ADVANCED AIRMANSHIP

BOOK 1
PRECISION FLYING

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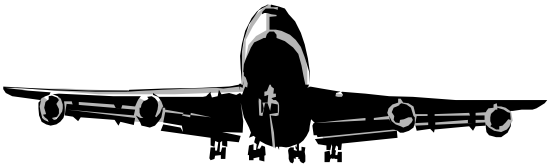

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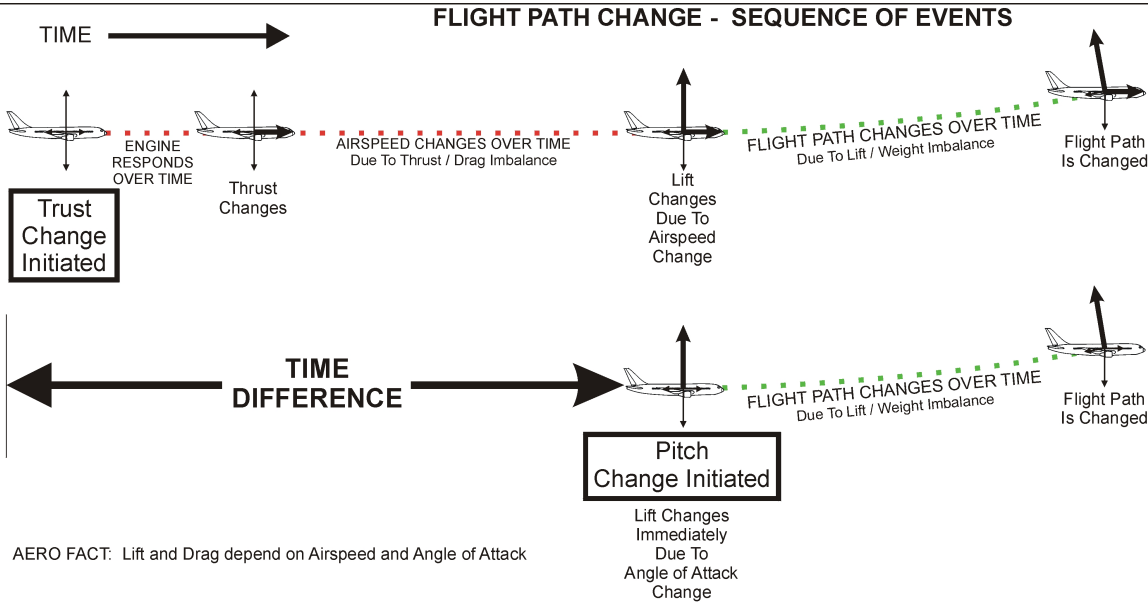
THE PITCH vs. POWER CONTROVERSY

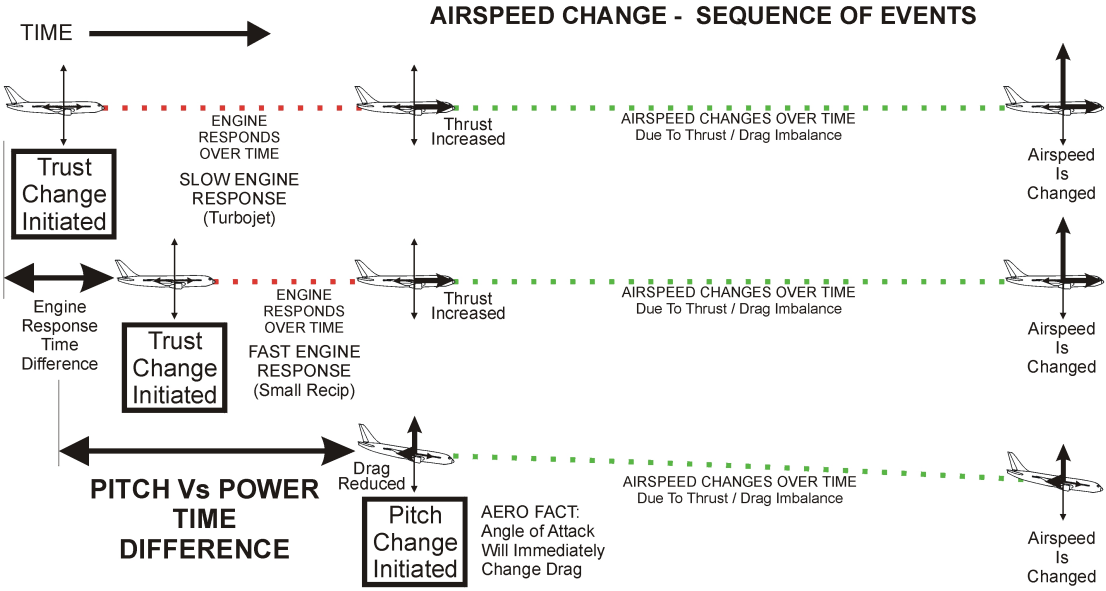
Do you control flight path with pitch and airspeed with power or flight path with power and airspeed with pitch? This question is so sure to start an insoluble argument in any group of pilots that the question seldom arises unless several hours are available for discussion. Most airline pilots will tell you to control flight path with pitch and airspeed with power, while Navy pilots generally will say the opposite. General Aviation flight instructors are often equally divided. Individuals sometimes see conflicts in their own beliefs. The pilot who controls flight path with pitch sees a conflict when he controls airspeed with pitch during a climb. Likewise, if you generally control airspeed with pitch, do you also sense conflict when you control altitude with pitch during cruise?

There is a good reason for this long standing controversy. It is complexity! All simple problems have been solved long ago. The Pitch vs. Power Controversy is probably the most complex problem in pilot technique. Luckily, computer simulation is now available to clearly show the complete picture without resorting to complex mathematical analysis.



Pitch changes Flight Path MUCH FASTER than Power, since the delays due to engine response time and time for the airspeed to change are not involved. Airspeed acceleration time is by far the most significant factor.

FIGURE 1.1



Pitch changes Airspeed SLIGHTLY FASTER than Power, since Drag is immediately changed by Angle of Attack. If Engine Response was instantaneous there would be no significant difference between the two methods.

FIGURE 1.2

change in airspeed. The difference is that engine response time is not a factor. Therefore, the only difference between pitch and power in the control of airspeed is the time needed for the engine to deliver the new thrust when power is changed. Pitch changes airspeed only slightly faster than power. The difference is dependent on the engine type. A small reciprocating engine responds quickly, so the difference between pitch and power is small. A turbojet engine accelerating from a low RPM may take several seconds to deliver the desired thrust, making the control of airspeed with pitch much faster.

The Basic Pitch-Power Rule

When control of both flight path and airspeed is desired, it is obvious from the previous discussion that the fastest control for both flight path and airspeed - Pitch - cannot be used for both at the same time. The slower control - Power - must be used for one of the variables. Figure 1.3 shows a computer plot of flight path and airspeed response using both pitch and power changes. To view these plots in action, actuate Demo #1 (select the Close-up - Below GS option) and Demo #7 on the Flight Demonstration Simulator.

The plots show the dramatic advantage of pitch over power in flight path control. They also show that power is only slightly slower in the control of airspeed. Since control of both variables at the same time is necessarily a compromise, it makes sense to accept the large gain in flight path response with pitch, while losing only a small amount of airspeed response with power.

The basic Pitch-Power Rule is:

When controlling both flight path and airspeed,
Control flight path with pitch and airspeed with power