GENERAL DATA/HANDLING IMPRESSIONS OF—

The Jet Provost

This month the RAAF begins the introduction of all-jet training with the Hunting Jet Provost. Here are some details and flying notes on this first Viper-powered trainer seen here.

THE arrival in Australia early in April of a Hunting Aircraft Jet Provost T.2 for evaluation by No. 1 Basic Flying Training School, Point Cook, heralds the first step towards the projected change over to all-through jet training in the Royal Australian Air Force.

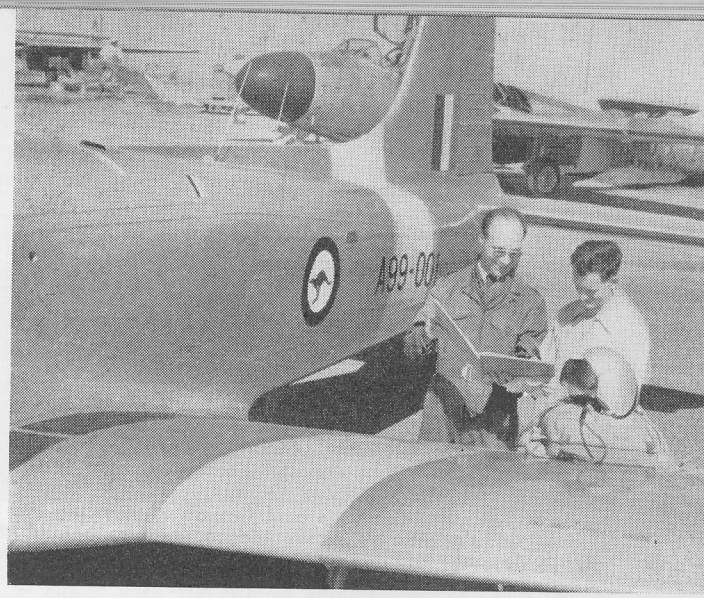
The Jet Provost will be operated at Point Cook for a six months' trial period, during which time two selected trainee pilots of No. 35 Pilot Training Course, scheduled to start flying early in May, will receive their basic training on this aircraft, while the remainder of the course are trained on the RAAF's standard basic training aircraft, the CAC Winjeel. The progress of the two jet pupils will be closely watched by RAAF training authorities and a comparison then made with the rate of advancement of their fellow pupils on the Winjeels.

All-through jet training has now been adopted as standard in the RAF, and the replacement of the propeller-driven Provost in RAF Basic Training Schools by the Jet Provost is now well under way. RAF evaluation of all-jet training began in 1955 when a small batch of the earlier Mk. 1 Jet Provost was allocated to No. 1 FTS, Hullavington. The results obtained from these aircraft which were operated as a separate flight alongside the standard propeller-driven Provost trainers with which the school was equipped were most encouraging. Average times to first solo were actually lower than on the propeller-driven aircraft, but RAF instructors formed the opinion that although the jet aircraft was easier to fly, it revealed the limitations of below average pupils at an earlier stage in their training, and thus enabled a considerable saving in the overall cost of flying training operations. It is unlikely that the results of the RAAF evaluation of the Jet Provost will be any less satisfactory than the results experienced by the RAF, and an order for 50 or 60 Jet Provosts to replace the Winjeel would appear to be the logical conclusion to be expected from the trials. As de Havillands are now associated with Hunting Aircraft and represent them in Australia, it would also appear logical to anticipate that if the Jet Provost is ordered for the RAAF, it will be built at Bankstown by de Havillands and that production would follow completion of the Vampire Trainer Mk. 35 order in approximately 12 months.

Originally designed as a jet-powered development of the Provost, the Mk. 1 Jet Provost first flew in June, 1954. It differed in many ways to the Mk. 2 version, which is now being demonstrated in Australia, and further minor modifications have been incorporated in the Mk. 3 model, which is the version now in full production for the RAF.

The Jet Provost G-AOHD arrived in Australia by sea and after assembly at de Havillands, Bankstown, was test flown by Hunting chief test pilot S. B. Oliver, who has carried out the Australian demonstration flying and conversion of the RAAF instructors who will fly the aircraft at Point Cook. G-AOHD had previously been used for a demonstration tour of South America between April and August of last year, and its flight after assembly at Bankstown was actually its first flight since leaving South America. It is the proud boast of Hunting Aircraft that on the South American tour G-AOHD flew 178 hours and covered 8400 miles of hard travel flying with a spares backing that was carried in two suitcases, and that at the end of the tour most of the spares items were still in the suitcases.

The Jet Provost is an all-metal 2-seater, low-wing monoplane, powered by a single 1750 lb. st Armstrong Siddeley Viper. Seating is side by side, and the aircraft is equipped with a retractable tricycle undercarriage. The fuselage is of all-metal stressed skin construction and is built in two sections, the front section containing the cockpit and the engine bay, and the rear section carrying the jet pipe and tail unit. Both fuselage sections are semi-monocoque structures with pressed frames, four main longerons and closely spaced top hat and Z section stringers. The two sections are joined together at the rear of the engine bay. Each mainplane is a separate unit and is attached to the fuselage by means of a three-point attachment at the fuselage side. The centre section is an integral part of the fuselage structure. The wing structure incorporates two spars, the main spar at 35% and the subsidiary spar at 77% of the chord. The wing is metal skinned throughout as, of course, are the flaps, ailerons and all other control surfaces. Long narrow airbrakes of light alloy construction are located forward of the flaps on both the upper and lower surfaces of the mainplane. Bays for three-bag type internal fuel tanks are located in each mainplane and total internal fuel capacity is 186 imp. gal. G-AOHD is also fitted with wingtip tanks of 50 gal. capacity, and these tanks are now fitted as standard to the production T.Mk.3 aircraft. The tip tanks are not jettisonable, but are readily removable and may be replaced by wingtip assemblies.



Hunting chief test pilot Stan Oliver (left) hands over the Jet Provost logs to F/L John Paule, the RAAF instructor who carried out the acceptance trials at Bankstown aerodrome.

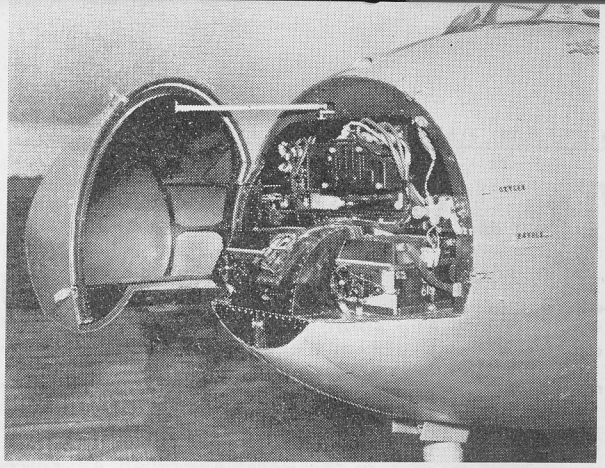
Fin, rudder, tailplane and elevators are of conventional design and construction. The one-piece tailplane is of two spar construction and is attached to the fuselage by two fittings at each of the spars.

The Armstrong Siddeley Viper engine is installed in a special engine bay in the centre fuselage and is readily accessible by means of opening doors and removable panels in the top and sides of the fuselage. The engine breathes by means of a bifurcated intake duct with an entry on either side of the fuselage level with the cockpit, and the tailpipe emerges at the extreme rear of the fuselage behind the tailplane. The Viper is a single shaft turbojet engine comprising a seven stage axial compressor, an annular combustion chamber and a single stage turbine. Maximum thrust at 13,800 rpm is 1750 lb. Overhaul life of the Viper is still only 300 hours, but an extension of this figure is expected to be approved shortly and it is anticipated that the period between complete overhauls will eventually reach 1000 hours. The Viper was originally designed as a short life expendable engine for use in target aircraft, but its development has come a long way since that time.

Engine accessories include a Dowty "Live Line" hydraulic pump, a 27.5 volt wide-speed-range DC generator and a Rotax electric starter. Retraction of the tricycle undercarriage is hydraulically operated, the main legs retracting inwards into the wing structure and the nosewheel leg forwards into the extreme nose section of the fuselage. Doors cover all three undercarriage wells when the units are either retracted or extended. The main wheels are equipped with Dunlop Disc type hydraulic brakes and the nosewheel is of the non-steerable castoring type. In addition to the undercarriage, the flaps and air brakes are also hydraulically operated.

The electrical system is 24V with all electrical equipment, batteries, inverters, etc., mounted in readily accessible positions in the nose of the aircraft under the hinged nose cap. In addition to the two 25 amp. hour batteries which are connected in parallel, an emergency battery is provided to supply standby current for radio, turn and bank indicator and emergency cockpit lighting. It is interesting to note that, although the Jet Provost is fully equipped for night flying, this equipment does not include a landing light. RAF night flying practice does not now include the use of a landing light.

An opportunity to fly a jet aeroplane is still a rare experience that does not often come the way of a civilian pilot, and I eagerly accepted a kind invitation by the Hunting representatives to sample the pleasures of flying the Jet Provost shortly after its assembly at Bankstown. As my only previous jet experience amounted to about an hour and a half dual in a Vampire

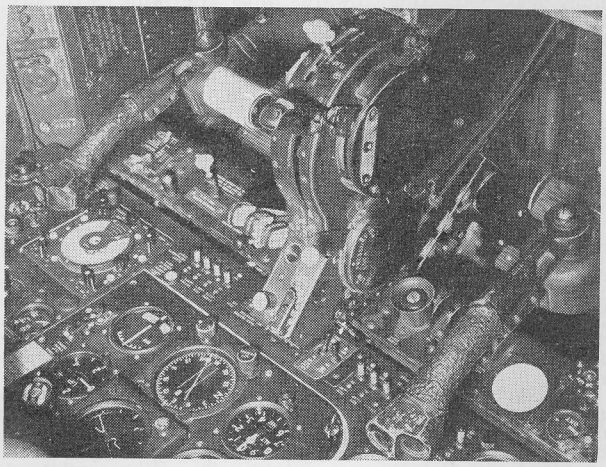


Particular attention has been paid to ease of servicing the Jet Provost. The Viper power unit is shown (left) exposed and easily accessible below the hinged cowlings behind the cockpit canopy. At right, the hinged nose section of the Jet Provost is shown open, giving ready access to batteries, radio equipment and oxygen changing point.

Trainer, I did not imagine that I was equipped to evaluate the Jet Provost in the strictly correct sense, but from my long experience as a flying instructor I did feel that I was qualified to assess the suitability of this type of aircraft as an *ab initio* trainer. The impression that I gained as a result of my flight was that *ab initio* training on this type of aircraft is a practical proposition. Although the Jet Provost is far removed from the old idea of an *ab initio* trainer it is easier to fly than a high powered piston engined aeroplane, yet is representative of the type of aircraft a Service trainee will go on to fly. It is not hard to see how overall economies in the cost of Service flying training would result from the use of an *ab initio* trainer such as this. The trainee pilot is introduced to modern jet handling technique from the very beginning and his eventual conversion to the costly advanced training aircraft will be easier, quicker and cheaper.

I flew with Stan (Olly) Oliver, who first walked me around the aircraft and pointed out the accessibility from a servicing point of view of various items in the radio, electric and powerplant departments. We first looked under the hinged nose cap and inspected the "black boxes" housed therein. Radios, batteries, inverters and all electrical equipment located in the nose is readily accessible from ground level. We next lifted the engine cowlings and inspected the powerplant installation—again all important items are readily accessible and a complete engine change can be carried out by two men in only two hours elapsed time.

Having completed our inspection we climbed aboard the Jet Provost and entered the cockpit from the walkaway on the wing. The cockpit is roomy, and although at first appears rather complicated, a brief acquaintance soon removes this impression. G-AOHD is not fitted with ejection seats, but all production Mk. 3 aircraft are so equipped. The standard seats in G-AOHD accommodate a parachute and are adjustable for height. Full dual control is fitted, the control columns are of the broken stick type and the rudder bars which are fitted with toe operated wheel brake pedals are adjustable for leg reach. The only engine control is the throttle and duplicate throttle levers are located to the left of each seat together with duplicate elevator trimming wheels, flap controls and undercarriage selector units. The instructor's controls are mounted on a central pedestal which also accommodates an aileron trimming wheel, the low and high pressure fuel cocks and the engine relight control.



Close-up of Jet Provost panel; note broken stick control.

The instrument panel features a central blind flying panel with engine instruments, machmeter, undercarriage indicator and fuel gauges, etc., to the left of the flight instruments and aircraft clock, radio controls, warning lights and systems to the right. The control and instrument layout is well planned and most controls come readily to hand in logical places where one might expect to find them.

Having strapped on our parachutes and shoulder harness, plugged in headsets, etc., and attended to all the other little chores which always seem to be associated with flying in a Service aircraft we set about starting up the Viper. This involves first turning on both the Low Pressure and High Pressure fuel cocks, ensuring that the throttle is closed and the battery isolator switch, ignition isolator switch and starter master switch ON. The starter button is then pressed and the starting sequence from that point on is automatic. When the Viper lights up the engine should idle at approximately 5500 rpm.

Flying The Jet Provost

After starting up we waved away the battery cart, wound the hood closed with the manually operated handle provided on the port side of the cockpit and proceeded to taxy out. No warm up period or run up is necessary, of course, and once the Viper is running the Jet Provost is ready to fly. Taxying is easy, but quite different from a piston engined aeroplane. Visibility in all directions is very good and the toe operated hydraulic brakes most effective, but the slow acceleration of the jet engine takes a little getting used to. When power is applied it is slow to come on, but when it does care must be taken not to allow the taxying speed to become excessive, about 8500 revs being required to get the Jet Provost moving, but once the aircraft begins to move the power may be reduced. A built-in control lock is fitted which, when engaged, restricts the throttle movement but permits enough throttle to taxy. Taxying with the control lock engaged simplifies use of the toe brakes and is convenient in gusty conditions. Bankstown's short gravel runway was conveniently into wind so we taxied around the perimeter road to the hard standing area on the eastern side of the aerodrome and lined up. Vital actions before takeoff are uncomplicated, elevator and aileron trims are set at neutral, takeoff flap selected, all fuel cocks should be ON and contents checked and the control lock out.

Normal takeoff procedure is to hold the aircraft on the toe brakes while the throttle is opened fully. Full throttle should give 13,800 revs and the jet pipe temperature should be below 705 deg. C. The brakes are then released and the Jet Provost moves forward slowly at first but accelerates fairly rapidly. There is no tendency whatsoever to swing, and at 65K the nosewheel can be lifted off the ground, at 75K the aircraft is ready to fly and breaks ground at the slightest backward pressure on the stick. Takeoff run into a 5-10K breeze appeared to be in the vicinity of 1500 ft. Once clear of the ground the brakes are applied to stop the wheels and the undercarriage retracted by the delightfully simple action of extending one's index finger from the throttle and pressing a button on the undercarriage selector unit, located immediately forward of the throttle. Power is reduced at a safe height to 13,500 rpm and the

Assembling the Jet Provost at the de Havilland Bankstown, NSW, factory. The Jet Provost is now in full production for the RAF, where it is to re-equip the Basic (Primary) Flying Schools of Flying Training Command during 1959.

flaps pulled up at 110K. Best climbing speed is 160K and I allowed the speed to slowly build up to this figure as we climbed away. Our clearance to the Richmond training area required us to remain at 1500 ft. until abeam Schofields and, at this height, using a power setting of 12,000 revs the Jet Provost cruised at an IAS of 200K.

Passing Schofields we called Richmond Tower for a clearance to 10,000 ft. and increased power to 13,500 revs. Climbing at 160K the rate of climb averaged 2000 ft./min., and we very quickly arrived at our operating altitude. Since we were not using oxygen we did not go above 12,000 ft. on this flight, but the performance of the Jet Provost as with other jet aircraft improves with altitude. At 30,000 ft. max. speed is 286K, Mach 0.45.

Settling down to get the feel of the Jet Provost I found that while the controls are not light if judged by light aeroplane standards, they are most effective. Of the three controls the ailerons are the lightest and the rudder the heaviest. Practically no rudder is required in a turn and as Stan Oliver commented, the rudder pedals are there the greater part of the time merely to rest your feet on. The aircraft is pleasant to fly and has a very satisfactory feel about it. Visibility in all important directions is very satisfactory and noise and vibration levels when judged by the standard of piston engined Service aircraft, very good indeed. Although intercom is, of course, normally used, it is possible to converse with the other occupant of the cockpit in normal conversational tones without its use.

The stalling characteristics are surprisingly docile. With flaps up and power off I found that the stall occurred at 75K and resulted in a gently dropped wing as the nose dropped away. There was very little aerodynamic warning of the approach of the stall and no artificial stall warning device is fitted. With flap extended and 8500 revs the speed went back to 65K before the stall occurred, but the result was similar.

The stall occurred in both cases before the stick was right back and aileron control remained effective down to and at the point of stall. When taking recovery action the jet engine is slow to accelerate if the revs are back below 8000 and the speed must be allowed to build up well before attempting to lift the nose; over eagerness in this respect will result in a further G stall.

No restriction is placed on spinning and the characteristics are entirely conventional, an important feature in a basic trainer. Full rudder as the nose drops away in the stall results in a slow shallow spiral which quickly steepens as the rate of turn increases; after about two turns the spin stabilises and loss of height is then about 500 ft. per turn. Full opposite rudder and forward stick result in recovery within a turn, but a reasonably strong force must be used on both controls to achieve the desired result. My first attempt resulted in a slow recovery simply because I had not pushed far enough, a second attempt resulted in full recovery after about three turns with a loss of just on 3000 ft.

Aerobatics in a high speed jet aeroplane are always easy and the Jet Provost is no exception to the rule; best speed for a roll is 180K, the rate of roll is high, about 120 deg./sec., and I found that little or no rudder is required to hold the nose up. In this type of aeroplane a loop is harder than a roll. Keeping straight in the loop requires careful attention to detail and it is easy to lose too much speed going over the top. Recommended speed for a loop is 220K and power should be set at 13,500 revs. My first attempt resulted in some judder at the top of the loop, but the second was a more presentable effort.

The airbrakes, controlled by a slide type switch on the throttle itself, may be extended at any speed and the deceleration as they are extended is most noticeable. Engine handling is at all times very simple, much more so, in fact, than in a high powered piston engined aeroplane. At all heights the throttle may be opened or closed with the utmost rapidity without any risk of compressor stall or a flameout. In the remote possibility of a flameout, however, a relight presents no difficulty and can normally be carried out at any altitude, though the certainty of a successful relight increases as altitude is reduced.

Back in the Bankstown circuit Stan Oliver carried out the first circuit and landing to show me how and then let me try two for myself. Power is reduced to 10,500 rmp on the downward leg and the undercarriage lowered at 125K, a check should be made that at least 35 gallons of fuel remain for an overshoot and after takeoff flap is lowered speed further reduced to 110K. Full flap is lowered on the base leg and the approach is continued at 100K, aiming to turn in at 600 ft.-700 ft. Power can be reduced slightly if necessary, but it is unwise to go below 8000 revs as the engine will only accelerate slowly if throttled right back. Care must be taken, due to the slow acceleration of the jet engine, not to let the speed get too slow on the approach with the power right back. The fence should be crossed at 85K, the final change of attitude is very small and the landing very positive, touch down speed is about 70K. No special skill is required to land the Jet Provost and the old school of instructors will possibly criticise its suitability as a trainer for this reason, but present day thinking on this subject reasons that as all modern aeroplanes are easy to land, why complicate things for the student by teaching him a technique that he will not, in practice, be called upon to use. Once on the ground the Jet Provost is quite happy to keep rolling straight ahead and the nosewheel can be held off until the speed drops off to about 60K.

Fuel consumption in the Jet Provost, as with all jets, varies considerably with altitude. At 30,000 ft. using an economical cruise power setting consumption is as low as 70 gal./hr., but when using high power at low levels, could be as as high as 180 gal./hr. The duration of our flight was one hour and it could be regarded as a typical training sortie. At the beginning of the flight the internal wing tanks were full and we had approximately 10 gallons in each wingtip tank, a total of approximately 186 gallons. At the end of the hour about one-third of the fuel still remained. The performance of the Jet Provost is such that a great deal can be achieved in one hour and it would be seldom that a training flight would need to be of longer duration. When practising circuits and landings normal training procedure is to carry out touch and go landings. With the docile takeoff and landing characteristics of these aircraft there is no need to carry every landing to a full stop, nor begin each takeoff from a standing start and the increase in the number of circuits per hour as a result of this practice offsets the disadvantage of the high fuel consumption of the jet aircraft when engaged on this type of low level operation.

There is little doubt that all-through jet training is here to stay and if the RAAF is to have a jet powered basic trainer ready to replace the Winjeel in three or four years' time the Jet Provost would appear to be the most likely candidate for selection. It is good to see the RAAF in the forefront of this new development in service flying training. The RAF is still the first Air Force to standardise on a jet basic trainer, but the USAF and French and German Air Forces are not far behind. The USAF is experimenting with the Cessna T.37, Beech Jet Mentor and Temco TT.1, but has yet to make a decision regarding standardisation. Both the French and German Air Forces have shown a great deal of interest in the French Magister trainer, but have not got past the stage of experiment *ab initio* courses.

KEITH ROBEY.