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"Taking that Step"

By Dave Currie

The STALLIO

Much has been written by pilots who have flown WW-II fighters and of the sheer exhilaration of flying such aeroplanes.

This article is written with a different objective in mind. To explain from my own experience the preparation taken for flying a WW-II fighter. I will focus on one fighter in particular, the P-51D Mustang. I will discuss the aircraft types that best prepared me for flying such a fighter. I will describe some of the technical aspects of flying the aeroplane, take-offs and landings, areas to exercise caution and dispel some myths.

In 2012 I attended Stallion 51 in Kissimmee, Florida to undertake their P-51D Mustang Checkout Training Programme.

Stallion 51 Corporation is a FAA certified organization that conducts flight operations in the P-51D Mustang and the T-6 Texan. Established in 1987 by Lee Lauderback and Doug Schultz, it has evolved to become a centre of excellence for Checkout & Re-Current Training in the North American P-51D Mustang fighter aircraft.

The Checkout Training Programme is a specialised course designed for the owner / pilot or potential owner of a P-51D Mustang or similar high performance WW-II fighter aeroplane. The U.S. Federal Aviation Administration and major insurance companies endorse the Course.

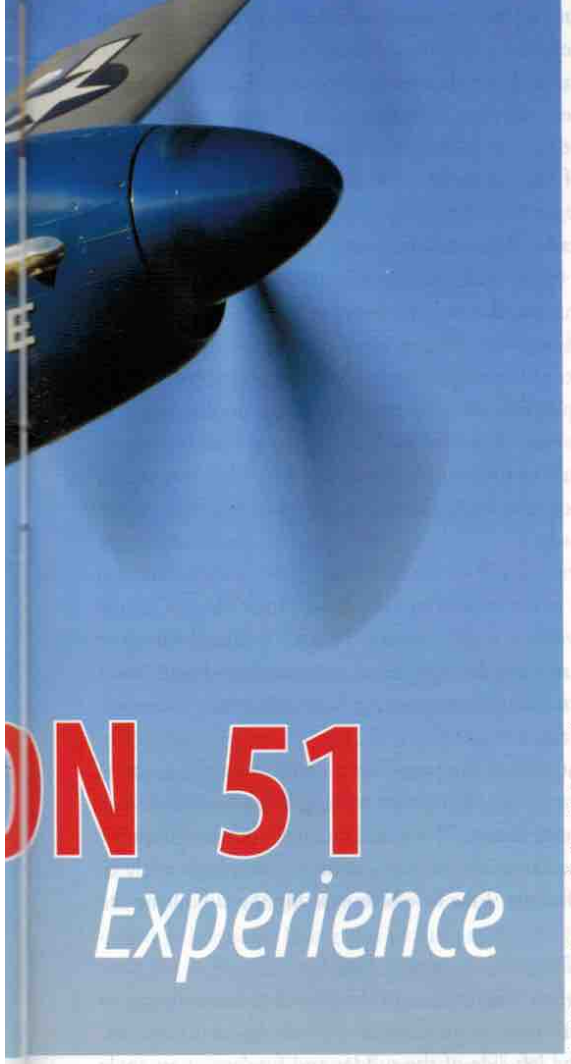
David Currie

The Stallion 51 team are known for the impeccable condition in which they maintain all of their aircraft and their equipment. The fact that the hangar floor is as shiny as the Mustangs speaks volumes about the culture of the company.

PREPARATORY TRAINING

The day before I commenced the Checkout Programme, I arrived at Stallion 51 to familiarise myself with the surroundings in which I would be training. As part of this, I sat in the cockpit of their TF-51D 'Crazy Horse' and immediately felt more comfortable than expected. I put such familiarity down to many years of tailwheel flying, particularly in Pitts S-2 Specials. When seated in the rear cockpit of a Pitts, looking to the front over the nose is surprisingly similar to looking over the nose of the P-51D despite the difference in length.

Therefore, in preparation for flying a P-51D, I suggest gaining a good level of competence and familiarity with flying the Pitts Special or similar such type. The Pitts is a particularly good



ON 51 Experience

Paul Bowen - Courtesy, Stallion 51 Corporation

platform for mastering approaches and landings where the runway is obscured by the nose attitude and you rely heavily on peripheral vision to assist in maintaining directional control. It is a very good aeroplane in which to finesse your attitude flying and airspeed control, particularly during the approach and landing phases. For example, being able to consistently recognise the correct three point landing attitude in the Pitts is just one of the important phases of attitude flying that can be transferred to your training on the P-51D. This is particularly so when conducting flapless and short field landings where airspeed and attitude control are all the more critical. Also, the Pitts Special, particularly the S-2B and S-2C models with 260 horsepower engine have a rapid acceleration on take-off which assists greatly in acclimatising pilots to what they will experience in a P-51D, albeit on a much smaller scale. As my Stallion51 instructor used to say, "We love Pitts time!"

The T-6 Texan, or Harvard, is another aeroplane worth gaining a good level of experience in flying. As most are already aware, the T-6 was the aeroplane used by most of the Allied air forces during WW-II for training pilots designated for single engine fighter operations. Unlike a light aeroplane such as the Pitts, the T-6 has weight and inertia more comparable to fighters such as the P-51D. It also incorporates a number of aerodynamic and mechanical features that make it the ideal transitional platform. The T-6 was such a successful trainer, it was used by a number of air forces for several decades after the war.

Some exposure to flying the T-6 from the rear cockpit is also worthwhile. Visibility is very limited making a curved approach onto the final leg all the more necessary to maintain visual contact with your aiming point for landing.

Like the P-51D, the T-6 was built by North American Aviation and uses the same tailwheel steering mechanism. When taxying a T-6, it is necessary to move the stick fully forward to unlock the tailwheel to negotiate tight turns. The aeroplane is then steered using differential braking. Otherwise, the T-6 is taxied with the stick aft using tailwheel steering via manipulation of the rudder pedals as is commonly the case with most modern tailwheel aeroplanes. This same method is used for taxying the P-51D. The T-6 is also a good preparatory aeroplane as it is manufactured with components that are also used in the P-51D.

THE MERLIN ENGINE

The P-51D uses a Packard built V-1650-7 Merlin engine. This engine is the same as the Rolls Royce equivalent, but was built under licence in the United States by the Packard Motor Car Company.

Caution must be taken when starting the Merlin, particularly in ensuring it is not over primed, otherwise a stack fire is inevitable! Typically the Merlin would be primed between 6 and 12 seconds when cold and for only 1 second when hot. On completion of priming, engage the starter and as the engine starts (usually after the propeller has turned three to four blades), select the magneto switch to BOTH and place the mixture control to NORMAL, which is equivalent to an auto lean setting. Set the throttle to 800 RPM and check the engine has an oil pressure of 50 psi within 30 seconds of starting.

Engine run ups are conducted at 2300 RPM where the propeller, magnetos, supercharger and engine parameters are checked. One of the more critical items to monitor with the Merlin is the coolant temperature. Unlike most modern engines, the Merlin is a liquid-cooled engine. Cooling is achieved through the circulation of ethylene glycol. The glycol in turn is cooled by circulating through the engine radiator positioned inside the air scoop on the underside of the fuselage. An outlet flap controls the flow of air through the radiator assembly.

It is very important that the coolant system be managed correctly. On the ground, if the engine overheats, stop taxing, point the aeroplane into wind and set 1500 RPM to allow slipstream from the propeller to enter the radiator scoop and cool the engine. In the air, many P-51Ds are fitted with a second coolant temperature gauge to assist the pilot in determining whether a real overheating condition exists, or whether it is a gauge error. If a Merlin does overheat, pressurised coolant will

David Currie

That view that you have worked so hard to call your own, and worth every bit of effort and expense to get to this point!

David Currie

These two photos illustrate why you experience asymmetrical thrust in the tail-down attitude. With aircraft in this nose-high attitude, which on the Mustang is approx. 11° to relative wind, the downward travelling blades on starboard (right) side of the aircraft have higher effective pitch than the upward travelling blades on the port (left) side, a difference of 27° to 5°. This produces more 'pull' on starboard side, causing the aircraft to yaw to the left.

David Currie

be extinguished out of a pressure release or pop off valve on the right side of the engine. If this occurs, it is important to open the radiator outlet flap to its full extent to get maximum airflow through the radiator and land as soon as possible.

TAKE OFF

Take off in a P-51D is a straight forward procedure provided it is managed correctly. Difficulties during taking off in this aeroplane are usually the consequence of a mismanagement of power. This was particularly so during the 1960s when surplus P-51Ds were available for sale and were purchased by low time pilots with very little or no experience with the amount of torque, gyroscopic precession and asymmetric blade effect associated with surplus fighters. Let us look briefly at each of these factors.

Gyroscopic precession is the tendency of a spinning object to precess or move about its axis when disturbed by a force. The propeller of a P-51D weighs 460 pounds and acts as a big gyroscope. It spins in a clockwise direction when viewed from the cockpit. During take-off, gyroscopic precession will have a tendency to swing the P-51 to the left as the tail is raised and to the right as the tail is lowered during landing.

Engine torque is the twisting effect coming from the engine that makes the propeller rotate. In accordance with Newton's third law (for every action there is an equal and opposite reaction), when the engine applies torque to the propeller to make it spin, the propeller reacts by applying an equal and opposite torque back onto the engine and airframe. A propeller that rotates clockwise when viewed from the cockpit, such as is the case with the P-51, will result in the aeroplane yawing to the left due to the additional drag of the left tyre being pressed down while the right tyre is being lifted simultaneously.

Assymmetric blade effect, or P-factor as it is otherwise known, will also cause the P-51D to yaw to the left during the take-off roll. The two factors affecting P-factor is power and angle of attack. P-factor is caused when the plane of the propeller is moving through the air at an angle to the direction of travel, such as when the aeroplane is moving down the runway at a nose high attitude, or a high angle of attack.

The descending right side of the propeller (as seen from the cockpit) has a higher angle of attack than the upward moving blade on the left side and therefore provides more thrust. This is accentuated when the propeller is not directly perpendicular to the relative airflow i.e. at a high angle of attack to the relative airflow, as is the case before raising the tail during the take-off roll.

(Source: M.Dillon, Air Progress, September 1968)

Slipstream effect is where the rotation of the propeller causes the air to rotate in a helical or corkscrew motion about the fuselage as it flows aft. The slipstream strikes the left side of the rudder and fuselage at an angle causing the aeroplane to yaw to the left, as is the case with the P-51D.

Wind direction is another important factor to consider prior to take off. During the take-off roll, a crosswind from the left will exacerbate a yawing motion to the left in a P-51D. This is due to the wind striking the left side of the vertical tail fin, resulting in the aeroplane yawing to the left, much like a weather vane. A crosswind from the right during the take-off roll is more favourable as it results in a yaw effect to the right which helps counteract all the left yawing tendencies described above.

When at low airspeed, the greater the power, the less controllability you have. This is particularly so with the P-51D. Therefore, if you find you are losing controllability, reduce power. For example, when taking off with a crosswind from the left, increase power slowly so you can better manage the controllability of the aeroplane. If you find you have applied full right rudder, yet the aeroplane still yaws to the left, then reduce power to increase your controllability which will enable you to keep the aeroplane tracking straight.

So, taking into account all of the above factors, how is a take-off performed in the P-51D? The key is not to raise the tail too early, otherwise there will be insufficient rudder effectiveness to overcome the left yawing tendency from the factors explained above. The Flight Operating Instructions for the P-51D do not state a specific speed, but states, "To hold the tail down until sufficient speed is attained". Therefore, I personally do not raise the tail during a take-off roll before reaching 50 knots indicated airspeed.

To commence take-off, I initially set 2300 RPM while holding the brakes and check the engine parameters are within normal limits before committing to the take-off roll. Release the brakes and set 40" MAP. At

50 knots raise the tail and continue increasing power smoothly to 55" MAP. 55" MAP is a good power setting to use as it allows for auto enrichment from the carburettor. At 100 knots, rotate to the climb attitude and raise the landing gear.

Once you pull the handle up to raise the landing gear, ensure you allow the cycle to complete itself. If you decide to lower the landing gear part way through the up cycle, there is a high risk of the landing gear being caught in the inner gear 'clamshell' doors. This is because the inner gear doors close automatically after engine start when hydraulic pressure is applied to the system. When the landing gear is raised, the inner doors open first, allowing the landing gear to be raised and housed in the wheel wells. Once this part of the cycle is complete, the inner gear doors again close automatically over the fully retracted landing gear. If the pilot for whatever reason decides to lower the landing gear part way through the up cycle, the landing gear will be out of sequence with the position of the inner gear doors with potentially hazardous consequences.

LANDING THE P-51D

When landing a P-51D, the key is to avoid rapid or large changes in power, particularly as the aeroplane will be in a low speed range with a high angle of attack. It is in this phase of flight more than any other that pilots of high performance fighters have come unstuck with unfortunate consequences.

An approach and landing in a P-51D is best achieved by gradually reducing airspeed with small reductions in power and increasing the angle of attack incrementally to maintain your flight path to the runway threshold. Using this technique the P-51D is gradually transitioned to the landing attitude such that the throttle is closed just as the aeroplane touches down. Typically I land on the main gear in a tail low attitude, with the tail wheel approximately 6 inches off the runway with an indicated airspeed of approximately 85 knots.

Managing this technique correctly avoids large power changes when close to the ground, or a high rate of descent to the runway resulting in a bounce, both of which are hazardous. Let us now look at each of these in turn.

One of the more common scenarios where large power increments may be required is during a missed approach or go around. If you sense a potential go around emerging during your approach, it is best to execute it earlier while you have the benefit of height and time to better manage this manoeuvre. Too often in the past, particularly during the 1960s when these aeroplanes were purchased as surplus fighters, inexperienced pilots conducted go arounds at the last minute close to the ground using large power changes by rapidly applying full throttle with disastrous consequences. Why? Because the aileron and rudder had

Courtesy, Stallion 51 Corporation

The front office of 'Crazy Horse'. Compare this with the very stock P-51B instrument panel below. Needless top say, this aircraft needs modern avionics for its training role.

The author, Dave Currie, in the front seat with Lee Lauderback in the rear following a re-currency flight at Stallion 51's Kissimmee base.

David Currie

Cockpit of the stunning, beautifully restored and very stock P-51B 'Berlin Express', also based in the Stallion 51 hangars.

David Currie

insufficient authority to counteract the large and rapid increment in torque produced by the engine and the asymmetric blade effect by the propeller.

So how should a go around be conducted in a Mustang? Firstly, smoothly and gradually increase power to 46" manifold pressure. Full power 62" is too excessive and not necessary. This will also give you more effective aileron and rudder authority. Confirm the aeroplane is stable with a flight path that is level or in a slight climb and then raise the flap to 30 degrees as soon as possible. (The P-51D has five stages of flap from 10 degrees to full flap 50 degrees). Once the speed has increased to 110 knots, raise the landing gear and the remaining flap in stages.

A high rate of descent upon touchdown that results in a bounce is also extremely hazardous. If mismanaged, a bounce could potentially lead to subsequent bounces where the aeroplane is airborne below the stall speed. Once again the aerodynamic forces described earlier will take hold, potentially resulting in the aeroplane rolling to the left only a few feet above the ground. At this point neither the rudder or aileron will have sufficient authority to counteract these forces. Any large or rapid increase in power will only exacerbate the effects of torque and P-factor. So, if a P-51D bounces upon landing, how is this situation managed? Firstly, after the initial bounce attempt to resettle and reland the aeroplane. Should a second bounce occur, it is necessary to 'peg' the main landing gear of the aeroplane to the runway with the use of forward stick to prevent a further bounce. Otherwise, the aeroplane is likely to be airborne below the stall speed.

Paul Bowen - Courtesy, Stallion 51 Corporation

So you can see, most of the hazards associated with approaches and landings in a P51 can be avoided by managing the approach carefully using small yet smooth increments in power.

CONCLUSION

Flying a high performance fighter is a challenging and exhilarating experience. I hope that sharing my experience has provided a useful insight as to one possible way of preparing for such a goal.

ABOUT THE AUTHOR

David Currie started his flying career as an aerobatic flight instructor. His first exposure to ex-military aeroplanes was flying charter operations in the Douglas DC-3 Dakota. He undertakes recurrent training with Stallion51 to maintain proficiency on the Mustang. He also flies other warbirds including the P-40 Kittyhawk.

David is currently the operator of Southern Warbird Adventures in Sydney which offers adventure flights and type training on the T-6/Harvard. www.southernwarbirdadventures.com.au