



# AUSA BACKGROUND BRIEF



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## ARMY EQUIPMENT SYSTEMS PERFORMANCE IN OPERATION DESERT STORM

As the Army and Congress work together to finalize the fiscal year 1992 budget and future budgets, it is important to consider how Army systems actually performed in the most realistic operational test conducted to date—Operation Desert Storm. The Army's continued modernization will be greatly influenced by the reports on how well its equipment operated under these conditions.

While the collection of detailed technical performance data and the preparation of operational reports are under way, that process will take several months. In the interim, we want to provide some of the information reported during and after the operation, as well as anecdotal information provided by commanders and soldiers who used the systems.

Descriptions and characteristics of selected Army equipment systems are provided below, followed by available information regarding their operational performance during Desert Storm.

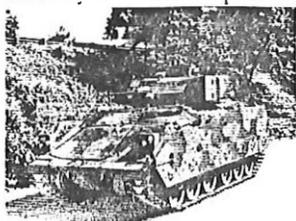
### ARMOR AND ANTIARMOR SYSTEMS

**M1 SERIES ABRAMS MAIN BATTLE TANK.** The Abrams tank is the Army's primary ground combat weapon system for closing with and destroying enemy forces using mobility, firepower and shock action. Its special armor, compartmentalization of fuel and ammunition stowage, and automatic fire detection and suppression system, along with high agility and mobility, provide the crew with the greatest possible levels of protection. The M1 tank is armed with a 105mm main gun. The M1A1 tank (pictured) added a 120mm smoothbore cannon that is able to hit tank-sized targets at ranges beyond 3,000 meters. A nuclear, biological, chemical (NBC) microclimatic cooling system, added to the already proven combination of thermal sight, laser rangefinder and full stabilization, gives the M1A1 the capability to operate under all climate and light conditions, as well as in an active chemical environment. The M1A1 weighs 67 tons (combat loaded), has a top speed of 41 mph and a crew of four; other armament includes one .50 caliber machine gun and two 7.62mm machine guns. The 1,500-horsepower turbine engine and improved suspension provide consistently superior handling and maneuverability, thus decreasing the tank's exposure to direct and indirect fire weapons.



**Performance.** After 100 hours of offensive operations, the operational readiness rates for both the VII Corps and XVIII Airborne Corps exceeded the Army's 90 percent standard. Especially noteworthy was one particular night move by the 3rd Armored Division covering 200 kilometers (120 miles). All of the more than 300 tanks in the division completed the move in operational condition. Seven separate M1A1 crews reported front hits by T72 tank rounds while sustaining no damage, attesting to the effectiveness of the heavy armor. Other crews reported that the M1A1 thermal sight allowed them to acquire Iraqi T72s through the smoke from oil well fires and other obscurants. The T72s did not have the same advantage. This situation gave the Abrams a significant edge in survivability, engagement range and night maneuverability. Additionally, tank crews report that the M829A1 tank round was extremely effective against the T72. The frontal armor of all the Iraqi tanks, including the T72, was clearly overmatched by the 120mm gun of the M1A1 tank. Also, crews reported killing tanks behind berms by shooting through the berm—the sabot round could penetrate all the way and still kill the tank. In sum, the combined performance of the Abrams' armor, thermal sight and ammunition attests to the system's exceptional lethality and survivability. Of the 1,956 M1A1 Abrams tanks in theater, four were disabled and four were damaged.

**M2/M3 SERIES BRADLEY FIGHTING VEHICLE SYSTEMS (FVS).** The M2 allows for mounted combat and provides the infantry a means to protect tanks and consolidate gains in the offensive. It is designed for a nine-man infantry squad, including the two-man turret for the commander and gunner. The main armament is the 25mm "chain gun." Both armor-piercing discarding sabot (APDS) and high-explosive (HE) ammunition are available. The 7.62mm coaxial machine gun is mounted to the right of the 25mm main gun. The TOW antitank missile launcher, housed in an armored rectangular box, is hinged to the left side of the turret, folded flat against it for traveling and then raised. The fire control system features an integrated day/night sight incorporating a thermal-imaging infrared device. The firing port weapons are modified 5.56mm M16A1 rifles, mounted in the rotating ball firing ports. The M2 has a top road speed of 42 mph and a cruising range of 300 miles. An upgraded version, the M2A1, has NBC protection and the Improved TOW 2 missile system. The M2A2 model (pictured) includes a spall liner, ammunition restowage, improved protection against kinetic energy



weapons and provisions for the attachment of add-on armor. An armored cavalry scout version of the FVS, the M3, is externally indistinguishable from the M2 and has the same armament and automotive performance. The major difference is the arrangement of the crew compartment and internal stowage, the M3 being designed to accommodate the five-man cavalry squad and their weapons. The M3 is not fitted with the 5.56mm firing port weapons.

**Performance.** Crews reported that the infrared sights were very effective, even during sand storms. Other crews reported that the 25mm Bushmaster cannon was more lethal than they expected. There were no reports of transmission failures during offensive operations. Of the 2,200 Bradleys in theater, three were destroyed; to date, the number damaged has not been determined.

**TOW MISSILE SYSTEM.** The TOW (Tube-Launched, Optically Tracked, Wire Command-Link Guided) antitank missile system is found at battalion level in ground units and is also mounted on the Bradley Fighting Vehicle, the Improved TOW Vehicle, the High Mobility Multipurpose Wheeled Vehicle (HMMWV) (pictured) and the AH-1S Cobra helicopter. When the missile is fired, a sensor in the launcher tracks a beacon in the tail of the missile. The gunner need only keep his crosshairs on the target. A computer in the launcher corrects any deviation of the missile from the crosshair aim point and sends corrections to the missile via two extremely thin wires that deploy in flight. The ground launcher weighs 240 lbs; the missile weighs 62.4 lbs and has a range of 3,750 meters. There is a three-man crew. The Basic TOW has been in the inventory since 1970. A thermal night sight, improved warhead, and other modifications to the Basic launchers provide the TOW 2 configuration. The TOW 2A missile, developed to counter Soviet reactive armor, is being fielded. Other improvements, to include warhead and sight, are under way.



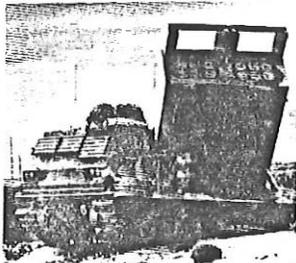
**Performance.** TOW missiles were fired from a variety of platforms during the ground war, to include the Bradley, HMMWV and Cobra. TOWs accounted for numerous armor kills and were particularly effective in the battle at Khafji.

**HELLFIRE MODULAR MISSILE SYSTEMS.** Hellfire is a third-generation airborne antiarmor weapon. It is presently employed as the main armament of the Apache helicopter. Hellfire homes in on a laser spot that can be projected from ground observers, other aircraft and the launching aircraft itself. This enables it to be employed in a variety of modes, including autonomous, air or ground, direct or indirect, single shot, rapid or ripple fire. There are four versions of the Hellfire missile: Basic Hellfire with semi-active laser seeker; improved Hellfire which adds a precursor for reactive armor; Hellfire Optimized Missile System (HOMS) which is lethal against the future threat; and Longbow, the millimeter wave seeker variation, under development.

**Performance.** See AH-64 Apache Attack Helicopter.

## ARTILLERY AND AIR DEFENSE SYSTEMS

**MULTIPLE LAUNCH ROCKET SYSTEM (MLRS).** MLRS is a free-flight artillery rocket system that consists of a 12-round launcher capable of firing rockets one at a time or in rapid ripples to ranges beyond 40 kilometers. One launcher salvo is approximately equivalent to that of a battalion of 155mm tube artillery. The primary missions of MLRS are counterfire and suppression of enemy air defenses. It supplements cannon artillery fire by delivering large volumes of firepower in a short time against critical, time-sensitive targets. MLRS employs shoot-and-scoot tactics to limit vulnerability to counterbattery fire. It is mounted on a modified M2 Bradley Fighting Vehicle and can travel 40 mph. In addition to the dual-purpose conventional submunition, the system can deliver scatterable mine warheads, each of which dispenses 28 antitank mines. The MLRS launcher is being updated to employ the Army Tactical Missile System (Army TACMS) against tactical missile sites and other priority targets. See separate comments on Army TACMS.

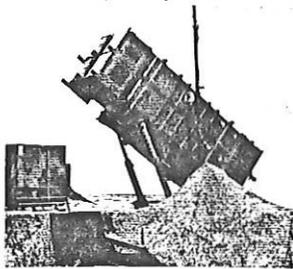


**Performance.** Although specific battle damage assessment is not available, MLRS overall performance was outstanding. Preliminary reports indicate that the artillery fired at least 5,000 rockets against such high value targets as howitzer and rocket battalions, air defense artillery battalions, command and control facilities and logistics facilities.

**ARMY TACTICAL MISSILE SYSTEM (ARMY TACMS).** Army TACMS provides the Army a long-range missile weapon that operates day or night in nearly all weather, is air transportable, and is capable of effectively engaging high priority land targets at ranges beyond the capability of cannons and rockets. The system is used to attack tactical surface-to-surface missile sites; air defense systems; logistics elements; command, control, and communication complexes; and second echelon maneuver units arrayed in depth throughout the corps area of influence. Army TACMS is a ground-launched conventional surface-to-surface semi-guided ballistic missile with an Anti-Personnel/Anti-Materiel (APAM) warhead. It is fired from the modified M270 MLRS launcher. The system utilizes the same targeting systems, engagement systems, and command and control systems as MLRS.

**Performance.** In January 1991, Army Central Command requested that all available Army TACMS be sent to support critical theater deep battle and suppression of enemy air defense operations. The Army sent 105 missiles. More than 30 missiles were fired against surface-to-air missile sites, logistics sites, SCUD positions, howitzer and rocket batteries, and tactical bridges. Army TACMS was viewed as a precious asset and placed under Army Central Command control to limit expenditures to high value targets. Initial battle damage assessments indicate that Army TACMS destroyed or rendered inoperable all its targets. The commander of the VII Corps Artillery reported, "It's working great." Used for the first time in Desert Storm, Army TACMS proved to be responsive and accurate in responding to targets well beyond 70 kilometers.

**PATRIOT.** The Patriot missile system is the centerpiece of theater air defense. The system's fast reaction capability, high firepower and ability to operate in a severe electronic countermeasure environment are features not previously available in air defense systems.



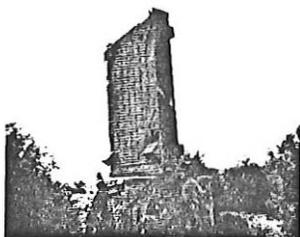
The combat element of the system is the fire unit, which consists of a radar set, an engagement control station, a power plant, an antenna mast group and eight remotely located launchers. The system is highly automated, combining high-speed digital processing with various software routines to effectively control the battlespace. The single radar, using phased array technology, provides for all tactical functions of airspace surveillance, target detection and tracking and support of missile guidance. The only manned element of the fire unit during air battle, the engagement control station provides the human interface for control of automated operations. Each launcher contains four ready-to-fire missiles, sealed in canisters which serve a dual purpose as shipping containers and launch tubes. Multiple targets can be engaged simultaneously. U.S. missile production deliveries include PAC-2 modifications. PAC-2 missiles and Post Deployment Build 3 software provide Patriot a limited asset defense against the theater ballistic missile threat.

**Performance.** The Patriot was the only fielded system with an antitactical ballistic missile capability. It was used to engage those "threatening" SCUDs within the missile footprint. Of the 47 SCUDs against which it was fired, Patriot successfully intercepted 45. Throughout its entire period of employment, the system demonstrated an overall exceptional operational readiness rate (97 percent). Following SCUD attacks on Dhahran and Riyadh during January 1991, a senior Air Force official said, "... no one should underestimate the value of the Patriot system in this war. . . . In the historical analysis and stories of this war, Patriot will be one of the key systems which influenced the outcome." It was limited, however, by its ability to attack only close-in targets out to approximately 15 kilometers.

**COPPERHEAD.** This laser-guided artillery round is fired from the 155mm howitzer. After launch, the round deploys fins and homes in on a target illuminated by a laser designator. The round is designed to penetrate the top of a tank, where the armor is less substantial. See OH-58D Kiowa Warrior Helicopter.

**Performance.** Combined, the VII Corps and XVIII Corps fired 90 Copperhead artillery rounds against various hard targets, achieving a high success rate.

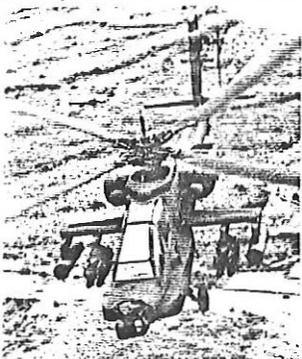
**FIREFINDER RADARS.** The AN/TPQ-37 Artillery Locating Radar (pictured) and the AN/TPQ-36 Mortar Locating Radar enable friendly forces to locate and bring immediate fire upon enemy indirect fire weapons and rocket-launching positions, silencing them before they can adjust their fires on friendly units and positions. The world's first automatic hostile-weapon-locating systems. Firefinder radars use advanced phased array antenna techniques with computer-controlled signal processing. They function by spotting enemy projectiles in flight and mathematically backplotting their trajectory. The position of the weapon is reported in grid coordinates that can be fed automatically into artillery fire centers, enabling them to target the enemy weapons with guns, rockets or other ordnance.



**Performance.** User reports indicate the AN/TPQ-37 performed well. It was able to plot the trajectory of incoming fire and compute the location of Iraqi artillery positions. This permitted rapid and accurate counterbattery fires and complemented the successful shoot-and-scoot tactics of Army artillery units.

## AVIATION SYSTEMS

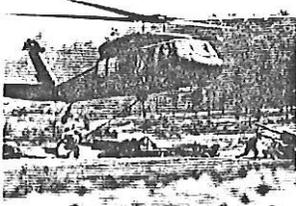
**AH-64A APACHE ATTACK HELICOPTER.** The AH-64A is an advanced attack helicopter able to locate, engage and destroy enemy armor forces and a wide variety of other targets. It complements other weapon systems on the battlefield with its high survivability, mobility and lethal firepower. It has superior ability to see the battlefield day or night and in adverse weather. The Apache is operated by a crew of two. It has a primary mission weight of 14,445 lbs and is powered by two turbine engines rated at 1,800 shaft horsepower (shp) each. Maximum level flight speed is 184 mph or 158 knots, with a service ceiling of 20,000 feet. The self-deployment range is more than 1,000 nautical miles. Mission endurance is 2.5 hours, carrying eight Hellfire antitank missiles, 38 Hydra-70 2.75-inch rockets and 1,200 rounds of 30mm cannon ammunition at a speed of 146 knots. Crew station armor plating and a blast fragment shield can prevent both aircrew members from being incapacitated from high-explosive incendiary rounds. The target acquisition designation sight (TADS) and the pilot night-vision sensor (PNVS) are the keys to the aircraft's day, night and adverse weather capability.



**Performance.** On 17 January, Apache attack helicopters from the 101st Aviation Brigade fired the first shots of the war. Two teams of four Apaches each conducted deep night attacks into western Iraq to destroy early warning ground control radar sites. The teams achieved complete surprise. The eight Apaches fired 27 Hellfire missiles and destroyed two radar sites. The mission created a corridor used by the Air Force to begin Desert Storm's air campaign. In addition to the Hellfire missiles, the Apaches fired 2.75-inch rockets and rounds of 30mm ammunition. The Apache crews experienced

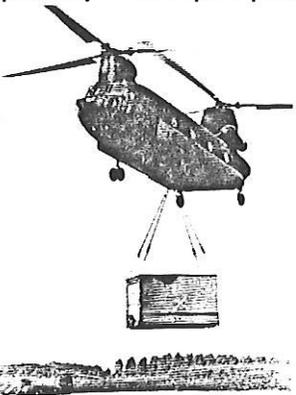
no 30mm gun jams. The mission took 15 hours and covered 950 nautical miles round-trip. All aircraft returned undamaged. Commanders and crews were extremely pleased with the system's lethality, survivability, reliability and availability. Throughout the entire operation, Apache readiness rates exceeded the Army standard. In one battle, the 4th Battalion 229th Aviation Brigade destroyed approximately 50 tanks. Initial expenditure reports, after hostilities ended, show that approximately 2,900 Hellfire missiles were fired. This figure could increase to as many as 4,000 to 5,000 when all units have reported. The system proved to be highly effective against radar sites, bunkers and tanks.

**UH-60 SERIES BLACK HAWK TRANSPORT HELICOPTER.** The Black Hawk is a twin-engine helicopter capable of carrying a crew of three and a combat-equipped 11-man infantry squad. Alternate seating can accommodate up to 14 troops and a crew of three. It performs the mission of transporting troops and equipment into combat, resupplying the troops while in combat, medical evacuation, repositioning of reserves, and command and control. The Black Hawk can also transport a 105mm howitzer with its crew and ammunition. The Black Hawk is replacing the UH-1H Iroquois in air assault, air cavalry, aeromedical evacuation and special forces units. The Army currently has two models. The UH-60A delivery began in 1978 and continued through September 1989. In October 1989, the UH-60L (pictured) was introduced with improved durability and a new primary engine. Normal mission endurance is 2.1 hours. Under hot day conditions, the Black Hawk will lift its crew of three and up to 11 combat-equipped troops, with a vertical rate of climb of 785 feet per minute and a cruising speed of 150 knots.



**Performance.** Commanders and crews were very complimentary of the aircraft's performance. As of 1 March, crews had flown more than 6,000 flight hours with no significant problems. Black Hawk missions included troop and artillery movements, medical evacuation, search and rescue, forward area resupply, and command and control. The fleet's average mission capable rate throughout the theater was a favorable 90 percent.

**CH-47D CHINOOK MEDIUM-LIFT TRANSPORT HELICOPTER.** The CH-47D is a medium lift transport helicopter used primarily to transport personnel, weapons, ammunition, equipment and other cargo in general support of combat units. Most operations consist of transporting supplies and external loads. Routinely, the CH-47D operates in secure areas. Payloads up to approximately 24,000 lbs can be carried. Performance at the design weight of 33,000 lbs includes maximum level flight speed of 158 knots, single-engine service ceiling of 13,100 feet, the ability to hover up to 17,250 feet, and maximum rate of climb of 3,450 feet per minute. The Army continues to modernize CH-47A, B and C models to the "D" configuration for one-to-one replacement in the field.



**Performance.** The aircraft was used extensively to establish refuel/rearm points in support of deep operations, to conduct long-range rescue missions, and to move large numbers of enemy prisoners of war. One aviation battalion flew 338 missions 120 nautical miles into Iraq the night preceding an XVIII Airborne Corps attack. There are reports of infrared and radar guided missile engagements against CH-47 and UH-60 helicopters. No aircraft were lost as a result of these engagements. In each instance, the survivability equipment either allowed the aircraft to evade attack or caused the missiles to miss the aircraft.

**OH-58D KIOWA WARRIOR.** The OH-58D is the Army's first true scout helicopter. It provides the combined arms team the capability to fight and defeat the threat during day or night operations, in adverse weather and in high temperature/high altitude conditions. The aircraft system incorporates a new drivetrain consisting of a four-bladed rotor, 650 HP engine, and compatible transmission and tail rotor systems. The OH-58D consists of a mast-mounted sight which provides day and night target acquisition sensors and a laser rangefinder designator located above the rotor to maximize aircraft survivability. A highly accurate navigation system permits precise target location information which can be passed to other aircraft or artillery elements via the airborne target handover system. The laser designator enables the OH-58D to provide designation for laser guided weapons to include Hellfire and other precision munitions. The OH-58D operates in air cavalry units and can be equipped with Air-to-Air Stinger (ATAS) missiles. Using ATAS, the OH-58D can provide security against threat aircraft. Maximum gross weight is 5,400 lbs; speed is 118 knots with a crew of two.



**Performance.** The system was used by ground forces primarily to designate targets for the Apache attack helicopter. Some Kiowa-Apache teams reported 15-20 tank kills per mission. On 21 January, two OH-58Ds operating from the *USS Nicholas* were used as part of a task force to destroy Iraqi air defense emplacements on oil platforms. In a 29 January letter, the commander of the 4/17th Aviation wrote, "Day two we attacked oil rigs while reconning an oil field. We fired three Hellfires and hit three platforms . . . took 23 enemy prisoners of war." Other missions included attack of Iraqi patrol, fast attack and minesweeper watercraft; search and rescue; laser designation/terminal guidance for Air Force laser-guided munitions and field artillery Copperheads. The overall readiness rates were between 85 and 90 percent.

## OTHER COMBAT SUPPORT SYSTEMS

**JOINT SURVEILLANCE AND TARGET ATTACK RADAR SYSTEM (Joint STARS).** Joint STARS is a battle management and targeting system which detects, locates, tracks, classifies and assists in attacking both moving and stationary targets beyond the Forward Line of Troops (FLOT). This allows the commander to decide (situation intelligence), detect (targeting intelligence), and deliver (trigger delivery of ordnance, direct attack aircraft or counter enemy movements by maneuver of friendly forces). The Air Force is responsible for the Prime Mission Equipment (PME): platform, radar, data link. The Army is responsible for the Ground Station Modules (GSM): tactical data processing and evaluation distribution centers that link the Joint STARS radar (through the data link) to Army C3 nodes at corps and division levels. The GSM processes Joint STARS and OV-10 Mohawk aircraft radar data. Situation development information is transmitted through the All Source Analysis System (ASAS) and targeting information is transmitted through the artillery tactical data system to their users. Detection range is in excess of 100 km into hostile territory. The aircraft is a militarized Boeing 707, the E-8.

**Performance.** Senior commanders were extremely pleased with the system's capabilities. On 22 January, Joint STARS located a division assembly area and a 60-vehicle convoy moving toward Kuwait. An air strike destroyed 58 tanks. On 5 February, the system reported to the Marine forces fighting in the town of Khafji that there were no approaching enemy follow-on forces to back up the initial attack. This information was vital to continuation of main operations. On the first day of ground operations (24 February), Joint STARS identified Iraqi elements moving into blocking positions while friendly forces of the Northern Area Command were conducting obstacle breaching operations. The enemy force was interdicted by tactical air strikes. On 26 February, Joint STARS identified a heavy volume of vehicle traffic headed north from Kuwait City toward Basra. Air strikes interdicted a causeway in advance of the traffic to block its flow. Joint STARS also identified targets for Army TACMS.

**SINGLE CHANNEL GROUND AND AIRBORNE RADIO SYSTEM (SINGARS).** SINGARS provides commanders with a reliable, easily maintained combat net radio system for command and control. SINGARS provides effective Electronic Counter-Counter Measures (ECCM) against threat Electronic Warfare (EW). SINGARS configurations include manpack, vehicular (both low and high power), and airborne models. The first radios fielded do not contain integrated communications security (COMSEC) but, instead, use the external VINSON COMSEC device. COMSEC is integrated in currently produced versions of the ground and airborne models (ICOM SINGARS). SINGARS radios have greatly improved reliability over the AN/VRC-12 and AN/PRC-77 series radios which they replace, and they are exceeding the requirement of 1,250 hours Mean Time Between Failure (MTBF). Weight is 22.5 lbs with battery and COMSEC device; ICOM weight is 19.6 lbs with battery. Frequency range is 30.000 to 87.975 MHz, with 2320 channels. The range is 8-35km.

**Performance.** Reports from units in the field indicate that the system experienced approximately 7,000 hours MTBF, compared to the 200-300 hours demonstrated by the VRC-12. The 1st Cavalry Division used SINGARS at retransmission sites and experienced about 30 percent increased range capability. Special operations forces praised its light weight.

**HIGH MOBILITY MULTIPURPOSE WHEELED VEHICLE (HMMWV).** The HMMWV is a light, highly mobile, diesel powered, four-wheel-drive tactical vehicle that uses a common 1¼-ton payload chassis. The HMMWV can be configured through the use of common components and kits to become a cargo/troop carrier, armament carrier, S250 shelter carrier, two- or four-litter ambulance or TOW missile carrier (pictured above). The HMMWV provides a successor to the ¼-ton Jeep, M718A1 ambulance, ½-ton M274 Mule, 1¼-ton Gamma Goat and M792 ambulance. Vehicle payload ranges from 1,920 lbs for the ambulance carrier and 2,500 lbs for the cargo/troop carrier to 3,177 lbs for the S250 Shelter Carrier.

**Performance.** The HMMWV is organic to virtually every type of Army unit that deployed to the Persian Gulf region. HMMWVs were effectively used throughout the operational area as reconnaissance vehicles armed with TOW and .50 caliber machine guns, as mobile command communications centers, for medical evacuation and for transportation of materiel. Their reliability has long been established and was evident in the roles performed during the conduct of the ground war.

**M9 ARMORED COMBAT EARTHMOVER (ACE).** The M9 ACE is a highly mobile tracked, amphibious armored earthmoving vehicle that can move, survive, and work with the flow of battle, responding immediately to the need for elimination of enemy obstacles, creation of obstacles to impede enemy maneuver, preparation of fighting positions for the fighting forces, expedient antitank ditching, and maintenance of roads and supply routes. The ability to perform these tasks assures that friendly force momentum is maintained in the offense; in the defense, enemy forces are slowed, channelized and made more susceptible to fires from protected positions. The M9 ACE weighs 18 tons empty and 26 tons loaded; road speed is 30 mph. It is transportable by C-130 and larger aircraft. Vehicle armor protects the crew from small arms, artillery fragmentation and NBC threats. Deliveries of the full production vehicles to the field began in the June-October 1989 time frame. Due to Operation Desert Storm, the M9 ACE was fielded to units in theater in November-December 1990.



**Performance.** ACE was designed to provide the maneuver force with a mobile dozer, road grading and excavation capability. Within days of arrival in theater the ACE was employed in all these tasks. ACE was used to break numerous tank ditches and sand berms in Kuwait and Iraq at the initiation of the ground offensive and later was used to dig fighting positions for combat vehicles when the assault phase was completed. The M9 ACE was able to move rapidly along with Abrams tanks and Bradley fighting vehicles so that it was readily available to support field commanders.

**NAVSTAR GLOBAL POSITION SYSTEM (GPS).** The GPS is a joint Army-Navy-Air Force program. It is a space-based navigation, three-dimensional positioning and time distribution system that will provide accurate, continuous, all-weather, common grid, world-wide navigation, positioning and timing information to land, sea, air and space-based users. GPS consists of three segments: (1) a Space Segment of 24 satellites; (2) a Ground Control Segment; and (3) a User Segment. The User Segment consists of receiver configurations for manpack/vehicular, low-to-medium and high dynamic aircraft and seacraft applications respectively. The Army is responsible for the testing of manpack/vehicular and low-to-medium dynamic aircraft receivers. The GPS receiver is a passive device that will be deployed extensively at all echelons and with Army aircraft.

**Performance.** Two Joint STARS developmental aircraft were deployed. The GPS was used to calibrate the aircraft radar in order to locate enemy vehicle movements. Early in the war a search and rescue helicopter used GPS to locate and recover downed pilots. The VII Corps and XVIII Airborne Corps used GPS to verify locations of units during the encirclement of Iraq's Republican Guard divisions. To help soldiers navigate in the desert, 8,000 commercial Small, Lightweight GPS Receivers (known as "Sluggers") were procured. Though less precise than the military version, the commercial version was immediately available off the shelf.

**NIGHT VISION DEVICES.** The soldier operates far more effectively at night through use of night vision image intensification (I2) and laser/thermal technologies. The AN/PVS-4 Individual Served Weapon Sight provides passive sighting and viewing using second generation image intensification techniques. The AN/PVS-4 is designed primarily for use with the M16 rifle, the M60 machine gun, the M72A1 rocket launcher and the M203 grenade launcher. It can also be used by a commander for surveillance. The AN/PVS-7 Night Vision Goggle (NVG) provides passive sighting and viewing using third generation (high performance) image intensification techniques. The AN/PVS-7 is a lightweight, head-mounted monocular unit. It is used in the operation of ground vehicles, for navigation, map reading, maintenance, first aid, etc. The AN/AVS-6 Aviation Night Vision Imaging System (ANVIS) is a lightweight, high performance binocular unit using third generation image intensification techniques. The AN/AVS-6 is designed specifically for use by helicopter pilots during night flights, including Nap-of-the-Earth (NOE) missions. The AN/PAQ-4A Infrared Aiming Light can be mounted on and boresighted to the M16A1/A2 rifle, M60 machine gun, M67 recoilless rifle and M72A1 rocket launcher. The AN/PAQ-4A provides accurate target sighting by placement on the target of an infrared beam which can be seen only with the use of the NVG.

**Performance.** Night vision goggles were used extensively by aviators during night flying operations. Copilot AH-64 gunners used the goggles in high speed night operations in conjunction with infrared equipment to assist in navigation. Overall, the extensive use of night vision devices gave Army forces the ability to operate effectively on the battlefield. U.S. forces enjoyed a tremendous advantage in night vision capability.

## SUMMARY

As can be seen from the preceding reports, Army systems performed well in combat. These reports validate Army research, development and acquisition programs over the past years. This is not to say that everything performed perfectly or that the Army is entirely satisfied. In some areas there is room for improvement. For example:

- Identification-friend-or-foe to reduce casualties from friendly fire.
- Heavy equipment transport.
- Night vision for aviators in featureless terrain.
- Helicopter communication during nap-of-the-earth flight.
- Antijam capability for tactical satellite communications.
- Lethality of light forces.

Overall, however, Operation Desert Storm clearly demonstrated that the Army has excellent soldiers and equipment that can win when supported by effective logistics, warfighting doctrine and training programs.

(This *Background Brief* was prepared by Colonel James D. Blundell, USA Ret., Assistant Director, AUSA Institute of Land Warfare, 2425 Wilson Blvd., Arlington, VA 22201. Reproduction of this *Background Brief*, in whole or in part, is authorized with appropriate acknowledgement of the source.)