APPENDIX F

FUTURE TECHNOLOGIES

Just as social and political changes are reshaping the nations of the world and their interaction with each other, so too are technological developments altering the nature of the battlefield. The current threat array and the types of weapons that may emerge in the near future present the Army with greater strategic, tactical, and training challenges than it has ever faced before.

Effective reconnaissance and security operations are, and will remain, particularly critical components in the complex, high-tempo battlefield environment. The Army is currently developing key technologies that, as they are fielded, will directly and fundarnentally affect how the scout platoon fights. This appendix identifies some of these developments and examines their potential impact on the scout platoon.

CONTENTS

Section I. DIRECTED-ENERGY WEAPONS

This section discusses directed-energy weapons (DEW) and gives an overview of how to defend against them. This new category of weaponry is different in operation and effect from any other weapon. There is evidence that DEWs

are in use in areas of conflict around the world. **(NOTE:** For information on technical characteristics, refer to the US Army capstone manual on DEWs and to TB MED 524.)

CHARACTERISTICS

DEWs include lasers, microwave radiation emitters, and particle beam generators. These weapons produce casualties and damage equipment by depositing energy on the target. While conventional weapons rely on the kinetic or chemical energy delivered by a sizable projectile, DEWs produce subatomic particles or electromagnetic waves that strike the target at or near the speed of light.

Measures to prevent injury, damage, or destruction from DEW engagement to soldiers and currently fielded equipment are limited. Current equipment and soldier apparel lack built-in passive defense mechanisms to counter the effects of DEWs. Future versions of these items will be manufactured with built-in defenses as they are developed; older equipment maybe refitted with protective devices.

At present, however, DEWs are able to damage only "soft" targets, including people or soft components of hard targets. Scouts can employ the measures discussed in this section to protect themselves from attack by these weapons.

LASERS

Lasers are the type of DEWs most likely to be used against US forces. All modern armies have increasing quantities of laser devices in their inventories. Any laser-emitting device, such as a target designator or a range finder, can be employed as a weapon if it is aimed at a type of target it can damage.

The most probable targets of laser weapons are optical and electro-optical systems, most notably fire control devices such as sights. The soldiers behind the sights are vulnerable as well.

A laser beam entering a direct-view optical system, such as a telescope, has its power increased by the magnification of that system. Anyone who happens to be looking through the system will suffer burns to the eye. The severity of the burns, the permanence of the damage, and the time required for the eye to heal itself depend on weather conditions, the intensity of the laser, the magnification

of the optical device, and the duration of the eye's exposure to the laser. Eye injuries range from temporary flash blinding and mild bums to total, permanent blindness. A soldier suffering this type of injury can be incapacitated; he may be unable to aim a direct-fire weapon or track a command-guided weapon. A laser weapon usually will fire at a target for only a split second, at most, before laying on another target.

A laser beam entering a nonsee-through electro-optical device, such as a night vision sight or thermal imagery device, deposits its energy in the form of heat on the sensor screens inside. If the heat is intense enough, it can bum out the screen, rendering the device useless. Some of the electrical circuits inside may also burn out from the heat and from the sudden surge of electricity caused by the laser's energy. Any device so affected will require extensive repairs.

Laser weapons can also be directed against people, although that is an inefficient way to employ them. They can burn human organs and tissue, with the eyes being the most susceptible to injury. For the person to suffer eye injury, however, he must be looking directly at the laser source. Since the eye is more sensitive to light at night, laser energy entering the eye during darkness can cause more severe damage than it would during daylight. Some types of lasers are hazardous to the eye even though the laser cannot be seen.

Any uncovered glass surface (such as eyeglasses, vision blocks, or binoculars) has the potential to attractor alert an antielectro-optical weapon's target acquisition system. This increases the probability of a laser attack as well as the chance of injury or equipment damage.

DEFENSIVE AND PROTECTIVE MEASURES

Apply the following techniques to avoid detection by antielectro-optical weapon systems:

- Use artillery, mortars, or direct-fire weapons to suppress known or suspected antielectro-optical weapons locations. Smoke rounds are good for temporarily defeating laser devices.
- When operating from fixed or semifixed positions in the line of sight of known or suspected enemy locations, reduce exposure of glass surfaces in the direction of the enemy by positioning vehicles and weapons in covered or concealed positions.

- When the mission requires maneuver and, as a result, the possible exposure of multiple glass surfaces, block the line of sight between friendly forces and known or suspected enemy locations with smoke, or plan routes to lessen exposure time.

- Use sound tactics to prevent friendly weapons locations from being pinpointed and targeted for attack by laser devices.

- Devices with external glass surfaces should be shielded until they are used. Even vision blocks and headlights can alert the target acquisition systems of antieletro-optical weapons; cover them whenever possible. Tape, canvas, sandbags, or other materials can be used as covers.

- When using optical or electro-optical devices to search for the enemy, use the minimum number possible to do the job and reduce exposure time. Shield the rest until they are required for fining or other purposes.

- Gunners can use the AN/TAS-4 to scan for enemy laser devices. A blooming of the image indicates the presence of a laser. The gunner should be instructed to find the enemy laser device. The unit can then avoid the laser or use indirect fire to neutralize it.

- Tubular extensions over objective lenses reduce the chance of detection except from almost head-on. They can be made from tubular ammunition packaging or other scrap materials.

- Low-energy antielectro-optical weapons work only if they have a line of sight to their target, although they are just as effective at night as during the day. Take advantage of smoke, fog, snow, and dust to degrade their effectiveness. Another good countermeasure against some laser devices is to cover one-half of the optical lens with tape or some other type of cover. This may result in some degradation of viewing capability; however, the benefits of reducing vulnerability to laser attack could justify the loss.

Soldiers should be aware of the potential hazards from laser devices in the US Army inventory. Laser range finders are the devices most likely to be found near friendly soldiers; they are used on the M551A1, M60A3, and M1-series

tanks. They are also used in artillery units and by FISTs in cavalry troops and squadrons. Other lasing devices used by FISTs include the following:

- The ground-locating laser designator and lightweight target designator.
- The GVS-5 binocular-type laser range finder (used by artillery FISTs and reconnaissance patrols).
- The laser designator used by attack helicopters to direct the Hellfire and Copperhead weapon systems.
- Laser devices used by artillery survey parties for surveying in gun positions.

Air Force and Navy aircraft can also carry laser target designators for aiming precision-guided munitions. The F-4, F-7, F-111, F-105, F-16, and A-6 aircraft can be equipped with these designators.

Operators of laser firing devices receive extensive training in using them safely. The devices themselves cannot be activated without conscious, deliberate action on the part of the operator. While accidents are rare, however, they can happen. A victim might suddenly and unexpectedly move directly into the path of the laser beam and look directly at it, or a laser beam might reflect off a shiny surface and strike a victim in the eyes.

To prevent such accidents, operators of laser firing devices must constantly be kept aware of friendly soldier locations, and they must positively identify targets before lasing them. Lasers should not be fired at reflective surfaces, and the warning "LASING" should be given before activating the laser.

Conversely, commanders of soldiers operating in areas near friendly lasers must ensure that the commanders of laser-operating forces are always aware of the locations of friendly soldiers. Soldiers should be told whenever there are friendly lasers in their area, including the exact locations, if possible. They should be warned not to look in the direction of the laser-emitting devices unless specifically told it is safe to do so. Whenever possible, soldiers should wear laser-protective goggles matched to the wavelength of the friendly lasers. These goggles are available through normal supply channels.

DIRECTED ELECTROMAGNETIC PULSE

Electromagnetic pulse (EMP) is electromagnetic radiation that has a frequency ranging from 10 MHz to 4 GHz. EMP can come from nuclear

detonations (nondirected EMP), from detonation of conventional explosives coupled with focusing electromechanical devices, or from electrically powered EMP generators on or above the ground.

EMP can damage or destroy sensitive electronic components, such as microchips, coils, and fuses by overloading them with electrical current. All equipment containing electronic components, including FM radios, is subject to damage or destruction from EMP attack. The extent of damage depends on the distance from the equipment to the source of the pulse.

EMP can be projected into target areas from long ranges. It can enter a targeted device through any opening and attack sensitive components inside even if the device is disconnected or turned off. For example, it can enter a radio set through the louvers over the cooling fans and destroy circuitry inside, leaving the radio useless. It can also enter through unshielded cables for antennas, power lines, and so on.

Protecting equipment from EMP is difficult because the attack lasts for only a split second and affects a large area. It is possible, however, to make operational equipment less susceptible to destruction during an attack and to ensure that other equipment is available for use after the attack.

The only truly reliable method of protection is to encase vulnerable equipment in some type of heavy-gauge metal shielding or to surround it with special metal screening. Burying or covering equipment with sandbags or other nonmetallic materials does not provide enough protection. Terrain masking is ineffective because EMP follows the curve of the earth.

When operated from combat vehicles, sensitive equipment should be disconnected when not needed and moved to the center of the vehicle. Smaller pieces of equipment should be placed in empty ammunition cans. Hatch covers should stay closed except when someone enters or exits the vehicle. Known or suspected locations of enemy ground-based EMP-generating weapons should be attacked by direct or indirect fire weapons within range.

TRAINING

Commanders at all levels must mentally condition their subordinates to face the threat of DEWs. These weapons appear at first glance to have devastating effects on men and equipment; effective defense against them seems nearly impossible. A basic understanding of what they are and how they work, however, reveals them to be far less fearsome.

Laser, microwave, and EMP weapons damage their materiel targets by attacking soft electronic components. Their terminal effects are less violent and destructive than those of conventional kinetic-energy or chemical-energy munitions. Even though they may render their targets just as combat-ineffective, they do not have the blast, fire, and fragmentation effects of conventional munitions.

For those same reasons, people face less danger from laser, microwave, or EMP attacks than from conventional attacks. While the thought of laser-induced eye injuries may be tightening to the soldier, the potential extent of such injuries, as well as the possibility of their occurrence, is much smaller than that for gunshot wounds. The expected recovery time is shorter as well. Permanent blindness in the affected eye occurs in only a small percentage of incidents.

The advantages of particle beam weapons (to the extent they are used) are their flat trajectory, long range, and large magazine capacity. Otherwise, these weapons are similar to conventional tank cannons in employment and effect. Whether a vehicle is struck by a HEAT round, an APDS round, or a particle beam hardly matters; the effect on the vehicle and its occupants is about the same in all cases. There are no countermeasures against a particle beam weapon system.

Until equipment is factory-hardened against DEWs, the defensive techniques discussed in this appendix are the key to surviving directed-energy attack. DEWs that can injure people are line-of-sight systems; the standard techniques employed against any direct fire weapon provide protection against personal injury from DEWs. Because DEWs have no bursting radius, these techniques may actually be more effective against directed energy than against conventional weapons.

LASER COUNTERMEASURE SYSTEM

Each squad is issued one laser countermeasure system (LCMS). The LCMS has the following capabilities in disrupting enemy optical and electro-optical sighting devices:

- Detection of all types of optics from extended ranges.
- Location of optical and electro-optical devices, allowing the gunner to track and suppress the enemy.

- Illumination of a 30-meter target at a range of up to 1,000 meters.
- Suppression of enemy personnel and equipment. The LCMS can temporarily flash-blind personnel who are using direct-view optics as well as those who happen to look directly at the laser without eye protection. The system can also cause temporary "blooms" in image intensifiers.
- Designation of a precise target area that can be used to cue and direct fires from other weapons.

The scout platoon leader uses the LCMS to assist in identifying targets during reconnaissance and security operations. Once targets are identified, the LCMS enhances the combat power of the maneuver force by pinpointing targets for direct and indirect fires. Target handoff criteria must be coordinated and specified in the OPORD to ensure the LCMS is not used before handoff assets become available. For example, if mortars are tasked to destroy identified targets, the squad will not activate the LCMS until the mortars are ready to fire. If the system is activated too early, the enemy can take measures to counter the effects of the mortars.

The LCMS can be used in either active or passive mode. In the passive mode, targets can be identified without the enemy's knowledge. In the active mode, the enemy may discover that he is being targeted. For safety, the LCMS should never be used to identify friendly forces.

The LCMS gives the platoon the ability to detect targets at long ranges; it is most valuable, however, when used in conjunction with other detection devices. The mission of the platoon does not change with the addition of the LCMS. The system provides high-quality operational information, but the platoon must rely on its tactical skills to move into a position to most effectively use it.

SECTION II. THE STINGRAY SYSTEM

The Stingray, which can be employed on the battlefield as an adjunct direct-fire system on the CFV and BFV, is a combat protection system that enhances survivability against enemy optical devices. The Stingray can counter multiple ground and aerial weapons under almost all battlefield conditions by detecting and jamming enemy optical sighting systems before the weapons can be fired. Current fielding plans will assign three Stingrays to each scout platoon

equipped with the CFV. There is no current fielding plan for HMMWV-equipped scout platoons.

CAPABILITIES AND OPERATION

The Stingray can operate in automatic, semiautomatic, or manual modes. The mode of operation depends on the control measures required to protect friendly forces and to obtain the maximum effect on enemy systems. The following conditions apply:

- The automatic mode is used when there is no danger to friendly forces and when there is a large number of enemy systems.
- The semiautomatic mode is used when more restrictive control measures are required. It restricts the Stingray system to its scanning function until the operator gives the command to fire.
- The manual mode is used for security reasons when tight control of the system is required because of command restrictions or restrictions on laser operations. Manual control also permits rapid reorientation to anew sector when a higher-priority threat appears or when one mission is completed and a change of sector is required.

In combat, the Stingray is an integral part of the platoon; the system allows the platoon to observe, detect, and jam enemy ground and aerial targets beyond the direct-fire engagement range of other organic weapon systems. Stingray-equipped CFVs not only can jam known enemy locations, but also can locate enemy positions that might otherwise go undetected.

On the battlefield, the Stingray is controlled in the same manner as other direct-fire weapons. It is assigned a sector of fire within the platoon. Stingray sectors are included on the CFV range card, and restrictions on the Stingray mode of operation are noted in the range card remarks section. The platoon leader employs the system in accordance with the commander's intent and plan. The Stingray normally operates in the automatic or semiautomatic mode, but some situations will require use of the manual mode. This information is included in the commander's OPORD to the platoon leader.

RECONNAISSANCE

During reconnaissance operations, Stingray vehicles should be employed on the flanks and forward of the platoon to provide maximum protection. They can be linked with each other to provide overlapping sectors of coverage. During

movement, the Stingrays are employed with the overwatch element. Prior to the movement of the bounding element, they sweep the area in the semiautomatic mode to detect the presence of enemy forces without jamming their systems. On engagement by the enemy, the Stingray can switch to the automatic mode to jam threat systems. If necessary, Stingrays can be employed with the bounding element, although this is not the most effective use of the system. In the bounding element, the Stingray operates in the semiautomatic mode. Upon contact, it is placed in the automatic mode to detect and jam threat systems.

SECURITY

Because of their ability to detect enemy optics. Stingray-equipped platoons can routinely perform screen missions. One Stingray-equipped CFV should be employed with each OP. The CFV moves to a hull-down position and sweeps the area under observation in the automatic mode. Once the area is cleared, the CFV returns to a hide position. At irregular intervals, the Stingray vehicle returns to a hull-down position and checks the area to ensure that OPs are not under enemy observation. The Stingray can also be employed as a redundant system (similar to GSR) to provide maximum area coverage along the screen line to detect any enemy approach. Stingrays operate in the semiautomatic mode during these missions; however, they can most effectively avoid detection when operated in the manual mode.

Section III. DIGITIZATION AND THE lNTRAVEHICULAR INFORMATION SYSTEM

The intravehicular information system (IVIS) can digitally transmit, receive, and display accurate friendly vehicle positions, laser-designated enemy vehicle locations, and a menu of operational reports and graphics. IVIS significantly increases the ability of the platoon to operate dispersed at a rapid tempo and then to rapidly concentrate at critical points when required.

The system's most important feature is the accurate eight-digit map grid that visually displays friendly and enemy vehicle locations. This permits virtually perfect spot reports and calls for fire. It also vastly improves the platoon leader's situational awareness. IVIS permits the digital transmission of operational graphics. This allows the commander to get his scouts moving as early as

possible in the mission; it also permits the scout platoon leader to receive and issue graphics for FRAGOs more rapidly and with greater accuracy. When integrated with either a global positioning system (GPS) or a positive navigation system (POSNAV), IVIS makes navigation easier and more accurate, particularly in the extremes of open or closed terrain.

IVIS is an integral part of the soon-to-be-fielded M1A2 tank. In addition, IVIS, or a similar system, will be incorporated into the M3A3 fighting vehicle and used in all CPs at battalion/squadron and higher level. Although the format is not yet determined, an IVIS-type system will eventually become available to HMMWV-equipped scout platoons. The impact of these digitized information systems will be an ever-faster tempo of operations, creating correspondingly more challenging command and control problems. Offsetting these negative elements will be the platoon's capability for instant transmission of highly accurate orders.

Section IV. REMOTELY PILOTED VEHICLES

Remotely piloted vehicles (RPV) are currently in active use by many nations. The US Army is rapidly developing this technology and has several versions of RPVs ready for fielding in the near future. It is likely that the RPVs will be available for employment by battalion and cavalry scout platoons, either as an assigned part of the platoon or as an attached element. Typical RPV capabilities and attributes include the following:

- Hand-launched.
- Transportable on the HMMWV or CFV.
- Battery-powered.
- One-hour flight duration.
- Both color and black-and-white video.
- Operating radius of 5 to 7 kilometers.
- Low noise and visual signatures.

- Operator-maintainable.
- Imagery resolution sufficient to recognize troops and vehicles.
- Video down-link that can provide a HMMWV or CFV base station with real-time images.

The major limitation of RPVs is their inability to conduct detailed reconnaissance and to locate small reconnaissance objectives such as dismounted enemy elements. Effective camouflage, limited visibility conditions, bad weather, and the use of dummy positions by the enemy also degrade the reliability of information received from RPVs.

RECONNAISSANCE

Despite their limitations, RPVs can significantly enhance the scout platoon's ability to conduct reconnaissance missions. RPV employment is in many ways similar to that of air cavalry elements. During reconnaissance, an RPV can assist in mission preparation, augment the ground reconnaissance effort, and execute independent reconnaissance tasks.

During mission preparation, RPVs can conduct rapid reconnaissance of such objectives as designated routes or the overall terrain in the area of operations. The platoon leader can then use this information to develop or refine his plan. If video playback is available, the results of the reconnaissance can become part of the platoon leader's OPORD.

RPVs can augment ground reconnaissance elements by searching for terrain, obstacles, and enemy forces forward of the scout teams. This enhances the scout teams' security and therefore can speed the tempo of the reconnaissance mission. When RPVs locate something significant, they transmit the information to the nearest scout team, which can then report the data and coordinate for handover of targets.

The scout platoon leader can use RPVs to execute independent reconnaissance tasks under a variety of circumstances. They can reconnoiter objectives that are difficult or impossible to reach on the ground. They are also useful in rapid reconnaissance of low-priority objectives; this can free ground scout teams to perform other tasks. RPVs can also perform rapid and effective

reconnaissance of high-priority objectives when conditions favor their use (open terrain and good weather are ideal) or when a detailed reconnaissance is not required.

SECURITY

During security operations, RPVs can perform independent security missions or augment screen line operations. Independent RPV missions are difficult to execute because of the requirement for continuous coverage, but such coverage can be maintained for short periods through careful management of aerial patrols. When used to augment the screen line, aerial patrols reconnoiter forward of the OP positions to provide early warning of enemy approach. They can also reconnoiter dead space throughout the depth of the screen line to provide security for the OPs and to prevent infiltration.

Section V. LONG-RANGE ADVANCED SCOUT SURVEILLANCE SYSTEM

This system, known as LRAS3, is designed for all-weather observation and target acquisition. It can be employed either mounted or man-portable, day or night, and under a variety of adverse conditions. It allows scouts to acquire and identify enemy equipment and positions while remaining outside the range of enemy small- and large-caliber direct fire acquisition and engagement systems.

The LRAS3 includes a laser range finder, thermal imaging system, daylight TV, and chemical detection capability. It may also have an integrated GPS and a digital link to IVIS or a similar command and control system.

The LRAS3's biggest asset is its enhanced ability to acquire targets without the enemy's knowledge; the scout platoon's target acquisition capability will be 50 to 70 percent better than with current systems. Scouts will also be able to make reports and call for indirect fire support more quickly and accurately. Dismounted OPs will have the same acquisition capability as vehicles without sacrificing stealth. The LRAS3 will increase the tempo of reconnaissance missions as scouts gain the ability to move and observe with more security and greater accuracy. It will permit scouts to make more efficient use of available time for planning and execution; their ability to keep pace with mobile operations and rapidly changing situations will improve as a result.

Section VI. BATTLEFIELD COMBAT IDENTIFICATION SYSTEM

As discussed throughout this manual, fratricide is a major battlefield hazard. Recent combat experience has spurred the Army to approach fratricide reduction from two directions. One approach focuses on training in situational awareness and risk assessment for all leaders and soldiers. At the same time, the battlefield combat identification system (BCIS) has been developed as a technological solution to fratricide. This system will permit electronic interrogation of an unknown vehicle by Army vehicles and aircraft. Friendly vehicles of all types will carry a transponder that will respond positively to the interrogation, greatly reducing the likelihood of fratricide.

The BCIS will be fielded on all direct fire weapons platforms (CFVs and tanks), as well as on direct acquisition systems (scouts and field artillery observers). On the CFV, BCIS is expected to be integrated into the vehicle fire control system. On the HMMWV, the BCIS will be part of an integrated sight unit such as the LRAS3. The system will also be integrated into the appropriate vehicle-mounted information system (such as IVIS). It is anticipated that dismounted troops will also be able to interface with BCIS.

The impact of BCIS on scout tactics, techniques, and procedures will be minimal. BCIS interrogation w ill be a routine step in the acquisition process; in addition, interrogation results will be included in all spot reports. The ultimate impact of BCIS will not be in changing how scouts operate, but rather in making it safer for them to operate forward of other friendly elements.

Section VII. JAVELIN

The Army is attempting to field the man-portable, “free-and-forget” Javelin antitank weapon system for all HMMWV-mounted scouts. The system can be loaded quickly and has the capability of attacking armored vehicles “top-down.” Weighing approximately 50 pounds, it will include a separate command launch unit that can operate as a thermal-capable night observation device even if there is no armor threat. The range of the system will be greater than 2,000 meters.

The Javelin's impact on scout capabilities will be significant. It will allow dismounted scouts to execute reconnaissance and combat patrols with a relatively lightweight thermal sight. It will also give dismounted patrols the capability of dealing with unexpected armored vehicle threats. (Scouts, however, will not use the Javelin to seek out and destroy enemy armor in offensive operations.)

During security operations, the Javelin will give HMMWV scouts who are manning OPs the ability to employ an effective antiarmor weapon in self-defense situations. It will also provide them with an effective, lightweight thermal sight system that can be employed instead of, or in addition to, other available dismounted thermal optics. (During screening operations, however, the Javelin will not be used as a substitute for an armor-killing counterreconnaissance force in augmenting scouts elements.)