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Background:

In the 1950s Pakistan aligned itself with the United States of America under the newly formed SEATO (South East Asian Treaty Organization) and the later British sponsored CENTO (Central Treaty Organization) security pacts formed to contain the former Soviet Union. As part of these pacts Pakistan was recipient of a Mutual Assistance Program (MAP) which formed the basis of Pakistan Air Force (PAF) being re-organized on modern lines based on the model of United States Air Force (USAF). Over the late 1950s and till the middle of 1960s, PAF was equipped with American aircraft like the F-86 Sabre, T-33, T-37s, C-130s and B-57s. Under this arrangement Pakistan also allowed United States basing rights for U-2 reconnaissance aircraft missions. In May 1960 it was during one of these missions that a U-2 aircraft piloted by Gary Powers was shot down over the Soviet Union. It was after this incident and subsequent Soviet threats to Pakistan that the US agreed to provide Pakistan with higher performance fighter aircraft. The choice ultimately settled on F-104As after PAF's refusal to accept an American offer for F-100 Super Sabre aircraft.

Induction:

A total of 12 F-104 Starfighter aircraft were transferred to Pakistan, including 10 A and 2 B models. The model numbers and USAF tail numbers (retained by PAF) are given in the table below¹.

Serial	Model	Tail number	Date Received
1	F-104A-20	56-802	August 05, 1961
2	F-104A-20	56-803	August 05, 1961
3	F-104A-20	56-804	August 05, 1961
4	F-104A-20	56-805	August 05, 1961
5	F-104A-20	56-807	August 05, 1961
6	F-104A-25	56-868	August 05, 1961
7	F-104A-25	56-874	August 05, 1961
8	F-104A-25	56-875	August 05, 1961
9	F-104A-25	56-877	August 05, 1961
10	F-104A-30	56-879	August 05, 1961
11	F-104A-15	56-773	June 08, 1964

12	F-104A-20	56-798	March 01, 1965
13	F-104B-10	57-1309	August 05, 1961
14	F-104B-15	57-1312	August 05, 1961

All the aircraft were ex-USAF Air Defence Command and were equipped with the 20 mm M61 Vulcan Gatling gun besides being able to carry AIM-9B Sidewinder air-to-air missiles on wingtips. All aircraft delivered were also equipped with the C2 upward firing ejection seat and higher thrust General Electric J-79-GE-11A engines.

The first three pilots selected to undergo type conversion in the United States included Sqn Ldr M Sadruddin, Flt Lt Mervyn Middlecoat, and Flt Lt Alauddin 'Butch' Ahmed. Sqn Ldr Sadruddin was sent to George AFB, California (east of Los Angeles) and spent time with 434 TFS, 479 TFW. This was part of "on the job" training as an executive officer for a squadron for 6-7 months. Towards the end of the stay he transitioned to F-104s and flew about 22 hrs on the aircraft while in the USA (4-6 hrs on dual and rest solo). Since the F-104As in US service were nuclear weapon capable, USAF considered stripping the aircraft of this equipment before allowing Sqn Ldr Sadruddin to go solo but later decided against this. During this timeframe Sqn Ldr Sadruddin also became the first Pakistani to fly at Mach 2. The other two pilots went to an Air National Guard unit in South Carolina for type conversion. The fully assembled aircraft were sent by ship to Pakistan where they arrived at Karachi harbour in August 1961ⁱⁱ.

Before these newly delivered Starfighters could scream through Pakistani skies at Mach 2, they had to undergo a more mundane journey i.e. travel on Karachi roads from the harbour to PAF Station Drigh Road (now called PAF Base Shakra-e-Faisal). This was done by towing aircraft with tractors during the night, with pilots sitting in the cockpit during this journey to apply aircraft brakes if necessary. The time also marked the arrival of USAF test pilot Maj. Swart Nelson who checked out the three PAF pilots after which the aircraft were ferried to PAF Station Sargodha (now PAF Base Mushaf).

At Sargodha these aircraft re-equipped PAF's No. 9 Squadron (Griffins, who today fly F-16s). This squadron is considered the oldest PAF squadron and was first established on January 3, 1944 at Lahore flying Hurricane IIC aircraft as part of the Royal Indian Air Force. The squadron was re-formed on August 15, 1947 just a day after Pakistan's independence. In 1961 the squadron was the last operational unit still flying Sea Fury aircraft while all other PAF squadrons had converted to jets. Perhaps to compensate its oldest squadron for such neglect, it was decided by Air Headquarters to equip it with the first Mach 2 capable jet in PAF's inventory. Sqn Ldr M Sadruddin took over as the squadron commander of the re-equipped 9 squadron with Flt Lt Alaudin Ahmed as his flight commander. Other early joiners included Flt Lt Jamal A Khan, Flg Off Farooq F Khan, Flt Lt Hakimullah, Flg Off M M Khalid, Flt Lt Arif Iqbal, Flt Lt Hashmi, Flg Off Amjad Hussain and Flg Off M Akbar. The squadron was at the same time joined by two US Air National Guard pilots, who along with

the already converted first three PAF pilots helped convert other PAF pilots to F-104s. That PAF senior commanders literally lead from the front is demonstrated by the fact that the Air Marshal Asghar Khan (PAF C-in-C at the time) and some other senior officers attended the relevant ground school and undertook number of familiarization flights on the aircraft. The conversion course included 2-3 weeks of academic classes followed by a few rides in F-104Bs and final check rides in a single seater. Once the pilot was qualified, an initial training period consisting of 40-50 sorties commenced. This included navigation, formation flying, gunnery, air combat manoeuvring and interceptions. ⁱⁱⁱ

F-104s clearly surpassed the F-86F Sabres in PAF inventory in terms of performance and represented the cutting edge of aviation technology at that time. Although the Sabre was loved for its beautiful handling and manoeuvrability, Starfighter's performance remained unmatched till the induction of F-6 and Mirage aircraft later in the decade.

The aircraft's sheer power and, if one could ascribe it a personality, is best illustrated by the mission profile for going to Mach 2. The first requirement for such a mission was to find out where the tropopause was on a particular day. This is important as the aircraft acceleration is quickest at this altitude and also met the requirement that the inlet air temperature did not go beyond 100 degrees centigrade. Once the tropopause had been determined the sortie could begin. The configuration for going Mach 2 meant a clean aircraft (no external tanks or air to air missiles. Even the launchers for the missiles and the pylons for the external tanks had to be removed.)

A standard subsonic climb at Mach 0.9 to the tropopause (generally around 37 to 40,000 feet in summer) was made. After levelling off and getting into the transonic regime at Mach 0.9 and level flight, full afterburner was selected and the acceleration to Mach 2 began. The acceleration was very rapid and going supersonic took only a few seconds and was hardly noticeable except for a quick flick of the Machmeter from 0.98 to 1.05. As the mach number increased so did the temperature of the air entering the intakes (because of friction of the air against the aircraft). For this reason the pilot had to monitor the movement of the shock cones and the intake air temperature. The shock cones moved forward automatically as the mach number increased so as to avoid the shock wave from entering the air intakes and causing a severe compressor stall. Also the pilot kept an eye on the inlet air temperature gauge as it rose towards 100 degrees centigrade maximum (with an increase in air temperature the air became less dense so the RPM automatically increased to 103%-103.2% max). This phenomena was called T2 reset. If the shock cones did not move forward, or the rpm did not increase to 103.2% as the temp reaches 100 degree the mission was to be aborted. Upon attaining Mach 2 the procedure for slowing down had to commence immediately or the airplane could accelerate well beyond Mach 2!!!. The deceleration maneuver was interesting as well. The pilot first shut down the afterburner (RPM still remained at 103.2% even if the throttle was reduced below 100%) and began a steep climbing turn with max available "G" which was about 3 "G" at this altitude so as to reduce speed below 1.6 mach. Once below Mach 1.6 the pilot applied speed brakes (opening speed brakes above Mach 1.6 was prohibited as this caused a sudden and violent aircraft nose drop which could cause a compressor stall). By the time the aircraft slowed down to below Mach 1.6, it would have climbed to above 45,000 to 47,000 ft. The pilot had to be careful not to cross 50,000 feet without a pressure suit. Once the airplane was below Mach 1.6 the rest was routine. The

inlet shock cones began retracting and the inlet temperature reduced below 100 degrees and the RPM dropped back to 100% or lower depending on the throttle position.

F-104's clean profile meant quick acceleration on takeoff and the pilots had to be quick with retracting under-carriage as the maximum allowable speed of 240 knots for undercarriages down was reached very quickly. That the gears retracted within 3 seconds of selection, was another small but impressive feature of the aircraft. In case the pilot did exceed the maximum allowable speed for gear down, then he had to enter a steep climb to bleed speed and reach the 240-knot figure.

Starfighter's thin wing aerofoil and high wing loading left little room for mistakes at low speed. The Starfighters had to be landed at minimum 150 knots IAS (with engine RPM at 88-90% during landings). The aircraft required careful handling, although features like the Auto Pitch Control (APC, also known as kicker) helped by automatically deflecting elevators for nose down position if the pilot pulled the aircraft to a high Angle of Attack. The APC was prevented from engaging when gears and take-off/landing flaps were engaged. Other impressive features included Boundary Layer Control which allowed flaps to function at high deflection angles and the very powerful M61 Vulcan cannon which fired 20mm shells at the rate of 66 per second^{iv}. The latter though resulted in high usage of electrical power requiring engine RPM to be at least 96% when firing. In fact, later during the 1965 war on at least one occasion an F-104 lost both generators and therefore total electric power, when Flg Off Abbas Mirza fired his gun during a night blind intercept of an IAF Canberra.^v

Though very advanced at the time, the avionics of the aircraft suffered from limitations inherent with late 1950 and early 1960s technology. The impressive sounding Infra Red (IR) sight and Airborne Intercept (AI) radar had very limited tactical applications. The IR sight was rudimentary and hardly provided information which could be useful to the pilot in a real tactical situation. The aircraft's AN/ASG-14T1 fire control system which incorporated AI radar suffered from severe ground clutter at low level and the very limited firing envelope of early AIM-9B Sidewinders seriously constrained firing opportunities in combat.

During the period 1961-65, PAF F-104s training mostly included GCI controlled High and Low level interceptions during day and night, Low Level Navigation/Strikes, ACM/Tail Chase, Zoom Climbs for very high level interceptions and Dissimilar Air Combat Training missions against F-86 aircraft. However PAF's night Low Level interception Capability was very limited due to non availability of low level radar coverage.

The PAF lost two aircraft from induction to the start of the September 1965 war. On November 11, 1963 F/O Asghar Shah while flying an air to air cine training mission entered into a spin and ejected. The mission leader, Flt Lt Farooq Umer recalls Asghar's aircraft nose pulling up followed by oscillation with the Auto Pitch Recovery system kicking in but failing to prevent spin entry. The aircraft lost was tail number 56-802. The second aircraft (56-803) was lost on September 3, 1964 when Flt Lt. Tariq Masood entered a dive at a steep angle while practicing ground strafing; the pilot pulled hard to recover the aircraft and though the nose of the aircraft cleared, its tail hit the ground. This time the crash was fatal.^{vi}

Both aircraft were replaced under the Mutual Aid Program by aircraft tail numbers 56-773 and 56-778.

1965 War

Prelude to the war

Tensions between the two regional rivals spilled over into armed conflict with the Rann-of-Kutch dispute in April 1965. This was also the first time when PAF's F-104s saw operational duties with a detachment of two F-104s sent to PAF Station Mauripur to reinforce the existing F-86F and B-57 squadrons. In order to avoid escalation of the conflict, PAF only undertook combat air patrols (CAP) well on its side of the border. During this period PAF made two interceptions of intruding IAF aircraft with one resulting in an IAF Ourgan surrendering to intercepting PAF Sabres by landing on Pakistani territory. The second interception of an IAF recce Canberra was made by a PAF Starfighter north-east of Sargodha. In this case the pilot visually tracked the intruding aircraft for 10 minutes but was under orders not to fire.

Starting September 1965 the cease fire line between Indian held and Pakistani Kashmir started heating up. During the first week of September 1965 PAF fighters including F-104s flew CAPs to provide air cover to the Pakistan Army units engaged in ground operations. On September 3rd, 1965 a CAP of two PAF Sabres was bounced by six IAF Gnats with PAF air defence controller scrambling a F-104 flown by Flg Off Abbas Mirza to the aid of the Sabres. The IAF Gnats scattered on sighting the charging Starfighter, "Pajh oye ... 104 eeee" is how Sqn Ldr Brij Pal Singh announced the arrival of the Starfighter (translated in English its means 'run...it's a 104', but as translations go it misses the point, only a Punjabi speaker can understand the sheer panic and loss of composure of this call). In the mean time another F-104 was vectored to aid the fight, flown by Flt Lt Hakimullah, it arrived after the Gnats had already split. Perhaps mixing this Starfighter with the first one or realising that there are now two F-104s, Sqn Ldr Brij Pal Singh concluded that safely egressing to India was not possible and landed at a nearby disused airfield at Pasrur in Pakistan. The surrendered Gnat continues to serve as a war trophy at the PAF Museum. The incident is recalled by Abbas Mirza,

"I was on air defense alert with the rank of Flying Officer in the cockpit (aircraft number 877) when I got the order to scramble. The weather was very hazy. The visibility on the ground was about 2 miles and in the air it got worse reducing to about a mile or so. There was no cloud. In other words an ordinary September day.

I was airborne within 2 minutes and made an accelerated climb to 15000 feet and 500knots IAS. The GCI (Ground controlled radar) directed me to head immediately towards the Sialkot sector as two F-86s were engaged in air combat against 6 IAF Gnats. The F-86 pair was led by Sqn Ldr Yousuf Ali Khan and his wing man was Flt Lt Khalid. Yousuf asked his wing man to return to base as on Khalid's aircraft one drop tank had failed to jettison. Yousuf was now alone against the 6 Gnats.

GCI urged me to accelerate to 600 knots as the situation against Yousuf was getting increasingly precarious. I must add that the brilliant maneuvering of Yousuf had kept the Gnats at bay for over 10 minute's inspite of being damaged in the vertical fin and rudder area. I was asked to descend to 12000 feet and then 10 000 feet and was informed that I was about 5 miles away from the fight and advised that the fight was taking place 12'O' clock to me. In the meanwhile another F-104 was scrambled with Flt Lt Hakimulah in the cockpit and was fast approaching the area. Suddenly, just ahead, about a mile or so I saw below me the F-86 in a tight turn to the right followed by the 6 Gnats. The lead Gnat was about 1000 feet behind Yousuf and the rest in a line astern formation. I initially thought the Indian aircraft were Hunters but when I saw them a bit closer they turned out to be Gnats.

Unfortunately since I was doing in excess of 500 knots when I had initial contact with the fight while the dogfight was around 200 or so I could not slow down fast enough to engage the enemy immediately, instead I decided consciously to pass in front of the F-86 to show Yousuf to hold on and to the Indians that reinforcements were on hand. I shut down my afterburner and simultaneously pulled up in a classic yo-yo maneuver to maintain the height advantage and also to slow down so as to keep the enemy in sight. The Gnats upon seeing me entering the melee immediately broke away from Yousuf and headed back towards the border. In the meanwhile Fl. Lt Hakimullah had been maneuvered into the area and he was close to Pasrur airfield (dis-used by PAF) which was about 5 or 6 miles away from the area of engagement. One of the Gnats (Birjpal) saw the second F 104 as well and decided against taking up a fight against two F-104's and landed his aircraft at Pasrur airfield. Had he known that neither Hakimulah nor I had visual contact with him till he was about to land he may have got away safely but I guess personal safety got the better of him. In the meanwhile as I reached the top of my yo-yo (16000 feet) and began to descend, I lost contact with the Gnats because of very poor visibility and also because the Gnat is an extremely small aircraft and difficult to spot from a distance even in good visibility. I stayed in the area for another 30 minutes under the guidance of GCI but no other Indian aircraft entered to engage me. GCI informed that Yousuf had landed safely in Sargodha but he had to engage the runway barrier placed at the end of the runway as he had lost hydraulics brakes and lowered his undercarriage through the manual system. His aircraft had suffered tail damage and some other non critical battle damage. (As a postscript the aircraft was recovered and subsequently flew again in the war.)"

Full scale hostilities

Full scale hostilities broke on September 06, 1965, with F-104s tasked for air defence duties. It was on an early morning Combat Air Patrol (CAP) on this day that Flt Lt Aftab Alam claimed an IAF Mystere with an AIM-9B Sidewinder when he intercepted a formation of IAF aircraft attacking a passenger train near Rahwali. The first day of hostilities later saw two F-104s doing a visual recce over Adampur and Halwara airbases in India to verify presence of IAF aircraft as a prelude to PAF's counter air strikes later in the day.

The first IAF air strikes on PAF bases took place on the morning of September 7, 1965. It was at 05:30 hrs that the first IAF strike on PAF's Sargodha airbase was detected when the formation of 6 IAF Mysteres was already pulling-up to attack the airfield. An F-104A flown by Flt Lt Amjad Hussain Khan was vectored by ground control to intercept the raid. According to Flt Lt Amjad he got behind two Mysteres which were exiting on a heading of 120 degrees at about 100 ft AGL. He fired an AIM-9B at one of the Mysteres which hit the ground after leaving the launcher. Closing in he fired at the Mystere with his gun and saw hits on the aircraft. The second Mystere meanwhile broke into the Starfighter forcing Amjad to make a high speed yo-yo and attack again. The Mystere turned into him again forcing another yo-yo with afterburners engaged. The Starfighter climbed to 13-15,000 feet and then dived to make another attack on the Mystere. This time the Mystere pilot did not see the F-104, with the Starfighter diving and closing in at 540 knots and opening cannon fire at a range of 3000 ft. The Mystere exploded when the range was 1000-1500 ft and before the Starfighter could pull up to clear the explosion, it flew through the resulting debris. The F-104's controls froze and aircraft stopped responding, going into a left bank. At this point about 75-100 ft AGL (Above Ground Level) Flt Lt Amjad Hussain ejected from the aircraft and landed near a village receiving a hero's welcome from the villagers and made back to Sargodha airbase by a bicycle, a horse and a helicopter!!!^{vii}

The British writer John Fricker in his book "The Battle for Pakistan: The 1965 air war" assigned this loss to Devayya actually shooting down the F-104. However no evidence was offered to substantiate this claim and Fricker also failed to explain how Sqn Ldr Devayya himself was shot down and killed. Later research showed that the site of both aircraft crashing was nearby which supports the likelihood of a mid-air collision or debris of the Mystere striking the F-104 (see Kaiser Tufail's *Great Air Battles of the Pakistan Air Force*).

PAF's tactics during the war included single or pairs of Starfighters providing top-cover to CAPS of F-86s. In addition F-104's radar based fire control system meant that it was the only fighter in PAF's inventory which could take up the role of a night interceptor against IAF Canberras with any degree of credibility. In this role too, the F-104s were limited by lack of a comprehensive low level radar network and the technology limitations of its onboard radar which suffered from ground clutter and limited search area. While most F-104s operated from Sargodha, a pair was deployed every night to Peshawar to provide night air defence over northern Pakistan.

The night intruding IAF Canberras were warned of F-104s presence by the Indian ground control radar at Amritsar and its own tail warning radar. On warning of an approaching F-104 the IAF Canberras would resort to sudden change in height making it difficult for F-104s to keep track of the target. The usual IAF method was to approach Pakistan at medium altitude of 25-30,000 feet and then descent to low level to approach the target. On target the IAF Canberras would pull-up to 8-10,000 ft to avoid flak and then egress at low level climbing up to medium level after crossing into India. Given PAF's own night counter attack missions, IAF had deployed its Canberra at airbases deeper inside India and therefore range considerations were important while flying the hi-lo-lo-hi mission profile just described. PAF's counter to this tactic was to extend the arc F-104s would patrol at, hoping to intercept an IAF

Canberra when it climbed to medium altitude while egressing from Pakistan. CAPS of one or two F-104s and F-86 Sabres were flown against each wave of intruding Canberras. It was hoped that the Sabre although lacking any night capability could act as a deterrent using GCI and infra-red homing heads of its Sidewinder missiles to detect and attack the Canberras at night.

The first positive contact between an F-104 and a Canberra took place on the night of September 13/14, when Sqn Ldr Middlecoat fired a Sidewinder on a Canberra in a blind intercept. An explosion was seen at a range of 4,000 ft but no confirmation was possible as the encounter took place over Indian territory. A confirmed kill was obtained on the night of September 21, when Sqn Ldr Jamal A Khan made radar intercept of an egressing Canberra and shot it down with an AIM-9B Sidewinder. In this particular case the IAF Canberra climbed earlier than usual due to fuel considerations and failed to switch on its tail warning radar while climbing. The pilot ejected and was captured.

One F-104 was lost on September 17 when Flg Off GO Abbasi landed short of the runway when Peshawar airbase was under a dust storm; miraculously the pilot still strapped in his seat was thrown clear of the crash and survived without any major injuries.

In another incident Flt Lt Amjad Hussain intercepted an IAF Canberra near Lahore and positioned himself neatly behind it, only to experience short circuiting of the gun – missile selection switch rendering both weapons unusable. Amjad then flew along side the Canberra with the IAF pilot looking at him. Other squadron pilots recall watching a long gun camera film of this incident.^{viii}

PAF's reconnaissance fleet consisted of RT-33 aircraft which were ill-suited for any recce missions in a high threat area. Therefore F-104s were used to escort any such recce missions and a pair of F-104s had to criss-cross the slower RT-33 to maintain formation. On at least one such mission the PAF formation came across an IAF Hunter formation which appeared to be returning to its base. The IAF Hunter formation promptly scattered, and the PAF F-104s being deep into Indian territory with an RT-33 to escort decided not to pursue matters. An innovative solution to the recce problem was found when two seater F-104Bs were used as recce birds with the pilot in the back seat holding a hand held camera. The F-104B would fly extremely low, pulling up slightly near the target airbase and go inverted, allowing the pilot in the back seat to get a better view for recce photos.

That the IAF had nicknamed the Starfighters as "Badmash" (meaning scoundrel) shows the healthy respect it had for the aircraft. This respect was well demonstrated by the unchallenged sweeps the F-104s flew over Indian territory on a more or less standard basis. A number of PAF pilots reported that they hardly saw any IAF activity on such missions and when they did make contact with IAF aircraft they would promptly disengage and not rise to the bait. Most of these pilots now admit that such audacious missions were foolhardy as a single F-104 deep inside Indian territory would have had little chance against a well planned and well flown interception.

On one occasion a faint sign of what might have been an ambush effort by the IAF was seen. On September 11, Flt Lt Hakimullah was orbiting over Indian territory, low on fuel he was about to turn for

Pakistan when PAF radar at Sakesar, monitoring IAF transmissions, reported two sections of IAF fighters reporting visual contact with the Starfighter. Flt Lt Hakimullah spotted two Gnats below him and as he was placing his sights on one of the Gnat he noticed that he was outside the firing parameters of AIM-9B missile. This necessitated bit more repositioning, as he heard the missile tone PAF radar warned him of two more contacts diving at him. He looked up and saw two MiG-21s diving at him, Flt Lt Hakimullah broke into them which took him further inside India. Given his fuel state he broke in the opposite direction and engaged afterburner. Egressing he saw two more MiG-21s approaching him head-on. Diving down with afterburners engaged he broke the sound barrier, although the MiGs tried to pursue, the Starfighter was able to outrun the MiGs. Crossing over to Pakistan, Flt Lt Hakimullah zoomed upto 25,000 ft and reduced power. It was obvious that the Starfighter would not make it back to Sargodha with the remaining fuel, and the pilot elected to make a power-off approach to the dis-used airstrip at Risalwala. The Starfighter made a touch down at Risalewala with the engine flaming-out as the aircraft turned off the runway.

More decisive engagements between later model Soviet aircraft and the F-104 had to wait for another day, more precisely to December 1971 when India and Pakistan were again engaged in full scale hostilities.

The 1965 war ended with 9 Squadron flying 254 sorties of which 246 were day and night air defence, 4 escort and 4 counter air.

The Intervening Period 1965-71

PAF lost two Starfighters during the 17 day conflict with India. Unlike the past these two losses were not replaced by the US given the arms embargo imposed on Pakistan. Therefore No. 9 Squadron was left with only 8 F-104s and 2 F-104Bs after the hostilities. In addition PAF faced the problem of dwindling spare parts stocks for the aircraft which were also embargoed and had to be sourced from third party sources and black market.

During this period one F-104A aircraft (tail number 56-805) was written-off in 1967 in a ground accident. During aircraft start-up the starter unit did not disengage automatically due to an electrical failure and became overheated due to high RPM and caught fire^x. This fire spread to the engine and the aircraft was switched off. Despite efforts by fire tenders the aircraft was completely burnt. Yet another F-104A was lost in 1968 when Flt Lt GO Abbasi had a fatal crash while practicing low level aerobatics near Mianwali (tail number 56-807). It is believed that during this practice mission he faced multiple technical problems which Board of Inquiry could not exactly pinpoint.

Flying, Comparisons and Feather Duster^x

Flight training during this period added more emphasis on low level night interceptions, which was not routinely practiced before the 1965 war. This was made possible by PAF's acquisition of some low level radars which were deployed to cover important areas and valuable points. To test the effectiveness of this radar system extensive night training was carried out for F-104 pilots and radar

operators. In addition air combat training missions were flown against other PAF aircraft. With the induction of Chinese F-6 (Mig-19) in PAF and PAF's increasing experience of flying Soviet built aircraft in the Middle East, comparison between the types was increasingly common.

The F-104 was ill-suited to the type of air combat likely in South Asia was well illustrated in the 'Feather Duster' report which the United States Air Force (USAF) completed in 1965. The study evaluated various USAF aircraft including F-104Cs against Mig15/17 type aircraft (simulated by F-86H Sabres). The study included defensive and offensive setups of various US fighters against F-86Hs. In case of USAF Starfighters the study concluded several lessons which unsurprisingly pointed to the type's very limited capability to engage in a manoeuvring fight. Out of 29 sorties where an F-86H acted as an offensive aircraft (positioned line astern and higher speed) a kill was scored on 21 occasions with the F-104's defensive manoeuvres like the break, turns or hard pull-ups being unsuccessful. The only manoeuvre which allowed F-104s to dis-engage on some of the occasions was an accelerating diving spiral. In an offensive set-up, F-104s key advantage turned out to be its small size which from certain positions made visual detection of the attack very difficult. In cases where the F-104 tried to follow the F-86H's defensive manoeuvre, it ended up overshooting the target. The report summarized by saying,

"As with the F-105, if a rear hemisphere missile/gun attack by Mig15/17 type aircraft is observed by defending F-104 aircraft, max acceleration 0-1 G diving separation is recommended. If the attack is observed too close for this type of separation, a diving accelerating spiral employing rapid roll rates is effective. The F-104 has an excellent chance to subsequently re-engage undetected visually by the enemy. If attacking threat is carrying missiles, the accelerating dive, if delayed until missile launch range, must rapidly generate angle-off prior to attempting escape.

The F-104 has little success in forcing overshoots through the use of breaks, hard turns, high G rolls or scissors manoeuvres.

In attacking with the F-104, an outstanding advantage is its small frontal silhouette. The F-104 attack should be pressed at supersonic speed, 1.1-1.3 mach, to ensure closure before the defender's turn forces an overshoot.

Both in attacking and defending with the F-104, once supersonic separation has been effected, initiation of climb must be delayed at least 1-2 miles to prevent Mig15/17 type aircraft from cutting off in vertical plane."

Informally air races between F-6 and F-104s were also organized with both aircraft lined next to each other on the runway and starting take-off roll together. F-6's shorter take-off distance allowed it to gain altitude and speed sooner with F-104s catching up and surpassing F-6 at higher altitude (around 30,000 ft) and higher speeds. It was considered that the MiG-21 had the same acceleration and rate of climb at low Mach numbers as the F-104s although the F-104 maybe slightly better at higher Mach numbers.

Compared to both the F-6 and MiG-21, the Starfighter had a more spacious cockpit with better visibility compared to the other two aircraft. In the F-104, the layout of cockpit instruments and all controls and switches was good. It was very easy to reach any switch/control and read all instruments clearly, without any confusion. On the other hand the lay out of F-6 & MiG-21 cockpit instruments and positioning of various switches and controls was not very good increasing the chances of wrong switch or button selection.

In terms of general handling, F-104 flight controls were slightly heavier than F-6 controls and controls response also slightly slower than F-6. However the J79 engine responded much better to throttle inputs than the F-6. The Starfighter within its operating limitations had little vices while the F-6 exhibited adverse yaw at high angles of attack during low speed or high-G maneuvering which could lead to the aircraft entering into a spin.

Within PAF it was assessed that F-104 was inferior in all flight regimes by the increasingly numerous MiG-21s with the Indian Air Force but superior to the Su-7s, also inducted by IAF. Especially in a close in fight the Starfighter was considered to be out matched by the MiG-21 given its superior manoeuvrability and similar speed and acceleration. Not unlike the conclusions of the Feather Duster report, PAF's F-104 tactics made use of aircraft's high speed to hit targets quickly, ideally using AIM-9B Sidewinder, and quickly egressing. Turning with more nimble fighters was not considered advisable.

Slowly but surely, the arms embargo on Pakistan started effecting F-104 flying, with the result that the aircraft were practically cocooned starting December 1969. While some flying was managed on a regular basis, squadron pilots did the bulk of their day flying on F-6 aircraft with other squadrons. The Starfighter were pulled out of the storage in July 1971 as hostilities with India built-up.

Upgrades and Modifications^{xi}

Given its ageing RT-33 aircraft based reconnaissance capability PAF attempted to use F-104s high speed performance for such missions. During 1968-69, at least one of the two F-104Bs was modified to carry Swedish made reconnaissance cameras (TA7M) in the rear seat. There were three cameras in one set of equipment, two oblique cameras and one vertical, with the vertical camera installed in the centre and oblique cameras installed on either side of vertical camera. This setting provided a total photo coverage angle of 170 degrees. This gave the F-104B the capability to look deep inside the enemy territory from a safe distance with coverage area depended on the height at which the aircraft would be flying. This modification flew quite a few trial missions before the war and the results were very encouraging. Although during the later 1971 war, the three available Mirage-IIIRPs were considered sufficient and the recce modified F-104Bs did not fly a recce mission.

Another important modification was installation of radar homing device on a single F-104A aircraft. This device called SLARD (Short range Low Altitude Radar Detection) and alternately Radar Locator (RALOR) was sourced through an American source and initial trials were carried on a twin engine communication plane. Based on results of such trials it was decided to fit an F-104A aircraft with this

equipment. Aircraft tail number 56-875 was modified with this equipment (near the war perhaps due to maintenance related issues the equipment was removed from 56-875 and installed on 56-804). Initial trial fitting on the aircraft made the cockpit very uncomfortable for the pilot and was also considered a safety hazard in case of an ejection. Such issues were resolved during the testing phase which included extensive missions against various PAF radars. The SLARD had two sensors on the right and left of the nose cone. The device had a pick up range of about 7-10 miles at low level. The display in the cockpit would indicate the location of radar about 30 degrees either side from the nose of the aircraft. A vertical line/mark would appear after every 2 to 3 seconds to guide the pilot about exact location of the target radar with reference to the aircraft.

The F-104s also had an infrared (IR) sight however its pick up range was too short to be of any operational use. After the 1965 war, a serious effort was made by PAF engineers to improve its performance. These efforts did succeed in increasing the pick up range from less than half a mile to seven-eight miles against a single jet engine source by cooling the IR cell with liquid Nitrogen. The modified system did give the pilots good pick up ranges but because of ice formation, the system would clog and shut down. It required good 15 minutes for the ice to clear and the system to start functioning again. Unable to find a satisfactory solution to the problem, the effort was finally abandoned.

Yet another major modification was to make the under wing fuel tank station a weapon station capable of carrying Sidewinder missiles. Both the F-104 A and B versions that Pakistan had acquired had four external stores positions, one on each wingtip capable of carrying either an external jettisonable fuel tank or a Sidewinder missile, and one under each wing capable of carrying a jettisonable fuel tank only. Of these external store stations, the wingtip station was much cleaner and far less drag producing than the under wing station. For all operational missions, when Sidewinder missiles were carried, the pilots had either to fly with no external fuel tanks at all or carry them on the under wing station.

Operationally the ability to carry both wingtip tanks and Sidewinder missiles was considered very desirable. It was thought that the underwing stations could be modified to carry Sidewinder missiles. After the 1965 war, efforts were made locally for this modification. PAF's technical staff was able to fabricate a set of Sidewinder launcher racks for the under wing station and also completed other necessary modifications like wiring, sighting and emergency jettisoning etc.

After thorough ground and flight testing, a number of live firing tests were carried out and the modification was declared successful. The entire fleet of F-104s was then modified at PAF's main engineering depot at PAF Base Faisal.

Assistance to Royal Jordanian Air Force

In 1968 Royal Jordanian Air Force (RJAF) had inducted F-104 A&B Starfighter Aircraft and a request was made to Pakistan Air Force to convert RJAF pilots on the aircraft along with leading some pilots to Instructor Pilot status. This started PAF's association with Jordanian F-104s. As the RJAF Starfighters started arriving at Prince Hassan Air Base (H-5) in USAF cargo airplanes and were being assembled

and test flown by test pilots from Lockheed Martin, the PAF pilots deputed to RJAF started the pilot conversion program. Standard Operating Procedures, Flight Orders, Check Lists, Flying Syllabus, Boards and Charts, and all other operational aspects that were required for the establishment of fighter squadron were created and initially 15 pilots were converted, including Major Ihsan Shurdom who later rose to command the RJAF.

King Hussain of Jordan, himself a keen aviator was a regular visitor to the F-104 squadron. This association with RJAF turned out to be very useful in later more testing times for PAF.

PAF Starfighter Operations during the 1971 War

As India-Pakistan tensions mounted around mid-1971, a number of pilots with previous F-104 experience were sent to Jordan for regaining currency on the aircraft, while pilots returning recently from Jordan were reposted to PAF's No. 9 squadron. In Jordan PAF pilots could also undertake Dissimilar Air Combat Training with Jordanian Hunters (given the significant presence of the type with IAF). When war broke out on 3rd December some of the pilots were still in Jordan and had to rush home. The following F-104 pilots were attached to No. 9 Squadron during the 1971 war:

1. Wing Commander M Arif Iqbal (Officer Commanding)
2. Wing Commander Mervyn L Middlecoat
3. Squadron Leader Amjad Hussain
4. Squadron Leader Rashid A Bhatti
5. Squadron Leader M Akbar
6. Squadron Leader Tariq Habib
7. Squadron Leader Manzoor Bokhari
8. Squadron Leader Waris Mujtaba
9. Squadron Leader Amanullah
10. Squadron Leader Abbas Mirza
11. Flight Lieutenant Samad Ali Changezi

As war broke out on Western front on 3rd December, PAF carried out pre-emptive strikes on forward Indian Air Force bases and radar units. As part of the pre-emptive strikes, No. 9 Squadron was tasked to attack Amritsar, Faridkot and Bernala radar stations.

The First Strikes

For the initial pre-emptive strikes the Starfighter pilots were tasked to attack IAF radar stations. The aim was to degrade their performance by damaging or destroying the antennas using the Starfighter's Vulcan cannon, affecting IAF capability to interdict PAF raids on the forward airfields. The initial strikes were planned to be carried on 3rd December close to dusk on Amritsar and Faridkot Radar Stations, using guns only. Further strikes were to be carried on these and other radar installations such as the one operating from Bernala from 4th December onwards.^{xii}

Wg Cdr Arif Iqbal and Sqn Ldr. Amanullah were to strike the Faridkot and Sqn Ldr. Amjad along with Sqn Ldr. Bhatti the Amritsar radar station.

Arif along with his wingman Amanullah got airborne from Sargodha just before dusk on 3rd December and set course at low level. During ingress to the target Amanullah maintained tactical formation on the right side of Arif, keeping 20 degrees behind the line abreast position. Few miles from the target Arif pulled up but could not spot the airfield due to limited visibility conditions as it was getting dark. Amanullah instead of pulling up kept low and went down to 100 feet and spotted the runway. Amanullah recalls^{xiii}:

“I went further down, and on the side of the runway (small abandoned airfield of British time) I saw radar vehicles and one temporary camouflaged shelter with a light aircraft. While Arif was orbiting on top still unable to spot anything, I made a 360 turn to line up with side of the runway where all vehicles were parked and made strafing attack with long burst firing 66 rounds per second with the 104’s Gatling gun. I managed to hit the target, made another 90-270 degrees turn and made a second pass. After the second pass I exited. Arif had left before I did therefore I was independent and alone. When I was exiting it was dark and I did not see Ravi and continued west 270 and passed south of Sargodha and when I pulled up it was over Indus River closed to Mianwali. I realised then and set course back for Sargodha. When I came to land, as it was the initial moments of war, the Ack Ack of Sargodha opened on me. I went round shouted at Sargodha ATCO and came back and landed. Base Commander was waiting for me and hugged me since I had come back late. He told me that I have hit an Indian light aircraft at Faridkot (announced by Indian radio). They did not say anything about radar, but the radar was silent after the attack throughout the war. Arif came back without firing while I had expended closed to 400 rounds.”

The first raid on Amritsar radar was carried out at 1710 hours by two F-104A aircraft lead by Sqn Ldr Amjad Khan, with Sqn Ldr Rashid A Bhatti as his wingman. Amjad was flying the specially equipped radar locator F-104A (56-804). Both the aircraft took off from Sargodha Air Base configured with two fuel tanks on pylon stations and two Sidewinder missiles on wing tips. The radar was located and engaged successfully and it went off the air. Next morning, 4th December, pilots were informed that the radar is back on air. Another mission was planned for 0500 hours with Bhatti as lead (in F-104A 56-804) and Amanullah as his wingman. As the formation arrived over the radar, heavy ack-ack opened up. The pilots decided to stay low and make a 180 degree turn to re-attack. While turning and pulling up, the Amanullah spotted a Gnat trying to level behind the Bhatti (lead) with all guns blazing. Amanullah gave out a warning “Gnat behind you, exit” with the lead punching his tanks and going full afterburner. While trying to position himself behind the leading F-104A, the Gnat pilot^{xiv} had not noticed the wingman. With Bhatti’s F-104A now pulling out of range at supersonic speed, Amanullah positioned himself behind the Gnat and after getting a locked-on tone fired the AIM9B Sidewinder missile. While the missile was homing on, the Gnat broke right and the missile exploded under its belly. Amanullah saw some parts of the Gnat flying off but did not see it crash. After the attack, the wingman also broke-off and headed home.

While flying back Bhatti looked at his wingtip tanks which were stuck and had not jettisoned. Since he was going supersonic the aileron got stuck, which happens because of torsional effect of the tanks on the aileron. Bhatti popped up his speed breaks and the aircraft came out of turn and he was able to safely exit^{xv}.

Since the mission was interrupted, another strike was planned on Amritsar Radar Station in noon time on the same day (4th December). This was Bhatti's third mission and he flew as No. 2 to Sqn Ldr Amjad Hussain, who once again was flying the specially equipped F-104 with SLARD. While crossing at low level, Bhatti spotted two Su-7 aircraft crossing above them at approximately 3000ft. Bhatti warned Amjad about the Su-7s, who by this time had also visually picked them up. Amjad manoeuvred to settle behind the lead Su-7 with the second Su-7 trying to come behind Amjad. Bhatti warned Amjad over R/T of the other Su-7 closing behind him, but being focused on trying to track the lead Su-7, he did not respond immediately. All this time Bhatti was also manoeuvring to get behind the second Su-7 to shoot it down before it could shoot down Amjad. With the second Su-7 now even closer to the Amjad, Bhatti gave a tactical call to "break right", and this time Amjad immediately responded. With Amjad now out of danger, Bhatti closed in on the second Su-7 and after getting a Sidewinder lock-on tone, fired the first missile from a distance of 4000 ft. Bhatti saw the missile hit the Su-7 and the aircraft crashing to the ground. Bhatti then tried to close in on the lead Su-7 and after getting a locked-on tone fired his second Sidewinder. Bhatti failed to notice if his second Sidewinder also hit its mark, as in the process of closing in on the lead Su-7, he was also fumbling with switches in the cockpit, trying to jettison his external fuel tanks. The fuel tanks failed to jettison and with emergency selection, only the right pylon fuel tank got released. Now with the left pylon fuel tank almost full the aircraft was uncontrollable due to asymmetric conditions at very high speed (550-600 knots). Bhatti however managed to control the aircraft and informed his leader. After crossing the border, Lahore Radar was also informed and Bhatti was cleared to climb to safe altitude and reduce aircraft speed as per procedural requirements. The aircraft recovered safely at Sargodha Air Base.

Once again, the mission remained unaccomplished. Now the fourth mission was planned for 5th at 13:30 hrs with Sqn Ldr Amjad as leader and young Flt Lt Samad A Changezi as his No. 2. Intel had reported the position of this radar at a road going towards Amritsar Airfield. The pilots approached the target from the south and Amjad made a strafing pass. In the first pass Amjad hit an antenna and realized it was a wooden decoy when he saw it splinter. Right at that moment he saw the actual antenna rotating on the right. Wingman Changezi also confirmed the contact on the right. Formation did a turnaround and attacked again, hitting the antenna. This time the radar station was struck successfully and it went off the air for the second time. During exit, Amjad's aircraft (56-804) was hit by anti-aircraft guns deployed around the radar station. He turned towards Pakistan, hoping to recover when his wingman gave an ejection call, confirming that fire is spreading. Amjad successfully ejected and was taken POW.

On 6th of December the squadron was ordered to move to PAF Base Masroor, Karachi. For the rest of the war the squadron performed day and night Air Defence and Counter Air Operations from this base. It was at PAF Base Masroor that the squadron received nine F-104s provided by the Kingdom of Jordan in support of Pakistan during the 1971 war. These Starfighters were ferried by RJAF pilots

(along with some PAF pilots) to Masroor on 13th December from where they operated for the remaining period of the war. The serial numbers of these RJAF Starfighters were as follows: 56-774, 56-775, 56-767, 56-777, 56-799, 56-839, 56-843, 56-845, 56-1789.^{xvi}

When the Jordanian No. 9 Squadron pilots were about 200 miles out from Karachi, a PAF Starfighter formation lead by Amanullah got airborne to escort them to Masroor as they were not armed. Amanullah was in formation with Major Ihsan Shurdom and Awni Bilal to guide them for landing while orbiting over head to give them top cover^{xvii}.

An Indian Navy Alize aircraft is shot down

On 10th December Wg Cdr Arif Iqbal along with Sq Ldr Manzoor Bokhari took off from Masroor Air Base in search for Indian Navy OSA Boats towards OKHA Base along the southern coast. As they were searching for the OSA boats Arif spotted an Indian Navy Alize aircraft at low level. Settling behind it in gun range, Arif shot it down with a gun burst. The Alize with its crew of three crashed into the sea. The formation safely recovered at Masroor.

HF-24 Marut is Destroyed

On the morning of 11 December, Wg Cdr Arif Iqbal along with Sqn Ldr Amanullah as his wingman took off from PAF Masroor for a Fighter Sweep mission. The aim was to catch any fighters taking off from IAF Base Utterlai. Navigating at low level the Starfighter formation pulled over the Utterlai air base completely undetected and noticed two HF-24 Marut lined up on the runway for takeoff. Amanullah aimed for one of the HF-24 and fired 170 rounds in one single burst, destroying the aircraft. As Amanullah pulled up and positioned for another attack, he saw Wg Cdr Arif, who was below him, firing at the other aircraft. Amanullah shifted his aim into an aircraft pen and fired another burst. The formation exited the area at low level and safely recovered at Masroor.

The Loss of Wg Cdr Middlecoat

A formation of two F-104's was tasked on 13th December to strike IAF's airfield at Jamnagar. Wg Cdr Mervin L Middlecoat was to lead this mission with Sqn Ldr Tariq Habib as his No.2. The formation ingressed for the strike at low level, with the Starfighters configured with wingtip tanks and two Sidewinders under the wings. Close to the target the formation pulled-up to 2-3000 feet with target offset to their right by 2-3 miles in order to line up for their strafing runs. For some reason Middlecoat who was leading the strike banked to the left while target was on the right^{xviii}. Habib gave him a call to correct this. Repositioning for the strafing run resulted in formation spending another minute or two near the target area. After repositioning when formation was again going in for a strafing run, Middlecoat gave Habib a call saying that a missile has been fired at him. Habib cleared his six but did not see anything. Moments later while exiting and over the Gulf of Kutch, Habib got a call from Middlecoat saying that he has been hit and is ejecting. Habib inquired if he could make it to overland but he replied in the negative. Habib saw Middlecoat ejecting and the Starfighter going into the water while inverted. At that moment Habib noticed a MiG-21 to his right. As he pulled up to convert behind

the MiG-21 his auto-pitch control malfunctioned and the aircraft nose started oscillating. After disengaging the APC Habib safely exited from the area.

Later from various published Indian accounts it transpired that two IAF MiG-21's had intercepted the Starfighters while they were lining up for the strafing run. The lead MiG-21 had fired an Atoll missile at Middlecoat's F-104 which missed^{xix} but was able to close-in for a gun kill. Wg Cdr M L Middlecoat was declared MIA.

The Loss of Flt Lt Samad Ali Changezi

PAF Base Masroor was a very important target for IAF attacks and used to come under regular night attacks by IAF Canberra Bombers. Due to the difficulty faced in launching missions from the base, while under attack at night, it was decided that two F-104 aircraft should be positioned at PAF Base Faisal for night Air Defence Missions as an alternate airfield.

On 16th December, 1971, Sqn Ldr Rashid Bhatti, along with Flt Lt Samad Changezi was detailed to move to PAF Base Faisal with two F-104A aircraft. These aircraft were out of those nine F-104 aircraft that came to Masroor from Jordan on 13th of December. The Jordanian Starfighters lacked the special modifications, carried out by PAF on its Starfighters, enabling them to carry two Sidewinders on under wing weapon pylons in addition to two on the wingtips.

Due to lack of this modification, Bhatti and Samad had no choice, but to fly these aircraft for night air defence with guns only and carry fuel on wingtip tanks for extended range. The main idea being that at night PAF wanted the IAF raiding bombers to know that Starfighters are in the air leaving them with a very uncomfortable position to continue their planned attacks.

Both Bhatti and Samad took off from PAF Base Masroor for PAF Base Faisal on 16th December at 1600hrs. After landing at Faisal the pilots completed necessary operational requirement to organize the Air Defence Hut in tents and both aircraft were made ready for the night mission.

On 17th December, both pilots were told to come back to Masroor and while preparing to return they received instructions from Air Defence Command, to fly a CAP around Mirpur Khas and Chor area before landing back at Masroor.

Both pilots started a CAP in the designated area. Samad was flying the RJAF Starfighter with tail number 56-767 and Bhatti 56-839. After an hour, while both pilots were planning to return to Masroor for landing, they heard a call from Badin Radar Station, informing them of two bandits, flying at 10,000 ft and heading in their direction. The radar controller asked if they would like to engage them, Bhatti replied affirmative. Radar controller started passing on the instructions to establish contact with the bandits.

As Starfighter was approaching near the targets in battle formation, Samad who was on Bhatti's left established contact with one of the IAF MiG-21s coming from opposite direction. Samad broke off from

his lead and tried to manoeuvre behind this MiG-21. Meanwhile Bhatti (lead) also picked up both the MiG-21s and tried to position behind them. Now the situation was such that Samad was behind one MiG-21 trying to close in within gun firing range (about 3500 ft) with the second MiG-21 trying to close in on Samad. At this time Bhatti saw the second MiG-21, while still diving and turning, fire one missile at a very high angle-off at Samad. This missile missed Samad's aircraft. At this moment Bhatti called Samad that one MiG-21 is behind him and has fired a missile which was a miss. Bhatti told Samad to jettison his fuel tanks and go full afterburner (full throttle) and disengage. Since Samad was very excited trying to get within the gun firing range of the MiG-21 he ignored Bhatti or was not very attentive in the heat of the situation.

The second MiG-21 fired another missile which was a direct hit and Samad's Starfighter exploded in the air^{xx}. The pilot had no time to eject and was killed instantly. Bhatti by now had closed in behind this second MiG-21, but both the MiG-21s made a hard turn to the right and headed east towards their base. Due to low fuel and lack of any air-to-air missiles, Bhatti also turned towards own base and recovered at Masroor.

This was the third and final Starfighter loss of 1971 war.

End of a Legend

Despite limited numbers (the Jordanian F-104s were available only in the last part of the war); the Starfighters flew a total of 104 sorties during the war. A more detailed breakdown of the sorties is^{xxi},

- i) Air Defence (Day) - 56 sorties (incl 27 over battle area)
- ii) Air Defence (Night) - 18 sorties
- iii) Counter Air - 24 sorties
- iv) Maritime Recce - 6 sorties

The remaining eight Jordanian F-104s supported by a PAF C-130 were flown back to Jordan about twenty days after the war ended. PAF offered Jordan one F-104 in lieu of the single Jordanian Starfighter lost, an offer which was declined by Jordan.

After the 1971 war due to continuous arms embargo and limited numbers due to accumulative attrition it became virtually impossible for Pakistan Air Force to maintain a reasonable in-commission rate on the F-104s. Subsequently it was decided by the PAF to phase it out of service in late 1972. This ended the memorable story of PAF and its love with an engineering marvel, remembered by many as a "missile with a man in it".

After the phase out the remaining airframes were preserved at PAF Museum and various air bases as gate guardians. Out of the total 14 F-104s received six survived 11 years of service and two wars to earn their retirement. These six include four A models and two B models.

A summary of all the Starfighters operated by PAF and their fate is documented below.

Induction Date	Tail Nr	Remarks
5 Aug 1961	56-802	Lost on 09-11-1963 when the aircraft went into a spin. F/O Asghar Shah ejected
5 Aug 1961	56-803	Lost on 03-09-1964 during a low pull-out. F/L Tariq Masood died in the accident
5 Aug 1961	56-804	Lost on 05-12-1971 due to AAA. F/L Amjad Hussain ejected
5 Aug 1961	56-805	Lost on 10-07-1968 due to fire while on ground. Pilot S/L Arif Iqbal survived
5 Aug 1961	56-807	Lost on 15-04-1968 due to an inflight fire. F/L G U Abasi died in the accident
5 Aug 1961	56-868	Lost on 17-09-1965 due to pilot getting disoriented. F/L G U Abbasi survived the accident
5 Aug 1961	56-874	Preserved at PAF Base, Sargodha
5 Aug 1961	56-875	Mounted at PAF Base Chaklala
5 Aug 1961	56-877	Lost on 07-09-1965. F/L Amjad Hussain ejected
5 Aug 1961	56-879	Mounted at PAF Base, Masroor
8 June 1964	56-773	Lost in air combat on 12-12-1971. Pilot W/C M L Middlecoat died after the ejection
1 Mar 1965	56-798	Preserved at PAF Base, Faisal
5 Aug 1961	57-1309	Preserved at PAF Academy, Risalpur
5 Aug 1961	57-1312	Preserved at PAF Museum, Faisal

Kills and Claims

In the two wars fought with India, the Starfighter claimed several kills, some of which have already been detailed in this article. Few of these claims are confirmed and accepted by Indian side while the rest remain ambiguous. Given below is a short analysis of some of the kill claims.

Force Landing of an IAF Gnat, 03 September 1965

Sqn Ldr Brij Pal Singh Sikand while flying a Gnat (Serial No. IE1083), force landed on a disused PAF airfield after an aerial engagement as narrated earlier in this article. The pilot was captured by Pakistan Army troops. During interrogation, Sikand claimed to have suffered multiple in-flight emergencies, such as radio and compass failure, gun jamming, erratic fuel flow etc. Before flown out of the airfield, Sikand also had an informal chat with another PAF pilot, Flt Lt Saad Akhtar Hatmi, who was sent to Pasrur to ferry the Gnat to Sargodha^{xxii}. According to Hatmi:

“During our friendly chat he confessed that he was unsure of his position but the presence of an F-104 overhead had helped him into a quick decision to land at Pasrur.”

Before ferrying the Gnat, a thorough pre-flight check was carried out by Hatmi and a team of technicians from Sargodha Air Base and all systems were found to be in working condition.

Shooting Down of Mystere, 06 Sep 1965

Sqd Ldr Aftab Alam Khan claims shooting down a Mystere near Rahwali railway station using a Sidewinder missile. This claim is not confirmed by Indian sources, though after the engagement, it was announced that part of the wreckage has been recovered. No additional information is available on this claim.

Shooting Down of Mystere, 07 Sep 1965

Sqn Ldr Ajamada B Devayya from IAF No. 1 Sqn was shot down by F-104A flown by Flt Lt Amjad Hussain as narrated earlier in this article. The loss is confirmed and accepted by both sides. The only point of contention is Amjad himself was shot down by the Mystere or did he actually fly through the debris of exploding Mystere /had mid-air collision with the Mystere. Recent research conducted by Air Cdre Kaiser Tufail^{xxiii}, which involved interviewing multiple witnesses, confirmed that Amjad indeed had a mid-air collision with the Mystere and was not shot down.

Shooting Down of Canberra, 14 Sep 1965

Sqn Ldr M L Middlecoat trying to intercept IAF Canberra's at night had fired a Sidewinder. An explosion was observed and the aircraft was noticed descending rapidly. No further information was available from Indian side, till an article written by Captain (retd.) Vivian Goodwin appeared on an Indian website^{xxiv}, in which the author claims to have noticed a "bright flash accompanied by red embers" over his cockpit while he was just short of Srinagar, after having climbed to an altitude of 40,000 ft. The Canberra was part of a larger formation that had just attacked Peshawar Air Base. Noticing the flash, Goodwin spiralled down to about 20,000 ft and maintained this altitude and recovered safely. It is very likely that this was the Canberra at which Middlecoat had fired the Sidewinder and which he had observed spiralling down.

Shooting Down of Canberra, 21 Sep 1965

This is a confirmed kill in which, Sqn Ldr Jamal A Khan shot down a Canberra using a Sidewinder. The pilot was taken PoW while the navigator perished in the crash.

Destruction of Light Aircraft, 03 Dec 1971

While attacking the radar installation at Faridkot airfield, Sqn Ldr Amanullah had noticed and strafed a light aircraft. The pilot did not claim this kill but on returning he was informed Ops room by Air Cdre (R) Z I Khan, who was operations officer, that Indian radio confirmed the destruction of a light aircraft parked at Faridkot.

Shooting Down of Gnat, 04 Dec 1971

It is not known with certainty if the Gnat aircraft crashed or if the pilot was able to nurse the aircraft back. One Indian source corresponded with Air Cdre (retd.) Amanullah and confirmed that the IAF Gnat pilot, at which Amanullah fired the Sidewinder was Wg Cdr Johnny Green, and that the pilot ejected safely^{xxv}. Other Indian sources are unable to confirm or deny this claim.

Shooting Down of Su-7, 04 Dec 1971

As narrated earlier, two Starfighters on a mission to strike Amritsar radar, came across a formation of Su-7, just close to the international border. These Su-7s were most likely returning from Close Support mission. Indian Air Force admits losing multiple Su-7s on this day, but additional details such as precise time, area and exact cause of some of the losses is unknown. It is highly probable that Sqn

Ldr Rashid Bhatti indeed shot down a Su-7, which might have been attributed to anti-aircraft or small-arms fire by Indian Air Force.

Shooting Down of Alize, 10 Dec 1971

There is no ambiguity about this claim. The loss is accepted by Indian Navy.

Destruction of HF-24 Marut, 11 Dec 1971

There is no ambiguity about this claim. The loss is accepted by Indian Air Force.

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Persons Interviewed

The authors interviewed and corresponded with a number of Pakistan Air Force officers who were directly involved with the events discussed in this article or have independently researched these events. These include:

1. Jamal A Khan, Air Chief Marshal (ret'd)
2. Hakimullah Khan, Air Chief Marshal (ret'd)
3. M Sadruddin, Air Vice Marshal (ret'd)
4. Farooq Umer, Air Vice Marshal (ret'd)
5. Abbas Mirza, Air Vice Marshal (ret'd)
6. Amjad Hussain, Air Vice Marshal (ret'd)
7. Rashid Bhatti, Air Commodore (ret'd)
8. Amanullah Khan, Air Commodore (ret'd)
9. Syed Mansoor Husain Shah, Air Commodore (ret'd)

10. Kaiser Tufail, Air Commodore (ret'd)
11. Tariq Habib, Wing Commander (ret'd)

Endnotes:

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- ⁱ 'Lockheed F-104 Starfighter' by Martin Bowman and Warbird Tech Series Volume 38: Lockheed F-104 Starfighter by Jim Upton
 - ⁱⁱ Interview with AVM M Sadruddin.
 - ⁱⁱⁱ Interviews and correspondence with AVM M Sadruddin, AVM Amjad Hussain and ACM Hakimullah.
 - ^{iv} The Vulcan gun can fire 100 rounds (as in the F-16), but can be limited, depending on the gun gas ingestion pattern on different aircraft. In the F-104 it was set at 66 rounds/sec.
 - ^v Interview with AVM Abbas Mirza.
 - ^{vi} Eyewitness accounts of both crashes were obtained in Interviews with AVM Farooq Umer and Abbas Mirza.
 - ^{vii} As narrated by AVM Amjad Hussain. The research done by the authors suggests no evidence which would support the analysis made by John Fricker attributing the Starfighter loss to an IAF Mystere. Fricker's analysis fails to explain how Sqn Ldr AB Devayya was shot down himself. Given the circumstances of the air combat and especially the fact the Amjad was approaching the Mystere at a very high speed a mid-air collision or external debris damage remains a very high possibility.
 - ^{viii} Conversation and correspondence with AVM Amjad Hussain and other squadron pilots. The incident is also narrated by John Fricker in "The Battle for Pakistan".
 - ^{ix} For F-104 start up an external APU & Compressed Air Unit (MD-3) is required. When the pilot is ready for start-up he gives a signal to ground party. MD-3 Unit starts to pump the compressed air to rotate the Compressor. At this stage the aircraft starter unit engages with the compressor and it rotates with the aircraft compressor. When the compressor RPM reaches around 67% then pilot signals the ground party to disconnect the MD-3. At this stage the starter unit is automatically gets disengaged from the aircraft compressor which is now rotating at very high speeds.
 - ^x The section is based on de-classified USAF documents and conversations and interviews with various PAF pilots who had the opportunity to fly all three types of aircraft.
 - ^{xi} The section is based on conversations and correspondence with various PAF officers who were involved in these projects and familiar with these developments during this period.
 - ^{xii} Such missions were considered fairly successful by PAF, some evidence for this is also found from Indian accounts. For example its is accepted by Indian sources that the Bernala radar station remained off air for at least 12 hours after one of these strikes.

- ^{xiii} As communicated to the authors by Air Cdre (retd.) Amanullah
- ^{xiv} It was later discovered that this Gnat was being flown by Wg Cdr Johny Green.
- ^{xv} F-104 test pilot Glen Reeves had informed Sqn Ldr Amanullah of this problem and the solution when they had flown together in Jordan.
- ^{xvi} This information was provided to the authors by ACM Jamal A Khan.
- ^{xvii} Amanullah had flown over 300 hours with RJAF at H-5 air base with Awni & Ihsan Shurdom. Awni later in 1983 did Air War College course with him in USA as well. He passed several years ago from a heart attack. Ihsan Shurdom later rose to command the RJAF and now living a retired life in Jordan.
- ^{xviii} As narrated by Tariq Habib to the authors.
- ^{xix} The Indian pilot claims that the missile was decoyed by flares. PAF Starfighters were never equipped with IRCM flares. The Indian MiG-21 pilot most likely saw F-104's afterburner being lit up and confused it with flares.
- ^{xx} As narrated to authors by Air Cdre (retd.) Rashid A Bhatti
- ^{xxi} All data on sortie generation was obtained by Air Cdre Kaiser Tufail from AHQ, and has been used in the article with his permission
- ^{xxii} I Flew the Indian Air Force, Gnat by Air Cdr (retd.) Saad Akhtar Hatmi
- ^{xxiii} Mystery of the Downed Mystere, The Great Air Battles of Pakistan Air Force by Air Cdre (retd.) Kaiser Tufail
- ^{xxiiii} Combat Diary of a Tusker by Captain (retd.) Vivian Goodwen, www.bharat-rakshak.com
- ^{xxv} Authors correspondence with Air Cdre (retd.) Amanullah