

Dassault Mirage F1 AZ / CZ

PRINT

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Top photo 1 Sqdn (H. Potgieter), bottom 3 Sqdn.

This aircraft type, ensured peace and stability, in the Southern Africa region, for almost 22 years!

The SAAF operated a large number of Mirage IIIs during the 1960s. Seven different variants of the Mirage IIIs, formed interceptor, ground attack, photo recce and operational training aircraft. The political climate at the time in Africa, forced the South African military strategists and political analysers to review our defensive position. The collapse of colonialism, gave communism the perfect opportunity to spread to Africa on a far larger scale.

The alarming rate at which communism spread southwards through Africa was a great concern to South Africa, especially the new weaponry employed by these countries, mostly of Soviet origin. It wasn't very difficult to forecast that similar revolutionary conflicts would also happen in Mozambique and Angola. This was right on South Africa's doorstep. In December 1969, the Minister of Defense, Mr P.W. Botha, announced that SA would be buying new aircraft in the early 70's. After evaluating several types, the SAAF selected the Dassault Mirage F1 from France. At the time one of the most technological advanced aircraft in the world. The SAAF was the first export customer. This aircraft type was for many years the symbol of our Nation's strength. At least two CZs were on permanent standby to guard against attacks from the North, while both AZs and CZs saw extensive combat during the Border War conflict, flying through one of the most advanced enemy air defence systems in the world. It is therefore no surprise that the Mirage F1 was the SAAF's most successful fighter attack aircraft. SAAF pilots loved the aircraft, and points out - to fly the aircraft is like the Sabre, only better and with the performance of the Mirage III.

Dassault Aviation:



The name Dassault has been associated with a number of successful aircraft types, the best known being the Mirage III. The Mirage III is Europe's most successful export supersonic fighter, as it was produced for 22 air forces, including South Africa.

However, while an excellent high altitude interceptor the delta design had a number of drawbacks, - the most common being, the delta generates too much drag in hard dog fights and causes a very high landing speed. The high landing speed of 339 km/h (210 mph) was the factor which caused Dassault to look at other options. Dassault Aviation, embarked on an intensive programme of prototype construction, flight testing and research & development - which is unequalled in aviation history! Some of the designs that emerged were the VTOL Mirage III - the French is considered to have perfected the VTOL concept, although the British made it practical in the form of the Harrier. The Mirage F type used conventional swept wings of very thin design and took considerable research & development by Dassault to perfect this very advanced construction. The F2 was a double seater and the scaled down F1 being a single seater, was powered by the Atar K, with its maiden flight on 27 December 1966. The Mirage G featured variable sweep wings. Dassault Aviation is the only aerospace company to successfully produce both VTOL and variable swept wing aircraft. These four main types were carefully researched and the various advantages weighed against each other. Even politics was entered into the equation and the selection fell on the single seater Mirage F1 (often referred to as the "Super Mirage"), powered by the most powerful fighter engine then available in France - the Atar 09K50. Most of these prototypes featured in the hit TV series (especially in SA) "Mirage". Today, these prototypes are on display at the Air & Space Museum, Le Bourget. Financially speaking, Dassault's decision to settle for an all-French product was a wise one, for the F1 was subsequently bought by at least two regimes of which the Americans heartily disapproved - South Africa and Libya. South Africa was Dassault's first export market for the F1 and also received a manufacturing license for the F1.

SAAF Variants:

In October 1971, the SAAF send an evaluation team to France. Commandants (Lt. Col.) Bossie Huyser and Zach Repsold evaluated the initial test F1 aircraft. The French was suitably impressed by these SAAF Mirage III pilots, who displayed superior airmanship and marksmanship, despite flying an essentially new aircraft. It was concluded after the initial evaluation that the F1 was in fact the correct choice for the SAAF. SA selected both the CZ which was very similar to the French CZ interceptor and a unique SA model, the AZ for the ground attack role. The AZ was later also exported to Libya, with a different component fit.

Mirage F1 CZ:

Mirage F1CZ

The F1CZ is a all-weather, multi-purpose fighter-interceptor. Internally the F1 did not offer improved armament - like the Mirage IIIs it was armed with two 30 mm cannons in its lower front fuselage, but with five strong points under the wings and belly for armament and extra fuel tanks. However, in other ways, it was a vast improvement on the older Mirages. As used in the SAAF the F1 CZ variant is slightly faster than the Mirage III family, capable of Mach 2,2 under combat conditions. Its endurance for patrol or



high altitude pursuit is triple compared to the earlier aircraft, while it has double the radius of action when deployed on close-support missions at low altitude. It requires 23% less runway for take-off, and the maximum approach speed when landing is 20% lower. The F1's maximum wing-loading is almost double of its predecessor, while slats on the leading edge of its wings have enhanced agility in combat. As its major combat aid the F1 carries in its nose an improved Thomson-CSF Cyrano IV multi-function radar system which provides automatic follow-up and fire control for the pilot. The familiar pilot friendly cockpit was improved with everything in the right place. The success of the aircraft is mainly due to the snug fit and general layout of the cockpit.

In 1974, Cmdt Bossie Huyser received the post to oversee the F1 programme. Much of the success of this aircraft type in the SAAF was largely due to his efforts. Soon after SAAF pilots Maj Chris Lombard, Capt. Jack Grundling and Capt. Mitz Maritz left for France for the conversion course. Together with Bossie Huyser, they became the SAAF's F1 Project team. On 2 December 1974, Maj Chris Lombard flew the first sortie in a SAAF F1CZ (201), after Cmdt Bossie Huyser in 202 experienced a technical glitch. F1 CZ No 200 remained in France to be standardized as this was the project aircraft, and was subsequently the last F1 CZ delivered to the SAAF in 1977.

No 204 was the first aircraft to be locally assembled by Atlas (DENEL) followed by 205 and later 201, 202 & 203. The first two F1CZs (No 204 - Cmdt Bossie Huyser & 205 Maj Chris Lombard) were flown from Atlas to the newly formed No.3 Squadron at Waterkloof AFB on April 4, 1975. Cmdt Bossie Huyser ensured he flew the first sortie over SA soil. It was, however, still very much a secret operation at that stage, particularly in South Africa.

At the bi-annual Paris Air Show in June 1975 Dassault displayed a SAAF F1 CZ and the first SAAF F1 AZ - but South Africans had no opportunity of seeing what their money had bought till September that year, when some F1CZs were displayed under armed guard at Waterkloof AFB near Pretoria - where photographs for publication were not exactly welcomed! In total, the SAAF received 16 F1 CZs, with serial numbers from 200 - 216. Until the retirement of the F1 CZ in September 1992, the Waterkloof F1s of 3 Squadron provided the Republic's northern border with its primary knock-out punch as part of the Northern Air Defence Sector (NADS). Two F1 CZs were always on standby in a special hangar. Plug-in cords kept their systems gently turning over and their pilots prepared for action in case the early-warning radar network detects suspicious-looking "blips" heading towards the Pretoria-Johannesburg complex. If that happens the hangar's door rolls up into its roof and the F1s blast down the runway. In less than a minute they are fast-vanishing dots in the northern sky. This function has since been taken over by the

A pair of F1CZs of 3 Sqdn, in formation over the Northern Transvaal (Northern Province).



Maj Chris Lombard the first SAAF pilot to fly the F1, in CZ no 201.

Cheetah C of 2 Squadron, based at AFB Louis Trichardt. (now AFB Makhado).

Mirage F1 AZ:

Mirage F1-AZ

The SAAF also ordered 32 of the F1 AZ variant (serial numbers 217 - 249), which is primarily a ground attack fighter, to replace the Mirage IIIEZ. In 1975, Capt Andre van der Heever was appointed to start the F1 AZ project. With Capt Gawie Winterbach they became the first F1 students and attended the course at 3 Sqdn. A few CZ flying hours later, they left for France to attend the first of the technical courses on the AZ. On 7 October 1975, Capt Gawie Winterbach flew the first AZ sortie by a SAAF pilot in No 216. During March 1976 the first AZs arrived at Atlas. On 24 March 1976, Capt Gawie Winterbach, flew the first AZ sortie over SA, again in 216. This was followed by Andre van der Heever in no 217. All the F1s were shipped by sea and then by road transport to Atlas for assembly, except no 239 - 247. The last nine aircraft were flown from France to SA by C130s from 28 Sqdn,



Mirage F1 AZ with vapour trails at the wing tips. Note the different nose profile as compared to the CZ.

to prevent delivery refusal due to the rapidly approaching arms embargo against SA. The F1AZ is visually distinguished by a slender conical nose due to the removal of the sophisticated, ultra-expensive Cyrano IV radar system. The aircraft features an integrated ground-attack system, with two on-board computers which enable the pilot to identify a target 5 km away and then provide him with all the data he needs to home in on it - after which the system automatically releases the bombs at the right moment. However, the range-finding ability of the EMD AIDA 2 radar unit permits the Mirage F1AZ to operate combat and visual interception missiles such as the MATRA R 550. However, these aircraft also used the locally developed helmet mounted sight. This enables the pilot to make of bore attacks, without having to manoeuvre until the optimum firing position. South Africa subsequently emerged as one of the pioneers and leaders in helmet mounted sight technology. The SAAF was also the first Air Force to fly the helmet sight operationally. Main avionics is moved from behind the cockpit to the nose. The instrument boom is attached on the underside of the nose out of the way of the AIDA radar.

Remaining space is taken up by an additional fuel tank behind the cockpit and a retractable refueling probe in the nose. In addition the South African F1 AZs are fitted with a laser range finder under the nose. This stealth device provides the attack computers with target info without the emission of radar signals. The F1 AZ remained South Africa's primary ground attack aircraft throughout its service life with the SAAF. (Although supplemented in later years by the Cheetah C).

The F1AZs started arriving in 1976 and were allocated to No.1 Squadron, then still flying Sabre Mk6s out of Air Force Base



F1 AZ refuelling from a 24 Sqdn, Buccaneer.

Pietersburg - which it shared with 85 Advanced Flying School. No. 1 Squadron handed its Sabres over to 85 AFS and moved to Waterkloof, there to operate its F1 AZs in such discreet manner that they were not revealed to the general public until another air show was held at Ysterplaat and Waterkloof in February 1980 to celebrate the SAAF's 60th anniversary. The Mirage F1AZ was the last new aircraft type delivered to South Africa!

Mirage F1 AZ / CZ in the Border War.



Top photo 1 Sqn (H. Potgieter).

The United Nations special committee on apartheid expressed fears that France was giving South Africa a military potential that many African states would be unable to match for several decades. In 1981 the "South West Africa Peoples Organisation" (SWAPO) declared France the "enemy of Africa" and said the jets would be used against Zambia, Tanzania and the black people of South Africa.

This propaganda never materialised, but fortunately for South Africa, France had enough backbone to supply the SAAF with the F1. For South Africa found itself suddenly all alone in the late 70's on a troubled continent and against the Communist supported regimes in Angola. The conflict intensified to the point where the Mirage F1 types were deployed against Angola from 1978. On 6 July 1978, Capt Steve Ferreira flew a 2 Sqn Mirage III R2Z on a photo recce mission into Zambia. Capt Andre' van der Heever, accompanied him in a F1 AZ. This was the first operational sortie flown by the F1 and was unopposed. From 3 November 1978 the F1s regularly deployed to the



F1 AZ with 4 Mk 81 bombs and two under wing fuel tanks. This configuration was typical during the early deployment to the operational area.

operational area. On 14 March 1979, Capt Tinkie Jones became the first 3 Sqdn pilot to fire his weapons in anger since WWII, while attacking a ground target. On 6 November 1981 a F1CZ flown by Maj. Johan Rankin shot down the first Mig 21. This was the first confirmed air-air victory for the SAAF since World War II. Even more remarkable, this was achieved by scrambling two F1CZs from Ondangwa and not combat air patrol (CAP). Maj Johan Rankin also shot down the second Mig 21 on 5 October 1982. The F1s were repeatedly involved with the Mig 21 and other East block aircraft - the SAAF's F1 always came out on top and none was ever lost to a East block aircraft. Both F1 types were used in the strike roll, armed with various types of "dumb" ordnance from free-fall, retarded & cluster bombs, to unguided rockets.



Mirage F1 CZs at AFB Ondangwa during the Border War conflict.

Later "smart weapons" were introduced - developed and manufactured in South Africa. As recognised by leading aircraft and defence publications the SAAF operated in what was at that time the most intensive air defense structure anywhere in the world. The latest East block radar and defence networks were deployed against the SAAF. Damage was initially high, but due to the skill of the pilots, they almost every time managed to bring the stricken aircraft home. This led to the local development of ECM and early warning systems for SAAF aircraft.

Tactics were also revised and adapted, with the SAAF pilots emerging as one of the pioneers in modern day, low-flying attack tactics to avoid radar and for ordnance delivery. The Border War also led to the current low-vis camouflage scheme. The first aircraft type to be painted in a low-vis scheme was the F1CZ and consisted of 3 tones of blue-grey. However, the F1AZs were over sprayed with a number of experimental schemes. This was done during times of war and there is no official record of paints or patterns employed. Also photo records of these patterns are extremely rare! The national insignia was also over sprayed and an Impala aircraft used to see which scheme was the most effective. At least two F1AZs were painted in similar blue-grey scheme as the F1CZ and photos exist of schemes similar to the Impala MkII scheme. Apparently only one F1AZ was painted in the current 3 tone scheme during the Border War conflict. On 23 March 1988 the Mirage F1AZs conducted the last flights in the Angolan conflict. During the last deployment to South West Africa (lasting 7 months) the Mirages flew 683 sorties, conducted 144 air raids over a period of 191 days and delivered 3068 bombs. Remarkably in this same period, more than 100 SAMs were fired at the South African Mirages, with only one fatality.

10 000 ft challenge:

The period after hostilities ended in the Border War area, saw the SAAF going through a number of rationalisation programmes. A number of Sqdns were closed and thus the F1 Sqdns also had to fight for their survival in the modern SAAF. One aspect that eased the air a bit was the much published air race to 10 000 ft. The Oryx is quite a powerful helicopter and the Oryx pilots challenged the "Vlammies" (All SAAF fighter aircraft pilots are called 'Vlamgat' - translated means 'flaming backside' and this refers to the afterburner section of aircraft.) for a race to be the first to reach 10 000 ft. On 3 November 1993, the race was run at AFB Waterkloof. Cmdt Dolf Prinsloo in F1 AZ No 230 and Cmdt Martin Kruger in the Oryx set out against each other. The F1 AZ won by 1000 ft, but this highlighted the phenomenal performance of the Oryx and showed by what degree helicopter technology progressed over the last few years.



Cmdt (Lt Col) Dolf Prinsloo, OC 1 Sqn winner of the air race.

International arena:

On 30 July 1994, F1 AZs intercepted and escorted an Air France 747 carrying President Mitterand into Cape Town for an official state visit to South Africa. The Sqn intercepted the 747 as sign of respect for the Mirage F1's country of origin. Simultaneously it provided the arrival with the necessary status and respect it deserved. The F1 AZs were flown by Lt Col Dolf Prinsloo OC 1 Sqn, Capt Chris Pretorius, Capt Wynand Serfontein and Capt Marcel von Gunten. At 07h30 the aircraft was scrambled from AFB Langebaanweg to intercept the Air France Boeing 747. The F1 AZs formed up on the wingtips of the 747 to give the aircraft and its passenger a SA welcome the Air Force way. On final approach into DF Malan Airport the F1s broke away and with the task complete, flew back to their home at AFB Hoedspruit.



Mirage F1 AZs with the Air France Boeing 747 that transported the French President to South Africa.

During 1995, the SAAF celebrated its 75 anniversary - the SAAF is the world's second oldest Air Force. The highlight was the International Air Show at AFB Waterkloof. A larger number of foreign aircraft attended, with many bidding to be the SAAF's new fighter aircraft. Unthinkable a few years before, but the Russians attended in official capacity, displaying the magnificent SU 35 (the first time in the West) and the MiG 29. After the air show two MiG 29s joined 1 Sqn in Hoedspruit for evaluation by the SAAF. The "Billy Boys" flew against the Russian aircraft, although this time in mock ACM. It was interesting to note that the helmet mounted sight in use on the Russian aircraft was an exact copy stolen from South Africa during the Russian spy scandal, involving a highly placed SA Navy official. For more realistic ground based intercept (GBI) control exercises, special international permission was obtained to

exceed the sound barrier over land. The base held an information evening explaining to residents of the Hoedspruit surrounding area, why the unusually high jet noise factor was currently experienced in the area. Aspects like the sound barrier etc were explained to the visitors. However it was quite a surprise to the SAAF personnel when one of the lady visitors remarked, that she was unaware the sound barrier could actually be found at Hoedspruit..... ;-)

On 5 July 1996, the 21st anniversary of the F1AZ in SAAF service was celebrated at AFB Hoedspruit, in spectacular fashion.

Mirage F1 AZ / CZ retirement.



F1 CZ retirement:

Due to Defence cut-backs and the withdrawal of South Africa from Namibia/Angola the Mirage F1CZ was the first to "go".

This was largely due to rationalisation in the SAAF. Although at the time Sqdn serviceability was 100%, with all the CZs in perfect working order. All the aircraft had the latest systems fitted and completed all the latest maintenance routines. On the day that the Sqdn closed down the personnel of 3 Sqdn still ensured that all 12 remaining CZs were in perfect working order and ready to face any crisis in a moments notice. This dedication by the men and women of 3 Sqdn was in stark contrast to that of the politicians who had so readily used them in times of crisis. On 30 September 1992, 3 Sqdn held its final parade at AFB Waterkloof, what could only be described as an emotional experience. Waterkloof was home to the CZ sqdn throughout its career of 17 years with the SAAF. To acknowledge this fact and as a final farewell, the Sqdn flew an immaculate 9 ship fly past over the base. After landing the final parade was held. Then Maj Rudi Mes, Maj Jeronkie Venter, Capt Leon Meech-Noyes and Capt Pietie le Roux took

off for a four ship flypast followed by a two versus two simulated ACM display. The ACM display was as a special tribute to the maintenance personnel, who in all the years never saw their beloved aircraft in action. After landing, the four aircraft taxied back to the readiness platform, where the other four aircraft were already waiting with engines turning. All aircraft taxied slowly back to 3 Sqdn's readiness platform, where they were lined up and dressed by the right, by the proud ground crew. All aircraft increased power to a deafening roar to kick up a storm of dust. With a radio call all pilots shut down their engines simultaneously. The silence was broken only by the ticking sound of the cooling metal. Cmdt Willie ("Skillie") Hartogh, the last OC of 3 Sqdn, then thundered into the area to begin his spectacular low level display. After landing he taxied back to park his aircraft right in front of the crowd of spectators. There was not a single dry eye amongst the crowd. Not even the hardened politician and Honorary Colonel of 3 Sqdn, Mr Pik Botha could hide the tears when he walked forward to present "Skillie" with an olive branch to acknowledge for the last time, the men of 3 Sqdn.

However, two F1CZs (no 205 & 209) remained flying in South Africa as flying test-beds for the V3S & V3P missiles and other systems. Although 3 Sqdn was closed in 1992, two F1 CZs remained flying for another 4 years for project purposes. This stretched the service of the CZ to 21 years as part of the SAAF. The last flights were flown in 1996. A final farewell function was held at AFB Waterkloof, on 27 March 1996, to pay tribute to this remarkable aircraft. Present at the function were the many of pilots and ground crew involved with the aircraft over the years. These included Maj Gen Bossie Huyser (ret), Maj Gen Chris Lombard, Brig Jack Grundling and Col Mitz Maritz. The four started the F1 chapter in the SAAF and it was only fitting that all four attended when the final chapter was written. As part of the function Maj Mike Edwards (in no 205) gave a brilliant low level display to be the last official flight as part of the SAAF. The next day Maj Mike Edwards flew the aircraft to DENEL for storage. There are currently no flyable F1 CZs left in South Africa. Although a few are on static display at various venues around South Africa. See Serial Numbers.



CZ 205 used in the last system test flights. Note drone kill marking.



Close-up of high speed drone kill marking. The pilot was Col. Des Barker, SAAF's chief test pilot at the time.



The last flight of the F1 CZ as part of the SAAF was flown on 27 March 1996.



Maj Mike Edwards after the last flight of the F1 CZ.

In January 1997, 1 Sqdn from the RAF paid a courtesy call to 1 Sqdn SAAF at AFB Hoedspruit.

F1 AZ retirement:

Originally, it was planned to keep the F1AZ flying until the SAAF's latest fighter arrived (South Africa selected the Gripen). However the axe fell far sooner due to down-sizing and the necessity to incorporate the many thousands of liberation force and former TBVC soldiers into the SANDF. This placed a large burden on the military budget and the SAAF experienced a number of budget cuts. The closure of 1 Sqdn was perhaps the heaviest blow to the SAAF as it was the most senior flying unit with more than 50 years of proud history. Fortunately for the aircraft enthusiasts, Mirage F1AZ no 229 flown by the last "Billy" of 1 Sqdn, Lt. Col J. Minnie gave the last public flying demonstration at the Silver Queen airshow on 20 September 1997 - AFB Swartkop. No 229 was for a number of years the "mascot" of 1 Sqdn and retained the original camouflage colour scheme. It was a sad feeling to watch this beautiful aircraft being put through its paces for the final time.



F1 AZ no 229 gave the last public flying demonstration at the Silver Queen air show, Swartkops AFB on 20 September 1997 - flown by the last Billy, Lt Col Jan Minnie.

The official retirement of the F1AZ and the disbandment of "the Billy Boys" was on 25 November 1997 - AFB Hoedspruit. It was done in typical SAAF style and was by invitation only - only fitting for such an aircraft. The ceremony started with a mock air refuelling display between two AZs and a Boeing 707, which transported the VIPs to Hoedspruit. This final in-flight refuelling was a tribute to the in-flight refuelling aircraft that assisted the AZ over the years - at first the Buccaneer and later the Boeing 707. A King-Air from 41 Sqdn flew the Parade Revue officer, Maj Gen Roelf Beukes to Hoedspruit. Lt Gen Willem Hechter was unable to attend as he was summoned by President Mandela for an urgent financial meeting.



The pilots that flew the last 5 ship formation: l-r Capt Spencer, Capt Williamsen, Maj Pretorius, Lt Col Potgieter, Capt Vasiljevic. Lt Col Potgieter is the SAAF's most experienced Mirage III pilot, with flying hours on all types.

The parade started with an immaculate 5 ship flypast. In his address, Lt Col Jan Minnie paid tribute to what became known as the F1 team - pilots, Squadron members, base personnel, the backup from Denel Aviation, Air logistics command and TFDC. The F1 team ensured, despite the aircraft's age, that they were in beautiful condition - almost as if they were delivered the previous day. On completion of the parade the five F1 AZs carried out a slow speed, dirty configuration fly-past. Before landing they carried out individual low level, high speed fly pasts. The aircraft taxied in to form a half circle around the saluting platform, where they carried out a synchronised shutdown. Lt Col Jan Minnie, then took off from the readiness shelter in a simulated scramble, before returning for an impressive low level display. His chosen aircraft was no 217 - the second F1AZ to fly in South Africa! After landing he taxied through the semi circle and finally stopped with his pitot almost touching the saluting base. Following AZs took part in the retirement ceremony 237, 236, 241, 220, 217, 225, 239 and 219. No 241 was one of two static aircraft with 217 the solo display aircraft.



The last Billy Lt Col Jan Minnie with his solo display aircraft - AZ no 217. Call sign Billy appeared in red the day before and in yellow on the day of the retirement ceremony, under the cockpit frame.

The engine shut down brought home the sickening truth that this beloved aircraft would no longer thunder through the South African skies. It was a very moving occasion and some hard combat veterans and aviation enthusiasts could not help to hide the tears.....

Who could blame them - No other aircraft represent the SAAF's ultimate goal as the Mirage F1 did - to protect her country..... and the Mirage F1 did this proudly for almost 22 years!



Lt Col Jan Minnie saying farewell to the beloved Mirage F1. No 241 one of two static AZs.

In both cases of the F1 namely the CZ and AZ, equipment and personnel were transferred to 2 Squadron - home of the Cheetah. To this day many believe the retirement of the Mirage F1 from the SAAF was unfortunate and premature. The "Billy Boys" were South Africa's oldest Squadron and it is hoped that when the Gripen enter service, the "Billy Boys" would once again thunder through the South African skies.....

Mirage 2000 or Rafale?

The SAAF operated both the Mirage III and F1 with exceptional success. One would therefore assume, the choice for the newest SAAF fighter would be from the same excellent fighter line. Rafale would be ultimate choice for South Africa, but prove too expensive. The Mirage 2000 was one of the "finalists" in the evaluation period, but ironically the choice went to the Gripen.



Mirage 2000 with 2 Sqn SAAF badges as displayed during SAAF 75. Click on photo for Mirage 2000 gallery.

AZ takes to SA skies again:



AZ No 233 took to the SA skies again during September 2001.

With the Mirage F1 no longer a familiar sight at air shows in SA, the aviation enthusiast felt something lost forever. This aircraft is quite popular. It was therefore excellent news that an AZ would once again fly at the SAAF Museum Swartkops Open Day during September 2001. Aircraft was no 233 previously from TFDC and had an unusual fairing between the two ventral strakes. This aircraft is used as an avionics demonstrator in aid of the revived Super Mirage F1 AZ programme. At about the same time the Super Mirage F1 AZ no 216 was removed from static display at Swartkops, by Aerosud. The Russian engine was refitted to no 216 and started flight testing during 2002. SA spectators were treated to spectacular displays during African Aerospace & Defence 2002, repeated at Fighter Meet 2005 at AFB Makhado. See Super Mirage F1 AZ.

Mirage F1 AZ / CZ Ordnance.



Information in this section was sourced from public records, leading publications and static exhibits accessible to the general public.

Note: The SAAF remains tight lipped over the exact details of ordnance as used on the Mirage F1, especially during the Border War. If you can contribute photos, please contact [IPMS SA](http://www.ipmssa.za.org) - full credit given.

Auxiliary Fuel Tanks:

The Mirage F1 AZ and CZ used both the standard French type centre line and underwing auxiliary fuel tanks. However, the centre line fuel tank was not popular with pilots. The AZ carried the underwing fuel tanks on most missions, during the Border War. Later in the 14 bomb configuration, the main underwing bomb dispenser, contained an integral fuel tank. This fuel/bomb rack combination is specific to the AZ in the 14 bomb configuration.



F1 CZ with centre line auxiliary fuel tank.



F1 AZ with under wing auxiliary fuel tanks. This could also be fitted to the CZ. This is another typical Border War configuration - 6x iron bombs, 2x underwing fuel tanks and 2x V3B missiles.



The latest underwing bomb rack as used in the 14 bomb configuration, use a underwing bomb dispenser unit, with integral fuel tank. Only the AZ carried this type of dispenser.

Iron Bombs:

A wide variety of dumb ordnance may be carried by all Mirage F1 variants, in both 125kg and 250kg iron bomb types. Despite the F1CZ being designed as an interceptor, it was also used as a "mud mover" during the Border War. South Africa developed a wide variety of fuses, explosive charges etc. highly effective against specific threats. Also, a wide variety of cluster bombs were locally developed.



Boosted Iron Bomb.



Retarded Iron Bomb.



The centre line bomb rack can accomodate 4 Mk81 (125kg) or Mk82 (250kg) bombs. Note that the two bombs at the back, hang 5 degrees nose down.



PGM - Precision Guided Munitions:

In the last stages of the Border War conflict, the SAAF used indigenously developed PGM (Precision Guided Munitions) munitions including TV Guided Bombs. The first generation of this type was the so called "H2" glide bomb, which could also be delivered by the F1 AZ. A small TV sensor signalled the glide path back to the delivery aircraft. The pilot used a small joystick control to steer the H2 to its target. The SAAF did not use Laser Guided Bombs during the Border War conflict. This capability was however operational soon after hostilities had ceased, but too late for the Border War conflict. I am looking for info on the H2 - If you can contribute, please contact [IPMS SA](#).

Air to Air Missile:

See also the Cheetah Ordnance article:

Early Missiles:

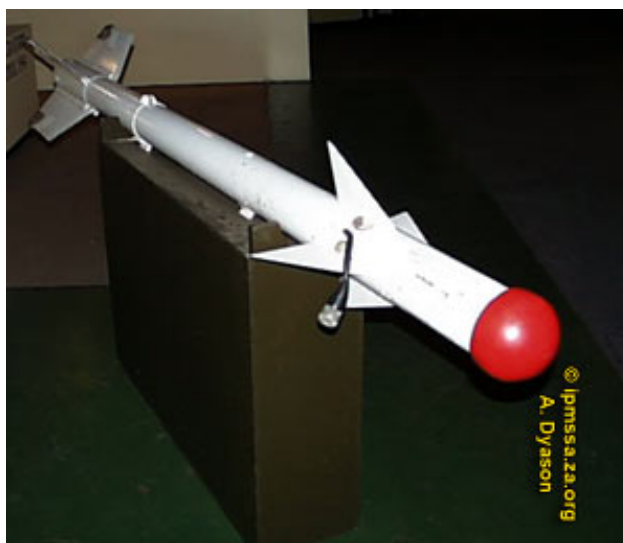
The first air-air missile in service with the SAAF was the MATRA R550 "Magic" followed by the MATRA R530. There are some reports that suggest a small number of early Sidewinders were also in service. Air to Air missiles were incorporated into the F1 CZ from its very first day in the SAAF. In the early days, for short range the Infra Red guided, Matra 550 was used. For longer range the radar guided, Matra R530 was used. However, R530 proved to be unsuitable for the demanding conditions in terms of war in Africa. Due to the number of problems experienced, the R530 was not used in the Border War area after the initial testing phase. It was also withdrawn from use within SA. The F1 CZ could carry two R530s on both inner wing pylons. Normally only one R530 was carried on the centre line pylon. The R550 was also found to be ineffective in the Border War (See "Vlamgat" by D. Lord for more info) and the development of locally designed air-air missile started in 1969 at the NIDeFR (National Institute of Defence Research) by reverse engineering a Sidewinder's IR sensor. The first missile attempt were known as the V1 - similar in appearance to the AIM 9B. From this attempt the V2 emerged and a local high tech company "Kentron" (today part of the DENEL group) was formed.



Matra R550 on Mirage F1CZ.



Matra R530. Used on early Mirage III and F1CZ.



Similar to V1A or AIM 9B.



New High Tech Generation:

The first practical missile was based on the R550 due to the numbers already in service with the SAAF. A new air-cooled IR seeker was developed which could be slaved to an indigenous developed, pilot helmet-mounted sight. This system offered the pilot the capability to achieve off axis missile lock-on. This missile was known as the V3A and entered service by 1978 for initial use by the F1 AZ and Mirage IIIs. It seemed Kentron was on the right track and work started almost immediately on the V3B "Kukri". The B model introduced a new improved rocket motor, new more sensitive IR seeker, better discrimination of the intended target and more resistance against counter measures. The helmet-mounted sight was improved with even larger off axis missile lock-on capability. The V3B has a unique profile which incorporated shaped canards. It was effectively a tail aspect missile with maximum range of between 2 - 4 km, which is the length of a commercial runway! It entered service from 1982 and was the standard missile used in the Border War and even saw service on the early Cheetahs. Greater range and all aspect capability were urgently needed, but everything needed to be developed from scratch due to the arms embargo. The next generation was the V3C ("Darter") and the profile looks similar to the later MATRA Magic. The previous missiles used moving canards, but the C model used moving elevons. Maximum range was increased and was the first air-air missile with genuine all-aspect capability, with the use of a high-tech IR seeker. Due to the delivery period, and as an interim measure, an all aspect missile, called the "Snake" was aquired, but arrived in the final few weeks when hostilities came to an end in the Border War. On the V3C the designator limits of the



V3B top, V3A middle, AIM 9B bottom. Note: different launcher rails.



AZ firing a V3B missile.

helmet sight were increased further while the seeker head had both bore sight and seeker modes. The missile used digital systems with "smart" capability. Various algorithms are pre programmed to increase the chances of a kill and not simply home in on the hottest spot. A 16-kg fragmentation warhead is used and is lethal out to a radius of 7m. The V3C was for many years the backbone of SA's air defence capability and saw extensive service on the Cheetah and Mirage F1 CZ / AZ. The missile was too late for the Border War and the first generation of the V3C entered service in the early 90s. Kentron managed to constantly improve the missiles with newer technology components and the final version of the V3C was renamed the "U-Darter". This version first entered service in 1997 as the standard short range missile with a range of 8km. All the air-air missiles so far were essentially WVR (Within Visual Range) missiles. Due to lessons learnt in the Border War conflict, the SAAF set out on a programme to offer BVR (Beyond Visual Range) missiles to its fighters. As an interim measure the V3S was developed utilising key components from the Rafael Python 3 and Kentron V3C missiles. But this missile arrived in inventory after hostilities ceased in the Border War and was thus not used operationally. This missile was fully integrated on the F1 AZ. The next missile considered came as a result of the possible upgrade of the SAAF's F1s with the Russian SMR-95 engine. The missile considered was the AA-11 Archer. Initially this missile was named V3P but in the end this was only a feasibility study and the whole project cancelled. This was also due to the CZ retirement, the cancellation of the Russian engine project and the new V4 missile already under development. However the V3P was for specific use on the F1CZ and possibly later the AZ. The V3C and "U-Darter" were followed by the V4 or "R-Darter" and entered production in 1994 as a 4th generation missile. This high tech missile gave the SAAF a very capable BVR (Beyond Visual Range) capability. Although the SAAF's BVR capability is supposed to be on the classified list, this aspect is highlighted in the report in "SA Soldier" published in 2002. As the V4 has sophisticated BVR, look-down / shoot-down capability, it offered the SAAF a strategic capability very few other air forces had.



V3C missile.



U-Darter on Mirage F1CZ.



F1 AZ with V3C missiles and dropping an anti infra

Further the missile may be launched in either of two modes: LOBL ("Lock On Before Launch") or LOAL ("Lock On After Launch"). Even more exceptional: this capability existed in the SAAF for a number of years, but is only now considered essential for future fighter aircraft. However this missile was not used on the F1. The V4 will also be used by the Gripen in SAAF service.

red decoy flare. Note unusual colour scheme on nose.



Cannon:



All Mirage F1s retain the twin internal DEFA canons similar to the type used in the Mirage III. The cannons received some local modifications and component upgrades. This cannon type is credited with two MiG 21 kills during the Border War conflict.

Reconnaissance:

During the time of the Border War, the SAAF used almost every fast jet aircraft for various aerial reconnaissance tasks. Aircraft used in this role include the Buccaneer, Impala, Mirage III and the Canberra. France have used the F1 CR as it's primary tactical reconnaissance aircraft for a number of years. However, the SAAF did not use the F1 in this role.

Air to Ground Ordnance:



Both the F1 AZ & CZ could be fitted with the Matra F4 68mm rocket pods. These pods house 18, 68mm rockets. Normal load was four Matra F4 pods with a centre line fuel tank. This configuration was unpopular with pilots due to high drag. The standard air to ground missile used by the SAAF was the Nord AS 30, with the AS 20 used as a training round. This missile could only be carried by the AZ, which use a special antenna, to steer the missile. This is mounted just ahead of the twin ventral strakes on the bottom of the aircraft. Although highly effective against anti aircraft installations, the missile was not popular with pilots, due to the method of delivery. The pilot has to steer the missile to it's target, which leaves the AZ vulnerable to other anti aircraft systems.

An AZ in typical later Border War configuration. Centre line 4 bomb MER, two under wing drop tanks, additional two bombs on the outer under wing pylons and two wing tip mounted V3B missiles. In front of the aircraft is the Nord AS 30 missile. Note the AS30 antenna ahead of the ventral strakes.

Counter Measurers:



Chaff & flare dispensers were housed in a slightly modified ventral strake on both the AZ & CZ.

During the Border War conflict the SAAF faced one of the world's most advanced air defence networks. Modern anti aircraft systems comprised, high tech missiles (infra red & radar guided), wide area radar coverage, short range radar, and the latest anti aircraft guns. The SAAF adapted, and subsequently the SAAF pilots emerged as one of the pioneers of modern low level flying tactics to avoid anti aircraft systems and for ordnance delivery. But this aspect alone could not guarantee success in every aspect. First to be used in the war against the anti aircraft systems were the use of Threat Situation Indicators with the use of Radar Warning Receivers. On going development of these systems led to SA as a leader in this area with the latest systems exported and in use in a number of foreign Air Forces. But as the pilots point out, the early variants of these systems were rather a device that indicated how quickly you are about to die. The next step was the use of effective passive counter measurers. Especially on the F1 this was a priority and the first chaff & flare systems were installed in the ventral strakes at the bottom of the aircraft. The dispensers were mounted in a slightly modified ventral strake, which is a bit wider if viewed from the front with reduced vertical dimensions. This had the added advantage that this capability of the SAAF could not be easily recognised from intelligence photos. However only a



An additional two chaff & flare dispensers may be fitted between the fuselage and inner wing pylon.



The first type of active counter measurers were housed in a special pod mounted on the outer under wing pylon.

limited number of dispensers could be carried. In order to increase the number of dispensers, a new dispenser was developed, which is fitted between the fuselage and the first inner wing pylon on both wings. This new dispenser was not used during the Border War and appeared at Sqdn level shortly before the AZ was retired. The ventral strakes with integral dispensers were retained. The next step was the development of Active Counter measurers. This was developed in record time and housed in a special pod, normally carried on the outer under wing pylon. These systems were highly effective during the Border War, despite teething problems. The latest systems are in use on the Cheetah C, but the SAAF has not released any specific details. To this day the SAAF is highly respected for it's capability to mount effective air support, air defence and counter air operations during the Border War - despite the advanced air defence network in use against the SAAF, at the time.

Lt. Bomba defects to South Africa.



Compiled by A. Dyason, original article D. Cooke, top photo 1 Sqdn (H. Potgieter).

Lt Adriano Francisco Bomba of the Mozambique Air Force took off from his air base outside Maputo at about 09H00, on Wednesday, 8 July 1981. The flight should have been a routine navigational training flight, but turned out to be a severe test of South Africa's early warning systems and our fighter aircraft's capability to counter foreign

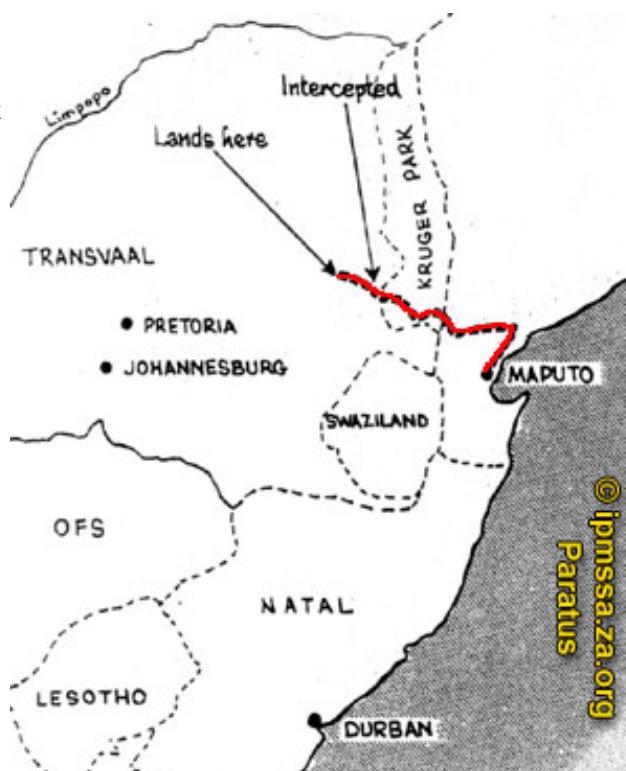
hostile threats. At the time, the "war" was perceived to be quite a distance away; being the northern border of what is today, Namibia. South Africa had by Western standards, one of the world's most sophisticated radar defense networks, capable of early detection of any hostile aircraft that could attack the industrial hart land of the PWV (today Gauteng).



Protection of the Pretoria - Johannesburg area was the radar network's number one priority. The initial system was developed with the help of Marconi and consisted of a number of radar installations at strategic locations, to cover the whole northern sector of South Africa. Even more remarkable, South Africa had one of the world's first computer based systems, capable of automatically detecting hostile threats and directing interception aircraft to the threat. This system was fully operational one year, before a similar system was installed for the use of NATO in Western Europe. The backbone of the SAAF's interception force was for a number of years the venerable Mirage F1 CZ, of 3 Sqdn, based at Waterkloof AFB. Two of these aircraft were on permanent standby, fully armed and systems kept at the ready, by ground equipment coupled to the aircraft. Pilots took turns in the readiness room. If the Northern Defense network detected a suspicious "blip", the standby F1 CZs would blast down the runway to intercept. The system was continuously upgraded over the years with ultra sophisticated equipment all locally manufactured and today cover the whole of South Africa, with the primary interception aircraft being the Denel Cheetah C.

The flight for asylum:

However, Lt. Bomba flew normally as far as Manhica, north east of Maputo and then turned north to the small town of Xinavane after which he dived to treetop level and headed due west for the South African border as fast as safety would allow at that altitude. About halfway to the border from Xinavane he followed the course, of the Massintonto River and crossed into South Africa at a point about 26 km north of Lower Sabie in the Kruger National Park. The MiG 17 crossed the Kruger National Park still at treetop height until reaching Mala Mala. Then Lt Bomba put his aircraft into a steep climb, levelling off at 22 000 feet to attract the SAAF's attention. To his amazement, after a few brief moments at 22 000 feet, two Mirage F1 AZs from AFB Hoedspruit, intercepted his aircraft - the Northern Defense network achieved it's primary goal, that being of detection of aerial threats and directing counter air operations. Two Mirage F1 AZs returning to base from a training exercise were diverted to intercept and investigate the unidentified aircraft and to take whatever action was necessary. Maj Pretorius said he and Capt Louw found the intruder without trouble.



Lt. Bomba's flight to South Africa in a Russian MiG 17.



Lt. A. Bomba of the Mozambique Air Force.

"At first, I could not believe my eyes when I saw the sky blue MiG with a Mozambique symbol. Not every day do you see a Russian plane flying over your home territory," he said. The MiG had been flying at about 900 km/h when intercepted about 40 km inside South African territory. South African pilots sent to investigate the unidentified aircraft flying at 22 000 feet, were ready to shoot it down when they recognised it as a MiG 17. But they held their fire when they realised that the pilot had no aggressive intentions. Unbeknown to the SAAF pilots. Maj F. Pretorius and Capt H. Louw, both of 1 Sqdn, the young Mozambican pilot was making desperate attempts to contact them by radio. But he did not know the correct frequency. The SAAF pilots made eye to-eye contact with Lt Bomba and, with an exchange of hand signals according to international procedure, instructed him to accompany them to their home base at Hoedspruit. Once the MiG was on course for Hoedspruit, Capt Louw took up a position where he could keep the aircraft in his sights while Maj Pretorius kept both aircraft covered from further behind to protect his colleague against surprises from behind. In case this MiG turned out to be the first of a much larger fighter force. Over the air base, the Mirages lowered their undercarriage and the MiG did the same and landed after the first Mirage. Capt Louw had to land first due to his low fuel reserve and the MiG did one more circuit with Maj Pretorius before landing at Hoedspruit. When he landed at Hoedspruit, Lt Bomba opened his canopy and announced to the party of SAAF Officers who met his aircraft that he wanted political asylum in South Africa. This was at 10h29 on July 8, less than half an hour earlier; Lt Bomba took off from Mozambique. In the fighter pilot's world things happen at a brisk pace. By this time, communication lines between the air base and Pretoria were already humming and the Mozambique Air Force was beginning to wonder what was keeping Lt Bomba ... A few hours later, the 23 year old Mozambique Air Force pilot told a crowded Press conference at the air base that he had come to South Africa because he did not agree with Frelimo policy. He spoke good English with a slight American accent. He was immaculately dressed in his Mozambican camouflage uniform, with brass lieutenant pips on his shoulders.

"In Mozambique after six years of independence, I can't see progress. The way of life in Mozambique is getting worse and worse and I am tired of this and so I made up my mind and decided to come to South Africa and ask for political asylum. When I arrived here in South Africa I was very well received and I am happy with that," he said. "The reception these gentlemen gave me - very good - and I feel myself to be all right here." "Now you must excuse me, you see, I look nervous, don't I? I am tired so excuse me." The SAAF was adamant that a Mozambican pilot would not fly the MiG out from the top secret Northern Transvaal (Mpumalanga) base. In the end the MiG 17 was thoroughly evaluated and even flown by SA test pilots and fighter pilots. The aircraft was even displayed at a SA airshow, before it was returned to Mozambique, by road. South Africa was not in a state of war with Mozambique, but opted to look after Lt. Bomba. However, various SAAF bases were on full alert due to the uncertainty of the action, Mozambique would take. But the incident was resolved peacefully with the return of the MiG 17 by South Africa.



Maj Pretorius and Capt Louw of 1 Sqdn.

The condition of the MiG 17:

The aircraft was painted in an overall grey blue colour with markings as per the drawings by Dave Cooke. SAAF technicians at Air Force Base Hoedspruit were not impressed by the state of the Mozambique Air Force MiG 17 used by Lt Bomba to fly to South Africa. On landing it was found that the 37 mm Nudelmann-Suranov NS-2 cannon - the MiG's main armament was jammed. The other two 23mm Nudelmann-Rikter VY cannons were loaded. The tyres of the main undercarriage were worn and should already been replaced. The most striking visual evidence of the maintenance standards at the home base of Lt Bomba's MiG Squadron was the state of the 400 litre drop tanks fitted at half span under each wing. Both tanks had been used as steps and had large dents.



External fuel tanks showed signs of being used as convenient steps.

The tanks would have been condemned and removed in any air force with high maintenance standards and the ground crew responsible would have been ordered to stop this practice. That the tanks had not been removed and the dents had obviously been made over long period made technicians at AFB Hoedspruit shake their heads in wonder. Although the cockpit was typical Russian, it was in a surprisingly good condition.

The Mozambique insignia:

The meaning of the symbols in the insignia of the Mozambique Air Force MiG 17 intrigued many who saw it close up for the first time at AFB Hoedspruit. The symbols, also incorporated into the flag of Mozambique, represent Industry (a gear wheel), Revolution (an assault rifle), Education (opened book), Agriculture (a hoe) and Marxism (a star).

In the end South Africa's early warning systems came under the spotlight as being highly capable and ultra sophisticated. The fact that the MiG was intercepted only 40 kms into South Africa, fuelled speculation that the aircraft must have been tracked from a considerable distance while still in Mozambique. But the SAAF never confirmed the speculation and remains tight lipped over SA's early warning network to this day. The MiG was not a great "catch" in terms of technological systems fitted to the aircraft. In fact it highlighted a far simpler aspect, namely camouflage. SAAF pilots that flew the aircraft remarked on the effective camouflage (at altitude) and this aspect highlighted the ineffectiveness of the SAAF camouflage schemes then in service on the fighter aircraft. This aspect and operations in the Border War area led to the current toned-down camouflage patterns in use by the SAAF.



Please note: No one seems to know what happened to Lt. Bomba - apparently he later returned to his home country, to fight the regime and was subsequently killed in a fire fight. But could not confirm this. If you have more info - please contact [IPMS SA](http://ipmsa.za.org). Also looking for the serial numbers of the Mirage F1 AZs flown by Maj Pretorius and Capt. Louw. Please accept my appologies for the poor condition of some of the photos, but the incident happened more than 20 years ago.

Mirage F1 CZ colour schemes and markings.

Original article N. Scheltema, former AZ driver & AZ display pilot. Additional, D. Cooke, J. van Zyl, A. Dyason, other F1 pilots and ground crew (anonymous).

The colours and markings used on the SAAF Mirage F1 CZ and AZ are often inaccurately quoted. In my research it was striking to note how many publications are inaccurate. Unfortunately this is also true of publications that appeared in recent years.

Please note:

- Unlike claimed by leading publications, there are distinct differences between the various colour schemes as used on both the AZ and CZ. The pattern is not the same for all the F1s that were in SAAF service.
- 'Light Admiralty Grey' does not actually exist in the SAAF. Light Grey was applied to the first few Mirage III and F1 types. But this was changed at a very early stage, to a colour that closely resembles Humbrol 65. Most photos were taken when the F1 entered service with the SAAF and thereafter photos were banned due to the classified nature of all operational aircraft. It is therefore assumed that the early photos reflect the entire time frame that the original colour schemes were in use.
- The SAAF never used paints based on the FS system, but these could be used with some colour tuning, to

obtain the correct shade for modelling purposes.

Mirage F1 CZ - Original colour scheme:



Examples of the original F1 CZ colour scheme based on the std. French pattern. Note fuel tank in Natural Metal.



Note the differences in the camou pattern. Although similar in general layout, some F1s had distinct differences. Note entire radome in matt Black.

The original colour scheme of Buff and Green was based on the standard French pattern. Most CZs were painted to a gloss finish in France. In SAAF service the finish was changed to a satin finish and later some examples were even seen in matt. The "brown" is not Sand, but rather a Mid Buff (closely a bit lighter than Humbrol 63) while the Green is original Olive Drab, with a slight Brownish tint added. The brownish tint is less than what was used on the Mirage IIIs & Sabres. The best hobby colour for the Green is Matt Olive Drab (Humbrol 66) and not the FS hobby equivalent. For a few years the CZs were painted in Light Grey on the undersides, but due to the vast blue skies found in sunny South Africa this changed at a very early stage. The Light Grey is similar to Light Aircraft Grey (FS 36495), but with a minute dash of mid blue added. Due to the ineffectiveness of the Light Grey the underside colour was changed to a colour that closely resembles Humbrol 65. The Light Grey was also changed on the Mirage III. The pattern contains sharp demarcations between the three colours used on the aircraft. A number of differences in the actual pattern have been noted in particularly on top of the wings and to rear of the aircraft on the starboard side. Refer to actual photos of the aircraft you intent to model. See pg 42 of "Aircraft of the SAAF" by H. Potgieter, the photo shows the top view of the early F1 CZ pattern, in perfect 1/48 scale!

The anti glare panel was in Satin Black with the radome in matt Black. Sometimes the anti glare panel was also finished in matt Black. Most F1 CZ s had the entire radome in matt Black, but at one time, some had the bottom fuselage colour painted in a narrow triangle towards the pitot, at the bottom of the radome. Antennas incorporated into the vertical fin were painted matt Light Grey, with a semi gloss White leading edge on the top part of the fin. The antennas on the spine were painted in matt Yellow with a Yellow Gold tint. Later the spine antennas were changed to Mid Buff (Humbrol 63). The brake parachute housing was in Light Grey, but some



The entire radome is not finished in matt Black on this CZ. Also note the intricate flaps, slats and all moving tail plane - all contributing to the success of the design.

examples were in Natural Metal. Just ahead of this housing is small band in Natural Metal. The antenna on top of the brake parachute housing was also in Light Grey, while the horizontal VOR antenna at the top part of the fin was in matt Light Grey with front and side edges in semi gloss White. The ventral strakes were painted in the same colours as the camouflage pattern on the outside while painted Light Grey or Humbrol 65 in later years on the inside. Drop tanks were in the same camou pattern or in Natural Metal. Throughout the F1 service life with the SAAF, the undercarriage and wheel wells were in Duraluminium or a darker shade of aluminum. The same applies for the rear of the fuselage which was left in the various shades of natural metal. The pitot and environmental probes were all in Natural Metal.

Markings used in the original scheme:

Similar to the Mirage III then in service. Blue and white bordered Castle with leaping gold Springbok insignia in standard SAAF six positions. Note the Springbok leap towards the fuselage on the top and bottom of the wings and towards the nose of the aircraft on the side of the fuselage. The rudder was painted in the colours of the Republic with Orange facing forward, followed by White and then blue. Most had the words "Avions M. Dassault" applied on the bottom of the rudder. No 3 Sqdn badge was towards the top of the fin on both sides. The serial number was carried in matt Black ahead of the tail plane on both sides of the rear fuselage and on the front undercarriage door. The servicing walkway areas on top of the wings were in Matt Red, including the lines indicating the wing to fuselage join and the flap and aileron to wing separation.



The following were in similar style as used on the SAAF Mirage III:

- Ejection seat warning triangles were in red and white, while the emergency

canopy release was in Yellow with instructions in White.

- Servicing stencils.
- Mirage F1 CZ in matt Black.
- All access points to open inspection panels were in Matt red.

Mirage F1 CZ - "Air Superiority" colour scheme:



le Spectre or Ghost, No 203 the first CZ painted in the Air Superiority scheme. Note MiG kill marking.



The first low viz colour scheme applied to the SAAF Mirages was on a Mirage III CZ no 802. Similar patters that are in use on the Cheetah C were used and effectiveness evaluated. This was mainly due to the colour scheme on the MiG 17 of Lt Bomba and operations in the Border War area. Experiments with no 802 led to the "Air Superiority" scheme of the F1 CZ, which Mid Buff and Green camouflage scheme was no help at altitude, during ACM (Air Combat Maneuvering). The first CZ to use the new low viz camou scheme was no 203 and this aircraft received the nickname "le Spectre" or French for "Ghost". The "Air Superiority" colour scheme comprises three individual colours: "Highveld Grey", "Mirage Grey" and "Intermediate Blue" or "PE Blue" in a distinctive matt finish. The closest FS number for "Highveld Grey" is FS 36251 Medium Grey and this colour was painted on the nose, both sides of the top part of the tailfin and to the upper and lower tips of the wings and the upper and lower tips of the tail planes. The closest FS number for the "Mirage Grey" is FS 36076 Engine Grey and this colour was used for the reverse diamond on the upper and lower mid section of the aircraft. This colour was also applied to both sides of the bottom leading edge part of the tailfin. The closest FS number for "Intermediate Blue" or PE Blue is FS 35164 Intermediate Blue or Humbrol 144 and the rest of the CZ was finished in this colour. Demarcation between the colours were a soft feather. The low viz pattern broke up the aircraft's outline, to cause confusion on the aircraft intended flight path to an observer of the aircraft. In the split second world of ACM, if your enemy hesitate for a moment, because he is unsure, it might just swing the scales in your favour. Photos exist of no 203 in



Bottom view of the low viz scheme.



For more realistic air-air combat training the number of 'bogey's were increased from 1 on 1, to two or even three. In order to distinguish the larger number of bogeys, the nose cone and tailplanes were painted matt white on the enemy aircraft.

the low viz scheme in the Border War area, during late 1981. The scheme's effectiveness was still evaluated and several feasibility sorties flown under actual combat conditions. Final effectiveness of the scheme was proven when "le Spectre" piloted by Maj Johan Rankin, shot down the second MIG 21. See page 202 of "The SAAF at War, by S. Bouwer & M. Louw" for photos of the CZs before they took off to intercept the MiGs. At the time 203 was the only CZ in the new scheme. However, not all the CZs received the new scheme, as the aircraft was used for strike missions, where it was reasoned that the Mid Buff and Green worked better at low level, than the low viz scheme. The antennas along the spine of the aircraft were painted in dark Yellow, but later appeared in the same colours as applicable to the particular area of the aircraft. However, at the time of the CZ's retirement, all the aircraft was painted in the new low viz scheme. Some time before the aircraft's retirement the CZs received a false canopy and false tailfin on the bottom of the aircraft in matt Black. The false tailfin has been largely overlooked by publications. Although three distinct colours are used in the "Air Superiority" scheme they quickly blend into each other due to the harsh SA conditions. When the colours blend the overall finish turn to be generally "bluer" in appearance. No 203 is today preserved at the SAAF Museum Swartkops. Another variation was used for ACM training. For more realistic air-air combat training the number of 'bogey's were increased from 1 on 1, to two or even three. In order to distinguish the larger number of bogeys, the nose cone and tail planes were painted matt White on the 'enemy' aircraft. Drop tanks were either left in Natural Metal or painted in Intermediate Blue.

Markings used in the Low Vis scheme:



One notable variation on the CZ toned down markings, is the striped outlined Castle Insignia. This appeared on CZ no 203 during 1982. See also the gallery.



As part of the striped outlined Castle insignia, the serial number also appeared in this striped outline.



Oversprayed National Insignia and markings.

Initially no 203 carried hardly any markings at all, except for ejection seat warning in a heavily toned down or over sprayed marking. But later the low viz CZs received National Insignia and markings, which was over sprayed in the same colour depending in which area the marking was applied on the aircraft. At times various variations in the markings as applied to CZs have been noted, including a stripe outlined Castle insignia. As far as could be established, no 203 was the only CZ that carried the striped outlined Castle and serial number. On this particular CZ no Sqdn markings were carried at the time. Also the aircraft was not fitted with RWRs.

The striped markings appeared during 1982. The CZ does not carry the serial number on top of the intake as claimed by some publications. Also no matt red stripes along the spine, only the diagonal stripes are used. All "Air Superiority" CZs carried the name of the last pilot assigned to the particular aircraft, when the type was withdrawn from service. This was in matt black at the bottom of the front left and front right windscreen. The names were NOT over sprayed. Pilot names were not carried during the Border War. CZ no 201 is the only CZ, which carried the name of the pilot in an odd font, size and a yellow colour at the aircraft's retirement. 201 was the personal aircraft of the last OC of 3 Sqdn, Kmdt Willie Hartogh, when the Sqdn closed down. Both 213 and 203 retained the MiG kill marking on the port side of the aircraft. The serial number was carried in matt Black ahead of the tail plane on both sides of the rear fuselage and on the front undercarriage door. The serial number on fuselage side was over sprayed, but not on the front under carriage door. With the false canopy applied, the serial number on the under carriage door was applied in matt Light Grey/White. After the CZ's retirement from SAAF service, at least two CZs remained flying with the SAAF. These aircraft were used for system testing and for development work on the V3S & V3P missiles. No 205 is credited with a high speed drone kill, illustrated by an appropriate marking. This was achieved by Col Des Barker, at the time, chief test pilot for the SAAF. No Sqdn markings were applied to this aircraft.



Not only a false canopy, but also a false tailfin at bottom of aircraft.



Antennas were initially left in Chrome Yellow primer, but later also painted in same low viz colours.



201 is the only CZ, that carried the name of the pilot in this font, size and colour.



This aircraft achieved the 2nd MiG kill. The name of the pilot is the last pilot assigned to the aircraft, when the type was withdrawn from service. Preserved at the SAAF Museum Swartkops. CZ no 203.



One of the last CZs used for system testing, no 205. Aircraft is credited with a high speed drone kill.



Close-up of high speed drone kill marking.



MiG kill marking as applied to the original CZ colour scheme.



Angola Air Force insignia.

Mirage F1 AZ colour schemes and markings.

Original article N. Scheltema, former AZ driver & AZ display pilot. Additional, D. Cooke, J. van Zyl, A. Dyason, other F1 pilots and ground crew (anonymous).

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- The SAAF never used paints based on the FS system, but these could be used with some colour tuning, to obtain the correct shade for modelling purposes.

Mirage F1 AZ - Original colour scheme:



Example of the original F1 AZ and CZ delivery colour scheme with Light Grey on the underside. As can be seen from the photo, the Light Grey was a sharp contrast against the SA skyline and thus changed to a colour closely to Humbrol 65.



This is the correct colour for the AZ & CZ during most part of the original colour scheme's service life with the SAAF - closely Humbrol 65. The fairing between the ventral strakes was not used by the SAAF, only on the technology demonstrator aircraft, no 233 & 235.

The original colour scheme of Buff and Green was also based on the standard French pattern. The AZs were painted to a distinctive matt finish, even the ones that were painted in France. All the AZs arrive in matt except no's 239 - 247 as the last nine aircraft were flown from France to SA by C130s from 28 Sqdn, to prevent delivery refusal due to the rapidly approaching arms embargo against SA. Some areas of the last nine arrived unpainted, but were painted to a matt finish in SA at the spray paint facilities of SAA, the National airline. In SAAF service all the AZs remained in a matt finish, although No 229 appeared in a satin finish at one time. The "brown" is not Sand, but rather a Mid Buff (closely a bit lighter than Humbrol 63) while the Green is original Olive Drab, with a slight Brownish tint added. The brownish tint is less than what was used on the Mirage IIIs & Sabres. The best hobby colour for the Green is Humbrol 66 (Matt Olive Drab) and not the FS hobby equivalent. For a few years the AZs were painted in Light Grey on the undersides, but due to the vast blue skies found in sunny South Africa this changed at a very early stage. The Light Grey is similar to Light Aircraft Grey (FS 36495), but with a minute dash of mid blue added. Due to the ineffectiveness of the Light Grey the underside colour was changed to a colour that closely resembles Humbrol 65. The Light Grey was also changed on the Mirage III. The pattern contains sharp demarcations between the three colours used on the aircraft. A number of differences in the actual pattern have been noted in particularly on top of the wings, to rear of the aircraft on the starboard side and behind the starboard air intake on the side of the fuselage. Refer to actual photos of the aircraft you intent to model.

The anti glare panel was in Satin Black with the radome in matt Black. Sometimes the anti glare panel were also finished in matt Black. Distinctive of the AZ, was the bottom fuselage colour painted in a narrow triangle towards the small radome above the pitot, at the bottom of the nose. Antennas



incorporated into the vertical fin were painted matt Light Grey, with a semi gloss White leading edge on the top part of the fin. The antennas on the spine were painted in matt Yellow with a Yellow Gold tint. Later the spine antennas were changed to Mid Buff (Humbrol 63). The brake parachute housing was in Light Grey, but some examples were in Natural Metal. Just ahead of this housing is small band in Natural Metal. The antenna on top of the brake parachute housing was also in Light Grey, while the horizontal VOR antenna at the top part of the fin was in matt Light Grey with front and side edges in semi gloss White. The ventral strakes were painted in the same colours as the camouflage pattern on the outside while painted Light Grey or Humbrol 65 in later years on the inside. Drop tanks were in the same camou pattern or in Natural Metal.

Formation of CZs & AZs. Note the differences in the camou patterns. On the CZs note the differences towards the rear and on the AZ just behind the air intake. Although similar in general layout, some F1s had distinct differences. Entire radome in matt Black on the CZ, while the AZ use the narrow pointed triangle towards the small radome on the nose, at the bottom of the aircraft. AZ does not carry Sqdn badges in this photo.

Throughout the F1 service life with the SAAF, the undercarriage and wheel wells were in Duraluminium or a darker shade of aluminium. The same applies for the rear of the fuselage which was left in the various shades of natural metal. The pitot and environmental probes were all in Natural Metal. Unlike the CZ, a few AZs retained the original colour scheme until the type's retirement, e.g. 229 & 233. Some AZs camou pattern differ on top rear of the aircraft, if compared to the pattern used on the F1 CZ.



Distinctive matt finish on the AZ.



AZ no 229 did however appear in this satin finish at one time.

Markings used in the original scheme:



AZ with the original Castle & Springbok markings.

Similar to the Mirage III then in service. Blue and white bordered Castle with leaping gold Springbok insignia in standard SAAF six positions. Note the Springbok leap towards the fuselage on the top and bottom of the wings and towards the nose of the aircraft on the side of the fuselage. The rudder was painted in the colours of the Republic with Orange facing forward, followed by White and then blue. Most had the words "Avions M. Dassault" applied on the bottom of the rudder. Note that No 1 Sqdn did not carry their badge at all on the aircraft during the early years, up until the type was publicly announced to be in service. The badge was then applied similar to 3 Sqdn, towards the top of the fin on both sides. Also note that by the time 1 Sqdn applied the Sqdn badge on the AZ, the bottom colour was already Humbrol 65. The serial number was carried in matt black ahead of the tail plane on both sides of the rear fuselage and on the front undercarriage door. The servicing walkway areas on top of the wings were in Matt Red, including the lines indicating the wing to fuselage join and the flap and aileron to wing separation.

The following were in similar style as used on the SAAF Mirage III:

- Ejection seat warning triangles were in red and white, while the emergency canopy release was in Yellow with instructions in White.
- Servicing stencils.
- Mirage F1 AZ in matt Black.
- All access points to open inspection panels were in Matt red.



A few AZs retained the original colour scheme until the type retirement e.g. No 229 & 233. Note the N. Insignia changed to the Castle & Eagle type.

Mirage F1 AZ - Interim Dark Earth, Dark Green colour scheme:



In typical late Border War configuration with 6 Mk 82 bombs, two underwing fuel tanks and two V3B missiles. This AZ is painted in the interim Dark Earth & Dark Green colour scheme.



Another view of the AZ in the interim colour scheme. Note that the antennas on the tailfin remained in Light Grey.

During the later stages of the Border War the colour scheme of the AZ was found to be ineffective. Especially if viewed from above, while flying at low level. This was realised during the debrief session, after a MiG 23 tried to engage a Mirage F1 AZ formation, on 25 February 1998. Major Johan Rankin took the decision to immediately over paint the Mid Buff colour of the AZ. The colour used was Dark Earth as used on the Impalas. This was roughly done in theatre and under conditions of war. Some of the markings were over painted. Later the green was changed to Dark Green (similar to FS Dark Green) also used on the Impalas. The Humbrol 65 colour was retained on the under side of the aircraft. Unfortunately there is no record of the numbers of the AZs so painted or the patterns used. Some aircraft that were repainted at Atlas during servicing were also painted in this scheme e.g. Mirage F1AZ 224. However, although this was done in 1998, on the cover of "Aircraft of the SAAF" by H. Potgieter, two AZs appear in the Dark Earth & Dark Green colour scheme. The book was first published in 1980.

Markings used in interim Dark Earth/Dark Green scheme:



On most aircraft the National Markings remained similar to the markings as used on the original colour scheme.

There is no official record of the last colour schemes as used during the Border War. This was done during a time of war and colour schemes were hastily applied in theatre. In general the National Markings remained the same as used in the original colour scheme. The markings were not normally oversprayed as was used on the CZ. Photos is just as rare, while stil the best source if you intend one of the experimental schemes of the AZ.

Mirage F1 AZ - Experimental colour schemes:



One of the experimental AZ schemes, based on the CZ Air Superiority scheme. Unfortunately the serial number is unknown. Note the absence of markings and antennas in the tail fin over painted in the same colour as used on the colour scheme. This could be No 243, but unable to confirm.

During the Border War period some experimental schemes were also flown and assessed. The current scheme of Dark Earth, Dark Green and Mirage Grey evolved from this. One experimental scheme was similar to the one used on the Mirage F1CZ but used only two colours, these being a mixture between PE Blue, Mirage Grey and Highveld Grey. The aircraft was Mirage F1AZ 243 and all stencilling and insignia were heavily over sprayed. This aircraft flew extensively in operations during the latter part of the war and a good photograph of this particular aircraft is available in the book "The SAAF at War" by S. Bouwer & M. Louw, page 225. A similar aircraft to the one above had the same colour scheme as the Mirage F 1 CZ but since the serial number was also over sprayed I was unable to confirm it. A photograph exists where the two grey aircraft are parked next to each other and confirm that the colours on the two are not the same. If you more photos of these colour schemes, please submit to [IPMS SA](http://www.ipmssa.za.org) - full credit given.

Markings used in the Experimental colour scheme:

There is no official record of the last colour schemes as used during the Border War. As far as could be established, all stencilling and insignia of the experimental schemes were heavily over sprayed to be almost invisible.

Mirage F1 AZ - Final Three Tone colour scheme:



AZ No 220 was the only AZ that used the final three tone colour scheme during the final stages of the Border War. Note the absence of Sqdn markings, the smaller National insignia and the antennas in the tail fin not overpainted.

From the Interim Dark Earth, Dark Green and the various experimental schemes evolved the last colour scheme as used by the AZ, the so called final Three Tone colour scheme. The scheme used Dark Earth, Dark Green and Mirage Grey. Only one aircraft, Mirage F1AZ 220 was used during operations in the Border War area, in this scheme. This aircraft flew extensively during the final stages of the Border War, where the scheme was found to be highly effective. There are small differences in the actual pattern used on different aircraft. One noticeable



This photo was taken shortly before the type retirement. Note the pristine condition of the aircraft, due to high maintenance standards of the SAAF, despite the aircraft having survived a war.

area is the waves on the side where the Grey meets the rest of the cammo. The cammo pattern used in the last AZ three tone scheme differs slightly on the top rear of the aircraft if compared to the original CZ & AZ patterns. It is not the same as the original pattern as claimed by most publications. Interesting to note that by 1990 no two AZ had similar three tone patterns. In particular, No 231, with no Dark Green patch on the front part of the nose. No 227 has a non standard pattern on the top of the tail plane. Some aircraft colour schemes were corrected, to the acceptable standard but most remained with small differences until their retirement. The most accurate drawings of this scheme can be found on this Website, drawn and thoroughly researched by Dave Cooke - see AZ drawings.



AZ no 231 - note the absence of the front Dark Green patch on the nose.

For the last 3 tone colour scheme of the AZ, the colours are Dark Green and Dark Earth from Humbrol. The Blue-Grey does not exist as an off-the-shelf hobby colour. However, this colour quickly faded in the harsh SA sunlight. The closest colour to this faded shade is RLM75 with a bit of colour tuning. Drop tanks were camouflaged in the similar three tone pattern as used on the aircraft. The only variation on the final scheme was used for ACM training. For more realistic air-air combat training the number of 'bogeys' were increased from 1 on 1, to two or even three. In order to distinguish the larger number of bogeys, the nose cone and tail planes were painted matt White on the 'enemy' aircraft.

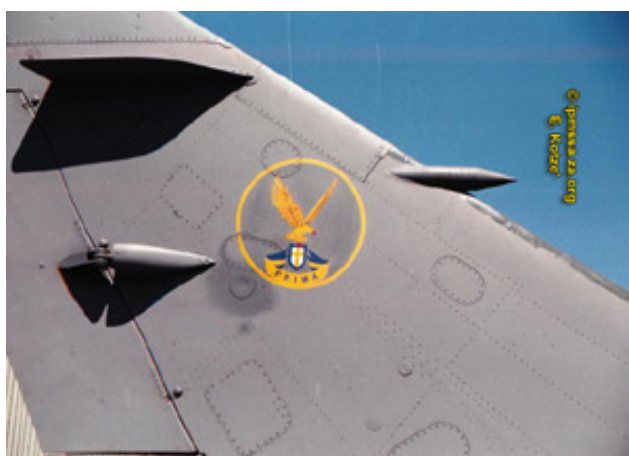


AZs during one of the final ACM camps with enemy AZs in white noses and tailplanes and the friendly AZs. During this camp the Cheetahs also attended and at least two AZs earned the nickname CheetahEater.

Markings used in the final Three Tone scheme:



Example of the last type of National Insignia as used on the AZ.



Final version of the 1 Sqn badg.



Mirage F1 AZ logo and ejection seat warning in matt Red.

The stencil markings used on the AZ as part of the final scheme, are the standard NATO markings and are in a dark Grey. One possible way to portray these is to use Black USAF or US Army decals and lightly over spray them with the cammo colour. The NO WALK areas on the wing and tailplane are demarcated with lines and are done in the same colour. Another feature of the new cammo is the use of strips of protective paint on the intake and tailplane leading edges, also in dark Grey. The Castle National Inignia on this cammo also differs from aircraft to aircraft. Some were the standard SAAF colours, others were the standard colours but heavily over sprayed and some were in low vis style outline only. All the other markings were applied in the toned down dark Grey colour. See the AZ drawing fro more info. Following a ACM camp with the Cheetahs, at least two AZs earned the nickname "CheetahEater" and this was applied to the side of the aircraft, below the cockpit windshield.



Following the movie TopGun, the SAAF also applied the pilot's call sign, at times to the fighter aircraft.

Mirage F1 AZ - Other colour schemes:



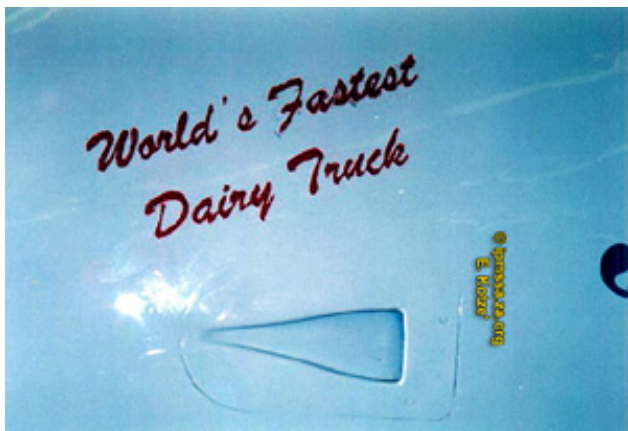
Avionic demonstrator, AZ no 235.



AZ no 233, used in the Citroen commercial.

At least two non standard SAAF combat colour schemes were used on the AZs. The first was a colourful, various shades of blue on AZ no 235, the avionic demonstrator. This aircraft is also known as the "World's Fastest Dairy Truck" due to the colour scheme. Colours used were Light Sky Blue, Dark Blue and White. See Milk Truck for more info. The other colour scheme was used for the Citroen commercial. AZ no 233 (exTFDC) was painted in a Dark Blue shade on top of the fuselage with a Light Yellow pin stripe. Light Yellow was also on the tips of the wing and tail plane. The bottom of the fuselage was painted in Light Grey. See Citroen for more detail. In both cases the aircraft was finished to a gloss finish. The small radome was painted in matt Black. Antennas on the tail fin were painted in matt Light Grey.

Markings used in the Other AZ colour schemes:



World's Fastest Dairy Truck logo applied to AZ no 235.

The "World's Fastest Dairy Truck" used standard SAAF Castle & Eagle markings on the sides of the intakes. "Mirage F1AZ" logo on sides of fuselage, under cockpit windshield was not in the original font and styling. The colour used was a Dark Blue. Ejection seat warning was in typical SAAF Mirage F1 styling, using gloss Red. On the port side, under the cockpit windshield, the aircraft's nickname "World's Fastest Dairy Truck" was applied in gloss Red. The emergency canopy release marking used gloss Yellow and gloss Black lettering. Servicing stencils were in gloss Black. On both sides of the tailfin the words "Avionic Flight Demonstrator" in gloss Black was applied near the leading edge. As small New National flag and the Denel logo with the words "Denel Aviation" can be found on the rudder. On top of the wing the wing/flap separator lines and "Keep Off" warnings were in the light Blue colour. Serial number in gloss Black. As far as I could established, the AZ used in the Citroen commercial did not use any markings.

Various

Mirage F1 AZ - No 235 "Fastest Dairy Truck"



See Colour Schemes for more info.

The highest level of technological advanced systems, developed by South Africa's local aviation industry are found

in the Rooivalk. Experienced gained in the Rooivalk's avionics, set the path for similar systems to be used in fighter aircraft. The systems were designed on a generic basis for easy installation into any fighter aircraft. A Mirage F1 AZ was used due to the small area available to house the new equipment. Further, the electrical outlet and cooling problems made the AZ a real challenge. In order to achieve a new high tech pilot office, futuristic systems were needed with very advanced HMI (Human Machine Interface). It is often reported that this was to be an upgrade for the other SAAF F1s then in service. But the project was only intended to be a feasibility study to ascertain South Africa's capability in this field. It would also be to SA's advantage if the local industry could provide local avionics for future aircraft. In doing so local currency would be preserved and significant progress would be made in high technology. A number of civilian companies were subcontracted under the main contractor ATE. The project was administrated by Directorate Engineering under Maj Dirk de Villiers of the SAAF.



Systems developed, included advanced GPS, GAINS (GPS Aided Inertial Navigation System), new mission computers with in flight update ability, entire glass cockpit instrumentation etc. Interestingly the aircraft was fitted with new EW sensors and even night formation strips. Part of the proposed upgrade was the fitment of the Martin Baker Mk10 ejection seat. This was however not fitted to the avionics demonstrators. A successful flight test programme was completed. Aircraft used in the programme were no 235 and later 233. Experience gained was incorporated into the cockpit instruments of the Pilatus Astra of the SAAF. In the end the SAAF did not select the avionics upgrade and decided on an entirely new fighter aircraft type. However, the Russian engine, avionics and new missile upgrades would've made the upgraded F1 a formidable modern aircraft. ATE did find a successful export customer in the Spanish Air Force. The entire Spanish F1s were upgraded by ATE with the new South African developed avionics during 2000.



AZ no 235 in the original intermediate colour scheme. Note night formation strip behind cockpit.

Mirage F1AZ, no 235 is known as the "World's Fastest Dairy Truck", due to the colour scheme of the aircraft. This aircraft was used as a technology demonstrator and for systems testing of a locally developed avionics suite. Currently on display at SAAF Museum Swartkops. However, the avionics suite and engine are removed from the aircraft.

SAAF F1 AZ stars in Citroen commercial.



Top photo: C. Hugo.

One of the SAAF's Mirage F1 AZs starred during 2002 in a TV commercial for Citroën. The AZ used was no 233 and painted in a special colour scheme. The aircraft was declared serviceable on 21 January 2002. Filming started on 22 January and ended on 23 January using a specially equipped Learjet (non SA). Flights were out of Waterkloof AFB in Pretoria. This AZ was not repainted and performed a few fly passes at Africa Aerospace and Defense 2002 at which time the commercial was also screened in South Africa. In the commercial the pilot actor wears the famous blue helmet of the "Billy Boys" with the callsign "Piranha" on the front of the helmet.



No 233 in used at TFDC.



No 233 with the paint scheme almost complete. The yellow stripe is not complete and the canopy still masked off.



No. 233 after it was declared serviceable. Filming of the commercial started the next day, 22 January 2002.



The Citroen C3.



I would like to thank C. Crous for submitting the photos to IPMS SA.

During AAD 2004 no 233 was one of the flying demonstrators - all to the delight of the crowd, as the F1 is very popular with the aviation enthusiasts. The colour scheme remained unchanged but received “AEROSUD” logos in silver on the fuselage and tail fin. Ejection seat warning markings in red and the most essential Mirage markings in yellow were also applied.

South African Super Mirage F1 AZ:



After the Border War, the SAAF went through a number rationalisation programmes. A number of aircraft types were retired. These included the Buccaneer and Canberra, which left a gap in the SAAF's strike capability. The SAAF set out a specification for a larger double seater with longer range in the strike role. But with the arms embargo still firmly in place this proved impossible and the requirement was cancelled.



Due to other upgrades completed successfully in the SAAF (e.g. Cheetah & Tp Dak) the possibility of upgrade was once again considered. If a newer more modern engine could power the AZ, the aircraft could continue to be a formidable strike aircraft. The other upgrade considered for the AZ included modern avionics using a glass cockpit layout. Engine of choice was the magnificent SNECMA M88 which power the Rafale. But France, bound by the UN's arms embargo could not supply the engine, to South Africa. Ironically the supplier of the new engine came from the same country which used to supply the SAAF's enemies with armament , throughout all the years of the Border War. This was none other than Russia. Although Russia also

The only photo released of No 216 while evaluated by the SAAF.

entered a new area, after the fall of communism. The Russian engine for the SAAF, was as a result of feasibility studies done by the SAAF for a future fighter aircraft. When the MiG 29 was evaluated on paper, the task team realised that the RD-33 Klimov engine of the MiG 29, could work in the Mirage F1 AZ. The first report of such an upgrade appeared in "Flight International" of January 1992. By that time secret negotiations between South Africa and Russia were already underway for a number of months.

The upgrade:

A big advantage of Russian equipment is price and the Russians delivered two RD-33 Klimov engines for installation in an F1 AZ and an F1 CZ. In exchange, a Mirage F1 CZ no 214 was flown to Russia for the fitment and feasibility study of the Russian engine upgrade. The project was therefore researched both in Russia and South Africa at the same time and this reduced the project turn around time. Most of the interfacing and ground tuning of the engine was carried out in Moscow by the Mikoyan and Klimov design bureau. Details were regularly exchanged between the South African and Russian teams to fit the engine also in South Africa.



The SMR-95 engine being installed in AZ No 216, by AEROSUD.



Ground test runs carried out in SA.

Local, high technology aerospace company, **Aerosud**, carried out the Russian engine upgrade.

The engine was lengthened and fitted with a new gearbox and designated SMR-95. The AZ converted was No 216 easily distinguished with the longer afterburner section. Initial tests were flown by Rick Culpan of Atlas (DENEL) aviation, during 1994. Later that same year Maj Viktor Parkhomenko of the Russian Air Force attended the F1 AZ conversion course and went solo on a SAAF F1 AZ. The other engine delivered was installed in a Cheetah D no 847, see Cheetah KB. The results were quite surprising, although the new engine only offered 10% more thrust; it was 350kg lighter, but at the same time consuming far less fuel. The performance achieved was very favourable with far less fuel consumption and it seemed that all the F1s would receive the upgrade, with the Cheetahs upgraded at a later date. No 216 was also displayed at SAAF 75 with a distinctive non-French sound. During this time the aircraft received the name "Super Mirage F1 AZ". Although the Mirage F1 was initially known as the "Super Mirage" in France. However, with South Africa entering the international arena once again after the new Government came to power in SA, the arms embargo was scrapped against SA. The SAAF therefore decided to cancel the Russian engine and the new AZ avionics upgrade and rather purchase new fighter aircraft. The Russian engines were removed and both the Super F1 AZ no 216 and Cheetah D no 847 were placed on static exhibit at the SAAF Museum Swartkops. Since then all the F1s have been withdrawn from SAAF service and offered for sale.

"Super F1 AZ" display in Russia:

It is believed that a number of foreign buyers started expressing interest in the SA F1s on offer for sale, due to the high price of new fighter aircraft. Apparently, the sale considered, specified that the Russian engine and avionics upgrade form part of the sale. Aerosud & DENEL removed the "Super F1 AZ" & Cheetah D no 847 and placed them on static display at Africa Aerospace & Defence 2000. Around the same time ATE from South Africa completed the avionics upgrade of the Spanish F1s. This avionic upgrade was initially developed for use on the SAAF's AZs. Cheetah D, No 847 went to DENEL and currently stored at AFB Waterkloof. However, the Russians saw potential in the F1s offered for sale and asked Aerosud to display the "Super Mirage F1 AZ" during the MAKS 2001 air show in Moscow. Another advantage is the AA-11 Archer already integrated on the AZ during the V3P trials (1995-1997). This was seen as an excellent co-operation between Russian and South African technology for the export market.

Aerosud re-installed the engine and revived the programme. It was completed in record time. No 216 was flown in a huge Antonov to Moscow. But this aircraft was not only on static display it was also displayed in a spectacular aerobatic display routine by one of DENEL's test pilots, Maj Blokkies Joubert, call sign "Cobra". In doing so he became the first Western pilot, to take part in a Russian air show. He was also flying a very unique aircraft, most probably the first Russian powered, Western aircraft, taking part in an air show in Russia. Maj Joubert, said the language was a huge barrier. Because no Western pilot took part in a Russian air show before, the air show controllers didn't speak English. An interpreter was used, but it still proved very difficult in the end. However, the Russians were suitably impressed by the South African and he was subsequently named as one of the top 10 best display pilots. He also received appraisals and a special award as the first Western display pilot, from President Wladimir Poetin. Indeed an achievement very few other pilots can put their name to.

Aerosud refined the upgrade on No 216 and the aircraft was displayed in spectacular fashion at Africa Aerospace and Defence 2002. Although a number of rumours are doing the rounds as to the buyer of the ex-SAAF F1s, this has not been confirmed or even if the F1s have in fact been sold. Currently, Aerosud uses three F1s for ongoing tests and project feasibility: No 216 as the flying demonstrator, No 233 as the avionic demonstrator (also used in the Citroen commercial) and No 227 as a static example.



No 216 as displayed at AAD 2002.

During the Fighter Meet at AFB Makhado on 08 October 2005, the Super F1 AZ was displayed by Blokkies Joubert saw the burner light up beautifully against the failing light. Blokkies Joubert was subsequently awarded the SAAB/BAe trophy for the most professional solo display.

Mirage 2000 or Rafale?



During SAAF 75 staged during 1995, a number of foreign aviation companies contended for the new SAAF fighter. Given the SAAF's excellent record with Dassault, it was quite a surprise when the SAAF announced the Gripen was selected as the future fighter.



The Mirage 2000 was displayed with 2 Sqdn badges.



2 Sqdn badge.

The first SAAF Gripen was rolled-out at the Gripen Factory in Sweden on 28 October 2005 and handed over to the SAAF. After initial flights in Sweden the aircraft will be shipped to South Africa to start flight trials at the Test Flight and Development Centre in 2006. It is hoped this aircraft will be one of the flying displays at AAD 2006 during September 2006.



First SAAF Gripen unveiled.

SAAF Mirage F1 Serial Numbers.

Following list compiled from "Vlamgat" by D. Lord & "African Airforces" by W. Brent. Revised and updated. All the SAAF F1s saw extensive combat in the Border War area. If you can contribute photos, please contact [IPMS SA](http://www.ipmssa.za.org) - full credit given.

CZ Serial Numbers:

Number:		Remark:
200		Project aircraft in France - last CZ type delivered. Aircraft written off on 15/02/79 after a slow flypast of F1AZ, 246's crash site. Pilot killed due to the seat's failure to deploy in time.

201		First F1CZ flown by a SAAF pilot, Maj Chris Lombard in France. Static display SAAF Museum Port Elizabeth. Aircraft of the OC, 3 Sqdn, Kmdt (Lt Col) Willie Hartog, when the Sqdn disbanded. Withdrawn from service.
202		Second F1CZ flown by a SAAF pilot, Cmdt Bossie Huyser in France. Withdrawn from service.
203		Withdrawn from service. Static display SAAF Museum Swartkops. Credited with 1 MiG kill. Last pilot name: Maj Johann Venter.
204		First type to be locally assembled by Atlas. First F1CZ flown by a SAAF pilot, Cmdt Bossie Huyser in SA. Withdrawn from service. After the type's withdrawel, the aircraft was placed on static display at SAAF Museum Durban. But the museum closed later. 204 to ThunderCity, Cape Town International for static display, on 27/01/02. Colours & stencilling incorrect on current aircraft.
		

205		Second F1CZ flown by a SAAF pilot, Maj Chris Lombard in SA. Partly written off on 08/02/85. During a Air-Air training mission, the pilot experienced severe engine fluctuations. During emergency landing at AFB Langebaanweg, the aircraft turned off runway and caught fire. Pilot safe. Fire was caused by a faulty ignitor jet. Later rebuild with components from 221 and 206 to return to operational use as 205. Used in missile trails of V3S etc. Currently allocated to Wits University, Aeronautical Department.
206		Written off on 27/09/87. Aircraft hit by either a AA-7 or AA-8 missile fired from a MiG 23 during a dogfight. Pilot displayed superior airmanship to nurse the aircraft home for an emergency landing at AFB Rundu. Due to loss of hydraulics, oil and brake parachute, the CZ overshot the runway - the subsequent crash caused the e. seat to fire. Pilot survived the ejection but as the parachute failed to open (Mk 4BS is not zero-zero) left him paralysed from the waist down. Tail section fitted to 205 to return to operational use as 205. See piercy.co.za for more info.
207		Withdrawn from service. Currently allocated to Stellenbosch University, Structure Laboratory, Department of Mechanical Engineering. Current photos of 207 during 2005.

		
		
208	Photo unavailable.	Written off on 04/11/80 near Groblersdal, due to a full upward runaway trim, during a night interception mission. Pilot ejected safely.
209		Withdrawn from service. Used with 205 in missile trails of V3S etc. Currently on offer for sale as part of the AZ group sale.
210		Withdrawn from service. Currently allocated to Pretoria University, Aeronautical Department.
211		Withdrawn from service.

212



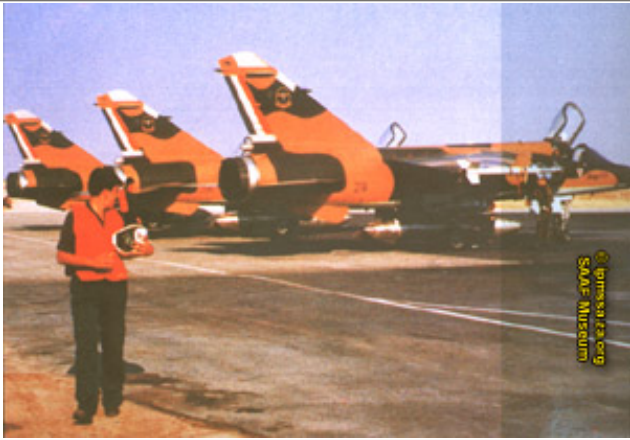
Withdrawn from service.

213



Withdrawn from service. Aircraft scored the first MiG kill in the Border War. It was first allocated to the CSIR, but moved to the SAAF Museum Ysterplaat instead. During its last flight to AFB Ysterplaat on 07/12/92, the aircraft covered the distance between Pretoria and Cape Town in 82 minutes!! Currently on static display at Thundercity, Cape Town International. Colours & stencilling incorrect on current aircraft. Last pilot name Kmdt Cobus Toerien.



214		Aircraft broken up for test fitment of the Russian engine during 04/92. Later scrapped.
215	Photo unavailable.	Written off on ?/86. Aircraft struck mountain ridge on low-level nav. exercise. Pilot ejected safely.

AZ Serial Numbers:

Number:		Remark:
216		First F1AZ flown by a SAAF pilot, Capt Gawie Winterbach in France and in SA. Fitted with Russian SMR-95 engine and displayed at SAAF 75. Failing SAAF interest the aircraft was moved to the SAAF Museum Swartkops on 22/12/97. However, during 2000 the aircraft was moved to Aerosud for the revival of the "Super Mirage F1AZ" programme as an export venture. Currently with Aerosud for engine and operational testing.
217		Second F1AZ flown by a SAAF pilot, Capt Andre van der Heever in SA. Withdrawn from service. On offer for sale. Used by the last "Billy" Lt. Col Jan Minnie for his solo display as part of the AZ retirement ceremony. Took part in final five ship display - last pilot name in yellow: Lt Kol Mienie "Billy". This was the last flight in SA by an F1 as part of the SAAF.

218		Withdrawn from service. On offer for sale.
219		Took part in AZ retirement ceremony. Static display. Withdrawn from service. On offer for sale.
220		Only aircraft used in the Border War that was painted in final three tone colour scheme. Aircraft used extensively in final stages of Border War. Took part in AZ retirement ceremony. Took part in final five ship display - last pilot name in yellow: Capt Spencer "Sandman". Withdrawn from service. On offer for sale.
221	Photo unavailable.	Written off on 23/07/85 at AFB Hoedspruit. Aircraft suffered fuel pipe problem. During the attempted emergency landing the aircraft crashed in spectacular fashion. Pilot walked away safely. Some components of this aircraft was mated to the front section of 205 and the aircraft returned to operational use as 205. The rest of this aircraft was later rebuild to fly as 221 again. It was written off on 05/02/92 after bird ingestion. The emergency landing attempt was unsuccessful as the aircraft crashed 1nm short of the runway. Pilot ejected safely.
222	Photo unavailable.	Written off on 04/04/85 at AFB Hoedspruit. Pilot ejected safely.

223	Photo unavailable.	Written off on 19/03/88. Aircraft crashed during low-level night operation in Angola. Pilot lost his life.
224		Written off on 09/06/93. During a low level bombing exercise the aircraft was damaged due to shrapnel. Pilot ejected safely.
225		Withdrawn from service. Took part in AZ retirement ceremony. Took part in final five ship display - last pilot name in yellow: Capt Williamson "Shotgun". On offer for sale.
226		Withdrawn from service. On offer for sale.
227		Withdrawn from service. Currently with Aerosud. On offer for sale.
228		Written off on 13/02/84 near Lydenburg. Pilot got lost during bad weather, with malfunctioning instruments. Pilot ejected safely.

229		Withdrawn from service. 229 was for many year the 'mascot' of 1 Sqdn. This aircraft performed the last public display of the AZ at the Silver Queen airshow, on 20/09/97, flown by the OC, 1 Sqdn, Lt Col Jan Minnie. On offer for sale.
230		Used in the air race against the Oryx, with Cmdt Dolf Prinsloo in the AZ taking victory. Withdrawn from service. On offer for sale.
231		Withdrawn from service. Non std. camou pattern on front part of the nose. On offer for sale.
232		Withdrawn from service. On offer for sale.
233		Used at TFDC for system and missile testing. Not painted in 3 tone toned scheme. Later to AFB Swartkop, but not on static display. Currently with Aerosud for system testing. Unusual fairing between ventral strakes, which is not fitted to SAAF AZs. Used in Citroen commercial in a "civilian" colour scheme. On offer for sale.

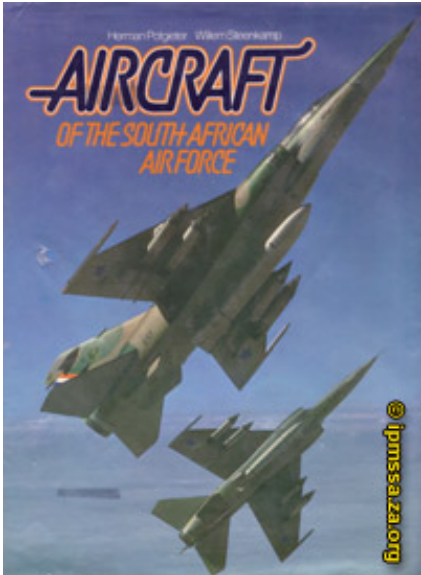
234		Aircraft written of on 23/11/93. During a low level maritime shipping strike exercise, the aircraft crashed into the sea, off Cape Point. Pilot ejected, but was lost at sea.
235		Later used as an avionics demonstrator and painted in a special bright blue/white scheme. Known as the "World's Fastest Dairy Truck". Similar fairing between ventral strakes as 233. Delivered to SAAF Museum Swartkop on 22/10/97 and placed on static display - engine removed.
236		Withdrawn from service. Took part in AZ retirement ceremony. Took part in final five ship display - last pilot name in yellow: Capt Vasiljevic "Dragon". On offer for sale.
237		Withdrawn from service. Took part in AZ retirement ceremony. Took part in final five ship display - last pilot name in yellow: Maj Pretorius "Piranha". On offer for sale.
238	Photo unavailable.	Withdrawn from service. On offer for sale.
239		Withdrawn from service. Took part in AZ retirement ceremony. Took part in final five ship display - last pilot name in yellow: Lt Col Potgieter "Gabriel". On offer for sale.

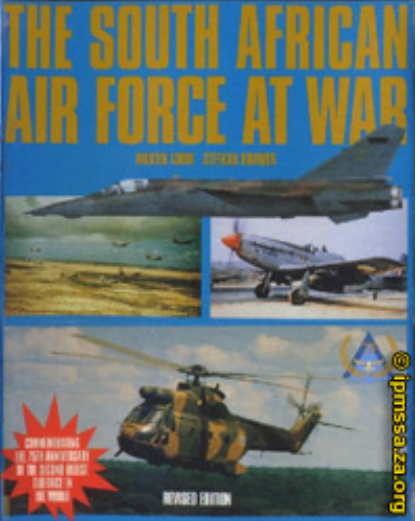
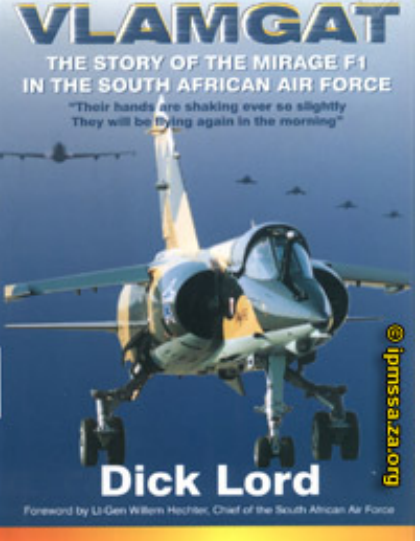
240	 A Dassault Mirage F1 AZ fighter jet in flight, showing its delta-wing configuration and canards. The aircraft is painted in a dark camouflage scheme. A vertical watermark on the right reads "© ipmssa.za.org A. Hugo Collection".	Withdrawn from service. On offer for sale.
241	 A Dassault Mirage F1 AZ fighter jet on the ground, viewed from the side. It features a dark camouflage paint scheme. A vertical watermark on the right reads "© ipmssa.za.org A. Hugo Collection".	Withdrawn from service. Took part in AZ retirement ceremony as static aircraft. On offer for sale.
242	 A close-up view of the cockpit of a Dassault Mirage F1 AZ. The canopy is open, and the aircraft's nose and intake are visible. A vertical watermark on the right reads "© ipmssa.za.org C. Hugo Collection".	Withdrawn from service. On offer for sale.
243	 A Dassault Mirage F1 AZ fighter jet on a runway, viewed from the side. It is painted in a dark camouflage scheme. A vertical watermark on the right reads "© ipmssa.za.org A. Hugo Collection".	Painted in experimental colour scheme, similar as "Air Superiority" of the CZ. Aircraft used extensively in last stages of Border War. Withdrawn from service. On offer for sale.
244	 A Dassault Mirage F1 AZ fighter jet on a runway, viewed from the side. It is painted in a light camouflage scheme. A vertical watermark on the right reads "© ipmssa.za.org A. Hugo Collection".	Withdrawn from service. On offer for sale.
245	 A Dassault Mirage F1 AZ fighter jet on a runway, viewed from the side. It is painted in a dark camouflage scheme with a white star on the nose. A vertical watermark on the right reads "© ipmssa.za.org C. Hugo Collection".	Written off on 20/02/88. Aircraft hit by SA-13 missile. Pilot lost his life. Exact circumstances that caused the death of the pilot is unclear to this day.

246	Photo unavailable.	Aircraft written off on 15/02/79, after experiencing repeated engine flame outs. Aircraft crashed near Cullinan. Pilot ejected safely. This was the first F1 lost by the SAAF.
247		Withdrawn from service. On offer for sale.

Further Reading: Mirage F1 AZ / CZ.

Note: "Aircraft of the SAAF" contains photos of the original F1 colour schemes, while "More than Game" contains photos of the later colour schemes. "Vlamgat" is an interesting read into the world of the SAAF's fast jet pilots. The most accurate drawings of the final F1 AZ's, three tone colour scheme is now available on this Website. Please verify all colour schemes with photos of the actual aircraft - there are a number of differences. See also Colour Schemes on this Website.

	0 86977 133 7	"Aircraft of the South African Air Force" - H. Potgieter & W. Steenkamp. In my opinion, still the publication standard, by which any publication on the SAAF, is judged - despite being more than 20 years old! This book features photos by the late Herman Potgieter and highlights his keen eye for detail, photo composition and beautiful aerial photography. Also features a comprehensive early SAAF history, which is well illustrated with photos, Sqdn badges, Sqdn history, aircraft drawings and specifications. This book illustrates the SAAF at its all time best and includes photos of all types then in service. This effort should be congratulated, without it much of our Air Force's history would've been lost forever. Never before did this type of info on the SAAF, appear in a single volume. In addition to, two hard cover editions a single soft cover edition also appeared. This book is sadly out of print and very, very difficult to obtain.
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	9 780620 192132	"More than Game" - H. Potgieter. The final comprehensive volume on the SAAF, by this renowned photographer, with the modern SAAF as it's main focus. This book feature all the modern types in service with the SAAF, like the Cheetah, Boeing 707, Oryx, Rooivalk etc. Also feature a bit of Sqdn history, Sqdn badges and some interviews with pilots. In terms of aerial photography, this book illustrates why the late Herman Potgieter was regarded as one of the world's leading aerial photographers. It is now out of print.
	0 86846 084 2	"The SAAF at War - revised edition" - S. Bouwer, M. Louw. An essential book for the SAAF modeller, as this book illustrates the various aircraft types under operational conditions. Focus is on the period from WWII until the Border War, as a pictorial with 875 photos. In all an exceptional effort to record the SAAF's history under operational conditions. Illustrations by Les Shand. This book is available directly from the author. Stefaan Bouwer.
	0-620-24116-0	"Vlamgat" - D. Lord. The story of the Mirage F1 in the SAAF, as told by a former pilot and Sqdn OC. This aircraft was responsible for peace & stability in the Southern Africa region for almost 23 years. A very interesting insight into the world of SAAF fighter pilots. Lots of info on the aircraft's involvement in the Border War conflict. One of the best publications on a single SADF/SANDEF subject, due to the comprehensive information contained in the publication. Still available in limited numbers.

	0-620-25922-1	"SA Colours & Markings Vol 1" - S. Bouwer, P. van Schalkwyk, W. Marshall. Mirage F1AZ, Hawker Hurricane, Ratel Infantry Combat Vehicle. This book consists of 36 pages of full colour line drawings and photo's. Available directly from the authors - contact William Marshall.
	0-620-27417-4	"SA Colours & Markings Vol 3" - S. Bouwer, P. van Schalkwyk, W. Marshall. SAAF Aircraft in American colours, Mirage F1CZ, SA Reconnaissance Cars (Marmon-Herrington) Part 2, Transvaal State Artillery Uniforms. This book consists of 44 pages of full colour line drawings, photo's, colour charts, badges and uniforms. Available directly from the authors - contact William Marshall.



Mirage F1 AZ / CZ Knowledge Base Sources

Publications:

- More Than Game - H. Potgieter
- Aircraft of the SAAF -H. Potgieter, W. Steenkamp
- Aireport '97 -H. Potgieter, L. Brins
-

- **The SAAF Posterbook -H. Potgieter**
- **Jane's World Aircraft Recognition Handbook**
- **African Air Forces -W. Brent**
- **Air International -Various**
- **Ad Astra -Various**
- **SA Flyer -Various**
- **AirForces Monthly -Various**
- **AirNews Africa -Various**
- **Encyclopedia of Aircraft**
- **DFA -Oct 2 1997**
- **SAAF at War -S. Bouwer, M. Louw**
- **75 Years on wings of Eagles - D. Becker**
- **Vlamgat -D. Lord**
- **World Air Power Journal no 17**
- **IPMS SA Magazine -Various**
- **Archimedes -Various**
- **Flight International -Various**
- **Salut -Various**
- **Paratus -Various**
- **SAAF Airshow publications -Various**
- **Aircraft Information Files -Various**
- **The Argus -Various**
- **SCOPE -9 December 1977**
- **Dassault Aviation Publications**
- **Denel Aviation marketing material**
- **Take Off -no 31**
- **Aircraft of the SAAF museum - Ysterplaat L. Vosloo**
- **African Air Review Jul '81 -Bomba article - submitted by D. Cooke**
- **The Citizen, 9 July 81 - Bomba article - submitted by D. Cooke**
- **Paratus, August 81 -Bomba article- submitted by D. Cooke**
- **Daily Dispatch, 9 July 81 -Bomba article- submitted by D. Cooke**
- **IPMS SA Magazine Vol 3, 98 -Bomba article - submitted by D. Cooke**

Photos:

Contributors of photos for this KB article.

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- **S. Bouwer**
- **R. Knott (dec.)**
- **D. Rowles**
- **N. Scheltema**
- **D. Cooke - Lt. Bomba's Mig 17.**
- **C. Crous - Citroen F1 AZ.**
- **W.R. Basson -CZ striped outline Castle Insignia.**
- **P. Dubois**
- **P. van Schalkwyk**
- **O. Strydom -CZ 207 @ University of Stellenbosch.**
- **W. Brent**
- **M. Booij-Liewes**

Websites:

- **Denel.co.za**
- **AirForce_technology.com**
- **Janes.com Army_technology.com**
- **Dassault Aviation**
- **News 24**
- **CNN**
- **Martin Baker**
- **TFDC**

Colour Schemes:

- **Original article by N. Scheltema**
- **AZ -Former 1 Sqdn pilots & ground crew - anonymous**
- **CZ -Former 3 Sqdn pilots & ground crew - anonymous**
- **Lt. Bomba's MiG 17 -D. Cooke**

Other:

- **SABC TV News Coverage**
- **Present & Ex- members 2 Sqdn Anonymous**
- **Ex- members 1 Sqdn Anonymous**
- **Ex- members 3 Sqdn Anonymous**
- **P. Dubois - AZ retirement ceremony serial numbers**
- **P. van Schalkwyk**



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