

= Typhoon Karen =

Typhoon Karen was the most powerful tropical cyclone to strike the island of Guam , and has been regarded as one of the most destructive events in the island 's history . It was first identified as a tropical disturbance on November 6 , 1962 , well to the southeast of Truk . Over the following two days , the system tracked generally northward and quickly intensified . Karen became a tropical storm late on November 7 , and within two days it explosively intensified into a Category 5 @-@ equivalent super typhoon on the Saffir ? Simpson hurricane scale . Turning westward , the typhoon maintained its intensity and struck Guam with winds of 280 km / h (175 mph) on November 11 . Once clear of the island , it strengthened slightly and reached its peak intensity on November 13 with winds of 295 km / h (185 mph) and a barometric pressure of 894 mb (hPa ; 26 @.@ 40 inHg) . The storm then gradually turned northward as it weakened , brushing the Ryukyu Islands on November 15 , before moving east @-@ northeastward over the open waters of the Pacific . Karen continued to weaken and transitioned into an extratropical cyclone on November 17 before losing its identity the following day between Alaska and Hawaii .

Karen devastated Guam with wind gusts estimated up to 280 km / h (185 mph) . Ninety @-@ five percent of homes were damaged or destroyed , leaving at least 45 @,@ 000 people homeless . Communication and utilities were crippled , forcing officials to set up water distribution centers to prevent disease . Total losses on the island amounted to \$ 250 million . Despite the severity of the damage , only 11 people were killed . In the wake of the storm , a massive relief operation evacuated thousands to California , Hawaii , and Wake Island . Thousands more were sheltered in public buildings , and later tent villages , for many months . More than \$ 60 million in relief funds were sent to Guam over the following years to aid in rehabilitation . Though the storm was devastating , it spurred new building codes and a revitalized economy .

= = Meteorological history = =

On November 6 , 1962 , a tropical disturbance was identified over the Pacific Ocean several hundred miles south @-@ southeast of Truk , in the Federated States of Micronesia , by the Joint Typhoon Warning Center (JTWC) . Tracking northwestward , the disturbance intensified and was classified as a tropical depression early on November 7 . Later that day , the system passed to the east of Truk and turned due north before attaining gale @-@ force winds . Around 18 : 00 UTC , the JTWC issued their first advisory on Tropical Storm Karen , the 27th named storm of the 1962 season . Several hours later , a reconnaissance mission into the storm revealed a partially closed 35 km (22 mi) wide eye . Over the following 30 hours , Karen underwent a period of explosive intensification as its eye became small and increasingly defined . Between 00 : 00 UTC on November 8 and 03 : 40 UTC on November 9 , Karen 's barometric pressure plummeted from 990 mbar (hPa ; 29 @.@ 24 inHg) to 899 mb (hPa ; 26 @.@ 55 inHg) , a drop of 91 mb (hPa ; 2 @.@ 69 inHg) . At the end of this phase , Karen featured an 8 to 10 km (5 to 6 mi) wide eye and had estimated surface winds of 295 km / h (185 mph) , ranking it as a modern @-@ day Category 5 @-@ equivalent super typhoon on the Saffir ? Simpson hurricane scale .

After attaining this initial peak intensity on November 9 , Karen weakened somewhat as it gradually curved west @-@ northwestward . By 15 : 14 UTC , the storm began to undergo an eyewall replacement cycle as a larger secondary eyewall , approximately 64 km (40 mi) in diameter , started developing . Although the storm 's winds failed to drop significantly , Karen 's central pressure rose to 919 mb (hPa ; 27 @.@ 14 inHg) during this phase . Accelerating slightly , Karen tracked steadily west @-@ northwestward towards Guam . By November 11 , the system had regained a well @-@ defined eye and deepened once more . Between 12 : 10 and 12 : 35 UTC on November 11 , the 14 km (9 mi) wide eye of Karen passed directly over southern Guam . At this time , the storm was estimated to have had winds of 280 km / h (175 mph) , which would have made it the most intense typhoon to strike the island since 1900 . However , years of post @-@ storm analyses have indicated that it may have been somewhat weaker when it passed over Guam . At the Weather Bureau station at the north end of Guam , a pressure of 942 @.@ 4 mb (hPa ; 27

@. @ 83 inHg) was measured . Farther south at Anderson Air Force Base , 939 @. @ 7 mb (hPa ; 27 @. @ 75 inHg) was recorded . The lowest verified pressure was 931 @. @ 9 mb (hPa ; 27 @. @ 52 inHg) at the Agana Naval Air Station . Closest to the eye was Naval Magazine where a pressure of 907 @. @ 6 mb (hPa ; 26 @. @ 80 inHg) was estimated but never verified .

Continuing west @-@ northwestward , Karen attained its peak intensity on November 13 with a central pressure of 894 mb (hPa ; 26 @. @ 40 inHg) . Between November 13 and 14 , Karen gradually turned towards the north as it underwent another eyewall replacement cycle . During this time , Karen finally weakened below Category 5 status as its winds dropped below 251 km / h (156 mph) . This marked the end of its near @-@ record 4 @. @ 25 @-@ day span as a storm of such intensity , second only to Typhoon Nancy of 1961 which maintained Category 5 status for 5 @. @ 5 days . Over the following days , the typhoon 's structure gradually became disorganized , with its eye no longer well @-@ defined by November 15 . By this time , Karen began accelerating northeastward and later east @-@ northeastward over the open ocean . The combination of its rapid movement and entrainment of cold air into the circulation ultimately caused the system to transition into an extratropical cyclone on November 17 . The remnants of Karen continued tracking east @-@ northeast and were last noted by the JTWC on November 18 roughly halfway between the southern Aleutian Islands and northern Hawaiian Islands .

= = Impact = =

= = = Guam = = =

Following the identification of a tropical disturbance on November 6 , a level four Typhoon Condition of Readiness (TCOR) , the lowest level of alert , was raised for Guam . By November 8 , three days prior to Karen 's arrival , this was raised to level three , prompting residents and military personnel to stock up on supplies . A public announcement was made that day as well , warning residents that the typhoon would likely strike the island . At 9 : 00 p.m. on November 10 (11 : 00 UTC) , a level two TCOR was put in place for Guam and a typhoon emergency was declared . Buildings were boarded up and emergency supplies were distributed . By 8 : 00 a.m. (22 : 00 UTC on November 10) , this was raised to level one , the highest level of warning . At this time , the USS Haverfield , USS Brister , USS Wandank , and USS Banner sought refuge from the storm over open waters . All personnel on the island were ordered to evacuate to typhoon @-@ proof shelters and emergency rations were prepared . Strategic air command planes stationed on the island were relocated to avoid damage . Many residents on the island sought refuge in government buildings designed to withstand powerful storms while others evacuated to Wake Island . Roughly 24 hours after the typhoon 's passage , all warnings were discontinued .

Striking Guam as a Category 5 @-@ equivalent typhoon , Karen produced destructive winds across much of the island . With the eye passing over the southern tip of the territory , the most intense winds were felt over central areas . Wind gusts over the southern tip of Guam were estimated to have peaked around 185 km / h (115 mph) . Due to the extreme nature of these winds , all anemometers on the island failed before the most intense portion of the storm arrived , and there were no measurements of the strongest winds ; however , post @-@ storm reports estimated that sustained winds reached 250 km / h (155 mph) in some areas . The highest measured gust was 240 km / h (145 mph) at a United States Navy anemometer on Nimitz Hill just before 11 : 00 UTC on November 11 , roughly two hours before the typhoon 's eye passed the station . Based on this measurement , a study in 1996 estimated that gusts peaked between 280 and 295 km / h (175 and 185 mph) over southern areas of the island . Newspaper reports indicated that a gust of 272 km / h (169 mph) was measured on the island before the anemometer was destroyed . There was also an unverified report of a 333 km / h (207 mph) wind gust . Nearly all measurements of rainfall during the typhoon were lost ; the only known total is 197 mm (7 @. @ 76 in) at the Weather Bureau station for the period of November 10 ? 12 .

Surveys of damage revealed belt @-@ like damage patterns from the winds , with some homes

being leveled and others nearby having only minor damage , akin to the impacts of tornadoes . The winds uprooted and snapped palm trees across the island and , in some instances , stripped the bark of tree trunks and branches as if they had been sandblasted . Vegetation was completely defoliated across central areas of the island . In some places , it was described as the aftermath of a forest fire . The winds also blew debris across the island . Metal roofing was found wrapped around trees . In one instance , a twin @-@ engine aircraft was carried 2 @.@ 4 km (1 @.@ 5 mi) from the hangar it was tied down in . A metal sign bolted into a warehouse was tossed 3 @.@ 7 km (2 @.@ 3 mi) and found half @-@ buried in the ground . Elsewhere , a quonset hut was lofted and carried for 125 m (411 ft) , intact , before being crushed on impact . Along the coast , the USS Arco was torn from her moorings , severing two anchors and shearing a cleat ? tested for over 23 @,@ 000 and 45 @,@ 000 kg (50 @,@ 000 and 100 @,@ 000 lb) , respectively ? in the process . The ROK Han Ra San and RPS Negros Oriental sank in the inner harbor of Guam .

Karen is regarded as the worst typhoon to ever impact Guam . Acting governor Manuel Guerrero stated that " the entire territory was devastated . " Almost all structures , both civilian and military , were severely damaged or destroyed . Even reinforced concrete structures at Anderson Air Force Base sustained severe damage . Though these structures withstood the direct impact of winds , sudden drops in pressure caused windows to shatter in most structures , ultimately exposing the interior to water damage . Military structures suffered the most from this phenomenon as the buildings were designed in a way that pressure differences between the interior and exterior would not equal out . Debris from damaged or destroyed homes became projectiles during the storm that created further damage , like " shrapnel or artillery missiles . "

George Washington High and Tumon Junior High were both destroyed . Guam Memorial Hospital and the island 's public works department were extensively damaged . Downtown Hagåtña , Guam 's largest city , was flattened . Along the city 's main road , Marine Drive , 20 cm (8 in) of sand accumulated from Karen 's storm surge . Overall , the city was 85 percent destroyed , while the villages of Yona and Inarajan were 97 and 90 percent destroyed , respectively . Additionally , Agaña Heights and Sinajana were reportedly leveled . The communication network on the island was completely destroyed as antennas and transmission equipment were blown away . Approximately 30 percent of telephone poles between the island 's naval station and Nimitz Hill and 95 percent of civilian telephone poles were downed . The power grid was also destroyed . The Guam portion of the Pacific Scatter Communications System suffered extensive damage , with all four 61 m (200 ft) antennas at Ritidian Point being reduced to a " mess of tangled , twisted steel and cable . " Losses from the antennas alone reached \$ 1 million . All airstrips on the island were rendered inoperable , hampering initial relief efforts . Numerous roads across the island were also impassable , covered by downed trees and smashed vehicles . The wreckage left in the wake of the storm was described as a " massive junkyard " .

Throughout Guam , 95 percent of homes were destroyed , and those left standing were damaged . Nearly every non @-@ typhoon @-@ proof home was severely damaged or destroyed and a majority of typhoon @-@ proof buildings sustained extensive damage . Preliminary surveys by the Red Cross on November 15 indicated that at least 5 @,@ 000 homes were destroyed and another 3 @,@ 000 were severely damaged . Approximately 45 @,@ 000 people , mostly Guamanians , were left homeless . A total of 11 people lost their lives and about 100 others were injured . At least four of the deaths were due to collapsed buildings , including three in one home that buckled due to pounding surf . Another death resulted from decapitation by airborne debris . Losses across the island amounted to \$ 250 million (1962 USD) . The damage across Guam was described as " ' much more serious " than it had been during the second Battle of Guam , when American troops retook the island from the Japanese . The U.S. Navy described the damage as equal to that of an indirect hit from a nuclear bomb . Guerrero said that the recovery effort of the previous 17 years had been " completely wiped out " .

= = = Elsewhere = = =

In the Mariana Islands , three ships under the command of Rear Admiral J. S. Coye Jr. sank ;

however , the crew had been evacuated prior to the storm 's arrival .

On November 13 , a level three TCOR was issued for Okinawa . This prompted military personnel to begin securing the island and preparing planes without hangars for evacuation . Brushing the region as a Category 3 @-@ equivalent typhoon , Karen caused considerable disruptions to airlines , trains , shipping , and communications . No serious damage was reported in Okinawa , but the nearby Daiyumaru and another Japanese fishing vessel with a total of 26 crew went missing .

On November 15 , residents in Taiwan were urged to take precautions to minimize casualties . Prior to the storm 's arrival , the USS Duncan , the USS Kitty Hawk , and two other aircraft carriers sought refuge in the Taiwan Strait . Despite attempts to escape the storm , large swells exceeding 3 @. @ 6 m (12 ft) battered the vessels , causing them to pitch up to 59 degrees . At times , the waves crashed onto the deck of the USS Kitty Hawk . According to crewmen , waves up to 4 @. @ 5 m (15 ft) struck Taipei , leaving water marks on many buildings .

= = Aftermath = =

In the immediate aftermath of the typhoon , the Pacific Air Forces were on standby to deliver supplies to Guam , but were delayed by inoperable airstrips . Guam Memorial Hospital was damaged , but other civilian and military installations , including the Navy 's hospital , were able to handle injured persons . On November 12 , Manuel Guerrero made an urgent appeal to the Government of the United States requesting that aid be rushed to the territory . Additionally , he instituted an island @-@ wide curfew between 8 : 00 p.m. and 6 : 00 a.m. local time to limit looting . At schools , teachers were called in to guard supplies and equipment . The Federal Emergency Management Agency , under orders from United States President John F. Kennedy , declared Guam a major disaster area later that day , allowing residents to receive federal aid . Additionally , 15 United States Air Force communications technicians were deployed from Manila , Philippines carrying three plane @-@ loads of communication supplies . Guerrero estimated that it would take four months to complete repairs to utilities . It was also estimated that schools on the island would be closed for six months .

Initially , residents across Guam were critical of the delayed response by the U.S. government ; no aid had arrived within two days of the storm , but unsafe conditions at airports had prevented aircraft from landing . With the majority of homes destroyed across Guam , structures that remained standing were used as temporary shelter for those left homeless . Similarly , damaged military installations at Anderson Air Force Base were made available to all civilians . By November 14 , the USS Daniel I. Sultan arrived in Guam with 1 @, @ 100 troops to provide emergency power . A U.S. Air Force AC @-@ 130 landed on the island that day carrying the first package of relief supplies . About 400 troops and 80 public works employees were sent from Hawaii on November 14 . The Red Cross and civil defense offices were placed in charge of coordinating recovery efforts . Water distribution centers were set up across the island to provide residents with clean drinking water .

On November 15 , a massive evacuation of residents began to remove survivors from unsafe conditions . Two flights to California took place on the first day of evacuation , carrying a total of 154 people . Thousands of residents were also brought to Wake Island for shelter . Military Air Transport Service planes from the United States mainland , Japan , the Philippines , and Hawaii were called in for the operation . On November 16 , residents were warned of a possible typhoid epidemic and urged to get inoculations for the disease . Over a three @-@ day span , roughly 30 @, @ 000 people were given preventative shots for the disease . In contrast to their previous ban on alien workers , the Government of Guam requested 1 @, @ 500 carpenters , masons , and other building workers from the Philippines . By November 21 , the Navy Supply Depot planned to have enough supplies for the entire populous shipped until replenishment arrived . In order to shelter homeless , the United States Navy set up tent villages across the island . Military kitchens were also established to provide food . Due to continued rains in the wake of the typhoon , many were unable to get a full meal for Thanksgiving .

On November 21 , insurance payments for losses were expected to exceed \$ 12 million . On January 1 , 1963 , a \$ 2 million relief fund was authorized by President Kennedy . Another \$ 5 @. @

4 million in relief funds were provided by President Lyndon B. Johnson on February 15 , 1964 . The United States Congress provided Guam with \$ 60 million , including \$ 45 million through federal loans , mainly to help rebuild the territory and promote expansion of the economy . Additionally , the storm brought about the end of military security on the island , which in turn aided economic growth . Within five years of this decision , Japanese tourism to the island dramatically increased , prompting a major increase in the number of hotels . In the long term , Typhoon Karen , along with other destructive storms , shaped the development of the island 's infrastructure . It led to higher quality buildings and more efficient utilities that could withstand powerful typhoons . Since Karen , most buildings on the island have been constructed with concrete and steel .

On April 29 , 1963 , less than half a year after Karen , Typhoon Olive caused extensive damage in Guam and the Mariana Islands . With many residents living in tents , and debris from the storm still scattered about , severe damage was anticipated . Schools , churches , and other structures were opened as shelters in order to protect those without homes . Ultimately , Guam was spared the worst of the storm though much of Saipan was devastated . The island was again devastated in 1976 by Typhoon Pamela which buffeted the island with destructive winds for 36 hours . Though weaker than Karen , the longer lasting impact of Pamela was regarded as more destructive .

Due to the severity of damage caused by the typhoon in Guam , the name Karen was retired and replaced with Kim .