

EQUIPMENT OF THE BORDER WAR

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1. INTRODUCTION

The counter-insurgency war fought along the border between Namibia and Angola in the 1970s and 1980s brought forth a range of new equipment, some of which is still in service today, but some of which is long forgotten. The South African Defence Force (SADF), as it then was, started off ill-equipped and had to scramble somewhat to meet the demands of a new war, but it ended the war with one of the best-equipped small armies in the world, as well as an air force with some very useful weapons optimised for this type of warfare. The Navy was not as lucky, being something of a stepchild during a war that involved mainly ground and air forces.

The weapons and equipment that grew out of this war were not only those typical of a counter-insurgency campaign, but also included systems, weapons and equipment that was developed for high-mobility semi-conventional operations. Many of those did not enter service in time to see action, but a fair number did make it into service with the new South African National Defence Force (SANDF). Among them are the Rooikat, the Rooivalk and the Umkhonto surface-to-air missile.

No article can discuss everything that entered service during this period, let alone the items that did not make it past the 'gleam in the eye' stage. This article only gives an outline of the main combat equipment, but should give some flavour of the time.

2. ARMY EQUIPMENT

2.1 SADF

The vehicles that immediately come to mind when discussing the Border War, are the mine-protected armoured personnel carriers. Particularly the early, ungainly looking Hippo, the Buffel with its frightening tendency to lean in curves, and the purposeful-looking Casspir. There were also lighter vehicles, the Rheebock, Ribbok

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and Rooibok among them, used mainly by the Police and various government agencies. While they may have looked a little basic and even weird, all of these vehicles did what they were designed to do - they saved the lives of their crews except in the most extreme cases.

The first step in this direction was the Bosvark, a Unimog fitted with a shallow mine-deflecting 'tub' on the chassis to protect the crew. Then came the first generation of purpose-built vehicles, the Hippo and various light types, which essentially consisted of armoured V-shaped hulls mounted on truck chassis (the Hippo used the Bedford, lighter vehicles used various bakkie chassis). The second generation was epitomised by the Buffel, which used a Unimog chassis with a mine-protected cab and a mine-protected crew compartment mounted on it. These early vehicles did the job, but the chassis were overloaded, they were not very agile off road, and stability was always a bit suspect.

Then came the purpose-designed monocoque Casspir that did away with the separate chassis, resulting in a tougher vehicle that was also lower and not as likely to fall over after detonating a mine. It also had a powerful engine (124 kW diesel) that gave this 11-ton vehicle good tactical agility and a speed of almost 100 km/h. A large diesel tank gave it a range of 770 km on roads. Originally developed by the CSIR for the Police, it proved the ideal vehicle for mobile operations and was soon adopted by the Army, becoming its standard armoured personnel carrier. In fact, both the Police and the Army de facto used the Casspir as an infantry fighting vehicle, arming it with 12,7 and 7,62 mm machine-guns and even 20 mm cannons.

Developed in parallel with these vehicles were logistic variants, the Zebra (Hippo), the 'Platbak Buffel', which also served as the platform for a 20 mm anti-aircraft gun, and the Blesbok (truck), Duiker (bowser) and Gemsbok (recovery) based on the Casspir.

There was also the Wolf, built by Windhoeker Maschinenfabrik for the SWA Police to complement and replace the Casspir. A much heavier and more powerful vehicle, it was well suited to operating in heavy bush, but proved too heavy (over 14 tons) and too powerful in soft sand. Its logistic variant was called the Strandwolf, and there was also a single 6x6 recovery variant.

Also forever associated with this war are the various mine-detection vehicles, some of them really weird in appearance: Taljaard's Trolley; the Kalahari Telephone-box (a small armoured cab mounted dead centre on a Bedford chassis; the Spinnekop (with eight long 'legs' to keep the cab clear of a mine blast); the 'Hotnotsgod' based on a road grader, with the cab perched right at the back of the vehicle, and finally

the 'Mynopsporingsvoertuig' or MOV that is still in service with the nickname 'Chubby'. A word of caution: former MOV drivers are best not addressed by a diminutive based on the vehicle's acronym.

The armoured fighting vehicle most obviously associated with the Border War is the Eland in both its 90 mm and 60 mm variants. Originally developed by Panhard for the French Army on the basis of their experience in Algeria, it was acquired by the SA Army (SAA) in the 1960s as a scout and patrol vehicle. The little Elands - also affectionately known as 'Noddy Cars' - were used for area and road patrols, sweeps, convoy escort and all of the traditional armoured car roles. Light (6 tons) and small, they were agile in the bush and proved very useful and effective, limited only by their 4x4 layout and their petrol engine that restricted their range to around 450 km on roads - a lot less in heavy sand and bush.

The Elands were also used extensively in the course of external operations, the Eland-90s being used as assault guns to deal with bunkers, and taking on tanks despite their very thin armour and the low pressure 90 mm gun that was really only effective if one could sneak up onto tanks from the side or, preferably, from behind. Also the standard ammunition load of 29 rounds did not last very long in a serious fight. Despite those disadvantages, the Eland-90s took on T-55s with their much thicker armour and 100 mm guns and won.

While the Eland-60 often did not impress at first with its little 60 mm mortar, it made a good partner to the Eland-90, giving the armoured car troop the ability to put indirect fire onto enemy behind cover, and also serving usefully as a means of placing smoke bombs to mark targets for air strikes or artillery fire.

The Ratel infantry fighting vehicle was developed for the SAA and, when it came into service in 1976, it was the third Infantry Fighting Vehicle (IFV) in the world, following the German Marder and the Soviet BMP-1. It was the first to have a proper commander's cupola to enable the car commander to have all-round vision, and the first with a dual-feed cannon that allowed the gunner to switch between armour-piercing and high-explosive rounds. Being designed for a small army in a large theatre, it was also the first wheeled IFV, sacrificing some armour protection (keeping weight to 18,5 tons) for the vastly greater operational mobility of wheels (105 km/h, 1 000 km range). Designed for extended operations, it also carried ample ammunition (1 200 rounds for its 20 mm cannon and 6 000 rounds of 7,62 mm for its machine-guns) and 100 litres of drinking water.

Still in service, the Ratel proved itself in operational use to be an effective, robust, reliable and comfortable vehicle. Its only real weakness has been the truck-like 1+2

axle layout, which limits cross-country mobility, although it is better for long-distance road moves.

In a burst of logic rarely found in armies, the SAA went on to buy variants of the Ratel to equip other elements of the mechanised infantry battalion. The Ratel-90 (with an Eland-90 turret, 72 rounds) served as tank destroyer, the Ratel-81 (81 mm mortar, 148 bombs) with the mortar platoon, and the Ratel Command (12,7 mm machine-gun) as company and battalion commander's vehicle. A variant with the Eland-60 turret was issued to the support troop (infantry) of the armoured car squadrons. A proposed 8x8 Ratel Logistic became too expensive and did not make production.

The last campaign of 1987/8 also saw one more Ratel variant enter service and action - the Ratel ZT3, armed with the 5 000 m range ZT3 laser-guided anti-tank missile developed by Denel. Several prototypes were deployed and proved devastatingly effective.

The other major armoured fighting vehicle to see service was the Olifant main battle tank, a locally upgraded Centurion. The Army originally acquired 200 Centurions for a proposed armoured division, but sold 100 of them in the 1960s when it decided that tanks would not be needed. Just a decade later it had to buy second-hand Centurions from Jordan and Centurion hulks from India to modernise and upgrade to reconstitute its tank force. That process took the Armoured Corps through various experimental vehicles - Skokiaan and Semel among them - until it arrived at the diesel-engined, 105 mm armed Olifant. Well armoured and now with a reliable diesel engine and the powerful British-designed 105 mm gun, the Olifant proved an effective tank for the theatre, lacking only in its range.

The first time those tanks were to see action was in 1987/8 when two squadrons were deployed to south-eastern Angola for Operations Moduler, Hooper and Packer. There they served as tanks, assault guns and bulldozers, fighting in terrain that most armies would consider entirely unsuitable for tanks, and doing so successfully. Having said that, the Angolan Army, too, deployed their T-55s where another army would not, and did so with good success against Unita. They were not, however, successful against the South African tanks and suffered bad losses when they did clash in the south-east and once in the south-west right at the end of the war.

The infantry's weapons and equipment also matured and developed over the course of the war. Among the developments were the unique six-shot, drum-fed 40 mm grenade launcher (MGL) developed by Milkor, and the SS77 light machine-gun

developed by Denel to replace the WWII era Bren and the FN MAG. Other development work addressed more mundane items such as uniforms, webbing and field rations. Much as it might surprise those who had to wear it, SAA webbing was highly regarded in other armies and was always a welcome gift!

The infantry's standard rifle was initially the 7,62 mm FN FAL and the South African produced R1 version, also produced in a folding-stock version for the paratroops. The R1 was then gradually replaced by the 5,56 mm R4, derived from the Israeli Galil and originally based on the 1943 German Sturmgewehr 43, developed via the Soviet AK-47 and Finnish Valmet M55. Spanish-manufactured G3 rifles were also used by some units for a time. Other light weapons included the 9 mm Uzi submachine-gun and the American M79 single-shot 40 mm grenade launcher, and some soldiers made use of a variety of captured weapons, notably the very practical RPD light machine-gun.

The thick bush in which much patrolling took place demanded the ability to put down a heavy weight of fire quickly. That led to extensive use of rifle grenades and the M79 and later the MGL. Handgrenades of all types were also extensively used.

The heavier weapons included some 'old faithfuls' like the British Vickers medium machine-gun (re-chambered to 7,62 mm), the Browning 50 calibre (12,7 mm) heavy machine-gun and some Browning 30 calibre (7.62 mm) machine-guns used as vehicle weapons. There were even some WWI era water-cooled Browning 50 calibre HMGs mounted on the lookout towers of some bases.

Mortars included the 60 mm patrol mortar and conventional 60 mm (2 100 m range) and 81 mm mortars (4 850 m) used at company and battalion level respectively, with the 81s also dug in at most bases for local defence. The patrol mortar was carried as a section weapon to give immediate indirect fire support, and could also be fired in the direct fire mode for the first shot to break contact.

Anti-tank weapons were not much used, but were deployed during the major external operations. The French Entac wire-guided missile was briefly used in 1975/76 during Operation Savannah, but was soon replaced by the Franco-German Milan wire-guided missile (2 000 m range), which was used during the last campaign to some effect. The Army also had the American 106 mm recoilless rifle (1 000 m), usually mounted on a Jeep but not much used. The standard light anti-tank weapons were the American 3.5" Bazooka (soon phased out), anti-tank rifle grenades and captured RPG-7s, later also manufactured in South Africa.

The Artillery entered the war in 1975 with the same 25-pounder (12 250 m range) and 5,5" (16 460 m) guns that it had used in Italy in 1944/45. Coming up against modern Soviet 130 mm (27 000 m) and 122 mm (15 300 m) guns and 122 mm multiple rocket launchers (20 500 m) in Angola in 1975/76, proved something of a shock. That led to an urgent project to acquire new artillery. The first results were a very small number of American 155 mm 'Long Tom' guns of WWII vintage and a number of Israeli 155 mm guns (G4, 23 500 m). The longer-term solution, however, was sought in developing artillery that would give a real edge. The result was the 155 mm G5 and G6 guns, which remain class leaders today.

The G5 combined foreign and local technology, using a long barrel (45 calibre lengths rather than the typical 39), a specially shaped shell, a larger propellant charge and the new 'base bleed' technology (which smoothes the airflow behind the shell to reduce drag) to achieve a range of over 39 000 m. The G5 entered service in 1981 and was used very aggressively, further enhancing the effect of its long range. It was, however, only the interim solution.

The real focus was on the G6 self-propelled version, which combined the G5's range which gave armour protection and the quick into/out of action times of a self-propelled gun. That made it less vulnerable to counter-battery fire and also to ambush while on the move between firing positions. The 46-ton G6 was also unique in being the only long-range gun on a wheeled chassis, chosen specifically because wheeled vehicles are better suited to long deployment moves than are tracked vehicles. The G6 began entering service in 1987, with three early guns still seeing action - very successfully - in Angola.

The range of both guns was extended to 75 km, using longer barrels, new shells and new charges.

The Artillery also developed two multiple rocket launchers after seeing the BM-21 in action. The first was a 22 500 m range 24-tube 127 mm system mounted on a Unimog chassis, the Visarend. Later came the 40-tube Bateleur firing a longer-range rocket to 40 000 m and mounted on a 6x6 chassis with an armoured cab.

At the light end of the scale the Parachute Brigade used French Hotchkiss Brandt 120 mm mortars (6 250 m range) and captured Chinese 8-tube 107 mm rocket launchers (9 800 m).

In parallel with the guns, the South African industry also developed target acquisition and artillery command systems, and the Artillery also used British mortar-locating radars such as Cymbeline and Green Archer.

The Army's Anti-Aircraft Artillery and the SAAF's Air Defence Artillery Group did not see much action. Oerlikon twin 35 mm (550 rounds/minute, 4 000 m range) and Tigercat (3 500 m) missiles (a British system acquired from Jordan) were deployed at the main air bases, but never saw action. Self-propelled 20 mm cannons mounted on a variant of the Buffel were deployed on several operations and finally saw action in 1987/88, shooting down three MiG-23s. That campaign also saw forward deployment of some 35 mm guns and the SAAF's Cactus 8 500 m range missile system, the latter credited with damaging one MiG-21. More to the point, once the 35s and the Cactus had deployed, no MiGs flew near that part of the battlefield. One other anti-aircraft success saw an Angolan Air Force transport shot down by a captured Angolan SA-9 self-propelled missile system.

The Cactus deserves additional mention: More widely known as the French Cro-tale, it was the first effective low-level surface-to-air missile to enter service, and actually originated from a South African requirement and was developed in large part by South African engineers.

Some 40 mm Bofors cannon were also deployed, but mostly mounted on towers along the perimeter of major bases to deter ground attack by guerrillas using light mortars or similar weapons.

Various air defence radars were deployed at the main air bases, including the Plessey AR3D, but only small search/acquisition radars were deployed for external, among them the Army's LPD-20 (with the 35 mm guns) and the Cactus acquisition radar.

The South African forces also took into service captured anti-aircraft weapons, some captured in such numbers as to become standard issue. Among them were the SA-7 'Strela' shoulder-launched infra-red homing missile and the 23 mm twin-barreled ZU-23-2 cannon. Others included Yugoslav triple 20 mm cannon and Soviet single 14,5 mm anti-aircraft machine-guns.

Often forgotten are the logistic vehicles without which no army can hope to operate. The SAA began the conflict with 3-ton 4x4 Bedfords, some 5-ton Mercedes-Benz gun tractors and 10-ton Magirus-Deutz trucks as gun tractors and heavy logistic vehicles. By the end of the conflict those had all been replaced with the Samil series of 5-ton (Samil-50) and 10-ton (Samil-100) trucks, many of them fitted with an armoured and mine-protected cab (Kwêvoël). There were also the commercial standard Sakom 7-ton and 12-ton trucks. All of these vehicles were based on Magirus designs fitted with Mercedes engines. There were also the

Albatross (Police) and Tierkat (locally developed in SWA) mine-protected cabs fitted to heavy trucks.

The lighter vehicles included Jeeps (French built), Jeep Gladiators and Land Rovers, with the latter remaining in service throughout in short and long wheelbase form. Just up from them in size was the Unimog, which proved immensely capable and robust, and which also served as the basis for the Buffel APC. It was replaced in the logistic role by the Samil-20. Other vehicles used in small numbers included Land Rover 1-ton office trucks and GMC office trucks, none of which proved popular.

The Army also had a vast range of other equipment: mines, mine-detectors, field engineer equipment and vehicles, tactical radios, night vision equipment, etc. Initially most of that equipment was imported, but over time much of it was local in design and manufacture. While there is far too much to discuss in this article, one point that must be made is that South African companies made immense strides in developing effective and secure tactical communications, among other things the first frequency-agile radios to enter service in any army in the world.

2.2 The opposing forces

The bulk of the equipment used by Swapo guerrillas and the Angolan armed forces was supplied by the Soviet Union and its Warsaw Pact client states. Some items were also obtained from the People's Republic of China and occasionally from other countries.

The Swapo guerrillas were generally lightly armed, with AK-47 assault rifles (in most of its variants), SKS carbines (used mainly to fire rifle-grenades) and RGP-7 anti-tank weapons. Late in the conflict the smaller but very effective RPG-18 also made an appearance. Many groups also carried a light machine-gun (RPD and RPK). Dragunov sniping rifles were encountered on a few occasions, and senior guerrillas carried pistols, with both the Makarov and the Tokarev being used. Hand-grenades were also carried, with the F-1 popular and quite often encountered.

The RPG-7 deserves particular mention because it was used as an all-purpose weapon - against the Army's armoured vehicles, as a 'stand-off' weapon to fire at small Army bases and, most often, as a general-purpose high-explosive weapon to deter pursuit or break and ambush. It did not initially prove very effective against vehicles such as the Buffel and Casspir, because they were open-topped which meant that a hit did not cause over-pressure in the crew compartment. As a result, an RPG hit would penetrate the armour but often cause no casualties or only light

injuries from splash or spalling, unless a soldier was unlucky enough to be in the direct line of the penetrating slug. Most of the anti-tank rifle-grenades had the same weakness. Later in the conflict the guerrillas learned to fire multiple RPG rounds at a vehicle, which would at least cause some casualties and distract the rest of the crew, even if it did not destroy the vehicle.

The RPG-7 was also sometimes used to engage helicopters, and it may well have been an RPG-7 that brought down the Puma lost during Operation Meebos in 1982.

The 62 mm and 82 mm mortars were occasionally brought in to carry out a 'stand-off bombardment' of a base. On a few occasions specialised teams also brought in single-tube 122 mm rocket launchers to bombard bases. A few groups also carried the SA-7 shoulder-launched surface-to-air missile, one of which damaged a Dakota.

Swapo's bases in southern Angola were generally well defended, with good use made of 14,5 mm and 23 mm anti-aircraft guns in the ground defence role as well as in their anti-aircraft role. The twin 23 mm ZU-23-2, in particular, proved a dangerous weapon that always had to be eliminated early in any action. The bases also had the use of 120 mm mortars, 76 mm and 122 mm (including the modern D-30) guns and 122 mm BM-21 multiple rocket launchers to provide defensive fire. Swapo also had armoured vehicles in small numbers, but those were mainly used by units protecting its bases deeper inside Angola and also in operations against Unita guerrillas.

The primary offensive weapon of Swapo's guerrillas was the anti-tank mine, typically a TM-46 or TM-57 laid on gravel roads in Ovambo to disrupt civilian traffic. Many civilians were, in fact, killed by mines, while the security forces were generally safe in their mine-protected vehicles. Anti-tank mines were also occasionally used for a targeted assassination of a headman or politician. On a few occasions heated sections of 200 litre drums were used to cut a hole in the surface of the main tarred road to lay a mine, but Bosbok 'night spotter' sorties stopped that. Guerrillas also tunnelled under the tar from the side. Most of these mines were detected by Army engineer teams that patrolled the tarred road at first light.

Small anti-personnel mines were at times placed around anti-tank mines in the hope of killing or injuring the engineers clearing the anti-tank mine. Anti-personnel mines were also used to deter or at least delay pursuit when guerrillas had been located by an Army or Police patrol. A favourite in that role was the POMZ, mounted on a rod more or less at shin height and connected to trip wires, which scattered shrapnel over a wide arc.

The Angolan Army used the same light weapons as Swapo, but had mechanised units with T-34 and T-55 battle tanks, PT-76 amphibious reconnaissance tanks, BRDM-2 armoured cars and BTR-152 and BTR-60 armoured personnel carriers. Later in the war they also used BMP-1 mechanised infantry combat vehicles in operations against Unita and, in 1987/88, against South African forces in south-eastern Angola. Artillery included the long-range 130 mm gun.

The Angolan forces also developed an extensive anti-aircraft system over time, which included guns (20 mm, 23 mm, 37 mm, 57 mm and even some larger calibres) and a full range of surface-to-air missiles. The latter included the SA-7, SA-14 and SA-16 shoulder-launched missiles; the SA-9 and SA-13 infra-red homing missiles mounted on armoured vehicles; the self-propelled SA-8 medium-range system (the first used outside the major Warsaw Pact forces) and the longer-ranged transportable SA-6 and static SA-3. The weapons were backed up by a comprehensive radar system. All in all the Angolan air defence system in the second half of the 1980s was very similar to that encountered by the allied forces in Iraq in 1991.

The SAAF was, however, generally able to continue to operate effectively, bypassing the air defences or conducting air defence suppression strikes. Several aircraft were lost to SAMs, including a Mirage F1 to an SA-13 and a Bosbok to an SA-8. Most of the SAAF's aircraft losses, however, were suffered by helicopters and Impalas flying low, and most of them were lost to light anti-aircraft guns.

3. AIR FORCE EQUIPMENT

The aircraft that dominated the Operational Area were the helicopters, particularly the Alouette III and the Puma. The large Super Frelon was never at its best under the 'hot and high' conditions of northern Namibia and southern Angola, and was only rarely used. One major operation in which it was used was Operation Reindeer, where Super Frelons joined Pumas in extracting the paratroops after the raid on Cassinga. In one other instance a Super Frelon was used to recover an Impala that had been shot down but had landed in reasonably good shape. The Impala was later repaired.

During the first years of operations along the border with Angola the Alouette III was used to support the Police, serving as a reconnaissance and command aircraft and as a light trooping aircraft. As the conflict escalated, the trooping role shifted to the Puma, and the Alouette was used chiefly as a gunship, both for close air support and in the armed reconnaissance role. It proved extremely effective in these roles, its low speed (210 km/h) being offset by its agility and the aggressive flying by its

crews. One key advantage was that it could be refuelled close to the scene of the action, only requiring fuel to be brought up by truck or Puma. Thus the close air support Alouette could be almost instantly available, whereas the fighters were tied to their bases.

Most Alouette gunships were armed with a side-firing 20 mm cannon, although some had a 12,7 mm Browning heavy machine-gun in the same mounting or with twin 7,62 mm machine-guns in a simpler mounting. Some Alouettes used in command or utility roles had a single pintle-mounted 7,62 mm machine-gun in the door. A quadruple 7,62 mm mounting was developed but did not see service. The gunships provided most of the close air support for Army and Police patrols in contacts with guerrillas south of the border, but were also extensively used in external operations, supporting the light infantry of 32 Battalion and even engaging mechanised forces during early external operations, such as Operations Sceptic and Protea.

The Puma was the overall workhorse of the war. It served as an assault helicopter, as a general-purpose trooping and cargo helicopter for casualty evacuation (casevac) and medical evacuation, and as airborne command post. It was a powerful aircraft, fast by helicopter standards (294 km/h), agile, with a good payload (12 troops or 3 tons in the 'hot and high' Operational Area), and good range (up to 500 km), and was immensely robust and tough. It landed troops virtually on top of the enemy when necessary, flew supplies to deep patrols, evacuated casualties, sometimes under fire, recovered the occasional shot down Alouette, and brought the canteen goods to distant bases. No one who served 'on the border' will forget the sound of the Puma. A few Pumas were briefly used as gunships, but they were too valuable in their other roles, so that business was left to the Alouettes.

The glamour boys were, of course, the fast jets, the Mirages and the Buccaneers. The Mirage F1AZ strike fighters were, arguably, the main actors of this group, flying air defence suppression, strike, interdiction and close air support sorties throughout the war, despite opposing MiGs, surface-to-air missiles and anti-aircraft guns. The F1AZ had a weapons load of up to 3 650 kg on fuselage and wing pylons as well as two 30 mm cannon and two air-to-air missiles on the wingtips. It had a combat radius of up to 900 km depending on the weapons load, and a top speed of over 2 300 km/h, although a more usual combat speed was around 1 200 km/h at low level. Most strikes were flown with between four and six 250 kg bombs, two dogfight air-to-air missiles and two tanks. Some were flown with eight bombs and other types of bomb, and unguided 68 mm rockets were occasionally used against vehicles and point targets. One F1AZ was shot down, in 1988, by an SA13 missile while pulling out after tossing its bombs.

The Mirage F1CZ interceptors did not have as interesting a war. At first there was no real opposition, although they did shoot down two MiG-21s; later in 1987 and 1988, the fighting had moved so far north that the Mirages had fuel for only a few minutes of combat. The opposing MiG-23s from relatively nearby bases had radar support and plenty of fuel. They also had a head-on missile, which the Mirages lacked. One F1CZ was damaged by just such a missile in 1988, and crashed while landing at Rundu on its return to base.

The Mirage IIIs saw less action. The Mirage IIICZ interceptors were not needed until they had in fact been superseded by the F1CZ, while the Mirage IIIEZ strike fighters were withdrawn during the late 1970s to be upgraded to Cheetah Es, and returned too late to see action. The Mirage IIIRZ and R2Z reconnaissance fighters were active right through the conflict, one being shot down.

The other fast jet of the era was the Buccaneer. Originally acquired as maritime strike aircraft, the 'Buc' proved extremely successful in the general strike role, able to carry up to 3 600 kg of weapons and having a combat radius of 800 to 1 000 km depending on the weapons load. The 'Buc' delivered mainly 250 and 450 kg bombs of various types, some carried in its internal bomb bay and others on wing pylons, and used 68 mm rockets in the early part of the war. The 'Buc' flew most of the precision-guided weapon strikes, neutralising air defences with French AS-30 missiles modified in South Africa to home on radars, and the South African H2 TV-guided glide bomb to drop the bridge at Cuito Cuanavale in 1988. The Buccaneer could fly at 1 000 km/h at 60 m above the ground when necessary.

The other British bomber type, the Canberra, flew some bombing missions, but was more heavily used as a long-range photo reconnaissance aircraft, where its maximum range of 6 100 km was invaluable. One Canberra was lost to ground fire.

The workhorse among the combat aircraft was the Impala Mk 2, a single-seat light attack aircraft developed from the Mk 1 jet trainer, and was used extensively during much of the conflict. It flew close air support and battlefield air interdiction missions during the major external operations, quick reaction air support missions during smaller operations, armed reconnaissance and photo reconnaissance, and even ambushed and shot down opposing helicopters. The Impala was armed with two 30 mm cannons and could carry up to 1 800 kg of rockets and bombs on six hardpoints, mixed with long-range tanks when needed. It had a radius of action of between 130 and 600 km depending on the profile and the weapons load. Relatively slow (840 km/h) it was withdrawn from external operations when the Angolan air defences became too effective.

In combat service for a decade, the Impala proved itself an extremely useful, reliable and very robust aircraft. One was recovered after being shot down, was repaired and brought back into service. Another carried home an SA-9 anti-aircraft missile's infra-red seeker stuck in its tail, giving the intelligence world something new to work on. A number were shot down, but the loss rate was very low for the work they were doing.

Some Impala Mk 1s were also deployed and used for photo reconnaissance work and as airborne communications relay aircraft (telstar). Interestingly there was also a small number of Harvards deployed to the Operational Area in the early days as spotters.

Before moving away from combat aircraft, we must not forget the Piper Cherokee of 'Ticklie' Kessler. Painted nutria, fitted with a chute for hand-grenades and armed with two under-wing AK-47s, it flew spotter missions for both the Army and the Police on many occasions before an engine problem forced a crash-landing in which Kessler died.

Much of this war was fought in the era before 'smart' air-to-surface weapons became the virtual standard. Also, most of the targets did not lend themselves to smart bombs or missiles, comprising groups of low value targets dispersed under bush cover. The smartest precision-guided bomb is of little use if targets cannot be precisely located. Instead, the SAAF used mainly high-explosive bombs until the very innovative local pre-fragmented bombs became available. Those were plastic-cased bombs filled with a layer of steel balls packed around the bursting charge, giving a very even spread of fragments, and far more effective than ordinary blast bombs. Different diameter balls allowed bombs to be optimised for use against personnel, soft-skin vehicles or radars and light armoured vehicles. A typical 120 kg bomb contained 11 000 balls of 8,7 mm diameter, a typical 250 kg bomb used against vehicles contained 7 000 balls of 16 mm diameter that easily penetrated BTR-60 armoured personnel carriers.

A proportion of these bombs were also produced as boosted bombs, fitted with a 127 mm rocket motor to allow them to be tossed over far greater ranges, enabling the SAAF's small fighter force to bomb targets while staying out of the range of most of the air defence weapons. Stand-off ranges of up to 16 km were achieved with these bombs. Other bombs were fitted with drogue parachutes to slow them down to allow very low level release without the aircraft running the risk of being hit by fragments of its own bombs.

Cluster bombs, runway penetration bombs and laser-guided bombs all came into the SAAF inventory at the end of the war but not in time to be used operationally. The SAAF also used a variant of the Alpha Bomb developed for the Rhodesian Air Force. This was a small spherical bomb that bounced on impact, detonating a few meters above the target. It was used by the Canberras, which carried a large number in their bomb bays. Later the bomb was incorporated into the CB-470 cluster bomb to enable other aircraft to use it.

The AS-30 missile was used on a few occasions, but was not very successful. Later it was modified as an anti-radar weapon and used in that role. The H2 smart bomb was originally developed as a stand-off anti-radar weapon with a large pre-fragmented, warhead, but grew into a family of bombs with different warheads for different target sets. Unguided 68 mm rockets were used by Mirages and Buccaneers for a time, but they later concentrated on missions other than close air support, and the rockets were then used mainly by the Impala Mk 2.

Air-to-air missiles included the French R550 close-range infrared-homing missile and the longer-range R530 radar-guided missile, which did not prove successful. Later the SAAF also began using a locally upgraded version of the R550, the first of the V3 series missiles. Israeli Python and Russian air-to-air missiles were acquired to arm the Mirage F1 and the new Cheetah C, but were not in time to see operational use.

At the very bottom of the glamour scale, but immensely valuable in the real world of military operations, were the light aircraft: the Cessna 185, the Kudu and the Bosbok. The former was originally operated by the Army Air Corps and then taken over by the SAAF as a spotter and light utility aircraft, and some operated in support of the Police in the Caprivi in the late 1960s.

The Bosbok and Kudu were Aeritalia designs manufactured by Atlas for the SAAF. The Bosbok was a two-seat spotter used to find and mark targets for the fighters and to direct artillery fire during the major external operations. It also flew spotter, visual reconnaissance and night surveillance missions internally, often staying aloft for most of its 4½ hours endurance. At least one Bosbok pilot silenced a twin 23 mm gun with his target marking smoke rockets when the Mirages kept missing it with their bombs – also convincing his back seat artillery spotter that light aircraft pilots were insane. One was lost to an SA-8 missile in 1987.

The Kudu used the same engine and wing but with a boxy utility fuselage, and was slow enough (260 km/h) to be unkindly called a "converter", a device for converting avgas into noise. This flying Kombi was an immensely useful utility tool,

however, moving people and light cargo around the operational area, able to land at most bases, needing only 260 m, and not always staying inside its payload limit of 650 kg or seven passengers! Kudus also flew spotter, route reconnaissance and telstar missions, able to stay up a little longer than even the Bosbok.

The best remembered transport aircraft of the war is probably the C130 Hercules, also known to thousands of soldiers as the 'Flossie', so called because it brought the relief unit ("aflos") when it was time to go home. With a payload of 22,5 tons and a range of 3 539 km with that load, or up to 7 800 km with a light cargo, the Hercules played a major role, both in moving cargo and personnel to the Operational Area and flying supplies to forces operating in southern Angola, landing on short strips or dropping the cargo by parachute. Operating in parallel with the Hercules was the lighter twin-engine C160 Transall (16 tons, 1 850 km range, 4 400 km with a lighter load). The Transall's great claim to fame was the ease and speed with which it could be loaded and unloaded, being able to 'kneel' and thereby allow cargo to be quickly winched in and out.

Old but very bold was the C-47 Dakota, a WWII veteran that is still in service with the SAAF today, albeit in turbo-prop form. The Dakotas were used mainly to move personnel and cargo (3,4 tons) around the Operational Area, although they did also fly in support of external operations. One flew fuel to a disused airstrip far inside Angola to allow Puma helicopters to refuel during a casevac mission to the Cazombo area in the far west of Angola. One Dakota was armed with a side-firing 20 mm cannon from an Alouette gunship and dubbed 'Dragon Dak', while some others were fitted with a variety of electronics for SIGINT work. The almost equally elderly DC4 was flown in the passenger role.

Near the end of the conflict the Boeing 707 began to make its appearance, but mainly in the SIGINT role. It later also served as airborne tanker and long-range transport.

While there was a strong air force in Angola, it focussed mainly on operations against Unita, only rarely challenging the South African forces. That only changed after 1987, when the newly delivered MiG-23s began to contest air superiority. While the Mirage F1CZs lacked the range to take them on over the battle area east of Cuito Cuanavale, the MiGs did not prevent F1AZs and Buccaneers flying their strikes. Nor were they effective in attacking South African and Unita forces on the ground, causing very few casualties and little damage and losing some aircraft in the process, to South African 20 mm guns and Unita's Stinger anti-aircraft missiles.

What did present problems was the ever-improving air defence system created in the south of Angola, mainly by Soviet technical personnel. That provided effective radar cover of almost the entire area, and included anti-aircraft guns and modern surface-to-air missiles in a mix almost identical to that encountered by coalition aircraft in Iraq in 1991. The SAAF dealt with that problem by developing anti-radar weapons and by flying low and around the danger areas. It did not stop flying strikes, continuing to hit targets right up to the end of the war.

The Angolan Air Force generally kept out of the fight between Swapo and the South African forces, although it did on occasion try to interfere with SAAF missions. Two of those attempts cost its MiG-21s to be shot down by Mirage F1s. A more concerted effort was made during the 1987/88 fighting east of Cuito Cuanavale. There the MiGs had the twin advantages of radar control and being close to home, giving them extended time on station, while the SAAF Mirage F1s were too far north to have radar support and had only a few minutes of combat time. By then the Angolan Air Force was also flying the MiG-23, which had more power and speed than the Mirage F1 and also had head-on radar-guided missiles, a major edge over the F1CZ, which had only infrared homing missiles. One F1CZ was damaged in such an encounter, and that incident plus the futility of trying to maintain a combat air patrol at the edge of the range envelope led the SAAF to stop combat air patrols. The MiGs never did, however, manage to stop the SAAF flying its strike missions.

The major impact of the MiGs was to force the South African ground forces to stop or at least slow down - and the G5s to stop firing - when they were overhead. They did not, however, despite more than 2 000 ground attack sorties, cause much damage.

The Angolan Air Force was much more active against Unita, using MiG-21s and 23s, Su-22 fighter-bombers and Su-25 ground attack aircraft for interdiction and ground attack work, and Pilatus PC-7 armed trainers and Mi-24, Mi-25 and Mi-35 'Hind' attack helicopters for close air support. Armed Mi-8 and Mi-17 transport helicopters were also used in that role as well as in their primary transport and air assault roles. Transport aircraft, including a number of large Antonov-12s and Ilyushin-76s as well as Lockheed L-100s, played a key role in supplying outlying bases in areas dominated or harassed by Unita. Many of these aircraft were lost to Stinger shoulder-launched missiles supplied to Unita by the United States.

4. THE NAVY

The Navy is generally not remembered as playing a part in the Border War but it did actually have an important role supporting strategic reconnaissance operations of the special forces. It also had an impact on the conflict right at its beginning and right at its end.

Right at the beginning of the Angolan Civil War the Soviets became concerned that South Africa might use its submarines to interdict the deployment of the Cuban forces that supported the MPLA seizure of power. So much so, that they made some discreet diplomatic enquiries. The South African government indicated that it would not take that step, and it never did. But the thought of those submarines remained in the minds of Soviet planners throughout the conflict and did impact on their strategic thinking in the region. Right at the end of the conflict in 1989, the Navy conducted a strategic deployment exercise and an amphibious landing exercise at Walvis Bay. Some Cuban negotiators later told their South African counterparts that that exercise had been the final straw as far as they were concerned: It raised the spectre of South Africa landing forces at Namibe to block the logistic support of the Cuban forces in the south-west of Angola, which would have meant either unaffordable escalation or military disaster.

The Navy's main active role, however, was to insert and extract reconnaissance teams of special forces operators. The main actors were the strike craft and submarines that did the actual insertion and extraction work, with the support ship SAS Tafelberg and occasionally the survey ship SAS Protea serving as way stations to refuel the smaller vessels and to have full-scale medical facilities available. All of these missions were executed without contact with opposing forces, although Angolan aircraft did launch to search for the strike craft on some occasions. There was also one unexpected - and entirely unwelcome for all concerned - brief stand off with a Russian destroyer near an Angolan harbour. Neither side was inclined to open hostilities, and the destroyer went back into the harbour while the strike craft completed their pick up and sailed home.

In the course of these operations the small (62 m, 430 ton) strike craft had to operate far from their home base and far from any support. The greatest danger was an air attack, as they had only their 76 mm guns with which to defend themselves. While they were more proficient in anti-aircraft fire than their counterparts in most navies, those were not ideal weapons against fast jets with guided weapons. The boats were also rather crowded with 47 members plus the reconnaissance team. The submarines were at less risk, but very slow and very uncomfortable with operators embarked. Most long-distance deployments actually saw the reconnaissance teams

deploy aboard the support ship and join the strike craft or submarine just before being landed. That also allowed the operators to maintain their fitness during the transit.

Right at the other end of things, the small RSA, a former Antarctic research ship, was used to gather electronic intelligence and jam the communications of the opposing forces. Her deployments often gave the naval planners restless nights. With a flat out speed of 9 knots she would have been hard put to escape any pursuit.

Angola's Navy was extremely small and played no part in the conflict.

5. TOO LATE FOR COMBAT

The war also led to the development of new equipment and systems that, as is normal in all armed forces, only came into service once the war was over. Some has entered service since, some was cancelled.

Among the equipment that did come into service are the Olifant Mk 1B, the Rooikat 8x8 wheeled combat vehicle, FT9 anti-tank rocket launcher, 40 mm automatic grenade launcher, 60 mm long-range (6 000 m) mortar and chemical warfare suits, filters and related equipment; the Cheetah C multi-role fighter, Rooivalk attack helicopter, Oryx medium helicopter and V3C and V4 air-to-air missiles; the upgraded combat systems of the strike craft and submarines; and the Umkhonto surface-to-air missile, which is now in service with the Navy and will probably also be bought by the Army, and which is one of the best in its class worldwide. The 10 000 m range Mokopa anti-tank missile is likely to enter service soon for the Rooivalk.

Cancelled in the spate of defence cuts after 1989 were a new tank (tank technology demonstrator), the ZA-35 self-propelled twin 35 mm anti-aircraft gun, the ICV-2000 Ratel replacement and new APCs; the Super Mirage F1 upgrade with the Russian SMR-95 engine, a Cheetah C upgrade with the same engine and Denel's 'advanced combat wing', the MUPSOW and TORGOS-guided stand-off weapons; the boosted anti-radar bomb (BARB) and Lark anti-radar drone, and the guided boosted bomb (GBB), which was essentially a forerunner to the GPS-guided bombs used by the US Air Force today; and plans to build both frigates and submarines in South Africa.

Also dropped, of course, were the nuclear weapons and the reconnaissance satellite programmes.