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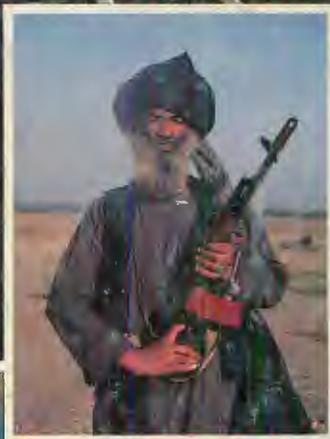
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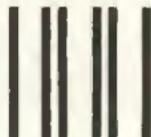
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WELCOME to the world of SOF's *Combat Weapons* — and a most interesting one it will be! CW will bring its readers the challenge of future battlefields with the most complete, international military weapons reviews ever published.

Combat Weapons evolved into a viable publication from the editors of *Soldier of Fortune* because a need was recognized. The time had come to put the writers, sources, contacts and resources of SOF to work on the subject of military firepower without deadline and subject restraints. We wanted to increase our coverage of military weaponry, yet realized *Soldier of Fortune* was not the place, since SOF is not a wholly weapons-oriented publication. *Combat Weapons* is.

For the last 10 years, *Soldier of Fortune* has pioneered its own style of covering war around the globe. It was only natural that SOF take its expertise and develop a forum in the area of military weaponry design, development and implementation. *Combat Weapons* will be that forum.

Unlike our competitors, *Combat Weapons* and its staff of editors, writers and correspondents are not strangers to the military world and the controversial field of military weaponry. *Combat Weapons* bases its background and experience in combat zones from Central America to Afghanistan, and from Africa to Southeast Asia. We cover the use of the newest military weapons systems from the field, not the briefing room. We realize our discerning readership can and will tell the difference between first-hand reporting from the battleground and proving ground versus writing from press reports and brochures.

When reading *Combat Weapons*, you'll notice articles that have datelines. These are your assurance that the writer personally went to the source of the story. On page four you'll find our report on the M16A2. This project is too important not to get the story from the source: the Marine Corps testing unit at Quantico, Virginia.

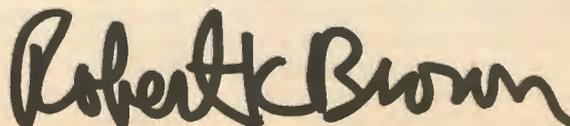
"Assignment: Afghanistan," appearing on page 16, was compiled from direct investigations conducted over five years in Afghanistan and Pakistan. These extensive field investigations resulted in unearthing the latest Soviet weaponry and its capabilities, direct from the battlefield.

Metulla, Lebanon, is the dateline on the article detailing the new Israeli Merkava Main Battle Tank on page 74. *Combat Weapons*' staff journeyed to the Middle East to report first hand, from the front, on this unique and in some ways revolutionary tank.

Page 72 previews the newest brainchild of Army procurement: the Fast Attack Vehicle. From Ft. Lewis, Washington, home of the Army's 9th Infantry Experimental Test Division, comes the dope on the FAV, and tells how *Combat Weapons* will continue its coverage of this subject in future issues.

Combat Weapons knows the military, and the field of military firepower. Our readers will get the facts, not the ad hype, and the facts will be delivered in the no-punches-pulled style you've come to expect from *Soldier of Fortune*. *Combat Weapons* is not jumping on anybody's bandwagon. We're starting our own by accepting the challenge of covering the scene of international military firepower from the inside out. We're doing it because you want to know, because the decisions made by procurement officers are going to affect your life and the security of the United States and our allies.

Each issue of *Combat Weapons* will give you an in-depth update on state-of-the-art military weaponry, tactics, strategies, training, and research and development. The fighting man on the ground, and the equipment he is issued, decides the fate of men and nations. We'll be covering weapons from the user's viewpoint, because what the fighting man sees is the *real* story.

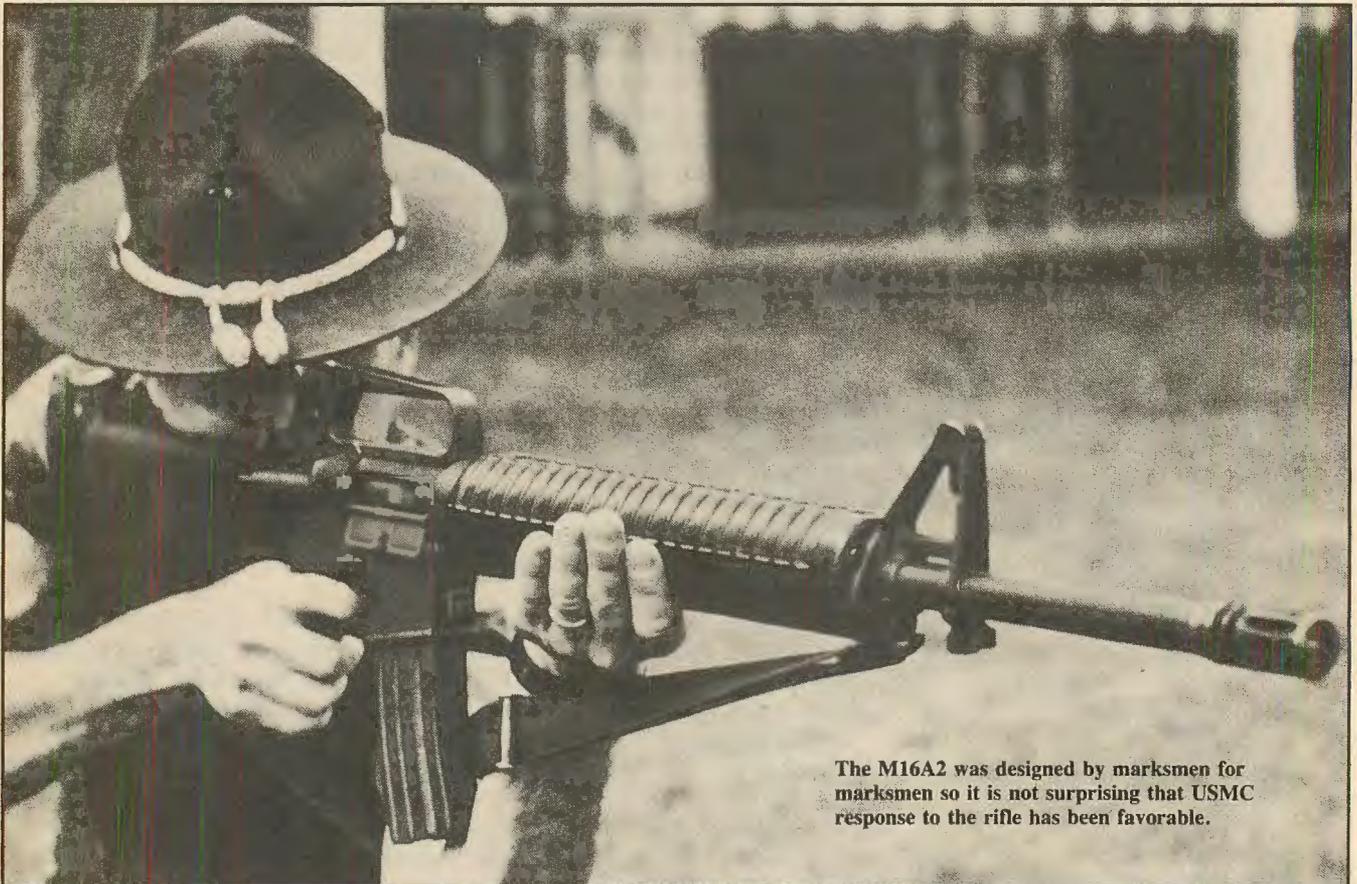


THIS IS MY RIFLE...

COLT M16A2

The Search Is Over for America's New Assault Rifle

by Andrew Tillman



The M16A2 was designed by marksmen for marksmen so it is not surprising that USMC response to the rifle has been favorable.

QUANTICO, VIRGINIA—The U.S. Marine Corps is made up of riflemen. They won't accept just any new service rifle. During the Vietnam War, they were ordered to give up the reliable and accurate M14 for a strange looking rifle made largely of plastic. Throughout the war the Marines complained about the M16's tendency to jam. It got people killed. Imagine the Marine Corps' reluctance to accept another battle rifle that is merely a revamped M16.

The result was just the opposite. The

Marines love their new rifle. And when the Marines like a rifle, it must be good.

Called the M16A2, it is the first battle rifle in 30 years to be readily adjustable by the shooter for both windage and elevation. With M855/SS109 ammunition it is capable of hitting man sized targets and perforating any practical body armor out to 800 meters. It is also the first assault rifle adopted on the division level or higher to feature a three-shot burst control in lieu of full-automatic capability.

The USMC Development and Education Command at Quantico, Virginia was largely responsible for its development. Twenty-five thousand M16A2s will be delivered to the USMC in Fiscal Year 1984 with follow-on orders of 50,000 more planned over the next two years. Total procurement for the USMC is expected to total 264,000 rifles.

The U.S. Army, which seldom agrees on operational requirements with the USMC, is also enthusiastic about the A2. They have requested 40 million dollars to purchase

75,000 M16A2s in FY 1985. If the Army's budget request makes it through Congress most of the rifles will probably go to RDF units like the 82nd Airborne.

Some foreign governments are getting into the act too. After evaluating Fabrique Nationale's FNC and the Colt M16A2, the Canadian defense department announced the purchase of 79,935 M16A2s (designated the C7 in Canada) for delivery in March of 1986. They will be made under license in Kitchener, Ontario by Diemaco, Inc. The Australian armed forces have also expressed interest in the A2, and will announce the winner of a shoot-off between it and the Steyr AUG A1 in mid-1985.

Mid-Life Update

Although the M16A2 looks almost identical to its predecessor, it isn't. We counted 24 modifications which distinguish the M16A2 from the M16A1! Most noticeable is the rear sight assembly which has a large 0.5 MOA windage adjustment knob and an elevation drum adjustable from 300-800 meters which resembles that on the Arma-lite AR-10. Unlike the A1, one turn raises the point of impact 1.4 MOA. The rear sight also has two apertures, one 5mm in diameter for shooting at close range or in subdued light and another 1.75mm in diameter for precise, long range shooting. (Those on the A1 are 2mm in diameter.) The front sight is rectangular, rather than a pyramidal post and is 0.70 inches thick.

The bottom two slots of the flash hider have been removed. This prevents escaping gas from disturbing loose sand or dirt when firing near the ground, and works as a muzzle-rise control device. A series of spacers rather than a single lock washer allow the flash hider to be rotated left or right producing a small but measurable effect on full auto dispersion. The barrel is six ounces heavier than that on the A1 and measures 0.73 inches in diameter from the gas port forward. It has a 1/7, rather than a 1/12 inch twist. The fore-arm is round, the halves are

The author looks pleased as he checks his 500 meter score. The six shot rapid-fire group measured only 8.5x14.5 inches in a 1.5 MOA wind.



The maximum effective range of the A2 in burst fire is little different than the A1. At 25 meters the rifle averaged a 31x17 inch bullet dispersion.

interchangeable and the retaining ring for the fore-arm has been canted to make removal easier. An improved heat deflector and 21 reinforcing ribs on the fore-arm increase the unit's strength and allow a more secure grip on the weapon.

A pyramidal cartridge case deflector strengthens this portion of the receiver and deflects ejected cartridge cases away from the shooter's face. The stock is 3/8 inch longer than that on the M16A1 and is made from foam filled high-impact plastic rather than foam filled fiberglass. The pistol grip has a finger swell between the index and second finger and is also made of high impact plastic. Even the door assembly on the butt plate has been changed to make storage and removal of cleaning gear easier. Finally, the M16A2s destined for the USMC, and probably those requested by the Army, will have a three shot burst control rather than full-automatic capability. With an empty magazine the M16A2 weighs 8.15 pounds, compared to 7.25 pounds for a similarly equipped M16A1; a 12 percent increase.

Three-Shot Burst Control

This may be the most controversial feature of the new M16A2. Observers should keep in mind two pertinent facts before passing judgement on it. First, the USMC is in the process of reconfiguring its squad from three four man fire-teams (plus a squad leader) to two five man fire-teams (plus a squad leader.) Each fire-team will have two M16A2/M203 grenade launchers, one M249 SAW and two to three riflemen. In other words, each fire-team will have twice the number of grenade launchers and the squad will have twice the number of belt-fed machine guns as it previously did! Secondly, when it's time to fight, both the USMC and Army RDF units will board their C-141s with 330 rounds of 5.56mm NATO ammo in their web gear and rifles and a backup ammo can of 840 rounds. That's all the ammunition they can count on for the next two weeks of non-stop combat. Is anyone still complaining about the three-shot burst control?

Our evaluation of the M16A2 at the home of Marine Corps marksmanship in Quanti-

co, Virginia, confirmed our previous findings. Off-hand or sitting, full-auto multiple hits with an M16 are not possible beyond 15 meters and its dispersion for area targets does not exceed 25 meters. Better control of the weapon is possible in the under-arm assault position than off-hand, but then the shooter has the problem of adequately aiming the weapon.

Either way, full auto capability in any shoulder fired automatic rifle is not what it is cracked up to be. The myth of full-auto capability is perpetrated by writers who should know better. Witness the following statement made several years ago in *Army Magazine*. "About the only way a shooter can keep a five-round burst on target from the standing position at 200 meters — if he weighs less than 200 pounds — is to loosen the sling from its rear attaching point and stand on it."

We defy anyone to keep a five round burst "on target" at 50 meters, let alone 75, 100 or 150 meters as the author suggests might be possible. Try to keep a five round burst on a giant military E silhouette at 25

M16A2 SPECIFICATIONS

Caliber	5.56x45mm NATO
Magazine capacity	30 rounds
Loaded magazine (with M855)	1.050 lbs.
Weight	
with magazine	7.9 lbs.
with empty mag.	8.15 lbs.
with loaded mag. (M855)	8.95 lbs.
Overall length	39.625 inches
Barrel length	20.0 inches
Method of operation	Gas operated
Muzzle velocity (M855)	3,100 fps
Muzzle energy (M855)	1302 ft-lb.
Effective range	
(100%/50% hits) M855	800 yds./1,000 yds.
(100%/50% hits) M193	500 yds./600 yds.
Rate of fire	600-940 rpm
Type of fire	Semi/Three-shot burst
Full automatic option	Available



Improved rear sight on the M16A2 is easily adjustable in the field; the first U.S. battle rifle to have this feature in 50 years. Photo: USMC

meters. The 19 by 39 inch target seems like an easy target but we have never met anyone who could do it. Typically, the first shot is where you aim, the second — if you are King Kong — will catch the upper right shoulder, and the third will be a yard high and a half yard wide! Unlike most military services, the Marine Corps has tested the dispersion of their assault rifles and found that full automatic fire is only effective from belt fed machine guns.

Our evaluation of the M16A2 did make us wish for full auto capability at very close range, however. Within seven meters against a single or several very closely bunched targets, full automatic fire can be a life saver when employing the under arm assault technique. You aim low, pull the trigger and let the barrel climb, adjusting your windage as you go. Typically, the first round is on center-of-mass within half a second and we can score three torso hits within 0.90 seconds. With the A2 we scored an average of only 0.66 hits per target and took 1.37 seconds to do so. (That's right, we missed the target entirely a third of the time!) Considering that it took only a second to shoulder, aim and fire a single round with an A1 or AKM with 100 percent hits at the same range, we do not recommend the

under-arm assault technique with the A2.

Full auto M16A2s are available from Colt, but we feel any such weapons should be ordered with a muzzle brake like that made by Defense Technology Associates in San Diego, California. This brake doubles the effective range of point or area fire with little or no increase in muzzle flash.

We fired three, three-shot bursts at both 15 and 25 meters off-hand with a stock A2. The average dispersion for the three shots was 14 inches vertically by 10 inches horizontally at 15 meters and 31 by 17 inches at 25 meters. At 50 meters sitting we only obtained one hit per burst. (With an AK-74 we recently obtained multiple hits two out of three times at the same range.) Thinking that the three-shot burst might make up for sighting error or a failure to follow through on a moving target, we aimed at the E target's lower left edge at both 25 meters off-hand and 50 meters sitting. Our results indicate that to expend more than three shots in this fashion only wastes ammunition and exposes the shooter to hostile fire for a longer period of time. At 25 meters we averaged one hit per target. The shots were well centered, indicating that the second shot in each string connected. Remember that we aimed at the lower left edge of the target. A

center hold would have given you a head shot or a miss. At 50 meters we grazed the lower left edge of the silhouette two times out of six, averaging only 0.3 hits per target. Since the mean radius of individually aimed shots at this range is 1.25 to 2.5 inches, it is possible that we would have had similar results firing semiauto.

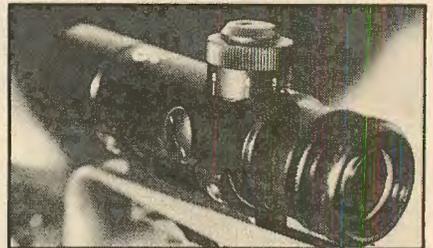
These tests indicate that the M16A2's maximum effective range on burst fire is 25 meters, which is little different than either the M16A1 or AKM but inferior to the AK-74.

Simple and Durable Burst Control Device Means More Training

The A2's burst control mechanism is accomplished by use of a ratchet with an overrunning clutch. It is comprised of nine separate parts. While much simpler and more durable than other three-shot burst control mechanisms, there is a disadvantage. If you only shoot a two shot burst (which is easy to do,) the next trigger pull will result in a single shot being fired rather than another three-round burst. Hopefully, infantrymen will have the opportunity to shoot the A2 in realistic training situations to familiarize themselves with this idiosyncrasy.

The first time this happened to us, we thought we had a malfunction! It is a nuisance, and could even get you killed but the alternative is a burst control mechanism as complex as a Swiss clock which probably would not work too well when submitted to a paste of carbon residue, dirt and lubricants.

You can't hit what you can't see. Many combat veterans would rather have a low power Colt scope on their service rifle than improved metallic sights like those on the M16A2.



The A2 burst control mechanism has also befuddled match shooters who have reported excessive creep in the M16A2's normally adequate trigger pull on the second and third shot of each cycle when the rifle is fired semiauto.

Multiple Targets

We were able to engage three targets at 25 meters using a three-shot burst in an average of 2.71 seconds. It took only 2.38 seconds with a single shot per target. After firing a number of timed drills, one soon begins to sense tenths of seconds almost as well as a stop-watch. Half way through this exercise, the overwhelming desire was to move on to the next target after the second shot in each cycle, but the Colt's burst control device forced me to keep the trigger down for three series of three shots to engage each of the

FIRING TABLE, 5.56x45 M855/M193

Range In Meters	Remaining Velocity (F.P.S.)	Time Of Flight (Sec.)	Range To Max. Ord. (Meters)	Maximum Ordinate (Inches)	Energy (Ft.-Lb.)
0	3100/3247	0	0	0.0	1326/1288
100	2787/2801	.11/.10	51/51	0.58/.50	1109/968
200	2497/2385	.24/.25	104/105	2.7/2.75	861/695
300	2223/2207	.37/.39	157/162	6.7/7.8	682/492
400	1960/1660	.53/.57	215/222	11.1/15.7	531/337
500	1714/1346	.71/.78	275/286	24.4/31.5	406/221
600	1495/1079	.92/1.1	337/355	40.7/55.1	309/142
700	1304/921	1.2/1.4	401/427	64.2/94.5	235/104
800	1146/796	1.4/1.8	466/6499	97.6/161.4	181/77
900	1048/688	1.7/6.2	530/567	142.9/259.8	152/58
1000	988/598	2.0/2.7	591/633	199.5/401.6	135/43



A little mud was all it took to render the M16A1 inoperable. While it is always important to keep your weapon clean, the M16A2 is less prone to break down because of a little grime. Photo: USMC

three targets. Even though this would probably have been a tactically sound procedure, it seems like it is asking a lot from a rifleman being charged by a dismounted BMP crew!

The M16A2's burst control device is a compromise. Though imperfect, it has enough advantages to justify both its design and adoption.

Long Range Accuracy

The targets for evaluating the M16A2's semiautomatic dispersion were the same large military silhouettes used to test its burst fire capabilities. Sighting in at 300 meters found the point of impact to be low and to the right: With this sight setting, maximum ordinate with SS109 ammunition is 6.7 inches at approximately 155 meters. Pity poor Ivan, whose battle sight setting is nearly 20 inches high at 190 meters with the AKM, and 230-300 meters with the AK-74 (the sights do not closely correspond to the bullet's trajectory).

Shooting prone in the Marine Corp's

unique synthetic military sling, it was child's play to consistently shoot five shot groups of 5.5 inches at 300 meters with SS109 ammunition (1.83 MOA). Similar group sizes were obtained with M193 ammunition though its point of impact was about eight inches lower than the NATO standard ammo. Once sighted in, shooting in the unsupported prone position made no change in the point of impact of the shots. Groups in the unsupported prone position opened up to about 7.5 inches, (2.5 MOA). Sitting, without a sling, produced 13-inch groups (4.3 MOA).

People love to complain about the M16 but few military rifles are as easy to shoot accurately off-hand, sitting or prone. Its human engineering is excellent.

Well satisfied with its accuracy at 300 meters, we moved to another range and prepared to fire at 500 meters. The M16A1 needed seven clicks of windage equal to seven MOA compared to only three clicks

equal to 1.5 MOA for the A2 with SS109 ammunition. It took several minutes to adjust the windage on the A1. Obviously, in a combat situation one would have just used "Kentucky windage." But a yard of Kentucky windage is pretty hard to guesstimate! The A2's windage drum was manipulated with the thumb and forefinger in a few seconds. Even with 30mm AGS-17 grenades going off nearby and a BMP's 70mm smooth bore bearing down on your perimeter, it is not too much to ask of trained marksmen to adjust their windage.

While this is far from a definitive test, it appears that SS109 ammunition is much more effective at this range than M193, and while not on par with 7.62 Match ammo, it is certainly capable of quickly and efficiently inflicting casualties on the enemy.

The best group of the day — fired rapid fire between wind gusts with SS109 ammunition — measured only 8.5 inches vertically by 14.5 inches horizontally, equal to only 2.3 MOA. A tight sling really helps rapid fire times. This is one piece of equipment every rifleman should be taught how to use. Unfortunately, it appears that the Marine Corps is the last institution in the world to do so. The extreme spread with both SS109 and M855 (the American equivalent,) averaged 19.5x18.5 inches, which is still good enough for 100 percent hits on an E target. M193 ammunition fired through the A2 had an extreme horizontal dispersion of 34.5 inches, or about twice that of SS109 ammo! It also shot lower than SS109, requiring use of the 600 meter sight setting to get on target at 500 meters.

Though we did not have the opportunity to shoot the A2 beyond 500 meters, USMC tests indicate it can still maintain nearly 100 percent hit probability out to 800 yards. Beyond that, accuracy falls off as the bullet enters the sub-sonic zone. Still, the M16A2 is reportedly as accurate at 1,000 yards as the AK-74 at 600. Colt has produced over six million M16A1s, whose extreme spread has never exceeded 3.0-3.25 inches for 10 shots at 100 yards. Current A2s are leaving the factory with an extreme spread of only 2.0-2.25 inches!

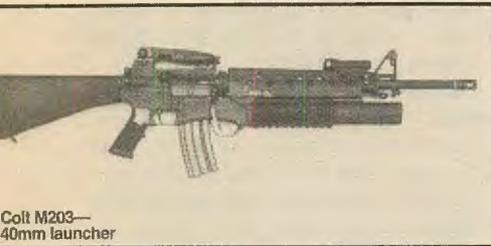
Marksmanship Is Not Absolute

After boot camp, the USMC spends two weeks qualifying their personnel on the M16A2. One week is spent in the classroom "snapping in," and reviewing basic shooting positions. An entire 12-hour day is spent on the principles behind adjusting a rifle's point of impact. Approximately half of this session specifically involves the sights on the A2. The next week is spent zeroing the rifle and firing on the Known Distance (KD) range at 200, 300 and 500 meters.

Unfortunately, the USMC may be the last military unit in the world to use this kind of training. It is marksmanship that wins battles. The Army "Train Fire" ranges which use pop up targets at 25 to 300 meters would be a useful addition to USMC training. If revenues ever permit building such a range, the expense would be well worth it. This would be an educational course as well as a



Colt M16A2 HBAR—
Model 741



Colt M203—
40mm launcher



Colt M16A2 carbine—
Model 723



Colt M16A2 Commando—
Model 733

morale booster.

One final improvement would be to include large visual aids during the "snap in" period demonstrating what typical burst fire dispersions are at seven, 15, 25 and 50 meters with the M16A2 so riflemen can judge when to use this feature. The Iran-Iraq war has demonstrated that a "target rich environment" can be expected on future battlefields and riflemen can play an important part in such a conflict. Distances at which the enemy is engaged will depend on the battle environment. Statistics from World War II to the present indicate the vast majority of small arms casualties occur within 100 meters. This concurs with our findings that this is the range at which a basically untrained individual can hit a standing man. But a trained marksman can do so at six times that range and a superior one even farther. He can also hit very small targets at moderate range (like the head of a machine gunner firing from defilade). As Col. Jeff Cooper (USMC ret.) has written, "I fail to see why a young man in 1900 could be taught to do something a young man in 1980 cannot — namely, to keep his head, hold and squeeze. Battlefields are certainly terrifying, but they are no more terrifying now than they were in 1918 — poss-

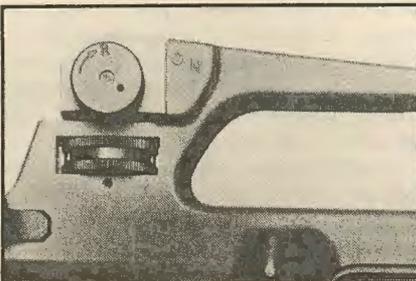
ibly to the contrary."

M855/SS109 Ammunition

For the most part, M855/SS109 ammunition is still unavailable to the services. For instance, shooters had to use M193 ammunition at the USMC Eastern Division Rifle and Pistol matches held at Camp Lejeune last May. The SS109 ammunition we fired through the A2 had the following specifications: bullet weight, 62.9 grains; powder charge, 26.3 grains; total cartridge weight, 194.0 grains; muzzle velocity, approximately 3,050 fps. It was interesting to note that the Berdan primed SS109 cases were about five percent heavier than M855 cases. M855 ammo is currently being made at Picatinny Arsenal in Dover, N.J.

SS109 ammunition has about three percent more Kinetic Energy (KE) at point blank range than M193 ammo; is 25 percent more powerful at 200 meters, 50 percent more powerful at 400 meters and nearly 100 percent more powerful at both 600 and 800 meters. M193 ammunition fired from an A1 has a rotational velocity of about 3,200 revolutions per second. The SS109 projectile has a rotational velocity of over 5,200 revolutions per second. Assuming adequate rotational velocity, longer bullets are more stable than shorter ones. The same principle explains why a car with a short wheel base is less comfortable over a bumpy road than one with a long wheel base. More than one observer has expressed concern that the comparatively long, stable SS109 projectile will not destabilize in tissue as rapidly as the short, unstable M193 bullet. This would negate much if not all of the SS109 ammunition's increase in KE.

Fortunately, this just isn't true. The SS109 projectile is 0.908 inches long. The M193 projectile is only 0.745 inches long, has a homogeneous core and a sectional density less than that of many pistol bullets. The SS109 projectile has a jacket that weighs approximately 20 grains, a 0.182 inch in diameter steel penetrator that weighs 10.2 grains and a lead core that weighs about 32 grains. There is also a small air space in the tip of the bullet since the penetrator has a blunt rather than a sharp nose. (It is virtually impossible to form a sharp point of a piece of steel that registers over 50 on the Rockwell C scale.) This air space, and the fact that steel is about 60 percent less dense than lead, moves the bullets center of gravity behind its center of form. In other



The M16A2's windage drum is manipulated with the thumb, and provides riflemen with the capability of combat windage adjustment.

words, the bullet destabilizes rapidly in tissue despite its length and high rotational velocity.

Out to about 150 meters, both M193 and SS109 ammunition often break in two at the cannellure. Beyond 200 meters both bullets will exit a 50 cm (19.6 inch) block of ordnance gelatin. Explosive type wounds can occur at even greater ranges if bone is struck. We fired five SS109 bullets into a five gallon can of water at 100 meters, and all but one of them broke in two at the cannellure. Water is about 33 percent less dense than muscle tissue, so there is no doubt that SS109 ammunition will be even more effective than M193. It seems to destabilize as rapidly and has much more KE. It also has more penetration. The steel penetrator was recovered after perforating 16 inches of water. The farthest M193 fragment penetrated 11 inches. The total weight of the jacket and core material from an SS109 bullet equals the mass of an entire M193 projectile, so just as many fragments should be created. In fact SS109 bullets should produce more shrapnel since the tip (from the cannellure forward) of M193 bullets usually remain intact. Finally, the SS109 bullets made a small fracture line in the front of the water cans. None of the M193 projectiles did so, which indicates that they are not producing as much overpressure inside the cans, which are, by the way, about the same volume as a man's chest. We feel certain that this is because the SS109 bullet has more surface area (when it pitches or yaws) through which to transmit its energy.

Barricade and Body Armor Penetration

While there is no doubt that SS109 ammunition is more lethal than M193, the new ammunition cannot overcome the Laws of Physics. Neither munition is very effective at perforating common building materials. SS109 could not perforate a common cement building block at a 90 degree angle at point blank range. Even Australian 5.56mm A.P. ammo with a tungsten core failed to do so. Yet the 7.62x39 with a lead core did it routinely and 7.62 NATO perforated two of them. To its credit, SS109 did nearly perforate the cement block while M193 only dented the front of the second face. However, it is doubtful that even an M249 SAW could endanger anyone standing behind a cinder block building considering there is a lot more cement to perforate at an angle as well as the interior framing, insulation and panneling. Operations in urban area will have to rely on the M433 DPHE 40mm grenade for the M203, the Shoulder-launched Multi-purpose Assault Weapon (SMAW,) M202A1 Multi-shot Portable Flame Weapon, LAW, and the M60, M2HB .50-caliber, and Mk.19 Mod. 3 40mm grenade launcher.

The SS109 bullet should be able to penetrate up to 70 percent more foliage than M193 ammo did. In our test we fired into a stop box of ¾-inch pine boards spaced ¾ inches apart. M193 ammo fired from an A1 penetrated 11 boards but broke in two on the

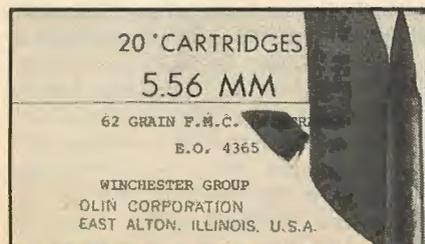
eighth. When fired in the 1-7-inch twist of the A2 it penetrated 12.5 boards and remained intact! SS109 ammunition penetrated 19 boards but broke into on the 14th. The Soviet 5.45x39 and 7.62x39 perforated 10 and 17 boards respectively, so it appears we have finally turned the tables on Ivan.

The thickest practical body armor (say, a 20 layer Kevlar vest) requires about 185 foot-pounds to perforate with a hard 5.56mm bullet. The A2 can do so with SS109 ammunition out to at least 800 meters. M193 ammo is probably only effective on such a target out to about 450 meters. 7.62x39 lead core ammo can penetrate out to about 250 meters, 7.62x39 steel core ammo (which was formally standard issue with the Soviets) can do so out to 400 meters, and 5.45x39 ammo out to about 600 meters. SS109 ammo can perforate 10mm of mild steel 50 percent of the time out to 300 meters. The armor on the glacis and top of a BMP, or any part of a BTR-50, BTR-60 or BRDM ATGM/SAM launcher ranges from five to 10mm in thickness. Very hard armor plate (over 70 on the Rockwell C scale) like that used in the Second Chance K47 inserts for their Hard Corps III vest will stop SS109 at point blank range and it is only 4.76mm thick.

An Undeservedly Bad Reputation

So the M16A2 is accurate, lightweight, lethal and has good armor and foliage penetration. It's not reliable, right? Wrong. The M16 has been under constant development and scrutiny for the past 25 years, something no other 5.56mm assault rifle can claim. During the NATO standard ammunition trials, the M16A1s used as a control group were the most reliable weapons tested. A brief review of the modifications that turned the Armalite AR-15 into the Colt M16A1 demonstrate why.

In 1961 Colt produced its first M16s on speculation and sold 1,500 to Indonesia. They had a 1/14-inch twist. In 1962 Colt sold 18,000 1/12-inch twist M16s to the U.S. Air Force. In 1963-64 ARPA supplied the South Vietnamese with their first M16s. As a result of user feedback, the Army purchased 85,000 XM16E1s with a bolt forward assist. In 1965 the 14-inch barrel CAR was developed. In 1966 the bird cage flash suppressor replaced the three-prong device used on previous rifles. The three prong suppressor got caught in foliage too easily. This was the year our arsenals also switched from extruded single base DuPont powder to double base ball powder. The reason they



Even at point blank range, no 5.56mm ammo could perforate a single cement building block. Olin's "Penetrators" came close.



Twenty five thousand M16A2s will be delivered to the Marine Corps in Fiscal Year 1984. Fifty thousand more will be procured within the next two years. Photo: USMC

switched, despite what you might have read in *Atlantic*, was to increase production rates through high speed reloading machines. This also resulted in a 100 fps increase in velocity and a higher cyclic rate. In 1967 Colt chromed the key and inside of the bolt carrier. By 1968 the M16 had become famous for producing short strokes and failing to eject its cartridge case. A number of things were responsible, but rust in the chamber was probably the main culprit. Within eight months in 1968, Colt replaced every known M16 barrel in Vietnam with one having a chromed chamber.

The M16 did not have a chromed chamber in the first place because the DOD did not request it. Chrome plating technology may not have been adequate to lay down a fine enough layer much earlier than this anyway. Between 1967 and 1969 the buffer system was modified. The original unit consisted of three washers. The replacement used seven steel weights with a plastic bumper between each weight. This altered the unlocking speed of the bolt and reduced the cyclic rate which resulted in greater longevity. In 1970 calcium carbonate, a flash suppressant, was almost eliminated from military 5.56mm powder. This reduced fouling of the rifle's gas tube. These changes made the M16A1 one of the most reliable assault rifles ever made. Unfortunately, we had to learn our lessons in the middle of a war. But then, life is seldom fair.

The M16A2 still retains one serious flaw it has inherited from the original Armalite AR-15; a receiver which has too little overtravel for the bolt group. This causes a comparatively high percentage of simple Class 1 malfunctions, especially when chambering the first round from a magazine. This can be avoided by training personnel to chamber the first round of a magazine by pulling back on the charging handle rather than using the

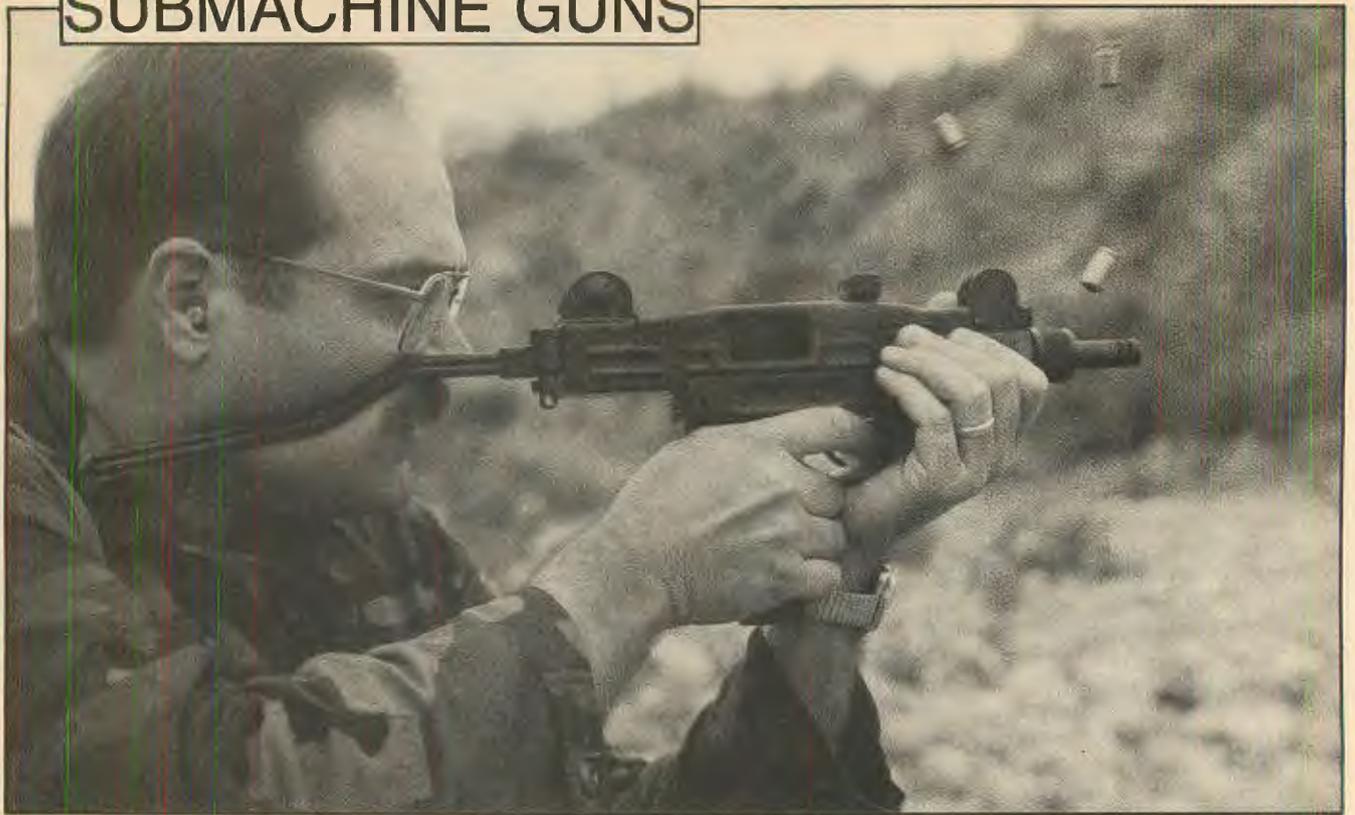
bolt catch. This gives the bolt group another 1/4-inch of overtravel, which is all you need for reliable operation. It is a pity Colt did not add half an inch to the receiver back in 1961. No one would have minded the extra length of pull! The ejector spring should be replaced after 6,000 rounds.

Our final criticisms have to do with the miniscule cam pin and retaining pin, both of which are easily lost and difficult to assemble in a hurry, in the dark, or with cold fingers. The inside of the bolt and bolt carrier are also difficult to clean. The Colt has six sub-assemblies when field stripped, the AK only four.

Dogs May Bark But the Caravan Moves On

Their is an old Arabic saying, "the dogs may bark, but the caravan moves on." Despite criticisms, the M16 was the first "third generation" (reduced caliber) battle rifle ever adopted by a military force and is indicative of our world-wide leadership in military science. Fortunately, the USMC got hold of the rifle and put back into it some "good old fashioned" concepts like decent sights, and ammunition that can disable a man as far away as he can be seen. The M16A2 is not perfect, but it is arguably the best reduced caliber assault rifle made in the West.

It is difficult to compare the M16A2 to the AK-74. The AK is only capable of 100 percent hits on a man out to about 330 meters. The M16 can do so out to at least 750 meters. An AK-47 or AKM can only get 50 percent hits out to about 200 meters. A man equipped with an A2 can carry his rifle and 450 rounds of ammunition and be within a "comfortable" 10 kg weight limit. Ivan can only carry 360 rounds. The M16A2 is not better than the AK-74, it is just different. But it is a difference "a few good men" will appreciate. □



ISRAEL'S MINI UZI

One for the Trenches

by Peter G. Kokalis

FOREVER branded with the stigma of police brutality and memories of the gangster era, the submachine gun lies hidden in the darkest corners of most U.S. police department arms lockers, awaiting Armageddon. However, a closet fascination with this supposed edge in firepower remains strong, and U.S. law-enforcement submachine-gun sales are brisk, but low profile. The growth of so-called police tactical teams has offered a convenient, but often blurred, rationalization for their procurement.

When properly employed by trained operators, the submachine gun is a more intelligent choice than the modern assault rifle for most urban law-enforcement scenarios, as its lower power and range become attributes. I was recently dismayed to hear

the rumor that the U.S. Secret Service has turned in its UZIs for short-barreled assault rifles. God help any innocent bystanders trapped in the hail of their blazing full-auto assault rifles!

Born in the trenches of World War I, the submachine gun was brought to dominance by the Soviets in World War II, when they swarmed like yellow jackets atop their T-34 tanks armed with the PPSH 41. Of the more than 20 million submachine guns produced by the belligerents of WWII, nearly half were PPSH 41s. At least three men out of every Russian eight-man infantry squad were armed with submachine guns. The Russians utilized the submachine gun principally for reasons of expediency. It was quick, dirty and cost-effective, i.e., two PPSH 41 barrels could be had from the same

stock required for one 7.62mm Mosin-Nagant rifle barrel.

When Israel became an independent nation in 1948, its need for small arms to fend off those pledged to its eternal damnation was desperate and immediate. With an industrial capacity in its infancy, an easily produced submachine gun was an attractive alternative. Under the direction of Israeli Army Maj. Uziel Gal, Israeli arms technicians examined the most advanced submachine-gun designs of the day to develop a suitable weapon. The result, borrowing heavily from the Czech ZK 476 and its descendants, the Czech models 23 and 25, was the UZI. First produced in 1951, it was used in combat almost immediately and saw extensive action during the Sinai campaign against Egypt in 1956.

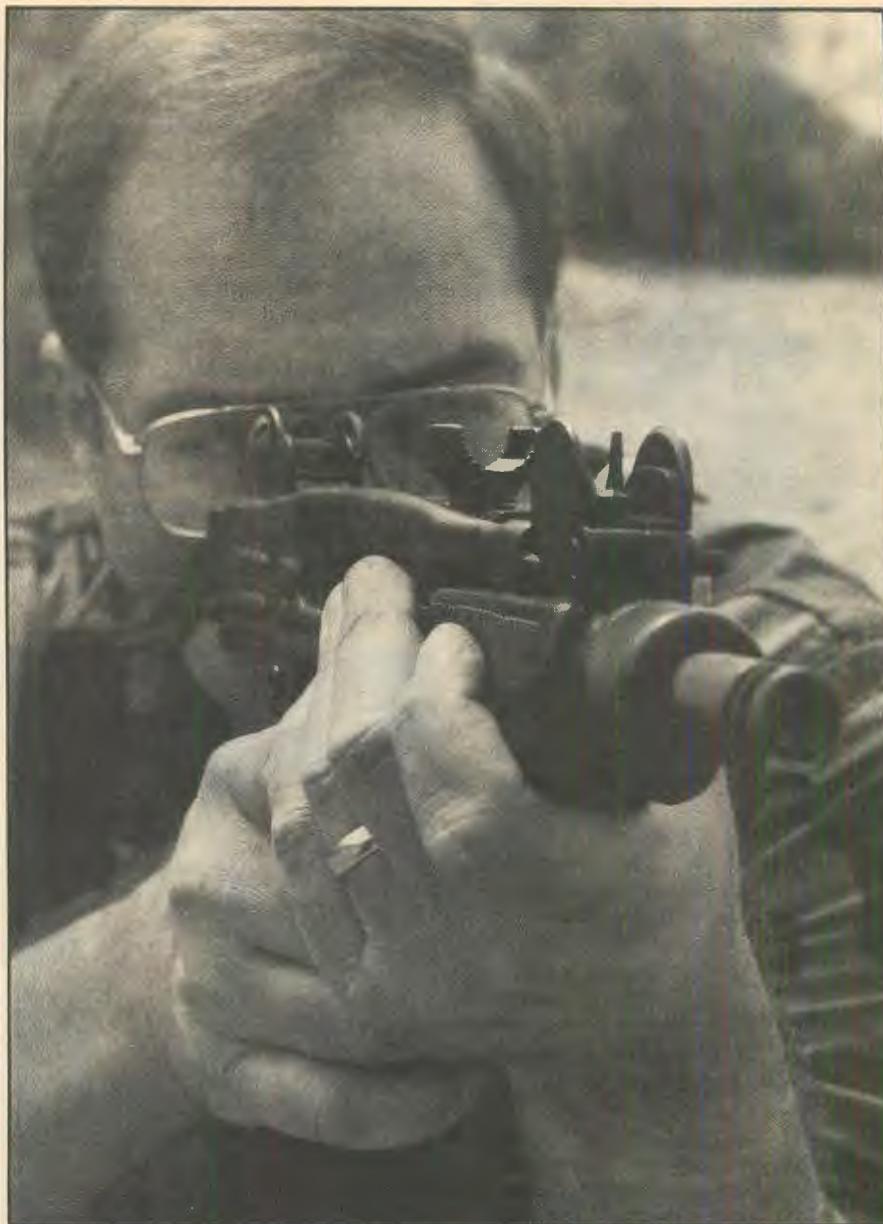
By now as easily recognizable to all as is the Thompson (the "Chicago typewriter"), the UZI went on to become one of the most reliable and widely used submachine guns in current production. Blowback-operated and firing from the open-bolt position by means of advanced primer ignition, the UZI achieved its relatively short overall length by telescoping the bolt over the barrel in the manner of the Czech designs. This allowed location of the magazine within the pistol grip, improving the weapon's balance and permitting rapid magazine changes, even at night, by the principle of "hand finds hand."

Once alone in its class, the UZI has, within the last decade, been the subject of increasing competition from the likes of Beretta (Model 12S) and Heckler and Koch (MP5). Originally equipped with a detachable wooden stock, a folding metal stock was designed by Israel Galili at the request of the Dutch. With their respective metal stocks folded, or retracted, the UZI with an overall length of 17.9 inches lies between the H&K MP5 (19.3 inches) and the Beretta M12S (16.4 inches). However, at 7.7 pounds, empty, the UZI is heavier than both the Beretta M12S (6.6 pounds) and the H&K MP5 (5.6 pounds). It's even heavier than the M16A1 rifle (7.0 pounds).

With Beretta, H&K, Colt (a new 9mm submachine gun using the M16 chassis has already moved beyond the prototype stage) and others breathing down their necks, Israel Military Industries (IMI) directed their premier designer, Israel Galili, to develop a new generation UZI. His response, appropriately enough, is called the Mini UZI.

In general configuration Galili's creation is still unmistakably an UZI. The method of operation remains the same: blowback with advanced primer ignition firing from the open bolt. The trigger housing assemblies are identical. Thus, the grip safety, which is not an option I favor, is still present. The selector switch is also the same. Although stiff and somewhat difficult to manipulate, it is at least arranged with the correct sense of direction: One pushes forward with the thumb to move from "S" (safe) to "R" (repetition: the British expression for the semiauto mode) and thence to "A" (full-auto). As with all submachine guns whose pistol grips envelop the magazine well, the grip-to-frame angle is not as ergonomically satisfying as those of the Sterlings and Beretta Model 12 series.

Well-protected by heavy ears, the rear sight is reduced in size, but retains same flip-type 100- and 200-meter apertures.



Improved stock and sights provide an excellent firing platform. Target-acquisition time has been reduced significantly over the Mini UZI's predecessor. A reliable performer, the new UZI should appeal to airborne and naval commando units.

The stamped sheet-metal receiver body, although shorter by almost three inches, bears the characteristic long, narrow side ridges which act effectively as dirt traps, ensuring reliable operation under the most extreme conditions of debris and sand. The receiver cover continues to carry the UZI's third safety — a ratchet which locks the bolt if the retracting knob (identical in both guns) is accidentally released from an incomplete cocking motion. The barrel retention system of the UZI is also duplicated — a threaded muzzle nut locked in place by a spring-loaded catch.

Galil has also retained the bayonet stud, a feature I find most bizarre on a submachine gun this small. The black baked-enamel finish over phosphate (Parkerizing) remains. It is durable and corrosion-resistant, especially in tropical climates.

The barrel length has been reduced from 10.2 inches to 7.7 inches. Both barrels have four grooves with a right-hand twist of one turn in 10 inches. At the moment of ignition



Folding stock doubles as a front-end pistol grip. This handy feature keeps the front hand away from the barrel.

the telescoping bolt surrounds 3.6 inches of the UZI's barrel and 2.1 inches of the Mini UZI barrel. By placing more weight over the chamber — where the explosion occurs — upward climb during recoil is somewhat reduced. This bolt/barrel relationship is also partially responsible for the natural pointing characteristics of most submachine guns that incorporate recessed bolts. In addition, it is an added safety factor in the event of a blown case.



New DeSantis rig for the Mini UZI allows easy access without bulk. Worn on the strong-arm side, the barrel is simply freed from bottom and swiveled into the firing position.

The Mini UZI bolt retains the same square-cut configuration and the width and height remain the same. The extractor and fixed firing pin are that of the UZI. The overall length, however, has been reduced by 1.6 inches with a corresponding reduction in weight from one pound, 10 ounces to one pound, four ounces. Shaving six ounces off the bolt's mass produces the expected

MINI UZI SPECIFICATIONS

- Caliber** 9mm Parabellum
Method of Operation Blowback; open breech; advanced primer ignition with fixed firing pin
Type of fire . Selective: full-automatic or semiautomatic
Magazine Staggered box-type; two-position feed; 20-, 25-, 32- and 40-rd. capacities
Safety Systems 1) Fire selector in position "S"; 2) Grip safety; and 3) ratchet on retracting knob
Sights Adjustable front post and flip-type aperture rear, 100 and 200 meters, adjustable for windage
Stock Folding one-piece metal stock
Barrel . four-groove, right-hand twist, one turn in 10 inches
Barrel length 7.7 inches
Length, stock folded 14 inches
Length, stock extended . . . 23.5 in.
Weight, empty 5.8 lbs.
Cyclic rate 1,100 rounds/minute
Price \$595
Manufacturer Israel Military Industries
Distributor Action Arms Ltd., Dept. CW, P.O. Box 9573, Philadelphia, PA 19124

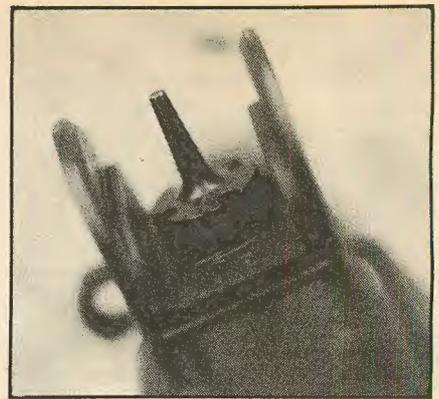
trade-off. The cyclic rate has been increased from 550-600 rpm — the generally accepted ideal range — to almost 1,100 rpm (although the instruction manual states it is 950 rpm). A two-vent brake has been cut into the upper right side of the barrel's muzzle to inhibit climb during full-auto fire. It proved to be quite effective during the CW test and evaluation. The recoil spring and guide rod have been cut by almost three inches and the fiberboard buffer deleted. The ejector remains attached to the bottom of the receiver body, just to the rear of the magazine well. The Mini UZI's overall weight is 5.8 pounds, empty — almost two pounds lighter than the 7.7-pound UZI and now almost as light as the H&K MP5.

The overall length of the Mini UZI with the stock folded is 14 inches, shorter by 3.9 inches than the UZI. The new folding metal stock offers a much needed improvement. The scissors-like stock — so difficult to open completely under stress — has been



replaced by a one-piece unit that pivots to the right. It's sturdy and rigid when extended and just the right length for a rapidly acquired and consistent stock-weld that improves the speed of target acquisition by a considerable margin. Yet, only a single sharp slap of the hand will swing it instantly against the receiver. When folded, the butt plate serves as a vertical foregrip to steady the weapon when firing from the hip assault position. The two-piece black-plastic hand-guard has been cut back by 1½ inches and now affords just barely enough purchase to prevent the support hand from slipping.

The front sight post, higher by a quarter inch than its predecessor, is now adjusted for initial elevation zero in the same manner as the M16. The post is no longer offset of center and its adjustment up or down will not change the windage zero. It and the rear sight are well-guarded by sturdy protective ears. Although reduced in size, the flip-type 100- and 200-meter rear-sight apertures keep the same diameters. They are now



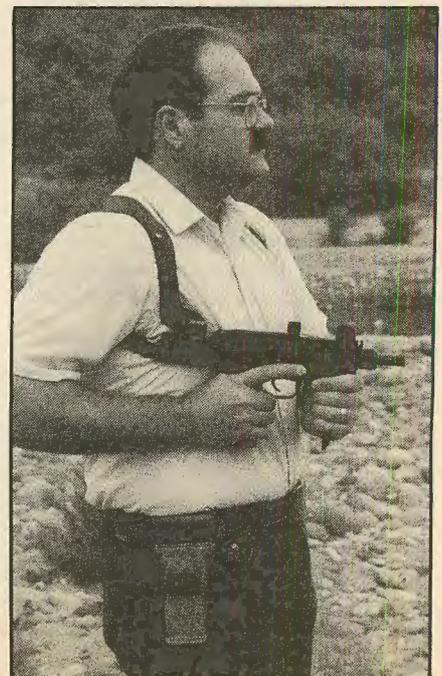
Mini UZI sights are simple and tough. Sturdy lips on sides of both front and rear sights protect them from damage.

more easily adjusted by the same tool provided to manipulate the front sight post.

To the somewhat shortened UZI sling have been added spring hooks which attach to the 360-degree rotating sling swivel eyelets mounted on the front and rear of the receiver body. The sling is now much easier to remove. The sling and sight tool are issued with the weapon along with a nylon cleaning brush, plastic oil bottle and cleaning rod (to which is attached a useful steel-and-leather washer travel-stop).

A new 20-round magazine has been provided to complement the Mini UZI's compact anatomy. It is of the two-position-feed type (originally developed by Beretta) and fully compatible with the 25-, 32- and 40-rd. UZI magazines. As less than ⅝-inch of the 20-rd. magazines protrudes from the magazine well, the IMI "L" clip, used to join two magazines, cannot be fitted. The optional magazine loader will accept all four magazines.

Gene DeSantis (DeSantis Holster and Leather Goods, Dept. CW, 155 Jericho Turnpike, Mineola, NY 11501) is well known as a provider of highly specialized



leather products for government agencies. Gene has modified his unique UZI shoulder rig to accommodate the Mini UZI. The Mini UZI really lends itself to concealed under-the-coat carry. The DeSantis rig holds the weapon, barrel down, under the strong-side (firing hand) armpit. A leather retention band which wraps around the rear of the receiver (with the stock folded, of course) in front of the rear sight is attached to an extra-wide, fully adjustable suede shoulder harness. The other end of the shoulder harness holds a magazine pouch under the weak-side armpit that contains two 32-rd. magazines. The pouch is secured to the wearer's belt by an elastic band. An adjustable muzzle carrier secures the Mini UZI to the belt also.

In use, one simply pulls the Mini UZI up to clear the muzzle carrier and then pivots the weapon forward into an underarm firing position. It's very fast and quite a bit more concealable than one would imagine. Gene's slick rig should prove to be just the right ticket for security personnel, police stake-out teams, clandestine government operatives, covert military units and the streets of San Salvador. The price is a very proper \$79.95.

Disassembly procedures for the Mini UZI follow those of its ancestor. After removal of the magazine and clearing of the weapon, move the selector switch to either "R" or "A." Depress the spring-loaded receiver-cover latch, pull the receiver cover upward and remove. Press the grip safety and push the bolt back, up and out, together with the recoil spring and guide rod. Press the barrel



Various capacity magazines are available for both UZIs. The staggered box-type, two-position feed magazine is available in a 20-rd. version to complement the Mini UZI's small profile.

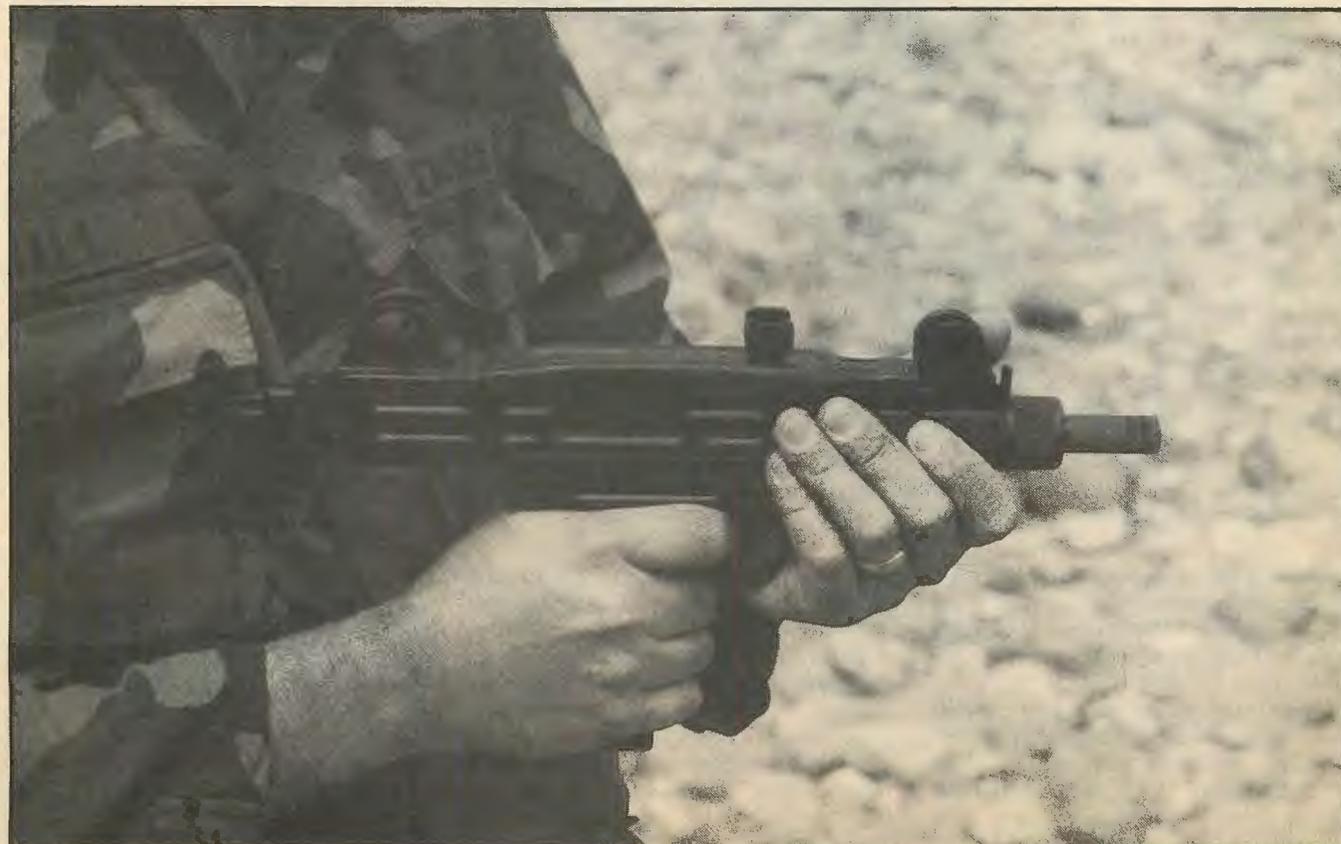
retaining catch, unscrew the barrel nut counterclockwise and withdraw the barrel. To remove the extractor, push out its retaining pin and pull out the extractor from the rear of the bolt body. The trigger housing assembly can be removed from the receiver body by pushing out its retaining pin.

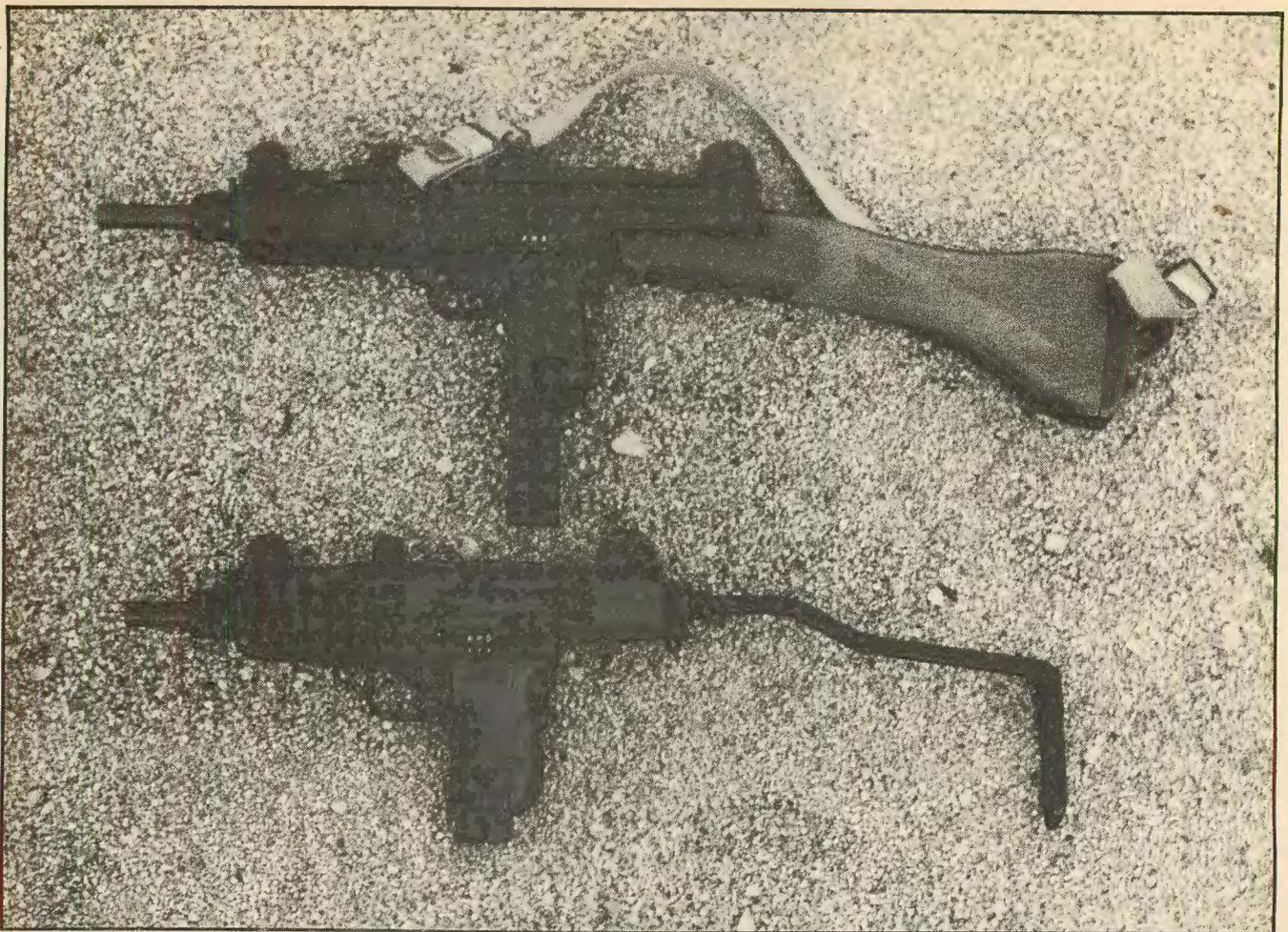
Assemble in the reverse order. When replacing the trigger housing make certain the sear does not protrude upward (if it does, place the selector switch to "R" and press the sear downward until it engages the disconnecter). After the extractor is reinserted

be sure the slot on its end is aligned with the arrow on the rear of the bolt body. When the barrel is put back in place its circular protrusion must line up with a similar protrusion on the barrel housing.

The submachine gun will live on, its role in military activities now sharply constricted to commando operations in counter-insurgency warfare and a few more specific applications, such as by Coast Guard boarding parties. As the last submachine gun officially adopted by the U.S. military services was the woeful M3/M3A1 "grease gun,"

Because its weight is greater than a pistol firing the same round, the Mini UZI has virtually no recoil. Two-vent brake cut into the upper-right side of the barrel's muzzle prevents climb during full-auto fire.





TOP: Side by side, the two Uzis are hard to differentiate. Old-style wood stock (top) makes full-size UZI almost as short as the Mini. **ABOVE:** Keeping the same overall configuration as the full-size model, the Mini UZI differs only in size and weight.

three years ago the Naval Weapons Support Center, under the auspices of JSSAP (Joint Service Small Arms Program), issued a Mission Essential Need Statement for this genre.

Their list of desired characteristics offers a useful commentary on the often considerable gap between reality and the dream sheets presented by the *end users* (not the illusory ivory-tower engineers that overpopulate the fevered fantasies of the popular

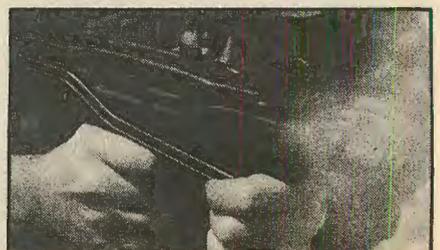
gun press). In the interest of NATO standardization, the weapon must fire the 9mm NATO cartridge. Cult worshippers of the almighty .45 ACP aside, the 9x19mm cartridge has spent the last half century demonstrating its superiority as the optimum sub-machine-gun chambering.

JSSAP's dream machine must be capable of functioning in both the full- and semiauto modes from both the open- and closed-bolt firing positions, with emphasis on closed-

bolt operation. A bolt lock for single-shot fire was also desired. These latter characteristics are for enhancement of accuracy and operation with a sound suppressor, also a required accessory. A cyclic rate of 400-500 rpm and a three-shot burst mechanism operating at 1,200 to 1,400 rpm was requested. The easily removable sound suppressor should reduce standard 9mm NATO peak sound-pressure levels by a minimum of 30 db in the 1-20,000 Hertz range, while not adversely affecting accuracy or velocity and giving no evidence of "first-round flash."

Heat buildup should be controllable and minimum bulk and long life are important. There must be no gas blowback into the firer's face in the suppressed mode. Mechanical noise must be minimized. Controllable one-hand firing in both the full- and semiauto modes is a paramount consideration. The weapon must have an integral

The old scissors-like stock — difficult to open under stress — has been replaced by this excellent one-piece unit that folds to the right.





Comparative bolt size of the UZI (top) and Mini UZI. Width, height, extractor and firing pin remain the same on the new square-cut bolt.

sight base that will accept commercial collimated sighting equipment (Armson O.E.G., Single Point, Quick Point, etc.). The issue sights must be simple, rugged and yet allow for complete adjustment. Corrosion-resistant materials and/or finishes are encouraged on all parts of the system. The minimum magazine capacity is to be 30 rounds. The magazine catch release must allow ambidextrous operation. A barrel length of eight inches or longer is preferred, as is a weight of four to six pounds, empty and without suppressor.

The empty case-ejection path must be away from the shooter's face, whether left or right handed, and should not be upward for reasons of position disclosure. The submachine gun must have a folding stock for compactness that permits firing when collapsed. The accuracy requirement is a maximum two-mil dispersion (3.865-inch-diameter circle at 50 meters) from a machine rest. The weapon must function reliably after exposure to military standard severe environments (dust, sand, salt water, temperature extremes, etc.) with a minimum life of 10,000 rounds without major repair. Finally, and most dumbfoundingly of all, the capability of firing a minimum of five rounds full-automatic with the ejection port blocked is of some interest!

The Mini UZI and every other submachine gun now in existence fall far short of meeting all of the above characteristics. While some of JSSAP's specifications bor-

der on the ludicrous, the stipulation for incorporation of a sound suppressor has now become the submachine gun's most viable military *raison d'être*. The future success of the Mini UZI would have been better assured by provision of this feature instead of a bayonet stud.

But the Mini UZI is a sturdy, reliable performer. After several thousand rounds it has more than adequately demonstrated its capacity to digest a wide assortment of 9mm Parabellum ammunition. My only serious reservations about this weapon lie in the area of its high cyclic rate. Yet, for an experienced operator, consistent three-shot bursts are the norm and group dispersion is no greater than would be expected at half the cyclic rate — a consequence, no doubt, of the integral muzzle brake.

The Mini UZI's capsulated envelope and reduced weight will appeal to airborne and naval commando units. And, fortunately, the accuracy potential has not been degraded. The improved stock provides an excellent firing platform and together with a fine set of sights has reduced target acquisition times significantly. When folded, the stock's buttplate acts as an excellent vertical foregrip which, with the sling correctly employed, greatly assists controllability in the hip assault-firing position. The trigger pull weight is a crisp 7.5 pounds — no less than it should be for a submachine gun and quite a bit better than most. During sustained firing tests no tendency to overheat was

noted, despite the increased cyclic rate and abbreviated handguard.

The Mini UZI is a logical evolution of its famed predecessor, which carries this series into the mainstream of current submachine-gun tactical-employment concepts and further serves to illuminate the continued military small-arms brilliance of its designer, Israel Galili.

The Mini UZI is available to law-enforcement agencies and qualified Class 3 dealers only through its exclusive U.S. importer, Action Arms Ltd. (Dept. CW, P.O. Box 9573, Philadelphia, PA 19124). □

Selector switch is identical to that of its big brother. A: full-auto; R: repetition; S: safe.



ASSIGNMENT: AFGHANISTAN

Omega Group Uncovers Soviet Secret Weapons

by David C. Isby

DARRA, PAKISTAN—There was little cover in the rock-strewn valley. Sentries on the crests of the surrounding hills kept watch, as did the Afghan *mujahideen* standing around the 12.7mm DShK heavy antiaircraft machine gun. The Afghans had set up a target range where we would do our work. I was there, along with Karen McKay, (executive director of the Washington-based Committee for a Free Afghanistan), the first Americans to test-fire the new Soviet AKR 5.45mm assault rifle (see "AKR," SOF, July '84) — another first for *Soldier of Fortune* and Omega Publications.

The AKR was not the first intelligence coup Omega Group had pulled off during the course of the war in Afghanistan. We have been reporting and analyzing the Afghanistan War since the Afghans began to fight against the shining future under communism the Soviets had prepared for them.

Many wars are noted for their intensive press coverage. Vietnam, Lebanon and El Salvador all attracted newsmen in battal-

ions. Reporters often decide events, rather than soldiers. But the American press has not shown itself in strength in Afghanistan. Part of the reason was that, after the initial invasion, it was not considered hot news. The United States was not involved. The fact that the one-and-only communist dictatorship superpower was busy slaughtering people meant less when the people wore strange clothes and spoke a strange language. No one has gotten very excited about Afghanistan. Just like no one got very excited when one-third of the population of Cambodia perished in a campaign of auto-genocide. We live in sophisticated times.

Afghanistan is a hard war to cover. Journalists cannot stay at a reasonable hotel with a reasonable bar, and cover the war a day at a time. Covering the war in Afghanistan means humping your pack over mountains out where anything flying belongs to the bad guys who enjoy nothing so much as dropping little land mines that will blow off your foot. Forget about doctors and hospitals. Because of this, our coverage of Afghani-

stan is a lot better than that appearing in most of the "prestige" press. It was not always so.

Earlier in this century, many popular publications ran front-line reporting from writers such as, for example, Ernest Hemingway, or Richard Harding Davis, to name just two. Today, Omega Group and *Combat Weapons* carry on the tradition of front-line journalism on a regular basis, unlike much of the prestige media. Our writers and readers tend to know a lot about war, weapons and their use. We can evaluate reports and material that the average journalist or writer cannot. This keeps the writers honest. They know our readers can tell the real thing from barroom war stories.

AFGHAN AUTHORITY

David Isby is the best kind of foreign correspondent.

His credentials as an expert in the field of Soviet tactics and weaponry are impeccable. Currently Omega Group's Contributing Editor on Soviet Affairs, Isby was an editor from 1970-79 at *Strategy and Tactics Magazine*. He is the author of the definitive *Jane's Weapons and Tactics of the Soviet Army* and has written well over 100 articles for dozens of publications.

Although Isby is an authority on the war in Afghanistan (see SOF, April '81, August '83, March '84), he was not content to sit back on his reputation and turn out articles based on second-hand information. When offered the chance to travel to Afghanistan he jumped at it, and spent part of 1984 in the field with the Afghan resistance as our correspondent. His reports from Afghanistan appeared in the July through October '84 issues of SOF.

When he isn't travelling and writing for us, Isby, a lawyer who specializes in international affairs, is a national security expert in Washington, D.C.

BELOW: *Combat Weapons* combat correspondent Galen Geer, on assignment inside Afghanistan, examines captured Soviet weapons with mujahid rebel. **RIGHT:** Omega Group Publications Publisher Robert K. Brown brandishes captured AKMS at a forward base inside Afghanistan.







To get the full story from Afghanistan, our reporters collect both news and hardware. Karen McKay and I arranged for our side to get their hands on what we were told was the first Soviet rifle silencer to come to this country since 1945 — an interesting if technologically primitive system (for a full profile of the silencer, see *SOF*, August '84, and coverage in this issue on page 102). We also found a Soviet copy of the U.S. Claymore mine, another example of the Soviet tendency to copy useful systems. (*SOF*, September '84, has information on this and other interesting hardware.)

The AGS-17 *Plamya* 30mm automatic grenade launcher was little known before they started to see action in Afghanistan. British intelligence — which has run an excellent technical intelligence operation from Afghanistan — brought out the first AGS-17 to come West. But it fell into the black hole of Official Secrecy. It was *Soldier of Fortune* that had the first open-source hands-on evaluation of the AGS-17, with Peter Kokalis and Jim Coyne getting to fire a captured one. (See "Raiders of the Lost Grenade Launcher," *SOF*, February '83.) We also brought back the first ammunition from the AGS-17 from Afghanistan, and were the first to find the flechette fragmentation grenades fired by these things. We're still looking for the reported HEAT antitank round.

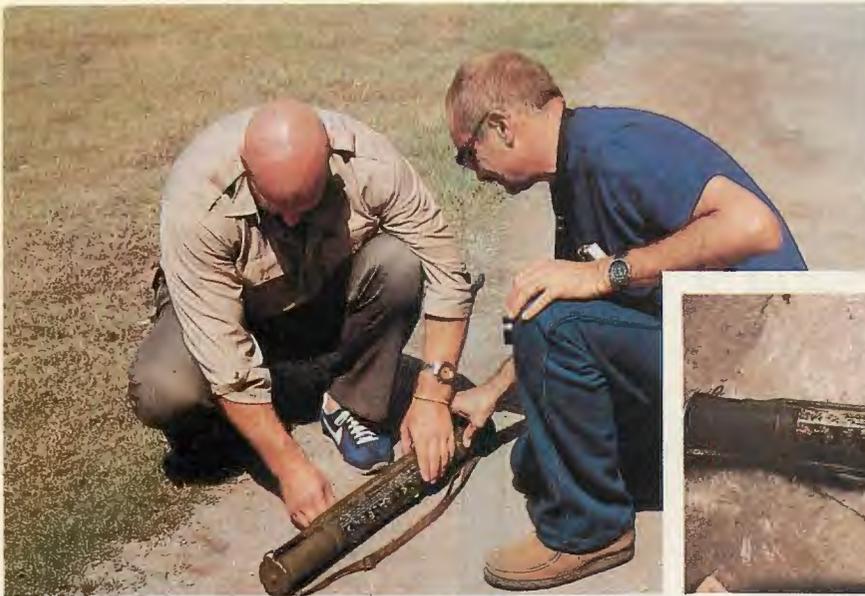
The Soviet copy of the U.S. 66mm M72 LAW, the RPG-18, first saw action in Afghanistan, and our reporters were able not only to examine these weapons in the field, but present photographs and analysis of yet another copied weapon ("USSR's Great Leap Backward," *SOF*, February, '83).

LEFT: "Poison Bullet" Soviet assault round was first brought to the West by Omega Group correspondent. **BELOW:** First to evaluate the RPK-74 LMG, Omega staffers continue to develop their long-standing relationship with the Soviet family of 5.45mm weapons.

One reason why we have put so much emphasis on the weapons with which the Soviets are fighting the war in Afghanistan is because one day it may be American fighting men — rather than Afghans — who are up against the Soviets. Our government has a distressing tendency to classify material, keeping it out of the hands of the end users who have the real need to know. If one of our reporters speaks to a guerrilla leader on the best way to ambush Soviet convoys, that is journalism. If one of our intelligence agencies does the same thing, that is intelligence gathering. Despite the fact that it may be the same information, their version will be highly classified while *Combat Weapons* will be available on your local newsstand. This frequently frustrates the professionals, but they by no means view our magazine as a competitor. Rather, the ability to be able to cite published sources in open literature for their facts makes their job easier. That is why the CIA reads *Soldier of Fortune* and *Combat Weapons*. It's not envy. To them, it's valuable source material.



LEFT AND BELOW: Omega Group's John Donovan (left) and Peter Kokalis examine Soviet copy of U.S. 66mm M72 LAW, the RPG-18. Our correspondents were the first to photograph this new weapon.



If there is any weapon, along with the Mi-24 Hind attack helicopter, that has become identified with the Soviet war against the people of Afghanistan, it is the PFM-1 antipersonnel mine. These are light, plastic horrors, dropped in containers from helicopters. When our correspondent first brought back samples of the PFM-1 from Afghanistan, there was no open-source information available on it in the West. Even *Jane's* reference books were silent. U.S. Army training literature did not mention it. As there was no attempt to tell the troops about these things, GIs with more curiosity than brains could have done what similarly blessed Afghans have done — picked the things up, with predictably disastrous results. *Soldier of Fortune* published a recognition chart, showing everyone what a PFM-1 looked like. We also paid to have an independent chemical analysis of the liquid explosive that is the key to the way the PFM-1 works. We also were the first people to discover that the PFM-1 was a copy of a U.S.-designed mine — the BLU-43/44 Dragontooth.

Our research was not limited to the technical details of the PFM-1. We described how it was used, and what it would do — it will take off a foot quite nicely (see "Another Successful Afghanistan Treasure Hunt," *SOF*, April '81). The PFM-1 is an excellent interdiction weapon. Denying the



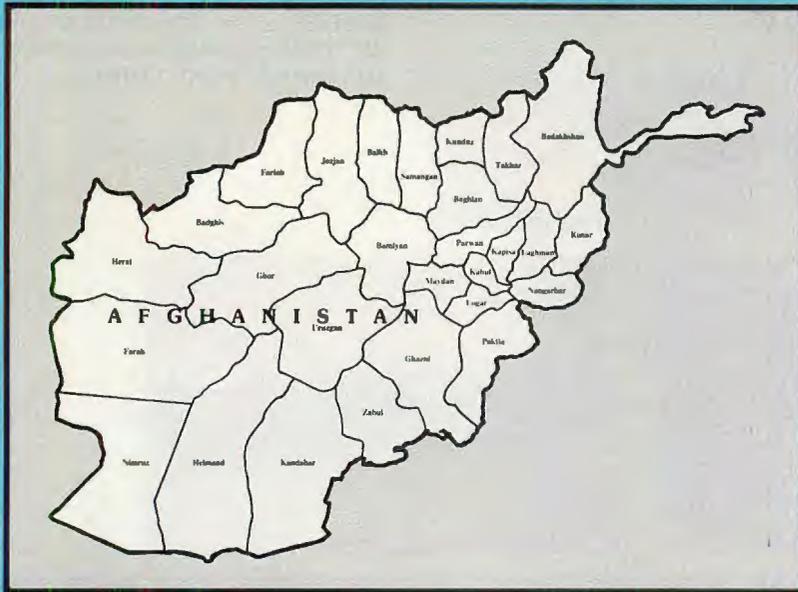
guerrillas free night movement has been one of the main Soviet tactical goals. Today, information on the PFM-1 is freely available to anyone who needs it — in part because the Omega staff first brought the mine to the world's attention.

A considerable number of 5.45mm AKS-74 assault rifles and RPK-74 light machine guns have now come to the West. But the first ammunition for this new series of weapons, and the first full open-source evaluation of these weapons, were brought to the free world by *Soldier of Fortune*. In a series of articles we detailed the story of this new series of Soviet infantry weapons.

The story of Omega Group and the Soviet 5.45mm weapons family is an epic one. It started back in 1980, when our man Galen Geer trekked into Paktia Province to meet with Jalulladin, the provincial commander of Younis Khalis's Hezbi-Islami party ("Assignment Afghanistan," *SOF*, September '80). Jalulladin's fighting men had captured 5.45mm ammunition. The rounds brought back by Geer were the first 5.45mm specimens to be examined in the United States. We provided samples for

ABOVE RIGHT: Omega correspondent Jim Coyne fires the AGS-17 30mm automatic grenade launcher. RIGHT: *Combat Weapons* Publisher Robert K. Brown examines captured Soviet AK-74 (shown field-stripped, below). Brown was first Western civilian to fire the new assault rifle.





OMEGA GROUP'S AFGHANISTAN "FIRSTS"

- September '80 — 5.45mm "POISON BULLET"**
Omega Group combat correspondent brings back first samples of new Soviet assault round to be examined in the West.
- February '81 — AK-74 ASSAULT RIFLE**
Robert K. Brown is first civilian to fire AK-74 assault rifle. Brown returned to the United States with 5,000 rounds for further testing.
- April '81 — PFM-1 ANTI-PERSONNEL "BUTTERFLY" MINE**
First to bring out samples and first to determine that mine is a copy of U.S.-designed BLU-43/44 Dragontooth mine.
- September '82 — 5.45mm AKS-74 and RPK-74 LMG**
First open Western source to test and evaluate this new series of Soviet infantry weapons, as well as bringing ammunition samples West.
- February '83 — AGS-17 "PLAMYA" GRENADE LAUNCHER**
First open source to conduct hands-on test-firing and evaluation and first to bring AGS-17 HE 30mm grenades West.
- February '83 — RPG-18**
One of the first to photograph and analyze this copy of U.S. 66mm M72 LAW.
- May '84 — SOVIET-ISSUE BODY ARMOR**
Brought home two examples of previously unknown light metal vests, plus heavier "flak-jacket" version.
- July '84 — AKR "KRINKOV" ASSAULT RIFLE**
First Westerners to test-fire new 5.45mm assault rifle.
- August '84 — AKM SILENCER**
First to examine captured "Spetzntaz" suppressor designed as issue equipment for Soviet 7.62mm AKM assault rifle.
- 1980 — Present — CHEMICAL WARFARE PROTECTIVE EQUIPMENT**
Omega group has continuously examined and brought back home samples of chemical protective equipment, including a filter element from a BMP-1 Infantry Fighting Vehicle, which may well have been the first of this type of system to be seen in the West.
- Mi-24 HELICOPTER PARTS AND ARMAMENT**
Omega staffers have continuously dealt with Afghan entrepreneurs in attempts to obtain various parts and armament from the Russian attack chopper. Some of these parts were offered for sale through the magazine.

In addition, Omega Group has procured documents, photographs, maps, interviews with Soviet prisoners, soldier's identification, papers and diaries that have provided Western intelligence analysts with a better understanding of Soviet strategy and tactics.

evaluation by the defense community — who fired them from a U.S.-produced barrel at Aberdeen Proving Ground — and the National Rifle Association. In September, 1980, Omega Group Publisher Robert K. Brown was the first civilian to fire the AK-74 and subsequently arranged for the transfer of 5,000 rounds of the new ammunition to U.S. military authorities for additional testing. We got a good idea why the Afghans call it "the poison bullet" because so few of those hit by it survive. Not only does it tumble when it hits a body, causing massive internal damage, but there is an internal "air space" that gives an almost hollow-point effect to these bullets. Our side appreciated having a good look at these.

While we did not bring any 5.45mm automatic weapons back to this country, due to miserable little technicalities like customs laws, over the years of the Afghanistan conflict Robert Brown, Jim Coyne and Peter Kokalis, as well as Karen McKay and myself, have been in the field with the Afghan guerrillas and had the opportunity to fire and evaluate not only the AKS-74 assault rifle, but the AKR assault rifle and the RPK-74 light machine gun as well. *Combat Weapons* has had a special interest in Soviet infantry weapons and equipment. Too often, the concerns of the people on the cutting edge of our national security are forgotten next to the admittedly important questions of grand strategy or which items of high-technology hardware to procure. Our staff remembers that it is the fighting man on the ground who has created or ended the lives of nations.

The discovery of Soviet body armor is another Omega Group first. Before the photograph of this body armor appeared in the magazine, there had been no discussion of any post-war Soviet body armor in any open-source Western publications. We also looked to find out how the body armor has been used in action. We have brought back two complete sets of a light metal vest, plus examined a heavier "flak-jacket" version. In the May '84 issue of *SOF*, we analyzed not only the body armor itself, but reported how it was used.

Chemical warfare has been a key part of the Soviet war effort in Afghanistan. We have brought out Soviet chemical protective

Soviet Anti-Personnel, Non-Detectable Plastic Mine (APNDPM), nicknamed "Squashy." The first of its kind to reach the U.S., it measures 4½ inches by 2½ inches and is made of green plastic.





Flanked by Mujahideen, Maj. McKay brandishes the newest addition to the Soviet small-arms arsenal — the AKR.

equipment — not only gas masks but also the filter unit from the protective system in a Soviet BMP-1 infantry fighting vehicle. This was significant because the BMP-1s that the U.S. has received from the Middle East were export models that had the chemical filter system deleted. Again, this may well have been the first of its kind to come West.

The helicopter has been the heart of the Soviet war effort in Afghanistan, and so attracted our interest. This has included working with "Honest Abdul," the largest distributor of previously owned Mi-24 Hind attack-helicopter parts in South Asia — his buddies have been fortunate enough to distribute a few over the landscape. Abdul, however, is most aware that 12.7mm ammunition does not come cheap. He wanted money with which to help get ammunition to waste more Hinds, money that we did not have — even for such a worthy cause. After a few discreet inquiries proved fruitless, we decided not to fool around. We advertised Abdul's wares on the inside back cover of the magazine — which created a bit of a stir in a few quarters. Security prevents us from discussing what became of the parts in question, but we trust they have been put to good use.

Abdul's competitors have also led us to a few interesting Hind items. These have included the reflector gunsight from a Hind-A of the Kabul Regime's Air Force, which we were able to bring out of country. We have also examined a weapons selection and control panel from a Hind-D cockpit.

SOF and *Combat Weapons* are not planning to rest on their laurels. Some items that we will be looking for on future trips include the rangefinder from a Soviet T-72 tank. We are also looking for the sensor that goes into the "bump" under the nose of Hind-D and Hind-E attack helicopters. It's probably a radar, but no one is quite sure. A vehicle-mounted version — possibly with a lengthened barrel — of the 30mm grenade launcher has been reported. The 82mm automatic mortar is also on our shopping list. There have been reports of a Soviet version of the U.S. M203 grenade launcher, which clips under the barrel of a rifle. There have also

been reports of Soviet rifle grenades being used — which the Soviet Army has not supposedly used for many years.

SOF has also excelled at interpretation of publicly available information: SOF's treatment of the T-80 tank controversy showed that ("Tracking the T-80," SOF, Jan. '84). Rumors of the future introduction of a Soviet armor superweapon proved to be a "product-improved" variant of the ubiquitous T-72.

Chemical warfare will remain a priority. In 1982 Omega Group offered a \$100,000 reward for the first communist pilot to defect to the West from Afghanistan, Laos or Cambodia with an aircraft designed to deliver and equipped with lethal chemical and/or biological weapons. We will also be looking for more evidence — the chemicals themselves, fragments, reports, protective equipment, anything.

Our journalists have brought out a wide variety of documents from the war in Afghanistan. This has included, for example, a map from an Mi-24 Hind shot down by Jamiat-I-Islami guerrillas near Khanda-



Omega Group staff were first Westerners to test-fire new 5.45mm AKR "Krinkov" assault rifle.

har in 1982. Marked up with the Hind's intended flight path — apparently an armed reconnaissance patrol — it gives a good idea of how Hinds do business.

Documentary evidence collected by SOF has also illuminated the life and conditions of service of the Soviet soldier in Afghanistan. We published an analysis of the first Soviet soldier's identity book we examined in Afghanistan ("Bulyaev's Background,"

SOF, May '81, p. 74) Since then, our further analysis has shown that, among other things, the Soviets are shipping soldiers who have little or no training to Afghanistan. Some have been shipped in when they have been in uniform for less than 30 days. The units in Afghanistan have to train these replacements as well as fight the war. We have also seen that the Soviet trooper does not have a limited tour of duty in Afghanistan, but stays there for the whole of his two-year hitch, going home only to be demobilized (unless he is among the one or two percent masochistic enough to re-enlist in the Soviet Army). Our investigations have also helped disprove initial reports. For example, Soviet officers and paratroopers are not on six-month tours of duty as has been suggested. They do the same two years as everybody else.

Despite the brutality of the war itself, the Soviet soldier remains close to many of his traditions. Icons and traditional Russian and Ukrainian crosses taken from dead troopers that have been shown to our reporters by the Afghans bear evidence of this. One dead paratrooper had a notebook of handwritten poetry in his pocket. Jim Coyne's interviews with Soviet prisoners of war has supplemented this evidence (see "SOF Interviews Soviet POWs," SOF, February '84). The Soviet Army is a good thing to avoid anywhere, but service in Afghanistan is the worst of all.

That our correspondents have been successful in intelligence gathering does not mean that the professionals have been unsuccessful. SOF rose to prominence in the mid-1970s, the time when U.S. intelligence services and capabilities were being torn down. That was the time when our uniformed leaders said they commanded a "hollow army." Our intelligence services were in far worse shape than their brethren in the combat units. While recent years have seen an attempt to rebuild America's intelligence capabilities, especially after the setbacks in Iran, Central America and Afghanistan, there is still a shortage of resources.

Technical intelligence, which we do for the benefit of our readers, is not one of the top priorities of many intelligence professionals. This is not because they consider it unimportant, but because with the limited resources at hand, the political and military "big picture" gets top priority — which is perhaps as it should be. However, someone has to look for the material that impacts the foundations of our national security, even if it is "only" new Soviet assault rifles and body armor. That is part of the story that we try to cover, and cover in such a way that is more than sitting back and sifting through second-hand reports. By doing this, we not only present our readers with a unique picture of the real situation in Afghanistan, but contribute to our understanding of the Soviets and their way of war. □

LIGHT ARMORED VEHICLES

U.S. Catches Up With ComBloc Mechanized Units

by Ed Besch

The views expressed are the author's and do not reflect the official policy or position of the Department of Defense or the U.S. Government.

QUANTICO, VIRGINIA — One of the newest and most significant weapons in the Marine Corps arsenal is the Light Armored Vehicle (LAV), which will be used by a new Light Armored Assault Battalion (LAAB) in each Marine Division. As General Paul X. Kelley, Commandant of the Marine Corps, reported in his fiscal year 1985 posture statement to Congress, "LAV(-equipped) battalions will provide a mobile, hard-hitting maneuver element . . . (and) will be capable of being transported to an objective area strategically by sea and air and tactically by helicopter."

The first Marine light armored vehicle company was formed in July 1983, and the first LAV-25 infantry squad carrier rolled off the production line on 26 October 1983. Eventually, each LAAB will have 145 of the eight-wheeled LAVs in at least six different versions.

The LAV-25 basic version is armed with a Hughes M242 Bushmaster 25mm electrically-powered chain gun and coaxial 7.62mm machine gun, and it can also mount a Mk 19 40mm machine gun (or grenade launcher) as auxiliary armament. Two-plane stabilization gives the main and secondary armament a fire-on-the-move capability. Optional firing ports on the LAV-25 would have given Marine infantry a mounted fighting capability using their new M16A2 rifles and squad automatic weapons, but they elected to leave them off. Two four-smoke grenade launcher sets enable the crew to screen the vehicle from enemy gunners in a tactical emergency.

The LAV-25 weighs approximately 14 tons combat-loaded and carries a three-man crew: driver, gunner, commander, and six infantry men. The armor protects against small arms fire, a proportion of artillery fragments, and antipersonnel mines. If damaged,





LEFT: Heliborne capability was a must for all LAV entries in the U.S. Army's competition. Here the Cadillac-Gage V-300 is suspended under a Sikorsky S-65. **TOP INSET:** M901 LAV-25 antitank variant. **Photo:** Jack Grimes. **BOTTOM INSET:** Cadillac-Gage's V-150 fires its 40mm gun during testing.



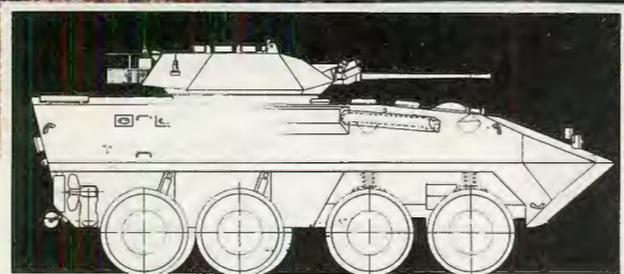
the vehicle can still be driven with any three of its four wheel sets inoperative. "Run-flat" tire liners enable it to be driven more than 25 miles if tires are punctured. Internal crew protection systems include a halon fire extinguisher system and a ventilated face mask nuclear-biological-chemical (NBC) collective protection system. Survivability also is enhanced by the vehicle's ground-hugging silhouette and low turret profile.

The LAV-25's outstanding cross-country mobility and swimming capability complement its fighting capabilities and survivability. The LAV is powered by a Detroit Diesel 6V53T turbocharged engine rated at 275 bhp, which drives an Allison MT 653DR five-speed automatic transmission. More than 600,000 53 series diesel engines and nearly 200,000 Allison MT653 transmissions have been built for commercial and military use—their reputation is exceptional. The power train gives the LAV-25 a power-to-weight ratio of 20:1, a road speed in excess of 60 mph, and a water speed of over six mph. The LAV has fully independent suspension, using coil springs on the front four wheels and torsion bars in the rear. The driver can select either four- or eight-wheel drive. The front of four wheels steer on land; a pair of rudders turn the vehicle when afloat.

During rough cross-country tests on varied terrain, the LAV-25 maintained average speeds from 17 to 22 mph and climbed grades of up to 70 percent elevation. The LAV can negotiate a 20-inch vertical step and crossed a 5.9-foot ditch. Dur-

"LAV-equipped battalions will provide a mobile, hard-hitting maneuver element..." reported Gen. Paul X. Kelley, Commandant of the Marine Corps, in his posture statement to Congress for Fiscal Year 1985.





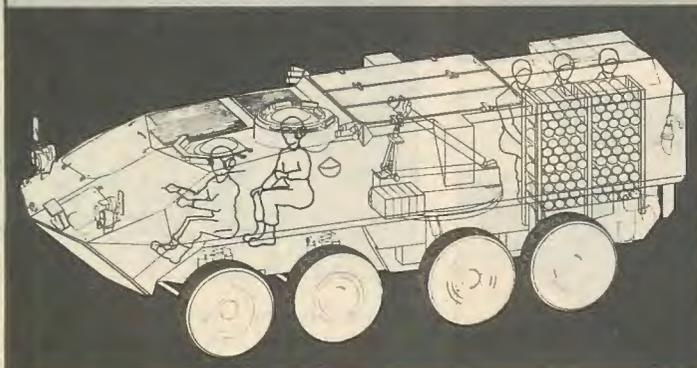
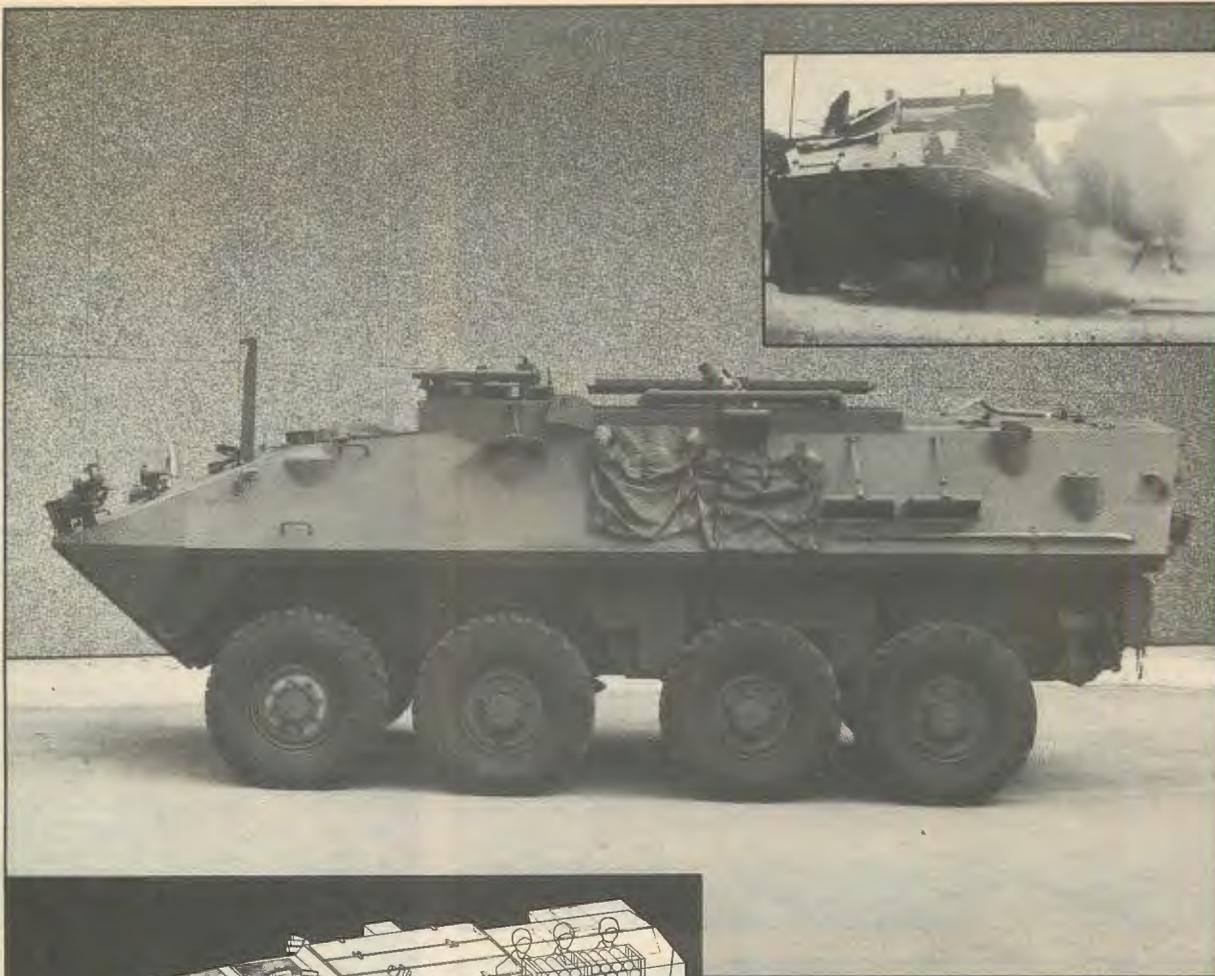
ABOVE: Highly maneuverable, the LAV-25 can operate quickly and effectively in forested terrain. Photo: Jack Grimes **LEFT:** Line drawing shows low silhouette of LAV-25. **BELOW LEFT:** Although this shallow pond will not test the swimming capabilities of the LAV, it has the ability to plunge through deep water by using its twin screws (see top photo). Photo: Jack Grimes



ing competition tests, U.S. military test crews rated the LAV-25 as "most agile" and scored it high in crew comfort and overall ride characteristics.

The LAV's combination of high speed, low silhouette, agility, and minimal exhaust signature enabled the vehicle to achieve 70 percent high avoidance over a two mile course against trained M60A1 tank crews, who rated it the most difficult to track of the test vehicles. The LAV can enter a water obstacle at 30 mph and leave without stopping, which reduces its vulnerability during an amphibious assault or water-crossing operation.

Five variants of the LAV-25 began testing early this year. These are: *antitank* vehicle fitted with the Emerson M901 dual TOW Under-Armor system designed to fire from a defilade position, *mortar carrier* mounting an improved 81mm mortar, *logis-*



ABOVE: LAV-25 81mm mortar variant. **UPPER INSET:** German Rheinmetall Rh-105-11 105mm lightweight soft-recoil gun being fired from test rig turret on MOWAG Piranha 8x8 chassis. This gun can fire the same ammo as the U.S. M60 series tanks. **LEFT:** Cutaway of LAV-25 mortar vehicle showing crew, mortar and stowed ammunition.

tics vehicle fitted with an enlarged cargo compartment and a 1,000-pound manual crane for cargo handling, *command and control vehicle*, and a *maintenance and recovery vehicle*. Two other LAV variants, an assault gun and an air defense vehicle, are still in design phase. The Marine Corps also is monitoring Air Force tests of an airground airfield defense vehicle. The LAV mounting a 105mm soft-recoil, lightweight tank gun or the ARES 75mm rapid fire gun is a candidate for the future Mobile Protected Gun System — an air transportable light tank for Army and Marine Corps use. Delco Systems is developing an add-on TOW-2 dual missile launcher capability for the LAV-25, which could carry six to 10 reload missiles internally instead of six infantrymen. The LAV-25/TOW-2 version could be used as an interim mobile protected gun by the Army or as an infantry platoon command/antitank vehicle for three LAV-25 infantry squad carriers.

Possibly the world's best designed and most tested wheeled LAV, the U.S. LAV-25 was originally developed by the

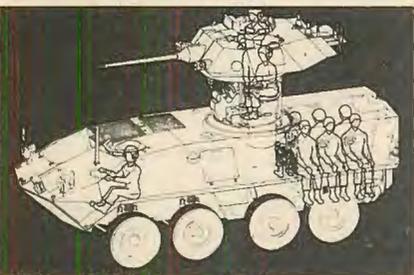
MOWAG firm of Kreuzlingen, Switzerland as the Piranha family of four-, six-, and eight-wheeled armored personnel carriers (APC). In the Piranha, MOWAG combined the configuration and fighting qualities of its tracked infantry fighting vehicles with experience accumulated in the development of several families of wheeled APCs. After studying 13-wheeled armored vehicles and testing three of them, Canadian Defense Forces adopted the 6x6 version of the Piranha, with modifications, as their "Armored Vehicle General Purpose" (AVGP) in late 1977. General Motors' Diesel Division, of London, Ontario, built 491 AVGP 6x6 vehicles in three versions: Cougar 76mm gun fire support/recon vehicle, Grizzly APC, and Husky maintenance and recovery vehicle.

After the U.S. Army-Marine Corps LAV Program was established in 1980 to select an off-the-shelf vehicle chassis and armament combination to meet both Services' needs for an LAV, the Piranha-AVGP went through a third round of development and/or product improvement to meet U.S. require-

ments. The U.S. Marine Corps was given responsibility for selecting the winning LAV candidate from contenders offered by seven U.S. and foreign firms, while the Army was given overall responsibility and contracting authority for the LAV. Four vehicles: British Alvis Scorpion and Stormer tracked vehicles and U.S. Cadillac-Gage V-150 4x4 and V-300 6x6 vehicles, in addition to the GM of Canada AVGP (improved MOWAG Piranha 8x8), were thor-

INFANTRY EXPERT

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TOP: The Cadillac-Gage V-300 struts its stuff as it blasts through a water obstacle. **ABOVE:** The LAV-25, built by GM of Canada, is air-transportable, a valuable asset for a rapid deployment force. Photo: Jack Grimes. **LEFT:** Cutaway of LAV-25 shows location of three-man crew and six infantrymen (rear).

oughly tested and evaluated for mobility and reliability before the latter vehicle was selected as the new standard U.S. Army-Marine Corps LAV. The LAV-25 or its Canadian and Swiss cousins also have been

tested in Europe, the Mid-East, and Far East; they have done very well against other tracked and wheeled LAVs. Chile produces the Piranha 6x6 under license, and numerous other countries have adopted these ver-



satile and reliable vehicles.

The LAV represents one of the few recent instances in which the U.S. adopted a major foreign military system. By doing so, the U.S. saved at least three to five years of design and development time and costs, in addition to the long intra- and inter-service wrangling over "requirements" that often has characterized U.S. development of a new type of weapon or vehicle (e.g., four prototype generations and three improvement programs for the alternative M113A1 APC over a 23-year period preceded rollout of the first M2 Bradley IFV in 1981). Despite its foreign origin and assembly in Canada under license to MOWAG, however, nearly 70 percent of the LAV components are produced in the United States, and all are available in North America.

The U.S. Marine Corps recognized both the worldwide threat posed by foreign LAVs, tanks, and artillery and the advantages of using its own LAVs, but the Army now intends to adapt a light truck, the 1 1/4-ton, 4x4 High Mobility Multipurpose Wheeled Vehicle — HMMWV (knicknamed "Hummer" by AM General) — as lightly protected weapon and infantry squad carriers in its light infantry divisions. The



Army's primary concern is strategic air lift limitations, but the Hummer may not be the best answer when all factors are considered.

For example, the LAV-25/TOW-2 version carrying a four- to five-man crew, dual TOW-2 missile launcher, and 10 missiles now being developed by Delco could serve as a platoon commander's vehicle alongside three LAV-25 nine-man infantry squad carriers. To match the firepower and carrying capacities of four LAV-25s (one fitted with TOW-2), it would require *nine* Hummers (10, if a separate platoon commander's vehicle were added) to carry four 25mm chain guns, two TOW-2 launchers, and the three eight- or nine-man infantry squads. Air Force C-130 and C-141B aircraft can carry three times as many Hummers each (three and six, respectively) as LAV-25s; the giant C-5A can carry 15 Hummers or eight LAVs. Thus, it would require one C-130 and .5 aircraft additional space in a C-141B, but .1 aircraft less space in a C-5A to carry a light mechanized infantry platoon equipped with four LAV-25s compared to carrying a reinforced light motorized infantry platoon riding in nine Hummers. The personnel costs and logistic requirements for ten or more extra Hummer drivers and

gunners, and the possible need for a tenth Hummer to achieve the same capabilities as four LAV-25s should be considered by Army planners along with other strategic mobility factors. Furthermore, the LAV-25 possesses significant advantages in cross-country mobility, a swimming capability, and survivability over the HMMWV.

When the Army decided recently to withdraw from the joint LAV Program, the Marine Corps was faced with a seriously escalating unit price for its relatively few LAVs on order. Undaunted, the Marines found a way to employ more LAVs themselves and confirmed their options for the LAV command and control, antitank, mortar carrier, logistics, and recovery variants, thus ensuring a continuous production run of 758 LAVs through Fiscal Years 1984 and 1985 to maintain contract procurement costs before Army withdrawal. Cost, in 1982 dollars (when the contract was let), for each variant are: LAV-25, \$496,600; command and control vehicle, \$321,000; TOW antitank vehicle, \$616,000; mortar carrier, \$280,900; logistics vehicle, \$281,000; and recovery vehicle, \$381,500. (Source: 5/1984 *International Defense Review*.) Expensive as it is, the LAV-25 costs only

Though no longer in the running for USMC LAV, the V-300 by Cadillac-Gage sees action elsewhere around the globe with other fighting forces. It is air-transportable by helicopter and an outstanding swimmer.

about one-third as much as the M2 Bradley Infantry Fighting Vehicle used by infantry squads in the U.S. Army's Armored and Mechanized Infantry Division, and its life-cycle cost is only about half that of the M113A1 tracked APC, according to Canadian experience with the M113A1 and the 6x6 version of the LAV-25.

The LAV-25 combines appropriate armament and vehicle technology with strategic and tactical mobility needed by light infantrymen during the '80s and '90s. Although the LAV-25 has suffered in procurement priority compared to more costly systems intended for the Army's heavy divisions in Central Europe, it is far more likely that the Marines' LAV-25 will be actually used in some conflict elsewhere. By using the LAV-25, Marines will not only catch up with Warsaw Pact and numerous Western and Third World light mechanized infantry units already using wheeled armored vehicles, but they should surpass them with the LAV-25. □

HECKLER & KOCH CLOSE ASSAULT WEAPONS SYSTEM

Combat Weapons Previews the CAWS

by *Combat Weapons Staff*

"Shotgun Wizard" John Satterwhite puts the CAWS through its paces. Integral optical sight in carrying handle was quick to provide a sight picture, and the bullpup-layout made it a smooth handling weapon. INSET: *Combat Weapons* advance photographs of the CAWS show right-side-only safety/selector lever and left-side ejection port, but current prototypes sport ambidextrous selectors and right-side ejectors.





CHANTILLY, VIRGINIA — Shotguns get respect. Unfortunately, combat shotguns are compromised as military weapons because of their sporting descent. Heckler & Koch and Olin Corporation's Close Assault Weapon System (CAWS) is meant to correct those defects.

From 17th century cuirassiers' blunderbusses to the Remington 870s of the Vietnam War, fighting scatterguns were civilians' field weapons pressed into military service. Terrific close-range lethality, load flexibility and hit-probability outweighed inconveniences of small ammunition loads and slowness of reloading. And at short ranges there was no competition.

But while other battlefield small arms advanced, the mankilling shotguns of the '70s were the same as their Great War counterparts. Pump shotguns and the occasional self-loader from jungle ambushes in Indochina and Malaya were mechanically identical to those carried by Pershing's doughboys. Meanwhile, the assault rifle evolved: Light, lethal cartridges fired from light, compact, reliable select-fire weapons narrowed the close-combat gap between shotgun and rifle.

The assault rifle's near replacement of the battlefield shotgun had nothing to do with competition between intermediate rifle cartridges and the traditional 12-gauge load for toe-to-toe lethality or 50-yard hit probability. AKs and '16s were just easier to load and more effective at ranges over 100 yards. In spite of low rates of fire and slowness of recharging tubular magazines, shotguns were still popular with the United States' post-M16 military in Southeast Asia. Even on rock'n'roll, the assault rifle only *approached* the effectiveness of the shotgun at close combat ranges.

By the end of the Vietnam War, grunts and weapons technologists alike understood the utility of, and wanted a shotgun with, characteristics of an assault rifle: It should be light and compact, with a straight-line stock to reduce perceived recoil and muzzle-climb, reloading should be accomplished by detachable magazines, and it should be capable of and controllable during full-automatic fire. The weapon had to fire and cycle both conventional plastic-cased



ABOVE LEFT: The CAWS can expect to see use as a close-in tactical combat piece for myriad special purpose SWAT uses and military commando operations. **ABOVE:** HK's Close Assault Weapons System will eat new ammo developed by Olin. Star Wars bullpup configuration resembles the HK G11 caseless gun, and is also reminiscent of Steyr's AUG infantry rifle system.

HK CAWS SPECIFICATIONS

Operation:	Gas operated with recoil assist, bullpup-layout, Internal Operating Floating System (IOFS)
Caliber:	12 gauge
Overall length:	33.94 inches with flash hider
Height:	10.27 inches
Width:	2.66 inches
Barrel length:	18.11 inches
Empty weight:	9.5 pounds
Magazine:	10-rd. box
Sights:	Optical, one to one magnification
Features:	Lethality out to 150 yards without adjustment or modification, left or right adjustable ejection, cyclic rate of approximately 250 rpm. Semiautomatic version may be available at a later date.

Weapon development currently being conducted by Heckler & Koch, Dept. CW, 933 N. Kenmore St., Suite 218, Arlington, VA 22201. Ammunition development continues at Olin Corp., Dept. CW, Winchester Group, E. Alton, IL 62024.



Shotgun Wizard goes rock'n'roll: John Satterwhite gets a grip on the future with the HK CAWS.

12-gauge and military brass-cased ammunition in loads from slug to flechette.

Winchester, Carroll Childers, John Foote and Maxwell Atchisson answered the challenge to design a machine shotgun, but the Remington 7188 is probably the only one to be commercially produced. The minimally-controllable, conventional-stocked, tubular-magazine, select-fire version of the civilian sporter Model 1100 was acquired in unspecified numbers (probably less than 20) for the SEALs toward the end of the Vietnam War. Needless to say, no information is publicly available on the battlefield use of the 7188.

Stock configuration and rate of fire spawned the 7188's control problems, and reloading was the same one-shell-at-a-time common to tubular magazine firearms. It certainly must have worked as a light machine shotgun, but its cyclic rate of 420 rpm would have emptied its seven-round tube rapidly, turning it into a weapon useful only for initial contact at close range.

For four years Heckler & Koch and Olin have worked on a close-range machine shot-

gun system that is not restricted by sporting-arm ancestry. Responding to the Joint Services Small Arms Program Repeating Handheld Non-rifled Ordnance (JSSAP/RHINO) requirement for a new close-quarters firearm, Olin Corporation and Heckler & Koch GmbH began development of a weapon purely for close-assault purposes, without constraint of previous availability or reliance on traditional designs.

The CAWS is a new weapon. Resembling the H&K G11 in general appearance the CAWS is a bullpup-layout, select-fire, 12-gauge machine shotgun. All machinery is enveloped in a streamlined, snag-free plastic shroud. A "reflex" sight, composed of a U-shaped channel ending in a prismatic optical element engraved with an aiming circle, is mounted in the tall carrying handle, which also shields the large, easily-accessible operating handle.

The most current prototype's selector is ambidextrous. The original advance photographs provided to *Combat Weapons* showed a right-side-only safety/selector

lever. While the older model has conventional German selector markings, the production weapon will probably be marked: "0" for safe, "1" for semiauto and "10" for fully automatic.

Ejection must be adjustable with a bullpup configured weapon, since wrong-side ejection would cause the shooter to be struck in the side of the face by a hot 12-gauge hull with each shot. Ejection is changed by removing the buttcap, pulling the bolt, reversing the ejector, turning the cheekpiece, and replacing the bolt and buttcap. All this can be done in the field, without tools.

Ammunition is held in a detachable, reloadable, sheet-steel double-column 10-round box magazine. When stripped off by the forward movement of the bolt, the cartridge is driven into a chamber milled to accept the special belted brass-cased shells. Ignition takes place by a hammer-driven inertial firing pin. Gas tapped from the barrel unlocks the multi-lugged bolt, while a conventional recoil system drives the action to extract and eject the expended hull before the rebounding bolt shoves a fresh round from the box magazine to the chamber.

The team-developed machine shotgun system also requires new ammunition, and that is Olin's job. JSSAP/RHINO requires that the CAWS kill at 150 meters, and that is clearly beyond the capability of normal shot cartridges. Slug rounds have a chance, and are being tested, but new loads are also being considered. Flechette cartridges have been around for years, but projectile weight and shape have been designed to damage soft targets. Olin's current experimental cartridges for the CAWS have small fin-stabilized metal arrows that engineers believe will fly farther, straighter, and with more retained energy than earlier flechettes. Experimentation is also proceeding on single-flechette loads that may extend the range of the shotgun or work as penetrators for hard targets. Payload innovations being tested include a shaped charge round.

The conventional round-shot cartridge hasn't been forgotten. Tungsten or other lead/heavy-metal alloy triple-ought balls may extend future combat shot ranges to 150 meters. These special military loads will be produced in a belted brass case that will prevent chambering in unmodified civilian shotguns.

The CAWS had been changed in development several times, and a commercial-ready, buyer's version should be unveiled by the time this article sees print. H&K is even considering production of a semiautomatic version. *Combat Weapons* correspondent John Satterwhite (also known as "The Shotgun Wizard") was able to test fire the CAWS at Heckler & Koch's Virginia plant. As we went to press, HK was about to finalize the version shown in the firing-sequence photographs. Watch for updates on continued development, production, procurement and future field tests in *Combat Weapons*. □

WARNING ORDER

COMING SOON FROM AL MAR KNIVES:



SERE*ATTACK

Designed by Al Mar especially for the Special Forces SERE group, located at the John F. Kennedy Special Warfare Center, Fort Bragg, North Carolina. Headed by its creator, Lt. Col. Rowe, the SERE program goal is to train members of all branches of the armed forces in the art of survival. To this end, the group turned to the expertise of Al Mar, former Special Forces member, to fulfill their need for a large, heavy-duty yet lightweight folding knife which would be used 90% of the time as a survival tool and 10% of the time as a fighting knife for close-in combat.

Specifications:

- **Blade:** Length, 114mm/4-1/2"
Thickness, 3mm/1/8"
- **Overall length:** 267mm/10-1/2"
- **Steel:** Exclusive AM-6, Rc 57-59
- **Bolsters:** Stainless steel
- **Liners:** Brass
- **Scales:** Camo green micarta
- **Top grain leather scabbard:** Black or woodland camouflage
- **Projected price:** \$135.00
- **Delivery date:** To be announced

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CARRIER GROUP DEFENSE

Modern Warfare Changes Flattop Tactics

by Damian Housman

THE fighting in the Falklands has provided another opportunity for critics of naval strategy to lambast the vulnerability of large surface vessels. Since the aircraft carrier is the largest of our fighting ships, it has taken most of the flak. Should we spend the billions of dollars necessary to maintain a carrier fleet that is capable of projecting U.S. power to the farthest reaches of the globe? Armchair admirals tell us that carriers are outdated and vulnerable. Their conclusion is that aircraft carriers are overly vulnerable to modern weapons of war, such as the *Exocet* missile used to such deadly effect in the South Atlantic. The reality is that carrier groups are well protected and readily able to defend themselves.

Since World War II, America has depended on aircraft carriers to project power across vast distances. Our commitments to friends and allies and our interests in the far reaches of the globe necessitate the ability to bring force to bear, in some cases on short notice.

In modern times, tactical aircraft are the basic units of military force in response to crisis but many potential hot spots do not have friendly airfields nearby. The solution is to bring the airfield with the planes, which can be done only with an aircraft carrier. Thus, like it or not, the aircraft carrier is central to our role as a great power.

The threat to aircraft carriers and other surface ships is real and growing. We have been keenly aware of the existence of anti-ship missiles ever since the sinking of the Israeli destroyer *Eilat* by Egyptian missile boats, firing Soviet-made *Styx* missiles. That was in 1967. Since that time the threat has grown enormously as the sophistication and numbers of such missiles has increased. And no longer are they restricted to the Soviets and their major clients. Today, nearly any nation that can afford a small boat can afford the means to sink ships many times their own size and cost. To make matters worse, our own ships can become the target of missiles made by our allies, or even ourselves. The erratic rulers of Iran have American-made *Harpoon* anti-ship missiles, perhaps the best such weapons in the world.

The Soviet military is not blind to the power of the carrier battle group (CVBG).

In fact, after building several medium-sized carriers, they are building the first of what may be several large, nuclear powered carriers. Their approach to countering our acknowledged carrier superiority is to use massive coordinated attacks from the air, surface and subsurface. According to plan, a CVBG will be located by any of several surveillance means: submarine, reconnaissance aircraft, or satellite. Submarines and surface ships will be dispatched to intercept, while precise location, composition, heading and speed information is obtained. When Soviet subs and surface ships are nearly in position for attack, bombers carrying anti-ship missiles will be sent toward the battle group. When all are in range, a massive salvo of missiles is unleashed at the battle group, the prime target of course being the aircraft carrier.

Dozens of missiles, large and small, will be fired. They may be all launched at the same time or timed to arrive on target at the same time. Some missiles fly close to the waves at nearly supersonic speed while others come in at steep dive angles, traveling at more than twice the speed of sound. They may all come in from the same direction to saturate the defenses of a zone, or they may be fired from several directions at once. As screening ships become saturated or experience critical hits, the carrier itself becomes vulnerable. Missiles pour in through gaps in the coverage like army divisions in a blitzkrieg, exploiting a breakthrough.

Because CVBGs are so expensive, we have a right to know whether or not they are just so many targets. The ability of carrier battle groups to defend themselves should not be the subject of pure conjecture. An examination of the carrier battle group may be helpful here. What is it, how does it operate, and what means does it have to defend itself?

The centerpiece of the CVBG is, of course, the aircraft carrier. In the U.S. Navy it is a ship with strong armored sides, a flat deck and excellent compartmentation to limit damage in case it takes hits. It can hold speeds in excess of 30 knots and several are nuclear powered. Each has a powerful air wing composed of planes for air and surface surveillance, anti-submarine warfare, elec-

tronic warfare, air defense and attack. A typical air wing may have squadrons of the following:

- F-14A** Fighter-Air Defense
- A-6E** All Weather Attack
- F-18A** Light Attack
- EA-6B** Electronic Warfare
- S-3A** Anti-Submarine Warfare (ASW)
- E-2C** Radar Surveillance
- KA-6** Tanker
- S-3H** ASW Helicopter

All told, between 75 and 95 aircraft form a carrier air wing, later model carriers having more than earlier ones.

Normally, two aircraft carriers form a CVBG, but this can change depending on tactical considerations and availability. The battle group is made up of about 17 ships of various kinds: the carriers together with their cruisers, destroyers, frigates and support ships. Frequently, attack submarines make up part of the battle group. Unlike the old days, subs are now just as fast as surface ships.

In the defense of the CVBG, cruisers provide the bulk of the surface to air missile defense while destroyers and frigates provide much of the ASW support. This system is not rigidly adhered to because cruisers also have significant ASW capabilities, while some destroyers can shoot down missiles and planes.

Most people familiar with carrier operations from the old days recall the basic formation. Carriers in the middle, cruisers sailing nearby and destroyers and frigates forming the outer screen. Well, forget it. There is no longer any such thing as a "standard" formation, and it is unlikely that any ship will be in sight of any other ship. The carriers will be anywhere, even on the edge of the formation! To leave them at the center of mass would make them too predictable, too easy for an enemy to strike.

The CVBG assigns defensive measures within three zones descriptively named the outer zone, the middle zone, and the inner

Fire control technicians aboard the U.S.S. *Jouett* load dummy 20mm rounds and *Phalanx* ammunition into the weapons system. The 3,000 round-per-minute Mk 15 is expected to be installed on 64 U.S. ships.



zone. These zones are not solid walls at specific distances, but are instead indicative of the capabilities of the weapons used in each zone. Naturally enough, it is preferable to find the enemy while he is still in the outer zone but the battle group must be prepared to find him anywhere.

Much of modern surveillance is conducted by satellite so predictable formations in recognizable shapes could give the enemy sufficient notice to mass forces and attack at the most vulnerable moment. To prevent being caught by surprise, several pairs of F-14s will normally form the combat air patrol, or CAP, with one or more E-2C radar planes to direct them toward the enemy. However, tactical considerations usually offset the CAP and E-2C some distance away from the battle group so that observing them will not betray the group location.

Each ship has an array of radar, sonar, radios and other devices which are useful in locating enemy ships, planes, and subs. However, it is normal to operate in a controlled emission environment, or EMCON, to keep the enemy from detecting the presence of the CVBG until the last possible moment. Ships and aircraft have passive

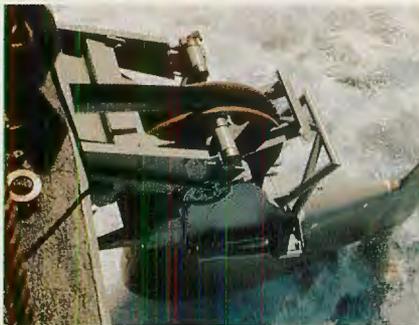
sensors which allow them to find the enemy without resorting to emitters. Many of these passive devices have far greater detection ranges than their emitting counterparts. Also, information from reconnaissance satellites and planes as well as our fixed sea-bed sonar systems can be passed to the battle group. The U.S. Navy has become so skilled in EMCON operations that a few years ago one CVBG went two weeks without once being detected by the Soviet Navy, even though they were sailing and operating aircraft close to the Soviet Pacific coast. Of

on six at a time. Its AIM-54 Phoenix missiles are reported to have a range of nearly 100 miles.

Since the F-14s normally range a good distance from the CVBG and since its own and the E-2Cs radars have ranges of up to 200 miles, the outer zone defensive capability can be considered to extend at least 300 miles.

Major U.S. combat scenarios inevitably involve a massive attack by the Soviets. CVBGs will be highly desirable targets in any serious battle. In the case of naval en-

BELOW: Underwater sonar equipment is tested on the fantail of the escort ship U.S.S. *Valdez*. **BOTTOM:** An ASROC missile is launched from the deck of the nuclear powered missile cruiser U.S.S. *South Carolina*. **RIGHT:** The nuclear-powered aircraft carrier U.S.S. *Nimitz* flanked by guided missile cruisers U.S.S. *California* and U.S.S. *South Carolina* plow through the calm Mediterranean Sea.



course, once the CVBG has been detected and must defend itself, all sensors are employed to aid in destroying the incoming missiles.

When the CVBG commander determines it is no longer tactically sound to maintain EMCON (such as when the group has been discovered), some or all of the group's detecting gear may be turned on. Radar from the E-2Cs or F-14s are most likely to locate an air or surface threat. The F-14s are tasked with destroying enemy bombers before they can launch their anti-ship missiles. Failing at that, they must destroy the missiles themselves — no small feat.

An F-14 has a sophisticated weapons system. Its AWG-9 can track 24 targets and fire

agements, it is unlikely that an entire enemy attack will be stopped in the outer zone. Considering the damage the CVBG can do if unhindered, it is probable that a determined attack will occur. Bombers (each with one or more missiles), a surface action group (each ship with many missiles), and several submarines are undoubtedly slated for action against the carrier groups. No defense can stop all the missiles — many will "leak" through the outer zone.

The next opportunity to stop them is in the middle zone. It extends from about 10 miles from each ship to the maximum range of the surface to air missiles used by the ships — about 80 miles. Interceptor aircraft

stay out of this area during battle except to return to the carrier to refuel and rearm. Anti-ship missiles which penetrate the defenses of the outer zone are prioritized based on the threat they present to the battle group. Factors such as time to target and speed as well as which ship they are headed for are all considered in assigning priority. The missiles are intercepted highest priority first.

The job of directing this stage of the air battle is given to the Anti-Air Warfare Commander. The AAWC may be located on a carrier or on the most capable AAW cruiser,

rearranges the firing sectors. Data link from the AAWC provides each ship with the information they need to find and attack their targets.

To actually hit those targets, however, the firing ship needs to be tracking the target on its own radar. Then the target is "designated," and an illuminating radar is pointed

versions (MR and ER) follow "kinetically improved" flight paths. This means that after launch they soar as high as they can go, and dive on their targets. This increases their range substantially. Also, the latest change allows the SM-2 to be launched before its target is illuminated. It flies out to a point high in the air and waits until an illu-



or conceivably another AAW ship. Tactical data link feeds information from sensors such as ship and aircraft radar into the Naval Tactical Data System (NTDS) which uses computer banks to analyze the situation. Depending on the circumstances, NTDS can do anything from offer advice on the best action to take to actually firing on incoming missiles. Most commanders like the idea of keeping a man in the loop so it would be unusual to allow NTDS to do the whole job.

NTDS also keeps track of the location and capabilities of friendly ships and can assign incoming targets to each of them. When friendly ships take hits and the CVBG loses their AAW capability, the AAWC

at it. This bathes the target with continuous wave radar beams allowing the SAM to home in on the target. If chaff, jamming, or maneuvering by the target cause the illuminator to stray from the target, the SAM will miss.

Until recently, all U.S. Navy SAMs were beam riders. That is, they climbed straight toward the target, staying within the beam until intercept. That limited their range. Later models of the Standard Missile 1 and 2 and both the medium and extended range

TOP: Sea Sparrow missile is launched through a frangible door on board the guided missile ship U.S.S. *Norton* during a sea test. **ABOVE MIDDLE:** Crewmen fire torpedoes from the destroyer U.S.S. *Newman K. Perry* during exercises in the Atlantic Ocean. **ABOVE:** Rapid-Bloom Off-Board Chaff (RBOC) missile decoy system aboard the destroyer U.S.S. *Hewitt*.



U.S.S. *Ticonderoga* is the first of the Aegis guided missile cruisers.



The nuclear powered guided missile cruiser U.S.S. *Bainbridge* executes search maneuvers while training in carrier group exercises.

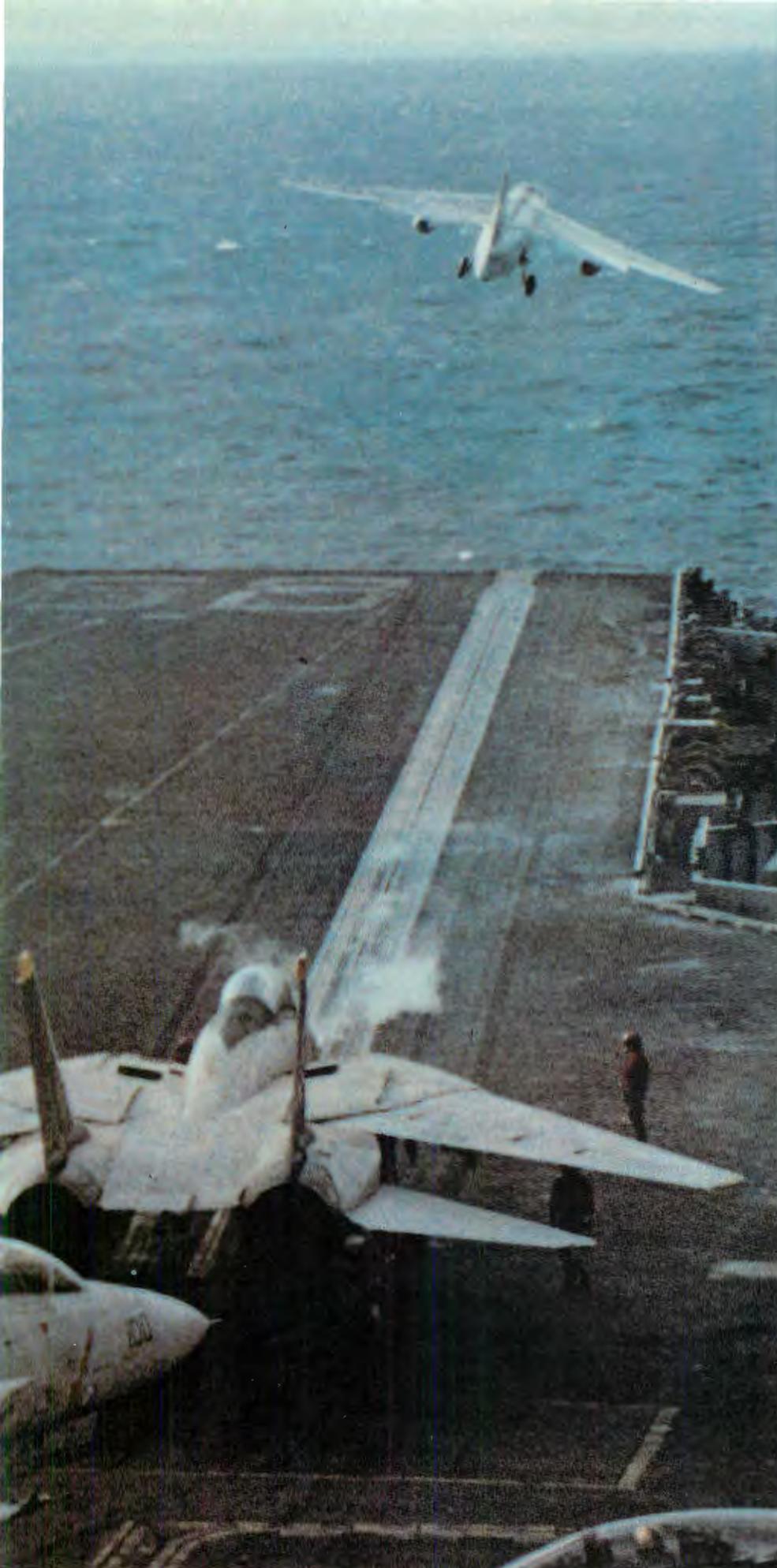


ABOVE: At sea: The destroyer U.S.S. *Spruance* gets underway off the coast of California. RIGHT: EA-3B "Skywarrior" gets airborne after being catapulted from the port side of the U.S.S. *Nimitz*. F-14As wait their turn on the starboard catapult.

minator becomes available. It only requires the illuminator for a few seconds to kill the target.

Even the best equipped ships have only three or four illuminators. Therefore, in a massive attack only a limited number of targets can be engaged by each ship. With





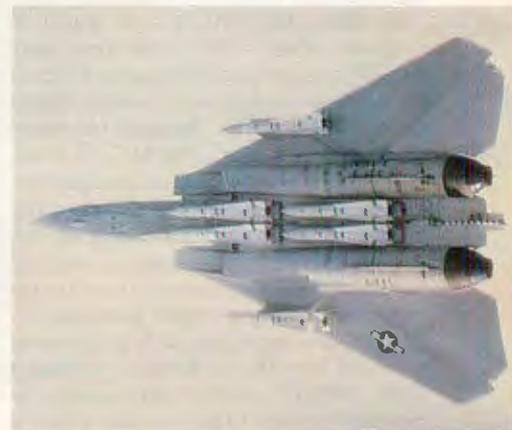
the ability to fly out to a point and wait for an illuminator, several times more targets can be engaged with the new system. Called the Aegis System, it was first installed on the cruiser USS *Ticonderoga*, and can control more than a dozen missiles in the air at once, though it has only four Mk 99 illuminators.

The difference between Standard Missile MR and ER versions is the rocket booster section on the ER, which nearly doubles the range. Unclassified sources give the SM-2ER a range of about 75 nautical miles. Ships like the USS *Ticonderoga* are built to handle only the MR version. The Aegis cruisers are highly capable, and incorporate the RCA SPY-1A radar and Aegis Mk 7 fire control system. The ship can track hundreds of targets at a time while acting as the AAW coordinator for the CVBG.

There was a recent dispute as to its ability to handle sea-skimming missiles and it flunked an AAW evaluation during trials. The Navy was quite concerned, since this is the backbone of AAW for the future CVBG. Twenty-four cruisers will be built, at more than a billion dollars each. More recent tests have been very successful. Actually, the problem with sea-skimmers had nothing to do with the USS *Ticonderoga* or her radar. It has always been able to detect, track, and fire on incoming missiles, no matter how low they fly. The problem is in the fuse of the SM-2 missile. The SM-2 has a proximity-fuse warhead which detonates up to several yards from the target. When dealing with sea-skimmers however, the SM-2 has to fly within several yards of the water which it also interprets as a target. There have been frequent premature detonations as the missile flies close to the surface. The problem has been fixed, and the fleet will see modified fuses before the end of the year.

Even with the sophisticated outer and middle zone defense systems, it is likely that a determined attack will see several missiles penetrating to the inner zone. Unlike the outer and middle zones which mea-

Underside view of a U.S. Navy F-14 Tomcat multi-role fighter aircraft. Armed with one 20mm cannon and six long-range radar guided solid fuel Phoenix air-to-air missiles, this plane is designed to sweep contested airspace of enemy aircraft and protect the carrier force.



sure distance from the CVBG, the inner zone is measured from each ship. The inner zone is the last ditch zone and each ship is responsible for its own point defense.

The original point defense was the Basic Point Defense Surface Missile System (BPDSMS). Based on the same AIM-7 Sparrow radar-guided missile used by planes to shoot down other planes it was manually operated. An automated system incorporating many advances became known as the NATO Seasparrow Surface Missile System (NSSMS), and has been adopted by many allied navies. The eight-cell Mk 29 launcher resembles an ASROC box which it was developed from. The range is slightly under 10 miles. It is carried primarily aboard destroyers and frigates but some aircraft carriers mount three launchers. Anti-ship missiles getting through the outer and middle zone defenses will be handled by the Sea Sparrow if the ship has it. If not, another system, the Phalanx, must take care of it.

Most ships now have at least one Phalanx. It is a fully automatic, quick-firing 20mm cannon. Its reaction time is said to be exceptionally fast, and it is a deadly shot with its discarding sabot depleted uranium penetrator rounds. It's not expensive, the probability of kill is high and it is simple to use. An aircraft carrier may have three or four of them, each guarding the approach from a different direction. Its major limitation seems to be a small ammo capacity but later models will have larger magazines.

A new system is in development which is highly regarded by our NATO allies. Called RAM (for Rolling Airframe Missile), it is small, cheap, fast and uses parts of other systems already in production. Its seeker is borrowed from the *Stinger* man-portable SAM and its body is borrowed from the *Sidewinder* with a small radar energy seeker added to the nose.

When fired at a radar-guided missile, a RAM homes in on the radar emissions. When close enough to detect the missile's heat source, it would use the *Stinger* seeker to guide on the heat. The U.S. Navy plans to put 10 RAMs into two boxes of a Seasparrow launcher, giving each ship a complement of six Seasparrows and 10 RAMs in the launcher; double the firepower. Not to be out done, European navies are developing a launcher with 24 RAMs.

No survey of CVBG defense would be complete without a look at electronic warfare. All combat ships have sensors to detect the electronic emissions of enemy ships, aircraft and missiles. Modern electronic warfare systems such as the SLQ-17 in aircraft carriers and the SLQ-32 in other surface ships can jam the seekers of incoming radar-guided missiles. EA-6 aircraft can also provide electronic cover.

Anti-ship missiles generally head for the center of the largest object it detects. To counter this each ship will fire several rounds of Super Rapid Blooming Offboard Chaff (SRBOC). As the chaff expands, the incoming missile heads for the center of



TOP LEFT: U.S.S. *Norton* launches the SM-2 from its anti-missile system. ABOVE: An SA-3A Viking ASW aircraft perches ready for launch on board the U.S.S. *Enterprise*. TOP RIGHT: Carrier based E-2C airborne early warning plane in flight. RIGHT: Side view of an F-18A Hornet from an air test and evaluation squadron. The aircraft is armed with Sidewinder (on wingtip) and Sparrow air-to-air missiles.



mass. Usually this means it goes for the chaff and not the ship, or at least for a point between the two.

Another threat to the CVBG comes from a very different direction. The Soviets have a huge number of attack submarines. The CVBG must be prepared for Soviet subs whether they attack as part of a massed formation or alone. The Anti-Submarine Warfare Commander (ASWC) is in charge of ASW operations for the CVBG. Intelligence on enemy sub locations reaches him through a variety of sources: Satellite, friendly subs, fixed seabed sonar arrays, land based ASW planes such as the P-3, and from the resources of the CVBG itself.

Finding subs is not easy. Passive ship sonars such as the SQR-19 *TACTAS*, now going aboard many of our ships, have detection ranges perhaps 50 percent greater than previous generation equipment. Detection range is dependent on the nature of the water and seabed in the area of search as well as such factors as water depth temperature. Once a contact is made, fixed wing S-3s and helicopters try to fix the precise location of the sub. Dropping patterns of active and passive sonobuoys in the water ahead of the predicted path of the sub will pick up the



sound of its engines and propellers. Data is relayed from the sonobuoys to the aircraft and ships where sophisticated systems such as the Carrier Tactical Support Center (CV-TSC) analyze the data. When the position, speed and direction of the sub are known, aircraft are vectored to the sub's location where they drop Mk 46 torpedos.

As with missile defense, some subs will penetrate the airborne ASW screen. Most ships in the group have active and passive sonar to locate the subs. ASROC, a ballistic rocket which carries a Mk 46 torpedo, is designed as a submarine killer. Closer in, many ships carry the Mk 46 in deck mounted launchers.

To avoid sound detection, most U.S. ships today have tiny holes in the bottom of their hulls and in their propeller shafts. Air is forced through the holes, forming a shield of bubbles designed to lower the sound level given off by the vessel.

If deception fails and an enemy sub gets close enough to launch a torpedo, decoys are employed. An early model, the T-Mark 6, trails behind the ship on a wire. It puts out a sound signature similar enough to the ship to draw off the torpedo. That was the idea anyway. A new decoy, the SLQ-25 *Nixie*, is programmable and more closely duplicates the ship's signature. A second *Nixie* is usually ready for deployment as soon as the first one is blown off.

No matter how ferocious the defense, a sustained and determined attack will result in some hits. Recalling the British experience in the Falklands, big hits on small ships can be devastating. It is true that one hit destroyed the British *Sheffield*. But remember, that was a small ship. Small ships simply don't have the ability to withstand damage to the extent large ships can.

Carriers are not small ships and they can take a lot of punishment. The side and deck armor of U.S. carriers is several times stronger than their World War II predecessors. Our latest carriers have several longitudinal bulkheads and there are 23 watertight transverse bulkheads. Compartmentation in a *Nimitz* Class carrier is tremendous: over 2,000 compartments. Clearly, it's not easy to sink a carrier. In 1969, nine Mk 82 bombs exploded on the flight deck of USS *Enterprise*. The *Enterprise* not only survived, but resumed the launch and recovery of aircraft within hours. In battle, enemy bombs won't explode on the deck — they will penetrate before exploding and the damage done will be much greater. But make no mistake, the *Enterprise* explosion illustrates the inherent strength of the aircraft carrier.

Carrier battle groups must go in harm's way if they are to carry the war to the enemy. Defending the CVBG is a difficult task in a high threat environment. It requires an integrated means of killing enemy subs, planes and missiles. We have that integrated system, and we are working to improve it every day. But despite the seeming futility of defending such a large target, it isn't an impossible mission. The Soviets need to understand that. □



JETS vs. GUERRILLAS

Fast-Movers Don't Cut it in COIN War

by Dana Drenkowski

WHILE leading a flight of F-4 Phantoms to a target on the Ho Chi Minh Trail, I heard a radio call: "Tac-air emergency — all fighters carrying ordnance please come up on Bravo frequency!" The adrenalin pumping, I quickly switched my flight to the frequency and called up the

Forward Air Controller (FAC). He responded, telling us he had a number of friendly ground troops about to be wiped out by a much larger enemy force.

"Thank God you're here!" he gasped. "What kind of ordnance do you have?" I replied we had four loads of 500 high drag

Bomb load expended, a USAF Skyraider rolls down through light cloud cover to make a strafing pass at a Viet Cong target.
Photo: USAF



AC-47s FOR EL SALVADOR

A major debate now rages within the Salvadoran Air Force and the U.S. military — the State Department vs. the Pentagon — regarding the use of Salvadoran air power. With mounting frequency, damning complaints are being raised over the use of jet aircraft to kill individuals, not masses of troops. The focus of this debate centers around the A-37 Dragonfly fighter/bomber. Guerrillas and their sympathizers within the media allege that the A-37s are being used for indiscriminate bombing of suspected guerrilla positions resulting in extensive and unnecessary civilian casualties. While it is apparent that the Salvadoran Air Force has made bombing errors involving numerous civilian casualties, many, if not all, have been civilians grouped into a category called "Las

USAf AC-47 aircraft of the 4th Air Commando Squadron fire upon a Viet Cong position outside Saigon. The AC-47, also known as "Puff the Magic Dragon," is equipped with three side-firing 7.62mm Miniguns, each of which fires 6,000 rounds per minute. This photo was taken from a rooftop in the city. Photo: USAF

Mazas," or guerrilla supporters. These civilians provide the necessary logistical support to keep the guerrilla army functioning. As such, to some observers, they are as legitimate a target as are the uniformed supply troops of a regular army. However, the fact remains that it is not the intent of the Salvadoran military or government to kill civilians.

Strategists within the U.S. military and civilian establishment have been reluctant to provide additional A-37 jet fighter/bombers to the Salvadoran Air Force because of this concern. They have taken the position that a bomb deli-

bombs with "daisy cutter" fuse extenders, as well as over 2,400 rounds of 20mm ammo.

"Excellent!" he cried. "Get 'em on over here!" He gave the coordinates and I set a new course for his position, less than five minutes away.

Almost as an afterthought, he asked, "What kind of birds are you flying?"

"Fox-Fours," I proudly told him, knowing we were the best planes in the Vietnam War.

There was a moment's pause. "I can't use you," said the FAC, grimly. "I need accurate ordnance deliverers to put bombs within yards of the friendlies. I need slower, lower planes."

As we F-4 pilots turned our planes and our deflated egos back to our original target, we heard the FAC back on emergency frequency, begging for *anyone* — except F-4s — to come save his troops in trouble.

I never did find out what happened.



An Air Force A-1E Skyraider of the 1st Air Commando Squadron blasts Viet Cong structures in South Vietnam with napalm bombs. The piston engine 'Raider could stay on station for hours, laying down more accurate fire and carrying a greater ordnance payload than any jet is capable of even today. Photo: USAF

vered from a jet aircraft is an inherently inaccurate weapon and thus not necessary in most counter-insurgency conflicts.

Not necessary, but not ineffective in many cases. It was my observation that there were targets where the Dragonfly's bombs were quite effective, particularly where the guerrillas were massing for major attacks, and when striking known guerrilla bases. The jets should not be relied upon for all striking missions, nor should they be ruled out completely for use in this war.

The strategists who seek more accurate weapons want small, light, technically simple aircraft with aimed or forward-firing ordnance such as machine guns and rockets. This ordnance allows the pilot or gunners to engage individual targets without fear of residual casualties.

The AC-47 — a C-47 cargo plane modified to carry a number of machine guns firing out the side of the aircraft — is such a weapon. The AC-47 can fly in a slight bank, keeping its machine guns aimed at a target at all times unlike a plane with forward-firing guns, which takes its guns off the target during a pass and re-attack. In addition, the use of a half-dozen machine guns or several rotating-barrel Gatling Gun cannons enables the gunship to bring an overwhelming amount of firepower on the target. The United States learned in Vietnam that this was the most effective counter-guerrilla weapon in our inventory. But we have allowed our counter-insurgency capabilities to degrade significantly, subsequent to the national revulsion and self flagellation as a result of the Vietnam War. Nothing in our current inventory exists to handle adequately COIN war. Our C-47s are no longer maintained. Even the A-37 jets are not in

service anymore, and were gleaned from reserve inventories for use in El Salvador.

Combat Weapons learned that the United States intended to introduce several gunship-modified C-47s into the Salvadoran conflict. Portions of our staff assisted in the search for suitable planes and weapons and provided technical expertise. Because the U.S. Air Force no longer maintains simple, effective weaponry for use in a guerrilla war, C-47s must be salvaged, and are now being revamped and modified from a few old hulks in the "Boneyard" at Davis-Monthan Air Force Base in Tucson, Arizona. This illustrates the U.S. military's failure to consider the needs of our armed forces to be equipped for low-intensity warfare, in spite of the fact that this is the type of war that America has fought or participated in since World War II.

The project of acquisition and modification of the AC-47s was recommended by a secret panel advising the U.S. government. This panel, headed by Maj. Gen. John Singlaub, questioned the effectiveness of jet fighter/bombers in a guerrilla war. General Singlaub told this writer that, "Bombing from a jet fighter/bomber does more to turn civilians against your side than it helps." He went on to say that an AC-47 provides accurate weapons delivery and reduces unwanted and unnecessary casualties.

Based on my experience as a participant in the Vietnam War and four other wars since, I think the El Salvador-bound AC-47s quickly will become the most effective weapon the Salvo Air Force has in its guerrilla-fighting arsenal. In addition, more A-37s would be useful in striking known guerrilla encampments and for quick-reaction assaults against masses of guerrillas. — DD

Several wars and a few years later, I realized that the frustrated FAC had taught me a lesson. If a field commander refuses to call in jets when enemy units are in close contact with his troops, why would he want to use them when guerrillas are in close contact with civilians? The answer is obvious, yet many military forces engaged in guerrilla warfare today still want jets.

"Dropping bombs on guerrillas with jet aircraft is an ineffective way to fight an insurgency," said USAF Brig. Gen. (Ret.) Harry C. "Heinie" Aderholt to me recently in a discussion on the role of aircraft in counter-insurgency (COIN) warfare. Recognized as America's leading expert on airpower in guerrilla war, I respected his judgment — after 30 years of fighting unconventional battles around the world, Aderholt spoke from experience.

Aderholt's words are virtually echoed by U.S. Army Maj. Gen. (Ret.) John Singlaub, whose own career spans three decades of unconventional and clandestine conflict. Singlaub forcefully argues that jets are inherently inaccurate due to their speed and the altitudes at which they perform most effectively, and have no loiter time to stay "on station" during engagements with elusive guerrilla targets. But most damning to both generals is the fact that inaccurate unguided bombs create more civilian casualties, with resultant sympathy for guerrillas from both civilians and world press, who in effect may join the insurgent's ranks as combatants or active supporters.

Singlaub points out that a bond forms between guerrillas and civilians who are subjected to aerial bombing. If they survive,

it becomes "us against them" as the civilians identify with the guerrillas, with whom they've faced death from faceless and seemingly insensitive government forces.

Traditionally, the government will have the advantage in the early stages of a guerrilla war providing it correctly exploits its strengths. It will almost invariably be better armed, particularly in heavy crew-served weapons. Governments generally have more mobility because of their control of main roads, waterways, and the skies. High ground and air capability afford the government a reconnaissance advantage, making it very difficult for daytime guerrilla movement. Finally, governments have superior medical facilities and evacuation capabilities. Where a guerrilla understands that even a minor wound may result in death, a government soldier can expect evacuation, treatment and recovery from even serious injury. This latter advantage has two benefits: increased morale and the return of casualties to the ranks.

Given these advantages, governments should always win. The reality, however, is that most government armies and air forces are designed, trained and equipped to fight external opponents. Strategy and tactics are geared to meet and defeat conventional invasions and threats from outside the country's borders, not internal insurgency.

When nations turn to America for aid in COIN operations, they find the United States is in the same position: our air forces — USAF, Marine, Navy and Army aviation branches — have spent the last four decades since World War II designing and fielding the most sophisticated, expensive machinery in the world, designed to defeat aggression from the Soviet Union in a large-scale conventional war. In such a war, the high speed and sophistication of jet fighters are an advantage. The relative inaccuracy of jet-delivered bombs is insignificant when the targets are masses of troops, tanks,

railyards, etc., often thousands of meters in diameter. When pin-point accuracy is called for, extremely expensive laser, television, electromagnetic and infrared weaponry is available.

Killing a single guerrilla, or attacking a 10-man guerrilla patrol with a \$100,000 television guided bomb dropped from a \$25 million-plus F-15 fighter/bomber is simply not a viable option, particularly for countries whose entire wartime military budgets are less than \$150 million per year, as in Thailand and El Salvador for instance.

What does the United States have to offer its allies or countries whose present governments are deemed preferable to Marxist tyranny? It has less than a score of AC-130 gunships, each costing over \$100 million. These could do a devastating job on guerrillas, but a country like El Salvador would have to demobilize all its infantry, armor and air forces just to own and operate one such AC-130. Other aircraft such as A-10s, F-15s, F-16s and F-18s are too sophisticated for a Third World country to operate and maintain without substantial assistance from American personnel. This doesn't take into consideration their original price tags. A few A-37s, small twin-engine jet trainers converted to machinegun-armed light fighter/bombers, are available, but they still fly too high, too fast and are unable to loiter on the battlefield long enough to be effective against guerrillas.

Most COIN war experts will concur that the ideal plane would be a piston or turbine plane with forward-firing machine guns/cannons, a reasonably heavy ordnance load

(usually accurate forward-firing rockets) and the capability to remain in the target area for hours.

In previous insurgencies in which the United States was involved, air forces advised by Americans were given World War II and Korean-era piston-engined fighter/bombers, such as the T-28 (later designated AT-28), the A-1 Skyraider series, and the B-26. All carried a heavy load of ordnance including rockets and machine guns in addition to the guns mounted in the wings or nose. All were capable of remaining in the target area for hours. Their accuracy with these weapons is almost legendary, which meant they were frequently on call even for conventional targets needing special precision.

An incident occurred during the Vietnam War that dramatically illustrates the astounding accuracy capabilities of the famed Skyraider. A downed U.S. pilot was picked up in a tidal flat by North Vietnamese militia and regular soldiers. As the mob of troops escorted him along, A-1 Skyraiders reached the scene. Using their 20mm cannons, the A-1s began strafing runs, picking off stragglers on the edge of the crowd only 20 meters from the pilot. As each plane made a pass, all the soldiers

Skyraider being launched from USS *Intrepid*, CVS-11, on air strikes over Vietnam, 20 May 1966. Photo: USN



except one on each side of the pilot began diving into the knee-deep mud and water. The pilot heard the approaching rescue helicopter, and with only his two captors still standing during each pass, he saw his chance. Drawing a Walther PPK .380 automatic from a concealed holster, he shot one standing captor and slugged the other (he said the other was "just a teenaged kid" and he didn't want to kill him) and quickly sprinted away from the NVA troops, still face down in the mud. The Skyraiders quickly made short work of them as the pilot raced for the chopper. The ability of the slow-moving Skyraiders to loiter over the position and pick off individual soldiers within yards of him saved the American pilot. This accuracy made the 'Raiders the most-re-



quested aircraft for Search and Rescue (SAR) operations and for close encounters of the worst kind in Vietnam ground warfare. The pilot probably would not have made it home if jets had been used instead of Skyraiders. The value of similar piston engine fighter planes in guerrilla warfare is obvious.

Only in the final phase of a guerrilla war, when regular guerrilla units (now in disciplined, conventional formations) engage in open battles with government troops, are jets preferable. Here the area weapons — unguided bombs — are useful when the targets are clearly defined and civilian casualties are not a consideration.

Why are more nations buying jets to fight insurgencies? The answer, unfortunately, is that most air forces attempting to fight guerrillas have a built-in preference for anything that goes higher and faster — and anything more glamorous. It is a sign of prestige and sophistication to own the newest, most advanced planes possible — meaning jets. It is little more than vanity, but it affects all pilots in all air forces.

A recent example illustrates this aspect of human nature to the extreme. Facing a potential war with Vietnam, Thailand recently sought new aircraft to upgrade its air force. Up against literally hundreds of Vietnamese Air Force Russian-supplied MiG fighters, the Thais had a number of options. After much consideration, they decided to blow their budget on 16 F-16 fighters at \$22 million a copy. Since only slightly less capable planes are available at 1/3 or 1/4 the cost, enabling the Thais to have up to 64 new F-20s or new Mirages, for example, the decision to purchase the F-16s can be explained only as a reach for prestige. In fact, makers of the F-20 argue forcefully that

USMC F-4B Phantom unloads "snake eye" ordnance over Viet Cong trenches, Da Nang, 1967. This bomb is equipped with high drag fins which pop out on release, slowing down bomb to allow F-4 to escape during low-level attack. Although the Phantoms were the hottest planes of the war, the lumbering Skyraider was the most requested aircraft for SAR and close air support. Photo: DOD



DRAGONFLYS AT WAR — FLYING THE A-37 IN EL SALVADOR

The runway sped rapidly beneath the nose of the diminutive jet. We reached rotation speed. It "slipped the surly bonds" of earth and climbed to cruising altitude, the four 750-pound bombs with their three foot fuse extenders nestled snugly under the wings. I was once again flying a jet fighter/bomber into combat, this time in the right seat of one of six A-37 Dragonflies operated by FAS (*Fuerza Aero Salvadoreña*) — El Salvador's air force.

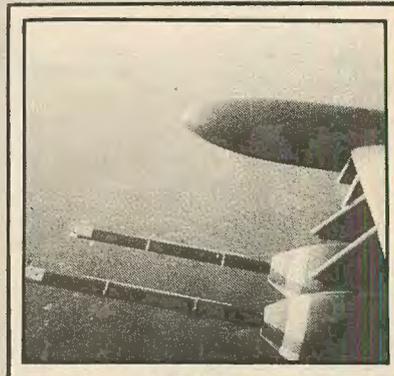
The A-37 Dragonfly is a slightly modified version of Cessna's twin-engine T-37 jet trainer. You know, the one caustically called a "6,000 pound dog whistle" by pilots. The addition of bomb racks, a Gatling gun, a 7.62mm machine gun in the nose and two more powerful engines turned this tiny trainer into a mini-powerhouse.

Guerrillas were using five abandoned farm buildings in a remote area as a training camp. Intelligence confirmed they were there last night and we were taking off at the crack of dawn to catch them.

In deference to my thousands of hours of flight time, including Vietnam combat tours in B-52s and F-4 Phantoms, the FAS pilot allowed me to take the controls on the way to the target.

Compared to the slow piston-driven O-2As and C-47s I had already piloted while with the FAS, this bird was like lightning. The rugged, mountainous terrain, its verdant hues an endless variety of greens, slipped by so rapidly that I was surprised when the pilot announced he had the targets in sight.

Taking the controls, he flipped the armament switches on, adjusted the mil setting on the dive bomb sight and swooped toward the first target. Four passes emptied our four-bomb payload, the fuse extenders ensuring above-ground explosions for maximum anti-personnel effectiveness.



Ordnance on El Salvadoran Air Force A-37 Dragonfly. Bombs are 750-pound general purpose with three-foot "daisy cutter" fuse extenders.

Chunks of terrain blew up in quick flashes, the white hemispherical concussion waves visible in the humid climate. Vertical columns of black smoke and dirt spewed from the impact toward the sky.

Time to change weapons. Four to five "G" pullouts squeezed the sweat from my brow as we clawed for altitude. The pilot's hands flew over the instrument panel as he switched from "Bombs" to "Guns," readjusting the gun sight as he did so. Six more dives expended 1,100 rounds of 7.62mm on the targets. On each pass, I could see the red tracers lazily arcing directly into the buildings and training fields.

I took the controls to make low passes at another rebel encampment on the way back to base, looking for Gs. Though I flew as low as I could, and made tight circles around the target, it was impossible to make positive identification of guerrillas. We returned to Ilopango without expending the rest of our ammunition.

Radio Venceremos later reported we had attacked a village, killing the usual supply of women, children and nuns — but no guerrillas. This time there was someone to dispute their lies. I was there and no village existed; only the five buildings that housed the Gs. — DD

LEFT: El Salvadoran Air Force A-37 Dragonfly prepares for COIN mission armed with 1,500 rounds of 7.62mm ammo for minigun and four 750-pound general purpose bombs with three-foot long "daisy cutter" fuse extenders. Daisy cutters detonate bombs three feet above ground for more effective anti-personnel capability.

their plane can outperform the F-16, but since it has not been purchased by the U.S. Air Force, it is not prestigious enough for the Thais.

Another example. Some years ago I was involved in an effort to sell various airplanes to certain U.S. approved African nations. A burgeoning guerrilla war was going on in one country, with no threat from any of its neighbors. I advised that a number of piston engine Skyraiders then available in the U.S. would perform an internal security role most satisfactorily. The country's representative, however, *insisted* they wanted *jet* aircraft. No matter that the jet aircraft most suitable could carry less than 1/4 the load of the Skyraiders. No matter that it could loiter over a target 150 miles away for less than five minutes while a Skyraider could be there for hours. Forget that after all external ordnance was delivered the Skyraider could still expend two to three times as much 20mm ammo as the jet could deliver 7.62mm rifle ammo or that the prop plane could be maintained by the primitive country's mechanics while the jet could not. The important thing was that the country wanted *jets* so its pilots could hold their heads high amongst the flying fraternity!

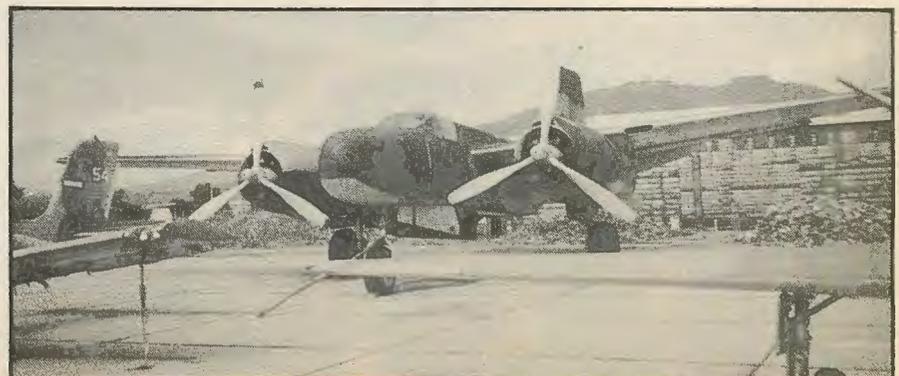
Practical considerations of war often take second place to prestige. The particular African nation in question bought a number of small twin jet trainer aircraft modified for light bombing at literally *20 times* the cost per airplane for the piston planes! And they got planes that couldn't do one fourth the job the piston planes could in their particular war.

Thanks to attitudes such as these, there are many fewer piston or turbine engine fighter planes being manufactured or designed today. There is a crying need for such aircraft in insurgencies, but few exist. In the meantime, air forces are using their jets to try to spot individual guerrillas. They use their maximum five to 10 minutes in the target area, during which period they usually can't see anything anyway, then drop inherently inaccurate bombs that do more to *lose* guerrilla wars than they do to win them. □

RIGHT: El Salvadoran Air Force B-26 is typical of aircraft the United States used to supply countries fighting internal insurgencies. Eight .50-caliber machine guns in the nose, and sometimes six additional guns in the wings plus huge ordnance capacity makes the B-26 a good guerrilla fighter. Most B-26s in El Salvador — and elsewhere around the world — aren't in this good shape. In deference to the glamor jet aircraft affords, pilots — and thus designers and builders — have neglected to put such excellent guerrilla-fighting planes to good use.



RIGHT: A USMC "Bird Dog" spotter plane loiters over Marines of 'E' Co. 2/9, ready to call in air support. Marines are on a sweep and destroy mission in the Royal Tombs area near Hue City, RVN. Photo: DOD. Slow, low and not as glamorous as the F-4 Phantom (above), the Bird Dog is nevertheless a better guerrilla fighter. BELOW RIGHT: AC-130H Gunship has proved itself to be one of the best guerrilla fighters in the skies, but prohibitive cost prevents poorer nations from buying them. Photo: USAF. BELOW: The war in El Salvador as seen from FAS A-37 Dragonfly cockpit. Burst of 750-pound general purpose bomb exploding can be seen in left center of photograph. Aircraft is in 90-degree bank turn.



THE ENEMY

SOVIET AIRBORN

Combat Weapons Looks at Russia



NE BRIGADES

n Order of Battle

by David C. Isby



“A battalion with six Wessex helicopters was worth more to me than a brigade without them.” General Sir Walter Walker, commander of British forces during the 1965-66 undeclared war with Indonesia, was one of the many commanders to realize that a modern army needs helicopter mobility to fight a counter-guerrilla war. This lesson has been learned by the French in Algeria, the United States in Vietnam, and now, the Soviets in Afghanistan.

The Soviets were latecomers to tactical use of helicopters. The first Soviet helicopter assault, using two battalions of paratroops, was during maneuvers in the fall of 1967. This was also the year the Soviets started to put greater emphasis on the conventional phase of a major conflict. U.S. experiences in Southeast Asia and their own studies and exercises told them that the helicopter could make a great contribution to conventional war-fighting capability.

To accompany the increased numbers of Soviet helicopters and the increased conventional airlift capability, the Soviets have organized and deployed different types of new units. These include air-assault and airmobile brigades, which are attached to front-level headquarters, as well as independent air-assault battalions attached to army-level headquarters. (A *front* is a Soviet operational unit consisting of several armies, and is roughly equivalent to a Western army group; all fronts are commanded by army officers, but include both army and air force units.) In addition, one motorized rifle battalion in each motorized rifle division and independent motorized rifle brigade has been trained for helicopter-lifted operations. The airmobile brigades were the first to be organized, in the early 1970s. The air-assault brigades and battalions were formed in the late '70s and early '80s.

The two types of brigades are organized and equipped differently, and are apparently intended for different missions. The air-

assault brigade is the heavier formation. It has four rifle battalions, two of them mounted in BMD airborne-infantry combat vehicles. It does not, however, have any organic helicopters. The airmobile brigade is more lightly equipped, with four rifle battalions, and does have its own helicopters. The ground personnel in these brigades are reportedly from the VDV (*Vozdushno-Desantnyye Voyska*, The Soviet Airborne Forces). Jump-trained, they wear the characteristic blue beret and striped undershirt of the Soviet paratroopers, although with a different insignia.

The helicopters organic to the airmobile brigade, like all Soviet helicopters devoted to land combat, are all the property of the Soviet Air Force. The Soviet Army has no aviation branch. The Hind, Hip and Hook helicopters are part of Frontal Aviation, the Soviet equivalent of the U.S. Air Force's Tactical Air Command. In previous years, the cooperation between army and air force in the Soviet armed forces was rather remote. Helicopters came under army command only at front headquarters. Today, however, not only do army and division-level headquarters have helicopter units under their command, but, in the case of the airmobile brigades, substantial Frontal Aviation helicopters have been placed under command of brigade headquarters.

This is a degree of integration between helicopter and ground forces that had not been previously seen in the Soviet Army. The Soviets had followed the model of the British Army and U.S. Marine Corps who

LEFT: BMP-1 on parade. Additional rocker arms behind the front road wheels distinguish it from basic BMP. **INSET:** Soviet airborne troops move out from LZ as Mi-8s, armed with 57mm rockets, withdraw.



rely on using line units for helicopter-lifted operations, rather than following the U.S. Army's organization which, although using any infantry unit when required, formed specialized airmobile and air-assault divisions.

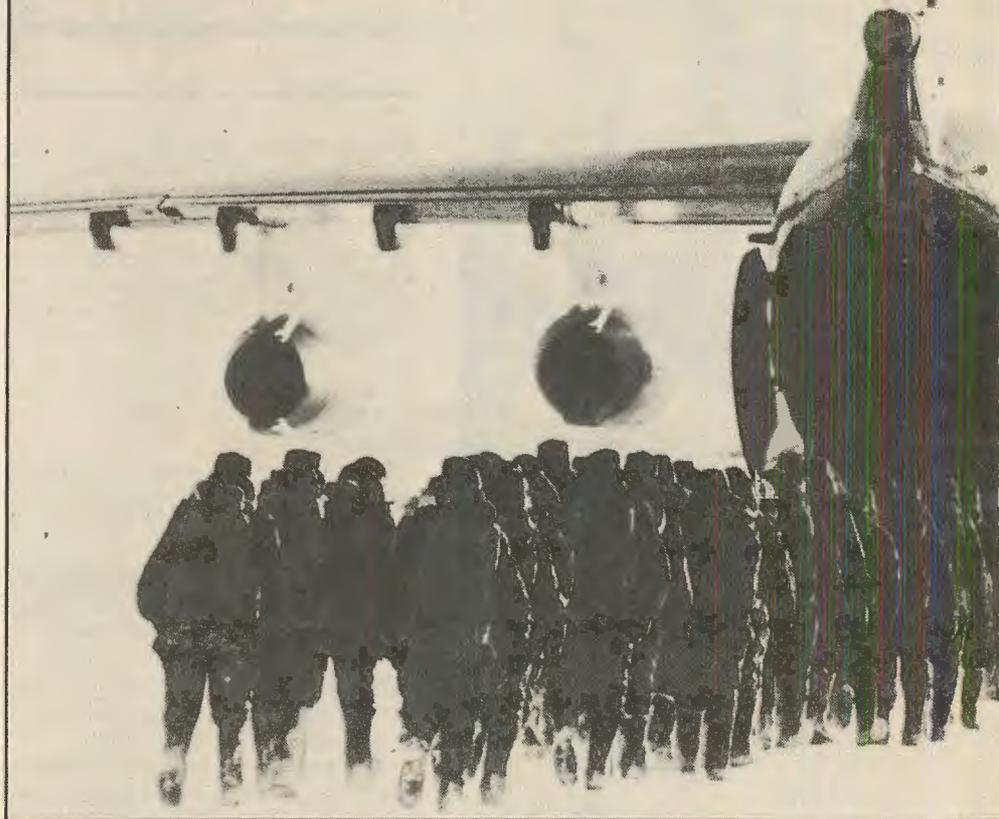
Like the U.S. 1st Cavalry (Airmobile) in Vietnam and the 101st Airborne (Air Assault) today, the Soviet airmobile brigade cannot lift itself in a single mission by its organic helicopters, although two missions could accomplish the task. The air-assault brigade does not have its own helicopters. When it moves by air, the Soviet Air Force has to provide helicopters or transport aircraft. Thus, it is like the U.S. 82nd Airborne Division. It can move by air, but has to rely on someone else's aircraft.

The Operational Mission of the Brigades

The airmobile and air-assault brigades are intended to strike into what the Soviets term the enemy's "operational depths" — 30 to 150 kilometers forward of the Soviet spearheads. The Soviets have been interested in the idea of striking deep into the enemy's position since the far-ranging Cossacks of the 18th and early 19th centuries inspired Russian military thinkers. When Marshall Tukhachevskii drew up his PU-36 plan in the 1930s for far-ranging offensives by armored and airborne forces into the enemy's rear, he was drawing from a long tradition.

The Soviet ability to strike deep has been greatly increased by the addition of the air-assault and airmobile brigades to the Soviet order of battle. Combined with the renewed emphasis on Operational Maneuver Groups in Soviet operational planning, these brigades can exploit the penetrations of the tank and motorized rifle divisions with their own considerable mobility and striking power. OMGs are not new — they are just a renewed emphasis on forces that will exploit any gaps in the enemy defenses with fast-moving combined-arms mechanized units. OMGs can link up with the air-assault and airmobile brigades, the Soviet Guards airborne regiments and divisions that have been used against operational targets, and Soviet special-forces units.

OMGs, air-assault and airmobile brigades, and Soviet paratroops can count on extensive support from many sources. New all-weather attack aircraft such as the Su-24 Fencer and the MiG-27 Flogger-D can accurately deliver conventional and chemical ordnance. New Soviet chemical-weapons technology allows them to approach the destructive effects of nuclear weapons without crossing the nuclear threshold. The SS-21 surface-to-surface missile, which replaced the FROG-7 rocket, is not only much more accurate, but has a longer range and a conventional capability. The ability of Soviet attack helicopters to suppress defenses and provide air support for helicopter-inserted forces has been dem-



onstrated in Afghanistan. The new types of Soviet heavy artillery introduced in the 1970s — 152mm and 203mm guns, 220mm multiple rocket launchers and 240mm mortars — also have a long reach.

Paratroopers have been part of the Soviet "deep strike" approach to modern combined-arms combat for many years. The first combat use of paratroops was in 1929, when the Soviets used them to reinforce a unit under attack by Islamic guerrillas during the long and brutal campaign to bring Central Asia under Soviet rule — a war very similar to the way the Soviets are conducting the war in Afghanistan. The Soviets still have not turned away from paratroops — they maintain the world's largest airborne force — but they realize that heliborne forces can perform missions that paratroopers cannot. They have a degree of tactical

mobility that paratroopers do not have once they hit the ground, even though Soviet paratroopers, unlike their Western counterparts, are a mechanized force. Soviet helicopter-lifted forces can provide their own supporting fire from armed helicopters. The Soviets are still limited in the number of paratroopers they can lift and resupply by air. For many years, one division at long range, or two (now increased to three) divisions at shorter ranges, was the maximum Soviet "surge" lift capability. Helicopters supplement this capability.

Another key difference between the new air-assault and airmobile brigades, and the Soviet Guards Airborne Divisions that have existed for years, is in the way they are subordinated to the command structure. The Guards Divisions are not under command of Soviet Army, front or military district-



Soviet paratroopers load into Il-76 Candids. Increased production of the Candid has created a greater Soviet airlift capability. LEFT INSET: Used in motor rifle and airborne units, the Sagger ATGM is one of the latest and best antitank manportable missiles in the Russian arsenal. RIGHT INSET: The AT-4 Spigot ATGM will replace the MCLOS antitank system.



strategic force-projection roles.

The air-assault brigade in Afghanistan is not part of a front, which is wartime-only headquarters, but rather is under command of 40th Army headquarters in Termez, S.S.R. This air-assault brigade has been deployed in Afghanistan since 1980. With its headquarters at Shir Khan, this brigade has apparently seen extensive combat. Because the 103rd Guards Airborne Division in Afghanistan seems, according to some observers, to be largely held back in the Kabul area to secure the Soviet hierarchy there and to guard against an uprising and mutiny by the puppet regime's army, it is likely that many of the combat reports from Afghanistan involving Soviet paratroopers refer to the combat actions of this brigade and the independent Guards Airborne Regiment, which has its headquarters at Bagram airfield, near Kabul.

The disbandment of the 105th Guards Airborne Division in Afghanistan in 1980 means that the Airborne Forces is the only category of Soviet Divisions to actually decrease in recent years, which may indicate that the airmobile and air-assault brigades are taking over some of the roles previously filled by the Guards Airborne Divisions. It may also indicate that there may not be sufficient airborne-trained conscripts available each year to fill the needs of both the new brigades and the existing Guards Divisions.

The Soviet style of invasion, as demonstrated in Prague in 1968 and Kabul in 1979, shows the importance of the use of air-inserted forces to seize key objectives ahead of the arrival of motorized rifle divisions. The air-assault and airmobile brigades would give the Soviets additional capabilities to seize mountain passes, airfields, road junctions, choke points, command and governmental centers, and other key objectives in conjunction with airborne forces. This holds special importance for an area that now has emerged as the most likely scenario for a military confrontation between the two superpowers: a Soviet invasion of Iran. Soviet tactical writings on combat in conditions such as might be found in Iran stress

headquarters in peacetime, but directly under the command of the Minister of Defense. Serving as a strategic reserve, the Soviet airborne forces are so independent of the army as to constitute almost a separate service, although in wartime they will be under army command. Air-assault and airmobile brigades, however, are under the command, in peacetime as in wartime, of Soviet operational-level headquarters — normally front-level headquarters. These brigades give the Soviet operational commander capabilities he has not had in the past. The addition of the air-assault and airmobile brigades to the Soviet order of battle allows for front-level commanders to have their own vertical envelopment forces without having to divert units of the Guards Divisions, which allows them to be used against deeper operational objectives or in

Paratroopers loading aboard Soviet Air Force An-12 Cub. Soviet air assault brigades use the Cub for all their operations.





that it is better to have a company at a crucial point before the enemy can react than to have a division arriving afterward. A campaign in Iran is likely to start out with a "race" to seize just such objectives which, if the Iranian forces do not take an active part, could turn into a situation similar to the opening stages of the 1942 Tunisian campaign, with light, often airlifted forces of both sides trying to expand into a vacuum.

In an invasion of Iran, the Soviets would probably commit Guards Airborne Divisions to strike as far forward as the situation permits — possibly a direct assault on the ports. The air-assault and airmobile brigades would be used for shorter-ranged objectives — Tehran and its airfields are a possibility, as are the choke points 30-150 kilometers back from the frontier. Once the Soviet motorized rifle and tank divisions have advanced through these choke points, the exploitation forces will move as fast as logistics permit to link up with the paratroops and complete the occupation of key points before the U.S. can react. Any Iranian resistance or airlift of reinforcements from outside would be blocked by air-strikes, probably including large-scale use of chemical weapons, or by Soviet special forces, paratroopers, or air-assault and airmobile brigades seizing the nerve points of the defense. The tactical and operational lessons of Afghanistan are our best indications of how the Soviets would invade Iran.

These new brigades are another part in the Soviets' jigsaw puzzle. When all the pieces are put together, it has the potential to give them the capability to mount a successful invasion of Iran. While the capability is emerging, Soviet intentions are known only to the old men in the Kremlin. However, Russia has invaded or occupied Persia no fewer than 11 times since the 18th Century.

BELOW: BMD airborne infantry fighting vehicle is standard equipment for the Guards Airborne Divisions. This heavily armed vehicle can be air-dropped; there is no U.S. equivalent. **ABOVE MIDDLE:** Mi-24 Hind-D is a radical departure from its predecessor, the Hind-A. It introduces a completely new forward fuselage with gunner and pilot in tandem under blown canopies, a turret mounted gun and an array of sensors.



Russia has never been known for not getting what it wants.

Air-assault brigades would also provide additional operational capabilities in a European environment. The use of helicopter and parachute-inserted forces to help secure river crossings has been a feature of Soviet large-scale exercises since the 1960s. Command posts, nuclear weapons, communications facilities and bridges could all be suitable objectives. Inserting these brigades into just about any scenario presents a new set of problems for NATO. Inserted in the rear of any NATO corps, an air-assault brigade could cut supply lines. It could be used, with troops from the Guards Divisions, to seize the Rhine bridges, the U.S. Army's POMCUS depots, airfields, and all the vital infrastructure of NATO's rear areas. The development of improved surface-to-surface missiles and strike aircraft, as well as munitions for them to use, such as cluster sub-munition warheads or -radiation missiles which home in on radar, means that the Soviets could have the capability to create a corridor through the NATO SAM belt through which to pass their transport aircraft or helicopters.

The ability of Soviet attack helicopters to suppress defenses and provide air support for helicopter-inserted forces has been demonstrated in Afghanistan and shows that the Soviets may emphasize the helicopter for both transportation and firepower for these brigades. The need to heli-lift more heavy equipment, especially BMD airborne-infantry combat vehicles, may have been one of the requirements of the Mi-26 Halo heavy-lift helicopter that the Soviets exhibited at the Paris Air Show in 1981. Halos have already been deployed to Afghanistan; a British journalist saw one flying near Jalalabad in 1983. The Hook is a good heavy-lift helicopter, although an old design. The air-assault brigade is especially dependent on its Hooks if it is to lift its BMDs into battle. This has already been done in Af-



ghanistan and in the war between Ethiopia and Somalia in the Ogaden desert in 1977, when a combination of Soviet commanders and Cuban troops yielded an Ethiopian victory.

The air-assault brigades can move to battle in helicopters or transport aircraft. The Soviets are willing to use their An-12 Cub tactical transports in situations where the Americans would not risk their comparable C-130 Hercules aircraft except in dire emergencies. The Soviets may use the Cubs in a way similar to how the Germans used their Ju-52/3m transports in the early days of the Second World War, such as flying them onto airfields or highways in the enemy rear before these had been secured by friendly forces. This resulted in a lot of German aircraft being destroyed, but it got at least some of the troops to their objective.

The most important single weapon for both brigades, however, is the Mi-24 Hind attack helicopter. The Hind will prepare the landing zones for the Hips and Hooks and provide accurate, intensive, supporting firepower once the troops are on the ground. The Soviets assign the close air-support mission to helicopters rather than high-performance jet aircraft. Hinds will also provide air cover for the brigade against enemy helicopters.

On the ground, the air-assault brigade has two battalions equipped with BMD airborne-infantry combat vehicles. This is a light, fast, but heavily armed vehicle capable of carrying a rifle squad. It has an NBC protection system and is armed either with a combination of a 73mm cannon and a Sagger antitank guided missile or a 30mm cannon and a Spanner antitank guided missile. The versions that use this latter armament are BMD M1981s, and are used primarily by air-assault brigades. The BMD has seen extensive use in Afghanistan, the Afghans calling it "the little tank like a jeep" (like a jeep, it also carries troops).

Organization

Airmobile brigades lack large numbers of vehicles — their armored fighting-vehicle



strength is limited to 13 BRDM scout cars, nine of them armed with antitank guided missiles. An airmobile brigade is 1,700-1,900 strong, organized into three assault battalions of airborne riflemen and one heavy battalion. Firepower is provided by batteries of six 120mm mortars, six 85mm antitank guns, and 21 man-portable Sigot or Sagger ATGMs. Engineers, signals, transport, and supply and maintenance companies provide support, as does an NBC defense platoon. Despite its small size, the brigade is well armed, with 90 machine guns, 114 RPG-16D antitank rocket-grenade launchers, 72 SPG-9 73mm antitank guns, and 36 SA-7 surface-to-air missile launchers included in its holdings. Wheeled transport consists of 71 GAZ-66 light trucks and 28 UAZ-469 jeeps, but the primary mobility asset of the brigade is its helicopters. The organic-helicopter strength is a composite regiment of 32 Mi-8 Hip medium helicopter squadrons, each of four four-Hip flights, and two heavy-lift helicopter squadrons, each of four three-Hook flights.

Despite some press reports, it appears that no airmobile brigades have been committed to action in Afghanistan. Their de-

ployment away from the Soviet "first line" against NATO in the Groups of Forces and the Western Military Districts indicates that they are intended to be used in environments with less intensive air-defense environments and with less need of tracked combat vehicles for the troops than would be the case in Western Europe. To lift the full brigade would require 60 Hip and 36 Hook sorties, while to lift one of the rifle battalions would require 13 Hip sorties.

The air-assault brigades are heavier formations. Larger than the airmobile brigades, 2,000-2,600 strong, the air-assault brigades have two airborne rifle battalions and two BMD-mounted airborne rifle battalions. Firepower is provided by a composite artillery battalion with 18 D-30 122mm howitzers and six 122mm airborne multiple-rocket launchers — 12-tube versions of the standard BM-21 on a towed mount. The other combat- and service-support units are the same as in the airmobile brigade, although the reconnaissance company has four BMD airborne-infantry combat vehicles instead of four BRDMs. Because it is jump-capable, the air-assault brigade also has a parachute rigging and resupply company. The brigade's weapons include 24 120mm mortars, six ZU-23 anti-aircraft guns, 45 SA-7 surface-to-air missile launchers, 14 Sigots or Sagers, 36 SPG-9 73mm antitank guns, six 85mm SD-44 antitank guns, 150 AGS-17 automatic grenade launchers, 111 machine guns, and 68 BMD airborne-infantry combat vehicles, to name a few. To lift the full brigade with its BMDs would require 41 Hip and 125 Hook sorties. Leaving the BMDs home would change this to 75 Hip and 35 Hook sorties.

Deployment

Airmobile brigades are reportedly deployed at Kutaisi in the Trans-Caucasus Military District, Mogocha in the Trans-Baikal Military District, and Magdagachi in the Far East Military District. Another is reportedly deployed in the Central Asia or Turkestan Military Districts.

The air-assault brigades are heavier units than the airmobile brigades, but lack the organic helicopters, depending on the allocation of helicopters or fixed-wing

transport assets held at army or front level. Ten are reported in the Soviet order of battle, including one each in Leningrad, Afghanistan, East Germany, Hungary, the Baltic Military District, the Byelorussian Military District, the Carpathian Military District, the Odessa Military District, the Central Asia Military District and the Far East Military District.

Supplementing the brigades are independent Air Assault battalions. Also made up of airborne-qualified personnel and without organic lift capability, Soviet army-level headquarters may have one — possibly more — of these battalions for operations up to 30 kilometers forward of the Soviet spearheads. Organized in the 1970s and early '80s, these battalions give a tactical air-assault capability for the types of missions that previously would require the detachment of a motorized rifle battalion from one of the army's divisions.

In addition to these units, each Soviet motorized rifle division and independent motorized rifle brigade (there are two of these, the 70th and the 66th, in Afghanistan) has one motorized rifle battalion especially trained for heliborne operations. This means that their commanders and troopers will be more flexible than the usual Soviet units, and will be used to fighting without their armored personnel carriers or infantry fighting vehicles. Previously, each Soviet motorized rifle regiment had one company specially trained for helicopter operations. This change shows that the Soviets are thinking in terms of larger helicopter operations.

A New Soviet Capability

The deployment of air-assault and airmobile brigades gives the West a new threat to have to deal with. The Soviets were moving toward large-scale heliborne operations even before Afghanistan, but their extensive experience in these types of actions in Afghanistan must have sharpened their capability. The improvement in helicopters has also been matched by an improvement in transport aircraft. There are now more available for Soviet airlifts, not only Cubs but more Il-76 Candids, equivalent to the U.S. C-141 and, now, the An-400 Condor, bigger even than the U.S. C-5A. The Soviets are combining their global interests with a global power-projection reach. Air-assault and airmobile brigades are but one manifestation of the increasing Soviet threat. □

Standard T-72 on parade in Moscow. Lack of smoke tubes on the turret front and armored skirts over the suspension are the main differences between T-72 and T-80.



Soviet paratroopers in action. Air assault and airmobile brigades are equipped with 5.45mm AKS-74 assault rifles.



LEGAL ARTILLERY

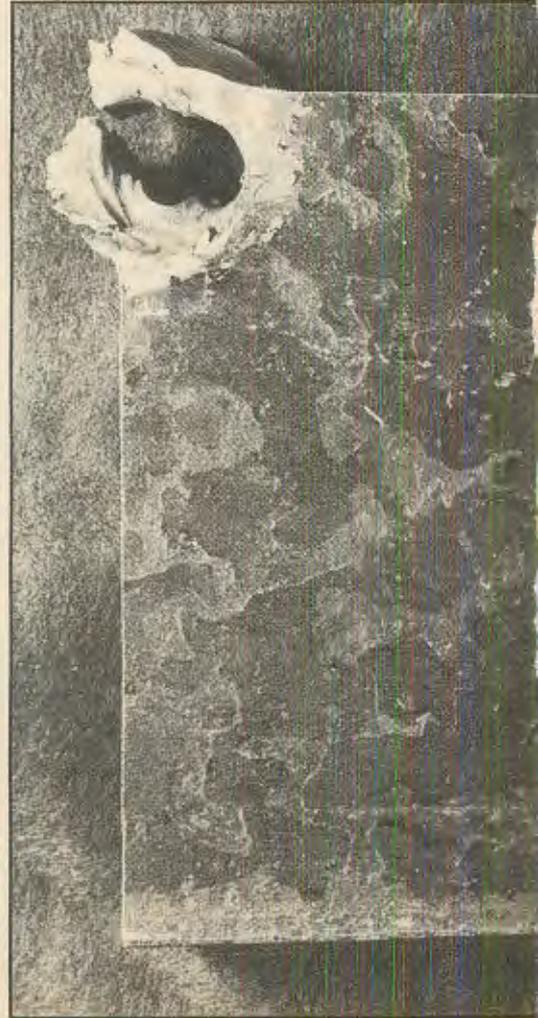
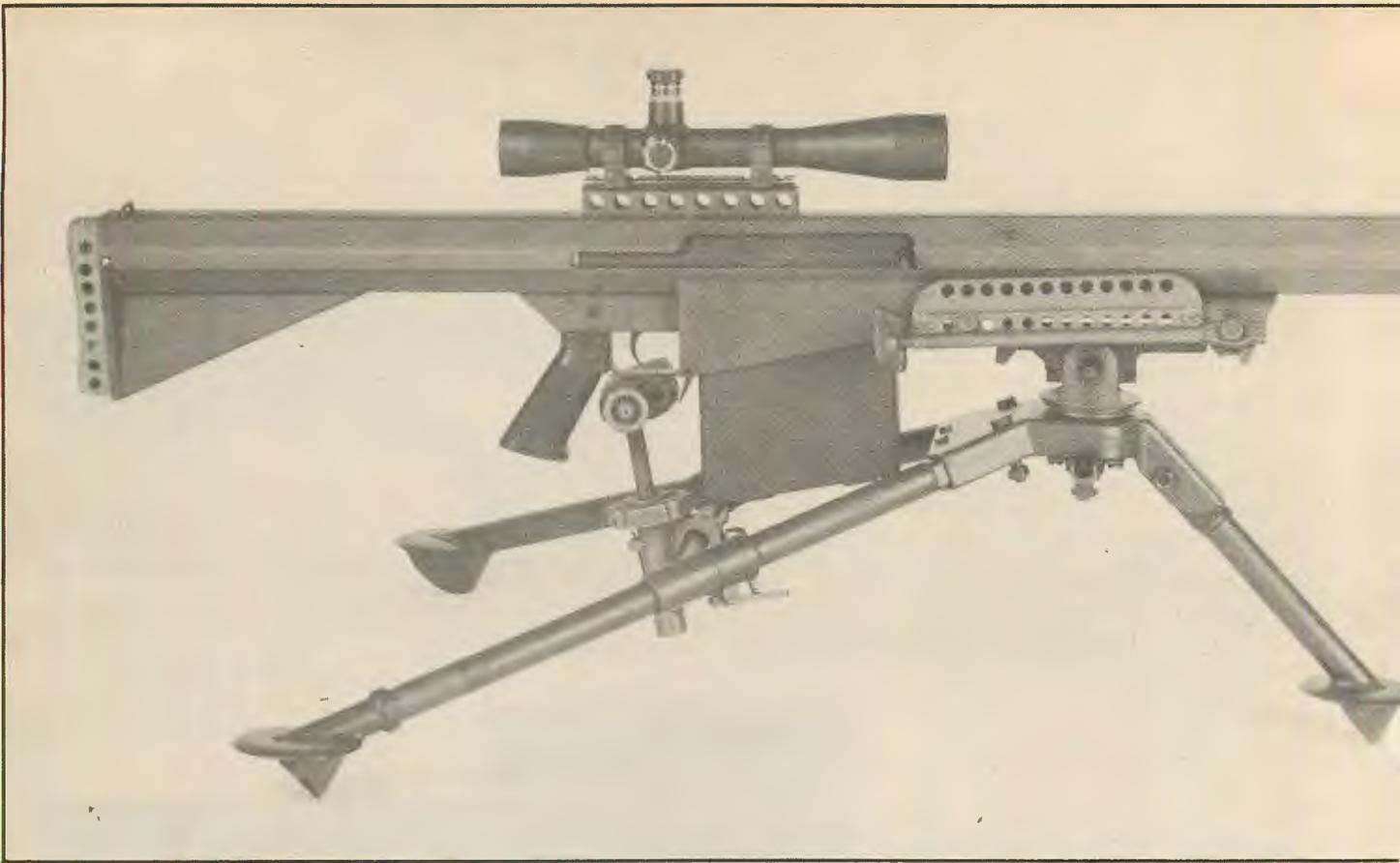
.50-CAL. SNIPER RIFLES

Quick Kills at 3,000 Yards

by *Combat Weapons Staff*

Distributor Richard Stroessner demonstrates Klaus Horstkamp's bolt-action, single-shot .50. Offset scope allows low, natural firing position.







TOP INSET: Barret Light .50 takes down easily, providing passable portability.
LOWER INSET: Barret muzzle brake provides soft recoil with moderate weight.
ABOVE: One-piece, solid steel, triangular faced bolt.

ing a mere 20 pounds.

All Horstkamp models are available with either carbon or stainless-steel barrels. Each is fitted with a large, perforated muzzle break that helps control recoil, but at present increases the rifle's signature by blowing dust all over the place. Purchasers have a choice of either wood or fiberglass stocks.

Horstkamp's rifles have the distinction of being the only specifically designed .50-cal. sniper rifles to have seen combat by U.S. forces. U.S. Navy SEALs carried two Horstkamp rifles into combat on Grenada last year. These sniper teams produced six confirmed, one-shot kills.

A common problem related to .50-cal. sniper accuracy is that the .50-cal. M1 Ball

ammo available for the rifles is not compatible to minute of angle accuracy. Designed for use in the M2 Browning HB, the M1 Ball is perfect for area fire on full-auto, but due to built-in low tolerances, unsuited to accurate single-shot firing. Because of the low tolerances held while the ammo is manufactured, a dispersion pattern is produced. This is excellent for area and aerial fire, but wholly unsuited to the sniper's requirements. The problem is solved by handloading .50-cal. sniper ammo. A few of Horstkamp's favorite loads are listed:

- 500 gr. bronze—242.5 gr. IMR 5010—3,035 fps
- 500 gr. bronze — 245.0 gr. IMR 5010 — 3,400 fps

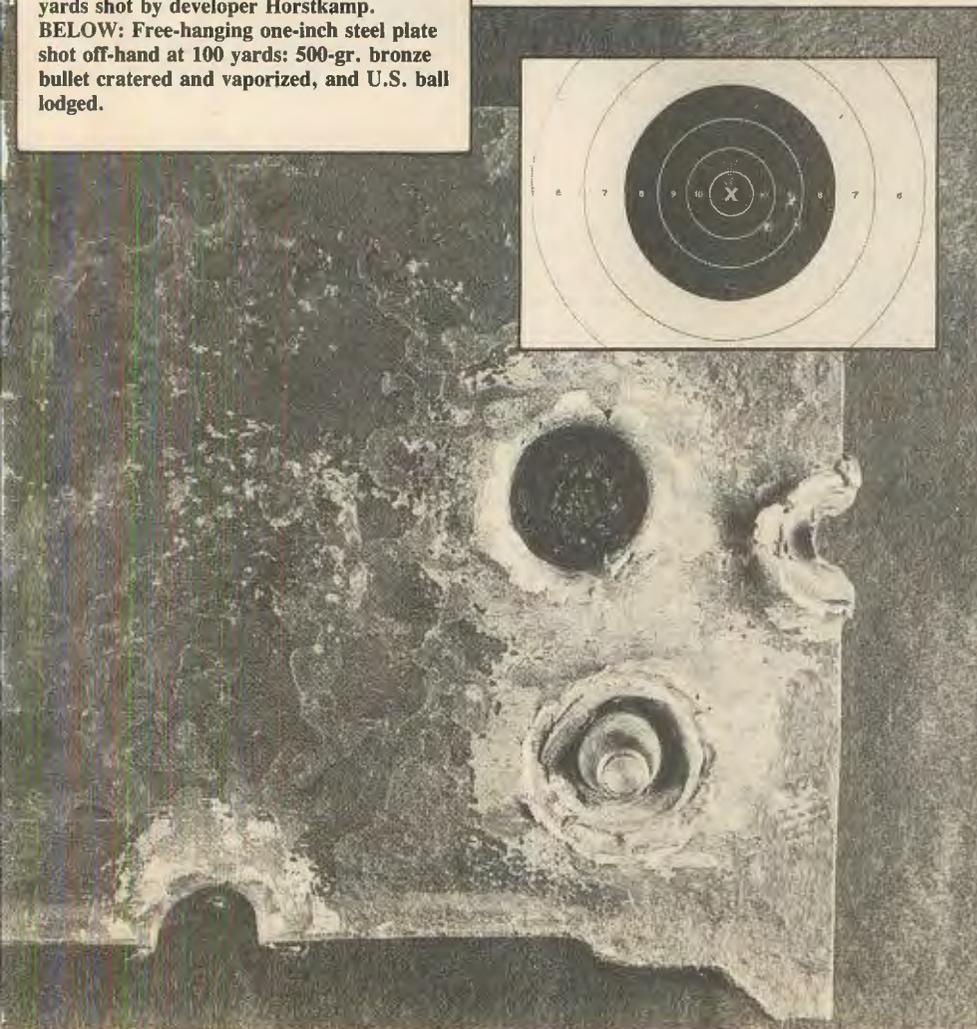
- 764 gr. bronze — 242.5 gr. IMR 5010 — 2,792 fps

Horstkamp's loads use lathe-turned bronze bullets. Obviously, .50-cal. sniper shooting is for more than the occasional hobbyist.

Work continues on the development of a .50-cal. sniper rifle that will be officially adopted by the U.S. military. When and if it happens, a controversial area of military procurement and mission will be defined. But in all truth, I would not hold my breath, for if you examine the record, you'll see the hassle involved in simply changing the service pistol, let alone adopting an entirely new weapon and mission to accompany it. □



ABOVE: Tripod-mounted Barret Light .50 is equipped with 12-rd. detachable box magazine. **BELOW LEFT:** VMP T80E1 is put through its paces at the range. **RIGHT:** One-and-three-eighths-inch group at 300 yards shot by developer Horstkamp. **BELOW:** Free-hanging one-inch steel plate shot off-hand at 100 yards: 500-gr. bronze bullet cratered and vaporized, and U.S. ball lodged.



acceptable accuracy at distances exceeding 2,000 yards.

Barrett Model 82

Barrett Firearms U.S.A. is a new outfit out of Murfreesboro, Tenn. The Model 82 is termed the "Light Fifty" by the manufacturer, and tips the scales at 35 pounds. According to Barrett, the Model 82 was designed "to equip the foot soldier with a heavy-caliber weapon, without the need for vehicle transport or crew service." Barrett's intent may be admirable, but I'd still plan on needing either a jeep or a truss.

Kidding aside, the Barrett Model 82 is a recoil-operated, semi-auto design that look's strikingly like an FN FAL with a hormone problem — very intimidating. Featuring a seven-pound recoiling barrel, the system reduces felt recoil by 35 percent. Upon firing, the barrel recoils 3½ inches, forcing the rearward motion of the bolt carrier and releasing the triangular bolt from the barrel. The exterior angles of the triangular bolt-head form the three locking lugs.

The Light Fifty is equipped with a 12-round detachable box magazine. Overall length is 60 inches. The rifle is constructed of milled 4140 steel, and the bolt itself is made from a new super-steel called "S-7." The rifle can proficiently and safely handle the 50,000 psi operating pressure generated by the .50 cartridge.

Since the Barrett Model 82 is semi-auto only, anyone can own the weapon. I'm certain you'll cause quite a stir at the range when you sidle up to the bench and let fly down range!

VMP T80E1

VMP's T80E1 is the brainchild of K.D. VanFossan, honcho of this new company out of El Cajon, Calif. The T80E1 is built around a Mauser turn-bolt design, fitted in bullpup configuration. Loaded, with an M60 bipod attached, the T80E1 weighs 40 pounds. Preproduction models feature walnut stocks, but these will be replaced on production guns with fiberglass numbers.

Utilizing a three-lug, forward-locking bolt, the T780E1 is a single-shot. Bolt rotation is 60 degrees. Barrel length is 36 inches, found to be optimum at duplicating velocities produced by the M2, for which the cartridge was originally designed.

Featuring a special muzzle break designed by DTA Associates, the T80E1's felt recoil and audio signature is effectively reduced to levels that approximate the firing of a 12 gauge, three-inch magnum from a standing breech scattergun.

Being of bolt-action design, the single-shot T80E1, like the Barrett Model 82, can be purchased by any firearms enthusiast.

Klaus Horstkamp—State Arms Gun Co.

This small Waunakee, Wis., manufacturer offers three .50-cal. sniper rifles, all of which are single-shots. The full-length bolt-action model, similar to the Mauser design, weighs 26 pounds. A falling-block version tips the scales at 23 pounds. Horstkamp's lightweight is the "SWAT" model, featuring a titanium straight-pull bolt and weigh-

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ROBERT K. BROWN

SOF's Editor/Publisher Robert K. Brown has been called an American anachronism. He's also been called a lot of other things not so complimentary. None of that bothers the 52-year-old patriot and driving force behind Omega Group Ltd. and *Soldier of Fortune* Magazine. He's a Vietnam veteran of service with the Army's elite Special Forces, a staunch patriot who's not afraid to take a position and hold it against detractors. Bob's insight, experience, moral commitment and philosophies are reflected in all of our publications.

On the way to creating a successful publishing company, Bob has appeared with regularity in world hot spots such as Central America, Africa, the Middle East

and Europe to insure his reporters and editors give SOF readers factual, hard-hitting accounts of events surrounding the fight for freedom.

Robert K. Brown

Born 1932, Monroe, Michigan
Graduated 1954, University of Colorado, Bachelor in History
Enlisted 1954, United States Army
Commissioned 1955, served as Special Agent, Counter Intelligence Corps
Graduated 1965, University of Colorado, Master's Degree in Political Science
Volunteered 1965 to go Airborne, Special Forces, A-Team
Printed 1975, 8,500 copies of the first issue of *Soldier of Fortune* Magazine, with total investment of less than \$10,000

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ATTACK CHO

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by Max Grosse



PPERS



SNAKES, Hinds, Cobras, gunboats, tank-busters or attack choppers — call them whatever twists your tail-rotor. These new airborne animals are the sexy starlets of the modern battlefield. Initially proven in the jungles of Southeast Asia, the armed helo has since earned a priority place in modern military strategy for both conventional and unconventional operations. The attack chopper's speed, agility, firepower and response time have saved thousands of grunts from an undesirable end.

No matter where they operate, or for what purpose, soldiers will likely find themselves calling for airborne gunships. Technology and tactics have come a long way since the days of two M60 machine guns and a case of frag grenades in the doors of a Huey.

Stories abound as to the origin of the armed helicopter concept. Rotorhead historians who fly for the USMC claim two crew chiefs and an aerial observer in Korea hung some rocket pods on an early bird after a tough day of medevac work and a tougher night brainstorming at the slop-chute. The whirlybird pioneers of the U.S. Army's helo school at Ft. Rucker, Ala., say the attack helicopter is a well-thought-out product of intricate staff studies and an underfunded R&D budget. The truth remains a mystery. But there is one thing for certain: American fighting men know more about building, flying and fighting attack helicopters than anyone else in the world.

Ever since the first chopper lifted off a pad bearing ordnance, the heavy-hitters in the armament and strategy game recognized the potential for using the armed birds as a sort of airborne, self-contained fire-support base. All the significant helicopter manufacturers in the world today — Bell, Hughes, Westland, Agusta, Aerospaziale, Sikorsky and Ivan's Mikhail Mil — have provided some sort of gunship for sale, trade or as an expression of foreign policy. What was once an improvised weapon has become the object of enough technology and research to make Darth Vader's Death Star look like a Caribbean cruise ship.



SKYWARS



ABOVE AND BELOW FAR RIGHT: Russia's front line-battle chopper, the Mi-24 Hind-D, is flown extensively by Soviet crews in Afghanistan. The Hind can fire its ammo load, then dismount its crew in a safe area to load its on-board stores. The crew compartment is pressurized, making the Hind ready for war on future NBC battlefields.

INSET: AH-64 Apache's sophisticated optical sighting system is linked to the Hughes XM230E1 30mm chain-gun mounted in a suspension under the crew compartment.

Modern military utility helicopters generally include troop transports, scouts, medevac birds and heavyweight cargo haulers. None of these are designed for toe-to-toe shoot-outs and generally carry only one or two machine guns in the .50-caliber or smaller range. Doorgunners saved the lives of countless pilots and infantrymen in Vietnam, but the fact remains that an M60 MG or the venerable "Ma Deuce" spraying lead out the door poses little threat to a Soviet ZSU-23-4. They will give a pesky Hind a bloody nose, but the gunners are really just defending themselves. When we talk about armed helos today, we mean birds with just one purpose: to locate and eliminate the enemy.

Few nations other than the United States, the Soviet Union and several NATO countries are able to fund the design, construction and production of an attack helo from the ground up. Most of the world's helo-supported armies get their birds from a Western or Soviet Bloc sugar daddy. And





their attack helicopters are generally provided in the form of bolt-on kits that effectively arm a small or medium transport ship such as the American Huey, the French Gazelle or the Russian Hip. Virtually all current European armed helicopters are derived from older, proven airframes.

The British armed the Westland Scout, an elderly light-reconnaissance bird, and used it effectively in the Falklands fight. Their employment of it in the gunship role was essentially a "Katy-bar-the-door" sort of innovation. As part of their planning for the Falklands landing, they also built add-on kits to give the Royal Marine Commando Air Squadron a rocket package for their French-built Gazelles. The entire work-up, from concept to issue, took only eight days. The kits were delivered just as the Third Commando Brigade set sail for the South Atlantic.

Having received the kits and rockets, the Commando Air Squadron sent a message requesting that an expert be placed aboard the task force ships to help with installation. The reply from Whitehall was immediate: "Once you have them installed and fired, *you* are the experts." Such last-minute quick fixes are common in the continually progressing business of building and employing attack helicopters.

Other European nations have armed their own standard reconnaissance or transport helos, mostly as dedicated antiarmor birds for the perceived tank-heavy scenario of war in the European flatlands. West Germany has TOW missiles on its MBB BO-105 light helicopter. France, the originator of the antitank helo concept, has an add-on package for the Gazelle that includes the HOT ATGM. Italy, Belgium and the Netherlands all have some sort of plan for arming their light helicopter fleets to serve in the air-to-ground attack role. The vast majority of these birds have not found their way out of Europe.

High-tech is the wave of the future for gunships, but there will continue to be plenty of work available for experts in the low-tech spectrum of attack helicopter employment, particularly in Third World conflicts. Given the long lead time before a helicopter is adopted, many of the sophisticated American, Soviet and Western European gunships of the future will not be realities

MI-24/HIND-D





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The Apache performs its tank hunting job admirably. Weapons on the AH-64 include 2.75-inch rockets, up to 16 Hellfire missiles, and ammo for the 30mm Hughes Chain Gun. It will prove to have outstanding offensive capabilities, and it's not easy to bring down, either. Large temperature-reducing exhaust pipes protect the aircraft against heat-seeking missiles. Flyability is excellent. With the possible exception of the Hind, it's the only chopper that can fight a night battle over a mid-intensity conflict.

that combat men will have to deal with for a few years

To make this account useful to the men who may fly or fight against gunships, I've limited the detailed explanations and comparisons here to the Russian Hip/Hind family and the American Cobra/Apache evolution, with some mention of Israeli combat experience with the Hughes Defender and its currently available variants.

The success of American attack helicopters in the latter years of the Vietnam War was not lost on the Soviets. The Russians have been stealing U.S. technology since World War II, so it is not surprising that American ideas about the design of helicopter gunships found their way into the inner sanctum of Mikhail Mil, the Russian helicopter design bureau.

The Soviets began to arm their transports just as the Americans did, primarily by making structural changes to a standard troop-carrier, the Mi-8 Hip. Their bolt-on weapons package included up to four pods for 16x57mm rockets or a mix of air-to-ground rockets and ATGMs. The later Hip-E was more heavily armed: a triple rack for external stores including antitank missiles, bombs and pods, each containing 16 to 32 57mm rockets, a 12.7mm machine gun in the nose and a rifle squad in the back. In its current configuration, the Hip-E is one of



The Soviet Mi-24 Hind has been the mainstay of the Soviet heliborne forces since it was first sighted by Western observers in 1973. Although heavily armed, the Hind can still carry a 12-man infantry section.

the most heavily armed helicopters in the world.

In the late 1960s, the latest American technology was again used as a basis for Soviet improvements in attack helicopters. The awesome Hind, which continues to raise hell with the mujahideen in Afghanistan, was essentially a rip-off of work done by Lockheed in conjunction with the U.S. Army.

Lockheed engineers developed a gem of a gunship that could cut through the air at more than 250 knots and carry enough ordinance to simulate a battalion of direct support artillery. Called the Cheyenne, it featured a pusher propeller on the tail and winglets to provide lift as well as stations for bombs, rockets or gun pods. The Cheyenne was to be the armed Huey what a B-17 was to the Piper Cub. Its production and introduction to Army aviation units was delayed by political in-fighting, and the project virtual-



The old gunship: Vietnam War-era AH-1 Cobra is now being replaced by the new AH-64 Apache. It's being replaced, but it won't disappear. Don't be surprised to see the old Snake in wars to come. Photo: AP/Wide World Photos

ly died in this country.

The Soviets did not have to deal with political considerations or tight budgeting, and ripped off the concept to produce the first operational versions of the Mi-24 Hind. They increased the size and lift by incorporating the proven engine and transmission package from the Hip, and added a new flight deck and improved weapons racks. It wasn't long before our G-2 types figured out they were facing a whole new breed of battlefield tiger.

The first operational Hind-A had wing stations for four pods (each carrying 32 57mm rockets) and rails for four Swatter ATGMs similar to the U.S. TOW. The bird also featured a 12.7mm machine gun in the nose which could be slaved to a TV sighting system.

In the Soviet view, the Hind-A was in reality an armed transport, able to provide the rifle squad it carried into combat with close-in fire support after depositing them in a landing zone. All current models of the Hind feature an armor-encased flight deck and a crew of four: pilot, co-pilot, gunner and observer/crew-chief. The Mi-24 is very large for the attack helicopter role and uses a fully articulated rotorhead which restricts its maneuverability, a bonus that is not lost on American helo pilots who may have to face Hinds in the air.

Soviet research and development in the Hind family has continued and produced the D variant (known as the Mi-27 in the Com-Bloc), regarded as the Russian front-line attack helicopter. The Hind-D is essentially a redesigned A model with a completely new weapons system and crew compartment. The large, flat-plate canopies of the Hind-A have been replaced with individual bubble-type canopies that cover a two-man cockpit. Slung under the nose is a four-barrel, 23mm Gatling-type cannon mounted on a slewable turret. The bird features a wide range of sensors and sighting devices, including a TV tracker for the Sagger ATGM and optics for the guns. Rumors of an infrared vision system in the Hind-D are thought by U.S. experts to be unfounded

speculation at this point.

The crew compartment of the Hind-D is pressurized to allow combat operations in chemical, biological or nuclear warfare. This feature has not been incorporated in current Western attack helicopters, demonstrating once again the Soviet obsession with flying, fighting and surviving on an NBC battlefield.

In place of the Russian rifle squad stacked in the back of the Hind-A, the D variant can carry a complete second unit of fire for its rocket pods and Swatter rails. In combat, a Hind-D could blast off its initial ammo load, jump behind the advancing line of motorized infantry, and dismount the crew to reload from on-board stores. It's essentially the same concept envisioned by the U.S. planners who touted the thin-skinned ONTOS antitank armored vehicle with its six externally-mounted 106mm recoilless rifles.

Obviously, the position of loader on an ONTOS was not overly popular among crews who took the vehicle into a fire fight and then had to stand out in a lead-storm to reload. I suspect the same would hold true for Hind crewmen who would not be over-anxious to leave their armored compartment to stand around in the midst of incoming and reload rocket pods or Swatter rails.

The Hind continues to be the Soviet Union's first-line attack chopper. The A model has been widely exported to Soviet client-states. Libyans, Algerians, Yemenis and Iraqis all fly Hind-As, and rumors persist that Cuban pilots are flying them in Nicaragua. The Hind-D has been distributed among eastern European forces and is flown extensively by Soviet crews in Afghanistan.

Approximately 2,000 Hinds of all variants have been built, including updated E and F models with various minor sophistications of the basic gunship. Most of the improved models are found among forces of the eastern European countries and with the massive Group of Soviet Forces in Germany. The Hind-E is a dedicated antiarmor bird fitted with the AT-6 Spiral ATGM, the Soviet counterpart to the American Hellfire.



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Although the range of the Spiral has not been officially revealed, the missile launched from a Hind is thought to be capable of engaging targets out to 7,000 meters.

The Hind, particularly the D/E models, is the primary threat in the European theater. Its combination of firepower, fire-control systems, armor and speed make it a serious contender for king of the hill. The Soviets continue to work on improving the Hind and are gaining valuable combat experience flying and fighting the bird in Afghanistan. They are rapidly building Hind fleets in Europe and beginning to export more of them to puppets around the world.

Defeating the Hind is no duck-shoot. Nor is it impossible. Like all helos, it is vulnerable to hits in the engine and transmission. Generally, rounds in the 30mm range will penetrate Hind armor, and the blast effect of Stinger, Redeye, Sidarm or Sidewinder-type missiles will ground a Hind quicker than a vodka-soaked mechanic.

Hind crews have very little vision to the rear of the aircraft, a fact that has not been lost on U.S. attack helo pilots. The Afghan rebels have repeatedly shown that the Soviet attack bird is vulnerable in the belly area, particularly if it is carrying an ordnance reload in the cargo bay. Sheer size and a lack of quick maneuverability will make it difficult for Hind pilots to out-fly smaller, more agile opponents in the air. The Hind is strong and deadly, but has never proven itself against anything more damaging than small-arms fire. It is not the undisputed king of attack helos.

Soviet helicopter designers have given only nodding consideration to crash-worthiness, an item that understandably concerns the men who fly gunships. Russian tactics call for filling disputed airspace with heavily armed birds. If one or two go down, there will be more to take their place. It's essentially an offshoot of their tank and infantry philosophies, and there is no hard intelligence as to how the lack of built-in survivability features affects the morale of Soviet helo crews.

Western designers, who like to generate high-tech jobs, have been more concerned with sophisticated systems that reduce a gunship's chance of being detected and then downed. They opt for high-cost items such

as radar jammers, IR suppressors, and ultra-quiet rotor systems. Most pilots — Soviet and American — agree that such things are important, but would like to see more bucks spent on ways to keep them alive if all the fancy gadgets don't work.

The Soviets don't have to justify defense expenditures and have opted for more armor and a bigger powerplant to solve the survivability problem. Soviet pilots rely on speed rather than maneuverability; their helos tend to wallow at low speeds. Western designers don't agree with this strategy, as modern anti-aircraft tracking systems provide lock-on and gunnery solutions very quickly — too quickly to be defeated by a 30-50-knot airspeed differential. U.S. gunships have better agility and handling characteristics than dash speed, giving them the edge when maneuvering to avoid fire among trees and mountainous terrain. U.S. design also pays more attention to crash-worthiness and survivability without sacrificing payload.

Perhaps the state of the art in that consideration is Hughes Aircraft Corporation's AH-64 Apache. At around \$8 million a copy, it is the most advanced, survivable and sophisticated gunship in the world today. It is designed to operate and last under the worst possible conditions. U.S. planners figure that will mean fewer birds to be purchased and fewer pilots to be trained — a philosophy that has permeated American weapons-system thinking from the B-1 bomber to the M1 tank.

Survivability in an attack helicopter translates to agility, speed, small size, a low IR signature, an ability to absorb punishing hits, and weapons that can be fired effectively from greater ranges than the enemy's. Hughes designers claim their Apache gives U.S. Army aircrews all of these and more. The bird has been designed to absorb hits of up to 23mm and remain airborne. The aircraft's vitals, like the crew, are protected by armor plate that will stop most 12.7mm fire, and the airframe can absorb an impact of 42 feet-per-second. Those are the good points,

which have yet to be combat-tested.

On the negative side, the Apache has a top speed of only 167 knots in level flight, which is not much improvement over current production model AH-1J and T model Bell Cobras. Some Army pilots have been heard grumbling about the Apache's relative sluggishness in the air, but most of them readily agree that the bird has the finest night-fighting capability in the world. It is a vast improvement over the after-dark capabilities of the current Army AH-1S and Q model Cobras.

The Apache sighting and fire-control package is amazing to most attack pilots who have flown the bird. The gunner has the ability, using low-light TV, to see in nearly total darkness. The crew can fly nap-of-the-earth (NOE) altitudes, find targets, fire and guide the weapons to their targets in total dark. The system that allows all this (TADS/PNVS) is contained in the barrel-and-ball housing mounted in the nose of the aircraft. The visual display is presented to the co-pilot/gunner through a single eyepiece which has been stabilized to dampen vibration from the rotor system and drive train. The gunner can slew the sight system, using a conical button on a control grip. The system depends on Forward Looking Infra-Red radar (FLIR) for nighttime function. Reflected heat from terrain or targets is displayed on a small scope in the gunner's position. The vision system is sophisticated enough to see through the daytime haze and smoke of a battlefield.

All this optical sighting sophistication is linked to the Hughes XM230E1 30mm chain-gun mounted in a suspension beneath the crew compartment. This weapon can pump out HEI/AP rounds at the rate of 800 rpm from an ammo bay that holds 1,200 rounds. But the Apache's big battlefield stick remains the Hellfire ATGM, designed to put a severe crimp in the future of the basic armored fighting vehicle.

Up to 16 of the laser-guided Hellfires can be carried on the Apache stub-wings. The

The U.S. Air Force plans to use the Blackhawk as its utility helicopter. An initial order of 243 UH-60s will augment the old UH-1s until they are replaced. Photo: AP/Wide World Photos



Hughes AH-64 U.S. Army's APACHE Attack Helicopter

AVIONICS/COCKPIT ARRANGEMENT

The APACHE has VHF-UHF-FM secure communication links and a lightweight doppler navigation system. Vertical-scale instruments and overall panel/console arrangements are designed to keep crew workload to the minimum.

PILOT'S DISPLAY PANEL

VERTICAL SCALE INSTRUMENTS
 • ENGINE TORQUE/TEMP
 • ENGINE/ROTOR SPEEDS
 • FUEL
 • OIL PRESS./TEMP

INTEGRATED WEAPONS CONTROLS

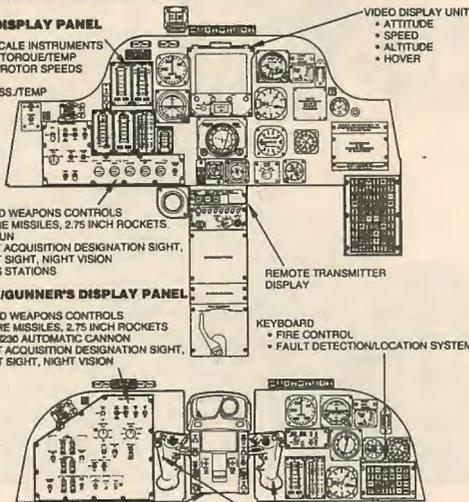
• HELLFIRE MISSILES, 2.75 INCH ROCKETS, 30mm GUN
 • TARGET ACQUISITION DESIGNATION SIGHT, HELMET SIGHT, NIGHT VISION
 • STORES STATIONS

CO-PILOT/GUNNER'S DISPLAY PANEL

INTEGRATED WEAPONS CONTROLS
 • HELLFIRE MISSILES, 2.75 INCH ROCKETS
 • 30mm M230 AUTOMATIC CANNON
 • TARGET ACQUISITION DESIGNATION SIGHT, HELMET SIGHT, NIGHT VISION

MULTIPURPOSE SIGHT SYSTEM
 • TARGET ACQUISITION DESIGNATION SIGHT
 • NIGHT VISION
 • HELLFIRE MISSILE/GUN CONTROL
 • FAULT DETECTION/LOCATION SYSTEM

VERTICAL SCALE INSTRUMENTS
 • ENGINE TORQUE
 • ENGINE/ROTOR SPEEDS



INDIAN COUNTRY ROLLS

Crews used to working in the cramped cockpits of Cobra gunships will feel like they've stepped up to a Rolls Royce when they climb inside the cabin of the Hughes AH-64 Apache. Relatively roomy and comfortable, the pilot's and gunner's compartments provide excellent all-around visibility while improving survivability odds with wrap-around armor.

Both crewmen sit behind armor shields that can take small-arms fire up to 23mm AP or HEI. That reassurance allows the gunner to concentrate on target lock-up without having to worry too much about distractions from passing shell fragments.

At the heart of the gunnery system is the TADS/PNVIS sight system that protrudes directly from the center of the gunner's instrument panel. Contained in the sight head are the direct-viewing optics (DVO) used for daytime engagements. Below the gunner's eyepiece is the electronic-display tube for the FLIR and daylight TV systems. An array of 28 switches on the sight head and hand-grip allows the gunner to select weapons and sensors, control the video display, slew the chain-gun and laser designator, track the target, fire the gun, rockets or Hellfire ATGM, and record the engagement via an on-board video recorder. To the gunner's left is a weapons-control panel and on his right a minimal reproduction of primary flight instruments. Apache gunners are provided normal flight controls, including a collapsible cyclic placed rather awkwardly in the "outrigger" style of the AH-1 Cobra.

Seated behind and slightly above the gunner, the pilot has full forward visibility and one of the most sophisticated instrument displays of any modern helicopter. Dominated by a video-display unit which provides both navigational and fire-control data, his panel follows an easy-to-read layout. Weapons switches and engine instruments are on the pilot's left, and the standard clock-face gauges have been replaced with multi-colored vertical tapes. Flight instruments are clustered around the video-display tube to provide a tight scanning pattern during IFR flight. A full-fault detection/location panel completes the pilot's instrumentation.

Both pilot and gunner share a helmet-mounted sight system (IHADSS) which allows them to exchange target information without speaking. In the AH-64, a small monacle in front of the right eye is the pilot's primary flight instrument for night operation, providing navigational cues and target information while allowing him to keep his head up and swiveling for external threats.

All this instrumentation is admittedly complex and will take some learning for efficient operation. There are, for instance, some 200 possible switch positions on the sight and ordnance panels, but the Apache's weapons and flight instrument systems have been well integrated. Once engaged, the gunner can fight without ever having to take his hands off the fire-control console. The machine can be flown and fought from either the pilot or gunner position, and the helmet-mounted sight allows for four eyes scanning the terrain in Indian country. — Max Grosse

missiles fly free of the aircraft rather than being guided by ultra-thin wire as is the case with the current TOW ATGM mounted on U.S. Cobras. Hellfires mounted on the Apache can be fired singly, in ripples or in a firing combination called "rip-rap."

Hellfires are launched in the general direction of a target and then ride a laser beam to impact. Coupled with the Pac-Man style sighting system, a basic attack helicopter engagement might happen like this:

After normal pre-flight and mission briefing, the crew enters routine flight, using a Doppler navigation system to the battle area. After lift-off, the pilot selects a first "waypoint" on the route, and a cockpit video system gives him turn indications through his helmet-mounted sight. This feature allows him to pick up navigation instructions from the system while keeping his eyes outside the cockpit and peeled for marauding Hinds or groundfire.

As the Apache crew passes the designated waypoint, a new one is selected and new heading cues are sent to the pilot. When they reach the designated target area, the gunner begins a search, using either direct-vision optics or FLIR, depending on condi-

tions in the area. When a tank has been identified, he switches to DTV and locks onto the target, using his TV screen display. With the movement of a single finger, he can "lase" the target to obtain a range for the TADS system. When he is ready to fire, the gunner signals the pilot to align the airframe with the target and squeezes off a Hellfire from one of the stub-wing hard-points.

The TADS system counts down the time of flight so the Apache can remain masked until a few seconds before impact. At the last second, the gunner again lases the target with a target-designating laser, and the Hellfire turns for a run down the beam. If it all works as advertised, the infantry can scratch one T-72 and get on with the war.

Hughes engineers also say their Apache can successfully attack multiple targets. Here's how that works. Let's presume our crew has arrived over the battlefield and determined that the bad guys are moving a column of tanks to attack friendly infantry and that the armor is protected by a worrisome ZSU-23-4 anti-aircraft vehicle. It's a little more difficult situation, but not out of the question for the Apache crew.

The gunner designates a first target with his laser sight. If he's smart, it'll be the ZSU that is marked as first to die. The data on that target is stored in the TADS. Several Hellfires are then punched off the rails, and one of them takes out the ZSU. Hovering just above the tree-tops, the Apache gunner then designates each tank in turn and puts Hellfires on course for collision. When the dust settles, all that can be heard is the roar of tank ammo cooking off and a steady clatter from the Apache's rotor-blades as the crew heads for home to reload.

If the ZSU can't be taken out and things are too hot for the Apache crew to loiter around the area for a pop-up attack, the AH-64 can simply fire off all its missiles from cover of a reverse slope and let infantry units on the forward slope designate the targets, using their own lasers. A section of gunships employed in such a manner could easily halt penetration by a battalion of enemy armor in places such as every tank-er's favorite German resort, the Fulda Gap. Out in the desert, things are a little different.

Desert sand and rolling dunes do not offer as much concealment for attack helos as do the forests and farms of central Europe.



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Rotor-wash can kick up an impenetrable cloud of troublesome sand, as demonstrated by the ill-fated helo crews who tried to take Chargin' Charlie Beckwith and his rescue force out of Desert One for the Iranian hostage mission. Engineers claim — and some testing supports it — that the Apache's navigation and sighting system is effective in such situations, but dust kicked up by the rotors produces a telltale cloud that can reveal the helo's position to antitank gunners.

Current solutions involve a system of running fire, such as Cobra pilots have perfected, or a combination of helos working together. To avoid loiter time or the necessity to hover close to the ground for protection, one helo would launch a missile while a partner designated the target with the laser. More experience with the Apache will likely perfect a solution, but the boys back at the airfield are still flying the Cobra as America's first-line gunship.

Bell developed the Cobra for escorting unarmed transports and close-in fire support for infantry in Vietnam. The design proved so successful that various configurations have been exported to Israel, Pakistan and Jordan. Under the former Shah, Iran purchased AH-1J model Snakes from the United States as did the government of South Korea. The Cobra is still being produced in a number of variants for the U.S. Army and Marine Corps.

Current plans for the Cobras being flown by the Army call for upgrading veteran AH-1Gs to Q and S models by adding a new, more powerful engine, flat-plate canopy, an IR suppressor, a 20mm cannon, Doppler navigation equipment, composite rotor blades and a laser range-finder. Army sources indicate all the improvements are needed to make the Cobra an effective match for Russian armor. Armed with the TOW ATGM, the Cobra represents a serious threat to the Russian tank phalanx. The bird's principal weakness is lack of firepower and its fire-control system.

The TOW is tracked optically. The gunner must keep the target in his sights during the entire time the TOW is moving from missile rail to target. That requirement means the Cobra and its two-man crew must loiter in the area of intense ground or anti-aircraft fire while the TOW travels to a target. The process generally takes about 30 seconds from launch to impact at typical



Based loosely on the Vietnam-era LOH-6 "Loach" design, the Hughes 500M Defender comes in several variants. The Defender is a relatively low-cost gunship, but has proven itself effective in combat. Defender 500M-D/TOW versions were employed in classic antitank roles by the Israeli Defense Force against Syrian armor. Smoldering T-62 hulks along the Beirut-Damascus road payed tribute to the little chopper's battle-worthiness.



ranges of engagement for a TOW. That's a mighty long time to hang around exposed in a hot fire fight, and certainly plenty of time for radar lock-on by AA weapons, not to mention the sustained fire that might be brought to bear in that period by infantry with heavy machine guns.

Current-model TOW Cobras have no night-vision equipment other than standard night-vision goggles worn by the crew. A FLIR-augmented TOW Cobra has been tested but is not yet in service with the Army or Marine Corps. The AH-1 will likely continue in active Army service well into the future. Orders for more AH-1S Cobras are currently in the hands of Bell contractors.

American Marines have a somewhat

different view of where gunships should go and how they should be used. For the USMC, the Cobra's primary mission is escorting assault transports flying troops in from ships offshore. Once ashore, helicopters are employed at the behest of ground combat commanders in the same role as envisioned for fixed-wing aircraft. They are not attached as an integral part of the ground unit as in the U.S. Army.

In the Marine Corps attack, helos for troop lift and armed escort are requested from the supporting aviation command and, when the fight is over, the Snakes go back to the barn for potential assignment to another unit. Because any Snake could be assigned any mission on a given day, the Corps has

opted for a standardized version of the bird. All USMC Cobras are being outfitted to carry TOWs as well as Zuni rockets, a 20mm Gatling-style cannon in the nose and an assortment of other weapons. In the final version envisioned by the Marines, the AH-1T will have bigger T700 engines (the same powerplant used in the AH-64 Apache), a Heads-Up Display (HUD) for the aircrew, an improved fire-control system, an inertial navigation system, composite rotor blades and a laser range-finder/designator. Hellfire will eventually replace TOWs on the Snake's stub-wings, and a new round will be loaded into the 20mm to provide more penetration against sophisticated armor.

But the big news among Snake drivers down on the flightline these days is that Marine helicopters are going to be armed with an anti-air missile: the combat-tested Sidewinder that served to down a number of MiGs over North Vietnam. This is being planned for the very near future, certainly before AH-64s are fielded in any great number. The Marines feel the addition of the Sidewinder will give them a gunship that can defeat the Hind in aerial fighting and be a serious threat to enemy fixed-wing aircraft flying over the battlefield as well.

On the friendly side of the seas, a number of other capable gunships are being produced to counter the Hip/Hind threat from the Soviet Union and client states. Among the helos that must take second seat to such deadly warbirds as the Apache and improved Cobras are aircraft such as the Hughes Aircraft 500M Defender. Based generally on the design of the familiar Vietnam-era LOH-6 (or "Loach"), Hughes designers have created a relatively low-cost gunship for those countries which cannot afford to spend the big bucks required to buy Apaches or Cobras. The Defender comes in four variants.

The basic Scout is the least changed from the venerable Vietnam-veteran Loach. It features surveillance gear, rockets and an externally mounted gun, either the 7.62mm machine gun or 30mm chain-gun, as well as a 40mm automatic grenade launcher.

For just a few dollars more, clients can purchase the 500M-D/TOW with rails for four ATGMs and a sighting system mounted in the nose of the aircraft. There is also the Hughes Quiet Advanced Scout which comes equipped with a rotor-mast-mounted sight that allows the aircraft to remain concealed behind trees or terrain features while still controlling the TOW to target, night-vision systems, a laser designator and a quiet rotor system that allows the bird to slip up on targets.

A fourth variant of the Defender is a 500M-D/ASW, a Navy helo armed with antisubmarine detection gear and a MK44 or 46 homing torpedo. Both the Koreans and the Israelis employ the 500M-D/TOW. The Korean Army has just placed an order for 200 of them to be employed in the anti-armor role. The Israelis proved the effectiveness of this relatively cheap gunship during the 1982 fighting in Lebanon. The



AH-64 Apache Attack Helicopter

AH-64A Specification Performance @ 14,700 Pounds

	Standard Day	95°F
Hover-In-Ground Effect (IRP)	14,600 Feet	8,000 Feet
Hover-Out-Of-Ground Effect (IRP)	11,200 Feet	6,700 Feet
Twin Engine Service Ceiling (IRP)	20,000 Feet	9,300 Feet
Single Engine Service Ceiling (IRP)	10,500 Feet	6,000 Feet
	Sea Level-Standard	4,000 Feet/95°F
Vertical Rate of Climb—FPM (IRP)	2,360	1,300
Maximum Rate of Climb—FPM (IRP)	3,150	2,500
Maximum Level Flight Speed—KTAS (IRP) ..	160**	155
Cruise Speed—KTAS (@ MCP)	160**	145
V _{DL} (Design Limit Speed)—KTAS	197	197
Maximum Range, Internal Fuel—NMI	235*	250*
Maximum Endurance; Internal Fuel—Hour ...	3.10	3.3

**Trans. Limit *30 Minute Reserve

Dimensions:

Main Rotor Diameter	48.0 Feet
Tail Rotor Diameter	9.17 Feet
Overall Length (Rotor Turning)	58.167 Feet
Maximum Height (to top of air data sensor) ..	15.24 Feet
Fuselage Width	3.96 Feet
Wing Span	17.15 Feet
Minimum Ground Clearance (Gun Stowed) ..	1.00 Feet
Main Landing Gear Width	6.66 Feet
Turning Radius	37.44 Feet

Engines (two each) T700-GE-701 Turboshaft 1694 SHP Each

Weights:

Weight Empty	10,600 Pounds
Maximum Internal Fuel Weight (JP-5)	2,555 Pounds
Maximum Weapons Station Weight Per Station ..	1,538 Pounds
Maximum Gross Weight	20,700 Pounds

Weapons Load Capability:

	Quantity
HELLFIRE Missiles	16
TOW Missiles	16
2.75 Inch Rockets	76
5:00 Inch Rockets	16
30mm Ammunition, Rounds	1,200
AIM-9 Sidewinder Missiles	6
Sidearm Missiles	6
Harpoon Missiles	4
Penguin Missiles	4



SKYWARS

HELO HASSLE ARMAMENT

Air-to-air combat conjures up the image of a steely-eyed aviator squinting through a gun or missile sight at the fiery tailpipe of a desperately scrambling enemy flier. The term has been typically — and all-too-romantically — associated primarily with fixed-wing fighter pilots. Those red-headed stepchildren of the aviation community — the guys who fly the helos — were typically presumed to be talking about evasive maneuvers when the subject of ATA came up at the officers' club.

Time and technology have changed all that. The gunship driver today knows the realities. He might well find himself loitering in attack position to bring fire on an enemy tank column one minute and in a life-or-death scramble with a marauding Hind the next. He also knows the issue will probably be decided in 30 seconds or less.

The U.S. doctrine on the subject views ATA combat between helicopters as chance encounters, occurring primarily when a gunship is either flying as armed escort or supporting ground troops in the antiarmor role. Planners recognize the relatively small American fleet of armed helos and do not envision a situation in which attack ships launch as a hunter-killer group seeking flights of enemy helos to engage in dogfights. And the U.S. Air Force jealously guards its heritage as dogfight experts. Most fast-mover jocks see the loss of the low-altitude fighter mission as a major threat to the fighter-pilot union charter.

In spite of all that, the U.S. Army's aviation command has recently adopted a plan for ATA helicopter combat. It's a day late, since attack-helo pilots have been working on their

own general theories for years.

The folks at Ft. Rucker have officially gotten into the helo ATA business only recently, but the Marines have been working on the scenario for at least six years in the air over the Arizona desert. In fact, Marine Weapons and Tactics Squadron 1, based at the Yuma, Ariz. air station, has been conducting a resident course and a traveling road show, instructing helo pilots on the finer points of winning an air-to-air hassle since 1978.

Their emphasis is on a proven recipe, including a thorough knowledge of potential adversaries and their capabilities, superior airmanship and an aggressive fighting spirit. MAWTS-1 graduates have returned to fleet helo squadrons as tactics instructors to bring front-line aircrews up to speed on fighting the ATA battle of the future. Despite all that, pilots recognize that tactics, knowledge and aggressiveness do not guarantee victory. Pilots do not live by stick and rudder alone.

To emerge as winners, combat crews need an aircraft armed with weapons that can engage an adversary accurately at great ranges and insure a reasonable chance of lethal effect. The present inventory of helicopter weapons was conceived entirely for air-to-ground work. Their use against flying targets was not envisioned by the planners who admit they are relatively ineffective in the ATA role.

Air-to-air rockets, even the supersonic Zuni, are effective only against large formations of transports or gunships in a hover mode. The TOW, with its wire guidance system, requires that a target be held and tracked for some 23 seconds at average engagement ranges. It is effective mostly as an ambush weapon in a situation where the victim does not realize he's being tracked for a kill or cannot otherwise bring effective counter-fire on the attacker.

For gunship pilots today, the most effective ATA weapon is clearly the 20mm or 30mm cannon mounted in their birds. The 20mm Gatling-style gun of the Cobra has a horizontal range of 1,500 meters. The Hughes Chain Gun on the Apache is effective to twice that range. Fortunately for crews of both birds, the 23mm cannon on the Hind can stretch effective range out to only about 1,100 meters. The U.S. crews can stand off and slug it out with enemy crews flying the Hind. And that's a good thing.

Current weapons limitations and the low altitudes at which most helos operate preclude the use of long-range search radar, which restricts the air-combat envelope to only a klick or two at most. The combination of limited range and limited visibility adds up to an obvious conclusion to attack helo pilots: By the time you see him, you're on him. And the first guy to get off an accurate shot flies away with all the marbles.

But there is room for maneuver, and pilots are rapidly developing tactics. Once an enemy bird is spotted, the good guys will try to remain undetected until they can move to within gun range or punch off an ATGM if they feel confident of their ability to hold and track the target safely. The ATGM option in ATA combat gives a significant range advantage, and the missile can be fired from any perspective on the target. A gun run, obviously, gives the best chance of a successful attack from the bad guy's six o'clock position.

If the attacking pilot discovers his target has wised up and has begun to maneuver, 2.75-inch FFARs can be used to restrict his evasive jinking, in the same manner a sheepdog herds a lamb, until the target finally flies into the fan of friendly groundfire. In the overview, though, the trusty gun is still the best club in the attack helo pilot's ATA bag.

Both guns and ATGMs are OK for dogfights and aerial ambushes, but both weapons are obviously limited by fire-control and aircraft-stability problems in a 3G-plus hassle. To increase the size of the engagement envelope and provide crews with reasonable first-round hits, the answer is an IR-seeking air-to-air missile. Both the Army and the Marines agree, but the two services' planners have typically taken a different approach. Army plans call for mounting an air-launched Stinger (ALS) on the AH-1, AH-64 and OH-58 birds, providing fire-and-forget capabilities at ranges of more than 5,000 meters. The lethality of the ALS is indisputable, but experts agree it has a drawback. The rocket trail provides a smoky finger pointing back to the launching bird. With the Stinger option, fire-and-forget really means: "Fire and get the hell out of the area."

Despite that consideration, the Stinger option suits the Army, which is trying to keep from overloading their already heavy gunships and scouts. The Marines have opted for longer-range engagements and a bigger punch by arming some Cobras with the AIM-9 Sidewinder air-to-air missile.

The Sidewinder is heavier and more complex than the Stinger, but it is the acknowledged granddaddy of the world's current heat-seeking dogfight weapons. The missile is 10 feet long, supersonic and designed to down fighter aircraft at engagement ranges of more than five miles. By choosing the AIM-9, the Marines feel they've gotten a serious ATA threat that can be used against attacking fixed-wing birds as well as enemy helos. Future technological advancements may even provide a lightweight version of the Sidewinder that can be carried in large quantities by both services on their gunships.

Experience with helicopter ATA combat is hard to come by among the pilots flying today, but all of them seem to agree on one thing: The key to surviving a dogfight with another armed helo is the same one that keeps ground-pounders alive in the bush. Keep your eyes open and your finger on the trigger.



Israeli Defense Force, which attaches all helicopters to the Air Force rather than ground units, has perhaps the most experience with TOW missiles as a basic anti-armor weapon for attack helicopters. Some examination of their experience facing Soviet armor might be interesting.

At the outbreak of fighting between the Israelis and the PLO, the primary targets were PLO tanks, mostly Soviet export versions of the T-34. These were often dug in and used as fire-support pillboxes by the Palestinians. The IDF pilots attacked them as hard targets with enormous success. Aircrews reported in mission de-briefs that the impact of the TOW literally lifts a T-34 into the air with its blast.

The TOW continued to be a battlefield winner when the Syrians got into the act. Hughes Defender 500M-D/TOWs were employed in classic antitank roles in Operation Shalom Hagalil and in action near Lake Caroun. Gunships under cover of fixed-wing Phantoms from the Israeli Air Force engaged and destroyed large numbers of Syrian tanks without significant losses. The helo role in these engagements was crucial.

Syrian tankers often hid their vehicles in friendly villages where they were essentially shielded from area attack by artillery or fixed-wing aircraft which would cause unacceptable civilian casualties. Only gunship crews could sniff out and engage them with sufficient accuracy and effectiveness. Israeli pilots describing such action typically understated the situation.

"Very static," commented one Defender pilot in response to a question about the nature of TOW-tank engagements. "The feeling is one of the sniper. You put the crosshairs on the target, fire the missile, and that's it."

Static action or not, the Defender did the job for the IDF, leaving the Beirut-Damascus road strewn with smoldering T-62 hulks. This bird has a secure place in the Israeli airborne arsenal.

Hughes is not the only American company profiting from renewed interest in attack helicopters. United Technology's Sikorsky Helicopter Corporation recently exhibited an armed version of their sleek S-76 executive transport bird. Sikorsky is the prime contractor for the UH-60 Blackhawk being flown by the U.S. Army and is trying to expand its interest in the gunship market. Many of the sophisticated components integral to the Blackhawk are modified and used on the S-76 Mark II Plus, as Sikorsky bills its attack bird. Although the company to date has valid orders for armed S-76s only from the Philippines, the bird is likely to gain popularity in both civilian and military areas where light attack helos are useful.

The S-76 Mark II Plus features door-mounted SU-11 Gatling-type guns, 2.75-inch rockets, Belgian TMP gunpods and the TOW ATGM. None of these gunships has yet been delivered, but Sikorsky predicts a brisk market among Third World nations.

American crews developed their gunship

tactics in the jungles and highlands of Vietnam. Gunship tactics were generally simple: Get in the target area, mix it up with a dug-in defender, or catch the bad guys in the open and hose them down with whatever ordnance happened to be on board. Weapons were mostly rockets and machine guns in a variety of mixes and sizes. Sighting systems ranged from grease-pencil marks on plexiglass windshields to high-power optics. American chopper crews owned the skies and flew like it.

After the war was over and tactical thinking returned to the problems of Soviet-NATO confrontations in Europe, helicopter-gunship employment changed. The old presumption that helicopters were safe anywhere above 1,500 feet disappeared with the appearance of the SA-7 SAM. The primary targets for attack helos were no longer troops in treelines but tanks and APCs. To fight and win, planners began to develop tactics that brought gunships right down on the deck, maneuvering at high speed.

Crews are being taught to use trees, draws and other natural cover to mask their movement, and increased emphasis has been placed on learning to fly and fight at night. American fliers learned from the massive Lam Son operations near the end of the Vietnam War that trying to force their way into a contested landing zone or a heavily defended objective was nothing more than a good way to end a promising career.

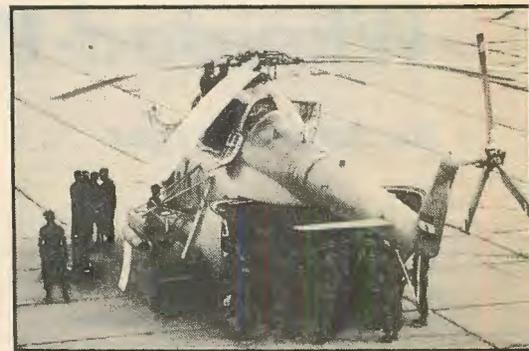
Current tactics call for airborne stealth and maneuver. Helicopter-gunship ambushes will become commonplace in the future. All the "gee-whizz" black-box electronic gear will be aimed at helping to keep as many of ours up and knocking as many of theirs down as possible.

Soviet tactical planners see it somewhat differently. After World War II, the Red Army rebuilt to emphasize heavy formations of artillery and armor. They relied heavily on massed artillery and tank units operating under the umbrella of their own air force to carry the day. Soviet tactics called for artillery — often entire battalions laid hub-to-hub — firing on objectives until the leading elements of the armored formations reached the area. Tanks and motorized infantry would then assault just as the final fragments of the rolling barrage fell to ground. The advent of armed helicopters on the battlefield called for a tactical compromise of that basic strategy. The Soviet solution was to heavily arm the helos, thus creating airborne artillery which could lay down the prep-fire for advancing infantry and armor.

A typical assault begins with Hind-Ds and Es escorting troop-carrying Hind-As. After the arty prep lifts, the Hinds roll in to begin firing on target, aiming for enemy armor or bunkers. The troops then land to assault while the Hinds loiter in the area for on-call missions in support. The second wave is generally Hips, ferrying more infantry and crew-served weapons. Once the objective is secured, the heavy-lift helos

bring in artillery and resupply to continue the advance. Through all this, Soviet attack pilots tend to view themselves as flying tank crews or APC drivers.

Their attack-helo formations are always tightly controlled and appear in pairs over the battlefield. Two sections under the control of a senior captain is the usual form of tactical employment for Hind gunships. They often fly in echelon, firing and then rolling off the target in sequence so that each section covers the roll-off of the preceding birds. Typical exposure time for Soviet attack formations is 30 seconds or about the same as that envisioned for NATO attack



The soldiers crowding around this Egyptian Mi-8 Hip-C, armed with S-57mm rocket pods, are U.S. Army officers. A standard 50-kg fragmentation bomb is displayed to the left.

helos in air-to-ground engagements.

Planning on both sides is taking into consideration the potential for air-to-air dogfights among helicopters. As mentioned previously, the Marines have taken a positive step toward solving this situation by arming some Cobras with Sidewinder air-to-air missiles. The Army development people at Ft. Rucker are currently looking at ways to hang Stinger missiles on both the OH-58 and the AH-1 without giving up too much other mission-essential ordnance on an over-loaded bird.

Rumors are circulating in the intelligence community that the Soviets have already field-tested a Hind-E armed with an air-to-air IR missile. There is no confirmation, but the Soviets are not foolish enough to ignore the possibility of having to face helos in dogfights over some future battlefield.

The U.S. Army has recently published a field manual on air-to-air combat for helicopter crews, and the Marines have been practicing such maneuvers for years over desert ranges near Yuma, Ariz.

It's clear that designers and dreamers on both sides of the Iron Curtain have become convinced that the attack helicopter is on the crest of the future combat wave. But it will be skill and tactical employment by gunship pilots that determine the outcome of the issue. Military history is full of examples of underarmed, outnumbered bright guys beating hell out of supposedly superior forces. It's bound to be the same way when the next battlefield is dominated by the roar of rotor-blades. □

FAST ATTACK VEHICLES

Wheeled-Warfare Preview

by John Metzger

FT. LEWIS, WASH. — The accelerating sophistication in military development today can make new equipment obsolete overnight. But even with the threat of nuclear conflict, borders will continue to be changed, regimes will be overthrown and villages will be overrun by small groups of lightly-armed, highly mobile and elusive combatants. Guerrilla warfare is the challenge of the future and American soldiers — if not acting as guerrillas themselves — will likely be fighting them. The quickest, most invisible and hardest to catch will cause the damage and win the wars. Superior firepower combined with unbeatable mobility will be the success formula for victorious ground troops, now and for the future. Movement capability will be a critically important weapon.

In anticipation of use with the Rapid Deployment Force, the U.S. Army 9th Infantry Division at Ft. Lewis is testing, breaking in and refining a new concept in wheeled warfare: The Fast Attack Vehicle (FAV). The present concept is one of *offensive* off-road movement. Not designed for mobilization duties (though they may serve as such), FAVs will carry attackers to target and get

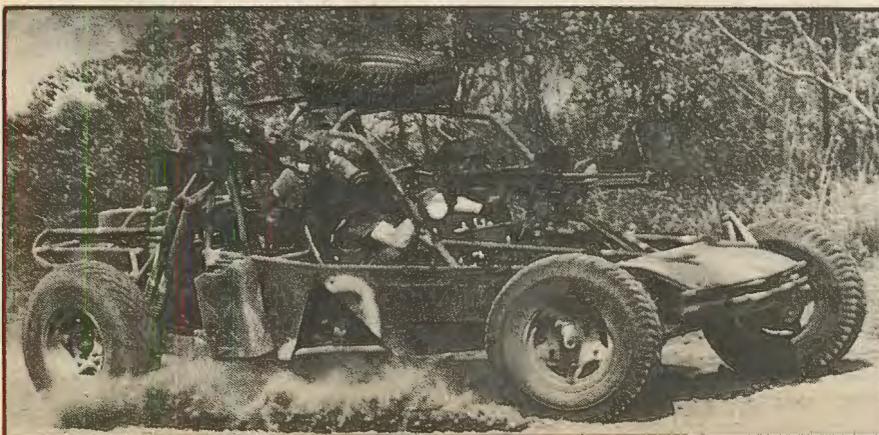
them out fast down a trail few could follow. Unless the enemy has a weapon of equal utility, FAV-borne American guerrilla fighters will have the edge in future fire fights.

Final results are not in, but field testers have established the requirement that the vehicle must be easily transportable by chopper or cargo aircraft. The 2/1 Infantry Bn. is presently establishing maneuver concepts, air transportability studies, and determining the best weapons mix for the FAV platform.

Combat Weapons correspondents are presently on assignment at Ft. Lewis, covering RDF developments, including the FAV program. The next issue of CW will provide a better look at these battle-ready dune buggies. Here's a quick look at three new vehicles that may see action in future conflicts.

One of the more successful designs in the test program, aptly christened the "FAV," is built by the Emerson Electric Company. Emerson has recently completed delivery of 120 vehicles to Ft. Lewis. The Army has developed a working weapons system for it, with primary armament being the Mk-19

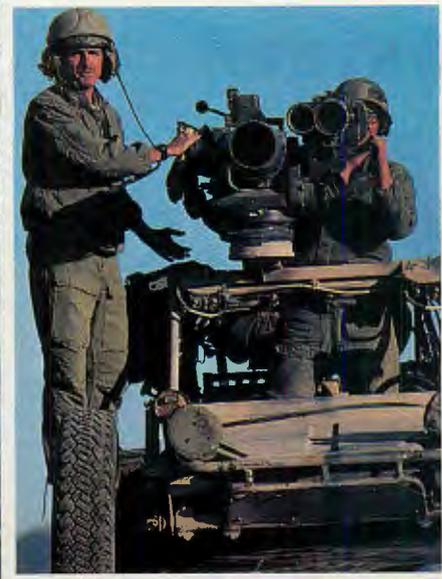
The NMC-40 Warrior FAV by Nordac Manufacturing Corp. represents the fast, highly-mobile and heavily armed attack vehicles currently undergoing tests at Ft. Lewis, Washington.



Though not in the running in the Army's FAV program, the amphibious Croco goes anywhere and represents a new vehicle system that may be adopted in addition to the high-powered and heavily armed FAVs.

40mm grenade launcher or the TOW anti-tank missile. With a chassis based on the Chenoweth off-road racing vehicle, the Emerson is powered by the AVCO-VM HR-488HTA turbo-charged four-stroke diesel. The six-cylinder version successfully passed the NATO AEP-5 durability test and Chrysler Defense Test, consisting of 1,500 hours of NATO trials. The wastegated turbo gives the water-cooled 134-cubic-inch engine quick acceleration and deceleration characteristics, putting out around 90 horsepower at 4200 rpm. Top speed is claimed to be 130 km/hr.

Somewhat more Spartan in appearance, but with the same built-in battle-ready ruggedness, is the "Warrior" NMC-40/Long Range Fast Attack Vehicle built by Nordac Manufacturing Corp. Its most salient feature is the high-coverage offered by a rear gunner's position, directly behind the driver and front gunner's seat. The Warrior's standard package deal includes gas masks, a PRC 77 radio, ammo cans, tree saw (a very important consideration for any type of serious off-road work), smoke grenades, CS grenades, vehicle cover, a pick and a shovel. They even offer flak vests, Kevlar helmets, individual weapons, goggles and



ABOVE: This Emerson FAV is one of 120 vehicles recently delivered to the 2/1 Infantry Battalion of the 9th Infantry Division at Ft. Lewis for tough testing in the Army FAV program. **INSET:** FAV with TOW at Ft. Lewis. Primary weapon will be TOW or Mk-19 40mm grenade launcher. Secondary armament is the M-249 Squad Automatic Weapon. Photo: Chuck Nacke/Picture Group

full-house Ranger-equipped ALICE packs — all standard equipment: everything you need to start your own war.

The rear mounted, four-speed German engine displaces 1800 cubic centimeters and runs on a standard 12-volt system. The four cylinders pump out a claimed 80 horsepower for a maximum performance of 150 kilometers per hour. With torsion bars, rack and pinion steering and steering dampers, the Warrior is a good off-road handler.

Not in the running for Army-issue FAV but still worth looking at, is the "Croco," built by KG Group. It isn't a fast moving, heavily armed dune buggy like the Nordac and Emerson. The Croco is built with 'go

anywhere' rather than speed in mind. Rack and pinion steering with ball joints to all wheels combined with a body that pivots in half allow the low-pressure tires to remain in constant track. It's an amazing design; a four-wheeled vehicle that applies the principle of a tripod to the ground. And the Croco swims. Advertising brochures prominently display the propeller-driven vehicle providing a stable platform for fishermen.

The 1.2 liter diesel motor is air cooled and produces 32 horsepower at 3,000 rpm. Croco is opting more for the civilian and light-industrial markets than military, but the Army may be evaluating this type of vehicle in addition to the FAV for slow but dependable mobility in extremely rugged terrain that none of the FAVs being tested could negotiate.

FAV testing has proven so successful that additional missions for the vehicles are now being considered, including military police, ground cavalry, artillery forward observers, Stinger air defense missile crews and combat engineer survey teams. Watch for continuing coverage of the FAV program in future issues of *Combat Weapons*. □

BELOW: Trooper takes a break during 9th Infantry Division tests. Once fielded, FAV-borne fighters will take advantage of assorted night vision equipment. Fixed night sighting systems may be incorporated as integral features on FAV weapons platform. Photo: Chuck Nacke/Picture Group

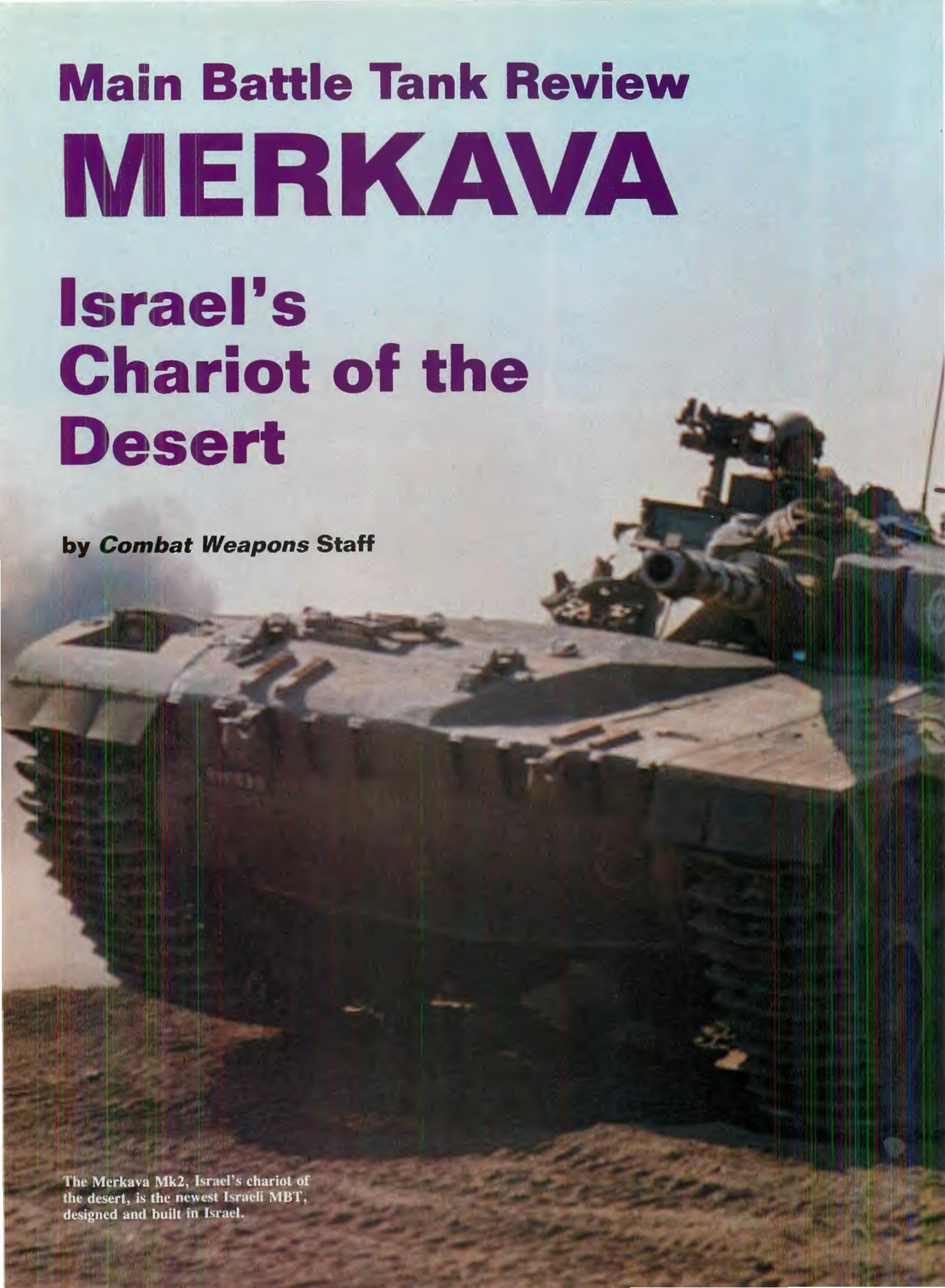


Main Battle Tank Review

MERKAVA

Israel's Chariot of the Desert

by *Combat Weapons Staff*

A photograph of an Israeli Merkava Mk2 main battle tank in a desert environment. The tank is shown from a low angle, highlighting its turret and main gun. The background is a clear, bright sky. The tank's hull is dark, and the turret is a lighter color. The main gun is prominent, pointing towards the right. The tank is positioned on a sandy, uneven terrain.

The Merkava Mk2, Israel's chariot of the desert, is the newest Israeli MBT, designed and built in Israel.



Merkava commander dons flak vest prior to beginning exercise; note the pintel-mounted FN MAG 7.62mm machine gun adjacent to the commander's hatch.

METULLA, LEBANON — Though winter snows continue to cling to the wooded slopes of Mount Hermon in the distance, our group of correspondents breathe the hot, dry air of the parched landscape surrounding us as we wait our turn to cross into Israeli-occupied Lebanon. A potent mixture of diesel fuel and dust assails our nostrils as jeeps and low-loaders of the IDF (Israeli Defense Force) claim right of way to the dirt track from our rented Peugeots. *Combat Weapons* has made the long trek to the Middle East to investigate first-hand the new Israeli main battle tank — the mysterious Merkava.



Due to its sleek, sharply angled design, the Merkava can hide effectively behind the proverbial ant hill.

The Merkava Main Battle Tank is the result of 10 years of extensive research and development on the part of several Israeli defense contractors. Preliminary R&D began at the end of the Six Day War in 1967. Due to the political and diplomatic constraints placed on previous armor suppliers to Israel, to include France, West Germany, Great Britain and the United States, the Israelis held a justifiable fear that the threat of an oil embargo could seriously affect their logistical train. Since the Israeli armor corps consisted of foreign tanks, the Israelis determined the time had come for an Israeli tank — designed and built in Israel.

In 1970, work on the Merkava (Chariot) project began in earnest. Given official

sanction by the Israeli government, the job of project director fell to Maj. Gen. Yisrael Tal, noted tank commander and veteran of the Sinai/Suez and Six Day campaigns. General Tal accomplished the impossible, and production tanks were delivered to the IDF in 1979. It was in the 1982 Lebanon incursion, known in Israel as "Operation Peace for Galilee," that the new Merkavas first saw combat.

Our trip into Lebanon allowed us to view the new Merkavas in their intended environment on the front line. A platoon of Merkavas provided a maneuverability and fire-power display, and an opportunity to discuss the new tank with the people who know it best — the Merkava crews.

From experience gained during the Six Day War, the Israelis determined that speed and maneuverability were secondary con-



cerns behind *survivability*. Armor protection became the design team's primary criteria; firepower came second, speed third. These tenets were carried through from design to production, and for these reasons, the Merkava is unique in the field of main battle tanks, with little similarity between it and the new U.S. M1 Abrams and the West German Leopard. In a professional force as small as the IDF, the protection of the tank crews is of paramount importance, and many experts claim the Merkava is the safest tank ever fielded.

Experience gained in previous wars showed the Israelis that most direct hits on tanks are frontal and on the turret. The greatest danger a tank crew faces is the explosion of his own ammunition supplies or the conflagration of on-board combustible materials. Given these facts, the Merkava was designed utilizing several unique points.

Among these design points was the parameter that the Merkava would have the smallest frontal mass of any MBT in existence. The Merkava's frontal mass, the target area visible to an enemy when the tank is in the hull-down position, is only .76 square meters. In comparison, the Soviet T-62 and T-72 is .90 square meters, the U.S. M1 Abrams 1.17 and the West German Leopard 1.19. The sharply angled, sloping hull/turret design, and the wide, low-mounted glacis plate of the Merkava is designed so that an incoming round would have to pass through a greater thickness of steel than it would at 90 degrees head on.

The Merkava utilizes cast and welded spaced armor, and cleverly positioned in-

terior compartments to guard the crew. Unlike other MBTs, the Merkava's massive Teledyne Continental AVDS-1790-5A V-12 diesel engine is mounted forward in the hull. Surrounding the engine on all sides are twin-layers of spaced armor, which create a hollow space between the exterior hull of the tank and the engine compartment within. Fuel is stored in this hollow area surrounding the engine compartment, so that if the Merkava were to take a direct frontal hit, the projectile would have to penetrate the exterior armor, pass through the second layer of spaced armor, and then pass through the engine block itself and *another* layer of spaced armor before arriving in the crew compartment.

Thus protected from frontal hits, the Merkava design engineers had to solve the second hazard, detonation of on-board ammo.

Due to the frontal mounting of the engine, a large area in the rear of the hull became available. The main gun ammo is stored below the turret, in heat-proof containers, in the least exposed area of the tank. Since tank ammo can explode at 170 degrees C, and heat generated by a direct hit can reach 800-1200 degrees C, the ammo containers were built to withstand these temperatures for short periods of time, at least enough for the Merkava's Spectronic Explosive Suppression system to work or for the crew to manually douse the flames or bail out.

The main gun turret is mounted far to the rear of the hull, and possesses an extremely shallow profile and front-on view. Current main armament consists of the 105mm M64-17 rifled gun manufactured in Israel by IMI (Israel Military Industries). Ammo storage capability is 85 rounds. The Merkava crew members told us that the normal complement during combat was 65 to 75 rounds. The gun will fire a variety of ammo types, to include: HEAT (high-explosive,

antitank), HESH (high-explosive, shrapnel), APDS (armor-piercing, discarding sabot) and a new APFSDS (armor-piercing, fin-stabilized, discarding sabot) round recently perfected by IMI and supposedly superior to the U.S.'s similar M765 round. In addition, the Merkava carries white phosphorous (WP/Willy-Peter) marking rounds. Future variants of the Merkava will be fitted with a 120mm gun.

When a full supply of ammo is not occupying the tank's rear compartment, space is available for four stretchers, or a nine-man combat squad. Accessible from the crew compartment or from the rear of the tank, this rear compartment can also be set up with communications gear so that the Merkava can serve as a combat command center. In all, an extremely versatile arrangement.

Access to the rear of the hull is provided by three hatches. The left hatch opens to expose the batteries, providing easy maintenance. The center hatch is two-part, one door opens upward and the other downward, allowing access to the main rear compartment for easy loading of ammunition, wounded or troops. The right hatch opens to the NBC pack that is integral to the pressurized crew compartment, allowing the crew members to operate in an NBC environment without the need for gas masks and cumbersome protective suits.

Within the turret, the commander sits on the right, while the gunner is positioned in front of and below the commander. The Merkava does not utilize a commander's cupola, but the commander does have a hatch cover that opens to the rear, and is fitted with periscopes for a 360-degree field of view. On the roof of the turret, adjacent to the commander's hatch, is an external optical sight with 20x magnification. This sight is also traversable 360 degrees. The gunner's optics are mounted on the forward end of the turret roof, and are protected

In the hull-down position, the Merkava presents the smallest frontal mass of any MBT — a mere .76 square meters.





ABOVE: The Merkava's business end; currently fitted with a 105mm cannon, the Merkava will also accept 120mm and 130mm guns. **RIGHT:** Secondary armament on the Merkava includes twin roof-mounted FN MAG 7.62mm machine guns, a 7.62mm coaxial machine gun and a 60mm roof-mounted mortar.

against shell fragments by steel ribs mounted at right angles to the sight.

The driver sits at the left side of the hull, forward of the turret. The driver has a one-piece hatch cover that opens to the left. Periscopes allow observation for driving when the hatch is closed. The loader sits on the left side of the turret and has access to a one-piece hatch cover that opens to the rear, akin to the commander's.

The gun turret's turntable is mounted to the hull's floor plate, which is supported by rollers that permit the turret and crew to traverse through 360 degrees. The turret is powered by a hydraulics system, with a manual override.

In addition to the main gun, the Merkava is fitted with a coaxial 7.62mm machine gun that is fed by a 3,000 round continuous belt. Additional Browning or FN MAG machine guns are mounted on the exterior of the turret, adjacent to the commander's and loader's hatches. The Merkava can also be fitted with a roof-mounted 60mm mortar and smoke dischargers.

The Merkava's V-12 diesel engine, which is basically the same unit utilized by the U.S. M60, develops 900 horsepower at 2,400 rpms. Top speed when battle loaded at 123,000 pounds is 29 miles per hour. This makes the Merkava very slow and heavy when compared to other current MBTs, to include the M1 Abrams and the West German Leopard. In comparison, the Abrams's gas-turbo generates 1,500 horsepower at 3,000 rpms for a top speed of 45 miles per hour, as does the Leopard 2 when fitted with the same engine. However, the Israelis are anticipating a Mark 3 variant Merkava that will be powered by a more powerful 1,200 horsepower turbo-diesel.

The Mark 1 Merkava's drive system is derived from the British Centurion tank that had been the IDF's MBT prior to the Merkava's fielding. Featuring a coil spring and bogie wheel arrangement, the Merkava uti-



lizes Centurion road wheels, with the drive sprocket at the front and the idler at the rear. Return rollers are also provided. The tracks are of the double-pin design, and function dry. The metal segments give good performance on rugged terrain, and provide yet

another layer of protective steel. Combat skirts protect the top of the tracks and can be retrofitted to the hulls.

It has become obvious that the primary design concern has been satisfied — the protection of the crew. An interesting fact is

MERKAVA MBT SPECIFICATIONS

Crew	4: commander, gunner, loader, driver
Combat Weight	60 tons
Dimensions	
Hull with gun forward	8.63 m
Hull	7.45 m
Width over tracks	3.70 m
Height to turret roof	2.64 m
Track width	0.64 m
Ground clearance	0.53 m
Mobility	
Speeds	
— maximum	58 km/h
— road (av)	44 km/h
— cross-country (av.)	40 km/h
— acceleration	0 to 32 km/h in 13 secs.
Cruising range	400 km
Agility	
— gradient (max.)	60% (31°)
— side slope	38% (21°)
— vertical obstacle (max. ht.)	1.00 m
— trench crossing	3.00 m
Fording without preparation	1.38 m
— with preparation	2.00 m
Main Armament	105 mm gun, rifled bore
Elevation	-8°, +20°
Azimuth	360°
Ammunition	62 rounds (nominal) APFSDS, APDS, HEAT, HESH, APERS, Phosphorous

Secondary Armament	
Machine guns	3: (1) coaxial, (2) on-deck, 7.62 mm MAG-type with 10,000 rounds
Mortar	60 mm
Fire Control	
Ballistic computer	sensors for temperature, wind, altitude, moving target, horizontal orientation (roll)
Peritelescope sights	
— commander	panoramic 360°, 4x to 20x zoom moving-mirror head, moving reticle, 1x and 8x magnification, laser rangefinder 10,000 m range
— gunner	image intensifier
Night vision	
Observation	
— driver	2 M-27, 1 special periscope; night — bi-ocular, passive, image intensifier
— commander	5 periscopes for hatch observation
— loader	1 periscope
Engine	model AVDS 1790-5A
Type	air-cooled diesel, 12 cylinders
Output (at full load)	900 bhp
Transmission	model CD-850-6B
Type	automatic, 3 gears: high, low, reverse
Suspension	
Type	independent: 6 pairs helical springs and bumpers on each side; 4 hydraulic, two-way shock absorbers
Road wheels	6 pairs on each side
Electrical system	
Alternator output	650 A at 28 Vdc (18.2 kW)
Battery	500 A/h at 24 Vdc
Miscellaneous	
	— NBC system
	— Fire extinguishing system
	— Communications



that 70 percent of the Merkava's total weight serves as all-around crew protection, compared to 50 percent for most other MBTs.

Rumor has it that a Mark 2 Merkava variant will be equipped with a new hydro-pneumatic suspension system developed in the United States and similar to the system used on the M1 Abrams. However, the existing suspension seems to be an improvement over the Centurion forerunner. We questioned several Merkava crewmembers about this, and since they had previously served on the Centurions, they are known as "Centurion babies." Their comments indicated that you can drink coffee in a Merkava rolling across country, while that same feat was impossible in the Centurion.

The Merkava's gyro-stabilized turret permits firing on the move, which is accomplished with the tank's fire control system featuring a digital ballistic computer and laser rangefinder. Mated to the commander's and gunner's sights, the ballistic computer processes the necessary data, to include environmental conditions, ammo type, velocity, recoil compensation, and deflection. The commander can, if the need arises, take over control of the main armament and fire the gun. A manual system of operation will override the electronics if a

failure occurs. Speculation holds that future Merkavas will be fitted with thermal imaging systems.

The Israelis are insistent on improving first round hit probabilities, and to that end commanders and gunners receive continuous training. It seems to pay off pretty well when you compare the Israeli's record to that of their opponents. One Merkava platoon commander related a story about a bout he had with a Syrian T-72 at 100 meters. Seems the Merkava was working its way down a *wadi* when the Syrian rounded the bend 100 meters ahead. The Syrian fired first, but his round went wide. Almost simultaneously, the Merkava fired, then fired again. The turret was blown askew on the T-72 by the twin hits from the Merkava's 105mm gun. What was most impressive was that the twin Merkava rounds produced a nice 12-inch group on the right side of the T-72's glacis plate, just below the main gun. That's shootin'!

From the logistics standpoint, the Merkava is a dream when it comes to field maintenance. Part of the IDF requirements for the Merkava was that it be capable of quick field turnaround should it become disabled. The Merkava was designed around a series of systems components, so that pre-assembled repair kits are shipped to the front for

instant repair. Even the engine itself can be pulled and replaced in a matter of hours, right at the front! Another long range goal that was accomplished was for the Merkava's constant modification with new systems as they become available. This enables the Israelis to retrofit existing Merkavas without the hassle of long delays in the shop, and the related expense.

During Operation Peace for Galilee, the Merkavas performed extremely well against the Soviet-bloc armor of their opponents. As a matter of fact, the Merkava is the only new generation Western tank that has seen combat against Soviet armor. Israeli records show that during the Lebanon operation, Merkavas accounted for half of the armor kills made by Israeli forces, the other half made primarily by antitank missiles. The Merkava's ammo capacity allowed the tanks to stay on the line far longer than their forerunners, and the crew protection systems worked admirably, with burn cases to crew members being virtually unknown.

We departed the Lebanon front realizing that the Israelis had accomplished a most admirable feat. The Merkava meets the needs of the IDF, and against Soviet-built armor, it need not take a back seat. As Oliver Hazard Perry said: "We have met the enemy and they are ours." □

THE PROWLER R2

ROBOT DEFENSE SYSTEMS, INC.

The **PROWLER** Robot combines on-board intelligence with multi-mission sensor and armament combinations to meet a variety of application needs. Using its on-board intelligence, the PROWLER can autonomously patrol a known perimeter and respond to an intrusion. A remote control station allows operator intervention as needed. The R2 PROWLER is equipped for extended missions and stealth operation to patrol and protect your sensitive installations.

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DETECTION: *The PROWLER*

- Interfaces with passive sensor systems
- Includes a rugged Remote Command Station
- Optional Sensor Input - *Thermal imaging, computer vision, NBC monitoring, IR imaging, noise detection.*

ASSESSMENT:

- Instant Recognition
- Instant Decision

RESPONSE:

- Immediate containment of intruders
- Overwhelming fire power options



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(303) 450-0793

RAMO RAIDER

Battle-ready Boston Whaler

by *Combat Weapons Staff*



The collaboration between Ramo and Boston Whaler has resulted in a seven meter attack/patrol craft with an unprecedented degree of firepower, maneuverability, safety and speed.

FROM the Fast Attack Vehicle for land-based conflicts, the next inventors' idea is likely to be a high-speed, maneuverable, light assault craft for waterborne warfare. Commander McHale's PT-73 probably won't be seeing much action anymore. In its place we can expect dramatic developments in light-assault craft with revised tactical considerations that go along with new equipment procurement.

The Ramo Raider, hot off the drawing boards, is now available for sale as a representative fast-attack/patrol weapons platform. It may become a common sight as a harbor and naval security boat as well as an offensive water raider in future battles by seacoasts or lakes.

"Absolutely unsinkable," claims Ramo. Anyone familiar with the venerable Boston Whaler boat hull will probably agree. The

18-degree 'V' bottom is non-porous, non-absorbent foam sandwich fiberglass, designed to withstand high-energy weapons recoil. Its extremely high buoyancy allows the boat to support 5,000 pounds in swamped condition.

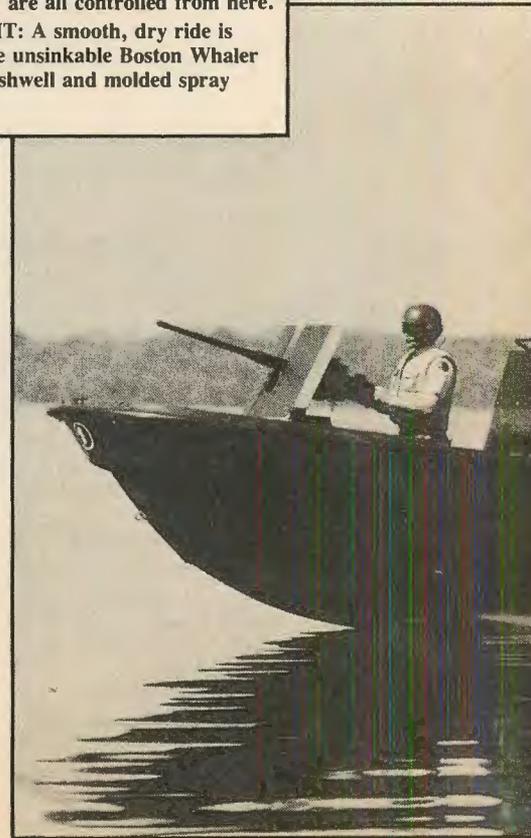
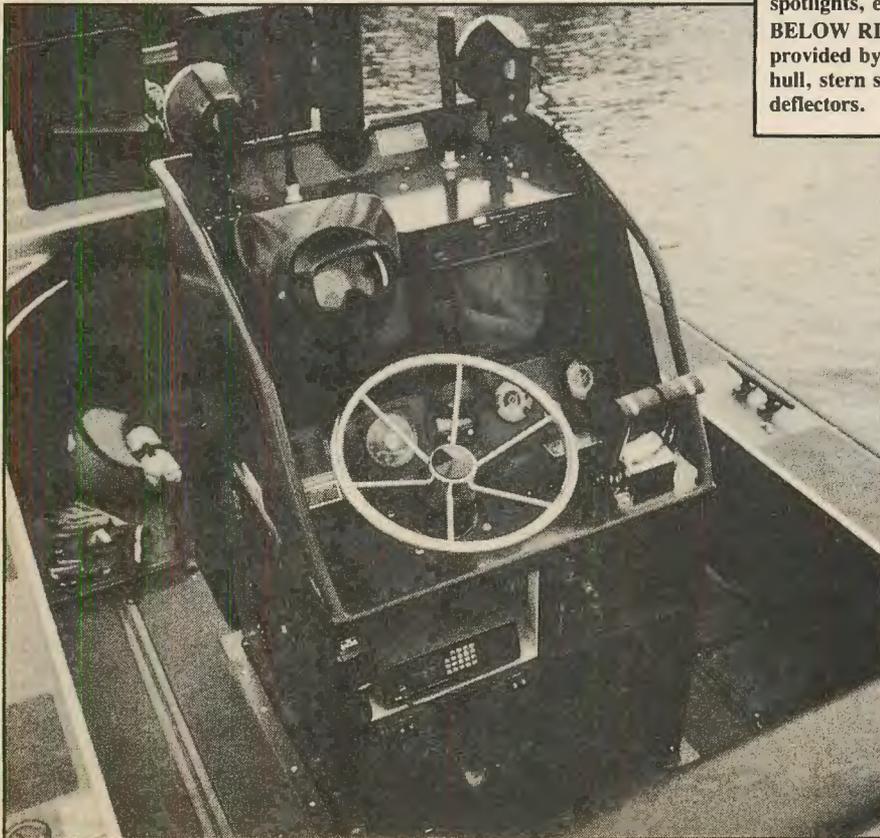
The weaponry includes two "Ma Deuce" Browning M2 Heavy Barrel .50-cal. Machine Guns (with armor on each gun) and two 7.62mm NATO GPMGs like the M60. The guns are mounted to a revolutionary skate ring that eliminates the need for pedestal mounts, which limit gunner position and restrict quick reaction capability. Weapons can be easily trolled by one man around the entire gunwhale of the Raider, providing effective attack range in any direction of more than 1,800 meters. High tensile marine aluminum side decks support the ring. This 180-pound "Ramo ring" has the ability to absorb shock on all sides of the craft, greatly strengthening the hull structure. This, along with stern splash well and molded spray deflection rails, make the Raider an extremely stable and dry craft, providing for a more accurate weapons platform.

An unexplodable gas tank feeds the Raider's twin, low-profile 140-horsepower Johnson outboard engines, which can provide eight hours of continuous service. If one engine experiences mechanical failure, the other will bring you home. Draft with engines tilted is only 14 inches.

The center-mounted command station looks like that found on a typical civilian Boston Whaler. The similarity stops upon closer scrutiny. Housed in the pilot's post is



ABOVE: This could be a common sight in future combat zone harbors, seacoasts and lakes. Lighter armed versions of the Ramo may serve as civilian harbor security.
BELOW LEFT: The Ramo Raider sports an elaborate command station — quite different than that found on a typical Boston Whaler. Radar, radio, hydraulics, spotlights, etc., are all controlled from here.
BELOW RIGHT: A smooth, dry ride is provided by the unsinkable Boston Whaler hull, stern splashwell and molded spray deflectors.



the hydraulic steering system, all controls, gauges, dual 100 amp hour batteries, 600,000 candlepower spotlight, compass, switch panel, ammo rack, radar, communication equipment plus storage. The radar mast base supports antennas and navigational lights and can fold down when transporting the boat over land or by air. Standard radar package is claimed to have a 1/4 to 25 mile range.

The Raider is transportable via its own trailer, helicopter sling or cargo aircraft. Its features combine to produce a light attack and patrol craft of previously unknown versatility. It has proven to function effectively in policing actions for harbor patrol, diving and surveillance operations, customs enforcement, drug interdiction and other law enforcement operations. It can be used for offensive and defensive purposes, carrying weapons, troops and electronic gear with ease.

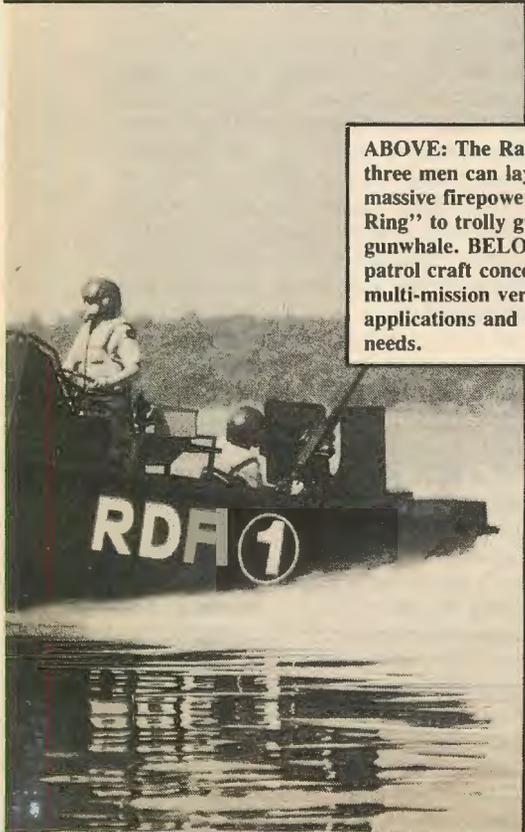
The demonstrator Raider has "RDF" painted on the sides. Obviously, Ramo hopes that Pentagon procurement officers

will be making decisions in their favor, and make the Raider part of the Rapid Deployment Force equipment roster. Readers can expect to see more coverage on new water-war concepts like the Ramo Raider in future issues. □

RAMO RAIDER SPECIFICATIONS

Length Overall 22 feet, 4 inches
Length Water Line. 21 feet, 0 inches
Beam 7 feet, 5 inches
Draft 14 inches engines up
 34 inches engines down
Freeboard 37 inches forward
 23 inches aft
Displacement 4400 lbs. light
 6500 lbs. loaded
 Three-man crew plus
 fuel-ammo-arms.
Engines Twin 140 h.p. Johnson
 outboard engines
 w/power trim and tilt
Performance . Top speed fully loaded
 (6500 lbs.) 40 knots
Fast cruise 30 knots
Fuel Consumption . . . Top speed, 23
 gallons per hour
 Fast cruise, 16 gallons per hour.
Range at top speed, 167 nautical mi.
 at fast cruise, 222 nautical mi.
 at varying speeds, 250 nautical mi.
Standard Weapons System:
 2 Machine guns .50 caliber/M2HB
 3 Communications helmets
 (w/intercom)
 Machine gun, 7.62mm GPMG
 MK19 40mm automatic
 grenade launcher
 Marine radar
 Night vision aiming capability
 Crew armor protection
 Explosafe fuel tank
Radio Marine, HF or VHF military
 Distributed by Napco International Inc.,
 Dept. CW, 1600 Second St., South
 Hopkins, MN 55343 (612) 931 2400.

ABOVE: The Ramo Raider's small crew of three men can lay down well-directed, massive firepower utilizing the "Ramo Ring" to trolley guns anywhere on the gunwhale. BELOW: The light attack and patrol craft concept may offer extraordinary multi-mission versatility for both military applications and civilian law enforcement needs.



SIG-Sauer P226

Going For the Gold In Joint Service Sidearm Trials

by Peter G. Kokalis

THE SIG-Sauer P226 pistol is surely one of the hottest contenders in the current XM9 trials. It's conventional in both appearance and method of operation with just the right mix of trendy, but minor, innovations — attributes which have traditionally appealed to the more stodgy elements in U.S. ordnance circles. By and large, the medflies have swarmed with dreary sameness around these juicy plums with the double-action, large magazine capacity theme. The winner of the XM9 trials gets everything, not only adoption by the U.S. military, but the prestige and vast sales potential to Third World countries whose posturing military Munchausens rush to emulate every move of their Washington or Moscow mentors. The losers will be left only impotent rage amid the usual screaming about curve balls.

The famous Swiss firm of Schweizerische Industrie-Gesellschaft (SIG) has combined with the West German J.P. Sauer and Sohn to produce a series of military and police pistols. The pistols were designed by SIG at Neuhausen Rhinefalls and are manufactured at the Sauer works, which moved from Suhl to Eckernforde, Thuringia in 1951. The marriage allowed SIG to slide around the stringent Swiss regulations controlling military small arms exports and provided Sauer with a vehicle to re-enter the lucrative field of military armaments. During WWII Sauer produced 98k rifles of highly regarded quality, the legendary Luftwaffe drilling and the unusual 38H (H for hammer fire) pistol (caliber 7.65mm). This clever hammer-type pistol was provided with a lever on the left side of the frame for both cocking and uncocking the hammer.

As a result the pistol could be fired either double-action or single-action at any time by manipulation of the lever only. SIG is equally noted, not only for the P210 pistol, but for 125 years of robust infantry rifles and machine guns.

The SIG-Sauer P226 pistol is the very model of a modern major general's concept of small arms technology. The frame is fabricated from an aluminum alloy, black anodized. All other metal components are charcoal finished by either salt bluing or phosphating. The slide is a mill-finished heavy-gauge steel stamping with the breech block as a separate component pinned in place and an electron-beam-welded forward extension. The hammer, trigger and magazine catch button are investment castings. The disassembly, hammer-drop and slide stop levers are sheet metal stampings. The grip panels and magazine follower are plastic. The recoil spring is made of two-strand cable like the recoil springs on the German WWII MG-42, the U.S. M60 GPMG and the Kalashnikov hammer and trigger springs. (It is a common misconception that this was done so that if one strand broke the weapon could continue to function. In truth it is simply less expensive to manufacture springs in this manner.) Roll pins abound throughout the pistol (in areas not normally associated with normal disassembly procedures). And, when you dry fire the P226 its rebounding hammer and spring sound just like a toy cap pistol or one of the S&W M39/59 series.

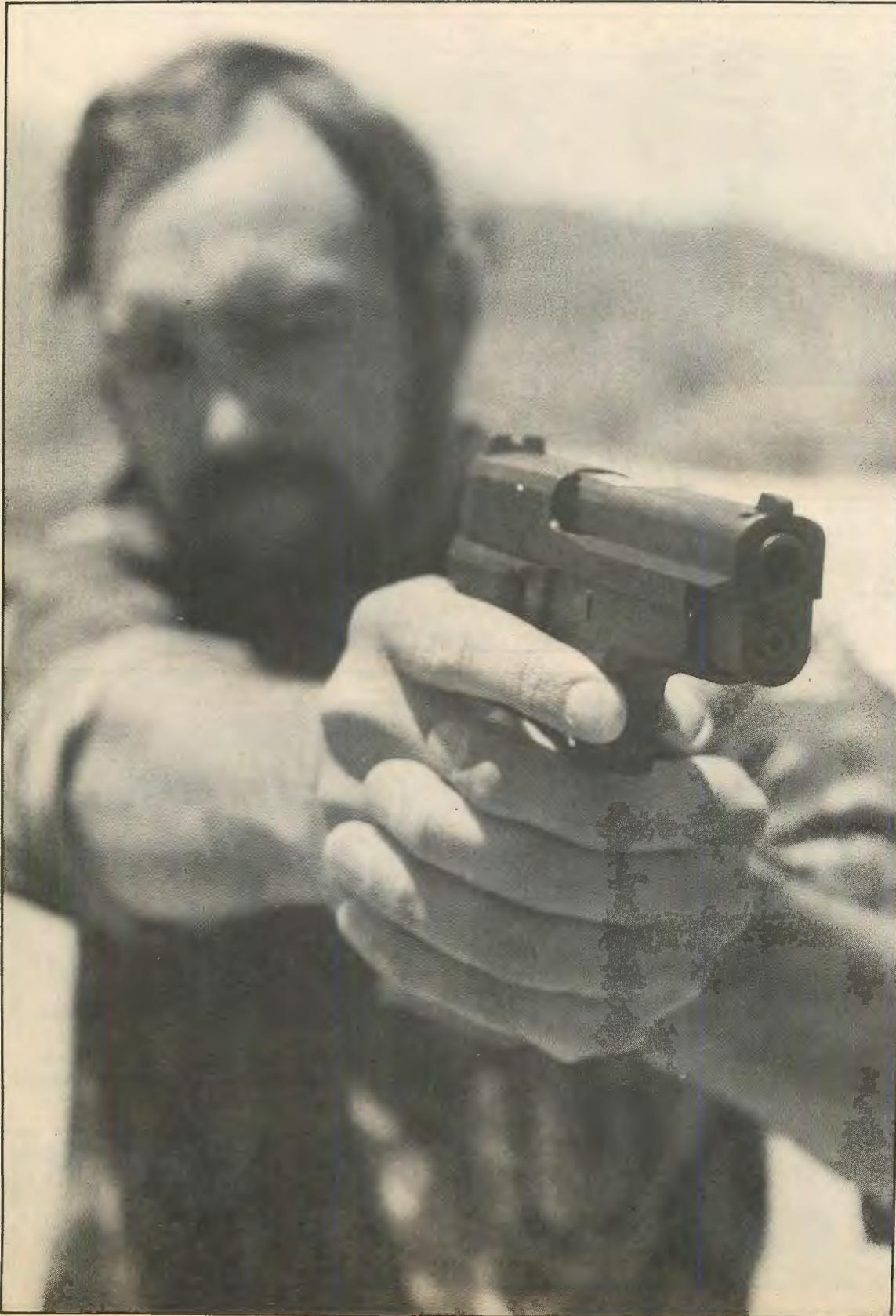
In 1975 the Swiss Armed Forces adopted the SIG-Sauer P220 pistol as the Model 75 in 9mm Parabellum. This pistol, chambered in either 9mm Parabellum, 7.65mm Para-

bellum (.30 Luger), .45 ACP or .38 Super was marketed in the U.S. by Browning under the name BDA (Browning Double-Action). Eventually the pistol was imported by Interarms under the SIG-Sauer designation.

In 1978 the SIG-Sauer P225 was introduced. Slightly smaller and lighter than the P220, it carries one less round in the magazine (eight instead of nine). The magazine catch release was relocated from the heel of the butt to the left side of the frame at the rear of the trigger guard. The grip portion of the frame was re-shaped. And, an automatic firing pin lock, which can only be deactivated by intentionally pulling the trigger, was installed to optimize safety. This combination of a locked firing pin and positive hammer rebound into a safety intercept notch prevents accidental discharge of a chambered round, even if the pistol is dropped with the hammer cocked, half-cocked or down. Designed as a compact police service pistol, the P225 is one of three recently standardized by the West German government, where it is known as the P6.

The P226 was conceived in 1980 specifically as SIG's candidate in the U.S. XM9 trials. It differs from the P220 in magazine capacity (15), the location of the magazine catch release and the ergonomics of its grip. About 80 percent of its components come from current production P220 and P225 pistols. This pistol is imported for commercial consumption in the U.S. by Interarms North American Group (Dept. CW, 10 Prince St., Alexandria, VA 22313). It has been entered into the XM9 trials by the Saco Defense Systems Division of Maremont Corp. (Dept. CW, 291 North St., Saco, ME

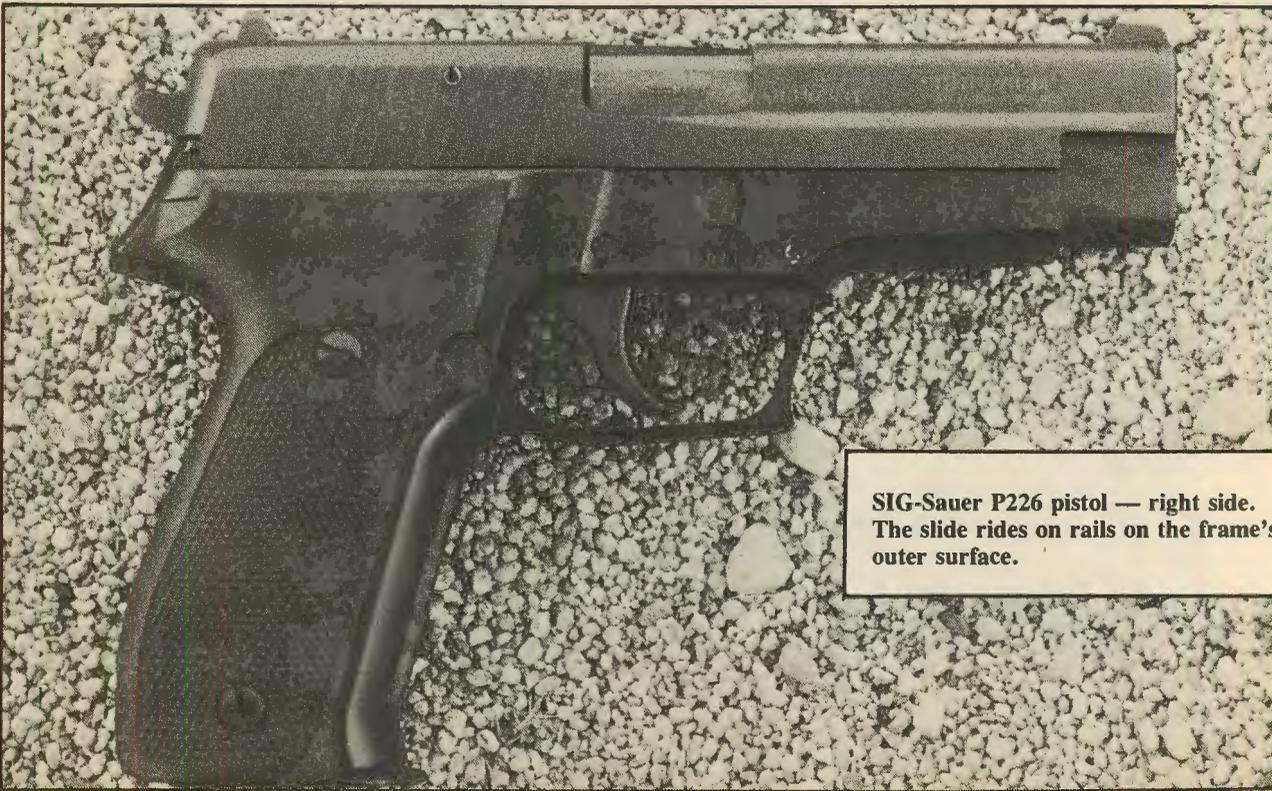
**The P226 is a slick effort
to incorporate every
specification requested
for the XM9 trials. It may
very well be the next U.S.
service pistol.**



The pistol serves little use on the battlefield. In war, the pistol stays home and an extra canteen takes its place.



SIG-Sauer P226 pistol — left side. Hammer, trigger and mag catch button are investment castings.



SIG-Sauer P226 pistol — right side. The slide rides on rails on the frame's outer surface.

04072). Maremont is a Swiss owned company.

The SIG-Sauer P220/225/226 series operates by the locked breech short-recoil method pioneered by John M. Browning. The single locking lug milled above the barrel's chamber uses the slide's ejection port as its locking recess. After ignition the slide and barrel together recoil rearward 0.12 inches until a cam slot milled into the bottom barrel lug contacts a ramp in the frame, which draws the barrel downward unlocking it from the front lip of the ejection port. By this time pressures have dropped to a safe level. I noted that the front contour of this barrel lug cam slot has been cut square to direct counter recoiling forces up and forward into the barrel itself. The cam slot on early Browning Hi-Power pistols was cut round and resulted in eventual fracture of the bottom barrel lug as the unlocking forces were propagated downward into the weakest portion of the lug. Unlike the SIG P210, the slide rides on rails located on the frame's outer surface.

It is intended that the first round fired will be double-action. The double-action pull is about half an inch with no "loading" at the end of the stroke. Double-action pull weight is 11 pounds. The hammer can be manually thumb-cocked to fire the first round single-action. Subsequent shots are fired single-action. The single-action pull weight is approximately 3.5 to four pounds with a crisp let-off and negligible over-travel. When the trigger is pulled in the double-action mode, a trigger bar, engaging the double-action notch, cocks the hammer. In the final phase of movement the trigger bar pivots the safety lever which frees the firing pin's movement and rotates the sear. At the final instant the trigger bar disengages from the double-action notch by camming against the hammer pivot pin. This trips the hammer which strikes the firing pin to ignite the primer. If the slide does not go fully forward into the battery, contact between the firing pin lock and safety lever does not occur and firing pin movement is prevented. In this unlocked state, the slide also cams down the trigger bar and interrupts subsequent trigger function.

The hammer-drop lever is located on the left side of the frame in the center of a triad of conveniently positioned controls, which also include the slide stop lever and the magazine catch release button. Thumbing downward on the hammer-drop lever takes the sear out of register with the full-cock hammer notch. As the hammer-drop lever is released, hammer spring pressure drops the hammer which is then caught by the sear



The P226 is SIG's candidate in the U.S. Army's XM9 trials for a new 9mm service sidearm. Similar to the P220 and P225 pistols, it is a mechanically locked short-recoil operated weapon.



At first glance the P226 appears bulky and massive. But its blocky aesthetics are deceiving.

engaging in the safety intercept notch, which is the hammer's rest position when the hammer spring is not compressed. During and after operation of the hammer-drop lever, the firing pin remains constantly blocked. No other manually operated safety is provided or required, as these pistols can be discharged only if the trigger is pulled. Gratefully, there is no magazine safety.

At first glance the SIG-Sauer P226 appears bulky and massive. But, its blocky aesthetics are deceiving. In overall length it is 7.7 inches, compared to 8.6 inches for the Colt M1911A1 and 8.5 inches for the Beretta 92SB. The P226 barrel is 4.4 inches long versus five inches for the M1911A1 and 4.9 inches for the 92SB. The P226 is 5.5 inches high and 1.5 inches wide. The P226 weighs 29.8 ounces with an empty magazine. The M1911A1 and 92SB tip the scales at 38.9 ounces and 34.5 ounces, respectively.

The P226's grip-to-frame angle is just about perfect. Although this will always remain a mostly qualitative assessment, nevertheless I feel it contributes significantly to the high first round hit probability of this pistol. The two-piece grip panels wrap around and meet at the rear of the frame. They are checkered on the sides and rear and swelled at the bottom rear to fill the natural contour of the average sized palm. The front of the grip frame has been vertically



P226 field-stripped for maintenance. No further disassembly is required or recommended.

grooved. The trigger guard has been squared off, grooved and slightly hooked for those who incorporate this fetish into their stance.

The P226 sights are excellent. The ramped front blade slopes to the muzzle and is 1/8 inch thick. It fits into a dovetail and can be adjusted for windage zero or replaced with one of a different height to compensate for the changing points of impact of lighter

or heavier projectiles. The one in my pistol is marked "8" and prints 115-124 gr. bullets to point-of-aim at 25 meters. The front sight blade has a circular white dot painted on its face. This is intended to rest on top of the square white dot painted on the face of the square-notched rear sight. It is my opinion that under stress scenarios in the real world, such sighting aids are of no value. But, they also interfere not in the slightest and so may just as well be left on for those who shoot gongs. The rear sight is also dovetailed into the slide and can be adjusted for windage zero. Remember, when you adjust a rear sight you must move it in the direction you want the bullet to go. When you manipulate a front sight you adjust it in the opposite direction you want to move the point of impact. The corners of the P226 rear sight have been properly rounded to prevent snagging.

To disassemble the P226, first retract the slide and lock it rearward with the slide stop lever. (I might add at this point that the grooves cut into the slide on each side to assist retracting are a bit too shallow and should be re-designed.) Remove the magazine and make certain the chamber is empty. Rotate the disassembly lever, located on the left side of the frame, downward 90 degrees. While holding the slide assembly, push down on the slide stop lever and draw the slide assembly forward until it separates from the frame rails. Remove the recoil spring and guide rod. Drop the barrel out of the slide. No further disassembly is required or recommended. Re-assemble in the reverse order.

Eight different makes of ammunition were fired through the SIG-Sauer P226:

SIG-SAUER P226 SPECIFICATIONS

Caliber:	9x19mm (Parabellum)
Operation:	Locked-breech, short-recoil, semiautomatic, double-action trigger system with hammer-drop lever, no manual safety
Weight, without magazine:	29.8 ounces
Overall length:	7.7 inches
Height:	5.5 inches
Width:	31.5 inches
Barrel:	Six-groove, right-hand twist, one turn in 9.8 inches
Barrel length:	4.4 inches
Magazine:	Staggered box type, single-position feed, 15-round capacity
Sights:	Front: Fixed forward sloping ramp type, 1/8-inch wide with white circular dot; rear: square notch with square white dot. Both adjustable for windage zero by drifting in frame dovetail
Price:	\$650, includes spare magazine
Importer:	Commercial sales: Interarms North American Group, Dept. CW, 10 Prince St., Alexandria, VA 22313.
Military Sales:	Saco Defense Systems Division of Maremont Corp., Dept. CW, 291 North St., Saco, ME 04072.

Musgrave Full Metal Jacket (FMJ) from South Africa, Remington 124 gr. FMJ, PMC 115 gr. FMJ, Eagle FMJ (black tipped SMG loads) from Israel Military Industries, S&W 100 gr. Jacketed Hollow Point (JHP), Browning 100 gr. JHP, Federal 115 gr. JHP and Portuguese military ball — a total of 800 rounds altogether.

The P226 digested everything poured into the magazine well with one trivial exception. The S&W 100 gr. JHP ammunition — now long out of production — proved to be entirely incompatible. There were two failures to feed, one stovepipe during ejection and two failures of the slide to hold open after the last round — all in just 25 rounds. The other seven lots of ammunition were easy meat for the P226.

The accuracy potential of this pistol is more than acceptable for the intended use. The 115-124 gr. bullets shot just slightly to the right of point of aim at 25 meters. This was easily corrected by tapping the rear sight to the left in its dovetail. The light 100 gr. projectiles, of course, shot well below the point of aim.

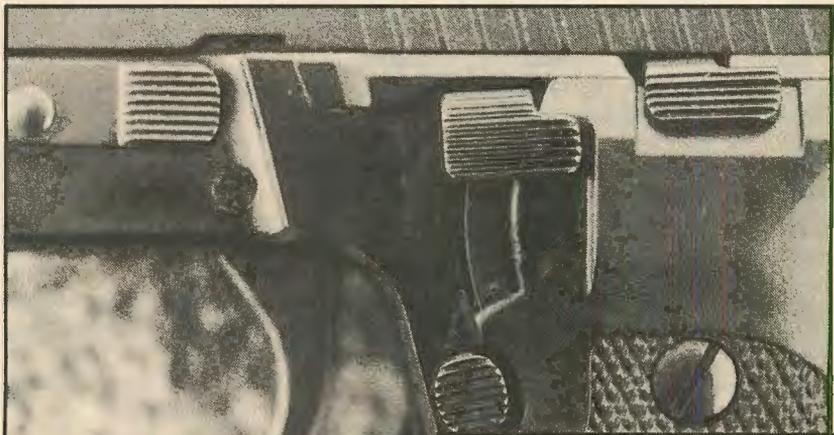
Unlike its famous predecessor, the SIG P210, the P226 produces no hammer bite during even the most extended firing sessions. Without exception, everyone who fired the P226 during the *Combat Weapons* test and evaluation commented on how comfortable the pistol felt in their hand. Felt recoil was also perceived to be quite low. Double taps with the first round fired double action, while not as tight as those shot from the Czech CZ 75 or Beretta 92SB, were acceptable — at the ranges one would expect to engage an enemy target with a pistol.

The 15-rd. magazine, patterned directly after that of the Browning Hi-Power, is no easier to load than any of the other large capacity types. It drops freely from the magazine well and cartridge cases are ejected into a rather tidy pile on the ground — parameters of interest primarily to IPSC shooters and reloaders, respectively.

The SIG-Sauer P226 is a slick effort to incorporate every specification requested for the XM9 trials in a cost effective manner. It may very well be the next U.S. service pistol. I couldn't care less. To me the XM9 trials are a tempest in a teapot stirred up by the armchair experts of the popular gun press. The big-bore screechers howl at the maximum magazine-capacity maniacs, both drowning out the fevered discharges of the double-action versus single-action true believers. Meanwhile, exclusive of parade ground pomp and circumstance, military police and its placebo effect on those sweat-



Firing the SIG-Sauer P226 pistol. Comfortable to grip, the P226 doesn't shift in the hand during firing. Recoil is light, making it easy to bring back on target quickly.



Control center of the P226: To the left is the disassembly lever, top right the slide-stop lever, center the hammer-drop lever and to the rear of the trigger guard is the magazine-release catch button.

ing snuffies who are mostly unauthorized to carry it, the pistol serves little function on the modern battlefield. From El Salvador to Israel, when combat troops form up to move out on an operation, the pistol stays in the

cuartel and in its place is an extra canteen of water.

The commercial version of the SIG-Sauer P226 is priced at a suggested retail of \$650.00. This is too expensive. □

XM9 CONTENDER

STEYR GB

Biggest Pistol With the Most Firepower May Capture the JSSAP Flag

by Peter G. Kokalis

THE German language is filled with words so long they boggle the Anglo brain while the tongue stumbles over them, as is the case with the Austrian Steyr *Selbstladepistole* GB: which simply means Self-loading Pistol, Gas Blowback. Originally produced in the late '70s by L.E.S. of Skokie, Ill. (see "Jammamatic," *Soldier of Fortune*, April '79, p. 40), the stainless-steel P18 (referring to its magazine capacity) was not a success.

In the intervening years Steyr-Daimler-Puch AG has expended no small effort in its redesign and improvement. The pistol has recently been reintroduced into the U.S. marketplace by Steyr's exclusive importer, Gun South (Dept. CW, P.O. Box 6607, 7605 Eastwood Mall, Birmingham, AL 35210).

The Steyr GB is unconventional-looking, which will surely bother some. However, conformation to traditional esthetics is not always necessary for success, as shown by the Mauser Model 1896 "Broomhandle" pistol, of which more than a million were made and which still manages to conjure exciting images of Teutonic villainy.

The stainless-steel construction is gone. Carbon steel is used throughout, including the frame (so often an alloy now). Only the grip panels and trigger guard are manufactured of high-impact molded plastic (the

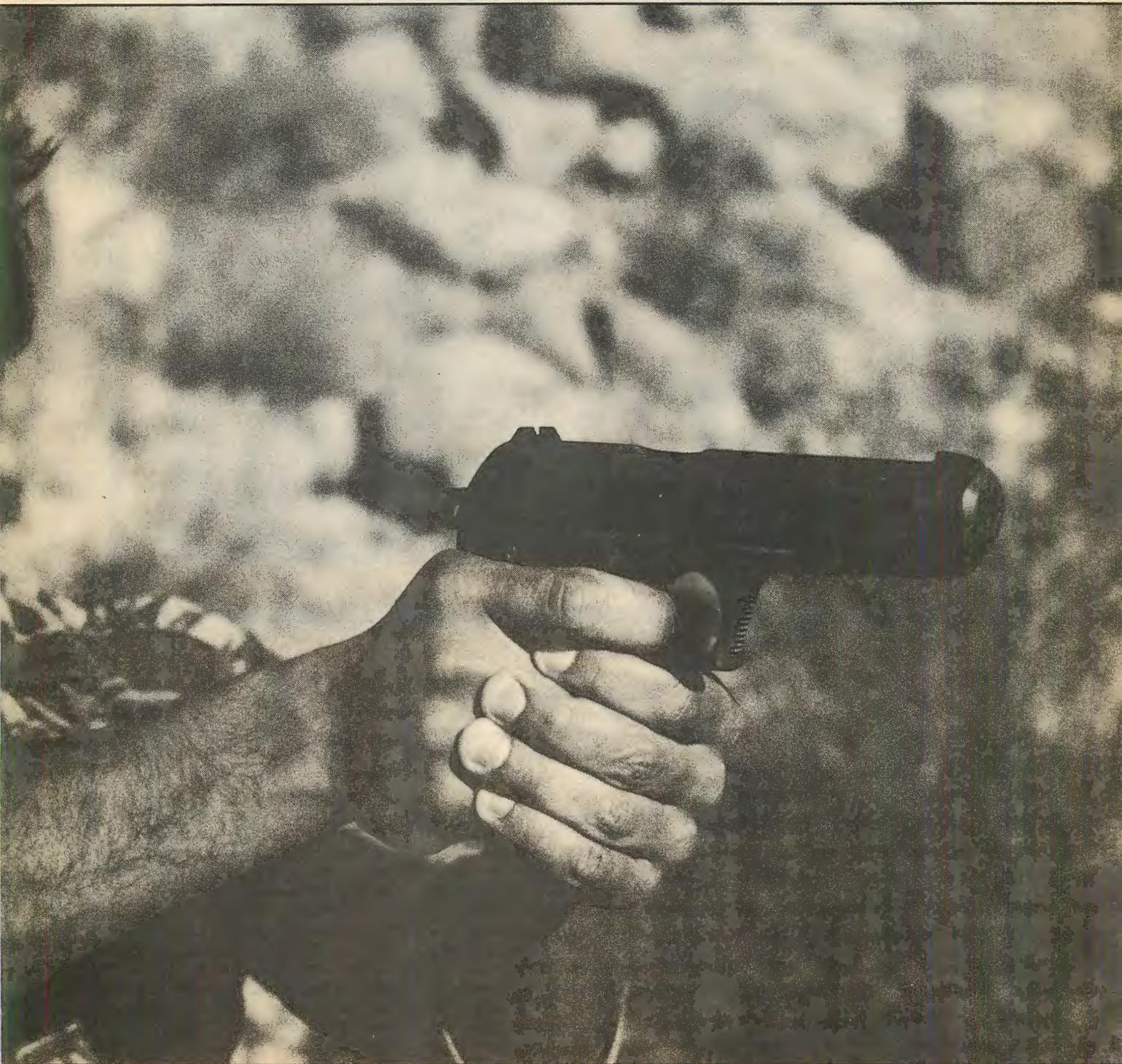
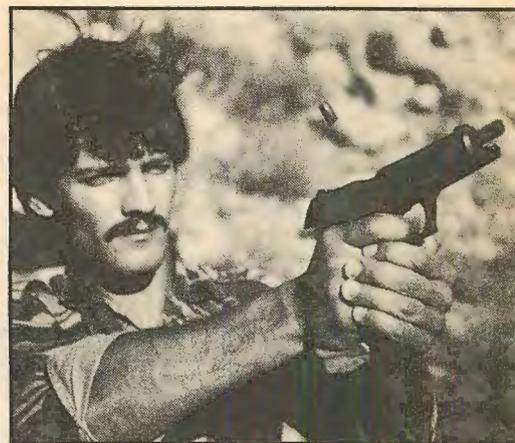
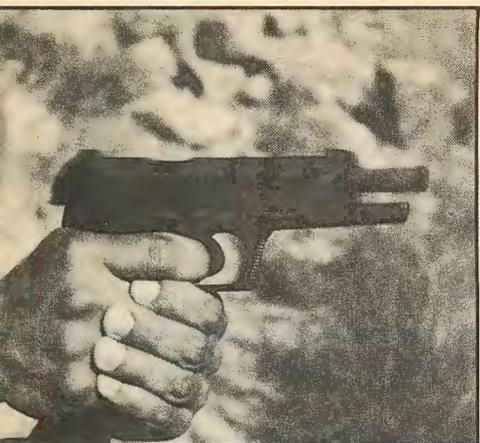
magazine spring guide is also plastic). (GBs submitted for the XM9 trials have steel trigger guards as well as ambidextrous hammer-drop levers, magazine release buttons and a phosphate finish.) The front of the trigger guard is squared off and checkered for those few who will make use of this feature.

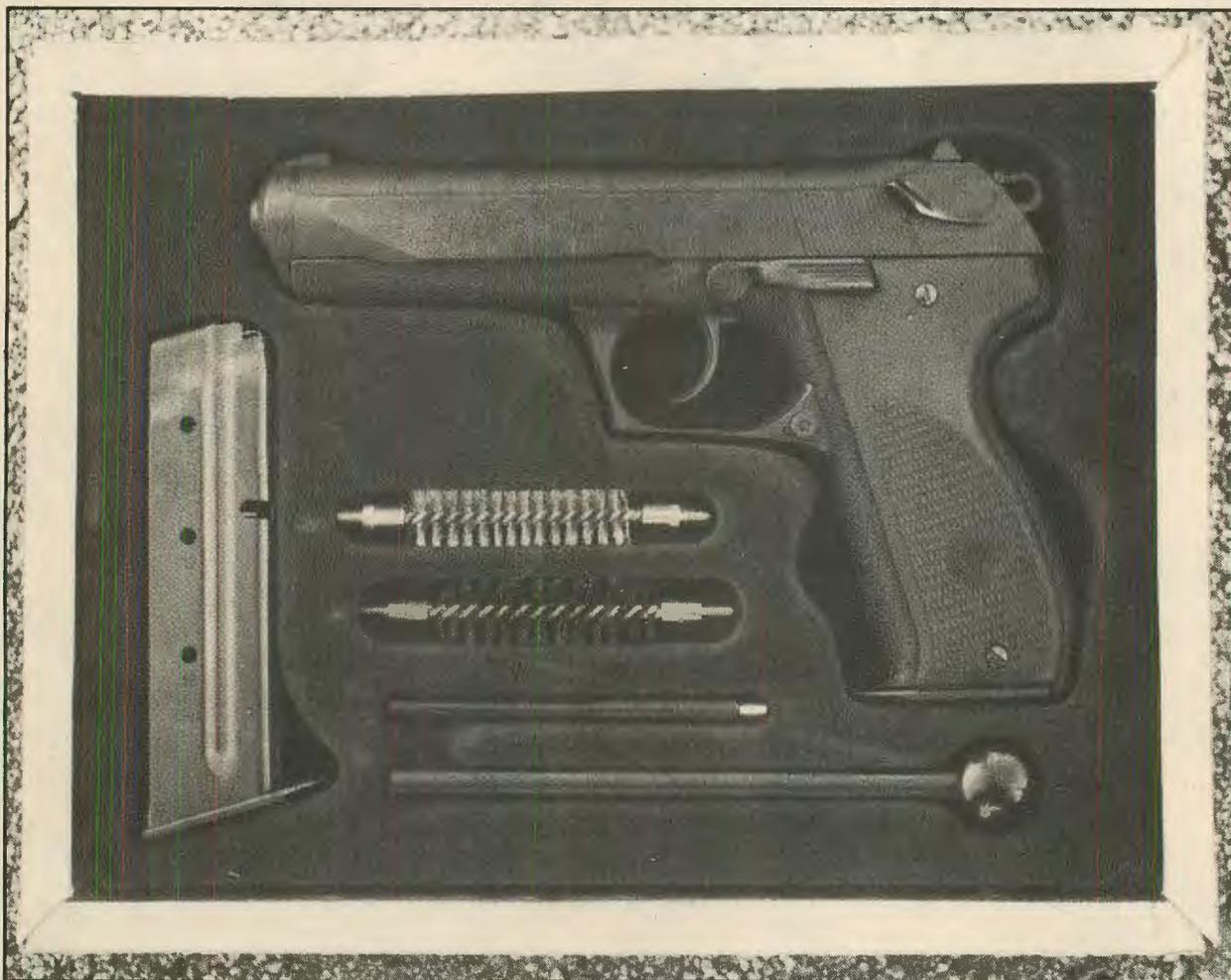
The weight, empty, is two pounds, two ounces. The frame is finished with a black, baked, wrinkle paint. Like that of the Sterling submachine guns, it takes some getting used to, but it's durable and corrosion-resistant. Unfortunately, the feed ramp has also been covered with this material. It should be removed carefully with a Moto tool to improve the feeding of jacketed hollowpoint (JHP) projectiles. The remainder of the steel components are salt-blued.

The pistol is massive and somewhat bulky. It's not readily concealable, but none of the newer genre of large-capacity military-service pistols are — this was not one of their design parameters. With a barrel length of 5.375 inches, the GB's overall length is 8.5 inches. The overall height is

Steyr GB points naturally. Levelness at full-recoil exhibits excellent controllability. Kokalis criticizes gas system, but lauds GB for quality construction, durable finish modest recoil and good ergonomics.







Cleaning brushes, rod and spare magazine come with Steyr GB.

5.625 inches, and the total width is 1.4 inches. Both the exterior and interior of the barrel have been hard-chromed to resist wear and reduce maintenance. The barrel has been bored with a polygonal profile.

The Steyr GB's salient characteristic is its unusual method of operation, which is best described as gas-delayed blowback. The barrel is threaded at the chamber end and attached by this means to the frame. It does not move during the recoil cycle, greatly enhancing the accuracy potential. It can be removed only with the appropriate armorer's wrench (not provided). About halfway along its length, the barrel's exterior has been lathe-turned into a piston head which fits snugly into a gas cylinder at the end of the muzzle-locking cap. Permitted gas blow-by is minimal. Two ports in front of the piston head vent gas at high pressure into the cylinder after the projectile has moved

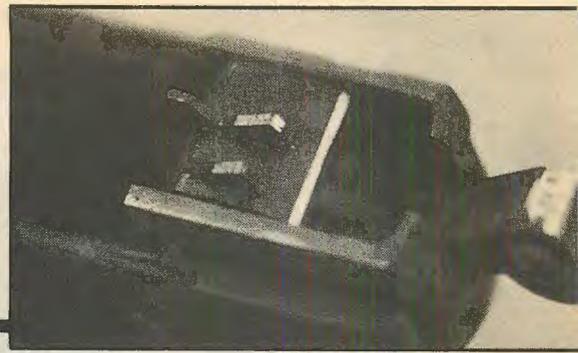
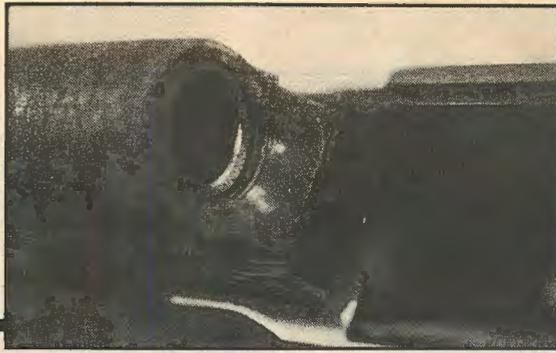
past this point. As the normal recoil action blows the unlocked slide and muzzle-locking cap rearward, the gases inside the cylinder are compressed by the stationary piston, thus retarding the slide's rearward movement until pressures drop to a safe level.

This method was first successfully employed in the German World War II Volksturm Gewehr VG 1-5 developed at Gustloffwerke, Suhl. The barrel was rigidly attached to the receiver of this crudely made "last-ditch" people's rifle. Surrounding the barrel and extending past it, over the receiver, was a thick-walled, machined operating cylinder. The cylinder was closed at the muzzle end by a collar that used interrupted threads (as does the Steyr GB) and a catch. The bolt body was pinned to the rear of the cylinder. The rear two-thirds of the cylinder was cut away along the bottom. The recoil

spring surrounded the barrel, compressed between the barrel's shoulder and the cylinder's forward collar. Upon firing and the initiation of blowback, gases passed through four radial vents in the barrel to be trapped in a cavity formed by the cylinder's collar and the barrel. As the action moved rearward, the trapped gases were compressed, retarding opening for one inch of rearward travel until the vents were exposed and normal blowback carried the action against the recoil spring.

Although this system was a simple, efficient means of operating a rifle chambered for the 7.92mm Kurz cartridge, it came too late to help Germany in WWII. However, serious independent researchers in Europe are still intrigued by this method of operation and its applications to the modern military-assault rifle. I recently fired a hand-made prototype which closely resembled

RIGHT: Barrel throat — unbelievably — is wrinkle-finished like pistol exterior. Kokalis recommends buffing baked enamel away, but admits GB fed reliably with finish intact. **FAR RIGHT:** Trigger mechanism is double-action but weapon can be fired single-action as well.



the original VG 1-5 and was also chambered for the 7.92mm Kurz round — a fine cartridge sadly neglected after WWII in Col. René R. Studler's mad rush to drive the 7.62x51mm cartridge down NATO's throat.

Is this method of operation useful in a firearm chambered for a pistol cartridge? I think not. Browning's locked recoil system is more than adequate for self-loading pistols. Gas operation, or any variant thereof, always introduces more carbon fouling and debris into the weapon's system and increases maintenance time. Gas operation can be justified in rifle-caliber weapons, since it gives necessary energy and provides an ample power reserve to meet the most adverse battlefield environments and frequent sustained-fire missions.

The trigger mechanism is of the double-action type. The pistol can be fired double-action with the hammer down, or single-action by manually thumb-cocking the hammer. Subsequent shots are fired single-action. The wide trigger has vertical grooves. The single-action pull weight is approximately six pounds with little slack, negligible over-travel and a scratchy let-off that cannot be easily improved without the danger of creating a full-auto machine pistol. Although the hammer spring is a round-wire torsion type, the double-action pull weight is 15 pounds. It's also far too long, with objectionable loading at the end of the stroke.

There is no manually operated thumb safety. A hammer-drop lever is mounted to the left side of the slide just to the rear of the retracting serrations. Somewhat stiff, it's easy enough to manipulate with the thumb of the shooting hand, but interferes with retraction of the slide. When the lever is moved downward, it first pivots a steel bar rearward to block the hammer face, then locks the firing pin against forward movement. At the end of its arc of travel, the lever trips the sear, dropping the hammer safely downward. When the hammer is fully down, a projection on top of the sear continues to block the firing pin from any forward movement. When the trigger is pulled, this projection is cleared only during the final instant of trigger and sear travel. The hammer also remains blocked until the trigger is pulled; thus no manual safety is required. The hammer spur has been skeletonized into a ring-type configuration.

The large slide stop is mounted to the left

side of the frame within easy reach of the thumb of the shooting hand. The magazine release has been repositioned from the butt to where it belongs at the lower rear end of the trigger guard. When the cross-button is depressed, the magazine falls freely out of the well.

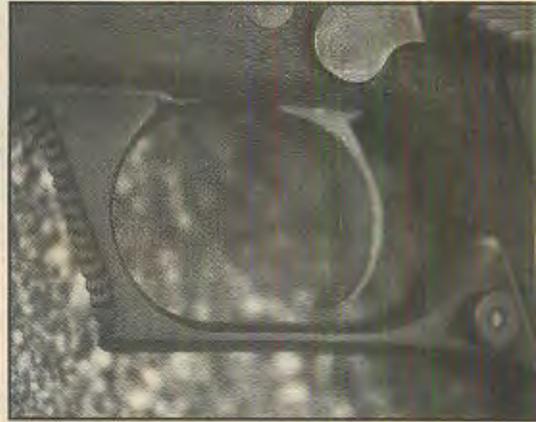
The pistol's unusual magazine is of the two-position feed type usually encountered on submachine guns. Yet it's no easier to load than any other large-capacity pistol magazine. To improve feeding within the narrow confine of the pistol's frame, the magazine has been designed so that the cartridges cant inward. At 18 rounds plus one in the chamber, the Steyr GB wins the current race to stuff the greatest number of cartridges into a 9mm self-loading pistol. Have we reached the practical limit?

How many rounds do we need in a military-service pistol? People have been doing a great job of killing each other for more than 70 years with only eight rounds in a Colt M1911A1. Do we need more because it's only a puny 9mm as the big-bore crazies would lead us to believe? Not hardly. Some of the allure is undoubtedly advertising hype: The most or biggest of just about anything often sells well with the unwashed masses. The comforting placebo effect for

the lad who totes it is also part of the phenomenon. As for me, if I can anticipate needing more than a dozen rounds, I'll opt for a submachine gun every time.

The sights are a modified form of the so-called Stavenhagen pattern. The slightly ramped front-sight blade carries a luminous dot inset into its rear surface. The blade is 3.5mm (9/64 inches) wide. The square-notch rear sight has a luminous dot on each side of the notch. The rear sight is adjustable

Double-action trigger pull weight is 15 pounds. It's far too long, with objectionable loading at end of stroke.

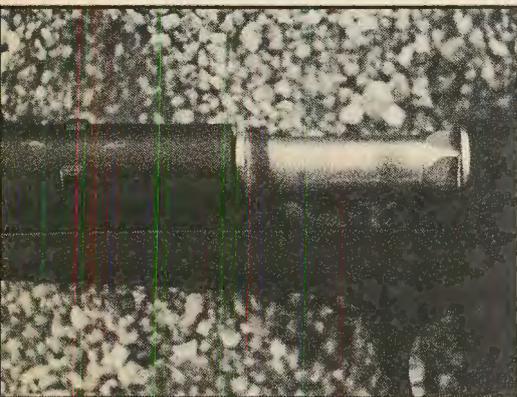


STEYR GB SPECIFICATIONS

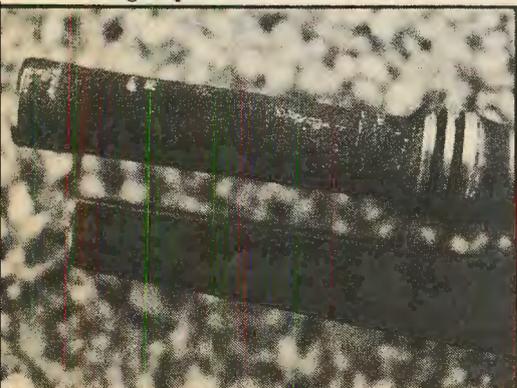
Caliber:	9x19mm (Parabellum)
Operation:	Unlocked gas-delayed blowback, semiautomatic, double-action trigger system with hammer-drop lever, no manual safety
Weight, empty:	2.2 pounds
Overall length:	8.5 inches
Height:	5.625 inches
Width:	1.4 inches
Barrel:	Polygonal profile, right-hand twist, 1 turn in 10 inches
Barrel length:	5.375 inches
Magazine:	Staggered box type, two-position feed, all-steel construction, 18-round capacity
Sights:	Front: fixed ramped type, 3.5mm (9/64 inches) wide with luminous dot. Rear: square notch with luminous dot on each side of notch, adjustable for windage zero by drifting in frame dovetail
Price:	\$595
Importer:	Gun South, Dept. CW, P.O. Box 6607, 7605 Eastwood Mall, Birmingham, AL 35210



Steyr GB field-strips without tools. No further disassembly is needed, nor should be attempted.



ABOVE: Extended muzzle locking cap (left) is gas cylinder, and machined collar on barrel (right) acts as piston. BELOW: Carbon fouling is a necessary consequence of gas operation.



for windage zero only by drifting the sight laterally in its dovetail on the slide. The rear notch is of adequate width for combat shooting. The sights are excellent and enable rapid target acquisition. Pistol dilettantes annoyed by the luminous dots can black them out with enamel.

The grip-to-frame angle is 17 degrees. The frame, constructed of two stamped steel pressings joined by welding, is swelled at the rear of the grip — an appropriate application of ergonomics. The pistol exhibits fine natural pointing characteristics.

Eight different makes of ammunition were fired through the Steyr GB: South African Musgrave Full Metal Jacket (FMJ), Remington 124-gr. FMJ, PMC 115-gr. FMJ, Eagle FMJ (Israeli — black-tipped SMG loads), S&W 100-gr. JHP, Browning 100-gr. JHP, Federal 115-gr. JHP and Portuguese military ball — a total of 1,000 rounds.

There were five failures to feed, two with round nose (RN) FMJ bullets and three with the Browning 100-gr. JHP bullet, which has a pronounced RN configuration. One failure to eject was also experienced while firing the Browning ammunition. The popular Federal JHP flowed like butter up the gravelly, wrinkle-finished surface of the GB feed ramp. Exclusive of the Browning ammunition, now a decade old and no longer available, the GB's performance was acceptable.

At 18 rounds plus one in the chamber, the Steyr GB wins the current race to stuff the greatest number of cartridges into a 9mm self-loading pistol. Have we reached the practical limit?

The GB's muzzle climb is considerably diminished as a consequence of its weight, configuration and point of balance. Felt recoil is also moderate, but no less than that of the S&W Model 469 and SIG-Sauer P226 also tested in the same time frame. No hammer bite was experienced, but the GB's trigger rebound is nasty and irritating. The only firearm I have ever evaluated that was worse in this regard was a Yugoslavian Kalashnikov with a rebounding trigger that bordered on the threshold of pain.

The accuracy potential is quite high, but thwarted by the poor trigger. The 115-124-grain projectiles shot to point-of-aim at 25 meters. As expected, the 100-gr. Browning



Carbon steel is used throughout the unconventional-looking GB. Only grip panels, trigger guard and magazine spring guide are plastic. Front of trigger guard is checkered for those few who will make use of this feature.

and S&W bullets shot below the point-of-aim. If a light and heavy bullet are both fired at the same muzzle velocity, the heavy one will produce greater recoil, driving the barrel higher and thus striking higher on the target. When a lighter bullet is fired at greater velocity than a heavier one, the heavier bullet still hits higher — at close ranges — since the lighter bullet leaves the barrel before the muzzle rises to a higher angle. In general, high- and low-velocity loads with the same bullet weight shoot nearly to the same point-of-impact in handguns. Increasing bullet weights will move the point-of-impact upward irrespective of the velocity.

No tools are required to field-strip the Steyr GB. Remove the magazine and clear any round from the chamber. Swing the disassembly lever — located on the right side of the frame above the trigger guard — downward. This draws the recoil spring and guide rod back away from the muzzle-locking cap/gas cylinder. Rotate the muzzle cap either clockwise or counterclockwise slightly more than one-eighth turn. Withdraw the muzzle cap. Drop out the recoil spring/guide rod assembly. Retract the slide to the stop, lift it up at the rear, then slide it forward and remove it from the frame and barrel assembly. No further disassembly is needed or should be attempted. Reassemble in the reverse order.

Those unfamiliar with gas-operated firearms may become disgruntled when

they first attempt to clean the Steyr GB pistol. Although the barrel's bore and exterior have been hard-chromed, the carbon fouling which accumulates, especially forward of the piston, resists removal. This fouling residue does not impede performance; the pistol was cleaned only after the completed test sequence.

Because the barrel is fixed to the frame, debris on its underside is particularly difficult to scrub away. Avoid the temptation to remove the barrel and clean it with the wire wheel of a bench grinder, since this also removes metal and will eventually increase gas blow-by around the piston. Discoloration left after careful hand-scrubbing with a stainless-steel brush is a cosmetic annoyance only. The gas cylinder must also be cleaned (a steel brush has been provided for this purpose). No lubricants of any kind should ever be applied to either the interior of the gas cylinder or the exterior of the barrel. They will bake like varnish on these surfaces and only increase maintenance time.

The Steyr GB is a well-made, reliable, accurate pistol from a highly respected firm. Its method of operation will intrigue the serious student of small-arms technology. Although it has been entered into the U.S. XM9 trials and is currently undergoing examination by the Norwegian military, I remain unconvinced it can ever be the proper choice for a military-service pistol. □



ABOVE: GB lacks manual safety: Lever at upper right is hammer-drop. BELOW: SMG-style two-position feed distinguishes Steyr auto-pistol magazines.



NIGHT VISION EQUIPMENT

A Look at What Sees in the Dark

by James Mason

DARKNESS is both friend and foe to field armies. Traditionally the time for resupply and relocation of troops, night has also been the cloak for surprise, stealth and infiltration.

Modern electronic technology is changing that. Beginning with infrared experiments in the late 1930s, a steady evolution of sensory amplification technology has led to current generations of night-vision devices.

During World War II, active illumination infrared lights bathed areas with invisible light. Reflected infrared light was focused on a photo-cathode by an objective lens. The cathode emitted electrons that illuminated a phosphor screen. Phosphor illuminating screens in viewers translated reflected infrared radiation into green images.

Such early infrared devices were made into the WWII Sniper Scope for the U.S. Army and the Vampir sight for German forces. Nighttime travel of mechanized equipment was enhanced by goggles worn by vehicle drivers that produced images of the roads or terrain. However, active infrared (IR) source lamps could be detected by an enemy at well beyond the range of the viewer, and so lamps were not used extensively for night ops for fear of incoming artillery fire. These early devices also required power. The big generators were not very mobile and emitted high-frequency audible sound.

Solid state miniature electronics of the 1960s dramatically intensified very low level ambient light, amplifying it to contrast levels tens of thousands of times greater.



BELOW LEFT: Thermal imaging sights for M60 and M1 Abrams tanks enhance both nighttime as well as daylight combat effectiveness. TI sights see through light fog, haze, and blowing dust to give continuous detection and observation of enemy armor movements and other targets. This view through the tank thermal sight (TTS) AN/VSG-2 shows ranging reticle squarely on target.

BELOW RIGHT: Currently, the AN/PVS-4 second generation scope sight is the top performing GI night vision sight. Being lighter in weight with much improvement in amplification and resolution of viewed images, this second generation design has already evolved into third generation devices to be fielded in the near future.



Such starlight sighting equipment was fielded during the Vietnam War. Tactical lessons learned in the field merged with improved technology to make the lightweight, amazingly efficient second generation night vision devices that we have today.

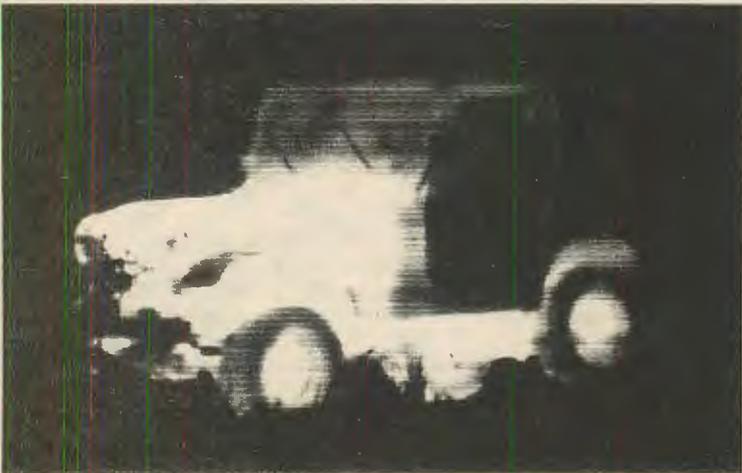
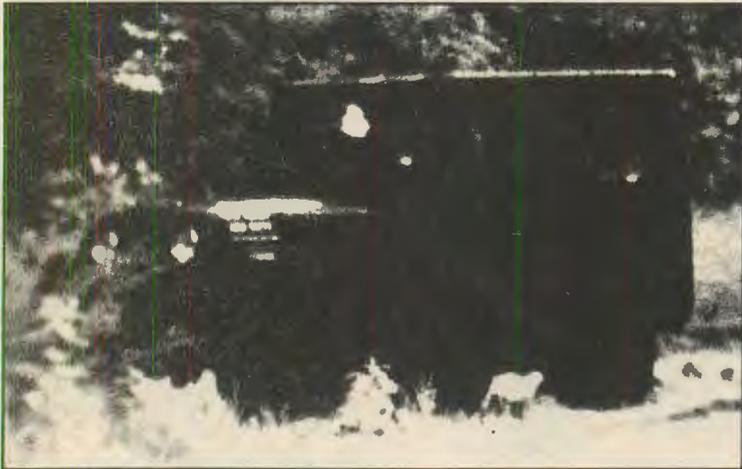
Technology Development

The Night Vision and Electro Optics Laboratory (NVEOL) Ft. Belvoir, Virginia, was established under the U.S. Army Electronic Research And Development Command (ERADCOM), to develop technology and systems for application to armed forces nighttime needs. Work was done within the visual light spectrum and near infrared

Anti-armor TOW (tube launched, optically tracked, wire guided) missiles are equipped with thermal imaging AN/TAS-4 sights. These systems will operate in and around armor maneuvering areas in combat, and so they need the same advantages of thermal imaging as tank gunners. These sights on anti-missile equipment are effective both in daylight hours and after dark.

wavelengths (image intensification) and in the far infrared spectrum (thermal imaging).

Over the years, basic and applied research in industry and at NVEOL has developed a number of systems and devices fielded today for night tactical use. Tech-

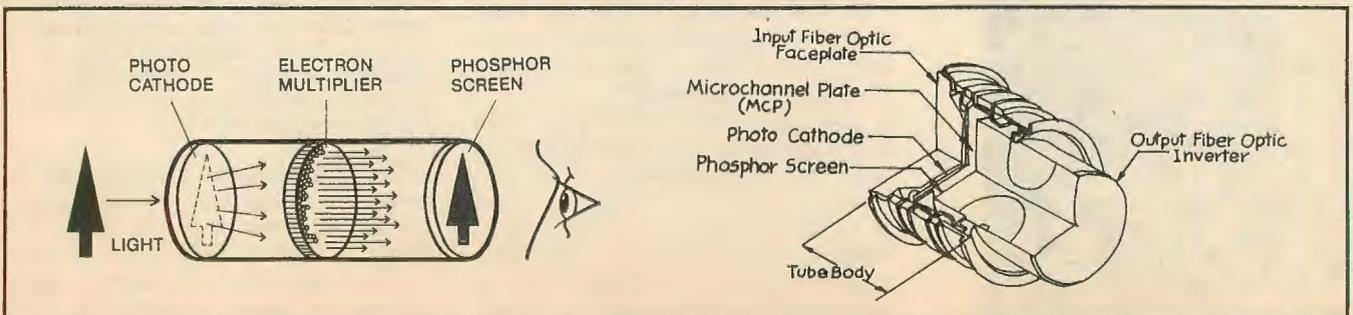


Scenes viewed through night sight equipment are seen in a green phosphor type visible light. These three pictures show a jeep as seen by a daylight optics (top), nighttime with an image intensifier (II), and at night through a thermal imaging device (bottom). Image intensification depends on faint starlight or moonlight reflecting off the object and its surroundings. Thermal imaging "reads" the object's temperature (heat) radiation if there is as little difference as 1 degree F from background radiation. The hotter the heat emissions, the whiter the areas of the image. Applications and techniques for these electro-optical instruments continue to expand, and promise to alter many tactical doctrines for warfare.

nology developed that created the first passive image intensifiers; they are called "passive" because they amplify faint ambient night light from moon or stars and do not require any active light emitting sources of their own. Hence, current issue image intensifiers (II) cannot be detected when in use.

First generation-II devices incorporate a three stage, cascade-type emitter and amplifier unit. They are designed to be sensitive to the visible light spectrum as well as a small area of near infrared radiation up to .85 microns wavelength. Light entering the objective end of the device falls on a photo cathode that emits electrons. These emitted electrons are concentrated by an electrostatic field and made to fall on a light emitting phosphor screen on the output end of the intensifier unit. Phosphor emissions are then conducted through a fiber-optic bed to the second and then to the third stage of amplification. In the last stage, the phosphor screen glows in variable intensity creating an image focused by eyepiece optics for viewing by the observer.

The micro channel plate (MCP) quarter sized discs, made up of thousands of glass tubes, is the heart of second generation image intensifier (II) devices. Entry of photo electrons into microscopic glass tubes produces a cascade of thousands of secondary electrons. Application of a 600-800 volt potential across the faces of the MCP disk accelerates the flow of electrons out the back of the device. These secondary electrons multiply or amplify the intensity and contrast of low light images. The electron input of the MCP then falls on a phosphor screen that excites emissions of visible green light. That enhanced image can then be focused for viewing by the human eye.



The amplification comes through electron generation in each of the three units. Fiber optic bundles between amplifiers maintain image continuity. By the third stage of amplification the image yields about 64,000 times more contrast than the ambient light that enters the objective end of the scope. There is a consummate increase in image contrast, making objects generally identifiable to the trained observer.

These first generation devices were a significant technical step ahead of active infrared scopes of WWII vintage. But they also had a number of drawbacks. These instruments, mounted on individual infantry weapons, were large and heavy. Even though operated by rather small batteries, many designs still had a voltage converter that whined in a frequency too high for detection by the human ear. However, dogs could be trained to react to the sound. Also, images would bloom and streak when intense light sources were viewed, such as vehicular lights, star shells or tracer ammunition and shell bursts.

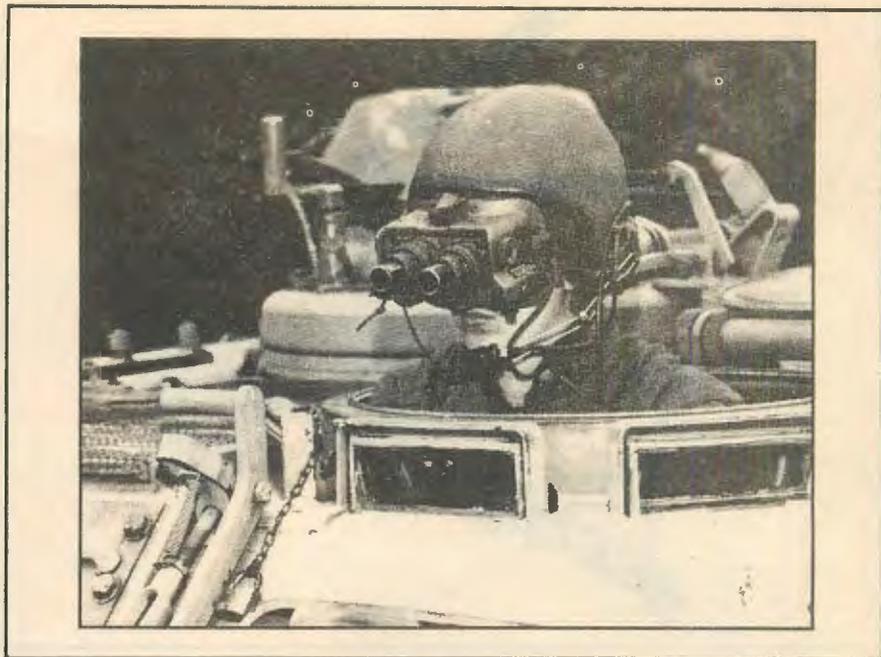
Second Generation II Devices

By the early 1970s another system was being developed at NVEOL. The second generation image intensifier utilized a vacuum tube containing a photo cathode, micro channel plate, and phosphor screen. An objective lens focused ambient light images (too weak to be seen with the naked eye) onto the photo cathode. The cathode emits electrons when exposed to light photons. The electrons emitted are few in number, but as they travel through the micro channel plate (MCP) they trigger emissions of many thousands of secondary electrons.

The MCP is the heart of second generation image intensifiers. The plate is a disk about the size of a quarter, containing millions of hollow glass tubes. Each microscopic channel is a separate high-grain electron multiplier or amplifier. As single electrons enter these tubes from the photo cathode side, they impinge on the walls of the channels and cause propagation of thousands of secondary electrons.

In this way, amplification of many thousands of times can be achieved. Application of a 600-800 volt potential between opposite faces of the MCP accelerates the flow of electronic emissions. As many as 10,000 to one electrons can be produced from each micro tunnel that then impinge on the phosphor screen. The screen converts electron emissions back into green visible light. Thus, a contrasting image amplified many thousands of times is produced on the phosphor plate. An eyepiece lens focuses the phosphor image so that it can be viewed by the human eye. The channeling of light through the image tube is done with a bundle of fiber optics, so as to reduce image diffusion.

An integral solid state power supply, which is operated from a 2.7-volt low current battery, is self-contained in the tube. Small size, high resolution, low noise, very low image distortion, and long life characterize the second generation image intensi-



What looks like 3CPO from Star Wars is an armor soldier fitted with AN/PVS-5 night goggles. The use of second generation AN/PVS-5 and 5A goggles increases the efficient deployment of armor and mechanized units during night movements. Increasingly, this type of equipment is being used in fixed and rotary wing aircraft operations, promising a 24 hour day for active tactical units.

fiers.

Currently, two standard sizes of these light amplification devices are made; one in 25mm and one in 18mm. The size of the device is determined by the diameter of the input fiber optic face plate and corresponding photo cathode surface. The smaller units are used for goggles and binoculars, while the larger sizes are used in telescopic sights and for crew served observation devices.

Third Generation Intensifiers

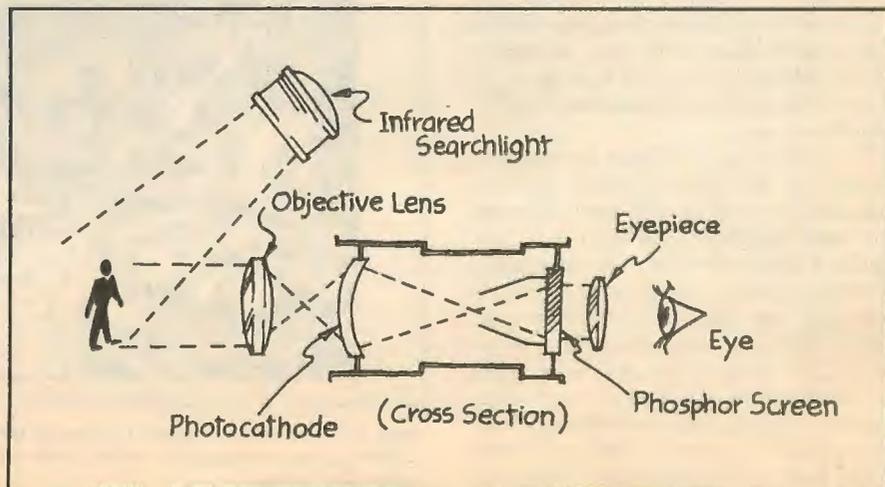
Principles of operation for third generation intensifiers are the same as for second

generation II devices. The chief difference is in the use of gallium arsenide photo cathodes instead of tri-alkali electron emitter surfaces. Improved control of such characteristics as gain, efficient photo cathode illumination, and output image quality are all enhanced in the third generation devices. Third generation intensifier units are in development now and will be fielded when production techniques can be refined and brought on line. Other refinements in voltage supplies and electron propagation efficiencies of the MCP all contribute to upgraded performance from third generation devices.

Far Infrared Thermal Imaging

While II technology fits 85 percent of tactical situations, there are times when light levels or ambient conditions simply are not adequate to operate II devices. Thermal imaging technology has been developed to interpret infrared heat emissions when they are more intense than that of background IR

World War II infrared scopes required a filtered light source. IR radiation, reflected from an object, was focused on a photo cathode by the objective lens of the scope. The cathode emitted electrons that impinged on a phosphor screen. The screen, in turn, emitted a green visible light on its surface. This image was then focused by an eyepiece for viewing by an observer.





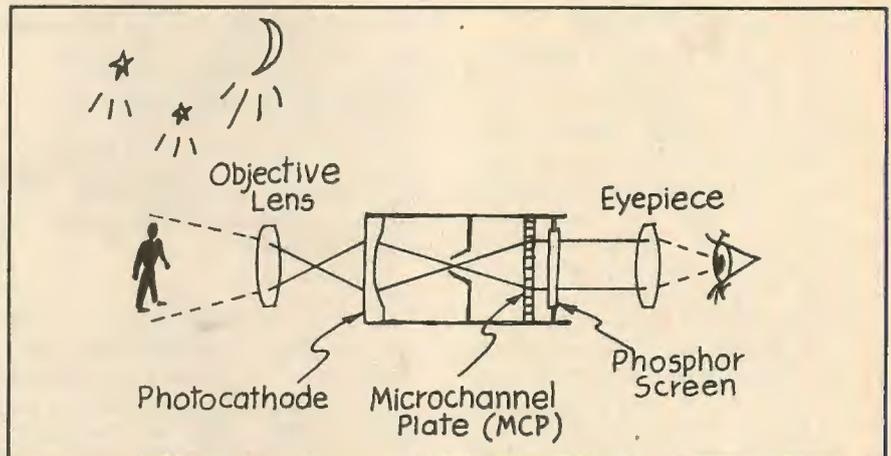
FLIR (forward looking infrared) applications for army aviation are typified in this TADS/PNVS equipped on the new Apache attack helicopter. Seen on the chin mount, the Target Acquisition Designation System (TADS) scans and displays target images on a TV type monitor for the helicopter gunner. This system can search, recognize, and engage up to 10 targets simultaneously with Hellfire missiles and other anti-armor ordnance. The Pilot's Night Vision Systems (PNVS) is located next to the TADS and provides a wide scan field for night flying. A Helmet Mounted Display (HMD) connects with the PNVS sensor apparatus, so that the unit scans as the pilot turns his head. This flexibility of observation is an aid both to target acquisition and navigation. Helicopters so equipped make formidable night fighting weapons systems.

radiation. Objects whose temperatures vary one degree F from their surroundings can be detected in this manner; the steeper the temperature variance the more evident is the object.

Image resolution for thermal imaging (TI) has advanced to where a person can be recognized in a scoping device from a few hundred meters distance in total darkness, even where there is not enough light to operate II equipment. Electronic miniaturization advances in the past decade have made possible lightweight battery operated, high performance systems.

Far infrared (in the three to five microns frequency range) is not visible and cannot be optically focused like visible spectrum energy. It is essentially heat radiation; objects will radiate far infrared energy even in very, very cold atmospheres. A special germanium lens is used to gather the far infrared radiation to let it fall on an oscillating mirror. The mirror directs the radiation across detector elements of a cryogenic (super cooled) sensory element which produces electronic signals of variable power in response to the amount of IR radiation picked up from the scene. These electronic signals are translated into voltage pulse gradients that fire light emitting diodes (LEDs) on a matrix screen. In this way, an image is reproduced much like the scan on a TV tube. A lens eyepiece focuses this image for the human eye.

A lot of research is being conducted to reduce the size and upgrade the performance of TI devices. Most TI applications are for tank observation and fire control and antitank missile launchers. Tactical applications are especially useful, since II technology only sees whatever visible light is reflected. Special clothing can be worn to avoid TI observation and intervening atmospheric disturbances (e.g., fog, smoke, dust or foliage) can still hide enemy activity from TI viewing. TI devices, on the other hand, see through many visible bar-



Second generation image intensifiers work on a single stage principle. The objective lens focuses ambient light onto a fiber optic bed. The light photons are then carried to and fall upon a photo cathode surface. Electrons are emitted from the cathode that pass into microscopic glass tube channels of the micro channel plate amplifier (MCP). Inside each of these channels a single electron can generate about 10,000 secondary electrons, greatly amplifying the intensity and contrast of the ambient light image. Electrons then impinge on the phosphor screen to produce visible green light that is focused by the eyepiece lens. Third generation intensifiers work in the same manner, but electron cathode emissions are greatly enhanced by using gallium arsenide cathode material instead of the tri-alkali type emitters of second generation designs.



Some first generation, cascade type image intensifiers are still used in the field. This AN/PVS-2 was developed in the late 1960s and was advanced compared to other first generation designs.

riers and can locate thermal emissions through light fog, smoke, or dusty conditions. A combination of II and TI in the same device holds great promise for tactical applications.

Forward Looking Infrared (FLIR) devices (specialized forms of TI apparatus) are being installed on aircraft (fixed and rotary wing) so ground targets can be located quickly in any weather. FLIR is also applicable for all-weather air-to-ground navigational systems.

Military Applications

The relatively high cost of II devices prohibits general issue to all tactical infantry. Selective use for sniping, surveillance, and security situations cover most current applications. Patrolling activity requires only point and flanking observers to be equipped with the night vision devices. In a defensive fight, once the enemy is detected, flare illumination provides light in the usual manner.

Night vision telescopic sights for individual and crew served weapons are seeing increased application (e.g., AN/PVS-4). Current second generation II telescopes are the standard, with some older, first generation, AN/PVS-2s still deployed.

Nighttime vehicle and ground support aviation activity make use of binocular and goggle imaging devices. Cyclops binoculars are used in selected patrolling operations. Increasingly, helicopter night operations are using II goggles as well as FLIR systems for navigation and fire control.

Thermal imaging is taking over for general long range surveillance from earlier II devices. Resolution for TI observation instruments has been enhanced. General size and power requirements have been reduced, so that TI applications are more practical. TI sees things II would miss in many battlefield situations due to atmospheric conditions.

Armored vehicle systems are using highly sophisticated observation and sighting equipment that utilizes many common modular parts for applications in many different kinds of devices. For instance, the M1 Abrams tank driver's periscope uses the same 25mm image intensifier tube used in individual and crew served telescopes. Aside from being a superior passive driving aid, the system also is sensitive to detection of enemy usage of active near infrared emissions.

M60 and M1 tanks use a tank thermal sight (TTS) for onboard fire control. Because these devices see through smoke and light fog or blowing dust, they are superior for armor applications both in daylight and for nighttime use.

To increase the effectiveness of antitank rocket weapons, current Army doctrine is fitting TI sighting devices on these launchers. This move will enhance detection, recognition, and missile guidance during night operations and in daylight where haze or other atmospheric conditions hamper direct visual operation.

Spin-offs in the Civilian Economy

Image intensification and thermal imaging applications are used in many civilian



Thermal imaging can see objects that would not show up on image intensification equipment. Foliage interrupts light patterns and so conceals the image of anything concealed from an II scope. Far infrared (heat) radiation is not stopped by foliage. In the top photo we see a harmless scene in a wooded area as would be viewed by an II scope. In the bottom photo, however, the same scene is viewed by a thermal imaging (TI) scope, revealing a man hidden in the dense undergrowth. Used in daylight, a TI device can spot a human body within 10 feet of the edge of a wooded area. Scouting and patrolling takes on a whole new dimension!

activities. These applications promise to become even more widespread as surplus equipment goes on the market at reduced costs.

Police uses for surveillance are natural applications. Drug Enforcement Administration agents used IR thermal scanners to discover where narcotics peddlers kept

money and cocaine storage in the walls of their Miami homes.

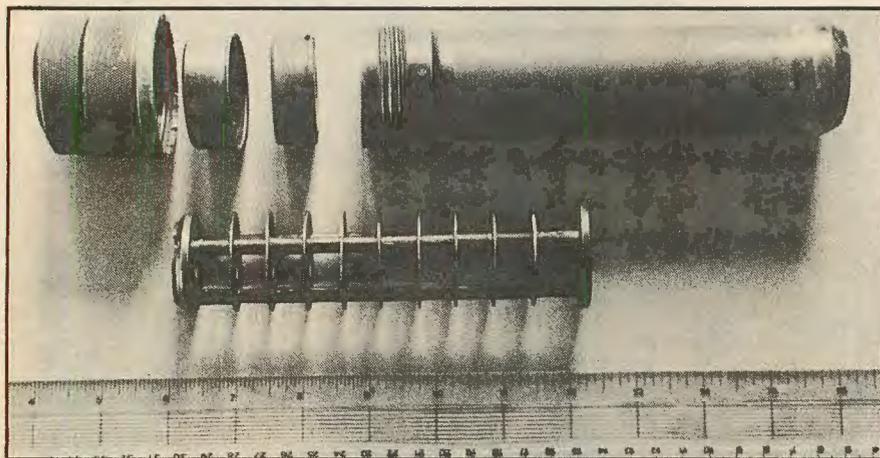
Wildlife wardens catch night poachers through the use of II scopes. Border Patrol operations use both TI and II devices to detect illegal aliens and to direct their apprehension from the bluffs overlooking border crossing areas. Many medical and community service applications are being made using night vision technology. The full scope of civilian uses is beyond the bounds of this article, but all this illustrates the synergism between many military developments and new private sector activities.

In future issues *Combat Weapons* will look closely at field and tactical problems using imaging night vision gun sights and binoculars. Suffice it to say, warfare is not the same any more. The penetration of nighttime barriers is creating whole new areas of tactical doctrine directed at 'round-the-clock military operations. □

SPETZNATZ SILENCER

Soviet Suppressor Brought Out of Afghanistan

by Dr. Philip M. Dater, MD



Unscrew the lid, and drop the parts out: as simple as they come.

A Russian sniper is stalking mujahideen: dangerous sport. He knows there is little difference between hunters and hunted. Hidden in low brush on a rocky shelf, he means to support a command-detonated anti-personnel-mine ambush set covering a gully-bottom trail.

Like every sniper, he knows silence is the only guarantee he'll live through the night. He reaches out to tighten the sound suppressor threaded to the muzzle of his AK-74.

Midnight passes. The mujahid column isn't coming. A long, cold watchful night will crawl along, since Russians don't dare move along the dark trails.

The night still belongs to the mujahideen. An older, simpler, more silent weapon than the Russian's — a Khyber knife — ended

meditation. The Holy Warrior took the sniper's weapon, since rare AK-74s still sell for thousands more than AKMs, and the strange fixture on the end of the barrel might be traded for more ammunition...

OMEGA Group has smuggled another Soviet weapon out of Afghanistan: a silencer. But it's best to qualify "silencer." "Sound suppressor" is what most weapons experts call a perforated, baffled, hollow, metal expansion chamber attached to a rifle or pistol to diminish its report.



Cleverly and simply, constriction holds baffle stack without additional hardware.

More people call it a silencer, but if they heard one they would know it was not silent. Also called mufflers and cans, suppressors do allow noise to escape from a firearm, but a good one doesn't allow you to tell it's a gun — or locate the shooter easily — if you're more than a few yards away. But the Soviet suppressor *isn't* a good one, and the

tag "silencer" couldn't be further from the truth.

Russia's new small arms sound-suppressor is 216mm long, 53mm at its widest diameter, and made up of five parts:

- 1) Outer tube, 182mm long with an average outside diameter of 41mm.
- 2) Rear end cap, 53mm in diameter and 50mm high, tapped to receive the threaded barrel.
- 3) Baffle stack which fills the interior of the suppressor.
- 4) Thick, flat diffusing baffle.
- 5) Baffle of questionable purpose with a conical cup cut into the forward face.

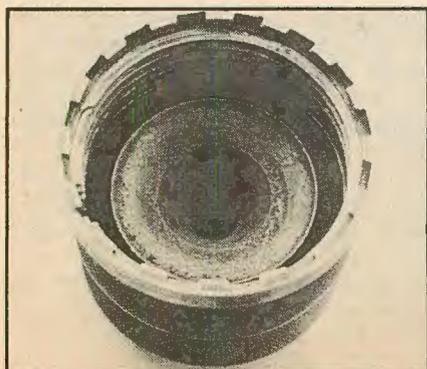
This slide-the-parts-in, screw-it-together silencer is designed with the user in mind. It is not designed with *silence* in mind, but this can is Marine-proof, as well as Russian-, Uzbek-, Tadzhik-, Mongol-, and Afghan-proof.

The suppressor disassembles from the rear: Unscrew the cap, remove the cupped baffle (retained only by the rear cap), then the thick diffusing baffle, and pull the baffle stack from the body tube. Removing the baffle stack leaves an empty tube, without ends. A slight constriction at the front of the tube stops the baffle-stack from being pushed all the way through, and the last baffle forms the end cap. Simple.

Assembly is the reverse of disassembly. It couldn't be easier.

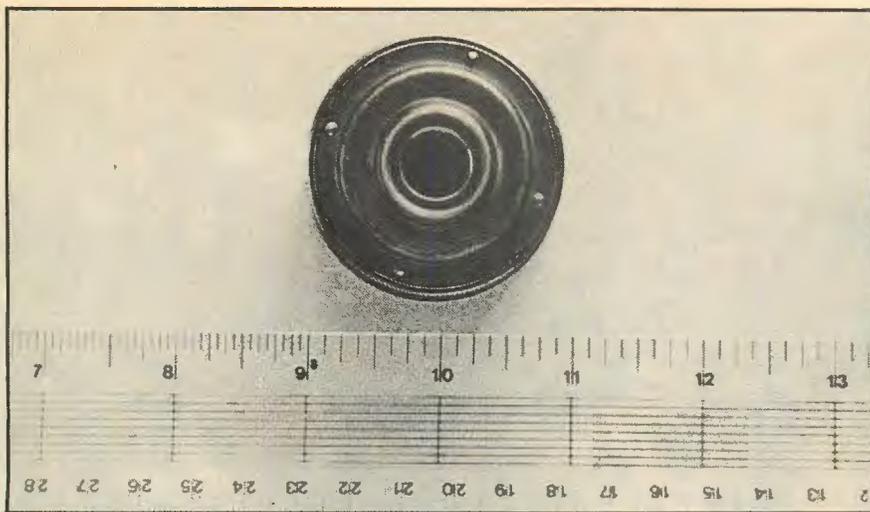
The baffle stack is made of nine flat washers. The middle seven are 1.8mm thick, and the two end baffles are a little over 2mm thick. The 39mm-diameter baffles are stacked on three 3.5x160mm bolts,

Odd cupped baffle may direct gases and seal joints.



Model number for Moscow's latest muffler.





Threaded entry hole of Soviet can shows rough manufacture.

with 6mm-long tubular spacers holding them apart. Holes in the baffles widen from 12.8mm, toward the rifle's muzzle, to 15mm at the front. The bullet's passageway is a cone.

The diffusing baffle measures 49mm in diameter and 17mm thick. A central hole 13.8mm in diameter is flanked by four 3mm vents spaced at 90-degree intervals around the central hole.

The peculiar cupped baffle at the near-end of the device has a hole 8.5mm in diameter. It isn't tight enough to be a wipe (a perforated piece of flexible material through which the bullet squeezes, designed to help control the flow of gases within the suppressor). Possibly it seals off leaks of gas (and sound) from joints inside the suppressor. The bullet passing through the cupped baffle is probably smaller than 7.62mm (.30 caliber). The can's low volume also suggests a microcaliber round.

The rule of thumb for suppressor volume is three times barrel volume. That is, a .22-cal. barrel has a lot less volume than a .30-cal. As gases expand to fill the chamber they lose pressure and heat. Now, the captured Soviet silencer only holds about 180cc. A couple of hundred cubic centimeters isn't much gas for most rifle rounds,

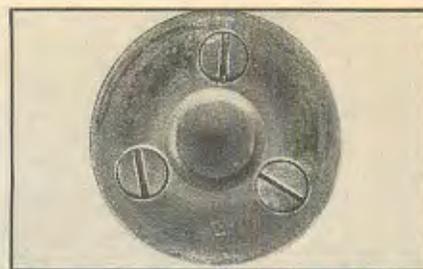
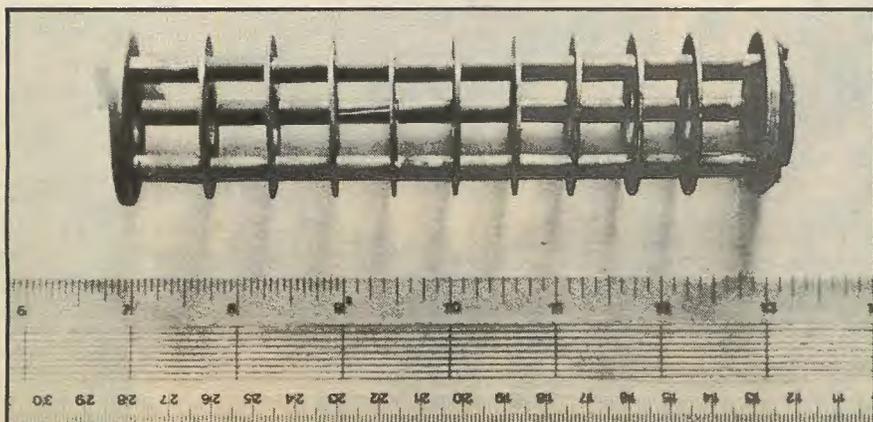
but it's appropriate for .22 centerfire gases. So, if this suppressor is designed around the Soviet 5.45mm cartridge, why is there a half-inch hole in the business end of this can?

Since the large exit hole in the silencer will allow more gas to escape, there's going to be more noise. Ivan's muffler should only take about 20 decibels off the report. By comparison, U.S. commercial suppressors will quiet a .22 centerfire by more like 40 decibels.

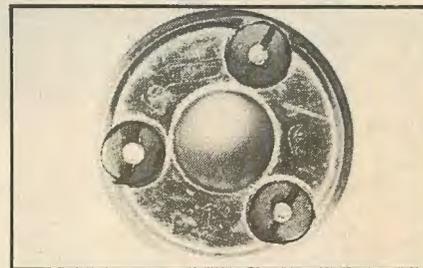
This Soviet design is louder than a suppressor with a smaller exit hole, but, again, there are user advantages. The Soviet suppressor's conical bullet channel will allow a mounting error of up to two degrees. My suppressors certainly won't do that... but my cans are quiet, and theirs aren't.

It all adds up: This primitive muffler is better than it looks. The Soviet suppressor will limit position disclosure, as long as it's screwed on a 5.45mm-bore AK-74. Almost soldier-proof, this can will work in the hands of nearly anyone who can hold it. A sniper who regularly kills a long way from battalion-level armorers also benefits from the simple field-maintainable design. Finally, its extreme margin of mounting error will allow primitive shop barrel-threading

Heart of primitive suppressor, an easy-access baffle stack.



Muzzle-end of baffle stack shows big slot screw heads for easy disassembly.

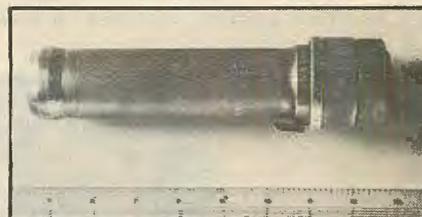


Big exit hole allows enormous mounting error.

methods, and suppressors of this model will interchange with virtually any similarly-threaded micro-caliber weapon. These are all valuable attributes for a military sound suppressor.

The Soviets are often bad craftsmen of inferior products. But remember: The Russians have gotten most of what they wanted in this century. They must be doing something right. In particular, this new Soviet silencer is simple, tough, and requires little skill to mount, maintain and use. It's exactly what they want. □

Crude Sov silencer: Below U.S. standard, but it serves its purpose.



QUIET EXPERT

'Doc' Dater's analysis of the Soviet silencer is an exercise in *The Higher Criticism*: He never laid hands on it.

Combat Weapons' tech-intel staff had several reasons — both of law and security — for not passing Ivan's silencer around the country for independent analysis. Since *Combat Weapons* couldn't get the suppressor for analysis, we dug up the one expert we trusted to estimate the can's performance from size and structure.

Dater's Automatic Weapons Company, Dept. CW, P.O. Box 1731, Socorro, NM 87801-1731, is one of the best known and most prestigious manufacturers of small arms sound suppressors in the United States.



ABOVE: Preparing to move out: M60 tankers awaiting maneuver orders.
BELOW LEFT: Roof-mounted M2 .50-caliber heavy machine gun provides secondary armament to the crew of the M60A1. **BELOW RIGHT:** The 105mm rounds sitting on the loading dock are of the discarding sabot variety, and very popular with tankers for their high velocity and high penetration on armored targets.



BATTLE TANKS

MBTs Ready to Roll Into Modern Warfare

by Joe Zambone



WHEN the first tank rumbled onto a World War I battlefield near the Somme River in September 1916, the opposing German forces were as curious as they were awed over this apparent tractor with armored sides. Having never seen a tank, they assumed it was designed to breach barbed-wire fortifications and span the extensive trench systems common to WWI battlefields. They were partly correct.

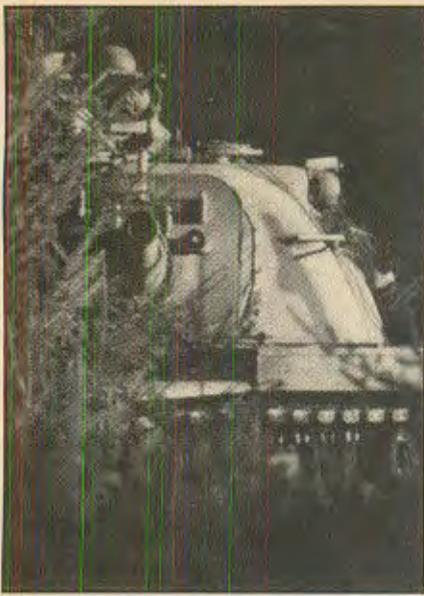
Those first tanks clanking into battle at about two miles per hour heralded what would become the "combat arm of decision," as tankers are fond of calling their branch of service, although the debut was actually a poor show of strength. No tactical manuals had yet been written about tank warfare, and British commanders failed to exploit breaches made in German defenses. Of the 49 tanks that went into action, 17 bogged down or failed mechanically, and others misinterpreted orders. Only nine carried out their missions. Still, a number of German soldiers were killed, some by shell fire from the miniscule 37mm main gun and some crushed by the treads.

It wasn't until November 1917 that British tanks at Cambrai put on a good show and justified several years of expensive development. Some 300 tanks stormed the Germans' six-mile front at dawn, broke through shattered defenses and carried the battle to the rear areas where pandemonium followed. German defenders discovered that a lumbering tank could be stopped only with great difficulty, so they ran like hell and dug deep into trenches to escape being crushed. British infantrymen following their armored spearhead easily captured the cowering enemy.

The Germans quickly found that artillery pieces make holes in tanks, but there remained the problem of finding gun crews to hunker down behind a field piece long enough to draw an accurate direct-fire bead on the approaching tanks. Most artillerymen were accustomed to relatively safe combat conditions, firing from thousands of yards behind the battle lines — a virtual life of luxury compared to the trench-bound dogface. When called upon to face tanks close up, the cannon-cockers were dismayed and often mutinied or went AWOL.

Tanks helped seal Germany's fate in WWI, and the Germans put the lessons learned to good use. During their clandestine rearming after the war, they developed sophisticated tanks which could deal effectively with Allied tanks. The blitzkrieg concept of massed armor attacks on a wide, fast-moving front enabled German panzer commanders to roll through Poland in less than a month. Before the tank era such a conquest could have taken months or even years. The Germans employed tanks for quick penetration of an enemy's defenses, leaving the mopping-up operations to following infantry and support elements. That's still what tanks are best at doing: blitzing through a panicked enemy's front-line defenses, rolling through supply areas while shooting everything up, and securing positions sometimes miles to the rear of the enemy's front lines.

One of the best main battle tanks (MBT) in the world today is the U.S. M60, in various versions designated "A1" through "A3." You might've heard about others, such as the M551, Bradley or the XM1 Abrams — but rest assured that virtually all



A formidable monster: M60 MBT uses available cover before moving out on maneuvers.

our battle tanks are M60 types which entered service in 1960. After graduating from the U.S. Army Armor School at Ft. Knox, Ky., I served in Germany as a mint-green second lieutenant commanding a platoon of M60s in maneuvers around the German countryside. Current forces still patrol the borders and stand ready to repel an enemy armored thrust with the M60. It will probably remain the U.S. MBT for some time because it takes years from a new tank's introduction until it's actually in the field for combat.

Tankers lovingly refer to their 53-ton steeds as "large, movable foxholes which serve as handy aiming points for enemy artillery." In a way they're right, at least about size. The M60A1, most common of the M60 series, weighs 106,000 pounds, stands 10 feet 8¾ inches high, is an inch less than 12 feet wide, and is 27 feet one inch long. Armor plating is as thick as 14 inches on the front slope, as thin as about one inch on top. The crew of four (driver, gunner, loader and tank commander) live and work in quarters so cramped they had better be friends, but their tank's interior is relatively spacious compared to Soviet bloc tanks.

A 12-cylinder diesel engine with turbocharging gives the M60A1 a top speed of 30 mph, but I suspect that speed is dictated by a governor. My driver in Germany toyed with our tank's governor, allowing us to reach a dazzling 42 mph on an autobahn. That's the speed the German policeman clocked us doing, anyway.

Baffled and rubberized (to prevent leakage after a hit) fuel tanks hold 375 gallons, giving the M60A1 a cruising range of 310 miles under ideal conditions. That's about .88 miles per gallon, and the figures apply only when terrain is level and a steady speed is maintained. In Germany we operated mostly off-road on hilly terrain, and fuel consumption wasn't nearly as thrifty as manual writers would have you believe.

An M60A1 will span a ditch or ravine 8½

feet wide and climb a vertical obstacle three feet high. Those figures can be changed when you dial in Yankee ingenuity. When I taught tank driving at Ft. Knox, one of my "experiments" was to see just how wide a ditch an M60 could cross. I learned that you can descend into a ravine wider than 8½ feet (normally it's the 10-foot and slightly wider ditches that stop tanks) and then erode a section of the ravine wall in front of you with the tank's front end, using the fallen dirt as a ramp of sorts for climbing out.

The wearing-away process is done with "neutral steer," a drivetrain setting in which one track goes backward while the other goes forward. This allows an M60A1 to turn around in its own length, but can also be used to grind enemy soldiers into the turf or turn a section of steep ravine-wall into a ramp. A combat adaptation uses a tank's main gun to blow out part of the far gully wall, also giving an exit ramp. The main gun will also conquer vertical obstacles higher than three feet: Sit back a hundred yards and light off a round or two. Presto! You can climb over the lower (or obliterated) obstacle.

Tanker Reporter

Joe Zambone is a photojournalist for the Washington National Guard who doesn't like to collect information over the phone. Zambone prefers working in the field. He likes the action, and gets it by visiting units all over the state. His writing and reporting skills have recently earned him two awards for excellence in military writing.

The first MOS for Zambone after receiving his second lieutenant bars at Ft. Lewis, was armor platoon leader. Next, he became an armored cavalry platoon leader, in command of three tanks and seven other armored vehicles. Zambone has taught new recruits how to drive tanks and taught tank gunnery in Grafenwhor, West Germany — the spot on the East German border where Rommel's Africa Corps trained.

Before returning with his unit to Ft. Lewis, Zambone served as a recon survey officer and a battery executive officer. His last year of active Army service saw him resuming his recon survey position back in the States.

M60s will ford rivers as deep as four feet without special preparation, according to training manuals and spec sheets, but such figures are misleading. If the watery obstacle is five feet deep but not too long, a tank can simply blast through it with the driver's hatch closed. Everything in the engine compartment is water-proofed, and the exhaust can still exit under water. The tank has a number of leakage spots, however, which limit water-travel time. In depths over four feet, water will seep into electrical couplings, the turret ring and the front hatch seal, which tends to crack in dry climates.

Tanks are actually moving gun platforms

with hard sides and the ability to cross most areas with impunity. A towed howitzer or antitank gun can inflict as much damage on the enemy as a tank, but the lighter vehicles cannot drive through wooded areas or buildings to get to a firing location. Tanks can. A tank driver who's practiced rough-terrain maneuvering can waltz through forests sporting trees two to three feet thick, knocking over those he cannot avoid. It takes skill, since a cross-wise tree *can* hang a tank up so that its tracks can't grip the ground, but I can personally vouch for the M60's ability to wreak wholesale devastation on forests when driven cautiously and intelligently.

The M60's turret weighs about 14 tons, and has armor plating more than a foot thick in front. Turrets are cast of homogenized armor-grade steel, which is resistant to impact and penetration. However, there isn't a tank turret in existence which cannot be penetrated by an armor-piercing chemical- or kinetic-energy projectile. A U.S. High Explosive Anti-Tank (HEAT) round will burn violently through more than two feet of steel, and ComBloc armies have equivalent rounds.

Mounted in the M60's turret is a rifled cannon with a bore of 105mm (just over four inches) that uses a variety of projectiles. The gun is "laid" (aimed at the target) with a hydraulic control system tied into a range-finder device operational out to 4,400 meters. Basically, the gunner ranges on a target by superimposing two images so they appear as one (the same principle used in range-finding binoculars or cameras), then places the crosshairs on what he believes is the enemy's most vulnerable spot (fuel tank, turret, tracks).

Since the various projectiles (we'll discuss them shortly) have different velocities and thus different trajectories, "Kentucky Windage" must be applied to hit a target. This is automatically dialed in by a ballistic

M60A1 waits at the loading dock to stow its complement of 105mm rounds.



computer with interior cams for different projectile characteristics. The gunner keys into the computer which round he'll be shooting, then aims the gun normally with his optical sights. If the round is slower (like HE, a High Explosive round), the gun will elevate automatically to compensate for increased projectile drop. In early tank weapon systems the gunner was forced to estimate range and apply true Kentucky Windage to hit his targets; one helluva lot of rounds hit only dirt as a result.

Main-gun ammunition is classified as either anti-personnel/materiel or armor-piercing (AP). Against personnel or "soft" targets, the 105mm gun usually employs High Explosive Plastic (HEP) rounds. These are rounded projectiles filled with plastic explosive with base-detonating fuses; they're rather slow at about 2,400 fps muzzle velocity, but since they're not nor-



During a lull in maneuvers, a tanker sits on top of his turret to stretch his legs.



M60 tanker relaxes against M85 .50-caliber machine gun. He is sitting on the gunner's periscope.

mally used against a serious threat (like another tank about to fire), this is no drawback. The HEP round sort of splatters when it hits — like a large gob of soft clay or mud thrown at a wall — then detonates.

Against troops or armored personnel carriers (APCs), HEP rounds act like artillery projectiles, simply blowing things sky high. Against a hard target like a bunker or enemy tank, HEP rounds are devastating because of the immense blast. Reinforced concrete

six to eight feet thick can be penetrated with HEP ammo, and while the ammo may not make a huge hole, the structure will be severely weakened and troops inside killed by flying fragments of concrete and reinforcing rod. The noise alone is enough to stun the enemy. HEP rounds can defeat enemy tanks through "spalling" (what happens when a violent explosion occurs on an armored vehicle's exterior). Fragments chip off from the hull and turret and zip around

the tank's interior, killing or seriously wounding the occupants. HEP rounds can create secondary explosions by lighting off the enemy tank's basic ammo load through shock effect — a quick finale.

An M60 carries 63 rounds of main-gun ammo which is electrically primed rather than impact-primed as in most weapons. In Germany I was investigating officer for an accident which killed three tanks. Their radio antenna hit overhead high-tension electrical lines and set off one of the main gun rounds; everything else went off in micro-seconds, blowing the turret — all 14 tons of it — more than 300 feet away and turning the tank's hull into Swiss cheese. Oddly, one man was blown clear; though injured, he survived. One man wasn't even found.

Thus, there's something to be said for trying to detonate the enemy's main-gun ammo supply.

HEAT rounds are chemical-energy shaped charges used to defeat any tank armor in the world. The 105mm HEAT round has a muzzle velocity of about 3,850 fps — as fast as any civilian rifle in the world except a few oddball varmint calibers. HEAT rounds are easily identified by a rod about one foot long sticking out of a cylindrical projectile base. This rod is a "stand-off" measurement that gives the shaped charge time to funnel all its energy into a tiny area; the projectile's fuse is also in the rod's nose. Like all main-gun ammo, HEAT rounds have tracer elements so that gunners can observe the flight path toward the target and correct their aim.

These rounds literally burn through dense armor plating two feet or more thick. White-hot metal is sprayed throughout the enemy tank's interior, and blast forces kill everyone inside. Secondary explosions are typical of a HEAT-round impact, and it's the rare tank that lives to fight another day after being clobbered with one of these devastating rounds.

Another nifty anti-personnel round is the "beehive," which is used against massed troops. It's filled with thousands of tiny steel flechettes which ventilate enemy troops even if they're wearing flak jackets.



Few armor battles have been fought since WWII, but during the 1973 Arab-Israeli War, tanks once again clashed with a fury not known since the Bulge. Here, an Israeli crew works on their tank during a respite in fighting in the Golan Heights.

At point-blank range beehive rounds offer a spread of about 119-meter width at 300-meter range, and correspondingly less width at closer ranges (normally taken care of by machine guns, anyway). A time-delay fuse is used with beehives fired at troops from 200- out to 4,400-meter distances. The fuse detonates about 75 to 100 meters before the setting, giving the flechettes time to scatter properly. Fuses can be set in 100-meter increments and signal their detonation by releasing a puff of yellow smoke; gunners can adjust fuse timing by checking the smoke's relationship to enemy targets.

White Phosphorus, also known as "WP," "Smoke" or "Willy-Peter," is another anti-personnel round designed to demoralize enemy ground troops. WP keeps on burning after it contacts skin, and a soldier trying to stop a chunk of burning WP from turning him into a torch doesn't have the time or inclination to take care of his normal duties . . . like aiming a guided missile at you.

Willy-Peter is also useful against pill-

Field maintenance shop is usually set up in rear area and is equipped to handle problems up to engine replacement. M88 tracked tank retriever sits behind M60A1.



boxes; simply chucking a round at a pillbox so some liquid fire goes through firing ports usually solves the problem. Smoke can also be used as a marker round; it can initiate an attack or mark a distant target seen by a tank commander who cannot accurately describe it to other tanks in the unit.

Our premier tank-defeating round is the Armor-Piercing Discarding Sabot (APDS) projectile, a kinetic-energy round which blasts through armor because of its weight and extreme velocity. Sabot projectiles are made of tungsten carbide or depleted uranium, both exceptionally heavy materials hard enough to penetrate anything. Each projectile, enclosed in 105mm-bore-diameter aluminum "petals," is only about 40mm in diameter, yet weighs about 28 pounds.

Manuals call for a muzzle velocity of 4,850 fps, but recent improvements have resulted in sabot rounds traveling in excess of one mile per second! The muzzle energy is something on the order of 13 million foot-pounds, quite a bit when compared with a .45 auto pistol's 347 foot-pounds. Sabot rounds are so fast the gunner can't even see the tracer element until the round is nearly a mile away, especially at night.

A sabot round's trajectory is like a stretched string, and for all practical purposes doesn't drop enough at any engagement range to worry about. You put the crosshairs on the enemy tank, and the sabot will hit within a foot or so of where you aim, out as far as 4,400 meters (the rangefinder's limit).

HEAT rounds are no slouch in the ballistics department, either. One of these chemical-energy projectiles will still travel at about one-quarter mile per second out at three kilometers, and about 700 fps at five kilometers. Since the HEAT round doesn't depend on kinetic energy (striking force) for effectiveness, it is the best ammo to use for long-range (beyond three miles) engage-

ments. The only problem then becomes accuracy. Good gunners can do it, but luck is necessary to hit an enemy tank at such long range.

The rather slow HEP round is still clocking 307 meters per second at 3,000-meter range. To get to a target that far away it rises 57.8 meters above the gun's line of sight; that means the ballistic computer has automatically elevated the main-gun tube to compensate for a trajectory which goes about 187 feet above the straight line from gun muzzle to target. This high point, called max ordinate, occurs at a range of 1,723 meters from the gun when a 3,000-meter target is engaged.

An M60 tank mounts a 7.62mm machine gun called a "co-ax" because it's set into the turret alongside the main-gun tube. Aiming and firing the co-ax is done by turning the turret and elevating or depressing the main gun; the gunner thus cannot engage an armored target and enemy ground troops at the same time unless they're all in the same area.

The 7.62mm co-ax fires AP, armor-piercing incendiary (API), tracer (tracer burnout is 900 meters) and ball ammunition. Standard loading is four rounds of ball to one tracer; tracers are used to visually "walk" suppressive fire onto targets. Basic 7.62mm ammo load is over 6,000 rounds, but if combat with many enemy ground soldiers is expected, a savvy tank commander will "promote" another 10,000 rounds or whatever he can get his hands on, storing

M60A1 MBT SPECIFICATIONS

Crew	4
Combat weight	48,987 kg
Unloaded weight	43,999 kg
Length hull	6.946 m
Width	3.631 m
Height	3.27 m
Length	gun forward 9.436 m
Firing height	2.095 m
Ground clearance	0.463 m
Track width	711mm
Length of track on ground	4.235 m
Max. speed	(road) 48.28 km/h
Fuel capacity	1,420 liters
Max. range	(road) 500 km
Fording depth	2.438 m
Gradient	60 percent
Vertical obstacle	0.914 m
Trench	2.59 m
Engine	Continental AVDS-1790-2A 12-cylinder air-cooled diesel developing 750 bhp at 2,400 rpm.
Transmission	General Motors Corp. cross-drive, single-stage with two forward and one reverse ranges.
Suspension	torsion bar
Armament	(main) 105mm (coaxial) 7.62mm MG (anti-aircraft) 12.7mm MG
Ammunition capacity	(main) 63 (7.62mm) 5,950 (12.7mm) 900

it on the tank's exterior if there's no room inside.

A .50-caliber machine gun known as the M85 mounts in the tank commander's cupola, the small turret on top of the main turret. This gun has a dual rate of fire, either 400 or 900 rounds per minute, the latter setting used against attacking aircraft (current doctrine is to throw up a curtain or cone of fire in front of an attacking plane and let the pilot run into it).

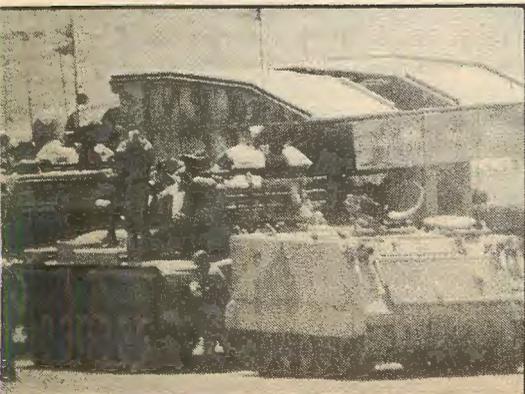
Fifty-caliber ammo is diverse, and includes AP, API, APIT (Armor-Piercing Incendiary Tracer), ball tracer, ball and frangible. Any .50-caliber round can be used effectively against troops out to two-mile range, but the weapon is generally reserved for use against lightly armored vehicles like trucks, APCs and self-propelled artillery. APIT ammo has tracer burnout at 1,600 meters, and is especially effective against troops in APCs because it not only makes lots of holes in light armor, it sets the interior on fire. It can be used against thin bunkers because repeated bullet strikes with AP slugs will penetrate several feet of concrete. Our M85 .50-caliber machine gun fires the same ammo as the .50-caliber heavy-barreled M2 Browning, but the link construction is different; linked ammo is thus not interchangeable.

An M60A1 tank differs from the A2 version in many ways. M60A2s are designated "engineer" tanks, and mount a stubby-barreled 152mm gun designed to blow bunkers and breach fortifications. A2 tanks usually mount a dozer blade in front and have heavy winches to remove obstacles. But, other than different missions and slightly different armament, the tanks are basically the same.

The M60A3 version has some Buck Rogers gadgetry to make it shoot faster, including space-age optical systems and laser rangefinders.

By using its xenon searchlight, any M60 tank can fire at night. Although the light illuminates a target two miles away, it also gives the enemy a nice spot to aim at. Tanks therefore generally work in teams when lighting areas; one tank lights for a few seconds, then switches off as another switches on. Searchlights can also be used to blind and disorient enemy troops. The

M113, M60A1 and pontoon bridge section await movement orders prior to beginning the armored exercise.



The wide open plains of Europe will be a likely site for the next major armor engagement. U.S. tankers train on similar terrain.

largest xenon light blazes with from 400- to 1,000-million candlepower — enough to toast marshmallows at 100 yards. It will illuminate targets out as far as 15,000 meters, or over nine miles away.

Infrared capabilities are used at times with the M60 tank system, allowing gunners on the blackest nights to acquire targets as far away as they'd be able to with white xenon light. Soviet forces have an infrared-sensing antitank missile now, however, so our current doctrine is being modified to follow the same theory as is used with white light: switching on for brief periods, and using overhead illumination from artillery when possible.

All in all, our M60 weapons system is a pretty damned good one, but this shouldn't promote a false sense of security in the guys who sit behind 14 inches of homogenized-steel armor-plate. One little soldier with an antitank grenade launcher can ruin a tank-er's day. For all their earth-shaking mass and firepower, tanks are still vulnerable to many weapons. Soviet forces have self-propelled antitank guns which we can defeat with machine-gun fire, but we have to see them first. It's estimated that the Russians will field many man-portable antitank weapons in the next war, such as the Sagger which can be launched and guided to its target by a man sitting in a foxhole or behind a tree as far away from the launcher as 15 meters.

Such wire-guided weapons can be defeated if they're seen in time. A Sagger missile is slow, taking 25 seconds to fly 3,000 meters; a tank driver can swerve at the last moment and the missile will fly by his tank since the Russian gunner can't change flight direction that fast. But electronic countermeasures (ECM) cannot be used against wire-guided missiles, and U.S. tanks remain very vulnerable to the Sagger, as it can defeat our armor out to 3,000 meters. The Swatter missile is radio-guided, and our ECM systems can screw it up nicely if we detect it in time.

Army experts estimate we'll face a five-to-one superiority if war breaks out in Europe. That's *five* Soviet tanks to our every *one*, and this information changes the ball game somewhat. Our emphasis now is on quick reaction, since it's been proven on

the battlefield that he who shoots first usually wins a tank battle. When I attend desert-warfare tank training at Yakima Firing Center with Washington's Army National Guard tankers, I see repeated tank gunnery exercises aimed at teaching gunners to acquire targets as fast as possible, and to get off an accurate first-round hit on target — usually within five seconds.

Other doctrine promotes use of cover and concealment in tank maneuvers, since the longer a tank is exposed, the shorter its lifespan when facing antitank weapons. In the past, tank warfare was usually evenly matched, and the winner usually had better equipment and maybe slightly better-trained crews. Now, however, Russian crews are well-trained. They have effective weapons, numerical superiority, and a mental discipline which causes them to worry little about throwing away their lives if they think they're fighting for the Motherland. They're tough, field-hardened soldiers capable of winning a war against anyone . . . except Americans.

You see, America is banking on good ol' Yankee Ingenuity to help win a tank war against overwhelming odds. Soviet soldiers are trained — but not to think for themselves. Instead, they're trained to "go by the book" in combat, just as their civilian lives are pretty much guided by the State. Living in a Big Brother society doesn't promote individualistic thinking, and that's where the savvy American tanker will win the day. We think on our feet, typically looking for a better or easier way to get a job done, despite the rules.

The very quality of free thinking I exhibited by trying to span a ditch 12 feet wide with an M60 tank — an act which would be completely foreign to Ivan — personifies the spirit of individuality American tankers have in abundance.

You can, when the smoke clears, liken modern tank warfare to old-time duels fought by gentlemen: Both were about equally vulnerable, and usually it was the guy who fired first who won. But if the rules change, and one duelist hides and shoots only when the shooting is safe, he'll be able to knock out quite a few duelists and stick around to fight another day. That's about the state of tank warfare right now. □

BOOK REVIEW

SMALL ARMS OF THE WORLD — Basic Manual of Small Arms. By Edward Clinton Ezell, Ph.D. Stackpole Books, Dept. CW, P.O. Box 1831, Harrisburg, PA 17105. 1983. 894 pp. Black-and-white photos and illustrations. \$49.95. Review by Peter G. Kokalis

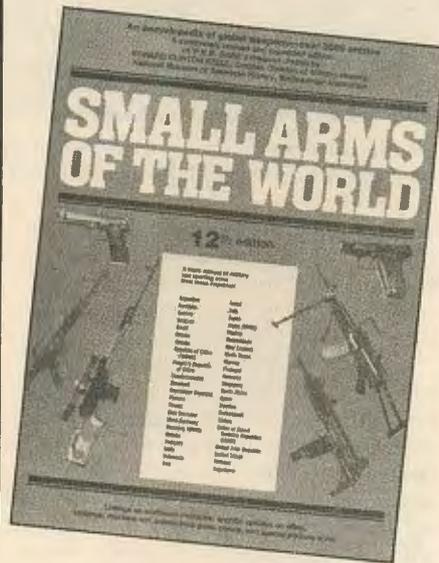
FORTY years ago W.H.B. Smith published the first edition of what he subtitled as "a basic manual of military small arms." Three decades ago I purchased my first copy of this now-famous volume, a 5th edition, for \$7.50. It was my entree to the passion of a lifetime. I still have that book, although the spine has been reglued several times and the pages are dog-eared and covered with gun grease. It has solved many a disassembly enigma for me.

The new 12th edition by Dr. Edward C. Ezell, curator of the Smithsonian Institute and the Western world's leading authority on military small arms, is the most comprehensive effort to date. It has been five years since Ezell composed the 11th edition, which is eclipsed in all aspects by this 1983 update. Expanded by 223 pages and printed on a better grade of paper stock (which has clarified many previously murky illustrations), the 12th edition of **Small Arms of the World** retains the format of its immediate predecessors.

Part 1, "Small Arms Developments Since 1945," is the most fascinating potpourri ever assembled on the topic and is, by itself, well worth the price of the entire volume.

Under Chapter 1, "Rifle and Carbine Development," we are treated for the first time in popular print to a complete description of the NATO trials which led to the standardization of the Belgian SS109 ammunition in caliber 5.45 x45mm. No weapons were standardized since the test weapons varied from prototypes to in-service models. "The reliability of the weapon system appears directly related to their maturity."

Following this is a detailed analysis of the history and development of the product-improved M16A1 rifle (M16 PIP), recently adopted by the USMC and U.S. Army as the M16A2. Ezell reports that the USMC concluded that a 5.56mm weapon was "roughly comparable" to a 7.62mm weapon in maximum effective range and rate of fire and that there was "no clear-cut superiority of one caliber



over the other" — pretty heady stuff for the big-bore looney tunes.

Ezell's brilliant insight into this controversy is best stated during his discussion of Heckler & Koch's G11 caseless rifle: "The 4.7mm bullet will not distort in human targets, being relatively stable even at short ranges. Some future judges of the G11 system may well question if complying with such guidelines does not run counter to the goal of providing a weapon-ammunition system with maximum incapacitating capabilities. It is precisely the tumbling of the American 5.56mm M193 and the Soviet 5.45mm M74 projectile that makes them so lethal and devastating. Being marginally stable as they pass through the air, they lose their stability and tumble when they strike the denser medium of human flesh. As they tumble, they tear the flesh, but more significantly they dump their kinetic energy quickly into the target. It is that sudden energy dump that results in serious incapacitating wounds or death. Very stable projectiles pass quickly through the target and do a minimum of traumatic damage from the release of kinetic energy. Humane bullets versus effective incapacitating projectiles is an issue that continues to demand closer scrutiny by military and civilian authorities."

Chapter 2, "Machine Gun Development," details the M73/M219 fiasco as well as the trials which led to adoption of the FN MAG (M240) over the M60E2 as the coaxial machine gun for use in all U.S. armored fighting vehicles. Also in-

cluded in this chapter is the most complete description of the U.S. Squad Automatic Weapon (SAW) Program ever to appear in print, including the bitter controversy between Heckler & Koch and Aberdeen over the HK23A-1 entry.

In Chapter 3, I must take exception to Ezell's distinction between submachine guns and machine pistols. They certainly cannot be distinguished by caliber, i.e., SMGs by definition fire full-power pistol cartridges and machine pistols fire less powerful pocket-pistol cartridges. This is simply not usually the case. We can more correctly say that submachine guns start in the design phase as just that (carbine-like, selective-fire weapons chambered for pistol cartridges) while machine pistols are basically extensive modifications of pre-existing, selective-fire auto-pistol designs, regardless of caliber. However, Ezell hits the mark when he concludes that in spite of their diminished tactical role, submachine guns will remain popular with foreign police and special operations units, especially in design envelopes that emphasize smaller size, less weight and suppressed capability.

Ezell strikes home, once again, in Chapter 4, "Handgun Developments," with the finest compendium to date on the JSSAP pistol trials. In February 1982 the DOD terminated plans to adopt a 9mm pistol. The reason submitted was the failure of the second round candidates (Beretta 92S1, HK P7A13, SIG-Sauer P226 and S&W 459A) to meet a sufficient number of the 71 test criteria. Most of the pistols failed at least 11 requirements — mud and sand were the biggest problems. Ezell correctly concludes that the U.S. military wanted too much. The requirement that the pistol must fire 800 rounds between major malfunctions is not related to the real world of the battlefield. No WWII Colt 1911A1 straight off the production line could shoot half that number without a stoppage, yet it has always been considered acceptably reliable.

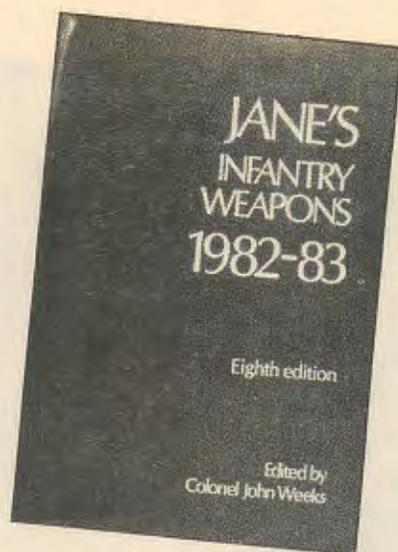
Chapter 5, "Special Purpose Weapons Development," covers trends in sniper rifles, firing-port weapons, suppressed weapons, combat shotguns, grenade launchers and, strangely enough, blank firing attachments. Arms by Nation and a Basic Manual of Current Weapons." This latter feature, in essence a step-by-step photographic sequence of disassembly/assembly pro-

cedures for most of the world's important small arms, has always been the series' most useful attribute. It is no less now, as the 12th edition adds coverage in the following areas: Argentina — FAL, FMK 3 and MEMS M.75/1 SMGs and grenade launchers; Australia — increased coverage on the domestic FAL series and FI SMG; Austria — AUG rifles and the Glock & Steyr 9mm pistols; Belgium — FNC rifle and the first field-stripping procedures in print for the FN Minimi (M249 SAW); Britain — complete coverage on the Individual Weapon (IW); Taiwan — Type 68 5.56mm rifle; France — greatly expanded coverage on the FAMAS 5.56mm rifle; Germany — HK P7 pistol, G41 (updated HK33) and PSG 1 sniper rifle; Japan — expanded coverage on the Type 62 GPMG; Portugal — FMBP M976 SMG; Singapore — SAR 80 rifle and Ultimax 100 SAW; Spain — new Star & Astra 9mm pistols, the CETME Modelo L 5.56mm rifle and the MG-82 SAW; Switzerland — SIG P220 9mm pistol; USSR — AK-74 rifle and AGS17 grenade launcher; USA — M231 firing-port weapon and the Mk19 grenade launcher; and new chapters on Brazil, South Africa and "Small Arms for Outdoor Sports," which describes the civilian versions of some of the most popular military weapons.

Plagued of late by a plethora of pseudo-experts dredged from the ranks of hunting rifle enthusiasts, MAC-10 shooters and steel gong commandos by the popular gun press to appease the spiralling interest in military small arms, the public would be better served and informed if every single page of Ezell's splendid volume were required reading for these cavorting maggots.

Yet at \$49.95 a copy we could expect that Israel Galili's name would be spelled correctly, that photo captions would not be missing, that RPD would not come out as RDP, the Beretta 70/78 SAW as the 70/.223 LM or the 55-gr. M193 projectile as 5.5-gr. In matters more of opinion, the AKM's anti-bounce device is most certainly not a rate reducer, the AK-74's muzzle device increases rather than decreases noise level, and no matter what they contend, Colt had produced several million more than 3,440,106 M16s by the end of 1976 (those left in Vietnam and sent to Israel having been left off the inventory, no doubt).

But, aside from these gremlins and minor irritants, I can recommend Ezell's new magnum opus most highly and without hesitation. Everyone who professes an interest in military small arms must own, read and continually refer to this paragon edition of **Small Arms of the World** □



JANE'S INFANTRY WEAPONS 1982-1983. Edited by Col. John Weeks. Jane's Publishing Co., Ltd., 238 City Road, London EC1V 2PU, UK. Distributed by Science Books International, Inc., Dept. SOF, 51 Sleeper St., Boston, MA 02210. 1982. \$140. Review by W.B. Guthrie

JANE'S is the best thing of its kind available without a security clearance. **Infantry Weapons** catalogs nearly everything a soldier can use, but don't treat it — or any encyclopedia — like it was the word of God. Every reference work and every writer performs certain tasks well and certain tasks poorly. **Jane's** is no exception.

Jane's, however, does most things well. The range of individual weapons and weapon variants covered by the yearbook is extensive. Everything, from the moribund BAR to Vietnamese copies of the Thompson SMG, is cataloged, making it hard to imagine that the world of small arms can be so consistently and reliably reported every year.

Mistakes in previous editions are corrected in this one. For example, last year the AK-74 was listed as having a magazine capacity of 40 rounds. Except for the interchangeable RPK-74 magazines, AK-74 boxes hold the same number as those for AK-47s and AKMs: 30 rounds. We found that out by stuffing one of our captured magazines with captured ammunition. The error is rectified in the current eighth edition of **Jane's**.

Under Col. Weeks's editorship, the infantry weapons yearbook is conservative, but generally this is unobtrusive. The yearly reactionary cracks about caseless cartridge development highlight conservatism. Although the tirade against this direction of small-arms development has its serial installment in the essay on ammunition, Weeks seriously, appropriately, and scrupu-

lously back-pedals in his foreword. The editor's foreword is probably the last thing added to the book and it is unlikely there was time to change the text of the ammunition section afterward.

The ammunition chapter is one of the most distinguished in the book. A few years ago, only a collector could love the cartridge section: brief descriptions of military cartridges for pistols, rifles, machine guns and cannon with a few photographs. **Jane's** ammunition adviser, Ian Hogg, seems to be responsible for the improvements, especially noticeable in layout. Cartridge references in the last two editions are alphabetized by country with reproductions of headstamps and a key to the color code, if known, and the names and locations of munitions plants. This chapter is now better suited to the collector's needs, and provides more background for the casual reader with detail for the specialist.

The only important omission from the cartridge section is the fine exposition of wound ballistics **Jane's** printed as recently as the 1979-1980 yearbook. The editor or staff may think it was too morbidly precise, or it may have been cut to make room for the much improved and expanded ammunition charts. In any case, it is unfortunate, because it was the most accurate, clear and complete short piece available to weapons students on what projectile-caused wounds are and how they happen. Every cracker-barrel stopping-power fetishist should have this essay tattooed on the insides of his eyelids. The wound ballistics article could easily replace the volume's chatty foreword.

The editor's foreword is the weakest part of the volume. It is a loosely strung collection of corrections, predictions and reflections which take up valuable room that could, instead, tell us how information is collected or who is responsible for this impressive catalog.

As any encyclopedia, **Jane's Infantry Weapons** is not the last word for the specialist. There are more detailed and more complete books available on any single subject than **Jane's**. For instance, P. Labbett's *Military Small Arms Ammunition of the World, 1945-1980* is a more perfect account of the ammunition that has been used in recent history, but this is possible because Labbett is not trying to cover all the world's weaponry.

Furthermore, **Jane's** gives a 300-word report on the Russian AGS-17 30mm grenade launcher with two bad pictures from Soviet sources and nothing in the way of hard technical information.

Jane's Infantry Weapons is, however, the only book in its class. It is staggering to think of the care and labor behind such an undertaking, and reassuring to see the job done so well. **Jane's** is the one weapons reference for all students of modern warfare that is indispensable. □

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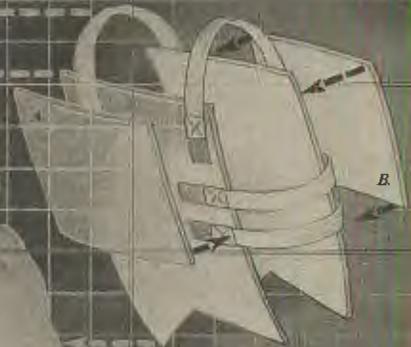
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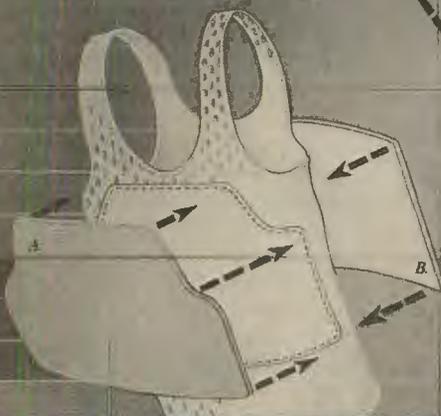
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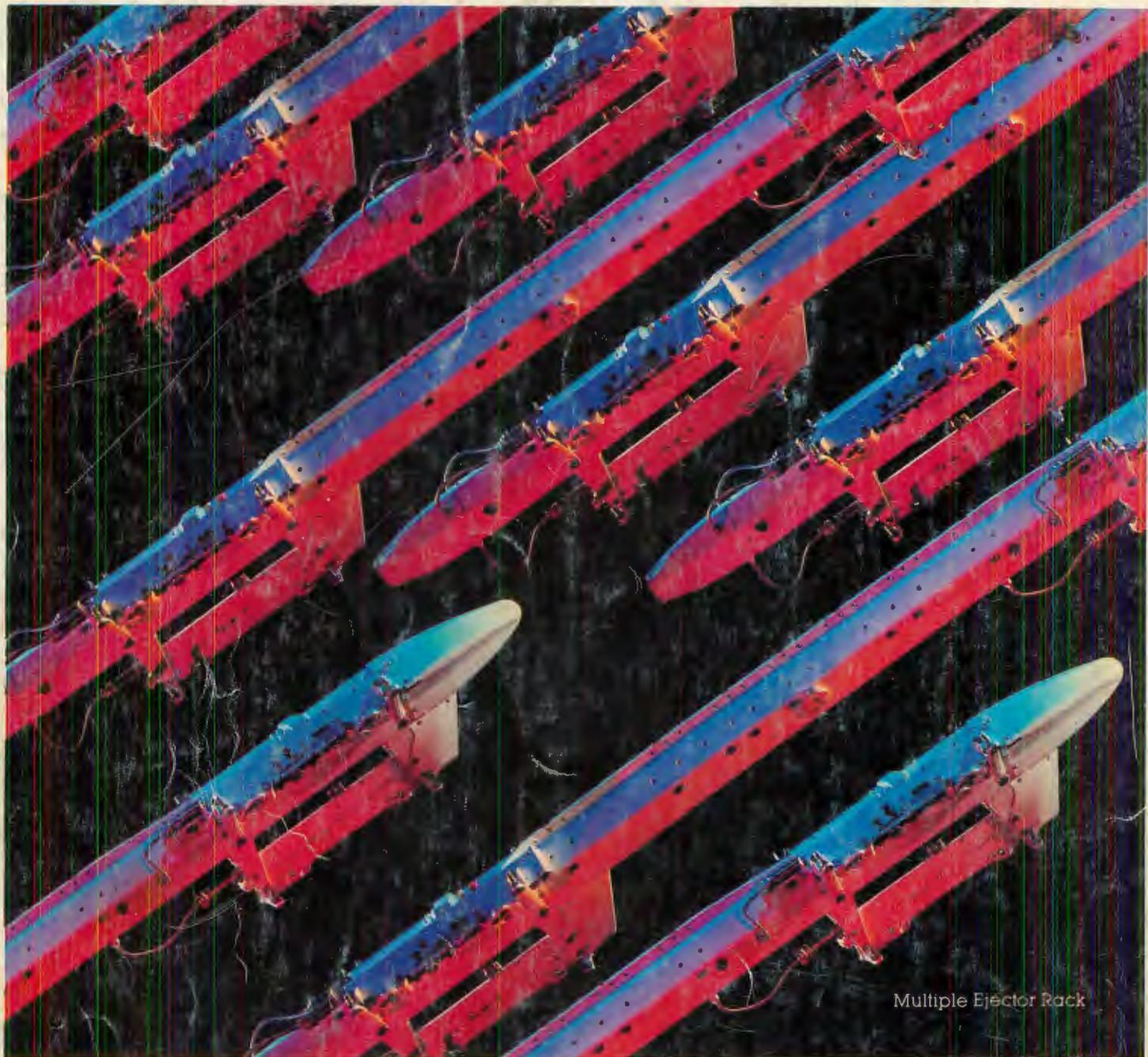
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