1961 CESSNA 310F Owner's Manual

SECTION IV

Emergency Procedures

ENGINE FAILURE.

ENGINE FAILURE DURING TAKE-OFF BELOW 95 MPH.

(1) Cut power on operative engine and decelerate to a stop.

NOTE

The airplane can be accelerated from a standing start to 95 MPH on the ground, and then decelerated to a stop with heavy braking within 2500 feet of the starting point of the take-off run at sea level, and within 3300 feet of the starting point at 5000 feet altitude (zero wind, hard surface runway, standard conditions, full gross weight).

ENGINE FAILURE AFTER TAKE-OFF ABOVE 95 MPH WITH ROUGH TERRAIN AHEAD.

(1) Throttles — FULL FORWARD.
(2) Propeller pitch levers — FULL INCREASE RPM.
(3) Landing gear switch — UP.
(4) Determine the inoperative engine (idle engine same side as idle foot).
(5) Propeller pitch lever — FEATHER (inoperative engine).
(6) Climb out at 95 MPH.
(7) Trim tabs — Adjust for climb with airplane banked 3° — 5° toward operative engine.
(8) Accelerate to 111 MPH after obstacle is cleared.
(9) Flaps switch — UP (if extended) in small increments.
(10) Secure dead engine by turning OFF auxiliary fuel pump switch, generator switch, ignition switches, mixture lever, fuel selector valve handle.
(11) Fuel selector valve handle (operative engine) — Select tank to maintain lateral balance.

SUPPLEMENTARY INFORMATION CONCERNING ENGINE FAILURE DURING TAKE-OFF.

The most critical time for an engine to fail in a twin-engine airplane is during a two- or three-second period late in the take-off run while the airplane is accelerating to a safe engine-out climb speed. A detailed knowledge of recommended single-engine airspeeds in the table below is essential for safe operation of this airplane:

SINGLE-ENGINE AIRSPEED NOMENCLATURE	IAS—MPH
1. Minimum control speed	80
2. Minimum safe climb speed	95
3. Best angle-of-climb speed	95
4. Best rate-of-climb speed (flaps up)	111

These speeds should be memorized for instant recollection in an emergency, and it is worthwhile to review them mentally, prior to every take-off. The following paragraphs present a detailed discussion of the problems associated with engine failures during take-off.

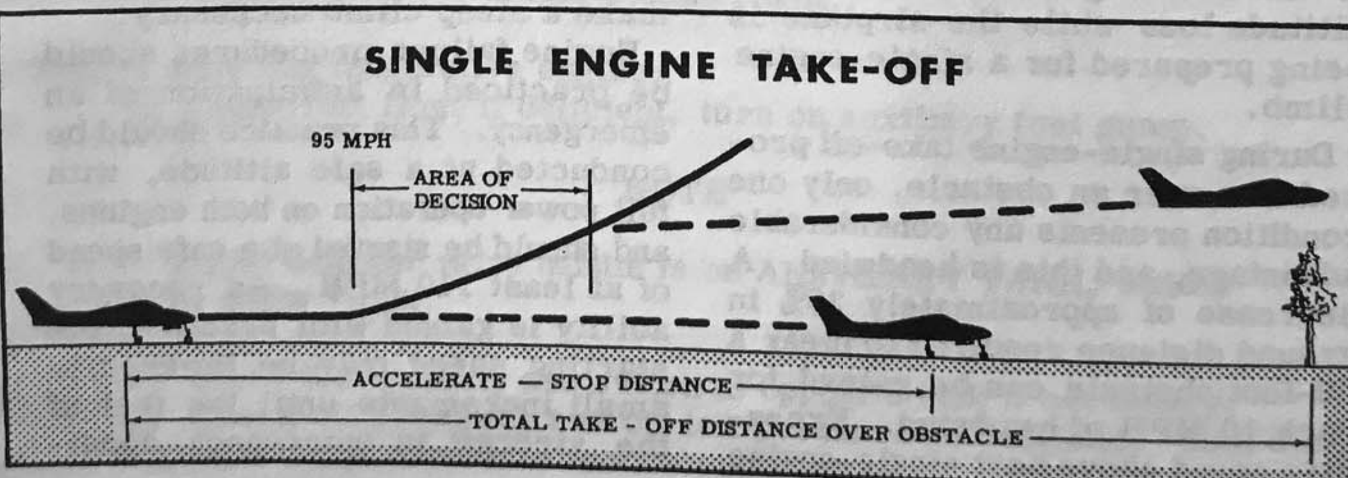
A multi-engine airplane has an advantage over a single-engine airplane only after the engine-out minimum control speed is reached. This speed is defined as the minimum speed at which controlled flight is maintained with one engine inoperative, and full power operation on the other engine. Under these conditions, full control surface deflection of any one control is normally required to counteract extreme yawing and rolling tendencies of the airplane. This airplane has an engine-out minimum control speed of 80 MPH. Since this speed is so far below the optimum climb speed, it is not suitable for single-engine operation near the ground, especially with the landing gear and flaps extended and the inoperative propeller windmilling. A more suitable minimum safe single-engine climb speed is 95 MPH, since at this speed altitude can be maintained more easily while the landing gear is being retracted and the propeller is being feathered.

The best angle-of-climb speed for single-engine operation is defined as the speed which gives the greatest increase in altitude in a given distance. This speed becomes important when there are obstacles ahead on take-off, because once the best single-engine angle-of-climb speed is reached, altitude becomes more important than airspeed until the obstacle is cleared. The best single-engine angle-of-climb speed is approximately 98 MPH with flaps up and 91 MPH with flaps 15° for an average single-engine altitude. For convenience, a speed of 95 MPH may be used for any flap setting between 0 - 15°, since it is an average speed which also is identical to the recommended minimum safe single-engine climb speed.

The best rate-of-climb speed for single-engine operation is defined as the speed that gives the greatest increase in altitude in the least time. This speed becomes important when there are no obstacles ahead on take-off, or when it is difficult to maintain or gain altitude in single-engine emergencies. The best single-engine rate-of-climb speed is 111 MPH with flaps up, and 101 MPH with flaps 15° at sea level. The flaps-up speed at 111 MPH is of primary importance, because rate-of-climb is appreciably greater with flaps up than with flaps 15°. The variation of flaps-up best rate-of-climb speed with altitude is shown in Section VII. For best climb performance, the wings should be banked 5° toward the operative engine.

Upon engine failure after reaching 95 MPH on take-off, the twin-engine pilot has a significant advantage over a single-engine pilot, for he has the choice of stopping or continuing the take-off. This would be similar to the choice facing a single-engine pilot who has suddenly lost slightly more than half of his take-off power. In this situation, the single-engine pilot would be extremely reluctant to continue the take-off if he had to climb over obstructions. However, if the failure occurred at an altitude as high or higher than surrounding obstructions, he would feel free to maneuver for a landing back at the airport.

Fortunately the airplane accelerates through this area where it is "slow and low" in just a few seconds. However, to make an intelligent decision in this type of an emergency, one must consider the field length, obstruction height, field elevation, air temperature, headwind, and the gross weight. The flight paths illustrated in the figure below indicate that the "area of decision" is bounded by: (1) the point at which 95 MPH is reached and (2) the point where the obstruction altitude is then reached. An engine failure in this area requires an immediate decision. Beyond this area, the airplane, within the limitations of single-engine climb performance shown in Section VII, may be maneuvered to a landing back at the airport.



At sea level, with zero wind and 4830 pounds gross weight, the distance to accelerate to 95 MPH and stop is 2390 feet, while the total unobstructed area required to take-off and climb over a 50-foot obstacle after an engine failure at 95 MPH is 2265 feet. This total distance over an obstacle can be reduced appreciably under more favorable conditions of gross weight, headwind, or obstruction height, However, it is recommended that in most cases it would be better to discontinue the take-off, since any slight mismanagement of single-engine procedure would more than offset the small distance advantage offered by continuing the take-off. The advantage of discontinuing the take-off is even more obvious at a 3000-foot field elevation where the corresponding distances are 2800 feet and 3295 feet, respectively. Still higher field elevations will cause the engine-out take-off distance to lengthen disproportionately until an altitude is reached where a successful take-off is improbable unless the airspeed and height above the runway at engine failure are great enough to allow a slight deceleration and altitude loss while the airplane is being prepared for a single-engine climb.

During single-engine take-off procedures over an obstacle, only one condition presents any considerable advantage, and this is headwind. A decrease of approximately 20% in ground distance required to clear a 50-foot obstacle can be gained for each 10 MPH of headwind. Excessive speed above best single-engine climb speed at engine failure is not nearly as advantageous as one might expect since deceleration is rapid and ground distance is used up quickly at higher speeds while the airplane is being cleaned up for climb. However, the extra speed is important for controllability.

From a study of the preceding facts, it is apparent that: (1) discontinuing a take-off upon engine failure is advisable under most circumstances: (2) altitude is more valuable to safety after take-off than is airspeed in excess of the best single-engine climb speed since excess airspeed is lost much more rapidly than is altitude; (3) climb or continued level flight at moderate altitude is improbable with the landing gear extended and the propeller windmilling; (4) in no case should the airspeed be allowed to fall below the engine-out best angle-of-climb speed, even though altitude is lost, since this speed will always provide a better chance of climb, or a smaller altitude loss, than any lesser speed. The engine-out best rate-of-climb speed will provide the best chance of climb or the least altitude loss, and is preferable unless there are obstructions which make a steep climb necessary.

Engine failure procedures should be practiced in anticipation of an emergency. This practice should be conducted at a safe altitude, with full power operation on both engines, and should be started at a safe speed of at least 110 MPH. As recovery ability is gained with practice, the starting speed may be lowered in small increments until the feel of the aircraft in emergency conditions is well known. Practice should be continued until: (1) an instinctive corrective reaction is developed, and the corrective procedure is automatic; and (2), airspeed, altitude, and heading can be maintained easily while the airplane is being prepared for a climb. In order to simulate an engine failure, set both engines at full power operation, and at a chosen speed pull the mixture control of one engine into IDLE CUT-OFF, and proceed with single-engine emergency procedures.

SINGLE-ENGINE CLIMB.

(1) Throttle - FULL FORWARD.
(2) Propeller pitch lever - FULL INCREASE RPM.
(3) Mixture lever - Adjust fuel flow to low side of dial range.
(4) Landing gear switch - UP (if not previously retracted).
(5) Wing flaps switch - UP (in small increments, if used).
(6) Climb at 111 MPH if no obstacles are ahead.
(7) Climb at 95 MPH with obstacles ahead.

NOTE

For maximum single-engine climb, bank the airplane 5° toward the operating engine. Refer to Section VII for single-engine climb data.

ENGINE FAILURE DURING FLIGHT.

At once:
(1) Throttles - FULL FORWARD.
(2) Propeller pitch levers - FULL INCREASE RPM.
(3) Mixture levers - Adjust fuel flow to low side of dial range.
(4) Determine inoperative engine (idle engine same side as idle foot).
(5) Trim rudder for single-engine flight.

Before securing inoperative engine:
(1) Check fuel flow; if deficient, turn on auxiliary fuel pump.

NOTE

If fuel selector valve handle is on AUXILIARY TANK, switch to MAIN TANK.

(2) Check fuel quantity and switch to opposite tank if necessary.
(3) Check oil pressure and oil temperature indications. Shut down engine if oil pressure is low.

(4) Check ignition switches.

If proper corrective action was taken, engine will restart. If it does not, secure it as follows:

(1) Mixture lever - IDLE CUT-OFF.
(2) Propeller lever - FEATHER.
(3) Turn off auxiliary fuel pump, generator, ignition switches and fuel selector valve.
(4) To conserve battery power, turn off sufficient electrical equipment to eliminate a negative ammeter reading.
(5) Select cruise power settings on operative engine.
(6) Trim airplane 3°- 5° wing-low on the side of the operative engine.
(7) Land at the nearest suitable airport.

RESTARTING ENGINE IN FLIGHT (After Feathering).

(1) Check fuel selector valve handle on MAIN.
(2) Advance throttle until gear warning horn is silent.
(3) Advance propeller pitch lever forward of feathering detent.
(4) Set mixture lever full forward for FULL RICH.
(5) Turn ignition switches ON.
(6) Turn auxiliary fuel pump switch to PRIME position.
(7) Turn ignition switch to START when fuel flow reaches 2 to 4 gal/hr.
(8) Release switch when engine fires.
(9) In cold weather, turn auxiliary fuel pump switch ON, if required.
(10) After engine starts, turn off auxiliary fuel pump.

NOTE

If start is unsuccessful, turn ignition and auxiliary fuel pump switch to OFF, retard mixture lever to IDLE CUT-OFF, open throttle fully, and engage starter for several revolutions. Then repeat air start procedure.

(11) Increase power slowly until cylinder head temperature reaches 200°F.

MAXIMUM GLIDE.

In the event of failure of both engines, maximum gliding distance can be obtained by feathering both propellers, and maintaining 107 MPH with the landing gear and wing flaps up. Refer to the Maximum Glide Diagram on page 4-7 for maximum glide data.