

should remain constant when the airplane is in level flight, any deviation from the desired altitude signals the need for a pitch change. If the aircraft is gaining altitude, the nose must be lowered. [Figures 7-7 and 7-8]



Figure 7-7. Using the altimeter for pitch interpretation, a high altitude means a nose-high pitch attitude.



Figure 7-8. Pitch correction following altitude increase—lower nose to correct altitude error.

The rate of movement of the altimeter needle is as important as its direction of movement in maintaining level flight without the use of the attitude indicator. An excessive pitch deviation from level flight results in a relatively rapid change of altitude; a slight pitch deviation causes a slow change. Thus, if the altimeter needle moves rapidly clockwise, assume a considerable nose-high deviation from level flight attitude. Conversely, if the needle moves slowly counterclockwise to indicate a slightly nose-low attitude, assume that the pitch correction necessary to regain the desired altitude is small. As the altimeter is added to the attitude indicator in a cross-check, a pilot learns to recognize the rate of movement of the altimeter needle for a given pitch change as shown on the attitude indicator.

To practice precision control of pitch in an airplane without an attitude indicator, make small pitch changes by visual reference to the natural horizon and note the rate of movement of the altimeter. Note what amount of pitch change gives the slowest steady rate of change on the altimeter. Then practice small pitch corrections by accurately interpreting and controlling the rate of needle movement.

An instructor pilot can demonstrate an excessive nose-down deviation (indicated by rapid movement of the altimeter needle) and then, as an example, show the result of improper corrective technique. The normal impulse is to make a large pitch correction in a hurry, but this inevitably leads to overcontrolling. The needle slows down, then reverses direction, and finally indicates an excessive nose-high deviation. The result is tension on the controls, erratic control response, and increasingly extreme control movements. The correct technique, which is slower and smoother, returns the airplane to the desired attitude more quickly, with positive control and no confusion.

When a pitch error is detected, corrective action should be taken promptly, but with light control pressures and two distinct changes of attitude: (1) a change of attitude to stop the needle movement and (2) a change of attitude to return to the desired altitude.

When the altimeter indicates an altitude deviation, apply just enough elevator pressure to decrease the rate of needle movement. If it slows down abruptly, ease off some of the pressure until the needle continues to move, but ease off slowly. Slow needle movement means the airplane attitude is close to level flight. Add slightly more corrective pressure to stop the direction of needle movement. At this point, level flight is achieved; a reversal of needle movement means the aircraft has passed through it. Relax control pressures carefully, continuing to cross-check since changing airspeed causes changes in the effectiveness of a given control pressure. Next, adjust the pitch attitude with elevator pressure for the rate of change of altimeter needle movement that is correlated with normal pitch corrections and return to the desired altitude.

As a rule of thumb, for errors of less than 100 feet, use a half bar width correction. [Figures 7-9 and 7-10] For errors in excess of 100 feet, use an initial full bar width correction. [Figures 7-11 and 7-12] Practice predetermined altitude changes using the altimeter alone, then in combination with the attitude indicator.

Vertical Speed Indicator (VSI)

The VSI, like the altimeter, gives an indirect indication of pitch attitude and is both a trend and a rate instrument. As a trend instrument, it shows immediately the initial vertical movement of the airplane, which disregarding turbulence can be considered a reflection of pitch change. To maintain level flight, use the VSI in conjunction with the altimeter and attitude indicator. Note any positive or negative trend of the needle from zero and apply a very light corrective elevator