AERODYNAMICS

ANGLE OF ATTACK An aircraft will stall when it exceeds its critical angle of attack. It may be stalled at any airspeed and in any attitude, but it will always stall at the same angle of attack for a given weight and wing.

a. The definition of angle of attack is the angle between the chord of the wing and the relative wind.
b. The definition of the chord is the straight line distance from the leading edge to the trailing edge of the wing.
c. The definition of relative wind is the air moving opposite the path of motion of the airplane.

LOAD FACTORS Meassured in " G " units, the load factor which an aircraft is experiencing is computed by dividing the weight of the aircraft into the weight on the wings. The weight on the wings increases with angle of bank if the altitude is being maintained. These calculations are easily done with the load factor chart which follows. Simply compute the load factor, and then multiply that factor by the weight of the aircraft given.

GROUND EFFECT As air passes over the top of the wings and then down, if you are within one wing span of the aircraft from the ground , the air pushing down on the ground actually holds the aircraft aloft. The phenonenon of ground effect can CAUSE THE AIRCRAFT TO FLOAT BEYOND A TARGET ON LANDING IF THE APPROACH SPEED IS TOO FAST, AND CAN CAUSE THE AIRCRAFT TO BECOME AIRBORNE BEFORE REACHING RECOMMENDED TAKEOFF SPEED.

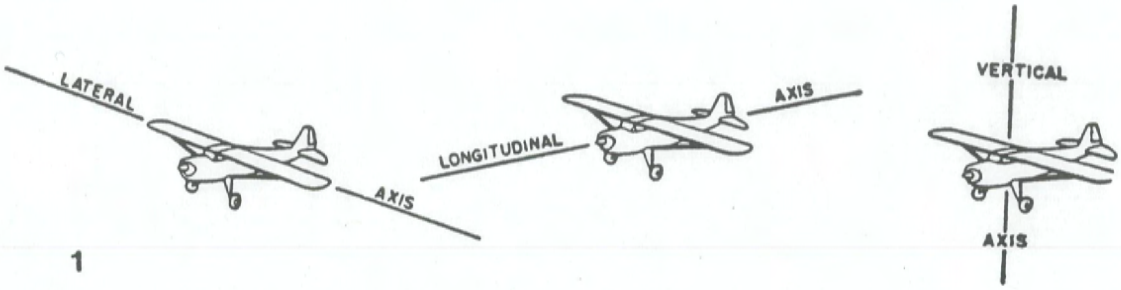
SPINS An aircraft must be in a stalled configuration in order to spin. The formal definition of a spin is " autorotation about the Center of Gravity while in a stalled configuration ". This autorotation is caused by depressing a rudder to the floor. This rudder deflection will cause ONE WING TO DEVELOP LIFT WHILE THE OTHER WING IS STALLED.

TORQUE EVERY ACTION HAS AN OPPOSITE AND EQUAL REACTION. Therefore, when the engine is turning clockwise as the pilot looks at the propeller, the aircraft wants to roll to the left. Therefore, when you are asked the question, " When an aircraft in cruise configuration is stalled out of a steep slipping turn to the right (right aileron and left rudder), will it roll? The answer is yes. It will roll to the left, primarily because of the effect of torque.

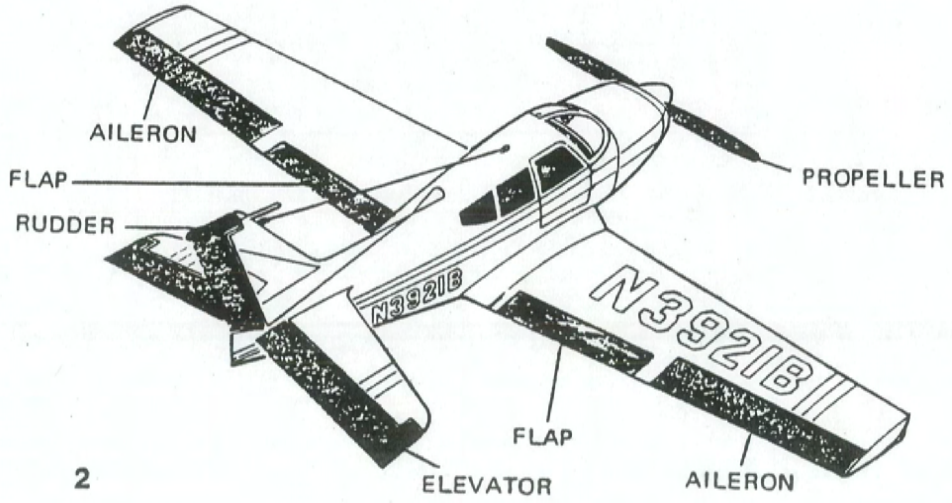
FLAPS Flaps change the configuration of the wing by lengthening the camber or distance over the top of the wing. Hence, more lift is available when the flaps are down. Remember, an increase in lift is always accompanied by an increase in drag, so with flaps down, the aircraft will slow down.

Remember
A. Flaps permit a steeper angle of descent without airpseed gain.
B. The stall speed of an airplane goes Down with the flaps.
C. Upon " flaring"out the aircraft during landing with flaps, The airplane will settle in and stop flying rapidly as you want it to do in a " short field approach to a landing "

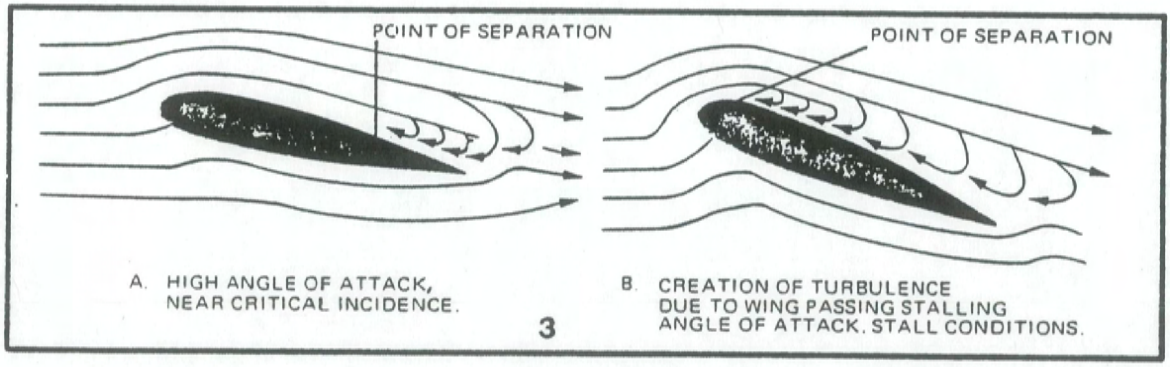
TAXIING An aircraft is in the most danger when taxiing in strong winds. The MOST DANGEROUS WIND CONFIGURATION FOR ALL AIRCRAFT, HIGH OR LOW WING, AND CONVENTIONAL OR TRICYCLE GEAR, IS TAXIING IN STRONG QUARTERING TAILWINDS. In Tailwinds, turn the Aileron Down on the side from Which the wind is blowing, and in headwinds, turn the Aileron Up on the side from Which the wind is blowing.


LATERAL
AXIS
LONGITUDINAL
AXIS
VERTICAL
AXIS

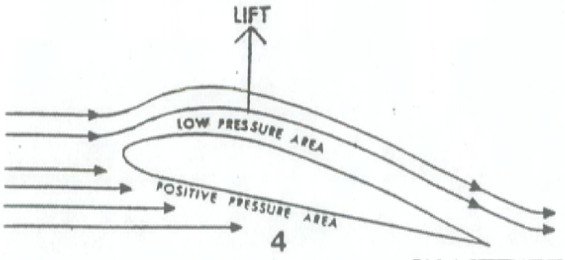
1


AILERON
FLAP
RUDDER
PROPELLER
N3921B
N3921B
FLAP
ELEVATOR
AILERON

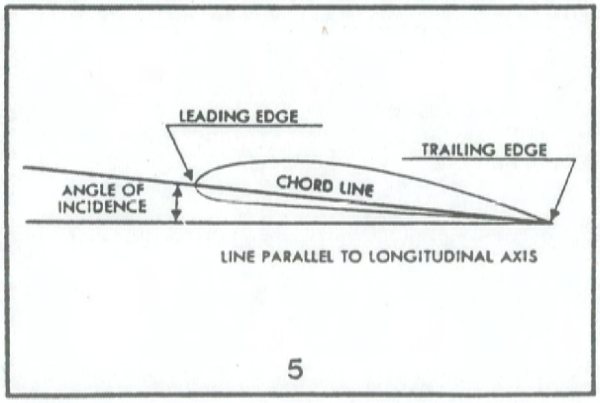
2


POINT OF SEPARATION
POINT OF SEPARATION
A. HIGH ANGLE OF ATTACK, NEAR CRITICAL INCIDENCE.
B. CREATION OF TURBULENCE DUE TO WING PASSING STALLING ANGLE OF ATTACK. STALL CONDITIONS.

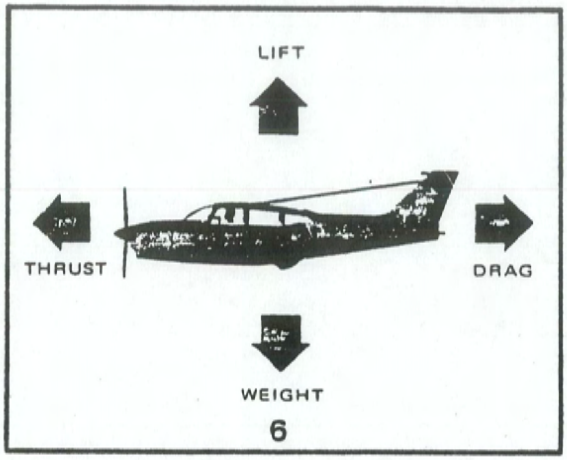
3


LIFT
LOW PRESSURE AREA
POSITIVE PRESSURE AREA

4


LEADING EDGE
TRAILING EDGE
ANGLE OF INCIDENCE
CHORD LINE
LINE PARALLEL TO LONGITUDINAL AXIS

5



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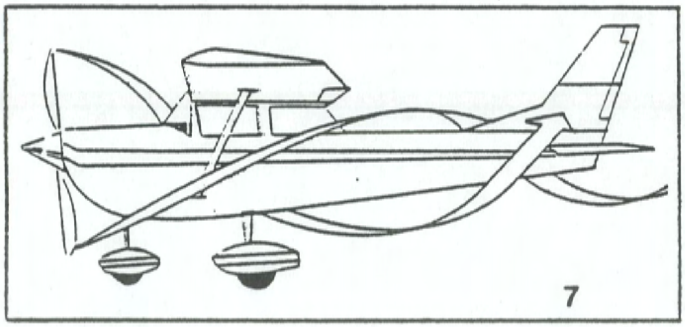
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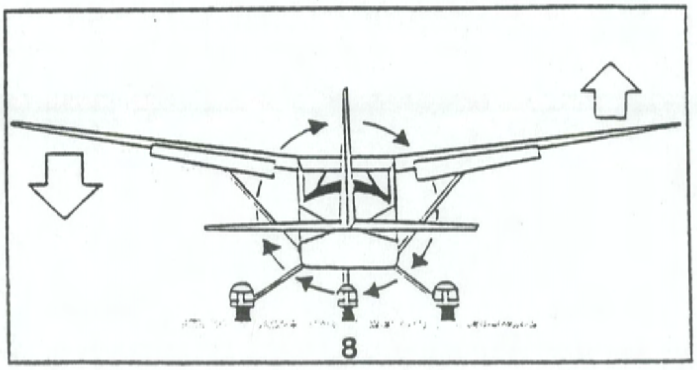
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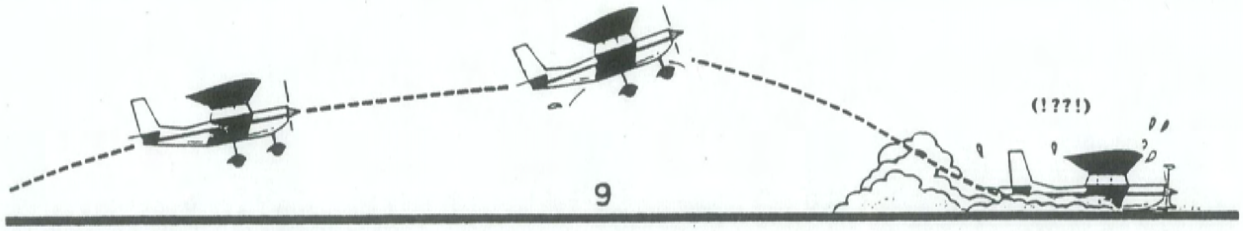
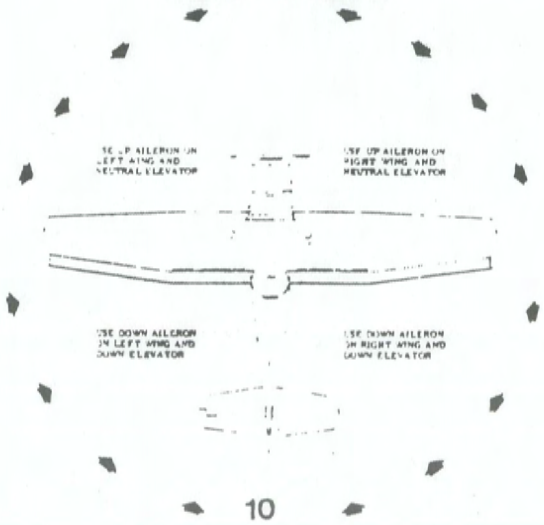


9

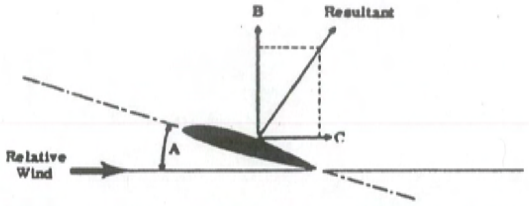
TAXIING DIAGRAM



10


11


12



575. Refer to the above illustration. The acute angle "A" is the angle of

021
1- dihedral.
2- attack.
3- camber.
4- incidence.

576. The term "angle-of-attack" is defined as the

021
1- angle between the wing chord line and the direction of the relative wind.
2- angle between the airplane's climb angle and the horizon.
3- angle formed by the longitudinal axis of the airplane and the chord line of the wing.
4- specific angle at which the ratio between lift and drag is the highest.

577. Select the true statement concerning the use of flaps during the approach for a landing.

020
1- The use of flaps increases the airplane's stability.
2- The use of flaps permits a decreased approach angle.
3- By using flaps, a steeper than normal angle of descent is possible without increasing the airspeed.
4- The use of flaps requires a higher indicated airspeed on the final approach.

578. To counteract the effect of torque in a conventional single-engine propeller-driven airplane, a pilot would normally add

023
1- left rudder pressure during the takeoff roll and while climbing with full power.
2- right rudder pressure when entering a glide from level cruising flight.
3- right rudder pressure during the takeoff roll and while climbing with full power.
4- left rudder pressure when entering a climb from level cruising flight.

579. The effect of torque would be most noticeable during

023
1- maximum speed in level flight with maximum continuous power.
2- flight at a critically slow airspeed with full throttle.
3- maximum structural cruising speed.
4- gliding flight with a reduced throttle setting.

558. The phenomenon of "ground effect" is most likely to result in which of the following problems in an airplane?

014
1- Settling back to the surface abruptly immediately after becoming airborne.
2- Becoming airborne before reaching recommended takeoff speed.
3- Inability to get airborne even though airspeed is sufficient for normal takeoff needs.
4- A rapid rate of sink and absence of normal cushioning during landings.

559. An airplane is usually affected by "ground effect" at what height above the surface?

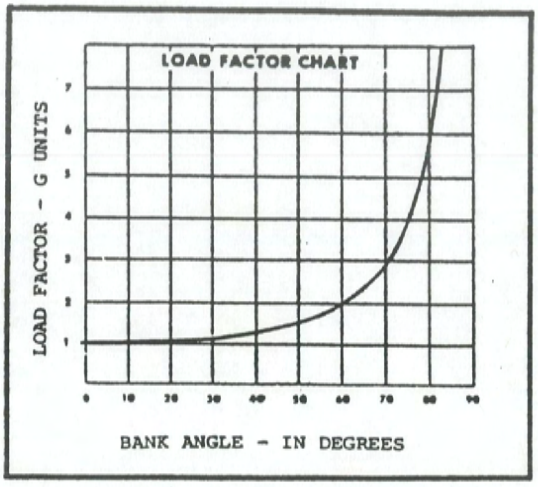
014
1- Between 100 and 200 feet above the surface in calm wind conditions.
2- Less than half of the airplane's wingspan above the surface.
3- Twice the length of the airplane's wingspan above the surface.
4- Three or four times the airplane's wingspan.

560. Select the true statement regarding "ground effect."

014
1- Ground effect may cause an airplane to float on landings or permit it to become airborne with insufficient power to sustain flight outside of the area of ground effect.
2- Light single-engine airplanes usually encounter "ground effect" at 200 or 300 feet above the surface.
3- In conditions of high gross weight, high density altitude, and high temperature an airplane will usually not encounter "ground effect."
4- Ground effect often causes an airplane to settle to the surface immediately after becoming airborne.

561. Refer to the chart to the right above. If the airplane has a maximum positive load factor of +3.8 G units, the maximum bank which could be made in a level turn without exceeding this load factor would be

017
1- unobtainable from the Load Factor Chart.
2- approximately 82°.
3- approximately 74°.
4- approximately 67°.



562. Use the chart above. If an airplane weighs 2,300 lbs., what approximate weight would the airplane structure be required to support during a 60° banked turn while maintaining altitude?

017
1- 3,400 lbs.
2- 4,600 lbs.
3- 2,300 lbs.
4- 5,200 lbs.

563. If an airplane weighs 5,400 lbs., what approximate weight would the airplane structure be required to support during a 55° banked turn while maintaining altitude?

017
1- 5,400 lbs.
2- 6,720 lbs.
3- 9,180 lbs.
4- 10,800 lbs.

NOTE: Use chart above.

564. Use the chart above. If an airplane weighs 3,300 lbs., what approximate weight would the airplane structure be required to support during a 30° banked turn while maintaining altitude?

017
1- 3,100 lbs.
2- 3,960 lbs.
3- 1,200 lbs.
4- 7,220 lbs.

565. Refer to the chart above. The maximum positive load factor for a particular airplane in the utility category is +4.4 G units. The maximum bank which could be made during a level turn without exceeding this load factor would be approximately

017
1- 67°.
2- 77°.
3- 82°.
4- 72°.

566. If an airplane weighs 3,100 lbs., what approximate weight would the airplane structure be required to support during a 40° banked turn while maintaining altitude?

017
1- 3,250 lbs.
2- 3,720 lbs.
3- 4,030 lbs.
4- 4,560 lbs.

NOTE: Use chart to the left.

569. Which statement is true regarding stalls?

019
1- An airplane can be stalled only when the nose is high and the airspeed is low.
2- An airplane can be stalled only when the airspeed decreases to the published stalling speed.
3- An airplane can be stalled only when the nose is too high in relation to the horizon.
4- An airplane can be stalled at any airspeed and in any flight attitude.

570. As you maneuver an airplane in the traffic pattern, you should realize that an airplane can be stalled

019
1- only when the nose is high and the airspeed is low.
2- only when the airspeed decreases to the published stalling speed.
3- at any airspeed and in any flight attitude.
4- only when the nose is too high in relation to the horizon.

571. What aerodynamic condition causes an airplane to spin?

019
1- When the ailerons lose their effectiveness due to a decrease in relative wind and the airplane begins to roll.
2- When one wing is producing effective lift while the other wing is stalled.
3- When the yaw force of the rudder causes the airplane to roll and the forward center of gravity limit is exceeded.
4- When the elevators lose their effectiveness due to a decrease in relative wind.

572. To enter a spin, an airplane must first and always be

019
1- partially stalled with one wing low and the throttle closed.
2- placed in a steep diving spiral.
3- stalled.
4- placed in a steep nose-high pitch attitude.

573. Will a properly rigged single-engine airplane roll when stalled, with cruising power, in a slipping steep turn to the right?

019
1- Yes, but only if additional power is applied during the recovery.
2- Yes; it will roll to the left.
3- Yes; it will roll to the right.
4- No; it will remain in the steep turn attitude.

574. If, while turning from base leg to final approach for landing, it becomes necessary to increase the bank to an angle of 40°, you should be aware that an airplane can be stalled

019
1- only at low airspeeds or when the angle of bank is greater than 50°.
2- in any flight attitude at any airspeed.
3- only during nose-up (nose above the horizon) maneuvers.
4- only when the indicated airspeed drops to the published stalling speed.

767. When taxiing with strong quartering tailwinds, which of the following aileron positions should be generally used?

U05
1- Aileron PARALLEL to the ground on the side from which the wind is blowing.
2- Neutral (streamlined position).
3- Aileron UP on the side from which the wind is blowing.
4- Aileron DOWN on the side from which the wind is blowing.

768. Which of the following aileron positions should you generally use when taxiing in strong quartering headwinds?

U05
1- Aileron up on the side from which the wind is blowing.
2- Aileron down on the side from which the wind is blowing.
3- Neutral.
4- Aileron as stated in response 1 for high-wing airplanes, but as stated in response 3 for low-wing airplanes