RESTRICTED

PILOT TRAINING MANUAL

FOR THE BLACK WIDOW

P-61

PREPARED FOR HEADQUARTERS AAF

OFFICE OF ASSISTANT CHIEF OF AIR STAFF TRAINING

BY HEADQUARTERS AAF, OFFICE OF FLYING SAFETY

RESTRICTED

HISTORY OF THE AIRPLANE

The plane you will soon fly was born for the job it has to do. The P-61 is the first American airplane designed and built to fly and fight at night.

Though for security reasons the Army Air Forces did not let the world know there was such a plane until January 9, 1944, when one flew over the Los Angeles Coliseum at an Army-Navy show, it existed in drawings as early as November, 1940.

Late in the gloomy fall of that tragic year, a top-ranking Army officer returned from England with a list of what the British and, incidentally, the Americans needed in the way of armament. He had been an anxious observer during the Battle of Britain. High on the list of requirements he compiled was a night fighter. He had watched the British make valiant use of converted pursuits and light bombers in trying to defend themselves against night raiders. These planes were not adequate.

What was needed was a new type of airplane. It should be able to prowl in the dark, intercepting enemy bombers before they could reach their objective, shooting them down as they attempted to return to their bases. But it was to do more than that. It should play an offensive role, too, intruding on the enemy and destroying his installations by night or on days too murky for the average plane to fly a mission.

To meet these specifications, the new night fighter must have excellent radar equipment and extensive radio installations of other kinds. It must be fast in flight but able to land at slow speeds on barely visible runways. It must be highly maneuverable but exceptionally stable, for its pilot would need to fly for long periods strictly on instruments, without having to make continual corrections. Most important of all, it must have extremely heavy firepower, enough to be certain of blasting an enemy plane out of the sky in the crucial few seconds of night interception.

This night fighter also had to have adequate accommodations for extensive equipment, and places for a pilot, gunner, and radar operator.

It was to be designed around the Pratt & Whitney R-2800 engine, then new, or the Wright R-3350 engine. Both of them are radial air-cooled engines of about 2000 horsepower (Hp).

When the P-61 finally emerged from the long ordeal of creation through which every airplane must go before Army or Navy acceptance, it had two 2000 Hp engines and two tail booms. This was one design. There was another with a single tail. The Army decided the less conventional model was superior.

Officials of Northrop Aircraft, Inc., which builds the P-61, flew East in November, 1940, for initial conferences about the first real night fighter plane. As a result of these talks, the original designs were made. Again there were conferences, and changes. A wooden mockup was built. Twenty six experts from the U. S. Army and Navy and from the Royal Air Force visited the factory and inspected the mockup. There were more changes as a result. Wind-tunnel models were made and tested. At last, the basic layouts were agreed upon and fixed. Then, factory engineers in groups went to work on the various parts of the plane which were their specialties: armament, controls, electrical equipment, crew nacelle, hydraulics, landing gear, and so forth. The stress group set out to calculate the loads the P-61 would be forced to withstand in flight. The test group soon began testing sub-assemblies to make sure they were strong enough to carry their design loads.

The manufacturer received an order for two XP-61 airplanes on January 30, 1941. These were the two experimental models the AAF Materiel Command customarily orders when considering the purchase of a new airplane. Normally, when the experimental models have been built and satisfactorily flight tested, the Y or service test order is given. That order is for 13 airplanes plus one static test plane. The 13 Y's go to the Army Air Forces for more tests, under service conditions. The static model has no engines or instruments. It consists only of load-carrying structures. It is sent to Wright Field, where it undergoes a wide variety of tests to find out how strong it is and what load will ultimately destroy it.

However, the XP-61 looked good on paper. Furthermore, the night fighter was urgently needed. So Army Air Forces officials decided to take the risk of departing from their usual procedure in acquiring a new airplane. An order for the Y series of service test P-61's was awarded 38 days after the XP order. The first production contract, calling for hundreds of P-61's, was signed on February 26, 1942, even before the first experimental model was flown.

That first experimental model was finished May 8, 1942. It was painted a shiny black, with red serial numbers and red inspection door

markings. Within a few hours after it was wheeled from the experimental department onto the main assembly floor at the factory, workers had christened it the Black Widow.

Like the deadly spider for which it was named, the Black Widow lurks in the dark, attacks unseen, and cuts down its prey with powerful venom. Its four .50-cal. machine guns and four 20-mm. cannon spit almost certain death at any enemy which comes within range.

P-61's are in action in the Pacific and in Europe. They made a spectacular debut in France. On their first missions, they wiped out four German raiders. One Black Widow downed a Messerschmidt-110 after a 23-minute battle at such close range the planes sideswiped each other. Afterwards, a P-61 pilot boasted:

"We'll take on any day fighter made."

The P-61 is conventional in design, except for its full-span flaps, spoiler-type ailerons, and booster-type elevator tabs. It had to have a lot of flap area to land at the exceptionally slow speed specified. The airplane can land at less than 80 mph. To make this possible, the flaps were extended into the part of the wings where the ailerons usually are placed. Therefore, the engineers had to design a new type of control to take the place of the aileron. What they did was to create a curved spoiler plate hinged along the upper surface of the wing. It has holes in it to lighten its weight. It extends along the outer two-thirds of the outer wing. In addition, on the P-61A there is a small trim tab, about 40 inches long, which is like the usual aileron both in shape and movement. One authority on airplanes called the spoiler type aileron control "the aileron control of the future."

Non-adjustable spring tabs on the elevators reduce control forces, especially at high speeds.

There was one requirement specified for a night fighter which the P-61 has not yet met satisfactorily: flame damping of the engine exhausts to eliminate glow in the dark. There have been many attempts to solve the problem perfectly. They are still being made and undoubtedly the answer will soon be found. At the present time, however, the flame damping is only fair. It represents the best compromise to date between good damping and good serviceability of the exhaust stacks and jet exhaust.

Pilots, both American and Allied, who have flown the P-61 generally are enthusiastic about the airplane. The only major unfavorable comment has been that the P-61A does not have sufficient range. That criticism is being met by equipping the airplane with external wing racks capable of carrying gasoline tanks in various combinations up to four 310-gal. tanks. These same racks can carry four 1600-lb. bombs, if they seem to be more important at times than the approximately 1800 extra miles of range which four 310-gal. tanks of gasoline provide.

Other changes built into the P-61B include:

1. Mechanically operated main landing gear doors, in place of the A model's hydraulic ones.
2. Bigger and better heater units for the crew nacelle.
3. Automatically operated lower engine cowl flaps, oil cooler air exit flaps, and intercooler flaps.
4. Night binoculars.
5. A main landing gear down-lock emergency release. The pilot now can trip the down locks in an emergency, even with the entire hydraulic system out.
6. A safety latch on the main landing gear hydraulic valve handles. This eliminates the possibility of tripping the gear on the ground.
7. Oil tanks in the engine nacelles instead of the outer wings.
8. Taxiing lamp added to landing gear strut.
9. Built-in fire extinguishing system.
10. Natural position trim tab controls. These rudder and elevator tab controls operate in the same plane as the change of trim desired.
11. An absolute altimeter.
12. A new gun camera (N-6).
13. Cannon chute ejection doors are being eliminated. The cannons no longer can jam because the ejection doors fail.
14. The aileron tab is being removed entirely. The Army requested this change, for it feels there is not sufficient need for a lateral trimming control.

The Black Widow is still painted shiny black, as she was when the first experimental model won the name which the plane bears. There is an excellent reason for this. You might think dull black would be harder to see at night. Actually, dull black looks almost white in searchlight beams. However, when those long blue-white pointers pick up a shiny black airplane they bounce right off it. It is almost impossible to see the plane.

When the Black Widow takes to the night sky, sticking her long nose into whatever trouble lies there, she is hard to see, hard to hit, and **hard to beat.**

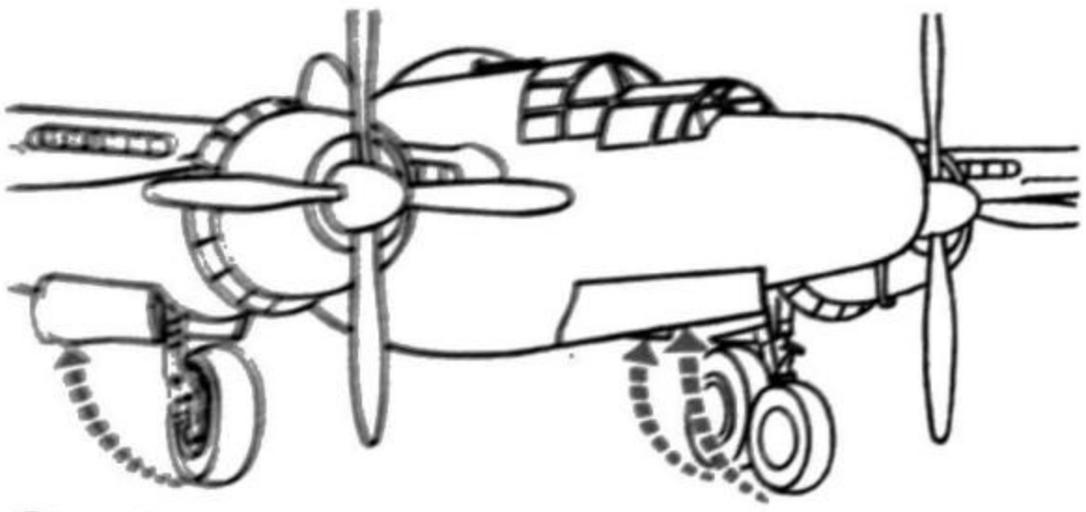
GENERAL DESCRIPTION

This is how the P-61 differs from the P-70:

In the first place, it has two tail booms and looks like an overstuffed P-38. It has a larger and roomier cockpit than the P-70. Its combat weight is roughly 8000 to 10,000 lbs. heavier. Its wing span is 66 feet, compared to the P-70's 61½ feet. Its length (nearly 49 feet) is only 1 ft. longer than the P-70. It feels heavier than the P-70, but is actually much more maneuverable in flight, smoother and more stable.

The relative positions of pilot and radar observer (RO) in the P-61 remain the same as in the P-70. In the P-61, however, a gunner is added to operate the turret.

Without bomb bay tanks (P-70) or external wing tanks (P-61), the two planes are similar in range and endurance. In speed, the P-61 has the edge over the P-70 at all altitudes. The P-61 also climbs much faster than the P-70, especially above 15,000 feet. The arrangement of instruments and controls in the P-61 is quite different from that of the P-70.



Structure

You already know the wing span and length of the P-61 and the fact that it has two engines, two tail booms, and two vertical stabilizers. It is an all-metal, midwing monoplane with tricycle landing gear. The main landing gear retracts to the rear and into the engine nacelles by hydraulic pressure. The nosewheel retracts hydraulically into the forward part of the crew nacelle. The P-61 has a stressed-skin, 2-spar, cantilever wing. You can get at the interior of the wing through removable doors.

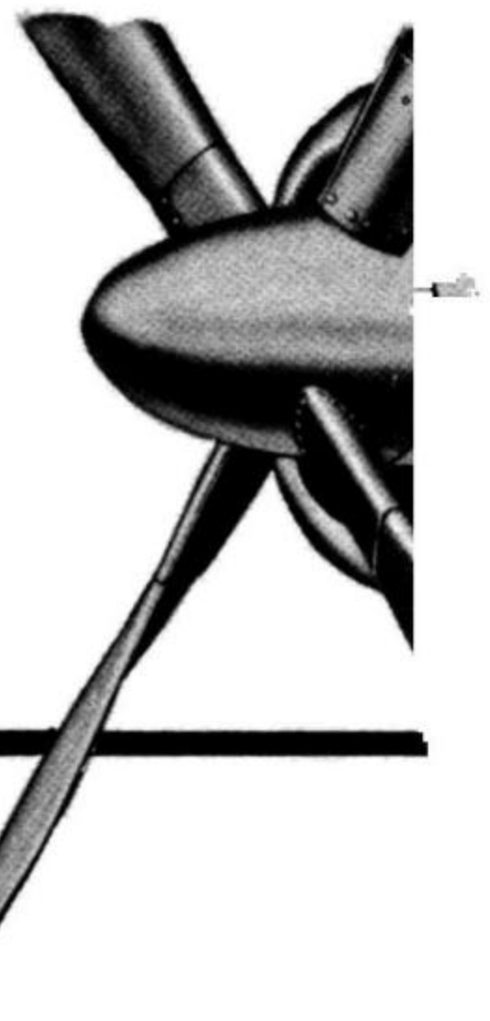
The pilot and gunner enter their forward compartment by a ladder attached to the front entrance door. That's located in the nosewheel well. The door has a latching handle and opens down. To close the door, first step on the rod that folds the ladder. Then pull the door up and turn the latch to secure it.

The RO enters his compartment by means of a ladder attached to the rear entrance door in the bottom of the crew nacelle. He opens the door by pressing a large red button in the bottom of the nacelle just forward of the plexiglas tail cone. When he pulls the door up after him, it closes securely as it latches.

There are dual hydraulic disk-type brakes on each main gear wheel of the P-61. These provide twice the braking surface of the P-70 and, consequently, are much more sensitive to operate. There is an emergency air brake system which you can use if the hydraulic system fails.

Engines

The airplane has two 2,000 Hp Pratt & Whitney engines. They are 2-stage, 2-speed, supercharged engines, designed to operate on Grade 100-130 fuel **only.** These engines are either Model R-2800-10 or R-2800-65. The difference lies in the magneto and ignition systems.



RATIO	
Compression ratio	6.65:1
Main blower gear ratio	7.80:1
Auxiliary blower LOW gear ratio	6.46:1
Auxiliary blower HIGH gear ratio	7.93:1
Propeller gear ratio	.500

OIL PRESSURE	
Desired, at 2000 rpm at 60°C	75-80 psi
Maximum, at 2000 rpm at 60°C	90 psi
Minimum, at rated rpm at 100°C	75 psi
Minimum, at 2100 rpm at 85°C	60 psi
Minimum, at 1200 rpm at 85°C	50 psi
Minimum, at idling	25 psi

OIL TEMPERATURES	
Minimum, for takeoff and flight	40°C
Desired	60°-75°C
Maximum, level flight	85°C
Maximum, climb	100°C

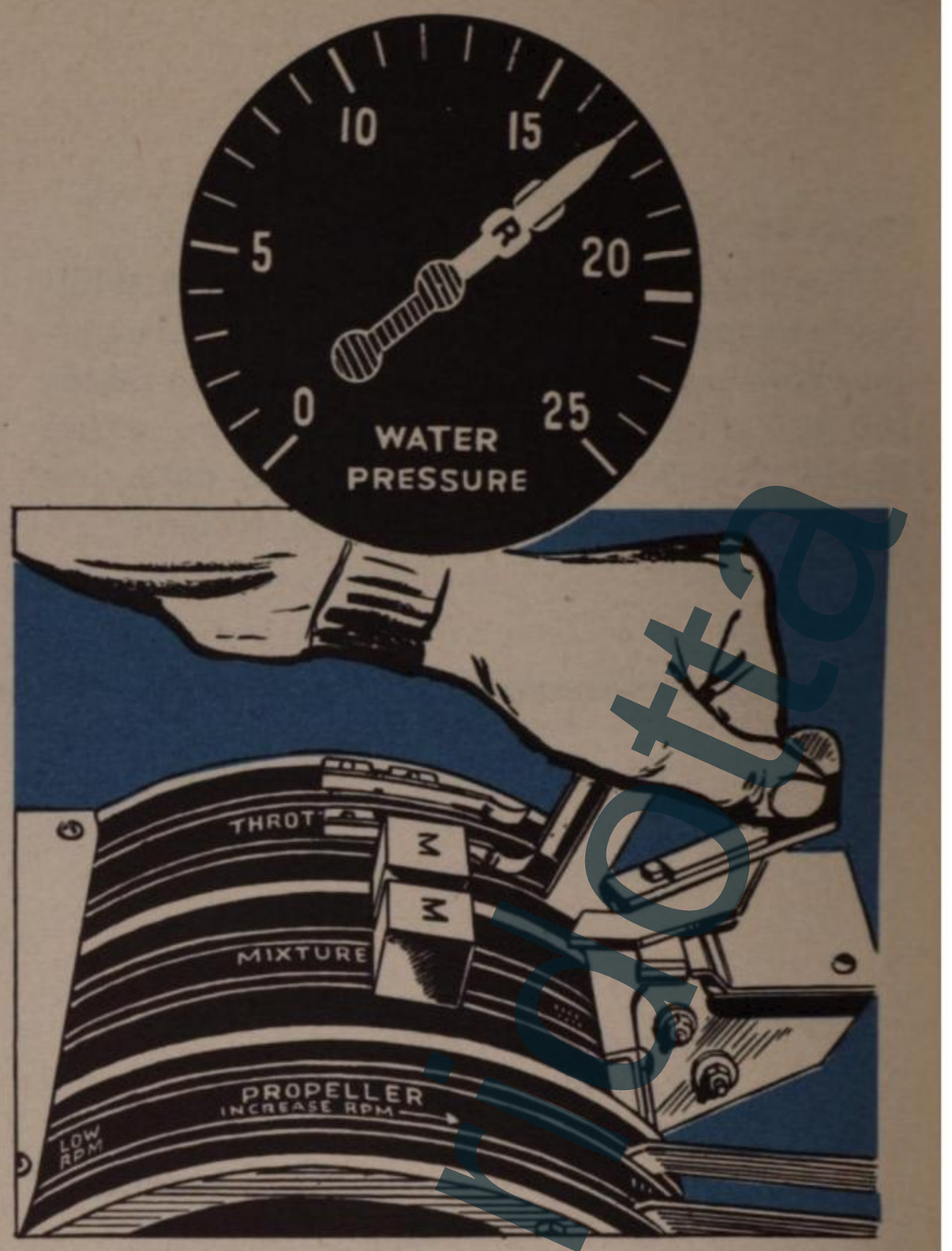
FUEL PRESSURE	
Desired	16 psi
Allowable	15-17 psi
Minimum	15 psi

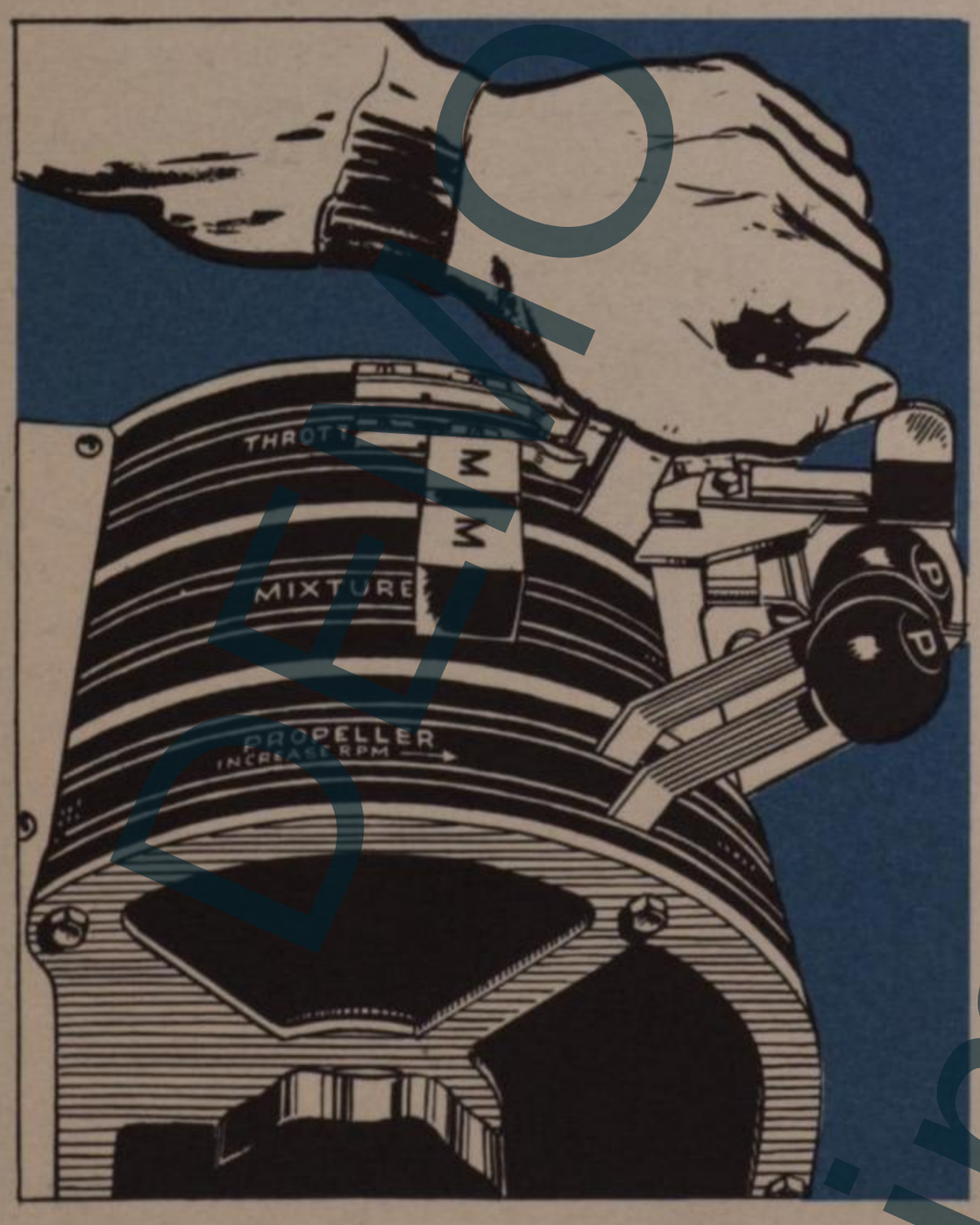
Water Injection

The actual fuel mixture which the P-61 uses at maximum power is too rich. This is necessary to keep the engines cool. If the mixture were leaned to best power, the maximum horsepower would increase about 15%. The engines, however, would burn up quickly.

By using water injection you accomplish nearly the same result with no harm to the engines. The cooling lost in leaning the fuel mixture is made up for by the water vapor added. In water injection, water containing about 30% alcohol to prevent freezing at high altitudes is actually mixed with gasoline before it enters the engines.

To operate the water injection feature of your plane, first push the throttles wide open. In the wide open position, they turn on a water pump in each engine, though the water pressure does not yet rise above its normal 3 to 5 psi. Just forward of the throttles there is a small lever. This lever is a switch that turns on the water supply to the engines and at the same

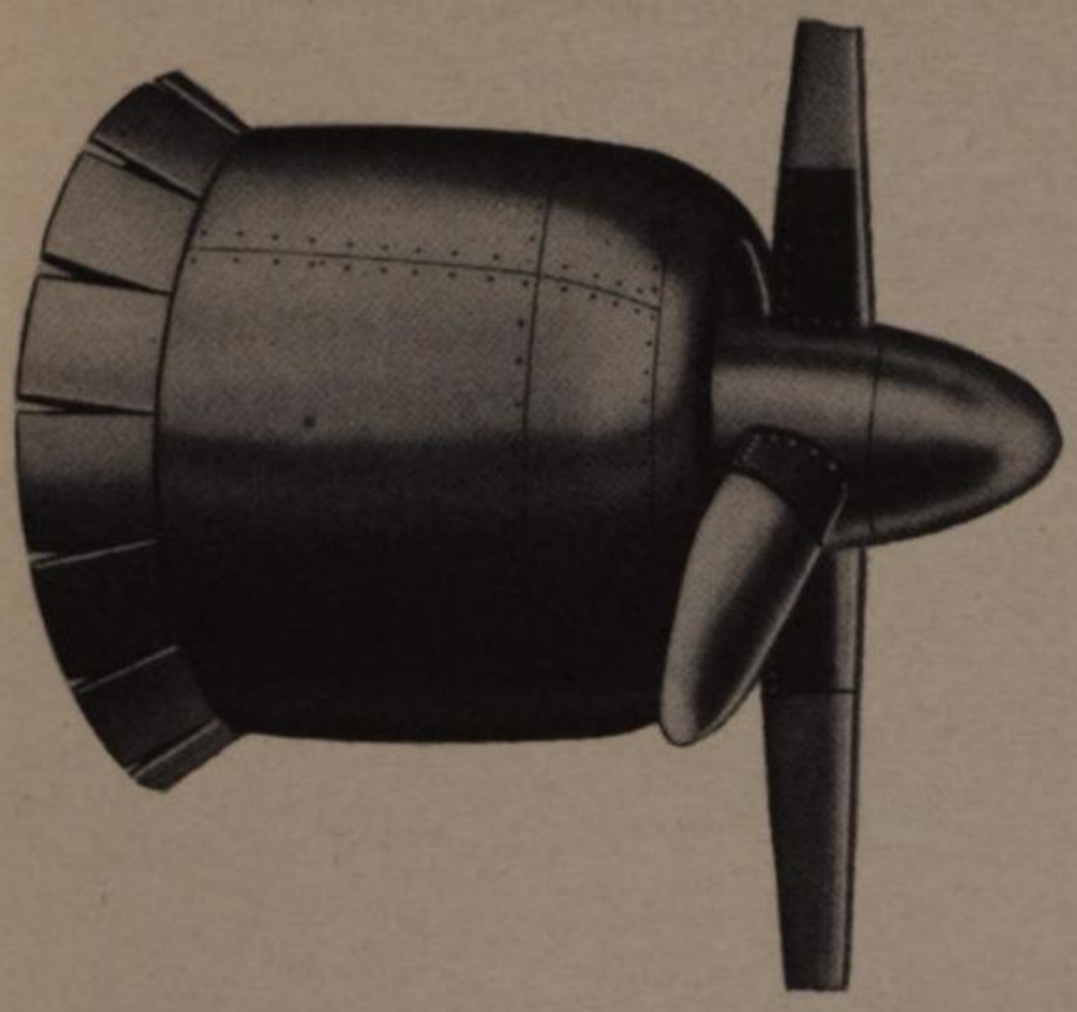




time leans out the fuel mixture. When you have pushed the throttles wide open, flip the lever to the left with your thumb. With the water injection feature in use, the water pressure gage at the right of your cockpit should now register 17 psi. If your water supply becomes exhausted, **be sure to turn off the water injection system.**

It is not practical, though it is possible, to test the water injection system while the plane is on the ground, for to do so you must open the throttles wide. You can test it in the air, however, without worrying about blowing other planes into a scrap heap with your prop wash. At an altitude where you can get military power (54″ Hg. manifold pressure and 2700 rpm), water injection, if it's working properly, increases your manifold pressure to 60″ Hg. and you can definitely feel the plane accelerate.

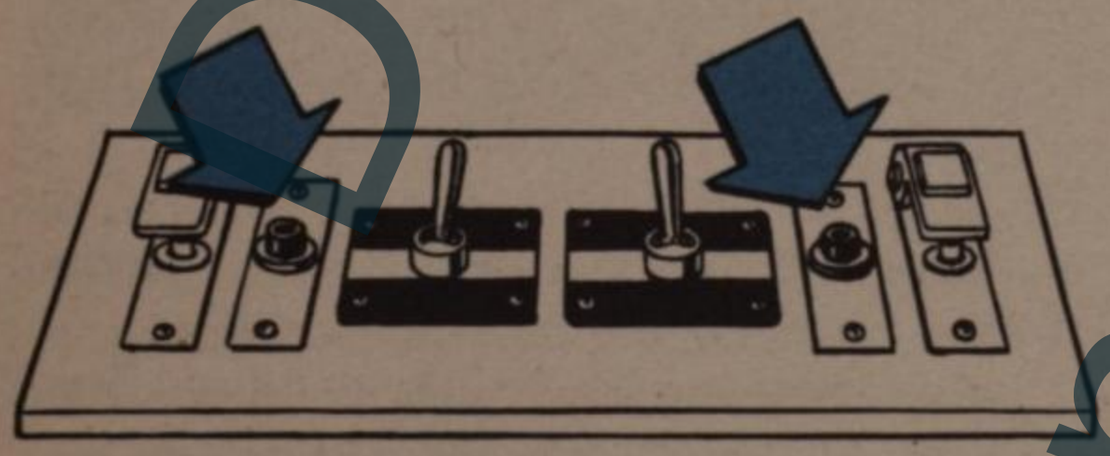
Never use water injection for more than 5 minutes at a time. Remember, it's your war emergency power. Save it (and the engine) for war emergencies.



Propellers

The P-61 engines operate two Curtiss electric, full-feathering, 4-bladed propellers, 12 feet 2 inches in diameter. The angle of the propeller blade is controlled automatically or manually. Normally, you control the propellers with the automatic constant-speed system. This system keeps the engines running at a constant speed, no matter what the throttle setting is. When the manual control system is used, you decrease or increase the blade angle by moving the propeller selector switch.

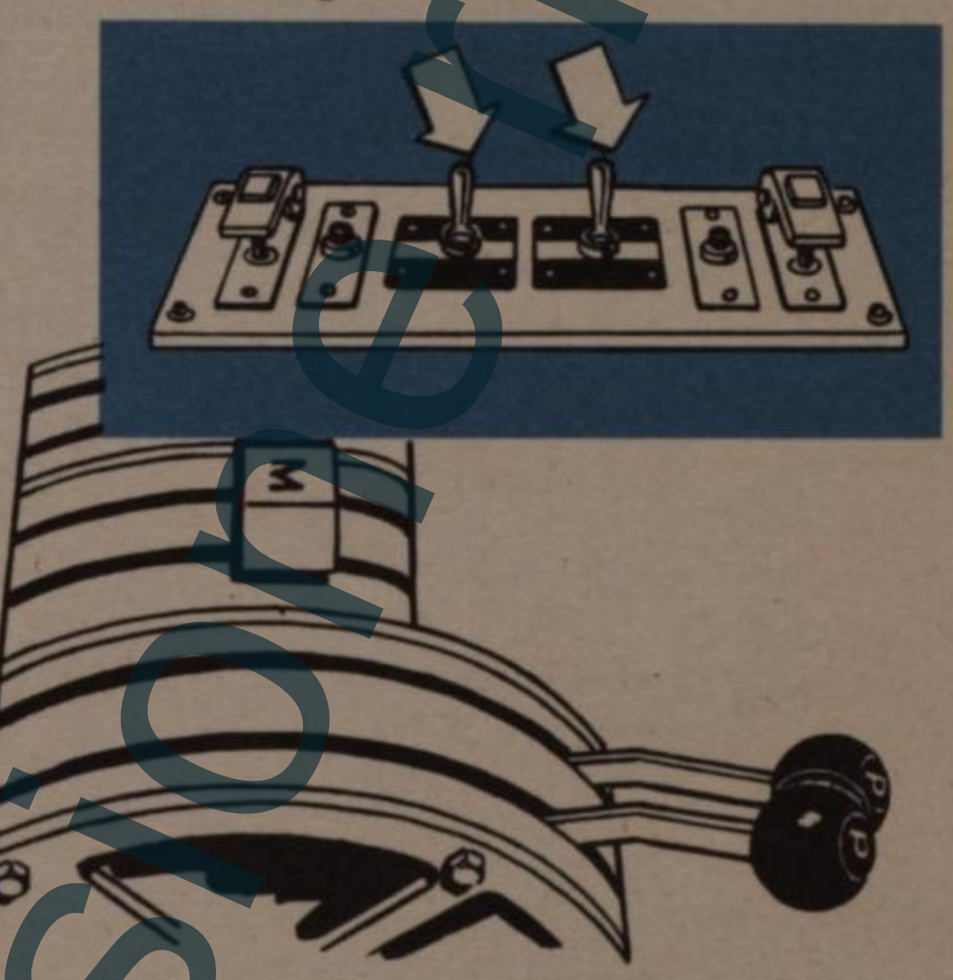
The propeller circuit breakers are of the push button type. You can't open them by hand after you've set them, but you must re-set them if an overload opens them. When a circuit breaker opens because of an overload on the propeller circuit, the blades remain at a fixed angle setting. Therefore, it is essential, in this event, that you re-set the circuit breaker to the ON position.



This type of circuit breaker is designed to carry extremely high loads when you hold the button in. By making careful use of this feature, you may set the propeller blades at a satisfactory angle in spite of a damaged or overloaded propeller circuit. **But don't hold the button in except in an emergency.**

Fixed Pitch Operation

Normally, there is no reason to fly the P-61 with its propellers in fixed pitch position. However, your generators or the voltage regulator system may become damaged so that the batteries won't charge. If this happens, you'll want to save the current normally used in holding the propellers at constant speed for more valuable use in keeping the radios going. Accordingly, you set the propeller selector switch at the FIXED PITCH position.

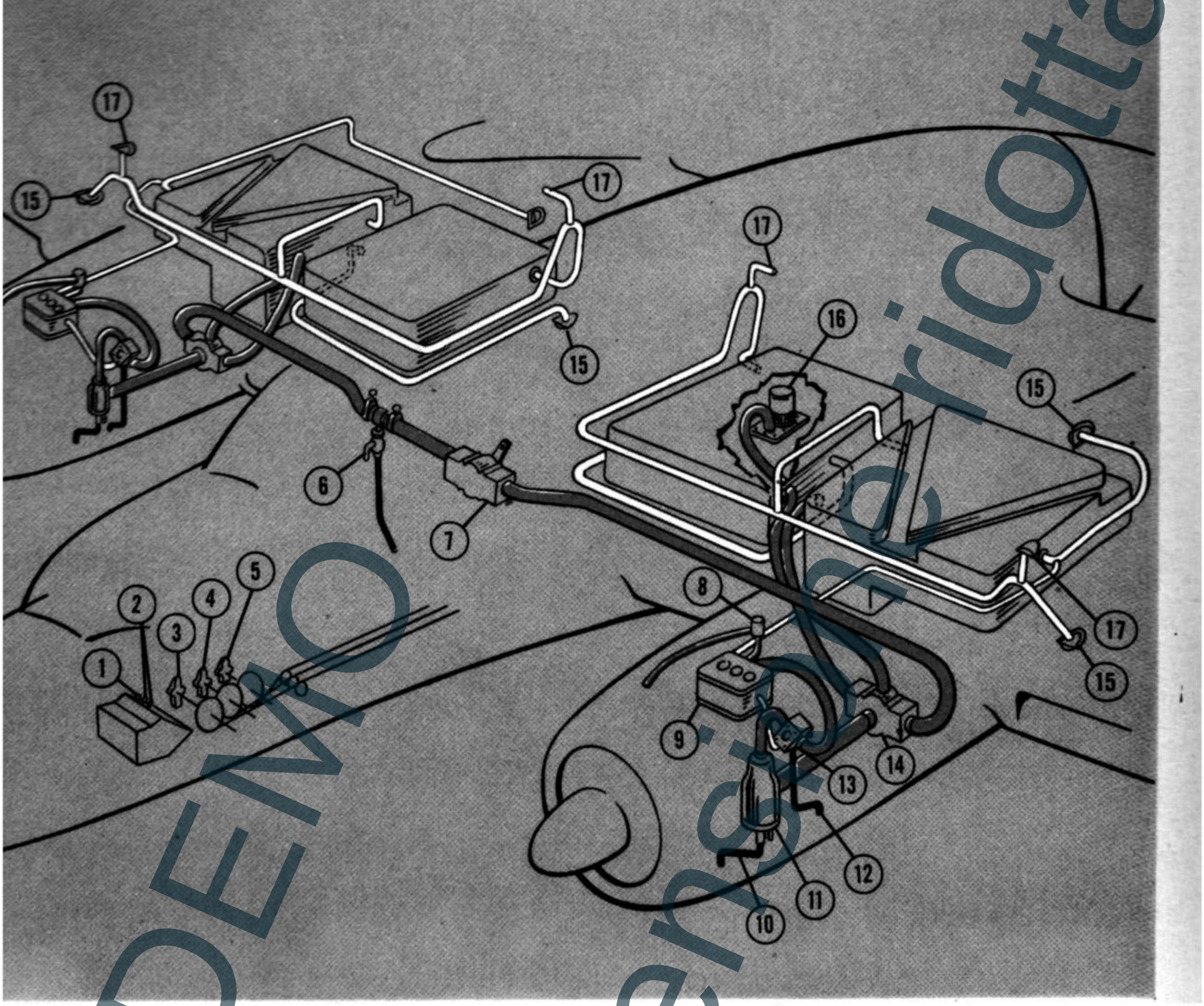


However, as you know, with the propellers at a fixed pitch, you must increase the engine rpm whenever you want to climb, and decrease it when you want to descend. To do this, hold the propeller selector switch either in the DECREASE or INCREASE position until the desired rpm is reached. Remember that the selector switch is spring-loaded. As soon as you let it go, it snaps back to the FIXED PITCH position.

Never, under any circumstances, take off in a P-61 with the propellers at fixed pitch. Never land with them at fixed pitch, either, except in an emergency.

FUEL LINES
DRAIN LINES
VENT LINES

1. PRIMER SWITCH 2. BOOSTER PUMP SWITCHES 3. CROSS FEED CONTROL
4. R.H. TANKS CONTROL 5. L.H. TANKS CONTROL 6. DRAIN COCK
7. CROSS FLOW VALVE 8. ELECTRIC FUEL PRIMER 9. CARBURETOR 10. DRAIN
11. STRAINER 12. VENT 13. FUEL PUMP 14. FUEL SELECTOR VALVE
15. AIR SCOOPS 16. BOOSTER PUMP 17. SIPHON BREAKER



Fuel and Oil System

The P-61 has four self-sealing fuel tanks built in the wings. The total capacity of these tanks is 630 U.S. gals. (522 Imperial gals.). Each outboard tank holds 200 U.S. gals.; each inboard tank, 115 U.S. gals. You can use fuel from any tank desired, but it is customary to use the right-hand tanks for the right engine, and the left-hand tanks for the left engine. There is a gage which tells you how much fuel there is in each tank. All built-in fuel and oil tanks on the plane are filled from the top of the wing.

Each tank has an electrically operated, 2-

1. OIL DILUTION VALVE 2. OIL IN 3. OIL OUT 4. OIL HOPPER 5. OIL FILTER CAP

6. OIL TANK 7. OIL TEMP. REGULATOR 8. OIL COOLER 9. COOLER DRAIN

10. OVERFLOW 11. OIL SUMP 12. SUMP DRAIN 13. OIL COOLER AIR INTAKE

14. CARBURETOR AIR INTAKE

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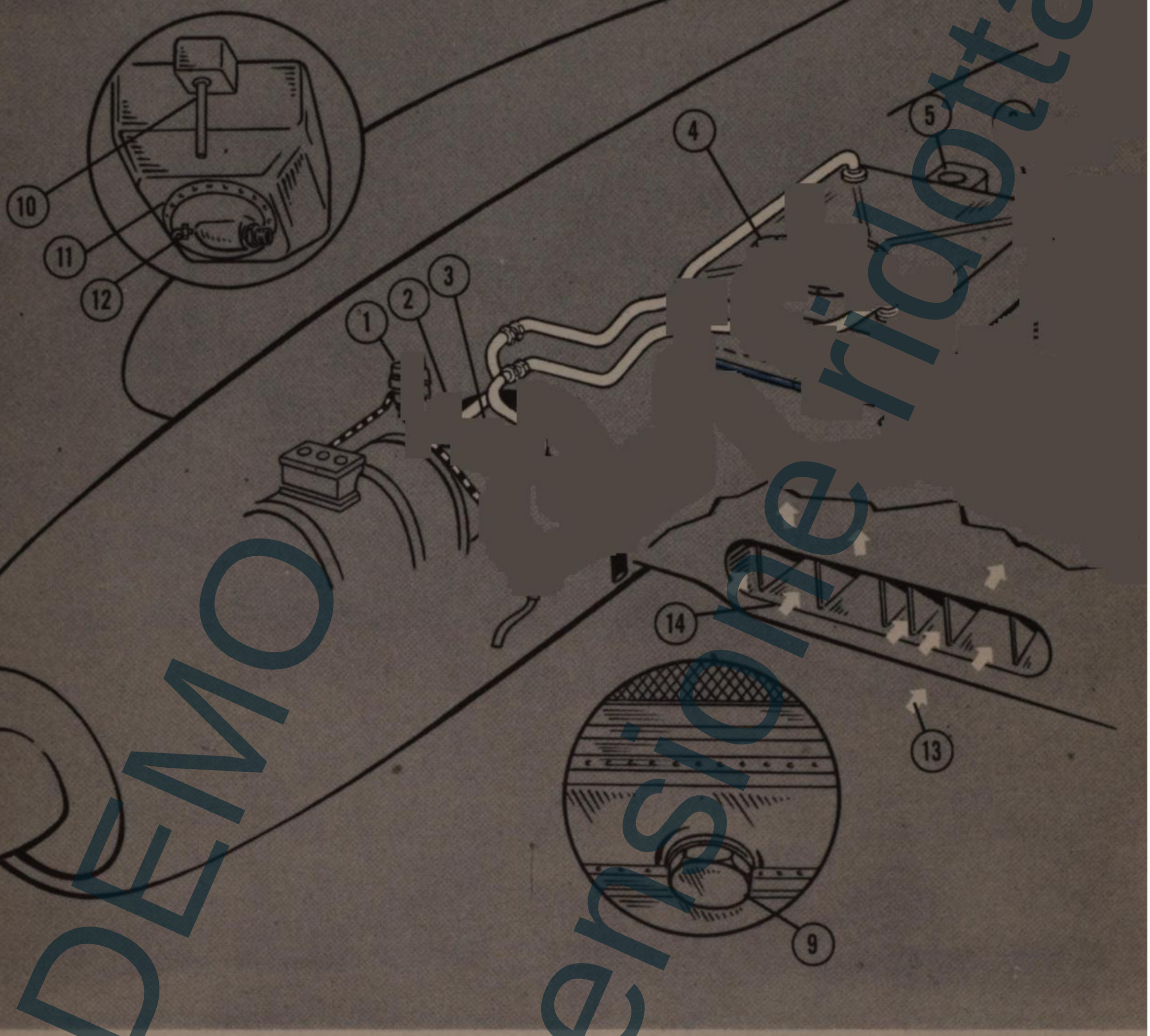


speed booster pump which you may use to supply fuel to the engine-driven pumps. Normally, the booster pumps are not used while the airplane is cruising, unless fuel pressure is low. The booster pumps operate either in LOW or HIGH position and, if the engine-driven pumps fail, you may use the boosters to supply fuel to the engines.

A crossfeed valve permits fuel to flow under pressure from one tank to another. Accordingly, you can quickly transfer fuel from a damaged tank to another tank.

The P-61A has one 22-gal. (U.S.) self-sealing oil tank in each outer wing panel.

TAKEOFF

When you have taxied to the end of the runway and have finished your propeller and magneto check, take one more careful look around the cockpit **from left to right** to make sure the plane is set for takeoff.

Here is an important precaution: If, for some reason, you have altered the position of any control since you made your cockpit check, **look at it now** to be certain you have returned it to takeoff position.

Pay special attention to the following points:

1. Have your trim tabs been set (in neutral position) for takeoff?

2. Are the fuel valves turned to the tanks you want to use (outboard tanks)?

3. Is your throttle lock tight enough to prevent the controls from creeping?

4. Are your fuel booster pumps on HIGH?

5. Are your wing flaps set right? Set them where you want them from the UP position. Don't jockey them around or they won't be even.

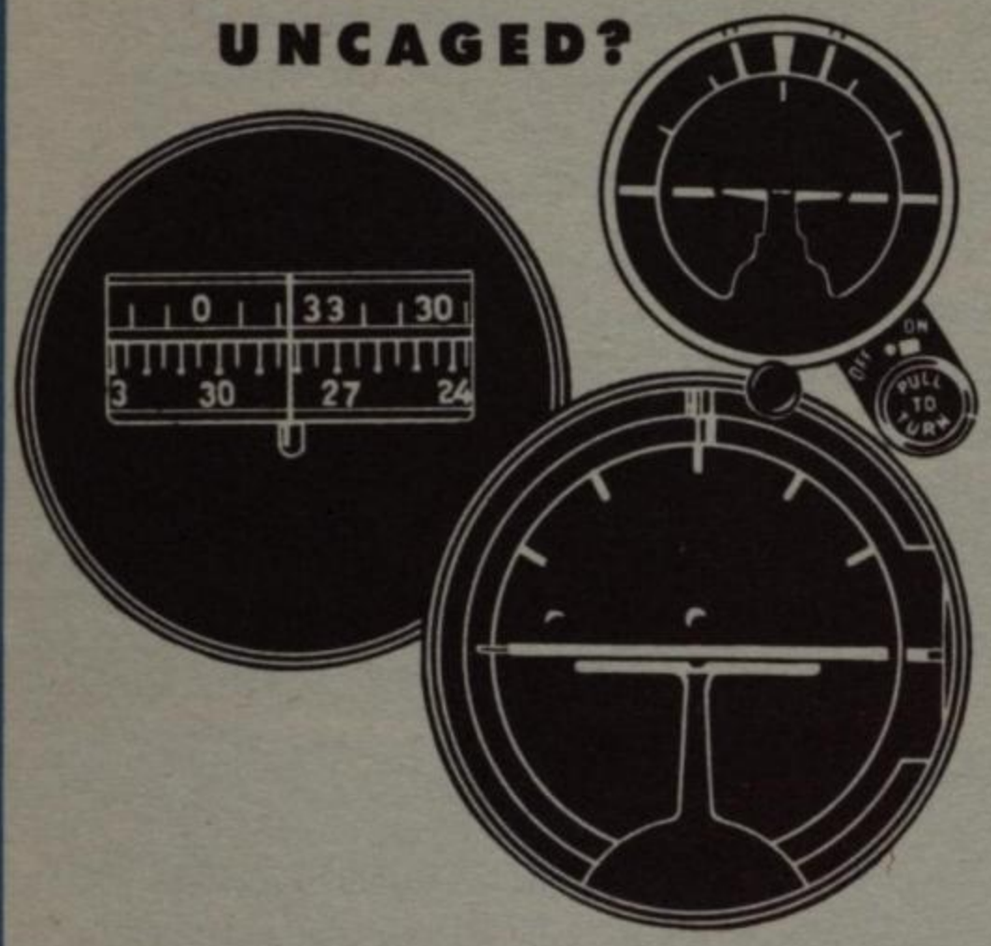
6. Are all three gyros uncaged and set properly?

7. Are your upper engine cowl flaps closed and the lower ones cracked an inch?

8. Is your automatic pilot OFF?

9. Are your controls free?

ARE YOUR GYROS UNCAGED?



In the course of a year, at a Southern air base, four experienced pilots crashed during night takeoffs within a mile and a half of the end of the runway. Nine men were carried to their deaths. **The pilots either had failed to uncage their gyros or had not used them during takeoff.**

It is the practice of night fighter pilots both here and in England to go on instruments immediately upon leaving the ground after dark. **They continue on instruments** until the planes have gained at least 1000 feet of altitude.

NORMAL TAKEOFFS (With Flaps)

In a P-61, you can make the best and smoothest takeoff by using ⅓ flaps. After obtaining the control tower's permission for takeoff:

1. Turn on to the runway. Open both throttles to about 35" Hg. against the brakes to clear the engines. Release the brakes and smoothly apply full takeoff throttle (54" Hg. manifold pressure) to the engines. Keep the plane straight during its run with the rudders.

By the time you have opened the throttles to 54" Hg., the engines should be turning up 2700 rpm, the plane doing at least 50 mph, and you may raise the nosewheel off the ground. The plane is then in a flying attitude and as soon as you have gained a speed of 100-110 mph IAS, **it lifts itself off the ground.**

Raise the landing gear as soon as the plane is safely off the ground. Level out long enough to attain critical single engine speed (110 mph IAS at 28,000 lbs. gross weight).

Critical single engine speed is the slowest speed at which the rudder has a safe margin of control over the unbalanced thrust of a single live engine at maximum power. So long as you have critical single engine speed, you are able to fly or land the airplane in the event one engine fails.

Never begin your climb until you have at-

tained this essential speed.

Raise the flaps as soon as possible after attaining critical single engine speed **and 500 feet altitude.** The flaps may not lock in the up position if they are raised at over 175 mph IAS.

Turn off booster pumps, unless you are going to climb above 15,000 feet, or unless the engine-driven pumps will not maintain 15-17 psi. If they won't, land and find out what the matter is.

You normally maintain an indicated airspeed of 165 mph, up to about 20,000 feet, while climbing. **If you make long climbs at lower IAS you overheat the engines, except in cold weather.**

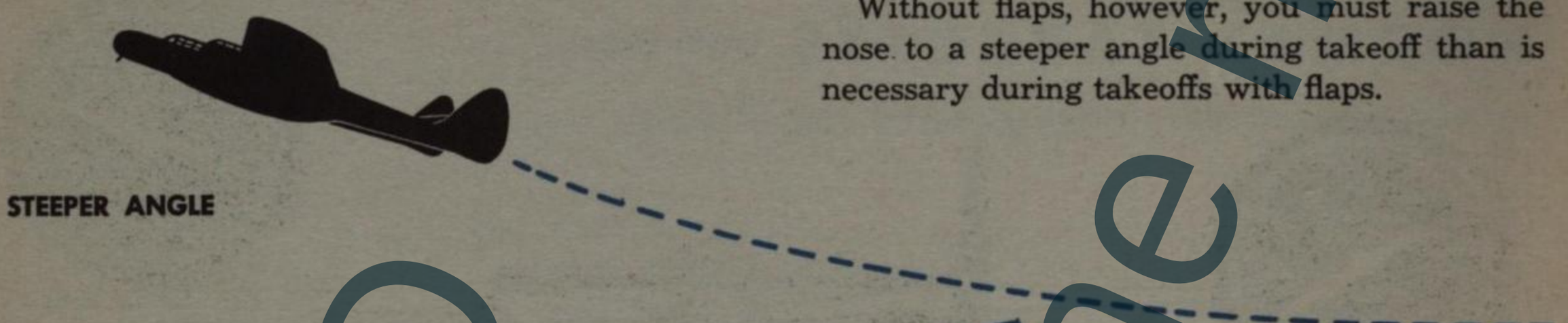
Above 20,000 feet, while climbing, you may reduce your IAS somewhat, varying it according to the oil and cylinder head temperatures registered. **Never allow the oil temperature to rise above 100°C or the cylinder head temperatures to exceed 260°C.**

In a short, rapid climb, you can obtain maximum rate at an IAS of 140 mph with full military power (54″ Hg. and 2700 rpm). **Remember, this is for short climbs only. Save it for emergency use.** Lower IAS and full power cause oil and cylinder-head temperatures to rise swiftly.

NORMAL TAKEOFFS (Without Flaps)

The P-61 makes a nice takeoff without flaps, provided the gross weight is below 30,000 lbs. Above that weight, use ⅓ flaps.

Without flaps, however, you must raise the nose to a steeper angle during takeoff than is necessary during takeoffs with flaps.



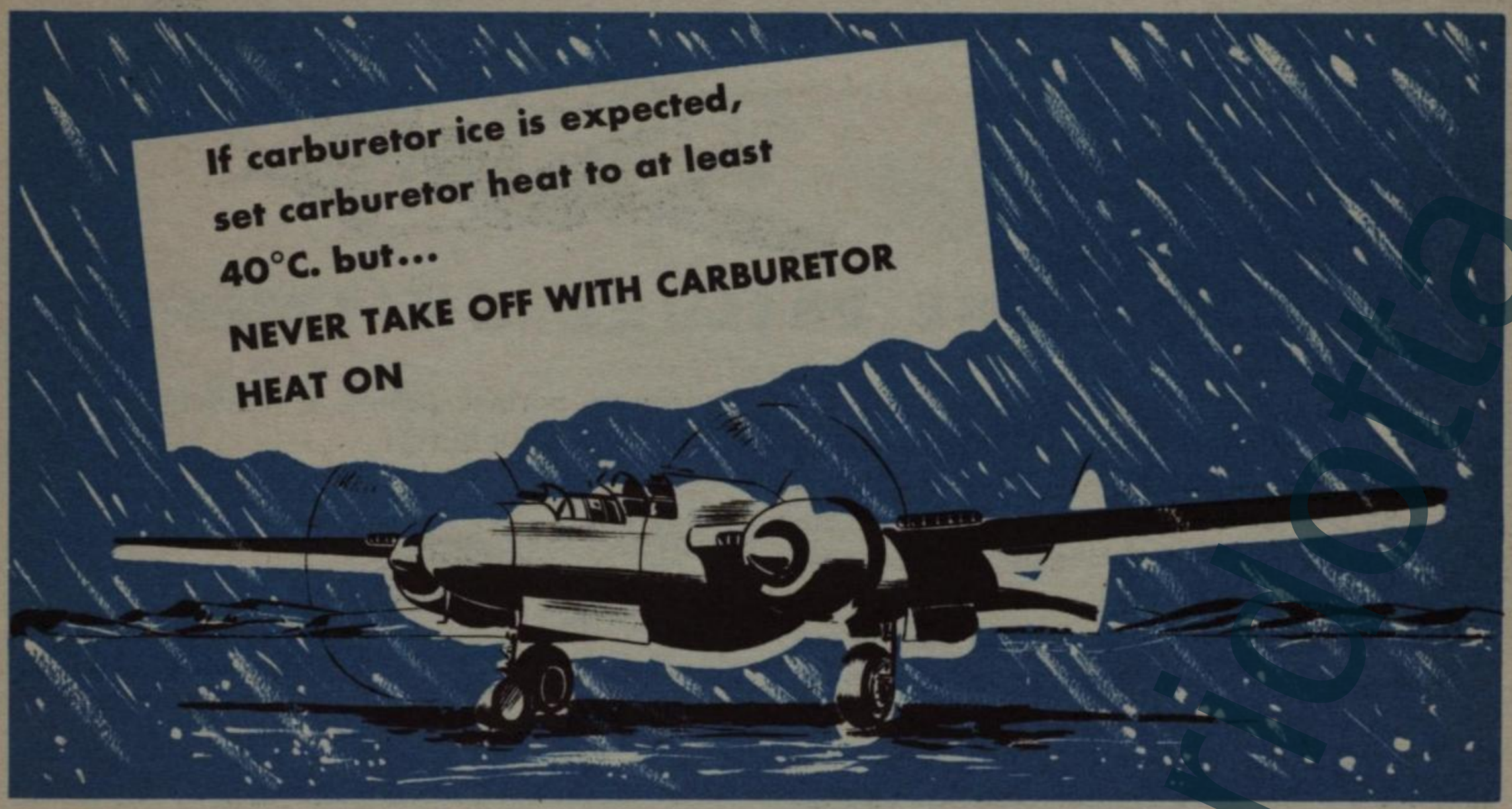
TRIMMING YOUR SHIP

To get the most out of your airplane, you must keep it in trim. This is especially true in instrument flying. As a night fighter pilot, you will be flying on instruments most of the time.

On takeoff, improperly set trim tabs can cause loss of control. During flight you can work yourself to death if you do not use trim tabs.

The P-61 trims as easily as the P-70. There is only a slight torque effect noticeable in climbing and diving. Consequently, you seldom set the rudder trim tabs more than 2° from neutral (zero) either way. You must use the elevator trim tab to compensate for any change of attitude or speed.

Because of the type of aileron used on the P-61, the aileron trim tab is practically unnecessary and has almost no effect. Accordingly, beginning with the P-61B, it has been eliminated.



ICING CONDITIONS

Icing conditions are more likely at night than in the daytime. If carburetor air temperatures warn that carburetor ice may form during engine run-up and taxiing, at a fixed throttle setting put the carburetor heat control ON. Leave it on until the carburetor air temperature rises to at least 40°C. Turn it OFF and return the control to LOCKED position for takeoff. When you have climbed to 1000 feet, turn the carburetor air temperature control ON again, if you need it. Don't use it in flight unless it's necessary. It causes you to use more fuel than you need and encourages detonation at high powers.

As a matter of fact, carburetor ice is not likely to form in P-61 engines, especially when the auxiliary blowers are operating. However, if ice does form, turn the carburetor heat control ON long enough to remove the ice, and then turn it OFF. If icing conditions persist, you may keep on using carburetor heat.

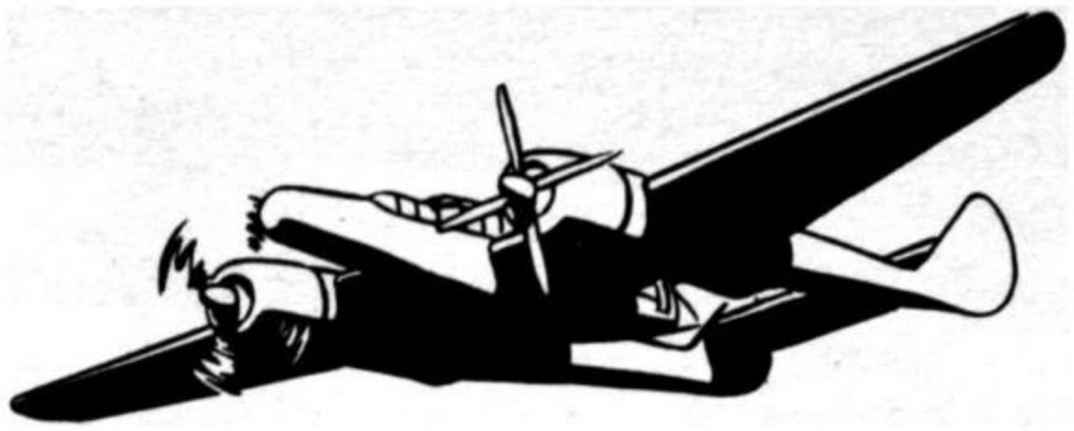
Warning of the presence of carburetor ice is given by a drop in manifold pressure when you're using NEUTRAL blowers. In the other blower positions, no such drop in manifold pressure is registered because of the automatic blower regulator.

Keep the intercooler doors closed as much as possible, unless carburetor air temperatures are above 32°C. This maintains carburetor heat when you're using LOW or HIGH blowers.

In case propeller icing is possible, turn the propeller anti-icing control on full for approximately one minute at low engine rpm just prior to takeoff. This distributes the anti-icing fluid over the entire length and breadth of the blades before ice is actually encountered.

The old adage, "An ounce of prevention is worth a pound of cure," is especially true in fighting propeller ice. If your propeller blades are thoroughly coated with anti-icing fluid before you take off, ice never has a chance to form. On the other hand, once the ice has formed, it is practically impossible to remove it from the leading edges of the blades, especially near the tips.

Never use the de-icer boots during takeoff or landing, no matter whether ice is present or not. They play nasty tricks with your stalling speed, for they act as spoilers.



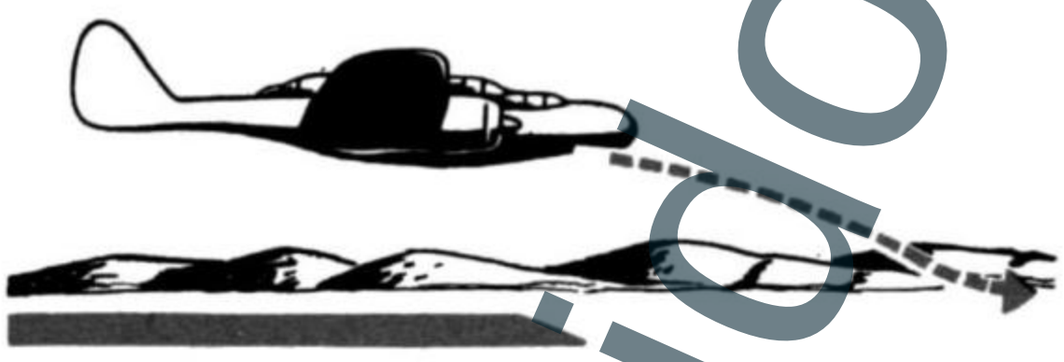
SINGLE ENGINE FAILURE ON TAKEOFF

You already know that a two-engine airplane can be flown and landed safely on one engine so long as you know how to do it. Fortunately, the P-61 performs unusually well on one engine. But don't be overconfident, just because the plane you are flying is exceptionally controllable. It is always hazardous to lose an engine during takeoff. **You've got to know what to do.** These are the basic rules:

1. **If you are carrying wing tanks, drop them as quickly as possible.** Do this first, whether an engine fails while you are still on the ground or after you are in the air. You don't want to make a crash landing surrounded by 1200 extra gallons of gasoline. For obvious reasons, if you are carrying bombs, drop them (unarmed) too.

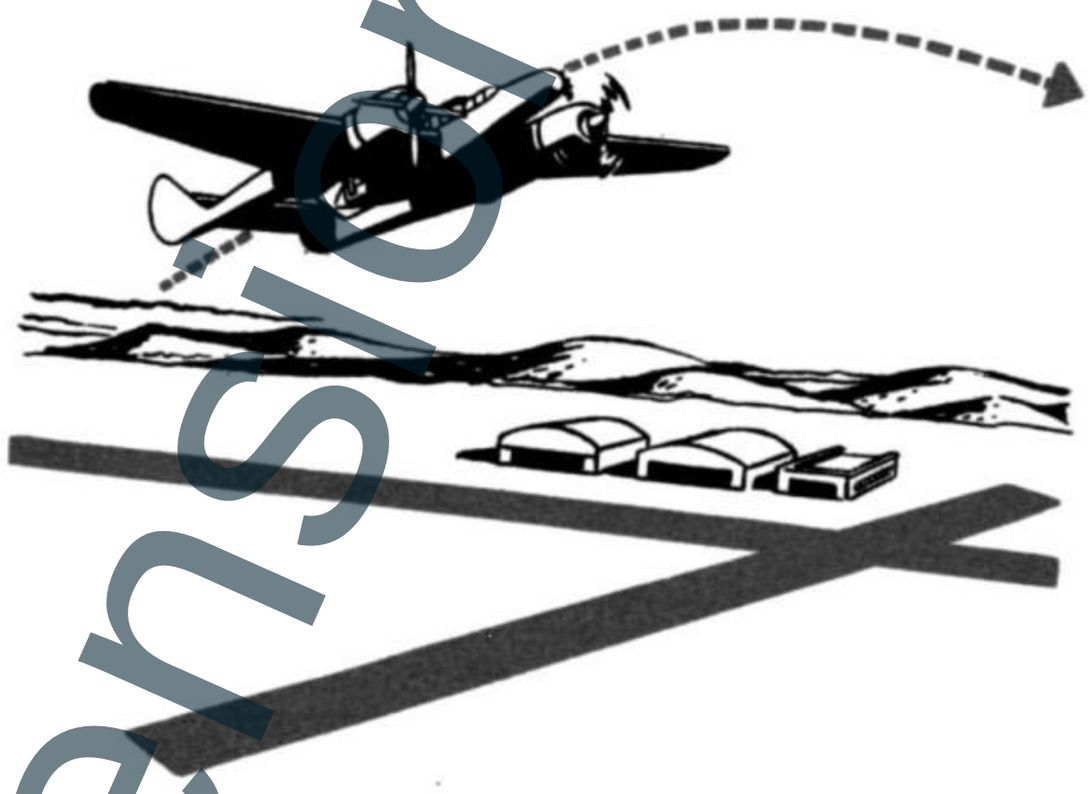
2. If one engine fails before the plane has left the ground, cut power on both engines and stop straight ahead. If it is apparent that you will run off the end of the runway before you can stop, **get your wheels up fast!**

3. If one engine fails in the air, but before the airplane has attained critical single engine speed, cut the power on both engines and land straight ahead. Obviously, if the wheels have already been retracted, you will make a wheels-up belly landing. If the wheels are still down, and there isn't enough runway left for you to make a normal power-off landing, get the wheels up in a hurry!

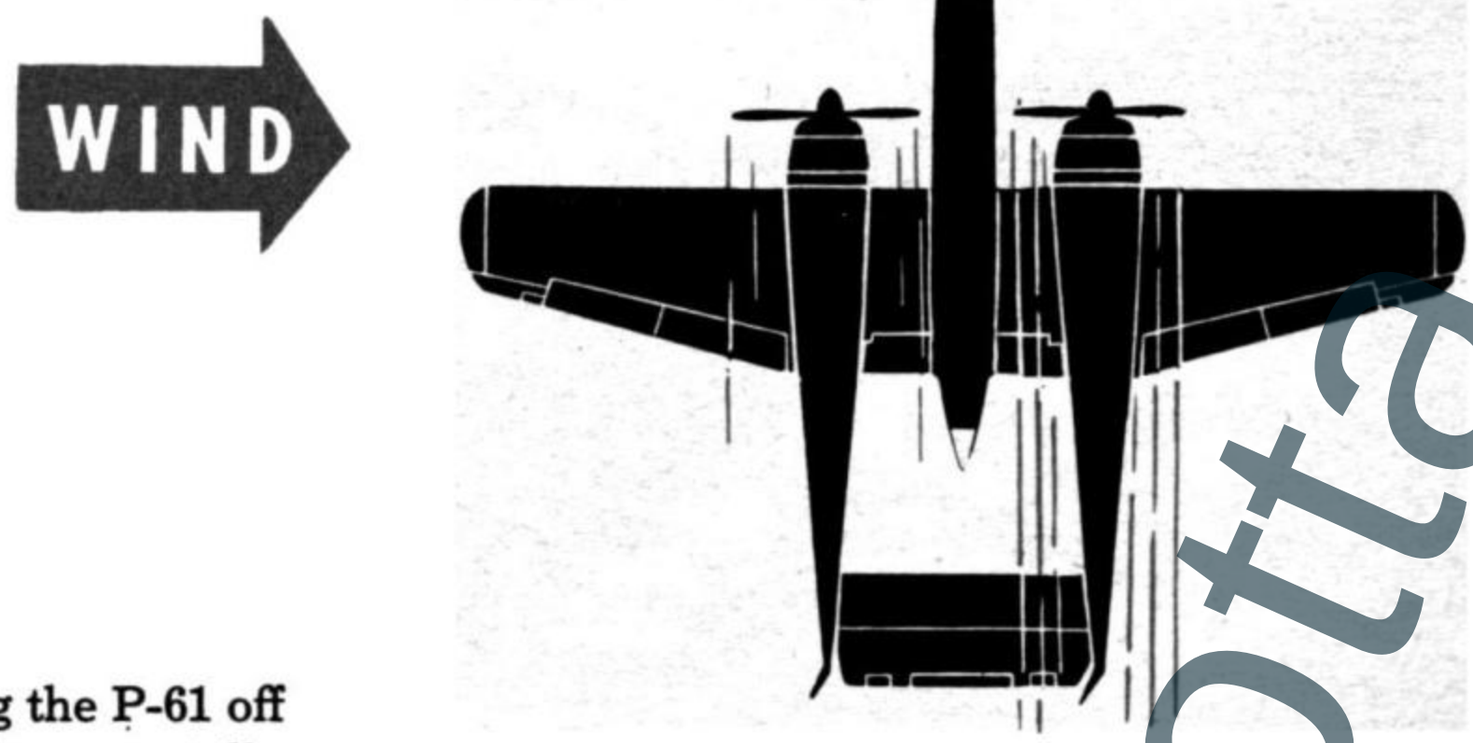


4. Never try to turn more than 15° or 20° in attempting to land straight ahead after one engine has failed during takeoff.

5. If one engine fails in the air, **after** critical single engine speed has been attained, feather the propeller on the dead engine, continue single engine flight and circle for a landing.

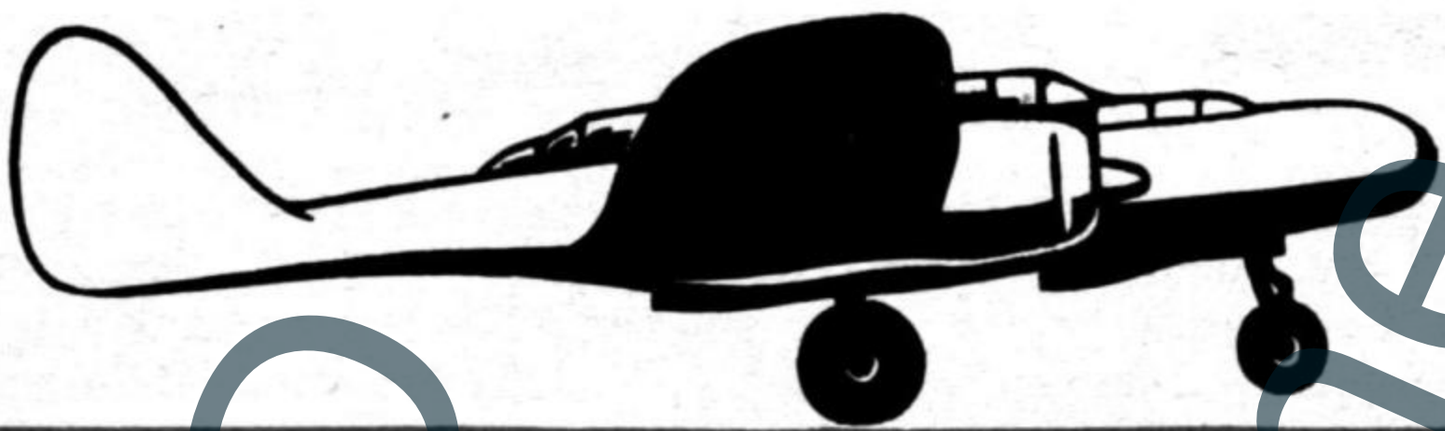


CHECK TABLE ON PAGE 66 TO FIND CRITICAL SINGLE ENGINE SPEEDS AT VARIOUS LIKELY WEIGHTS

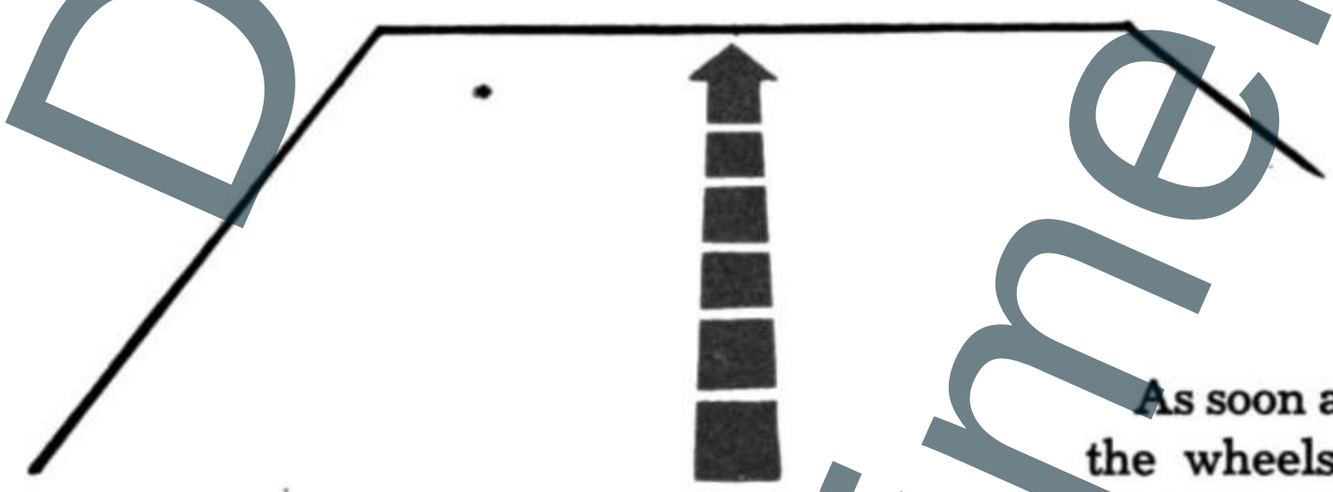


CROSSWIND TAKEOFFS

You find little difficulty in taking the P-61 off the ground in a crosswind. Just be especially careful to keep it going straight down the runway. You normally do this with the aid of a little rudder on the downwind side, at the same time rolling your ailerons slightly into the wind. In very strong crosswinds, use a slight lead on the upwind throttle for additional control.



Raise the nose at the usual time (50-60 mph), but keep both main wheels solidly on the runway until you have attained plenty of speed for takeoff. Then pull the plane smoothly and cleanly off the runway to avoid bouncing. Any bouncing is made with the drift, and therefore is extremely hard on the landing gear. The landing gear isn't built for heavy side stresses.



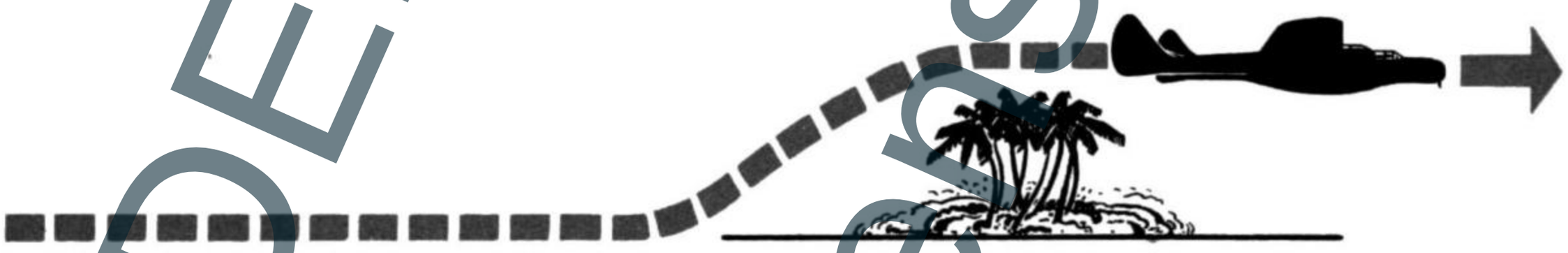
As soon as the airplane is off the ground, raise the wheels and crab into the wind to avoid drifting off the line of the runway.

SHORT-FIELD TAKEOFFS

Suppose you are on a field pitted with bomb holes. You must get off the ground as soon as possible. However, we'll assume there are no obstacles to clear. Therefore, you do not have to pick up altitude quickly.

1. Make the usual pre-takeoff check.
2. Lower your wing flaps ⅔.
3. Line up for takeoff as close to the end of the runway as possible.
4. Run the engines to full takeoff manifold pressure (54" Hg.) against the brakes.
5. Release the brakes and start your run, but keep the nosewheel on the ground as long as you can while picking up speed.
6. Pull the nosewheel off the ground and take off as soon as you have reached flying speed (75 mph at 29,000 lbs. gross weight). Then, raise the wheels and level off to attain critical single engine speed before climbing.

In short-field takeoffs, you may use your water injection system to increase the engines' horsepower and help you get off sooner.



TAKEOFFS OVER OBSTACLES

Fields bordered by obstacles generally are also short. To take off under these conditions, follow the procedure of a short-field takeoff, with the following exceptions:

1. Take off at the last possible moment.
2. After getting off the ground, raise your wheels and climb steeply until you have cleared the obstacle. Then level off to gain speed.

NIGHT TAKEOFFS

Before you fly a P-61 at night you must really know your cockpit. You must be able to tell by touch whether the controls are correctly set and be able to reach accurately for levers without hesitation.

Always have a flashlight within reach, in case the airplane's electrical system fails while you are in the air.

During your training period, it is not always practical for you to be completely night adapted before flying. That is because you are going to fly a plane which someone else has been flying. It should be checked thoroughly before you take off. You will probably do this with the aid of a flashlight and, in the process, lose what night adaptation you had.

In a combat area, however, you fly your own plane and make your NFT (night flying test) the afternoon before you fly. Your plane is always all set for you to hop in and scramble. Under these conditions, you must be night adapted. Any light would doubtless attract unwelcome visitors other than insects.

Under combat conditions, you make the usual pre-takeoff check by touch and the use of fluorescent instrument lights. **Be absolutely certain your gyro instruments are uncaged and properly set.**

After the normal run-up, line up your plane with the flare path, give her the gun, get off the ground, and **go on instruments** from the time you are airborne until you reach an altitude of at least 1000 feet. Your margin for error below that is nearly nil.

LANDING

While approaching a field on which you plan to land, but **before you have entered the traffic pattern:**

1. Be sure your fuel valves are turned to the fullest tank. Many an accident has occurred because a pilot carelessly turned to an empty tank instead of a full one while coming in from a long flight. **Make certain you have turned to the tank you intend to use.** Do not land while using the fuel from a bomb rack tank.
2. Set your mixture controls at AUTO RICH.
3. Turn off the automatic pilot.
4. Turn off the de-icer boots.
5. Make sure the gun turret is locked in the forward position.
6. Turn your booster pumps to HIGH.
7. Set the supercharger at NEUTRAL.
8. Turn cockpit heaters OFF.

Once you are on the downwind leg of the traffic pattern, check the following:

1. **Landing gear.** Put it down at less than 175 mph IAS. Be sure it is down and locked. Check your warning horn and the landing gear indicator on the instrument panel. Also, **look** to see if the wheels are extended. As the landing gear descends, the nose of the plane rises until the wheels are about half way down. From that point on, the plane's nose drops and you have to re-trim the elevators.
2. **Cowl flaps.** Generally, you close them for landing.
3. **SYSTEM and ACCUMULATOR hydraulic pressures.** They should indicate 800-1100 psi.
4. **Brakes.** Test them to see if they feel normal.
5. **Propellers.** Increase to 2400 rpm on the base leg.

LEVEL FLIGHT With Wheels Down

You need about 25″ Hg. manifold pressure at 2400 rpm to maintain level flight with wheels down at 150 mph IAS and with a gross weight of 26,000 lbs.

SWITCH TO FULLEST TANK
MIXTURE AUTO RICH
AUTOMATIC PILOT OFF
TURN DE-ICER OFF
BOOSTER PUMP HIGH
SUPERCHARGER NEUTRAL
COCKPIT HEATERS OFF

LESS THAN 175 MPH

LANDING GEAR DOWN

TRIM ELEVATORS

TEST BRAKES

WIND

85 MPH

100 TO 110 MPH

FLARE OUT 75 FEET ALTITUDE

⅔ FLAPS

LESS THAN
175 MPH

When you turn on to the approach leg, put your flaps down, **but never when the plane is traveling faster than 175 mph IAS.** As the flaps go down, start rolling back on the elevator trim tab, because the flaps make the airplane nose down rather steeply. You can make a good, smooth landing with ⅔ flaps.

At the average landing weight of the airplane (26,000 lbs.), you should maintain an approach speed of 105-110 mph IAS, and the ship should be slightly nose heavy in trim, to avoid difficulty if you have to go around. It is necessary to use 10″ to 15″ Hg. manifold pressure to keep the glide from becoming too steep. Don't get careless and let your speed drop too low on the approach or in the pattern. The airplane will probably not spin if it stalls, but you won't have enough altitude left to recover from the stall.

Start your flare out (breaking the glide) smoothly and gradually at about 75 feet altitude. Cut your power and land. The P-61 touches down nicely at 85 mph IAS. Keep the nosewheel off the ground as long as possible in order to lose speed without using the brakes. Then lower the nosewheel and apply the brakes smoothly and evenly until the landing roll is completed. Avoid putting too much pressure on the brakes, or you'll skid the wheels.

After you have turned off the runway, bring the plane to a stop, raise your wing flaps and open your cowl flaps. Push your propeller controls to full INCREASE RPM and set your elevator trim tab for takeoff.

FULL-FLAP LANDING

You may use full wing flaps for landing a P-61 any time you desire. Bear in mind, however, that the approach is steeper in order to maintain airspeed. Your flare out must start a few feet higher, and it requires considerably more power in case you have to go around again. The last ⅓ of the wing flaps adds a lot of drag and braking action and practically no increase in lift over the first ⅔.

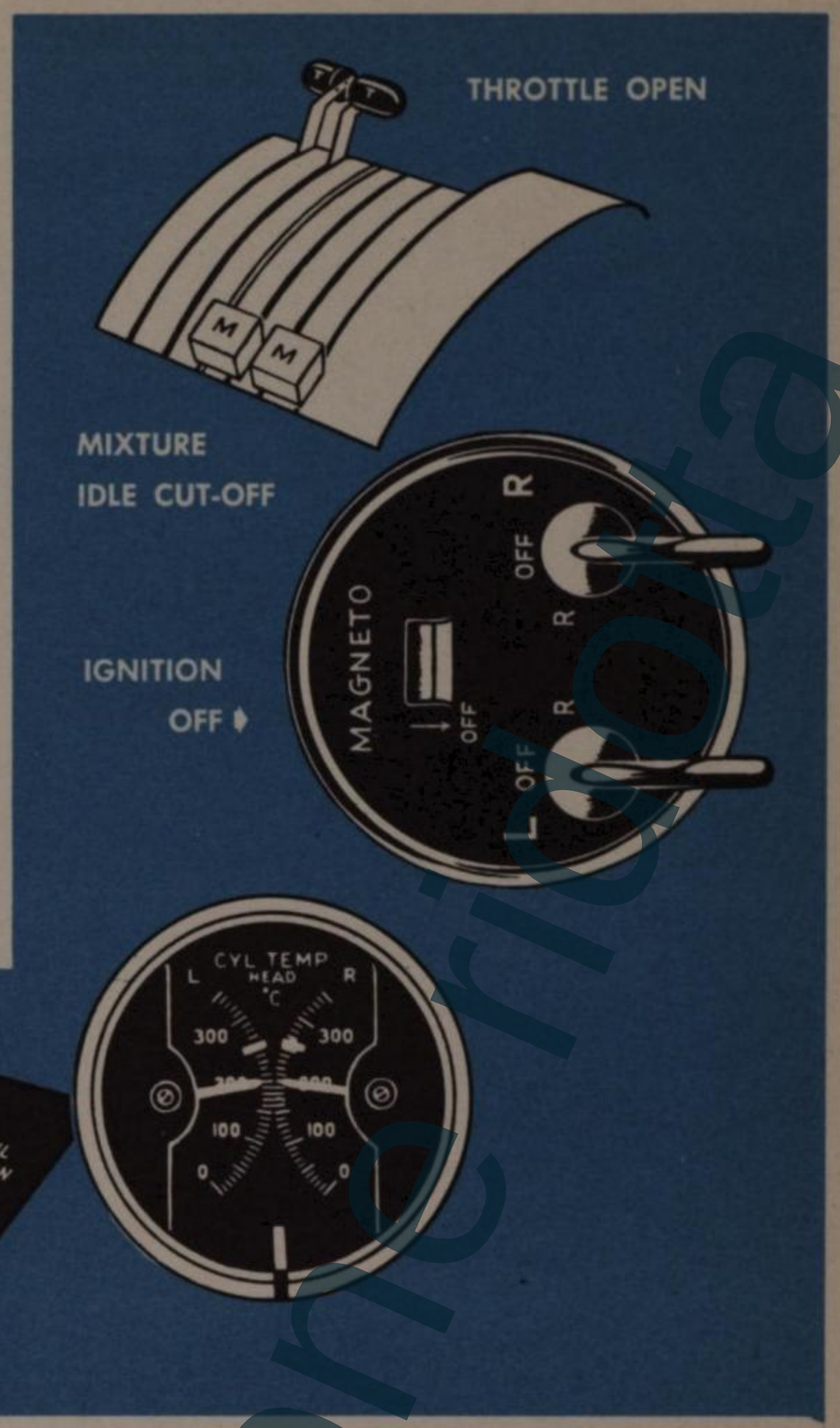
If you have finished flying, taxi to the line and park the airplane where the crew chief wants it. He places the chocks and waits for you to stop the engines. If the cylinder head temperatures are high, after landing, allow the engines to idle for a short time at 1000-1200 rpm. Do this until the cylinder head temperatures drop below 205°C. Mixture must be AUTO RICH, oil cooler flaps must be open, and all cowl flaps must be open.

How to Stop the Engines

To stop the engines, move the mixture control levers to IDLE CUT-OFF and slowly open the throttles all the way. Turn the ignition switches OFF when the engines have stopped. Turn off all the other electrical switches before you leave the plane. Leave the mixture controls in IDLE CUT-OFF and **do not shut off the fuel tank selector valves.**

If IDLE CUT-OFF doesn't stop the engines, close the throttles, turn the ignition switches OFF and slowly open the throttles wide as the engines quit. Have the IDLE CUT-OFF adjusted properly as soon as possible.

If the weather is cold, use your oil dilution system before the engines are stopped and after the cylinder head temperatures have dropped below 205°C.



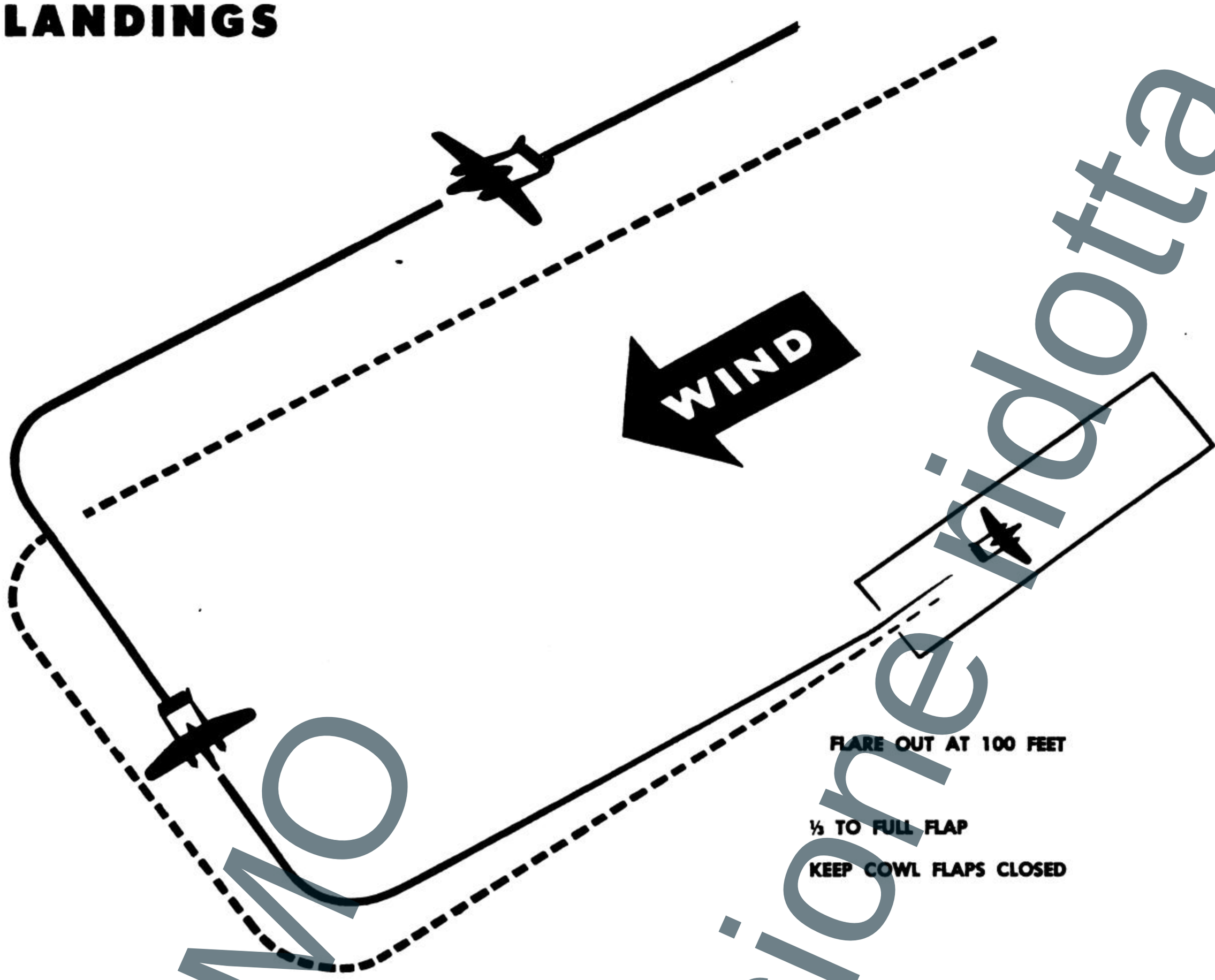
Afterflight Check

Lock the flight controls before you leave the cockpit. Set the lock by moving the lever into the ON position. Then gently move the elevator, aileron, and rudder controls until you feel them lock in neutral.

Don't set the parking brakes if they're hot, or the mechanic later may have to take them apart to move the airplane.

Before you and your crew walk away from the plane after a flight, go into a huddle to see if they've found anything you should enter on the Form 1. If they have, put it down on paper right away. Don't say to yourself, "I'll have to see the crew chief about that." He may be out having a coke when you hunt him up, and then you'll forget it.

POWER-OFF LANDINGS



Power-off landings in a P-61 require an unusually steep approach to maintain gliding speed. This is because of the exceptionally large flap area on the airplane.

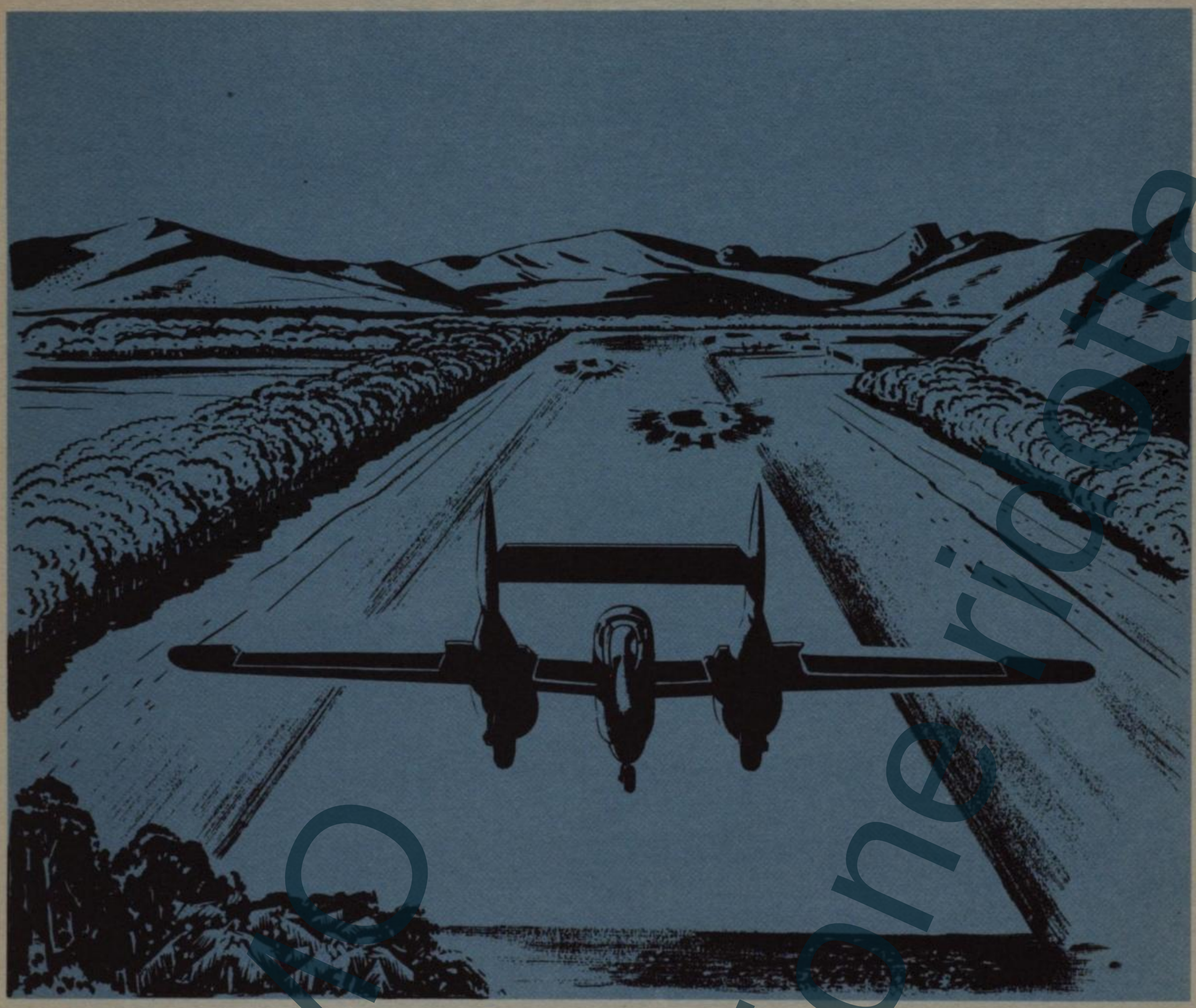
You should maintain an IAS of 110-115 mph during the approach, and start your flare out smoothly and gradually at 100 feet above the level of the runway.

Your tendency during the first few power-off landings is to undershoot the field by a wide and uncomfortable margin. So be ready with the throttles to correct your error in judgment.

You may use from ⅓ to full flaps on power-off landings. Naturally, the greater the angle of flap, the steeper the glide.

Always close cowl flaps in making power-off landings and avoid letting your engines cool below 100°C. When throttles are opened to correct the glide, open them smoothly and slowly to avoid giving the engines an embarrassing coughing spell.

Remember your stalling speed is higher without power and you touch down at a slightly higher speed.



SHORT-FIELD LANDINGS

You normally make short-field landings under one of two conditions:

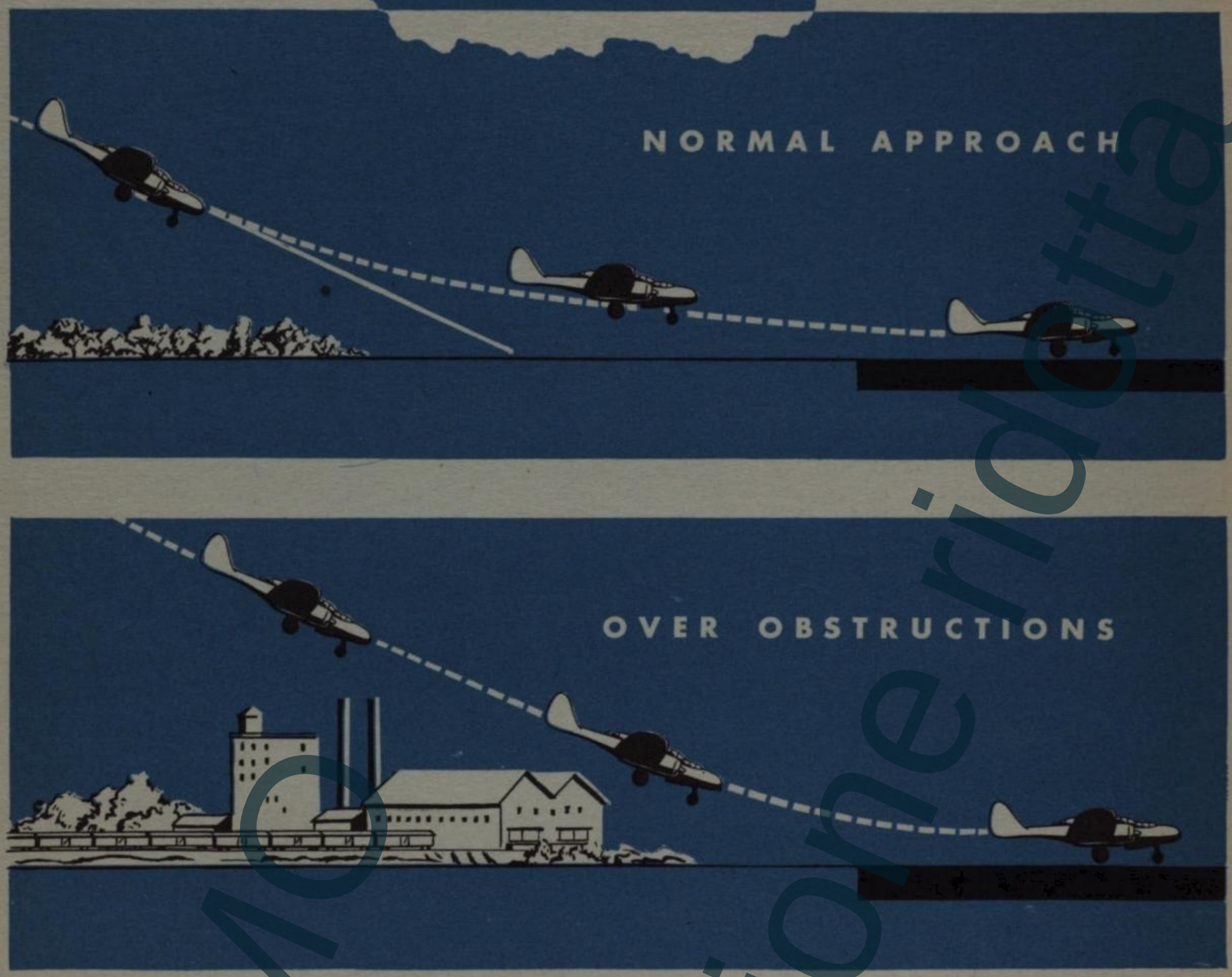
1. When the field is naturally short.
2. When part of the runway has been destroyed by bombs.

The full-flap, wheels-down stall, both with power on and power off, and slow flying are the basis for short-field landings. In fact, you must be proficient in these three maneuvers before you can make good short-field landings.

When you make a short-field landing:

1. Establish a normal full-flap glide with power, in order to undershoot the field slightly.
2. Hold normal speed throughout the flare out, then gradually pull up the nose, increase power, and go directly into slow flying. Do this when you are close enough to the ground to land as soon as the power is cut.
3. As you approach the point where you want to land, cut the power. Since the airplane is already at the power-off stalling speed, you can make the landing easily. You may use maximum permissible brakes, **but do not skid the tires.**

APPROACH OVER OBSTRUCTIONS



Obviously, the type of approach described above isn't practical if you are landing over an obstruction. In approaching over an obstacle, establish the base leg so that you can make a fairly steep power approach, clear the obstacle, and touch the wheels as soon as possible after you have cleared it.

Plan your glide so that you can clear the obstacle **by power** rather than by depending upon your judgment as in the power-off approach. Reduce speed according to the height of the obstacle.

Bring the airplane to a 3-point attitude and control the rate of descent as you approach the obstacle. The approach path governs how high above and how far behind the obstacle the airplane should assume this position.

As the airplane approaches the ground, your speed should be the power-off stalling speed. The rate of descent should not exceed 1000 feet per minute.

Under the above conditions, you can cut power as soon as the plane is close enough to the ground for a safe landing.

Be careful not to drop in too hard as a result of cutting power suddenly.

CROSSWIND LANDINGS

It is important that you know how to make a good crosswind landing. Advanced air fields in combat areas usually have only one runway. Frequently, the wind is blowing across it. Therefore, you must know how to land your airplane without exerting side loads on the gear, blowing a tire, or collapsing an oleo.

There are three possible ways to land crosswind:

1. Hold the airplane straight and level toward the landing strip, and drop one wing into the wind just enough to counteract drift.

2. Head the airplane into the wind enough to keep a straight ground path (crabbing).

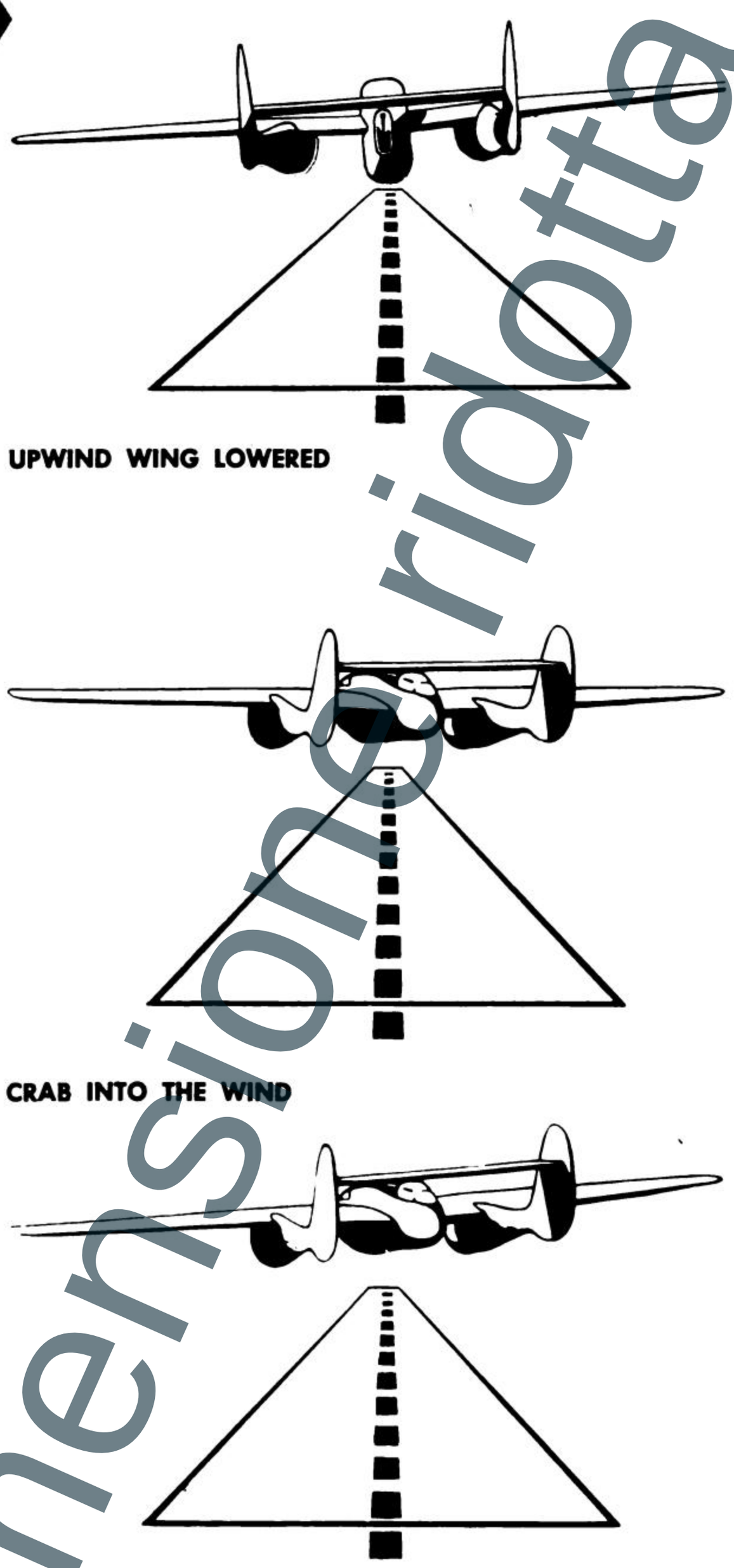
3. Combine the first two methods.

The best method is the third—head into the wind and lower the upwind wing. This keeps you from dropping the wing too low or crabbing too much. It is easier to straighten the airplane when close to the ground. But remember to crab just enough to avoid slipping. Any uncoordinated movement may raise the stalling speed of the airplane.

Recognize the importance of the approach. Allow for drift on the turn into the approach so as not to overshoot or undershoot the approach leg. Correct for drift as soon as possible. The airplane should then be making a straight path to the landing strip and the only correction needed on actual landing is the angle of crab.

If there is only a moderate wind, use full flaps; in stronger winds, use less flaps.

As the airplane begins the flare out for landing, bring up the low wing and straighten the plane so there is no side load on the gear as it touches the ground. It may be necessary to kick the rudder hard to straighten the plane properly. Other controls available for keeping the airplane headed straight after landing are: cautious use of downwind brake, and smooth use of the upwind engine.



UPWIND WING LOWERED

CRAB INTO THE WIND

UPWIND WING LOWERED
CRAB INTO THE WIND

SINGLE ENGINE LANDINGS

The P-61 handles remarkably well on one engine, but there are certain fundamental rules which should be applied to a single engine landing in any two-engine airplane:

1. Make the turns of your traffic pattern in the direction of your good engine, if practicable. It is entirely possible to turn in the direction of the dead engine, **provided you know how to do it.** Trim the airplane for straight and level flight, leaving a little rudder pressure on the side of the good engine. Be sure to keep your airspeed constant. Lose a little altitude on the turns, if necessary, to maintain critical single engine speed or whatever airspeed you may have above that minimum.

2. Be sure you have made a careful pre-landing cockpit check. You do not want to run out of gas on your one good engine.

3. Follow the normal traffic pattern, if possible. Under any circumstances, notify the control tower that you are coming in with a dead engine to make an emergency landing. Tell the tower the traffic pattern you plan to follow.

4. Lower the landing gear only after you have turned in on the approach leg, and when you are sure you are going to make the field.

5. Lower the flaps not more than ½ when you are certain you are going to reach the field. In case there is danger of overshooting, lower the flaps all the way.

6. Keep only a small amount of power on the good engine. Make your approach as normal as possible. However, the airplane has the gliding angle of a streamlined brick and full flaps and no power and you may reach the field from quite a high approach. But put the plane on the ground and stomp on the brakes, even if you're doing 150 mph. Don't hold it off. It is better to hold a little rudder pressure into your good engine than to trim the plane to fly hands off with the power on. This prevents a sudden large change in rudder pressure when you cut the engine for landing.

If, through an error in judgment, you come in too fast, **go ahead and complete the landing even at 150 mph.** Don't try to go around on one engine, and run the risk of a stall near the ground. The good engine may quit, too.

NIGHT LANDINGS

By the time you first fly a P-61, you will have flown at least 100 hours at night in a P-70. The two planes fly much alike, except that the P-61 is smoother and more stable. It also lands slower. Moreover, because of the P-61's greater flap area, the pitching motion is much more noticeable when flaps are lowered. Don't let this so disconcert you that you plow a new approach path through the tops of the trees.

Usually, you land without the use of wing lights. If you use them, never lower these lights when you're flying faster than 140 mph IAS. The normal procedure of night fighter squadrons is to land with the aid of a glide-path indicator and the runway lights.

Make sure you know what the glide-path indicator is and where it is located. It gives out three distinct color bands of light. The landing you make with its help is similar to an instrument landing. **You are supposed to come in on the green band of light.**

If the airplane approaches on the yellow band, it is too high: if on the red band, it is too low. Learn how to follow the green band—keeping as near the center of it as possible—and make contact with the ground near the approach light. This insures clearing all obstacles in the approach path and leaves enough runway to complete the landing.

Remember, you must hold a constant rate of descent (about 500 ft. per minute) for the full distance of the approach. As you approach the glide-path indicator, and the runway lights begin to level out, decrease the speed and start a slight flare out. Then ease the airplane down to a tail-low landing.

It is easier to make blind approach beacon landings in the P-61 than in the P-70. The P-61's greater stability makes all instrument flying in it easy.

Go-Around Procedure

There are many reasons why you may have to go around after starting a landing. Whatever the reason, don't waste time debating with yourself. Level off, advance the throttles to climbing manifold pressure and raise the wheels immediately. Then, re-trim your elevators. The trim tabs are powerful, and if you don't re-set them as soon as you apply increased power, it is most difficult to keep the nose down. Your propellers already should be set at climbing rpm. Don't exceed recommended maximum airspeed—flaps down.

When you have sufficient altitude, raise the flaps slowly and resume normal operations. Milk the flaps up gently. Remember that flaps change the lift of the wing and the attitude of the plane.

Weight and Balance

The P-61 is a Class 1B airplane, according to the definition of T.O. 01-1B-43. Accordingly, it is unlikely that it will be incorrectly loaded except under unusual circumstances. However, if you have any doubt at all about the loading condition of the plane, check the weight and balance chart. Obviously, you should know the gross weight and corresponding stalling speed of the plane you're going to fly.

TABLE OF GROSS WEIGHTS AND CORRESPONDING CRITICAL SINGLE ENGINE AND STALLING SPEEDS

CONDITION OF AIRPLANE	GROSS WEIGHT (P-61B Weighs Approx. 350 Lbs. More)	CRITICAL SINGLE ENGINE SPEED (CLEAN)	STALLING SPEED (Flaps Full Down, Wheels Down, Rated Power (1600 Hp On Each Engine)
Without gun turret, ammunition and external wing tanks	27,494 lbs.	120 mph	75 mph
With gun turret and ammunition, but without external wing tanks	29,007 lbs.	125 mph	78 mph
With gun turret, ammunition, and two 165-gal. external wing tanks.	31,077 lbs.	130 mph	85 mph
With gun turret, ammunition, and two 1000-lb. bombs	31,087 lbs.	130 mph	85 mph
With gun turret, ammunition, and two 300-gal. external wing tanks	32,969 lbs.	133 mph	87 mph
With gun turret, ammunition, and four 165-gal. external wing tanks	33,147 lbs.	133 mph	87 mph
With gun turret, ammunition, and four 310-gal. external wing tanks	37,091 lbs.	137 mph	95 mph

DITCHING

Never ditch a P-61 at night, unless you are too low to bail out. If serious trouble develops while you're flying over water in daylight, and you decide to ditch the plane, don't wait until the last minute before letting the crew in on your decision. There are several things you all have to do before setting the plane down. Warn the crew by interphone; or ring the warning bell six times and then leave it on.

As soon as you have decided on ditching, send out an SOS, giving time and position. Do this in plenty of time before you hit the water. If it turns out that you don't have to ditch the plane after all, you can always cancel the distress call.

If the plane is carrying external wing tanks, drop them immediately. If it is carrying bombs, release them unarmed. Provided you have time, fire all the ammunition in the plane. This precaution has double value. It prevents an ammunition explosion on landing and at the same time lightens the plane considerably.

Unfasten your parachute, and have the crew do the same, but be sure you all re-fasten shoulder harnesses and safety belts.

Have your RO and gunner check to make sure the bottom entrance doors of the forward and aft compartments of the crew nacelle are closed and fastened. Then, each one of you must open his overhead escape hatch. The gunner can get rid of his entirely. Yours and the RO's will almost certainly blow away. Then, there is no danger of jamming the hatches when you land. All three of you can make a quick getaway the instant the plane stops moving.

If you have to ditch at night, turn off all bright lights inside the plane as soon as it is feasible to do so. This helps you and the crew to accustom your eyes to the darkness before you have to leave the plane.

Ditch the airplane while there is still enough

fuel left to make a power-on landing. Under power, you are sure of being able to control the plane and flatten it out properly for a satisfactory landing on the water.

Approach and Landing

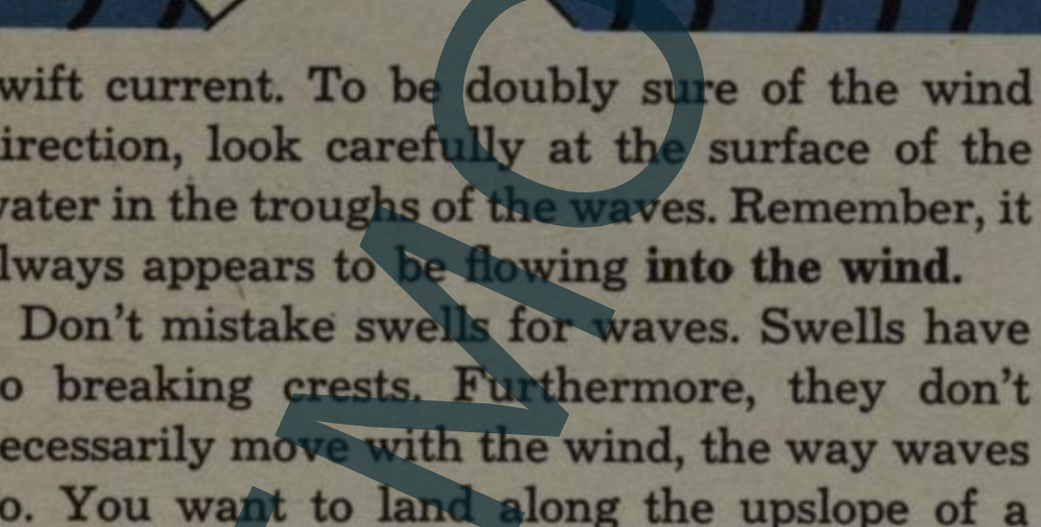
As the airplane nears the water, try to find out which way the wind is blowing on the surface and about how strong it is. Watch the lines of waves and note which direction they are moving. The wind is certain to be at right angles to them, unless you are close to shore or over a

swift current. To be doubly sure of the wind direction, look carefully at the surface of the water in the troughs of the waves. Remember, it always appears to be flowing **into the wind.**

Don't mistake swells for waves. Swells have no breaking crests. Furthermore, they don't necessarily move with the wind, the way waves do. You want to land along the upslope of a swell, if surface conditions permit.

Land at the slowest possible IAS. **Don't lower your landing gear.** Put your wing flaps down about ⅓.

If only a light wind is blowing across the swell, land crosswind and ditch the plane on an upslope, parallel to the movement of the swell. If a heavy wind is blowing across the swell, face into the wind as much as possible and ditch the plane on an approaching upslope near the top. If you are landing in waves or in a steep swell, set the plane down on the top of a wave or swell, unless there is an exceptionally strong crosswind.



Have it understood with your crew that just before the plane strikes the water each man is to shield his face with his left forearm. This protects the head from pieces of debris and helps absorb shock in case it is thrown forward against part of the structure.

Land the plane in the water with its tail down. You feel a slight jolt as the rear of the airplane strikes, then a severe jolt and rapid stop as the rest of it hits the surface. The faster you are traveling when you strike the water, the more rugged the impact is and the greater the danger of having the plane collapse. Also, in an overly fast landing, the plane usually bounces. This makes collapse all the more likely.

You and your crew must release your safety belts and climb out through the top escape hatches as soon as the plane stops. Inflate your Mae Wests. Pull your individual dinghies loose from the parachutes. Inflate the dinghies and wriggle into them. Salvage the parachutes if you possibly can, for sails, cover, and extra lines. They come in mighty handy.

If the Hydraulic System Fails

Your hydraulic system may fail because of a leak in a line or unit, or failure of the engine-driven pumps. The pressure gage usually warns you of such failure by dropping well below the normal reading of 850-1000 psi.

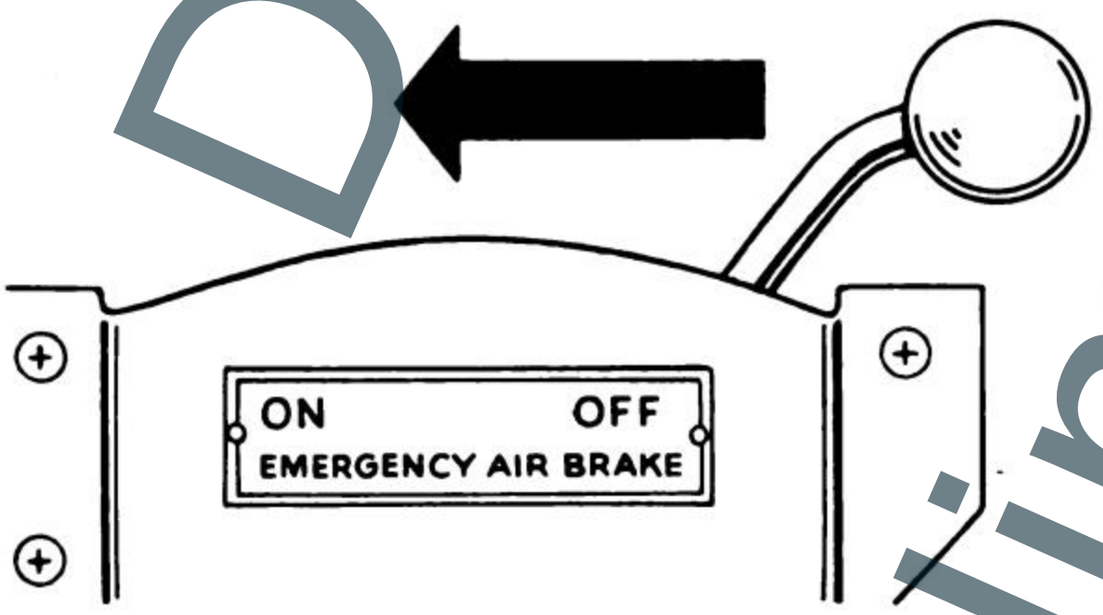
If there's a leak in the main system, the hydraulic fluid in the accumulator and about one-third of the fluid in the main reservoir is still available for emergency operation.

For a short time, if you pump like mad, you can operate all the hydraulic equipment except the automatic pilot by means of your hand pump. That is, unless the fluid is leaking so fast the hand pump can't supply pressure. The best idea, in case the hydraulic system fails, is to save the hand pump for operating your flaps and brakes during landing. Both of them work from the accumulator.

Emergency Air Brake

There is a good chance that the hydraulic pressure you build up with the hand pump will be all gone after you've lowered the wing flaps. In that case, use your emergency air brake system in landing. The release lever, marked EMERGENCY AIR BRAKE, is along the cockpit rail at your left, just above the electrical panel. When you pull this lever ON, air pressure flows into the brake lines from a storage bottle and forces the brakes on. There is enough air pressure in the storage bottle to enable you to apply and release the brakes about six times.

If you have to use the emergency air brake system, make sure the ground crew bleeds the lines afterwards and refills the storage bottle to 425 psi.



No-Flaps Landing

If your flaps won't come down, either because they're stuck or because there isn't any hydraulic pressure, follow the normal traffic pattern, approach the field at 130-135 mph IAS (with normal landing weight of 27,000 lbs.), and put the main wheels on the ground at about 110 mph IAS. The plane's nose will be higher than usual during the approach and landing. Try to avoid hitting the ground with the tail either during or after landing.

In making a landing without flaps, use the emergency air brake rather than wasting time trying to build up brake pressure with the hydraulic hand pump. There may not be any hydraulic fluid left.

Emergency Operation of Landing Gear

In case the main hydraulic system of the plane fails, operate your landing gear with the aid of the hand pump, if you can. Put the landing gear lever DOWN, turn the hand pump selector valve to SYSTEM, and pump as hard as you can until the landing gear wheels are locked DOWN.

If you can't build up enough hydraulic pressure for this procedure to work, try another method. Reduce the airplane's speed to 130 mph IAS or less. Then, with the landing gear lever DOWN, pull the landing gear emergency release handle. Hold this handle up until the nose gear is locked in the down position before you release it.

Belly Landing

In the event that you have to land the P-61 with its gear up, follow this procedure:

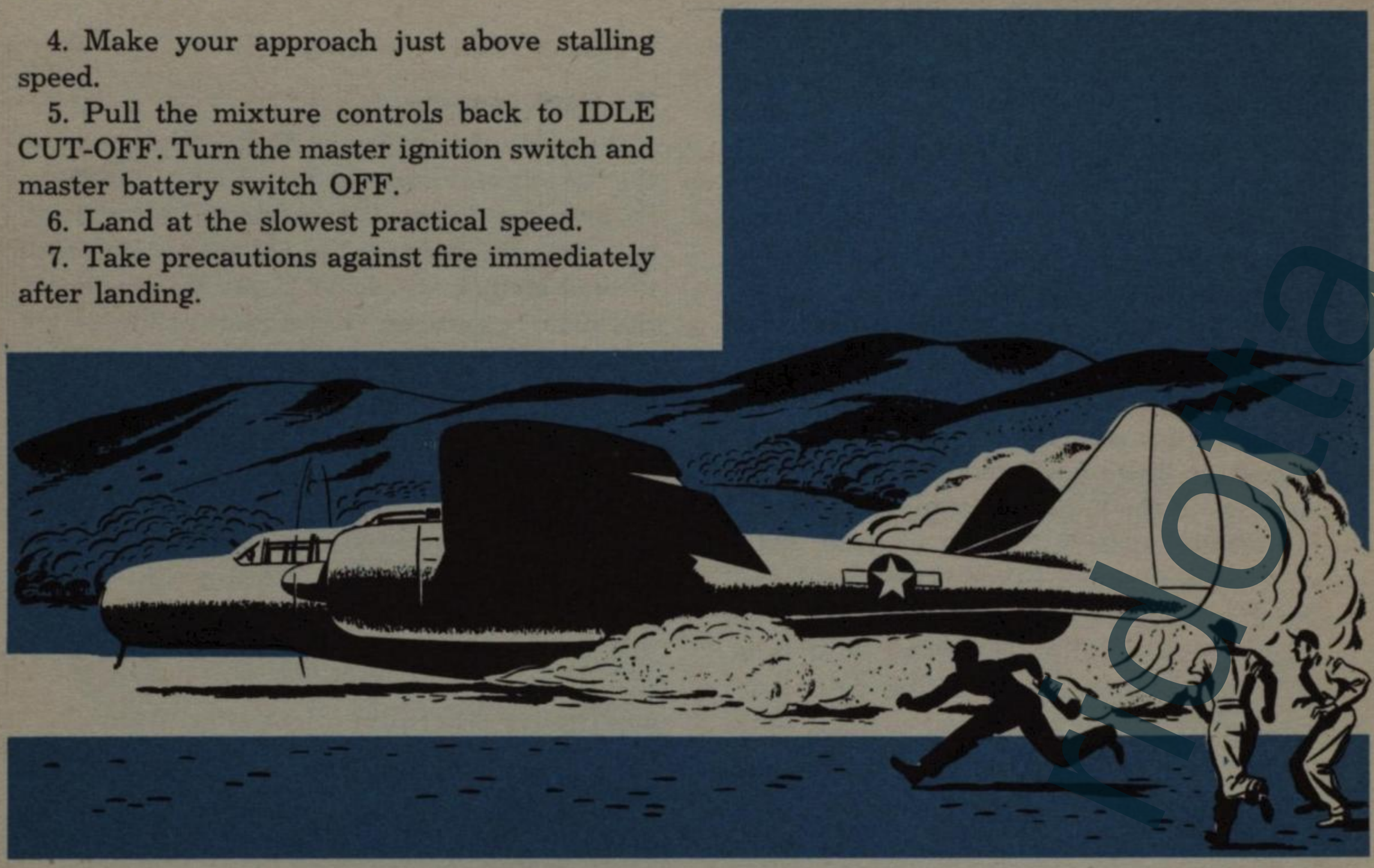
1. If you have time, and other conditions permit, fire all the 20 mm. cannon ammunition.
2. Drain the airplane's oxygen supply completely. (You should have told your crew in advance that whenever you have to make a belly landing each man is to turn the red emergency knob of his oxygen regulator ON.) Get rid of the oxygen and you have removed a principal source of fire in gear-up landings.
3. Lower wing flaps all the way.

4. Make your approach just above stalling speed.

5. Pull the mixture controls back to IDLE CUT-OFF. Turn the master ignition switch and master battery switch OFF.

6. Land at the slowest practical speed.

7. Take precautions against fire immediately after landing.

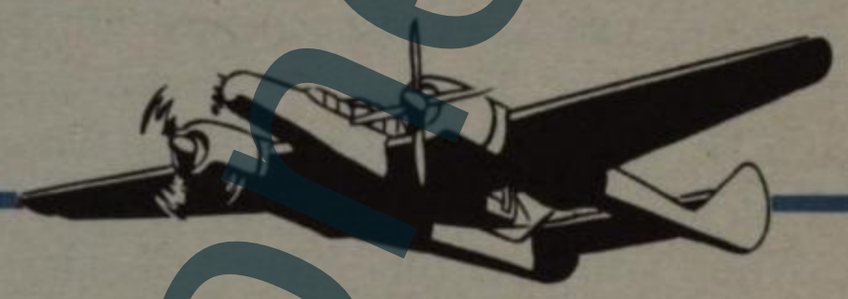


Propeller Feathering (Practice)

As soon as you have been checked out properly in a P-61, thoroughly understand the correct way to stop and start the engines in flight, and are familiar with the way the plane flies with one engine dead, practice feathering the propellers. Do this frequently until you are sure that if an engine fails in flight you'll feather its propeller quickly and smoothly.

But **here's an important point to remember:** To protect the engines from possible damage, you **practice** feathering in a slightly different way than you do it in an emergency. It's a slight but vital difference. **In practice,** you **close the throttle of the engine before you touch the feathering switch. In an emergency,** you set the feathering switch and **then** close the throttle.

Because this distinction is important, first learn the proper way to practice feathering, as it is given just below. But study, too, the box on Emergency Feathering which appears on the opposite page. Memorize so well the procedure given there that if an engine fails in flight, your brain instantly will remind you, "Feathering switch first!"



In practice this is the way to feather a propeller:

1. Close throttle.
2. Set feathering switch to FEATHER.
3. Move mixture control to IDLE CUT-OFF.
4. Shut off supply of fuel to the dead engine.
5. Turn ignition switch OFF, after the propeller stops rotating.

EMERGENCY FEATHERING

In an emergency, this is the way to feather a propeller:

1. Set feathering switch to FEATHER.
2. Close throttle.
3. Move mixture control to IDLE CUT-OFF.
4. Shut off supply of fuel to the dead engine.
5. Turn ignition switch OFF, after the propeller stops rotating.

If for any reason the feathering circuit fails to work, you can still place the propeller blade at the feather angle. Return the feathering switch to NORMAL and hold the propeller selector switch in the DECREASE RPM position until the blade is feathered.

Unfeathering the Propeller

To return a propeller blade to the position it was in before you feathered it:

1. Turn ignition switch ON while throttle remains closed.
2. Put propeller control lever in the DECREASE RPM position.
3. Turn fuel supply ON.
4. Move mixture control to AUTO RICH.
5. Set the feathering switch at NORMAL. Hold selector switch in the INCREASE RPM position until the engine speed reaches 800 rpm, then release it.
6. If the engine has cooled while the propeller was feathered, get the cylinder-head temperatures up to 100°C at about 800 rpm before you increase engine speed.
7. As soon as proper engine operating temperatures are reached, put selector switch in AUTOMATIC. Adjust mixture, throttle, and propeller control levers to the desired power and engine rpm.

Engine Failure During Flight

With one engine dead and its propeller windmilling, with military power on the other engine, and with rudder trim neutral, you can control a P-61 down to a normal stalling speed (gear and flaps up) of 102 mph IAS. With gear and flaps lowered, you can control the plane down to a normal stalling speed of 80 mph IAS. **But you've got to do the right things quickly.**

Under normal conditions, you won't have to cut the power of your good engine. Just change its mixture to AUTO RICH. However, on the dead engine:

1. Set feathering switch to FEATHER.
2. Close throttle.
3. Move mixture control to IDLE CUT-OFF.
4. Shut off supply of fuel.
5. Turn ignition switch OFF, after the propeller stops rotating.
6. Close cowl, oil cooler and intercooler flaps.

If your forward speed happens to drop below the minimum for adequate control, gain speed by losing altitude. Don't apply additional power.

Avoid violent maneuvers when you're flying on one engine. Don't make steep turns into the dead engine, unless you know exactly how.

If Fuel System Fails in Flight

If a fuel pump fails while you are in flight, the booster pump should maintain enough fuel pressure to keep the engine running normally. If the engine fails, however, turn the fuel selector valve to another tank and restart it. In case both fuel and booster pumps for one engine fail, turn the crossfeed valve ON, switch the booster pump on your good engine to HIGH, and restart the dead engine.

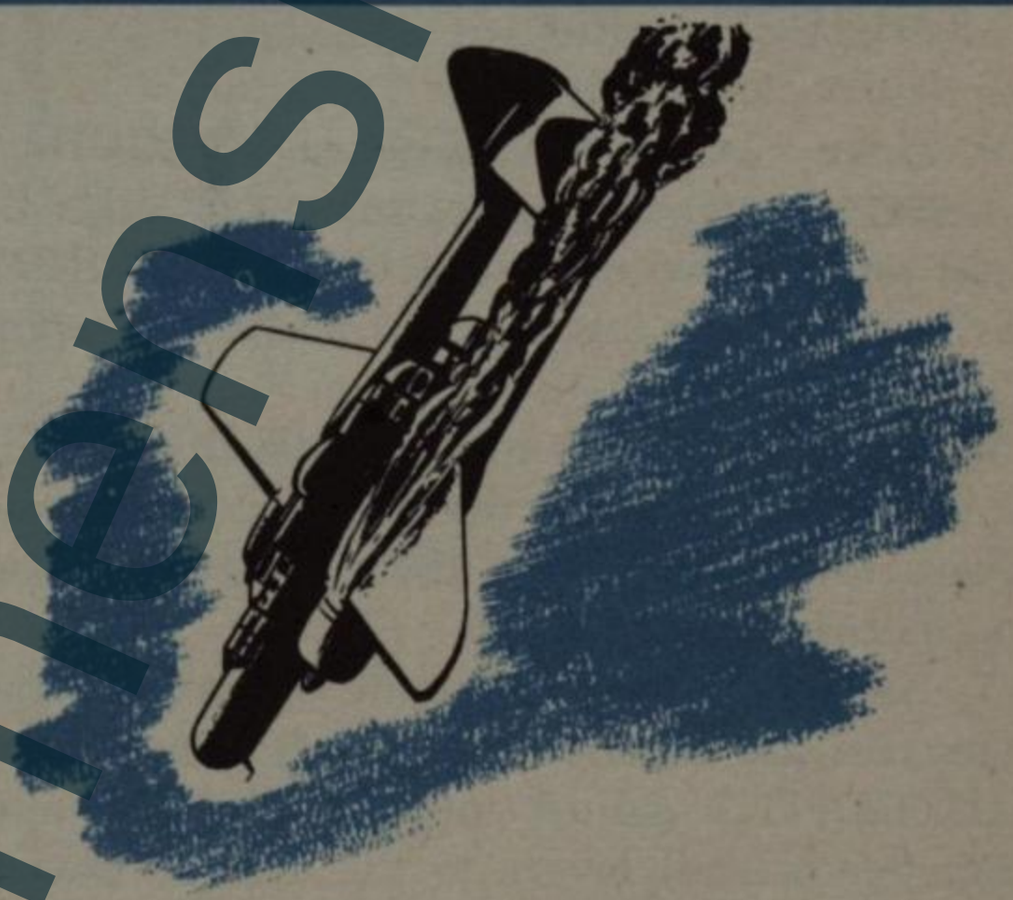
In the event that the fuel system on one engine has failed because of a break in the line to the engine, first turn the mixture control for that engine to IDLE CUT-OFF. Turn OFF the booster pump on the side where the break has occurred. Turn the selector valve OFF. If the crossfeed valve is ON, turn that OFF, too. Feather the propeller on the dead engine. Turn the ignition switch for that engine OFF as soon as the propeller stops rotating. Fly the plane on one engine and **keep a sharp lookout for fire.**

If Oil System Fails in Flight

If the oil system in one engine fails while you are flying, follow this procedure:

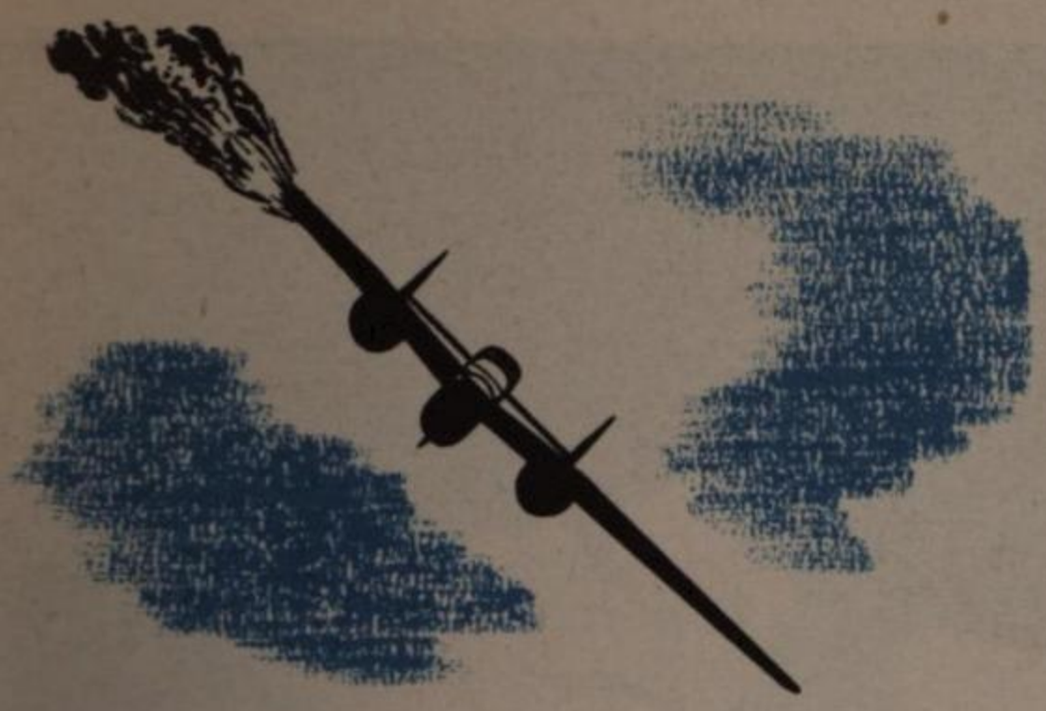
1. Turn mixture control for that engine to IDLE CUT-OFF.
2. Turn selector valve OFF until the other engine needs the gasoline.
3. Turn booster pump OFF.
4. Feather the propeller on the dead engine. Turn OFF the ignition switch as soon as the propeller stops rotating.
5. Fly on one engine.

FIRES IN FLIGHT



If a fire breaks out in an engine nacelle, first turn OFF the fuel supply for that engine and open the throttle. Then, close the cowl flaps. This may smother the blaze. If that treatment doesn't work, dive the plane. You may be able to blow out the fire.

In the event there is fire in a wing, turn OFF all switches for landing and navigation lights. Try to put out the fire by sideslipping.



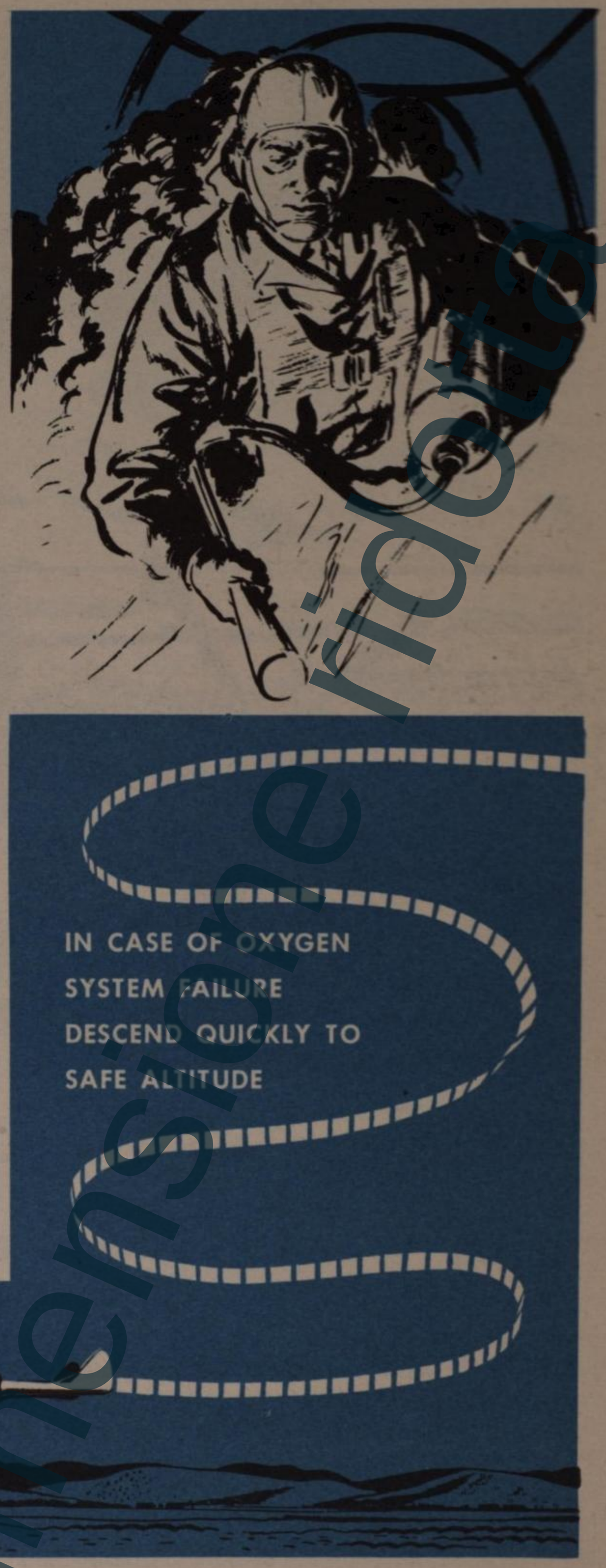
If a fire breaks out in the crew nacelle, first close all windows and ventilators. Then, if the fire is in the electrical system, turn the master switch OFF. If the blaze has started in a leaking fuel or hydraulic line, shut off the valves.

Use a fire extinguisher **immediately.** It is effective in fighting fires only as they start.

Oxygen System Failure

Separate systems supply you and your gunner and RO with oxygen. Have it thoroughly understood with them both that when one of them finds his oxygen supply has failed or is running low, he is to notify you immediately on the interphone, if he can. You will then descend at once, if tactical conditions permit, to an altitude at which lack of oxygen won't be fatal to him.

You have the responsibility, in addition, of checking frequently with both crew members at oxygen altitudes to make sure they are keeping an eye on their oxygen equipment. You can usually tell if the gunner is all right by looking over your shoulder at him. If your interphone query to the RO brings no response, descend immediately, if possible, to an altitude at which canned oxygen is not necessary.



COLD WEATHER OPERATIONS

Don't read this chapter unless you are going into a cold weather theater of operations. It is confusing and valueless for pilots flying P-61's in mild climates. However, the information it contains is vital to your safety and the efficiency of your plane when you're flying in weather that's really cold.

Normally, a discussion of how to operate this airplane in cold weather would begin with preflight instructions. However, before you can start the P-61's engines in Arctic temperatures, the oil must be diluted. And this is part of the **afterflight procedure.** It is done after landing, **after the cylinder-head temperatures have dropped below 205°C,** and **before you have stopped the engines.**

There is danger of freezing your lungs if you overexert in temperatures of —25°F or below. Overexertion causes you to breathe more deeply than usual. To avoid freezing your lungs, if you unintentionally exert yourself enough to start breathing deeply, **put your head down and breathe inside your clothing until you're breathing normally again.**

In extremely low temperatures, maintenance crews must have light tent shelters or heated nose hangars to enable them to work efficiently with tools and equipment. They can insulate metal tools against cold by wrapping the handles with light cord.

Don't touch any metal part of the airplane without gloves. In extreme cold, your hands freeze to metal as soon as they touch it and freezing them is a painful process.

Avoid spilling gasoline on your hands or clothing in sub-zero temperatures. It acts somewhat like liquid air, freezing your flesh a few seconds after contact.

You, as pilot, must check before every flight made during winter and beyond the local area of established Arctic bases, to make sure the airplane contains a sleeping bag, emergency rations and matches, mukluks and woolen socks, parka, and emergency kit for everyone aboard.

If you have to make a forced landing, keep your crew close to the plane afterwards. This conserves their energy and makes rescue easier. Never attempt to travel after a forced landing

unless you have adequate equipment and have had previous experience living outdoors in the Arctic in winter. There are only two exceptions to this rule: when you know exactly where you are and shelter or help is within easy reach; and when you know that searchers probably will not reach you.

You can survive many days without food if you relax, keep dry, and get plenty of sleep.

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