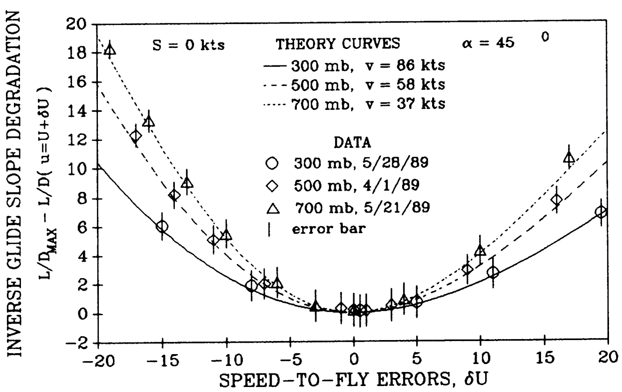
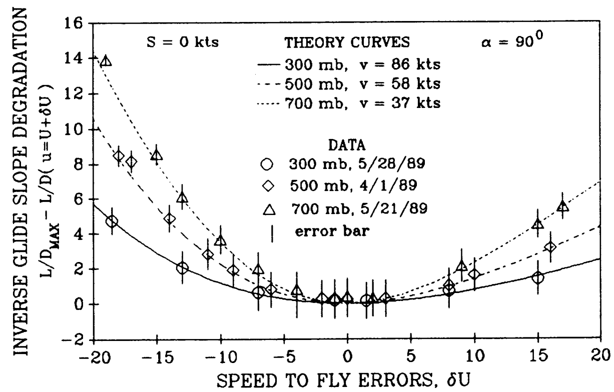


a)



b)

Fig. 9 Effects of speed-to-fly errors in quartering tailwinds and direct crosswinds.

ranging from 11.4 to 37.8 statute miles so that the maximum altitude variance about any one of these levels did not exceed ± 2000 ft. Since the test aircraft lacked accurate positioning equipment, no attempt was made to test speed-to-fly theories within the variable vertical velocities of the lee wave field. Instead, the way points were selected upwind of the wave generating topography to test the direct crosswind calculations and a considerable distance downwind of the wave generating topography for quartering tailwind tests. This arrangement was aided by the fact that the lee waves were generated over a broad tilted plateau and were, therefore, essentially hydrostatic in nature with vertically upward propagation and no secondary or tertiary phases downwind (see Ref. 5).

Figure 9 shows the results of these tests during which known speed-to-fly errors δU were flown to yield measured inverse glide slopes $L/D(u = U + \delta U)$. The speed-to-fly errors are corrected for the airspeed system errors measured by Johnson.[8] In every case for which a nonzero speed-to-fly error was flown, the resulting inverse glide slopes are found to be less than the theoretical maximum $L/D_{\max}$ when exact adherence to speed-to-fly and optimal crab angle is maintained. The curves in Fig. 9 are generated by a numerical search about either side of the speed-to-fly solutions computed from Eqs. (14–18) for the respective altitudes and winds. The particular wind speeds for those computations are selected in between the San Diego and Blythe soundings based on a minimization of the variance between the data and resulting theory curves. A check of the $L/D_{\max}$ values is provided by the data points gathered for zero speed-to-fly errors. The loss in L/D due to any given speed-to-fly error is greater at lower altitudes for both quartering tailwinds and direct crosswinds. Furthermore, flying too slowly produces a greater degradation in L/D than flying too fast. Speed-to-fly errors have a greater adverse impact in quartering tailwinds than in direct crosswinds. However, in either case, the speed-to-fly errors resulting from flying too slowly can diminish the L/D by 15 points or more. This is equivalent to turning the clock on aerodynamic design back by as much as 50 years. In other words, pilotage must be considered a leading-order process.

Conclusions

1) Speed-to-fly during glides skewed relative to the wind by less than 90 deg requires flying faster through sinking air or into a headwind component and flying slower through rising air or with a tailwind component such that the crab angle does not become excessively large, $\beta < \mathcal{O}(45 \text{ deg})$.

2) Speed-to-fly in direct crosswinds requires flying faster through sinking air or with increasing wind speed and flying slower through rising air or with decreasing wind speed, using crab angles that may exceed 45 deg for the case of strong winds in a nonsinking air mass.

3) Maximum L/D with any given tailwind component is achieved at lower altitudes.

4) Maximum L/D with any given headwind component or any given direct crosswind is achieved at higher altitudes.

5) Speed-to-fly errors resulting from flying too slowly yield the greatest losses in L/D.

6) Losses in L/D for any given speed-to-fly error are greater at lower altitudes.

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