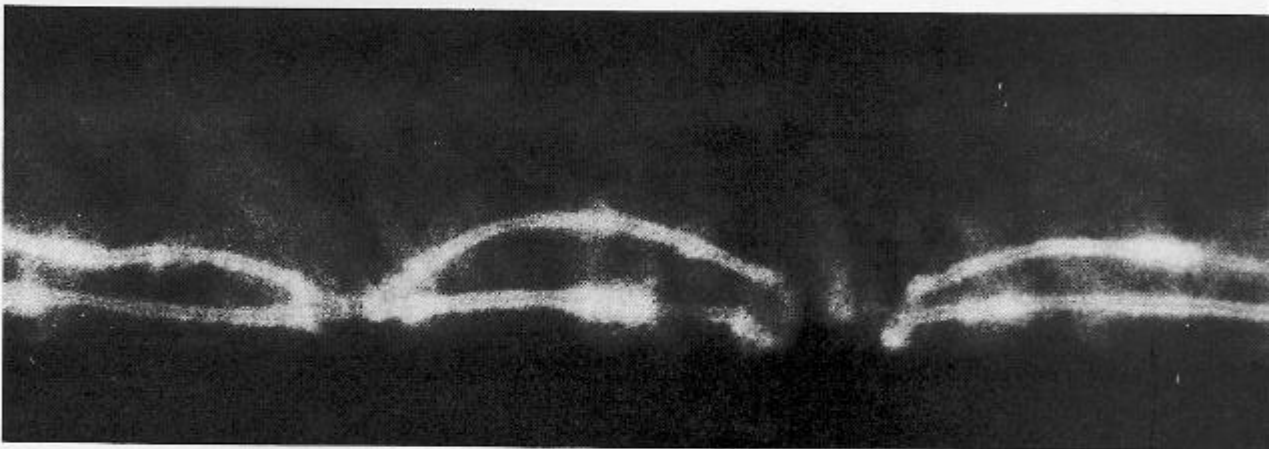
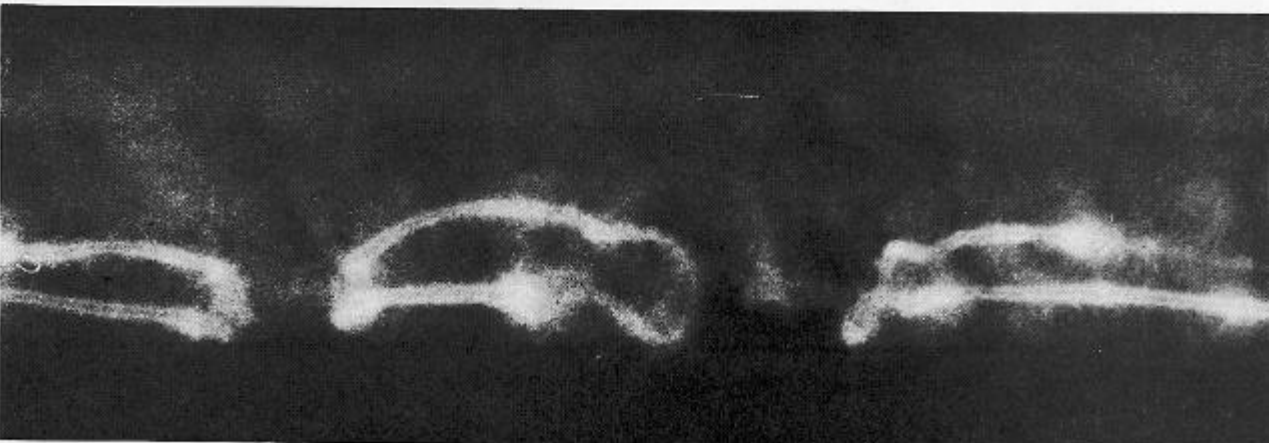


Wake age 85 seconds



Wake age 90 seconds



Wake age 95 seconds

Fig. 1: Vortex trails showing formation of 'Crow loops' (From Ref.4)

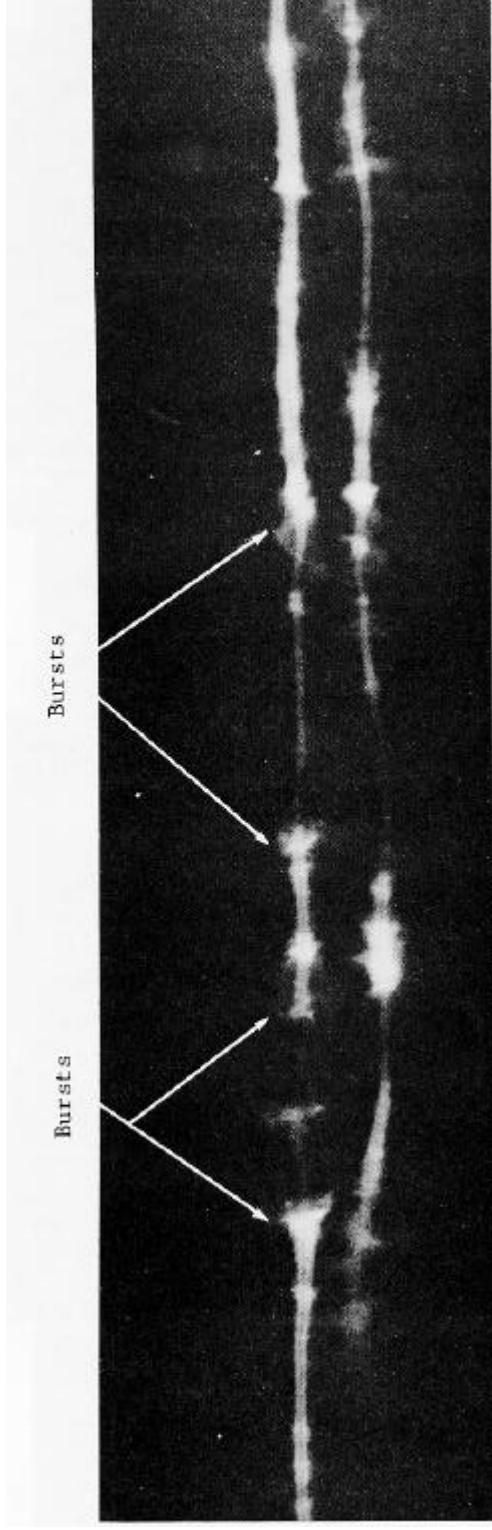
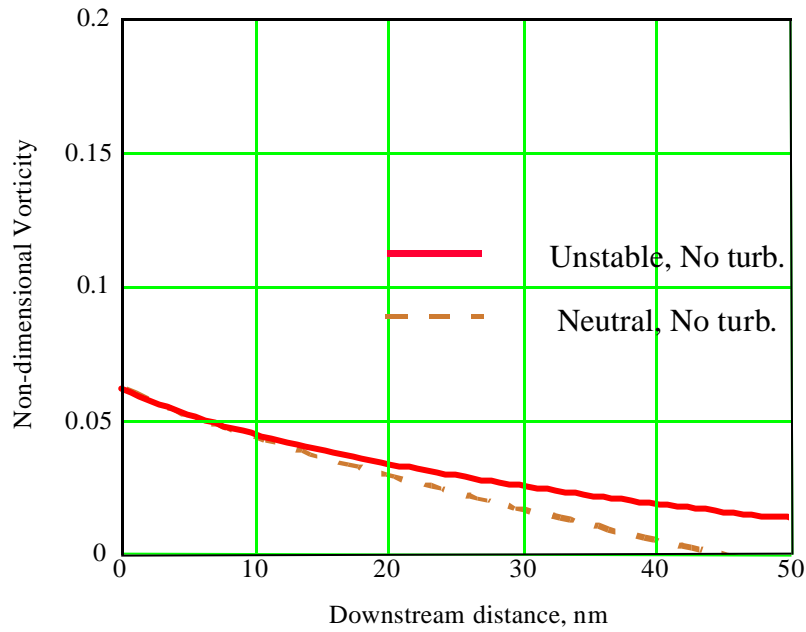


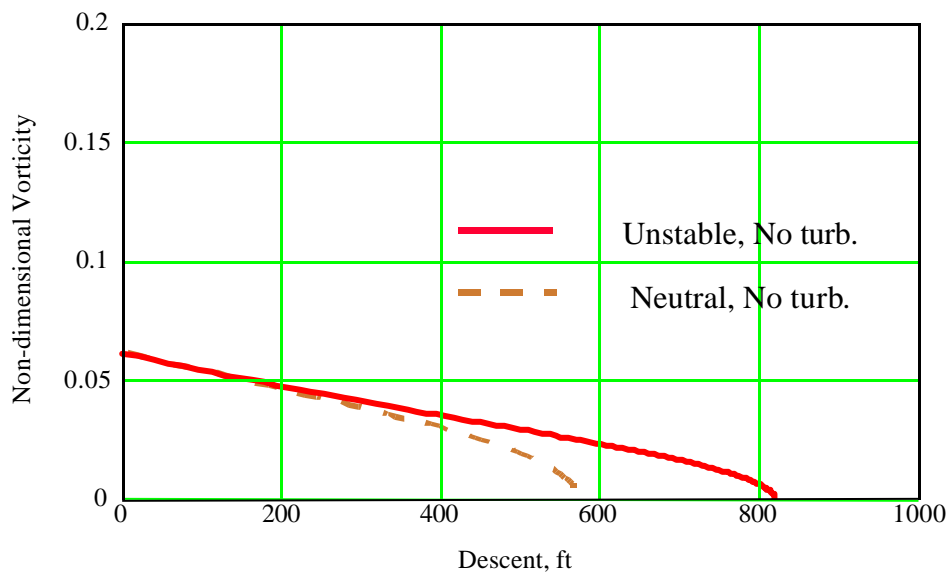
Fig. 2: Vortex trails showing bursting (From Ref. 4)

Unstable = Atmospheric temperature decreases with increasing height

Neutral = No change in atmospheric temperature with height



a) Variation of vorticity with downstream distance

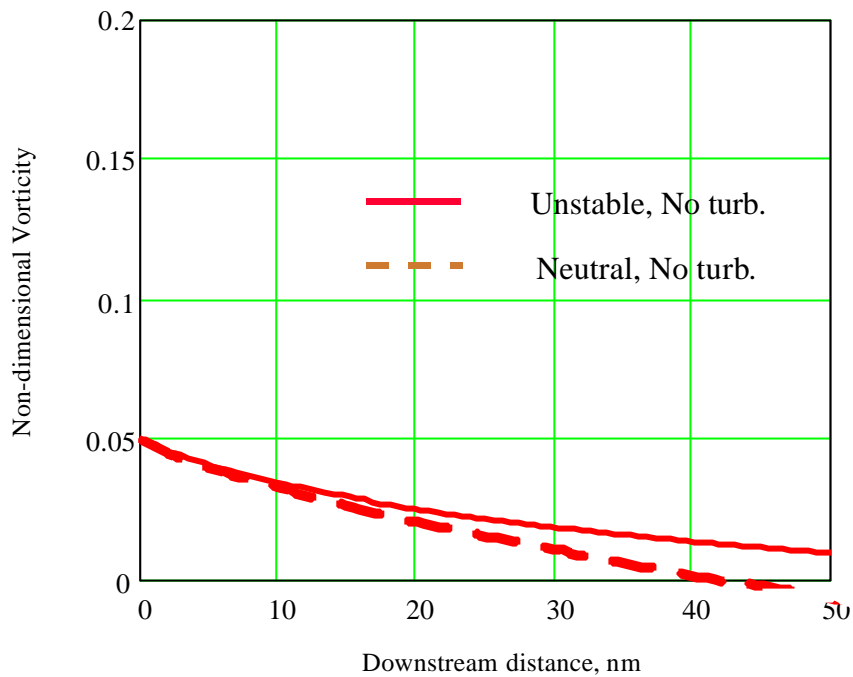


b) Variation of vorticity with descent distance

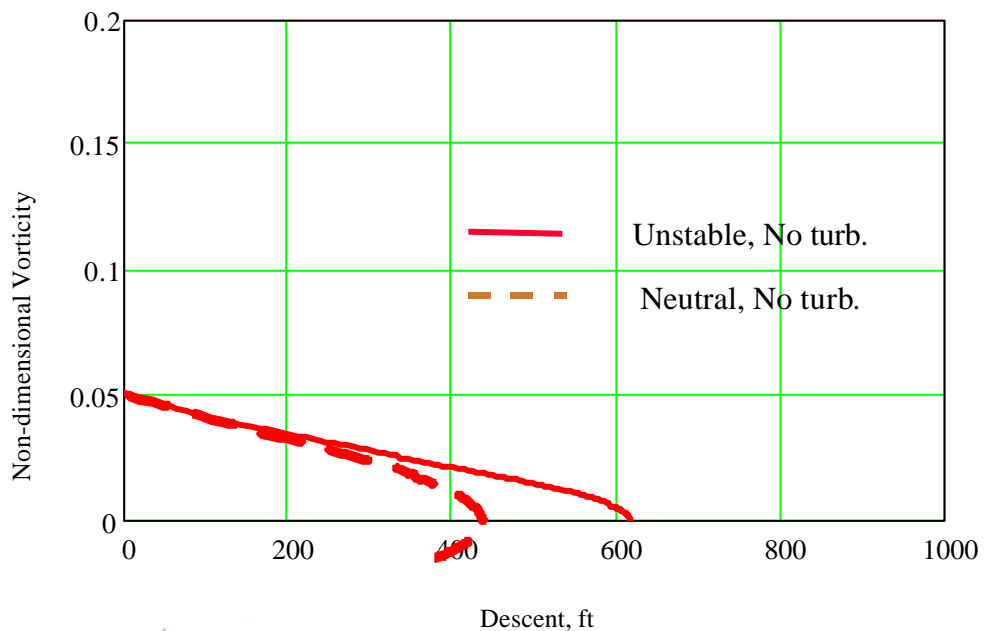
Fig. 3: Estimates of Vortex Decay and Vertical Motion for a B747-400 at MTOW: Altitude 36,000 ft, $M = 0.85$

Unstable = Atmospheric temperature decreases with increasing height

Neutral = No change in atmospheric temperature with height



a) Variation of vorticity with downstream distance



b) Variation of vorticity with descent distance

Fig. 4: Estimates of Vortex Decay and Vertical Motion for an A310-200 at MTOW: Altitude 36,000 ft., $M = 0.85$

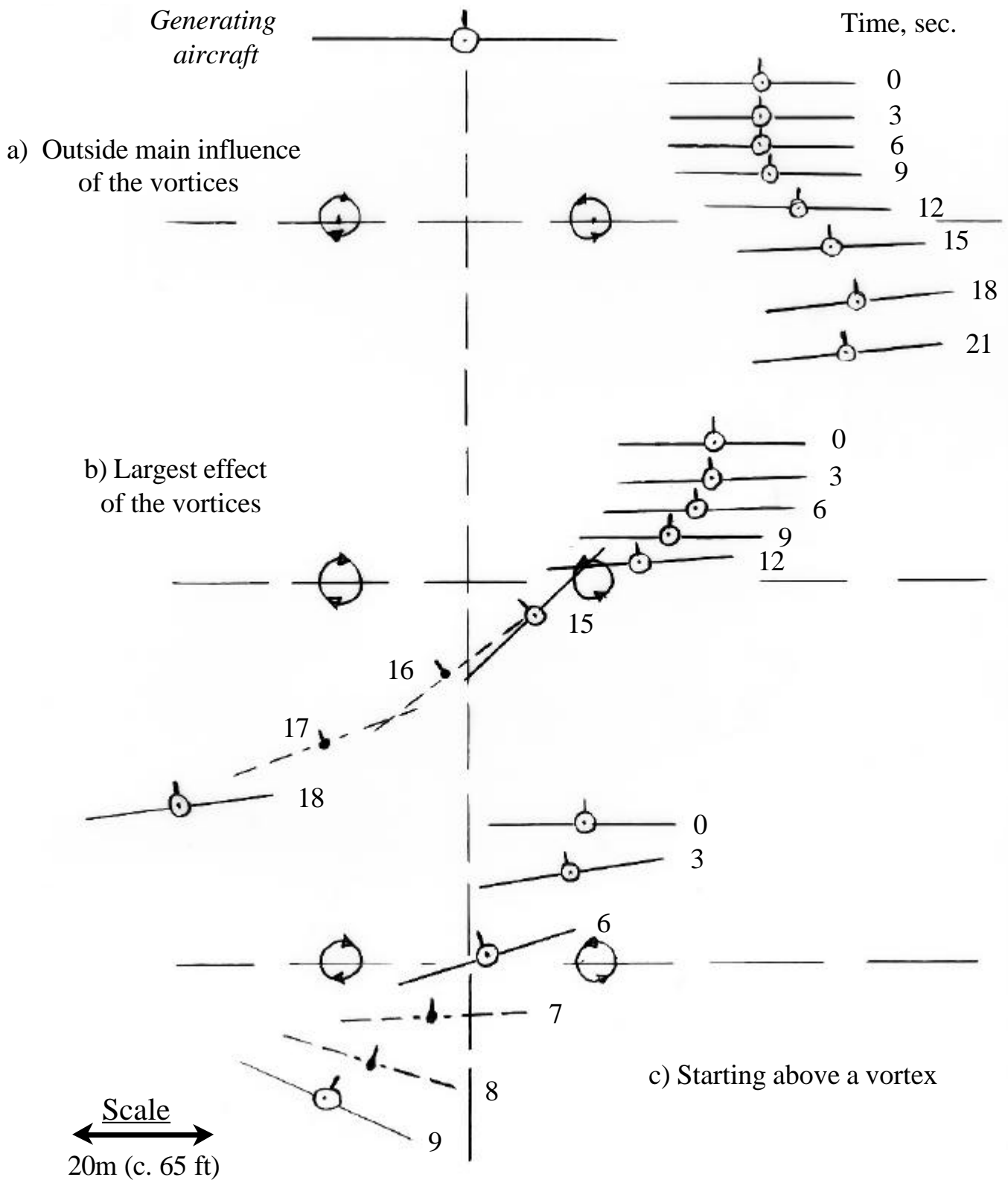


Fig. 5: Aircraft trajectory and roll motion descending through a strong pair of vortices
(Maximum induced rolling moment = 3.8 times roll control)

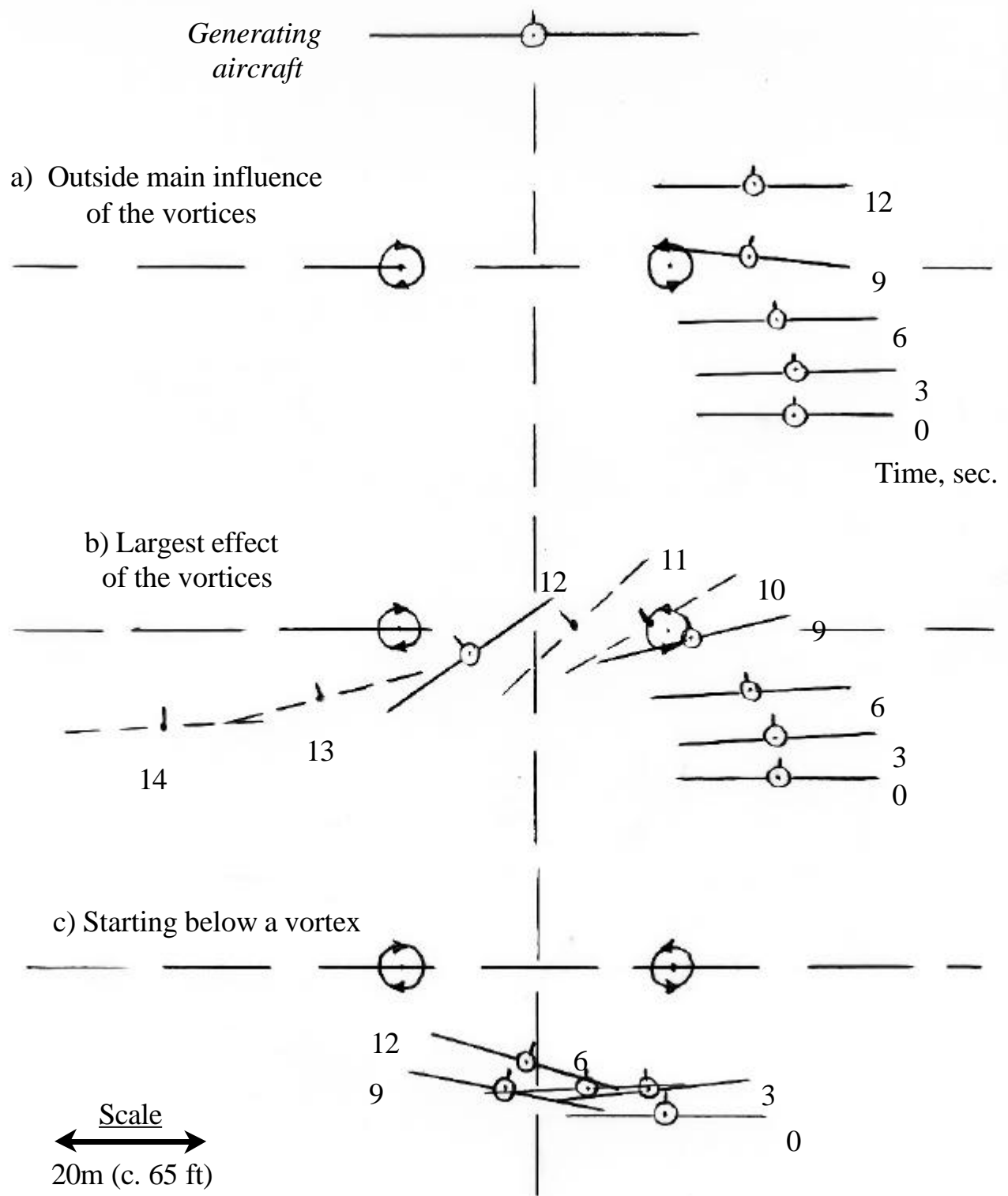


Fig. 6: Aircraft trajectory and roll motion climbing through a strong pair of vortices
(Maximum induced rolling moment = 3.8 times roll control)

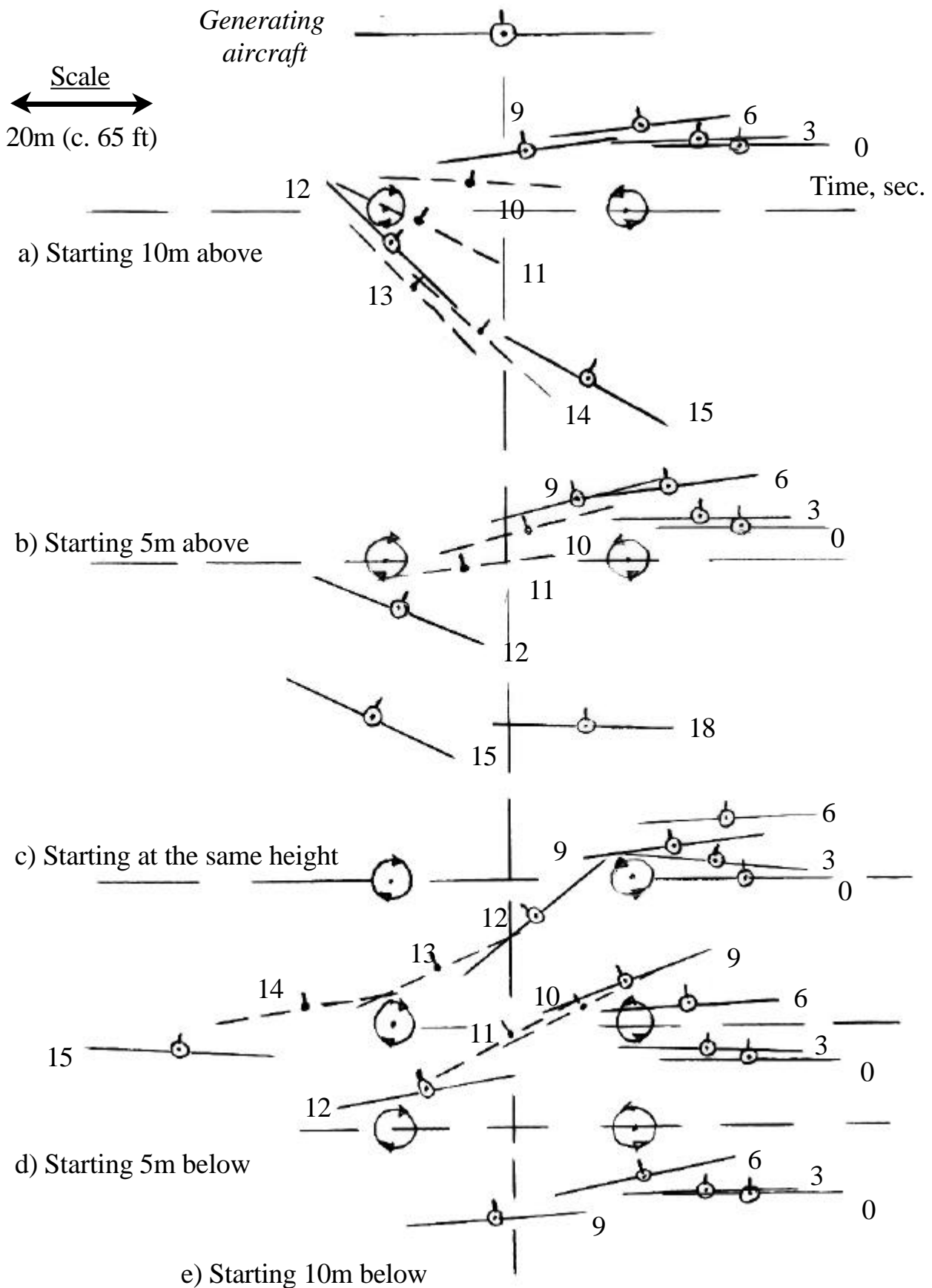


Fig. 7: Aircraft trajectory and roll motion crossing from right to left through a strong pair of vortices
(Maximum induced rolling moment = 3.8 times roll control)

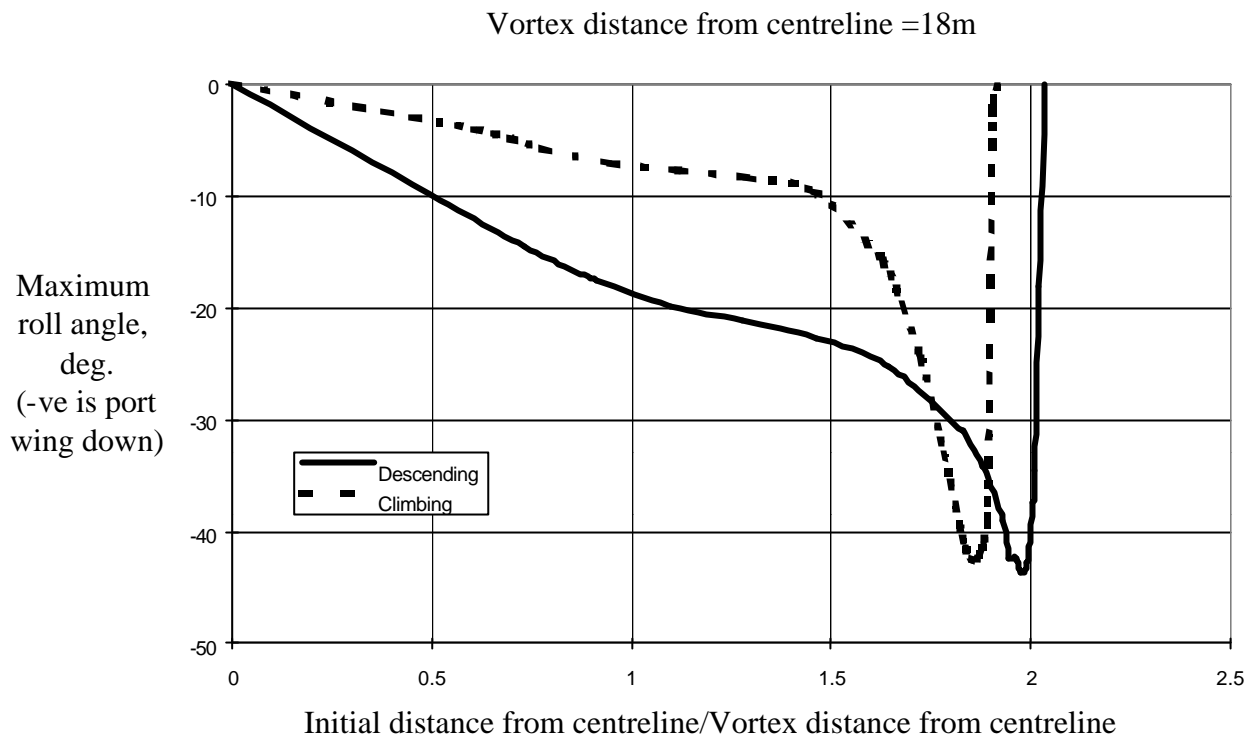


Fig. 8: Variation of Maximum roll deviation with lateral position for climbing and descending conditions (Figs. 5 & 6)

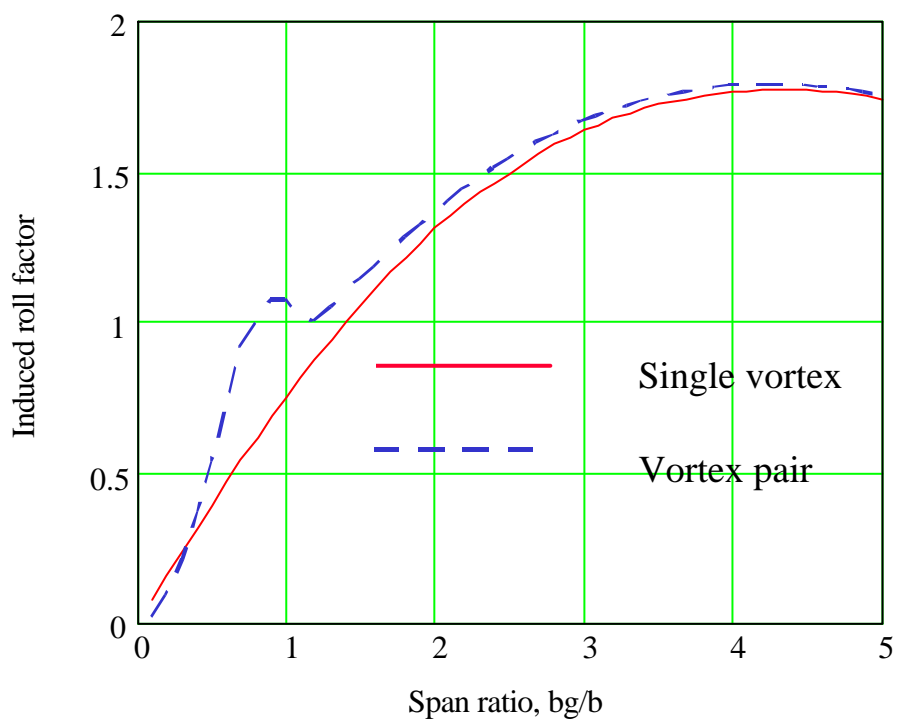


Fig. 9: Variation of induced roll moment factor with span ratio

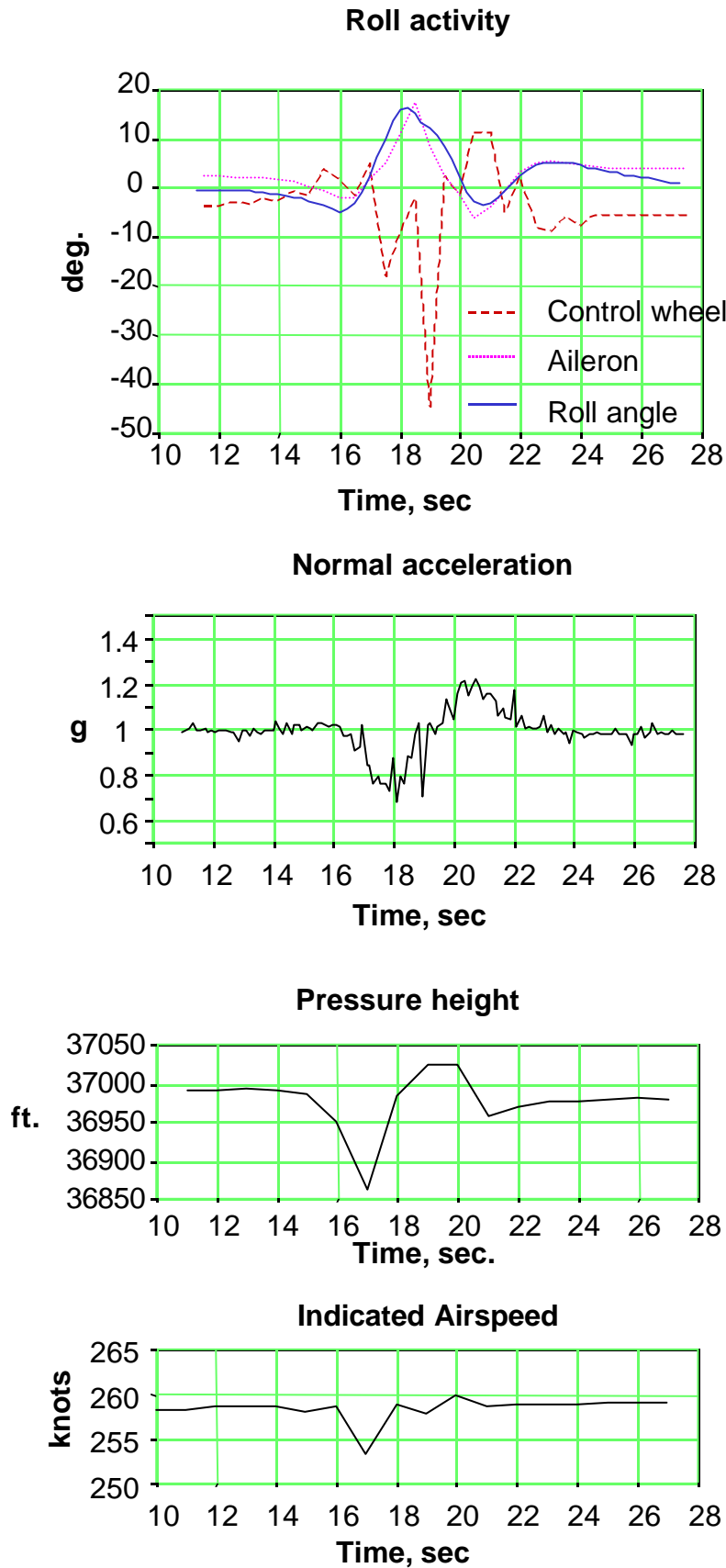


Fig. 10: B767 encounter at FL370 with wake vortices 10 nm behind a B777 descending through the same FL

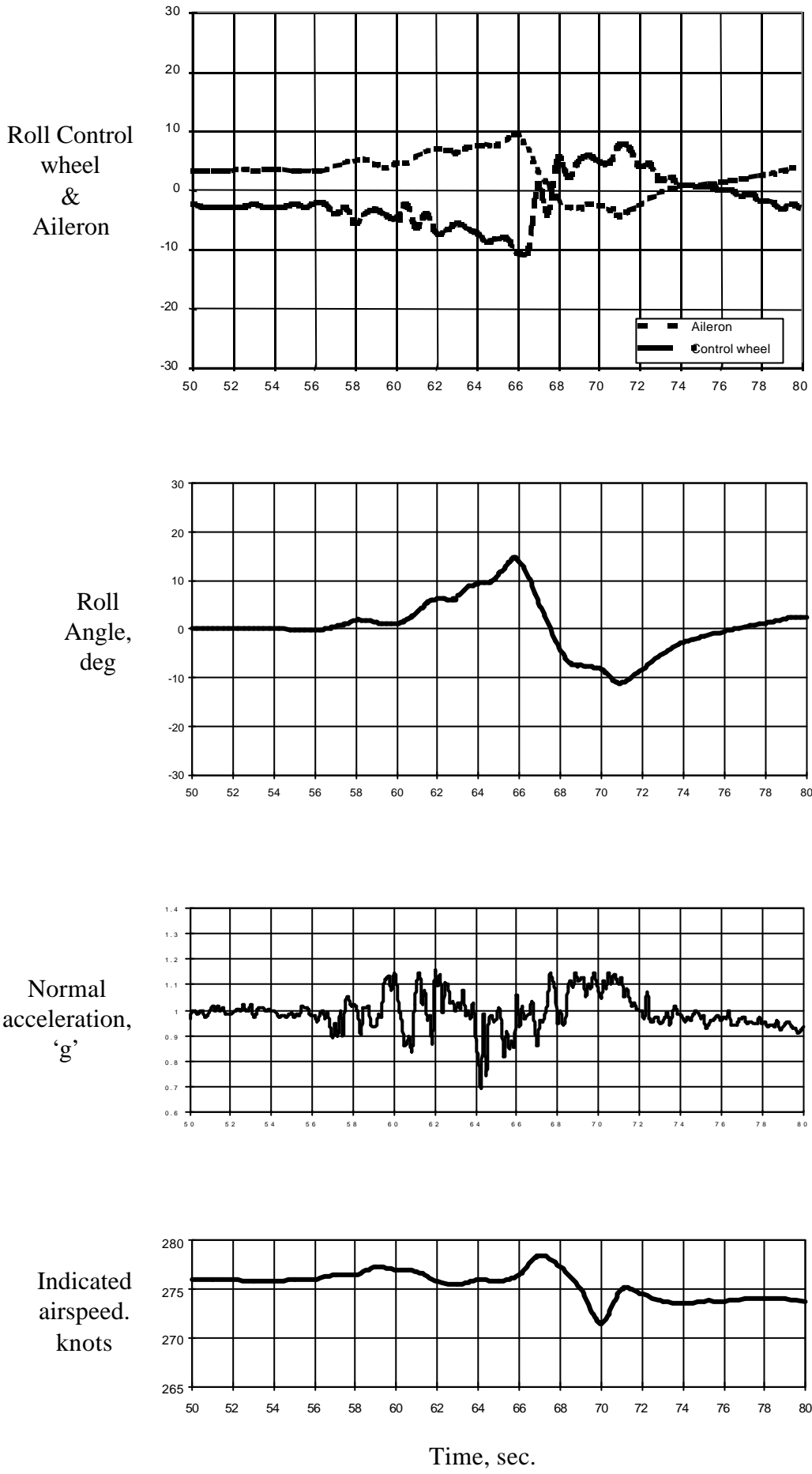


Fig. 11: B767 encounter when climbing to FL350 and 10nm behind an unknown aircraft type at FL340

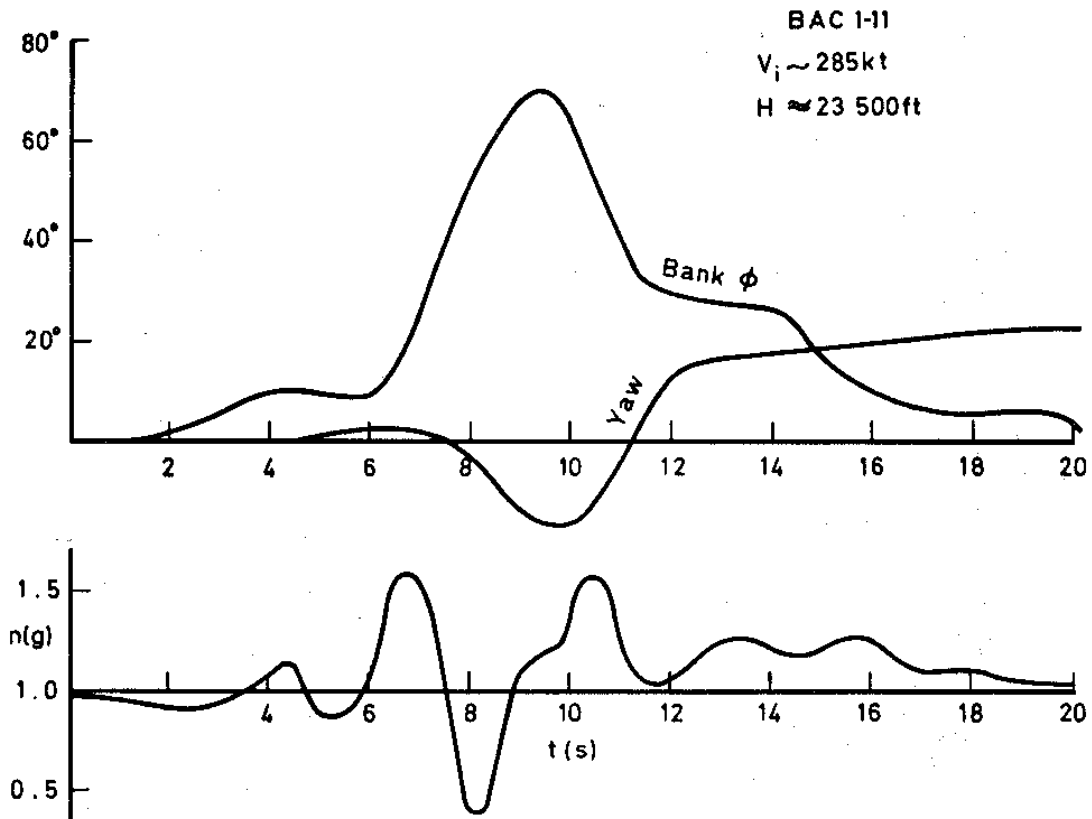


Fig. 12: BAC 1-11 encounter 16-20 nm behind a descending B747 (Ref. 8)

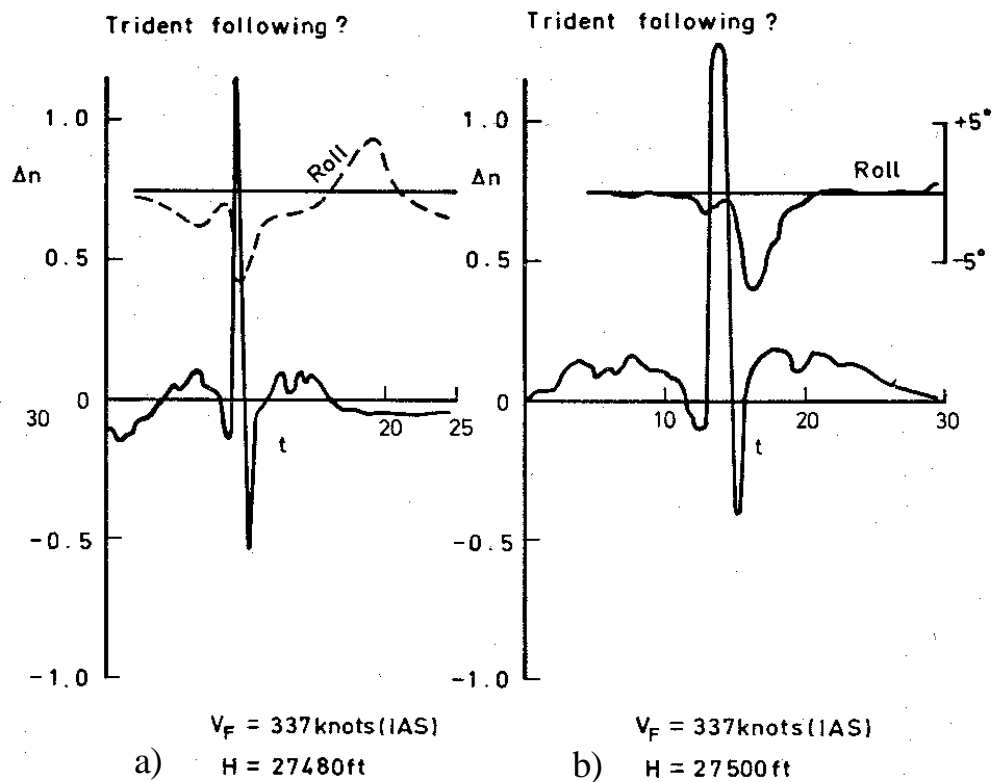


Fig. 13: Trident encounters crossing vortices from unknown aircraft (Ref. 8)

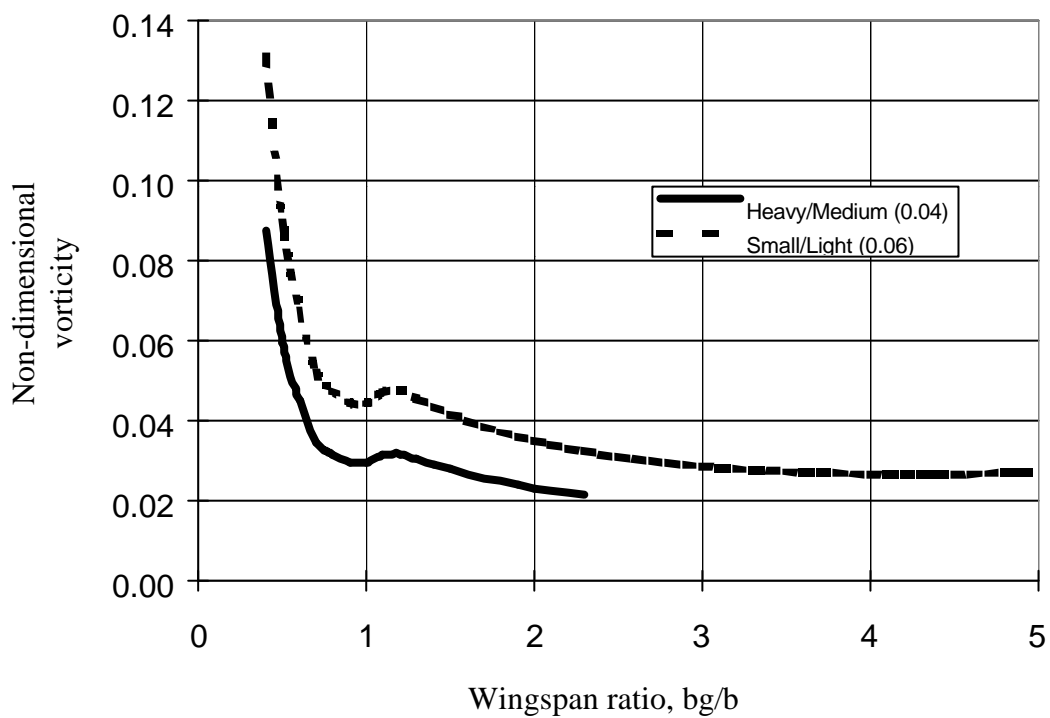


Fig. 14: Provisional maximum non-dimensional vorticity for encounters during cruise
 (Maximum Roll Moment Ratio of 0.8 resulting in 30 deg roll)