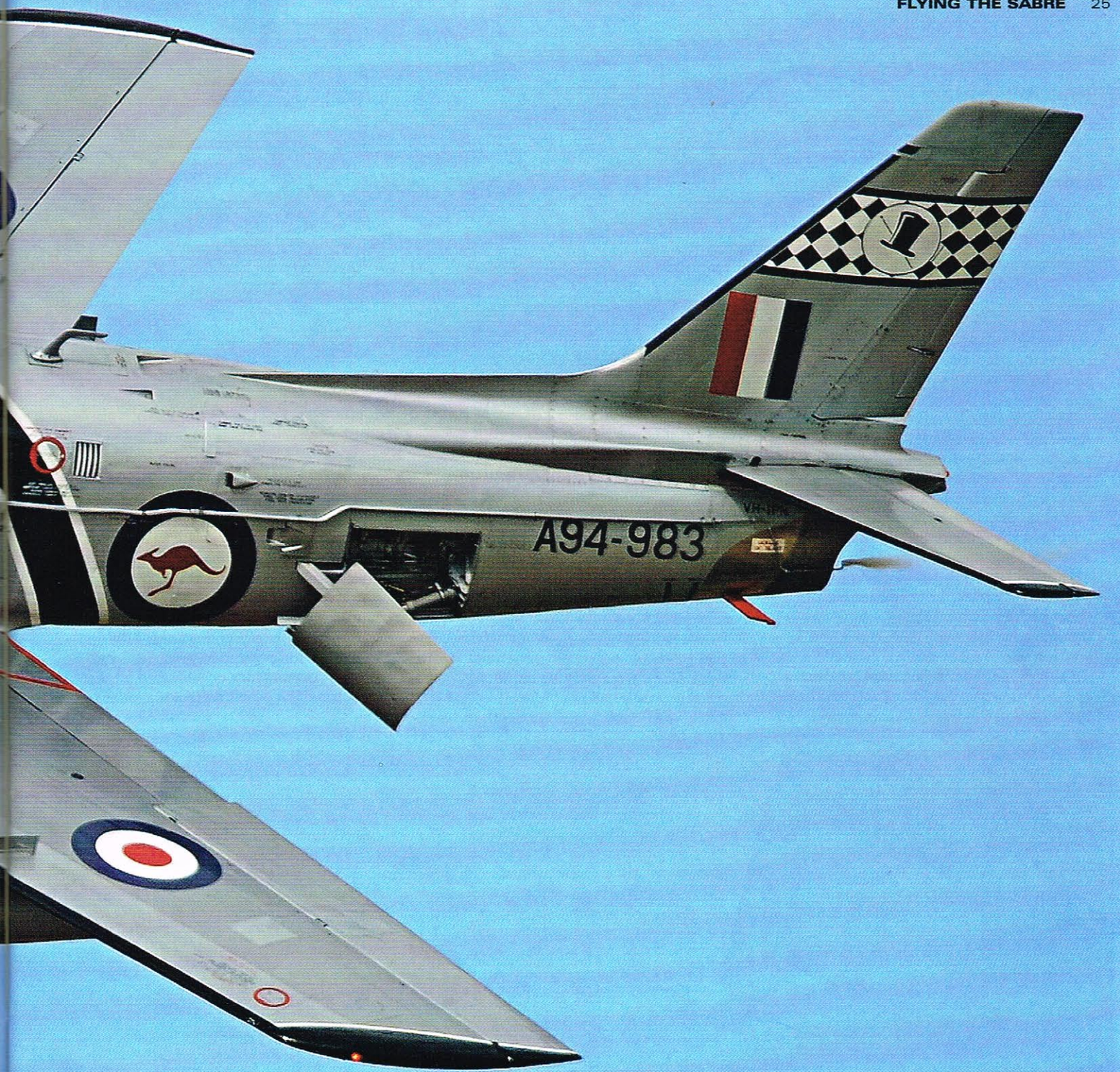
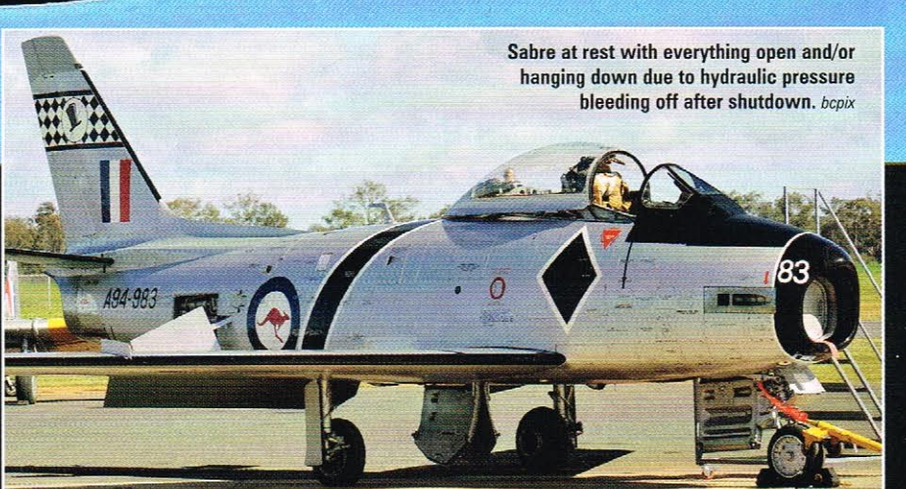
Sabre

From the Cockpit

Above: CAC Sabre Mk.32 A94-983 owned by the RAAF Museum and restored and operated by the Temora Aviation Museum, which finances the whole project. '983' flies in the colours of 75 Squadron's Black Diamonds aerobatics team. *bcpix*

The locally-built and largely redesigned Commonwealth Aircraft Corporation (CAC) Avon-Sabre was the Royal Australian Air Force's front line fighter for a decade until it began to be replaced by the supersonic Dassault Mirage from 1965. We put you into the cockpit of a Sabre to provide a taste of what it was like to fly.





Sabre at rest with everything open and/or hanging down due to hydraulic pressure bleeding off after shutdown. *bcpix*

FORMER WING COMMANDER Noel Kruse (later founder of the famed Sydney Aerobatic School) logged more than 1600 hours on RAAF Sabres and served with 3, 76 and 79 Squadrons in Australia and overseas. Here, he takes us through a Sabre training mission from RAAF Williamtown near Newcastle, NSW in the late 1950s.

The mission is a ground attack gunnery exercise at the nearby Saltash firing range and we are in the lead aircraft of a flight of four. >>>

PRELIMINARIES

Prior to each sortie there would be a roughly 30 minutes briefing. Even though each of the pilots had heard it all 50 or 100 times before we still went over everything carefully because there's always the odd change and it was not good to get complacent.

You'd go through the standard thing, start, taxi, takeoff, first heading then departure, the runway, the rejoin procedure, run in, pitch out and so on, working your way right through the approximately 40 minute sortie.

Having briefed the sortie, next would be to go into the safety equipment section where you'd kit up, collecting your parachute, 'bonedome' and G-suit. One thing people don't realise with the Sabre was that the North American ejection seat didn't have the parachute installed in it, you wore your parachute on your back as you walked out to the aeroplane and back again.

You sat in this seat which was a 'catapult' only, unlike the Martin-Baker which had everything included. The seat kicked you out once you'd ejected and at whatever height you happened to be, so you'd free fall until you either pulled the chord to open the 'chute or the automatic barostatic device opened it for you at around 14,000 feet.

After putting your G-suit and Mae West on and your parachute over that it was time to go out to the aeroplane via the flight office where you'd be assigned your aircraft, check the unserviceabilities and sign the necessary forms. Even though some aeroplanes had pilots' names painted on the side, that was mainly a PR exercise and you by no means ended up in 'your' aeroplane, even though it may well have been involved in your particular flight.

"By the time you got to your aircraft the ground power units were plugged in and working." *Wendy Wilson*

By the time you got to your aircraft the ground power units were plugged in and working. These were great big old Diesel driven things called a Deutz which used to chug away throwing out large quantities of black smoke. There would be at least one airman there to help you strap in.

PRE-FLIGHT

After placing your parachute and helmet on the port wing it was time for the walkaround, starting at the front fuselage near the port wing root leading edge walking around the aeroplane checking everything in general and some things in particular.

In both the gun panels there was a little

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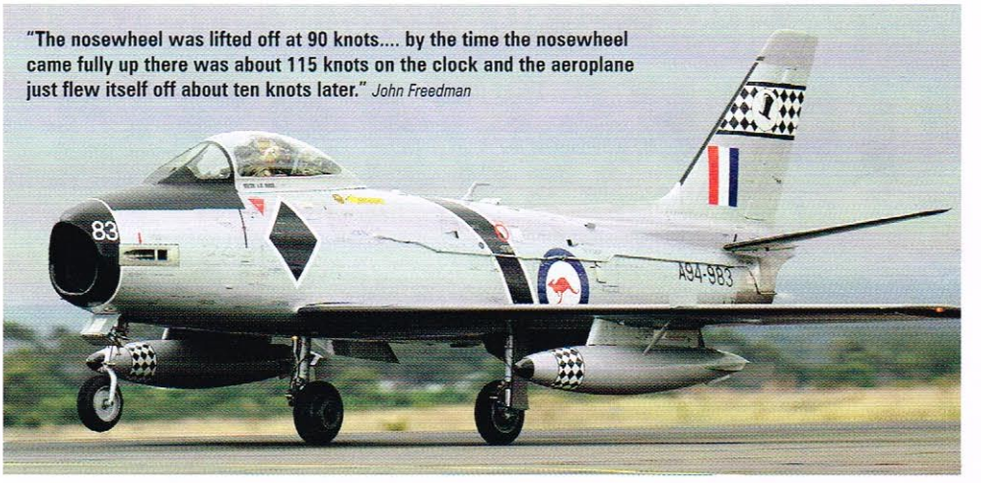
Ryan Fletcher



"The nosewheel was lifted off at 90 knots.... by the time the nosewheel came fully up there was about 115 knots on the clock and the aeroplane just flew itself off about ten knots later." *John Freedman*

slot in which you should not see a red flag if you had live guns, or you would see it if they were safe. There was a pin with a red flag in there, so if you were going out for some live gunnery it shouldn't be visible.

Walking around the front of the aeroplane you checked that the nosewheel steering mechanism was engaged. It's a hydraulically actuated mechanism but when they towed the aeroplane they could physically disconnect the wheel from the upper part of the leg so it fully castored, so you had to check it was properly reconnected.

Checking inside the nosewheel bay there were a couple of gauges which indicated the pressure of the hydraulic reservoirs for the nosewheel and speedbrake emergency extension accumulators – about 1200psi was what we were looking for. Other things to check included strut extension, tyre condition and so on.

Walking around to the right wing you checked all the retraction mechanism because the Sabre had one particular possible malfunction which if it occurred meant the emergency system wouldn't work. This was a matter of checking a weld but of course there were several other things that could go wrong.

In the well was a 'door closed' switch which had to be flipped to the closed position. Nothing happened because at this stage there was no hydraulic power to the aeroplane. When it arrived, all the flipper doors would close automatically.

Then it was the wing, just checking its general condition and that of the control surfaces, the filler caps and so on while trying not to do yourself an injury by walking into the pitot tube!

The ailerons were rigid – you couldn't wiggle them up and down like your average light aeroplane – because they were all hydraulic and irreversible. In fact if they did move you had a problem. The flaps were electrically actuated and hydraulically driven so they were usually in the down position. They only went down 30 degrees so they were really for lift only.

Standing at the trailing edge of the wing there were a couple of louvres in the fuselage which were dump valves for the compressor. Below a certain rpm the compressor delivered too much air to the engine so it would come out through these louvres. You had to check they were clear.

Immediately behind that was the right hand speed brake and near there was an another accumulator for this which also had a pressure valve which had to be checked for pressure.

Then it was down to the tail. Some taller people could just reach up, grab the elevators and make sure they were also rigid but most couldn't reach so they didn't bother. One thing well worth checking was that the tailpipe inside the rear fuselage did have a bit of movement in it because when it got hot it expanded and would lock solid. If it was too tight you'd get rubbing between it and the main fuselage and a very disconcerting vibration in the airframe.

Then it was down the left hand side to the speedbrake and another compressor dump valve to check the left hand wing and control surfaces and back to the left hand undercarriage. Apart from checking all the normal things in the undercarriage well there were a couple of switches which had to be in the 'on' position as they were associated with the starting cycle.

Also the exhaust from the starter motor came out through the left hand wheel well and you had to ensure the undercarriage flipper door was flipped up manually because there was a little hole in it which came up and engaged the exhaust pipe. Otherwise this red hot exhaust would play on the inside and probably melt the flipper door. There was a microswitch in the well which wouldn't allow you start the engine if the door wasn't closed.

This walkaround took about five minutes to perform once you knew what to look for. At this point you walked out to the front of the aircraft and wait for the other guys in your formation to do the same thing because there was no point in getting into the cockpit only to sweat to death if somebody had a problem which delayed them. When everyone gave the thumbs up you'd get into the aeroplane after clipping on your parachute.

The strapping in process was a little involved. First you'd have to attach your dinghy lanyard to the left hand side of your Mae West, you then connected your G-suit hose which came out of your left hand hip into another hose which came up through the floor in the centre, then you'd do up your harness which was just a lapstrap and shoulder harness – there was no negative 'g' strap.

This was a bit unfortunate because the lack of it meant that many pilots were never as firmly attached to the seat as they'd have liked despite pulling the lapstrap as tight as possible.

As part of connecting the buckle, you had to insert what they called the 'carrot'. This was a spring loaded cable which clipped into the top of the buckle. If you needed to eject, this cable would remain attached and reel itself out to about five feet and then pull out the switch which activated the barostatic device which was supposed to automatically open your parachute at 14,000 feet. Before starting the cockpit checks the last thing to do was put your helmet on and attach and check the oxygen system.

IN THE COCKPIT

The cockpit check was in a left to right sequence starting from the side console on the left. The throttle quadrant was on the left side and it had an emergency speedbrake dump valve, the throttle, the flap lever and the high pressure cock arranged in priority by size with the throttle the biggest.

Forward of that was the Sidewinder panel and a fuel dip switch, a device which >>>

CAC SABRE Mk.32

POWERPLANT	One 7500lb (33.3kN) thrust CAC-built Rolls-Royce RA.7 Avon Mk.26 axial flow turbojet; internal fuel capacity 412imp gal (1873lt), provision for 100 or 167imp gal (454/759lt) underwing drop tanks.
DIMENSIONS	Wing span 37ft 1in (11.30m); length 37ft 6in (11.43m); height 14ft 4in (4.37m); wing area 302.3sq ft (28.1m²).
WEIGHTS	Empty 12,000lb (5443kg); normal loaded 17,720lb (8038kg), maximum 21,210lb (9621kg).
ARMAMENT	Two 30mm Aden cannon in nose with 162 rounds per gun; two AIM-9B Sidewinder AAMs; up to 24 air-to-ground rockets, two 500 or 1000lb (227 or 454kg) bombs or eight practice bombs.
PERFORMANCE	Max speed Mach 0.92 – 609kt (1126km/h) at sea level, 584kt (1081km/h) at 10,000ft, 528kt (977km/h) at 38,000ft; typical cruise 478kt (885km/h); initial climb 12,000ft (3658m)/min; service ceiling 52,000ft (15,850m); ferry range (external fuel) 1000nm (1850km).
IN RAAF SERVICE	1954-71.
NUMBER	1 prototype, 22 Mk.30, 20 Mk.31, 69 Mk.32, total 112.
RAAF SERIALS	Prototype A94-101, Mk.30 A94-901/922, Mk.31 A94-923/942, Mk.32 A94-943/990, 351/371.

Above: **".... the undercarriage had to be retracted immediately because the gear limiting speed of 180 knots came up very quickly.... the flaps had to be quickly retracted for the same reason."** *Ryan Fletcher*
Right: **".... the Sabre's best climb speed was about 350 to 400 knots which explains why you never saw them doing steep climbs immediately after takeoff."** *Wendy Wilson*

retarded the throttle by around 300rpm when a Sidewinder missile was launched. This was to avoid engine compressor surge as the missile hurtled past the intake, sending a shockwave down it. This operated automatically and under deceleration the engine wouldn't surge. It would pick up again after about five seconds.

The main flight panel had all the standard things plus a hydraulic valve with a selector switch for the three separate hydraulic systems – the normal and alternate systems which only powered the flight controls and a utility system which drove everything else. `Alternate' was the one selected at this stage. There was also a single radio with preset frequencies.

Next was the centre console with the weapons switching with switches for bombs, rockets guns and camera. There was a switch down there which was `sight/camera/radar' in the down position and `sight/camera/radar/guns' in the up position.

There were bomb selectors, rocket selector – you could select whether you wanted to fire them singly or in ripple fashion – and a gunsight depression device on which you could set the depression of your sight to suit various bombing or gunnery functions. These were set in advance, in this case for air-to-ground gunnery.

The right hand panel contained all the engine switches with low pressure cock, engine master switch, fuel transfer switches. On the right hand side was a radio compass and a circuit breaker panel which you couldn't see despite the lovely labels on them! If anything went wrong all you could do was slide your hand along the panel and if you found anything sticking out, push it back in!

Time to start the engine. The ground crewman would switch the `ground/flight/off' switch to `ground' which gave the aircraft a power supply – remember you're hooked up to the Deutz – and then you could test the warning lights and so on.

Turn the radio on, look across at the other pilots and check they're ready to go, for example `Stingray Blue check' and you'd hear `Blue Two, Three, Four'. Then it was simply `Stingray Blue start engines'. Starting was simple – hit the starter button and at the same time advance the HP cock and sit back and let it all happen.

The engine would spin to 1800-2000 revs on the starter motor, then the fuel would be injected automatically at the appropriate moment, the engine would catch and wind up to about 3000rpm.

As soon as the motor started to wind up the aircraft's main hydraulic pumps were operational and what had to be done very quickly during this initial run up stage was check out the automatic transfer system on the hydraulics. If the system you had selected failed it would automatically change over to the other flight controls system. The `alternate' was electrically powered, the `normal' system was engine driven.

The first check – before you start – is that alternate hydraulic pressure was OK and as soon the engine started and before the >>>

"The engine would spin to 1800-2000 revs on the starter motor, then the fuel would be injected automatically at the appropriate moment, the engine would catch and wind up to about 3000rpm."

"The gunnery pattern was flown at 1500 feet, the attack speed was around 400 knots and the dive angle was 15 degrees." *bcpix*

hydraulics had fully built up you'd flick a little switch on the side which would change the system from 'alternate' to 'normal'. Then you'd immediately grab the stick and furiously wobble it around the cockpit.

The aim was to exercise the controls so dramatically that the hydraulic pressure dropped to a level low enough to make the system automatically switch to the other system. In other words you were checking the automatic changeover was working properly. It must have looked strange, all these Sabres in a neat row on the flight line with their control surfaces moving up and down with gay abandon!

After completing the remainder of the after start checks which included setting up the sight for the mission and then caging for the taxy and take off, the ground crews were given the thumbs up at which point they changed the external `ground/flight/off' switch to `flight', unplugged the ground power, closed the panel and we're away on internal power.

Another look along the line and another radio check on the squadron frequency that everyone in the flight was ready then it was onto the tower frequency and another check that everyone was OK. It was standard procedure to check everyone was on line after a frequency change.

AIRBORNE

After taxi clearance had been given the flight moved off. With the engine idling at 3000rpm the taxi was quite fast so constant jabs on the brakes were necessary. The nosewheel steering was connected to the rudder pedals but it had to be engaged by pressing a button on the front of the control column grip which had to be held in the whole time.

While taxying in staggered pairs the pre-take off checks were performed. The mnemonic was TAFFIOH: Trim – just short of fully aft; Airbrakes – cycle them once to make sure they're working; Fuel – quantity, HP cock on, booster pump on, check that the pressurisation warning light had gone out if you were carrying tanks; Flaps – down; Instruments – standard checks plus making sure the gyro compass was synchronised; Oxygen – recheck the indication blinkers and everything else was working; Harness; Hydraulics (pressure, alternate light out, `normal' selected) and of course a check that the controls were free and in the correct sense.

Upon lining up on the runway you'd set the air conditioning and close the canopy, remembering to duck because the frame was at about eye height!

The leader would pull up on the extreme left hand side of the runway, number two would be just to the right of the centreline and number three would fit in between which

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Above and below: **The Commonwealth Aircraft Corporation (CAC) built 112 Avon-Sabres starting with the CA-26 prototype A94-101 (first flight 3 August 1953) and ending in December 1961 with delivery of the last CA-27 Mk.32. The prototype and an early Mk.32 (A94-946, delivered September 1956) are illustrated.** *RAAF*

left room for number four on the right hand side. A quick nod from one pilot to the others to indicate 'ready' would be followed by a wind up signal from the leader.

The engine would be run up to about 7600rpm which would take six to eight seconds to achieve. At that number of revs you had to check your jet pipe temperature (JPT) was in the correct 580-680°C range, there were no fire warning lights, the generator light was out and the oil pressure was at a minimum of 15psi.

Then it was another quick look around to make sure everyone was OK, then a nod of the head by the leader and a simultaneous brake release for a formation take off with the rear pair starting a few seconds later.

The nosewheel was lifted off at 90 knots and if it wasn't up by about 100 you'd never get off the ground due to the nose down stance of the Sabre. At that speed negative lift was generated if the angle of attack hadn't been raised to the correct level.

If for some reason the nose hadn't come off you had to shove the stick sharply forward and back again to bounce the aircraft off the nosewheel and up into the correct attitude. If that didn't work the take off had to be aborted there and then because the runway was fast disappearing behind you.

By the time the nosewheel came fully up there was about 115 knots on the clock and the aeroplane just flew itself off about ten knots later. You'd hold that very flat attitude for some time to build up speed. Don't forget that the Sabre's best climb speed was about 350 to 400 knots which explains why you never saw them doing steep climbs immediately after takeoff.

As soon as the aircraft left the ground the undercarriage had to be retracted immediately because the gear limiting speed of 180 knots came up very quickly with the aircraft accelerating rapidly. The flaps had to be quickly retracted for the same reason. It looked all very 'gung ho' retracting the wheels so soon but it was an operational necessity as they took quite a few seconds to go up and it was very easy to exceed that limiting speed.

As this flight's going to the nearby Saltash range you'd restrict your speed to around 300 knots to allow numbers three and four to catch up. As the range was only five miles north of the airfield you had to fly a dumbbell pattern out to sea to allow the formation to get set and speed and height to be established.

INTO ACTION

By the time you made the final 90 degree turn to run into the range across the beach and what is now the light aircraft lane you were established at the correct height – 1500 feet in the case of a gunnery exercise – and at the release speed and in an echelon right formation.

Another frequency change – to the range frequency – and another check in followed then it was onto the range: "Stingray Blue five miles out with four chicks" and they'd reply "clear on."

The run into the pattern would be along the attack direction and then there would be a pitch out into the circuit [see the diagram reproduced here] at six second intervals. In those days it was a left hand pattern. The gunnery pattern was flown at 1500 feet, the attack speed was around 400 knots and the dive angle was 15 degrees.

The circuit pattern was much the same size as what you'd do in a Tomahawk or 152 at Bankstown accept it was somewhat faster which meant that 4-4.5g was being pulled on the corners as you stood the Sabre on its wingtips.

"Blue One in live" was the phrase used as the leader turned onto base leg and the Range Safety Officer's responsibility was to clear each aeroplane in on each pass. Meanwhile the pilot has already selected `sight/camera/radar/guns' on the armament master selector while the master switch providing power to the circuit was not turned on until the aircraft was well into its attack run just in case the pilot inadvertently pulled the trigger while moving the control column.

The range was judged purely by estimation and a two second burst was the normal for this kind of exercise. The target was a very course mesh like a stiff hessian bag about 15 feet square strung up between telephone poles. It was black with a big orange circle in the middle.

The one thing that helped in assessing the range was that they told you how big the circle was and the pipper on the gunsight >>>

"Once over the threshold.... it was off with the power and aim to touch down on the piano keys at around 120 knots." *Wendy Wilson*

was the same size at firing range. So we're in the gunnery pass and the slope range of about 1500 feet has to be assessed with a cease fire no closer than 600 feet from the target which is pretty close when you're going 400 knots. The fall of shot could be seen straight away, you'd see dust hopefully behind the target.

At this stage, coming towards the target in a 15 degree dive at 400 knots you are destined to fly over the target at low altitude unless something fairly dramatic was done. There was a real danger of picking up ricochets, not so much from your shells but from the guy behind you, whose shell might hit another one already embedded in the sand behind the target. This happened to a Sabre, hit by a round fired by a Meteor ten years earlier!

The sequence was this: as soon as you'd fired it was a 5g pull into a 60 degree nose up pitch which puts the aircraft into a rate of climb somewhere in the region of 12,000 feet per minute. Of course the circuit height is only 1500 feet, so something's got to be done quickly to stay within reasonable height limits.

You rolled on 90 degrees of bank, keeping the 'g' on, pulled it onto its back pointing about 30 degrees down and rolled it out at 1500 feet on downwind. The aircraft would reach a peak height of about 3500-4000 feet before dropping back to the correct height. It was lots of fun!

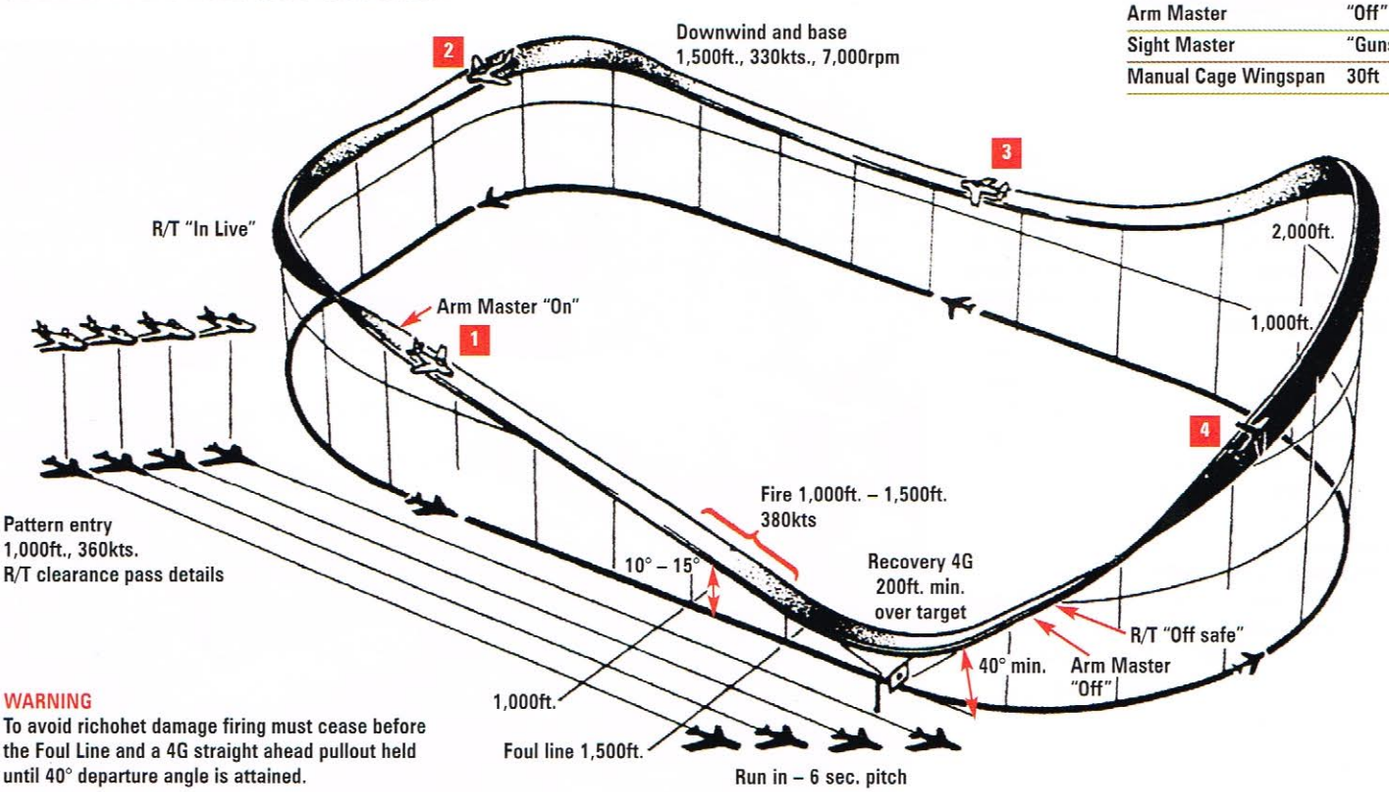
There was the odd occasion when you were feeling really exuberant when you'd roll the other way and do a Derry turn back onto the straight and level! While all this was going on you had to flip the armament master switch to off, call "off safe" and commence the next run.

Eight runs would be the normal number and it all got a bit hectic with four aeroplanes screaming around in this very tight pattern at relatively high speed. They were going >>>

SABRE AIR-TO-GROUND GUNNERY

SWITCHES

Arm Master	"Off"
Sight Master	"Guns"
Manual Cage Wingspan	30ft



WARNING

To avoid richohet damage firing must cease before the Foul Line and a 4G straight ahead pullout held until 40° departure angle is attained.

".... the Sabre was one of the worst stopping aeroplanes ever built.... the trouble was, the brakes were too powerful and all too easy to lock up.... so they couldn't be used very much which in turn lengthened the landing roll." *bcpix*

over the target about once every ten seconds, a fair old rate.

On the way into the final pass the leader would call "in live, last pass" and after firing, the flight would recover straight ahead rather than flying back into the pattern and set course for home.

The pilots wouldn't know how good their shooting had been until they were back at base after the targets had been pulled down, examined, and the results telephoned through. Each aircraft had its rounds dipped in a different coloured thick gooey paint which left a stain on the target so they could tell who'd done what.

COMING HOME

Over the aerodrome the flight was settled into echelon right and would then make an upwind run at circuit height – 1500 feet – and as it ran down the runway they would simply pitch out at four second intervals.

The aim of the pitch was to slow down. In a fighter the best way to lose airspeed was in a turn while pulling a high angle of attack, so it was a 60 degree, 2g turn with power back to about 5500rpm and speed brakes out. This would bring the speed back from 360 to about 185 knots as the aircraft rolled out downwind.

Then it was down with the gear, and if you'd judged the turn correctly your wingtips were tracking down the runway. The reason for maintaining not less than 5500rpm was simply that below that it took a long time to spool up again, which could be embarrassing if you needed to go around.

Onto base leg it was time to put the flaps down to 30 degrees. With everything down and speed brakes out about 6200rpm would see the aircraft come down on a constant turning approach from 1500 feet at around 160 knots and would slowly be bleeding speed off until it was down to 150 knots when you rolled out of the turn and 130 over the threshold.

The approach was fairly flat in the latter stages because the nose had to be gradually eased up in the last quarter of a mile to get rid of airspeed.

Once over the threshold you were virtually committed to land so it was off with the power and aim to touch down on the piano keys at around 120 knots. Wasting as little runway as possible was important because the Sabre was one of the worst stopping aeroplanes ever built!

The trouble was, the brakes were too powerful and all too easy to lock up, blow a tyre and have a nasty accident off the runway somewhere so they couldn't be used very much which in turn lengthened the landing roll. In the wet the aeroplane would aquaplane very easily with its high pressure tyres until it got down to about 90 knots.

Remember, we're touching down at 120 or so, so a fair bit of speed had to be knocked off before the tyres would provide any grip and allow the brakes to be used. This took half the runway to achieve using correct aerodynamic braking technique.

The trick was to use the flaps. The aim was to raise the nose and stall the wings on the ground, but having just touched down the aeroplane was still well above its stalling speed with flaps down and would tend to take off again if the stick was pulled back.

So the moment the aircraft touched down you'd raise the flaps – which would increase the stalling speed and help pitch the nose up – hold the nose well up and when the stall was felt put the flaps back down again even if they hadn't cycled fully up yet.

You could feel the aircraft dig right in – it was like hitting a brick wall – and you could bring the speed back to 70 knots after which you could lower the nosewheel and gently use the brakes.

Of course as soon as everything was nicely under control it was standard procedure to move to the exit side of the runway just in case the guy behind hadn't been so successful in slowing it all down!

After taxying back to dispersal and shutting down the pilots went to the flight hut to sign off the aeroplane and note any unserviceabilities, then it was back to the crew room via the safety equipment section to return parachutes, Mae Wests and helmets.

A debrief followed, at which the newest pilot who the leader had just bagged for not keeping up with the formation properly or similar minor misdemeanours, inevitably returned the highest score on the gunnery range!

The story of the Sabre's Australian production programme and RAAF service was told in AERO Issue 14 (April-June 2007).