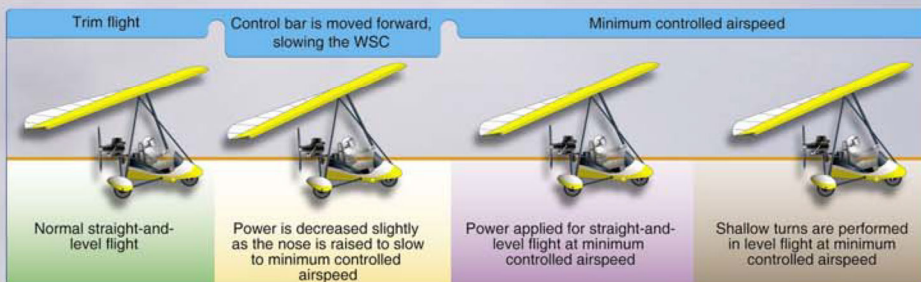


Weight-Shift Control Aircraft Flying Handbook



U.S. Department
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strongly the necessity for forming correct habits in flying straight and level. All flight is in essence a deviation from this fundamental flight maneuver. It is not uncommon to find a pilot whose basic flying ability consistently falls just short of minimum expected standards, and upon analyzing the reasons for the shortcomings discover that the cause is the inability to fly straight and level properly.

In learning to control the aircraft in level flight, it is important that the control forces be exerted just enough to produce the desired result. Some wings are more responsive than others. The student should learn to associate the apparent movement of the control bar with the response in pitch and roll. In this way, the student can develop the ability to regulate the change desired in the aircraft's attitude by the amount and direction of forces applied to the controls without the necessity of referring to outside references for each minor correction.

Straight-and-level flight is flight in which a constant heading and altitude are maintained. It is accomplished by making immediate and measured corrections for deviations in direction and altitude from unintentional slight turns, descents, and climbs. Level flight is a matter of consciously fixing the relationship of the position of something on the aircraft, used as a reference point with a point on the horizon. In establishing the reference point on the aircraft, place the aircraft in the desired position and select a reference point. A typical reference point on the WSC aircraft is a point on the front tube.

The WSC aircraft reference point depends on where the pilot is sitting, the pilot's height (whether short or tall), and the pilot's manner of sitting. It is, therefore, important when establishing this relationship, the pilot sit in a normal manner; otherwise the points will not be the same when the normal position is resumed. [Figures 6-6 and 6-7]

Straight-and-level flight should first be practiced in calm air where the control movements determine the actual movement through the air and air movement has minimal effect on the aircraft's altitude and direction.

A trim speed needs to be set if the WSC aircraft has an inflight trim system or the trim speed set on the ground is used. The throttle is adjusted so the aircraft is flying level, not climbing or descending. This can be determined by looking at the altimeter or the vertical speed indicator (if so equipped). The throttle setting is the control for maintaining level flight for a specific weight, loading, trim speed, and density altitude.

Level flight is maintained by selecting some portion of the aircraft's nose as a reference point, and then keeping that point in a fixed position relative to the horizon. Using the

principles of attitude flying, that position should be cross-checked occasionally against the altimeter to determine whether or not the throttle setting and pitch attitude are correct. If altitude is being gained or lost, the pitch attitude should be readjusted with the throttle in relation to the horizon. Then, recheck the altimeter to determine if altitude is being maintained and adjust the throttle accordingly. The throttle setting for this condition should be noted and all future changes in weight, trim speed, and density altitude referenced to this known throttle setting.

After level flight is mastered in calm air, it can be practiced in air that is moving, minor turbulence or "active air." The throttle settings for similar weight, trim, and density altitude are the same, but more pilot input is required to maintain a constant altitude. The throttle is used to maintain a selected distance above the reference point for local air movement, but the pitch pressure (nose up or nose down) is used to control this attitude for shorter duration air disturbances.

Typically, updrafts or thermals raise the nose of the aircraft and downdrafts at the edge of thermals lower the nose of the aircraft. For minor updrafts the nose is lowered by pitch control input by the pilot slightly increasing the speed of the aircraft to keep the pitch at a constant level. In moderate to severe updrafts, the throttle can be reduced to assist in maintaining a reasonably constant pitch angle with the horizon.

Similarly for minor downdrafts that lower the nose, the nose is raised by pitch control input by the pilot slightly decreasing the speed of the aircraft to keep the pitch at a constant level. An additional caution for raising the nose and decreasing the speed is that raising the nose too high could stall the aircraft. Therefore, caution must be exercised in moderate downdrafts not to reduce the speed too much to approach a stall speed/critical angle of attack. Similar to reducing the throttle in updrafts to reduce pitch angle, increasing the throttle typically increases the pitch angle. [Figure 6-8]

WSC aircraft can use the front tube as a reference to align perpendicular with the horizon and the wings leveled. It should be noted that any time the wings are banked even slightly, the aircraft will turn.

The front tube can be used as an indicator to determine turn rate. If the bar is moving side to side to any established reference point, the aircraft is banked and should be corrected to eliminate any turn. The objective of straight-and-level flight is to detect small deviations from level flight as soon as they occur, necessitating only small corrections.

Straight-and-level flight requires almost no application of control pressures if the aircraft is properly trimmed and the

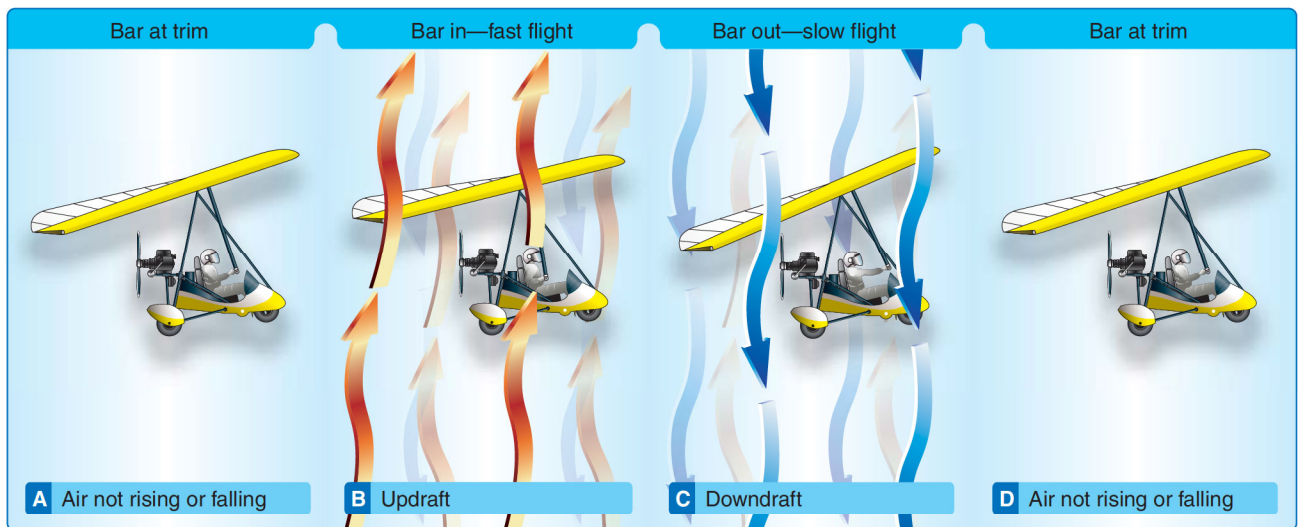


Figure 6-8. Thermal updraft and downdraft sequence.

air is smooth. For that reason, pilots must not form the habit of constant, unnecessary control movement. Pilots should learn to recognize when corrections are necessary, and then make a measured response easily and naturally.

Common errors in the performance of straight-and-level flight are:

- Attempting to use improper reference points on the aircraft to establish attitude.
- Forgetting the location of selected reference points.
- Too tight a grip on the flight controls resulting in overcontrol and lack of “feel.”
- Improper scanning and/or devoting insufficient time to outside visual reference (head in the flight deck).
- Fixation on the nose (pitch attitude) reference point only.
- Unnecessary or inappropriate control inputs.
- Failure to make timely and measured control inputs when deviations from straight-and-level flight are detected.
- Inadequate attention to sensory inputs in developing feel for the aircraft.

Trim Control

The use of trim systems relieves the pilot of the requirement to exert pressures for the desired flight condition. An improperly trimmed aircraft requires constant control pressures, produces pilot tension and fatigue, distracts the pilot from scanning, and contributes to abrupt and erratic aircraft control.

Most WSC aircraft have a ground adjustable pitch/speed trim system that adjusts the carriage hang point on the wing keel that is set for the desired speed. Some WSC aircraft have additional pitch control systems that can adjust the trim speed in flight as described in Chapter 3, Components and Systems.

There is no yaw trim but the roll trim is usually adjusted on the ground for a wing that has a turn in it. Roll trim is usually adjusted so the wing flies straight in cruise flight. This is a balance between the full power torque of the engine wanting to turn it in one direction and minimum power when the WSC aircraft is in a glide. WSC pilots usually have to exert some pilot roll input for high power engines at full power climb to fly straight because of the engine turning effect.

Level Turns

A turn is made by banking the wings in the direction of the desired turn. A specific angle of bank is selected by the pilot, control pressures are applied to achieve the desired bank angle, and appropriate control pressures are exerted to maintain the desired bank angle once it is established.