Altimeter

At constant power, any deviation from level flight (except in turbulent air) must be the result of a pitch change. If the power is constant, the altimeter gives an indirect indication of the pitch attitude in level flight. Since the altitude should remain constant when the airplane is in level flight, any deviation from the desired altitude signals the need for a pitch change. For example, if the aircraft is gaining altitude, the nose must be lowered.

In the PFD, as the pitch starts to change, the altitude trend indicator on the altitude tape begins to show a change in the direction of displacement. The rate at which the trend indicator grows and the altimeter numbers change aids the pilot in determining how much of a pitch change is necessary to stop the trend.

As a pilot becomes familiar with a specific aircraft's instruments, he or she learns to correlate pitch changes, altimeter tapes, and altitude trend indicators. By adding the altitude tape display and the altitude trend indicator into the scan along with the attitude indicator, a pilot starts to develop the instrument cross-check.

Partial Panel Flight

One important skill to practice is partial panel flight by referencing the altimeter as the primary pitch indicator. Practice controlling the pitch by referencing the altitude tape and trend indicator alone without the use of the attitude indicator. Pilots need to learn to make corrections to altitude deviations by referencing the rate of change of the altitude tape and trend indicator. When operating in IMC and in a partial panel configuration, the pilot should avoid abrupt changes to the control yoke. Reacting abruptly to altitude changes can lead to large pitch changes and thus a larger divergence from the initial altitude.

When a pilot is controlling pitch by the altitude tape and altitude trend indicators alone, it is possible to overcontrol the aircraft by making a larger than necessary pitch correction. Overcontrolling causes the pilot to move from a nose-high attitude to a nose-low attitude and vice versa. Small changes to pitch are required to insure prompt corrective actions are taken to return the aircraft to its original altitude with less confusion.

When an altitude deviation occurs, two actions need to be accomplished. First, make a smooth control input to stop the needle movement. Once the altitude tape has stopped moving, make a change to the pitch attitude to start back to the entry altitude.

During instrument flight with limited instrumentation, it is imperative that only small and precise control inputs are made. Once a needle movement is indicated denoting a deviation in altitude, the pilot needs to make small control inputs to stop the deviation. Rapid control movements only compound the deviation by causing an oscillation effect. This type of oscillation can quickly cause the pilot to become disoriented and begin to fixate on the altitude. Fixation on the altimeter can lead to a loss of directional control as well as airspeed control.

As a general rule of thumb, for altitude deviations less than 100 feet, utilize a pitch change of 1 degree, which equates to ⅕ of the thickness of the chevron. Small incremental pitch changes allow the performance to be evaluated and eliminate overcontrolling of the aircraft.

Instrumentation needs to be utilized collectively, but failures will occur that leave the pilot with only limited instrumentation. That is why partial panel flying training is important. If the pilot understands how to utilize each instrument independently, no significant change is encountered in carrying out the flight when other instruments fail.

VSI Tape

The VSI tape provides for an indirect indication of pitch attitude and gives the pilot a more immediate indication of a pending altitude deviation. In addition to trend information, the vertical speed also gives a rate indication. By using the VSI tape in conjunction with the altitude trend tape, a pilot has a better understanding of how much of a correction needs to be made. With practice, the pilot will learn the performance of a particular aircraft and know how much pitch change is required in order to correct for a specific rate indication.

Unlike older analog VSIs, new glass panel displays have instantaneous VSIs. Older units had a lag designed into the system that was utilized to indicate rate information. The new glass panel displays utilize a digital air data computer that does not indicate a lag. Altitude changes are shown immediately and can be corrected for quickly.

The VSI tape should be used to assist in determining what pitch changes are necessary to return to the desired altitude. A good rule of thumb is to use a vertical speed rate of change that is double the altitude deviation. However, at no time should the rate of change be more than the optimum rate of climb or descent for the specific aircraft being flown. For example, if the altitude is off by 200 feet from the desired altitude, then a 400 feet per minute (fpm) rate of change would be sufficient to get the aircraft back to the original