

SUPER TYPHOON NELSON (20W)

Nelson was the first significant tropical cyclone of October and the only super typhoon of 1988. It developed in the Philippine Sea in the monsoon trough. The super typhoon recurved and threatened the Ryukyu Islands and the main Japanese Islands of Kyushu and Honshu.

In late September, after the multiple outbreak of Tropical Storms Kit (17W), Lee (18W) and Mamie (19W), there was a week long lull in tropical cyclone activity. In the meantime polar air pushed southward across the Asian mainland and Japanese Islands. The

monsoon trough had returned to its normal climatic location along with the maximum cloud zone. The disturbance that would later become Super Typhoon Nelson was first detected in this maximum cloud zone 200 nm (370 km) southwest of Guam by satellite reconnaissance. The Significant Tropical Weather Advisory, that is normally issued at 0600Z each day, was reissued at 301400Z September to include this area of suspect cloudiness. Nelson developed within the monsoon trough and began steadily organizing (Figure 3-20-1). A noticeable increase in central convection led to the issuance of a

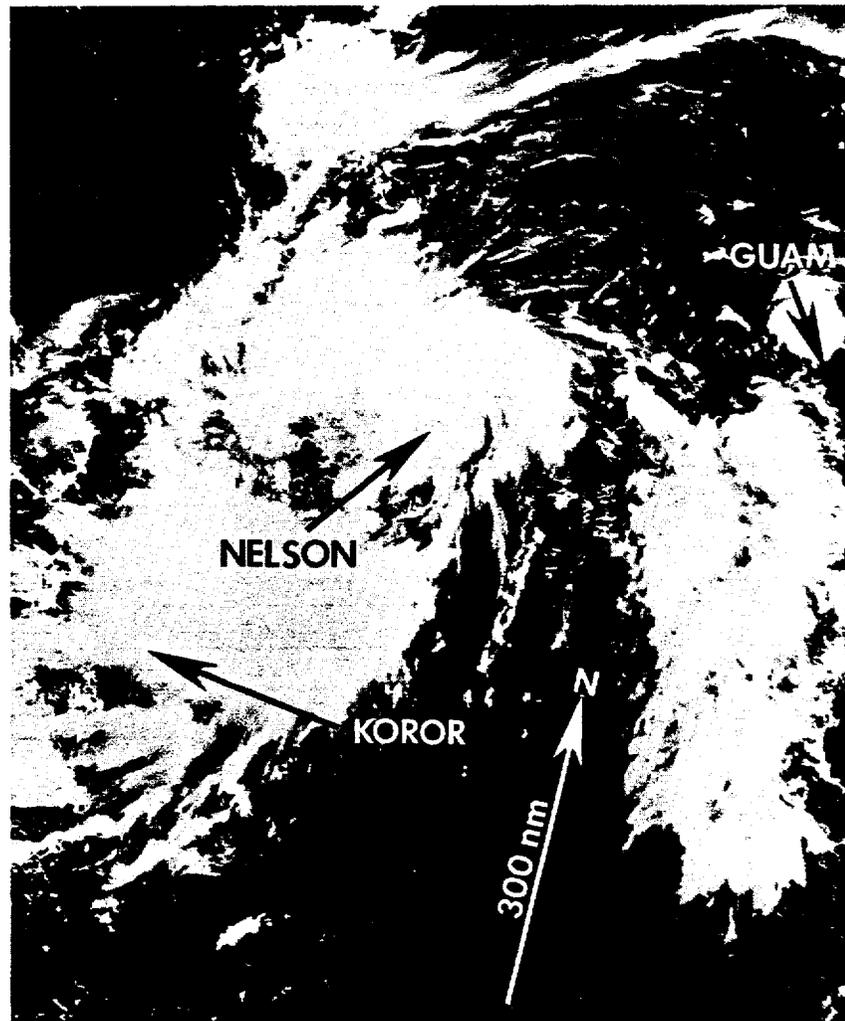


Figure 3-20-1. Nelson as a tropical disturbance (010016Z October DMSP visual imagery).

Tropical Cyclone Formation Alert at 0900Z on 1 October. The first warning followed at 011200Z, based on a satellite intensity estimate of 45 kt (23 m/sec) sustained surface winds. (Post analysis indicates the disturbance, most probably, achieved tropical storm intensity earlier at 010600Z.) Nelson initially moved westward towards the Philippine Islands, and then west-northwestward as it tracked along the periphery of the subtropical ridge.

Only 24 hours after the initial warning was issued, a satellite intensity estimate of 65 kt (33 m/sec) winds resulted in an upgrade to typhoon status at 021200Z. At 022100Z, a 15 nm (28 km) diameter eye first became visible on satellite imagery. (The eye persisted until 7 October.) Nelson continued to rapidly intensify

and reached super typhoon intensity at 040600Z (Figure 3-20-2). The normal rate of intensification (Dvorak, 1984) is one T-number per day. From 020000Z to 041200Z, Nelson developed more rapidly than normal (Figure 3-20-3). Conversion (Atkinson and Holliday, 1977) of intensity to minimum sea-level pressure indicates a fall from 991 to 898 mb — 93 mb in 60-hours — and sustained rapid intensification (Holliday and Thompson, 1979)(Figure 3-20-4). On 4 October, Nelson slowed and tracked through an area where, according to climatology (Annual Typhoon Report, 1970), a large number of tropical cyclones reach super typhoon intensity (Figure 3-20-5). The typhoon's intensity peaked at 140 kt (72 m/sec) at 041200Z.

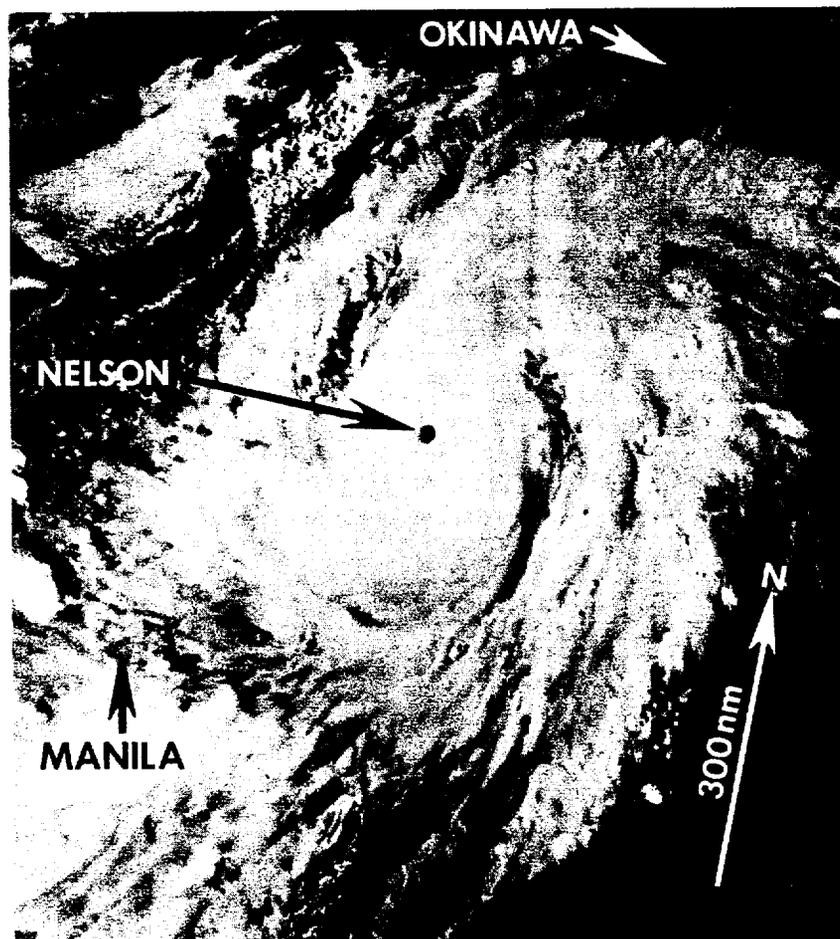


Figure 3-20-2. Super Typhoon Nelson near peak intensity displays a well defined 20 nm (37 km) diameter eye (040709Z October NOAA visual imagery).

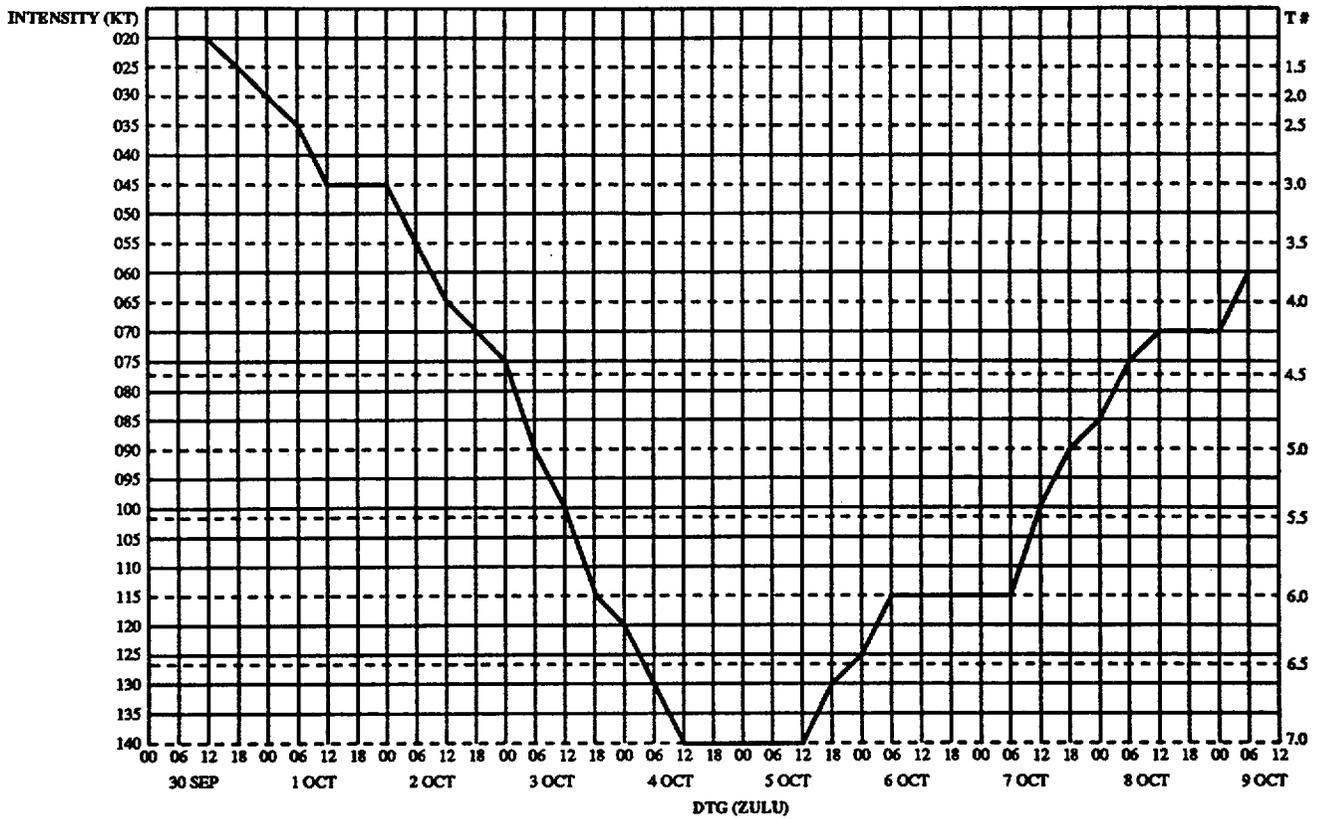


Figure 3-20-3. Analysis of intensity with time shows Super Typhoon Nelson's rapid intensification from 020000Z to 041200Z October. Note the peak intensity of 140 kt (72 m/sec) persisted from 041200Z to 051200Z October.

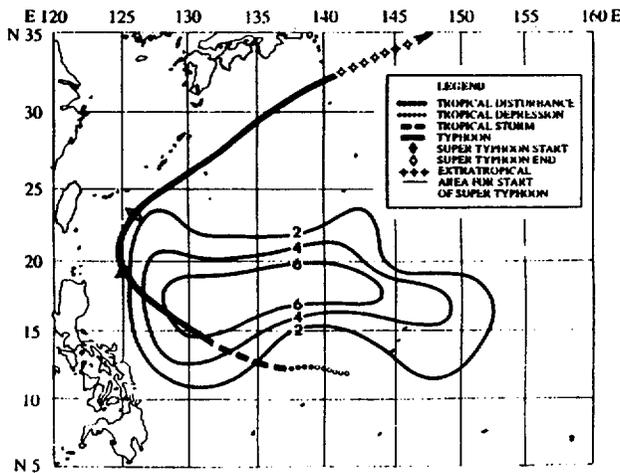


Figure 3-20-4. Nelson's final best track is superimposed upon the areas where tropical cyclones rapidly intensified during summer and early fall (20 June - 16 October) for the years 1956 to 1976 (Holliday and Thompson, 1979).

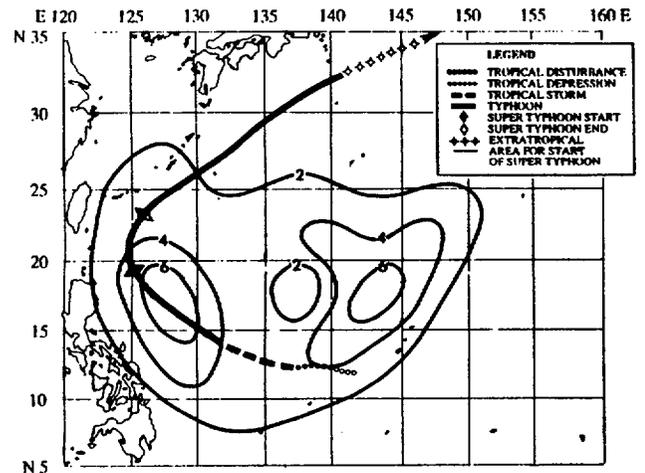


Figure 3-20-5. Nelson's final best track superimposed upon climatic areas of super typhoon occurrence. Areas of first super typhoon intensity include number of occurrences from the period 1959 to 1970 (Annual Typhoon Report, 1970).

Packing the most intense winds of any tropical cyclone for the year, Nelson rounded the western end of the subtropical ridge at a speed of 6 kt (11 km/hr), and slowly accelerated northeastward. In addition to satellite reconnaissance, a total of 177 radar position reports greatly aided the accurate tracking of the

typhoon's recurvature and subsequent acceleration. Moving along the edge of the modifying polar air, Nelson weakened and was downgraded to typhoon intensity at 060000Z. The tropical cyclone passed 85 nm (157 km) southeast of the island of Okinawa at 060930Z (Figures 3-20-6 and 3-20-7). The maximum

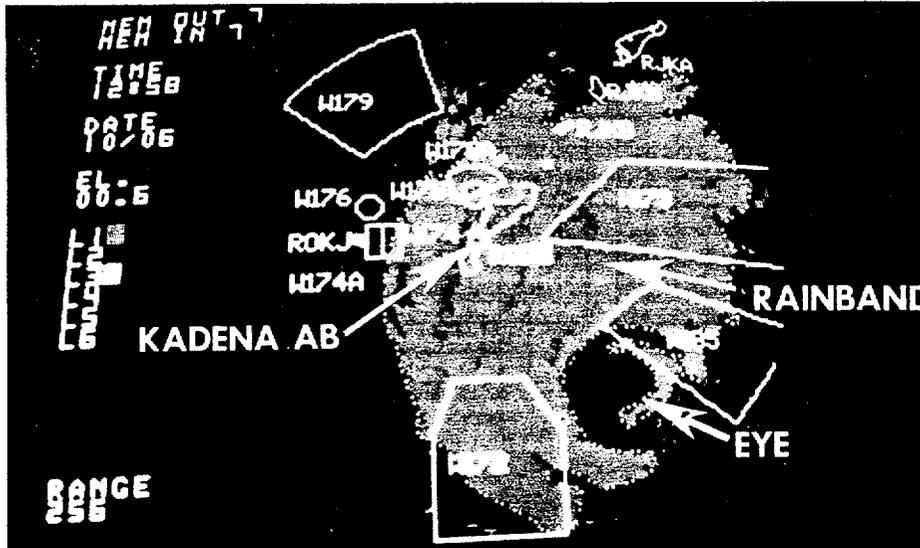


Figure 3-20-6. Nelson's primary rainband and eye as viewed by the radar at Kadena Air Base, Okinawa at 061258Z. Dots have been added to enhance the subtle edge of the rain echoes (photograph courtesy of Detachment 8, 20th Weather Squadron).

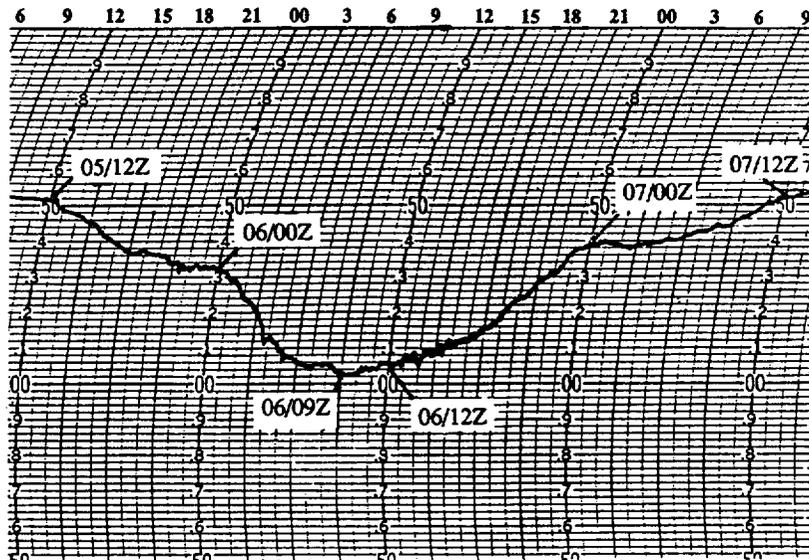


Figure 3-20-7. Microbarograph trace from Kadena Air Base, Okinawa. The time of the lowest minimum sea-level pressure of 29.02 inches Hg coincides with Nelson's closest approach to the island (barograph trace courtesy of Detachment 8, 20th Weather Squadron).

sustained winds reported by Detachment 8, 20th Weather Squadron at Kadena Air Base on Okinawa were 38 kt (20 m/sec), with a peak gust of 59 kt (30 m/sec). Close by, maximum sustained winds of 40 kt (21 m/sec), with a peak gust of 64 kt (33 m/sec) were reported by the Marine Corps Air Station at Futenma. The rainfall totals recorded on Okinawa ranged from 7.30 inches (18.54 cm) at Futenma to 8.35 inches (21.21 cm) at Kadena Air Base.

Nelson continued to weaken, move

northeastward and accelerate (Figure 3-20-8). As it lost its persistent central convection, the typhoon transitioned to an extratropical system 190 nm (352 km) southeast of Tokyo, Japan at 081500Z. By this time it was moving at a speed of 28 kt (52 km/hr). Extratropical Nelson retained winds of typhoon intensity and moved rapidly northeastward. The final warning was issued at 081800Z. The remnants of Nelson were identifiable on satellite imagery for the next two days. No reports of significant damage were received.

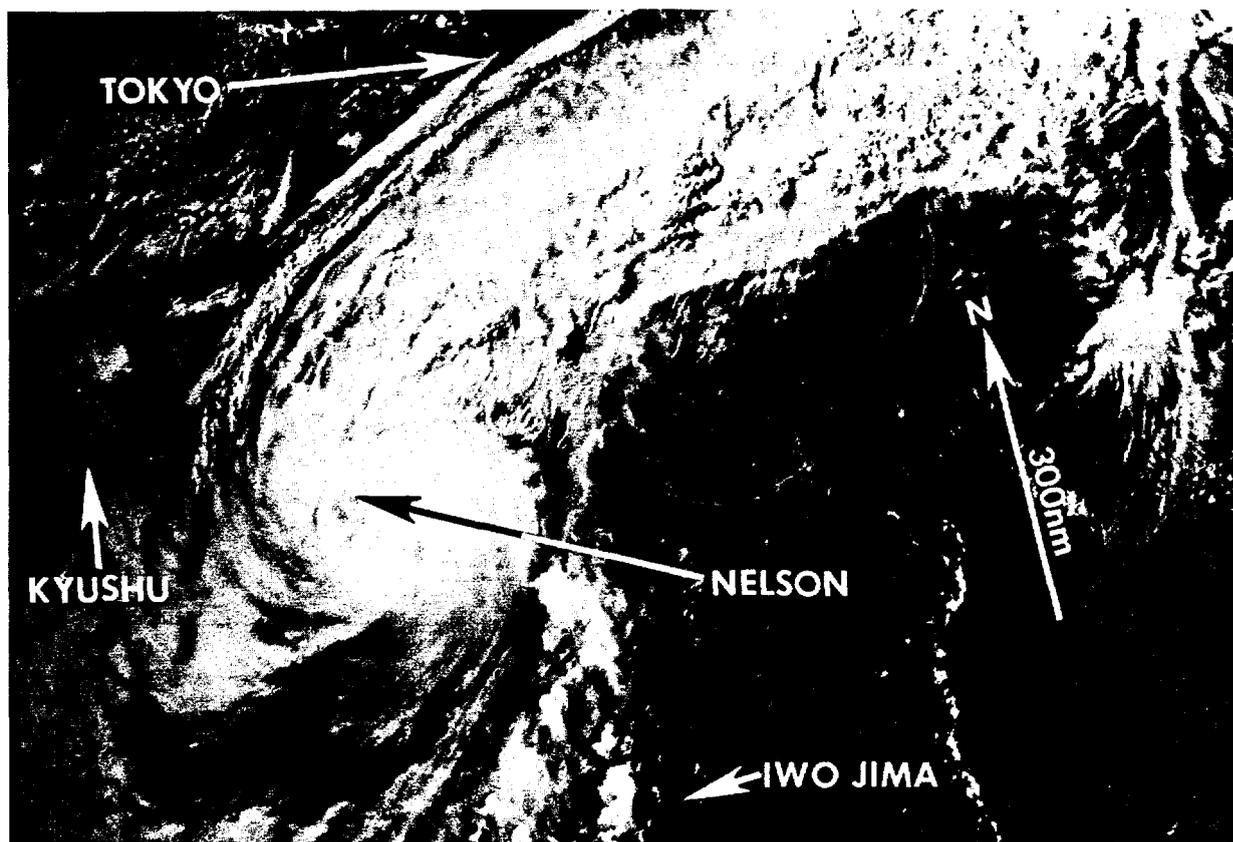


Figure 3-20-8. Nelson during its weakening stage (072235Z October NOAA visual imagery).