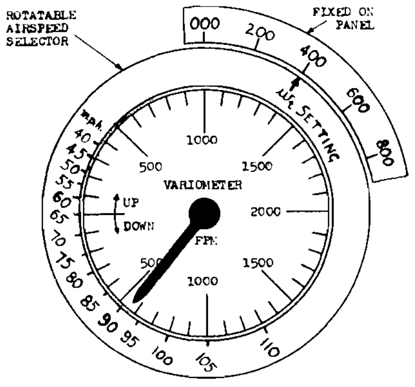
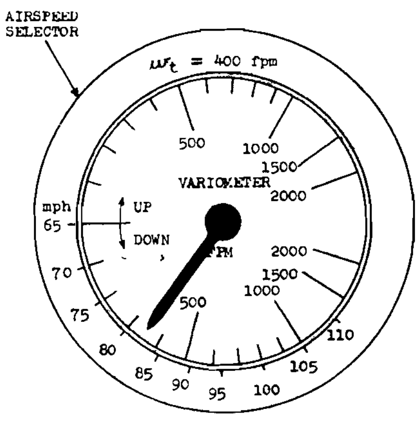


LINEAR SCALE

spacing between the "hundred feet per minute" units), the adjustable table can be made into a ring which can be set by rotating it to the appropriate w_t value. Then the one ring will be valid for all conditions.

If the variometer is not linear (as for example the Aircraft Indicators Co. model), a new ring must be installed for every w_t. w_t is usually fairly constant throughout a flight, so this entails little trouble. It is sufficient to make up a set of rings for $w_t = 000$, 200, 400, 600 and 800 fpm — and ordinarily the 400 fpm card will be the only one used. It is convenient to list the velocities in 5 mph steps.



NON-LINEAR SCALE

Obvious adaptations of these selectors can be made for pellet variometers, such as the Robinson or Cosim.

There should be some correction for altitude, for although the airspeed indicator becomes less sensitive as altitude increases, the variometer may even become *more* sensitive. Some calculations show that for a typical case, if the indicated airspeed is used, the variometer reading should be reduced by a factor $\left(\frac{\rho}{\rho_0}\right)^{3/4}$ where ρ is the air density at altitude and ρ_0 the density at sea level. Roughly, this means subtracting 10% from the variometer reading for every 5000 feet of altitude above sea level. Using this correction may be too much trouble so it is easiest just to remember to fly a little slower than indicated by the airspeed selector when at high altitudes.

The airspeed selector may be used with variometers having total energy venturis.

Late in the day, as thermals weaken, the maximum altitude in each gets less and less. The problem changes from one of getting maximum velocity to one of merely staying aloft, since it is always distance one is after in the final analysis. On the last long glide, with the assumption of no more thermals, one can use the $w_t = 000$ fpm table — with reservations. If the wind is zero, the table will maximize distance. If there is a tail wind, fly slower than the table indicates, thereby staying up longer and getting more help from the wind. With a head wind, fly correspondingly faster.

An error of 5 mph in airspeed from the optimum airspeed makes negligible difference in average speed, so do not worry about being exact.

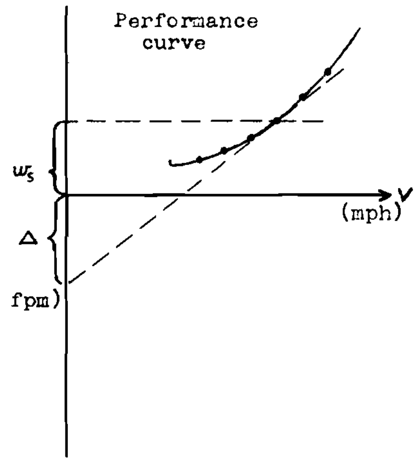
It is instructive to calculate some specific cases of cross-country speeds. The following table is based on estimating that the glider sinks 200 fpm through the rising air during climb in thermals, that the downcurrent strength is 1/8th the upcurrent strength, and that the pilot flies by the airspeed selector but never exceeds an arbitrary limit of 110 mph.

w_t	v (mph)	Average velocity (mph)
000	48	00.0
200	72	28.0
400	89	39.0
600	103	47.5
800	108	53.0
1000	110	58.9
2000	110	73.2

If the pilot only flew 60 mph for $w_t = 400$ fpm, he would average but 36.0 mph instead of the maximum 39.0 mph. However, if the thermals were 5 miles apart, he would only sink 1335 feet between them at 60 mph instead of 1730 feet at 89 mph; sometimes the additional altitude is more valuable than the speed. For stronger downcurrents the situation may be different. If $w_t = 400$ fpm and the downcurrent strength is 600 fpm, the airspeed selector shows 110 mph, giving an average speed of 25.6 mph through the air mass. If the pilot goes 60 mph, he will only average 20.0 mph, and he will sink more between 5-mile thermals — 3970 feet as compared to 3600 feet.

As a general rule, use a lower w_t than the actual one if conserving height is very important.

For the derivation of the airspeed selector one minimizes the time for the sailplane to reach a thermal and regain the original height. The resulting equation is $W + w_t = V\frac{df(v)}{dv}$, where f(v) is the performance curve of the glider. It may be solved graphically to yield the tables given earlier as follows:



Step 1) Draw the performance curve of the glider (w_s, sinking speed, vs. velocity).

Step 2) Construct tangents to the curve at 10 mph intervals which intersect the ordinate, and record the intercepts (Δ).

Step 3) Plot $w_s + \Delta$ vs. velocity on another graph. $w_s + \Delta$ is the same as $W + w_t$, so from this graph one can compile a $(W + w_t)$ vs. v table as already used earlier in this paper.