a variety of technological equipments ever assembled. Infact, the runways at Saudi air bases took on the appearance of the Farnborough Air Show held each year in Great Britain, the racks of bombs and long-range fuel tanks held under shelters, the planes parked in every available parking space under corrugated roofs and in blast-hardened shelters.⁴⁹ The runways at Iraqi air bases took on the appearance of cratered moonscapes after relentless, around-the-clock bombardment by allied forces to cripple Saddam Hussein's air force, the most powerful in the region and a major threat to allied troops and civilians in around the region.

⁴⁹ Major C.Douglas Dawson; United States Air Force, Deputy Chief, Security Assistance Office, U.S. Embassy, Kuala Lumpur, Malaysia, 8 September, 2003

The coalition air war was fought not only from bases strategically placed across Saudi Arabia but also from the sea and, interestingly enough, from the sea in the form of submarine-launched cruise missiles, unmanned computer controlled flying bombs capable of striking their targets with pinpoint accuracy. In addition, a NATO base at Incirlik, Turkey, was used as a staging ground fighter-escorted bombing runs by F-111s headed into northern and western Iraq.⁵⁰

The allied toolbox included a deadly mix of interceptors and strike aircraft, including F-117A Stealth Fighters, agile F-16s, heavily armed F-15s, radar-killing F-4s and carrier based A-6s, F-18s and F-14s along with Tomahawk cruise missiles and a smorgasbord of exotic weapons ranging from laser-guided bombs to big, 2-ton ground pounders. The American air power also included six aircraft carriers, the Midway, and Ranger in the Persian Gulf and the Saratoga, Roosevelt, America and Kennedy in the Red Sea, contributing about 450 aircraft to the coalition total.

During the 1991 Gulf War the common intelligence system was part of the technology used in aerial warfare. Originally designed to meet an overwhelming threat in Central Europe, the Joint Surveillance Target Attack Radar System (JSTARS) was featured in the 1991 Gulf War after performing well in Europe. Until

⁵⁰ Author; U.S. Army Reserve Officers Training Corp (ROTC); Alpha Company; Command Center. UofL, KY, USA, 1990-1992

the war against Iraq, it had not seen combat. JSTARS is a radar and information processing system for U.S. artillery, aircraft and missiles.

Installed on a modified Boeing 707 aircraft, it scans the ground day or night and in all weather seeking enemy tanks and armored personnel carriers (APCs). Once it detects enemy tanks or APCs, it passes targeting information to U.S. artillery, aircraft and missile commanders on the ground, enabling them to be destroyed. It also can assess the damage caused by U.S. attacks. Since being brought into the Gulf War, JSTARS has helped to gauge the extent of damage caused by allied planes to enemy supply lines. It can also monitor the location and movement of Iraqi tanks and armored vehicles.⁵¹

JSTARS made it possible for the Gulf War air campaign has it managed to overcome Iraqi armored forces before the ground war took effect. The Armored forces were the heart of the Iraqi military and if the air campaign failed to destroy large portions of these forces, the ground campaign would have been bloody. U.S. Army and Marine deaths in a ground campaign, under these circumstances, would have easily run into the thousands. JSTARS not only helped reduce allies casualties, but also helped destroy Iraqi armored columns, making victory easier.

Another high-tech U.S. system that proved critical in the ground war is the Army Tactical Missile System (ATACMS). ATACMS is an Army surface-to-

surface missile designed to strike large concentrations of tanks and armored personnel carriers behind enemy lines.⁵² It is well suited for countering Iraq, which has thousands of tanks and armored personnel carriers stationed in southern Iraq and Kuwait. If the air campaign did not break Iraq's hold in Kuwait, a ground campaign will be necessary.⁵³

Among the highest priorities in such an attack will be to destroy the armored forces not knocked out by the air war. The highly accurate ATACMS, armed with cluster bombs or special armor-piercing warheads that are deadly against armored forces, can destroy Iraq's armor before it threatens U.S. troops.⁵⁴ There are no full reports how well ATACMS does in the battlefield, but successful test indicated that it performed well.

The Stealth Fighter is the first aircraft in the world designed from the ground up to elude radar detection. It is equipped with a redundant computer assisted "fly by wire" flight control system and sophisticated digital avionics. The Stealth Fighter is capable of using location and velocity data from global positioning system navigation satellites for inertial navigation.⁵⁵

⁵¹ Internet Website: http://www.fas.org/man/dod-101/ops/desert_storm.htm, June 5, 2001

⁵² Internet Website: http://www.fas.org/man/dod-101/ops/desert_storm.htm, June 5, 2001

⁵³ Watson, Russell; "Battle Ready"; *Newsweek*; August 20, 1990; pp 20-25

⁵⁴ Dowell, William, "The 100 Hours"; *Time*; March 11, 1991; pp 22-32

⁵⁵ Internet Website: <http://www.pbs.org/wgbh/pages/frontline/gulf/weapons/stealth.html>, October 7, 2000

Most operational details about the Stealth Fighter are classified, but the aircraft is known to exhibit high subsonic performance. Bombs and other weapons are mounted on an internal carriage that apparently drops down into the airstream before deployment, but details about the Stealth offensive and defensive systems are classified. The aircraft made its combat debut during the American invasion of Panama when two Stealth's dropped 2,000-pound laser-guided bombs. During Operation Desert Storm, the Stealth Fighters reportedly struck targets in Baghdad with great precision.⁵⁶

In the 1991 Gulf War of Operation Desert Storm, B-52s were used for deadly carpet-bombing raids on the headquarters of the Republican Guards in and around Basra near the Iraq-Kuwait border. The B-52s carried round the clock carpet-bombing attacks against Iraqi troop concentrations and defenses during the war. Prior to the war in the Gulf, the B-52s were used in combat in the Vietnam War for carpet bombings raids in South Vietnam where strongholds of the Vietcong army were located.⁵⁷

The giant eight-engine, 488,000-pound B-52 first made its debut in 1954. That it is still flying in active service is a testament to its designers and an aggressive program to constantly upgrade the big war birds to adapt them to a variety of combat missions, including a key role in the 1991 Gulf War of Operation Desert

⁵⁶ Internet Website: <http://www.pbs.org/wgbh/pages/frontline/gulf/weapons/stealth.html>, October 7, 2000

⁵⁷ Internet Website: <http://www.pbs.org/wgbh/pages/gulf/weapons/b52.html>, October 7, 2000

Storm. Capable of carrying some 60,000 pounds of ordnance, including AGM-86 cruise missiles, gravity bombs and AGM-69A SRAMs, the B-52 is powered by eight Pratt and Whitney trust engines. It has a wingspan of 185 feet, measures about 160 feet long and stands 40 feet and 8 inches tall. Top speed is about 650 mph with an operational ceiling of 55,000 feet. With a crew of six, the B-52 has a range of about 10,000 miles without refueling.⁵⁸

All active B-52s are equipped with advanced avionics, including forward-looking infrared (FLIR) low-light viewing systems, ground hugging terrain contour matching (TERCOM) guidance, satellite communications and a full suite of electronic countermeasures and attack warning gear. Armament varies according to mission, but B-52 models can carry eight SRAMs on wing pylons and conventional nuclear bombs inside the plane's bomb bay or air launched cruise missile if SRAMs are excluded. The B-52 model can carry a full load of conventional weapons, including Harpoons. Its conventional bombs include the three different Mark 82 bombs.⁵⁹

Operation Desert Storm began with the launchings of Tomahawk cruise missiles from the battleships Missouri and Wisconsin. One Tomahawk was launched from a submerged submarine within the first week of aerial combat.⁶⁰ These

⁵⁸ *ibid*

⁵⁹ *ibid*

⁶⁰ Author; U.S. Army Reserved Officer Training Corp (ROTC); Alpha Company, Command Center, UofL, KY, USA, 1990 – 1992.

super accurate weapons are about 20 foot long with booster rockets attached to them. Initial propulsion is provided by a solid fuel booster rocket after which a small turbojet engine takes over. This system used is called the TERCOM (ground hugging terrain contour matching) precise guidance method⁶¹

The Tomahawks used against Iraq feature the TERCOM (ground hugging terrain contour matching) guidance system that compares local topography with images stored in its computer memory as the ground-hugging missiles streak toward their targets up to over 1,500 miles. The missiles are very accurate, difficult to detect and are capable of flying at extremely low altitudes between 100 feet and 300 feet, making them ideal for use against heavily defended targets that poses too great a risk for manned aircraft. It was a Tomahawk that, with astonishing precision struck the headquarters of the Iraqi Air Force in the city of Baghdad.⁶²

The Tomahawk played an all important role for Navy and Air Force pilots by destroying heavily defended bunkers housing the Iraqi military leadership without using these pilots which may have caused casualties. The cost of a Tomahawk is far less than an F15 Strike Eagle attack aircraft if fired upon. Finally the highly accurate Tomahawk also results in fewer civilian deaths or injuries. Because it is so accurate, it can land approximately close to targets as well as striking precisely at military targets.

⁶¹ Internet Website: <http://www.pbs.org/wgbh/frontline/gulf/weapons/tomahawk.html>, October 7, 2000

⁶² Internet Website: <http://www.pbs.org/wgbh/frontline/gulf/weapons/tomahawk.html>, October 7, 2000

Among the other high-tech weaponry used to minimize the need to place American pilots in danger is the Unmanned Aerial Vehicle (UAV), or Remotely Piloted Vehicle (RPV) as they are sometime called. The UAV was another Gulf War success story. Several times larger than remote control airplane a hobbyist might own, the UAV is equipped with a television camera that relays live battlefield pictures to the control site.⁶³ Launched from ships, or from the ground, it can operate for several hours at a distance of more than 100 miles from the launch point. Information gained from the UAV is used to direct gunfire and gather other real-time information from behind enemy lines without risking the lives of airborne or ground-based forward spotters.⁶⁴

These UAV's provided substantial imagery support to the forces during the Gulf War and these systems were employed for battlefield damage assessment (BDA), targeting and adjusting the accuracy of battleship guns, which were used extensively against Iraqi fortifications along the Kuwaiti coastline as well as surveillance missions, particularly in high threat airspace.⁶⁵

These UAV's spy planes surveyed the Persian Gulf theater of operations and to determine Iraqi troop movements, weapons placement and to help

⁶³ Internet Website: <http://www.pbs.org/wgbh/pages/frontline/gulf/weapons/drones.html>, October 7, 2000

⁶⁴ Internet website: <http://www.pbs.org/wgbh/pages/frontline/gulf/weapons/drones.html>, October 7, 2000

⁶⁵ Barnaby, Frank; *Future War*; Armed conflict in the next decade; Multimedia Publications (UK) Ltd 1984; pp 77-78

gather data for bomb damage assessments, or BDAs, to show military planners the results of bombing raids and which targets might need extra attention.

The 2,200-pound Patriot missile, which can be equipped with nuclear or conventional warheads, made an impressive battlefield debut in Operation Desert Storm, knocking Iraqi Scud missiles out of the sky before they could hit their targets.⁶⁶ Equipped with solid fuel rocket motor, Patriot missiles are capable of speeds up to Mac 3 and range up to 43 miles. Four Patriots are mounted on a single mobile launcher. The key to their operation is sophisticated phased-array radar, which detects and tracks incoming missiles and sends guidance data to an attacking Patriot. The rockets stand about 17 feet high and are 16 inches wide.⁶⁷

Despite the success of the Scud as a weapon of terror, Iraqi's seemed clearly out-gunned by American air power bolstered by allied high -tech weapons. Such sophisticated delivery systems and state of the art computer controlled weaponry added up to an overwhelming combination of air power that gave the allied coalition control of the sky over Kuwait and Iraq during the initial stages of the war.

The Apache is designed for the attack role of battle tanks. It is armed with up to 16 Hellfire missiles, a 30 mm Hughes M-230A1 chain gun and a 1,200 round magazine and its four hard points can also carry pods of Hydra 70 rockets. Its

⁶⁶ Internet Website: <http://www.pbs.org/wgbh/pages/frontline/gulf/weapons/patriot.html>, October 7, 2000

⁶⁷ Internet Website: <http://www.pbs.org/wgbh/pages/frontline/gulf/weapons/patriot.html>, October 7, 2000

Hellfire missile is a third generation anti-armor weapon, which is a sophisticated missile. The Hellfire homes in on laser spot that can be aimed either from attacking Apache allowing the Apache to launch its missiles indirectly without ever seeing the target. It weighs just under 100 pounds and is 7 inches in diameter.⁶⁸ The Apache has a maximum speed of 184 mph and a maximum cruise of 182 mph; it has a range of 300 miles and endurance of just less than 2 hours. It has twin turbines and a crew of two. It weighs about 20,000 pounds fully loaded and is armored in key areas to stop rounds of up to 23mm.⁶⁹

There is a night vision device for the pilot and a target acquisition designation sight for the weaponry. It can follow ground terrain and is equipped with infrared suppression devices, a laser detector, a variety of jamming and chaff and flare dispensers and it also has forward-looking infrared gear for night fighting.⁷⁰ During the Gulf War the Apache used low-energy tactics for night time and high-energy for the day time to get close to enemy targets, shoot and get away fast. This technological equipped helicopter played a reconnaissance role and was effective in pulling off surprise attacks at the enemy.

⁶⁸ Internet Website: <http://www.pbs.org/wgbh/pages/frontline/gulf/weapons/apache.html>, October 7, 2000

⁶⁹ *ibid*

⁷⁰ *ibid*

3.4 TECHNOLOGY AND WEAPON SYSTEMS USED BY ALLIED NAVY

The allies assembled an armada of at least 160 naval vessels devoted initially to enforcing the United Nations sanctions on trade with Iraq. They conducted literally thousands of shipping inspections in the weeks leading up to the war and boarded several hundred ships to make sure no war materiel made its way to Iraq. But one of history's most powerful armadas was not in and around the Persian Gulf simply to enforce an economic blockade, it was there to provide the muscle that would be needed in the event negotiations broke down and Iraq refused to leave Kuwait.

The American contribution to the fleet included vessels, two battleships, six aircraft carriers and at least one nuclear submarine, American sailors, Tomahawk cruise missiles and state-of-the art carrier fighters and attack bombers. Although many of the weapons, systems and missiles were being used by the Air Force, the Navy also used similar equipment. Here, I will touch on some technological weapons and systems used by the Navy on the pretext of Naval warfare.

Among the combatants, Great Britain sent the guided missile destroyer HMS Gloucester and assigned it to work with the USS Wisconsin operating in the Northern Persian Gulf. The Gloucester, powered by Rolls Royce gas turbines, weighed 4,775 tons fully loaded and could hit just over 29 knots in a sprint. It carried

Lynx helicopter, the GWS-30 Sea Dart missile system, two close-in Gatling gun systems and a 5 inch gun that could hurl shells up to 10,000 meters.⁷¹ Other frontline U.S. warships contributed both the Tomahawk launch and to the blockade that was thrown up around Iraq immediately after its invasion. The international naval force spent its days and nights intercepting shipping that appeared headed for Iraq and sending boarding parties where necessary.

One of the most vital classes of ships in the Gulf was the minesweepers, vessels with the dangerous job of seeking out and disabling Iraqi mines, mines so powerful they could send a plume of water hundreds of feet into the air. Several U.S. Avenger class minesweepers were sent to the Gulf on floating dry dock for use in finding and disabling Iraqi mines. The British contributed minesweepers capabilities as well as the Germans.

The Avenger class, according to the Navy, is a revolutionary concept in mine warfare. The ships have a remotely piloted, tethered mine neutralization system that has sonar, video capability, cable cutters and a detonating device. The ships are sheathed in fiberglass and have a wooden hull to foil mines that are triggered by metal. They are fairly light displacing 1,312 tons when loaded and small

⁷¹ Watson, Russell; "Battle Ready", Newsweek, August 20, 1990;pp 20-25

at just 224 feet in length. They are only 39 feet wide and can only make 13.5 knots. As a further protection, their engines have aluminium blocks.⁷²

While the Navy would not say how many submarines were involved and where they were located, officials as well as my personal knowledge as an Reserve Officer (ROTC) that at least one cruise missile was fired from the Red Sea by the USS Louisville, a Los Angeles class 688 attack submarine. Such subs measures 360 feet long with a beam of 33 feet and have 12 vertical launch tubes packed into forward buoyancy spaces just behind the sonar dome. Missiles are ejected from the launch tube in a canister that falls free once it shoots out to the surface. A rocket motor then ignites and once aloft, a small jet engine takes over. The Louisville, known as SSN-724, was built by General Dynamic's and displacing 6,900 tons submerged. The sub was powered by a single nuclear reactor and could do more than 30 knots submerged.⁷³

The command ship of the Middle East Task Force, the USS La Salle, began its life as a landing platform dock ship and was modified for use as the flagship. Placed in service in 1964, the La Salle displaced 14,650 tons when fully loaded. Equipped with light armor and Babcock and Wilcox boilers, the La Salle was manned by 25 officers and 445 men plus a flagstaff of 12 officers and 47 enlisted

⁷² Internet website: <http://www.pbs.org/wgbh/pages/frontline/gulf/weapons/avenger.html>, October 7, 2000

⁷³ Author; U.S. Army Reserve Officer Training Corp (ROTC); Alpha Company; Command Center, UofL, KY, USA, 1990 – 1992.

personnel. It had a helicopter hanger on the after deck. It was known affectionately as the “Great White Ghost” because of her all white paint scheme. To support her command responsibilities the La Salle was equipped with two satellite communication antennas.

3.5 TECHNOLOGY FOR THE ALLIED FORCES IN THE GULF CAMPAIGN

Allied leaders suspected from the beginning that air power alone would not be enough to budge Iraq from Kuwait. A ground campaign was likely, so planners prepared for one of the most intensive tank battles they could imagine. America’s M-1a1s, Britain’s Challengers and Chieftains and France’s AMX-30s were shipped in to combine the best of old-fashioned hardware with modern targeting computer software, the kind of electronic wizards that lets the U.S. Abrams fire at speeds of up to 20 mph.

Softening up areas of potential battle was the mission of the thousands of artillery tubes brought in for the assault. The job of the Navy and Marine airpower was to rake the beaches where air cushion landing craft were brought in to help thousand of Marines skim ashore in a novel new form of the battle-tested amphibious landing. And multiple launch rocket tubes were designed to lay waste to huge patches

of Iraqi defenses with the kind of power that leaves not a single thing standing and not a single thing living.⁷⁴

Then, and only would the infantryman be sent onto the field of battle, protected initially by a wide array of armored personnel carriers and infantry fighting vehicles that have been developed for the modern battlefield. Iraq apparently planned to force the allies into ground fighting ahead of their schedule, sending troops probing into Saudi territory at Khafji. They succeeded in drawing blood from the allied defenders but were finally repulsed with heavy losses in men and machines.⁷⁵

The final pieces of the air-land battle doctrine, the A-10 Warthog jet and the Cobra and Apache helicopters, all tank killers able to fire from over the horizon, invisible to the front line. Not to be overlooked was the E-8 J-Stars surveillance plane capable of painting a radar map of the battlefield and giving ground commanders a picture not only of what's in front but also what's coming up from the rear. The cornerstones of the allied tank corps were the U.S. M-1A1 Abrams and Britain's Challenger. The capabilities of each are amazing. "We own the night," the Army is fond of saying, and the Abrams was a prime tool in the night-fighting arsenal.⁷⁶

⁷⁴ Dowd, William; "The 100 Hours"; *Time*; March 11, 1991; pp 22-32

⁷⁵ *ibid*

⁷⁶ Author; U.S. Army Officer Training Corp (ROTC); Alpha Company; Command Center, UofL, KY, USA, 1990 – 1992.

A rolling fortress that radiates menacing power, the four man M-1A1 weighs in at 63 tons and measures 26 feet long, 12 feet wide and eight feet high to the tip of its squat turret. The tank's primary weapon is a 120 mm M-68E1 smoothbore cannon. Other armament includes two 7.62 mm M-240 machine guns and one 50-caliber Browning M2 HB machine gun. The M-1A1 has a top speed of about 42 mph and has a range of about 290 miles.⁷⁷

The M-1A1's crew compartment is equipped with chemical, biological and nuclear fallout protection, a major advantage over earlier M-1 tanks. The Abrams also can carry more ammunition than its predecessor and it is equipped with an advanced carbon-dioxide laser rangefinder, a thermal viewing for night fighting. The M-1A1 ability to fire reliably when moving at speed over rough ground (stabilized gun mount) gave it the capability that proved valuable in the Gulf War at firing enemy targets at precise accuracy.⁷⁸

In conjunction with tanks, it is the thousands of infantrymen and Marines who must take hold of the ground after battle commences. The Allied forces had a variety of protective systems to get the fighting men to the front. The task of the armored personnel carriers and infantry fighting vehicles is to travel close behind the tanks, letting the troops jump out for close-quarter fighting if necessary.⁷⁹

⁷⁷ Internet Website: <http://www.pbs.org/wgbh/pages/frontline/gulf/weapons/m1.html>, October 7, 2000

⁷⁸ Internet Website: <http://www.pbs.org/wgbh/pages/frontline/gulf/weapons/m1.html>, October 7, 2000

⁷⁹ Price Alfred, Dr., *War in the Fourth Dimension: US Electronic Warfare from the Vietnam War to the Present*; Greenhill Books, Lionel Leventhal Limited, 2001, pp215-230

The Bradley is a tracked vehicle with light armor that can be used by scout and armored cavalry units to screen troops and reconnaissance. There are two varieties, the M-2 infantry-fighting vehicle and the M-3 cavalry-fighting vehicle. Both have a two-man turret carrying a 25 mm cannon, and they carry the TOW anti-tank weapon along with 7.26 coaxial machinegun. The M-2 model and its various upgrades also have six 5.56 mm firing port weapons along the side and rear of the vehicle.⁸⁰

Its mobility is comparable to the M-1 tank. It can travel at 38 mph and ford bodies of water at 4.4 mph. It has a range of 300 miles and the 60,000-pound vehicle is powered by 600 horsepower diesel engine. It is about 21 feet long, 10 feet wide and 9.75 feet high. In addition, many have reactive armor on the exterior to help improve survivability. It can also climb a 60 percent slope. The M-2 carries a three-man crew and six infantrymen. The M-3 has a three-man crew and two scouts. The newer models, in addition to the appliqué armor, have spall liners to reduce the danger of shrapnel from penetrating rounds and rearranged storage for fuel and ammunition.⁸¹

The M-113A3 is the upgraded armored personnel carrier of the U.S. military, and it can be outfitted with a variety of weapons such as the TOW missile. One version even has a Chaparral SAM launcher added. It can be used to carry

⁸⁰ Messenger, Charles; *Armed Forces Of The World*; Bison Books Ltd. 1984-1985, pp 42-56

troops, equipment and cargo during combat missions and the newest model the A-3, has a spall liner in it.⁸²

The fully tracked vehicle is armored with aluminum, and has external fuel tanks and upgraded engine and transmission to take the added weight of the spall liner and outside tanks. It weighs 27,200 pounds, is armed with 50-caliber machine gun and 2,000 rounds of ammunition, and has 275 horsepower. It has a top speed on the road of 42 mph; travels cross-country at 20 mph and can carry 13 troops. It can ford water areas at 3-6 mph and has a range of 300 miles. It can climb a 2-foot obstacle, get over a 5.5-foot trench and climb a 60 percent slope.⁸³

Used both by the Army and the Marine Corps, the LAV as it is known carries a 25mm cannon and a 7.62 mm machine gun in its rearward turret. It travels on eight huge tires and can hit 62 mph on land and 6.5 mph in water. It has a cruising range of 400 miles and can go straight up 1 60 percent slope or across a 30 percent hill. It carries 71 gallons of fuel, weighs about 28 pounds, has a crew of seven including four infantrymen and its turret can be depressed at 8 degrees.⁸⁴ The LAV-25 is the centerpiece of the light armored infantry battalion. It is widely used for reconnaissance, and its cannon fires armor piercing rounds, incendiary traces and it

⁸¹ O'Neil, Richard; An Illustrated Guide To The Modern US Army; Salamander Books, 1984, pp 38-43

⁸² *ibid*

⁸³ *ibid*

⁸⁴ *ibid*; pp50-53

can take on enemy personnel carriers at 2,750 yards. It is 21 feet long, 7.2 feet wide and 8.2 feet high.⁸⁵

It is essential to be able to keep the airspace overhead clear, and to have the ability to pound the front lines of an opponent with rockets to soften them up for an attack. The United States and the allies have a variety relatively standard artillery pieces, like 105 mm howitzers towed behind various vehicles and the self-propelled 155mm. Typical of them is the Army's M-119 105mm howitzer.

Multiple launch rockets systems or MLRS were other systems used by the infantry. This especially deadly U.S. weapon system can fire a dozen rockets in less than 60 seconds, spreading up to 8,000 bomblets over an area the size of four football fields. The 13 foot-long, 9 inch wide rockets are mounted in two six missile canisters carried by self-propelled launcher loader. The three-man crew of the MLRS can reload the launcher without leaving the protection of the vehicle, which can move about at 40 mph when necessary. MLRS missiles weigh about 600 pounds and have a range of more than 18 miles.⁸⁶

The Hawk missile is a medium-range air defense system to hit low and medium altitude aircraft attacking an allied position. It can be moved about, operated in all weather and is extremely reliable. It can get to altitudes of more than 33,000

⁸⁵ *ibid*; pp 50-53

⁸⁶ O'Neil, Richard; *An Illustrated Guide to Modern US Army*; Salamander Books Ltd; 1984, pp 98-101

feet and travel more than 19 miles.⁸⁷ The Hawk, deployed worldwide, comes with acquisition radar, a tracking system, and a device to help determine if the approaching plane is a friend or foe, and each launcher has three missiles. A typical battery has three or four launchers. The missiles are guided by reflected radar energy and use a proximity fuse to trigger the warhead.⁸⁸

The Chaparral is a short-range air defense and surface-to- surface missile. It is self-propelled, and the missile is a lightweight, supersonic missile that can be aimed and fired. It uses passive infrared homing and has the tracking system to determine from hitting friendly aircraft. A new smokeless rocket motor has been developed for the missile.⁸⁹

The Stinger is a shoulder-fired infrared homing missile for air defense at short ranges. It seeks out the heat trail of jet and propeller engines, using a computer to calculate an intercepting course. It also has the determining factor featured to ensure it does not knock down friendly aircraft. A tone tells the operator a target has been locked on, and when the trigger is pulled, a small motor punches the missile out of its launch tube. Once safely away from the gunner, a larger rocket fires off. It was deployed back in Germany in 1981 and later at the Gulf War.⁹⁰

⁸⁷ *ibid*

⁸⁸ *ibid*

⁸⁹ *ibid*

⁹⁰ *ibid*

Destroying tanks is a critical element of any modern land battle and the Allied coalition fields a variety of especially nasty weapons to knock out enemy firepower. These missiles were tremendously used to counter the threat of Iraqi missiles, which were considered to be unpredictable as well as the possibility of carrying chemical compound within the missiles.

The Dragon, a medium-range wire-guided anti-tank missile is a highly accurate shoulder-launched rocket that is particularly useful at the platoon level. The operator merely sights on the target through a cross-hair scope and then fires at the target. Sensors in the 6.5-pound launcher then track the heat given off by the rocket motor and send a course-correction command to the missile through thin wires that trail out behind it. The missile weighs about 24 pounds and has a range of 3,000 feet.⁹¹

At Kafji, Tube Launched Optical Tracked Wire Guided Missile (TOWs) was successful in hitting Iraqi armor. A portable heavy anti-tank weapon, the tube-launched, optical-tracked, wire-guided TOW missile is extremely effective in delivering shaped-charged explosives to their targets. Once a soldier selects a target, the missile is fired, trailing wires behind it that are used to route commands from the launcher to the rocket's steering fins. Each TOW missile is about 4.6 feet long, 6

⁹¹ *ibid*

inches wide and weighs about 47 pounds at launch. It can hit targets up to 12,000 feet away at speeds up to 625 mph.⁹²

There were also an assortments of specific missiles used by fighter aircrafts during the Gulf campaign. These smart weapons were used in almost all of the weapons used by the coalition forces in engaging the war against Iraq. The technology used was advanced in its own ways and the microelectronics and the development of new materials was a turning point for the victory in the Gulf War. Latest radar systems, high-speed computers were part of the systems used in the weapons. The US in many ways strived to retain a technological superiority in as many weapons systems as possible.

The AGM-65 Maverick missiles are carried by wide variety of warplanes, including A-7 Corsairs, A-10 Thunderbolts, F-4 Phantoms, F-16 Falcons, F-15Es and F-111 bombers.⁹³ A single aircraft in clusters of three under each wing that can carry up to six Mavericks. Two versions of the weapons system are in use; one uses a television system for guidance and the other uses a heat –sensitive imaging infrared system for use at night.

Before launching a Maverick, the pilot first selects a target on a cockpit television screen using an image from the missile. Once the target is locked

⁹² ibid

in, the missile is launched and continues on without further direction from the pilot. Various combinations of imaging sensitivity, control software and warhead design currently are in use. The missiles weigh between 462 pounds and 670 pounds depending on warhead weight, measuring about 8 feet and 1 foot in width. Top speed is supersonic and the missile has a range of up to 25 miles.⁹⁴

Smart bombs such as the modular gliding tv-guiding “smart” bombs come in several sizes and work in similar fashion. The 2,450-pound GBU-15, for example, measures 12.8 feet long, 1.5 feet wide and has a wing-span of about 5 feet.⁹⁵ The unit is made up of a 2,000-pound Mark 84 bomb equipped with either a television or infrared targeting system that feeds an image to the launching aircraft. The operator either guides the bomb all the way to a target or orders the weapon to home in on its own like some high-tech video game.

Laser –guided bombs are equipped with sensor kits that allow the weapon to use laser beams fired from the attacking aircraft (or another friendly aircraft) to home in on their targets. Such smart bombs come in a variety of sizes and can be carried by virtually all U.S. strike aircraft. Laser weapons are currently utilized in range-finding applications as target designators, and as weapons to damage or incapacitate an enemy’s optical systems on, for instance, tanks.⁹⁶

⁹³ Young, Susan H.H.; “Gallery of USAF Weapons”; Airforce Magazine, May, 1990, pp 141-160

⁹⁴ *ibid*

⁹⁵ *ibid*

⁹⁶ Barnaby, Frank; Future War: Armed conflict in the next decade; Multimedia Publications (UK) Ltd 1984, pp100

3.6 IRAQI FORCE, AIR POWER, NAVY AND WEAPONS

In terms of manpower, an estimated 545,000 Iraqi regular army and reserve troops were dug in within the borders of Kuwait awaiting the expected coalition ground attack, relying on tank traps, rocket launchers, mine fields and other deadly surprises to offset the allies' advantage in technology. The Elite Republican Guard, six divisions of highly nationalistic troops loyal to Saddam Hussein, was headquartered in Basra, just north of the Iraq-Kuwait border, and deployed throughout the region.

It has been noted that the Iraqi military contributed 995,000 combat troops including about 480,000 reserves, 5,500 main battle tanks, including 1,000 Soviet-built T-72s, 100 light tanks, 6,000 armored personnel carriers as well as about 3,000 artillery pieces and at least 36 and probably more mobile and fixed-base Scud-B missile launchers. Others include 50 FROG-7 missile battlefield launchers, 160 surface-to-air (SAM) SA-2 missiles, 140 SA-3s, some 300 others. It also has 4,000 air defense guns, a 5,000-man navy made up of five frigates, six corvettes, eight missile carriers, six torpedo boats, eight mine warfare units, six amphibious craft and two presidential yachts. The Air force had 809 combat aircraft and an unknown number of paramilitary "people's army" irregulars.

3.6.1 IRAQI AIR POWER

At the start of Operation Desert Storm, the 40,000 man Iraqi air force fielded 809 combat aircraft, including six squadrons of bombers, 22 squadrons of ground attack aircraft and 17 squadrons of fighter jets, including 30 Soviet MiG (Mikoyan-Gurevich)- 29s, 25 MiG Foxbats, 150 MiG-21s and 30 Mirage F-1. Iraq fielded one squadron of 12 reconnaissance jets, which were 5 MiG 21s and seven MiG-25s, and two squadron of Soviet-built transport planes.

The Iraqi's air power was also made up of top of the line weapon systems used. The Mig-29 Fulcrum twin-engine was capable of flying faster than the speed of sound and a fast turning combat aircraft with wide range capabilities. The Mig-25 Fox bat could be used either a high-altitude interceptor or a reconnaissance platform with operational ceiling of more than 88,000 feet. It is capable of high speeds and carries a wide range of Soviet air-to air missile.⁹⁷

The AA-6 and the AA-7, another medium to long range air-to air missile uses both radar homing and heat seeking infrared technology to destroy targets within 50 miles. The MiG-23 multi-role fighter is equipped with electronic gear allowing it to detect aircraft up to 53 miles away, it is believed, and to lock onto

⁹⁷ Russell, Watson; Staring Down the Bully; Newsweek: September 3. 1990; pp 17-31

targets at a range of about 34 miles. Soviet export models, however are thought to have a less powerful avionics package. It carries heat-seeking air-to-air missiles.

Looking at the all famous MiG-21, the first batch of the MiGs carries a small number of weapons and is not equipped with modern instrumentation but is considered highly reliable in certain capabilities like flying six sorties a day for several days a row. The Sukhoi Su-7, a ground attack warplane has been a popular aircraft among pilots and it is tough and reliable and easy to fly. It is equipped with an avionics system first installed in the early 60's.

The Iraqi air defense however suffered losses at the beginning of the war even before fighter planes could take off from Baghdad, as the airports were raided by carpet bombings by the Stealth fighters, which were undetected. There were not much "dog fights" as they were not able to show their air superiority though they were well equipped with state of the art systems.

3.6.2 IRAQI NAVY

Iraq's naval force, badly damaged in the early skirmishes with allied forces, was negligible to start with. Saddam Hussein began the war with four Italian built frigates, each displacing no more than 2,525 tons when provisioned for battle. There was a training frigate, lightly armored and four guided missile frigates. They

had five-inch guns and Albatros SAM system along with the Otomat Mark 11 surface-to-surface missile and they carried two AB-212 anti-submarine warfare helicopters.

Iraq also had four guided missile corvettes, 10 guided missile patrol boats and a variety of small patrol boats, most bought from the Soviet Union and other Eastern Bloc nations. The Iraqi vessels were largely ineffective against the allied armada and several small patrol boats were sunk in the early days of the war.

3.6.3 IRAQI WEAPONS

The weapons used by the Iraqi's, assembled what may say is the fourth largest military machine in the world, all for a country with roughly 16 million people. Although the inventory included older U.S. and allied equipment, it was Russia that actually supplied the bulk of Iraq's most modern weaponry.

These included the T-72 Main Battle Tank, T-62 Main Battle Tank, Mi-24 which was the backbone of Iraq's helicopter corps totaling some 40 of the famed Soviet Hind attack helicopters that saw extensive service in Afghanistan and the Anti-Aircraft Guns including the 23mm ZSU-23-4, a self-propelled, radar-directed gun that can

throw a shell more than 8,000 feet. As well as the ZSU-57-2, a 55mm weapon that is also self-propelled. Iraq also had a variety of towed anti-aircraft guns.⁹⁸

A major element in any land war is preventing enemy warplanes from achieving air superiority over the battlefield. The Iraq army and air force fielded a variety of Soviet made surface-to-air-missiles, the SAM to knock down coalition aircraft. While exact numbers were impossible to obtain, the Iraqi military, in theater and out, was believed to have a total SAM force of about 160 SA-2, 140 SA-3 and some 300 SA-6, 7,8,9,14s and 100 Roland self-propelled air defense missile systems.⁹⁹ In addition, the Iraqi's were thought to have, in total 4000 air defense guns of various sizes. Massive anti-aircraft batteries were in place around Baghdad.

The following are examples illustrate the capabilities of the SAM systems in place during the war. SA-7 a heat-seeking shoulder missile capable of hitting aircraft up to 6 over miles away. The system uses a trigger to activate the missile's infrared seeker. Once the sensor "looks on" a red light changes to green and the trigger is pulled. A solid fuel charge fires the rocket out of the launch tube and after it is a safe distance away, a solid fuel motor ignites, pushing the warhead to Mach 1.5. The SA-7 is in wide use around the world. The SA-8 is a Soviet built made up of four radar or infrared guided missiles mounted on an amphibious vehicle along with search and guidance radars. These missiles are able to hit top speeds of

⁹⁸ ibid

Mach 2. The Roland a self-propelled missile defense system is in wide use around the world, including Iraq.¹⁰⁰ They can be optically or radar guided with a range of about 4 miles and service ceiling of 16,400 feet.

The surface-to surface missiles, which comprises the Frog-7, a Soviet built is a tactical missile mounted on a ZIL-135 transporter with a single quick raised launch rail and an on-board crane for speedy reloading. It has a range of up to 9.3 miles. And the most spoked about missile during the war, was the ever-frightening Scud missile, a Soviet built liquid-fueled rocket. The Scud is a ballistic surface-to surface missile that can be launched from fixed sites or mobile launchers. Capable of carrying nuclear or conventional warheads, Iraqi's Scud's were modified to increase their range. Allied forces feared the Iraqi versions were capable of carrying chemical or biological warheads as well. However, the Scuds effectiveness was limited by their inaccuracy, and by the devastating success of the U.S. Patriot missiles.¹⁰¹

Among the Soviet systems in the Iraqi artillery was the D-30 122mm howitzer. It has a range of 9.5 miles and because the shell is larger, it is significantly more lethal than the 105mm system. It also requires more crew to mend it and it has earlier models of the U.S. built 155mm howitzer. Iraq's armored personnel systems were mostly Armored Personnel Carrier (APCs) and some were U.S. built M-113 A1

⁹⁹ ibid

¹⁰⁰ ibid

¹⁰¹ Internet Website: <http://www.pbs.org/wgbh/pages/frontline/gulf/weapons/scud.html>, October 7, 2000

and A-2 models, meaning they lack the spall liners and external fuel tanks.¹⁰² The Soviet built MT-LB was another carrier that lacked behind the more advance APCs. The Iraqi army also is equipped with a variety of anti-tank weapons, the Soviet built AT-3 Sagger and the AT-4 Spigot. In basic design they are similar to Western anti-tank weapons, portable and wire-guided. The AT-3, with a range of up to 3,280 yards, weighs about 25 pounds.¹⁰³ At close ranges it is guided by eye but at longer ranges the target is viewed through a periscopic sight that magnifies the field of view. The wire-guided AT-4 has a range of up to 2,700 yards and fires a 120mm round that can penetrate armor of up to 600mm.

3.7 CONCLUSION

The “smart” weapons and laser-guided bombs used in the war with Iraq during the 1991 Gulf War introduced a new age of weaponry to nearly everyone in the world. Millions of people had birds-eye view of enemy command and control centers enveloped in clouds of smoke and debris as television broadcast vivid images of the bombs hitting their mark. There were many success stories Operation Desert Storm, including new weapons, previously fired only in testing, evaluation or training exercises.¹⁰⁴ For the most part, they performed exactly as they were intended. The

¹⁰² Russell, Watson; *Staring Down the Bully*; *Newsweek*, September 3, 1990, pp 17-31

¹⁰³ *ibid*

¹⁰⁴ Alpert, Mark; “What Comes Next”; *Fortune*, February 11, 1991, pp36-43

“old reliables” also proved to be just as good. The ships, planes, bombs, and missiles all worked well.

Within the foreseeable future, however, wars will not be limited to cyberspace. The psychological effect alone will continue the practice of fighting wars with bombs and bullets, though with ever-increasing accuracy of standoff weapons. The world witnessed the precision with which the United States and Allied military could strike targets in Baghdad, at the same time inflicting few, if any, injuries to civilian noncombatants.¹⁰⁵

We also looked into the weapons systems of the Iraqi defense, which were considered to be sophisticated and were advanced in their own right, but the Iraqi’s were unable to leash out their skills in using the technologies within the weapons on the pretext that most of their defense capabilities were taken out by the Allies in the early days of the war.

Technology is the “force multiplier” that allows U.S. forces to shoot farther and more precisely than their enemies. The best is always expensive, but the prize for deploying anything less ultimately will be paid in the lives of American soldiers, sailors, and airman. This lesson will endure throughout, though the fighting

¹⁰⁵ *ibid*

in the 1991 Persian Gulf War has ended, a new one had began in 2003 and justifies technology in its role played.

We can justify that missile defenses during the Gulf War was crucial. The anti-missile Patriot was able to succumb Scud missiles from targeting countries like Israel and Saudi Arabia inflicting casualties at large numbers. Conventional cruise missiles were also key weapons in the U.S. arsenal. Advance combat systems as the Joint Surveillance Target Attack Radar System (JSTARS) airborne radar and the Army Tactical System (ATACMS) were critical against enemy tanks.¹⁰⁶

At a news conference during the conflict, General. Colin Powell outlined the coalition strategy for ending Iraqi stranglehold on Kuwait:

“This is an air-land-sea campaign, not just air campaign which at some point will end and then something else starts. It is a single, coherent, integrated air-land-sea campaign. Our strategy to go after this army (in Kuwait) is very simple. First, we’re going to cut it off. And then we’re going to kill it.” Gen. Colin Powell.¹⁰⁷

“ I just want everybody to know that we have a toolbox that’s full of lots of tools and I brought them all to the party.” Gen.Colin Powel, Chairman, Joint Chiefs of Staff.¹⁰⁸

¹⁰⁶ Dowel, William; “The 100 Hours”: *Time*, March 11, 1991, pp 22-34

¹⁰⁷ Undated cutting provided by Major C. Douglas Dawson, United States Air Force, Deputy Chief, Security Assistance Office, U.S. Embassy, Kuala Lumpur, Malaysia, 27 May 2002

¹⁰⁸ *ibid*

3.8 TABLE

TABLE: 1.1

COALITION AND IRAQI WEAPONS

Reviewing the troops: How the Sides Measure Up

“Saddam Hussein’s vast Army-the largest military force in the Middle East, looks invulnerable on paper. But much of the Iraqi weaponry is antiquated, and the desert heat and dust can foul even the most advanced equipment. Despite the difficulty of sending an army across the world, U.S. and Saudi ground forces, backed up by air power, stack up well against the Iraqis.”

(Russell Watson, Newsweek: August 20,1990)

UNITED STATES/COALITION FORCES	IRAQ
MISSILES	MISSILES
Patriot Air Defense	Scud
AIM-7 Sparrow	AA-6 Acrid
AIM-9 Sidewinder	AA-7 Apex
HARM	Otomat Mark 11
Shrike	AB-212 Anti-Submarine
AGM-65 Maverick Missile	AT-3 Sagger Anti-Tank
AGM-84 Harpoon Anti-Ship	AT-4 Spigot Anti-Tank
AGM-54 Phoenix	
Drundal Anti-Runway Bomb	
Magic	
Hellfire	
Dragon Anti-Tank	

AIRCRAFT	AIRCRAFT
F-117A Stealth Fighter	MiG-29 Fulcrum
F-4G Phantom “Advance Wild Weasel”	MiG-25
F-15 Eagle	MiG-25 Foxbat
F-16 Fighting Falcon	MiG-21
F-111 Tactical Strike Aircraft	MiG-30 Mirage F-1
B-52 Stratafortress	MiG-29
A-7 Corsair 11	MiG-23
F/A-18 Hornet	Sukhoi Su-7
A-10 Thunderbolt	Su-24 Fencer
A-6 Intruder/Prowler	Su-20 Fitter
A-4 Skyhawk	Tupolev TU-22 Blinder
AV-8B Harrier 11	TU-16 Badger
E-2C Hawkeye	Mi-24 Hind Helicopter
Panavia Tornado	
Mirage F-1	
Mirage 2000	
Jaguar	
CH-53 Super Stallion Helicopter	
AH-64 Apache Helicopter	
AH-1 Cobra Helicopter	
OH-58D Kiowa Scout Helicopter	
OV-10 Bronco	
MH-60K Aerial Refueling	
MH-47E Aerial Refueling	

SMART WEAPONS	SMART WEAPONS
Gliding TV-Guided Smart Bomb	Albatros SAM System
Laser-Guided Smart Bomb	
ARGIS Weapons System	
E-3 Sentry Airborne Warning And Control Systems (AWACs)	
J-Stars	

SHIPS	SHIPS
BB-63 Missouri	Corvettes
BB-64 Wisconsin	Patrol Boats

USS Bunker	4 Italian made Frigates
USS Moosbrugger	
HMS Gloucester	
US Avenger Minesweeper	
HMS Herald Minesweeper	
HMS Atherstone	
USS Louisville Submarine	
Landing Craft	
USS Blue Ridge Command Ship	
USS Iwo Jima Command Ship	
USS Okinawa Command Ship	
USS Barbour Command Ship	
USS Durham Command Ship	
USS La Salle Command Ship	
USS Mercy Hospital Ship	
USS Comfort Hospital Ship	

BATTLE TANKS	BATTLE TANKS
M-1A1 Abrahams Tank	T-72
M-60	T-62
British Challenger	
Cheftain	
AMX-30	

ARTILLERY/AIR DEFENSE	ARTILLERY/AIR DEFENSE
MLRS Rocket System	SA-7 Shoulder Fired
Hawk Medium Range	SA-8 Guided Missile
Chaparral Short range	Roland Self-Propelled
Stinger Shoulder Fired	Frog-7
	Anti-Aircraft Guns

ARMOURED PERSONNE CARRIERS	ARMORED PERSONNEL CARRIER
Bradley Fighting Vehicle	M-113 A1
M-113A3	M-113 A2
Light Armored Vehicle LAV-25	
LVTP-7	
AMX-10	

Source: Internet Website; The Gulf War: <http://www.pbs.org/wgbh/pages/frontline/gulf/weapons>
 Newsweek: August 20, 1990 and Time, March 18.1991