



ABOVE: South African G5 155mm towed gun as used in the indirect-fire role.

DEATH FROM A DISTANCE

South Africa's Homegrown G5/G6 155s

by Peter Kokalis

Photos Courtesy Armscor

GROUNDPOUNDERS like me develop a deep-seated distrust of artillery early on. A master sergeant once told me that the only thing more accurate than enemy incoming artillery fire was friendly incoming artillery fire.

Five years ago in El Salvador, as part of a 217-man relief column humping toward the Atlacatl Immediate Reaction Battalion tactical operations center, established the day before after fierce and bloody fighting on a hill called Hacienda El Carmen just east of the Rio Lempa in Usulután Province, I found myself trudging across a railroad trestle bridge to reach our objective. Unbeknownst to me, a battery of 105mm howitzers were in place directly under the bridge on the west bank of the Rio Lempa. Without prior announcement, they cut loose with a salvo, and I clearly remember levitating

what seemed like 3 feet off the bridge. Coming down with one foot between the railroad ties, my previous bad attitude about "cannon cockers" was intensified severalfold.

Be that as it may, cannon have their uses. The first certain record of the use of ordnance, as they are sometimes called, on battlefields in the western hemisphere was the employment of brass cannon firing iron balls during the siege of Metz in 1324. They've come a long way since then. Most of the significant advances in artillery technology took place during the 19th century. In that time frame the transition from smooth bore to rifled artillery occurred, and this resulted in important increases in accuracy and range. By 1867 Alfred Nobel had perfected dynamite, which increased the explosive power of the projectiles. At about the same time, Alfred Krupp designed

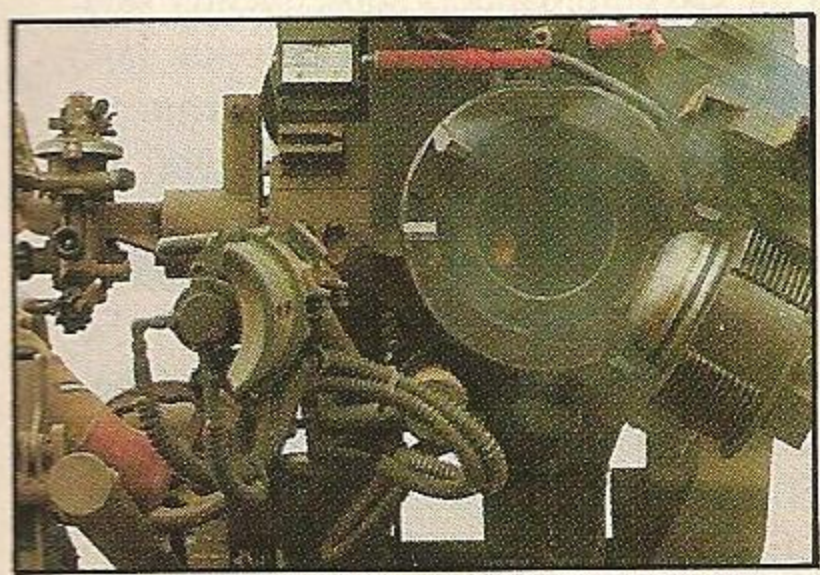
ABOVE: South African G6 Rhino 155mm 45 caliber SP gun in action.

RIGHT: G5 is equipped with a dial sight and direct-fire system mounted just to the left of the breech, which is shown in the open position immediately after a round has been fired.

and produced successful breech-loading artillery pieces that were used with great effect during the Franco-Prussian War of 1870-71. Finally, near the end of the 19th century, Colonel Hippolyte Langlois, a Frenchman, developed a 75mm cannon with a recoilless carriage and quick-firing semiautomatic action (propellant gases were used to open the breech and eject the shell casing).

Since then, enhancement of artillery effectiveness has largely consisted of sophisticated refinement of these basic elements developed more than a century ago. Today, no country fields artillery superior to that of the Republic of South Africa (RSA).

When the South African Defence Force (SADF) marched across the Angolan border in 1975 to counter Cuban troops supporting

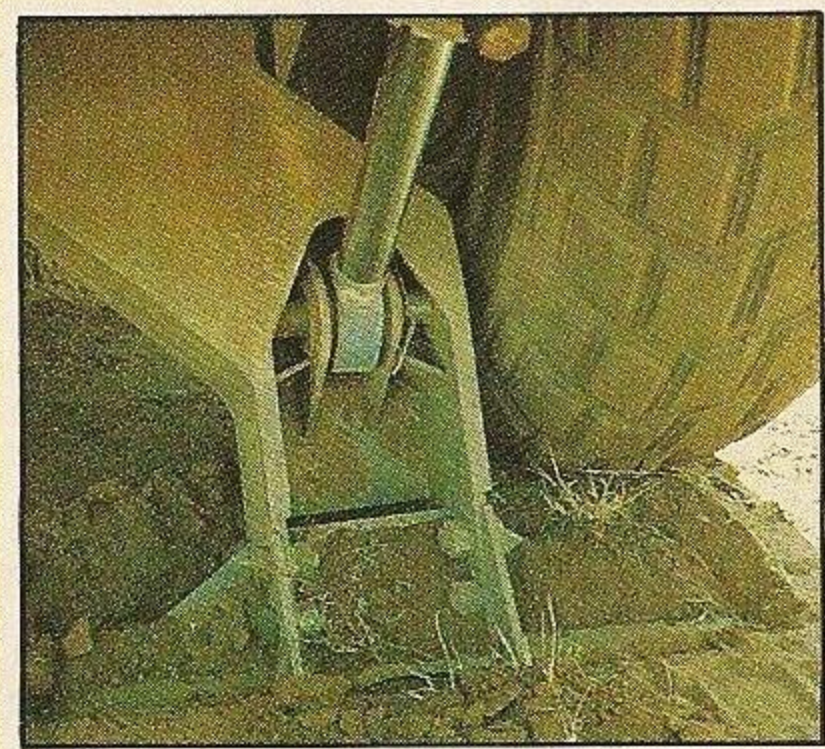


ABOVE: South African G6 Rhino 155mm 45 caliber SP gun in action.

LEFT: Projectiles are placed by hand on the G5's semiautomatic, hydraulically operated, electronically controlled flick rammer.

BELOW: Emergency ammunition supply for the G6 Rhino is stored in a compartment at the rear of the hull which is provided with blow-off doors.





One of the hydraulically controlled stabilizers on the G6 Rhino. In and out of action times are an amazing 60 and 30 seconds, respectively.

the communist MPLA forces, they were equipped with the same artillery they had used against the Germans in Italy during World War II. They were clearly outgunned by the more modern Soviet equipment provided to the Cubans. But within less than a decade, the South Africans reversed this imbalance in their favor.

Development of both a new artillery piece and ammunition system commenced in 1976. By 1983, the 155mm G5 towed howitzer had become operational with the SADF. Its origin, and that of its unique ammunition, can be traced to the now-defunct Space Research Corporation of Canada, although series production was established exclusively at Lyttelton Engineering Works (LEW), an Armscor affiliate, in Verwoerdburg outside of Pretoria.

Heart of the G5 is its 155mm/45 caliber barrel (i.e., the barrel length — 6.975 meters — is 45 times the 155mm bore diameter) designed to complement Extended Range Full Bore Base Bleed (ERFB BB) ammunition. The monobloc autofrettaged (frettaging is the process of reinforcing the barrel, originally by placing heated hoops of wrought iron or steel around it that contracted as they cooled to strengthen it) barrel comes to LEW as a forging manufactured from high-grade steel billets at the Union Steel Corporation in Vereeniging. Its starting weight of 3.5 metric tons is reduced by machining to 1.6 metric tons. The bore has 48 grooves, with a twist of one turn for every 20 caliber lengths.

The G5 barrel has an open-type, single-baffle muzzle brake. The breech mechan-

ACTION IN ANGOLA

On 17 August 1987, one battery of G5s of the South African Defence Force became involved in combat for the first time during Operation Modular.

On that day the first Soviet T-54 tank was destroyed by a direct hit fired by a 155mm gun at a range of 20,000 meters. It was to set the pattern for what was to come. For the next eight months South African guns tore the heart out of the FAPLA/Cuban forces in Angola and gave them a taste of what hell was like.

But it was at the town of Cuito Cuanavale that the full effect of the G5s was felt.

South African artillery units were deployed with UNITA elements close to the Cuito River. They had a good view of the town and the airport terminal buildings.

"We had an aerial photo of the town with the exact locations of the HQ and deployments — we even knew where the Cuban advisers lived," said one of the gun commanders.

"Our task was to destroy three main elements in the town: one the HQ, two the radar systems, and three any enemy aircraft on the ground.

"As a very low priority we could destroy enemy artillery systems, but for that job another battery of G5s was deployed south of the Mianei River," he said.

"We went to work as ordered. We had a direct hit on the building we believed housed the enemy HQ. Our intelligence boys later confirmed this. We had hit the HQ of the political commissar and on that occasion killed 17 soldiers. Another time we killed 26 with a direct hit."

Yet it was the effect on morale that was most devastating to the FAPLA/Cuban forces.

In an intercepted radio message back to the high command at Menongue, the FAPLA commander at Cuito reported: "The enemy guns are giving me a headache."

Later the South African guns did more

than just give him a headache. Intelligence sources claim he was killed during an artillery attack shortly before Christmas.

There is no doubt the G5s proved devastating at Cuito. A good example was on 1 November 1987, when a report confirmed the following losses caused by artillery fire alone: four helicopters (two destroyed east of the Cuzizi River, and two at the Cuito Cuanavale airfield), two SAM-8 systems, six enemy tanks, five BM-21 multiple rocket launchers, two air defense radar systems, two MiG-21 fighter aircraft and one AN-12 transport aircraft destroyed at the airfield at Cuito Cuanavale.

But it was not only at Cuito that the G5 saw service.

"To me one of the highlights was the attack on 59 Brigade," said an artillery regimental commander.

"The important aspect was the enemy was as scared as hell of the guns at that stage. In fact, they were so scared that I only used 650 rounds in total to force 21 Brigade into withdrawing from their positions at the junction of the Cuatir and Cuanavale rivers, forcing 25 Brigade to withdraw to the Chambinga bridge and high ground and win the battle against 59 Brigade.

"I think our success against 16 Brigade, 21 Brigade, 47 Brigade and the Tactical Group eventually made the enemy realize there was no way to prevent a G5 projectile from reaching its target," he said.

"The POWs told us they were totally vulnerable and that we shot out or neutralized every enemy gun or battery that tried to fire on us."

The mobile, self-propelled version of the G5, the G6, was deployed in Angola largely as a high-speed, mobile artillery system. Its primary role was that of long-range tank killer, where it would fire on specific enemy tanks with devastating effect.

Just after dawn one morning in September 1987, FAPLA's elite 21 Bri-

gade, with support from Cuban sub-units and Cuban advisers, consolidated at the Lomba River with the objective of launching an advance on the UNITA stronghold at Mavinga.

A tactical group of 21 Brigade, consisting of a strengthened battalion of infantry and a tank company, attempted to cross the Lomba River at a point where the Cunzumbia and Gombe rivers flow into it. Using a Russian TMM bridge, five tanks managed to cross to the south along with the infantry sent to secure the area.

They were engaged by UNITA anti-tank units armed largely with 120mm mortars and RPG-7 rockets, but the assistance of the South Africans was requested.

"The observation post gave us a grid reference which indicated a range on one of the tanks of some 35 kilometers," one of the G6 commanders subsequently said.

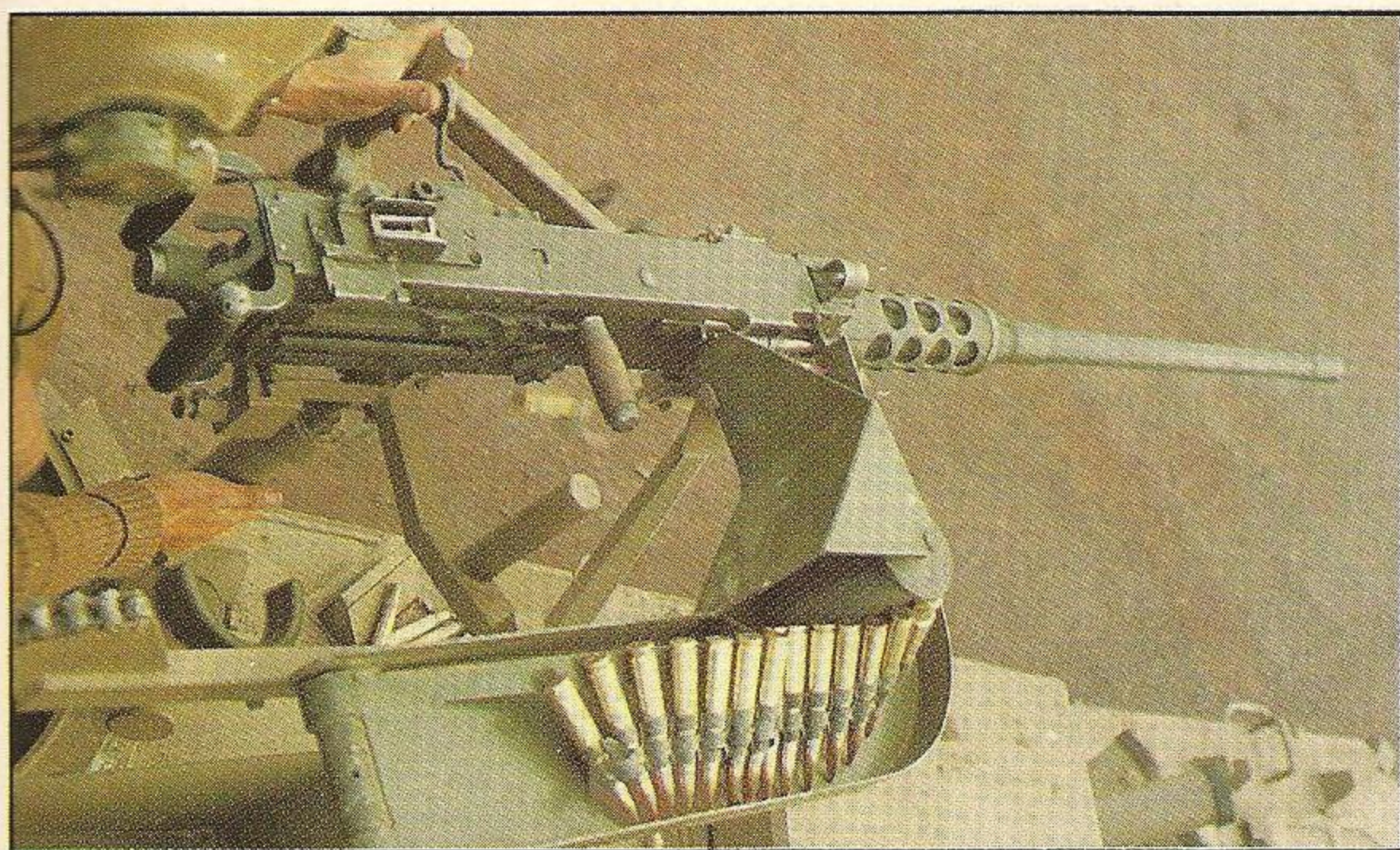
"We fired and a few seconds later heard a whoop over the radio from the OP. We were spot on target, and the delighted OP reported a T-55 merrily burning."

In the ensuing battle six Soviet T-54/55 tanks were destroyed (three north and three south of the river) and an estimated 160 FAPLA and Cuban soldiers killed.

FAPLA then called in an air strike, and several hours later an ineffective high-level bombing run was carried out. Later in the afternoon four MiG-21s flew a sortie against UNITA forces, but by mistake FAPLA's 47 Brigade sited to the west was hit. The Cuban pilots obviously feared the U.S. Stinger missiles deployed by UNITA and consequently avoided more effective low-level ground strikes.

Cuban advisers were subsequently withdrawn north of the Lomba River and evacuated by helicopters. And 21 Brigade was forced to withdraw to a position north of the river from where it fled to Cuito Cuanavale, arriving badly mauled only in November.

— Hilton Hamann



ism is very similar to that of the U.S. M198 155mm howitzer and is semiautomatic with an electrical or mechanical firing mechanism. Behind the breech is a manually operated pneumatic rammer, on whose tray the projectile is loaded and slides into the chamber before it is rammed. While the length of its barrel, almost 23 feet, is partially responsible for the G5's exceptional accuracy and long range, its superior performance is largely due to the base bleed ammunition developed for this weapon.

The range of an artillery shell can be increased by reducing "base drag." During its flight to the target, an area of low pressure behind the projectile, caused by its passage through the air, produces drag and reduces its velocity and hence its range. A cavity in the base of ERFB BB projectiles contains a small quantity of propellant, which when ignited bleeds gas into the base region to fill up the low pressure area and eliminate the drag. This system can add as much as 30 percent to the maximum range of the shell. With this ammunition, the G5 can reach out and touch someone more than 25 miles from the muzzle. This matches the range of the Mark 7 Mod O 16-inch/50 caliber gun (with barrel length of more than 66 feet) mounted in the turrets of USS *Iowa*-class battleships — albeit with a much smaller projectile. Others, such as Austria's Hir-

Browning .50 caliber M2 HB machine gun, mounted to the G6 Rhino's left cupola, is loaded with the standard ratio of four ball rounds to one tracer.

tenberger, Belgium's PRB, the Hellenic Arms Industry (EBO) of Greece, the People's Republic of China, Spain's SITECSA and Talley Defense Systems of the United States have all developed ERFB BB ammunition in recent years. However, to date, only South Africa has combat tested base bleed munitions.

South African extended-range projectiles include high explosive (HE), screening smoke (SCR SMK), illuminating (ILUM), red phosphorus (RP), propaganda (PROP)

**South African G6 Rhino
155mm 45 caliber
SP gun in action.**



and submunition — anti-personnel/anti-armor (CLSTR). The hollow-charge submunition projectiles contain 56 individual bomblets which cover an area of 30x100 meters in size and will self-destruct on the ground after three seconds. .M57 HE ammunition is of the high-fragmentation type with welded splines. A TNT-filled version fragments into 3,032 pieces and another with Composition B filling breaks into 4,756 pieces. The projectiles can be standard (18.6-mile maximum range) or base bleed. A six-zone charge system is used to optimize the projectile/gun combination and give a range overlap for the total distance. Use of the newly developed M43A3 combustible cartridge increases the life expectancy of the barrel from 600 to more than 1,200 rounds with the maximum charge. Available fuzes comprise direct action (superquick or delay), radio proximity (with superquick selectable and back-up) and electronic time (with direct action back-up).

The G5 carriage has a slightly angled trunnion (the axis shaft on which the barrel pivots) for balancing the barrel and the recoil forces produced on firing. During firing the carriage is raised hydraulically on a firing platform by an auxiliary power unit which also supplies hydraulic power to raise and lower the trail wheels and to open and close the trails. The hydraulic power is also used for the limited self-propelled mode, which enables the G5 to reach speeds exceeding 10 miles per hour and climb up gradients of 40 percent. The recoil system has a buffer, recuperator and replenisher. When traveling, the barrel rests over the

Continued on page 82

dropped out of the mist and landed alongside the KP. "Where are your tanks, major," said a familiar voice even before his boots had touched the ground. ✕

SOUTH AFRICA'S 155s

Continued from page 33

trails in a clamp. Only two men are required to get the G5 into action. Elevation and traverse controls are manual.

To the left of the breech is a dial sight for indirect firing and direct-fire sight mounted on a mechanism that compensates for trunnion cant. The fire control computer has processing capability to compensate in elevation for range, projectile mass, zone of charge and temperature, all of which is communicated to the gun crew by means of the gun display unit. It also calculates the equivalent full charge (EFC), recoil length, number of rounds fired and pressure of each round. There are also alarms on the gun monitor unit for incomplete recoil run-up, low battery voltage, limits of firing arc, and a warning device that indicates high chamber temperature. The application range of the direct sight is 1,200 meters, but it can operate up to 5,000 meters. Additional optional equipment includes a fire-control computer, data-entry terminal, muzzle-

velocity analyzer, meteorological ground station and special helmet radios for the gun crews.

Weighing 13.5 metric tons, the G5 is air-transportable in the Lockheed C130. The G5 is towed by a special gun tractor which also accommodates the full crew of eight, charges, fuses, primers, and 15 projectile pallets. A hydraulic crane is used to handle the ammunition.

Soviet bloc countries have traditionally focused on towed artillery for indirect fire with some recent interest on auxiliary-propelled towed guns. In general, they still seem to consider the self-propelled (SP) gun as no more than a second-class tank that moves forward with the infantry and armor to destroy targets at close range. Few, if any, of their SP weapons exhibit the stabilizing devices required for consistent indirect fire. These ComBloc assault guns are almost exclusively "offensive" in employment.

Western views on SP artillery have, on the other hand, stressed their ability to "keep up with the armor" (some authorities feel this is a dubious capability) and "shoot and scoot" to avoid retaliatory fire. Heavy, complicated and expensive, their indirect-fire capabilities emphasize the "defensive" mindset of the NATO alliance.

Recognizing that while the towed G5 could adequately support their tanks and highly mechanized infantry it lacked protec-

tion against enemy fire, the South Africans commenced development of an SP gun in 1978. The major design requirements were 1) fire power, with particular attention to a high rate of fire, long range, increased lethality and quick engagement of alternative targets; 2) mobility, with emphasis on high speed, long range, cross-country capability and quick in/out of action time; 3) protection against direct enemy fire and counter-bombardment; and 4) standardization with existing equipment.

The 155mm/45 caliber gun (somewhat modified) and most of its optional equipment were selected because they would be standardized with the proven G5 system and its ERFB BB ammunition and, as the 155mm caliber is world-wide in operation, other 155mm ammunition could be used interchangeably. Its fume extractor, fitted two-thirds of the way along the barrel, is constructed of carbon reinforced epoxy which is lightweight and reduces out-of-balance moments. Directly behind the breech is a semiautomatic, hydraulically operated, electronically controlled flick rammer for ramming the projectile after the projectile has been placed on the rammer tray by hand.

Whether offensive or defensive, most SP artillery, with the exception of the Czech Vzor 77 152mm SP howitzer DANA, rolls about the countryside on tracks. However, after intensive investigations, the South

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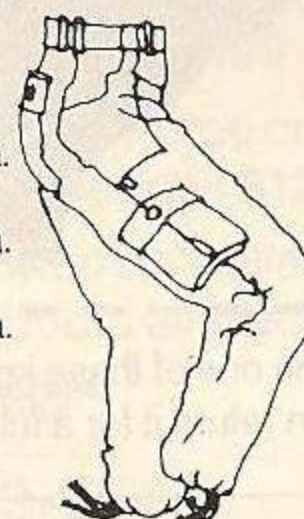
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The G6 Rhino SP six-wheeled gun is now in service with the SADF. It is used for offensive and defensive fire support with direct firing capability and used in indirect fire service as a gun, howitzer or mortar. The G6 has a crew of six, with a driver and five other crew members who travel inside the turret. During firing, four crew members operate the gun while the driver and one other member of the crew resupply the ammunition at the rear. The G6 carries 47 projectiles and 50 charges together with the fuzes and primers. Nineteen of these rounds are directly accessible from inside the turret. For continuous bombardments, ammunition can be fed from outside via a transfer chute. Three crew members can replenish all the main weapon ammunition

in 15 minutes. A firing rate of four rounds per minute can be achieved for a period of 15 minutes. Experienced personnel can fire a burst of three rounds in 21 seconds.

The G6 is also equipped with a gun display unit to communicate firing orders to the crew. A gun-monitor system can also be provided, with all the alarm functions and a chamber temperature warning device. An optional direct link between the gun display unit and gun control system permits automatic laying of the gun.

To the left of the breech is a panoramic sight and direct-fire system mounted on a compensating mechanism. Range capabilities of the direct and indirect sight is the same as for the G5. To enhance its performance, the G6 can be equipped with a navigation system and inertial fire directing system while still retaining the direct fire capabilities.

In and out of action times are an astounding 60 and 30 seconds, respectively, including lowering and raising of the four hydraulically operated stabilizer legs. From one position, the G6 can cover an area of 415 square miles. It can elevate from minus five degrees to 75 degrees in five seconds and traverse through 80 degrees in seven seconds.

Another superb feature of the G6 is its exceptional mobility. It can reach a speed of almost 55 mph on the open road, and it has a strategic range of 375 miles without refueling. Maximum speed over desert terrain is

20 mph with a turning circle of 105 feet in sand and 82 feet on the road.

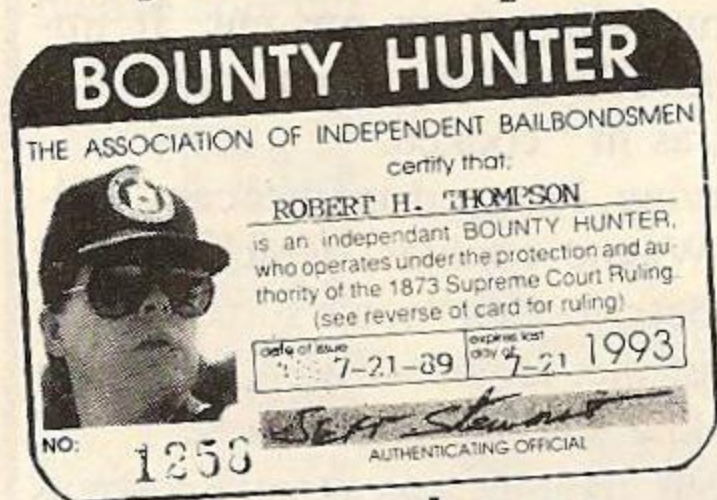
The G6's mobility is, in no small measure, due to the run-flat tires used on the G5/G6 artillery series (as well as the Ratel AFV). South Africa originally employed Michelin tires of the type found on heavy-duty grading equipment, but quickly found the sidewall construction too thin. In addition, the tread design was incorrect for arid-region terrain, so the South Africans designed their own instead. Called "Sand Trails," they have a 28-ply rating, and with their special run-flat insert a vehicle equipped with them can be driven for about 45 miles at 25 mph with one or more tires flat. Air pressure in these 21.00x25 tires is controlled by the driver to provide maximum flotation.

The vehicle hull (manufactured by Sandock Austral) and turret are fabricated from high strength armor steel and offer all around protection from 7.62x51mm NATO armor piercing (AP) ammunition and artillery fragments, and protection from 20mm AP from a 60-degree frontal angle. The double-armored floor offers increased protection against mines. The driver's side and front windows provide the same degree of protection as the hull and excellent visibility through the front 180-degree arc. The center window can be covered by an armored shutter, in which case the driver views the terrain ahead through a periscope.

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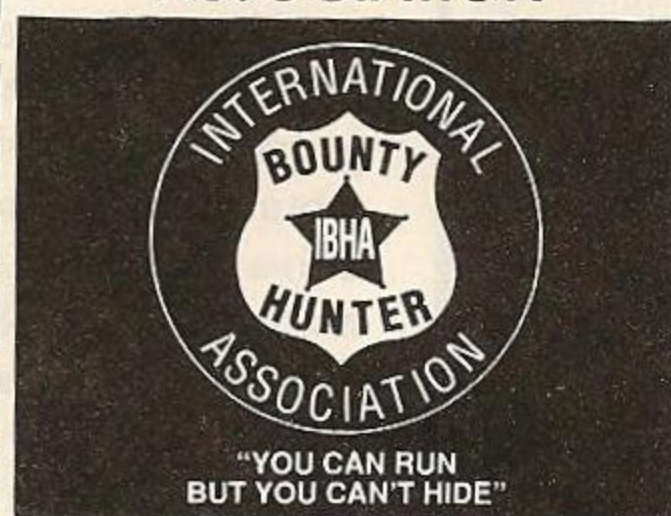
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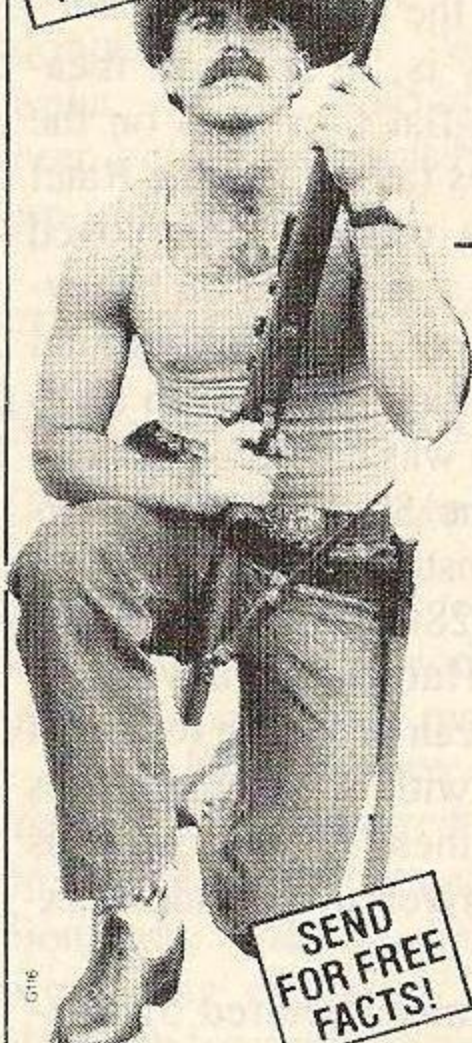
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Entrance to the turret is by means of a main door on the right-hand side or two roof hatches. There are four firing ports on the turret, two on either side. I doubt that they are ever used in combat. They reduce the rifleman's hit probability and increase the possibility of an accidental discharge within the vehicle.

Some degree of NBC protection is provided, and the design permits additional armor to be fitted as a shield against gamma and neutron radiation. Because of its over-pressure system, personnel inside the vehicle do not have to wear protective clothing. Blow-off doors at the rear cover a storage compartment for emergency ammunition. In the event of a pressure build-up, one of these doors will blow off. A fast reacting, automatic fire extinguisher for both engine and crew compartments (with manual back-up) has a 12-millisecond flame detector and uses halon gas for fire suppression. An air-conditioning unit with NBC filters, directly to the rear of the turret, feeds air into the turret from the outside.

A wedge-shaped box in front of the driver's compartment holds 16 projectiles and serves as brush-clearing device capable of cutting down shrubs and small trees.

Overall length of the G6 is 33.8 feet with a total combat weight of 101,660 pounds (46 metric tons). Powered by an air-cooled diesel engine developing 525 hp, the G6 has an automatic transmission with six forward and two reverse gears and both automatic and manual gear selection. Steering is power-assisted and the drive system is a permanent 6x6. The engine and gearbox are mounted on a subframe and can be changed within two hours. Independent suspension with torsion bars and a hydropneumatic damping system helps reduce crew fatigue during extended combat operations.

Mounted on each side of the turret is a bank of four electronically operated 81mm grenade launchers that fire smoke grenades. Optional auxiliary weapons include the Browning .50 caliber M2 HB heavy machine gun (mounted to the left cupola on SADF G6s), Browning caliber 7.62x51mm NATO machine gun or the GA1 20mm automatic cannon (a derivative of the World War II Mauser MG-151).

In the SADF, G6 Rhinos are deployed in batteries of eight, with three batteries to a regiment. In Angola, the batteries were often split into two troops of four each while shooting and scooting about in the operational area.

Battle-proven in Angola, the G5 and G6 Rhino currently stand supreme among heavy ordnance. The G5 has also demonstrated its ability on the Iraqi side of the front in their recent war with the Ayatollah. It will soon be manufactured under license by Chile. Other nations will be hard-pressed to match the performance level of the G5/G6 series anytime in the foreseeable future. Military procurement agencies should contact Lyttelton Engineering Works (Pty) Limited, Dept. SOF, Private Bag X5, Verwoerdburg 0140, Republic of South Africa, for further information. ✂

FAREWELL HAM & MAMMIES

Continued from page 67

We'd spent a typical delightful day humping notable landmarks like "Mount Mother-----," and were put in pre-dug fox-holes to defend our stretch of California beach from attack by Viet Cong swimming the Pacific.

Our troop handlers, with sadistic glee, threw boxes of C-rations at us and announced, since we were simulating *real* combat, we'd eat them cold (meaning someone had forgotten the heat tabs).

We'd never seen C-rations before. I guess they thought boot camp was traumatic enough without them. We were hungry (a boot always being hungry) and curiously excited to be eating what "real" Marines ate. So we tore into the brown boxes in what anthropologists call a "feeding frenzy," when applied to lower species and grunts.

(Well... I said "tore." The sadist who invented Cs also came up with the fiendishly simple idea of putting only two P-38 can openers in each case. This meant that unless you were the biggest and baddest, you had no way of opening them. As ITR wore on and you got your own, to prove you were "salty" you wore them around your dogtag chain, where they gouged you every time you fell down, and you fall down a lot in the Corps.)

My "entree" was Spaghetti and Rocks, which was actually one of the more edible possibilities. I hungrily opened the can, to stare at the huge ball of congealed grease at the top. I tried to stir it, succeeding only in breaking my plastic spoon. Saying "OOHRAH!" I ate it anyway, ignoring the ominous rumblings from my gut. It immediately rebelled, being used to much finer cuisine, as in "cooked."

Still starving, I opened another can, finding John Wayne cookies, which can be charitably described as "some sort of cracker." I never met anyone who actually ate one, including starving Vietnamese.

Under that, though, was a treat known as a "jungle bar." This was a candy designed for tropical climates. It wouldn't melt in your hand. Or your mouth. Or your esophagus or lower bowel, the ensuing condition being treatable only by doses of the Corps' ubiquitous green Kool-Aid.

Some boxes contained canned fruit, which were wonderful bargaining tools and pretty fair blunt weapons. The prize catch was fruit cocktail, with which you could curry the dubious favors of female indigenous personnel or in extreme cases the issue of entire small villages.

Most of the boxes contained a can of what was optimistically labeled "poundcake." Eating it was considered a legitimate suicide attempt, as it took huge quantities of water (generally unavailable) to wash it down. You could disguise it by mashing it with water, cocoa powder packages, dirt, small twigs and rocks and closing your eyes as you swallowed. I once saw a picture of a

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