ANNUAL TYPHOON REPORT
1967

U. S. FLEET WEATHER CENTRAL/
JOINT TYPHOON WARNING CENTER
COMNAVMARIANAS BOX 12
FPO SAN FRANCISCO 96601

J. H. NEGELE
Captain, U.S. Navy

COMMANDING

WILLIAM D. ROPER
Major, USAF

DIRECTOR, JOINT TYPHOON WARNING CENTER

STAFF

LCDR E. Lee Geraldson, USN
CAPT Paul Y. Haraguchi, USAF
LT Vincent E. Brewer, USN
LT James C. Langemo, USN
LT William R. Newman, USAF
SGT John H. Depew, USAF
SGT Joseph Halsteter, USAF
SGT Donald G. Martin, USAF
AGAN Glen R. Andreasen, USN
AGAN Kenneth J. McGuire, USN
AN David B. Sumner, USN
Miss Alvina L. Buquing, Secretary

1967
ANNUAL TYPHOON REPORT

U. S. FLEET WEATHER CENTRAL/
JOINT TYPHOON WARNING CENTER
COMNAVMARIANAS BOX 12
FPO SAN FRANCISCO 96601

FWC/JTWC:ELG:alb
3140
Ser: 05
3 January 1968

From: Commanding Officer, U. S. Fleet Weather Central/Joint Typhoon Warning Center, Guam
To: Chief of Naval Operations
Via: Commander in Chief, U. S. Pacific Fleet

Subj: Annual Typhoon Report, 1967; submission of

Ref: (a) OPNAV Instruction 3140.17E of 29 Oct 65
(b) SECNAV Instruction 5600.16 of 2 Nov 60

1. The Annual Typhoon Report, 1967, is submitted herewith in accordance with reference (a).

2. During calendar year 1967, a total of 20 typhoons, 15 tropical storms and six tropical depressions were detected in the Western North Pacific area between 180 degrees longitude and the Malay Peninsula, north of the equator, for which 957 warnings were issued. FWC/JTWC, Guam was in a "Warning Status" for 185 calendar days. Both the number of warnings issued and the number of days in warning were records over any previous year. 1967 was an unusual year in that tropical cyclone development occurred farther north than normal when compared with previous years. Also, cyclone tracks were noticeably scattered and erratic during the 1967 season as they were in 1966.

3. Reference (a) directed the Fleet Weather Centrals at Pearl Harbor and Alameda to forward summaries of tropical cyclones in their areas to the Fleet Weather Central/Joint Typhoon Warning Center, Guam, for inclusion in the subject report. Fleet Weather Central Alameda issued a total of 422 warnings on five hurricanes, 12 tropical storms and two tropical depressions in their area of responsibility. Fleet Weather Central Pearl Harbor issued a total of 52 warnings on one hurricane and two tropical storms. A summary of tropical cyclones east of 180 degrees longitude is included in Annex A. Position data for tropical cyclones one through eight in Fleet Weather Central Alameda area of responsibility were not available at the time of publication.

4. This report has been reviewed in accordance with reference (b).

J. H. NEGELE

FOREWORD

This report is published annually and summarizes Western North Pacific Tropical Cyclones. Annex A is added to summarize Tropical Cyclones from 180 degrees eastward to the North American Coast.

When directed by CINCPAC in May 1959, CINCPACFLT redesignated Fleet Weather Central Guam as Fleet Weather Central/Joint Typhoon Warning Center (FWC/JTWC), Guam with the following responsibilities:

1. To provide warnings to U. S. Government agencies for all tropical cyclones west of 180 degrees longitude north of the equator to the Asiatic coast and Malayan Peninsula.

2. To determine tropical cyclone reconnaissance requirements and assign priorities.

3. To conduct investigative and post analysis programs including preparation of the Annual Typhoon Report.

4. To conduct tropical cyclone forecasting and detection research as practicable.

Fuchu Air Force Weather Central, coordinating with Fleet Weather Facility Yokosuka was designated as alternate JTWC in case of failure of FWC/JTWC Guam.

The JTWC, which is an integral section of FWC/JTWC Guam, is staffed by three Air Force and three Navy meteorologists and three enlisted men from each service. The senior Air Force Officer has been designated as the Director, JTWC.

The Joint Hurricane Warning Center in Hawaii, a coordinated agency composed of the U. S. Weather Bureau, Honolulu, the Air Force Kunia Weather Center, and Fleet Weather Central Pearl Harbor, is responsible for surveillance and issuance of warnings in the Central North Pacific area north of the equator between 180 degrees and 140 degrees west.

The Fleet Weather Central, Alameda, California, is responsible for issuance of warnings between 140 degrees west and the North American Coast.

TABLE OF CONTENTS

Chapter I		Operational Procedures	
	A.	General	I-1
	B.	Analysis and Data Source	I-1
	C.	Forecast Aids	I-3
	D.	Forecasting Procedure	I-4
	E.	Warnings	I-4
Chapter II		Reconnaissance	
	A.	General	II-1
	B.	Reconnaissance Responsibility	II-1
	C.	Evaluation of Data	II-1
	D.	Communications	II-3
	E.	Summary of Reconnaissance Support	II-6
Chapter III		JTWC Studies	
	A.	A Comparison of Objective Techniques for Typhoon Movement	III- 2
	B.	A Note on the Stage C - "Comma Configuration"	III-13
	C.	Forecasting Development of Tropical Cyclones	III-22
	D.	An Example of Two Vortices Within a Large Tropical System	III-26
	E.	Preliminary Results of Using Reconnaissance Peripheral Height Data to Forecast Typhoon Movement	III-29
		Typhoon Tracks 1965 - 1967	III-31
Chapter IV		Summary of Tropical Cyclones 1967	IV- 1
		1967 Average Forecast Errors	IV- 4
		1967 Forecast Errors (in terms of Closest Distance to Best Track)	IV- 5
		Forecast Error Tabulation - 1967	IV- 6
		Distance Between Operational Warning Posits and Best Track Posits	IV- 7
		1967 Typhoon Tracks	IV- 8
		1967 Tropical Cyclones	IV- 9
		1967 Tropical Storm and Tropical Depression Tracks	IV-11
		Tropical Storms Position Data	IV-12
		Tropical Depressions Position Data	IV-17
Chapter V		Individual Typhoons of 1967	
		SALLY	V- 3
		VIOLET	V- 9
		ANITA	V-19
		BILLIE	V-25
		CLARA	V-31
		ELLEN	V-38

	KATE	V- 45
	MARGE	V- 50
	NORA	V- 57
	OPAL	V- 62
	RUTH	V- 73
	SARAH	V- 81
	WANDA	V- 88
	AMY	V- 95
	CARLA	V-103
	DINAH	V-110
	EMMA	V-122
	FREDA	V-129
	GILDA	V-134
	HARRIET	V-143
Annex A	Summary of Tropical Cyclones in the Eastern North Pacific	AN- 1
	1967 Hurricane Tracks	AN- 3
	1967 Tropical Storm and Tropical Depression Tracks	AN- 4
	Tropical Storms Position Data	AN- 5
	Hurricane CARLOTTA	AN- 8
	Hurricane JEWELL	AN-12
	Hurricane KATRINA	AN-16
	Hurricane LILY	AN-20
	Hurricane PRISCILLA	AN-24
	Hurricane SARAH	AN-28
Appendix A	Abbreviations	AP- 1
	Definitions	AP- 3

A. GENERAL

Operational procedures involve the sequence of events leading to the issuance of tropical cyclone warnings, the chief product of the Joint Typhoon Warning Center (JTWC). This includes analysis of all available data, use of forecast aids to arrive at the forecast track, and preparation and transmission of the warnings. Within the Fleet Weather Central/Joint Typhoon Warning Center (FWC/JTWC), collection and basic analysis of data is the responsibility of the FWC. This includes receipt of analyses and prognosis from Fleet Numerical Weather Facility (FNWF), Monterey through the Naval Environmental Data Network (NEDN). JTWC is responsible for meso-scale analyses, collection of reconnaissance data, making tropical cyclone forecasts, and preparation of warning bulletins. Transmission of the warnings is accomplished by the communications section of FWC, operated by the Naval Communications Station, Guam.

B. ANALYSES AND DATA SOURCES

1. FWC Analyses:

   a. Surface isobaric; 0000Z, 0600Z, 1200Z, and 1800Z.
   b. Surface isobaric, micro-analyses of South China Sea; 0000Z and 1200Z.
   c. Gradient level streamlines; 0000Z, 0600Z, 1200Z and 1800Z.
   d. 850 mb streamlines; 0000Z and 1200Z.
   e. 700 mb streamlines; 0000Z and 1200Z.
   f. 500 mb streamlines; 0000Z and 1200Z.
   g. 200 mb streamlines; 0000Z and 1200Z.
   h. Sea Surface Temperature Charts; 5-day mean and daily.
   i. Checkerboards (Stidd diagrams) of selected tropical stations.
   j. Time cross sections of selected tropical stations.
   k. Selected upper air soundings.
   l. AROWAGRAM for Guam.
   m. Nephanalyses.

2. JTWC Analyses:

   a. Sectional surface charts; hourly and 3-hourly, as required.
   b. Reconnaissance data.
   c. 700 mb meso-scale contours; 0000Z and 1200Z.
   d. 500 mb meso-scale contours; 0000Z and 1200Z.
   e. 300 mb meso-scale contours; 0000Z and 1200Z.
   f. Stidd diagram for selected stations as required when special observations are requested.
   g. 500 mb contour; Western North Pacific; 0000Z and 1200Z.

3. Satellite Data:

JTWC received excellent cloud picture coverage throughout 1967 from the ESSA II and NIMBUS satellites through the APT receiver at FWC. Gridding and display procedures have greatly improved, making these satellite cloud pictures of high value in determining formation, size, and location of tropical cyclones. The daily passes of the APT satellites received at Guam normally cover the majority of the JTWC area. In order to extend the area of coverage, an experimental exchange of satellite pictures between FWC Pearl Harbor, FWC Guam, and FWF Sangley Point over the NEDN transmission lines was begun this year. While quality has been erratic to date, the system has been useful and shows good future possibilities.

The satellite bulletins issued by the National Environmental Satellite Center (NESC) and the gridded cloud picture mosaics also originated by NESC have both been very useful. The latter cover the entire tropical Pacific Ocean and have been transmitted experimentally through the ATS satellite.

4. Land Radar:

Land radar reports are very helpful when tropical circulations are approaching or are over land areas. These reports include range and bearing of the eye from the radar station, eye characteristics, and sometimes the direction and speed of movement of the center.

5. Computer Products from FNWF, 0000Z and 1200Z:

a. Hemispheric analyses and barotropic prognoses (out to 72 hours) for surface (isobaric); 850mb, 700mb, 500mb, 300mb, and 200mb levels (contours); and 700mb, 500mb, and 300mb levels (isotachs).

b. Computer hemispheric contour analyses of 700mb, 500mb and 300mb levels are locally expanded onto large polar projection charts for the Western North Pacific area.

c. Computer analyses and prognoses of wind fields in printed format at 5 degree intervals of longitude and 1 degree intervals of latitude for 700mb and 500mb levels; Western North Pacific.

d. FNWF 500mb decomposition fields, SD, SR, and SL analyses and prognoses which correspond roughly to small scale disturbances, mean flow, and long wave pattern, respectively.

C. FORECAST AIDS

1. Climatology:

The folowing climatological publications were utilized:

a. Tropical Cyclones in the Western Pacific and China Sea Area (Royal Observatory, Hong Kong), covering 70 years of typhoon tracks.

b. Climatological Aid to Forecasting Typhoon Movement (1st Weather Wing).

c. Climatological 24-hour typhoon movement (McCabe, J. T., 1961).

d. Western Pacific Typhoon Tracks, 1950-1959 (FWC/JTWC).

e. Far East Climatic Atlas (First Weather Wing, February 1963).

f. Annual Typhoon Report, 1965 (FWC/JTWC), covering tracks for 1953-1965.

g. Annual Typhoon Report, 1966 (FWC/JTWC), covering tracks for 1965-1966.

2. Persistence:

Extrapolation of tropical cyclone tracks from past positions was always considered along with climatology in making up initial tracks and in making the "first draft", so to speak, of any forecast. Extrapolation has proven to be one of the most reliable techniques for a 12 to 24 forecast period, as shown by the JTWC computer verification program (See Chapter III).

3. Computer Products:

In addition to the computer prognoses detailed in paragraph B.5. above, forecast positions based on steering trajectories at the 1000mb, 700mb, and 500mb levels were available for 6, 12, 18, 24, 36, 48, and 72-hour positions. These steers came from the HATRACK program which is outlined in Chapter III. These forecasts were available from FNWF and were obtained after each fix was received. Toward the end of the 1967 season this computer program was adapted for running on the FWC, Guam computer on a trial basis, thus providing computer steering on a more convenient and timely basis. This should be fully operational for the 1968 typhoon season.

4. Objective Techniques:

During the 1967 typhoon season the following individual objective techniques were used by JTWC:

a. Arakawa - using surface data.

b. Tse - using 700mb data.

See Chapter III for verification of these techniques, along with verification of extrapolation, climatology, and computer steering, using the JTWC computer verification program.

D. FORECASTING PROCEDURE

In preparation for issuance of the initial warning on a tropical cyclone, a track based on climatology and extrapolation is developed for a time period of 3 or 4 days. The track is then modified in accordance with the existing and forecast upper air patterns. Numerical steering forecasts and objective techniques are also considered before the initial warning is issued.

Subsequently, the basic track is modified as dictated by consideration of all forecast aids. For each forecast, extrapolation is checked against climatology, objective techniques, and numerical steering forecasts, with extrapolation being favored for a 12 to 24 hour period. Subjective modifications are also based on meso-analyzed 700mb, 500mb and 300mb charts and on numerical hemispheric prognoses. 200 mb streamline analyses provide indications of divergent areas relating to changes in intensity.

The resulting forecast track is thus a subjective integration of these many factors, with extrapolation and numerical steering being most heavily weighted for short period forecasts, while climatology and forecast flow patterns govern the longer range outlooks.

E. WARNINGS

In the JTWC area of responsibility, tropical cyclone warnings are issued at 0000Z plus every six hours. In accordance with CINCPAC INST. 3140.1H, the warning message contains the position of the tropical cyclone which is valid for the scheduled transmission time. Therefore, the 24-hour and 48-hour forecasts are actually 30-hour and 54-hour forecasts from the last available synoptic data.

The warning position of a tropical cyclone is actually a short range forecast from the last "best" position. The last "best" position is usually about 2 hours old based on land radar or reconnaissance fixes, 3 to 6 hours old based on surface synoptic reports, or 6 to 12 hours old based on upper air synoptic reports. It is for this reason that the 0600Z warning, for example, may not agree with the position of the tropical cyclone as indicated by the 0600Z analysis. Amendments are issued when this difference is significant.

The numbering of tropical cyclone warnings runs consecutively regardless of whether the cyclone is upgraded or downgraded from one stage to another. If warnings are discontinued and the circulation regenerates, the new series of warnings are numbered consecutively from the number of the last warning of the previous series. Amendments and corrections which are issued as required are given the same numbers as the warnings which they amend or correct.

When tropical cyclones become extratropical before dissipating, a final warning is issued by JTWC and extratropical warning responsibility is transferred to the appropriate Fleet Weather Central.

All 24, 48, and 72-hour forecasts made when a tropical cyclone is of tropical storm or typhoon intensity are verified against the "best track" as determined by post-analysis. The 1967 verification summary is contained in Chapter IV.

In addition to the tropical cyclone warnings, JTWC issues a prognostic reasoning twice daily for a 72-hour period for tropical storms and typhoons. A tropical weather summary for the JTWC area of responsibility is issued each day at 0600Z from 1 May through 31 December.

CHAPTER II
RECONNAISSANCE

A. GENERAL

Land stations in the tropical Pacific are sparse. Although additional observing units have been activated during the past year and more are expected to be located at strategic sites in the future, the stations will continue to remain widely scattered. Ships which transmit weather observations are usually concentrated along the shipping lanes which do not pass through the areas of formation and development of tropical systems. Also, ships which are near a tropical cyclone will normally take evasive action as soon as the first warning is received. The pictures from the ESSA and NIMBUS weather satellites have proven to be a tremendous aid, especially in initial detection of suspect areas. However, satellites cannot report the wind, pressure, and other important meteorological parameters needed to properly analyze a tropical cyclone. Aerial reconnaissance thus remains the only method to provide sufficient surface and upper air data for complete and proper analysis of a tropical cyclone.

Reconnaissance aircraft can remain in the vicinity of a storm to provide an accurate position and to report storm characteristics such as eye shape, intensity, and extent of cloud patterns. By taking dropsondes or making ascent or descent soundings, the aircraft obtains the lapse rate profile to the surface, heights of standard levels, sea level pressures, and temperature and dew point at any level.

The accuracy of tropical warnings is directly related to the quality and quantity of reconnaissance data received from the aircraft. Continuous surveillance of tropical systems is of the utmost importance in order to insure that warnings are issued in time to facilitate proper preparations for safeguarding life and property.

B. RECONNAISSANCE RESPONSIBILITY

During 1967 two squadrons were assigned the responsibility of tropical cyclone reconnaissance to meet the requirements of the Joint Typhoon Warning Center, Guam. These squadrons were the U. S. Navy Airborne Early Warning Squadron One (VW1), equipped with the EC121K aircraft based at the Naval Air Station, Agana, Guam and the U. S. Air Force 54th Weather Reconnaissance Squadron (54WRS), equipped with WC-130 aircraft based at Andersen Air Force Base, Guam.

C. EVALUATION OF DATA

During the 1967 season, four fixes per day were normally scheduled on typhoons and tropical storms. Tropical Depressions were

scheduled for one or more fixes per day depending on location, potential, and feasibility of radar coverage.

In general, low (1500ft or below) or intermediate (700mb) level fixes were made by VW1 at 1000Z and 1600Z, and intermediate level fixes were made by the 54WRS at 2200Z and 0400Z. High level (500mb) fixes were made on storms in the vicinity of high terrain. In addition to the fixes, both squadrons flew synoptic and investigative flights throughout the year.

Aerial reconnaissance can be divided, according to data gathered, into three categories: peripheral data, eye data from penetration, and eye data from radar.

Peripheral data is all information reported enroute to and outside the eye of the storm. It includes hydrometeor description, sea level pressure, pressure-height, a complete description of clouds including types, amount and heights of bases and tops, flight altitude winds, temperature, dew point, and surface winds. This same type of data is provided on all synoptic tracks and investigations.

Eye data from penetration includes all information reported in peripheral data plus eye size, shape, description, slope, cloudiness, maximum flight level wind, maximum temperature inside and outside the eye, and maximum surface wind. Remarks which might be of help to the forecaster such as feeder band description, and direction and speed movement of the center are also included.

Eye data from radar provides a description of the radar eye and its location, including description of spiral bands and height and width of the wall cloud. Also included is the aircraft position at the time the radar observation is taken and the maximum observed winds when available.

On all eye messages a center selection evaluation is made. An evaluation of "Positive", "Fair", or "Poor" is given along with an estimate of the navigational accuracy of the fix and the type of navigation used by the aircraft. These were used by JTWC as a guide in evaluating fix accuracy. When radar fixes are made from a considerable distance, attenuation can distort the radar image; therefore, the distance of the aircraft from the storm center must be considered when evaluating the radar fix.

During 1967, daylight penetrations were made on all but a few of the most severe storms. When possible, EC121K aircraft also penetrated the storms for night fixes. Many of the night penetrations were made at 1500 feet or below, especially when the storms were too weak for radar coverage. Location of the circulation center with the aid of the aircraft landing lights was not uncommon when the center could not be determined by other means.

AIRCRAFT RECONNAISSANCE DATA
(Number of Fixes and Investigations)

1961	1962	1963	1964	1965	1966	1967
350	496	465	772	666	674	845* 112 957

* 112 No Credit (see Paragraph E) not included.

In addition there were 484 synoptic tracks flown by the two squadrons during 1967.

The information from the aircraft was continually checked for consistency and accuracy. Where possible, JTWC graphs and other aids were used to check and compare data with previous reports. Verification was immediately requested from the observing aircraft on any apparent discrepancy in the data.

D. COMMUNICATIONS

The primary means of communications between ground stations and reconnaissance aircraft was voice single sideband. Andersen Airways (AIE2), Guam was the primary air to ground station for 54WRS aircraft. The Joint Typhoon Warning Center "Enjoyment" circuit was the primary air to ground station for VW1 aircraft for relay of weather messages. Clark Airways (AIC2), Republic of the Philippines, Fuchu Airways (AIF2), Japan, and Kadena Airways (AID2), Okinawa, were the secondary air to ground stations. Data received by AIE2 were relayed to JTWC by local teletype circuit SDE 9. This circuit also connects VW1, 54WRS, NCS Guam, and Naval Air Station, Agana, Guam. Data received by AIC2, AIF2, and AID2 were relayed to JTWC through the Defense Communications System.

When aircraft were in contact with AIE2 or JTWC "Enjoyment" circuit, reports were normally received by JTWC in sufficient time to allow the forecaster to make a comprehensive study of the information prior to warning time. The extensive use of these two means of communications made it operationally feasible for JTWC to adjust the fix times to two hours prior to warning time vice three hours as in previous years. This provided more current and timely data for the issuance of warnings. However, when the aircraft had to communicate through one of the secondary stations there were many cases of excessive delay in receipt of the eye data. In some instances it was not received until after warning time.

A comparison of the JTWC "Enjoyment" circuit delay times with the next most reliable means, Andersen Airways via the SDE 9 circuit, revealed an average delay time difference of 23 minutes in favor of "Enjoyment".

The average delay time from the aircraft to JTWC direct was 30 minutes. This includes the delay in the aircraft by the meteorologist, and the time for JTWC to copy the complete eye data message. The maximum delay over the JTWC circuit was 3 hours, 41 minutes and the minimum delay just a few minutes. Receipt of the eye data message in less than 10 minutes from fix time was not uncommon when the flight meteorologist expedited the message and communications were good. One of the more noticeable advantages of "Enjoyment" was the elimination of excessive delay in receiving data from remote areas such as the South China Sea. NCS Guam, by using high gain antennas especially suited for receipt of data from particular geographical areas, was able to provide communications with the aircraft even under adverse conditions. Another distinct advantage of direct communications with the aircraft was the ability to clarify doubtful data with minimal delay. Also, relay of the latest meteorological data directly to the flight meteorologist on investigative flights often provided more useful information and permitted the aircraft to remain in the area longer for a thorough investigation, since late information such as satellite readout gave a more exact location of the suspect area.

The constant use of the "Enjoyment" circuit required an excessive number of man hours by JTWC personnel in direct communications with the aircraft and subsequent relay of the weather reconnaissance data through the Defense Communications System. The limited number of personnel assigned to JTWC and the lack of qualified communications personnel precludes the continued use of this system.

A method to improve existing communications and also preclude the need for additional personnel to work the "Enjoyment" circuit was requested by JTWC to CINCPAC. If approved, the 54WRS weather monitor would be tasked with the processing and retransmission of all RAINPROOF VW1 weather reconnaissance observations. In addition, discrete frequencies would be assigned for the relay of weather reconnaissance observations to preclude preemption by other airways traffic.

The addition of a telephone line from Andersen Airways to JTWC with the associated monitoring equipment has been approved. This will enable JTWC to monitor incoming weather reconnaissance data simultaneously with the receipt by the 54WRS weather monitor and provide direct phone patch capability with the reconnaissance aircraft when required.

The following statistics show the delays between time of fix and time of first receipt at JTWC. The methods used in getting the fix to JTWC are shown for comparison.

DELAY IN RECEIPT OF RECONNAISSANCE FIX DATA FOR 1967

METHOD	NUMBER OF CASES	MAX DELAY TIME	MIN DELAY TIME	AVG DELAY TIME
SDE9	346	2 HR 44 MIN	0 HR 18 MIN	0 HR 52 MIN
ENJOYMENT	460	3 HR 41 MIN	0 HR 04 MIN	0 HR 30 MIN
OTHER	70	11 HR 20 MIN	0 HR 05 MIN	1 HR 24 MIN

Table II-1 contains some revealing statistics on communications delays encountered in 1967 along with figures from previous years for comparison.

A COMPARISON OF DELAY TIME WITH PREVIOUS YEARS

	1964	1965	1966	1967
MAX DELAY TIME	60 HRS 45 MIN	60 HRS 09 MIN	4 HRS 33 MIN	11 HRS 20 MIN
AVG DELAY TIME	1 HR 14 MIN	1 HR 05 MIN	1 HR 02 MIN	0 HR 43 MIN
MIN DELAY TIME	8 Minutes	9 Minutes	"Few Minutes"	"Few Minutes"
% OF EYE MESSAGES DELAYED MORE THAN 1 HOUR	59%	39%	38%	16%
NUMBER OF FIXES RECEIVED AFTER WARNING TIME	46	34	30	23*
% RECEIVED AFTER WARNING TIME	8%	6%	5%	3%*

* 1967 FIXES SCHEDULED 2 HOURS VICE 3 HOURS PRIOR TO WARNING TIME PRIOR TO 1967.

TABLE II-1

E. SUMMARY OF RECONNAISSANCE SUPPORT

In an effort to make the crediting of the reconnaissance effort more objective and meaningful, a system was devised in 1965 to credit fixes and investigations. The same system, with minor changes, was used during the 1966 and 1967 seasons. First of all, the problems of why a fix was early, late or missed completely, although of interest and concern to JTWC, belong to the Tropical Cyclone Reconnaissance Coordinator (TCRC). The time of warning and inherent delay from scheduled fix times were the determining factors used in the crediting scheme. Obviously, it would be desirable to have the fix made as near warning time as possible, and in the past it was necessary to have the fix times scheduled 3 hours prior to warning time because of communications delays. However, more rapid communications during 1967 permitted JTWC to adjust these fix times to 2 hours prior to warning time. This usually allowed ample time to digest the information after receipt of the data. The crediting system is described below.

DEFINITIONS OF FIX CREDITS

CLASS	DEFINITION	FIX CRITERIA
1	Full Credit	From 1 hour before to ½ hour after levied time.
2	Full Credit	Aircraft in area requested within 1 hour before to ½ hour after levied time but unable to locate a center.
3	Early/Late	Center located 1 to 1½ hours before or ½ to 2 hours after levied time.
4	Very Early/Very Late	Greater than 1½ hours before or more than 2 hours after levied time.
5	Attempted but missed fix	Recon provided some useful peripheral data but no fix was made. Reasons may include clearance problems, mechanical trouble, low fuel, etc.
6	Missed Fix	Missed fixes not falling into any category above.
7	Full Credit	Fix made on investigative flight or synoptic track.
8	Full Credit	Investigative flight, no fix made.
9	No Credit	Preliminary or intermediate fix made between scheduled fixes.

This system, although as objective as possible, requires subjective evaluation of some fixes. For example, an aircraft could be in the area assigned on time, but unexpected storm acceleration could make the cyclone too distant to be reached within normal fix time limits. In this case, full credit is given with no penalty for being late.

Applying the above system for the 1967 season, the following statistics are obtained:

EVALUATION OF TIMELINESS OF RECONNAISSANCE FOR 1967

Class	Number
1	668
2	24
3	17
4	12
5	4
6	12
7	43
8	77
9	112

This Chapter is a collection of studies conducted during the 1967 typhoon season. Some topics appear in their entirety. Other topics are of a continuing nature and will be completed when data becomes available.

The following is a list of the topics discussed in this Chapter:

A. A COMPARISON OF OBJECTIVE TECHNIQUES FOR TYPHOON MOVEMENT.

B. A NOTE ON THE STAGE C - "COMMA CONFIGURATION."

C. FORECASTING DEVELOPMENT OF TROPICAL CYCLONES.

D. AN EXAMPLE OF TWO VORTICES WITHIN A LARGE TROPICAL SYSTEM.

E. PRELIMINARY RESULTS OF USING RECONNAISSANCE PERIPHERAL HEIGHT DATA TO FORECAST TYPHOON MOVEMENT.

A. A COMPARISON OF OBJECTIVE TECHNIQUES FOR TYPHOON MOVEMENT

1. Introduction

Few statistics have been compiled concerning the merits of various forecast methods under operational conditions for tropical cyclones in the Pacific. If a number of forecasts are prepared at a given synoptic time using different methods, the Typhoon Duty Officer (TDO) is confronted with a wide divergence of forecast tracks. Unless it is known which technique is superior in a given situation, little or no weight can be given to any of the objective systems. With this in mind, a study was undertaken to evaluate a large number of objective forecasting techniques for tropical cyclones under operational conditions using numerical methods.

Two sets of logs were maintained on all storms. These logs were prepared to facilitate using numbered codes for all entries. The Best Track log was completed following each tropical cyclone, figure III-1A. The Best Track of a cyclone is a post-analyses summary giving cyclone locations, intensities, and directions and speeds of movement. As the various forecasts were made, the 24 Hour Objective Forecast log was filled out by the TDO, figure III-1B. The logs were double checked for accuracy and the data were cut on Hollerith machine cards. The data card information was read into the computer, processed and printed using the online printer.

A simplified flow diagram of the verification program is depicted in figure III-2. The program is such that one or multiple storms may be run at any one time. Examples of the two printouts produced by the program are shown in figure III-3. The first printout, figure III-3A, gives a summary for each individual tropical cyclone. For each individual technique the following information is listed: the verification time, the vector error from the Best Track position to the forecast position, and the average 24 hour forecast error. The second printout, figure III-3B, provides a summary for all the cyclones plus a stratification of the storms by intensity.

To enable a direct comparison of the various objective techniques with the official forecast under operational conditions, the following procedures were incorporated. The verification times were chosen as 0600Z and 1800Z to facilitate using the latest 0000Z and 1200Z upper air charts. Therefore, in terms of upper air charts, a 24 hour forecast is actually a 30 hour forecast. Reconnaissance fixes are normally taken two hours prior to warning time (0400Z, 1000Z, 1600Z and 2200Z). After receipt of the fix at JTWC, this fix position is extrapolated out for a period of two hours. The extrapolated position is then used on the 0000Z, 0600Z, 1200Z and 1800Z warnings. This extrapolated position was

also used as a base for the various objective techniques. Therefore, in terms of reconnaissance fixes, a 24 hour forecast is in reality a 26 hour forecast--two hour extrapolation plus the 24 hour objective forecast. All intensities of tropical cyclones were verified (tropical depressions, tropical storms and typhoons).

2. Discussion of Forecast Techniques Tested

A brief summary of the forecasting techniques tested follows and are not listed in order of performance.

a. JTWC - The official Joint Typhoon Warning Central, Guam, forecast. It was used for comparison purposes only.

b. Tse [1] - A method which incorporates the 700 mb synoptic pattern into the forecast scheme. The differences in the 700 mb contour height north-south and east-west are used as the predictors. A nomogram is then entered to give the 24 hour forecast position.

c. Arakawa [2] - The Arakawa technique uses regression equations to forecast 24 and 48 hour movement plus intensities. Using a grid overlay, pressures on the latest surface chart are transferred to a worksheet. Simple computations result in the forecast positions.

d. Climatology - The assumption made using this procedure is that a given storm will move the mean direction and speed of all typhoons that have been located at approximately the same latitude and longitude during that month of previous years. Climatological charts used in this study were compiled by Chin [3] .

e. Extrapolation - Extrapolation is a semi-objective method by which the forecast track is determined using past values of speed, direction and intensity.

f. Monterey 500 mb HAT - Numerical steers obtained from Fleet Numerical Weather Facility (FNWF), Monterey, California, over the computer data line. The program, called HAT, was written by FNWF personnel and uses a grid surrounding the tropical cyclone. The 500 mb barotropic height prognosis is heavily smoothed in the area surrounding the storm. The cyclone is treated as a point vortex and is advected in one hour time steps up to a forecast period of 72 hours.

g. Monterey 1000 mb P - Numerical steers obtained from a program called HATRACK. The program was written by Lcdr. B. L. Bradford and Lt. G. A. Brearton at FNWF and is still considered to be experimental in nature. There are two versions of the program, the first using SR prognostic fields and the second using SR analyses fields. SR fields [4] are constant level data

fields in which the small scale disturbances are smoothed out. The storm is advected as a point vortex on the SR field in six hour time steps up to a forecast period of 72 hours. The output steer message gives the following information: (1) name and/or number of the tropical cyclone, (2) date time group of the analysis or forecast field used, (3) time and position of initial request and (4) time, position, and movement vector for each six hour forecast period. A sample output message is shown in figure III-4. Steers were provided at the 1000, 700 and 500 mb levels, however, the program can be modified to use any standard level up to and including 100 mb. The Monterey 1000 mb P technique provides steers using 1000 mb prognostic SR fields.

h. Monterey 700 mb P - Numerical steers using 700 mb prognostic SR fields.

i. Monterey 700 mb A - Same as item "h" except analyses fields are used for the steers.

j. Monterey 700 mb P Modified - A modification of the Monterey 700 mb P technique using history errors. A detailed description of how history errors were applied is contained in part 3.

k. Monterey 500 mb P - Numerical steers using 500 mb prognostic SR fields.

l. Monterey 500 mb A - Same as item "k" except analyses fields are used for the steers.

m. Monterey 500 mb P Modified - A technique similar to item "j" except 500 mb prognostic SR fields are utilized in the steers.

n. Monterey 700 mb A Modified - A method similar to item "j" except analyses rather than prognostic SR fields are used. This technique was used operationally near the end of the typhoon season because of its timeliness. The prognostic SR steers, although resulting in superior forecasts, were often not available unitl after the tropical cyclone warnings were issued.

3. Description of the Monterey SR Modified Technique

In the pursuit of developing a technique for the improvement of the SR forecasts, a method developed by Hardie [5] was tested and with slight modifications was used. In using a history modification, the assumption is made that forecast errors made in the past will continue to occur in the future. The use of a history modification technique is justified in that it corrects for use of the wrong steering level, use of geostrophic rather than actual wind, and errors that have occurred in the prognostic and analyses fields. A vector diagram depicting the modification tech-

nique is shown in figure III-5.

4. Testing and Results

The procedures outlined in the previous sections were incorporated to predict the 24 hour movement of the 1967 tropical cyclones in the JTWC area of responsibility. The figures in the tables give average forecast errors in nautical miles and the number of cases used to compute the averages in parenthesis. Direct comparisons between the various forecasting techniques are difficult as the sample size was not homogeneous and the life cycle of the storms tested was not always the same. However, all statistics and comparison figures were made using the same cyclones in the sample. When a specific technique was not doing well in comparison with others, a different technique was substituted in its place, therefore, sample sizes vary considerably. Official forecast verification figures are included in all tables for comparison purposes.

Table III-1A depicts three objective techniques--Tse, Arakawa, and Climatology. The Tse technique, although forecasting direction of movement fairly well, appeared to be consistently slow in speed of movement. The Arakawa forecasts did exceptionally well when the atmosphere was vertically consistent up to 500 mb, however, in cases where vertical consistency did not exist, large forecast errors occurred. Although Climatological forecast errors were larger than any other technique, it still proved to be very useful in the lower latitudes where, frequently, insufficient data was available to use the other techniques to advantage.

Evaluation of the Monterey 500 mb HAT Steers, table III-1B, were discontinued early in the season after ascertaining that the new Monterey HATRACK steers were doing much better in comparison.

Extrapolation, as shown by table III-1C, proved to be one of the best short range forecasting techniques available. However, being a semi-objective method, a direct correlation exists between forecast errors and forecaster experience. In addition, in the Pacific region, upper air measurements are sparse and in many cases non-existent regardless of the geographical location of the tropical cyclone. Therefore, in most cases, "educated" extrapolation will result in superior verifications when compared with other techniques that require accurate upper air analyses.

As was previously mentioned in section 2, in most cases the Monterey SR prognostic steers were not available until after the 06Z and 18Z warnings were issued. The prognostic steers were available for use in issuing the 00Z and 12Z warning, however, verification figures were not made at those times. Verification results of the Monterey prognostic steers, given in table III-1D, indicate that overall, the 700 mb level was the best single steering level by a considerable amount.

A comparison of Monterey steers using analyses versus prognostic fields is shown in table III-1E. the improvement in the forecasts using prognostic over analyses steers was near 17 miles, however the number of cases involved was relatively small.

The application of the history correction as describe in section 3, showed considerable improvement in the Monterey steers. As noted in table III-1F, average errors decreased from 148 to 120 miles for the 700 mb level and 181 to 131 miles for the 500 mb level. It seems reasonable that this type of correction could be applied to other objective forecasting techniques, thereby decreasing forecast errors.

Late in the typhoon season, after determination of the best steering level and how to best apply the history correction, the Monterey 700 mb A Modified technique was tested under operational conditions. Although the number of cases was again relatively small, the results, table III-1G, were comparable in accuracy to the JTWC forecast.

5. Concluding Remarks

Of the 14 tropical cyclone steering methods tested, four showed superior verifications. These were the Monterey 700 mb P Modified, Monterey 700 mb P, extrapolation and Monterey 700 mb A Modified.

If the prognostic SR steers can be made available prior to the issuance of the official warning, they will be of considerable value as an easily used and highly accurate forecasting aid. In addition, use of the history modification technique further reduces the forecast errors by a significant amount. Until such time as prognostic SR steers are available, the history modified analyses SR steers provide one of the best objective forecasting techniques available.

Several limitations of the SR steers were noted during the 1967 season. If the tropical cyclone is of considerable size, greater than 800 miles in diameter, it appears that the SR fields are not sufficiently smoothed. The end result is that the cyclone is steered around its own circulation. A second limitation occurs when the cyclone location is south of 10 degrees north latitude. It is felt that the poor steers resulting in these cases were associated with the treatment of the coriolis parameter in the lower latitudes.

REFERENCES

1. S.Y.W.Tse, "A New Method for the Prediction of Typhoon Movement Using the 700 mb Chart", Quarterly Journal of the Royal Meteorological Society, vol. 92, No. 392, April 1966, pp. 239 - 253.

2. H. Arakawa, "Studies on Statistical Prediction of Typhoons", National Hurricane Research Project Report No. 61, U. S. Weather Bureau, April 1963, 15 pp.

3. P. C. Chin, "Tropical Cyclones in the Western Pacific and China Sea from 1884 to 1953", Royal Observatory Hong King, 94 pp.

4. R. E. Huges, "Fleet Numerical Weather Facility, Monterey, California, Technical Note 21", July 1966.

5. J. S. Hardie, "Tropical Storm Steering Using Geostrophic Winds Derived from Smoothed 700 mb and 500 mb Height Fields", Masters' thesis, Department of Meteorology and Oceanography, Naval Postgraduate School, Monterey, California, 1967.

BEST TRACK LOG

3	YEAR	36_	36_	36_	36_
2	CYCLONE #	_ _	_ _	_ _	_ _
2	MONTH	_ _	_ _	_ _	_ _
4	DTG	_ _00	_ _06	_ _12	_ _18
3	LATITUDE	_ _ _	_ _ _	_ _ _	_ _ _
3	LONGITUDE	_ _ _	_ _ _	_ _ _	_ _ _
3	DIRECTION OF MVMT	_ _ _	_ _ _	_ _ _	_ _ _
2	SPEED OF MVMT	_ _	_ _	_ _	_ _
3	MAX WND SPEED	_ _ _	_ _ _	_ _ _	_ _ _

A

24 HR OBJECTIVE FORECAST LOG

3	YEAR		56_	56_	56_	56_
2	CYCLONE		_ _	_ _	_ _	_ _
2	MONTH		_ _	_ _	_ _	_ _
4	DTG		_ _06	_ _18	_ _06	_ _18
3	JTWC	LAT	_ _ _	_ _ _	_ _ _	_ _ _
3		LONG	_ _ _	_ _ _	_ _ _	_ _ _
3	TSE	LAT	_ _ _	_ _ _	_ _ _	_ _ _
3		LONG	_ _ _	_ _ _	_ _ _	_ _ _
3	ARAKAWA	LAT	_ _ _	_ _ _	_ _ _	_ _ _
3		LONG	_ _ _	_ _ _	_ _ _	_ _ _
3	CLIMATOLOGY	LAT	_ _ _	_ _ _	_ _ _	_ _ _
3		LONG	_ _ _	_ _ _	_ _ _	_ _ _
3	MTRY 700 PROG M	LAT	_ _ _	_ _ _	_ _ _	_ _ _
3		LONG	_ _ _	_ _ _	_ _ _	_ _ _
3	MTRY 500 ANAL	LAT	_ _ _	_ _ _	_ _ _	_ _ _
3		LONG	_ _ _	_ _ _	_ _ _	_ _ _
3	EXTRAPOLATION	LAT	_ _ _	_ _ _	_ _ _	_ _ _
3		LONG	_ _ _	_ _ _	_ _ _	_ _ _
3	MTRY SFC PROG	LAT	_ _ _	_ _ _	_ _ _	_ _ _
3		LONG	_ _ _	_ _ _	_ _ _	_ _ _
3	MTRY 700 PROG	LAT	_ _ _	_ _ _	_ _ _	_ _ _
3		LONG	_ _ _	_ _ _	_ _ _	_ _ _
3	MTRY 500 PROG	LAT	_ _ _	_ _ _	_ _ _	_ _ _
3		LONG	_ _ _	_ _ _	_ _ _	_ _ _

B

* All fcsts based on 00Z and 12Z charts and extrapolated an additional 6 hrs to conform with our 24 hr fcst.

** All latitudes and longitudes in 10ths of deg.

Figure III-1 JTWC logs

FLOW DIAGRAM FOR 24 HOUR OBJECTIVE TECHNIQUES VERIFICATION PROGRAM

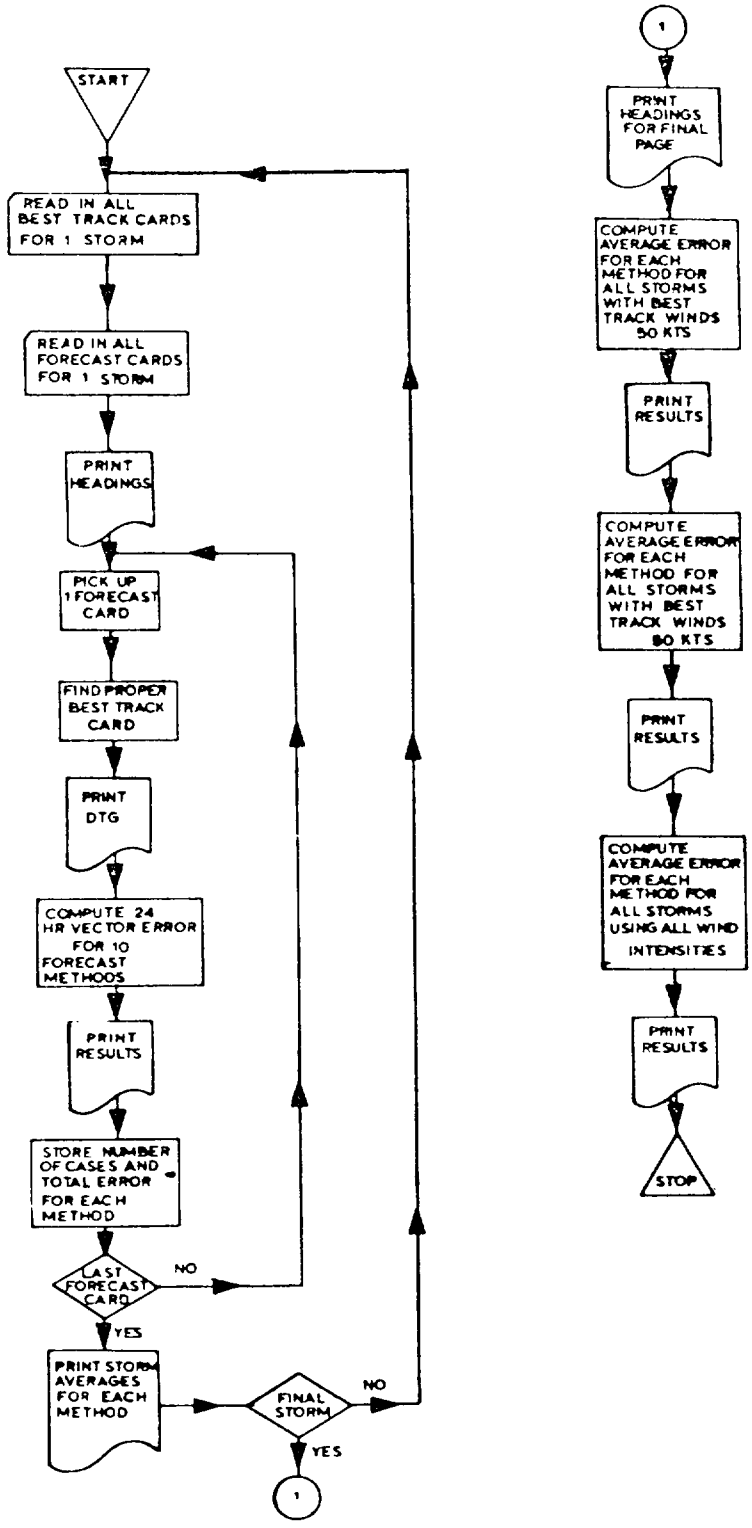


Figure III-2 Computer flow diagram of 24 hour objective techniques verifications program.

24 HOUR OBJECTIVE TECHNIQUES VERIFICATION DATA
TROPICAL CYCLONE 32

DTG	JTWC DEG DIST	MTRY 7 AM DEG DIST	MTRY 5 PM DEG DIST	MTRY 7 A DEG DIST	MTRY 7 PM DEG DIST	MTRY 5 A DEG DIST	EXTRAP DEG DIST	MTRY 1 P DEG DIST	MTRY 7 P DEG DIST	MTRY 5 P DEG DIST
290600Z	267--102	--------	--------	345-- 24	--------	057-- 60	--------	263--132	199-- 36	104-- 90
291800Z	295--192	313--126	277--132	326--108	281--144	060--114	295--192	284--240	281-- 90	0[illegible]4-- 12
300600Z	350--138	347-- 84	052--102	344--132	003--120	--------	357--120	295--318	332--12[illegible]	068--138
301800Z	018--276	014--102	007--114	355--156	335-- 84	063--192	039--198	299--294	329--1[illegible]2	0[illegible]1--192
010600Z	015-- 72	050-- 54	277-- 48	360-- 48	314-- 24	098-- 78	295--108	290--288	308--102	077--126
011800Z	099--102	110--186	123--108	094--150	121--156	107--240	099--204	266-- 78	110-- 48	097--192
020600Z	078--240	077--150	090--186	076--186	077--150	094--306	078--240	049-- 72	077--12[illegible]	093--300
021800Z	090--288	081--150	083--132	079--210	061--144	091--324	078--138	05[illegible]--120	073--156	087--300
030600Z	108--108	086-- 72	019-- 54	078--240	093-- 90	079--270	103--108	081--174	074--223	07[illegible]--270
031800Z	136--138	165--114	153--156	094--210	160--138	096--270	150--180	095--120	089--174	090--270
040600Z	168--144	176-- 96	180-- 54	120--234	205-- 72	115--270	168--144	150--144	116--156	099--270
041800Z	188-- 48	171-- 84	230-- 54	138--198	196-- 42	118--258	234-- 30	178--180	133--144	105--252
050600Z	293-- 54	240--150	258--186	180--204	250--216	146--192	238--234	209--318	186--174	134--168
051800Z	149--102	219--102	174--132	187--258	187--102	152--240	149--102	221--408	190--258	160--234

		MILES
1.	JTWC AVERAGE ERROR	143
2.	MTRY 700 ANAL MOD AVERAGE ERROR (OPER)	113
3.	MTRY 500 PROG MOD AVERAGE ERROR	112
4.	MTRY 700 ANAL AVERAGE ERROR	168
5.	MTRY 700 PROG MOD AVERAGE ERROR	114
6.	MTRY 500 ANAL AVERAGE ERROR	217
7.	EXTRAPOLATION AVERAGE ERROR	153
8.	MTRY 1000 PROG AVERAGE ERROR	206
9.	MTRY 700 PROG AVERAGE ERROR	141
A 10.	MTRY 500 PROG AVERAGE ERROR	201

OBJECTIVE TECHNIQUES VERIFICATION SUMMARY FOR ENTIRE YEAR

A. MAXIMUM WINDS LESS THAN 50 KNOTS

		MILES	CASES
1.	JTWC AVERAGE ERROR	135	10
2.	MTRY 700 ANAL MOD AVERAGE ERROR (OPER)	130	5
3.	MTRY 500 PROG MOD AVERAGE ERROR	117	2
4.	MTRY 700 ANAL AVERAGE ERROR	123	8
5.	MTRY 700 PROG MOD AVERAGE ERROR	132	2
6.	MTRY 500 ANAL AVERAGE ERROR	156	6
7.	EXTRAPOLATION AVERAGE ERROR	142	8
8.	MTRY 1000 PROG AVERAGE ERROR	185	8
9.	MTRY 700 PROG AVERAGE ERROR	112	7
10.	MTRY 500 PROG AVERAGE ERROR	132	7

B. MAXIMUM WINDS 50 KNOTS OR GREATER

		MILES	CASES
1.	JTWC AVERAGE ERROR	119	76
2.	MTRY 700 ANAL MOD AVERAGE ERROR (OPER)	133	72
3.	MTRY 500 PROG MOD AVERAGE ERROR	144	47
4.	MTRY 700 ANAL AVERAGE ERROR	157	68
5.	MTRY 700 PROG MOD AVERAGE ERROR	124	47
6.	MTRY 500 ANAL AVERAGE ERROR	203	67
7.	EXTRAPOLATION AVERAGE ERROR	135	67
8.	MTRY 1000 PROG AVERAGE ERROR	178	54
9.	MTRY 700 PROG AVERAGE ERROR	140	59
10.	MTRY 500 PROG AVERAGE ERROR	187	58

C. AVERAGE FOR ALL WIND INTENSITIES

		MILES	CASES
1.	JTWC AVERAGE ERROR	121	86
2.	MTRY 700 ANAL MOD AVERAGE ERROR (OPER)	133	77
3.	MTRY 500 PROG MOD AVERAGE ERROR	143	49
4.	MTRY 700 ANAL AVERAGE ERROR	153	76
5.	MTRY 700 PROG MOD AVERAGE ERROR	124	49
6.	MTRY 500 ANAL AVERAGE ERROR	199	73
7.	EXTRAPOLATION AVERAGE ERROR	136	75
8.	MTRY 1000 PROG AVERAGE ERROR	179	62
9.	MTRY 700 PROG AVERAGE ERROR	137	66
B 10.	MTRY 500 PROG AVERAGE ERROR	181	65

Figure III-3 24 hour objective techniques verification program printouts.

```
FM COMPUTER CNTR
TO JTWC
TROPICAL CYCLONE STEERING
EXPERIMENTAL       ANAL
G39 GILDA
ANAL TIME    00181167
LEVEL      700MBS
12181167     243N 1207E  3604
18181167     248N 1206E  0004
00191167     253N 1207E  0104
06191167     258N 1208E  0204
12191167     263N 1210E  0204
18191167     268N 1212E  0306
00201167     273N 1216E  0306
06201167     279N 1220E  0406
12201167     285N 1225E  0408
18201167     291N 1231E  0508
00211167     297N 1238E  0508

LEVEL      500MBS
12181167     243N 1207E  0615
18181167     250N 1221E  0715
00191167     257N 1238E  0717
06191167     263N 1257E  0719
12191167     270N 1278E  0721
18191167     276N 1301E  0823
00201167     280N 1328E  0925
06201167     282N 1356E  0927
12201167     280N 1387E  1029
18201167     278N 1420E  1031
00211167     272N 1455E  1033
```

Figure III-4 Monterey computer steer message.

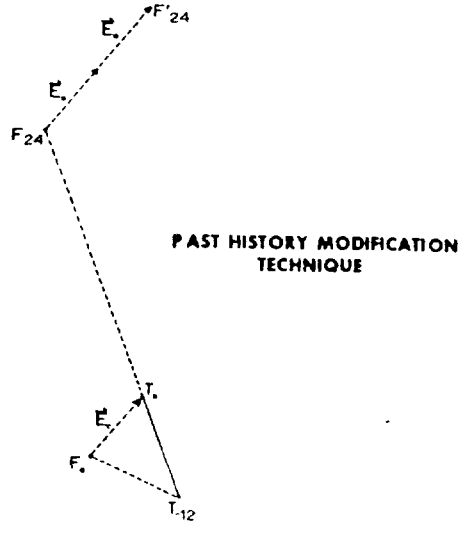


Figure III-5 24 hour history modification technique.

T_o= Present position of storm from latest JTWC warning

T_{-12}= Position of storm 12 hours previous from reconnaissance reports

F_o= Forecast position of storm from position T_{-12}

E'_o= Vector error for previous 12 hour forecast

F_{24}= 24 hour forecast position from T_o

F'_{24}= 24 hour forecast position of storm with 2 times the past 12 hour vector error applied

Tse, Arakawa and Climatology

Official----------166 (193)
Tse----------189 (189)
Arakawa----------198 (155)
A Climatology----------212 (149)

Monterey 500 MB Hat

Official----------1 5)
B Monterey 500 mb Hat----------1 +0)

Extrapolation

Official----------152 (279)
C Extrapolation----------151 (268)

Monterey Prognostic (P) Steers

Official----------159 (234)
Monterey 1000 mb P----------192 (210)
Monterey 700 mb P----------153 (209)
D Monterey 500 mb P----------173 (200)

Monterey 700 MB and 500 MB Anal (A) Steers
vs
Monterey 700 MB and 500 MB Prog (P) Steers

Official----------121 (86)
Monterey 700 mb A----------153 (76)
Monterey 700 mb P----------137 (66)
E Monterey 500 mb A----------199 (73)
Monterey 500 mb P----------181 (65)

Monterey 700 MB and 500 MB Prog (P) Steers
vs
Monterey 700 MB and 500 MB Prog (P) Modified Steers

Official----------153 (173)
Monterey 700 mb P----------148 (163)
Monterey 700 mb P Modified----------120 (128)
Monterey 500 mb P----------181 (160)
F Monterey 500 mb P Modified----------131 (128)

Monterey 700 MB Anal (A) Steers
vs
Monterey 700MB Anal (A) Modified Steers

Official----------118 (75)
Monterey 700 mb A----------154 (65)
G Monterey 700 mb A Modified----------126 (65)

Table III-1 24 hour objective techniques verification figures.

B. A NOTE ON THE STAGE C - "COMMA CONFIGURATION"

MAJOR ROBERT W. FETT, USAF
54th Weather Reconnaissance Squadron
Andersen AFB, Guam, Mariana Islands

Numerous examples have been collected which testify to the general validity of the model of tropical cyclone formation described by the author in 1964 [1] . (See figure III-6). Two examples showing a Stage B and a Stage C "Comma Configuration" are displayed in figures III-7 and III-8 respectively. Maximum wind speeds reported for the Stage B depression in the Gulf of Mexico were 20 knots and for the formative stage of Marie shown in figure III-8 reported values of 30 knots were obtained. These values are in excellent agreement with the model shown in figure III-6.

In figure III-9 an example of a storm which does not fit the model is shown. Pronounced banding of low cloudiness north of the major overcast area suggests a center of circulation very near 27.8N and 60.3W. This position is on the edge of the bright overcast cloudiness. The center is embedded by less than 1/2 degree within the overcast cloudiness and hence the storm cannot be classified as to intensity according to the scheme of Timchalk, Hubert and Fritz [2] . The storm can be classified as an intense example of a Stage C+ "Comma Configuration". However, maximum wind speed reported by reconnaissance within one hour of the pictures was 70 knots, a value not at all in keeping with the storm's apparent formative structure.

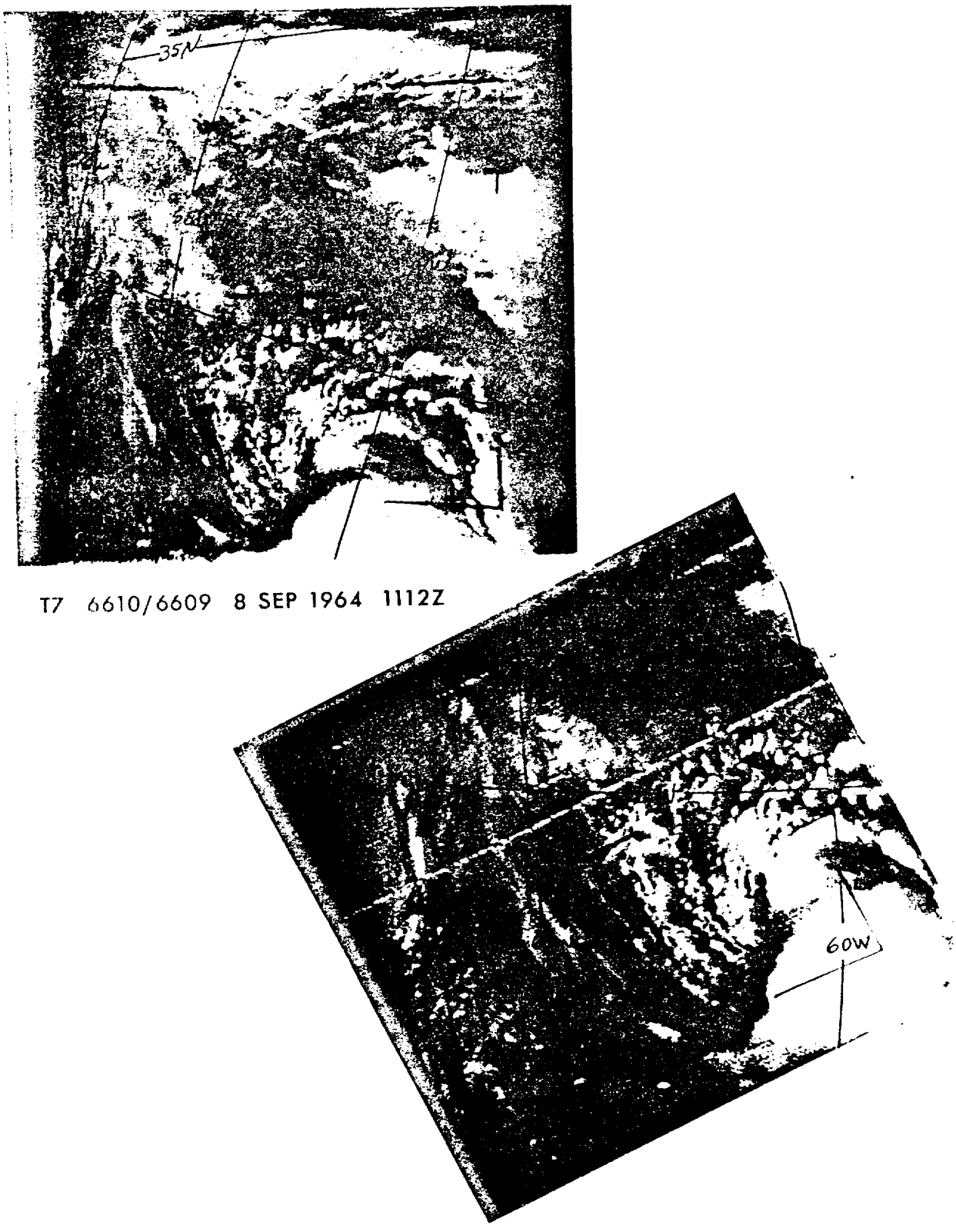
A few examples of similar storms with unusually high winds have been noted during the past several years of satellite observations. Until now these storms have been considered oddities and no explanation has been suggested to account for the deviation from the normal pattern.

On the 5th of July 1967 the author flew a reconnaissance mission into what was thought to be a formative tropical cyclone. ESSA II pictures of the storm (Billie) on July 4, 1967 at 2320 GMT are shown in figure III-10. The center of circulation of the storm is apparent on the north side of overcast cloudiness near 16.5N, 128E. The storm has the appearance of a Stage C, Comma Configuration and therefore maximum winds of about 30 knots were anticipated. Instead, as the aircraft approached the center, wind speeds of 70 to 80 knots were suddenly encountered. The "eye" of the storm was formed by swirling masses of flattened cumulus and stratocumulus. A picture of the eye taken by the author on 5 July at 0330 GMT is shown in figure III-11. The aircraft's altitude was 10,200 feet. Tops of these clouds were about 4,000 feet. In the area of the eye, no higher cloudiness and certainly no wall cloud in the conventional sense existed. All convective cloudiness of importance lay at least 30

miles to the south of the storm's center. Yet the storm had a very definite warm core. On the first penetration on July 4th at 2120 GMT, temperatures at the 726 mb level rose from values of 14.1°C a few miles away from the eye to a value of 17.2°C directly over the eye. On the second penetration on July 5th at 0330 GMT at 700 mbs temperature rose from values of 13.5°C a few miles outside of the eye to a value of 18.5°C directly over the eye. The temperature rises were noted as the aircraft flew over the eye in perfectly clear, cloud-free conditions. This, then was the key to an understanding of why the storm was so intense. Somehow it had become "warm-core" without ever developing a wall-cloud. Turning back to figure III-9 it can be seen that the eye of this storm was also apparently formed only by low cloudiness. Note the shadow of upper-cloudiness falling on the low clouds which swirl about the eye.

How can a warm core be established in a storm which does not have a wall-cloud? The obvious answer is through forced descent of upper-tropospheric air into the storm's center, resulting in warming through compression. The storm could not have become warm core through ascending motion and release of latent heat near the eye. Any upward motion in such a moist environment would surely have produced significant cloudiness of great vertical development and this was not observed. On the contrary, low cloudiness present was flattened and suppressed. What mechanism could cause forced descent of upper tropospheric air into the narrow region around the eye? A most probable answer is low level divergence. If the winds about the storm center (which we may assume was initially cold core) were through some mechanism to become super-gradient, then cyclonic outflow and evacuation of air would occur from the storm center at low levels. Descending air from higher levels would be required by continuity followed by warming through compression. A lowering of pressure would occur because of the warming and the pressure gradient force into the storm center would be increased. Winds now swirling about the storm center would suddenly become sub-gradient and converge toward the storm center. But by conservation of angular momentum as they converged toward the center their speeds would increase until they were again super-gradient. In this manner pulsating between super-gradient and sub-gradient wind speeds would gradually increase until some upper limit was reached and steady state attained. Based on the sample of storms viewed over the past several years including three storms similar to Billie which the author has flown into, this upper limit appears to be about 70 to 80 knots. Storms of greater intensity invariably have a wall-cloud over a large segment around the eye.

It is easily seen why storms which do have a wall-cloud can become more intense. The upper limit in a storm of the Billie variety is necessarily prescribed by the temperature of the undisturbed high level tropospheric air drawn down into the eye. Higher temperatures in storms with wall-clouds must be attributed to forced warming of air already



T7 6610/6609 8 SEP 1964 1112Z

Figure III-9

Figure III-10

Figure III-11

C. FORECASTING DEVELOPMENT OF TROPICAL CYCLONES

A method to forecast formation of Tropical Cyclones was formulated using conventional synoptic data and local APT cloud pictures. 200 mb synoptic data were used to determine potential development 72 hours in advance and surface and 700 mb data were used to forecast development in 48 hours or less. The four basic types of formation in this method are:

1. Type 1A: Vortex in the Intertropical Convergence Zone (ITC) or in the basic easterly low level wind flow during the summer.

2. Type 1B: Vortex in the low level southwesterly monsoon during summer.

3. Type 2: Vortex embedded in the basic southerly low level "feeding" into another storm, during summer.

4. Type 3: Vortex in the ITC or in the basic easterly low level wind flow during winter.

The following methods were used to forecast formation.

1. 72 hour outlook:

a. If Mid-Pacific Trough or other major troughs at 200 mbs are absent west of 175E: Typhoon formation unlikely: Only type 1B in the South China Sea and type 2 which is relatively rare should occur.

b. If Mid-Pacific Trough is present north of 15N, Type 1A formation possible during summer in an area between 25N - 15N and 135E - 170E.

c. If Mid-Pacific Trough is present south of 15N, Type 1A formation possible during summer in an area between 15N - Equator and 135E - 175E. Type 3 formation possible during winter in an area between 10N - Equator and 135E - 160E.

2. 24 to 48 hour forecast:

a. Inspect current surface streamline analysis and locate lows of the 4 types:

(1). During summer:

(a). Type 1A vortex embedded in the easterlies south of 15N.

(b). Type 1B (in the South China Sea) vortex embedded in the low level southwest monsoon flow with easterlies to the north of it.

(c). Type 2 vortex to the east or south of a typhoon.

(2). During winter:

(a). Type 3 vortex embedded in the easterlies south of 10N with the following synoptic pattern.

/1/. Veering of wind at nearby island station.

/2/. Cyclonic turning of wind flow into southern hemisphere.

/3/. Shearline approaching vortex from the northwest.

b. Inspect current 700 mb streamline analysis and locate lows of the 4 types:

(1). During summer:

(a). Type 1A vortex south of 15N in the easterly flow.

(b). Type 1B (in the South China Sea) vortex present if Clark AFB, Philippine's wind is southerly and Vietnam's wind is northerly or westerly.

(c). Type 2 low to east or south of a typhoon.

(2). During winter:

(a). Type 3 low south of 10N with trough oriented east-west slightly north of the equator.

(b). Tropical depression not possible if low clouds are absent.

c. Inspect current APT cloud pictures.

(1). If there are no significant overcast cloud systems south of 25N, no Tropical Depression possible.

(2). During summer, with a surface and 700 mb low present, the cloud pictures will verify the existence of a low and show its stage of development. The four cloud pictures (figures III-12 through III-15) illustrate the important features to observe.

In summary, this article is not all conclusive for forecasting tropical cyclone development. Other types exist, however, the four types discussed above were the ones most frequently observed during the 1967 season.

Figure III-12

TYPE 1A:

1. Almost circular overcast cloud mass (core).
2. Major overcast cloud mass (bands) located south of center.
3. Cloud bands turning cyclonically into overcast cloud mass.
4. Cirrus blow-off from tops of overcast clouds.

Figure III-13

TYPE 1B in the South China Sea:

1. Cloud bands oriented parallel to the southwest monsoon flow.
2. Small central overcast cloud mass (core).
3. Cyclonic turning of cloud bands into overcast mass.
4. Cirrus blow-off towards west.

Figure III-14

TYPE 2:

1. Cut-off overcast cloud mass (core) from the southerly low level wind flow into another storm to north or west.
2. Cyclonic turning of smaller cloud bands into center.
3. Cirrus blow-off.
4. Major cloudiness to the south of center.

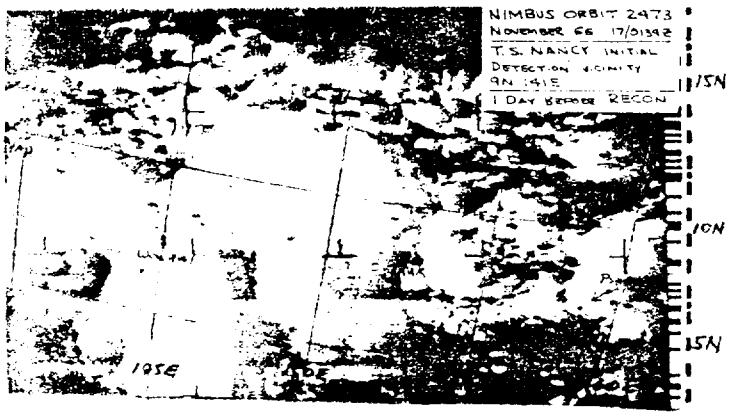


Figure III-15

TYPE 3:

1. Overcast cloud mass forming in ITC.
2. Overcast cloud mass (core).
3. Major cloud mass (bands) to the south of center.
4. Cyclonic turning of cloud bands around center.
5. Shearline approaching center from the north.
6. Cirrus blow-off.

D. AN EXAMPLE OF TWO VORTICES WITHIN A LARGE TROPICAL SYSTEM

During the two week period of 14 to 28 July, 1967 several interesting aspects of tropical cyclone behavior occurred in the Western Pacific. The period began with an undesignated tropical low forming southwest of Guam in the ITCZ. This low moved northwest through the Ryukyu Islands and into the Yellow Sea, resulting in a break in the subtropical ridge in the Ryukyu Islands area by 20/0000Z. However, the ridge remained strong eastward from Japan. Then followed the development of a large tropical system, which included Tropical Storm DOT and Tropical Depression NINE in the area of Guam, as noted on synoptic charts and APT cloud pictures. The ultimate movement of this system was also toward the northwest, following nearly the same track as that of the previous cyclone into the Yellow Sea.

Between 20/0000Z and 21/0000Z T.S. DOT and T.D. Nine were fixed by reconnaissance aircraft and warnings were issued on the two systems. The two centers began interacting as they moved cyclonically toward one another; T.D. Nine curved from a northerly to a westerly track while DOT moved eastward, figure III-16A.

During the period 21/0000Z to 22/0000Z the two centers appeared to undergo a partial Fujiwhara rotation. T.D. Nine, moving westward, passed about 200 miles north of T.S. DOT, while the latter curved toward the north. During this period DOT developed quite rapidly in intensity and became a very large circulation; for example, at 22/0000Z its surface circulation pattern extended 900 miles from north to south and 1100 miles from east to west. DOT's maximum observed surface wind speed reached 50 kts at this time while T.D. Nine remained weak but still had a distinct center as reported by reconnaissance aircraft and as shown by APT pictures, figure III-16B.

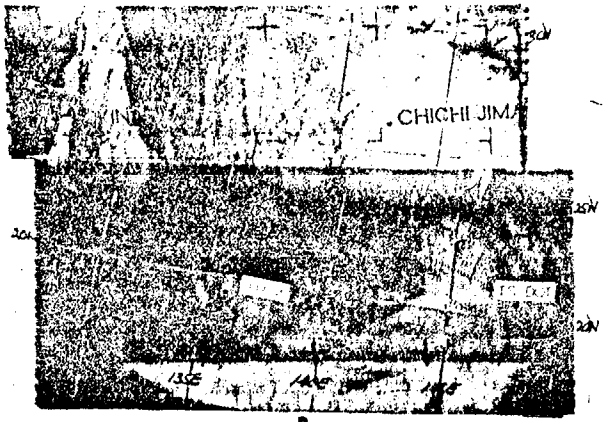
By 23/0000Z T.D. Nine became absorbed into the large circulation of T.S. DOT. DOT's circulation remained very large through 25 July as indicated by satellite pictures, reconnaissance data, and surface reports, figure III-16C.

Throughout the period 22 to 26 July the remnants of T.D. Nine appeared to track along as a secondary center in DOT's circulation. Because of the large size of the overall circulation, the relative weakness of the storm, and the presence of the secondary center, this was a difficult period for both the forecasters and the reconnaissance missions. It was decided that the most meaningful "best track" for this period, as determined from post-analysis, would be the track of the geographical center of the overall circulation. As can be seen from the fix positions for DOT, the most

consistently fixed center, and apparently the most intense, was that to the north of the mean track, while a second center, the remnant of T.D. Nine, followed along to the south, figure III-16D. As DOT passed southern Japan its center became well-defined, the circulation became much smaller, and it reached its greatest intensity. After this, DOT was fixed consistently as one distinct center as it followed a northwesterly track into the Yellow Sea where it became extratropical.

A

NIMBUS 20/0136Z
JULY 1967

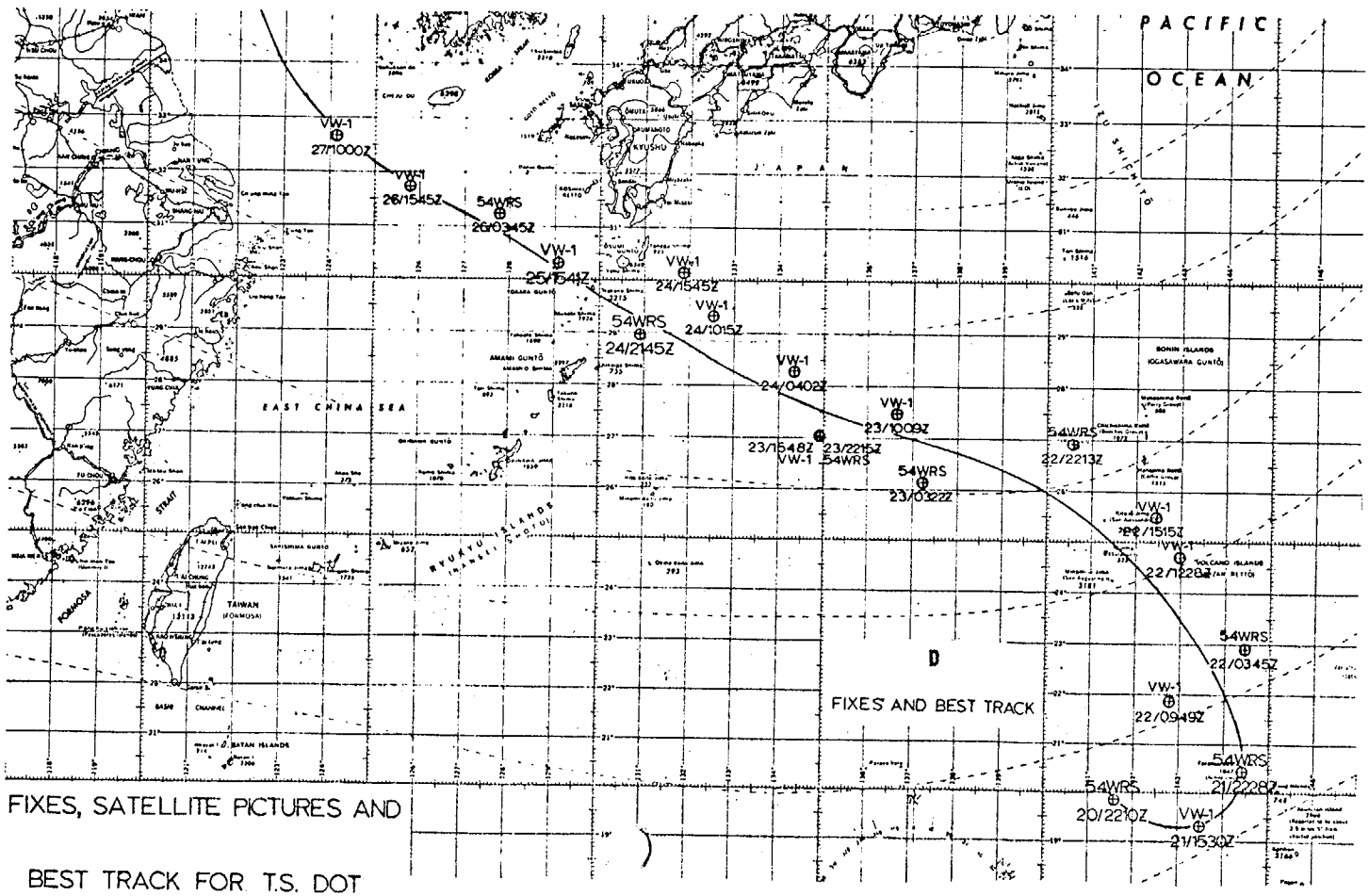


B

NIMBUS 22/0226Z
JULY 1967

C

ESSA II 23/2316Z
JULY 1967



FIXES, SATELLITE PICTURES AND

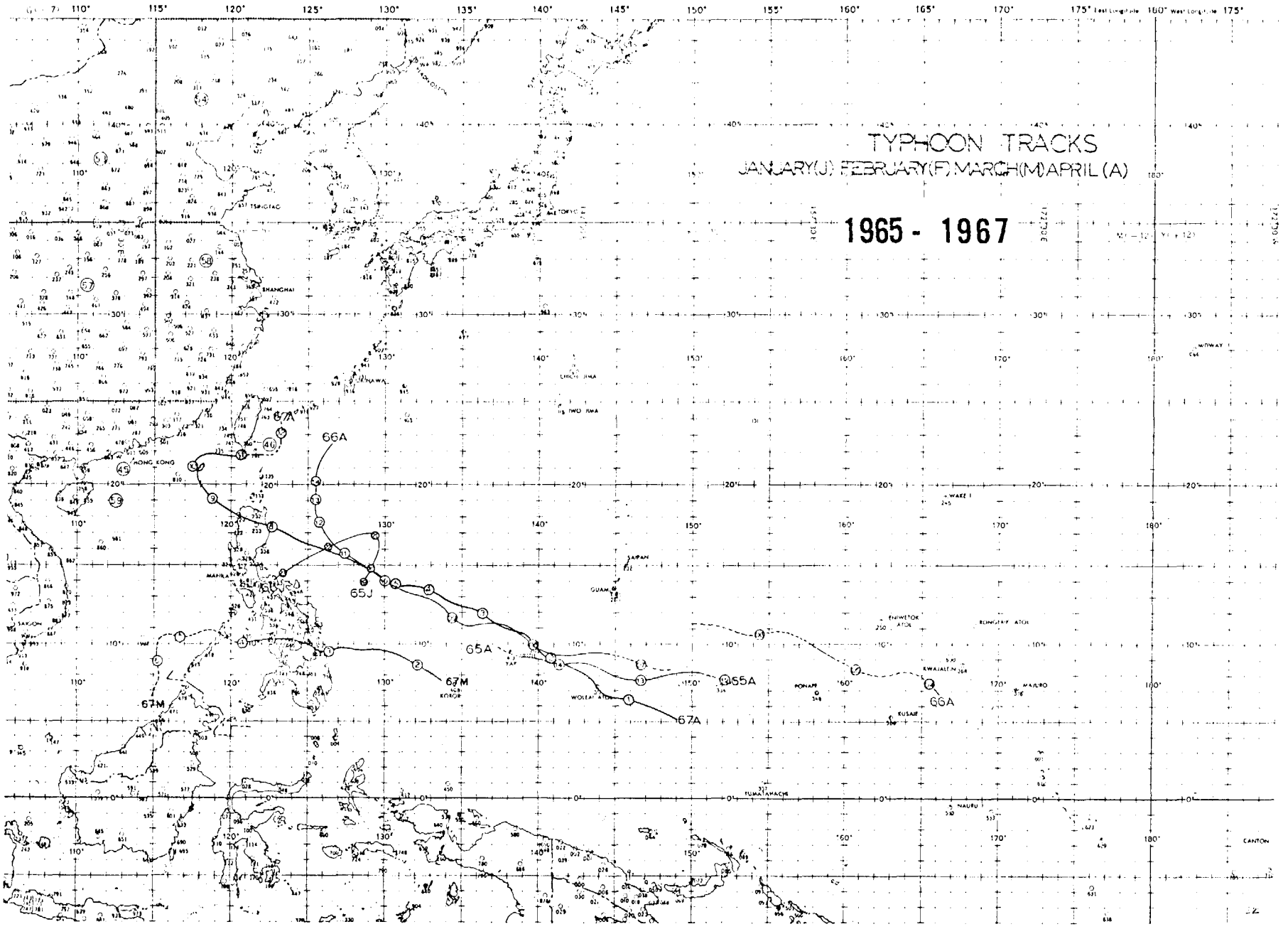
BEST TRACK FOR T.S. DOT

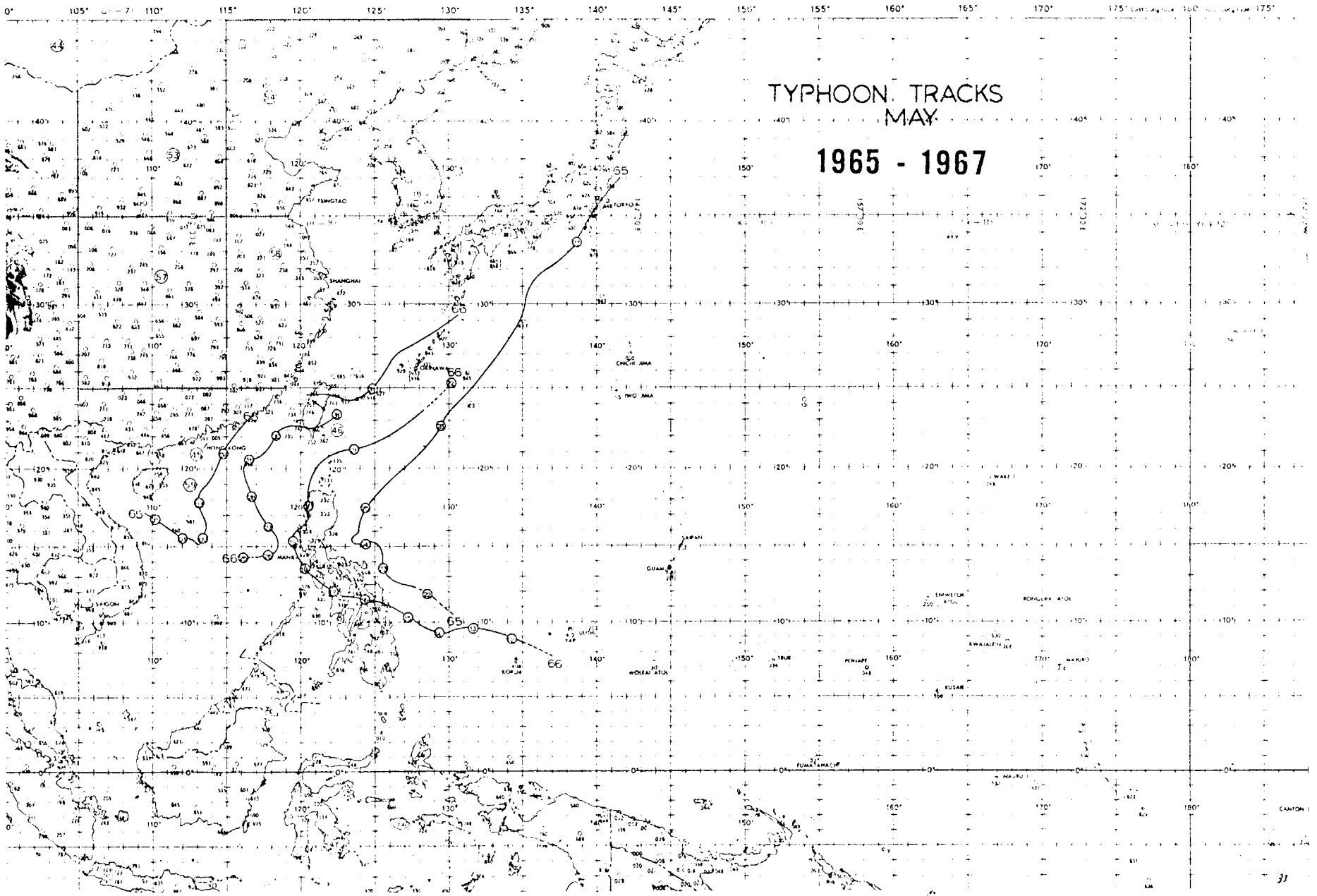
Figure III-16

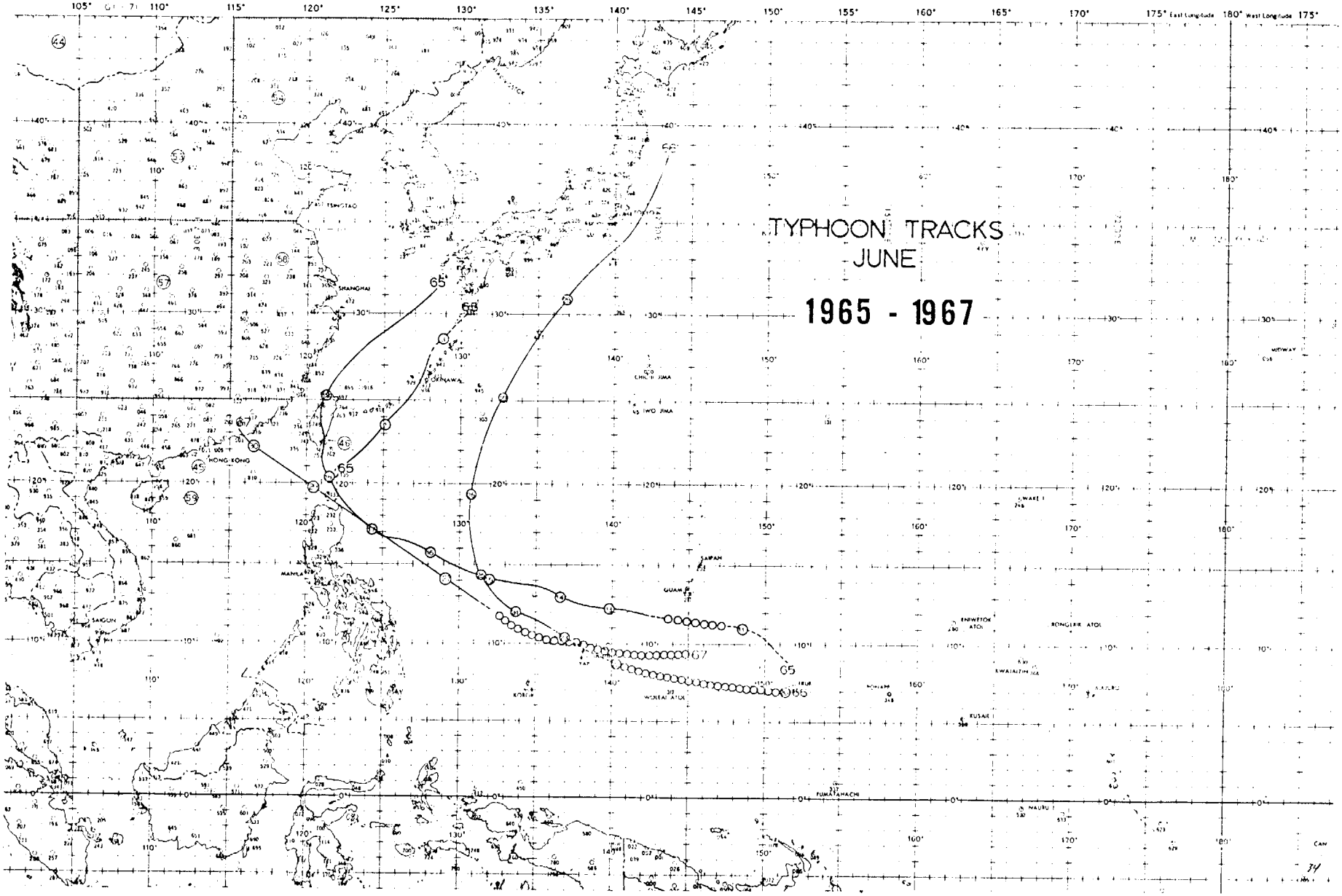
TYPHOON TRACKS

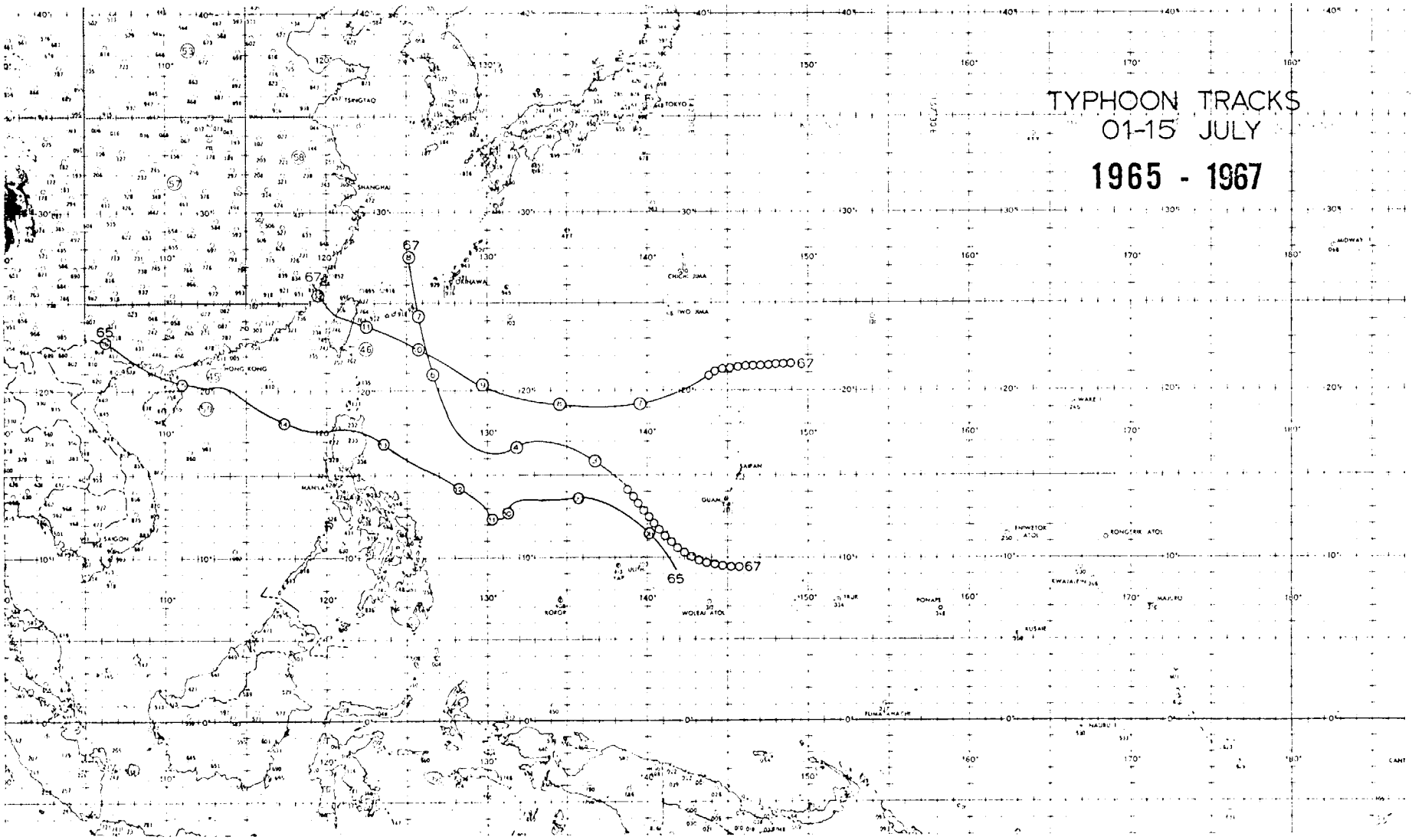
1965 - 1967

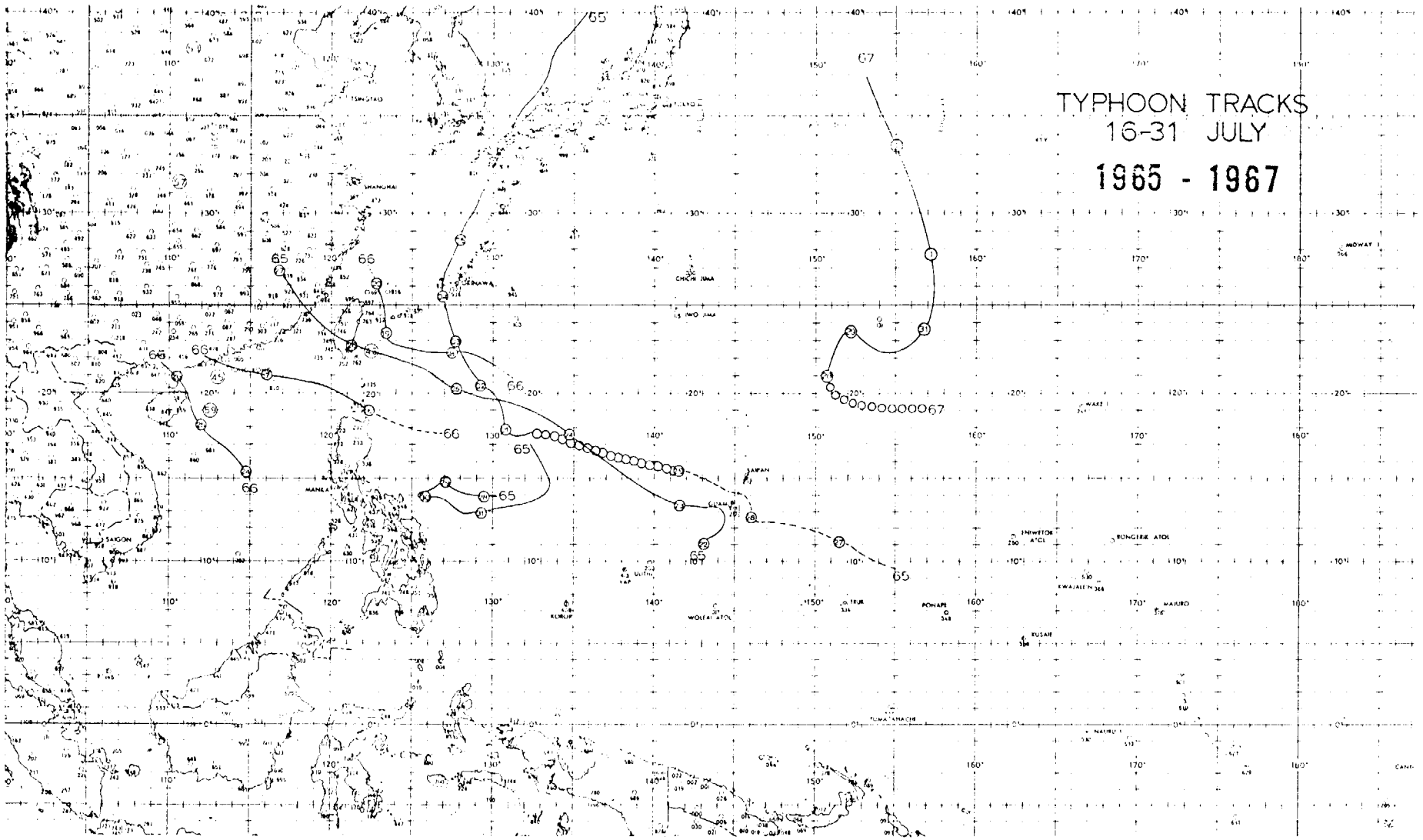
Tracks for the 1965-1967 seasons are included in this report. For all tracks, by month, prior to 1965 see prior Typhoon Reports.

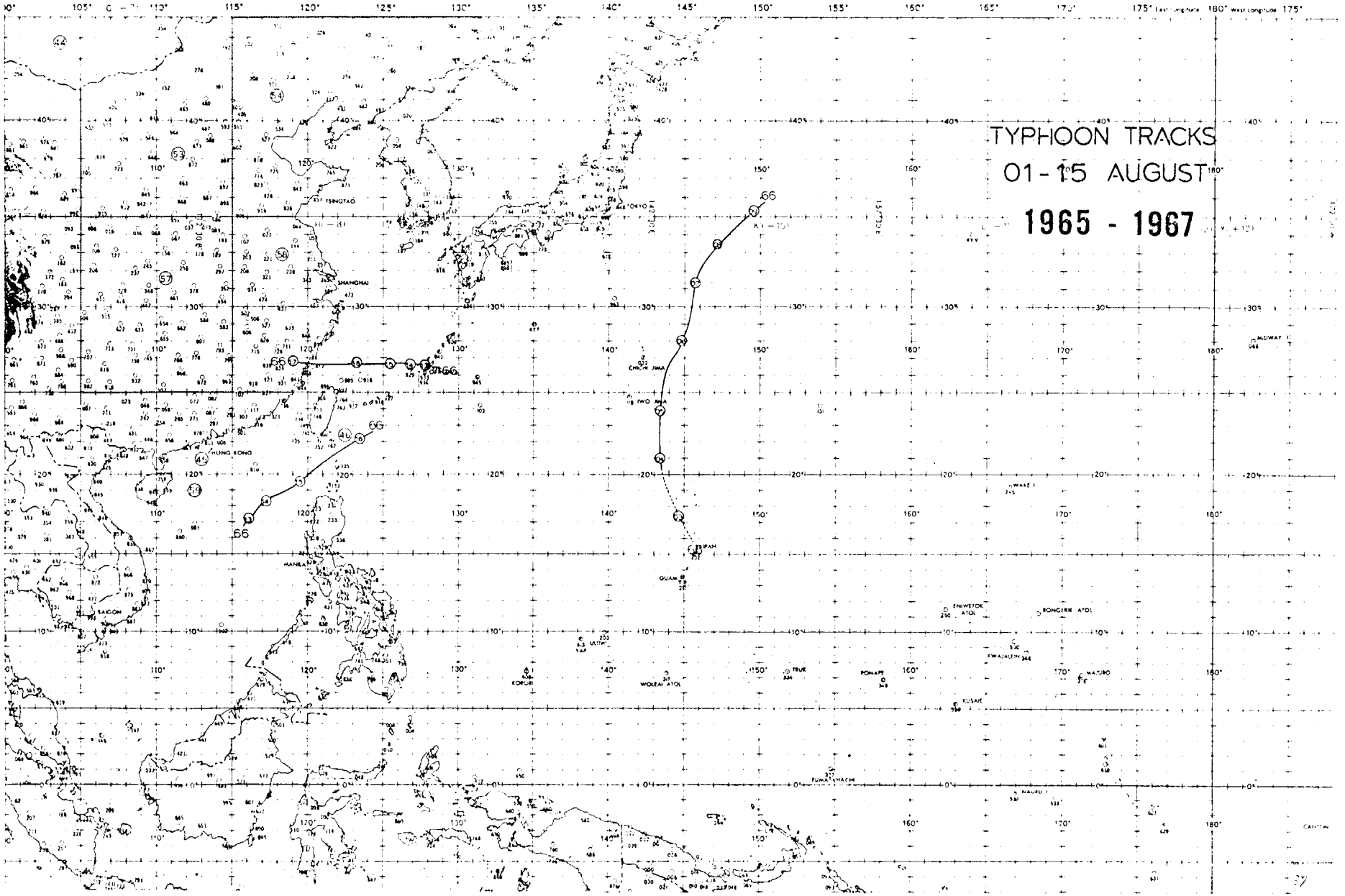

TYPHOON TRACKS
JANUARY(J) FEBRUARY(F) MARCH(M) APRIL (A)
1965 - 1967
67A
66A
65J
65A
67M
67M
65A
66A
67A

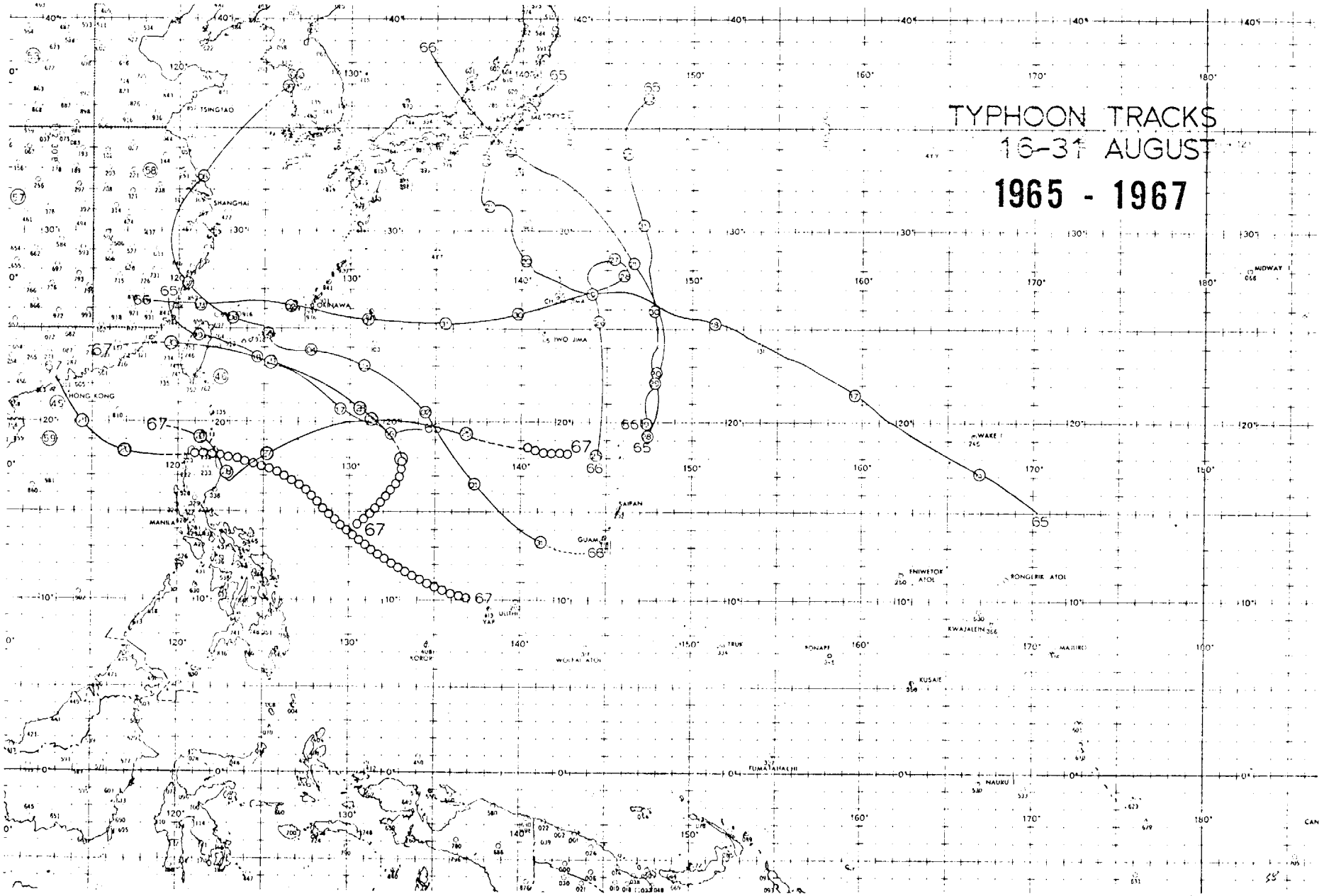

TYPHOON TRACKS
MAY
1965 - 1967

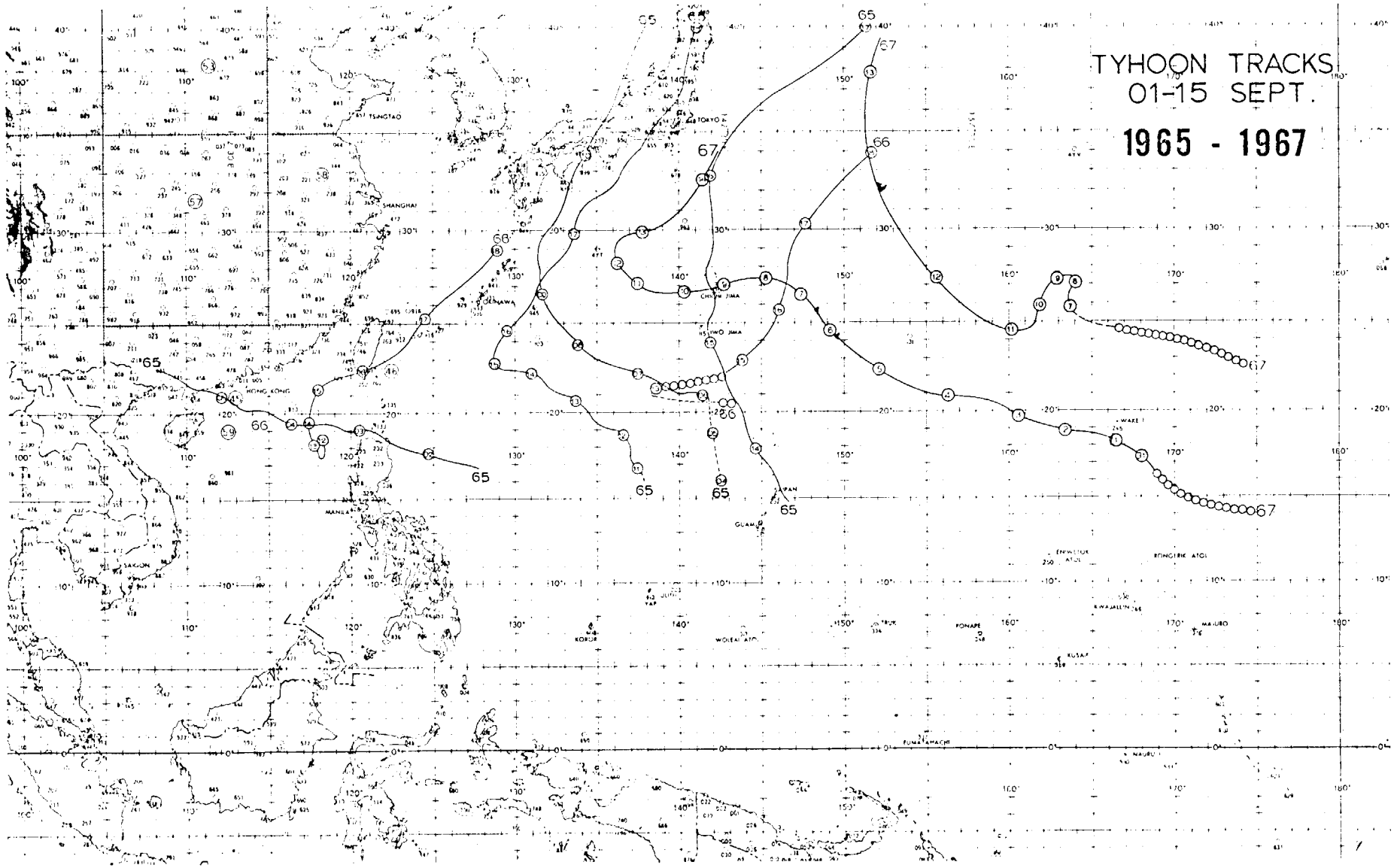

TYPHOON TRACKS
JUNE
1965 - 1967

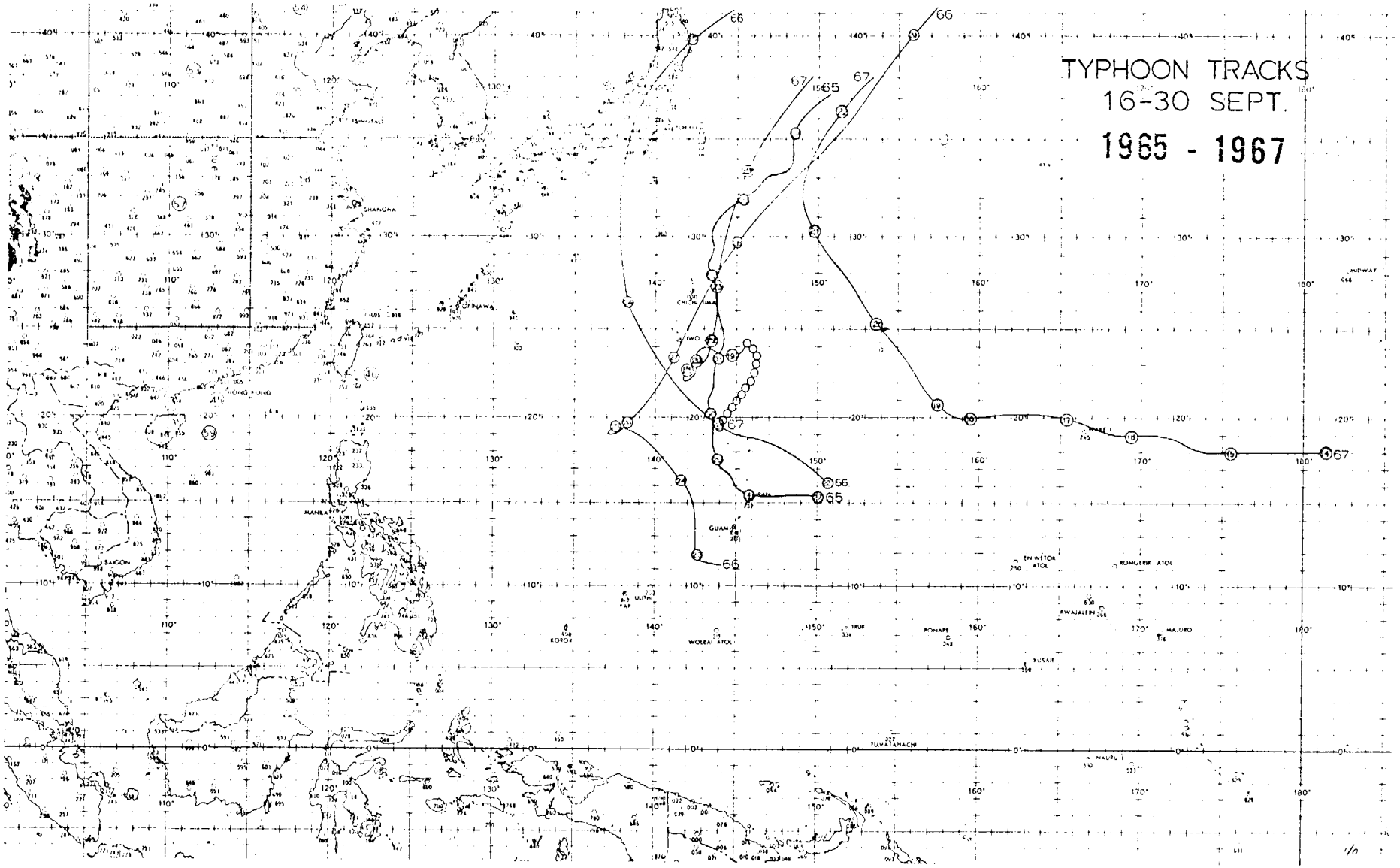

TYPHOON TRACKS
01-15 JULY
1965 - 1967
67
67
65
67
65
TSINGTAO
SHANGHAI
TOKYO
OKINAWA
CHICHI JIMA
IWO JIMA
HONG KONG
MANILA
SAIGON
GUAM
JAPAN
MIDWAY I
WAKE I
ENIWETOK ATOL
RONGERIK ATOL
KWAJALEIN ATOL
WOLEAI ATOL
ULITHI
ROROR
TRUK
PONAPE
MAJURO
KUSAIE
FUNAFUTI
NAURU I

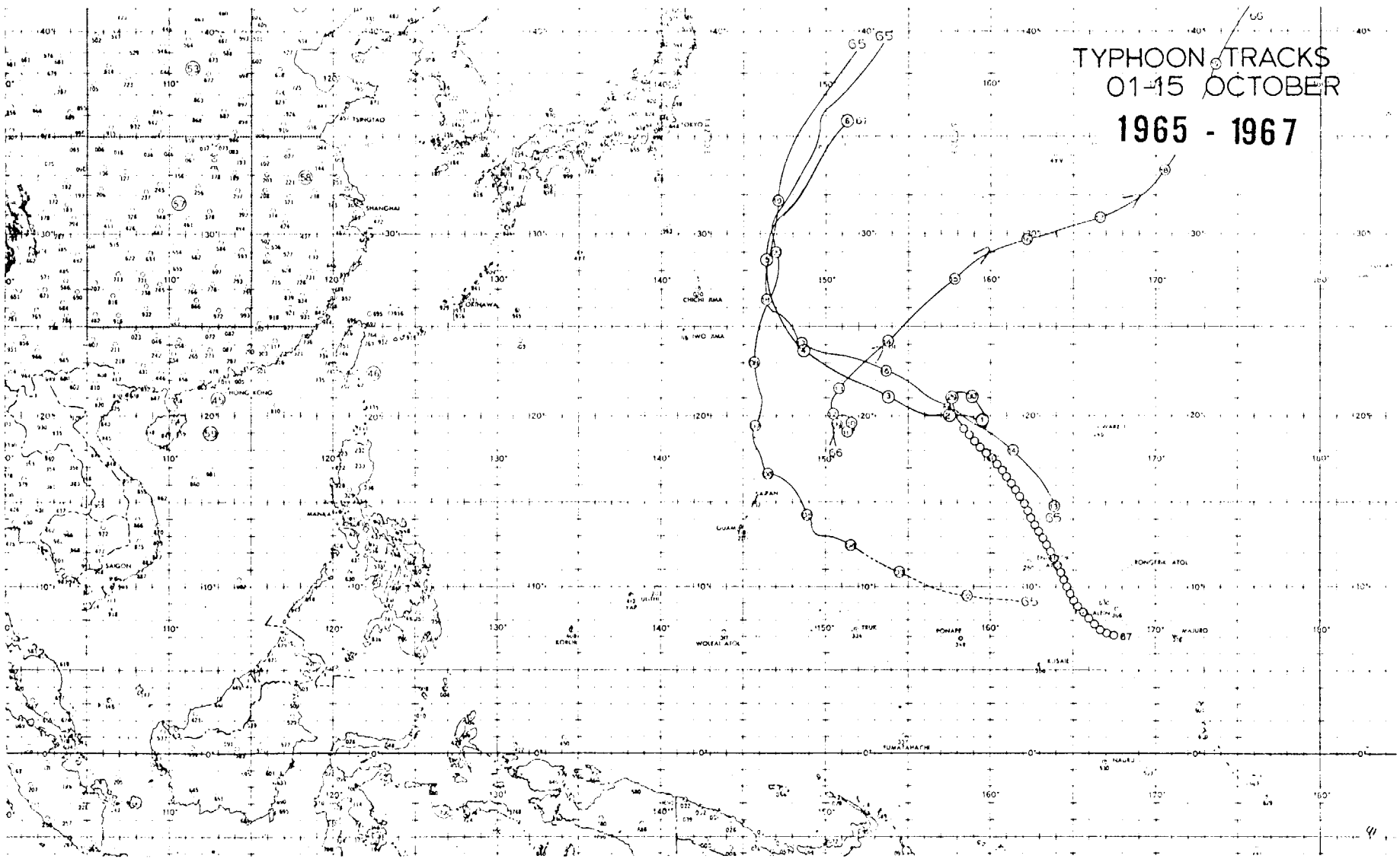

TYPHOON TRACKS
16-31 JULY
1965 - 1967
65
66
67
SAIGON
MANILA
SAIPAN
GUAM
PONAPE
KUSAIE
MAJURO
MIDWAY
WAKE
CHICHI JIMA
IWO JIMA
SHANGHAI
TSINGTAO
KOROR
WOLEAI ATOL
ENIWETOK ATOL
RONGERIK ATOL
KWAJALEIN
TUMATAHACHI
NAURU

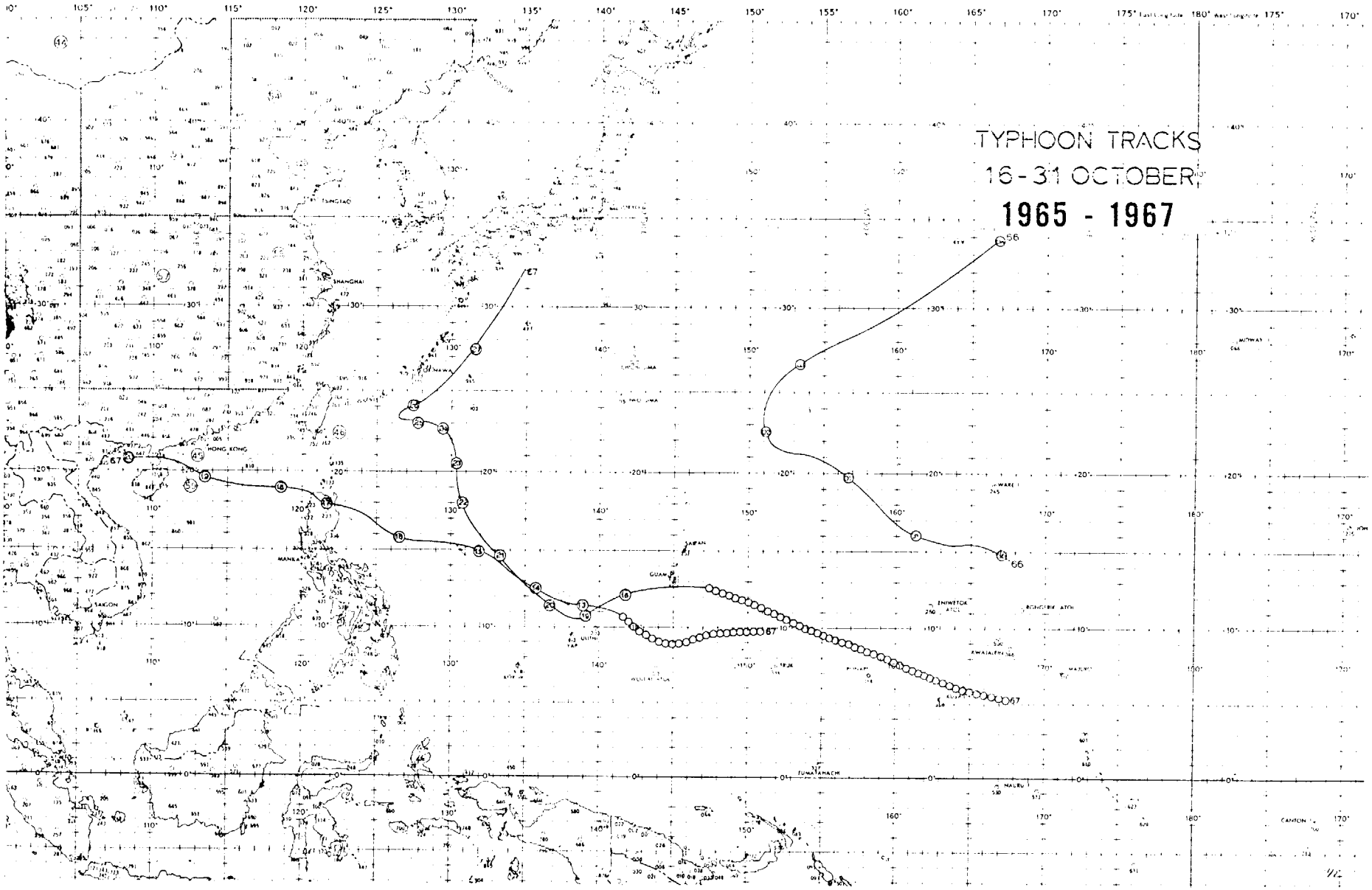

TYPHOON TRACKS
01-15 AUGUST
1965 - 1967

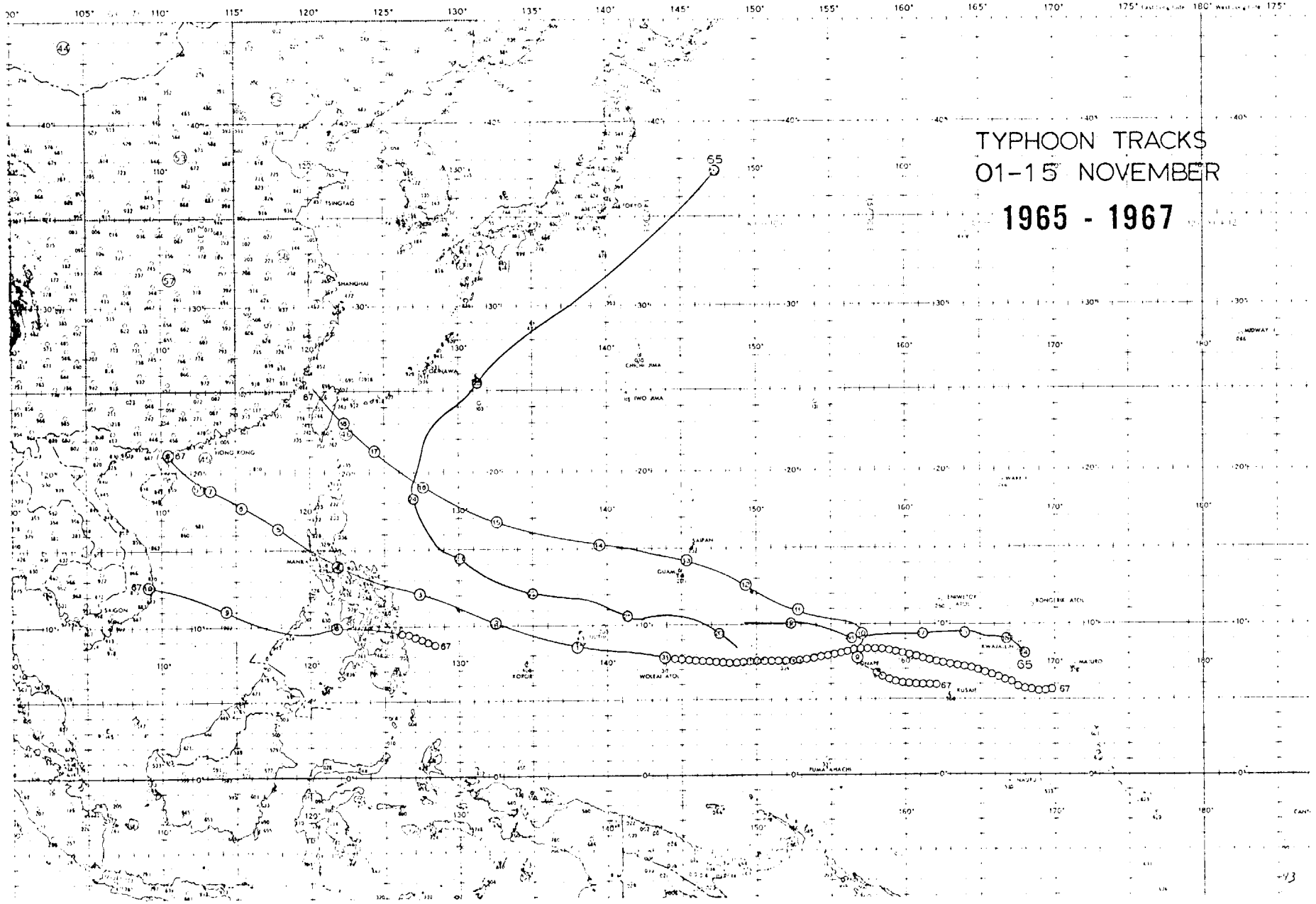

TYPHOON TRACKS
16-31 AUGUST
1965 - 1967
TSINGTAO
SHANGHAI
OKINAWA
IWO JIMA
HONG KONG
MANILA
SAIPAN
GUAM
YAP
TRUK
PONAPE
KUSAIE
KWAJALEIN
MAJURO
ENIWETOK ATOL
RONGERIK ATOL
WAKE I.
MIDWAY I.
NAUKU
FUNAFUTI
65
66
67


TYHOON TRACKS
01-15 SEPT.
1965 - 1967
TSINGTAO
SHANGHAI
HONG KONG
MANILA
SAIGON
TOKYO
CHICHI JIMA
IWO JIMA
GUAM
WAKE I
ENIWETOK ATOL
RONGERIK ATOL
KWAJALEIN
MAJURO
KUSAIE
PONAPE
WOLEAI ATOL
KOROR
YAP
FUMATAMACHI
NAURU
65
66
67

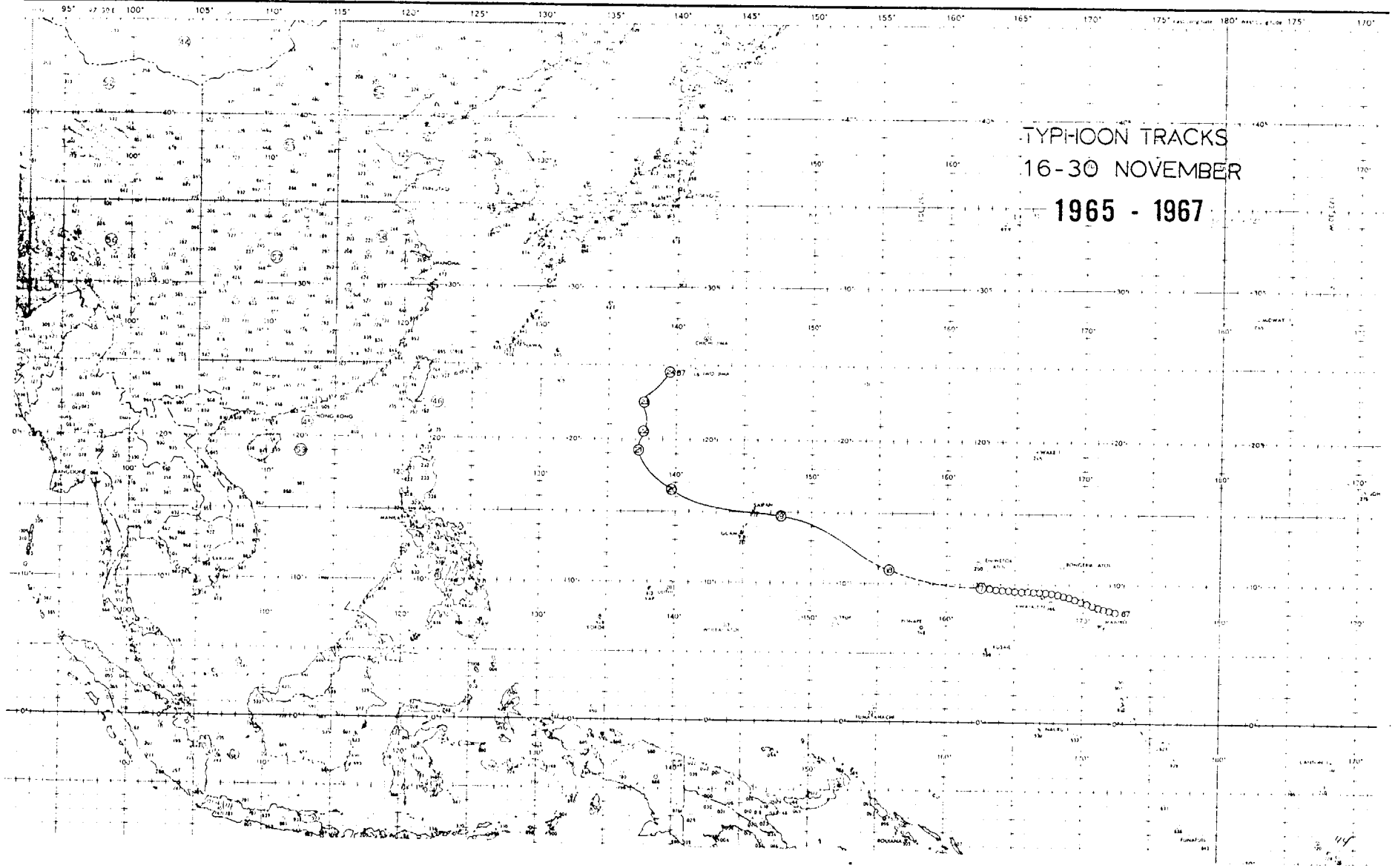

TYPHOON TRACKS
16-30 SEPT.
1965 - 1967
SHANGHAI
HONG KONG
MANILA
SAIGON
GUAM
WOLEAI ATOL
KOROR
TRUK
PONAPE
KWAJALEIN
MAJURO
ENIWETOK ATOL
RONGERIK ATOL
KUSAIE
TUVATAHACHI
NAURU I
MIDWAY
66
67
65

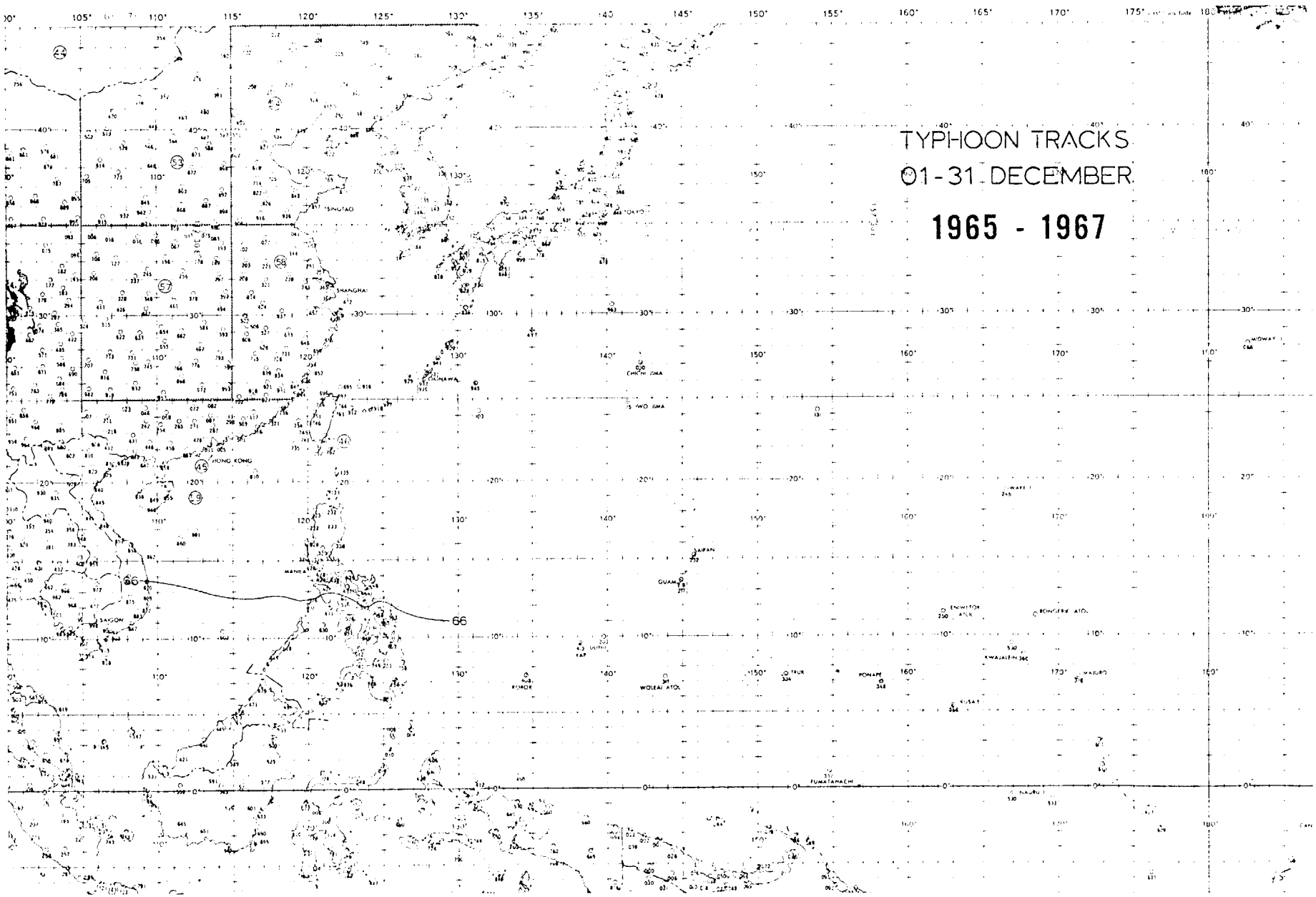

TYPHOON TRACKS
01-15 OCTOBER
1965 - 1967


TYPHOON TRACKS
16-31 OCTOBER
1965 - 1967
SHANGHAI
HONG KONG
MANILA
SAIGON
GUAM
SAIPAN
ENIWETOK ATOL
RONGERIK ATOL
KWAJALEIN
MIDWAY
CANTON
NAURU
TUMATAHACHI
67
66


TYPHOON TRACKS
01-15 NOVEMBER
1965 - 1967
TSINGTAO
SHANGHAI
HONG KONG
MANILA
SAIGON
TOKYO
CHICHI JIMA
IWO JIMA
SAIPAN
GUAM
WOLEAI ATOL
KOROR
KWAJALEIN
KUSAIE
MAJURO
MIDWAY
PUMA KAHACHI
65
67

TROPICAL WEATHER PLOTTING CHART—WESTERN PACIFIC AREA




TYPHOON TRACKS
01-31 DECEMBER
1965 - 1967
SINGTAO
SHANGHAI
HONG KONG
MANILA
SAIGON
OKINAWA
CHICHI JIMA
IWO JIMA
SAIPAN
GUAM
WOLEAI ATOL
PONAPE
KWAJALEIN
MAJURO
FUMATAHACHI
NAURU
MIDWAY
66

TYPHOON FREQUENCY
10 YEAR PERIOD

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL TOTAL
1958	1	0	0	0	1	2	5	3	3	3	1	1	20
1959	0	0	0	1	0	0	1	5	3	3	2	2	17
1960	0	0	0	1	0	2	2	8	0	4	1	1	19
1961	0	0	1	0	2	1	3	3	5	3	1	1	20
1962	0	0	0	1	2	0	5	7	2	4	3	0	24
1963	0	0	0	1	1	2	3	3	3	4	0	2	19
1964	0	0	0	0	2	2	6	3	5	3	4	1	26
1965	1	0	0	1	2	2	4	3	5	2	1	0	21
1966	0	0	0	1	2	1	3	6	4	2	0	1	20
1967	0	0	1	1	0	1	3	4	4	3	3	0	20
AVE	.2	0	.2	.7	1.2	1.3	3.5	4.5	3.4	3.1	1.6	.9	20.6

During 1967 the Joint Typhoon Warning Center issued a total of 957 tropical warnings on 20 typhoons, 15 tropical storms and six tropical depressions. Warnings were issued on two or more tropical cyclones simultaneously on a total of 62 calendar days; on 17 of the 62 days three tropical cyclones were in existence.

The following data for the JTWC area of responsibility is presented for comparison:

COMPARATIVE WESTERN PACIFIC TROPICAL CYCLONE DATA

	1960	1961	1962	1963	1964	1965	1966	1967
TOTAL NUMBER OF WARNINGS	766	738	815	663	730	805	752	957
CALENDAR DAYS OF WARNING	157	165	154	146	153	167	155	185
TROPICAL DEPRESSIONS	3	11	9	3	5	6	8	6
TROPICAL STORMS	8	11	6	6	14	13	10	15
TYPHOONS	19	20	24	19	26	21	20	20
TOTAL TROPICAL CYCLONES	30	42	39	28	45	40	38	41

In the area of the North Pacific Ocean east of 180 degrees, 474 warnings were issued on a total of 20 tropical cyclones (See Annex A). One tropical cyclone, SARAH, developed in the area between 150 degrees and 140 degrees west and tracked across the dateline into JTWC's area of responsibility. This necessitated the transfer of a cyclone from JHWC, Hawaii, to FWC/JTWC. The track of SARAH (4499 MI) was the longest in history.

There were four "Super Typhoons" (maximum sustained surface winds of 130 knots or greater) compared with three during 1966 and a record of 11 during 1965. The most intense storm of 1967 was Typhoon Carla (12-20 Oct) with maximum sustained surface winds of 160 knots. The minimum sea level pressure of 901 mb and the minimum 700 mb height of 2170 meters were observed at 142138Z. The maximum wind was observed over water, although considerable damage to property resulting from flooding occurred as CARLA tracked westward over Northern Luzon with sustained surface winds of near 100 knots.

Examples of the Fujiwhara effect were exhibited by Typhoons Marge and Nora during August, and Tropical Storm Dot and Tropical Depression Nine during July. Dot was a well-documented case of secondary eyes within the same overall circulation of a storm (see Chapter III).

An abnormal number of tropical cyclones developed north of 20 degrees north latitude during the 1967 season. Four typhoons and six tropical storms fell into this category.

As in other years, the 24, 48, and 72 hour mean forecast error for each typhoon was computed by two methods. In addition to the standard mean forecast error (Tables IV-1 and IV-2), a computation of closest-distance (right angle) error from best track (Table IV-3) has been included for comparison. This error computation is based on the closest right angle distance of the forecast position to the best track without regard to time.

Note: The positions in Tropical Storm Position Data are for periods of tropical storm intensity only; i.e., where the best track showed the intensity to be greater than 33 knots.

The following tabulation of the average forecast error for the past 18 years is given for comparison:

FORECAST VERIFICATION;
AVERAGE ERROR (NAUTICAL MILES)

	24 HR	48 HR	72 HR
1950-58	170	---	---
1959	*117	*267	---
1960	*177	*354	---
1961	136	274	---
1962	144	287	476
1963	127	246	374
1964	133	284	429
1965	151	303	418
1966	136	280	432
1967	125	276	414

*Forecast positions north of 35N were not verified.

TABLE IV-1

1967 AVERAGE FORECAST ERRORS (MI)*

TYPHOON	24 HR FORECASTS NO. OF CASES	24 HR FORECASTS MEAN ERROR	48 HR FORECASTS NO. OF CASES	48 HR FORECASTS MEAN ERROR	72 HR FORECASTS NO. OF CASES	72 HR FORECASTS MEAN ERROR
SALLY	5	74	1	78	--	---
VIOLET	35	111	28	228	12	347
ANITA	13	71	6	89	1	36
BILLE	19	136	10	276	3	254
CLARA	20	74	16	124	6	159
ELLEN	19	257	15	588	5	878
KATE	6	118	1	18	--	---
MARGE	16	188	8	405	2	543.
NORA	8	83	--	---	--	---
OPAL	58	106	54	262	25	477
RUTH	27	163	20	355	8	498
SARAH	29	118	25	286	11	422
WANDA	22	144	18	290	7	406
AMY	28	144	24	388	10	718
CARLA	25	102	20	165	8	207
DINAH	38	151	34	333	14	465
EMMA	28	74	24	171	10	246
FREDA	8	89	4	226	--	---
GILDA	38	84	30	175	13	260
HARRIET	23	186	14	385	5	423

AVERAGE ERROR - 24 HR FORECASTS (465 CASES)...125 MI
AVERAGE ERROR - 48 HR FORECASTS (352 CASES)...276 MI
AVERAGE ERROR - 72 HR FORECASTS (140 CASES)...414 MI

*Includes Forecast Errors during tropical storm intensity

TABLE IV-2

1967 FORECAST ERRORS*
(IN TERMS OF CLOSEST DISTANCE TO BEST TRACK)

TYPHOON	24 HR FORECASTS NO. OF CASES	24 HR FORECASTS MEAN ERROR (MI)	48 HR FORECASTS NO. OF CASES	48 HR FORECASTS MEAN ERROR (MI)	72 HR FORECASTS NO. OF CASES	72 HR FORECASTS MEAN ERROR (MI)
SALLY	5	69	1	73	--	---
VIOLET	35	51	28	100	10	156
ANITA	13	47	6	83	1	29
BILLIE	21	106	11	244	3	210
CLARA	20	56	16	98	5	89
ELLEN	17	150	13	312	4	544
KATE	6	84	1	7	--	---
MARGE	18	93	8	234	2	471
NORA	7	76	1	66	--	---
OPAL	57	84	54	204	25	385
RUTH	27	77	20	145	8	215
SARAH	29	73	23	157	11	256
WANDA	22	59	18	150	7	163
AMY	28	72	24	159	10	320
CARLA	28	63	23	131	9	104
DINAH	38	80	30	137	12	247
EMMA	28	62	24	126	9	184
FREDA	8	37	4	40	--	---
GILDA	38	55	30	114	13	193
HARRIET	23	122	10	282	4	421

AVERAGE ERROR - 24 HR FORECASTS (468 CASES)...76 MI
AVERAGE ERROR - 48 HR FORECASTS (345 CASES)..157 MI
AVERAGE ERROR - 72 HR FORECASTS (133 CASES)..256 MI

*Includes Forecast Errors during tropical storm intensity.

TABLE IV-3

To better understand the areas in which larger or smaller errors occur, the mean errors are tabulated with respect to latitude for the 24, 48 and 72 hour forecast positions (Table IV-4). Also, distances from positions given in the bulletins versus the best track positions is summarized (Table IV-5). Possibly this information will give the user a better understanding of the ability of JTWC to forecast the effects of a typhoon in a particular area.

FORECAST ERROR TABULATION (MI) - 1967

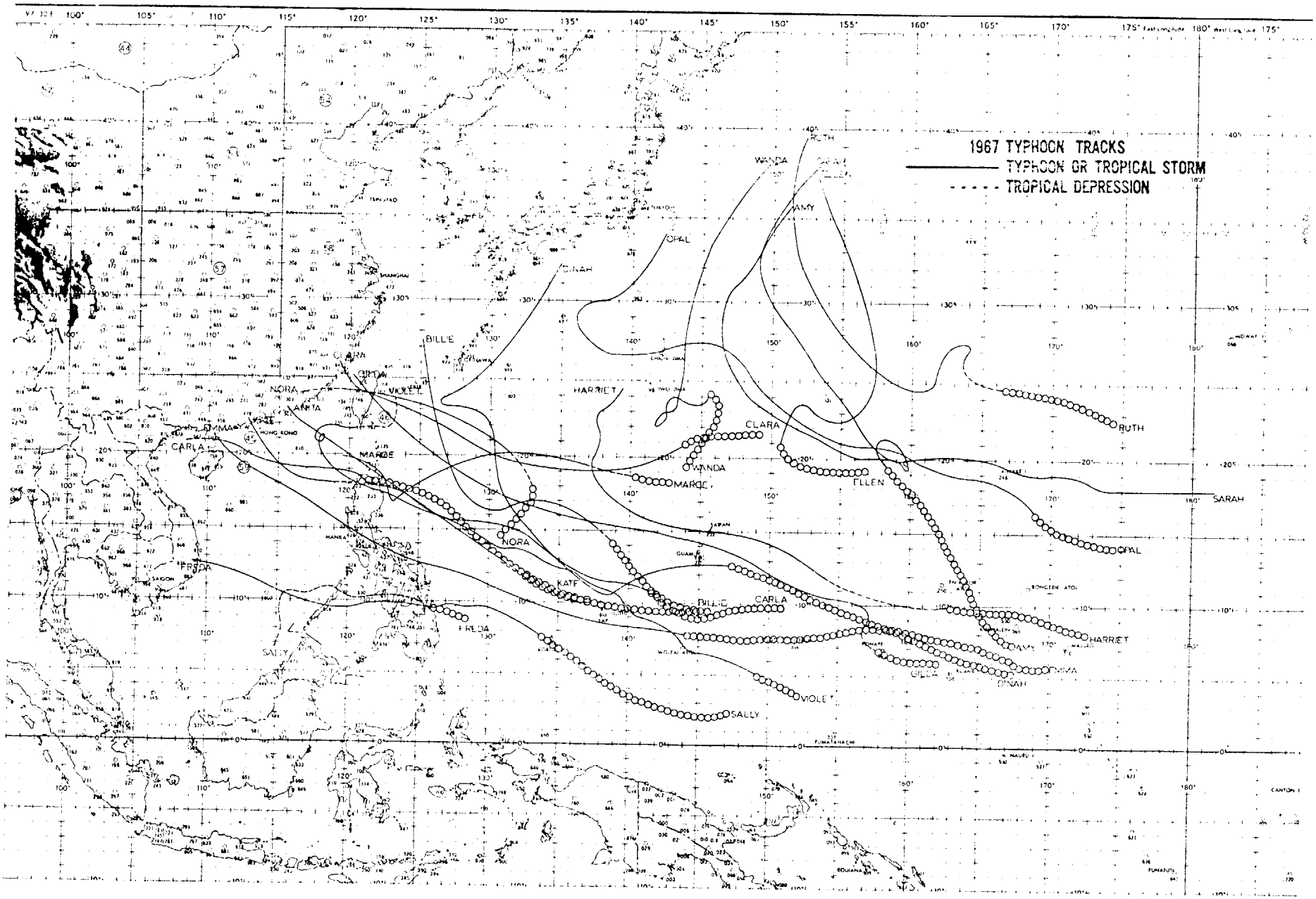
	NUMBER OF CASES	MEAN ERROR (MI)
24 Hour		
Total	465	125
Below 20N	218	111
20N-30N	216	131
Below 30N	433	121
Above 30N	31	184
48 Hour		
Total	352	276
Below 20N	138	217
20N-30N	183	301
Below 30N	321	265
Above 30N	31	386
72 Hour		
Total	140	414
Below 20N	46	294
20N-30N	79	468
Below 30N	125	404
Above 30N	15	500

TABLE IV-4

DISTANCE BETWEEN OPERATIONAL WARNING
POSITS AND BEST TRACK POSITS

CYCLONE	CASES	CYCLONE AVERAGE (MI)	MAX (MI)	MIN (MI)
1. RUBY	38	46	156	2
2. SALLY	21	33	90	4
3. THERESE	34	27	121	0
4. VIOLET	45	19	78	2
5. WILDA	21	35	111	0
6. ANITA	17	17	65	0
7. BILLIE	25	31	101	0
8. CLARA	25	23	124	2
9. T. D.	5	55	96	6
10. DOT	31	36	96	5
11. T. D.	11	35	99	7
12. ELLEN	23	30	105	2
13. GEORGIA	41	34	101	2
14. FRAN	18	34	131	4
15. HOPE	20	42	80	12
16. T. D.	4	42	73	9
17. T. D.	7	24	61	7
18. IRIS	5	36	79	6
19. LOUISE	30	32	230	3
20. JOAN	16	42	128	12
21. KATE	10	19	50	6
22. MARGE	22	21	121	0
23. T. D.	7	62	141	3
24. NORA	14	31	136	4
25. OPAL	62	16	81	1
26. PATSY	12	36	120	7
27. RUTH	31	25	66	3
28. SARAH	33	17	102	0
29. THELMA	11	43	99	7
30. VERA	12	65	250	8
31. WANDA	26	26	106	2
32. AMY	32	16	64	2
33. BABE	8	17	67	4
34. T. D.	3	40	78	4
35. CARLA	32	20	60	0
36. DINAH	42	18	56	0
37. EMMA	33	17	41	2
38. FREDA	12	18	45	6
39. GILDA	43	17	78	0
40. HARRIET	29	27	110	1
41. IVY	10	21	59	3
OVERALL AVERAGE:		27.0		

TABLE IV-5


1967 TYPHOON TRACKS
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
RUTH
WANDA
AMY
OPAL
DINAH
BILLIE
CLARA
GILDA
VIOLET
NORA
ANITA
EMMA
CARLA
MARGE
HARRIET
ELLEN
SARAH
KATE
FREDA
SALLY
HONG KONG
SHANGHAI
SAIGON
MANILA
GUAM
SAIPAN
TOKYO
CHICHI JIMA
IWO JIMA
MAJURO
BONGERIK ATOL
FUMATAHACHI
NAURU
CANTON
FUNAFUTI
ROUIANA

1967 TROPICAL CYCLONES

CYCLONE	TYPE	NAME	*DATE	*CALENDAR DAYS OF WARNING	*MAX SFC WND	MIN OBS SLP	MAX RADIUS SFC CIRC	TOTAL NO. WARNINGS ISSUED	NO. WARNINGS ISSUED AS TYPHOON	*DISTANCE TRAVELED
01	TS	RUBY	28 JAN-09 FEB	11	40	996	300	39	-	942
02	T	SALLY	01 MAR-06 MAR	7	85	971	180	22	9	1374
03	TS	THERESE	16 MAR-24 MAR	9	60	988	420	34	-	1614
04	T	VIOLET	01 APR-12 APR	12	120	929	450	45	32	2688
05	TS	WILDA	08 MAY-13 MAY	7	40	1002	300	21	-	642
06	T	ANITA	26 JUN-30 JUN	5	80	967	415	17	10	1164
07	T	BILLIE	02 JUL-08 JUL	7	75	979	430	25	8	1326
08	T	CLARA	06 JUL-12 JUL	7	100	960	320	25	19	1518
09	TD		20 JUL-21 JUL	2	30	993	180	5	-	114
10	TS	DOT	21 JUL-28 JUL	8	60	975	600	31	-	1842
11	TD		25 JUL-28 JUL	4	30	997	540	11	-	444
12	T	ELLEN	28 JUL-02 AUG	6	80	969	400	23	5	1380
13	TS	GEORGIA	29 JUL-08 AUG	11	60	975	540	41	-	3160
14	TS	FRAN	29 JUL-02 AUG	5	60	953	360	18	-	528
15	TS	HOPE	04 AUG-09 AUG	6	60	982	360	20	-	1242
16	TD		10 AUG-11 AUG	2	30	995	120	5	-	180
17	TD		11 AUG-13 AUG	3	30	990	120	7	-	420
18	TS	IRIS	15 AUG-16 AUG	2	50	994	180	5	-	228
19	TS	LOUISE	16 AUG-23 AUG	8	60	975	300	30	-	1632
20	TS	JOAN	18 AUG-22 AUG	5	50	985	180	16	-	654
21	T	KATE	19 AUG-21 AUG	3	70	978	300	10	3	540
22	T	MARGE	24 AUG-29 AUG	6	125	937	450	22	11	1326
23	TD		25 AUG-26 AUG	2	30	998	300	7	-	522
24	T	NORA	27 AUG-30 AUG	4	70	981	340	14	3	1026
25	T	OPAL	30 AUG-14 SEP	16	155	752	550	69	57	2544
26	TS	PATSY	04 SEP-07 SEP	4	50	995	300	12	-	786
27	T	RUTH	06 SEP-13 SEP	8	110	939	350	31	14	1674

TABLE IV-6

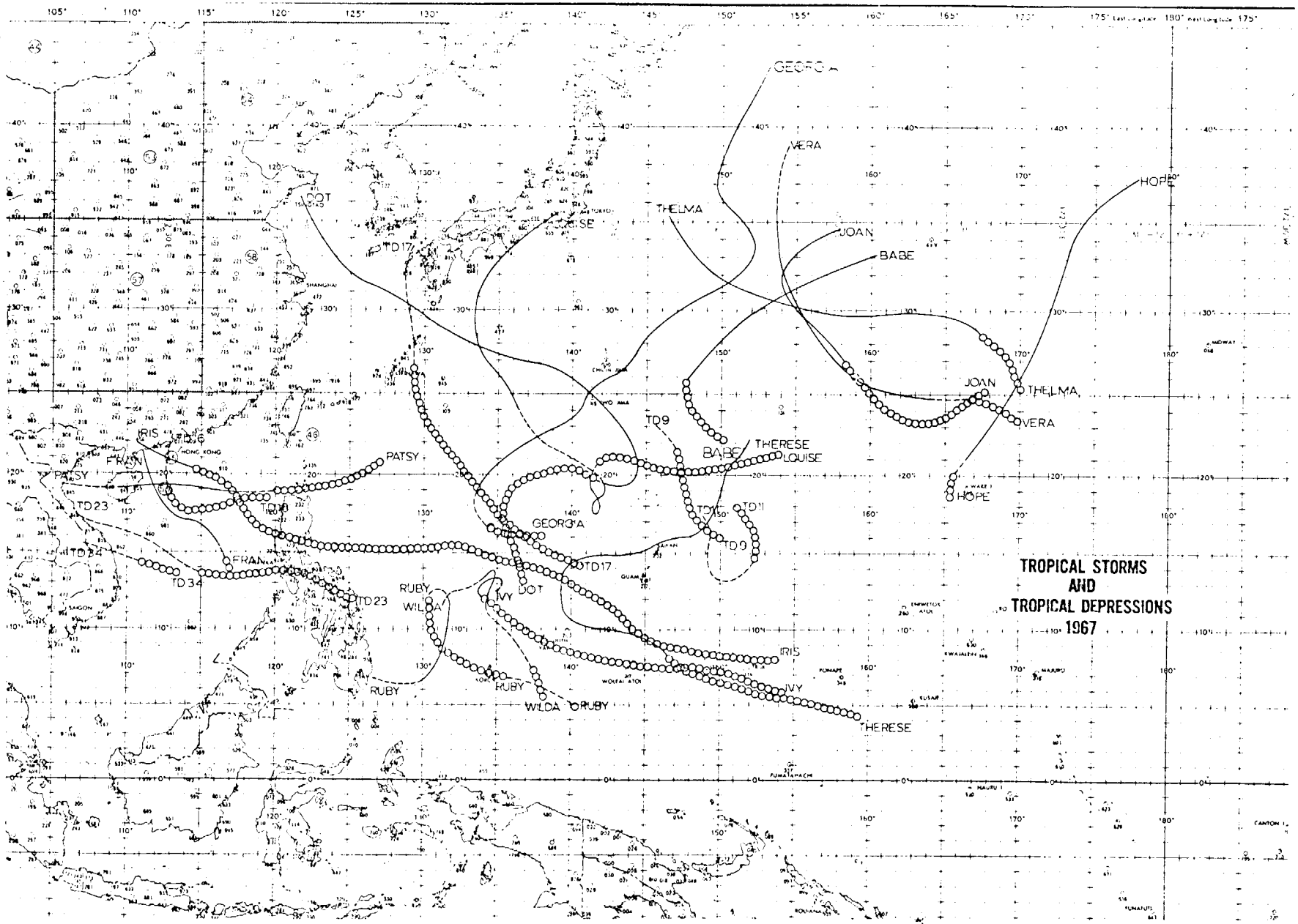
1967 TROPICAL CYCLONES (Cont'd)

CYCLONE	TYPE	NAME	*DATE	*CALENDAR DAYS OF WARNING	*MAX SFC WND	MIN OBS SLP	MAX RADIUS SFC CIRC	TOTAL NO. WARNINGS ISSUED	NO. WARNINGS ISSUED AS TYPHOON	*DISTANCE TRAVELED
28	T	**SARAH	06 SEP-22 SEP	15	125	930	500	55	33	4499
29	TS	THELMA	10 SEP-12 SEP	3	50	991	120	11	--	1212
30	TS	VERA	13 SEP-16 SEP	4	45	994	180	12	--	1290
31	T	WANDA	18 SEP-24 SEP	7	95	960	360	26	18	1356
32	T	AMY	28 SEP-06 OCT	9	80	961	500	32	7	1872
33	TS	BABE	08 OCT-10 OCT	3	60	967	300	8	--	798
34	TD		08 OCT-09 OCT	2	30	1000	360	3	--	174
35	T	CARLA	12 OCT-20 OCT	9	160	901	675	32	20	2046
36	T	DINAH	17 OCT-27 OCT	12	100	948	725	44	24	2334
37	T	EMMA	31 OCT-08 NOV	9	140	908	550	33	18	2184
38	T	FREDA	07 NOV-10 NOV	4	85	971	250	12	7	1044
39	T	GILDA	08 NOV-18 NOV	12	130	890	600	45	32	2580
40	T	HARRIET	17 NOV-24 NOV	8	110	953	275	29	15	2028
41	TS	IVY	17 DEC-19 DEC	3	60	980	330	10	--	222
			TOTALS:					957	345	

*DATA TAKEN FROM BEST TRACK

**COMBINED DATA; JTWC, GUAM AND FWC, PEARL

TABLE IV-6 (Cont'd)


GEORGIA
VERA
HOPE
THELMA
JOAN
BABE
DOT
TD17
TD9
THERESE
LOUISE
TD11
PATSY
FRAN
TD23
TD34
RUBY
WILDA
IVY
IRIS
TROPICAL STORMS
AND
TROPICAL DEPRESSIONS
1967

TROPICAL STORMS 1967
POSITION DATA

TROPICAL STORM RUBY
28 JAN-09 FEB

DTG	LAT	LONG	DTG	LAT	LONG
050000Z	12.3N	131.6E	060000Z	09.5N	131.7E
050600Z	11.6N	131.8E	060600Z	08.8N	131.5E
051200Z	10.9N	131.8E	061200Z	08.2N	131.3E
051800Z	10.2N	131.8E	061800Z	07.4N	130.9E

TROPICAL STORM THERESE
16 MAR-24 MAR

DTG	LAT	LONG	DTG	LAT	LONG
160600Z	08.8N	146.2E	201200Z	14.7N	142.7E
161200Z	09.3N	145.5E	201800Z	14.8N	143.7E
161800Z	09.7N	144.1E	210000Z	15.2N	145.3E
170000Z	09.9N	142.8E	210600Z	16.0N	146.6E
170600Z	10.0N	141.9E	211200Z	16.0N	147.8E
171200Z	10.2N	141.0E	211800Z	16.4N	148.7E
171800Z	10.4N	140.3E	220000Z	16.9N	149.3E
180000Z	10.7N	139.9E	220600Z	17.7N	149.7E
180600Z	11.0N	139.7E	221200Z	18.4N	149.9E
181200Z	11.4N	139.5E	221800Z	19.2N	150.1E
181800Z	12.0N	139.4E	230000Z	19.8N	150.2E
190000Z	12.8N	139.3E	230600Z	20.2N	150.3E
190600Z	13.4N	139.4E	231200Z	20.6N	150.6E
191200Z	13.9N	139.6E	231800Z	21.0N	151.0E
191800Z	14.5N	140.2E	240000Z	21.5N	151.5E
200000Z	14.7N	141.0E	240600Z	22.1N	151.9E
200600Z	14.8N	141.8E			

TROPICAL STORM WILDA
08 MAY-13 MAY

DTG	LAT	LONG	DTG	LAT	LONG
100000Z	11.5N	134.1E	101200Z	13.4N	134.6E
100600Z	12.6N	134.6E	101800Z	13.3N	134.1E

TROPICAL STORM DOT
21 JUL-28 JUL

DTG	LAT	LONG	DTG	LAT	LONG
210500Z	19.5N	142.2E	250000Z	29.3N	130.8E
211200Z	19.3N	143.1E	250600Z	29.7N	130.1E
211800Z	19.8N	144.2E	251200Z	30.0N	129.5E
220000Z	21.2N	144.4E	251800Z	30.3N	128.9E
220600Z	22.7N	143.6E	260000Z	30.7N	128.1E
221200Z	24.1N	142.5E	260500Z	31.1N	127.3E
221800Z	25.3N	141.0E	261200Z	31.4N	126.5E
230000Z	26.3N	139.3E	261800Z	31.8N	125.7E
230600Z	26.8N	137.6E	270000Z	32.1N	125.1E
231200Z	27.3N	136.0E	270600Z	32.5N	124.5E
231800Z	27.6N	134.8E	271200Z	32.8N	124.0E
240000Z	28.0N	133.7E	271800Z	33.5N	123.3E
240600Z	28.4N	132.7E	280000Z	34.4N	122.7E
241200Z	28.8N	131.9E	280600Z	35.8N	122.0E
241800Z	29.1N	131.3E			

TROPICAL STORM GEORGIA
29 JUL-08 AUG

DTG	LAT	LONG	DTG	LAT	LONG
291200Z	18.3N	133.5E	031200Z	30.8N	148.9E
291800Z	19.1N	133.8E	031800Z	31.3N	149.9E
300000Z	19.8N	134.2E	040000Z	31.8N	151.0E
300600Z	20.5N	134.7E	040600Z	32.7N	152.0E
301200Z	21.1N	135.3E	041200Z	33.6N	152.3E
301800Z	21.6N	136.0E	041800Z	34.3N	152.1E
310000Z	22.0N	136.7E	050000Z	34.8N	151.5E
310600Z	22.4N	137.5E	050600Z	35.2N	151.0E
311200Z	22.6N	138.0E	051200Z	35.5N	150.6E
311800Z	22.8N	138.5E	051800Z	35.7N	150.3E
010000Z	22.9N	139.0E	060000Z	35.9N	150.1E
010600Z	23.0N	139.3E	060600Z	36.3N	149.8E
011200Z	23.3N	139.8E	061200Z	37.1N	149.7E
011800Z	23.8N	140.6E	061800Z	37.9N	149.8E
020000Z	24.9N	141.8E	070000Z	38.7N	150.2E
020600Z	26.2N	143.0E	070600Z	39.6N	150.8E
021200Z	27.6N	144.3E	071200Z	40.6N	151.4E
021800Z	28.8N	145.7E	071800Z	41.8N	152.3E
030000Z	29.6N	146.8E	080000Z	33.2N	153.4E
030600Z	30.2N	147.9E			

TROPICAL STORM FRAN
29 JUL-02 AUG

DTG	LAT	LONG	DTG	LAT	LONG
291200Z	15.5N	116.3E	311800Z	18.2N	112.3E
291800Z	16.2N	115.8E	010000Z	18.5N	112.1E
300000Z	16.7N	115.2E	010600Z	18.8N	111.9E
300600Z	16.9N	114.6E	011200Z	19.3N	111.7E
301200Z	17.0N	114.1E	011800Z	19.7N	111.5E
301800Z	17.1N	113.6E	020000Z	20.2N	111.3E
310000Z	17.4N	113.3E	020600Z	20.7N	111.2E
310600Z	17.6N	112.9E	021200Z	21.4N	111.1E
311200Z	17.9N	112.6E			

TROPICAL STORM HOPE
04 AUG-09 AUG

DTG	LAT	LONG	DTG	LAT	LONG
041800Z	20.8N	166.4E	070000Z	34.0N	173.8E
050000Z	21.2N	166.8E	070600Z	34.5N	174.8E
050600Z	21.9N	167.4E	071200Z	35.6N	175.2E
051200Z	23.2N	168.3E	071800Z	36.3N	176.0E
051800Z	24.7N	169.3E	080000Z	36.7N	176.5E
060000Z	26.5N	170.3E	080600Z	36.8N	176.9E
060600Z	28.7N	171.4E	081200Z	37.0N	177.4E
061200Z	30.9N	172.2E	081800Z	37.2N	177.8E
061800Z	32.7N	173.0E			

TROPICAL STORM IRIS
15 AUG-16 AUG

DTG	LAT	LONG	DTG	LAT	LONG
150600Z	20.4N	114.3E	151800Z	21.1N	112.1E
151200Z	20.7N	113.1E	160000Z	21.4N	111.3E

TROPICAL STORM LOUISE
16 AUG-23 AUG

DTG	LAT	LONG	DTG	LAT	LONG
161200Z	20.3N	141.5E	201200Z	28.4N	133.5E
161800Z	20.0N	141.3E	201800Z	29.1N	133.4E
170000Z	19.4N	141.2E	210000Z	29.8N	133.4E
170600Z	18.7N	141.5E	210600Z	30.6N	133.5E
171200Z	17.8N	141.9E	211200Z	31.5N	133.9E
171800Z	18.3N	141.5E	211800Z	32.2N	134.3E
180000Z	18.8N	142.1E	220000Z	32.9N	135.0E
180600Z	19.7N	142.0E	220600Z	33.6N	135.7E
191200Z	24.0N	136.4E	221200Z	34.2N	136.4E
191800Z	25.7N	135.6E	221800Z	34.5N	137.0E
200000Z	26.8N	134.4E	230000Z	34.8N	137.6E
200600Z	27.7N	133.8E			

TROPICAL STORM JOAN
18 AUG-22 AUG

DTG	LAT	LONG	DTG	LAT	LONG
180600Z	27.0N	158.2E	200600Z	31.9N	154.0E
181200Z	27.9N	157.6E	201200Z	32.3N	154.1E
181800Z	28.6N	156.8E	201800Z	32.7N	154.3E
190000Z	29.3N	156.0E	210000Z	33.1N	154.7E
190600Z	29.8N	155.2E	210600Z	33.5N	155.2E
191200Z	30.4N	154.5E	211200Z	33.9N	155.9E
191800Z	30.9N	154.1E	211800Z	34.2N	156.7E
200000Z	31.5N	154.0E			

TROPICAL STORM PATSY
04 SEP-07 SEP

DTG	LAT	LONG	DTG	LAT	LONG
041200Z	18.8N	118.2E	050600Z	19.1N	113.7E
041800Z	18.9N	116.7E	051200Z	19.2N	112.0E
050000Z	19.0N	115.2E	051800Z	19.2N	110.5E

TROPICAL STORM THELMA
10 SEP-12 SEP

DTG	LAT	LONG	DTG	LAT	LONG
100000Z	28.8N	167.1E	111200Z	30.2N	154.3E
100600Z	29.3N	166.2E	111800Z	31.0N	151.6E
101200Z	29.7N	164.8E	120000Z	32.0N	149.2E
101800Z	29.9N	162.8E	120600Z	33.4N	147.3E
110000Z	29.8N	160.1E	121200Z	35.2N	146.4E
110600Z	29.8N	157.1E			

TROPICAL STORM VERA
13 SEP-16 SEP

DTG	LAT	LONG	DTG	LAT	LONG
131200Z	24.8N	164.2E	141800Z	29.8N	155.2E
131800Z	25.0N	161.9E	150000Z	31.2N	154.4E
140000Z	25.6N	159.6E	150600Z	32.6N	153.8E
140600Z	26.9N	157.6E	151200Z	34.4N	153.4E
141200Z	28.5N	156.2E			

TROPICAL STORM BABE
08 OCT-10 OCT

DTG	LAT	LONG	DTG	LAT	LONG
080600Z	25.8N	147.9E	090600Z	30.1N	152.4E
081200Z	26.8N	148.5E	091200Z	31.1N	154.7E
081800Z	27.8N	149.5E	091800Z	32.3N	157.6E
090000Z	29.0N	150.6E	100000Z	33.3N	160.4E

TROPICAL STORM IVY
17 DEC-19 DEC

DTG	LAT	LONG	DTG	LAT	LONG
170600Z	12.1N	133.9E	181200Z	13.2N	134.2E
171200Z	12.4N	133.6E	181800Z	13.5N	135.1E
171800Z	12.5N	133.6E	190000Z	13.1N	135.5E
180000Z	12.5N	133.6E	190600Z	12.8N	135.4E
180600Z	12.8N	133.7E	191200Z	12.7N	135.2E

TROPICAL DEPRESSIONS 1967
POSITION DATA

TROPICAL DEPRESSION NINE
20 JUL-21 JUL

DTG	LAT	LONG	DTG	LAT	LONG
200600Z	21.7N	147.0E	210000Z	22.8N	146.1E
201200Z	22.1N	146.8E	210600Z	23.1N	145.7E
201800Z	22.4N	146.5E			

TROPICAL DEPRESSION ONE ONE
25 JUL-27 JUL

DTG	LAT	LONG	DTG	LAT	LONG
250600Z	14.3N	152.0E	251800Z	13.8N	149.1E
251200Z	13.7N	151.5N	270000Z	14.9N	149.1E
251800Z	13.3N	150.9E	270600Z	15.9N	149.4E
260000Z	13.0N	150.2E	271200Z	16.9N	149.2E
260600Z	13.1N	150.0E	271800Z	17.4N	148.9E
261200Z	13.2N	149.7E			

TROPICAL DEPRESSION ONE SIX
10 AUG-11 AUG

DTG	LAT	LONG	DTG	LAT	LONG
101200Z	19.2N	112.8E	110000Z	21.2N	112.9E
101800Z	20.2N	112.8E	110600Z	22.2N	113.0E

TROPICAL DEPRESSION ONE SEVEN
11 AUG-13 AUG

DTG	LAT	LONG	DTG	LAT	LONG
111200Z	26.7N	129.2E	121200Z	31.5N	128.8E
111800Z	27.7N	129.3E	121800Z	32.6N	128.9E
120000Z	28.9N	129.1E	130000Z	33.6N	129.2E
120600Z	30.3N	128.8E			

TROPICAL DEPRESSION TWO THREE
25 AUG-26 AUG

DTG	LAT	LONG	DTG	LAT	LONG
250000Z	13.7N	114.8E	260000Z	16.4N	109.4E
250600Z	14.3N	113.3E	260600Z	16.8N	108.0E
251200Z	15.2N	112.0E	261200Z	17.3N	106.7E
251800Z	16.0N	110.7E			

TROPICAL DEPRESSION THREE FOUR
08 OCT-09 OCT

DTG	LAT	LONG	DTG	LAT	LONG
081200Z	14.4N	110.4E	090000Z	15.4N	107.5E
081800Z	14.9N	109.1E			

The statistics, fix data and verification pages for each typhoon have been automated and are identified by cyclone number.

For convenience a list of cyclone numbers versus typhoon names follows:

CYCLONE	NAME
02	SALLY
04	VIOLET
06	ANITA
07	BILLIE
08	CLARA
12	ELLEN
21	KATE
22	MARGE
24	NORA
25	OPAL
27	RUTH
28	SARAH
31	WANDA
32	AMY
35	CARLA
36	DINAH
37	EMMA
38	FREDA
39	GILDA
40	HARRIET

See Appendix A for definitions or clarification of certain words and phrases that appear in this chapter.

TROPICAL CYCLONE 02 - 03/01/1800Z TO 03/07/0000Z

I. DATA
   A. STATISTICS
      1. NUMBER OF WARNINGS ISSUED - 22
      2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 09
      3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 1374 MI

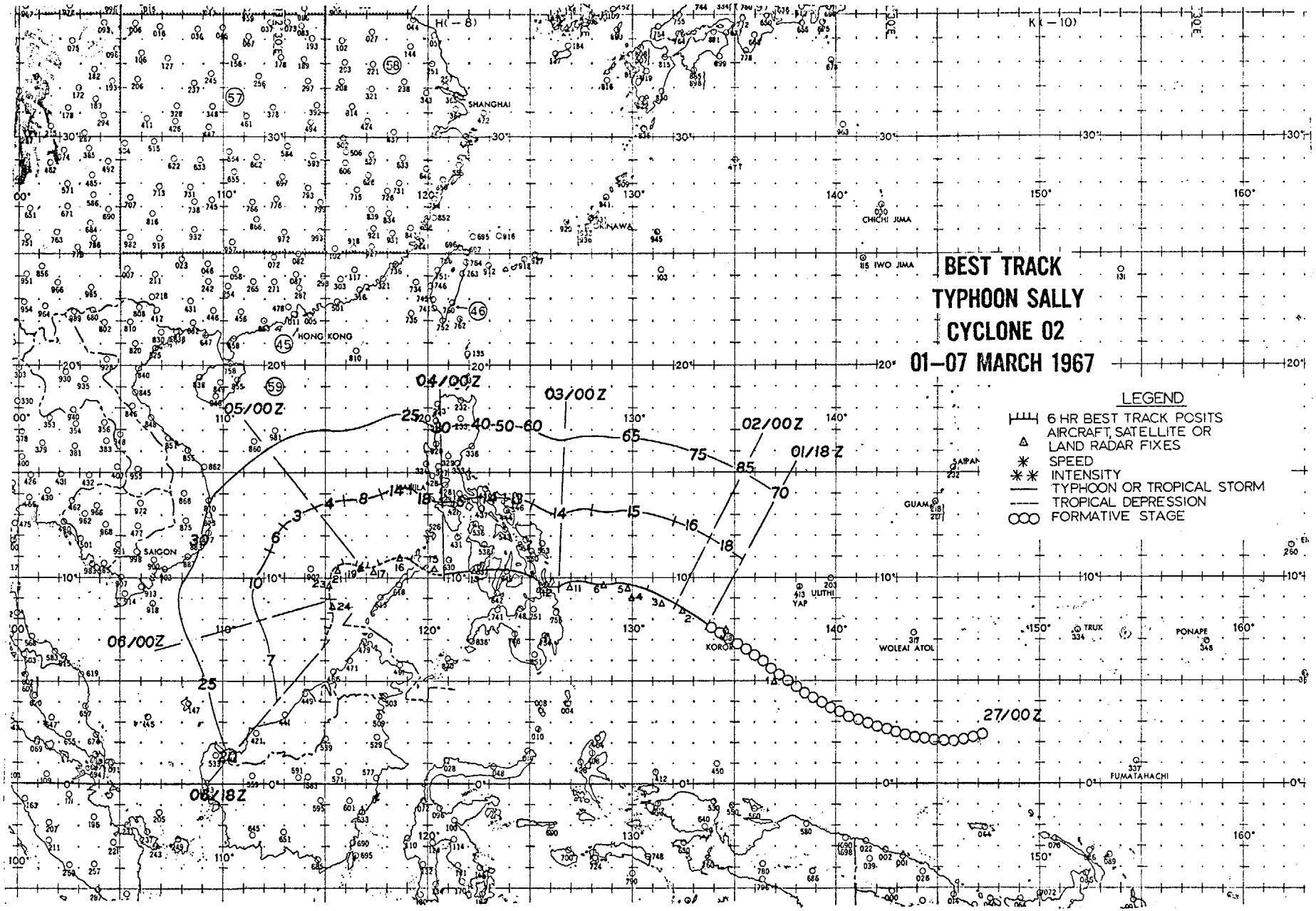
   B. CHARACTERISTICS AS A TYPHOON
      1. MINIMUM OBSERVED SLP - 971MBS AT 020230Z
      2. MINIMUM OBSERVED 700MB HEIGHT - 2893M. AT 012330Z
      3. MAXIMUM SURFACE WIND - 085 KTS (FROM BEST TRACK)
      4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 180 MI

II. DEVELOPMENT
   A. INITIAL IMPETUS - FRACTURE OF A POLAR TROUGH AND AN EASTERLY WAVE

   B. INITIAL SURFACE VORTEX
      1. EMBEDDED VORTEX AT 270000Z
      2. SURFACE PRESSURE LESS THAN 1006MB

   C. 200MB FLOW ABOVE SURFACE VORTEX
      1. INITIAL - SOUTHEAST
      2. UPON REACHING TYPHOON INTENSITY - SOUTHEAST

III. FINAL DISPOSITION - DISSIPATED OVER WATER


BEST TRACK
TYPHOON SALLY
CYCLONE 02
01–07 MARCH 1967
LEGEND
6 HR BEST TRACK POSITS
AIRCRAFT, SATELLITE OR LAND RADAR FIXES
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
FORMATIVE STAGE
04/00Z
03/00Z
05/00Z
02/00Z
01/18Z
06/00Z
06/18Z
27/00Z
SHANGHAI
OKINAWA
CHICHI JIMA
IWO JIMA
HONG KONG
SAIPAN
GUAM
SAIGON
YAP
ULITHI
KOROR
WOLEAI ATOL
TRUK
PONAPE
FUMATAHACHI

EYE FIXES - CYCLONE 02

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
1	0104127	05.0N 137.0E	SLTLS	STG X	DIA 02	BNDS 1							
2	0123307	08.6N 132.2E	54-P-P05	3220M	070	075	983	2893	09/--	CIRC	----	20	08
3	0202307	08.9N 131.5E	54-P-P05	3200M	085	100	971	2902	09/--	CIRC	----	12	08
4	0205087	09.0N 130.0E	SLTLS	STG X	DIA --	BNDS 2							
5	0209017	09.5N 130.1E	VW-UNK10		---	---	---	---	--/--	----			--
6	0209257	09.6N 129.9E	VW-R-P05	0500M	---	025	011	---	--/--	ELIP	NW-SE	26X17	F.B.
7	0211307	09.8N 128.6E	VW-UNK--	0500M	---	---	---	---	--/--	CIRC	----	20	--
8	0213007	09.7N 128.9E	VW-UNK--		---	---	---	---	--/--	CIRC	----	20	--
9	0214007	09.8N 128.8E	VW-UNK--		---	---	---	---	--/--	----			--
10	0215007	09.9N 128.6E	VW-R-P05	0490M	047	015	009	---	--/--	CIRC	----	11	08
11	0222217	09.5N 127.0E	54-P-P03	3290M	075	065	988	2993	16/--	CIRC	----	12	05
12	0303177	09.9N 125.8E	54-P-F01	5250M	060	065	986	---	--/--	----			--
13	0305567	10.0N 125.0E	SLTLS	STG X	DIA 05	BNDS 3							
14	0308407	--.-N 1--.-E	54-UNK--	4H10M	---	---	---	---	--/--	----			--
15	0314507	--.-N 1--.-E	VW-UNK--	700MB	056	---	---	---	--/--	----			--
16	0319057	10.3N 122.2E	VW-R-P05	700MB	---	---	---	---	--/--	----			--
17	0320557	10.2N 122.0E	VW-P-P02	700MB	060	---	990	---	--/--	CIRC	----	15	08
18	0403147	10.4N 120.3E	54-R-P01	5820M	025	---	998	---	--/--	CIRC	----	08	01
19	0409007	10.9N 118.6E	54-P-P01	500MB	025	---	008	3112	09/07	----			F.B.
20	0414457	10.3N 117.2E	VW-R-F05	0280M	024	---	004	---	--/--	----			F.B.
21	0503307	10.5N 116.7E	54-P-F03	700MB	025	015	004	---	--/--	CIRC	----	30	--
22	0508007	10.8N 116.4E	54-P-P03	0460M	015	020	999	---	--/--	----			--
23	0514477	10.4N 115.6E	VW-P-P02	0440M	030	---	007	3150	09/05	CIRC	----	10	--
24	0517507	10.0N 115.2E	VW-UNK--	0220M	---	---	004	---	--/--	CIRC	----	10	--

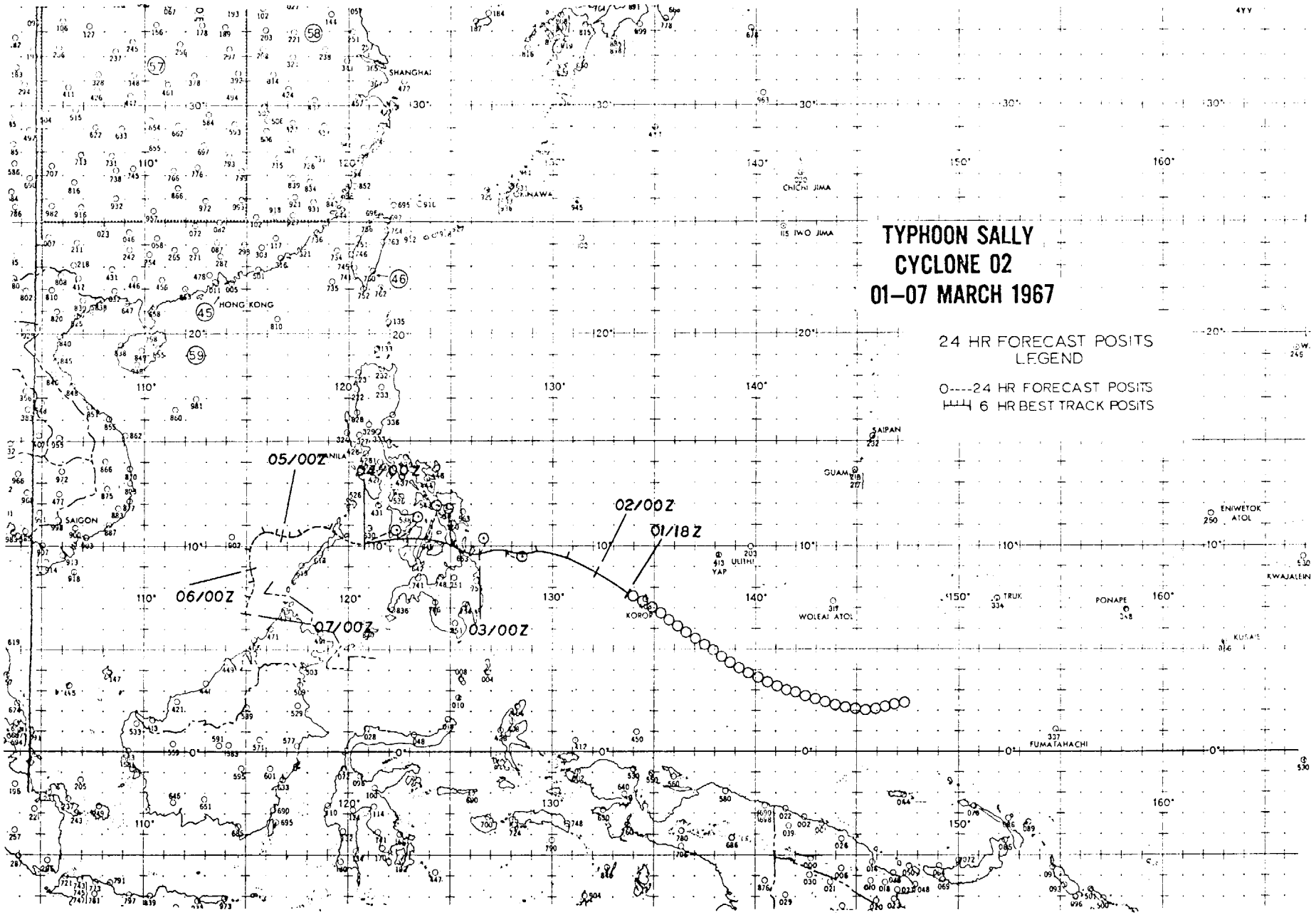
EYE FIXES CYCLONE 02

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
25	0521007	09.8N 115.1E	VW-P-L04	0440M	025	---	002	---	--/--	----			--
26	0603227	08.6N 115.3E	54-P-P03	0450M	040	030	007	---	--/--	----			--
27	0703307	--.-N 1--.-E	54-UNK--	0150M	---	---	---	---	--/--	----			--

TROPICAL CYCLONE 02 -- 03/01/1800Z TO 03/06/1800Z
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION LAT.	LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
011800Z	07.7N	133.6E	--------	--------	--------
020000Z	08.6N	132.1E	--------	--------	--------
020600Z	09.4N	130.7E	--------	--------	--------
021200Z	09.6N	129.2E	--------	--------	--------
021800Z	09.8N	127.8E	116-0036	--------	--------
030000Z	09.5N	126.4E	015-0048	--------	--------
030600Z	10.1N	125.1E	356-0108	--------	--------
031200Z	10.3N	123.8E	020-0108	--------	--------
031800Z	10.3N	122.4E	039-0072	031-0078	--------

AVERAGE 24 HOUR ERROR - 0074 MI.
AVERAGE 48 HOUR ERROR - 0078 MI.
AVERAGE 72 HOUR ERROR - ---- MI.


TYPHOON SALLY
CYCLONE 02
01–07 MARCH 1967
24 HR FORECAST POSITS
LEGEND
0----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS
05/00Z
04/00Z
02/00Z
01/18Z
06/00Z
07/00Z
03/00Z
SHANGHAI
OKINAWA
CHICHI JIMA
IWO JIMA
HONG KONG
SAIPAN
GUAM
MANILA
SAIGON
ULITHI
YAP
WOLEAI ATOL
KOROR
TRUK
PONAPE
ENIWETOK ATOL
KWAJALEIN
FUMATAHACHI

V-8

TROPICAL CYCLONE 04 - 04/01/0600Z TO 04/12/0600Z

I. DATA
   A. STATISTICS
      1. NUMBER OF WARNINGS ISSUED - 45
      2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 32
      3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 2688 MI

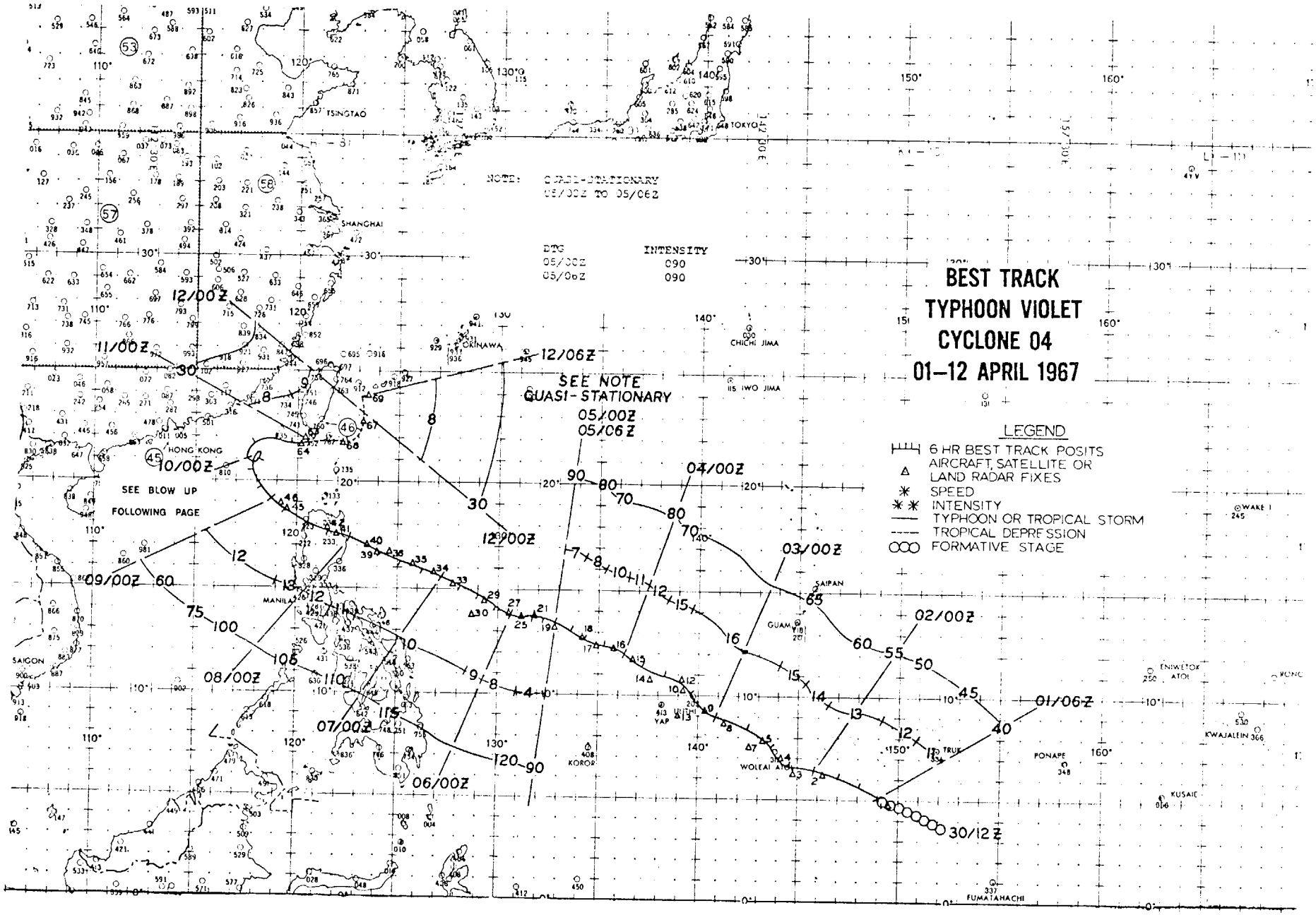
   B. CHARACTERISTICS AS A TYPHOON
      1. MINIMUM OBSERVED SLP - 929MBS AT 060825Z
      2. MINIMUM OBSERVED 700MB HEIGHT - 2460M. AT 060825Z
      3. MAXIMUM SURFACE WIND - 120 KTS (FROM BEST TRACK)
      4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 450 MI

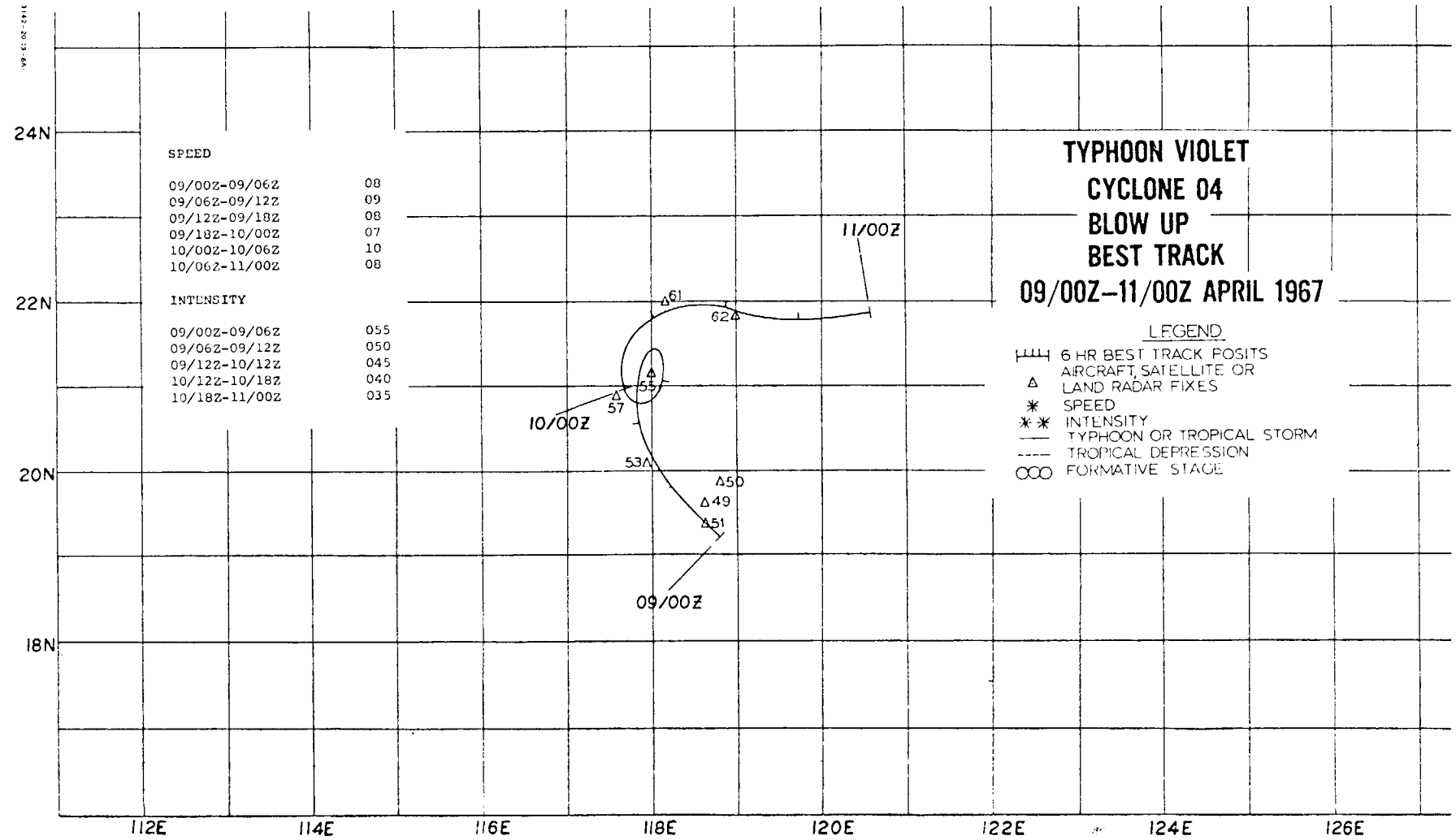
II. DEVELOPMENT
   A. INITIAL IMPETUS - FRACTURE OF A POLAR TROUGH AND AN EASTERLY WAVE

   B. INITIAL SURFACE VORTEX
      1. INDUCED VORTEX AT 301200Z
      2. SURFACE PRESSURE LESS THAN 1004MB

   C. 200MB FLOW ABOVE SURFACE VORTEX
      1. INITIAL - EAST
      2. UPON REACHING TYPHOON INTENSITY - EAST

III. FINAL DISPOSITION - DISSIPATED OVER WATER


BEST TRACK
TYPHOON VIOLET
CYCLONE 04
01–12 APRIL 1967
LEGEND
6 HR BEST TRACK POSITS
AIRCRAFT, SATELLITE OR LAND RADAR FIXES
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
FORMATIVE STAGE
NOTE: QUASI-STATIONARY 05/00Z TO 05/06Z
DTG INTENSITY
05/00Z 090
05/06Z 090
SEE NOTE QUASI-STATIONARY 05/00Z 05/06Z
SEE BLOW UP FOLLOWING PAGE
12/00Z
11/00Z
10/00Z
09/00Z
08/00Z
07/00Z
06/00Z
12/06Z
04/00Z
03/00Z
02/00Z
01/06Z
30/12Z
TSINGTAO
SHANGHAI
OKINAWA
CHICHI JIMA
IIS IWO JIMA
HONG KONG
MANILA
SAIGON
GUAM
SAIPAN
YAP
KOROR
WOLEAI ATOLL
ENIWETOK ATOL
PONAPE
KWAJALEIN
KUSAIE
FUMATAHACHI
TOKYO
WAKE I


TYPHOON VIOLET
CYCLONE 04
BLOW UP
BEST TRACK
09/00Z–11/00Z APRIL 1967
LEGEND
6 HR BEST TRACK POSITS
AIRCRAFT, SATELLITE OR LAND RADAR FIXES
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
FORMATIVE STAGE
SPEED
09/00Z-09/06Z 08
09/06Z-09/12Z 09
09/12Z-09/18Z 08
09/18Z-10/00Z 07
10/00Z-10/06Z 10
10/06Z-11/00Z 08
INTENSITY
09/00Z-09/06Z 055
09/06Z-09/12Z 050
09/12Z-10/12Z 045
10/12Z-10/18Z 040
10/18Z-11/00Z 035
11/00Z
10/00Z
09/00Z
24N
22N
20N
18N
112E
114E
116E
118E
120E
122E
124E
126E

EYE FIXES CYCLONE 04

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
1	0103107	04.9N 149.5E	54-P-F10	0460M	035	035	000	3066	07/--	----			F.B.
2	0121257	06.3N 146.3E	54-P-P05	700MB	035	035	995	---	--/--	CIRC	----	30	10
3	0203007	06.3N 144.9E	54-P-P05	0460M	050	050	986	---	--/--	CIRC	----	25	--
4	0206157	07.5N 142.5E	SLTLS	STG X	DIA 05	BNDS 2							
5	0208307	07.0N 144.3E	VW-P-P--	0300M	045	045	990	3048	15/07	CIRC	----	12	--
6	0213307	07.8N 143.2E	VW-R-P05	700MB	---	---	---	---	--/--	----			--
7	0214307	07.9N 143.0E	VW-P-P05	700MB	---	---	992	3002	14/08	CIRC	----	16	--
8	0222007	08.6N 141.3E	54-P-P05	700MB	060	075	991	2978	11/--	CIRC	----	30	--
9	0302007	09.2N 140.4E	54-P-P03	3310M	055	060	982	2972	10/--	CIRC	----	25	--
10	0303107	09.0N 139.0E	SLTLS	STG C	DIA --	BNDS -							
11	0307507	10.3N 139.2E	VW-UNK10		---	---	---	---	--/--	----			--
12	0309007	10.3N 139.5E	VW-P-P05	0310M	065	065	988	---	--/--	CIRC	----	25	08
13	0312307	10.9N 138.3E	VW-UNK20		---	---	---	---	--/--	----			--
14	0314417	10.7N 137.6E	VW-P-P05	700MB	050	---	---	---	--/--	----			F.B.
15	0320447	11.6N 136.8E	54-P-P02	700MB	045	---	975	2874	17/--	CIRC	----	10	08
16	0403007	12.2N 135.7E	54-P-P03	3300M	065	050	977	2880	10/--	CIRC	----	10	--
17	0403127	12.0N 135.0E	SLTLS	STG X	DIA 04	BNDS 4							
18	0408167	12.4N 134.9E	54-P-P05	3110M	065	075	969	2804	14/--	CIRC	----	05	40
19	0414457	12.8N 134.1E	VW-P-P07	0460M	---	065	967	---	--/--	ELIP	N-S	10X06	--
20	0420407	13.2N 132.9E	VW-P-P05	700MB	---	050	974	2841	12/06	ELIP	N-S	23X12	--
21	0503007	13.2N 133.0E	54-P-P02	3320M	080	050	978	2920	15/--	CIRC	----	30	05
22	0503527	13.8N 131.8E	ACFT RDR		---	---	---	---	--/--	----			--
23	0505037	13.0N 132.5E	SLTLS	STG X	DIA 05	BNDS 4							
24	0509007	13.2N 132.7E	54-P-P02	700MB	095	100	942	2600	20/--	CIRC	----	30	05

EYE FIXES CYCLONE 04

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
25	051250Z	14.0N 132.5E	ACFT RDR		---	---	---	---	--/--	----			--
26	051500Z	13.6N 132.1E	VW-P-P03	700MB	050	---	932	2502	21/12	CIRC	----	25	05
27	051930Z	13.7N 131.2E	VW-R-P--		---	---	---	---	--/--	----			--
28	052107Z	13.7N 131.0E	VW-P-P02	700MB	080	070	977	2877	21/12	ELIP	NW-SE	26X17	04
29	060130Z	13.9N 130.6E	54-UNK--	500MB	---	---	---	---	--/--	----			--
30	060330Z	14.1N 130.3E	54-P-P05	700MB	105	095	931	2472	20/--	ELIP	NW-SE	35X25	05
31	060825Z	14.5N 129.3E	54-P-P12	700MB	115	100	929	2460	18/--	CIRC	----	25	05
32	061348Z	14.7N 128.8E	VW-UNK--		---	---	---	---	--/--	----			--
33	061500Z	14.9N 128.8E	VW-P-P02	2200M	060	---	940	2575	--/--	CIRC	----	22	04
34	062100Z	15.3N 127.7E	VW-P-P03	2440M	110	---	940	2572	17/13	CIRC	----	23	04
35	070300Z	15.8N 126.8E	54-P-P02	2820M	050	100	947	2618	17/--	CIRC	----	25	05
36	070900Z	16.1N 125.8E	54-P-P02	700MB	075	050	948	2624	14/--	CIRC	----	20	05
37	071129Z	16.3N 126.0E	ACFT RDR		---	---	---	---	--/--	----			--
38	071519Z	16.7N 124.6E	VW-P-P02	2480M	080	---	954	2705	17/11	CIRC	----	25	05
39	071730Z	16.8N 124.0E	VW-UNK--		---	---	---	---	--/--	----			--
40	072109Z	17.1N 123.5E	VW-P-P02	700MB	090	---	958	2723	16/10	CONC		60-25	05
41	080330Z	17.5N 122.0E	54-R-L05	700MB	085	100	---	---	--/--	CIRC	----	30	--
42	080700Z	17.8N 121.5E	54-R-P--		---	---	---	---	--/--	----			--
43	080835Z	17.7N 121.3E	54-R-L05	3300M	---	---	---	---	--/--	CIRC	----	25	--
44	081512Z	18.6N 119.6E	VW-P-P02	700MB	070	---	993	2995	12/05	CIRC	----	40	05
45	082109Z	19.0N 119.3E	VW-P-P02	0270M	055	045	991	---	--/--	CIRC	----	80	--
46	082250Z	18.9N 119.1E	LND RDR		---	---	---	---	--/--	----			--
47	090000Z	19.3N 118.8E	LND RDR		---	---	---	---	--/--	----			--
48	090100Z	19.5N 118.6E	LND RDR		---	---	---	---	--/--	----			--

EYE FIXES CYCLONE 04

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
49	090200Z	19.8N 118.8E	LND RDR		---	---	---	---	--/--	----			--
50	090300Z	19.4N 118.5E	54-P-P03	700MB	050	050	991	2987	12/--	CIRC	----	25	--
51	090300Z	19.6N 118.8E	LND RDR		---	---	---	---	--/--	----			--
52	090439Z	19.5N 118.0E	SLTLS	STG X	DIA 05 BNDS 3								
53	090910Z	20.1N 117.9E	54-P-P03	3390M	060	050	993	3002	12/--	CIRC	----	30	--
54	091500Z	21.3N 118.0E	VW-P-F15	0350M	---	040	995	---	--/--	CIRC	----	85	--
55	091700Z	21.2N 111.8E	VW-UNK--		---	---	---	---	--/--	----			--
56	091800Z	21.1N 118.1E	VW-UNK--		---	---	---	---	--/--	----			--
57	091900Z	19.9N 118.0E	VW-UNK--		---	---	---	---	--/--	----			--
58	092127Z	20.8N 117.6E	VW-P-P05	700MB	053	---	998	3027	14/12	CIRC	----	40	--
59	100310Z	21.0N 117.8E	54-P-F10	700MB	050	060	994	3024	11/--	----			--
60	100820Z	22.0N 118.3E	54-P-F05	700MB	070	060	995	3024	12/--	----			F.B.
61	101520Z	21.7N 119.0E	VW-P-P02	0220M	045	050	997	---	--/--	CIRC	----	30	--
62	101930Z	22.0N 120.4E	VW-UNK--		---	---	---	---	--/--	----			--
63	102100Z	21.7N 120.1E	VW-P-P02	0220M	035	030	999	3060	12/--	----			--
64	110300Z	21.8N 120.8E	54-P-P01	700MB	025	025	009	3136	12/--	CIRC	----	10	--
65	110845Z	21.8N 121.7E	54-P-P02	700MB	---	025	000	3103	11/--	----			N.F.B.
66	111445Z	22.8N 123.3E	VW-P-F10	700MB	040	---	998	3182	12/11	----			--
67	111454Z	21.9N 123.3E	ACFT RDR		---	---	---	---	--/--	----			--
68	112117Z	23.9N 123.3E	VW-P-P02		---	030	011	---	--/--	----			N.F.B.

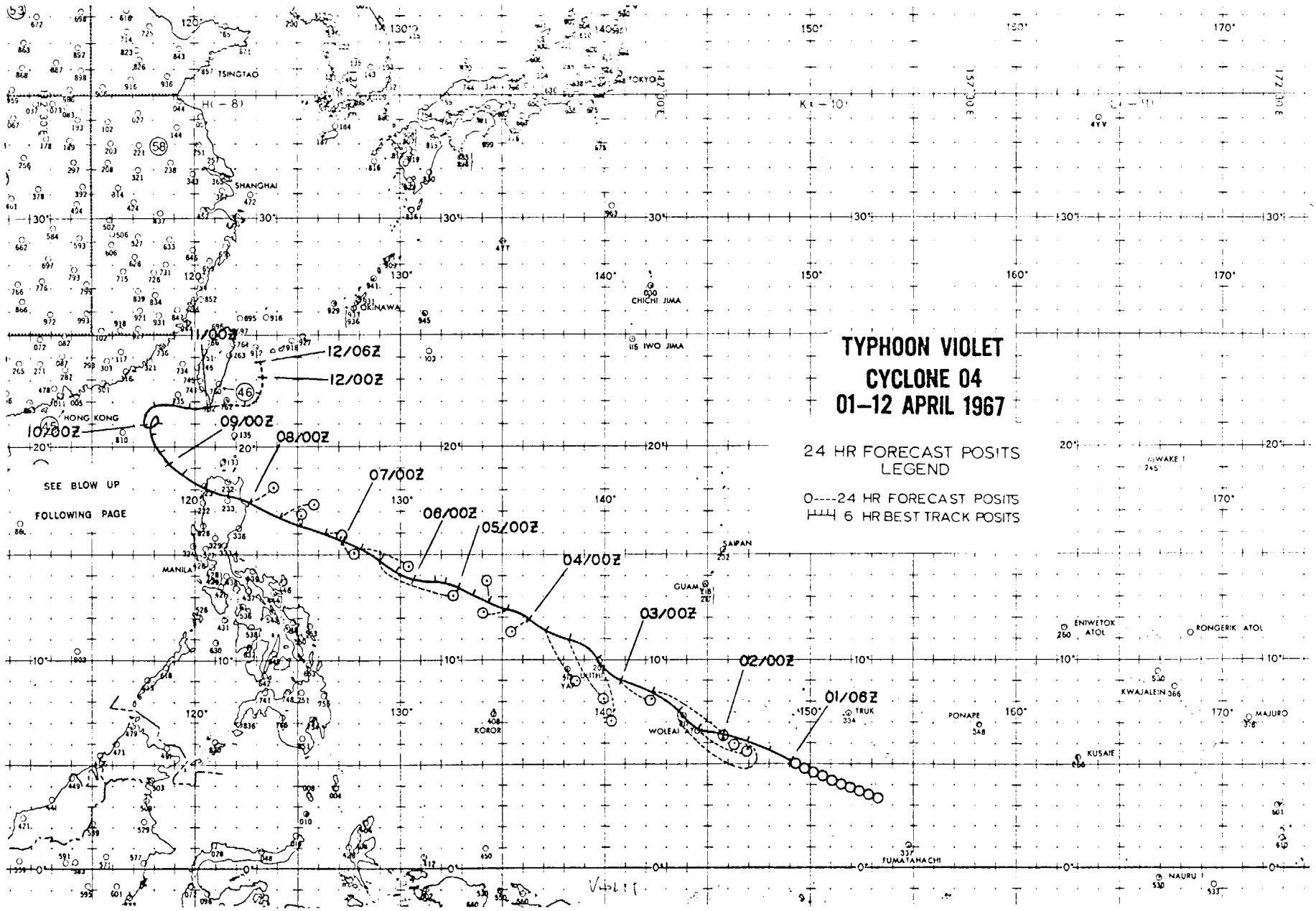
TROPICAL CYCLONE 04 -- 04/01/0600Z TO 04/12/0600Z
POSITION AND FORECAST VERIFICATION DATA

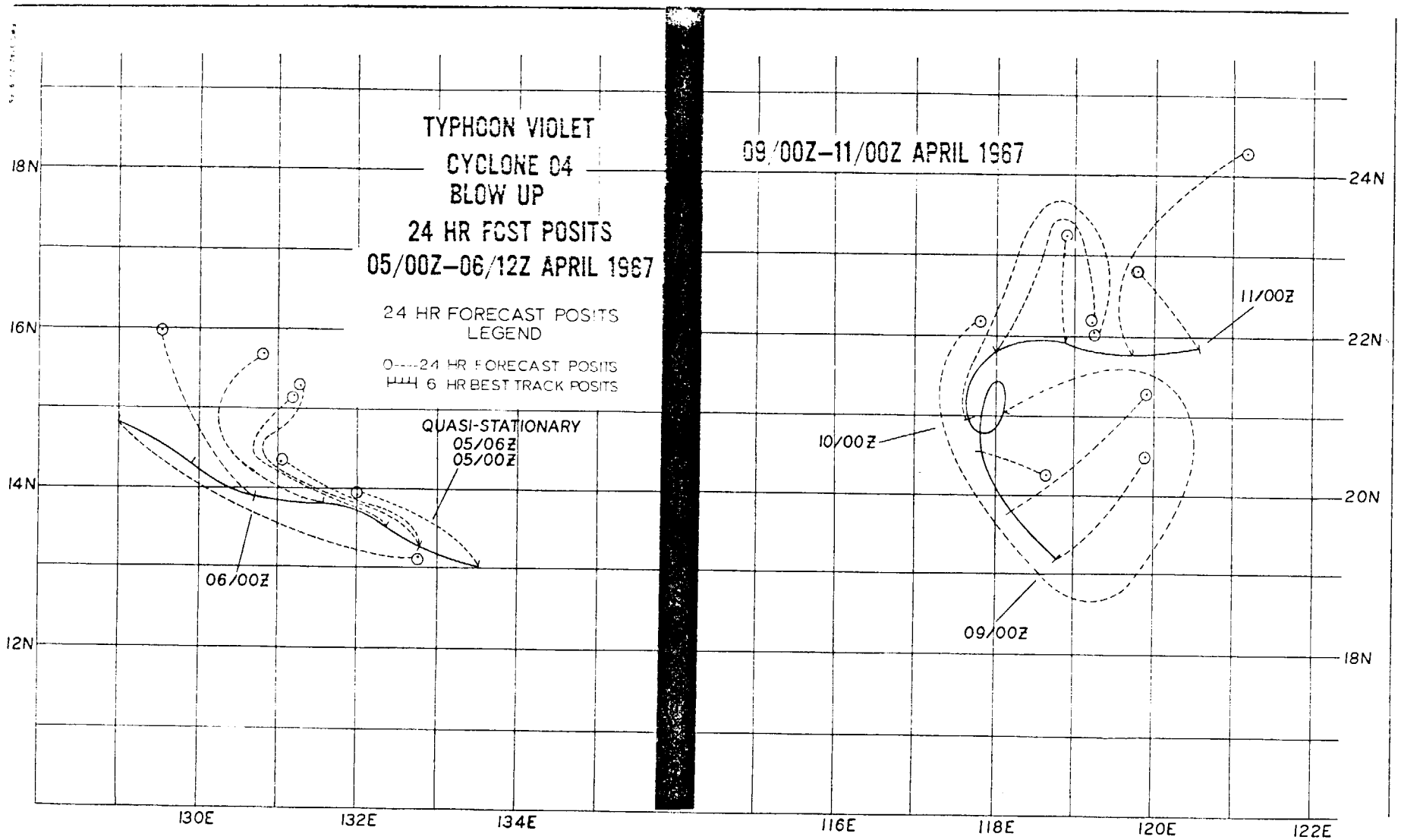
DTG	STORM POSITION LAT.	LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
010600Z	05.1N	149.0E	--------	--------	--------
011200Z	05.6N	148.0E	--------	--------	--------
011800Z	06.1N	147.0E	--------	--------	--------
020000Z	06.2N	145.8E	--------	--------	--------
020600Z	06.6N	144.6E	106-0144	--------	--------
021200Z	07.6N	143.6E	120-0186	--------	--------
021800Z	08.2N	142.3E	120-0234	--------	--------
030000Z	08.9N	140.8E	121-0090	--------	--------
030600Z	10.0N	139.6E	166-0174	--------	--------
031200Z	10.9N	138.3E	150-0192	--------	--------
031800Z	11.1N	137.1E	146-0150	--------	--------
040000Z	12.0N	136.3E	230-0054	133-0228	--------
040600Z	12.3N	135.2E	270-0060	165-0282	--------
041200Z	12.7N	134.3E	360-0066	152-0240	--------
041800Z	13.0N	133.5E	299-0096	157-0186	--------
050000Z	13.3N	132.8E	302-0120	282-0168	--------
050600Z	13.3N	132.8E	325-0144	290-0258	188-0288
051200Z	13.5N	132.4E	327-0120	322-0264	--------
051800Z	13.7N	131.6E	337-0120	303-0300	222-0132
060000Z	13.8N	130.7E	333-0144	302-0318	--------
060600Z	14.3N	129.9E	073-0078	342-0258	299-0360
061200Z	14.7N	129.0E	113-0228	356-0186	--------
061800Z	15.1N	128.1E	106-0144	004-0192	307-0402
070000Z	15.5N	127.2E	134-0030	016-0216	--------
070600Z	15.9N	126.3E	105-0042	085-0198	016-0348
071200Z	16.3N	125.2E	000-0030	107-0354	--------
071800Z	16.8N	124.1E	074-0102	103-0258	040-0318
080000Z	17.3N	122.8E	052-0072	090-0156	--------
080600Z	17.6N	121.7E	065-0108	080-0192	089-0360
081200Z	18.1N	120.5E	067-0102	065-0210	--------
081800Z	18.7N	119.4E	065-0096	077-0264	099-0426
090000Z	19.2N	118.7E	038-0096	063-0234	--------
090600Z	19.7N	118.2E	044-0126	066-0258	073-0408
091200Z	20.6N	117.8E	113-0042	070-0252	--------

TROPICAL CYCLONE 04 -- 04/01/0600Z TO 04/12/0600Z
POSITION AND FORECAST VERIFICATION DATA (CONT)

DTG	STORM POSITION LAT.	LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
091800Z	21.1N	116.1E	349-0066	066-0216	078-0390
100000Z	20.9N	117.6E	052-0114	048-0228	--------
100600Z	21.8N	117.0E	074-0072	052-0226	069-0396
101200Z	21.9N	118.9E	033-0096	033-0188	--------
101800Z	21.7N	119.7E	027-0174	009-0156	053-0342

AVERAGE 24 HOUR ERROR - 0111 MI.
AVERAGE 48 HOUR ERROR - 0228 MI.
AVERAGE 72 HOUR ERROR - 0347 MI.


TYPHOON VIOLET
CYCLONE 04
01–12 APRIL 1967
24 HR FORECAST POSITS
LEGEND
0----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS
SEE BLOW UP
FOLLOWING PAGE
12/06Z
12/00Z
11/00Z
10/00Z
09/00Z
08/00Z
07/00Z
06/00Z
05/00Z
04/00Z
03/00Z
02/00Z
01/06Z
TSINGTAO
SHANGHAI
HONG KONG
MANILA
OKINAWA
CHICHI JIMA
IWO JIMA
TOKYO
SAIPAN
GUAM
KOROR
TRUK
PONAPE
WOLEAI ATOL
ENIWETOK ATOL
RONGERIK ATOL
KWAJALEIN
MAJURO
KUSAIE
FUMATAHACHI
NAURU I
WAKE I


TYPHOON VIOLET
CYCLONE 04
BLOW UP
24 HR POST POSITS
05/00Z–06/12Z APRIL 1967
24 HR FORECAST POSITS
LEGEND
0----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS
QUASI-STATIONARY
05/06Z
05/00Z
06/00Z
18N
16N
14N
12N
130E
132E
134E
09/00Z–11/00Z APRIL 1967
24N
22N
20N
18N
11/00Z
10/00Z
09/00Z
116E
118E
120E
122E

TROPICAL CYCLONE 06 - 06/26/0600Z TO 06/30/0600Z

I. DATA

A. STATISTICS

1. NUMBER OF WARNINGS ISSUED - 17
2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 10
3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 1164 MI

B. CHARACTERISTICS AS A TYPHOON

1. MINIMUM OBSERVED SLP - 967MBS AT 281600Z
2. MINIMUM OBSERVED 700MB HEIGHT - 2696M. AT 281600Z
3. MAXIMUM SURFACE WIND - 080 KTS (FROM BEST TRACK)
4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 415 MI

II. DEVELOPMENT

A. INITIAL IMPETUS - LOW LEVEL SURGE INTO CYCLONIC CIRCULATION FROM THE SOUTH WITH SUBSEQUENT DIVERGENCE AT 200MB LEVEL

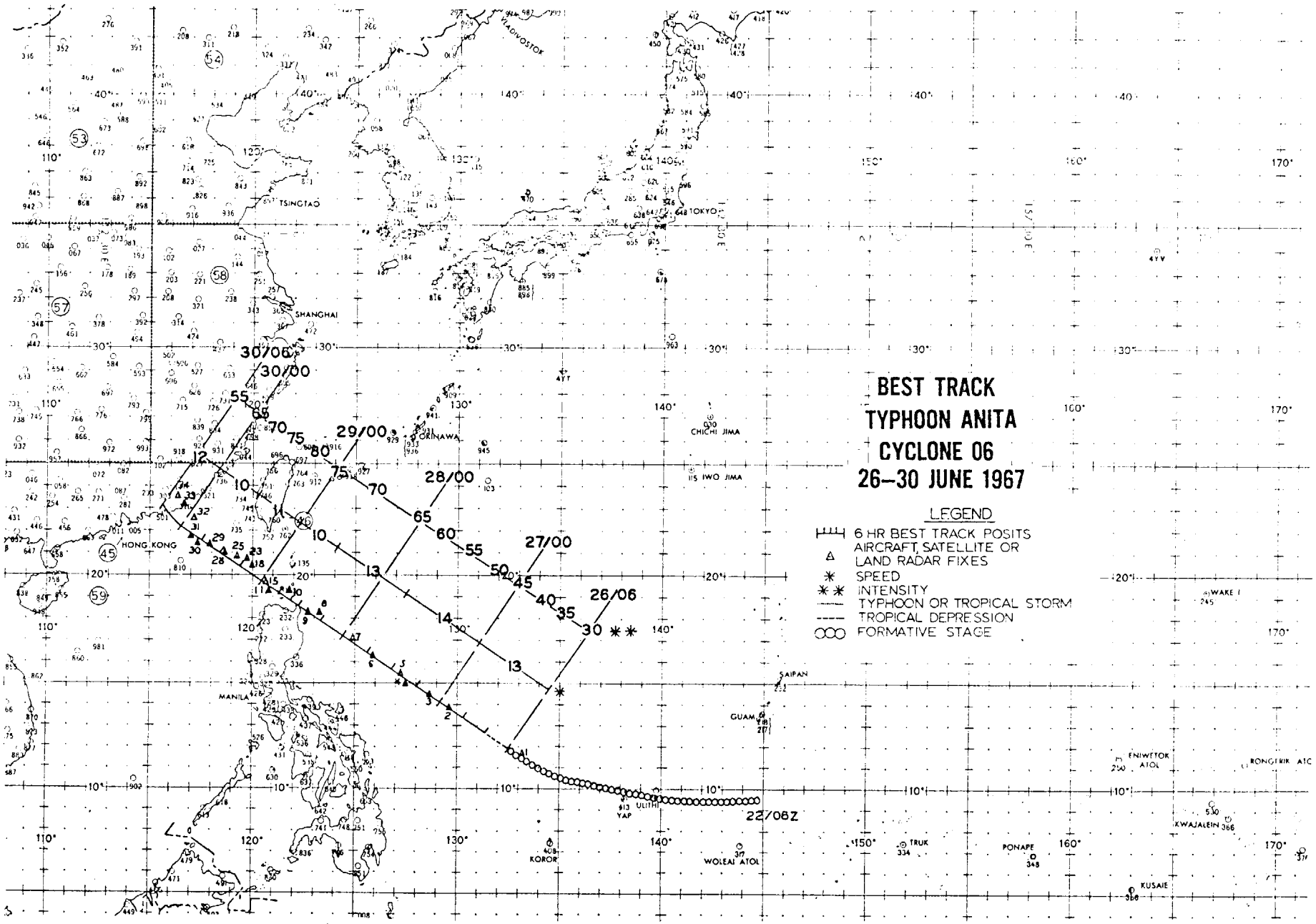
B. INITIAL SURFACE VORTEX

1. JUNCTION VORTEX AT 240000Z
2. SURFACE PRESSURE LESS THAN 1008MB

C. 200MB FLOW ABOVE SURFACE VORTEX

1. INITIAL - NORTHEAST
2. UPON REACHING TYPHOON INTENSITY - NORTHEAST

III. FINAL DISPOSITION - DISSIPATED OVER LAND


BEST TRACK
TYPHOON ANITA
CYCLONE 06
26–30 JUNE 1967
LEGEND
6 HR BEST TRACK POSITS
AIRCRAFT, SATELLITE OR
LAND RADAR FIXES
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
FORMATIVE STAGE
30/06
30/00
29/00
28/00
27/00
26/06
22/06Z
VLADIVOSTOK
TSINGTAO
TOKYO
SHANGHAI
OKINAWA
CHICHI JIMA
IIS IWO JIMA
HONG KONG
MANILA
SAIPAN
GUAM
YAP
ULITHI
KOROR
WOLEAI ATOL
TRUK
PONAPE
KUSAIE
KWAJALEIN
ENIWETOK ATOL
WAKE I

EYE FIXES CYCLONE 06

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
1	260228Z	11.6N 133.2E	54-P-P--	046OM	035	025	002	---	--/--	----			--
2	262200Z	13.9N 129.6E	54-P-P05	046OM	042	040	997	---	--/--	----			--
3	270300Z	14.5N 128.7E	54-P-P05	046OM	049	045	994	---	--/--	CIRC	----	08	--
4	270700Z	15.0N 127.5E	SLTLS	STG X	DIA 03	BNDS 2							
5	270946Z	15.4N 127.2E	54-P-P02	700MB	040	050	990	3021	13/--	----			F.B.
6	271603Z	16.3N 125.9E	VW-P-P05	024OM	---	050	984	2981	14/--	CIRC	----	10	05
7	272200Z	17.0N 124.9E	VW-P-P05	028OM	---	070	984	2996	13/--	CIRC	----	14	05
8	280650Z	18.2N 123.3E	54-P-P02	700MB	050	060	980	2899	13/--	----			F.B.
9	281150Z	18.3N 122.6E	54-P-P03	500MB	055	050	978	2915	15/14	CIRC	----	25	10
10	281600Z	19.2N 121.8E	VW-P-P02	700MB	050	---	967	2696	13/--	CIRC	----	20	--
11	282000Z	19.3N 120.8E	LND RDR		---	---	---	---	--/--	----			--
12	282100Z	19.2N 120.7E	LND RDR		---	---	---	---	--/--	CIRC	----	10	--
13	282133Z	19.5N 120.8E	VW-P-P02	700MB	---	070	972	2910	--/--	CIRC	----	08	--
14	282200Z	19.3N 120.6E	LND RDR		---	---	---	---	--/--	CIRC	----	10	--
15	282310Z	19.7N 120.6E	LND RDR		---	---	---	---	--/--	----			--
16	290005Z	19.6N 120.3E	LND RDR		---	---	---	---	--/--	----			--
17	290010Z	19.7N 120.4E	LND RDR		---	---	---	---	--/--	CIRC	----	30	--
18	290115Z	20.0N 120.4E	LND RDR		---	---	---	---	--/--	----			--
19	290155Z	20.0N 120.2E	LND RDR		---	---	---	---	--/--	----			--
20	290250Z	20.0N 120.1E	LND RDR		---	---	---	---	--/--	----			--
21	290315Z	20.2N 120.0E	LND RDR		---	---	---	---	--/--	----			--
22	290355Z	20.3N 120.1E	54-P-P02	700MB	060	075	978	2896	15/--	CIRC	----	20	--
23	290415Z	20.6N 119.8E	LND RDR		---	---	---	---	--/--	----			--
24	290550Z	20.7N 119.6E	LND RDR		---	---	---	---	--/--	----			--

EYE FIXES CYCLONE 06

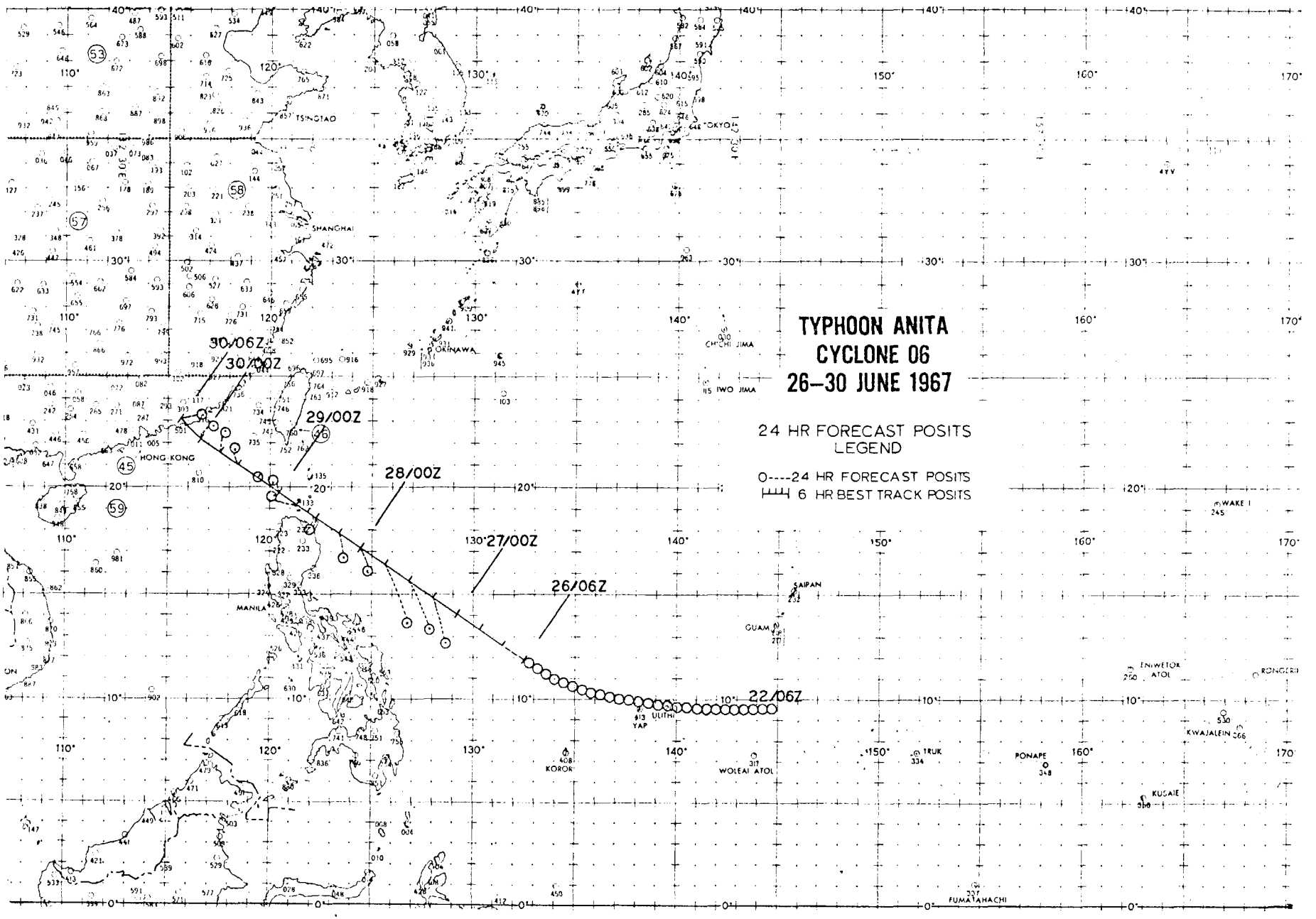
FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
25	290715Z	20.7N 119.3E	LND RDR		---	---	---	---	--/--	----			--
26	290815Z	20.8N 119.1E	LND RDR		---	---	---	---	--/--	----			--
27	290945Z	20.7N 119.0E	54-P-P02	700MB	064	080	975	2874	17/--	CIRC	----	12	--
28	291050Z	21.0N 118.6E	LND RDR		---	---	---	---	--/--	----			--
29	291600Z	21.4N 117.9E	VW-P-P10	700MB	---	---	998	2917	15/11	CIRC	----	07	--
30	291900Z	21.5N 117.4E	VW-R-P10	700MB	---	---	---	---	--/--	----			--
31	292158Z	21.7N 117.0E	VW-P-P05	0240M	---	085	980	---	--/--	CIRC	----	15	--
32	300210Z	22.5N 117.2E	LND RDR		---	---	---	---	--/--	----			--
33	300300Z	23.1N 116.8E	LND RDR		---	---	---	---	--/--	----			--
34	300600Z	23.5N 116.6E	LND RDR		---	---	---	---	--/--	----			--

TROPICAL CYCLONE 06 -- 06/26/0600Z TO 06/30/0600Z

POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION LAT.	LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
261200Z	12.7N	131.4E	--------	--------	--------
261800Z	13.4N	130.3E	--------	--------	--------
270000Z	14.2N	129.2E	--------	--------	--------
270600Z	14.9N	128.0E	161-0132	--------	--------
271200Z	15.7N	126.8E	156-0150	--------	--------
271800Z	16.5N	125.6E	156-0174	--------	--------
280000Z	17.3N	124.5E	165-0072	--------	--------
280600Z	18.0N	123.3E	165-0072	--------	--------
281200Z	18.8N	122.2E	190-0036	--------	--------
281800Z	19.3N	121.3E	291-0060	--------	--------
290000Z	19.9N	120.5E	303-0018	171-0084	--------
290600Z	20.5N	119.5E	----0000	169-0066	--------
291200Z	21.1N	118.5E	351-0042	214-0018	--------
291800Z	21.6N	117.6E	012-0060	012-0090	--------
300000Z	22.1N	116.6E	036-0048	047-0120	--------
300600Z	23.0N	115.8E	074-0060	066-0156	099-0036

AVERAGE 24 HOUR ERROR - 0071 MI.
AVERAGE 48 HOUR ERROR - 0089 MI.
AVERAGE 72 HOUR ERROR - 0036 MI.


TYPHOON ANITA
CYCLONE 06
26–30 JUNE 1967
24 HR FORECAST POSITS
LEGEND
0----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS
30/06Z
30/00Z
29/00Z
28/00Z
27/00Z
26/06Z
22/06Z
TSINGTAO
SHANGHAI
TOKYO
OKINAWA
CHICHI JIMA
IWO JIMA
HONG KONG
MANILA
SAIPAN
GUAM
YAP
ULITHI
KOROR
WOLEAI ATOL
TRUK
PONAPE
KUSAIE
ENIWETOK ATOL
KWAJALEIN
WAKE I
FUMATAHACHI

TROPICAL CYCLONE 07 - 07/02/0000Z TO 07/08/0000Z

I. DATA

A. STATISTICS

1. NUMBER OF WARNINGS ISSUED - 25
2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 08
3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 1326 MI

B. CHARACTERISTICS AS A TYPHOON

1. MINIMUM OBSERVED SLP - 979MBS AT 060354Z
2. MINIMUM OBSERVED 700MB HEIGHT - 2938M. AT 060720Z
3. MAXIMUM SURFACE WIND - 075 KTS (FROM BEST TRACK)
4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 430 MI

II. DEVELOPMENT

A. INITIAL IMPETUS - DEVELOPMENT OF DIVERGENCE AT 200MB LEVEL OVER SURFACE CYCLONIC CIRCULATION

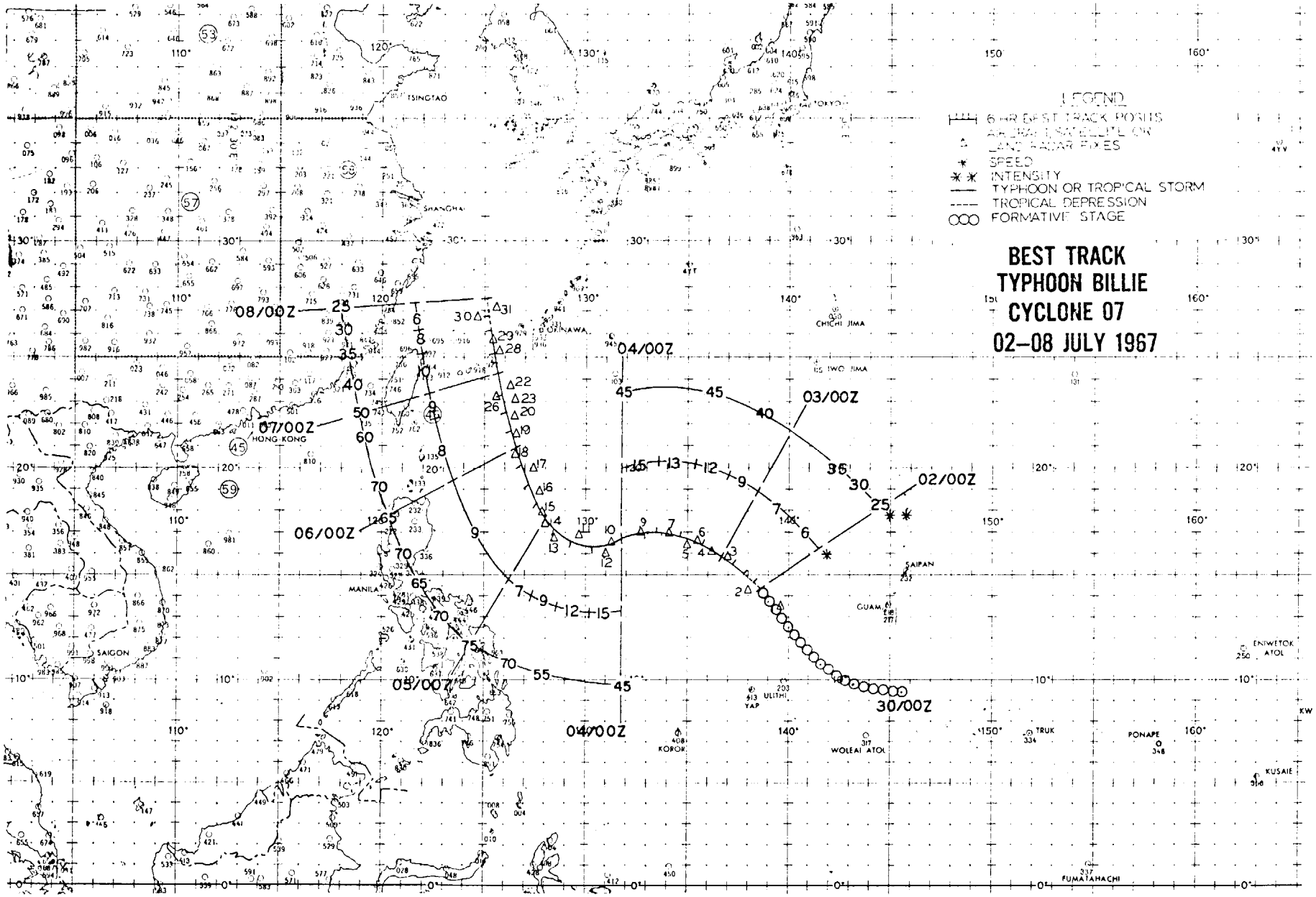
B. INITIAL SURFACE VORTEX

1. JUNCTION VORTEX AT 280600Z
2. SURFACE PRESSURE LESS THAN 1008MB

C. 200MB FLOW ABOVE SURFACE VORTEX

1. INITIAL - SOUTHEAST
2. UPON REACHING TYPHOON INTENSITY - NORTHEAST

III. FINAL DISPOSITION - BECAME EXTRATROPICAL


LEGEND
6 HR BEST TRACK POINTS
AIRCRAFT, SATELLITE OR LAND RADAR FIXES
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
FORMATIVE STAGE
BEST TRACK
TYPHOON BILLIE
CYCLONE 07
02–08 JULY 1967
08/00Z
07/00Z
06/00Z
05/00Z
04/00Z
03/00Z
02/00Z
30/00Z
HONG KONG
MANILA
SAIGON
SHANGHAI
TSINGTAO
OKINAWA
CHICHI JIMA
IWO JIMA
SAIPAN
GUAM
YAP
ULITHI
WOLEAI ATOL
KOROR
TRUK
PONAPE
ENIWETOK ATOL
KUSAIE
FUMATAHACHI

EYE FIXES CYCLONE 07

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
1	012349Z	13.6N 139.7E	54-P-P02	043OM	035	025	003	---	--/--	ELIP	NE-SW	60X10	--
2	020300Z	14.2N 138.0E	VW-P-P10	031OM	038	038	003	---	--/--	ELIP	NE-SW	90X40	--
3	022201Z	15.9N 137.0E	54-P-P03	046OM	020	035	001	---	--/--	ELIP	NW-SE	30X10	--
4	030322Z	16.1N 136.2E	54-P-P03	046OM	037	030	998	---	--/--	CIRC	----	10	--
5	030515Z	16.4N 135.0E	ACFT RDR		---	---	---	---	--/--	----			--
6	030459Z	17.0N 138.0E	SLTLS	STG B	DIA -- BNDS -								
7	030940Z	16.6N 135.5E	VW-P-P05	024OM	035	032	997	---	--/--	----			F.B.
8	031530Z	17.0N 134.1E	VW-P-P05	027OM	030	---	997	---	--/--	----			F.B.
9	032124Z	17.0N 132.8E	54-P-P02	046OM	030	030	994	---	--/--	----			--
10	040200Z	16.5N 131.2E	54-P-P02	046OM	035	030	997	---	--/--	CIRC	----	25	--
11	040537Z	16.0N 131.0E	SLTLS	STG B	DIA -- BNDS -								
12	041030Z	16.9N 129.6E	VW-P-P05	034OM	050	050	988	3029	18/09	----			F.B.
13	041625Z	16.8N 128.3E	VW-P-P05	700MB	050	---	990	3009	09/06	CIRC	----	35	--
14	042120Z	17.5N 128.0E	VW-P-P05	700MB	---	055	---	2966	17/--	CIRC	----	08	--
15	050330Z	17.9N 127.9E	54-P-P03	700MB	062	070	982	2932	19/--	----			F.B.
16	050931Z	18.9N 127.8E	54-P-P02	700MB	045	055	985	2969	18/--	CIRC	----	15	--
17	051600Z	19.9N 127.4E	VW-P-P01	030OM	072	070	982	---	--/--	CIRC	----	25	--
18	052140Z	20.6N 126.6E	VW-P-P02	024OM	060	060	984	---	--/--	CIRC	----	25	--
19	060354Z	21.5N 126.4E	54-P-P03	700MB	042	065	979	2941	18/--	----			N.F.B.
20	060720Z	22.3N 126.4E	54-P-P03	700MB	042	055	979	2938	18/--	----			--
21	060946Z	22.4N 126.3E	54-P-P03	700MB	050	055	982	2951	17/--	----			--
22	061518Z	23.8N 126.2E	VW-UNK--		---	---	---	---	--/--	----			--
23	061520Z	23.1N 126.4E	LND RDR		---	---	---	---	--/--	----			--
24	061620Z	23.3N 126.4E	LND RDR		---	---	---	---	--/--	----			--

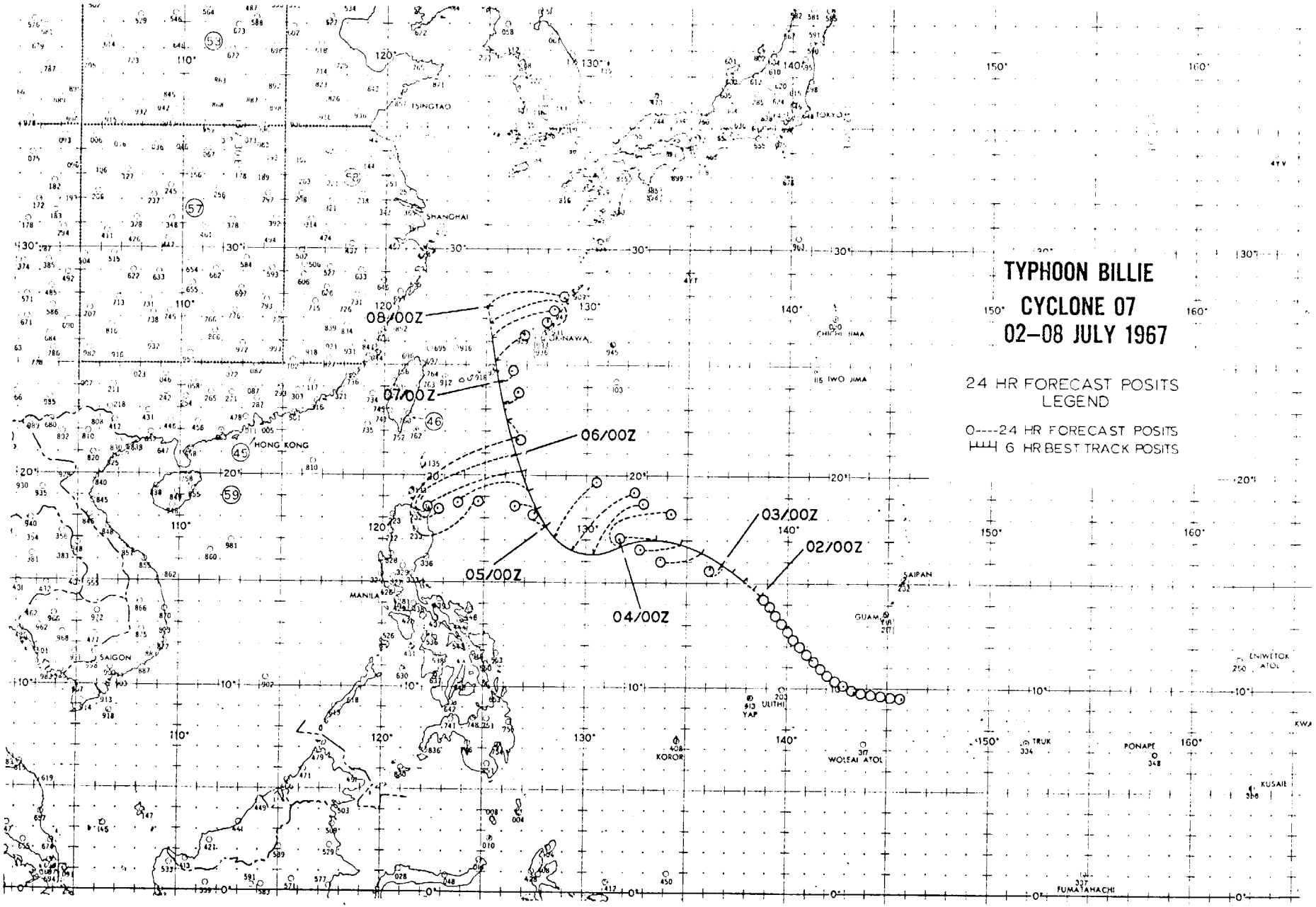
EYE FIXES CYCLONE 07

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
25	061750Z	23.4N 126.2E	LND RDR		---	---	---	---	--/--	----			--
26	061830Z	23.2N 125.7E	VW-P-P02	0370M	060	045	985	---	--/--	CIRC	----	50	--
27	062148Z	23.6N 125.7E	VW-P-P02	700MB	---	050	---	3011	21/--	CIRC	----	12	N.F.B.
28	070430Z	25.2N 125.8E	54-P-P02	0460M	030	035	995	---	09/--	CIRC	----	10	--
29	070920Z	25.6N 125.4E	54-P-P02	0490M	032	035	996	---	--/--	----			--
30	071830Z	26.7N 124.6E	VW-P-L05	700MB	040	---	---	3103	12/--	----			--
31	072145Z	27.1N 125.6E	VW-P-L05	700MB	030	025	005	3093	15/--	----			--

TROPICAL CYCLONE 07 -- 07/02/0000Z TO 07/08/0000Z
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION LAT.	LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
021200Z	15.0N	137.7E	--------	--------	--------
021800Z	15.5N	137.3E	--------	--------	--------
030000Z	15.9N	136.7E	244-0024	--------	--------
030600Z	16.4N	135.8E	262-0114	--------	--------
031200Z	16.8N	134.7E	264-0108	--------	--------
031800Z	17.0N	133.4E	270-0096	--------	--------
040000Z	16.7N	131.8E	058-0156	--------	--------
040600Z	16.3N	130.4E	044-0198	--------	--------
041200Z	16.5N	129.2E	049-0228	--------	--------
041800Z	17.1N	128.4E	037-0192	--------	--------
050000Z	17.7N	128.1E	324-0048	--------	--------
050600Z	18.5N	127.7E	275-0066	036-0198	--------
051200Z	19.3N	127.3E	262-0198	035-0180	--------
051800Z	20.2N	126.9E	248-0276	013-0132	--------
060000Z	21.0N	126.6E	235-0270	254-0222	--------
060600Z	21.8N	126.3E	206-0192	253-0258	022-0162
061200Z	22.5N	126.1E	159-0048	259-0366	--------
061800Z	23.2N	125.9E	046-0048	253-0438	016-0180
070000Z	24.2N	125.6E	046-0042	243-0444	--------
070600Z	25.1N	125.4E	046-0108	226-0414	254-0420
071200Z	26.1N	125.2E	067-0174	152-0114	--------

AVERAGE 24 HOUR ERROR - 0136 MI.
AVERAGE 48 HOUR ERROR - 0276 MI.
AVERAGE 72 HOUR ERROR - 0254 MI.


TYPHOON BILLIE
CYCLONE 07
02–08 JULY 1967
24 HR FORECAST POSITS
LEGEND
0----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS
08/00Z
07/00Z
06/00Z
05/00Z
04/00Z
03/00Z
02/00Z
HONG KONG
SHANGHAI
TSINGTAO
TOKYO
OKINAWA
IWO JIMA
SAIPAN
GUAM
MANILA
SAIGON
YAP
ULITHI
KOROR
WOLEAI ATOL
TRUK
PONAPE
ENIWETOK ATOL
KUSAIE
FUMATAHACHI

TROPICAL CYCLONE 08 - 07/06/0600Z TO 07/12/0600Z

I. DATA

A. STATISTICS

1. NUMBER OF WARNINGS ISSUED - 25
2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 19
3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 1518 MI

B. CHARACTERISTICS AS A TYPHOON

1. MINIMUM OBSERVED SLP - 960MBS AT 102103Z
2. MINIMUM OBSERVED 700MB HEIGHT - 2626M. AT 100920Z
3. MAXIMUM SURFACE WIND - 100 KTS (FROM BEST TRACK)
4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 320 MI

II. DEVELOPMENT

A. INITIAL IMPETUS - A COLD CORE LOW BECOMING WARM CORE AFTER DEVELOPMENT OF DIVERGENCE AT 200MB

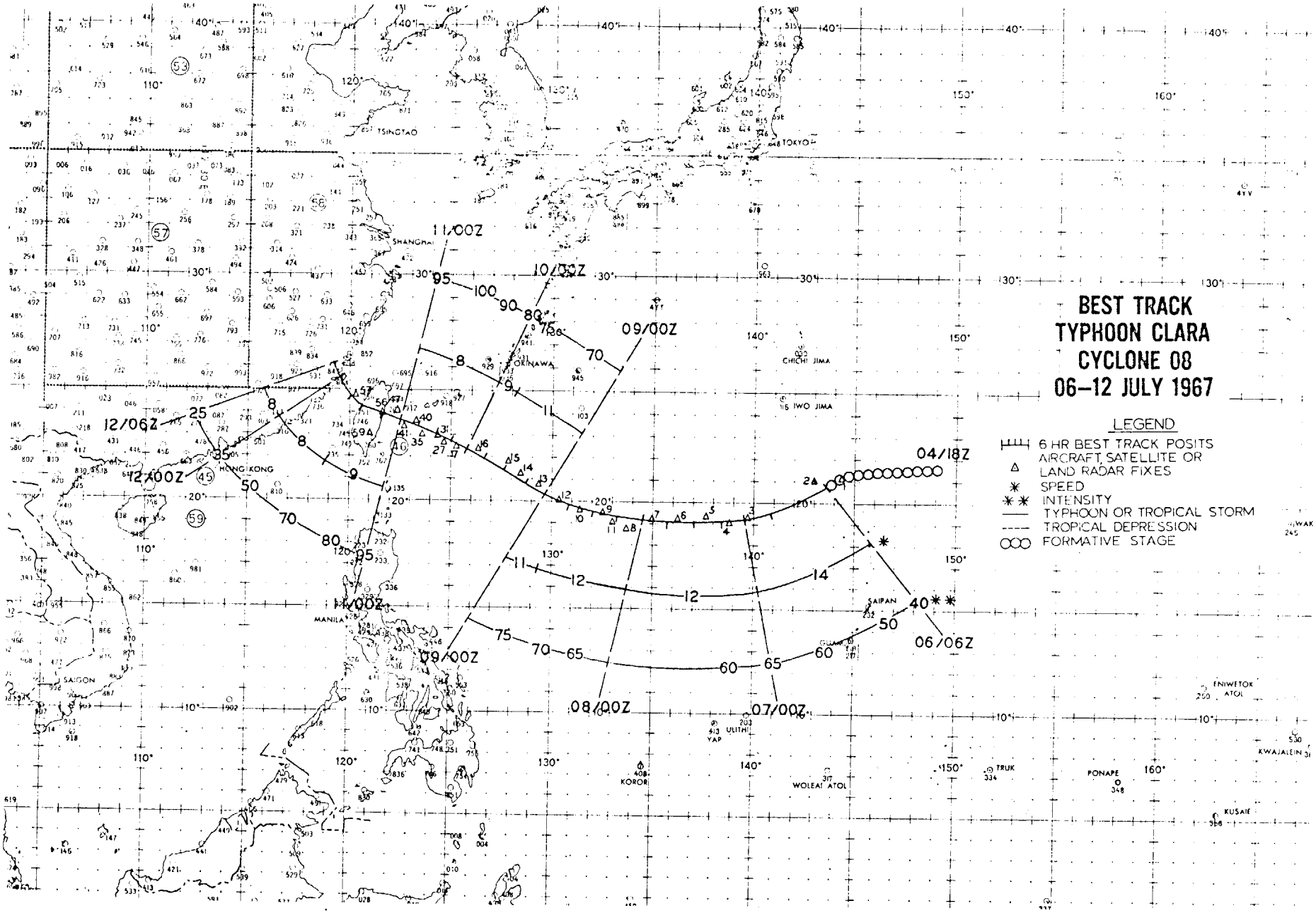
B. INITIAL SURFACE VORTEX

1. COLD VORTEX AT 041800
2. SURFACE PRESSURE LESS THAN 1010MB

C. 200MB FLOW ABOVE SURFACE VORTEX

1. INITIAL - NORTHEAST
2. UPON REACHING TYPHOON INTENSITY - NORTHEAST

III. FINAL DISPOSITION - DISSIPATED OVER LAND


BEST TRACK
TYPHOON CLARA
CYCLONE 08
06–12 JULY 1967
LEGEND
6 HR BEST TRACK POSITS
AIRCRAFT, SATELLITE OR
LAND RADAR FIXES
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
FORMATIVE STAGE
11/00Z
10/00Z
09/00Z
08/00Z
07/00Z
06/06Z
04/18Z
12/06Z
12/00Z
11/00Z
09/00Z
SHANGHAI
TSINGTAO
TOKYO
OKINAWA
CHICHI JIMA
IWO JIMA
HONG KONG
MANILA
SAIGON
YAP
ULITHI
KOROR
WOLEAI ATOL
SAIPAN
TRUK
PONAPE
KUSAIE
ENIWETOK ATOL
KWAJALEIN

EYE FIXES CYCLONE 08

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
1	060350Z	21.1N 144.3E	54-P-P03	700MB	055	060	997	3018	14/--	ELIP	NW-SE	15X10	F.B.
2	060500Z	21.0N 143.0E	SLTLS	STG X	DIA 03	BNDS 1							
3	062310Z	19.2N 139.7E	54-P-P05	700MB	070	065	984	2984	16/--	CIRC	----	08	--
4	070345Z	19.0N 138.9E	54-P-F03	700MB	040	070	989	3039	14/--	----			--
5	070930Z	19.3N 137.7E	VW-P-P08	0460M	---	060	987	3063	17/14	----			--
6	071537Z	19.1N 136.2E	VW-P-F12	0460M	---	---	989	---	--/--	----			N.F.B.
7	072205Z	19.2N 135.0E	54-P-P05	700MB	045	065	987	3005	16/--	ELIP	NW-SE	25X10	--
8	080350Z	18.8N 133.8E	54-P-F03	700MB	050	065	995	3042	14/--	----			--
9	080610Z	19.0N 133.0E	SLTLS	STG C	DIA 06	BNDS -							
10	081000Z	19.5N 132.5E	VW-P-P02	0410M	050	055	982	---	--/--	----			F.B.
11	081541Z	19.6N 131.3E	VW-P-P05	0250M	050	065	978	---	--/--	CIRC	----	15	--
12	082146Z	20.0N 130.4E	VW-P-P05	0230M	070	070	977	---	--/--	CIRC	----	22	--
13	090419Z	20.7N 129.3E	54-P-P02	700MB	072	070	978	2905	17/--	----			F.B.
14	090646Z	21.0N 128.0E	SLTLS	STG B	DIA --	BNDS -							
15	090925Z	21.2N 128.3E	54-P-P02	700MB	052	055	978	2908	16/--	----			F.B.
16	091618Z	21.8N 126.9E	VW-P-P10	0460M	---	---	979	---	--/--	CIRC	----	10	--
17	092130Z	22.3N 126.2E	VW-P-P10	0370M	050	065	974	---	--/--	ELIP	NW-SE	16X07	--
18	100000Z	22.4N 125.3E	LND RDR		---	---	---	---	--/--	----			--
19	100130Z	22.3N 125.1E	LND RDR		---	---	---	---	--/--	----			--
20	100250Z	22.3N 124.9E	LND RDR		---	---	---	---	--/--	----			--
21	100300Z	22.3N 125.3E	LND RDR		---	---	---	---	--/--	----			--
22	100350Z	22.3N 124.9E	LND RDR		---	---	---	---	--/--	----			--
23	100353Z	22.4N 125.3E	54-P-P03	700MB	070	090	965	2833	26/--	CIRC	----	15	--
24	100530Z	22.3N 124.8E	LND RDR		---	---	---	---	--/---	----			--

EYE FIXES CYCLONE 08

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
25	100630Z	22.4N 125.0E	LND RDR		---	---	---	---	--/--	----			--
26	100645Z	22.6N 124.8E	LND RDR		---	---	---	---	--/--	CIRC	----	20	--
27	100810Z	22.6N 124.8E	LND RDR		---	---	---	---	--/--	----			--
28	100845Z	22.6N 124.7E	LND RDR		---	---	---	---	--/--	ELIP	N-S	22X18	--
29	100903Z	22.7N 124.8E	LND RDR		---	---	---	---	--/--	----			--
30	100920Z	22.6N 124.7E	54-P-P03	700MB	070	100	968	2826	17/--	CIRC	----	35	08
31	101140Z	22.9N 124.3E	LND RDR		---	---	---	---	--/--	----			--
32	101300Z	23.0N 124.2E	LND RDR		---	---	---	---	--/--	CIRC	----	30	--
33	101315Z	22.9N 124.1E	LND RDR		---	---	---	---	--/--	----			--
34	101430Z	22.7N 124.1E	LND RDR		---	---	---	---	--/--	----			--
35	101540Z	23.0N 123.6E	VW-P-P10	0240M	080	080	967	---	--/--	CIRC	----	20	--
36	101630Z	23.0N 123.8E	LND RDR		---	---	---	---	--/--	----			--
37	101645Z	22.9N 123.5E	LND RDR		---	---	---	---	--/--	----			--
38	101840Z	23.1N 123.3E	LND RDR		---	---	---	---	--/--	----			--
39	101900Z	23.2N 123.2E	LND RDR		---	---	---	---	--/--	----			--
40	101920Z	23.2N 123.6E	VW-UNK--		---	---	---	---	--/--	----			--
41	102103Z	23.5N 123.2E	VW-P-P05	0210M	120	110	960	---	--/--	CIRC	----	14	07
42	102000Z	23.2N 122.9E	LND RDR		---	---	---	---	--/--	----			--
43	102100Z	23.4N 122.8E	LND RDR		---	---	---	---	--/--	----			--
44	102230Z	23.4N 123.0E	LND RDR		---	---	---	---	--/--	----			--
45	102300Z	23.7N 123.8E	LND RDR		---	---	---	---	--/--	----			--
46	102330Z	22.8N 122.5E	LND RDR		---	---	---	---	--/--	----			--
47	110030Z	23.8N 122.3E	LND RDR		---	---	---	---	--/--	----			--
48	110100Z	23.8N 122.5E	LND RDR		---	---	---	---	--/--	----			--

EYE FIXES CYCLONE OB

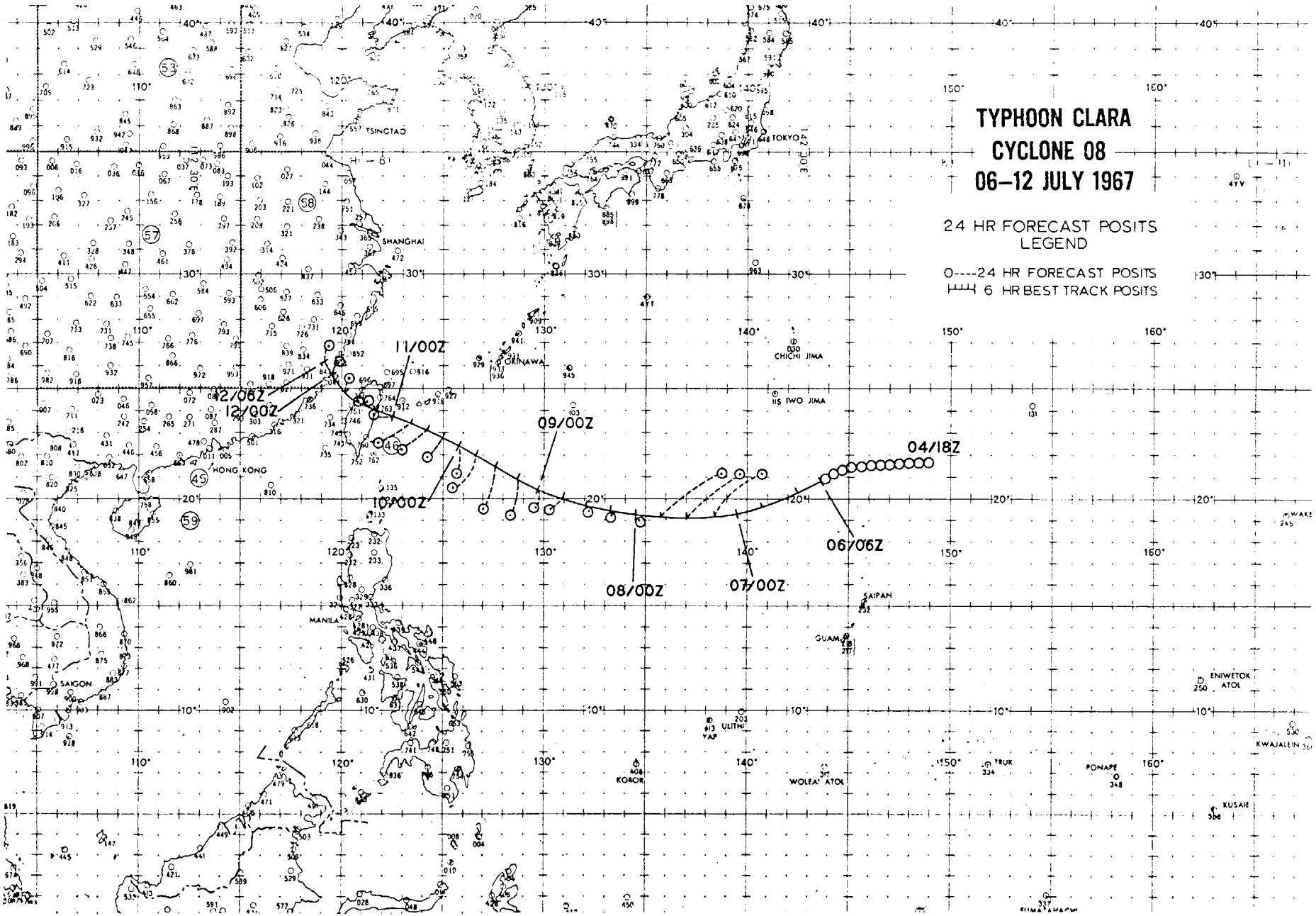
FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
49	110130Z	23.9N 122.4E	LND RDR		---	---	---	---	--/--	----			--
50	110200Z	23.8N 122.3E	LND RDR		---	---	---	---	--/--	----			--
51	110222Z	24.0N 122.3E	LND RDR		---	---	---	---	--/--	----			--
52	110230Z	23.8N 122.3E	LND RDR		---	---	---	---	--/--	----			--
53	110300Z	23.9N 122.2E	LND RDR		---	---	---	---	--/--	----			--
54	110344Z	23.8N 122.3E	54-P-P02	500MB	075	070	965	2817	17/09	CIRC	----	20	10
55	110430Z	23.9N 122.1E	LND RDR		---	---	---	---	--/--	----			--
56	110600Z	24.0N 121.6E	LND RDR		---	---	---	---	--/--	----			--
57	110611Z	23.0N 121.0E	SLTLS	STG X	DIA 04	BNDS 3							
58	111930Z	24.7N 120.2E	VW-UNK--		---	---	---	---	--/--	----			--
59	112030Z	24.9N 120.1E	VW-UNK--		---	---	---	---	--/--	----			--

TROPICAL CYCLONE 08 -- 07/06/0600Z TO 07/12/0600Z

POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION LAT.	LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
060600Z	20.8N	143.6E	--------	--------	--------
061200Z	20.1N	142.3E	--------	--------	--------
061800Z	19.5N	140.7E	--------	--------	--------
070000Z	19.2N	139.5E	--------	--------	--------
070600Z	19.1N	138.3E	049-0180	--------	--------
071200Z	19.1N	137.0E	052-0192	--------	--------
071800Z	19.1N	135.8E	056-0210	--------	--------
080000Z	19.2N	134.5E	153-0012	--------	--------
080600Z	19.3N	133.2E	180-0006	065-0252	--------
081200Z	19.5N	132.0E	134-0006	069-0258	--------
081800Z	19.9N	130.9E	226-0030	075-0264	--------
090000Z	20.4N	129.8E	180-0054	134-0048	--------
090600Z	20.9N	128.7E	191-0102	180-0072	088-0288
091200Z	21.4N	127.7E	198-0114	180-0084	--------
091800Z	22.0N	126.7E	215-0114	199-0072	098-0294
100000Z	22.4N	125.8E	180-0078	180-0078	--------
100600Z	22.7N	125.0E	226-0066	204-0150	180-0054
101200Z	23.1N	124.2E	228-0084	212-0156	--------
101800Z	23.4N	123.4E	238-0096	236-0138	000-0024
110000Z	23.7N	122.6E	282-0054	198-0078	--------
110600Z	24.0N	121.7E	300-0030	247-0090	215-0168
111200Z	24.3N	120.8E	046-0006	258-0084	--------
111800Z	24.8N	120.1E	012-0030	270-0090	255-0126
120000Z	25.5N	119.5E	022-0030	355-0078	--------

AVERAGE 24 HOUR ERROR - 0074 MI.
AVERAGE 48 HOUR ERROR - 0124 MI.
AVERAGE 72 HOUR ERROR - 0159 MI.


TYPHOON CLARA
CYCLONE 08
06–12 JULY 1967
24 HR FORECAST POSITS
LEGEND
0----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS
11/00Z
12/06Z
12/00Z
10/00Z
09/00Z
08/00Z
07/00Z
06/06Z
04/18Z
TSINGTAO
SHANGHAI
OKINAWA
CHICHI JIMA
IWO JIMA
HONG KONG
MANILA
SAIGON
GUAM
SAIPAN
YAP
ULITHI
KOROR
WOLEAI ATOL
TRUK
PONAPE
ENIWETOK ATOL
KWAJALEIN
KUSAIE
WAKE
TOKYO

TROPICAL CYCLONE 12 - 07/28/0000Z TO 08/02/1800Z

I. DATA

A. STATISTICS

1. NUMBER OF WARNINGS ISSUED - 23
2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 05
3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 1380 MI

B. CHARACTERISTICS AS A TYPHOON

1. MINIMUM OBSERVED SLP - 969MBS AT 310325Z
2. MINIMUM OBSERVED 700MB HEIGHT - 2832M. AT 310325Z
3. MAXIMUM SURFACE WIND - 080 KTS (FROM BEST TRACK)
4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 400 MI

II. DEVELOPMENT

A. INITIAL IMPETUS - FRACTURE OF A POLAR TROUGH AND AN EASTERLY WAVE

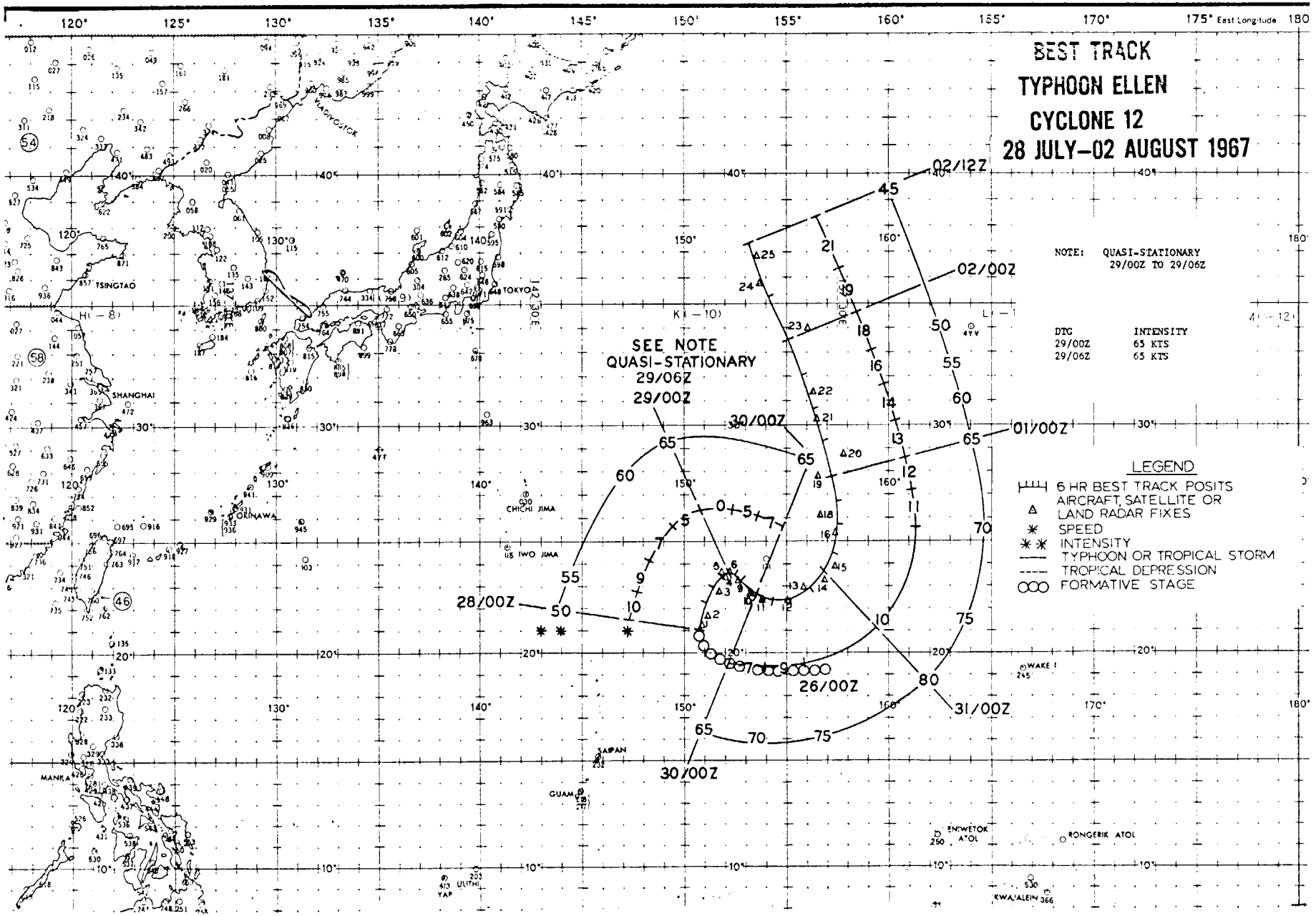
B. INITIAL SURFACE VORTEX

1. EMBEDDED VORTEX AT 260000Z
2. SURFACE PRESSURE LESS THAN 1006MB

C. 200MB FLOW ABOVE SURFACE VORTEX

1. INITIAL - SOUTH
2. UPON REACHING TYPHOON INTENSITY - SOUTH

III. FINAL DISPOSITION - BECAME EXTRATROPICAL

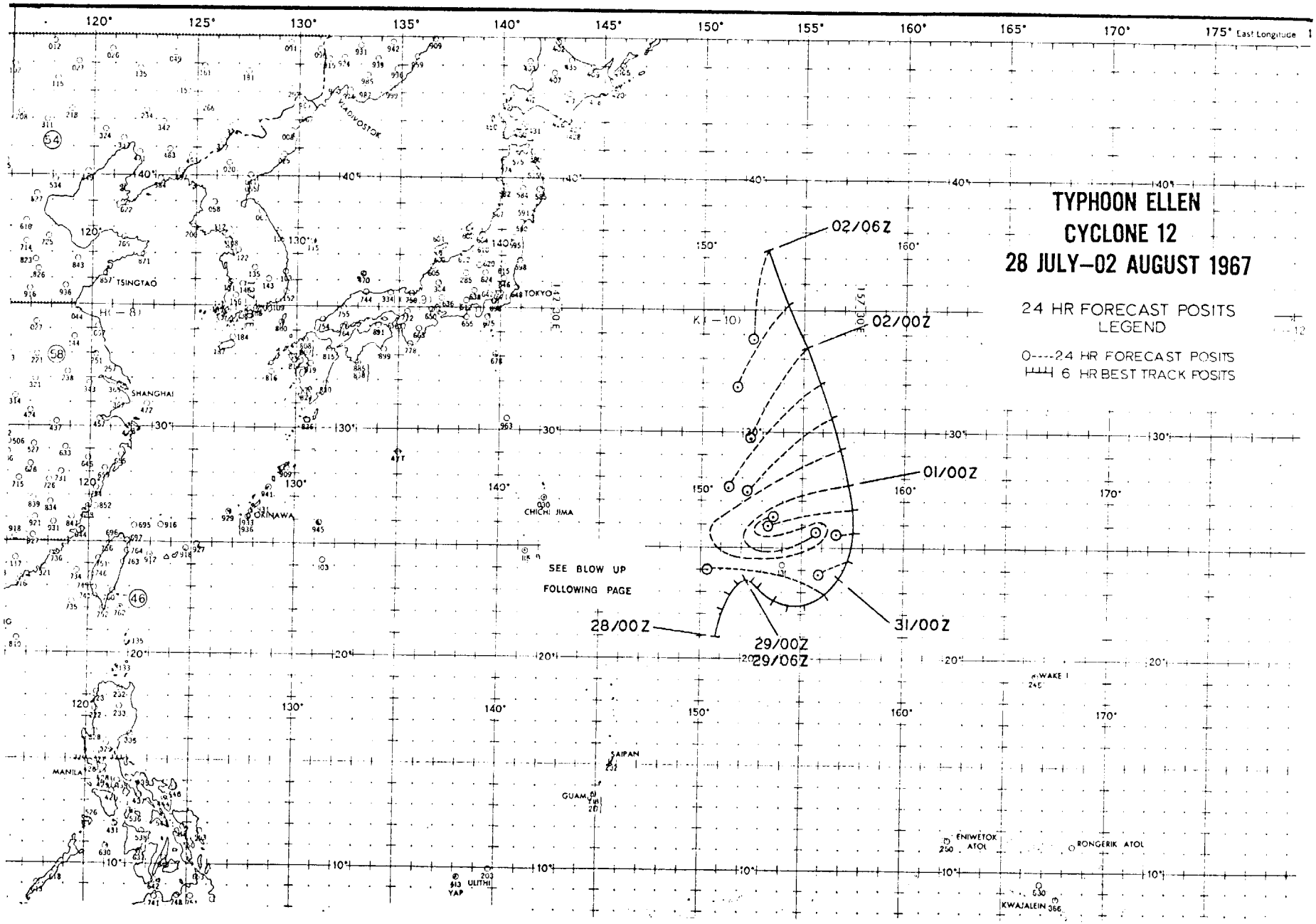

BEST TRACK
TYPHOON ELLEN
CYCLONE 12
28 JULY–02 AUGUST 1967
NOTE: QUASI-STATIONARY 29/00Z TO 29/06Z
DTG INTENSITY
29/00Z 65 KTS
29/06Z 65 KTS
SEE NOTE
QUASI-STATIONARY
29/06Z
29/00Z
30/00Z
02/12Z
02/00Z
01/00Z
28/00Z
26/00Z
31/00Z
30/00Z
LEGEND
6 HR BEST TRACK POSITS
AIRCRAFT, SATELLITE OR LAND RADAR FIXES
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
FORMATIVE STAGE
VLADIVOSTOK
TSINGTAO
SHANGHAI
TOKYO
OKINAWA
CHICHI JIMA
IWO JIMA
SAIPAN
GUAM
YAP
ULITHI
MANILA
WAKE I
ENIWETOK ATOL
RONGERIK ATOL
KWAJALEIN
120°
125°
130°
135°
140°
145°
150°
155°
160°
165°
170°
175° East Longitude
180
40°
30°
20°
10°

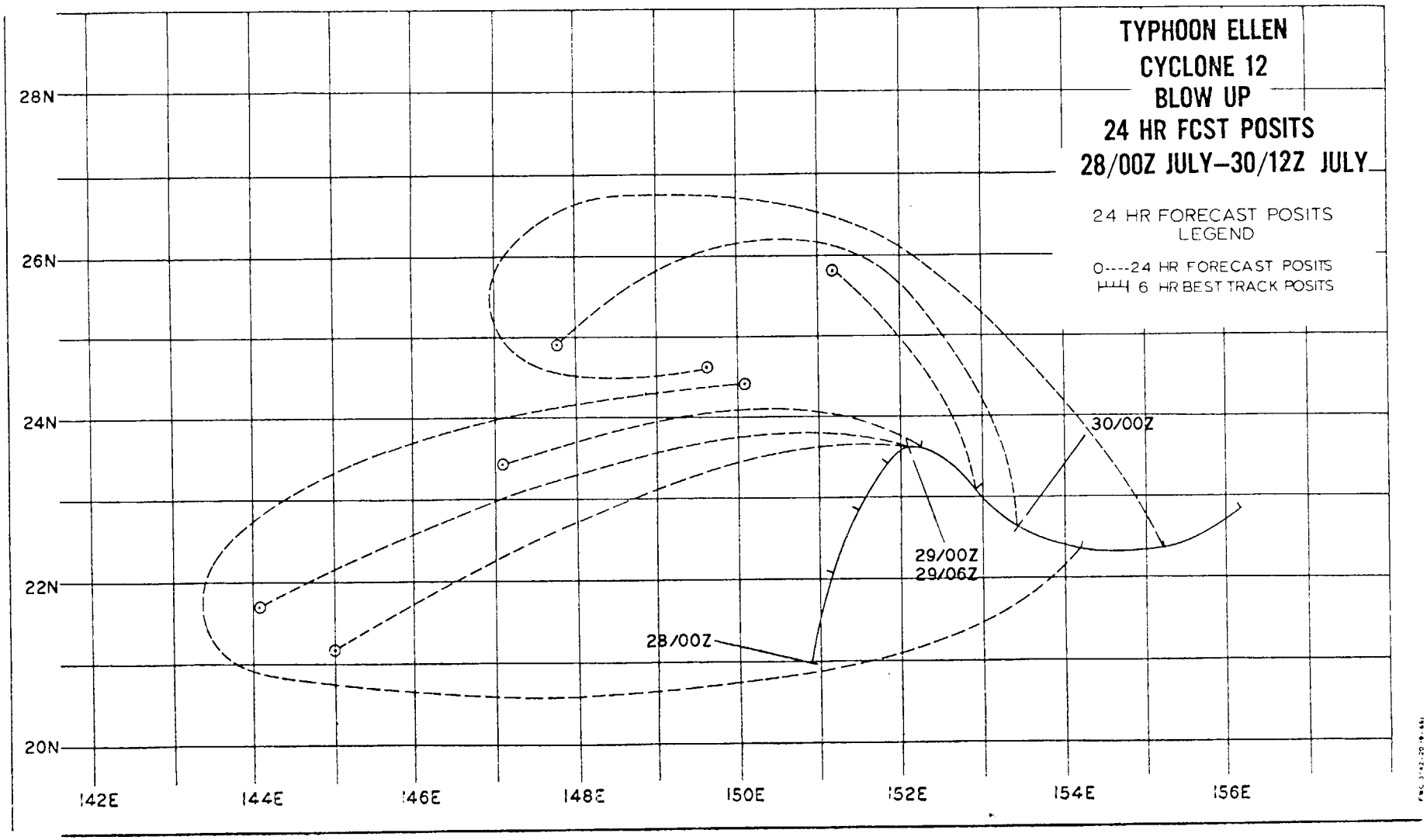
EYE FIXES CYCLONE 12

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
1	280130Z	21.2N 150.9E	54-P-L--		---	050	---	---	--/--	----			--
2	280400Z	21.6N 151.1E	54-P-P05	046OM	050	050	984	---	--/--	CIRC	----	20	--
3	281115Z	22.7N 151.6E	VW-P-P02	035OM	---	050	988	---	--/--	ELIP	NW-SE	38X20	--
4	281615Z	23.4N 152.0E	VW-R-P03	040OM	056	065	988	---	--/--	ELIP	N-S	30X25	--
5	282200Z	23.6N 151.8E	54-P-P08	700MB	038	045	985	2972	14/--	CIRC	----	12	--
6	290400Z	23.6N 152.1E	54-P-P03	700MB	035	045	983	2941	15/--	----			--
7	290925Z	23.7N 152.2E	VW-P-P05	034OM	---	045	986	---	--/--	CIRC	----	20	--
8	291230Z	23.5N 152.3E	VW-R-P--	055OM	---	---	---	---	--/--	----			--
9	291525Z	23.3N 152.7E	VW-P-P05	024OM	064	055	983	---	--/--	CIRC	----	18	--
10	292200Z	22.7N 153.2E	54-P-P05	700MB	058	060	983	2929	17/--	----			F.B.
11	300400Z	22.4N 153.8E	54-P-P03	700MB	055	060	978	2943	17/--	----			F.B.
12	300931Z	22.3N 155.0E	VW-P-P05	030OM	---	060	976	---	--/--	CIRC	----	12	--
13	301515Z	22.9N 155.8E	VW-P-P02	700MB	---	---	975	2869	16/--	CIRC	----	21	06
14	302207Z	23.2N 156.9E	54-P-P10	700MB	060	065	971	2832	15/--	CIRC	----	10	--
15	310325Z	23.9N 157.3E	54-P-P04	700MB	065	070	969	2832	16/--	CIRC	----	15	15
16	310509Z	25.0N 157.0E	SLTLS	STG X	DIA 05	BNDS 1							
17	311021Z	25.4N 157.4E	VW-P-P02	026OM	045	030	977	---	--/--	ELIP	NE-SW	50X20	12
18	311554Z	26.1N 156.6E	VW-P-P05	700MB	070	040	973	2914	--/--	ELIP	NW-SE	40X15	--
19	010000Z	27.8N 156.5E	54-P-P05	700MB	040	040	975	2911	22/--	CIRC	----	08	--
20	010322Z	28.7N 157.8E	54-P-P05	700MB	040	045	978	2914	19/--	----			F.B.
21	011025Z	30.2N 156.5E	VW-P-P05	031OM	038	035	978	---	--/--	----			F.B.
22	011526Z	31.4N 156.2E	VW-P-P05	031OM	050	038	979	---	--/--	----			F.B.
23	012106Z	34.0N 156.0E	SLTLS	STG -	DIA --	BNDS -							
24	020851Z	36.7N 153.6E	VW-P-F01	023OM	---	040	982	---	--/--	----			--

EYE FIXES CYCLONE 12

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
25	021000Z	36.8N 143.4E	VW-R-F01	0410M	066	050	985	---	--/--	----			F.B.


TYPHOON ELLEN
CYCLONE 12
28 JULY–02 AUGUST 1967
24 HR FORECAST POSITS
LEGEND
0----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS
02/06Z
02/00Z
01/00Z
28/00Z
29/00Z
29/06Z
31/00Z
SEE BLOW UP
FOLLOWING PAGE
120° 125° 130° 135° 140° 145° 150° 155° 160° 165° 170° 175° East Longitude
VLADIVOSTOK
TSINGTAO
SHANGHAI
TOKYO
OKINAWA
CHICHI JIMA
MANILA
SAIPAN
GUAM
YAP
ULITHI
WAKE I
ENIWETOK ATOL
RONGERIK ATOL
KWAJALEIN


TYPHOON ELLEN
CYCLONE 12
BLOW UP
24 HR FCST POSITS
28/00Z JULY–30/12Z JULY
24 HR FORECAST POSITS
LEGEND
0----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS
28N
26N
24N
22N
20N
142E
144E
146E
148E
150E
152E
154E
156E
30/00Z
29/00Z
29/06Z
28/00Z

TROPICAL CYCLONE 12 -- 07/28/0000Z TO 08/02/1200Z

POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION LAT.	LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
280000Z	21.0N	150.9E	--------	--------	--------
280600Z	22.1N	151.2E	--------	--------	--------
281200Z	22.8N	151.5E	--------	--------	--------
281800Z	23.4N	151.9E	--------	--------	--------
290000Z	23.6N	152.1E	250-0414	--------	--------
290600Z	23.6N	152.1E	255-0456	--------	--------
291200Z	23.6N	152.3E	288-0282	--------	--------
291800Z	23.1N	152.9E	330-0180	--------	--------
300000Z	22.6N	153.4E	294-0330	265-0816	--------
300600Z	22.3N	154.2E	299-0252	268-0852	--------
301200Z	22.3N	155.2E	294-0330	277-0684	--------
301800Z	22.8N	156.2E	282-0330	289-0588	--------
310000Z	23.5N	157.0E	258-0210	280-0804	--------
310600Z	24.4N	157.4E	252-0090	275-0624	263-1320
311200Z	25.6N	157.5E	262-0042	272-0696	--------
311800Z	26.7N	157.5E	260-0228	263-0606	270-0900
010000Z	27.8N	157.3E	214-0138	234-0330	--------
010600Z	29.2N	157.0E	226-0258	233-0342	264-0786
011200Z	30.6N	156.5E	229-0294	224-0372	--------
011800Z	32.0N	155.9E	223-0360	233-0504	248-0750
020000Z	33.5N	155.3E	215-0264	211-0486	--------
020600Z	35.2N	154.1E	212-0228	215-0594	217-0636
021200Z	37.3N	153.3E	191-0204	212-0534	--------

AVERAGE 24 HOUR ERROR - 0257 MI.
AVERAGE 48 HOUR ERROR - 0588 MI.
AVERAGE 72 HOUR ERROR - 0878 MI.

TROPICAL CYCLONE 21 - 08/19/0600Z TO 08/21/1200Z

I. DATA
   A. STATISTICS
      1. NUMBER OF WARNINGS ISSUED - 10
      2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 03
      3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 0540 MI

   B. CHARACTERISTICS AS A TYPHOON
      1. MINIMUM OBSERVED SLP - 978MBS AT 202138Z
      2. MINIMUM OBSERVED 700MB HEIGHT - 2935M. AT 210726Z
      3. MAXIMUM SURFACE WIND - 070 KTS (FROM BEST TRACK)
      4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 300 MI

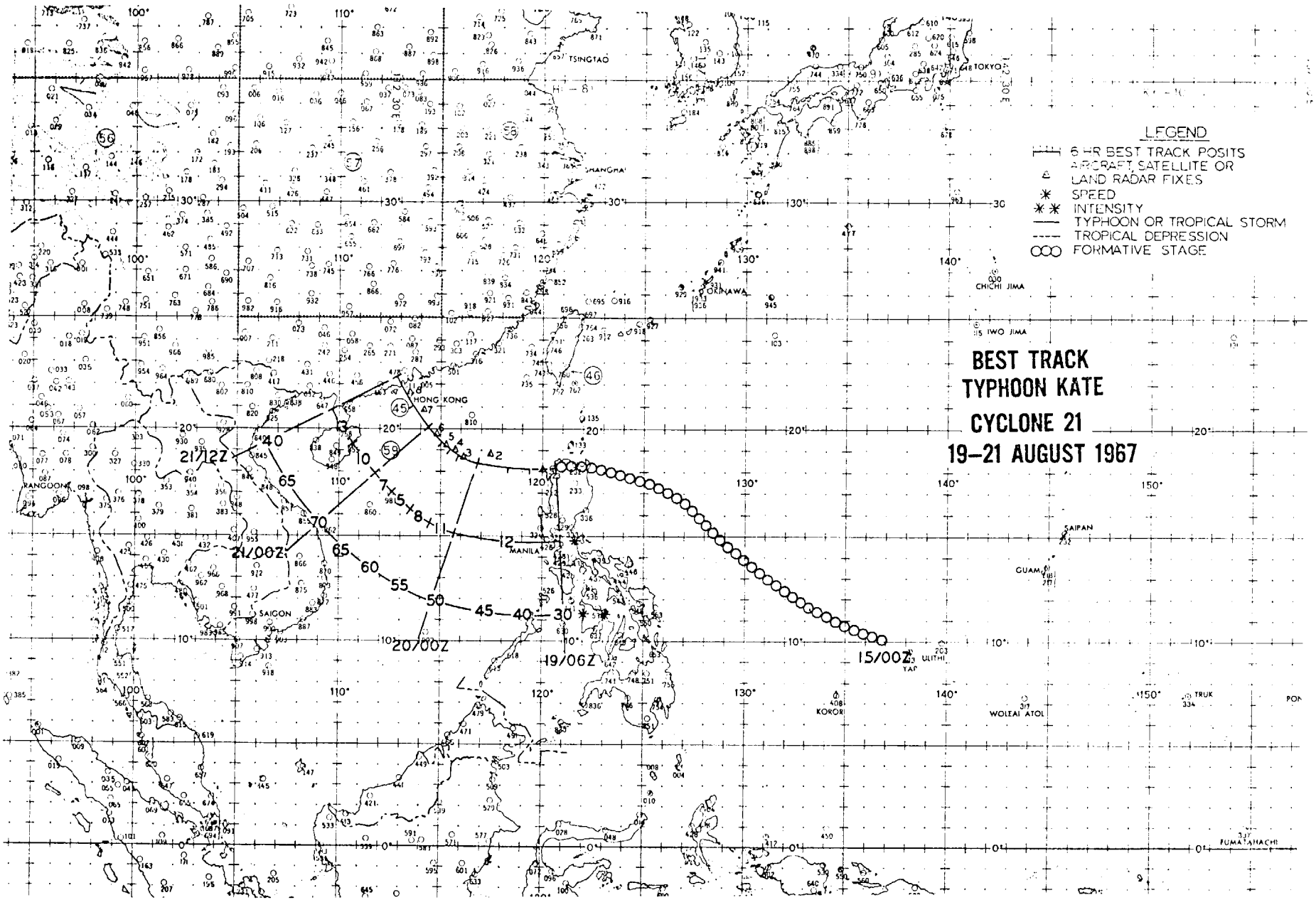
II. DEVELOPMENT
   A. INITIAL IMPETUS - MONSOONAL SURGE WITH SUBSEQUENT DEVELOPMENT OF 200MB DIVERGENCE

   B. INITIAL SURFACE VORTEX
      1. EMBEDDED VORTEX AT 150000Z
      2. SURFACE PRESSURE LESS THAN 1007MB

   C. 200MB FLOW ABOVE SURFACE VORTEX
      1. INITIAL - EAST

      2. UPON REACHING TYPHOON INTENSITY - NORTHEAST

III. FINAL DISPOSITION - DISSIPATED OVER LAND


LEGEND
6 HR BEST TRACK POSITS AIRCRAFT, SATELLITE OR LAND RADAR FIXES
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
FORMATIVE STAGE
BEST TRACK
TYPHOON KATE
CYCLONE 21
19–21 AUGUST 1967
21/12Z
21/00Z
20/00Z
19/06Z
15/00Z
TSINGTAO
SHANGHAI
TOKYO
NAHA
CHICHI JIMA
IWO JIMA
HONG KONG
RANGOON
MANILA
SAIPAN
GUAM
SAIGON
YAP
ULITHI
KOROR
WOLEAI ATOL
TRUK
FUMATAHACHI

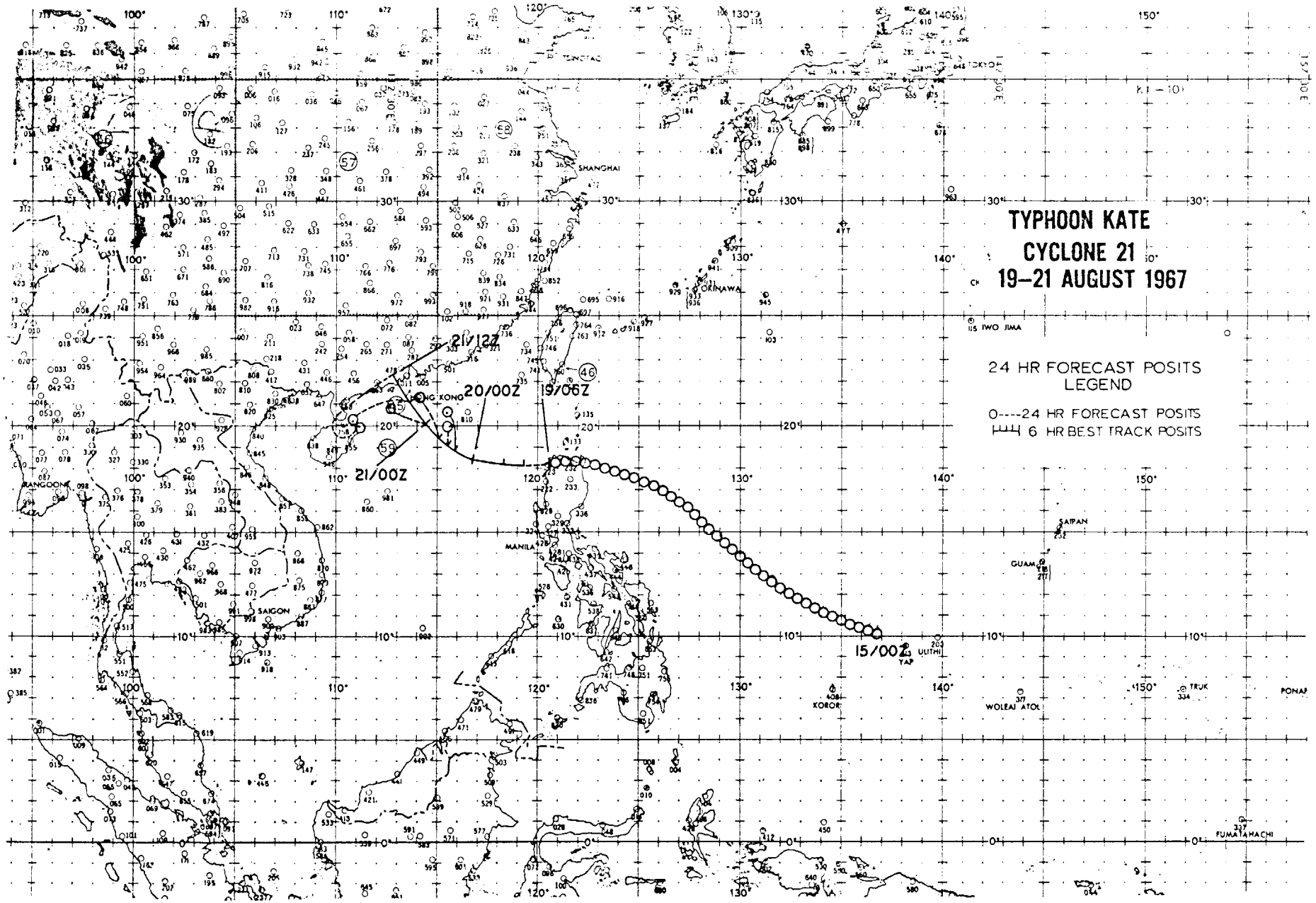
EYE FIXES CYCLONE 21

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
1	190918Z	18.1N 120.0E	VW-P-P03	0310M	040	038	987	3009	13/06	----			--
2	192207Z	18.8N 117.4E	VW-P-F05	0420M	045	035	986	---	--/--	----			F.B.
3	200349Z	18.7N 116.1E	54-P-P02	0440M	041	055	000	---	--/--	ELIP	N-S	40X20	--
4	200927Z	19.0N 115.7E	54-P-P05	700MB	046	075	984	2963	14/--	----			N.F.B.
5	201535Z	19.2N 115.3E	VW-P-P05	700MB	---	065	982	2999	25/--	----			F.B.
6	202138Z	19.7N 114.8E	VW-P-P03	0450M	048	065	978	2972	15/--	CIRC	----	40	--
7	210346Z	20.8N 114.1E	54-P-P01	700MB	072	065	982	2944	14/--	ELIP	N-S	30X20	--
8	210726Z	21.5N 113.3E	54-P-L01	700MB	075	065	---	2935	13/--	----			--

TROPICAL CYCLONE 21 -- 08/19/0600Z TO 08/21/1200Z
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION LAT.	LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
191200Z	18.1N	119.4E	--------	--------	--------
191800Z	18.2N	118.2E	--------	--------	--------
200000Z	18.4N	116.9E	--------	--------	--------
200600Z	18.8N	115.9E	349-0102	--------	--------
201200Z	19.2N	115.5E	015-0048	--------	--------
201800Z	19.4N	115.1E	330-0120	--------	--------
210000Z	20.1N	114.5E	295-0108	--------	--------
210600Z	21.1N	113.7E	249-0162	--------	--------
211200Z	22.3N	112.9E	215-0168	326-0018	--------

AVERAGE 24 HOUR ERROR - 0118 MI.
AVERAGE 48 HOUR ERROR - 0018 MI.
AVERAGE 72 HOUR ERROR - ---- MI.


TYPHOON KATE
CYCLONE 21
19–21 AUGUST 1967
24 HR FORECAST POSITS
LEGEND
0----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS
21/12Z
20/00Z
19/06Z
21/00Z
15/00Z
HONG KONG
SHANGHAI
OKINAWA
IWO JIMA
MANILA
SAIGON
RANGOON
SAIPAN
GUAM
YAP
ULITHI
KOROR
WOLEAI ATOL
TRUK
PONAPE
FUMATAHACHI

TROPICAL CYCLONE 22 - 08/24/0600Z TO 08/29/1200Z

I. DATA

A. STATISTICS

1. NUMBER OF WARNINGS ISSUED - 22
2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 11
3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 1326 MI

B. CHARACTERISTICS AS A TYPHOON

1. MINIMUM OBSERVED SLP - 937MB AT 270400Z
2. MINIMUM OBSERVED 700MB HEIGHT - 2576M. AT 270400Z
3. MAXIMUM SURFACE WIND - 125 KTS (FROM BEST TRACK)
4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 450 MI

II. DEVELOPMENT

A. INITIAL IMPETUS - FRACTURE OF A POLAR TROUGH AND AN EASTERLY WAVE

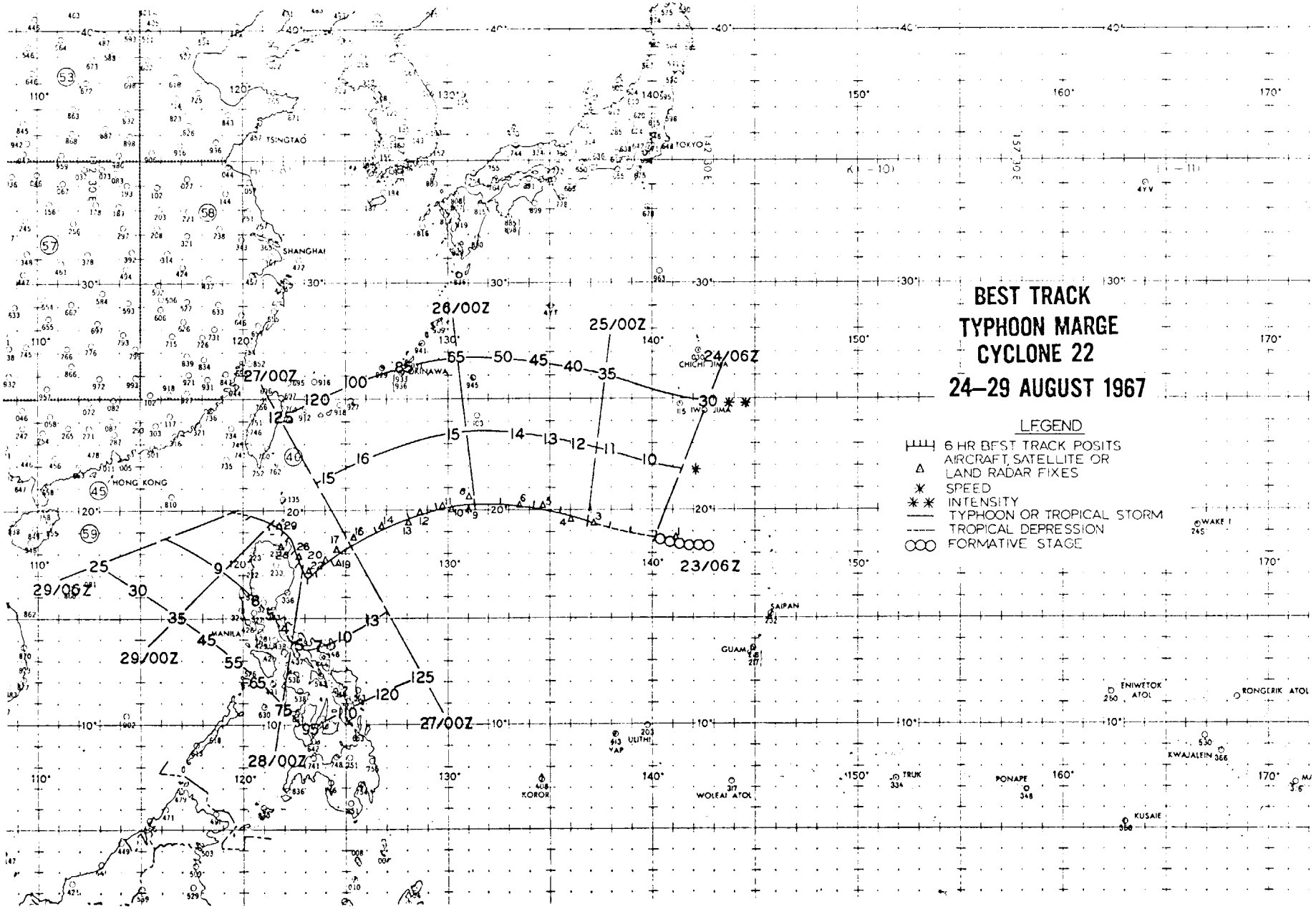
B. INITIAL SURFACE VORTEX

1. EMBEDDED VORTEX AT 230600Z
2. SURFACE PRESSURE LESS THAN 1004MB

C. 200MB FLOW ABOVE SURFACE VORTEX

1. INITIAL - EAST
2. UPON REACHING TYPHOON INTENSITY - SOUTH

III. FINAL DISPOSITION - DISSIPATED OVER WATER


BEST TRACK
TYPHOON MARGE
CYCLONE 22
24–29 AUGUST 1967
LEGEND
6 HR BEST TRACK POSITS
AIRCRAFT, SATELLITE OR LAND RADAR FIXES
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
FORMATIVE STAGE
26/00Z
25/00Z
24/06Z
27/00Z
23/06Z
29/06Z
29/00Z
28/00Z
27/00Z
TSINGTAO
SHANGHAI
TOKYO
CHICHI JIMA
IWO JIMA
OKINAWA
HONG KONG
MANILA
SAIPAN
GUAM
ENIWETOK ATOL
RONGERIK ATOL
KWAJALEIN
ULITHI
YAP
KOROR
WOLEAI ATOL
TRUK
PONAPE
KUSAIE
WAKE I

EYE FIXES CYCLONE 22

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
1	240030Z	18.6N 141.1E	54-UNK--	0370M	---	035	002	---	--/--	----			--
2	240633Z	18.5N 141.0E	SLTLS	STG C	DIA --	BNDS -							
3	242218Z	19.4N 137.1E	54-P-P05	0460M	036	035	002	---	--/--	----			--
4	250356Z	19.5N 136.0E	54-P-P05	0460M	048	050	997	---	--/--	----			F.B.
5	250940Z	20.1N 134.6E	VW-P-P10	0370M	035	035	993	---	--/--	CIRC	----	10	--
6	251510Z	20.2N 133.5E	VW-P-P10	700MB	055	---	---	---	--/--	CIRC	----	30	12
7	250520Z	20.0N 135.0E	SLTLS	STG C	DIA --	BNDS -							
8	261004Z	19.8N 128.6E	VW-P-P05	0300M	---	100	969	---	--/--	ELIP	NE-SW	15X08	--
9	262209Z	20.5N 131.0E	SLTLS	STG -	DIA --	BNDS -							
10	260025Z	20.0N 131.0E	54-P-P01	700MB	---	---	983	2954	16/--	CIRC	----	10	--
11	260412Z	20.0N 130.1E	54-P-P01	700MB	---	---	975	2895	18/--	ELIP	NE-SW	25X15	20
12	260527Z	20.1N 129.8E	54-P-P01	700MB	---	080	---	2883	18/--	ELIP	NE-SW	25X15	--
13	261245Z	19.5N 128.0E	VW-R-P10	700MB	---	---	---	---	--/--	----			--
14	261530Z	19.2N 126.7E	VW-R-P10	700MB	---	---	---	---	--/--	CIRC	----	06	30
15	260557Z	21.0N 129.0E	SLTLS	STG X	DIA 03	BNDS 5							
16	262200Z	18.7N 125.4E	54-P-P02	700MB	110	120	950	---	--/--	CIRC	----	19	--
17	270215Z	18.1N 124.5E	54-R-P--		---	---	---	---	--/--	----			--
18	270400Z	18.0N 124.5E	54-P-P01	700MB	150	150	937	2576	25/11	CIRC	----	15	20
19	270600Z	17.6N 124.6E	54-R-P--		---	---	---	---	--/--	----			--
20	270650Z	17.7N 124.0E	54-R-P--	700MB	---	---	---	---	--/--	----			--
21	270900Z	17.6N 123.8E	54-P-P01	700MB	125	150	947	2694	28/04	CIRC	----	25	10
22	271650Z	17.1N 123.2E	VW-R-P10	700MB	---	---	---	---	--/--	----			--
23	272150Z	17.2N 123.3E	VW-P-P05	700MB	---	090	974	2900	22/--	CIRC	----	30	--
24	280430Z	17.2N 122.9E	54-P-P02	700MB	060	045	983	2947	25/--	CIRC	----	45	--

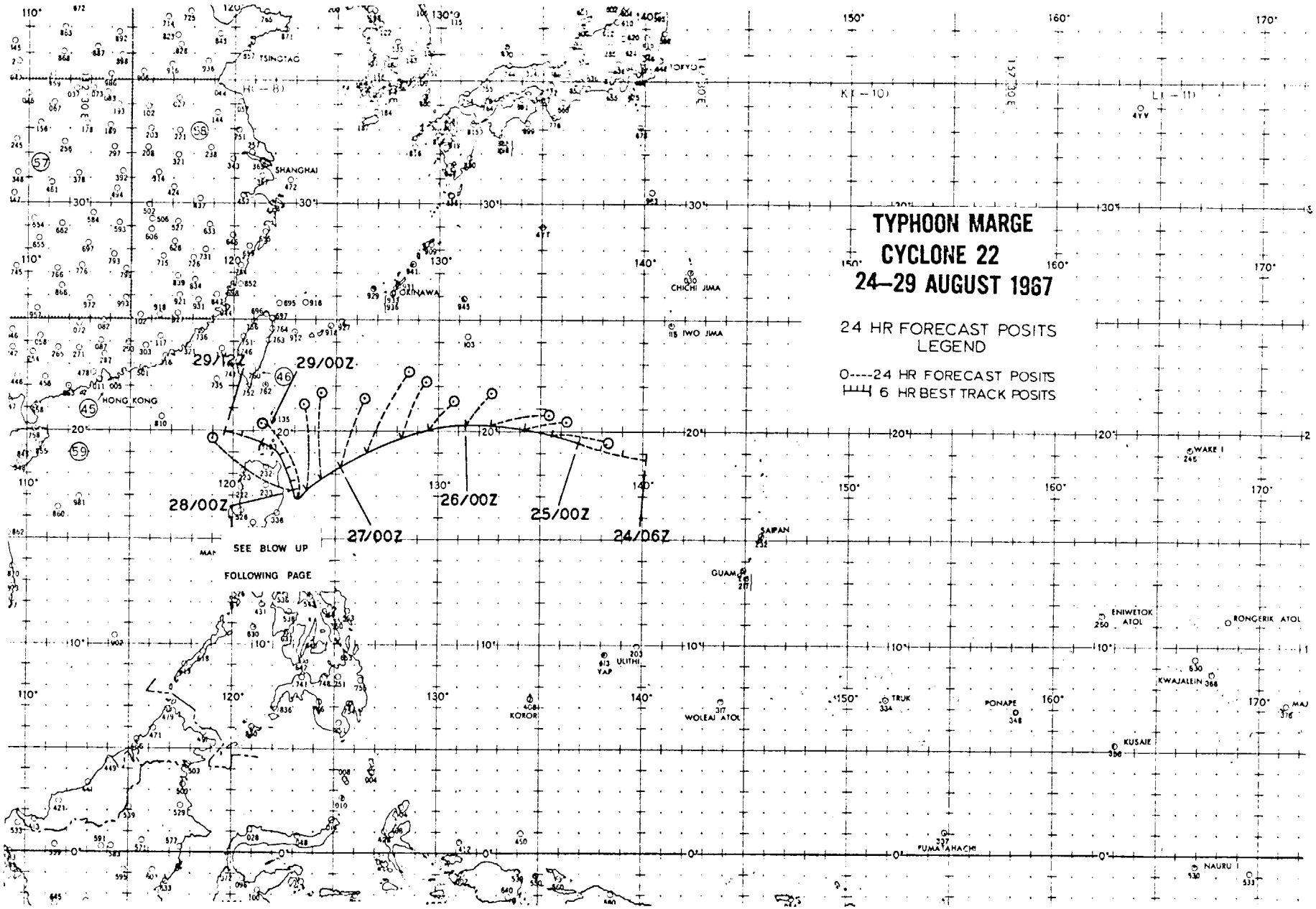
EYE FIXES CYCLONE 22

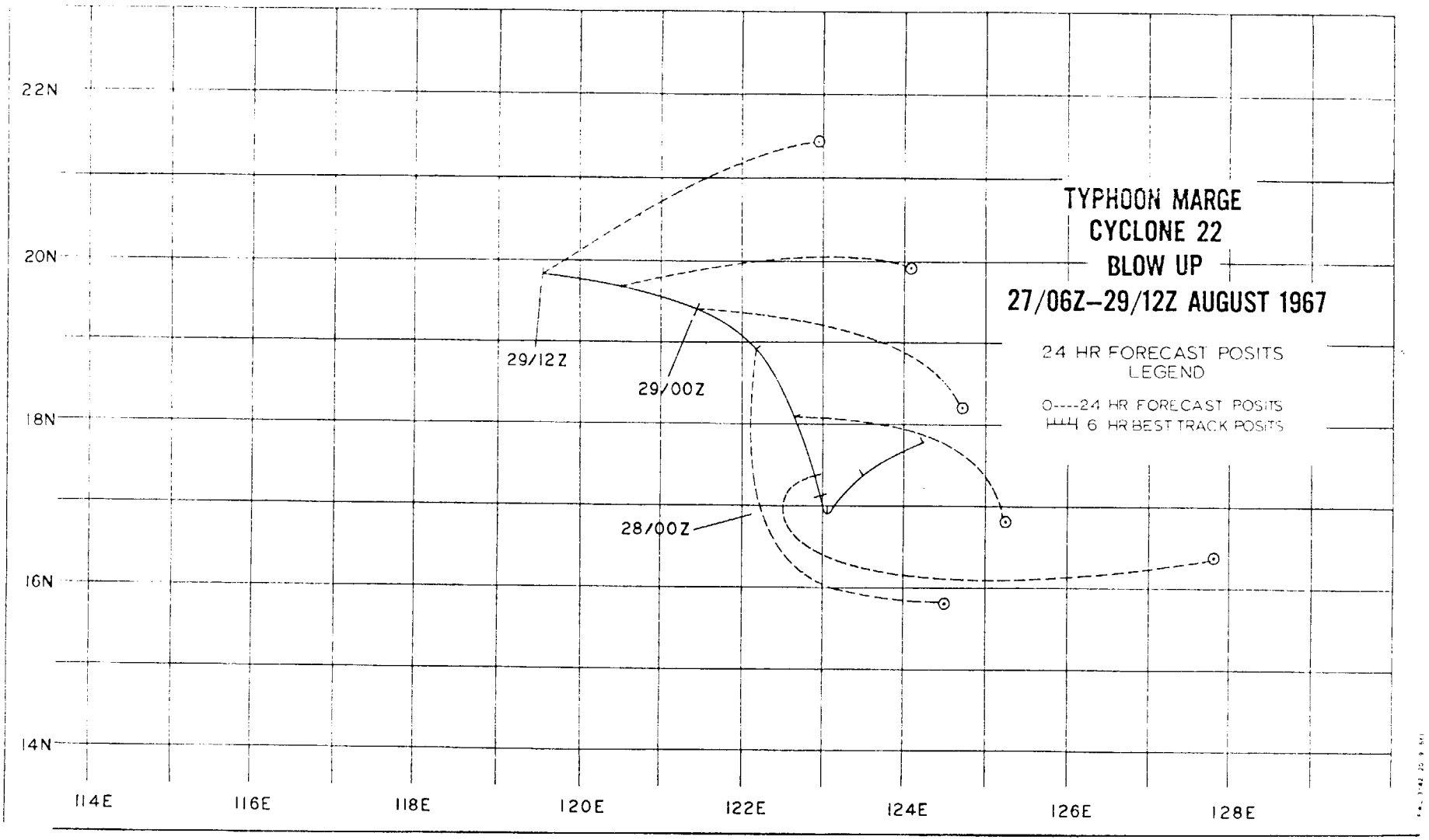
FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
25	270630Z	17.5N 123.0E	SLTLS	STG X	DIA 05	BNDS 3							
26	280845Z	17.8N 122.7E	54-UNK--	700MB	---	070	---	2951	18/--	----			--
27	281000Z	17.9N 122.8E	54-P-P01	700MB	050	075	985	2951	17/--	CIRC	----	30	--
28	281620Z	18.4N 121.9E	VW-P-P02	700MB	050	---	993	3022	15/08	----			N.F.B.
29	282210Z	19.2N 121.7E	VW-P-P02	700MB	---	050	991	3033	14/08	CIRC	----	10	--

TROPICAL CYCLONE 22 -- 08/24/0600Z TO 08/29/1200Z
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION LAT.	LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
250000Z	19.4N	136.9E	--------	--------	--------
250600Z	19.8N	135.6E	102-0134	--------	--------
251200Z	20.1N	134.2E	084-0108	--------	--------
251800Z	20.3N	132.7E	084-0150	--------	--------
260000Z	20.2N	131.2E	044-0120	--------	--------
260600Z	20.0N	129.5E	043-0102	--------	--------
261200Z	19.7N	128.1E	027-0156	--------	--------
261800Z	19.2N	126.4E	030-0228	--------	--------
270000Z	18.4N	125.2E	019-0186	--------	--------
270600Z	17.8N	124.2E	002-0234	027-0372	--------
271200Z	17.4N	123.5E	358-0228	012-0456	--------
271800Z	16.9N	123.1E	332-0222	008-0534	--------
280000Z	17.2N	123.0E	302-0264	002-0420	--------
280600Z	17.4N	122.8E	101-0294	346-0414	012-0492
281200Z	18.1N	122.7E	120-0162	336-0360	--------
281800Z	18.9N	122.2E	145-0228	314-0324	006-0594
290000Z	19.3N	121.4E	109-0192	286-0366	--------

AVERAGE 24 HOUR ERROR - 0188 MI.
AVERAGE 48 HOUR ERROR - 0405 MI.
AVERAGE 72 HOUR ERROR - 0543 MI.


TYPHOON MARGE
CYCLONE 22
24–29 AUGUST 1967
24 HR FORECAST POSITS
LEGEND
0----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS
29/12Z
29/00Z
28/00Z
27/00Z
26/00Z
25/00Z
24/06Z
SEE BLOW UP
FOLLOWING PAGE
TSINGTAO
SHANGHAI
OKINAWA
CHICHI JIMA
IWO JIMA
HONG KONG
SAIPAN
GUAM
WAKE I
ENIWETOK ATOL
RONGERIK ATOL
KWAJALEIN
ULITHI
YAP
KOROR
WOLEAI ATOL
TRUK
PONAPE
KUSAIE
FUMA HACHI
NAURU I


TYPHOON MARGE
CYCLONE 22
BLOW UP
27/06Z–29/12Z AUGUST 1967
24 HR FORECAST POSITS
LEGEND
O----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS
29/12Z
29/00Z
28/00Z
22N
20N
18N
16N
14N
114E
116E
118E
120E
122E
124E
126E
128E

TROPICAL CYCLONE 24 - 08/27/0600Z TO 08/30/1200Z

I. DATA

A. STATISTICS

1. NUMBER OF WARNINGS ISSUED - 14
2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 03
3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 1026 MI

B. CHARACTERISTICS AS A TYPHOON

1. MINIMUM OBSERVED SLP - 981MBS AT 282035Z
2. MINIMUM OBSERVED 700MB HEIGHT - 2953M. AT 291000Z
3. MAXIMUM SURFACE WIND - 070 KTS (FROM BEST TRACK)
4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 340 MI

II. DEVELOPMENT

A. INITIAL IMPETUS - LOW LEVEL SURGE INTO CYCLONIC CIRCULATION FROM THE SOUTH WITH SUBSEQUENT DIVERGENCE AT 200MB LEVEL

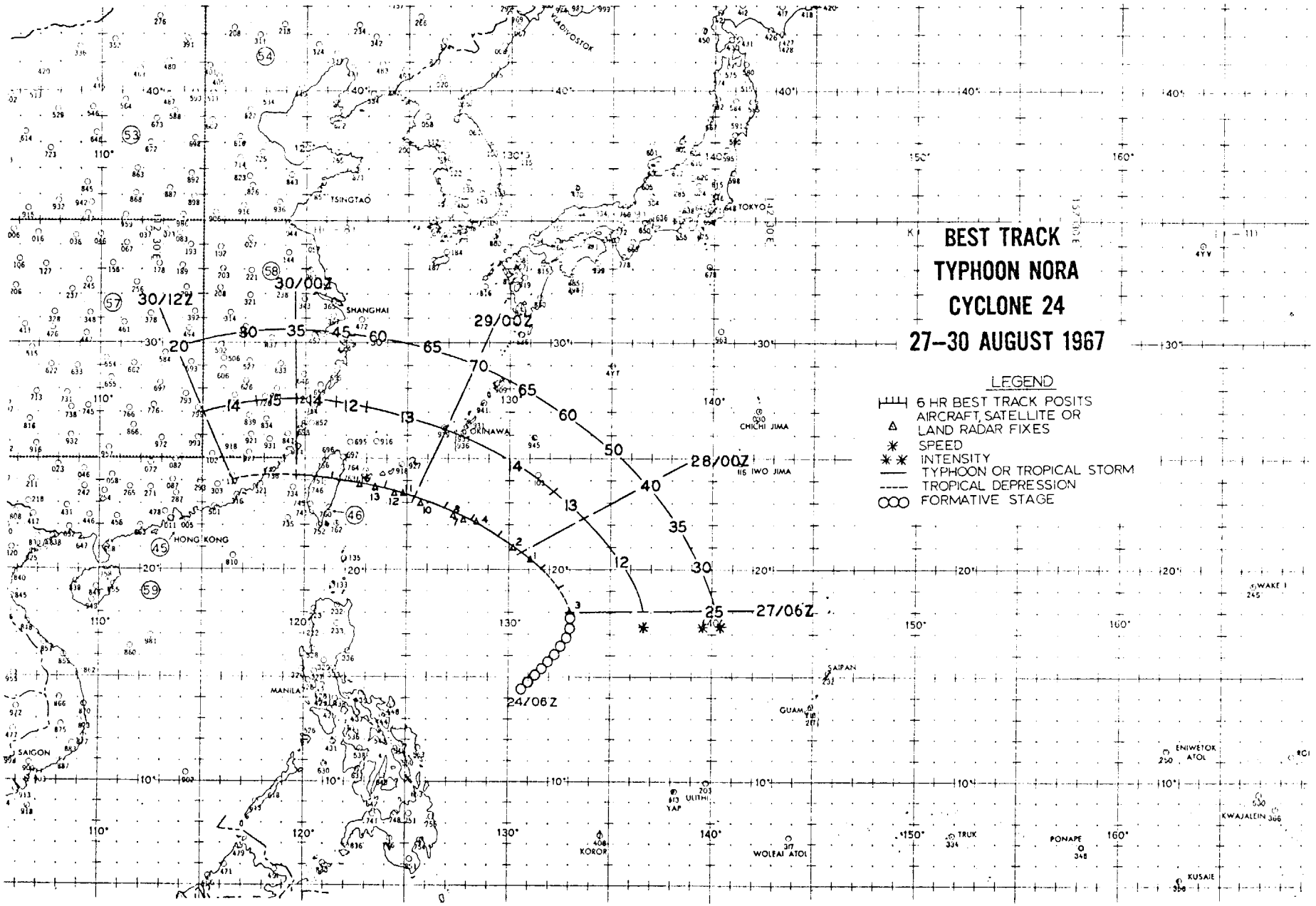
B. INITIAL SURFACE VORTEX

1. JUNCTION VORTEX AT 240600Z
2. SURFACE PRESSURE LESS THAN 1003MB

C. 200MB FLOW ABOVE SURFACE VORTEX

1. INITIAL - SOUTHEAST
2. UPON REACHING TYPHOON INTENSITY - EAST

III. FINAL DISPOSITION - DISSIPATED OVER LAND


BEST TRACK
TYPHOON NORA
CYCLONE 24
27–30 AUGUST 1967
LEGEND
6 HR BEST TRACK POSITS
AIRCRAFT, SATELLITE OR
LAND RADAR FIXES
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
FORMATIVE STAGE
30/12Z
30/00Z
29/00Z
28/00Z
27/06Z
24/06Z
SHANGHAI
TSINGTAO
VLADIVOSTOK
TOKYO
OKINAWA
CHICHI JIMA
IWO JIMA
HONG KONG
MANILA
SAIGON
GUAM
SAIPAN
YAP
ULITHI
KOROR
WOLEAI ATOL
TRUK
PONAPE
ENIWETOK ATOL
KWAJALEIN
WAKE I
KUSAIE

EYE FIXES CYCLONE 24

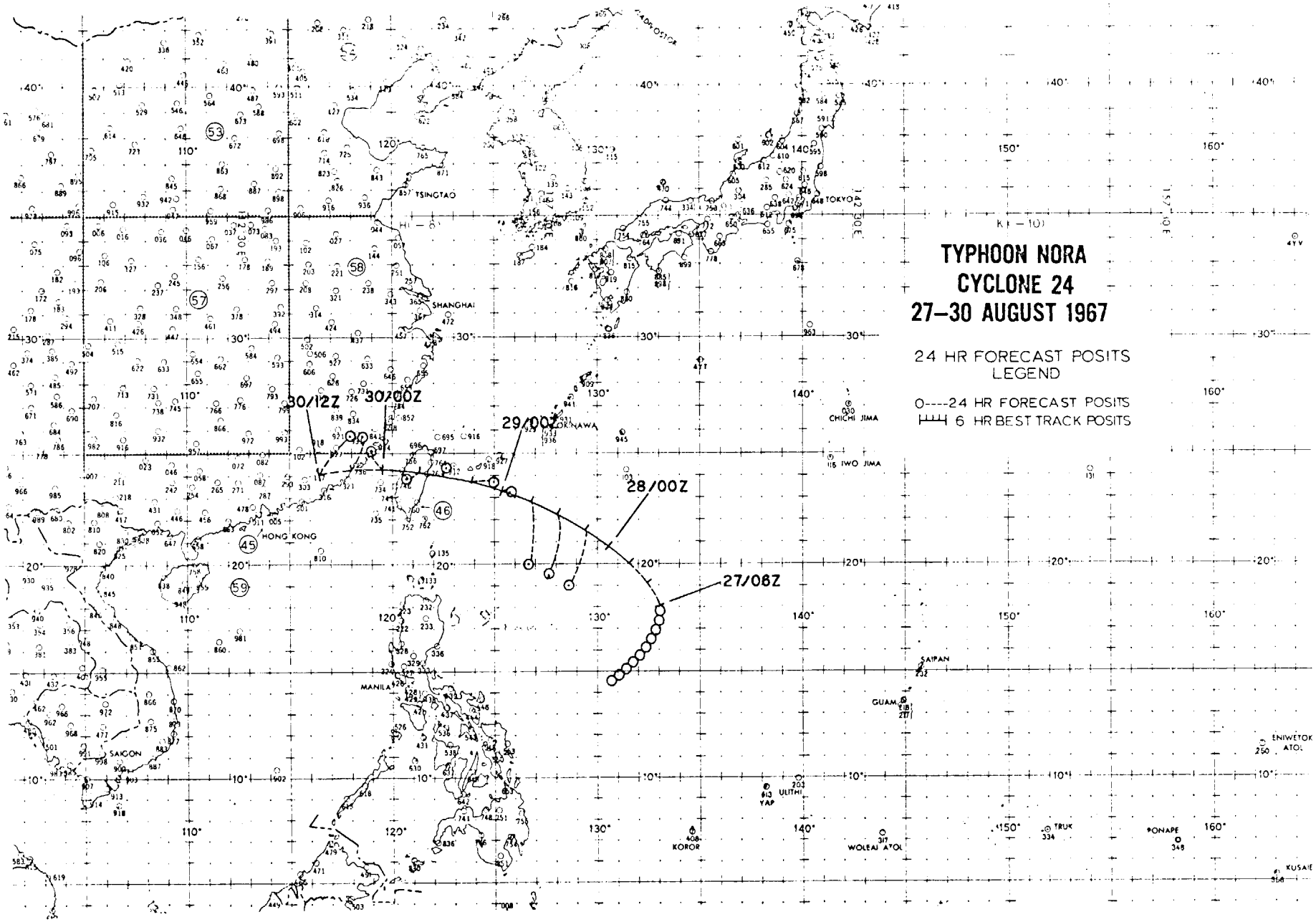
FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
1	272100Z	20.4N 131.0E	54-P-P03	700MB	030	030	997	3057	11/10	----			--
2	280230Z	20.9N 130.2E	54-P-P03	700MB	047	045	991	3005	14/--	CONC		30-15	--
3	270630Z	18.0N 133.0E	SLTLS	STG A	DIA --	BNDS -							
4	281012Z	22.1N 128.4E	VW-R-F10	036OM	---	---	---	---	--/--	----			--
5	281045Z	22.1N 128.6E	VW-P-P03	029OM	055	070	987	---	--/--	CIRC	----	20	--
6	281200Z	22.1N 128.3E	VW-R-P--	098OM	---	---	---	---	--/--	----			--
7	281400Z	22.2N 127.8E	VW-R-P--	700MB	---	---	---	---	--/--	----			--
8	281600Z	22.4N 127.2E	VW-P-P03	700MB	040	---	---	2963	16/--	CIRC	----	10	--
9	281500Z	22.2N 127.5E	VW-R-P--	700MB	---	---	---	---	--/--	----			--
10	282035Z	22.9N 125.6E	VW-P-P05	700MB	045	---	981	2984	16/--	CIRC	----	20	--
11	290130Z	23.4N 124.7E	LND RDR		---	---	---	---	--/--	----			--
12	290325Z	23.5N 124.3E	54-P-P02	700MB	050	045	993	3008	14/--	----			F.B.
13	290900Z	23.7N 123.3E	LND RDR		---	---	---	---	--/--	----			--
14	291000Z	23.7N 123.1E	LND RDR		---	---	---	---	--/--	----			--
15	291000Z	23.8N 123.1E	54-P-P02	700MB	050	045	982	2953	17/--	CIRC	----	05	--
16	291045Z	23.8N 122.6E	LND RDR		---	---	---	---	--/--	----			--
17	291145Z	24.0N 122.5E	LND RDR		---	---	---	---	--/--	----			--
18	291400Z	24.0N 122.2E	LND RDR		---	---	---	---	--/--	----			--

TROPICAL CYCLONE 24 -- 08/27/0600Z TO 08/30/1200Z

POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION LAT.	LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
271800Z	20.0N	131.5E	--------	--------	--------
280000Z	20.7N	130.5E	--------	--------	--------
280600Z	21.5N	129.4E	196-0150	--------	--------
281200Z	22.2N	128.1E	187-0162	--------	--------
281800Z	22.7N	126.7E	177-0162	--------	--------
290000Z	23.2N	125.3E	090-0024	--------	--------
290600Z	23.6N	123.9E	090-0060	--------	--------
291200Z	23.9N	122.6E	012-0030	--------	--------
291800Z	24.1N	121.4E	249-0030	--------	--------
300000Z	24.3N	119.5E	330-0048	--------	--------

AVERAGE 24 HOUR ERROR - 0083 MI.
AVERAGE 48 HOUR ERROR - ---- MI.
AVERAGE 72 HOUR ERROR - ---- MI.


TYPHOON NORA
CYCLONE 24
27–30 AUGUST 1967
24 HR FORECAST POSITS
LEGEND
0----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS
30/12Z
30/00Z
29/00Z
28/00Z
27/06Z
TSINGTAO
SHANGHAI
NAHA
CHICHI JIMA
IWO JIMA
HONG KONG
MANILA
SAIGON
SAIPAN
GUAM
YAP
ULITHI
KOROR
WOLEAI ATOL
TRUK
PONAPE
ENIWETOK ATOL
KUSAIE
TOKYO

TROPICAL CYCLONE 25 - 08/31/0600Z TO 09/14/1200Z

I. DATA

A. STATISTICS

1. NUMBER OF WARNINGS ISSUED - 69
2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 57
3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 2544 MI

B. CHARACTERISTICS AS A TYPHOON

1. MINIMUM OBSERVED SLP - 752MBS AT 031535Z
2. MINIMUM OBSERVED 700MB HEIGHT - 2331M. AT 031535Z
3. MAXIMUM SURFACE WIND - 155 KTS (FROM BEST TRACK)
4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 550 MI

II. DEVELOPMENT

A. INITIAL IMPETUS - DEVELOPMENT OF DIVERGENCE AT 200MB LEVEL OVER SURFACE CYCLONIC CIRCULATION

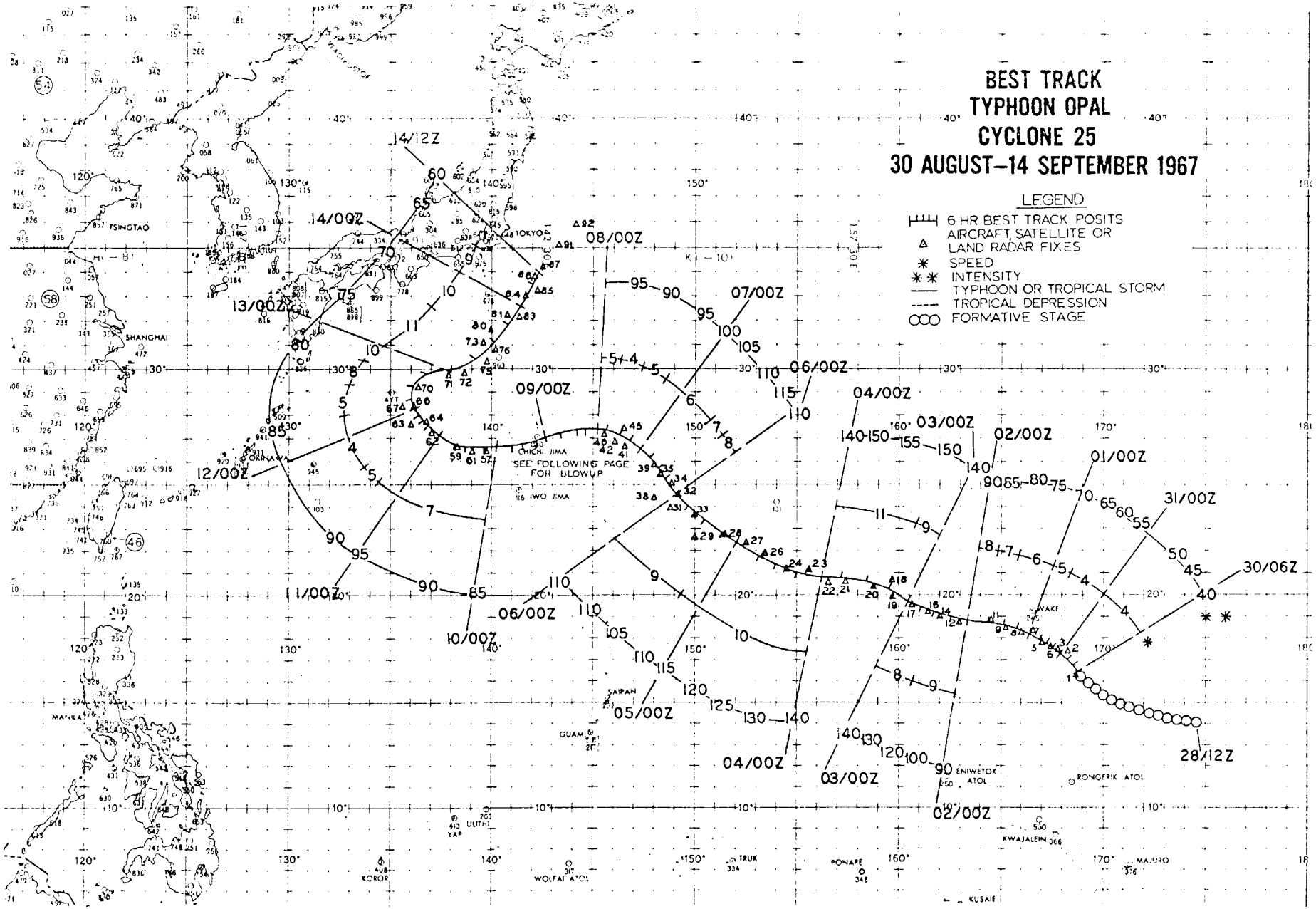
B. INITIAL SURFACE VORTEX

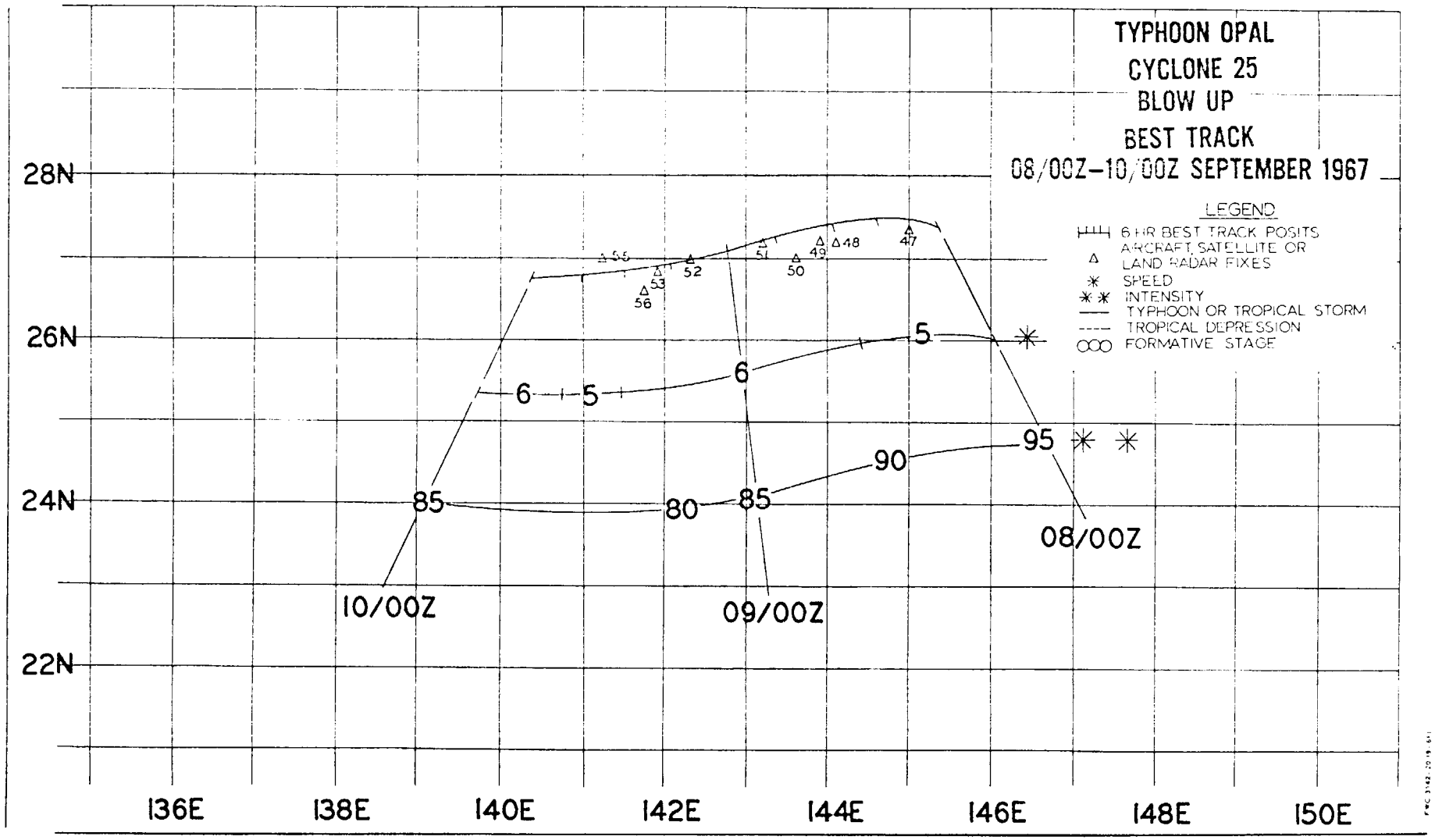
1. EMBEDDED VORTEX AT 281200Z
2. SURFACE PRESSURE LESS THAN 1008MB

C. 200MB FLOW ABOVE SURFACE VORTEX

1. INITIAL - NORTH
2. UPON REACHING TYPHOON INTENSITY - NORTH

III. FINAL DISPOSITION - BECAME EXTRATROPICAL


BEST TRACK
TYPHOON OPAL
CYCLONE 25
30 AUGUST–14 SEPTEMBER 1967
LEGEND
6 HR BEST TRACK POSITS
AIRCRAFT, SATELLITE OR LAND RADAR FIXES
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
FORMATIVE STAGE
SEE FOLLOWING PAGE FOR BLOWUP
12/00Z
13/00Z
14/00Z
14/12Z
08/00Z
07/00Z
06/00Z
09/00Z
04/00Z
03/00Z
02/00Z
01/00Z
31/00Z
30/06Z
11/00Z
10/00Z
06/00Z
05/00Z
04/00Z
03/00Z
02/00Z
28/12Z
TSINGTAO
SHANGHAI
OKINAWA
TOKYO
CHICHI JIMA
IWO JIMA
SAIPAN
GUAM
MANILA
YAP
ULITHI
KOROR
WOLEAI ATOL
TRUK
PONAPE
KUSAIE
ENIWETOK ATOL
RONGERIK ATOL
KWAJALEIN
MAJURO
WAKE I


TYPHOON OPAL
CYCLONE 25
BLOW UP
BEST TRACK
08/00Z–10/00Z SEPTEMBER 1967
LEGEND
6 HR BEST TRACK POSITS
AIRCRAFT, SATELLITE OR LAND RADAR FIXES
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
FORMATIVE STAGE
28N
26N
24N
22N
136E
138E
140E
142E
144E
146E
148E
150E
10/00Z
09/00Z
08/00Z
85
80
85
90
95
6
5
6
5
56
53
52
51
50
49
48
47

EYE FIXES CYCLONE 25

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
1	300404Z	16.3N 168.7E	54-P-P03	700MB	042	050	992	3075	12/--	CIRC	----	08	15
2	302135Z	17.2N 168.2E	54-P-P02	700MB	040	065	982	2960	16/--	CIRC	----	10	10
3	310320Z	17.5N 167.5E	SLTLS	STG X	DIA 02	BNDS 2							
4	310324Z	17.4N 167.9E	54-P-P03	700MB	068	070	975	2929	16/--	ELIP	NE-SW	15X02	10
5	310935Z	17.4N 167.7E	VW-P-P15	0240M	045	---	966	---	--/--	CIRC	----	30	09
6	311508Z	17.8N 167.0E	VW-R-P10	0480M	046	---	---	---	--/--	CIRC	----	18	08
7	312200Z	18.3N 166.6E	54-P-P01	700MB	060	065	976	2911	21/--	CIRC	----	20	10
8	010347Z	18.2N 166.0E	54-P-P01	700MB	053	060	986	2926	16/--	CIRC	----	40	05
9	011000Z	18.5N 165.3E	VW-P-P03	700MB	070	---	949	2908	16/10	CIRC	----	30	--
10	011500Z	18.6N 164.8E	VW-R-P--	700MB	---	---	---	---	--/--	----			--
11	011600Z	18.8N 164.5E	VW-P-P01	700MB	078	---	972	2832	15/--	CIRC	----	25	--
12	020110Z	19.0N 162.0E	SLTLS	STG X	DIA 04	BNDS 4							
13	020150Z	18.6N 162.9E	54-P-P03	700MB	080	075	975	2899	19/--	ELIP	NE-SW	25X20	--
14	020350Z	19.0N 162.8E	54-P-P03	700MB	093	075	976	2908	17/--	CIRC	----	20	--
15	021003Z	19.0N 161.9E	VW-P-P01	700MB	---	---	932	2502	18/--	CIRC	----	15	--
16	021545Z	19.2N 161.5E	VW-P-P05	700MB	---	---	935	2451	20/--	ELIP	NW-SE	18X15	05
17	022205Z	19.5N 160.6E	54-P-P02	700MB	120	100	936	2810	18/--	CIRC	----	20	03
18	030114Z	20.6N 159.7E	SLTLS	STG X	DIA 05	BNDS 4							
19	030347Z	19.9N 159.8E	54-P-P02	700MB	110	120	919	2306	20/--	CIRC	----	16	04
20	030950Z	20.3N 158.8E	VW-P-P03	700MB	100	---	824	2334	21/--	CIRC	----	18	03
21	031535Z	20.6N 157.4E	VW-P-P05	700MB	150	---	752	2331	21/--	CONC		50-15	06
22	032200Z	20.6N 156.6E	54-P-P05	700MB	140	130	922	2402	18/--	CONC		40-15	--
23	040330Z	21.1N 155.6E	54-P-P05	700MB	118	080	919	2393	23/--	CIRC	----	35	--
24	041000Z	21.1N 154.5E	VW-R-P15	0870M	---	---	---	---	--/--	----			--

EYE FIXES CYCLONE 25

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
25	041015Z	21.3N 154.4E	VW-R-P05	2890M	082	060	---	---	--/--	ELIP	NE-SW	38X33	07
26	041555Z	21.9N 153.4E	VW-P-P05	700MB	120	---	925	2460	19/--	ELIP	N-S	36X25	--
27	042207Z	22.3N 152.5E	54-P-P05	700MB	090	126	962	2758	20/--	ELIP	NE-SW	30X20	--
28	050350Z	22.7N 151.5E	54-P-P05	700MB	090	120	960	2774	20/--	CIRC	----	25	--
29	050430Z	23.0N 151.0E	SLTLS	STG X	DIA 05	BNDS 4							
30	051030Z	22.6N 150.0E	VW-R-F20	700MB	---	050	---	---	--/--	ELIP	N-S	75X40	--
31	051540Z	23.6N 150.0E	VW-R-F10	700MB	---	---	---	---	--/--	CIRC	----	35	04
32	052122Z	24.0N 148.9E	SLTLS	STG -	DIA --	BNDS -							
33	052230Z	24.5N 149.2E	54-R-P15	700MB	070	065	944	2594	16/--	ELIP	N-S	40X20	20
34	060242Z	24.5N 148.0E	SLTLS	STG X	DIA 05	BNDS 4							
35	060400Z	25.0N 148.9E	54-P-P01	700MB	100	075	940	2506	18/--	ELIP	NW-SE	40X20	--
36	060910Z	25.4N 148.3E	VW-R-F15	0460M	---	---	---	---	--/--	----			--
37	060954Z	25.4N 148.2E	VW-R-P02	0340M	085	060	973	---	--/--	CIRC	----	10	10
38	061130Z	25.4N 148.2E	VW-P-P02	700MB	---	---	---	2640	--/--	----			--
39	061520Z	25.9N 148.0E	VW-P-P02	700MB	075	---	---	---	18/10	ELIP	NW-SE	35X25	--
40	062150Z	26.0N 147.6E	54-P-P05	700MB	055	070	949	2630	18/--	ELIP	NE-SW	40X20	--
41	070332Z	26.6N 146.6E	54-P-P05	700MB	075	065	945	2676	17/--	CIRC	----	30	--
42	070544Z	26.5N 146.0E	SLTLS	STG X	DIA 04	BNDS 3							
43	070930Z	26.9N 146.1E	VW-R-F15	0380M	---	---	---	---	--/--	----			--
44	071000Z	27.0N 146.4E	VW-R-P05	0350M	065	085	---	---	--/--	ELIP	NE-SW	26X18	--
45	071500Z	27.4N 146.4E	VW-R-P05	0370M	073	045	992	---	--/--	CIRC	----	20	--
46	072200Z	27.2N 145.5E	54-P-P02	700MB	060	---	955	2694	16/--	CIRC	----	20	--
47	080300Z	27.4N 145.0E	54-P-P02	700MB	080	055	955	2694	16/--	CIRC	----	20	--
48	081025Z	27.2N 144.1E	VW-P-P03	700MB	085	---	954	2740	14/12	CIRC	----	10	--

EYE FIXES CYCLONE 25

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL T/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
49	081240Z	27.2N 143.9E	VW-R-P--		---	---	---	---	--/--	----			--
50	081530Z	27.0N 143.7E	VW-P-P03	700MB	035	---	948	2759	15/--	CIRC	----	10	--
51	082200Z	27.2N 143.2E	54-P-P02	700MB	065	045	965	2792	17/--	ELIP	NE-SW	20X15	--
52	090345Z	26.9N 142.3E	54-P-P02	700MB	070	050	965	2783	16/--	ELIP	NE-SW	20X15	--
53	090940Z	26.7N 141.9E	VW-R-P15		---	---	---	---	--/--	----			--
54	091000Z	26.9N 141.9E	VW-P-P03	700MB	080	055	965	2813	16/--	CIRC	----	20	--
55	091530Z	27.0N 141.3E	VW-P-P01	700MB	080	---	---	2788	18/--	ELIP	NE-SW	20X15	--
56	092200Z	26.6N 140.7E	54-P-P01	700MB	069	045	966	2792	16/--	CIRC	----	30	--
57	100322Z	26.5N 139.8E	54-P-P02	700MB	069	055	966	2786	13/--	CIRC	----	30	--
58	100404Z	26.5N 139.0E	SLTLS	STG X	DIA 06	BNDS 3							
59	100950Z	26.5N 139.3E	VW-P-P02	700MB	075	075	978	2808	15/09	ELIP	NW-SE	25X20	--
60	101533Z	26.7N 138.3E	VW-P-P03	700MB	060	---	974	2836	13/08	ELIP	NW-SE	35X25	--
61	102100Z	26.8N 138.0E	54-P-P02	700MB	060	---	965	2777	16/--	CIRC	----	20	--
62	110235Z	27.2N 137.0E	54-P-P02	700MB	075	045	963	2783	17/--	ELIP	N-S	20X15	20
63	110304Z	27.5N 136.0E	SLTLS	STG X	DIA 05	BNDS 4							
64	111030Z	27.6N 136.7E	VW-P-P03	700MB	080	065	968	2707	16/--	ELIP	N-S	25X20	--
65	111510Z	27.7N 136.6E	VW-P-P02	700MB	075	---	---	2789	16/--	ELIP	NE-SW	25X20	--
66	112207Z	28.3N 136.1E	54-P-P03	700MB	040	040	959	2737	17/--	ELIP	NE-SW	15X08	--
67	120323Z	28.3N 135.7E	54-P-P03	700MB	---	050	959	2746	16/--	ELIP	NE-SW	15X08	--
68	120658Z	28.5N 135.5E	SLTLS	STG X	DIA 05	BNDS 3							
69	120920Z	28.7N 136.1E	VW-P-P05	1200M	055	065	973	---	--/--	CIRC	----	20	--
70	121520Z	29.4N 136.3E	VW-R-F05	700MB	055	---	---	---	--/--	CIRC	----	30	--
71	122332Z	29.8N 137.9E	54-P-P03	700MB	051	040	964	2792	17/--	----			--
72	130323Z	29.8N 138.6E	54-P-P03	700MB	070	040	962	2749	17/--	ELIP	NE-SW	25X05	--

EYE FIXES CYCLONE 25

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
73	130250Z	30.0N 138.5E	SLTLS	STG X	DIA 05	BNDS 3							
74	130800Z	30.3N 139.8E	LND RDR		---	---	---	---	--/--	----			--
75	130900Z	30.7N 140.1E	LND RDR		---	---	---	---	--/--	----			--
76	130956Z	31.1N 139.5E	VW-P-P01	0550M	080	075	961	---	--/--	----			F.B.
77	131000Z	30.9N 140.3E	LND RDR		---	---	---	---	--/--	----			--
78	131100Z	31.0N 140.6E	LND RDR		---	---	---	---	--/--	----			--
79	131311Z	31.4N 139.9E	VW-R-F--		---	---	---	---	--/--	----			--
80	131530Z	31.6N 140.0E	VW-P-P02	1370M	086	050	963	---	--/--	CIRC	----	05	--
81	131700Z	32.0N 140.6E	LND RDR		---	---	---	---	--/--	----			--
82	131800Z	32.1N 140.8E	LND RDR		---	---	---	---	--/--	----			--
83	132144Z	32.2N 141.3E	54-P-P03	700MB	075	060	964	2786	17/--	CIRC	----	40	03
84	140300Z	33.1N 142.1E	LND RDR		---	---	---	---	--/--	----			--
85	140348Z	33.1N 141.8E	54-P-F03	700MB	070	080	968	2822	17/--	----			F.B.
86	140914Z	33.5N 142.1E	VW-P-P02	0260M	080	070	970	---	--/--	CIRC	----	20	--
87	141525Z	34.1N 142.5E	VW-P-P02	1220M	050	---	972	---	--/--	----			F.B.
88	142245Z	33.0N 145.0E	SLTLS	STG -	DIA --	BNDS -							
89	150206Z	33.3N 141.8E	54-P-P03	700MB	065	035	974	2859	17/--	----			N.F.B.
90	150630Z	33.6N 142.8E	VW-R-L--	700MB	---	---	---	---	--/--	----			--
91	152216Z	35.1N 143.3E	54-P-P02	700MB	030	045	976	2899	18/--	----			--
92	160300Z	35.9N 144.1E	54-P-P02	700MB	035	050	976	2911	20/--	----			--

TROPICAL CYCLONE 25 -- 08/30/0600Z TO 09/14/1200Z

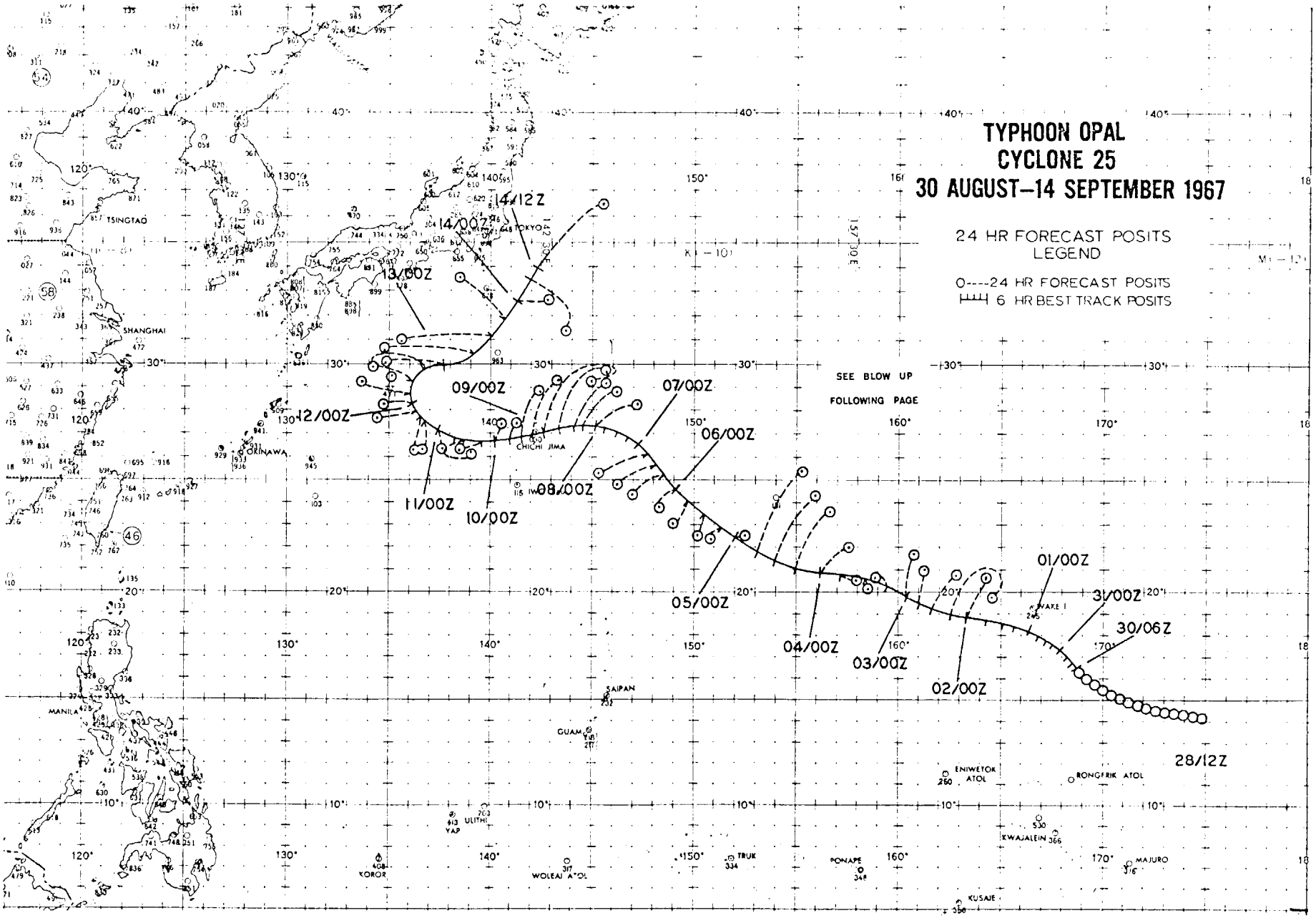
POSITION AND FORECAST VERIFICATION DATA

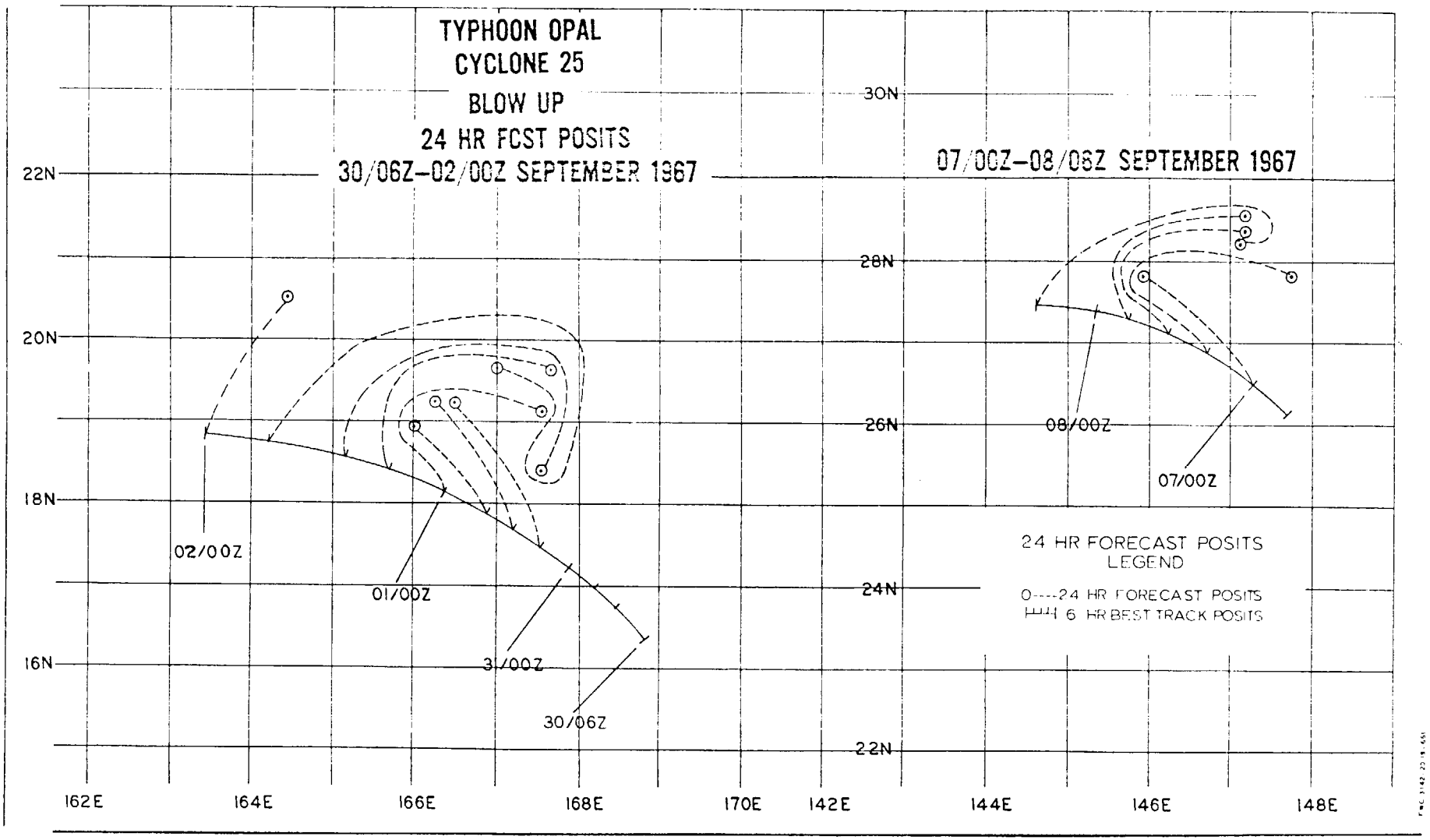
DTG	STORM POSITION LAT.	LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
300600Z	16.4N	168.8E	--------	--------	--------
301200Z	16.7N	168.5E	--------	--------	--------
301800Z	17.0N	168.2E	--------	--------	--------
310000Z	17.3N	167.9E	--------	--------	--------
310600Z	17.5N	167.6E	329-0114	--------	--------
311200Z	17.7N	167.3E	309-0138	--------	--------
311800Z	17.9N	166.9E	290-0168	--------	--------
010000Z	18.2N	166.4E	049-0078	--------	--------
010600Z	18.4N	165.7E	057-0126	330-0264	--------
011200Z	18.6N	165.1E	095-0132	332-0258	--------
011800Z	18.7N	164.2E	071-0162	333-0252	--------
020000Z	18.8N	163.4E	028-0114	050-0312	--------
020600Z	18.9N	162.5E	067-0114	052-0354	339-0462
021200Z	19.1N	161.7E	037-0108	067-0378	--------
021800Z	19.4N	161.0E	008-0096	059-0390	028-0480
030000Z	19.7N	160.3E	009-0114	027-0300	--------
030600Z	20.2N	159.3E	314-0024	054-0240	050-0600
031200Z	20.5N	158.3E	153-0024	038-0216	--------
031800Z	20.7N	157.1E	102-0054	024-0234	057-0654
040000Z	20.8N	156.1E	048-0102	022-0336	--------
040600Z	21.1N	155.0E	031-0162	024-0174	052-0516
041200Z	21.5N	154.0E	033-0198	048-0168	--------
041800Z	21.9N	153.1E	030-0228	052-0174	037-0510
050000Z	22.4N	152.0E	104-0024	048-0282	--------
050600Z	22.8N	151.2E	192-0030	037-0408	040-0366
051200Z	23.3N	150.3E	188-0048	041-0480	--------
051800Z	24.0N	149.6E	207-0066	046-0480	053-0342
060000Z	24.7N	149.0E	218-0066	068-0246	--------
060600Z	25.2N	148.6E	238-0096	219-0144	050-0720
061200Z	25.7N	148.2E	241-0120	223-0174	--------
061800Z	26.1N	147.7E	246-0126	233-0192	055-0804
070000Z	26.5N	147.2E	317-0096	246-0168	--------
070600Z	26.8N	146.7E	042-0072	254-0204	236-0258
071200Z	27.1N	146.3E	[illegible]84	257-0234	--------

TROPICAL CYCLONE 25 -- 08/30/0600Z TO 09/14/1200Z
POSITION AND FORECAST VERIFICATION DATA (CONT)

DTG	STORM POSITION LAT.	LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
071800Z	27.3N	145.8E	046-0096	269-0216	245-0300
080000Z	27.3N	145.3E	061-0108	338-0246	--------
080600Z	27.4N	144.5E	048-0114	043-0216	269-0300
081200Z	27.3N	144.1E	038-0132	036-0252	--------
081800Z	27.2N	143.4E	043-0186	041-0288	296-0300
090000Z	27.1N	142.8E	041-0174	047-0300	--------
090600Z	26.9N	142.1E	023-0156	041-0342	038-0534
091200Z	26.8N	141.5E	022-0126	040-0366	--------
091800Z	26.8N	141.0E	027-0036	041-0408	039-0582
100000Z	26.6N	140.4E	015-0048	042-0372	--------
100600Z	26.5N	139.6E	260-0066	028-0306	044-0570
101200Z	26.6N	138.8E	146-0018	030-0276	--------
101800Z	26.8N	138.1E	046-0012	038-0156	049-0726
110000Z	27.1N	137.4E	156-0042	360-0030	--------
110600Z	27.4N	136.8E	180-0060	242-0174	046-0534
111200Z	27.7N	136.6E	185-0078	210-0108	--------
111800Z	27.9N	136.3E	260-0096	236-0090	048-0264
120000Z	28.3N	136.1E	259-0060	201-0120	--------
120600Z	28.6N	136.0E	287-0114	218-0156	246-0378
121200Z	29.2N	136.2E	289-0108	230-0234	--------
121800Z	29.8N	136.8E	258-0084	253-0294	246-0372
130000Z	29.9N	137.9E	272-0156	264-0306	--------
130600Z	30.4N	139.1E	269-0222	286-0336	243-0480
131200Z	31.2N	140.0E	266-0228	275-0360	--------
131800Z	31.9N	140.7E	308-0150	265-0324	256-0630
140000Z	32.7N	141.5E	095-0066	278-0294	--------
140600Z	33.4N	142.0E	144-0150	282-0282	306-0252
141200Z	33.9N	142.4E	046-0210	278-0246	--------

AVERAGE 24 HOUR ERROR - 0106 MI.
AVERAGE 48 HOUR ERROR - 0262 MI.
AVERAGE 72 HOUR ERROR - 0477 MI.


TYPHOON OPAL
CYCLONE 25
30 AUGUST–14 SEPTEMBER 1967
24 HR FORECAST POSITS
LEGEND
0----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS
SEE BLOW UP
FOLLOWING PAGE
14/12Z
14/00Z
13/00Z
12/00Z
11/00Z
10/00Z
09/00Z
08/00Z
07/00Z
06/00Z
05/00Z
04/00Z
03/00Z
02/00Z
01/00Z
31/00Z
30/06Z
28/12Z
TSINGTAO
SHANGHAI
OKINAWA
CHICHI JIMA
TOKYO
MANILA
SAIPAN
GUAM
YAP
ULITHI
KOROR
WOLEAI ATOL
TRUK
PONAPE
KUSAIE
ENIWETOK ATOL
RONGERIK ATOL
KWAJALEIN
MAJURO
WAKE I
157°30'E


TYPHOON OPAL
CYCLONE 25
BLOW UP
24 HR FCST POSITS
30/06Z–02/00Z SEPTEMBER 1967
07/00Z–08/06Z SEPTEMBER 1967
30N
28N
26N
24N
22N
22N
20N
18N
16N
162E
164E
166E
168E
170E
142E
144E
146E
148E
02/00Z
01/00Z
31/00Z
30/06Z
08/00Z
07/00Z
24 HR FORECAST POSITS
LEGEND
0----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS

TROPICAL CYCLONE 27 - 09/06/0600Z TO 09/13/1800Z

I. DATA

A. STATISTICS

1. NUMBER OF WARNINGS ISSUED - 31
2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 14
3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 1674 MI

B. CHARACTERISTICS AS A TYPHOON

1. MINIMUM OBSERVED SLP - 939MBS AT 120300Z
2. MINIMUM OBSERVED 700MB HEIGHT - 2566M. AT 120300Z
3. MAXIMUM SURFACE WIND - 110 KTS (FROM BEST TRACK)
4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 350 MI

II. DEVELOPMENT

A. INITIAL IMPETUS - A COLD CORE LOW BECOMING WARM CORE AFTER DEVELOPMENT OF DIVERGENCE AT 200MB

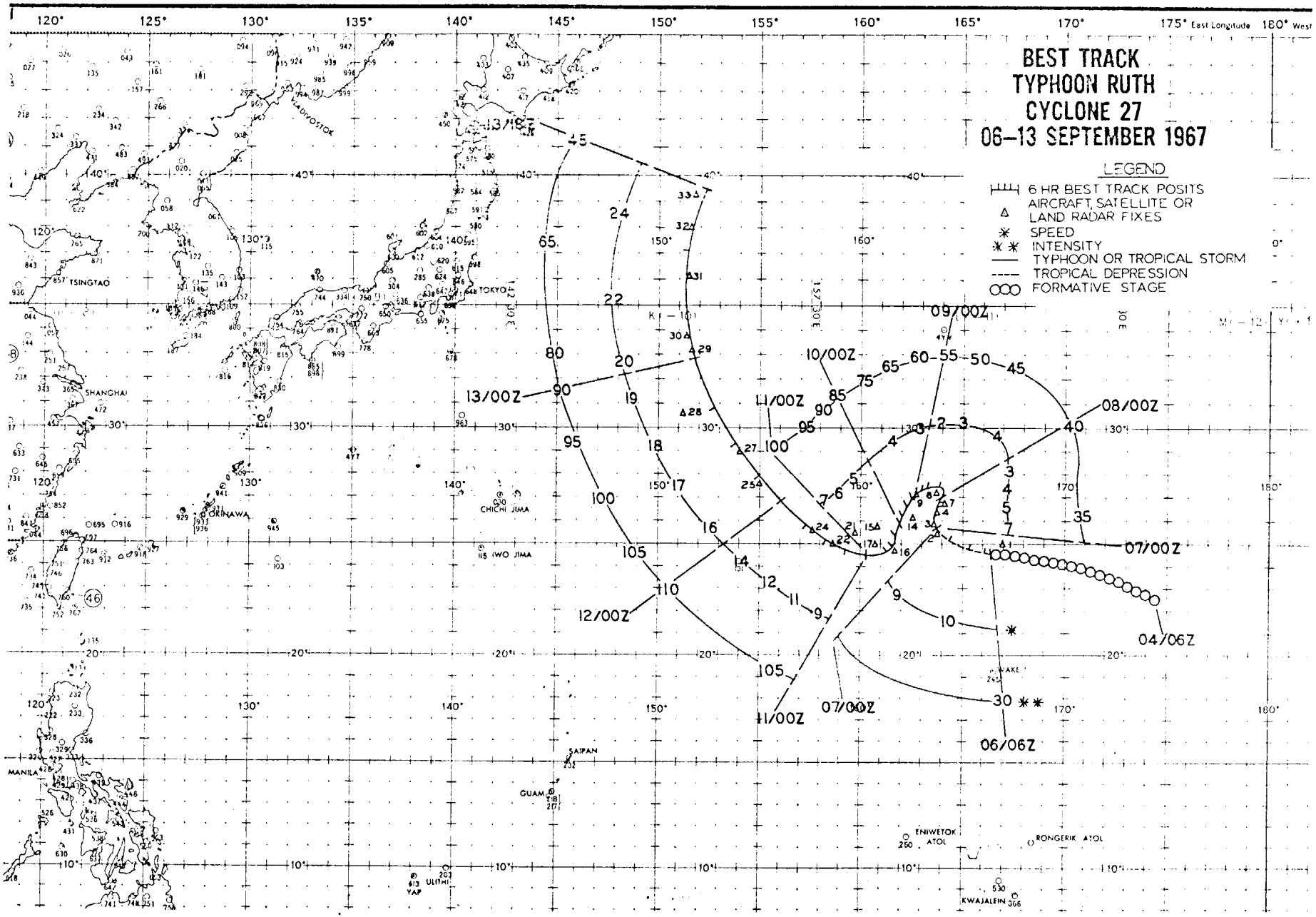
B. INITIAL SURFACE VORTEX

1. COLD VORTEX AT 040600
2. SURFACE PRESSURE LESS THAN 1010MB

C. 200MB FLOW ABOVE SURFACE VORTEX

1. INITIAL - SOUTH
2. UPON REACHING TYPHOON INTENSITY - NORTHWEST

III. FINAL DISPOSITION - BECAME EXTRATROPICAL


BEST TRACK
TYPHOON RUTH
CYCLONE 27
06–13 SEPTEMBER 1967
LEGEND
6 HR BEST TRACK POSITS
AIRCRAFT, SATELLITE OR LAND RADAR FIXES
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
FORMATIVE STAGE
120° 125° 130° 135° 140° 145° 150° 155° 160° 165° 170° 175° East Longitude 180° West
40° 30° 20° 10°
VLADIVOSTOK
TSINGTAO
TOKYO
SHANGHAI
OKINAWA
CHICHI JIMA
IWO JIMA
SAIPAN
GUAM
MANILA
YAP
ULITHI
WAKE
ENIWETOK ATOL
RONGERIK ATOL
KWAJALEIN
13/18Z
13/00Z
12/00Z
11/00Z
10/00Z
09/00Z
08/00Z
07/00Z
06/06Z
04/06Z

EYE FIXES CYCLONE 27

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
1	062222Z	25.5N 163.8E	54-P-P08	0300M	043	035	999	---	--/--	CIRC	----	20	--
2	070124Z	25.5N 163.0E	SLTLS	STG C	DIA -- BNDS -								
3	070211Z	25.9N 163.6E	54-P-P10	0300M	043	040	995	---	--/--	CIRC	----	05	--
4	070905Z	26.4N 163.8E	VW-P-P05	0290M	020	035	995	---	--/--	CIRC	----	15	04
5	071532Z	26.4N 163.6E	VW-P-P05	0310M	028	030	995	---	--/--	CIRC	----	40	--
6	072100Z	26.7N 164.0E	54-P-P10	0330M	033	035	996	---	--/--	----			F.B.
7	080305Z	27.2N 163.7E	54-P-P05	0310M	038	035	994	---	--/--	CIRC	----	12	--
8	080958Z	27.1N 163.4E	VW-P-P05	700MB	022	---	---	3021	15/--	CIRC	----	20	--
9	082127Z	27.0N 163.0E	54-P-P05	0350M	038	045	992	---	--/--	CIRC	----	06	--
10	090300Z	27.1N 162.8E	54-P-P10	0450M	050	050	988	---	--/--	CIRC	----	08	--
11	091000Z	26.6N 162.6E	VW-R-P20		---	---	---	---	--/--	----			--
12	091110Z	26.7N 162.2E	VW-P-P05	700MB	038	---	980	2941	18/--	CIRC	----	12	--
13	091525Z	26.1N 162.6E	VW-R-P15	700MB	040	---	---	3040	13/--	CIRC	----	08	09
14	100214Z	25.2N 162.0E	SLTLS	STG X	DIA 03 BNDS 3								
15	100330Z	25.7N 161.9E	54-P-P10	700MB	---	065	962	2755	15/--	CONC		12-06	--
16	100900Z	24.8N 161.8E	VW-R-P30		---	---	---	---	--/--	----			--
17	101300Z	25.0N 161.7E	VW-R-P--	700MB	---	---	---	---	--/--	----			--
18	101515Z	24.8N 161.8E	VW-P-P05	700MB	068	---	990	2750	17/--	CIRC	----	18	06
19	110300Z	24.9N 160.0E	54-P-P10	700MB	075	075	963	2710	14/--	CIRC	----	20	--
20	110304Z	25.5N 159.8E	SLTLS	STG X	DIA 03 BNDS 4								
21	110900Z	25.0N 158.8E	VW-R-P25		---	---	---	---	--/--	----			--
22	111547Z	25.6N 157.6E	VW-R-P02	700MB	050	---	---	3048	--/--	CIRC	----	15	08
23	112200Z	26.4N 156.3E	54-P-P05	700MB	110	110	945	2603	16/--	CIRC	----	20	--
24	120300Z	27.6N 155.0E	54-P-P10	700MB	115	120	939	2566	19/--	CIRC	----	18	--

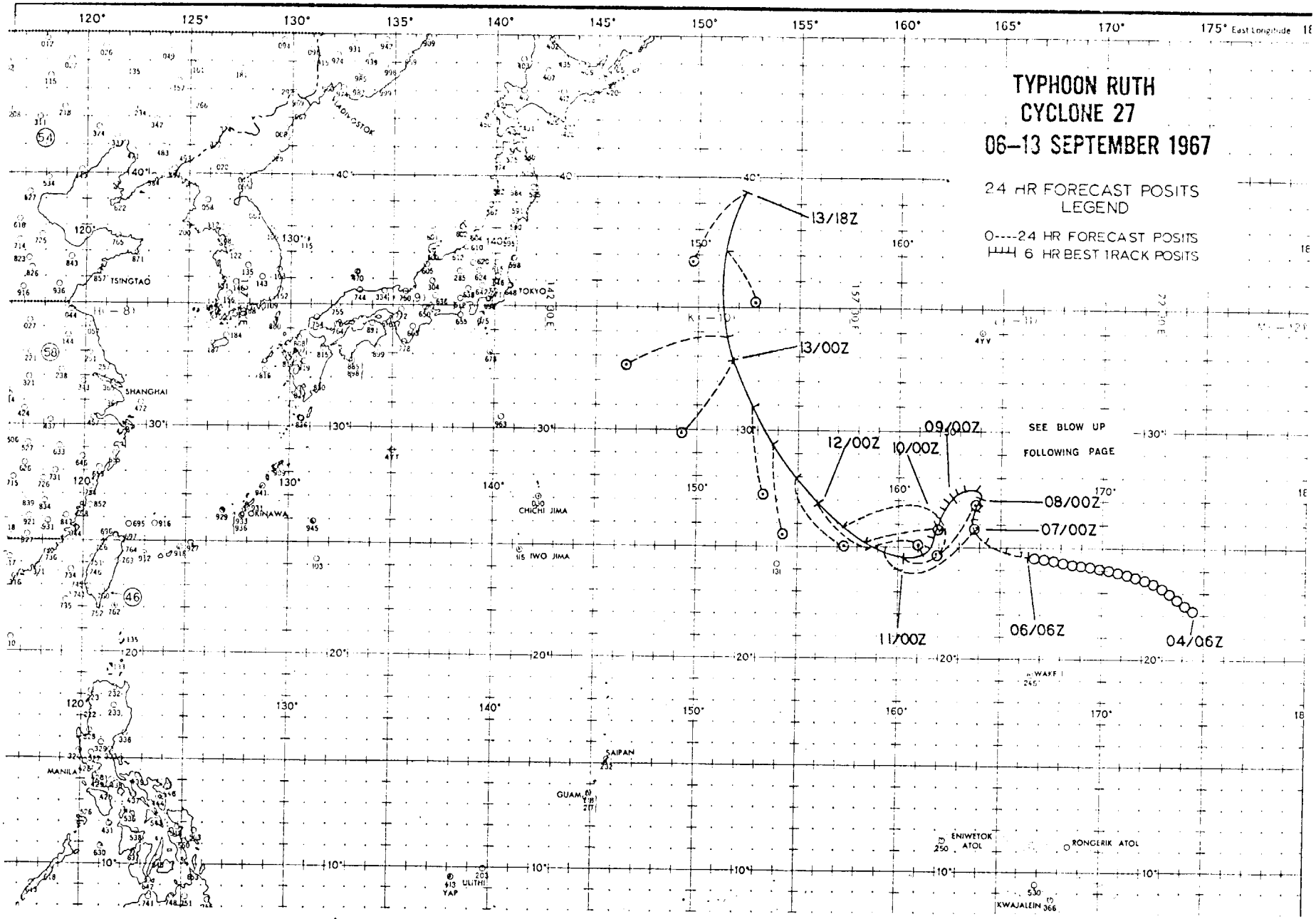
EYE FIXES CYCLONE 27

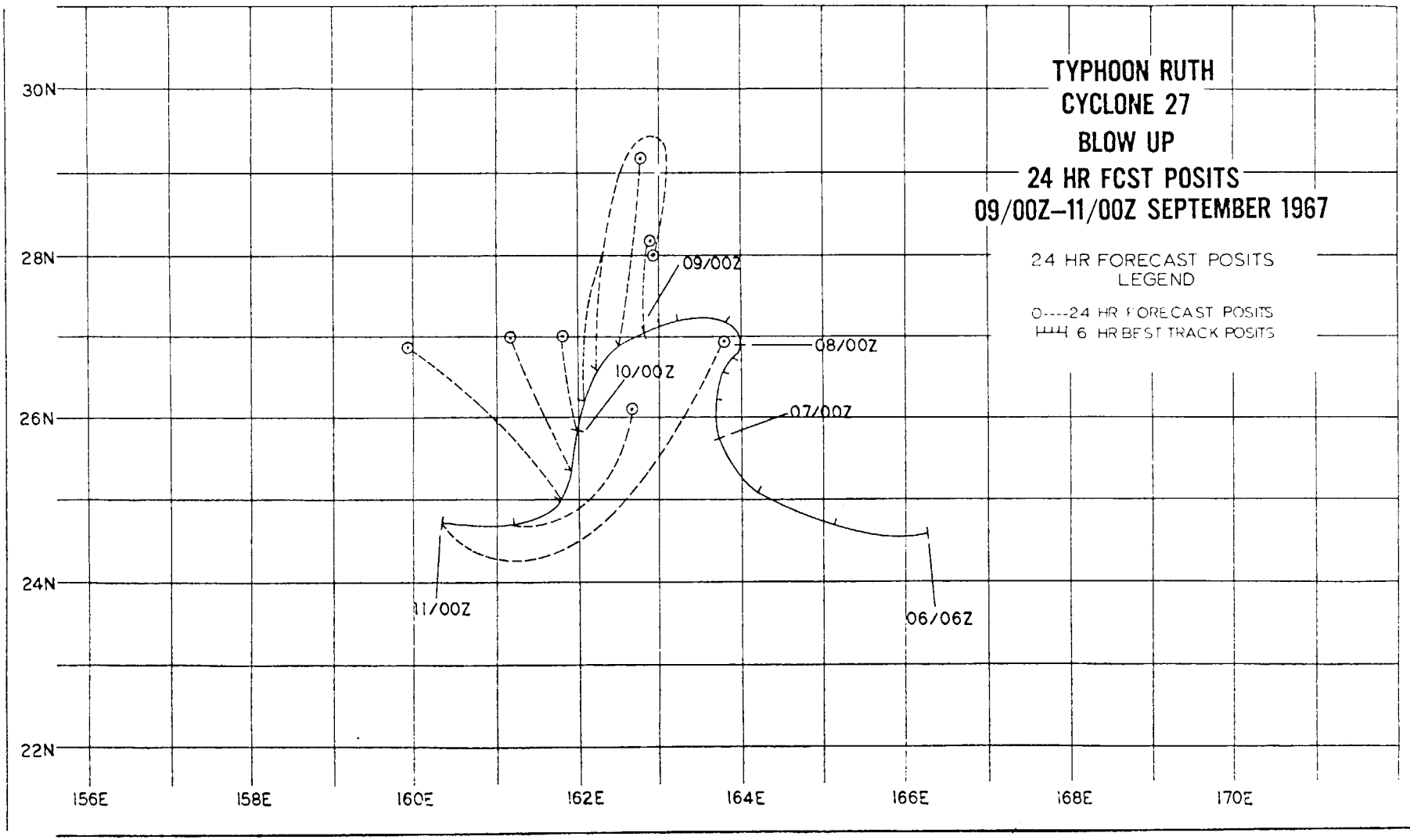
FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
25	120500Z	28.0N 154.5E	SLTLS	STG X	DIA 04	BNDS 4							
26	121000Z	29.0N 154.0E	VW-R-P03	0400M	---	---	---	---	--/--	CIRC	----	14	05
27	121610Z	30.5N 151.1E	VW-R-P25	700MB	---	---	---	3112	--/--	CIRC	----	22	--
28	130155Z	33.2N 151.6E	54-P-P02	700MB	080	100	964	2771	19/--	CIRC	----	20	--
29	130250Z	33.0N 151.5E	SLTLS	STG X	DIA 03	BNDS 4							
30	130355Z	33.9N 151.4E	54-P-P02	700MB	085	100	962	2743	18/--	CIRC	----	30	--
31	131000Z	36.1N 151.5E	VW-R-P05	1360M	---	---	---	---	--/--	CIRC	----	30	--
32	131510Z	38.2N 151.8E	VW-R-P10	1270M	---	---	---	---	--/--	CIRC	----	50	10

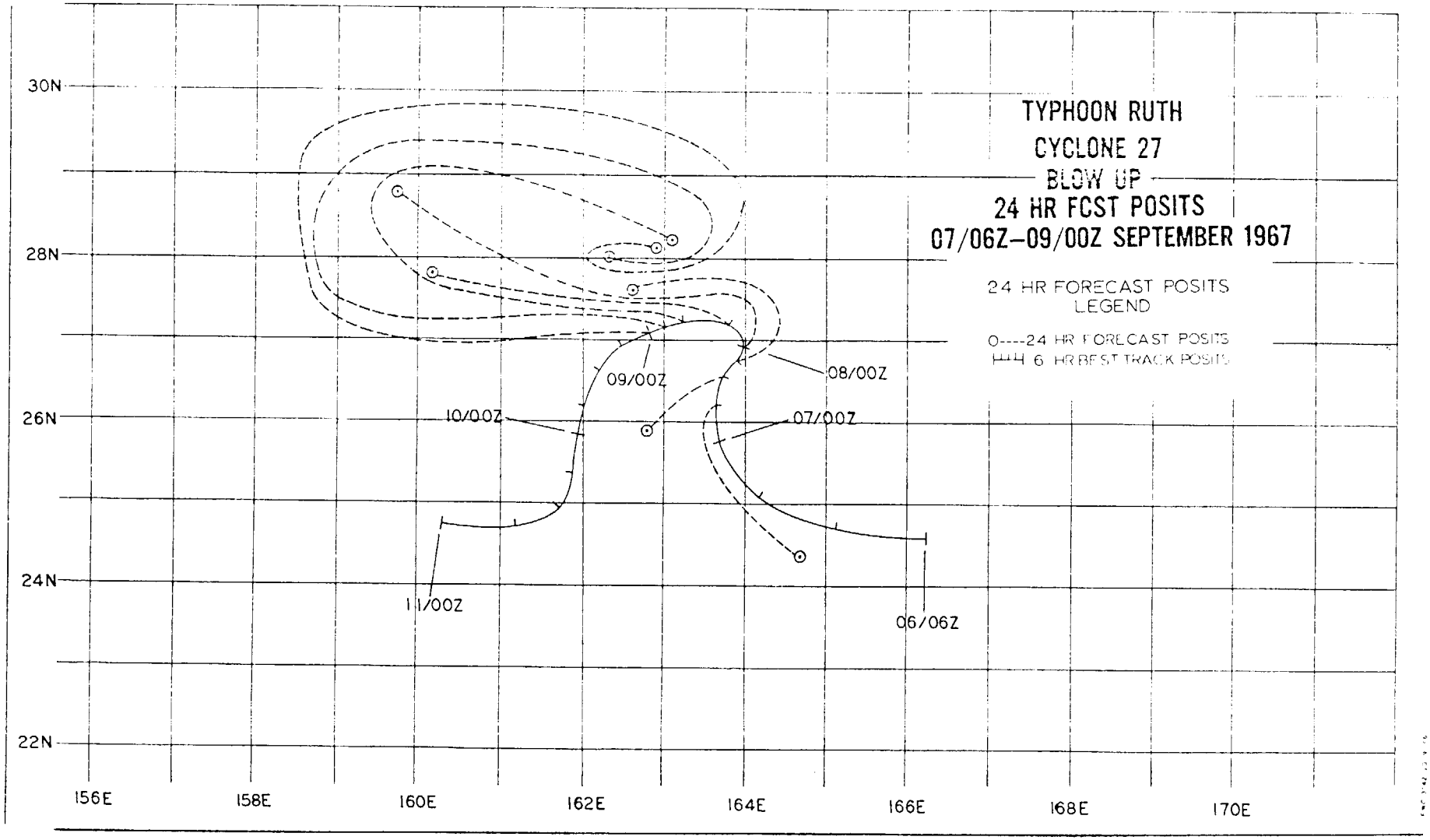
TROPICAL CYCLONE 27 -- 09/06/0600Z TO 09/13/1800Z
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION LAT.	LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
070600Z	26.2N	163.7E	156-0114	--------	--------
071200Z	26.5N	163.8E	233-0066	--------	--------
071800Z	26.7N	163.9E	309-0084	--------	--------
080000Z	26.9N	164.0E	297-0246	--------	--------
080600Z	27.2N	163.7E	280-0186	--------	--------
081200Z	27.2N	163.3E	354-0060	--------	--------
081800Z	27.2N	163.0E	323-0060	--------	--------
090000Z	27.1N	162.8E	006-0066	296-0354	--------
090600Z	26.9N	162.5E	005-0144	312-0318	--------
091200Z	26.6N	162.2E	024-0090	000-0228	--------
091800Z	26.2N	162.0E	024-0114	356-0222	--------
100000Z	25.8N	161.9E	360-0072	007-0258	--------
100600Z	25.4N	161.9E	336-0102	005-0354	336-0486
101200Z	24.9N	161.8E	316-0144	007-0306	--------
101800Z	24.7N	161.3E	039-0102	011-0318	006-0480
110000Z	24.7N	160.4E	054-0222	341-0150	--------
110600Z	24.9N	159.4E	077-0252	347-0132	025-0582
111200Z	25.2N	158.2E	082-0204	346-0102	--------
111800Z	25.8N	157.1E	103-0258	074-0192	039-0474
120000Z	26.7N	155.8E	109-0294	066-0378	--------
120600Z	28.0N	154.6E	140-0234	090-0480	080-0096
121200Z	29.4N	153.7E	174-0234	117-0378	--------
121800Z	31.0N	152.6E	172-0228	132-0498	125-0372
130000Z	32.7N	151.8E	220-0216	138-0558	--------
130600Z	34.8N	151.3E	241-0282	164-0594	114-0648
131200Z	37.1N	151.5E	151-0132	186-0618	--------
131800Z	39.5N	152.3E	217-0198	194-0672	161-0846

AVERAGE 24 HOUR ERROR - 0163 MI.
AVERAGE 48 HOUR ERROR - 0355 MI.
AVERAGE 72 HOUR ERROR - 0498 MI.


TYPHOON RUTH
CYCLONE 27
06–13 SEPTEMBER 1967
24 HR FORECAST POSITS
LEGEND
0----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS
13/18Z
13/00Z
12/00Z
11/00Z
10/00Z
09/00Z
08/00Z
07/00Z
06/06Z
04/06Z
SEE BLOW UP
FOLLOWING PAGE
TSINGTAO
SHANGHAI
OKINAWA
CHICHI JIMA
IWO JIMA
TOKYO
MANILA
SAIPAN
GUAM
YAP
ULITHI
ENIWETOK ATOL
RONGERIK ATOL
KWAJALEIN
WAKE
175° East Longitude


TYPHOON RUTH
CYCLONE 27
BLOW UP
24 HR FCST POSITS
09/00Z–11/00Z SEPTEMBER 1967
24 HR FORECAST POSITS
LEGEND
O----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS
09/00Z
08/00Z
10/00Z
07/00Z
11/00Z
06/06Z
30N
28N
26N
24N
22N
156E
158E
160E
162E
164E
166E
168E
170E


TYPHOON RUTH
CYCLONE 27
BLOW UP
24 HR FCST POSITS
07/06Z–09/00Z SEPTEMBER 1967
24 HR FORECAST POSITS
LEGEND
0----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS
30N
28N
26N
24N
22N
156E
158E
160E
162E
164E
166E
168E
170E
09/00Z
08/00Z
10/00Z
07/00Z
11/00Z
06/06Z

TROPICAL CYCLONE 28 - 09/08/1800Z TO 09/22/0600Z

I. DATA

A. STATISTICS

1. NUMBER OF WARNINGS ISSUED - 55
2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 33
3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 4499 MI

B. CHARACTERISTICS AS A TYPHOON

1. MINIMUM OBSERVED SLP - 930MBS AT 151130Z
2. MINIMUM OBSERVED 700MB HEIGHT - 2478M. AT 142225Z
3. MAXIMUM SURFACE WIND - 125 KTS (FROM BEST TRACK)
4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 500 MI

II. DEVELOPMENT

A. INITIAL IMPETUS - DEVELOPMENT OF DIVERGENCE AT 200MB LEVEL OVER SURFACE CYCLONIC CIRCULATION

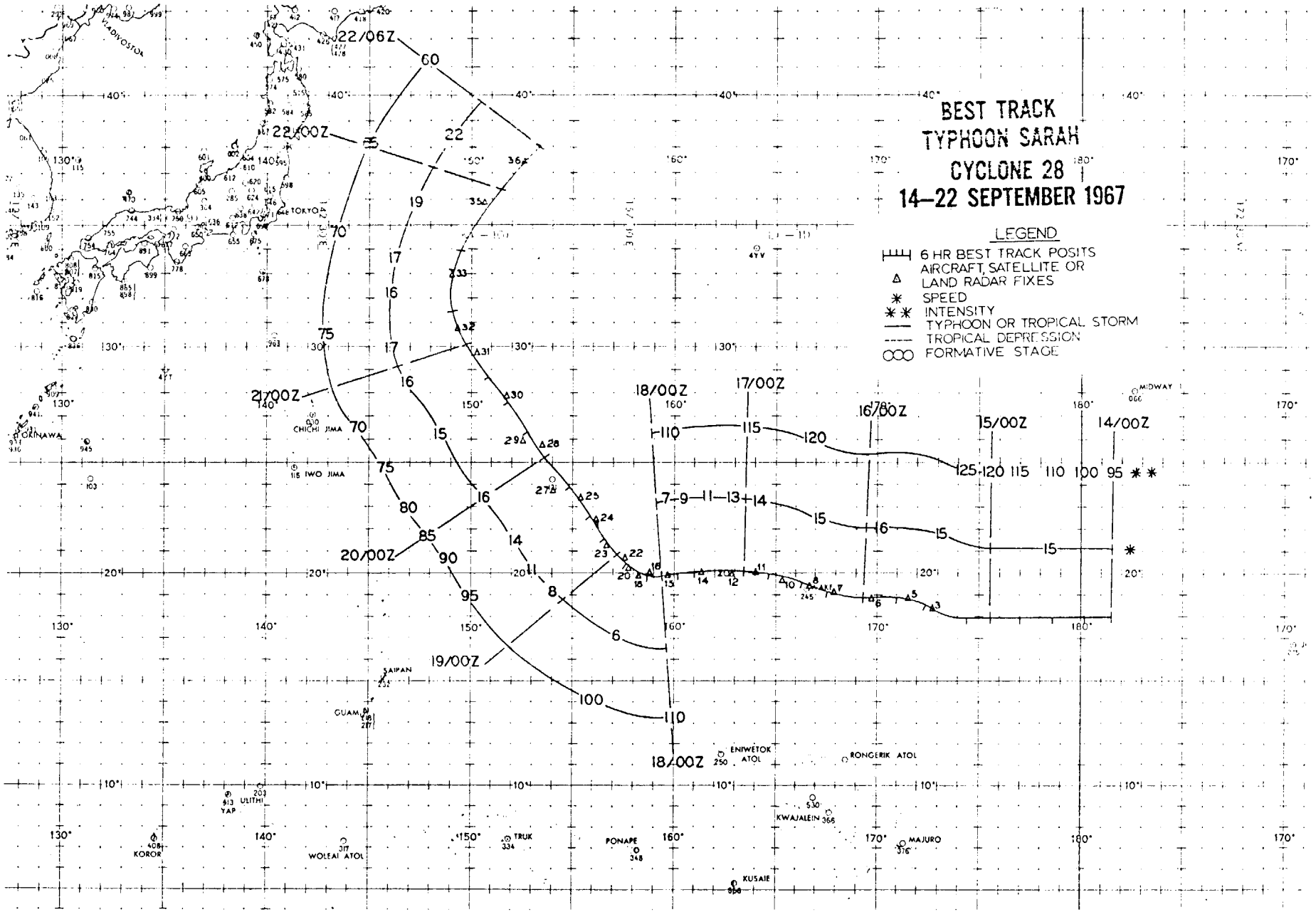
B. INITIAL SURFACE VORTEX

1. JUNCTION VORTEX AT 071800Z
2. SURFACE PRESSURE LESS THAN 1007MB

C. 200MB FLOW ABOVE SURFACE VORTEX

1. INITIAL - SOUTH
2. UPON REACHING TYPHOON INTENSITY - SOUTH

III. FINAL DISPOSITION - BECAME EXTRATROPICAL


BEST TRACK
TYPHOON SARAH
CYCLONE 28
14–22 SEPTEMBER 1967
LEGEND
6 HR BEST TRACK POSITS
AIRCRAFT, SATELLITE OR LAND RADAR FIXES
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
FORMATIVE STAGE
22/06Z
22/00Z
21/00Z
20/00Z
19/00Z
18/00Z
17/00Z
16/00Z
15/00Z
14/00Z
18/00Z
VLADIVOSTOK
TOKYO
OKINAWA
CHICHI JIMA
IWO JIMA
SAIPAN
GUAM
YAP
ULITHI
KOROR
WOLEAI ATOL
TRUK
PONAPE
ENIWETOK ATOL
RONGERIK ATOL
KWAJALEIN
MAJURO
KUSAIE
MIDWAY

EYE FIXES CYCLONE 28

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIENTATION	EYE DIA	THKNS WALL CLOUD
1	142225Z	17.9N 176.0E	54-P-P05	700MB	090	050	931	2486	18/--	CONC		40-10	08
2	150330Z	18.0N 174.3E	54-P-P05	700MB	090	100	933	2502	17/--	CIRC	----	10	10
3	151030Z	17.8N 173.2E	VW-R-P10		---	---	---	---	--/--	----			--
4	151130Z	18.4N 172.8E	VW-P-P05	700MB	090	---	930	---	17/--	CIRC	----	28	05
5	151625Z	18.9N 171.5E	VW-P-P05	700MB	075	---	936	2541	17/--	ELIP	N-S	27X20	--
6	152200Z	18.8N 169.7E	54-P-P02	700MB	---	060	940	2576	23/--	CIRC	----	18	15
7	160533Z	19.1N 167.9E	54-P-P02	700MB	085	090	934	2506	18/--	CIRC	----	15	--
8	161050Z	19.4N 166.6E	VW-R-P10	0420M	---	---	---	---	--/--	----			--
9	161110Z	19.4N 166.6E	VW-R-P05	0410M	040	035	---	---	--/--	CONC		40-12	06
10	161510Z	19.7N 165.3E	VW-R-P05	700MB	070	---	---	---	--/--	CONC		40-12	--
11	162130Z	20.0N 164.0E	54-P-P02	700MB	090	080	946	2615	16/--	CONC		45-18	15
12	170221Z	20.0N 162.5E	SLTLS	STG -	DIA --	BNDS -							
13	170300Z	20.0N 162.8E	54-P-P02	700MB	112	100	939	2548	18/--	CONC		40-15	--
14	171020Z	20.0N 161.2E	VW-P-P05	700MB	090	---	934	2619	17/10	CONC		28-14	05
15	171515Z	20.1N 160.3E	VW-P-P10	700MB	060	---	---	2606	13/--	CIRC	----	30	05
16	172200Z	20.0N 159.7E	54-P-P03	700MB	080	060	948	2606	17/--	CIRC	----	20	10
17	180345Z	20.0N 158.9E	54-P-P03	700MB	085	075	946	2600	15/--	CIRC	----	15	15
18	181000Z	20.1N 158.4E	VW-R-P--	700MB	---	---	---	---	--/--	----			--
19	181100Z	20.0N 158.3E	VW-P-P03	700MB	---	070	946	2631	16/--	CIRC	----	18	07
20	181300Z	20.0N 158.0E	VW-R-P--	700MB	---	---	---	---	--/--	----			--
21	181520Z	20.2N 157.7E	VW-P-P05	700MB	080	---	---	2643	18/--	CIRC	----	14	08
22	182200Z	20.6N 157.4E	54-P-P02	700MB	083	065	952	2658	18/--	CIRC	----	18	--
23	190300Z	21.3N 156.8E	54-P-P05	700MB	080	100	957	2704	12/--	----			--
24	191030Z	22.3N 156.0E	VW-R-P--	700MB	---	---	---	---	--/--	----			--

EYE FIXES CYCLONE 28

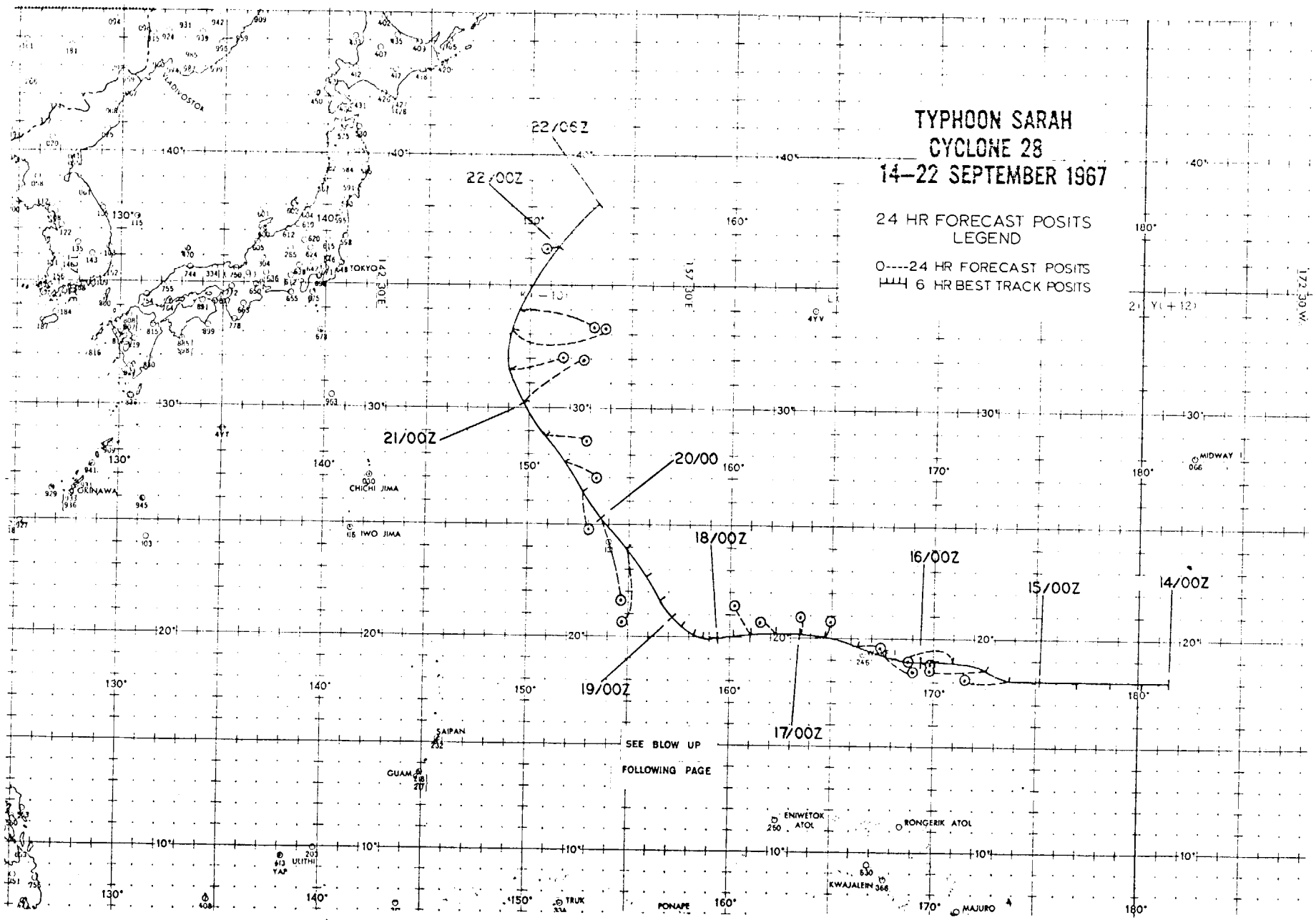
FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
25	1910502	22.4N 156.0E	VW-P-P03	700MB	090	---	958	2728	18/--	CIRC	----	22	05
26	1915152	23.3N 155.3E	VW-P-P03	700MB	065	---	958	2756	18/--	CIRC	----	16	05
27	1922242	24.4N 154.0E	54-P-P02	700MB	070	075	965	2782	20/--	ELIP	NE-S*	40X20	--
28	2002282	25.7N 153.3E	54-P-P02	700MB	070	070	970	2835	18/--	CIRC	----	40	--
29	2002582	26.0N 152.5E	SLTLS	STG X	DIA 04	BNDS 4							
30	2015102	27.8N 151.8E	VW-P-P10	0310M	080	060	966	---	--/--	CIRC	----	25	05
31	2022162	29.7N 150.1E	54-P-P10	700MB	090	070	964	2789	20/--	CIRC	----	20	--
32	2101532	30.5N 149.5E	SLTLS	STG X	DIA 03	BNDS 3							
33	2103352	30.9N 149.2E	54-P-P03	700MB	080	070	963	2789	20/--	CIRC	----	30	--
34	2112002	33.0N 149.0E	VW-P-P05	0240M	070	070	968	---	--/--	----			--
35	2122002	35.9N 150.7E	54-P-P05	700MB	080	065	967	2929	21/--	----			--
36	2203232	37.5N 152.3E	54-P-P05	700MB	075	065	977	---	19/--	----			--

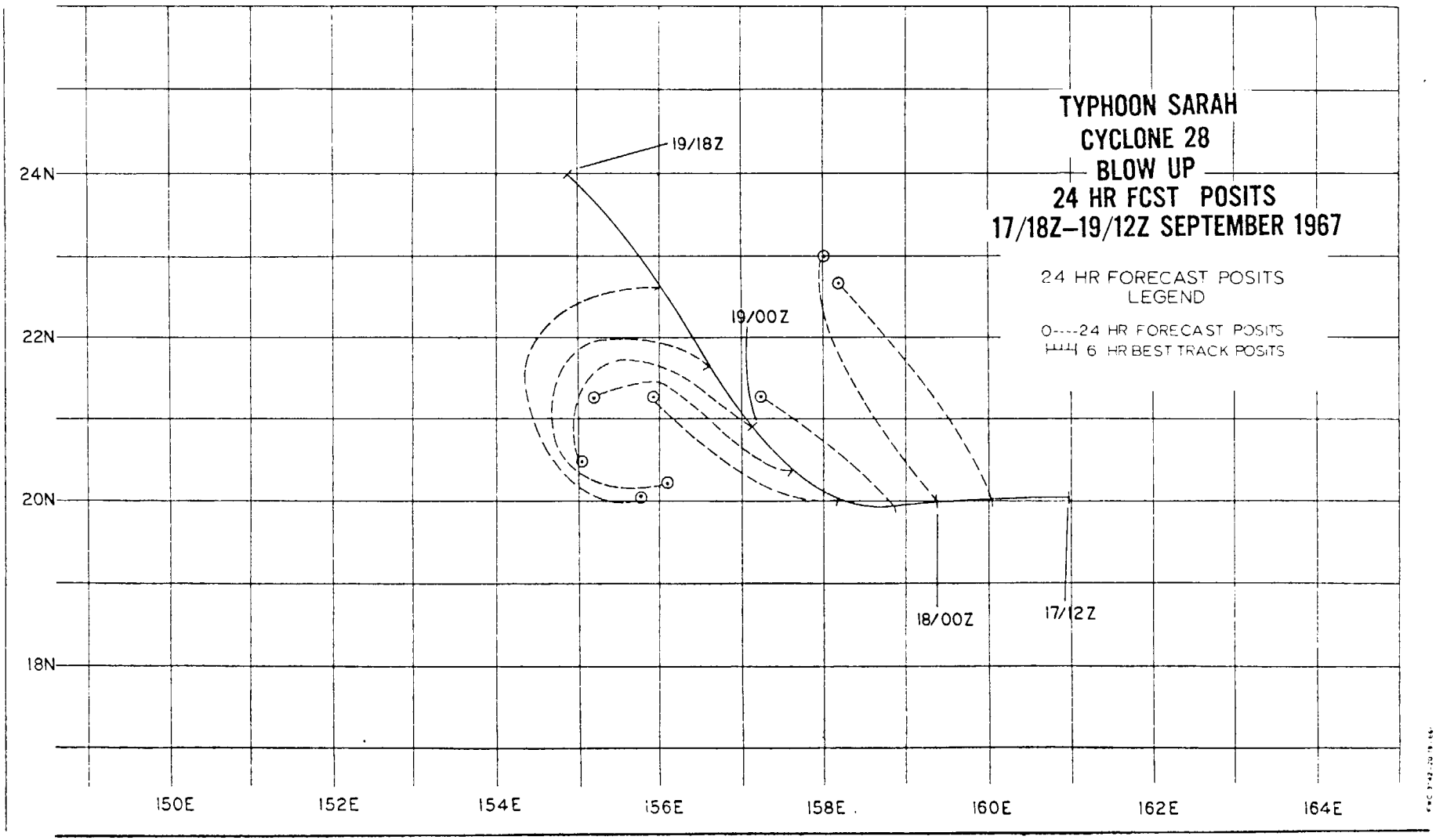
TROPICAL CYCLONE 28 -- 09/14/1200Z TO 09/22/0600Z

POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION LAT.	LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
141200Z	18.0N	178.5E	--------	--------	--------
141800Z	18.0N	177.0E	--------	--------	--------
150000Z	18.0N	175.5E	--------	--------	--------
150600Z	18.1N	173.9E	--------	--------	--------
151200Z	18.6N	172.5E	268-0144	--------	--------
151800Z	18.9N	171.0E	270-0132	--------	--------
160000Z	18.9N	169.3E	120-0030	--------	--------
160600Z	19.1N	167.8E	114-0072	--------	--------
161200Z	19.5N	166.3E	097-0048	303-0126	--------
161800Z	19.9N	164.8E	016-0042	314-0132	--------
170000Z	20.1N	163.4E	000-0048	040-0138	--------
170600Z	20.1N	162.1E	308-0036	092-0162	--------
171200Z	20.1N	161.0E	329-0078	035-0144	--------
171800Z	20.0N	160.1E	327-0186	000-0258	343-0336
180000Z	20.0N	159.4E	336-0192	360-0318	--------
180600Z	19.9N	158.8E	313-0120	341-0306	011-0186
181200Z	20.0N	158.2E	301-0144	345-0372	--------
181800Z	20.4N	157.6E	293-0132	335-0516	000-0570
190000Z	20.9N	157.2E	259-0114	340-0516	--------
190600Z	21.6N	156.6E	196-0084	286-0246	351-0540
191200Z	22.6N	155.9E	183-0150	275-0264	--------
191800Z	23.9N	154.9E	180-0204	262-0240	001-0726
200000Z	25.2N	153.7E	164-0222	212-0270	--------
200600Z	26.4N	152.8E	172-0090	180-0318	248-0294
201200Z	27.6N	151.9E	120-0078	175-0390	--------
201800Z	28.8N	150.9E	097-0096	176-0438	232-0336
210000Z	30.1N	149.7E	055-0180	166-0438	--------
210600Z	31.5N	149.0E	078-0138	131-0150	180-0534
211200Z	33.1N	149.0E	089-0234	114-0246	--------
211800Z	34.8N	149.8E	118-0204	107-0306	190-0696
220000Z	36.5N	151.2E	226-0012	090-0438	--------
220600Z	38.2N	153.1E	240-0102	115-0306	154-0228

AVERAGE 24 HOUR ERROR - 0118 MI.
AVERAGE 48 HOUR ERROR - 0293 MI.
AVERAGE 72 HOUR ERROR - 0444 MI.


TYPHOON SARAH
CYCLONE 28
14–22 SEPTEMBER 1967
24 HR FORECAST POSITS
LEGEND
0----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS
22/06Z
22/00Z
21/00Z
20/00
19/00Z
18/00Z
17/00Z
16/00Z
15/00Z
14/00Z
SEE BLOW UP
FOLLOWING PAGE
TOKYO
CHICHI JIMA
IWO JIMA
OKINAWA
SAIPAN
GUAM
YAP
ULITHI
TRUK
PONAPE
ENIWETOK ATOL
RONGERIK ATOL
KWAJALEIN
MAJURO
MIDWAY


TYPHOON SARAH
CYCLONE 28
BLOW UP
24 HR FCST POSITS
17/18Z–19/12Z SEPTEMBER 1967
24 HR FORECAST POSITS
LEGEND
0----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS
19/18Z
19/00Z
18/00Z
17/12Z
24N
22N
20N
18N
150E
152E
154E
156E
158E
160E
162E
164E

TROPICAL CYCLONE 31 - 09/18/0600Z TO 09/24/1200Z

I. DATA

A. STATISTICS

1. NUMBER OF WARNINGS ISSUED - 26
2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 18
3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 1356 MI

B. CHARACTERISTICS AS A TYPHOON

1. MINIMUM OBSERVED SLP - 960MBS AT 211015Z
2. MINIMUM OBSERVED 700MB HEIGHT - 2752M. AT 210330Z
3. MAXIMUM SURFACE WIND - 095 KTS (FROM BEST TRACK)
4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 360 MI

II. DEVELOPMENT

A. INITIAL IMPETUS - DEVELOPMENT OF DIVERGENCE AT 200MB LEVEL OVER SURFACE CYCLONIC CIRCULATION

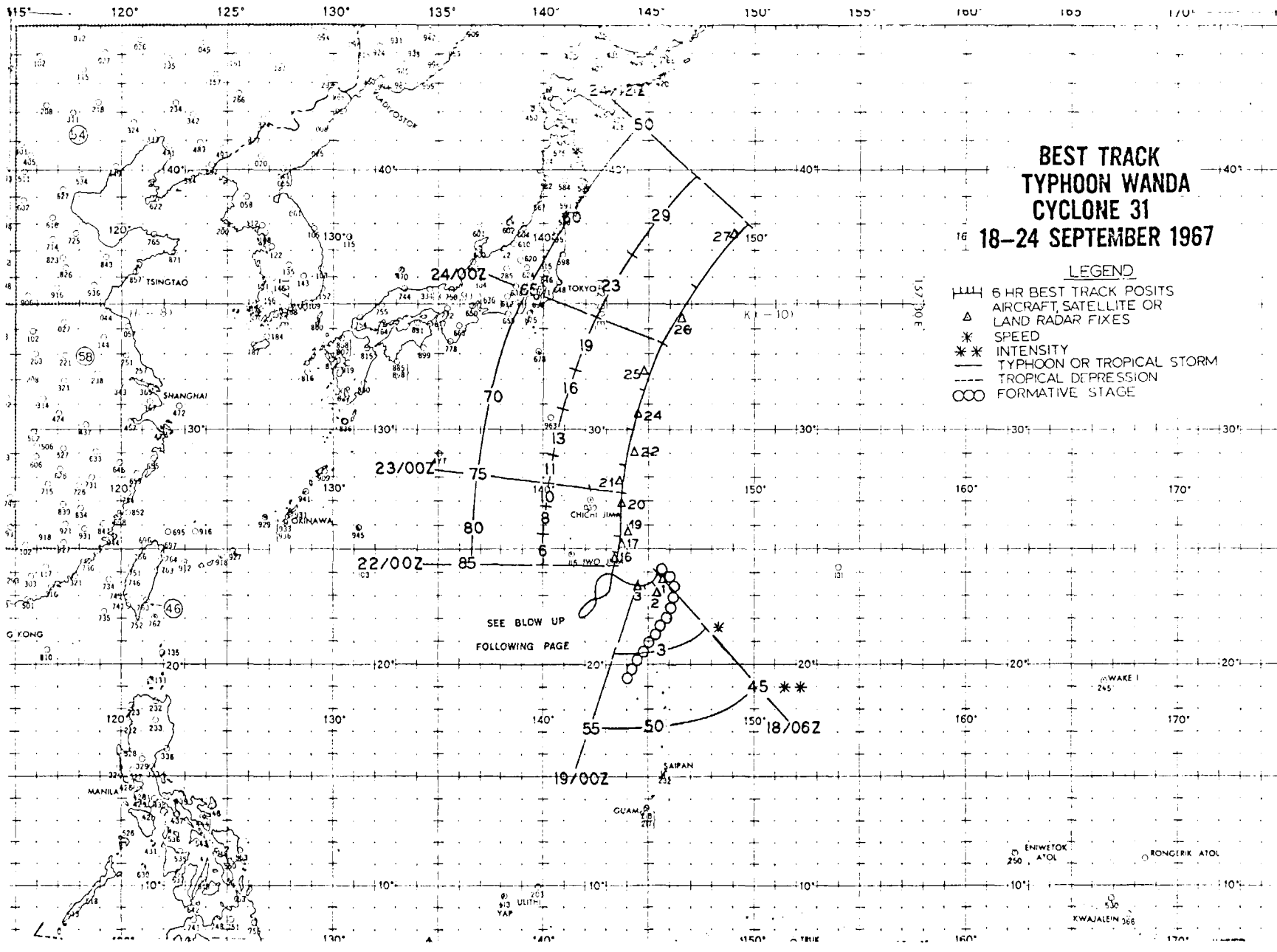
B. INITIAL SURFACE VORTEX

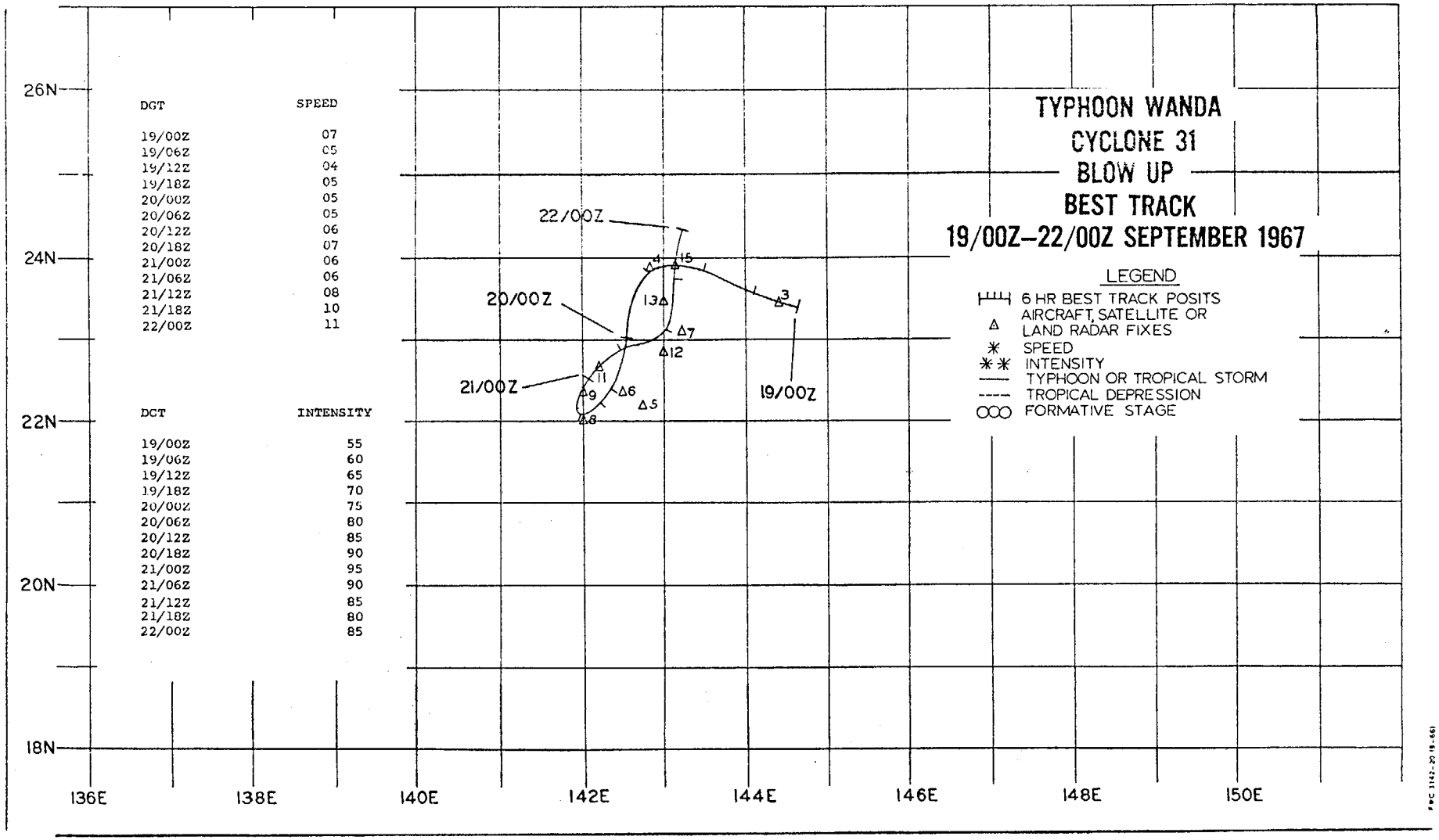
1. JUNCTION VORTEX AT 150000Z
2. SURFACE PRESSURE LESS THAN 1003MB

C. 200MB FLOW ABOVE SURFACE VORTEX

1. INITIAL - WEST
2. UPON REACHING TYPHOON INTENSITY - SOUTHWEST

III. FINAL DISPOSITION - BECAME EXTRATROPICAL


BEST TRACK
TYPHOON WANDA
CYCLONE 31
18–24 SEPTEMBER 1967
LEGEND
6 HR BEST TRACK POSITS
AIRCRAFT, SATELLITE OR LAND RADAR FIXES
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
FORMATIVE STAGE
24/00Z
23/00Z
22/00Z
19/00Z
18/06Z
SEE BLOW UP FOLLOWING PAGE
TSINGTAO
SHANGHAI
OKINAWA
TOKYO
CHICHI JIMA
IWO
SAIPAN
GUAM
MANILA
WAKE I
ENIWETOK ATOL
RONGERIK ATOL
KWAJALEIN
YAP
ULITHI



DGT	SPEED
19/00Z	07
19/06Z	05
19/12Z	04
19/18Z	05
20/00Z	05
20/06Z	05
20/12Z	06
20/18Z	07
21/00Z	06
21/06Z	06
21/12Z	08
21/18Z	10
22/00Z	11

DGT	INTENSITY
19/00Z	55
19/06Z	60
19/12Z	65
19/18Z	70
20/00Z	75
20/06Z	80
20/12Z	85
20/18Z	90
21/00Z	95
21/06Z	90
21/12Z	85
21/18Z	80
22/00Z	85

EYE FIXES CYCLONE 31

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	OBS FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
1	180305Z	23.9N 145.6E	54-P-P05	700MB	040	030	992	3033	--/--	----			F.B.
2	182119Z	23.1N 145.4E	54-P-P03	700MB	030	040	987	2996	14/--	CIRC	----	05	--
3	190322Z	23.5N 144.4E	54-P-P03	700MB	050	040	984	2963	14/--	----			F.B.
4	191602Z	23.9N 142.8E	VW-P-P05	0360M	080	075	976	---	--/--	CIRC	----	15	03
5	192201Z	22.2N 142.8E	54-P-P02	700MB	042	065	972	2844	15/--	CIRC	----	30	--
6	200258Z	22.0N 142.0E	SLTLS	STG X	DIA 04	BNDS 4							
7	200358Z	22.4N 142.5E	54-P-P02	700MB	070	070	969	2810	16/--	CIRC	----	45	--
8	201020Z	23.1N 143.3E	VW-P-P10	0290M	050	060	966	---	--/--	ELIP	NW-SE	30X20	04
9	201540Z	22.3N 142.0E	VW-P-P03	700MB	050	---	986	2772	14/--	ELIP	NW-SE	40X25	05
10	202200Z	22.3N 142.0E	54-P-P03	700MB	070	065	963	2780	17/--	CIRC	----	30	--
11	210330Z	22.5N 142.3E	54-P-P03	700MB	074	065	962	2752	17/--	CIRC	----	20	--
12	210344Z	22.5N 142.0E	SLTLS	STG X	DIA 03	BNDS 3							
13	211015Z	22.8N 143.0E	VW-P-P03	700MB	070	---	960	2824	15/--	CIRC	----	40	--
14	211600Z	23.5N 143.0E	VW-P-P03	700MB	080	---	964	2830	14/--	CIRC	----	40	--
15	212200Z	23.9N 143.2E	54-P-P02	700MB	076	055	969	2795	14/--	CIRC	----	50	--
16	220244Z	24.5N 143.0E	SLTLS	STG X	DIA 03	BNDS 4							
17	220332Z	24.5N 143.4E	54-P-P02	700MB	077	060	965	2765	13/--	CIRC	----	50	--
18	221015Z	25.1N 143.8E	VW-P-P10	0290M	060	065	966	---	--/--	CIRC	----	40	10
19	221515Z	25.7N 144.0E	VW-P-P05	700MB	085	---	---	---	17/--	CIRC	----	30	05
20	222200Z	27.0N 143.8E	54-P-P03	700MB	067	060	964	2792	17/--	ELIP	NE-SW	40X20	10
21	230334Z	27.5N 148.5E	SLTLS	STG X	DIA 03	BNDS 3							
22	230415Z	27.9N 143.6E	54-P-P03	700MB	068	070	964	2783	17/12	ELIP	NE-SW	50X10	--
23	230932Z	29.0N 144.3E	VW-P-P05	0290M	050	045	972	---	--/--	CIRC	----	50	10
24	231529Z	30.7N 144.5E	VW-R-P05	0400M	040	035	---	---	--/--	ELIP	N-S	48X27	12

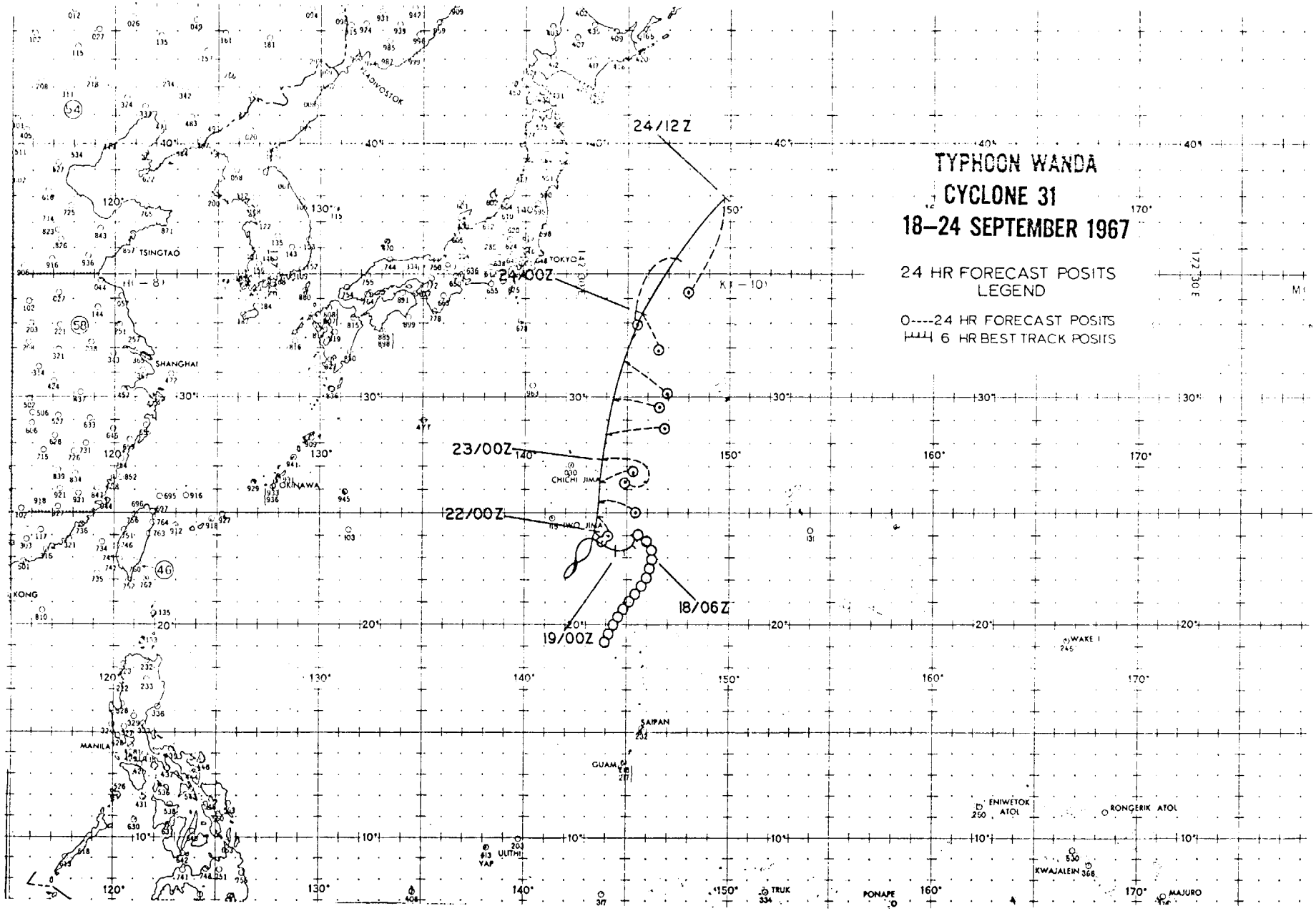
EYE FIXES CYCLONE 31

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
25	232129Z	32.3N 144.9E	54-P-P05	700MB	120	100	967	2841	20/--	ELIP	NE-SW	30X20	--
26	240345Z	34.5N 146.4E	54-P-P05	700MB	095	085	966	2819	19/--	ELIP	NW-SE	30X25	--
27	241030Z	37.5N 149.2E	VW-P-P10	0300M	050	035	968	---	--/--	CIRC	----	17	--

TROPICAL CYCLONE 31 -- 09/18/0600Z TO 09/24/1200Z
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION LAT.	LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
180600Z	23.9N	145.4E	--------	--------	--------
181200Z	23.6N	145.2E	--------	--------	--------
181800Z	23.4N	144.9E	--------	--------	--------
190000Z	23.4N	144.6E	--------	--------	--------
190600Z	23.5N	144.1E	357-0162	--------	--------
191200Z	23.8N	143.5E	004-0180	--------	--------
191800Z	23.7N	142.8E	010-0222	--------	--------
200000Z	23.0N	142.6E	090-0156	--------	--------
200600Z	22.4N	142.4E	010-0174	002-0360	--------
201200Z	22.3N	142.1E	012-0216	004-0402	--------
201800Z	22.1N	142.0E	004-0228	002-0498	--------
210000Z	22.5N	142.1E	056-0246	081-0186	--------
210600Z	22.8N	142.5E	041-0102	010-0342	358-0474
211200Z	23.1N	143.1E	043-0258	008-0354	--------
211800Z	23.7N	143.1E	104-0024	358-0246	009-0732
220000Z	24.3N	143.3E	158-0030	049-0390	--------
220600Z	24.8N	143.5E	165-0048	041-0258	024-0438
221200Z	25.4N	143.6E	104-0090	046-0474	--------
221800Z	26.3N	143.7E	073-0078	086-0150	024-0294
230000Z	27.3N	143.8E	134-0072	081-0186	--------
230600Z	28.4N	144.0E	086-0144	113-0162	054-0354
231200Z	29.9N	144.3E	101-0114	118-0204	--------
231800Z	31.6N	144.6E	128-0144	107-0216	097-0276
240000Z	33.4N	145.5E	154-0096	142-0246	--------
240600Z	35.5N	147.1E	210-0168	108-0282	146-0276
241200Z	38.0N	149.8E	201-0234	150-0276	--------

AVERAGE 24 HOUR ERROR - 0144 MI.
AVERAGE 48 HOUR ERROR - 0290 MI.
AVERAGE 72 HOUR ERROR - 0406 MI.


TYPHOON WANDA
CYCLONE 31
18–24 SEPTEMBER 1967
24 HR FORECAST POSITS
LEGEND
0----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS
24/12Z
24/00Z
23/00Z
22/00Z
19/00Z
18/06Z
VLADIVOSTOK
TSINGTAO
SHANGHAI
TOKYO
OKINAWA
CHICHI JIMA
IWO JIMA
SAIPAN
GUAM
MANILA
WAKE I
ENIWETOK ATOL
RONGERIK ATOL
KWAJALEIN
MAJURO
TRUK
PONAPE
ULITHI
YAP

TROPICAL CYCLONE 32 - 09/28/0600Z TO 10/06/0000Z

I. DATA

A. STATISTICS

1. NUMBER OF WARNINGS ISSUED - 32
2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 07
3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 1872 MI

B. CHARACTERISTICS AS A TYPHOON

1. MINIMUM OBSERVED SLP - 961MBS AT 041510Z
2. MINIMUM OBSERVED 700MB HEIGHT - 2768M. AT 050400Z
3. MAXIMUM SURFACE WIND - 080 KTS (FROM BEST TRACK)
4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 500 MI

II. DEVELOPMENT

A. INITIAL IMPETUS - A COLD CORE LOW BECOMING WARM CORE AFTER DEVELOPMENT OF DIVERGENCE AT 200MB

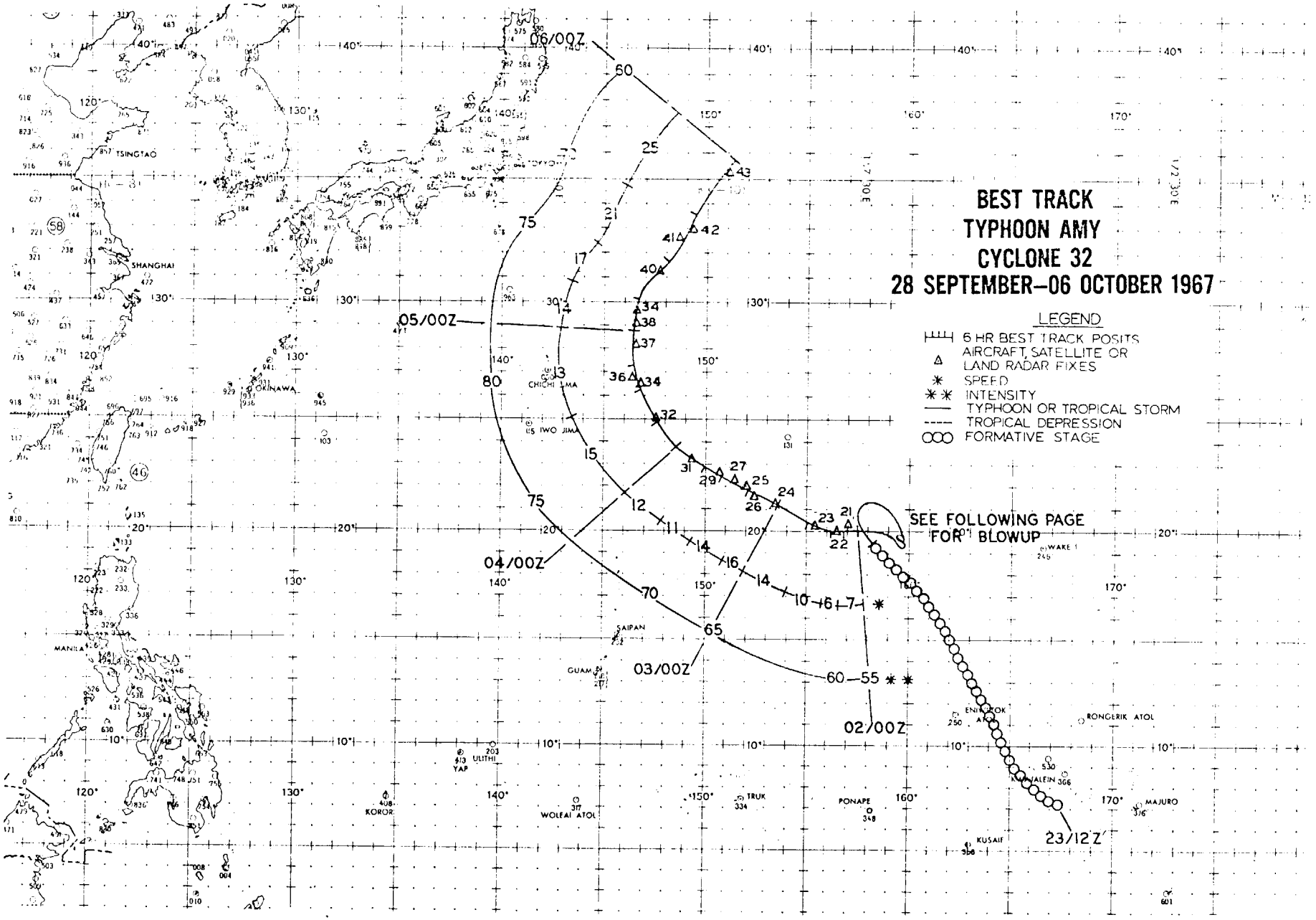
B. INITIAL SURFACE VORTEX

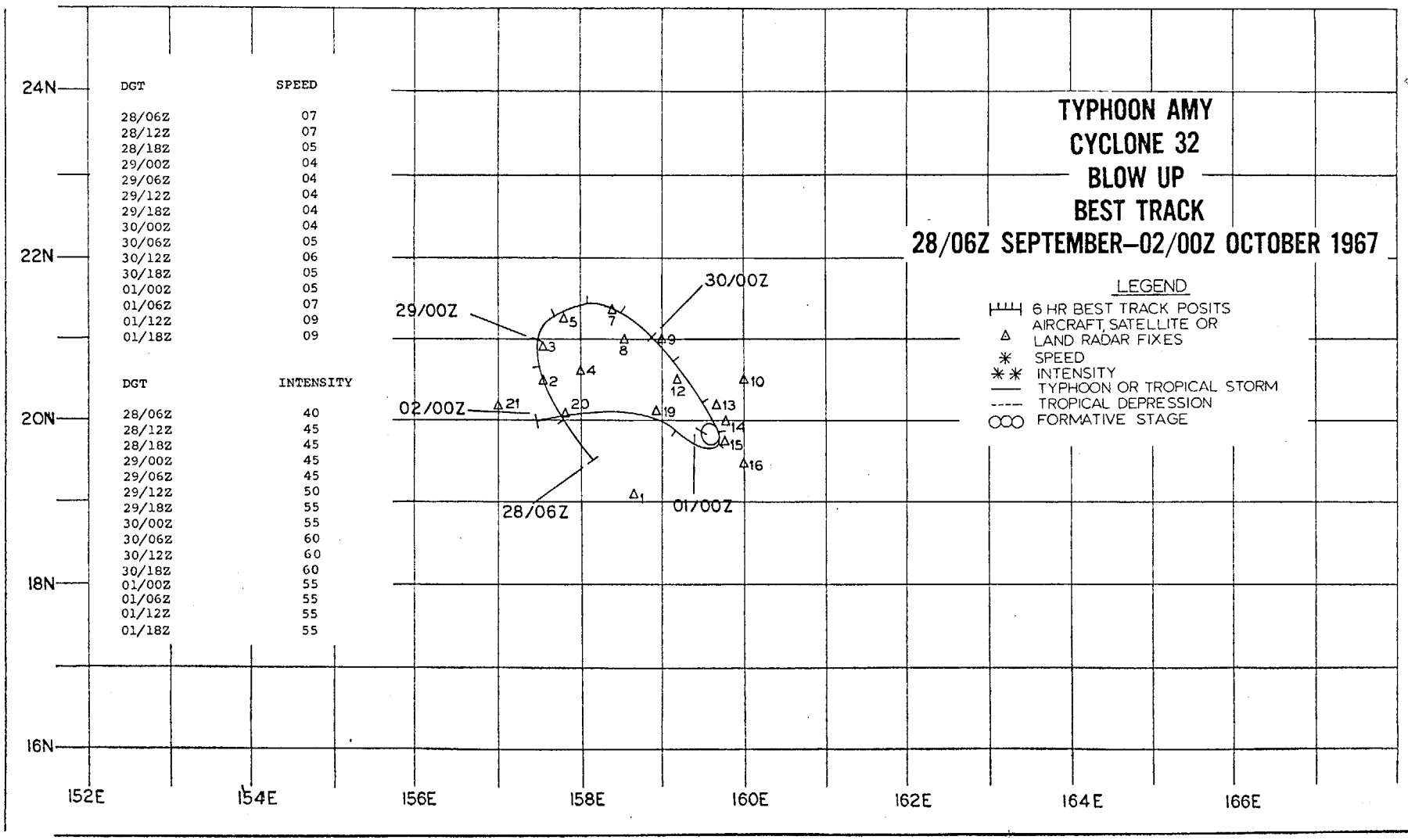
1. COLD VORTEX AT 231200
2. SURFACE PRESSURE LESS THAN 1010MB

C. 200MB FLOW ABOVE SURFACE VORTEX

1. INITIAL - SOUTHEAST
2. UPON REACHING TYPHOON INTENSITY - ANTICYCLONIC

III. FINAL DISPOSITION - BECAME EXTRATROPICAL


BEST TRACK
TYPHOON AMY
CYCLONE 32
28 SEPTEMBER–06 OCTOBER 1967
LEGEND
6 HR BEST TRACK POSITS
AIRCRAFT, SATELLITE OR LAND RADAR FIXES
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
FORMATIVE STAGE
SEE FOLLOWING PAGE FOR BLOWUP
06/00Z
05/00Z
04/00Z
03/00Z
02/00Z
23/12Z
TSINGTAO
SHANGHAI
OKINAWA
CHICHI JIMA
IWO JIMA
SAIPAN
GUAM
MANILA
YAP
ULITHI
KOROR
WOLEAI ATOL
TRUK
PONAPE
KUSAIE
ENIWETOK ATOL
RONGERIK ATOL
KWAJALEIN
MAJURO
WAKE I



DGT	SPEED
28/06Z	07
28/12Z	07
28/18Z	05
29/00Z	04
29/06Z	04
29/12Z	04
29/18Z	04
30/00Z	04
30/06Z	05
30/12Z	06
30/18Z	05
01/00Z	05
01/06Z	07
01/12Z	09
01/18Z	09

DGT	INTENSITY
28/06Z	40
28/12Z	45
28/18Z	45
29/00Z	45
29/06Z	45
29/12Z	50
29/18Z	55
30/00Z	55
30/06Z	60
30/12Z	60
30/18Z	60
01/00Z	55
01/06Z	55
01/12Z	55
01/18Z	55

EYE FIXES CYCLONE 32

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
1	280204Z	19.1N 158.6E	54-P-P03	0400M	040	040	996	---	--/--	CIRC	----	05	--
2	281550Z	20.5N 157.5E	VW-P-P05	0240M	030	020	996	3112	--/--	CIRC	----	16	--
3	282200Z	20.9N 157.5E	54-P-P10	700MB	045	040	996	3042	15/--	----			--
4	290253Z	20.5N 158.0E	SLTLS	STG X	DIA 02	BNDS 2							
5	290340Z	21.3N 157.7E	54-P-P10	700MB	050	040	994	3036	15/--	CIRC	----	15	--
6	291022Z	21.2N 157.7E	VW-P-P03	0310M	020	030	999	---	--/--	----			F.B.
7	291500Z	21.4N 158.4E	VW-P-P03	0460M	029	045	985	---	--/--	CIRC	----	06	--
8	292130Z	21.0N 158.5E	54-R-F04	500MB	050	---	---	---	--/--	CIRC	----	18	--
9	292202Z	21.0N 159.0E	54-P-P05	700MB	070	055	980	2923	17/--	CIRC	----	20	--
10	300147Z	20.5N 160.0E	SLTLS	STG X	DIA 04	BNDS 2							
11	300235Z	20.9N 159.1E	54-P-P05	700MB	070	055	980	2911	23/--	----			F.B.
12	301018Z	20.5N 159.3E	VW-P-P05	0260M	---	055	981	---	--/--	CIRC	----	22	07
13	301315Z	20.2N 159.6E	VW-R-P10	700MB	---	---	---	---	--/--	----			--
14	301520Z	20.0N 159.7E	VW-P-P05	0260M	---	050	981	---	--/--	CIRC	----	24	--
15	302200Z	19.7N 159.7E	54-P-P02	700MB	058	060	977	2911	19/--	CIRC	----	20	--
16	010238Z	19.5N 160.0E	SLTLS	STG X	DIA 03	BNDS 2							
17	010400Z	19.9N 159.8E	54-P-P03	700MB	040	040	985	2972	19/--	----			F.B.
18	010920Z	19.6N 159.8E	VW-P-P05	0150M	040	045	986	3057	16/08	----			F.B.
19	011502Z	20.1N 158.9E	VW-P-P05	0260M	050	055	986	---	--/--	CIRC	----	35	15
20	012143Z	20.1N 157.8E	54-P-P03	700MB	053	060	990	2981	16/12	ELIP	NE-SW	25X15	--
21	020351Z	20.2N 157.0E	54-P-P02	700MB	025	030	990	2999	14/--	----			--
22	021000Z	20.0N 156.5E	VW-P-P05	0340M	063	050	988	---	--/--	----			--
23	021550Z	20.2N 155.3E	VW-P-P02	0340M	055	045	988	2997	14/08	----			F.B.
24	022140Z	21.1N 153.4E	54-P-P04	700MB	030	060	988	2997	14/13	CIRC	----	05	--

EYE FIXES CYCLONE 32

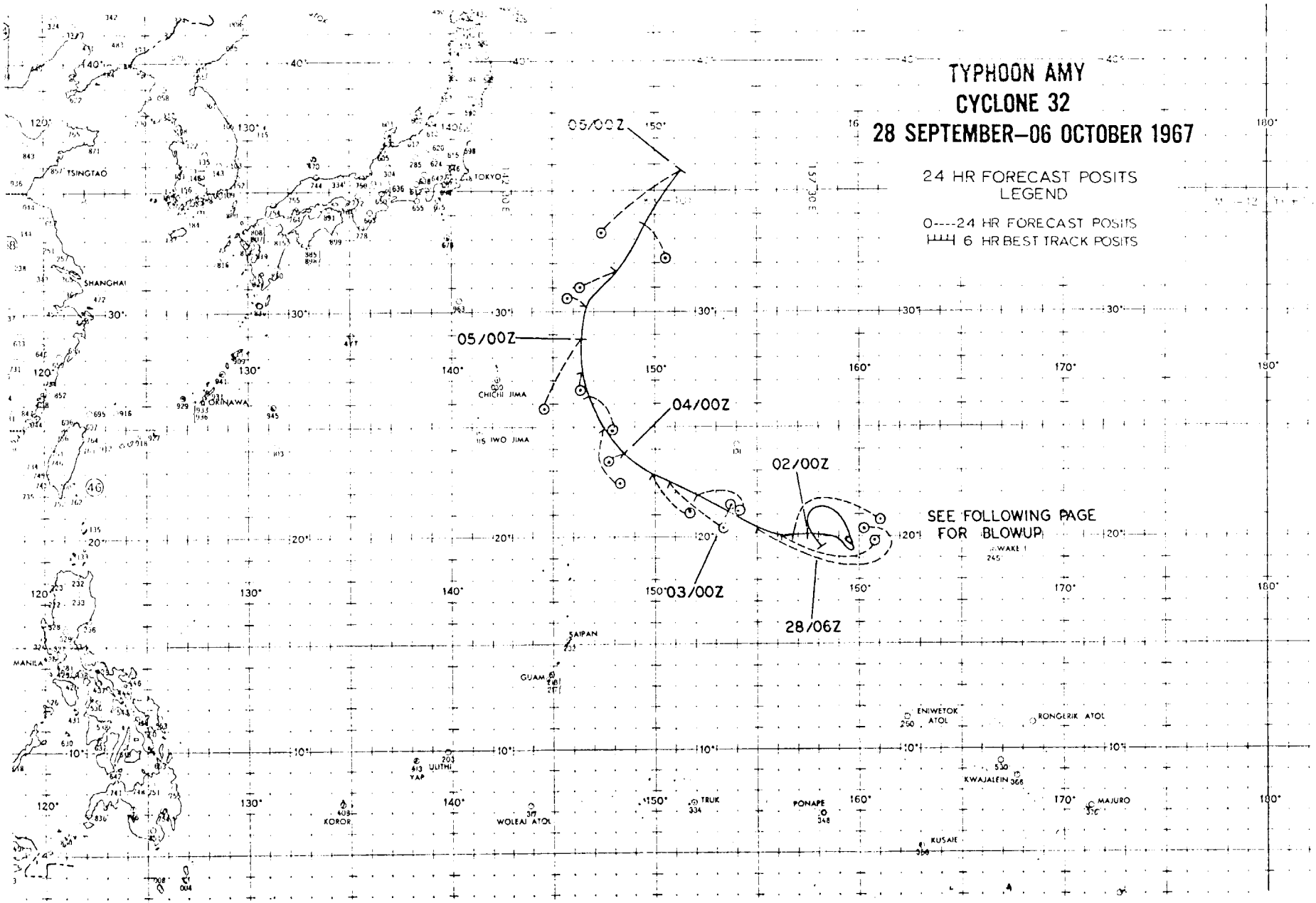
FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
25	030224Z	22.0N 152.0E	SLTLS	STG X	DIA 05 BNDS 2								
26	030400Z	21.6N 152.4E	54-P-P05	700MB	060	065	984	2954	15/--	----			F.B.
27	030930Z	22.3N 151.3E	VW-R-F15	0310M	---	---	---	---	--/--	----			--
28	031010Z	22.3N 151.4E	VW-R-P10	0250M	080	075	---	---	--/--	CIRC	----	10	--
29	031410Z	22.6N 150.7E	VW-R-P10	1100M	---	---	---	---	--/--	----			--
30	031514Z	22.9N 150.4E	VW-P-P05	700MB	045	---	980	2966	13/09	CIRC	----	08	--
31	032215Z	23.4N 149.2E	54-P-P02	700MB	055	045	980	2875	14/--	CIRC	----	10	--
32	040315Z	25.0N 147.5E	SLTLS	STG X	DIA 06 BNDS 3								
33	040345Z	24.8N 147.7E	54-P-P02	700MB	080	065	967	2822	15/--	CIRC	----	10	--
34	040945Z	26.5N 146.8E	VW-R-P10	0270M	052	050	---	---	--/--	ELIP	NW-SE	50X35	12
35	041315Z	26.4N 146.7E	VW-R-P10		---	---	---	---	--/--	----			--
36	041510Z	26.8N 147.4E	VW-P-P05	700MB	060	---	961	2798	18/--	ELIP	NW-SE	60X40	15
37	042221Z	28.3N 146.4E	54-P-P03	700MB	065	050	964	2804	17/--	ELIP	NE-SW	60X40	--
38	050215Z	29.0N 146.5E	SLTLS	STG X	DIA 05 BNDS 3								
39	050400Z	29.6N 146.6E	54-P-P03	700MB	080	050	962	2768	18/--	ELIP	NE-SW	60X40	--
40	051000Z	31.2N 147.7E	VW-P-P10	0290M	070	070	961	---	--/--	ELIP	NW-SE	80X60	15
41	051400Z	32.8N 148.8E	VW-P-P--	0270M	---	060	962	---	--/--	----			--
42	051535Z	33.0N 149.1E	VW-P-P03	0280M	075	065	962	---	--/--	----			F.B.
43	052222Z	35.4N 151.0E	54-P-P02	700MB	065	075	969	3085	22/--	----			N.F.B.

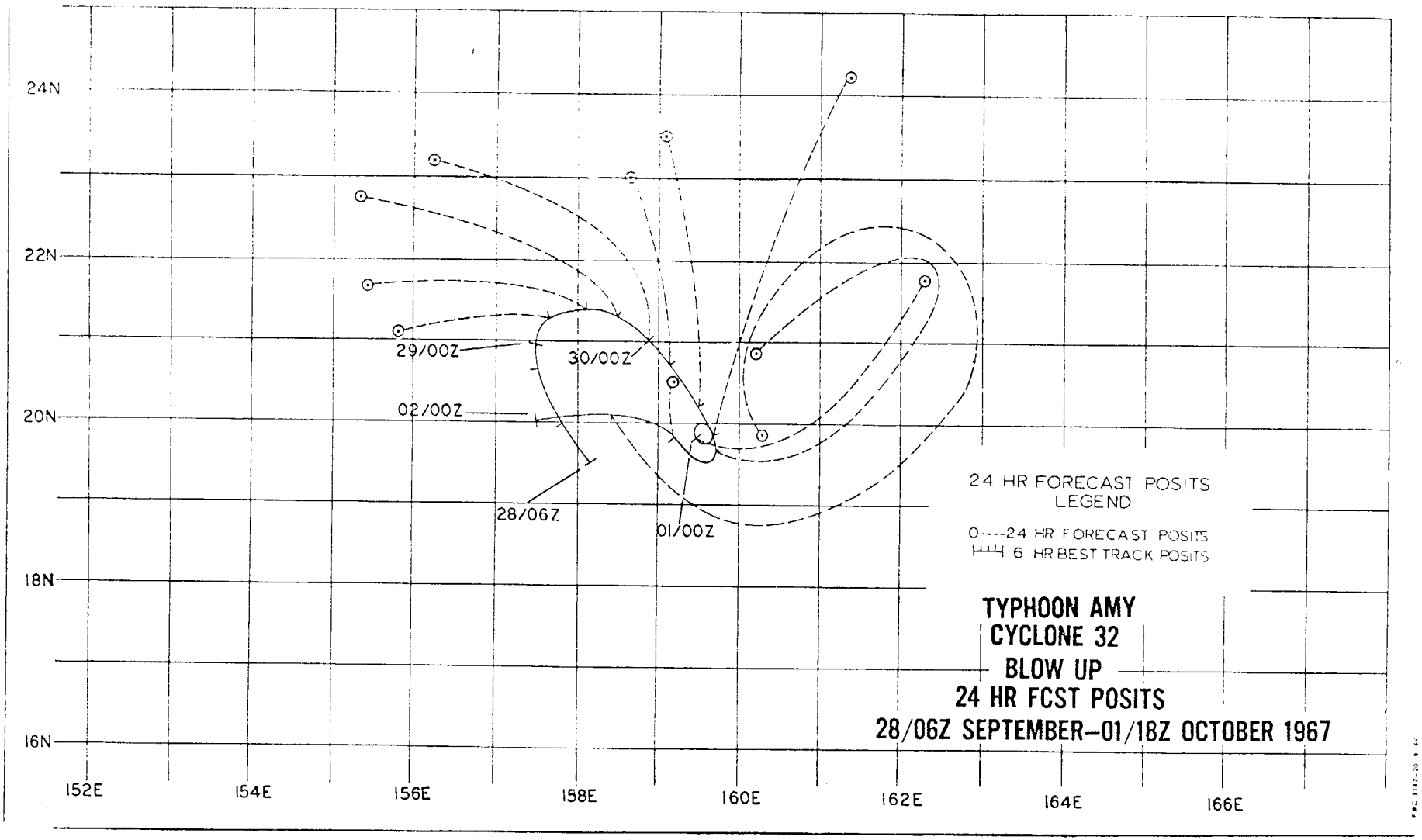
TROPICAL CYCLONE 32 -- 09/28/0600Z TO 10/06/0000Z

POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION LAT.	LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
280600Z	19.5N	158.2E	--------	--------	--------
281200Z	20.0N	157.7E	--------	--------	--------
281800Z	20.6N	157.5E	--------	--------	--------
290000Z	20.9N	157.5E	--------	--------	--------
290600Z	21.2N	157.7E	267-0102	--------	--------
291200Z	21.4N	158.1E	274-0150	--------	--------
291800Z	21.5N	158.5E	295-0192	--------	--------
300000Z	21.1N	158.9E	311-0186	--------	--------
300600Z	20.7N	159.2E	350-0138	291-0342	--------
301200Z	20.2N	159.4E	356-0198	298-0402	--------
301800Z	19.8N	159.7E	018-0276	310-0456	--------
010000Z	19.8N	159.6E	051-0186	330-0438	--------
010600Z	19.7N	159.8E	015-0072	013-0336	300-0558
011200Z	19.8N	159.3E	000-0042	025-0414	--------
011800Z	20.1N	158.4E	099-0102	037-0540	317-0564
020000Z	20.0N	157.5E	098-0120	059-0534	--------
020600Z	20.0N	156.8E	078-0240	070-0336	045-0618
021200Z	20.0N	156.3E	091-0258	074-0264	--------
021800Z	20.3N	155.0E	090-0288	084-0390	052-0984
030000Z	21.1N	153.5E	046-0012	091-0462	--------
030600Z	21.8N	152.0E	108-0108	085-0654	078-0780
031200Z	22.4N	150.9E	132-0174	090-0696	--------
031800Z	22.9N	149.9E	136-0138	096-0666	092-0750
040000Z	23.8N	148.7E	241-0060	117-0150	--------
040600Z	24.9N	147.6E	168-0144	125-0246	090-1032
041200Z	26.2N	146.8E	147-0096	141-0336	--------
041800Z	27.3N	146.5E	188-0048	155-0282	103-1008
050000Z	28.7N	146.4E	209-0198	171-0114	--------
050600Z	30.1N	146.8E	293-0054	180-0186	161-0360
051200Z	31.6N	148.1E	250-0102	202-0198	--------
051800Z	33.6N	149.5E	149-0102	226-0312	199-0528
060000Z	35.7N	151.4E	234-0252	225-0576	--------

AVERAGE 24 HOUR ERROR - 0144 MI.
AVERAGE 48 HOUR ERROR - 0388 MI.
AVERAGE 72 HOUR ERROR - 0718 MI.


TYPHOON AMY
CYCLONE 32
28 SEPTEMBER–06 OCTOBER 1967
24 HR FORECAST POSITS
LEGEND
0----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS
05/00Z
04/00Z
03/00Z
02/00Z
28/06Z
SEE FOLLOWING PAGE FOR BLOWUP
TSINGTAO
SHANGHAI
TOKYO
OKINAWA
CHICHI JIMA
IWO JIMA
SAIPAN
GUAM
MANILA
WAKE I
ENIWETOK ATOL
RONGERIK ATOL
KWAJALEIN
MAJURO
ULITHI
YAP
KOROR
WOLEAI ATOL
TRUK
PONAPE
KUSAIE


24N
22N
20N
18N
16N
152E
154E
156E
158E
160E
162E
164E
166E
29/00Z
30/00Z
02/00Z
28/06Z
01/00Z
24 HR FORECAST POSITS
LEGEND
0----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS
TYPHOON AMY
CYCLONE 32
BLOW UP
24 HR FCST POSITS
28/06Z SEPTEMBER–01/18Z OCTOBER 1967

TROPICAL CYCLONE 35 - 10/12/0600Z TO 10/20/0000Z

I. DATA
   A. STATISTICS
      1. NUMBER OF WARNINGS ISSUED - 32
      2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 20
      3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 2046 MI

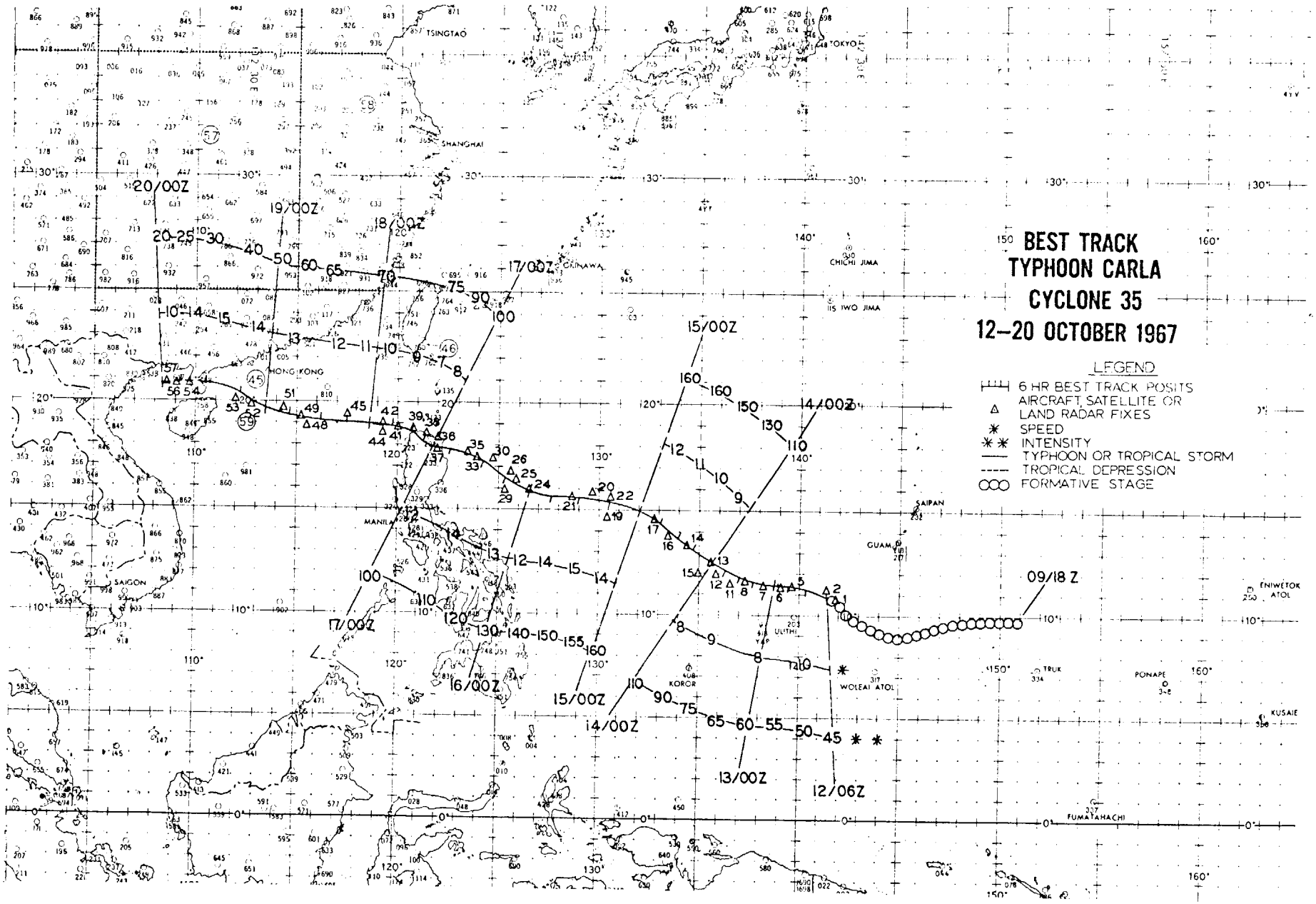
   B. CHARACTERISTICS AS A TYPHOON
      1. MINIMUM OBSERVED SLP - 901MBS AT 142138Z
      2. MINIMUM OBSERVED 700MB HEIGHT - 2170M. AT 142138Z
      3. MAXIMUM SURFACE WIND - 160 KTS (FROM BEST TRACK)
      4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 675 MI

II. DEVELOPMENT
   A. INITIAL IMPETUS - LOW LEVEL SURGE INTO CYCLONIC CIRCULATION FROM THE SOUTH WITH SUBSEQUENT DIVERGENCE AT 200MB LEVEL

   B. INITIAL SURFACE VORTEX
      1. JUNCTION VORTEX AT 091800Z
      2. SURFACE PRESSURE LESS THAN 1006MB

   C. 200MB FLOW ABOVE SURFACE VORTEX
      1. INITIAL - SOUTHEAST
      2. UPON REACHING TYPHOON INTENSITY - EAST

III. FINAL DISPOSITION - DISSIPATED OVER WATER


BEST TRACK
TYPHOON CARLA
CYCLONE 35
12–20 OCTOBER 1967
LEGEND
6 HR BEST TRACK POSITS
AIRCRAFT, SATELLITE OR
LAND RADAR FIXES
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
FORMATIVE STAGE
20/00Z
19/00Z
18/00Z
17/00Z
15/00Z
14/00Z
13/00Z
12/06Z
16/00Z
09/18 Z
TSINGTAO
SHANGHAI
TOKYO
OKINAWA
CHICHI JIMA
IWO JIMA
HONG KONG
MANILA
SAIGON
SAIPAN
GUAM
KOROR
WOLEAI ATOL
ULITHI
ENIWETOK ATOL
TRUK
PONAPE
KUSAIE
FUMATAHACHI

EYE FIXES CYCLONE 35

FIX NO.	TIME	POSIT	UNIT-METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TEMP	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
1	120400Z	10.6N 141.7E	54-P-P03	040OM	036	040	993	---	--/--	----			--
2	120410Z	10.5N 141.5E	SLTLS	STG X	DIA 05	BNDS 1							
3	120745Z	11.1N 141.3E	VW-R-P15	041OM	---	---	---	---	--/--	CIRC	----	17	--
4	120903Z	11.0N 141.2E	VW-P-P05	030OM	045	040	993	3033	12/05	CIRC	----	20	09
5	121536Z	11.3N 139.7E	VW-P-P05	700MB	---	---	991	3022	15/--	CIRC	----	15	--
6	122114Z	11.3N 139.1E	54-P-P02	700MB	045	040	989	2989	13/--	CIRC	----	20	--
7	130306Z	11.5N 138.0E	SLTLS	STG X	DIA 02	BNDS 3							
8	130405Z	11.3N 138.2E	54-P-P02	031OM	045	045	981	---	--/--	CIRC	----	10	--
9	130900Z	11.5N 137.3E	VW-R-P--	034OM	---	---	---	---	--/--	----			--
10	131000Z	11.5N 137.3E	VW-P-P05	700MB	040	---	979	2901	14/12	CIRC	----	25	--
11	131532Z	11.8N 136.6E	VW-P-P05	700MB	045	---	979	2895	13/--	CIRC	----	20	05
12	132148Z	11.9N 135.9E	54-P-P02	700MB	060	060	963	2774	15/--	CIRC	----	15	--
13	140344Z	12.6N 135.5E	54-P-P02	700MB	065	100	938	2573	19/--	CIRC	----	10	10
14	140356Z	12.0N 135.0E	SLTLS	STG X	DIA 03	BNDS 2							
15	140930Z	13.3N 134.4E	VW-R-P10	027OM	055	040	---	---	--/--	CIRC	----	08	05
16	141520Z	13.8N 133.4E	VW-R-P10	700MB	100	---	---	---	--/--	CIRC	----	20	05
17	141815Z	14.3N 132.8E	ACFT RDR	500MB	---	---	---	---	--/--	----			--
18	142138Z	14.2N 132.3E	54-P-P02	700MB	125	110	901	3170	20/13	CIRC	----	02	--
19	150347Z	14.7N 130.4E	54-P-P02	700MB	100	120	908	2283	19/12	CONC		15-05	--
20	150447Z	15.5N 130.5E	SLTLS	STG X	DIA 05	BNDS 3							
21	150900Z	15.8N 129.7E	VW-R-P10	031OM	---	---	---	---	--/--	----			--
22	151015Z	15.5N 128.8E	VW-R-P10	700MB	---	050	---	---	--/--	CONC		23-03	09
23	151528Z	15.8N 128.2E	VW-R-P02	700MB	---	---	---	---	--/--	ELIP	NW-SE	08X04	05
24	152232Z	15.9N 127.1E	SLTLS	STG -	DIA --	BNDS -							

EYE FIXES CYCLONE 35

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
25	160038Z	15.9N 126.5E	54-P-P03	700MB	090	100	944	2594	17/--	CONC		35-05	--
26	160207Z	16.3N 125.9E	54-R-P--	500MB	108	---	---	---	--/--	----			--
27	160235Z	15.7N 125.6E	LND RDR		---	---	---	---	--/--	----			--
28	160347Z	16.0N 125.5E	SLTLS	STG X	DIA 04	BNDS 4							
29	160400Z	16.3N 125.6E	54-P-P03	700MB	095	070	935	2560	20/--	CONC		60-20	--
30	160510Z	15.7N 125.3E	LND RDR		---	---	---	---	--/--	----			--
31	160830Z	17.0N 124.9E	ACFT RDR		---	---	---	---	--/--	----			--
32	160904Z	17.2N 124.8E	VW-UNK--		---	---	---	---	--/--	----			--
33	161015Z	17.3N 124.2E	VW-P-P01	700MB	100	095	---	2667	18/--	CIRC	----	40	15
34	161215Z	17.4N 124.0E	VW-R-P--	700MB	095	---	---	2595	--/--	----			--
35	161600Z	17.7N 123.5E	VW-P-P02	700MB	080	---	---	2607	20/--	CIRC	----	40	--
36	162125Z	18.1N 122.0E	LND RDR		---	---	---	---	--/--	----			--
37	162144Z	17.8N 122.0E	54-P-P03	500MB	065	050	---	---	--/--	CIRC	----	25	--
38	170400Z	18.1N 121.3E	54-P-P10	500MB	080	100	---	---	--/--	CIRC	----	20	--
39	170945Z	18.5N 120.8E	VW-R-P03	0300M	070	080	---	---	--/--	----			--
40	171200Z	18.8N 120.7E	VW-R-P03	700MB	050	---	---	2957	--/--	CIRC	----	18	--
41	171527Z	18.8N 120.0E	VW-P-P05	700MB	---	---	978	2908	16/--	----			--
42	172045Z	19.0N 119.2E	VW-P-P05	0310M	050	045	979	---	--/--	CIRC	----	80	--
43	180001Z	18.7N 118.5E	VW-P-P05	0400M	085	070	982	---	--/--	CIRC	----	80	--
44	180300Z	18.6N 118.1E	54-P-P03	700MB	060	060	979	2917	14/--	CIRC	----	40	--
45	180527Z	19.0N 117.5E	SLTLS	STG C	DIA --	BNDS -							
46	180646Z	19.3N 117.6E	54-P-P--	700MB	030	040	---	2923	13/--	----			--
47	180940Z	19.5N 117.1E	54-P-P08	700MB	072	---	983	2938	12/--	CIRC	----	15	--
48	181500Z	18.9N 115.5E	VW-P-P05	700MB	---	060	982	2990	--/--	CIRC	----	10	--

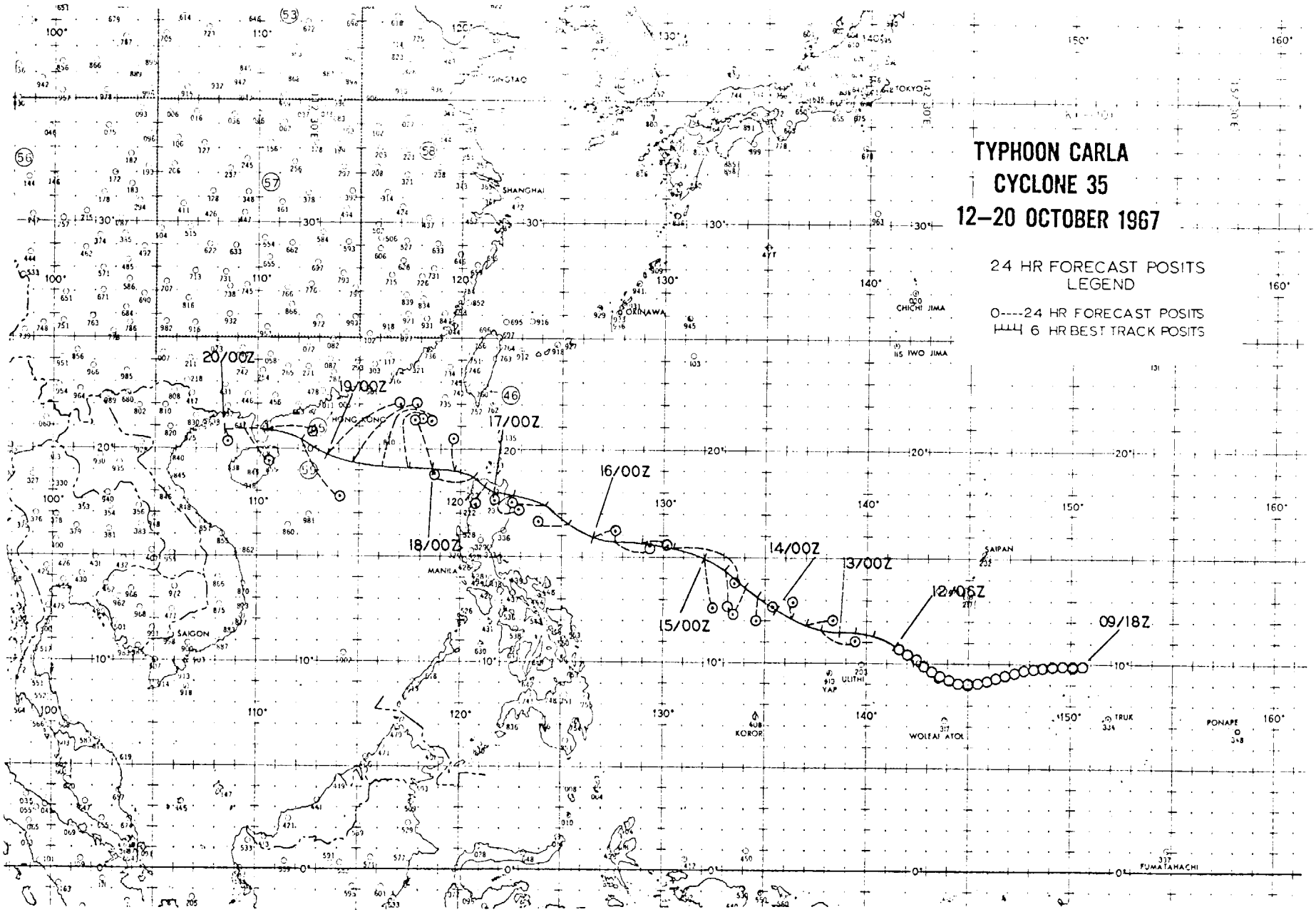
EYE FIXES CYCLONE 35

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
49	181640Z	19.2N 115.1E	VW-R-P02	700MB	---	---	---	---	--/--	----			--
50	181807Z	19.3N 115.0E	VW-R-P--	700MB	---	---	---	---	--/--	----			--
51	182030Z	19.6N 114.3E	VW-P-P03	700MB	060	---	986	2981	16/--	CIRC	----	10	--
52	190301Z	19.8N 112.7E	S4-P-F03	700MB	070	040	984	2960	15/--	ELIP	NE-SW	30X20	--
53	190423Z	20.0N 112.0E	SLTLS	STG X	DIA 03	BNDS 3							
54	191330Z	20.7N 109.9E	VW-R-P05	1420M	---	---	---	---	--/--	CIRC	----	05	--
55	191600Z	20.9N 109.5E	VW-R-P05	1420M	---	---	---	---	--/--	----			--
56	191900Z	20.7N 109.0E	VW-R-P05	1390M	---	---	---	---	--/--	----			--
57	192100Z	20.7N 108.9E	VW-R-F05		---	---	---	---	--/--	----			--

TROPICAL CYCLONE 35 -- 10/12/0600Z TO 10/20/0000Z
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION LAT.	LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
120600Z	10.9N	141.3E	--------	--------	--------
121200Z	11.2N	140.3E	--------	--------	--------
121800Z	11.3N	139.4E	--------	--------	--------
130000Z	11.2N	138.7E	--------	--------	--------
130600Z	11.3N	137.8E	098-0078	--------	--------
131200Z	11.7N	137.0E	080-0066	--------	--------
131800Z	12.0N	136.2E	010-0036	--------	--------
140000Z	12.4N	135.6E	333-0012	--------	--------
140600Z	13.0N	134.8E	200-0066	--------	--------
141200Z	13.5N	134.0E	204-0090	113-0090	--------
141800Z	14.1N	133.0E	176-0108	158-0030	--------
150000Z	14.6N	131.8E	167-0132	153-0048	--------
150600Z	15.3N	130.5E	122-0174	177-0168	--------
151200Z	15.6N	129.0E	107-0078	168-0174	--------
151800Z	15.6N	127.8E	094-0072	146-0192	106-0150
160000Z	15.8N	126.6E	080-0066	137-0228	--------
160600Z	16.5N	125.3E	270-0078	109-0336	154-0216
161200Z	17.3N	124.1E	273-0090	109-0180	--------
161800Z	17.8N	122.7E	158-0030	109-0192	143-0330
170000Z	17.9N	121.7E	180-0018	110-0102	--------
170600Z	18.2N	121.2E	201-0048	270-0108	110-0450
171200Z	18.7N	120.6E	276-0108	266-0168	--------
171800Z	18.9N	119.6E	000-0084	251-0084	116-0144
180000Z	18.9N	118.6E	342-0138	261-0108	--------
180600Z	19.0N	117.4E	016-0132	240-0066	274-0168
181200Z	19.1N	116.1E	047-0180	313-0126	--------
181800Z	19.2N	114.7E	050-0228	025-0270	273-0090
190000Z	19.6N	113.4E	056-0240	026-0324	--------
190600Z	20.3N	112.1E	145-0186	042-0360	193-0054

AVERAGE 24 HOUR ERROR - 0101 MI.
AVERAGE 48 HOUR ERROR - 0167 MI.
AVERAGE 72 HOUR ERROR - 0200 MI.


TYPHOON CARLA
CYCLONE 35
12–20 OCTOBER 1967
24 HR FORECAST POSITS
LEGEND
0----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS
20/00Z
19/00Z
17/00Z
16/00Z
18/00Z
15/00Z
14/00Z
13/00Z
12/06Z
09/18Z
HONG KONG
MANILA
SAIGON
SHANGHAI
TOKYO
OKINAWA
CHICHI JIMA
IWO JIMA
SAIPAN
YAP
ULITHI
KOROR
WOLEAI ATOL
TRUK
PONAPE
FUMATAHACHI

TROPICAL CYCLONE 36 - 10/17/0600Z TO 10/27/1200Z

I. DATA

A. STATISTICS

1. NUMBER OF WARNINGS ISSUED - 44
2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 24
3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 2334 MI

B. CHARACTERISTICS AS A TYPHOON

1. MINIMUM OBSERVED SLP - 948MBS AT 222058Z
2. MINIMUM OBSERVED 700MB HEIGHT - 2634M. AT 240010Z
3. MAXIMUM SURFACE WIND - 100 KTS (FROM BEST TRACK)
4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 725 MI

II. DEVELOPMENT

A. INITIAL IMPETUS - DEVELOPMENT OF DIVERGENCE AT 200MB LEVEL OVER SURFACE CYCLONIC CIRCULATION

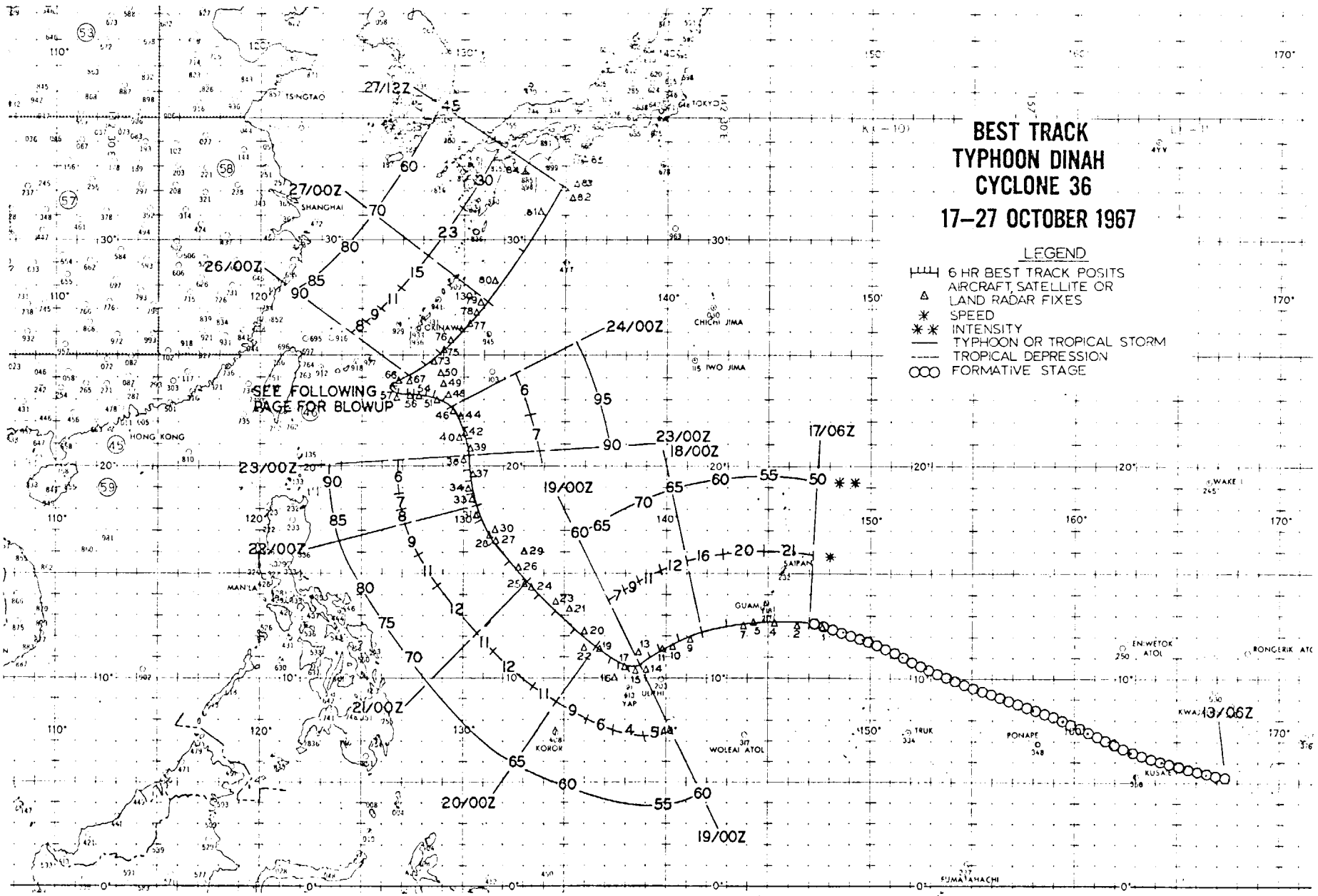
B. INITIAL SURFACE VORTEX

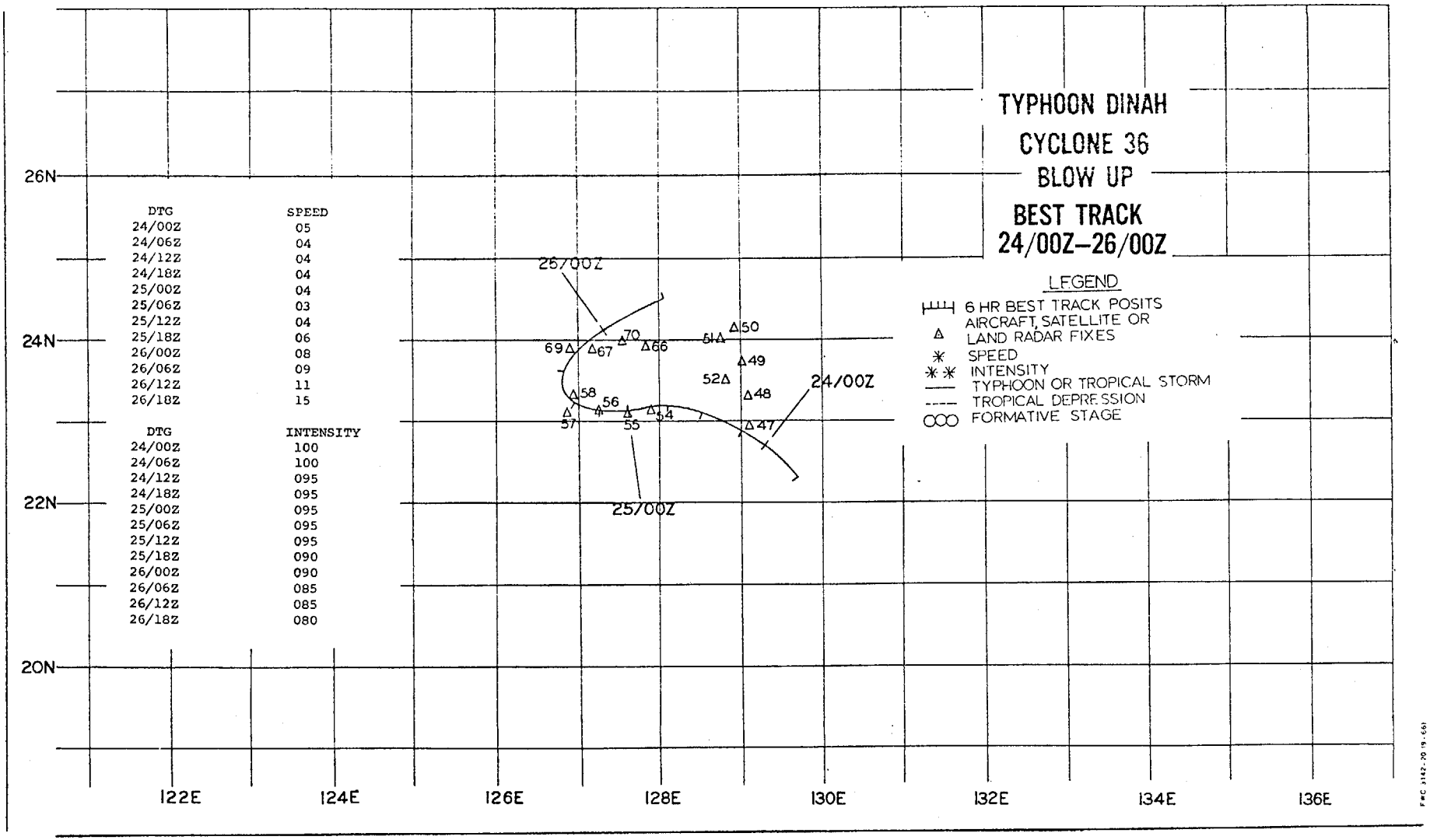
1. JUNCTION VORTEX AT 130600Z
2. SURFACE PRESSURE LESS THAN 1004MB

C. 200MB FLOW ABOVE SURFACE VORTEX

1. INITIAL - NORTHEAST
2. UPON REACHING TYPHOON INTENSITY - NORTHEAST

III. FINAL DISPOSITION - BECAME EXTRATROPICAL


BEST TRACK
TYPHOON DINAH
CYCLONE 36
17–27 OCTOBER 1967
LEGEND
6 HR BEST TRACK POSITS
AIRCRAFT, SATELLITE OR LAND RADAR FIXES
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
FORMATIVE STAGE
SEE FOLLOWING PAGE FOR BLOWUP
27/12Z
27/00Z
26/00Z
24/00Z
23/00Z
22/00Z
21/00Z
20/00Z
19/00Z
18/00Z
17/06Z
13/06Z
TSINGTAO
SHANGHAI
HONG KONG
MANILA
OKINAWA
CHICHI JIMA
IWO JIMA
SAIPAN
GUAM
YAP
ULITHI
KOROR
WOLEAI ATOL
TRUK
PONAPE
KUSAIE
ENIWETOK ATOL
RONGERIK ATOL
WAKE I
FUMATAHACHI


TYPHOON DINAH
CYCLONE 36
BLOW UP
BEST TRACK
24/00Z–26/00Z
LEGEND
6 HR BEST TRACK POSITS
AIRCRAFT, SATELLITE OR LAND RADAR FIXES
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
FORMATIVE STAGE
DTG SPEED
24/00Z 05
24/06Z 04
24/12Z 04
24/18Z 04
25/00Z 04
25/06Z 03
25/12Z 04
25/18Z 06
26/00Z 08
26/06Z 09
26/12Z 11
26/18Z 15
DTG INTENSITY
24/00Z 100
24/06Z 100
24/12Z 095
24/18Z 095
25/00Z 095
25/06Z 095
25/12Z 095
25/18Z 090
26/00Z 090
26/06Z 085
26/12Z 085
26/18Z 080
25/00Z
24/00Z
25/00Z
69
67
70
66
51
50
49
52
48
58
56
57
55
54
47
26N
24N
22N
20N
122E
124E
126E
128E
130E
132E
134E
136E

EYE FIXES CYCLONE 36

FIX NO.	TIME	POSIT	UNIT-METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
1	170325Z	12.5N 147.8E	VW-P-P05	0270M	050	050	997	---	--/--	CIRC	----	15	02
2	170755Z	12.6N 146.4E	LND RDR		---	---	---	---	--/--	----			--
3	170855Z	12.7N 146.1E	LND RDR		---	---	---	---	--/--	----			--
4	171015Z	12.7N 145.3E	VW-P-P05	0310M	043	050	996	---	--/--	CIRC	----	13	--
5	171220Z	12.8N 144.2E	LND RDR		---	---	---	---	--/--	----			--
6	171300Z	12.8N 144.4E	VW-P-P05	0310M	052	055	995	---	--/--	CIRC	----	06	06
7	171500Z	12.4N 143.9E	VW-R-P--		---	---	---	---	--/--	----			--
8	171600Z	12.3N 143.5E	VW-P-P05	0310M	050	040	991	---	--/--	CIRC	----	08	--
9	180400Z	11.8N 141.1E	54-P-P07	700MB	050	065	983	2932	14/--	CIRC	----	10	--
10	180850Z	11.6N 140.3E	VW-R-P--	0490M	---	---	---	---	--/--	----			--
11	181100Z	11.5N 139.9E	VW-P-P05	700MB	045	---	986	---	12/--	CIRC	----	12	--
12	180328Z	11.5N 141.0E	SLTLS	STG C	DIA --	BNDS -							
13	181600Z	11.3N 138.6E	VW-P-P03	700MB	---	---	---	---	--/--	ELIP	NE-SW	15X10	--
14	182149Z	10.5N 139.0E	54-P-P05	700MB	031	050	995	3044	13/12	ELIP	NE-SW	15X10	--
15	190323Z	10.4N 138.5E	54-P-P05	700MB	040	045	994	3042	13/--	CIRC	----	20	--
16	190419Z	10.0N 137.5E	SLTLS	STG C	DIA --	BNDS -							
17	191000Z	10.5N 138.0E	VW-P-P05	0340M	037	030	991	---	--/--	----			F.B.
18	191628Z	10.7N 137.8E	VW-P-P05	0260M	---	---	987	---	--/--	----			F.B.
19	192212Z	11.4N 136.7E	54-P-P03	700MB	038	040	988	---	--/--	----			--
20	200315Z	11.5N 136.0E	SLTLS	STG X	DIA 02	BNDS 1							
21	200344Z	12.1N 136.0E	54-P-P03	0400M	050	045	988	---	--/--	----			--
22	200958Z	13.3N 135.2E	VW-P-P10	0330M	050	040	988	---	--/--	CIRC	----	20	--
23	201510Z	13.7N 134.5E	VW-P-P10	700MB	052	---	---	3026	15/--	CIRC	----	15	--
24	202150Z	14.4N 133.3E	54-P-P02	700MB	070	060	990	3036	17/--	CIRC	----	20	--

EYE FIXES CYCLONE 36

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIENTATION	EYE DIA	THKNS WALL CLOUD
25	202300Z	14.5N 133.0E	ACFT RQR		060	---	---	---	--/--	----			--
26	210343Z	15.2N 132.8E	54-P-P02	700MB	070	065	985	2963	16/12	CIRC	----	20	--
27	210405Z	16.0N 133.0E	SLTLS	STG X	DIA 02	BNDS 2							
28	210953Z	16.5N 131.5E	VW-R-P10	0290M	068	065	---	---	--/--	CIRC	----	05	--
29	211238Z	16.7N 131.1E	VW-R-P--		---	---	---	---	--/--	----			--
30	211500Z	17.0N 131.4E	VW-P-P05	700MB	076	---	977	2887	14/--	CIRC	----	05	--
31	212155Z	17.7N 130.6E	54-P-P03	700MB	050	050	966	2795	16/--	ELIP	N-S	25X15	--
32	220000Z	17.8N 130.5E	54-P-P03	700MB	060	060	965	2792	15/--	ELIP	N-S	25X15	--
33	220255Z	18.5N 130.4E	54-P-P03	700MB	080	070	964	2777	15/--	ELIP	N-S	35X20	--
34	220456Z	18.5N 130.5E	SLTLS	STG X	DIA 04	BNDS 3							
35	220840Z	18.9N 130.2E	VW-P-P05	0290M	080	075	959	---	--/--	CIRC	----	15	--
36	221205Z	19.1N 130.2E	VW-R-P10	700MB	080	---	---	---	--/--	CIRC	----	18	--
37	221423Z	19.6N 130.4E	VW-P-P10	700MB	055	---	962	2790	16/--	CIRC	----	20	--
38	222058Z	20.2N 130.0E	54-P-P03	700MB	060	---	948	2673	18/--	CIRC	----	40	--
39	230257Z	20.9N 130.3E	54-P-P03	700MB	085	050	960	2722	23/--	----			--
40	230356Z	20.5N 130.0E	SLTLS	STG X	DIA 04	BNDS 4							
41	230813Z	21.4N 129.8E	VW-R-P10	700MB	---	---	---	---	--/--	----			--
42	230900Z	21.5N 129.8E	VW-R-P10	700MB	068	060	---	---	--/--	CIRC	----	12	--
43	231000Z	21.5N 130.0E	VW-R-P10	700MB	---	---	---	---	--/--	----			--
44	231200Z	21.8N 130.2E	VW-R-P10	700MB	---	---	---	---	--/--	CIRC	----	12	--
45	231500Z	22.2N 129.8E	VW-R-P10	700MB	---	---	---	---	--/--	CIRC	----	16	--
46	232100Z	22.6N 129.4E	54-P-P03	500MB	060	---	951	2670	15/15	CIRC	----	40	--
47	240010Z	22.7N 129.3E	54-P-P03	700MB	085	040	950	2634	17/--	CIRC	----	40	--
48	240257Z	22.9N 129.1E	54-P-P03	700MB	090	075	950	2627	16/--	CIRC	----	25	--

EYE FIXES CYCLONE 36

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
49	240430Z	23.4N 129.1E	LND RDR		---	---	---	---	--/--	----			--
50	240700Z	23.7N 129.0E	LND RDR		---	---	---	---	--/--	----			--
51	240800Z	24.2N 128.9E	LND RDR		---	---	---	---	--/--	----			--
52	240810Z	23.0N 128.8E	VW-R-P10	0330M	075	060	---	---	--/--	CIRC	----	25	15
53	241145Z	23.5N 128.8E	VW-R-P10	0870M	095	---	---	---	--/--	CIRC	----	22	--
54	241435Z	23.4N 128.7E	VW-R-P10	700MB	080	---	---	---	--/--	CIRC	----	25	--
55	242123Z	23.1N 127.9E	54-P-P03	700MB	085	---	948	2646	16/--	CIRC	----	30	--
56	250019Z	23.1N 127.6E	54-P-P03	700MB	090	065	950	2664	15/--	CIRC	----	25	--
57	250305Z	23.1N 127.3E	54-P-P03	700MB	085	070	950	2673	16/--	CIRC	----	25	--
58	250630Z	23.1N 126.8E	LND RDR		---	---	---	---	--/--	----			--
59	250730Z	23.3N 126.9E	LND RDR		---	---	---	---	--/--	----			--
60	250900Z	23.1N 127.2E	VW-R-P05	700MB	042	050	---	---	--/--	CIRC	----	25	06
61	251000Z	23.1N 127.1E	VW-R-P05	700MB	---	---	---	---	--/--	----			--
62	251030Z	23.2N 127.0E	LND RDR		---	---	---	---	--/--	----			--
63	251100Z	23.2N 127.1E	VW-R-P10	700MB	---	---	---	---	--/--	----			--
64	251210Z	23.2N 127.0E	VW-R-P05	700MB	---	---	---	---	--/--	CIRC	----	28	06
65	251500Z	23.2N 126.9E	VW-R-P05	700MB	076	---	---	---	--/--	CIRC	----	28	04
66	252030Z	23.9N 126.8E	LND RDR		---	---	---	---	--/--	----			--
67	252100Z	23.8N 127.2E	LND RDR		---	---	---	---	--/--	----			--
68	252100Z	23.8N 127.1E	54-P-P03	700MB	075	---	961	2722	14/--	CIRC	----	35	--
69	252130Z	23.9N 126.9E	LND RDR		---	---	---	---	--/--	----			--
70	260007Z	24.0N 127.5E	54-P-P03	700MB	080	050	958	2731	15/--	----			F.B.
71	260300Z	24.1N 127.6E	54-P-P03	700MB	094	070	961	2731	15/--	----			F.B.
72	260330Z	24.2N 127.4E	LND RDR		---	---	---	---	--/--	----			--

EYE FIXES CYCLONE 36

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL T/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
73	2608302	24.8N 128.5E	LND RDR		---	---	---	---	--/--	----			--
74	2610352	25.0N 128.5E	VW-R-F15	700MB	070	---	---	---	--/--	CIRC	----	30	--
75	2612302	25.2N 129.0E	VW-UNK--		---	---	---	---	--/--	----			--
76	2614202	25.5N 129.2E	VW-P-P05	700MB	055	---	---	2824	14/--	CIRC	----	30	--
77	2619302	26.3N 130.2E	LND RDR		---	---	---	---	--/--	----			--
78	2621302	26.9N 130.6E	S4-P-P02	700MB	070	055	969	2826	17/--	CIRC	----	40	--
79	2623582	27.3N 130.9E	S4-P-P02	700MB	068	060	969	2877	18/--	CIRC	----	40	--
80	2702052	28.3N 131.5E	S4-P-P02	700MB	065	065	---	2835	16/10	CIRC	----	50	--
81	2703222	28.0N 133.0E	SLTLS	STG X	DIA 05	BNDS 3							
82	2708502	31.1N 133.8E	VW-P-P05	700MB	056	045	---	2792	14/--	CIRC	----	50	--
83	2711002	31.8N 135.3E	LND RDR		---	---	---	---	--/--	----			--
84	2712302	32.3N 135.5E	VW-P-P--	700MB	070	---	---	2798	14/13	----			--
85	2715222	33.4N 136.0E	VW-P-P05	700MB	---	---	---	2792	14/--	----			--

TROPICAL CYCLONE 36 -- 10/17/0600/ TO 10/27/1200Z

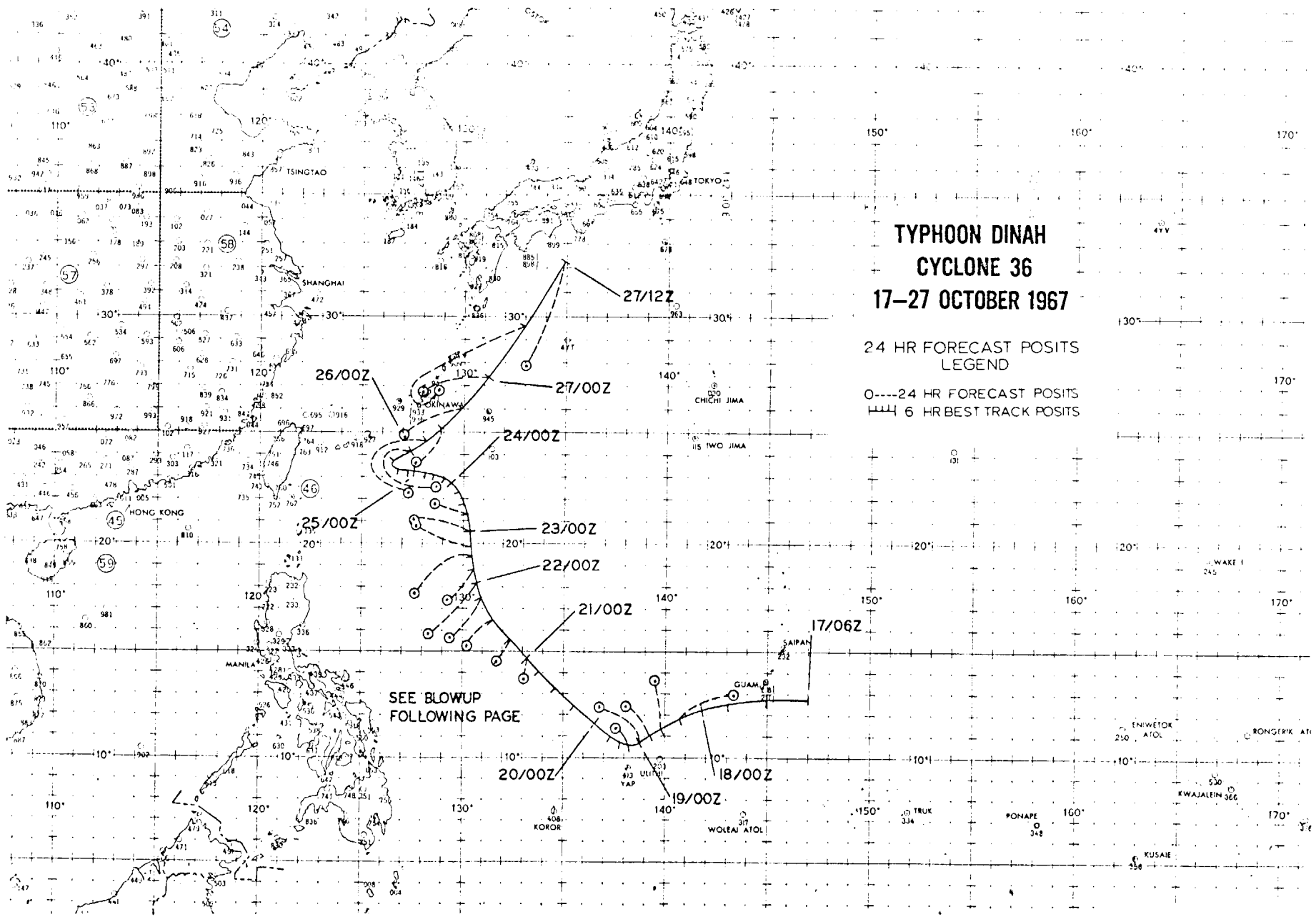
POSITION AND FORECAST VERIFICATION DATA

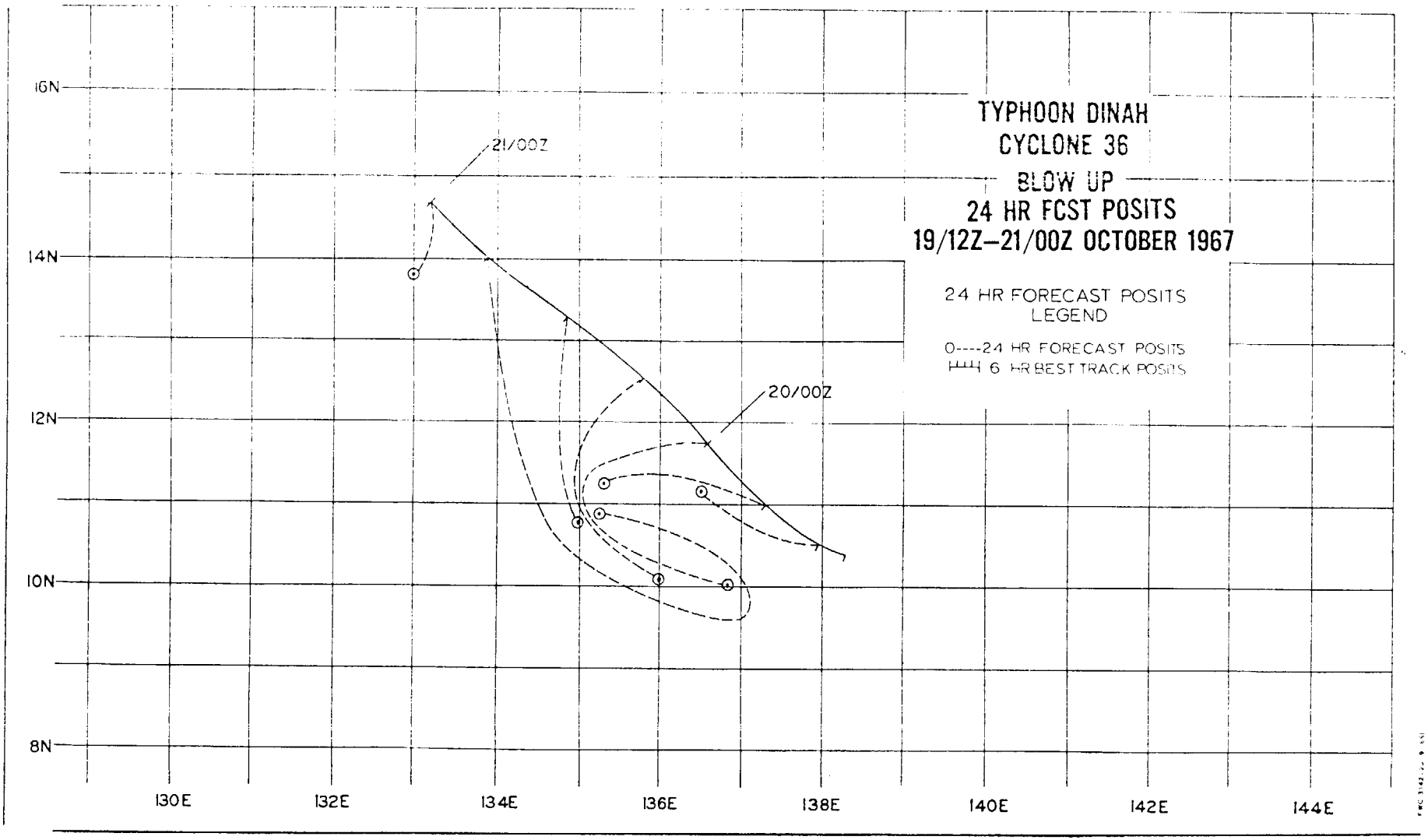
DTG	STORM POSITION LAT.	LONG.	24 HR. ERROR DEG.	DIST.	48 HR. ERROR DEG.	DIST.	72 HR. ERROR DEG.	DIST.
170600Z	12.7N	147.0E	--------		--------		--------	
171200Z	12.7N	144.8E	--------		--------		--------	
171800Z	12.4N	143.0E	--------		--------		--------	
180000Z	12.1N	141.8E	--------		--------		--------	
180600Z	11.7N	140.8E	064-	0156	--------		--------	
181200Z	11.3N	139.8E	352-	0132	--------		--------	
181800Z	10.9N	139.2E	321-	0102	--------		--------	
190000Z	10.6N	138.7E	313-	0144	--------		--------	
190600Z	10.4N	138.3E	325-	0072	018-	0198	--------	
191200Z	10.5N	137.9E	298-	0084	334-	0222	--------	
191800Z	11.0N	137.3E	275-	0174	302-	0168	--------	
200000Z	11.7N	136.6E	173-	0102	289-	0180	--------	
200600Z	12.5N	135.7E	175-	0144	242-	0150	350-	0108
201200Z	13.3N	134.8E	175-	0156	226-	0156	--------	
201800Z	14.0N	133.9E	159-	0204	244-	0276	251-	0138
210000Z	14.7N	133.2E	187-	0054	175-	0240	--------	
210600Z	15.5N	132.3E	207-	0066	173-	0282	216-	0288
211200Z	16.4N	131.4E	223-	0102	182-	0294	--------	
211800Z	17.3N	130.8E	215-	0144	180-	0336	235-	0420
220000Z	18.0N	130.4E	222-	0186	200-	0156	--------	
220600Z	18.7N	130.2E	218-	0096	218-	0222	190-	0408
221200Z	19.3N	130.2E	277-	0144	231-	0300	--------	
221800Z	19.8N	130.3E	293-	0162	235-	0348	211-	0450
230000Z	20.5N	130.3E	280-	0156	237-	0408	--------	
230600Z	21.2N	130.2E	289-	0084	240-	0258	234-	0438
231200Z	21.7N	130.0E	226-	0066	288-	0264	--------	
231800Z	22.3N	129.7E	082-	0042	302-	0240	243-	0510
240000Z	22.7N	129.3E	064-	0024	302-	0216	--------	
240600Z	22.9N	129.0E	050-	0264	345-	0114	250-	0312
241200Z	23.1N	128.5E	051-	0288	199-	0018	--------	
241800Z	23.2N	128.1E	047-	0330	059-	0348	012-	0336
250000Z	23.1N	127.6E	048-	0336	057-	0312	--------	
250600Z	23.1N	127.3E	039-	0240	055-	0894	040-	0414
251200Z	23.2N	126.9E	096-	0102	056-	0918	--------	

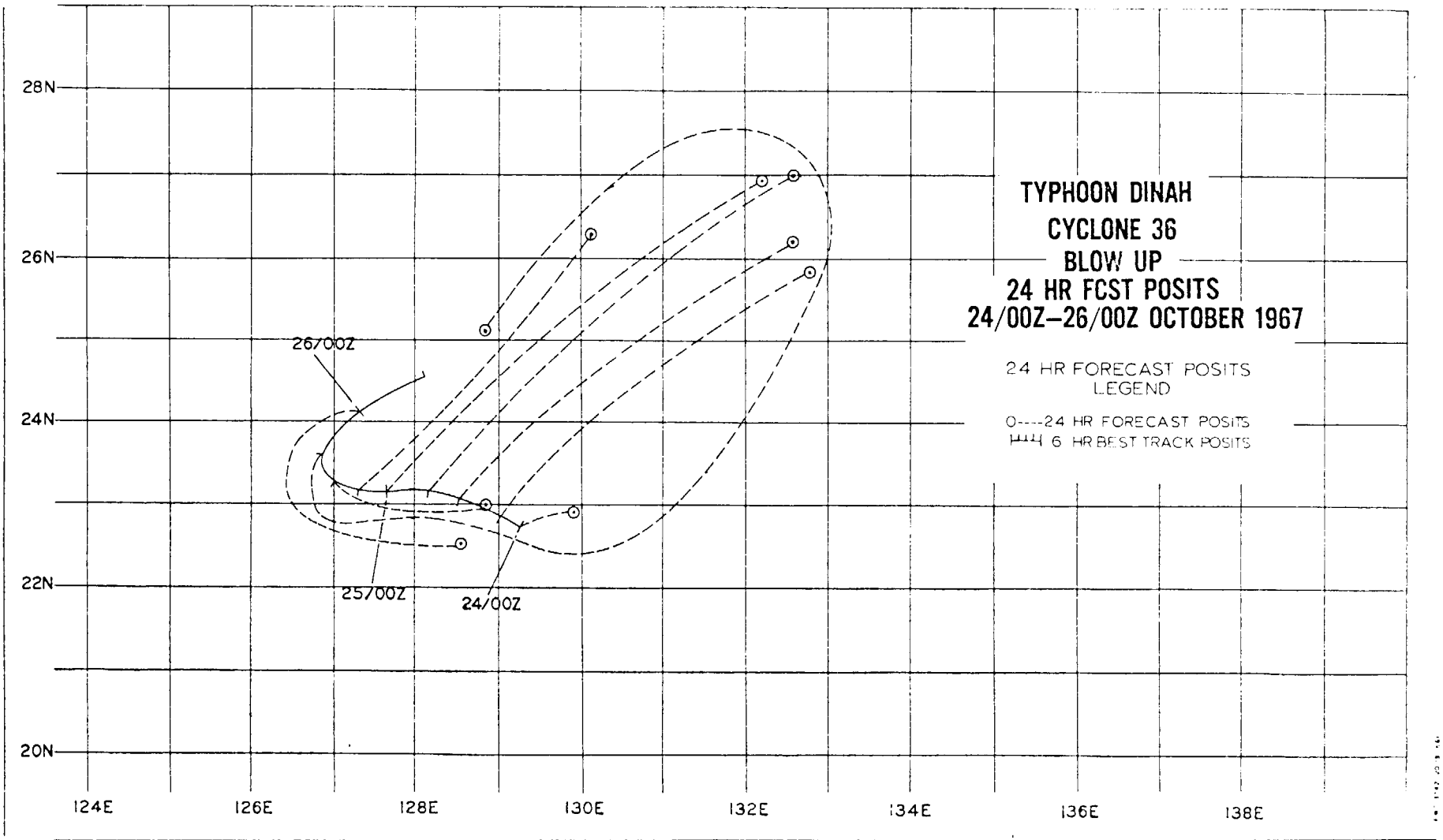
TROPICAL CYCLONE 36 -- 10/17/0600Z TO 10/27/1200Z
POSITION AND FORECAST VERIFICATION DATA (CONT)

DTG	STORM POSITION LAT.	LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
251800Z	23.6N	126.8E	051-0134	058-0954	061-0744
260000Z	24.1N	127.4E	147-0108	058-0864	--------
260600Z	24.5N	128.1E	200-0138	054-0576	065-1332
261200Z	25.2N	128.8E	213-0120	046-0090	--------
261800Z	26.1N	129.7E	237-0168	053-0216	--------
270000Z	27.4N	131.0E	253-0180	240-0162	--------
270600Z	29.8N	132.8E	234-0288	222-0420	072-0618
271200Z	32.2N	135.0E	202-0276	230-0540	--------

AVERAGE 24 HOUR ERROR - 0151 MI.
AVERAGE 48 HOUR ERROR - 0333 MI.
AVERAGE 72 HOUR ERROR - 0465 MI.


TYPHOON DINAH
CYCLONE 36
17–27 OCTOBER 1967
24 HR FORECAST POSITS
LEGEND
0----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS
27/12Z
27/00Z
26/00Z
24/00Z
25/00Z
23/00Z
22/00Z
21/00Z
17/06Z
20/00Z
19/00Z
18/00Z
SEE BLOWUP
FOLLOWING PAGE
TSINGTAO
SHANGHAI
TOKYO
OKINAWA
CHICHI JIMA
IWO JIMA
HONG KONG
MANILA
SAIPAN
GUAM
YAP
ULITHI
KOROR
WOLEAI ATOL
TRUK
PONAPE
KUSAIE
KWAJALEIN
ENIWETOK ATOL
WAKE I


TYPHOON DINAH
CYCLONE 36
BLOW UP
24 HR FCST POSITS
19/12Z–21/00Z OCTOBER 1967
24 HR FORECAST POSITS
LEGEND
0----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS
21/00Z
20/00Z
16N
14N
12N
10N
8N
130E
132E
134E
136E
138E
140E
142E
144E


28N
26N
24N
22N
20N
124E
126E
128E
130E
132E
134E
136E
138E
26/00Z
25/00Z
24/00Z
TYPHOON DINAH
CYCLONE 36
BLOW UP
24 HR FCST POSITS
24/00Z–26/00Z OCTOBER 1967
24 HR FORECAST POSITS
LEGEND
0----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS

TROPICAL CYCLONE 37 - 10/31/0000Z TO 11/0A/0000Z

I. DATA
   A. STATISTICS
      1. NUMBER OF WARNINGS ISSUED - 33
      2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 18
      3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 2184 MI

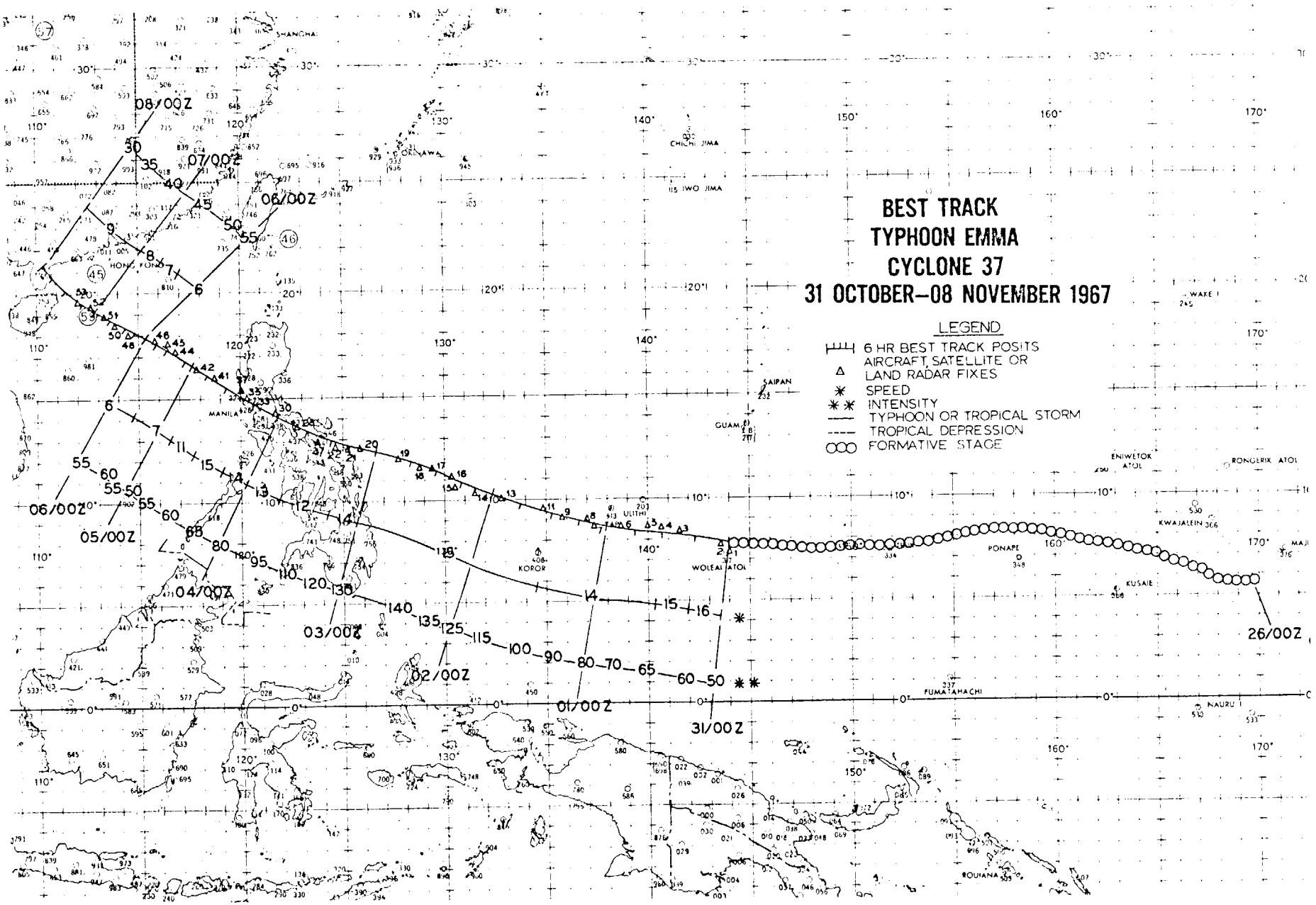
   B. CHARACTERISTICS AS A TYPHOON
      1. MINIMUM OBSERVED SLP - 906MBS AT 022200Z
      2. MINIMUM OBSERVED 700MB HEIGHT - 5204M. AT 021520Z
      3. MAXIMUM SURFACE WIND - 140 KTS (FROM BEST TRACK)
      4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 550 MI

II. DEVELOPMENT
   A. INITIAL IMPETUS - 200MB ANTICYCLONE OVER THE SURFACE CYCLONE

   B. INITIAL SURFACE VORTEX
      1. JUNCTION VORTEX AT 260000Z
      2. SURFACE PRESSURE LESS THAN 1008MB

   C. 200MB FLOW ABOVE SURFACE VORTEX
      1. INITIAL - SOUTHEAST
      2. UPON REACHING TYPHOON INTENSITY - NORTH

III. FINAL DISPOSITION - DISSIPATED OVER LAND


BEST TRACK
TYPHOON EMMA
CYCLONE 37
31 OCTOBER–08 NOVEMBER 1967
LEGEND
6 HR BEST TRACK POSITS
AIRCRAFT, SATELLITE OR
LAND RADAR FIXES
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
FORMATIVE STAGE
08/00Z
07/00Z
06/00Z
05/00Z
04/00Z
03/00Z
02/00Z
01/00Z
31/00Z
26/00Z
SHANGHAI
OKINAWA
CHICHI JIMA
IWO JIMA
HONG KONG
MANILA
SAIPAN
GUAM
KOROR
ULITHI
WOLEAI ATOL
ENIWETOK ATOL
RONGERIK ATOL
KWAJALEIN
PONAPE
KUSAIE
WAKE I
FUMATAHACHI
NAURU I
ROUIANA

EYE FIXES CYCLONE 37

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
1	302150Z	07.5N 144.0E	SLTLS	STG -	DIA --	BNDS -							
2	310100Z	07.8N 143.6E	VW-P-P03	0200M	055	050	991	---	--/--	CIRC	----	20	03
3	310920Z	08.4N 141.5E	VW-P-P05	0250M	050	045	990	---	--/--	CIRC	----	25	15
4	311230Z	08.5N 140.7E	VW-R-P--		---	---	---	---	--/--	----			--
5	311545Z	08.6N 140.0E	VW-P-P05	0300M	060	060	983	2980	11/--	CIRC	----	25	10
6	312131Z	08.6N 138.6E	54-P-P03	700MB	060	065	975	2883	15/--	CIRC	----	25	--
7	010315Z	08.7N 137.3E	54-P-P03	700MB	080	075	978	2847	15/--	CIRC	----	30	--
8	010346Z	09.0N 137.0E	SLTLS	STG X	DIA 06	BNDS 2							
9	010900Z	09.0N 136.1E	VW-R-P--	0380M	---	---	---	---	--/--	CIRC	----	35	--
10	010950Z	09.0N 135.7E	VW-P-P02	0370M	100	100	971	---	--/--	CIRC	----	30	--
11	011400Z	09.5N 134.9E	VW-R-P--	700MB	---	---	---	---	--/--	----			--
12	011520Z	09.8N 134.7E	VW-P-P02	700MB	085	---	960	2743	16/--	CIRC	----	20	--
13	012230Z	10.0N 132.9E	54-P-P05	700MB	105	080	939	2585	20/--	CIRC	----	20	--
14	020307Z	10.3N 131.4E	54-P-P02	700MB	095	130	---	2521	23/--	CIRC	----	25	--
15	020900Z	10.6N 130.5E	VW-R-P--	0330M	---	---	---	---	--/--	----			--
16	021015Z	11.1N 130.3E	VW-P-P10	700MB	095	100	942	2603	22/13	CIRC	----	16	05
17	021345Z	11.5N 129.2E	VW-R-P--	700MB	---	---	---	---	--/--	----			--
18	021520Z	11.6N 128.8E	VW-P-P10	700MB	095	---	916	2204	24/--	CIRC	----	14	05
19	022200Z	12.0N 127.7E	54-P-P02	700MB	112	100	908	2252	24/--	ELIP	N-S	20X15	--
20	030330Z	12.5N 125.8E	54-P-P05	700MB	110	100	938	2576	20/--	CIRC	----	15	--
21	030800Z	12.6N 125.1E	LND RDR		---	---	---	---	--/--	----			--
22	030900Z	12.6N 124.9E	LND RDR		---	---	---	---	--/--	----			--
23	031000Z	12.7N 124.5E	VW-R-P--	700MB	---	---	---	---	--/--	----			--
24	031000Z	12.6N 124.8E	LND RDR		---	---	---	---	--/--	----			--

EYE FIXES CYCLONE 37

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
25	031130Z	12.8N 124.4E	VW-P-P01	700MB	090	---	956	2695	15/15	CIRC	----	12	08
26	031300Z	12.8N 124.2E	VW-R-P02	700MB	---	---	---	---	--/--	----			--
27	031530Z	12.9N 123.9E	VW-R-P02	700MB	---	---	---	---	--/--	CIRC	----	18	05
28	032100Z	13.7N 122.7E	LND RDR		---	---	---	---	--/--	----			--
29	032215Z	13.9N 122.4E	54-P-P02	500MB	080	---	---	---	--/--	----			--
30	040117Z	14.3N 121.7E	LND RDR		---	---	---	---	--/--	----			--
31	040325Z	14.3N 121.3E	54-P-P03	500MB	075	---	---	---	--/--	----			--
32	040400Z	14.1N 121.3E	LND RDR		---	---	---	---	--/--	----			--
33	040630Z	14.8N 120.6E	LND RDR		---	---	---	---	--/--	----			--
34	040730Z	14.9N 120.5E	LND RDR		---	---	---	---	--/--	----			--
35	040830Z	15.0N 120.2E	LND RDR		---	---	---	---	--/--	----			--
36	040900Z	15.0N 120.2E	LND RDR		---	---	---	---	--/--	----			--
37	040930Z	15.3N 120.0E	LND RDR		---	---	---	---	--/--	----			--
38	040947Z	15.2N 119.9E	LND RDR		---	---	---	---	--/--	----			--
39	041004Z	15.5N 119.9E	VW-R-P05	2300M	035	045	---	---	--/--	CIRC	----	20	--
40	041100Z	15.5N 119.6E	LND RDR		---	---	---	---	--/--	----			--
41	041531Z	16.0N 118.8E	VW-R-P05	700MB	070	---	---	---	--/--	CIRC	----	18	--
42	042219Z	16.2N 117.7E	54-P-P02	700MB	057	050	980	2919	14/--	----			--
43	050300Z	16.2N 117.2E	54-P-P02	700MB	047	055	983	2932	12/--	----			--
44	050935Z	17.1N 116.8E	VW-P-P03	0310M	070	070	982	---	--/--	CIRC	----	10	--
45	051615Z	17.6N 116.4E	VW-R-P03	0440M	056	035	---	---	--/--	CIRC	----	12	--
46	052101Z	17.8N 115.9E	VW-R-P02	0400M	073	045	---	---	--/--	CIRC	----	22	--
47	060420Z	17.9N 115.1E	54-P-P02	700MB	070	040	976	2899	14/--	CIRC	----	30	--
48	060413Z	18.0N 114.5E	SLTLS	STG X	DIA 02	BNDS 4							

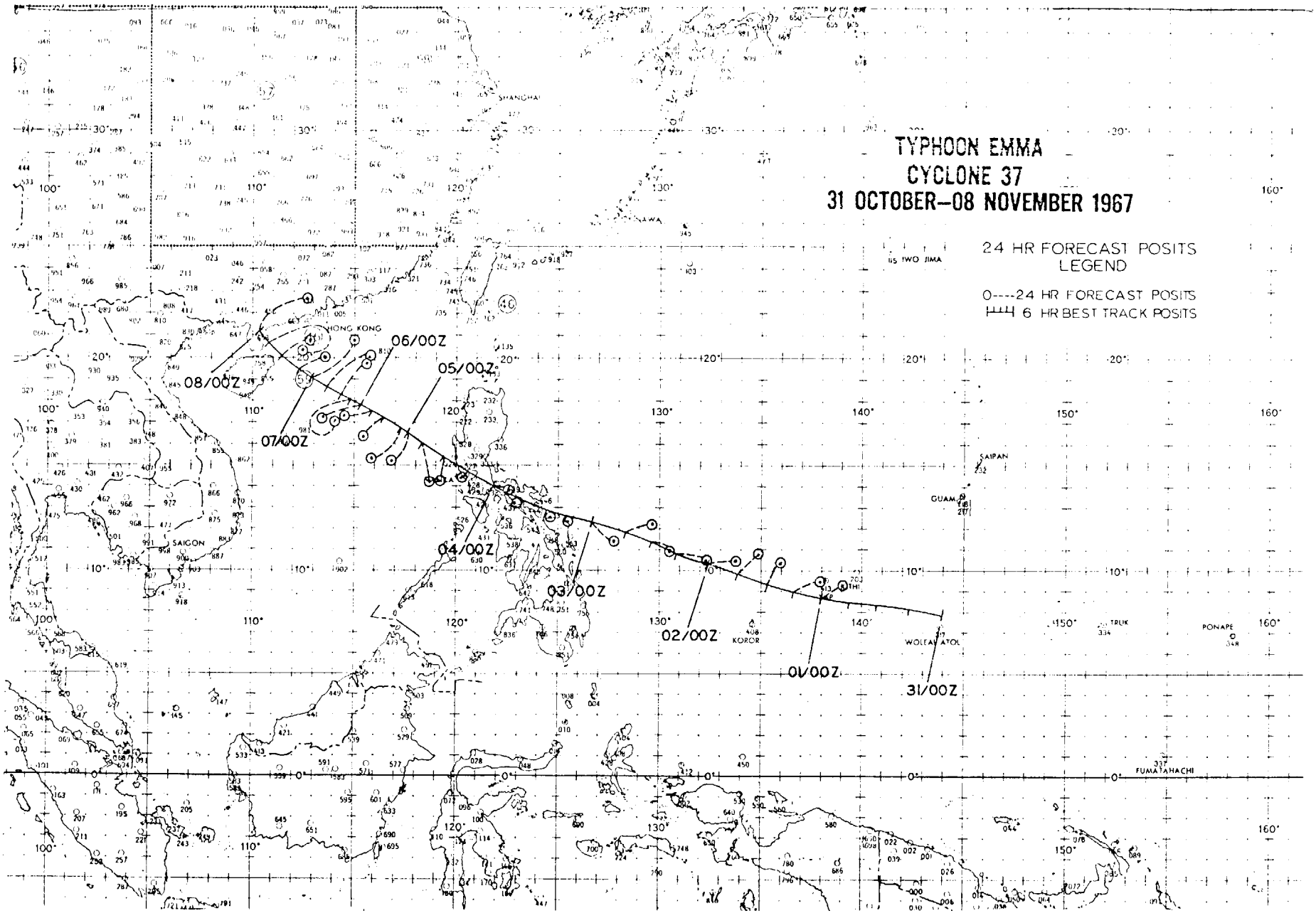
EYE FIXES CYCLONE 37

FIX NO.	TIME	POSIT	UNIT-METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
49	060907Z	18.2N 114.5E	54-P-P02	700MB	080	050	976	2862	14/--	CIRC	----	30	--
50	061628Z	18.4N 113.9E	VW-P-P10	700MB	090	---	---	2904	13/--	ELIP	NE-SW	45X25	03
51	062135Z	19.0N 113.2E	VW-P-P10	700MB	060	---	---	---	--/--	ELIP	NE-SW	30X15	--
52	070400Z	19.4N 112.5E	54-P-P10	700MB	085	---	---	2862	13/--	CIRC	----	30	--
53	070503Z	19.5N 112.0E	SLTLS	STG X	DIA 03	BNDS 4							

TROPICAL CYCLONE 37 -- 10/31/0000Z TO 11/06/0000Z
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION LAT.	LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
310000Z	07.8N	143.9E	--------	--------	--------
310600Z	08.1N	142.2E	--------	--------	--------
311200Z	08.3N	140.7E	--------	--------	--------
311800Z	08.4N	139.3E	--------	--------	--------
010000Z	08.6N	137.9E	064-0066	--------	--------
010600Z	09.0N	136.6E	072-0072	--------	--------
011200Z	09.3N	135.2E	031-0066	--------	--------
011800Z	09.7N	133.7E	046-0084	--------	--------
020000Z	10.2N	132.3E	086-0072	084-0156	--------
020600Z	10.7N	130.9E	109-0066	082-0168	--------
021200Z	11.3N	129.5E	113-0054	070-0132	--------
021800Z	11.8N	128.1E	075-0084	073-0162	--------
030000Z	12.1N	126.6E	120-0066	087-0204	--------
030600Z	12.6N	125.3E	180-0018	099-0186	085-0270
031200Z	12.9N	124.2E	146-0018	106-0102	--------
031800Z	13.4N	123.1E	252-0018	096-0108	069-0222
040000Z	14.0N	121.9E	111-0030	126-0108	--------
040600Z	14.7N	120.6E	234-0030	174-0060	100-0252
041200Z	15.5N	119.3E	189-0084	166-0102	--------
041800Z	16.1N	118.3E	171-0120	193-0108	131-0204
050000Z	16.4N	117.6E	209-0084	176-0096	--------
050600Z	16.7N	117.1E	219-0102	231-0132	191-0132
051200Z	17.2N	116.4E	229-0072	223-0192	--------
051800Z	17.4N	115.9E	270-0090	205-0168	228-0228
060000Z	17.7N	115.4E	259-0114	241-0228	--------
060600Z	18.0N	114.8E	218-0066	237-0228	244-0276
061200Z	18.3N	114.3E	037-0108	248-0174	--------
061800Z	18.7N	113.7E	053-0126	269-0192	223-0264
070000Z	19.2N	113.0E	049-0144	257-0204	--------
070600Z	19.6N	112.3E	071-0066	222-0126	233-0354
071200Z	20.1N	111.5E	058-0078	051-0396	--------
071800Z	20.7N	110.8E	102-0084	056-0378	257-0258

AVERAGE 24 HOUR ERROR - 0074 MI.
AVERAGE 48 HOUR ERROR - 0171 MI.
AVERAGE 72 HOUR ERROR - 0246 MI.


TYPHOON EMMA
CYCLONE 37
31 OCTOBER–08 NOVEMBER 1967
24 HR FORECAST POSITS
LEGEND
0----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS
08/00Z
07/00Z
06/00Z
05/00Z
04/00Z
03/00Z
02/00Z
01/00Z
31/00Z
HONG KONG
SAIGON
SHANGHAI
IWO JIMA
SAIPAN
GUAM
KOROR
WOLEAI ATOL
TRUK
PONAPE
FUMATAHACHI

TROPICAL CYCLONE 38 - 11/07/0600Z TO 11/10/0000Z

I. DATA
   A. STATISTICS
      1. NUMBER OF WARNINGS ISSUED - 12
      2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 07
      3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 1044 MI

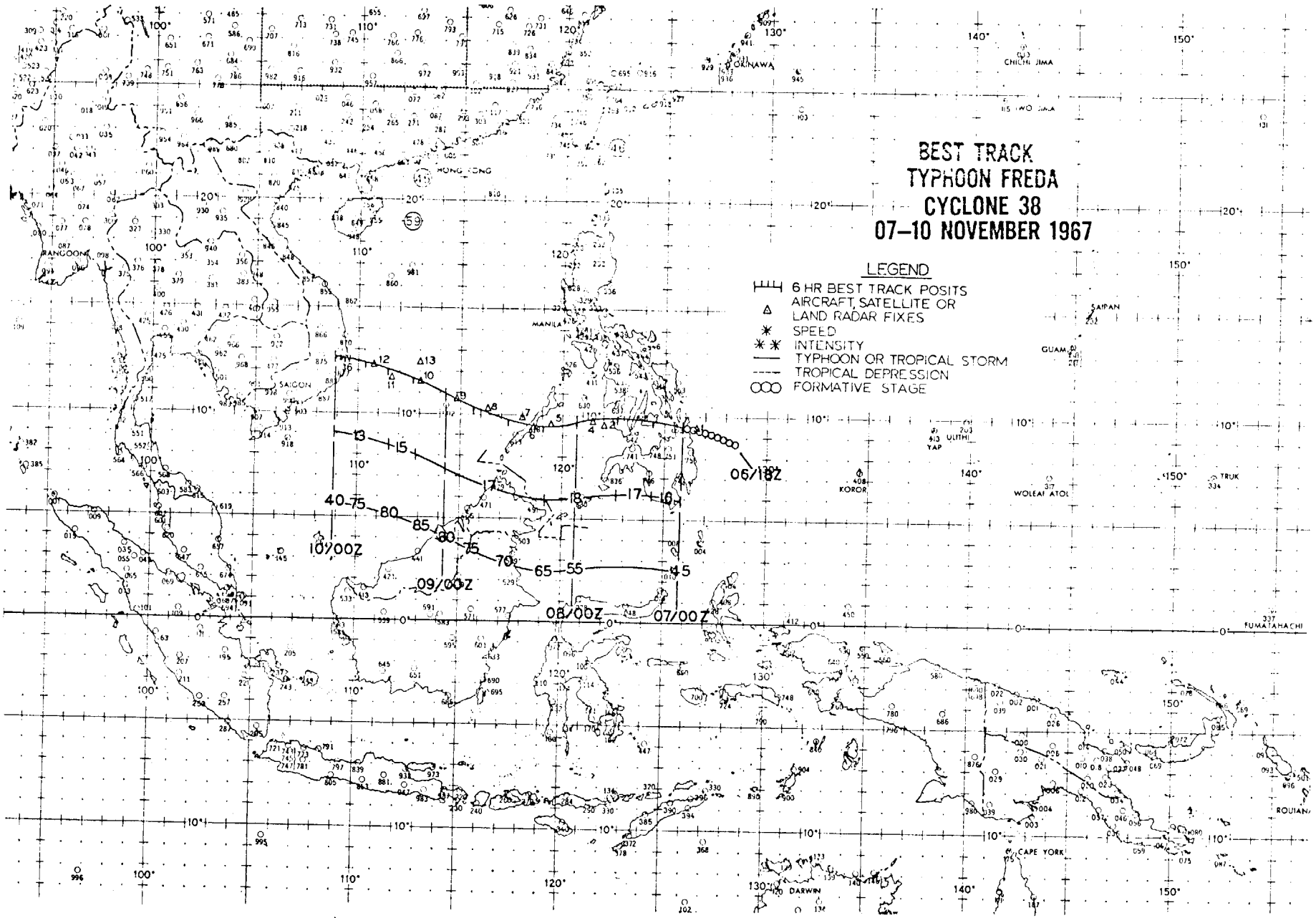
   B. CHARACTERISTICS AS A TYPHOON
      1. MINIMUM OBSERVED SLP - 971MBS AT 090940Z
      2. MINIMUM OBSERVED 700MB HEIGHT - 2917M. AT 090415Z
      3. MAXIMUM SURFACE WIND - 085 KTS (FROM BEST TRACK)
      4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 250 MI

II. DEVELOPMENT
   A. INITIAL IMPETUS - DEVELOPMENT OF DIVERGENCE AT 200MB LEVEL OVER SURFACE CYCLONIC CIRCULATION

   B. INITIAL SURFACE VORTEX
      1. INDUCED VORTEX AT 061800Z
      2. SURFACE PRESSURE LESS THAN 1006MB

   C. 200MB FLOW ABOVE SURFACE VORTEX
      1. INITIAL - FAST
      2. UPON REACHING TYPHOON INTENSITY - EAST

III. FINAL DISPOSITION - DISSIPATED OVER LAND


BEST TRACK
TYPHOON FREDA
CYCLONE 38
07–10 NOVEMBER 1967
LEGEND
6 HR BEST TRACK POSITS
AIRCRAFT, SATELLITE OR LAND RADAR FIXES
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
FORMATIVE STAGE
06/18Z
10/00Z
09/00Z
08/00Z
07/00Z
RANGOON
SAIGON
MANILA
HONG KONG
OKINAWA
CHICHI JIMA
IWO JIMA
SAIPAN
GUAM
ULITHI
YAP
KOROR
WOLEAI ATOL
TRUK
FUMATAHACHI
ROUIANA
CAPE YORK
DARWIN

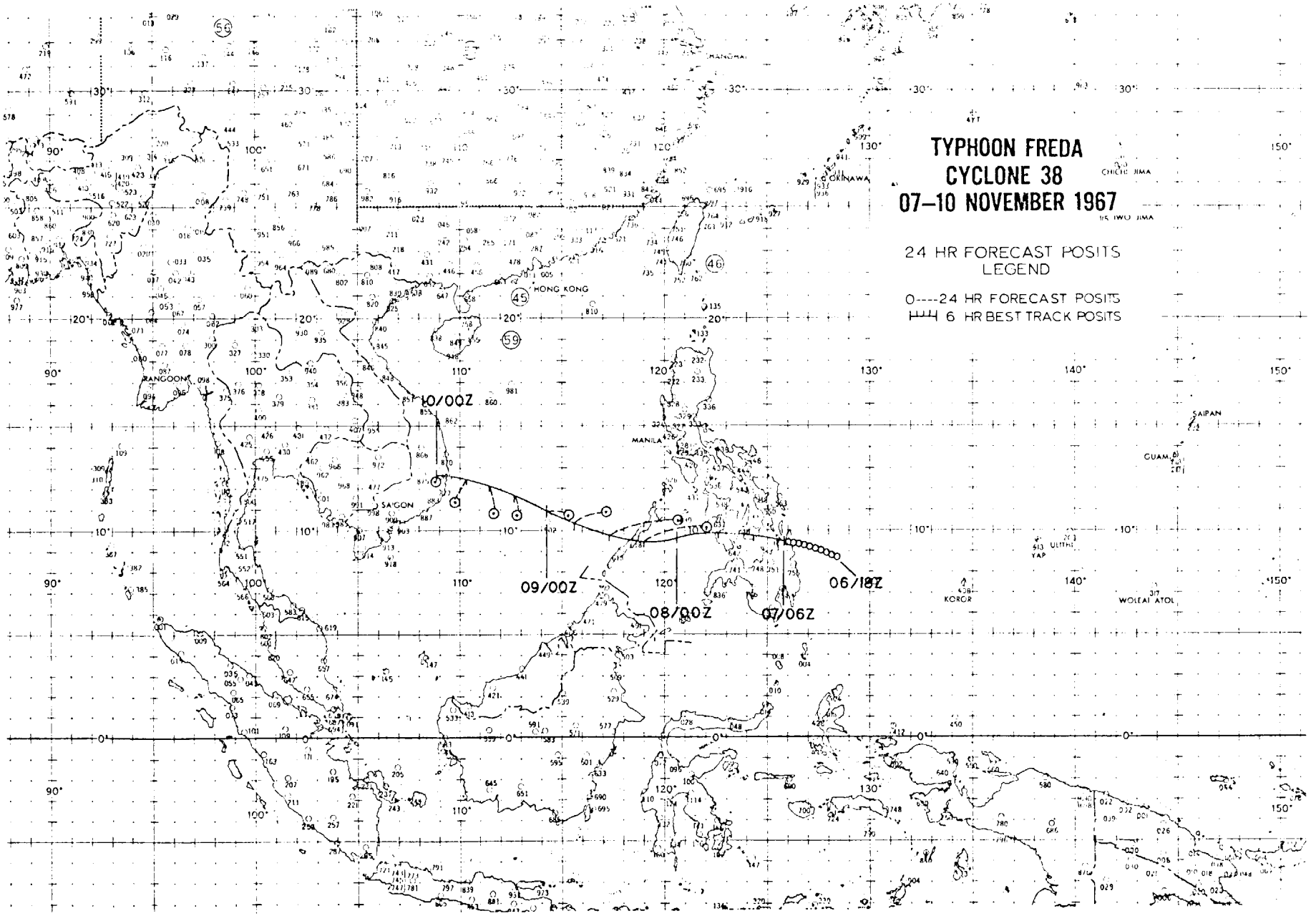
EYE FIXES CYCLONE 38

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
1	070322Z	09.3N 126.4E	54-P-F02	500MB	055	045	---	---	--/--	ELIP	N-S	20X10	N.F.B.
2	070459Z	08.0N 124.0E	SLTLS	STG X	DIA 03	BNDS 2							
3	071700Z	09.5N 122.0E	VW-P-L--	700MB	---	---	---	3062	--/--	----			--
4	072145Z	09.8N 121.3E	VW-P-P02	700MB	065	070	979	3065	13/--	CIRC	----	20	N.F.B.
5	080415Z	09.6N 119.2E	54-P-P03	500MB	075	---	---	---	--/--	CIRC	----	20	--
6	080549Z	09.5N 118.5E	SLTLS	STG X	DIA 04	BNDS 2							
7	080913Z	09.9N 118.0E	54-P-P05	500MB	070	060	984	2939	13/13	ELIP	N-S	20X09	--
8	081530Z	10.3N 116.2E	VW-P-P10	0380M	065	045	987	3120	09/00	CIRC	----	25	04
9	082130Z	10.7N 114.9E	VW-P-P10	700MB	060	---	---	---	--/--	CIRC	----	18	06
10	090415Z	11.5N 113.0E	54-P-P03	700MB	095	110	976	2917	18/17	CIRC	----	25	--
11	090445Z	12.5N 113.0E	SLTLS	STG X	DIA 04	BNDS 3							
12	090940Z	11.8N 111.7E	54-P-P04	700MB	085	120	971	---	18/--	CIRC	----	20	--
13	091600Z	12.3N 110.7E	VW-P-P03	0310M	085	090	977	---	--/--	CIRC	----	19	--
14	091800Z	12.4N 110.3E	VW-R-P--	700MB	---	---	---	---	--/--	----			--
15	091830Z	12.5N 110.1E	VW-R-P--	700MB	---	---	---	---	--/--	----			--
16	092030Z	12.5N 109.4E	VW-R-P01	700MB	---	---	---	---	--/--	CIRC	----	20	--

TROPICAL CYCLONE 38 -- 11/0706007 TO 11/1000007
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION LAT.	LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
070600Z	09.5N	125.9E	--------	--------	--------
071200Z	09.8N	124.3E	--------	--------	--------
071800Z	09.8N	122.6E	--------	--------	--------
080000Z	09.6N	120.8E	--------	--------	--------
080600Z	09.5N	119.0E	081-0174	--------	--------
081200Z	09.9N	117.4E	085-0192	--------	--------
081800Z	10.4N	115.7E	069-0078	--------	--------
090000Z	11.0N	114.2E	109-0066	--------	--------
090600Z	11.5N	112.7E	173-0054	099-0312	--------
091200Z	12.0N	111.4E	170-0072	103-0282	--------
091800Z	12.4N	110.3E	202-0060	094-0144	--------
100000Z	12.8N	108.9E	180-0018	122-0168	--------

AVERAGE 24 HOUR ERROR - 0089 MI.
AVERAGE 48 HOUR ERROR - 0226 MI.
AVERAGE 72 HOUR ERROR - ---- MI.


TYPHOON FREDA
CYCLONE 38
07–10 NOVEMBER 1967
24 HR FORECAST POSITS
LEGEND
0----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS
10/00Z
09/00Z
08/00Z
07/06Z
06/18Z
HONG KONG
MANILA
SAIGON
RANGOON
OKINAWA
SAIPAN
GUAM
YAP
KOROR
WOLEAI ATOL

TROPICAL CYCLONE 39 - 11/08/0600Z TO 11/18/1800Z

I. DATA
   A. STATISTICS
      1. NUMBER OF WARNINGS ISSUED - 45
      2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 32
      3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 2580 MI

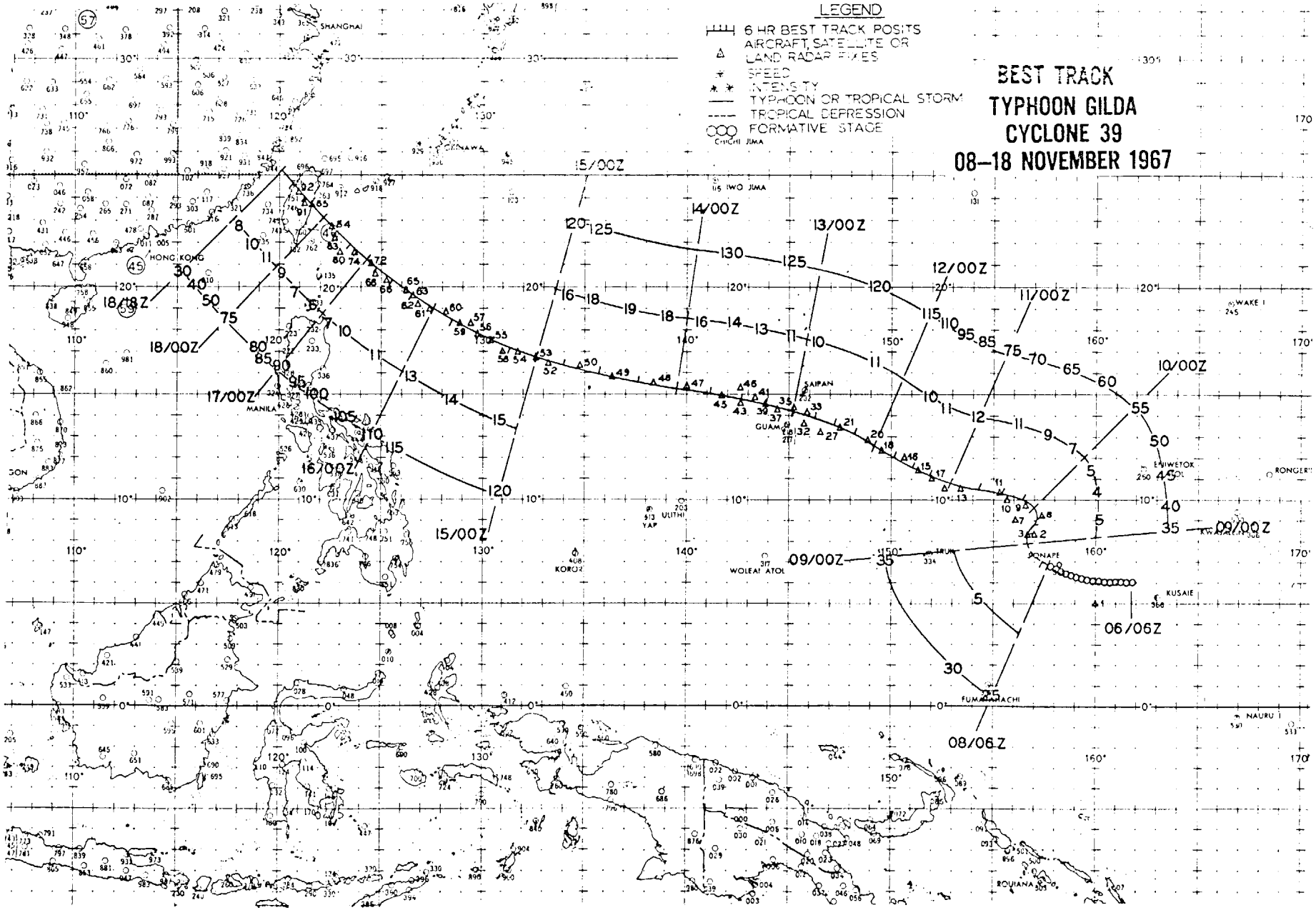
   B. CHARACTERISTICS AS A TYPHOON
      1. MINIMUM OBSERVED SLP - 890MBS AT 140400Z
      2. MINIMUM OBSERVED 700MB HEIGHT - 2270M. AT 140400Z
      3. MAXIMUM SURFACE WIND - 130 KTS (FROM BEST TRACK)
      4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 600 MI

II. DEVELOPMENT
   A. INITIAL IMPETUS - FRACTURE OF A POLAR TROUGH AND AN EASTERLY WAVE

   B. INITIAL SURFACE VORTEX
      1. JUNCTION VORTEX AT 060600Z
      2. SURFACE PRESSURE LESS THAN 1004MB

   C. 200MB FLOW ABOVE SURFACE VORTEX
      1. INITIAL - SOUTHWEST
      2. UPON REACHING TYPHOON INTENSITY - NORTHEAST

III. FINAL DISPOSITION - DISSIPATED OVER WATER


LEGEND
6 HR BEST TRACK POSITS
AIRCRAFT, SATELLITE OR LAND RADAR FIXES
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
FORMATIVE STAGE
BEST TRACK
TYPHOON GILDA
CYCLONE 39
08–18 NOVEMBER 1967
SHANGHAI
HONG KONG
MANILA
IWO JIMA
SAIPAN
GUAM
ULITHI
YAP
KOROR
WOLEAI ATOL
TRUK
PONAPE
KUSAIE
ENIWETOK
WAKE I
NAURU I
ROUIANA
15/00Z
14/00Z
13/00Z
12/00Z
11/00Z
10/00Z
09/00Z
08/06Z
06/06Z
18/18Z
18/00Z
17/00Z
16/00Z
15/00Z

EYE FIXES CYCLONE 39

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
1	080200Z	05.0N 160.0E	SLTLS	STG C	DIA --	BNDS -							
2	082132Z	08.5N 157.0E	SLTLS	STG -	DIA --	BNDS -							
3	090150Z	08.5N 156.8E	54-P-P15		---	---	999	---	--/--	----			--
4	090250Z	09.0N 156.0E	SLTLS	STG X	DIA 05	BNDS 2							
5	090425Z	08.5N 156.9E	54-P-P15	700MB	045	040	998	3033	11/--	----			F.B.
6	090950Z	08.3N 157.0E	VW-P-P10	0380M	026	030	995	---	--/--	CIRC	----	80	--
7	091540Z	08.6N 156.1E	VW-P-P05	0350M	032	035	991	3027	--/--	CIRC	----	90	--
8	092220Z	09.3N 157.2E	54-P-P05	700MB	045	040	988	2990	12/--	CIRC	----	20	--
9	100140Z	09.5N 156.0E	SLTLS	STG X	DIA 05	BNDS 2							
10	100409Z	09.8N 156.6E	54-P-P02	700MB	050	050	977	2920	16/--	CIRC	----	10	--
11	100952Z	10.0N 155.7E	VW-P-P05	0290M	070	060	982	---	--/--	ELIP	NW-SE	35X20	--
12	101540Z	10.4N 155.3E	VW-P-P05	0360M	060	055	981	2956	13/10	ELIP	NW-SE	70X50	--
13	102135Z	10.5N 153.4E	54-P-P01	700MB	055	070	975	2896	21/12	----			--
14	110300Z	10.7N 152.5E	54-P-P05	700MB	065	080	968	2822	19/--	----			--
15	110949Z	11.3N 151.2E	VW-P-P03	0190M	080	085	967	---	--/--	ELIP	NE-SW	70X55	06
16	111555Z	12.0N 150.6E	VW-P-P05	0230M	105	100	961	2835	16/--	CIRC	----	64	15
17	110236Z	11.0N 152.0E	SLTLS	STG X	DIA 06	BNDS 3							
18	112045Z	12.4N 149.5E	54-R-F10	700MB	---	---	---	---	--/--	----			--
19	112355Z	12.6N 149.3E	54-P-P03	700MB	080	130	964	2789	17/--	CIRC	----	20	--
20	120327Z	13.0N 148.5E	SLTLS	STG X	DIA 05	BNDS 3							
21	120346Z	12.9N 148.9E	54-P-P15	700MB	070	075	963	2783	18/--	ELIP	NW-SE	50X20	--
22	120900Z	13.3N 147.7E	LND RDR		---	---	---	---	--/--	----			--
23	120930Z	13.4N 147.6E	LND RDR		---	---	---	---	--/--	----			--
24	120955Z	13.4N 147.4E	VW-P-P03	0230M	100	100	953	---	--/--	ELIP	NW-SE	40X30	04

EYE FIXES CYCLONE 39

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
25	121000Z	13.4N 147.4E	LND RDR		---	---	---	---	--/--	----			--
26	121100Z	13.4N 147.1E	LND RDR		---	---	---	---	--/--	----			--
27	121200Z	13.4N 146.7E	LND RDR		---	---	---	---	--/--	----			--
28	121400Z	13.4N 146.5E	LND RDR		---	---	---	---	--/--	----			--
29	121452Z	13.6N 146.3E	VW-R-F05	700MB	---	---	---	---	--/--	----			--
30	121500Z	13.5N 146.3E	LND RDR		---	---	---	---	--/--	----			--
31	121600Z	13.5N 146.3E	VW-P-P02	700MB	075	045	958	2477	19/10	CIRC	----	21	--
32	122200Z	14.1N 145.6E	LND RDR		---	---	---	---	--/--	CIRC	----	27	--
33	122000Z	13.8N 145.9E	LND RDR		---	---	---	---	--/--	CIRC	----	28	15
34	122212Z	14.0N 145.6E	54-P-P01	700MB	080	075	943	2597	19/--	CIRC	----	21	--
35	122300Z	14.2N 145.4E	LND RDR		---	---	---	---	--/--	CIRC	----	22	--
36	130000Z	14.3N 145.1E	LND RDR		---	---	---	---	--/--	CIRC	----	21	--
37	130227Z	14.0N 144.5E	SLTLS	STG X	DIA 04 BNDS 3								
38	130230Z	14.4N 144.3E	LND RDR		---	---	---	---	--/--	----			--
39	130400Z	14.3N 144.3E	54-P-P01	700MB	120	100	920	2432	22/--	CIRC	----	20	10
40	130650Z	14.6N 143.9E	LND RDR		---	---	---	---	--/--	----			--
41	130900Z	14.6N 143.3E	VW-R-P--		---	---	---	---	--/--	----			--
42	131000Z	14.9N 143.2E	LND RDR		---	---	---	---	--/--	----			--
43	131000Z	14.7N 143.5E	VW-R-P05	0400M	---	---	---	---	--/--	CIRC	----	24	08
44	131200Z	14.8N 142.7E	VW-R-P--	700MB	---	---	---	---	--/--	CIRC	----	18	08
45	131300Z	15.2N 142.5E	LND RDR		---	---	---	---	--/--	----			--
46	131600Z	14.9N 141.7E	VW-R-P05	700MB	---	---	---	---	--/--	CIRC	----	18	06
47	132148Z	15.3N 140.0E	54-P-P03	700MB	090	130	909	2286	26/--	CIRC	----	20	--
48	140318Z	15.5N 138.5E	SLTLS	STG X	DIA 06 BNDS 4								

EYE FIXES CYCLONE 39

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
73	162020Z	20.9N 124.7E	VW-R-P05	700MB	---	---	---	---	--/--	----			--
74	162100Z	21.1N 124.5E	VW-P-P02	700MB	060	045	972	2666	17/15	CIRC	----	18	--
75	170300Z	21.1N 124.1E	54-P-P01	700MB	060	045	955	2707	16/--	----			F.B.
76	170354Z	21.5N 124.0E	SLTLS	STG X	DIA 05	BNDS 3							
77	170600Z	21.7N 123.7E	LND RDR		---	---	---	---	--/--	----			--
78	170600Z	21.6N 123.7E	54-P-P01	700MB	075	050	955	2691	15/--	----			F.B.
79	170900Z	21.3N 123.2E	LND RDR		---	---	---	---	--/--	----			--
80	170900Z	21.8N 123.5E	54-P-P01	700MB	075	050	955	2688	14/--	----			F.B.
81	171025Z	21.6N 123.6E	LND RDR		---	---	---	---	--/--	----			--
82	171125Z	21.8N 123.0E	LND RDR		---	---	---	---	--/--	----			--
83	171200Z	21.8N 122.9E	LND RDR		---	---	---	---	--/--	----			--
84	171600Z	22.1N 123.1E	VW-P-F10	700MB	---	---	953	2710	14/--	----			--
85	171800Z	22.4N 122.7E	VW-P-P10	700MB	---	---	---	2740	14/--	----			--
86	172030Z	22.8N 122.5E	VW-P-F05	700MB	---	---	---	2734	14/--	ELIP	N-S	40X30	--
87	172200Z	22.9N 122.2E	LND RDR		---	---	---	---	--/--	----			--
88	180200Z	23.8N 121.7E	LND RDR		---	---	---	---	--/--	----			--
89	180000Z	23.1N 122.5E	LND RDR		---	---	---	---	--/--	----			--
90	180249Z	23.9N 121.5E	54-R-P10	4880M	045	---	---	---	--/--	CIRC	----	20	--
91	180445Z	24.5N 121.0E	SLTLS	STG X	DIA 04	BNDS 2							
92	180555Z	23.9N 121.2E	54-P-P08	8250M	035	---	---	---	--/--	----			--
93	180846Z	24.2N 120.9E	54-P-F10	7610M	050	---	---	---	--/--	----			N.F.B.

EYE FIXES CYCLONE 39

FIX NO.	TIME	POSIT	UNIF-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL T/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
49	140400Z	15.5N 138.2E	54-P-P03	700MB	112	100	890	2270	19/--	CIRC	----	18	--
50	141000Z	15.9N 136.3E	VW-P-P03	700MB	110	---	910	2627	17/15	CONC		70-14	--
51	141500Z	16.3N 134.7E	VW-R-P10	700MB	---	---	---	---	--/--	CONC		65-19	--
52	142200Z	16.6N 133.1E	54-P-P02	700MB	080	080	919	2277	17/--	CIRC	----	25	--
53	150000Z	16.8N 132.6E	54-P-P01	700MB	125	100	---	---	--/--	----			--
54	150300Z	17.0N 131.8E	54-P-P01	700MB	130	100	919	2350	20/--	CIRC	----	40	--
55	150408Z	17.0N 131.0E	SLTLS	STG X	DIA 05	BNDS 4							
56	151030Z	17.6N 130.2E	VW-P-P03	700MB	085	---	928	2405	20/--	CIRC	----	35	--
57	151200Z	17.9N 129.8E	VW-R-F--		---	---	---	---	--/--	----			--
58	151300Z	18.0N 129.8E	VW-R-P--		---	---	---	---	--/--	----			--
59	151400Z	18.1N 129.5E	VW-R-P--		---	---	---	---	--/--	----			--
60	151500Z	18.3N 129.2E	VW-R-F--		---	---	---	---	--/--	----			--
61	151600Z	18.3N 128.9E	VW-P-P03	700MB	070	---	926	2432	19/--	ELIP	N-S	40X30	05
62	152120Z	18.9N 128.1E	54-P-P03	700MB	095	---	928	2481	24/--	CIRC	----	30	10
63	160053Z	19.0N 127.3E	54-P-P03	700MB	090	085	931	2512	18/--	CIRC	----	30	--
64	160313Z	19.2N 126.9E	54-P-P03	700MB	090	100	937	2548	18/--	CIRC	----	30	--
65	160533Z	19.6N 126.5E	54-P-P03	700MB	090	100	937	2859	17/--	CIRC	----	30	--
66	160630Z	19.6N 126.3E	ACFT RUR		---	---	---	---	--/--	----			--
67	160900Z	19.9N 126.1E	VW-R-P05	0300M	---	---	---	---	--/--	CIRC	----	08	08
68	161412Z	20.3N 125.1E	VW-R-P10	0400M	---	---	---	---	--/--	----			--
69	161500Z	20.4N 125.0E	VW-R-P04	0430M	100	085	---	---	--/--	CIRC	----	20	09
70	161600Z	20.6N 125.1E	VW-R-P--		---	---	---	---	--/--	----			--
71	161700Z	20.6N 124.8E	VW-R-P--		--	---	---	---	--/--	----			--
72	161800Z	20.7N 124.8E	VW-P-P02	700MB	0	045	951	2643	12/09	CIRC	----	30	0

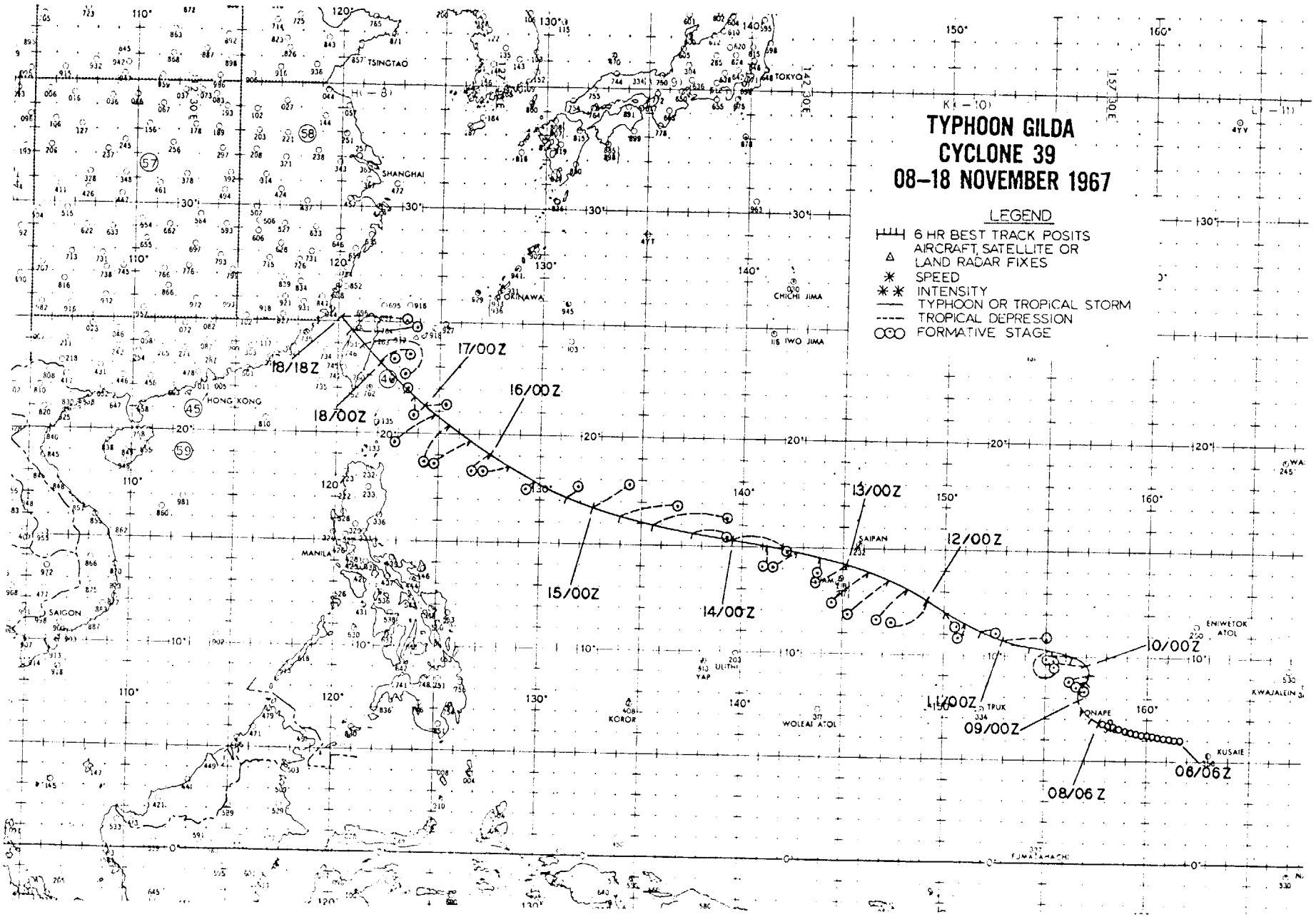
TROPICAL CYCLONE 39 -- 11/08/0600Z TO 11/18/1800Z
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION LAT.	LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
090000Z	07.8N	156.7E	--------	--------	--------
090600Z	08.3N	156.8E	116-0012	--------	--------
091200Z	08.7N	156.9E	217-0030	--------	--------
091800Z	09.0N	157.1E	244-0048	--------	--------
100000Z	09.6N	157.0E	277-0096	--------	--------
100600Z	10.0N	156.3E	266-0072	--------	--------
101200Z	10.3N	155.3E	180-0036	--------	--------
101800Z	10.4N	154.1E	214-0018	--------	--------
110000Z	10.6N	152.9E	085-0120	--------	--------
110600Z	11.1N	151.9E	101-0030	270-0090	--------
111200Z	11.6N	151.0E	189-0042	199-0036	--------
111800Z	12.1N	150.1E	147-0054	226-0072	--------
120000Z	12.7N	149.1E	237-0126	144-0102	--------
120600Z	13.1N	148.1E	221-0114	201-0102	246-0240
121200Z	13.5N	147.1E	229-0144	227-0144	--------
121800Z	13.9N	146.1E	226-0144	206-0138	230-0234
130000Z	14.2N	145.1E	233-0096	242-0258	--------
130600Z	14.5N	143.9E	180-0048	234-0228	227-0198
131200Z	14.7N	142.7E	238-0078	234-0252	--------
131800Z	15.0N	141.1E	180-0060	226-0234	222-0216
140000Z	15.3N	139.4E	104-0162	238-0078	--------
140600Z	15.7N	137.6E	101-0090	128-0102	224-0258
141200Z	16.1N	135.7E	089-0198	180-0042	--------
141800Z	16.4N	134.0E	080-0156	119-0144	206-0234
150000Z	16.7N	132.6E	060-0114	102-0372	--------
150600Z	17.2N	131.2E	051-0042	089-0234	114-0204
151200Z	17.8N	129.8E	249-0030	090-0318	--------
151800Z	18.5N	128.4E	261-0072	081-0282	113-0240
160000Z	19.0N	127.4E	218-0066	068-0234	--------
160600Z	19.6N	126.4E	237-0108	093-0102	084-0342
161200Z	20.3N	125.4E	210-0108	229-0144	--------
161800Z	20.7N	124.7E	238-0120	253-0192	073-0354
170000Z	21.1N	124.2E	085-0060	234-0198	--------
170600Z	21.5N	123.7E	170-0036	245-0258	093-0090

TROPICAL CYCLONE 39 -- 11/08/0600Z TO 11/18/1800Z
POSITION AND FORECAST VERIFICATION DATA (CONT)

DTG	STORM POSITION LAT.	LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
171200Z	21.9N	123.2E	046-0006	239-0252	--------
171800Z	22.4N	122.7E	007-0054	247-0282	246-0330
180000Z	23.1N	122.1E	072-0072	103-0102	--------
180600Z	23.9N	121.1E	124-0144	134-0132	240-0444
181200Z	24.5N	120.5E	085-0186	104-0138	--------

AVERAGE 24 HOUR ERROR - 0084 MI.
AVERAGE 48 HOUR ERROR - 0175 MI.
AVERAGE 72 HOUR ERROR - 0260 MI.


TYPHOON GILDA
CYCLONE 39
08–18 NOVEMBER 1967
LEGEND
6 HR BEST TRACK POSITS
AIRCRAFT, SATELLITE OR LAND RADAR FIXES
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
FORMATIVE STAGE
18/18Z
18/00Z
17/00Z
16/00Z
15/00Z
14/00Z
13/00Z
12/00Z
11/00Z
10/00Z
09/00Z
08/06Z
TSINGTAO
SHANGHAI
TOKYO
OKINAWA
CHICHI JIMA
IWO JIMA
HONG KONG
MANILA
SAIGON
SAIPAN
YAP
ULITHI
KOROR
WOLEAI ATOL
TRUK
PONAPE
ENIWETOK ATOL
KWAJALEIN
KUSAIE
FUJIYAMACHI

TROPICAL CYCLONE 40 - 11/17/0000Z TO 11/24/0000Z

I. DATA

A. STATISTICS
1. NUMBER OF WARNINGS ISSUED - 29
2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 15
3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 2028 MI

B. CHARACTERISTICS AS A TYPHOON
1. MINIMUM OBSERVED SLP - 953MBS AT 202100Z
2. MINIMUM OBSERVED 700MB HEIGHT - 2691M. AT 202100Z
3. MAXIMUM SURFACE WIND - 110 KTS (FROM BEST TRACK)
4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 275 MI

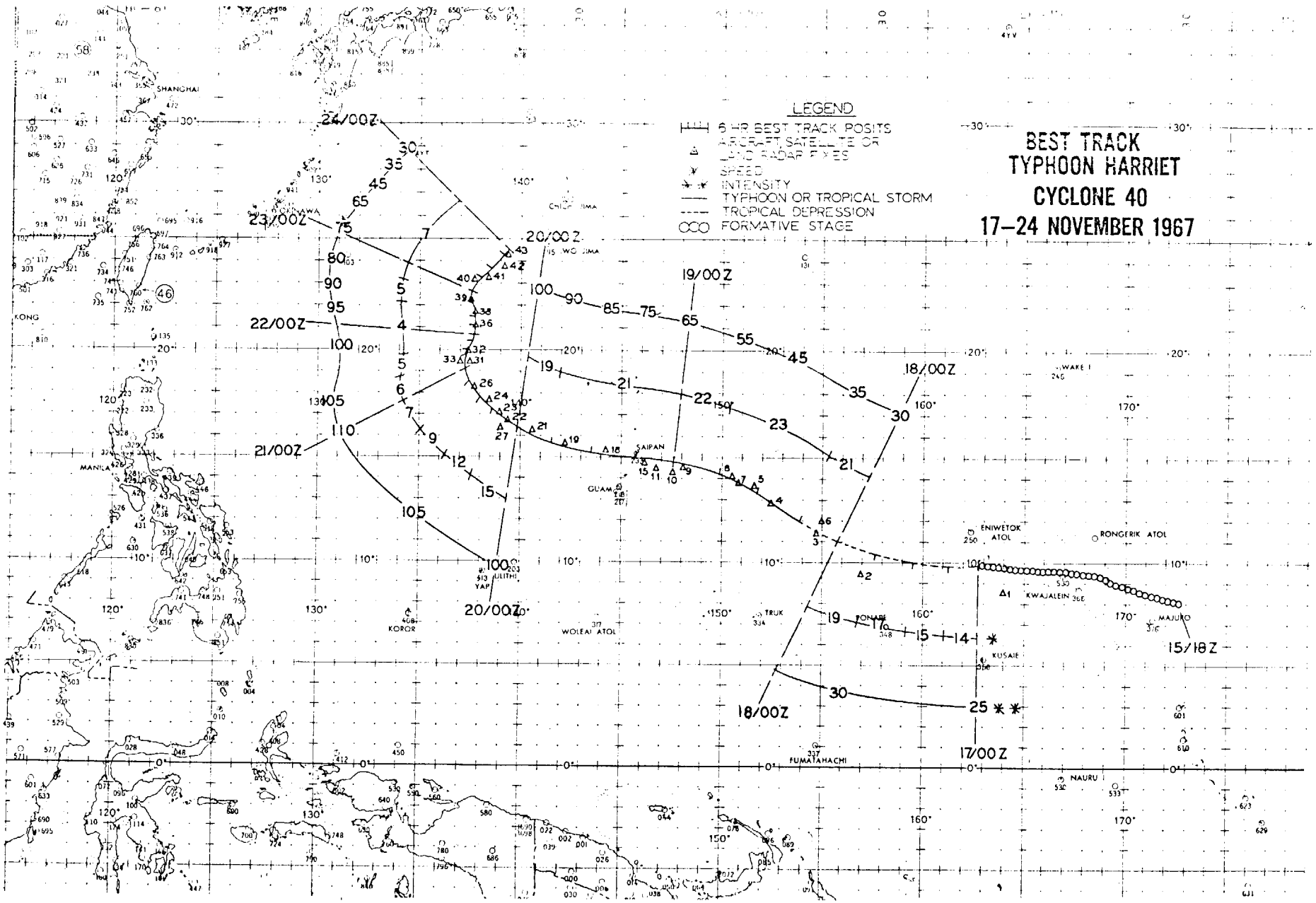
II. DEVELOPMENT

A. INITIAL IMPETUS - LOW LEVEL SURGE INTO CYCLONIC CIRCULATION FROM THE SOUTH WITH SUBSEQUENT DIVERGENCE AT 200MB LEVEL

B. INITIAL SURFACE VORTEX
1. JUNCTION VORTEX AT 151800Z
2. SURFACE PRESSURE LESS THAN 1007MB

C. 200MB FLOW ABOVE SURFACE VORTEX
1. INITIAL - FAST
2. UPON REACHING TYPHOON INTENSITY - NORTHEAST

III. FINAL DISPOSITION - DISSIPATED [illegible] WATER


LEGEND
6 HR BEST TRACK POSITS
AIRCRAFT SATELLITE OR
LAND RADAR FIXES
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
FORMATIVE STAGE
BEST TRACK
TYPHOON HARRIET
CYCLONE 40
17–24 NOVEMBER 1967
24/00Z
23/00Z
22/00Z
21/00Z
20/00Z
19/00Z
18/00Z
17/00Z
15/18Z
SHANGHAI
CHICHI JIMA
IWO JIMA
SAIPAN
GUAM
MANILA
KOROR
YAP
ULITHI
WOLEAI ATOL
TRUK
ENIWETOK ATOL
RONGERIK ATOL
KWAJALEIN
MAJURO
KUSAIE
FUMATAHACHI
NAURU
WAKE I

EYE FIXES CYCLONE 40

FIX NO.	TIME	POSIT	UNIT-METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
1	170155Z	08.5N 164.0E	SLTLS	STG C	DIA -- BNDS -								
2	172113Z	09.5N 157.0E	SLTLS	STG -	DIA -- BNDS -								
3	180245Z	12.0N 155.0E	SLTLS	STG C	DIA 02 BNDS -								
4	180316Z	11.4N 154.8E	54-P-P03	0400M	026	025	004	---	--/--	----			--
5	180915Z	12.8N 152.2E	VW-P-P10	0320M	---	045	992	---	--/--	CIRC	----	10	05
6	181300Z	13.6N 151.6E	VW-R-P10	0810M	---	---	---	---	--/--	----			--
7	181521Z	13.9N 150.9E	VW-P-P05	0400M	---	050	982	---	--/--	ELIP	NE-SW	14X10	03
8	181815Z	14.1N 150.5E	VW-R-P08	0400M	---	---	---	---	--/--	ELIP	NW-SE	14X12	06
9	182245Z	14.5N 148.0E	54-P-P05	700MB	---	065	985	2954	12/--	CIRC	----	20	--
10	190015Z	14.3N 147.5E	LND RDR		---	---	---	---	--/--	----			--
11	190100Z	14.7N 146.8E	LND RDR		---	---	---	---	--/--	----			--
12	190100Z	14.7N 147.4E	54-P-P05	700MB	---	070	982	2920	13/--	CIRC	----	10	--
13	190200Z	14.7N 146.8E	LND RDR		---	---	---	---	--/--	----			--
14	190230Z	14.7N 146.6E	LND RDR		---	---	---	---	--/--	----			--
15	190336Z	15.0N 146.0E	SLTLS	STG C	DIA -- BNDS -								
16	190400Z	14.9N 146.1E	54-P-P01	700MB	068	070	978	2908	15/--	CIRC	----	10	--
17	190500Z	14.9N 145.7E	LND RDR		---	---	---	---	--/--	----			--
18	190600Z	15.0N 145.6E	LND RDR		---	---	---	---	--/--	----			--
19	191017Z	15.3N 144.1E	VW-P-P05	0240M	---	090	979	---	--/--	----			--
20	191601Z	15.7N 142.1E	VW-P-P05	700MB	---	---	970	2914	15/--	CIRC	----	18	04
21	192147Z	16.3N 140.6E	54-P-P02	700MB	085	075	963	2777	14/--	CIRC	----	20	--
22	200400Z	16.9N 139.4E	54-P-P01	700MB	082	080	977	2893	15/--	CIRC	----	25	--
23	200237Z	16.5N 139.0E	SLTLS	STG X	DIA 03 BNDS 4								
24	200500Z	17.1N 139.0E	54-R-P--		---	---	---	---	--/--	----			--

EYE FIXES CYCLONE 40

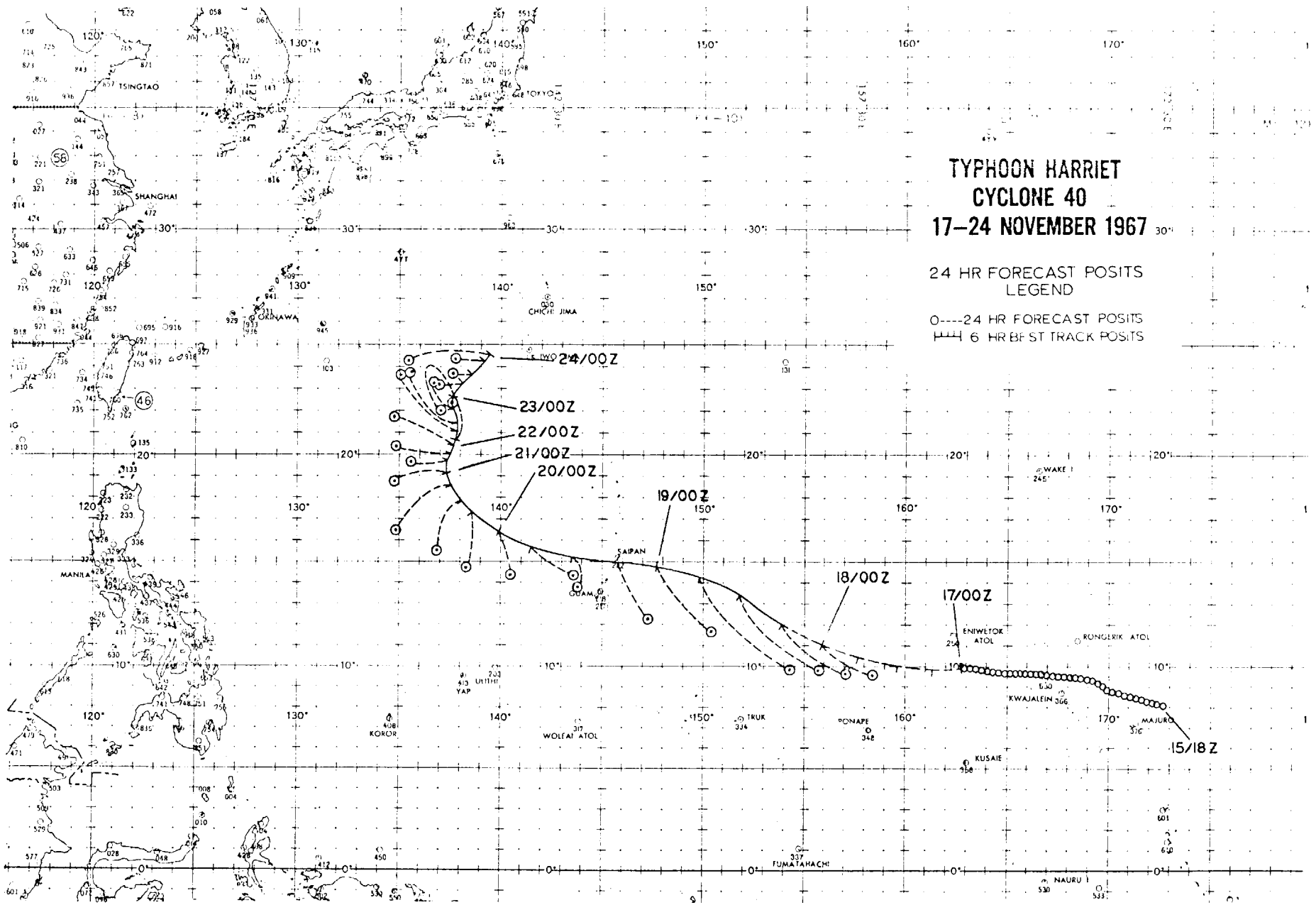
FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
25	200930Z	17.8N 138.3E	VW-R-F1S	0440M	---	---	---	---	--/--	----			--
26	200945Z	17.6N 138.5E	VW-R-P05	0440M	---	---	---	---	--/--	CIRC	----	15	--
27	201250Z	18.4N 137.8E	VW-R-P--	0380M	---	---	---	---	--/--	----			--
28	201500Z	18.2N 138.0E	ACFT RDR	6400M	---	---	---	---	--/--	----			--
29	201600Z	18.4N 137.6E	VW-R-P05	700MB	043	035	---	---	--/--	CIRC	----	12	05
30	202100Z	18.6N 137.4E	54-P-P03	700MB	040	100	953	2691	21/--	CIRC	----	15	--
31	210238Z	19.5N 137.3E	54-P-P03	700MB	103	110	953	2732	22/--	CIRC	----	10	05
32	210326Z	19.5N 137.0E	SLTLS	STG X	DIA 04	BNDS 4							
33	210900Z	20.0N 137.3E	VW-P-P05	0240M	---	080	967	---	--/--	CIRC	----	20	11
34	211500Z	20.3N 137.6E	VW-P-P05	0310M	072	080	972	---	--/--	CIRC	----	32	07
35	212200Z	20.2N 138.1E	54-P-P02	700MB	095	100	967	2847	22/--	CIRC	----	40	--
36	220400Z	21.1N 137.7E	54-P-P05	700MB	080	120	962	2841	18/--	CIRC	----	30	08
37	221030Z	21.3N 137.7E	VW-P-P03	700MB	---	---	980	2879	10/--	CIRC	----	25	08
38	221535Z	21.9N 137.8E	VW-R-P05	700MB	---	---	---	---	--/--	CIRC	----	25	05
39	222130Z	22.4N 137.5E	54-P-P05	700MB	085	080	974	2859	19/--	CIRC	----	30	--
40	230330Z	23.1N 137.7E	54-P-P05	700MB	100	120	975	2874	20/--	CIRC	----	30	--
41	230946Z	23.4N 138.3E	VW-P-P05	700MB	---	---	998	3048	21/--	ELIP	NE-SW	40X20	10
42	231624Z	23.9N 139.1E	VW-P-P05	0310M	035	---	002	3086	15/00	CIRC	----	30	08
43	232148Z	24.3N 139.3E	54-P-P02	700MB	027	030	006	3149	13/--	CIRC	----	40	--

TROPICAL CYCLONE 40 -- 11/17/0000Z TO 11/24/0000Z

POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION LAT.	LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
180600Z	11.9N	153.9E	127-0222	--------	--------
181200Z	13.3N	151.9E	133-0300	--------	--------
181800Z	14.2N	149.9E	135-0360	--------	--------
190000Z	14.5N	147.7E	140-0234	--------	--------
190600Z	15.0N	145.7E	155-0180	--------	--------
191200Z	15.4N	143.5E	172-0096	--------	--------
191800Z	15.9N	141.5E	130-0156	--------	--------
200000Z	16.6N	140.0E	172-0138	--------	--------
200600Z	17.3N	138.8E	191-0156	--------	--------
201200Z	17.9N	138.0E	202-0156	174-0234	--------
201800Z	18.6N	137.6E	230-0204	170-0252	--------
210000Z	19.1N	137.3E	258-0138	207-0282	--------
210600Z	19.7N	137.3E	270-0102	225-0360	--------
211200Z	20.0N	137.4E	274-0144	234-0402	--------
211800Z	20.3N	137.5E	299-0168	251-0468	209-0360
220000Z	20.7N	137.6E	352-0090	270-0402	--------
220600Z	21.0N	137.7E	038-0204	283-0264	246-0582
221200Z	21.4N	137.8E	046-0198	282-0282	--------
221800Z	22.0N	137.7E	073-0228	345-0186	264-0702
230000Z	22.8N	137.5E	101-0246	058-0354	--------
230600Z	23.3N	138.0E	089-0204	075-0636	324-0180
231200Z	23.5N	138.7E	090-0186	074-0630	--------
231800Z	24.1N	139.2E	087-0186	082-0642	044-0294

AVERAGE 24 HOUR ERROR - 0186 MI.
AVERAGE 48 HOUR ERROR - 0385 MI.
AVERAGE 72 HOUR ERROR - 0423 MI.


TYPHOON HARRIET
CYCLONE 40
17–24 NOVEMBER 1967
24 HR FORECAST POSITS
LEGEND
0----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS
24/00Z
23/00Z
22/00Z
21/00Z
20/00Z
19/00Z
18/00Z
17/00Z
15/18Z
TSINGTAO
SHANGHAI
OKINAWA
CHICHI JIMA
TOKYO
MANILA
SAIPAN
GUAM
YAP
KOROR
WOLEAI ATOL
TRUK
PONAPE
KUSAIE
ENIWETOK ATOL
KWAJALEIN
RONGERIK ATOL
MAJURO
WAKE I
NAURU I
FUMATAHACHI

ANNEX
A

SUMMARY OF TROPICAL CYCLONES

IN THE

EASTERN NORTH PACIFIC OCEAN
(180 DEGREES TO NORTH AMERICAN COAST)

FOR

1967

Fleet Weather Central Alameda and Fleet Weather Central Pearl Harbor issued a record total of 474 tropical warnings on 6 hurricanes, 12 tropical storms and 2 tropical depressions in the Eastern North Pacific during 1967.

The following six year summary covering the Fleet Weather Central Alameda/Fleet Weather Central Pearl Harbor areas is presented for comparison:

SUMMARY OF EASTERN PACIFIC TROPICAL CYCLONE DATA

	1962	1963	1964	1965	1966	1967
TOTAL NUMBER OF WARNINGS*	122	80	60	244	342	474
CALENDAR DAYS OF WARNINGS*	35	26	21	73	70	119
TROPICAL DEPRESSIONS				2	6	2
TROPICAL STORMS	6	5	4	9	6	12
HURRICANES	2	4	2	1	7	6
TOTAL TROPICAL CYCLONES*	8	9	6	12	19	20

*Tropical Depression information not available 1962-1964.

Land strikes on Baja, California were recorded on Hurricane KATRINA and Tropical Storm OLIVIA. Extensive damage, flooding and loss of property resulted in KATRINA's overland passage.

An attempt was made to utilize the Fleet Numerical Weather Facility (FNWF) "Hatrack" steering program as a tool for predicting movement of tropical systems. Both the 700 and 500 mb levels were monitored, but to date results are inconclusive. In addition, a local program utilizing the FNWF "RADFO" is in the development stage. Both programs will be tested extensively during the 1968 season.

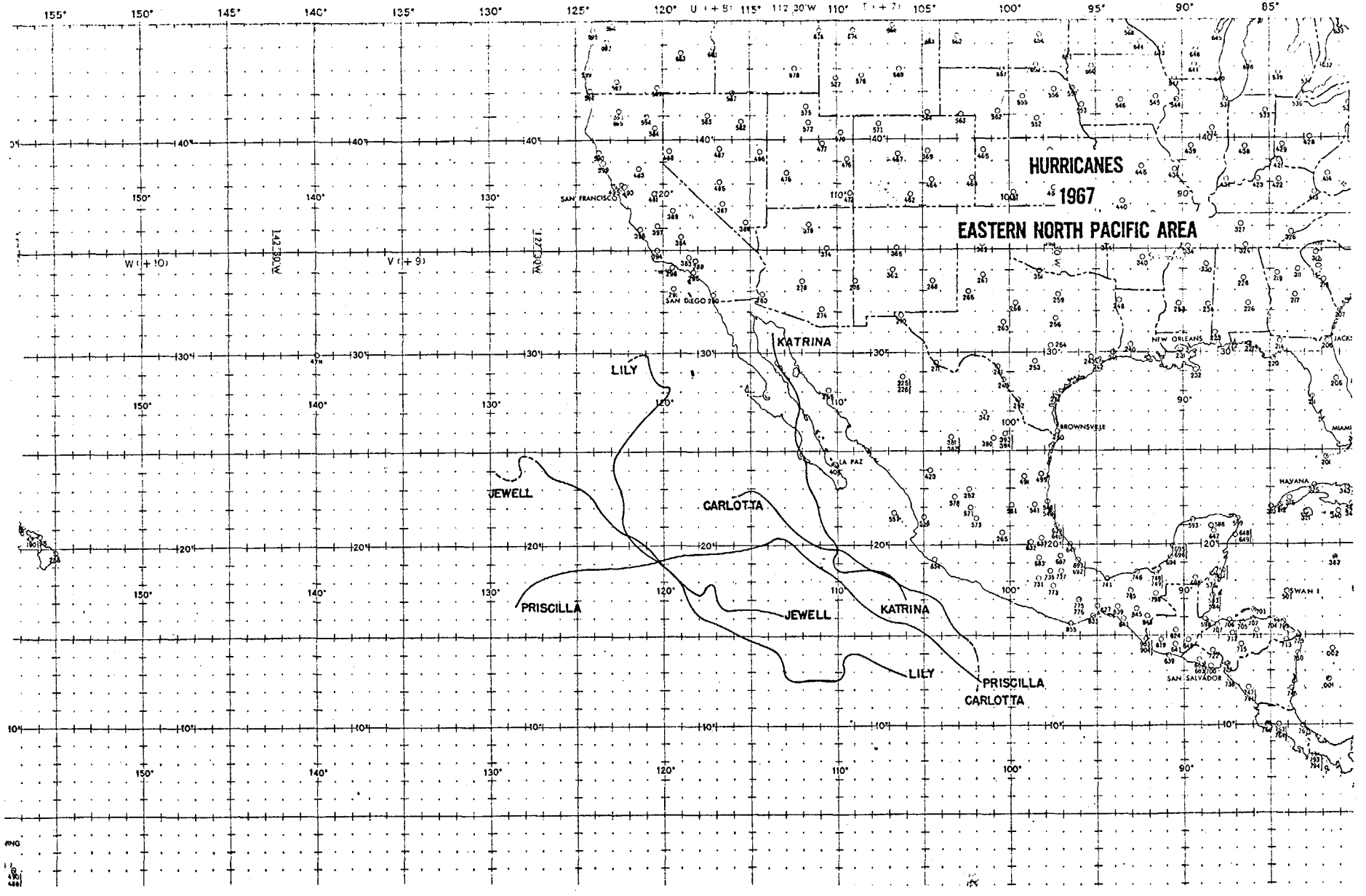
The APT system remains as the primary source of location as shown below in a satellite/recon comparison:

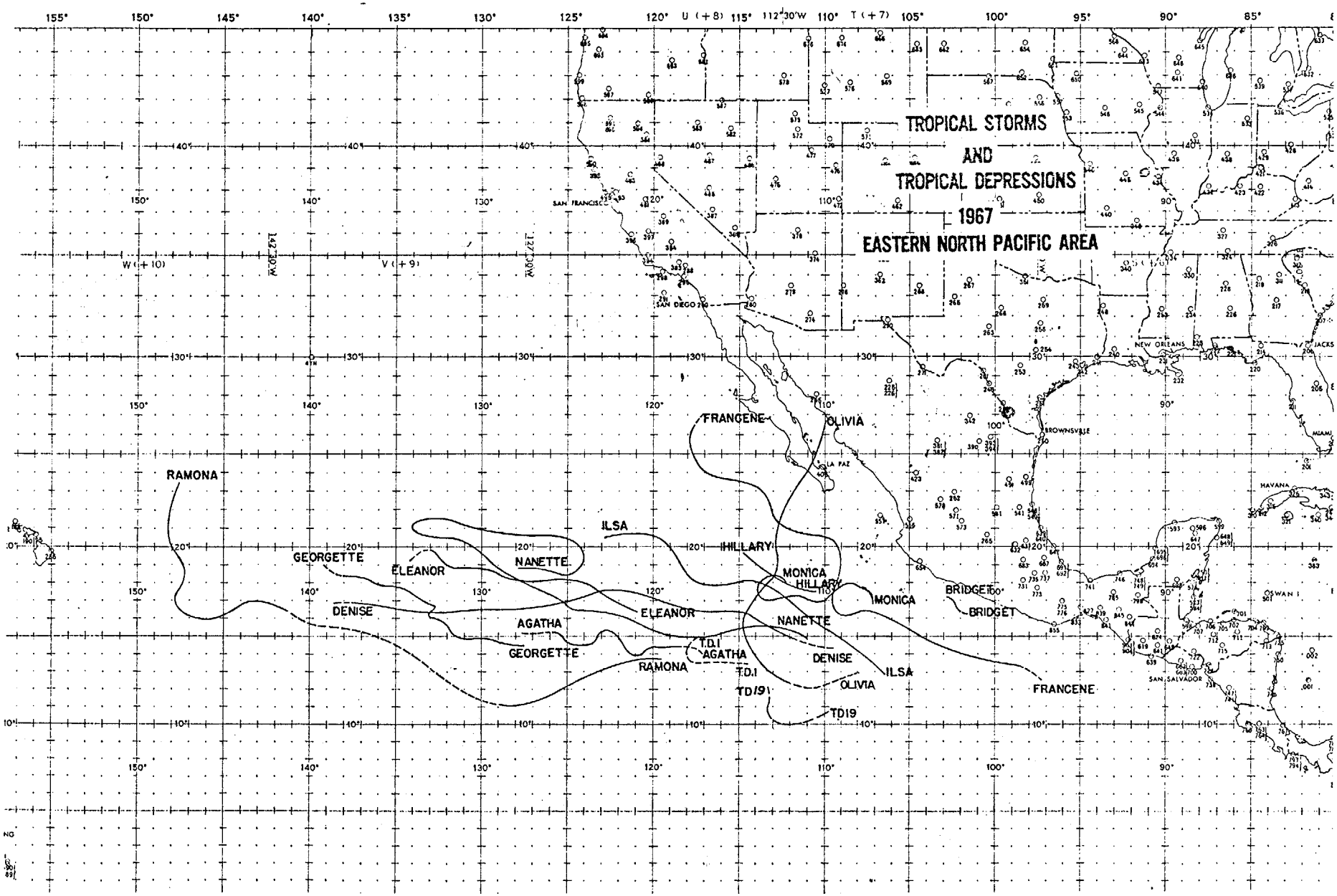
STORM	SATELLITE FIX	RECON FIX
Carlotta	9	1
Jewell	7	5
Katrina	1	2
Lily	15	3
Priscilla	7	1
Sarah	4	8

Antenna location and interference at the ESSA, San Francisco Airport site continues to be a major problem in locating and discerning tropical systems below 20 degrees north latitude. Back up data from PMR Pt. Mugu is most helpful, but descriptions of cloud patterns are verbal and analysts at Fleet Weather Central Alameda are hampered by being unable to actually see the tropical systems on APT readouts.

TROPICAL CYCLONES FOR THE 1967 SEASON

	CYCLONE	PERIOD
01.	Tropical Depression	18 MAY - 19 MAY
02.	Tropical Storm AGATHA	07 JUN - 11 JUN
03.	Tropical Storm BRIDGET	15 JUN - 16 JUN
04.	Hurricane CARLOTTA	22 JUN - 27 JUN
05.	Tropical Storm DENISE	08 JUL - 15 JUL
06.	Tropical Storm ELEANOR	13 JUL - 16 JUL
07.	Tropical Storm FRANCENE	23 JUL - 28 JUL
08.	Tropical Storm GEORGETTE	26 JUL - 30 JUL
09.	Tropical Storm HILARY	10 AUG - 11 AUG
10.	Tropical Storm ILSA	11 AUG - 16 AUG
11.	Hurricane JEWELL	17 JUL - 23 JUL
12.	Hurricane KATRINA	29 AUG - 02 SEP
13.	Hurricane LILY	04 SEP - 12 SEP
14.	Tropical Storm MONICA	13 SEP - 22 SEP
15.	Tropical Storm NANETTE	13 SEP - 23 SEP
16.	Tropical Storm OLIVIA	05 OCT - 14 OCT
17.	Hurricane PRISCILLA	14 OCT - 21 OCT
18.	Tropical Storm RAMONA	22 OCT - 03 NOV
19.	Tropical Depression	25 OCT - 29 OCT
28.	Hurricane SARAH	08 SEP - 14 SEP


HURRICANES
1967
EASTERN NORTH PACIFIC AREA
KATRINA
LILY
JEWELL
CARLOTTA
PRISCILLA
JEWELL
KATRINA
LILY
PRISCILLA
CARLOTTA
SAN FRANCISCO
SAN DIEGO
LA PAZ
NEW ORLEANS
BROWNSVILLE
HAVANA
SAN SALVADOR
SWAN I


TROPICAL STORMS
AND
TROPICAL DEPRESSIONS
1967
EASTERN NORTH PACIFIC AREA
RAMONA
GEORGETTE
ELEANOR
NANETTE
ILSA
HILLARY
MONICA
BRIDGET
DENISE
AGATHA
T.D.I
TD19
OLIVIA
FRANCENE
SAN FRANCISCO
SAN DIEGO
LA PAZ
NEW ORLEANS
BROWNSVILLE
HAVANA
SAN SALVADOR

Position data for tropical cyclones one through eight were not available at the time of publication. For amplifying information on those storms, contact Fleet Weather Central, Alameda.

TROPICAL STORM HILARY
10 AUG - 11 AUG

DTG	LAT	LONG	DTG	LAT	LONG
100000Z	17.5N	110.6W	101800Z	19.0N	114.0W
100600Z	17.7N	111.7W	110000Z	19.8N	114.8W
101200Z	18.2N	112.8W			

TROPICAL STORM ILSA
11 AUG - 16 AUG

DTG	LAT	LONG	DTG	LAT	LONG
111800Z	13.0N	106.3W	140000Z	18.0N	116.0W
120000Z	13.7N	107.4W	140600Z	18.1N	117.7W
120600Z	14.5N	108.5W	141200Z	19.1N	118.6W
121200Z	15.2N	109.5W	141800Z	20.4N	119.4W
121800Z	15.9N	110.7W	150000Z	20.8N	120.1W
130000Z	16.6N	111.6W	150600Z	21.8N	121.1W
130600Z	17.3N	112.7W	151200Z	21.7N	122.2W
131200Z	18.0N	113.8W	151800Z	20.5N	123.0W
131800Z	18.2N	115.1W			

TROPICAL STORM MONICA
13 SEP - 22 SEP

DTG	LAT	LONG	DTG	LAT	LONG
131800Z	16.6N	107.2W	180000Z	17.8N	109.3W
140000Z	16.7N	107.2W	180600Z	17.5N	109.5W
140600Z	16.8N	107.3W	181200Z	17.1N	109.9W
141200Z	16.9N	107.4W	181800Z	17.0N	110.4W
141800Z	17.0N	107.5W	190000Z	17.2N	110.9W
150000Z	17.1N	107.6W	190600Z	17.3N	111.4W
150600Z	17.2N	107.7W	191200Z	17.3N	112.3W
151200Z	17.3N	107.8W	200000Z	17.1N	113.5W
151800Z	17.4N	107.9W	200600Z	17.2N	113.8W
160000Z	17.5N	108.0W	201200Z	17.6N	113.9W
160600Z	17.5N	108.1W	201800Z	18.0N	113.9W
161200Z	17.6N	108.2W	210000Z	18.4N	113.6W
161800Z	17.7N	108.4W	210600Z	18.6N	112.9W
170000Z	17.8N	108.5W	211200Z	18.4N	112.2W
170600Z	17.8N	108.6W	211800Z	17.9N	112.1W
171200Z	17.9N	108.8W	220000Z	17.9N	112.1W
171800Z	18.0N	109.0W			

TROPICAL STORM NANETTE
13 SEP - 23 SEP

DTG	LAT	LONG	DTG	LAT	LONG
130000Z	15.0N	111.0W	181200Z	18.1N	127.8W
130600Z	15.3N	112.0W	181800Z	18.8N	128.7W
131200Z	15.6N	112.9W	190000Z	19.5N	129.7W
131800Z	15.6N	114.0W	190600Z	20.0N	130.2W
140000Z	15.4N	115.2W	191200Z	20.3N	130.8W
140600Z	15.2N	116.2W	191800Z	20.4N	131.3W
141200Z	15.1N	116.5W	200000Z	20.7N	132.0W
141800Z	15.0N	117.0W	200600Z	21.0N	134.0W
150000Z	15.0N	117.6W	201200Z	21.7N	133.0W
150600Z	15.0N	118.1W	201800Z	21.1N	130.2W
151200Z	15.2N	119.2W	210000Z	20.8N	127.9W
151800Z	15.3N	119.7W	210600Z	20.8N	127.1W
160000Z	15.6N	120.3W	211200Z	20.6N	125.2W
160600Z	15.9N	120.9W	211800Z	20.2N	124.2W
161200Z	16.1N	121.4W	220000Z	19.8N	124.0W
161800Z	16.2N	122.2W	220600Z	19.5N	124.0W
170000Z	16.5N	123.0W	221200Z	19.0N	124.2W
170600Z	16.5N	123.8W	221800Z	18.8N	124.6W
171200Z	16.6N	124.8W	230000Z	18.6N	124.9W
171800Z	17.0N	125.1W	230600Z	18.8N	125.8W
180000Z	17.4N	126.0W	231200Z	18.9N	126.8W
180600Z	17.9N	126.8W	231800Z	18.9N	127.9W

TROPICAL STORM OLIVIA
05 OCT - 14 OCT

DTG	LAT	LONG	DTG	LAT	LONG
051800Z	13.0N	108.0W	100600Z	15.5N	114.9W
060000Z	12.5N	109.5W	101200Z	15.8N	114.8W
060600Z	12.2N	110.2W	101800Z	16.4N	114.7W
061200Z	12.1N	110.9W	110000Z	16.9N	114.3W
061800Z	12.1N	111.5W	110600Z	17.5N	113.9W
070000Z	12.2N	112.0W	111200Z	18.1N	113.3W
070600Z	12.4N	112.2W	111800Z	18.6N	113.0W
071200Z	12.5N	112.5W	120000Z	19.0N	112.7W
071800Z	12.6N	112.8W	120600Z	19.7N	112.8W
080000Z	12.9N	113.0W	121200Z	20.5N	112.9W
080600Z	13.0N	113.2W	121800Z	21.2N	112.8W
081200Z	13.4N	113.9W	130000Z	21.9N	112.5W
081800Z	13.7N	114.0W	130600Z	22.6N	112.1W
090000Z	13.9N	114.0W	131200Z	23.6N	111.5W
090600Z	14.0N	114.2W	131800Z	24.5N	110.8W
091200Z	14.3N	114.3W	140000Z	25.2N	110.6W
091800Z	14.8N	114.8W	140600Z	25.8N	110.3W
100000Z	15.2N	114.8W	141200Z	26.8N	110.0W

TROPICAL STORM RAMONA
22 OCT - 03 NOV

DTG	LAT	LONG	DTG	LAT	LONG
220000Z	14.9N	119.5W	281200Z	15.6N	138.9W
220600Z	14.9N	120.4W	281800Z	15.6N	139.8W
221200Z	13.7N	121.3W	290000Z	15.9N	140.4W
221800Z	13.4N	122.2W	290600Z	16.2N	140.9W
230000Z	13.3N	122.9W	291200Z	16.4N	141.4W
230600Z	13.0N	123.5W	291800Z	16.8N	141.9W
231200Z	12.5N	124.6N	300000Z	16.9N	142.4W
231800Z	11.9N	125.7W	300600Z	16.9N	143.3W
240000Z	11.5N	126.5W	301200Z	16.8N	143.8W
240600Z	11.3N	127.0W	301800Z	16.7N	144.2W
241200Z	11.2N	127.6W	310000Z	16.4N	144.6W
241800Z	11.2N	128.3W	310600Z	16.3N	144.9W
250000Z	11.3N	129.0W	311200Z	16.1N	145.2W
250600Z	11.4N	129.8W	311800Z	16.0N	145.5W
251200Z	11.7N	130.6W	010000Z	16.0N	146.0W
251800Z	12.0N	131.3W	010600Z	16.0N	146.5W
260000Z	12.4N	132.0W	011200Z	16.1N	147.0W
260600Z	12.8N	132.4W	011800Z	16.3N	147.3W
261200Z	13.2N	133.2W	020000Z	16.5N	147.6W
261800Z	13.6N	133.6W	020600Z	17.4N	147.9W
270000Z	14.0N	134.2W	021200Z	18.5N	147.3W
270600Z	14.3N	134.8W	021800Z	19.6N	147.7W
271200Z	14.7N	135.4W	030000Z	20.3N	148.1W
271800Z	15.2N	136.8W	030600Z	21.2N	148.3W
280000Z	15.3N	137.1W	031200Z	22.4N	148.0W
280600Z	15.5N	138.0W	031800Z	23.5N	147.7W

HURRICANE "CARLOTTA" - 220600Z TO 270000Z JUNE 1967

I. DATA
   A. Statistics
      1. Number of warnings issued - 20
      2. Number of warnings with hurricane intensity - 8
      3. Total distance traveled during tropical warning period - 1030 mi

   B. Characteristics
      1. Minimum observed SLP - Unknown
      2. Minimum observed 700 mb height - UNKNOWN
      3. Maximum surface wind - 65 knots
      4. Maximum radius of surface circulation - 300 mi

II. DEVELOPMENT
   A. Initial impetus - ITCZ

   B. Initial surface vortex
      1. 220600Z
      2. Surface pressure less than 1008mb

   C. Time storm reached hurricane intensity - 240000Z

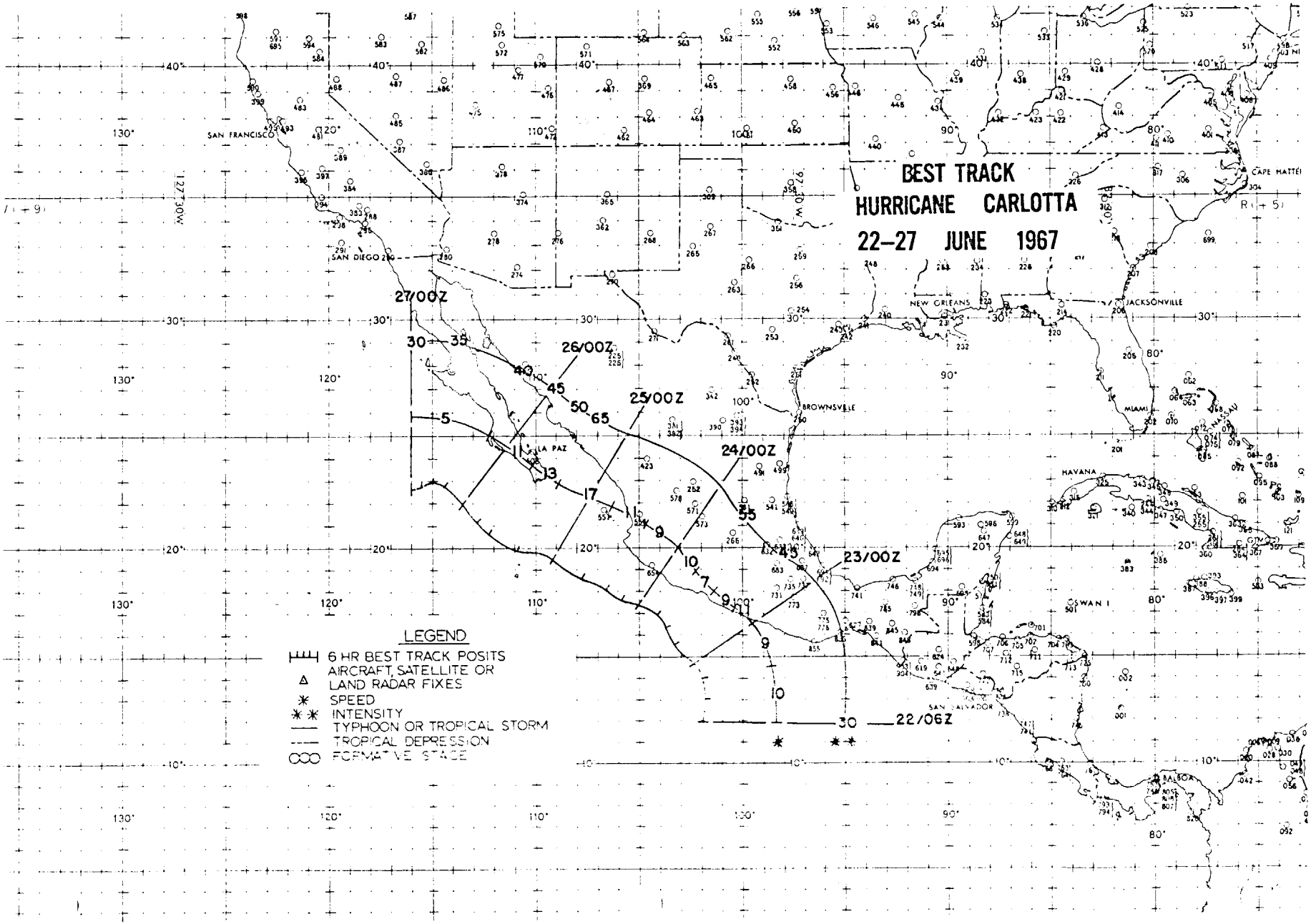
III. FINAL DISPOSITION
   A. Dissipated over water

TROPICAL STORM OLIVIA
05 OCT - 14 OCT

DTG	LAT	LONG	DTG	LAT	LONG
051800Z	13.0N	108.0W	100600Z	15.5N	114.9W
060000Z	12.5N	109.5W	101200Z	15.8N	114.8W
060600Z	12.2N	110.2W	101800Z	16.4N	114.7W
061200Z	12.1N	110.9W	110000Z	16.9N	114.3W
061800Z	12.1N	111.5W	110600Z	17.5N	113.9W
070000Z	12.2N	112.0W	111200Z	18.1N	113.3W
070600Z	12.4N	112.2W	111800Z	18.6N	113.0W
071200Z	12.5N	112.5W	120000Z	19.0N	112.7W
071800Z	12.6N	112.8W	120600Z	19.7N	112.8W
080000Z	12.9N	113.0W	121200Z	20.5N	112.9W
080600Z	13.0N	113.2W	121800Z	21.2N	112.8W
081200Z	13.4N	113.9W	130000Z	21.9N	112.5W
081800Z	13.7N	114.0W	130600Z	22.6N	112.1W
090000Z	13.9N	114.0W	131200Z	23.6N	111.5W
090600Z	14.0N	114.2W	131800Z	24.5N	110.8W
091200Z	14.3N	114.3W	140000Z	25.2N	110.6W
091800Z	14.8N	114.8W	140600Z	25.8N	110.3W
100000Z	15.2N	114.8W	141200Z	26.8N	110.0W

TROPICAL STORM RAMONA
22 OCT - 03 NOV

DTG	LAT	LONG	DTG	LAT	LONG
220000Z	14.9N	119.5W	281200Z	15.6N	138.9W
220600Z	14.9N	120.4W	281800Z	15.6N	139.8W
221200Z	13.7N	121.3W	290000Z	15.9N	140.4W
221800Z	13.4N	122.2W	290600Z	16.2N	140.9W
230000Z	13.3N	122.9W	291200Z	16.4N	141.4W
230600Z	13.0N	123.5W	291800Z	16.8N	141.9W
231200Z	12.5N	124.6N	300000Z	16.9N	142.4W
231800Z	11.9N	125.7W	300600Z	16.9N	143.3W
240000Z	11.5N	126.5W	301200Z	16.8N	143.8W
240600Z	11.3N	127.0W	301800Z	16.7N	144.2W
241200Z	11.2N	127.6W	310000Z	16.4N	144.6W
241800Z	11.2N	128.3W	310600Z	16.3N	144.9W
250000Z	11.3N	129.0W	311200Z	16.1N	145.2W
250600Z	11.4N	129.8W	311800Z	16.0N	145.5W
251200Z	11.7N	130.6W	010000Z	16.0N	146.0W
251800Z	12.0N	131.3W	010600Z	16.0N	146.5W
260000Z	12.4N	132.0W	011200Z	16.1N	147.0W
260600Z	12.8N	132.4W	011800Z	16.3N	147.3W
261200Z	13.2N	133.2W	020000Z	16.5N	147.6W
261800Z	13.6N	133.6W	020600Z	17.4N	147.9W
270000Z	14.0N	134.2W	021200Z	18.5N	147.3W
270600Z	14.3N	134.8W	021800Z	19.6N	147.7W
271200Z	14.7N	135.4W	030000Z	20.3N	148.1W
271800Z	15.2N	136.8W	030600Z	21.2N	148.3W
280000Z	15.3N	137.1W	031200Z	22.4N	148.0W
280600Z	15.5N	138.0W	031800Z	23.5N	147.7W

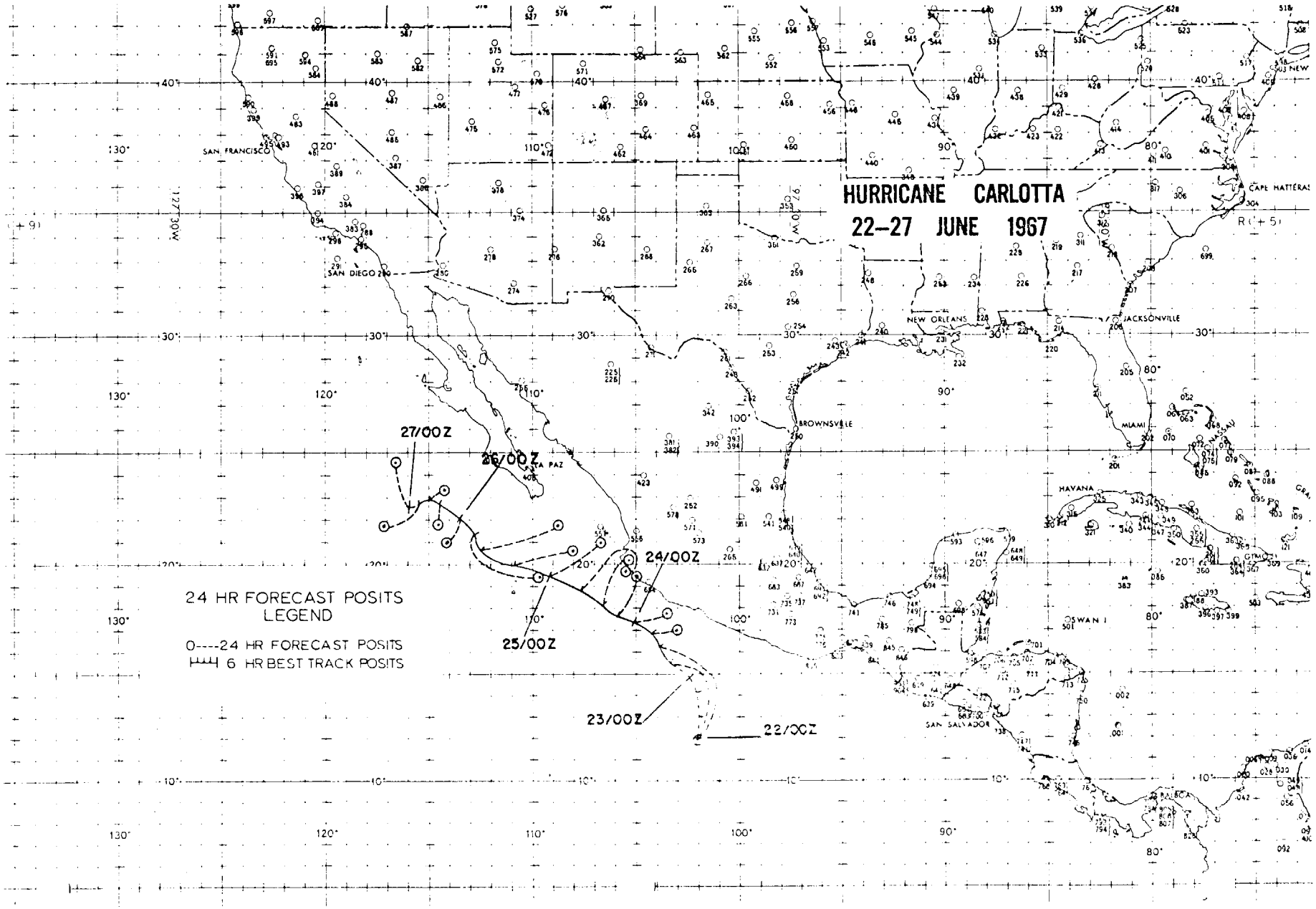

BEST TRACK
HURRICANE CARLOTTA
22–27 JUNE 1967
SAN FRANCISCO
SAN DIEGO
LA PAZ
BROWNSVILLE
NEW ORLEANS
JACKSONVILLE
CAPE HATTERAS
MIAMI
NASSAU
HAVANA
SWAN I
SAN SALVADOR
BALBOA
27/00Z
26/00Z
25/00Z
24/00Z
23/00Z
22/06Z
LEGEND
6 HR BEST TRACK POSITS
AIRCRAFT, SATELLITE OR LAND RADAR FIXES
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
FORMATIVE STAGE

AN-9

HURRICANE "CARLOTTA" 22 JUL-27 JUN 1967
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION LAT.	LONG	24 HOUR ERROR DEG. DISTANCE	48 HOUR ERROR DEG. DISTANCE
220600Z	12.0N	102.0W	-------	-------
221200Z	13.0N	102.0W	-------	-------
221800Z	14.0N	102.0W	-------	-------
230000Z	14.8N	102.4W	-------	-------
230600Z	15.4N	103.4W	158-172	-------
231200Z	16.2N	103.8W	157-276	-------
231800Z	16.8N	104.2W	081-077	-------
240000Z	17.3N	105.1W	074-102	-------
240600Z	17.5N	105.9W	024-202	-------
241200Z	18.1N	106.7W	038-210	-------
241800Z	18.5N	107.8W	065-242	-------
250000Z	19.5N	109.2W	058-168	-------
250600Z	19.9N	110.9W	078-175	-------
251200Z	20.5N	112.5W	070-210	-------
251800Z	21.2N	112.8W	116-235	078-462
260000Z	22.1N	113.6W	226-072	063-361
260600Z	22.7N	114.5W	192-054	077-384
261200Z	23.0N	115.0W	080-105	063-322
261800Z	22.6N	115.5W	243-108	092-270
270000Z	22.8N	116.0W	338-113	-------

AVERAGE 24 HOUR ERROR 110 mi
AVERAGE 48 HOUR ERROR 158 mi


HURRICANE CARLOTTA
22–27 JUNE 1967
24 HR FORECAST POSITS
LEGEND
0----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS
27/00Z
26/00Z
25/00Z
24/00Z
23/00Z
22/00Z
SAN FRANCISCO
SAN DIEGO
LA PAZ
BROWNSVILLE
NEW ORLEANS
JACKSONVILLE
MIAMI
HAVANA
SAN SALVADOR
CAPE HATTERAS

HURRICANE "JEWELL" - 171800Z TO 230600Z JUL

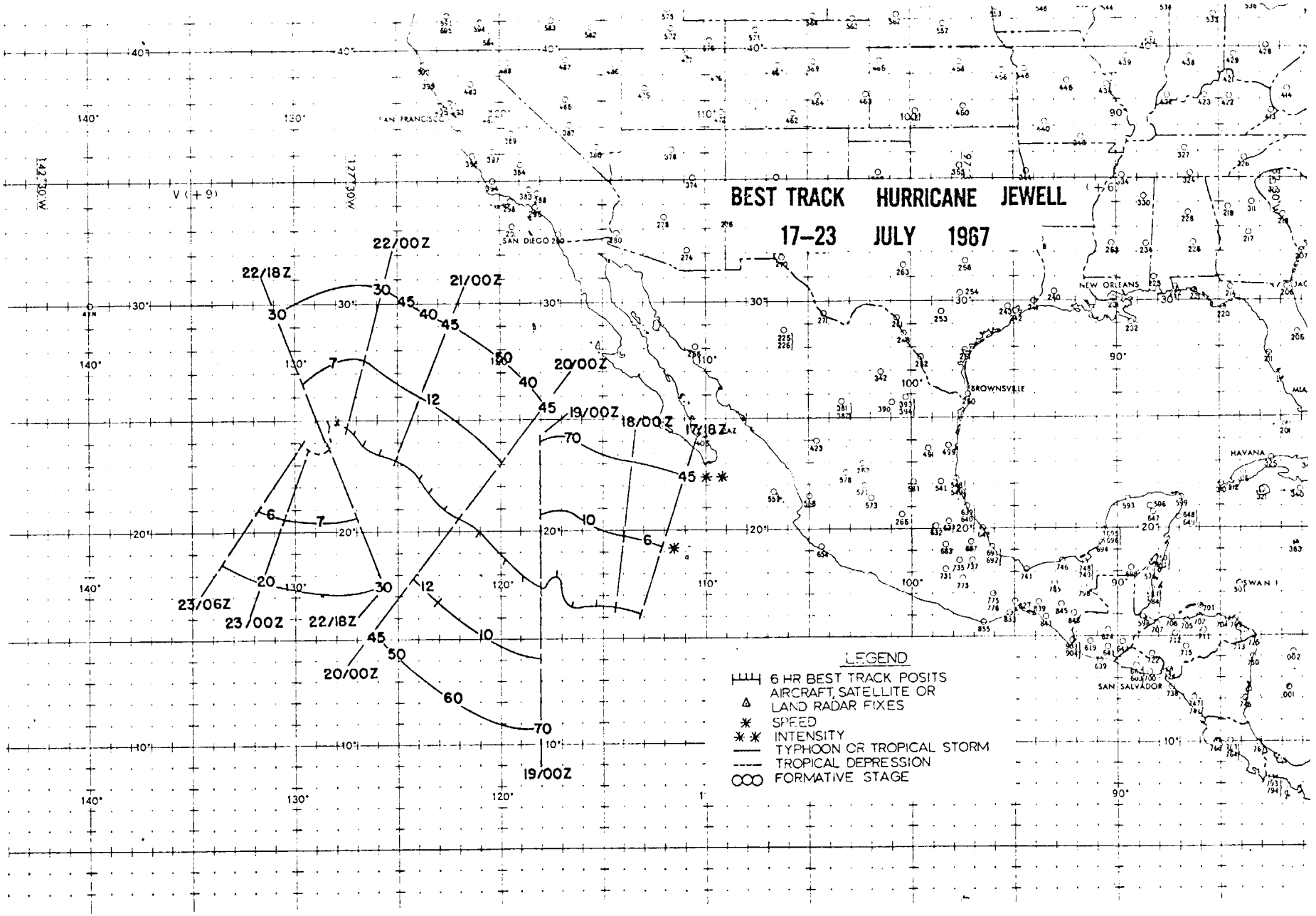
I. DATA
   A. Statistics
      1. Number of warnings issued - 24
      2. Number of warnings of hurricane intensity - 4
      3. Total distance traveled during tropical warning period - 1250 mi

II. DEVELOPMENT
   A. Initial impetus - ITCZ

   B. Initial surface vortex
      1. Time - 171800Z

   C. Time storm reached hurricane intensity
      1. 182230Z

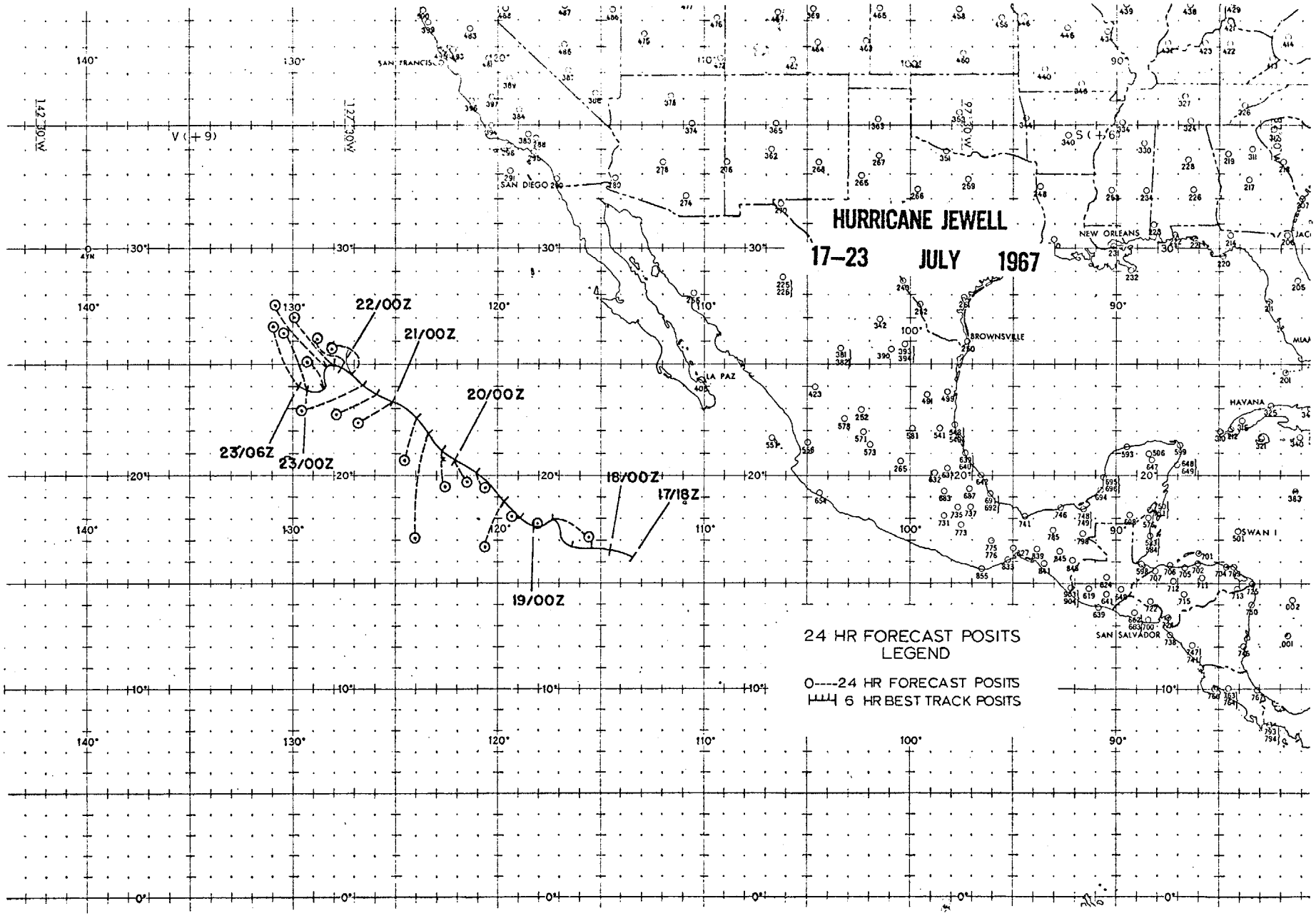
III. FINAL DISPOSITION
   A. Dissipated at sea


BEST TRACK HURRICANE JEWELL
17–23 JULY 1967
22/00Z
22/18Z
21/00Z
20/00Z
19/00Z
18/00Z
17/18Z
23/06Z
23/00Z
22/18Z
20/00Z
19/00Z
LEGEND
6 HR BEST TRACK POSITS
AIRCRAFT, SATELLITE OR LAND RADAR FIXES
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
FORMATIVE STAGE
SAN FRANCISCO
SAN DIEGO
NEW ORLEANS
BROWNSVILLE
HAVANA
SAN SALVADOR

HURRICANE JEWELL 17 JUL-23 JUL 1967
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION LAT.	LONG	24 HOUR ERROR DEG. DISTANCE	48 HOUR ERROR DEG. DISTANCE
171800Z	16.2N	113.3W	-------	-------
180000Z	16.3N	114.5W	-------	-------
180600Z	16.6N	115.4W	-------	-------
181200Z	16.5N	116.5W	-------	-------
181800Z	17.9N	117.1W	118-120	-------
190000Z	17.6N	117.9W	270- 10	-------
190600Z	18.1N	118.7W	260- 25	-------
191200Z	17.0N	119.8W	200-140	-------
191800Z	20.0N	121.0W	140- 50	125-240
200000Z	20.3N	122.1W	140- 60	165- 80
200600Z	20.7N	123.3W	165-100	185-100
201200Z	21.1N	124.4W	185-290	190-340
201800Z	22.5N	124.0W	195-120	190-145
210000Z	23.2N	125.0W	240-120	185-180
210600Z	23.9N	126.0W	240-130	190-200
211200Z	24.6N	127.0W	250-180	190-420
211800Z	23.8N	126.7W	310-100	245-255
220000Z	25.0N	127.7W	310-115	-------
220600Z	25.3N	128.3W	310-200	-------
221200Z	25.6N	128.9W	320-220	-------
221800Z	23.3N	128.1W	330-100	-------
230000Z	23.6N	128.7W	340-165	-------
230600Z	23.7N	129.3W	330-190	-------

AVERAGE 24 HOUR ERROR 128 MI
AVERAGE 48 HOUR ERROR 217 MI


HURRICANE JEWELL
17–23 JULY 1967
22/00Z
21/00Z
20/00Z
23/06Z
23/00Z
18/00Z
17/18Z
19/00Z
24 HR FORECAST POSITS
LEGEND
0----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS
SAN FRANCISCO
SAN DIEGO
LA PAZ
BROWNSVILLE
NEW ORLEANS
HAVANA
SAN SALVADOR
SWAN I
V (+9)
S (+6)

HURRICANE "KATRINA" - 291800Z AUGUST TO 020500Z SEPTEMBER 1967

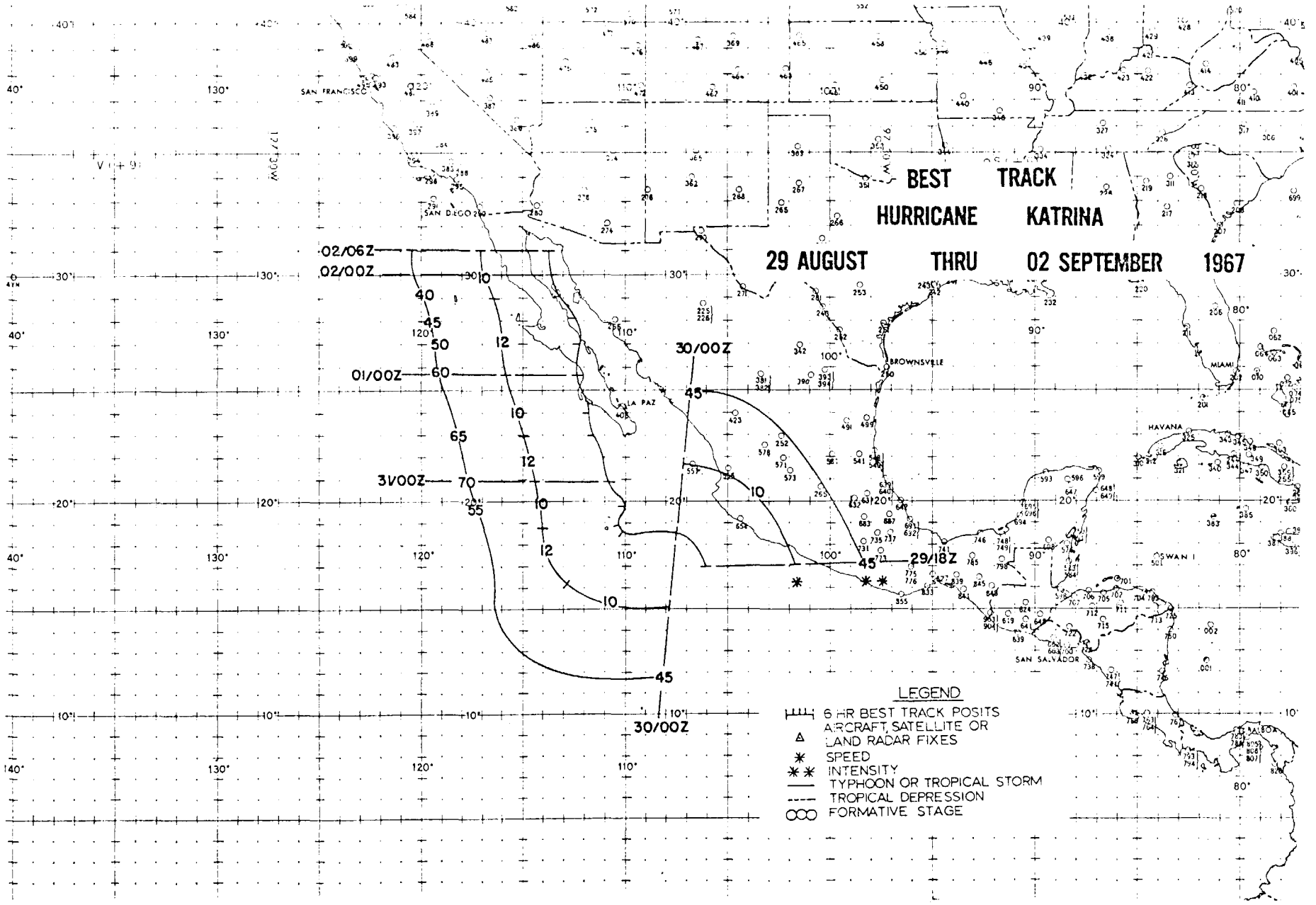
I. DATA
   A. Statistics
      1. Number of warnings issued - 15
      2. Number of warnings with hurricane intensity - 4
      3. Total distance traveled during tropical warning period - 1128 mi

II. DEVELOPMENT
   A. Initial impetus - ITCZ

   B. Initial surface vortex
      1. Time - 291800Z Aug

   C. Time storm reached hurricane intensity - 310000Z Aug

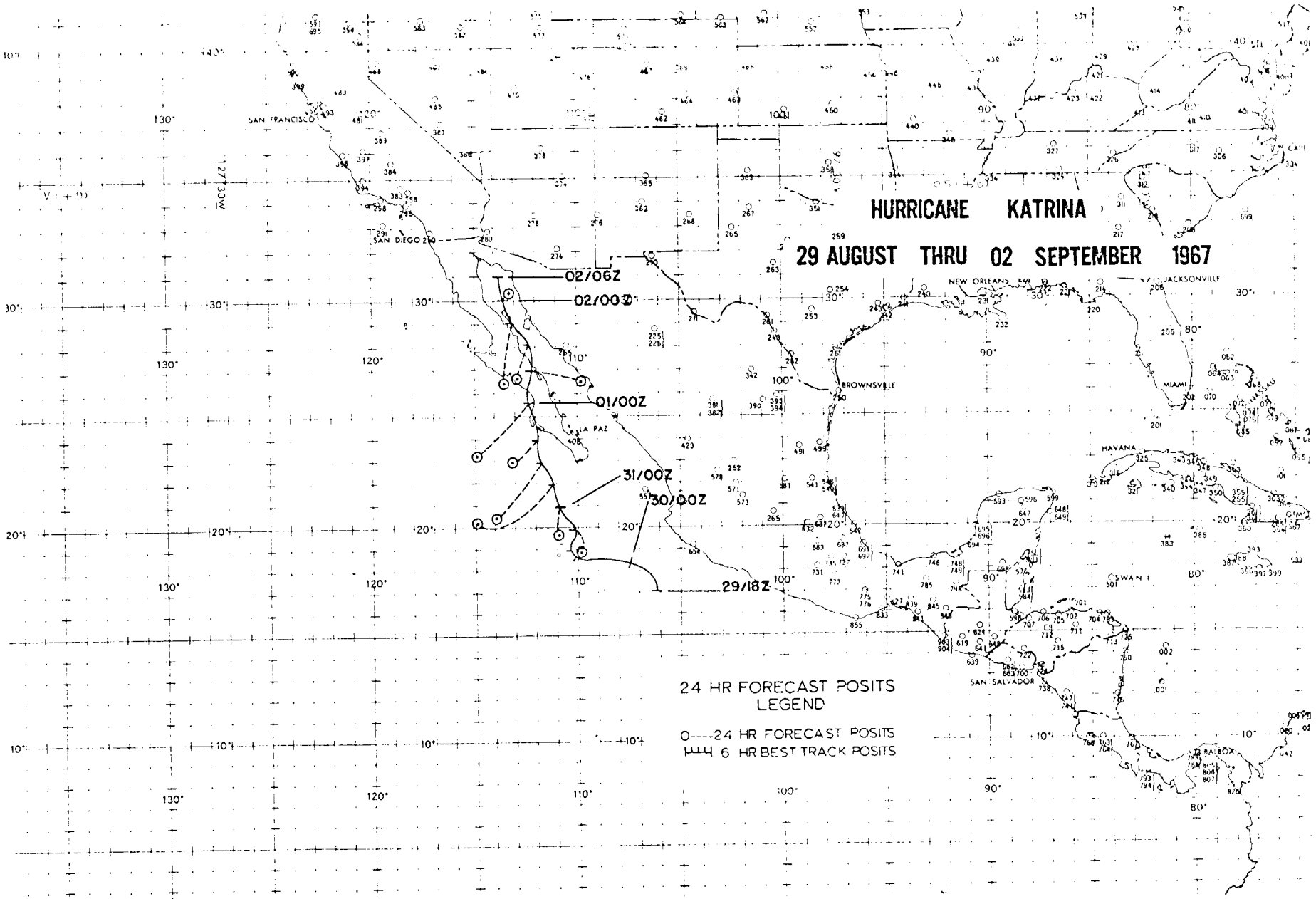
III. FINAL DISPOSITION
   A. Dissipated over land


BEST TRACK
HURRICANE KATRINA
29 AUGUST THRU 02 SEPTEMBER 1967
02/06Z
02/00Z
01/00Z
31/00Z
30/00Z
29/18Z
LEGEND
6 HR BEST TRACK POSITS
AIRCRAFT, SATELLITE OR LAND RADAR FIXES
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
FORMATIVE STAGE
SAN FRANCISCO
SAN DIEGO
LA PAZ
BROWNSVILLE
HAVANA
MIAMI
SAN SALVADOR

HURRICANE "KATRINA" 29 AUG-02 SEP
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION LAT.	LONG	24 HOUR ERROR DEG.	DISTANCE	48 HOUR ERROR DEG.	DISTANCE
291800Z	17.0N	106.0W	-------		-------	
300000Z	18.5N	107.2W	-------		-------	
300600Z	18.6N	110.2W	-------		-------	
301200Z	18.8N	110.3W	-------		-------	
301800Z	20.0N	110.0W	180-	85	-------	
310000Z	20.8N	110.9W	180-	60	-------	
310600Z	22.0N	111.1W	245-	255	-------	
311200Z	23.0N	111.7W	220-	215	-------	
311800Z	23.9N	111.8W	240-	110	210-	270
010000Z	25.5N	112.4W	230-	210	205-	290
010600Z	27.0N	112.3W	100-	150	235-	550
011200Z	28.2N	112.3W	205-	100	220-	510
011800Z	29.0N	113.3W	180-	145	210-	530
020000Z	30.0N	113.5W	045-	10	215-	610
020600Z	31.0N	113.6W	-------		-------	

AVERAGE 24 HOUR ERROR 134 MI
AVERAGE 48 HOUR ERROR 460 MI


HURRICANE KATRINA
29 AUGUST THRU 02 SEPTEMBER 1967
02/06Z
02/00Z
01/00Z
31/00Z
30/00Z
29/18Z
SAN FRANCISCO
SAN DIEGO
LA PAZ
BROWNSVILLE
NEW ORLEANS
JACKSONVILLE
MIAMI
HAVANA
SAN SALVADOR
24 HR FORECAST POSITS
LEGEND
0----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS

HURRICANE "LILY" - 040000Z TO 120600Z SEP

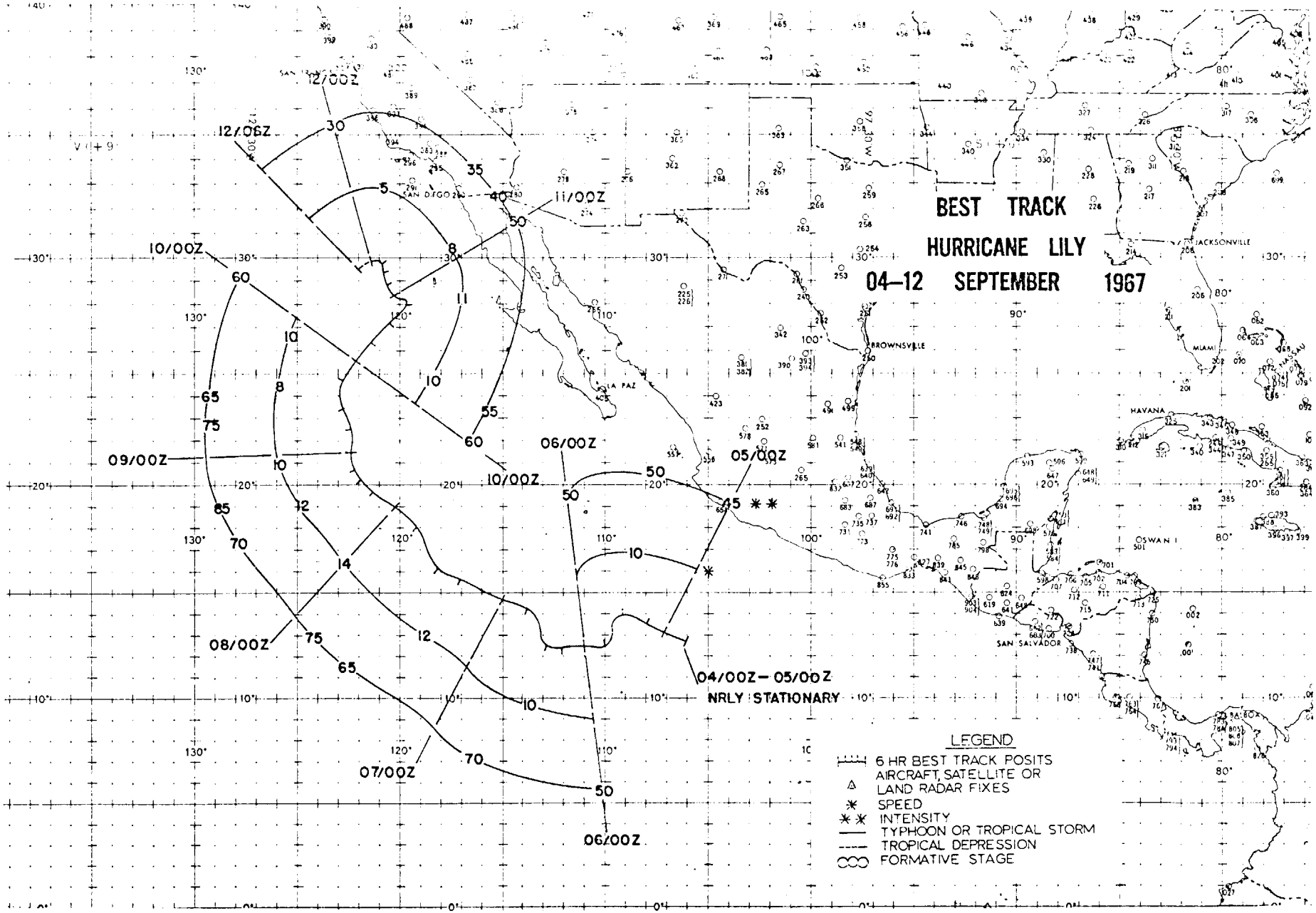
I. DATA
   A. Statistics
      1. Number of warnings issued - 34
      2. Number of warnings with hurricane intensity - 13
      3. Total distance traveled during tropical warning period - 2249 mi

II. DEVELOPMENT
   A. Initial impetus - ITCZ

   B. Initial surface vortex - 040000Z SEP

   C. Time storm reached hurricane intensity - 061800Z SEP

III. FINAL DISPOSITION
   A. Dissipated at sea

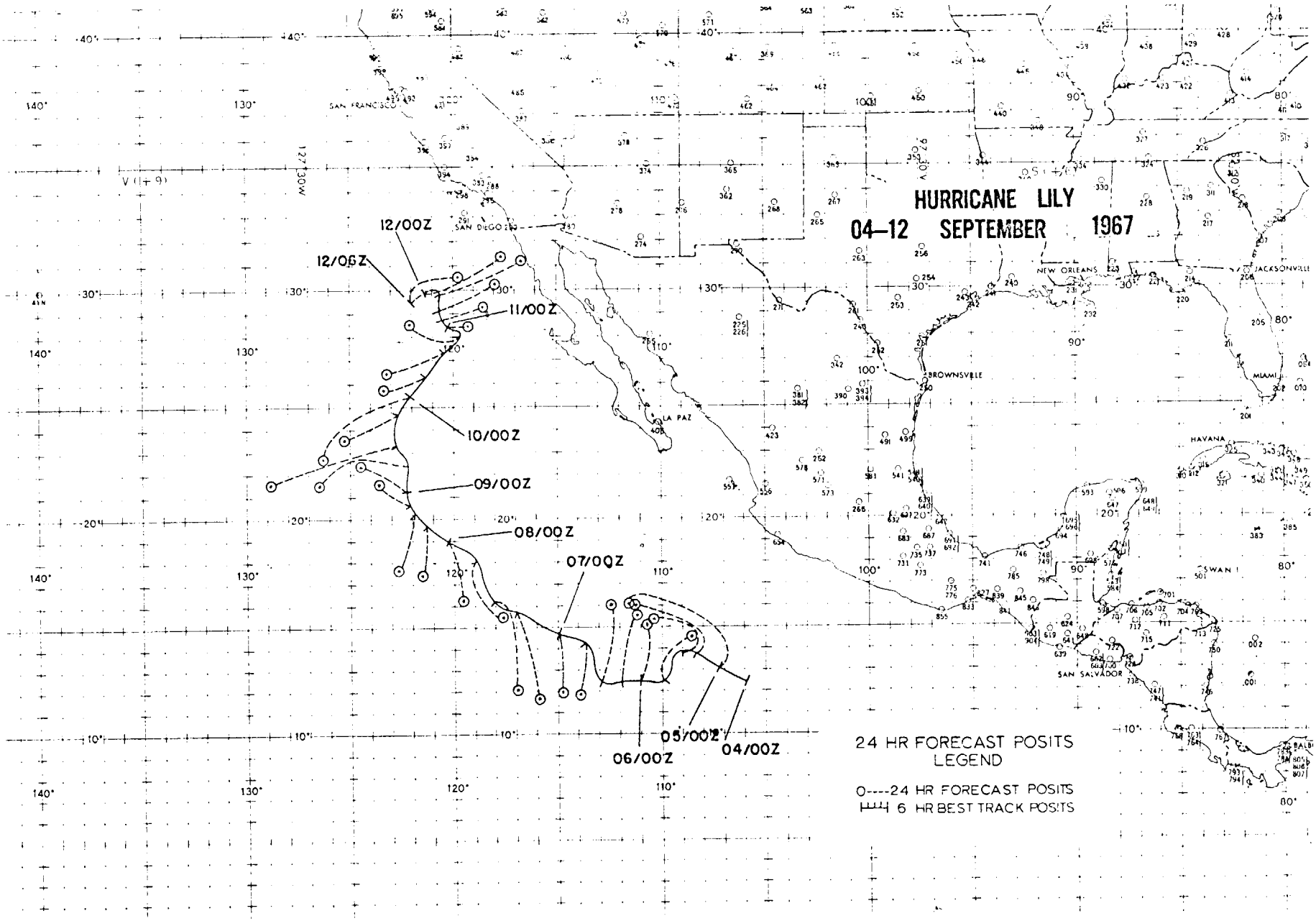

BEST TRACK
HURRICANE LILY
04–12 SEPTEMBER 1967
12/00Z
12/06Z
11/00Z
10/00Z
09/00Z
08/00Z
07/00Z
06/00Z
05/00Z
04/00Z – 05/00Z
NRLY STATIONARY
LEGEND
6 HR BEST TRACK POSITS
AIRCRAFT, SATELLITE OR LAND RADAR FIXES
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
FORMATIVE STAGE
SAN DIEGO
LA PAZ
BROWNSVILLE
JACKSONVILLE
MIAMI
HAVANA
SAN SALVADOR

AN-21

HURRICANE "LILY" 04 - 12 SEP 1967
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION LAT.	LONG	24 HOUR ERROR DEG. DISTANCE	48 HOUR ERROR DEG. DISTANCE
040000Z	12.8N	106.0W	-------	-------
040600Z	13.4N	107.2W	-------	-------
041200Z	13.9N	108.1W	-------	-------
041800Z	12.6N	105.1W	-------	-------
050000Z	13.2N	107.1W	300-240	-------
050600Z	13.6N	108.0W	305-260	-------
051200Z	14.0N	109.0W	310-195	-------
051800Z	12.5N	110.0W	035-155	-------
060000Z	12.5N	111.0W	010-160	-------
060600Z	12.3N	112.0W	010-200	-------
061200Z	12.2N	113.0W	010-235	-------
061800Z	14.2N	113.7W	185-155	-------
070000Z	14.5N	115.0W	180-155	020-180
070600Z	15.7N	117.0W	165-260	050-175
071200Z	16.1N	118.1W	165-260	050-180
071800Z	18.0N	119.0W	150-175	170-420
080000Z	19.0N	120.3W	165-175	170-480
080600Z	19.7N	121.3W	190-140	170-530
081200Z	20.2N	122.6W	180-150	170-485
081800Z	20.6N	121.8W	300-120	175-220
090000Z	21.2N	122.5W	300-150	195-390
090600Z	22.7N	122.3W	250-250	225-320
091200Z	23.5N	122.6W	255-400	225-365
091800Z	24.8N	122.8W	245-165	250-380
100000Z	25.5N	122.0W	235-315	255-460
100600Z	26.3N	121.3W	255-130	250-740
101200Z	27.1N	120.7W	255-150	245-800
101800Z	28.0N	119.5W	285-165	250-650
110000Z	28.3N	120.3W	075- 55	240-670
110600Z	28.7N	120.5W	070-175	270-175
111200Z	29.2N	120.5W	070-160	280- 90
111800Z	29.8N	120.5W	070-245	025-125
120000Z	29.9N	121.3W	060-180	070-285
120600Z	29.5N	122.0W	070-145	065-380

AVERAGE 24 HOUR ERROR - 188 MI
AVERAGE 48 HOUR ERROR - 386 MI


HURRICANE LILY
04–12 SEPTEMBER 1967
12/00Z
12/06Z
11/00Z
10/00Z
09/00Z
08/00Z
07/00Z
06/00Z
05/00Z
04/00Z
SAN FRANCISCO
SAN DIEGO
LA PAZ
NEW ORLEANS
JACKSONVILLE
BROWNSVILLE
MIAMI
HAVANA
SWAN I
SAN SALVADOR
24 HR FORECAST POSITS
LEGEND
0----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS

HURRICANE "PRISCILLA" - 140000Z TO 210600Z October 1967

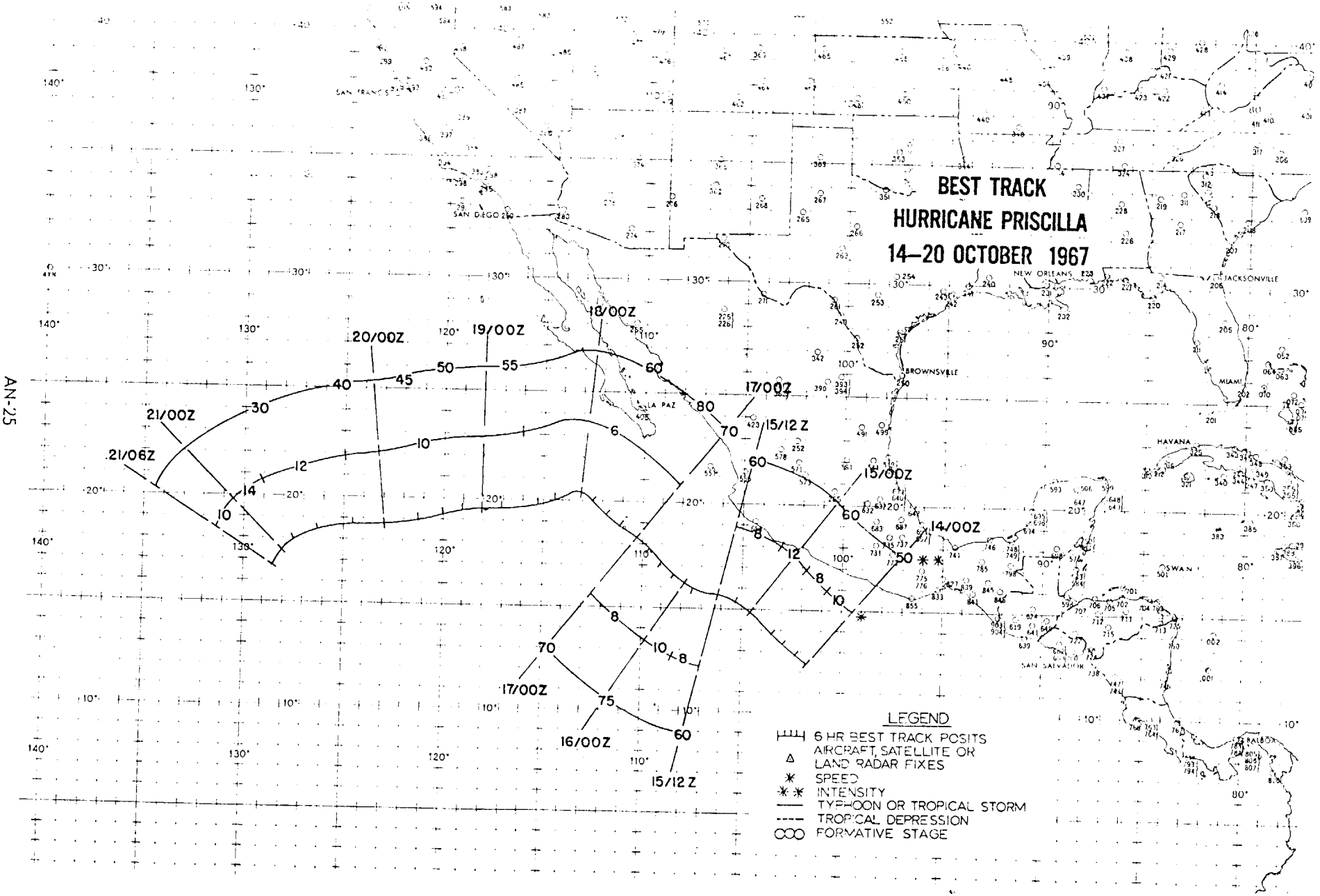
I. DATA
   A. Statistics
      1. Number of warnings issued - 31
      2. Number of warnings of hurricane intensity - 7
      3. Total distance traveled during tropical warning period - 1750 nm

II. DEVELOPMENT
   A. Initial impetus - ITCZ

   B. Initial surface vortex - 140000Z

   C. Time storm reached hurricane intensity - 160000Z

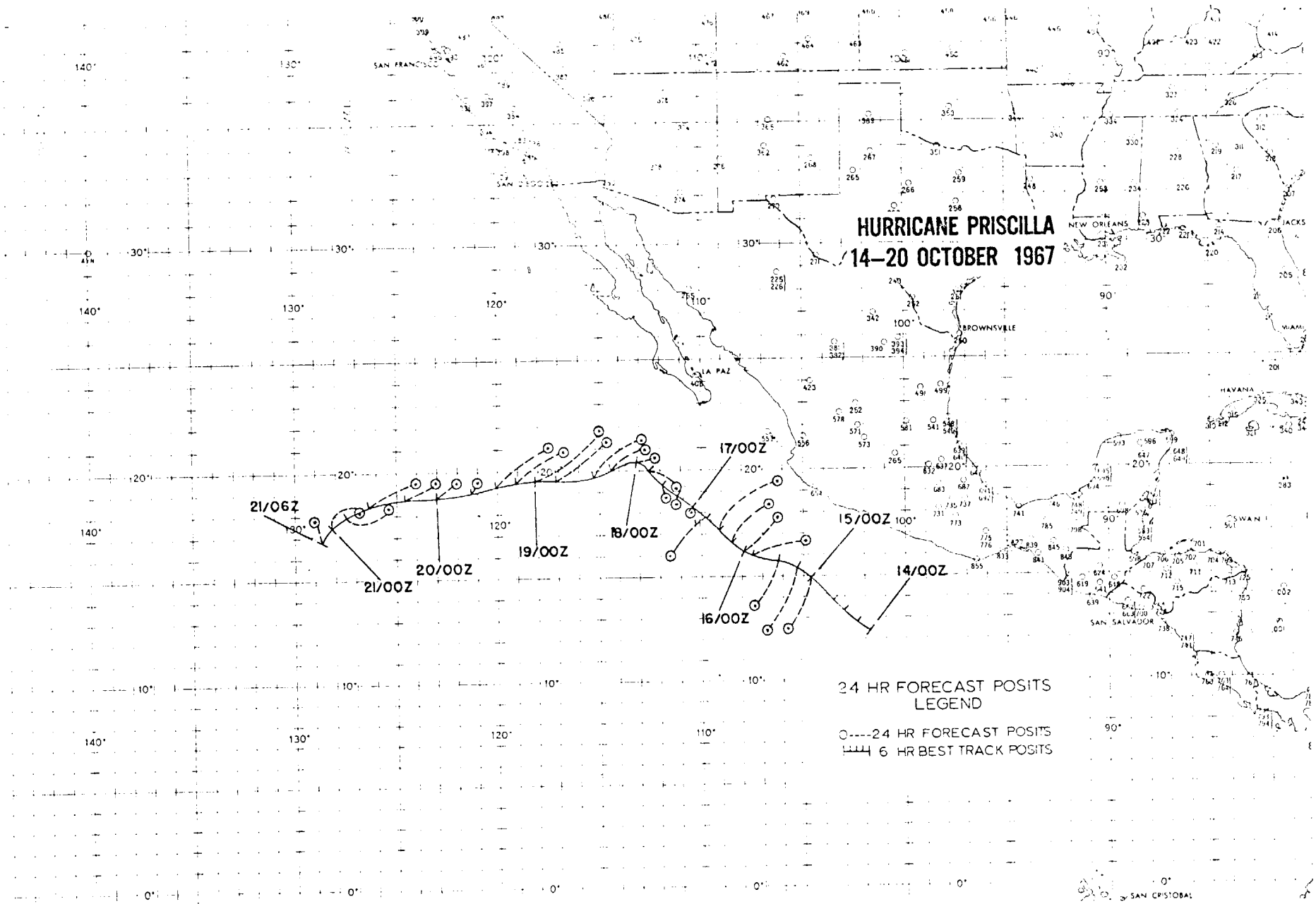
III. FINAL DISPOSITION
   A. Dissipated over water


BEST TRACK
HURRICANE PRISCILLA
14–20 OCTOBER 1967
18/00Z
19/00Z
20/00Z
21/00Z
21/06Z
17/00Z
15/12Z
15/00Z
14/00Z
16/00Z
LEGEND
6 HR BEST TRACK POSITS
AIRCRAFT, SATELLITE OR LAND RADAR FIXES
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
FORMATIVE STAGE

HURRICANE "PRISCILLA" 14 Oct-21 Oct 1967
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION LAT.	LONG	24 HOUR ERROR DEG. DISTANCE	48 HOUR ERROR DEG. DISTANCE
140000Z	12.5N	101.7W	-------	-------
140600Z	12.5N	102.7W	-------	-------
141200Z	12.5N	103.7W	-------	-------
141800Z	13.9N	103.4W	-------	-------
150000Z	15.0N	104.5W	200-150	245-330
150600Z	15.5N	105.0W	200-180	260-300
151200Z	16.5N	105.3W	210-150	265-270
151800Z	16.0N	107.5W	080-150	020-230
160000Z	16.4N	107.7W	050-120	360-370
160600Z	16.7N	108.3W	045-140	015-410
161200Z	17.1N	109.0W	050-215	030-355
161800Z	17.5N	109.0W	225-160	250-350
170000Z	18.3N	110.3W	185- 30	295-180
170600Z	19.0N	111.0W	195- 40	295-180
171200Z	19.5N	111.4W	170- 50	290-175
171800Z	20.0N	112.5W	120-140	055- 65
180000Z	20.5N	113.0W	075- 55	010-140
180600Z	20.0N	114.5W	060-110	005-160
181200Z	20.1N	115.1W	050-170	010-210
181800Z	19.5N	117.0W	055-170	005-120
190000Z	19.5N	118.0W	050-215	020-190
190600Z	19.5N	119.0W	055-150	355-120
191200Z	19.5N	120.0W	055-180	010-130
191800Z	19.0N	121.2W	030- 30	280-210
200000Z	18.8N	123.0W	050- 70	285-175
200600Z	18.7N	124.3W	065-100	285-150
201200Z	18.6N	126.2W	065-130	290-110
201800Z	18.5N	128.0W	080-120	260-110
210000Z	17.0N	127.5W	065- 80	270-160
210600Z	16.8N	128.5W	335- 65	275-290

AVERAGE 24 HOUR ERROR 122 NM
AVERAGE 48 HOUR ERROR 210 NM


HURRICANE PRISCILLA
14–20 OCTOBER 1967
21/06Z
21/00Z
20/00Z
19/00Z
18/00Z
17/00Z
16/00Z
15/00Z
14/00Z
24 HR FORECAST POSITS
LEGEND
0----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS
SAN FRANCISCO
LA PAZ
BROWNSVILLE
NEW ORLEANS
HAVANA
SAN SALVADOR
SAN CRISTOBAL

AN-27

HURRICANE SARAH - 081800Z to 140000Z September 1967

I. DATA

A. STATISTICS

1. Number of warnings issued in FWC Pearl Harbor's area: 22

2. Number of warnings with hurricane intensity: 4

3. Total distance traveled in FWC Pearl Harbor area: 1925 nautical miles. (as T.S. 1645 nm; as hurricane 280 nm)

B. CHARACTERISTICS AS A HURRICANE

1. Minimum observed slp and 700 mb height: All reconnaissance flights were high level at 300 mb.

2. Maximum surface wind in FWC Pearl Harbor area: 65 knots

3. Maximum radius of surface circulation: 500 nautical miles

II. DEVELOPMENT

A. INITIAL IMPETUS: ITCZ

B. INITIAL SURFACE VORTEX

1. 071800Z

2. Surface pressure less than 1007 mb.

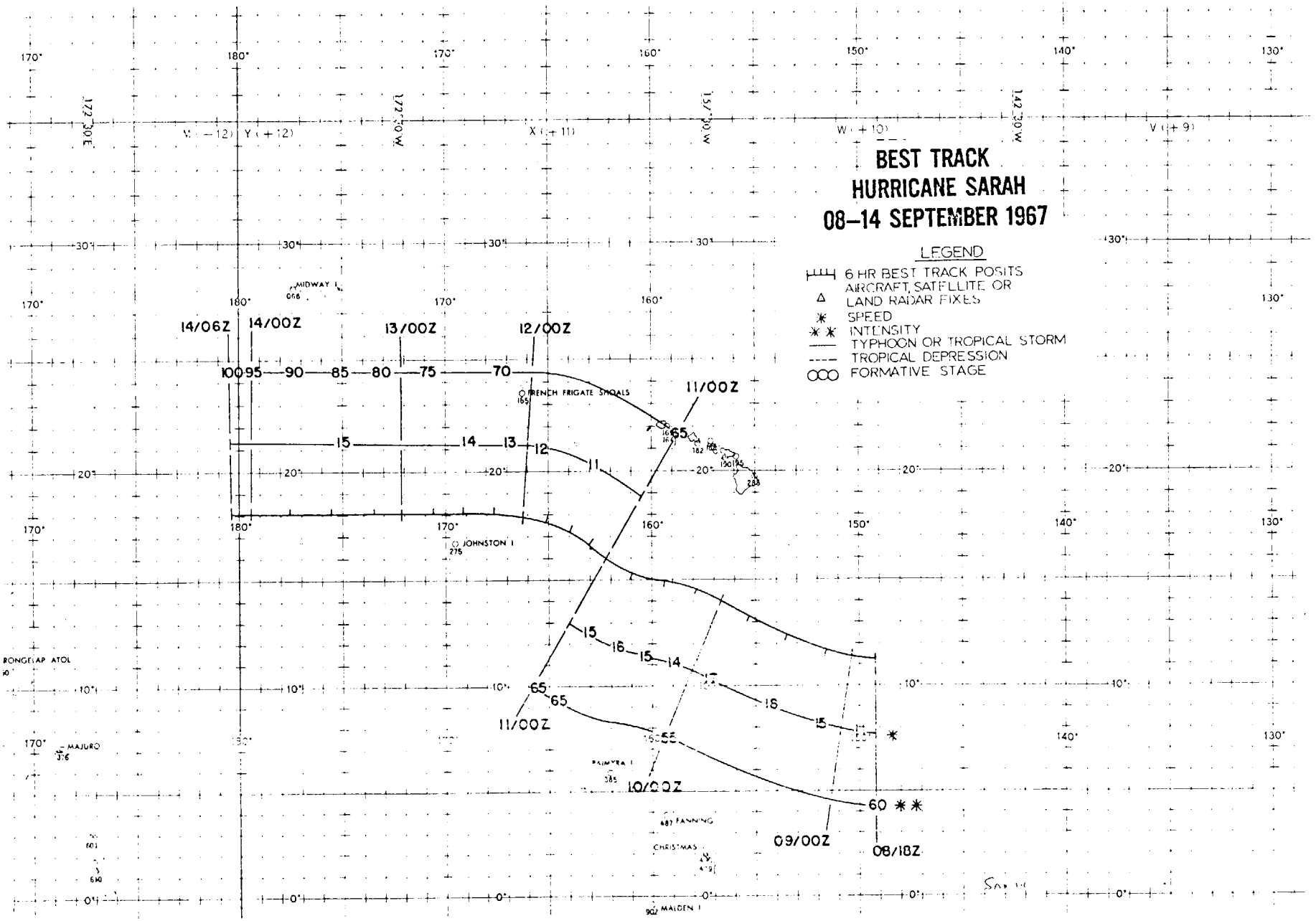
3. Time storm reached hurricane intensity: 101800Z

C. 200 MB FLOW ABOVE SURFACE VORTEX

1. Initial: South to southeasterly as surface low progressed to west northwest under ridge aloft.

2. Upon reaching hurricane intensity: Southerly for next 60 hours gradually becoming variable as SARAH was temporarily downgraded to tropical storm intensity. Surface vortex was gradually caught up in northeast flow at 200 mb and recurved to the west while slowly intensifying.

III. FINAL DISPOSITION: SARAH crossed the date-line into FWC Guam's area of responsibility as a tropical storm with slow intensification continuing.

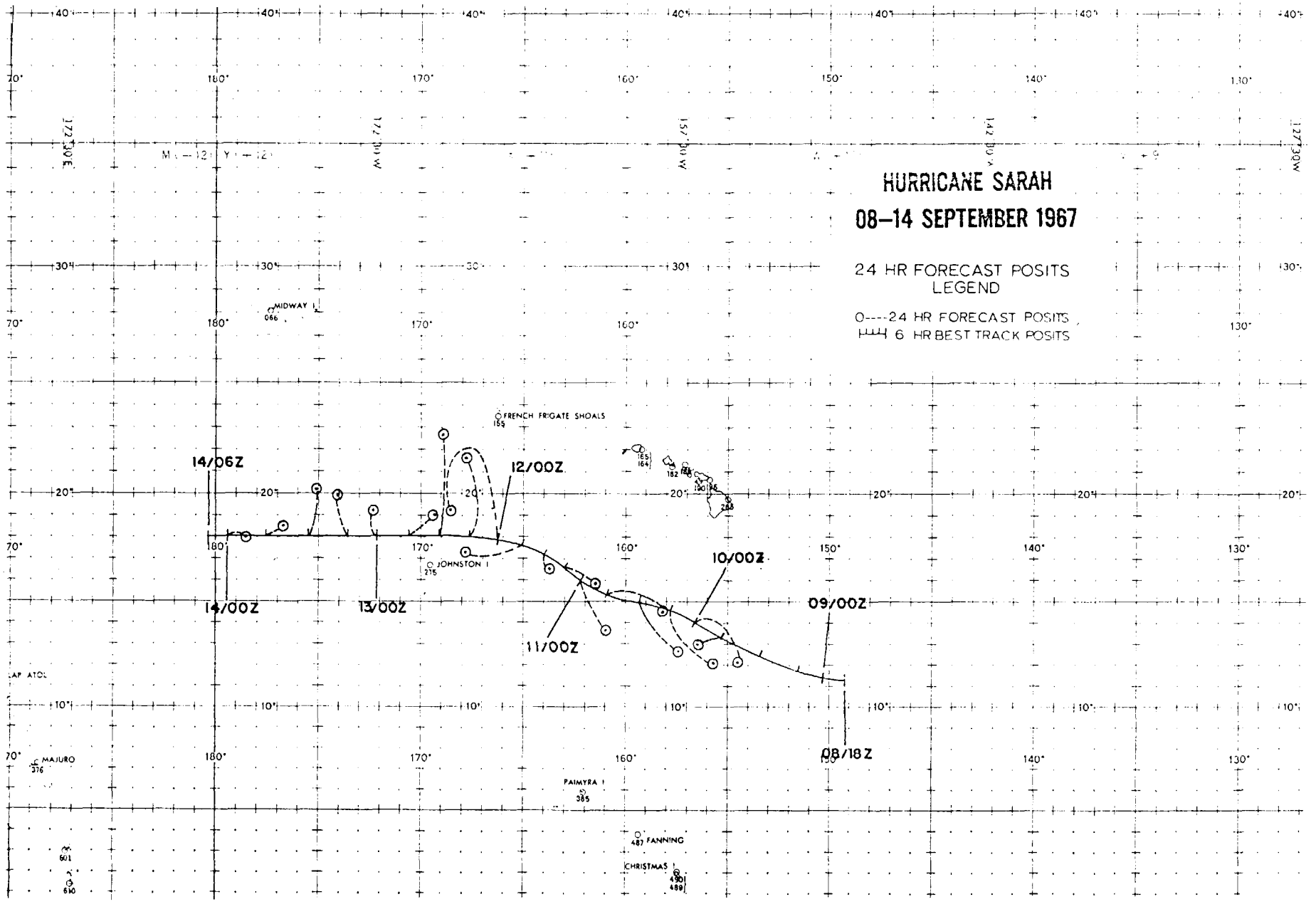

BEST TRACK
HURRICANE SARAH
08–14 SEPTEMBER 1967
LEGEND
6 HR BEST TRACK POSITS
AIRCRAFT, SATELLITE OR LAND RADAR FIXES
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
FORMATIVE STAGE
14/06Z
14/00Z
13/00Z
12/00Z
11/00Z
10/00Z
09/00Z
08/18Z
MIDWAY I.
FRENCH FRIGATE SHOALS
JOHNSTON I.
RONGELAP ATOL
MAJURO
PALMYRA I.
FANNING
CHRISTMAS
MALDEN I.

EYE FIXES CYCLONE 28

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
1	100400Z	14.3N 157.2E	AF-R-P05	9640M	---	---	---	---	--/--	CIRC	----	20	--
2	110059Z	16.0N 162.4E	AF-R-P--	9640M	060	---	---	---	--/--	CIRC	----	10	--
3	110220Z	16.7N 162.8E	AF-R-P05	9640M	060	---	---	---	--/--	CIRC	----	--	--
4	112314Z	17.7N 166.1E	AF-R-P05	9410M	---	---	---	---	--/--	CIRC	----	15	--
5	121715Z	18.0N 170.5E	AF-R-P03	9030M	---	---	---	---	--/--	CIRC	----	20	--
6	121930Z	18.2N 171.0E	AF-R-P03	9100M	---	---	---	---	--/--	CIRC	----	25	--
7	130432Z	18.0N 173.2E	AF-R-L03	9990M	---	---	---	---	--/--	CIRC	----	10	--
8	131822Z	18.3N 177.9E	AF-R-L10	9100M	---	---	---	---	--/--	CIRC	----	20	--

HURRICANE SARAH 8 SEPT-14 SEPT 1967
FORECAST VERIFICATION DATA
(Distance From Best Track in Nautical Miles)

DTG	ERROR AT WRNG TIME (n.m.)	FORECAST ERROR 12HR	24HR	48HR	72HR
081800Z	0				
090000Z	18				
090600Z	36	99			
091200Z	6	94			
091800Z	72	144	78		
100000Z	30	112	192		
100600Z	33	83	210		
101200Z	24	83	175		
101800Z	6	88	193	218	
110000Z	15	54	155	330	
110600Z	39	96	113	365	
111200Z	72	69	40	295	
111800Z	6	105	172	250	405
120000Z	18	165	155	259	413
120600Z	8	47	210	150	436
121200Z	30	36	278	69	348
121800Z	0	66	110	270	334
130000Z	6	98	69	246	320
130600Z	0	18	132	472	312
131200Z	6	0	132	525	192
131800Z	72	6	18	274	370
140000Z	72	0	6	193	432
Average Error:	25.8	73.1	135.5	279.7	356.2


HURRICANE SARAH
08–14 SEPTEMBER 1967
24 HR FORECAST POSITS
LEGEND
O----24 HR FORECAST POSITS
6 HR BEST TRACK POSITS
14/06Z
12/00Z
10/00Z
14/00Z
13/00Z
11/00Z
09/00Z
08/18Z
MIDWAY I.
FRENCH FRIGATE SHOALS
JOHNSTON I.
PALMYRA I.
FANNING
CHRISTMAS I.
MAJURO

APPENDIX A

ABBREVIATIONS AND DEFINITIONS

1. Words and phrases that appear frequently in this report are abbreviated as follows:

APT	Automatic picture transmission (weather satellite)
CINCPAC	Commander in Chief, Pacific
CINCPACAF	Commander in Chief, Pacific Air Force
CINCPACFLT	Commander in Chief, Pacific Fleet
CIRC	Circulation
DEG	Degree(s)
DTG	Date-time group
FNWF	Fleet Numerical Weather Facility, Monterey California
FWC/JTWC	Fleet Weather Central/Joint Typhoon Warning Center, Guam, M. I.
54WRS	54th Weather Reconnaissance Squadron, Andersen AFB, Guam
ITCZ or ITC	Intertropical Convergence Zone
JHWC	Joint Hurricane Warning Center, Hawaii
KT(S)	Knots(s)
MAX	Maximum
MB(S)	Millibar(s)
MIN	Minimum
MI or N.M.	Nautical miles
NEDN	Naval Environmental Data Network
NESC	National Environmental Satellite Center, Suitland, Md.
POSIT(S)	Position(s)
SLP	Sea level pressure
T. D.	Tropical Depression
T. S.	Tropical Storm
VW1	Airborne Early Warning Squadron ONE, NAS, Agana, Guam

2. The following items define and clarify certain words and phrases that appear in the Eye Fix Summaries in Chapter V. Several definitions in this section have special meanings with regard to the machine prepared Eye Fix Summaries and may not necessarily have the same meaning as used elsewhere in the report.

a. FIX NO. - this number corresponds to the number of the fix plotted on the "Best Track Chart".

b. TIME - the date-time of the fix.

c. POSIT - the latitude and longitude of the fix.

d. UNIT - METHOD - ACCY:

(1) UNIT - the unit that made the fix if made by a reconnaissance squadron; 54-54WRS, VW-VW1.

(2) METHOD - the method used to make the fix; P - penetration, R - Radar (these two refer to fixes by reconnaissance squadrons), LND RDR - land radar, SHP RDR - ship radar, SLTLS - satellite cloud picture location, ACFT or ACFT RDR - aircraft other than reconnaissance squadrons.

(3) ACCY - center determination and estimated navigational accuracy of the fix (in nautical miles); P - positive, F - fair, L - poor.

EXAMPLE:

VW-R-P4: fix made by VW1 aircraft by radar, center determination positive, navigational accuracy given as 4 n.m.

e. FLT LVL - altitude of aircraft at time of fix in whole meters above mean sea level or given as a constant pressure surface; or, stage (STG) of development for a satellite location.

f. FLT LVL WND - maximum observed flight level wind speed in knots; or, diameter (DIA) in whole degrees of latitude for a satellite location.

g. OBS SFC WND - maximum observed surface wind speed in knots; or, number of bands (BNDS) for a satellite location.

h. OBS MIN SLP - minimum observed sea level pressure in whole millibars (reported on penetration fixes only).

i. MIN 700 MB HGT - minimum observed 700 mb level height in whole meters.

j. FLT LVL TT/TD - flight level temperature (TT) and dewpoint (TD) at fix location.

k. EYE FORM - description of cloud eye; CIRC - circular, ELIP - elliptical.

l. ORIENTATION - direction of orientation of an elliptical eye to an eight point compass.

m. EYE DIA - eye diameter or major/minor axes of an elliptical eye, in n.m.

n. THKNS WALL CLOUD - thickness of wall cloud in n.m. if observed. F.B. (feeder bands) or N.F.B. (no feeder bands) may be entered if wall cloud thickness not observed.

3. The following definitions are given to clarify usage in this report:

a. VORTICES:

(1) Cold vortex - a closed cyclonic circulation identified as having originated as a cold core system removed from the ITCZ or any easterly wave.

(2) Embedded vortex - a closed cyclonic circulation along an easterly wave and separated from the ITCZ.

(3) Junction vortex - a closed cyclonic circulation at the junction of an easterly wave and the ITCZ.

b. RECONNAISSANCE FLIGHTS:

(1) Synoptic track - a set reconnaissance pattern between specified coordinates scheduled to gather and report meteorological data.

(2) Investigative flight - weather reconnaissance of an area containing a suspected circulation.

(3) Fix mission - aircraft reconnaissance scheduled to fix the center position of and gather peripheral data about a known tropical cyclone.

c. Fix - the determination of the position of a tropical cyclone at a precise time, generally by reconnaissance aircraft penetration of the center or by airborne, land, or ship radar. In the case of a reconnaissance aircraft penetration the actual fix may be based on any of the following: visual observation of the cloud pattern and sea surface, radar, surface pressure, surface or flight level winds, constant pressure height, and temperature.

d. The term "tropical cyclone" has two definitions as used herein depending on usage:

(1) "Tropical cyclone" may be used to describe a suspected cyclonic circulation which appears to be capable of intensification.

(2) "Tropical cyclone" may be used in the general sense e.g., "Typhoon Carla was the most intense tropical cyclone of 1967", or "tropical cyclones most frequently develop during August and September".

e. TROPICAL DEPRESSION (T.D.) - as used by JTWC this is a numbered tropical cyclone in which the maximum sustained surface wind speed is 33 knots or less and whose winds are expected to increase to 34 knots or more within 48 hours.

f. TROPICAL STORM (T.S.) - a named tropical cyclone in which the maximum sustained surface wind speed is greater than 33 knots but less than 64 knots.

g. TYPHOON/HURRICANE - a named tropical cyclone in which the maximum sustained surface wind speeds are 64 knots or greater. West of 180 degrees longitude these are called typhoons, east of 180 degrees they are called hurricanes. All references to typhoons apply equally to hurricanes.

h. Recurvature - that point at which a tropical cyclone ceases movement to the west of north and commences moving east of north.