REPORT OF THE 1969

INTERDEPARTMENTAL HURRICANE WARNING CONFERENCE

(COMBINED - ATLANTIC AND PACIFIC)

Miami, Florida

January 15-17, 1969

AD HOC GROUP ON HURRICANE CONFERENCE
SUBCOMMITTEE ON BASIC METEOROLOGICAL SERVICES

March 1969

CONFERENCE DELEGATES

Department of Defense

SAES

CAPT	R.M. Cassidy	Washington,D.C.
Lt.Col.	D.C. Winner	Washington,D.C.

Air Force

Col.	R.G. Suggs	Scott AFB, Ill.
Col.	F.G. Brenner	McClellan AFB,Cal.
Col.	R.L. Kane	Scott AFB, Ill.
Col.	A. Kouts	Washington,D.C.
Lt.Col.	M.H. Sipple,Jr.	Scott AFB, Ill.
Lt.Col.	W.E. Smurro	Scott AFB, Ill.
Lt.Col.	A. Smith	Suitland, Md.
Lt.Col.	R.E. Boyce	Charleston AFB,S.C.
Lt.Col.	E.P. Sugrue	McClellan AFB,Cal.
Lt.Col.	G.D. Thurman	Ramey AFB, P. R.
Lt.Col.	R.H. Dowd	Patrick AFB, Fla.
Major	C.U. Hendricks,Jr.	Scott AFB, Ill.
Major	G.D. Atkinson	Scott AFB, Ill.
Major	W.V. Yelton	McClellan AFB,Cal.
Major	J.N. Sullivan	Langley AFB, Va.
Capt.	D.N. Gerbaz	McClellan AFB,Cal.
Capt.	W.S. Muir	Ramey AFB, P. R.
Capt.	P.J. Bergn	Miami, Fla.
CMSgt.	I.S. DeGroff	Scott AFB, Ill.
Mr.	R.E. Hairston	Miami, Fla.
Mr.	O.H. Daniel(PAA)	Patrick AFB, Fla.

Navy

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CAPT	C.L. Armstrong	Washington,D.C.
CAPT	J.P. Fleet	Norfolk, Va.
CAPT	J.P. King	Norfolk, Va.
CAPT	R.J. Brazzell	Jacksonville, Fla.
CAPT	R.W. Grill	Pensacola, Fla.
CAPT	J.F. Steuckert	Alameda, Calif.
CDR	C.J. Cush	Jacksonville, Fla.
CDR	D.F. Marsh	Jacksonville, Fla.
LCDR	J.F. Bullington	Jacksonville, Fla.
LT	L.E. Zeigler	Jacksonville, Fla.
LT	F.E. Horn	Jacksonville, Fla.
CWO-4	R.A. Griffin	Jacksonville, Fla.

Department of Transportation

FAA

Mr.	T.L. Speakman	Washington,D.C.
Mr.	Q.E. Edwards	Houston,Texas
Mr.	J.J. Staut	New York,N.Y.
Mr.	H.W. Fraley	New York,N.Y.
Mr.	P.E. Cox	San Juan,P.R.
Mr.	H.L. Mount	Miami,Fla.

Coast Guard

LTJG	J.H. Blake	Miami,Fla.

Department of Commerce

ESSA

Mr.	K.R. Johannessen	Silver Spring,Md.
Dr.	R.H. Simpson	Miami, Fla.
Dr.	R.C. Gentry	Miami, Fla.
Dr.	B.I. Miller	Miami, Fla.
Mr.	H.F. Hawkins	Miami, Fla.
Mr.	W.D. Mallinger	Miami, Fla.
Mr.	L.M. Mace	Suitland, Md.
Mr.	H.M. Johnson	Miami, Fla.
Mr.	J.A. Brown	San Francisco,Cal.
Mr.	J.A. Colon	San Juan, P.R.
Mr.	W.J. Freedman	Miami, Fla.
Mr.	W.S. Callahan	Miami, Fla.
Mr.	H.W. Davis	Miami, Fla.
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Mr.	J.R. Gulick	Miami, Fla.
Mr.	A.L. Sugg	Miami, Fla.
Mr.	D.H. Shideler	Miami, Fla.
Mr.	N.L. Frank	Miami, Fla.
Mr.	P.J. Hebert	Miami, Fla.
Mr.	J.R. Hope	Miami, Fla.
Mr.	R.H. Kraft	Miami, Fla.
Mr.	G.B. Clark	Miami, Fla.
Mr.	H.M. Pelissier	Miami, Fla.
Mr.	W.F. Brown	Miami, Fla.
Mr.	R.L. Redus	Miami, Fla.
Mr.	S.O. Grimm,Jr.	Silver Spring,Md.

OFCM

Mr.	R.E. Beck	Washington,D.C.

University of Miami

Mr.	H.V. Senn	Miami, Fla.

WORKING COMMITTEES

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Chairman	Mr. Sugg	(DOC)
	Mr. Johannessen	(DOC)
	Dr. Simpson	(DOC)
	Mr. Brown	(DOC)
	Mr. Colon	(DOC)
	Mr. Mace	(DOC)
	Mr. Shideler	(DOC)
	Mr. Frank	(DOC)
	Mr. Clark	(DOC)
	Mr. Pelissier	(DOC)
	Mr. Johnson	(DOC)
	Mr. Friedman	(DOC)
	Lt.Col. Sipple	(DOD)
	Lt.Col. Winner	(DOD)
	Lt.Col. Boyce	(DOD)
	Lt.Col. Sugrue	(DOD)
	Lt.Col. Smith	(DOD)
	Major Sullivan	(DOD)
	Capt. Bergn	(DOD)
	Mr. Daniel	(DOD)
	CAPT Eaton	(DOD)
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	CAPT King	(DOD)
	CAPT Brazzell	(DOD)
	CAPT Steuckert	(DOD)

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	Mr. Cox	(FAA)
	Mr. Fraley	(FAA)
	LTJG Blake	(DOT)
	Mr. Hope	(DOC)
	Mr. Brown	(DOC)
	Mr. Redus	(DOC)
	Mr. Friedman	(DOC)
	CAPT Grill	(DOD)
	LCDR Bullington	(DOD)
	CWO-4 Griffin	(DOD)
	Major Hendricks	(DOD)
	CMSgt. DeGroff	(DOD)

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Co-Chairman	CDR Cush	(DOD)
	CAPT Cassidy	(DOD)
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	CDR Marsh	(DOD)
	LT Zeigler	(DOD)
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	Lt.Col. Dowd	(DOD)
	Major Yelton	(DOD)
	Capt. Gerbaz	(DOD)
	Capt. Muir	(DOD)
	Mr. Hairston	(DOD)
	Mr. Mount	(FAA)
	Mr. Edwards	(FAA)
	Mr. Staut	(FAA)
	Mr. Callahan	(DOC)
	Mr. Davis	(DOC)
	Mr. Mallinger	(DOC)
	Mr. Kraft	(DOC)
	Mr. Hebert	(DOC)
	Mr. Grimm	(DOC)

Steering

	CAPT Cassidy	(DOD)
	Mr. Johannessen	(DOC)
	Mr. Speakman	(FAA)

REPORT OF THE 1969

INTERDEPARTMENTAL HURRICANE WARNING CONFERENCE

The 23rd Annual Interdepartmental Hurricane Warning Conference convened at 9 AM January 15, 1969. Dr. Robert H. Simpson, Director, National Hurricane Center (NHC) welcomed the delegates to Miami and invited the heads of participating delegations to offer a few opening remarks. Mr. K. R. Johannessen, Associate Director of Meteorological Operations; Captain R. M. Cassidy, Deputy Special Assistant for Environmental Services, Organization of the Joint Chiefs of Staff; and Mr. T. L. Speakman, ATS Weather Staff, Federal Aviation Administration (FAA) responded. Captain Cassidy then asked the chief representative of the Air Force and Navy for their comments: Colonel Ralph G. Suggs, Vice Commander, Air Weather Service; Captain Max A. Eaton, Deputy Commander, Naval Weather Service Command responded. Dr. Simpson noted with regrets that a regular representative for many years Mr. Hugh Henline, FAA Communication Staff, was not present at this years meeting. He then introduced; several members of his staff, Mr. Arnold Sugg and Mr. David Shideler; LTJG J. H. Blake, Miami Coast Guard Station; Dr. Cecil Gentry, Director, National Hurricane Research Laboratory; and Mr. William Callahan, Research Flight Facility.

Dr. Simpson turned the chairmanship of the meeting over to Mr. Johannessen who then asked for reports on the General Agenda Items.

1. Aircraft Reconnaissance Operations

   a. Col. Kane presented the following summary for the Air Weather Service:

      (1) Types of aircraft used in weather reconnaissance and aerial sampling.

      (2) Air Force 1968 reconnaissance activity and

      (3) Their 1969 capability in both the Atlantic and Eastern North Pacific (see Attachment 1).

   b. CDR Marsh presented a summary of the Navy reconnaissance activity for 1968 and their capability for the 1969 hurricane season provided by the WEARECONRON (VW-4) in the Atlantic (see Attachment 2).

   c. Mr. Callahan, ESSA RFF indicated that their capability would be the same as last year. However during the weeks in June and July that BOMEX is operating, the RFF will give support of 2 missions per day to this project. The range of the B-57 will be extended from 1450 miles to 1850 miles by the time the hurricane season starts.

2. Meteorological Summary of the 1968 Hurricane Season in the Atlantic (ESSA)

   Dr. Simpson pointed out that this was a mild hurricane season however there was abundant tropical activity. There were 13 hurricane days as compared to an average of 30 to 35 days, however, there was a bumper crop of tropical disturbances (107) followed this year. From all these disturbances

we had only 7 named storms (4 hurricanes and 3 tropical storms) in the Atlantic. He then stated that the warnings issued this year covered the areas affected very well but there is still considerable overwarning and NHC is going to be studying this problem.

The National Hurricane Center now has a core of hurricane specialists who will be working on improving diagnostic and prognostic tools (see Attachment 3).

3. Resume of the 1968 Tropical Storm Season in the Pacific (ESSA)

a. Mr. Brown presented a resume of the 1968 Hurricane Season in the Eastern North Pacific and indicated a record breaking hurricane season in that area. He also discussed data acquisition problems of the San Francisco Hurricane Warning Office (see Attachment 4).

b. Mr. Grimm read a Report on the 1968 Tropical Cyclone Season in the Central North Pacific (see Attachment 5).

4. Report on Hurricane Research (ESSA)

Dr. Gentry and Dr. Miller discussed (1) verification results for the 1968 hurricane forecasts in the three Atlantic Areas (see Tables 1 and 2), (2) the research activities at the National Hurricane Research Laboratory, (3) the 1968 Storm Fury activities (see Attachment 6).

5. Satellite Data, Coverage and Weather Bulletin Program (ESSA)

Mr. Mace discussed the following items applying to satellite operations:

a. Tropical and Subtropical Disturbance Classification from Satellite Data (see Attachment 7A).

b. Classification/Banding Category graph which indicates wind speed vs. diameter of overcast (see Attachment 7B).

c. The graph in Attachment 7C indicates the total frequency distribution of classification stages included in Satellite Weather Bulletins (SWB) in 1968 for the Pacific and Atlantic areas. A graph, with two curves, was also presented indicating the frequency distribution of SWB calls in 1968 for the Atlantic and the Eastern Pacific.

d. Probable satellites in operation for 1969 (see Attachment 7D).

e. Plans for moving ATS-III to 75°W longitude for this severe local storms season.

He also mentioned the daily calls by National Environmental Satellite Center (NESC) to NHC and calls to other offices during the hurricane season. In addition they are preparing estimated high level winds for use on upper air charts.

6. Computer Determination of Critical Wind Probabilities (DOD)

Mr. Daniel presented a computer program to estimate the probability of operationally significant winds (50 knots or greater) affecting Air Force Eastern Test Range sites during the passage of a tropical cyclone. Concern for the safety of Atlantic Missile Range facilities on the Florida mainland during the passage of hurricane Donna in September 1960 pointed up the need for objective methods to aid the command decision making processes.

A paper on methods for making objective probability forecasts of operationally significant winds was prepared by Mr. H. S. Appleman and published by the Air Weather Service as Technical Report 164 in August 1962. Mr. Appleman's technique was then programmed for the IBM-1620 computer. For the 1968 hurricane season the computer program was expanded to include several additional parameters. These include hourly tabulations of wind speeds and directions and probable high water levels.

Mr. Johannessen then presented the agenda to the delegates for additions, withdrawals, or change of assignment to committees or assignment to several committees for consideration.

a. DOD added two items to the agenda:

II-1-D Clarification of Term "Maximum Winds"
III-12 Pacific Tropical Cyclone Reconnaissance Coordinator (TCRC)

DOD withdrew the following item:

IV-2 APT Readouts in San Francisco Area

b. ESSA withdrew the following item:

II-5 Consolidation of Central and Eastern North Pacific

c. FAA withdrew the following item:

III-8 ATC Adjustments to Altitude/Track of Hurricane Reconnaissance Flights

d. Primary responsibility for agenda item III-4 (Post Flight Summary Report) and III-6 (First Light Fixes), Reconnaissance Committee was assigned to Forecast and Warnings Committee. Secondary responsibility for agenda item II-11-B (Receipt of National Hurricane Operations Plan and STORMFURY Plan 1968), Forecast and Warnings was assigned to the Reconnaissance Committee.

The committee chairmen were then appointed and the opening plenary session was adjourned. Committee meetings began about 2:30 PM on the 15th.

The final plenary session was called to order at 10:15 AM January 17th by the Conference Chairman. Mr. Johannessen expressed his appreciation for the expeditious handling of the items by the committee and stated that the head of each delegation had read and approved the reports of the three committees. The following committee representatives reported on their committee recommendations:

a. Mr. Sugg, Chairman, Forecasts and Warnings stated that their committee was able to reach agreement on all items except Item II-8-B which was turned over to the steering committee for resolution. With this problem resolved he was able to present a complete package of recommendations for approval.

b. Captain Armstrong, member of the Reconnaissance Committee presented their package of recommendations for approval.

c. Mr. Speakman, Chairman, Communications Committee presented their package of recommendations for approval.

The reports were adopted without further discussion.

Mr. Johannessen, Colonel Suggs, Captain Cassidy, Mr. Speakman and Dr. Simpson in their closing remarks expressed appreciation to the chairmen of the working groups and the committee members for their positive spirit and hard work. The conference was adjourned at 10:45 AM January 17, 1968.

SUMMARY MINUTES

1. FORECAST AND WARNINGS

1.1 Tropical Terminology and Definitions

1.1.1 Tropical Disturbance (ESSA)

DISCUSSION: A tropical disturbance has traditionally been interpreted as a perturbation in the wind field. Since the use of satellite data, this term has been applied to cloud masses many times without perturbations in the wind field. This change in usage should be reflected by a change in the definition of a tropical disturbance.

RECOMMENDATION: That the definition for Tropical Disturbance in the Plan read as follows: A discrete system of apparently organized convection, generally 100 to 300 miles in diameter originating in the tropics or subtropics, having a non-frontal migratory character and having maintained its identity for 24 hours or more. It may or may not be associated with a detectable perturbation in the wind field. As such, it is the basic generic designation which, in successive stages of intensification, may be subsequently classified as a tropical wave, depression, storm or hurricane.

1.1.2 Tropical Wave (ESSA)

DISCUSSION: The Regional Center for Tropical Meteorology, NHC pointed out that there are many varieties of complex systems, encountered in tropical analysis. They call a system a tropical wave when the analyst can conclude, through his own synoptic reasoning, that the dynamics of the wave form is producing the development. Therefore, a more all inclusive term such as tropical wave is needed to describe the more complex early stages of a tropical system. It was pointed out that "tropical wave" is not a substitute for the term "easterly wave".

RECOMMENDATION: That the definition for Tropical Wave be added to the Plan and read as follows: A trough or cyclonic curvature maximum in the trade wind easterlies. The wave may reach maximum amplitude in the lower middle troposphere, or may be the reflection of an upper troposphere cold low or equatorward extension of a middle latitude trough.

1.1.3 Clarification of Terms "Wind Speeds" and "Maximum Winds" (DOD)

DISCUSSION: Definitions (Hurricane, Tropical Storm and Depression), hurricane advisories, bulletins, discussions,

warnings, etc., provide information on present and forecast winds. The use of the term maximum winds also requires clarification. DOD representatives placed emphasis on the need for a distinction between sustained winds and gusts, from the users point of view. ESSA pointed out that "sustained" implies "fastest mile".

RECOMMENDATIONS:

(1) That on page 64 of the Plan: Change definition of Hurricane, Tropical Storm, and Tropical Depression by replacing "highest winds" with "highest sustained winds".

(2) In Weather Bureau Form 656-6 change "maximum winds" to "maximum sustained winds" the first time it appears.

(3) Insert "sustained" between the words "maximum" and "winds"whenever they appear on pages 6, 7 and 8 of the Plan.

1.2 Tropical Outlook (ESSA)

DISCUSSION: News media have complained about the times of issuance of the tropical outlook. Since the beginning of daylight time, the 1645 GMT (12:45 EDT) release is not available for the noon broadcast. Moreover there is no tropical outlook during the early evening hours and we could make excellent use of the afternoon satellite information for this issuance.

RECOMMENDATION: That NHC issue three tropical outlooks beginning June 1, 1969. These will be issued at 0930, 1530 and 2130 GMT.

1.3 Early Release of Military Advisory (ESSA)

DISCUSSION: The military advisory is generally issued 1/2 hour prior to the public advisory. On occasion later reconnaissance or other data may change the storm position, direction of movement and intensity. The Weather Bureau policy has been to ensure that important last minute changes be incorporated in the public advisory and an amended Military Advisory issued.

RECOMMENDATION: That the Plan include, in Chapter 2, the following statement: Last minute changes of hurricane position, direction of motion and intensity included in a public advisory require an issuance of an amended Military Advisory. The number used for the amended advisory will be the same as the advisory being amended.

1.4 Change Time of Radar Scan (ESSA)

DISCUSSION: ESSA described problem involving simultaneous release of hurricane advisory and radar sequence collection (scan) on RAWARC.

They suggested that the radar scan begin at H plus 15 minutes rather than the present H plus 45 minutes. DOD agreed in principle but pointed out the need to refer this item to the proper committee in SC/BMS for further consideration.

RECOMMENDATION: That the radar observations be taken at H plus 15 minutes and that the scan begin at H plus 25 minutes. This item should be referred to SC/BMS to ascertain the feasibility of the above recommendation.

1.5 Use of Satellite Classification "Stage X Category 1" (ESSA)

DISCUSSION: ESSA expressed difficulty in the proper interpretation of Stage X Category 1 systems because of their wide range of wind speeds and considers that these systems do not properly belong in the X classification. DOD would like to retain the Stage X Category 1 type of system but perhaps under another designation. ESSA agreed to this suggestion. The Committee took note of the fact that the classification system is constantly undergoing changes and this item will probably reappear at the 1970 conference.

RECOMMENDATION: That Stage X Category 1 not be used in Satellite Weather Bulletins (SWBs) distributed by NESC during the 1969 season. Disturbances which meet this criteria will be called Stage B; a parenthetical remark will be included, when appropriate, to indicate location of the center of cloud curvature more than half a degree within the associated cloud mass.

1.6 Surveillance of Tropical Areas by Satellites

1.6.1 Satellite Weather Bulletin Content (ESSA)

DISCUSSION: NHC pointed out that there were some apparent conflicts in the releases issued by NHC and NESC regarding trends (storm movement and development). DOD is content with the present system and appreciates receiving these comments. The committee urged the Satellite Center to include all pertinent remarks especially regarding intensity trends.

RECOMMENDATION: That for tropical disturbances in the Caribbean, Gulf of Mexico and the Atlantic west of 30°W longitude delete past movement and trend in development from the Satellite Weather Bulletins. That NESC include all pertinent remarks, especially regarding trends as indicated by the appearance of the disturbance.

1.6.2 Changes to Chapter 10 of the National Hurricane Operations Plan 1968 (DOD)

DISCUSSION: There was no significant controversy on the first four recommendations listed below. On recommendation number five the committee members had the following comments: In the absence of other data, DOD prefers to use the Banding Category/Overcast Circle Diameter/Wind Speed (BC/OCD/WS) graph (see Attachment 7D) to determine whether a tropical cyclone is a storm or hurricane. ESSA does not believe that satellite interpretation has progressed far enough to consistently determine the intensity of tropical cyclones.

RECOMMENDATIONS:

(1) That paragraph 3, page 77, be changed to read "Satellite picture data (Nephanalyses, strip pictures, digitized mosaics, etc.) for the Pacific, Atlantic and Indian Ocean areas of tropical cyclone activity during their storm seasons will be provided as expeditiously as possible to the forecast centers whose forecast responsibility includes these areas.

(2) That the NESC Tropical Disturbance Classification Chart be included in the Plan as an appendix (see Attachment 7C).

(3) That the Satellite Weather Bulletin format be included in the Plan as an Appendix (see Attachment 8).

(4) That "Miscellaneous Satellite Bulletin" be changed to "Satellite Weather Bulletin" wherever it appears in the Plan.

(5) That paragraph 8, page 78, be changed to read as follows:

"8. Guide lines for classifying tropical cyclones as named tropical storms or hurricanes/typhoons based solely on information from satellites are as follows:

(a) Classification will be based on the standard NESC Banding Category/Overcast Circle Diameter/Wind Speed (BC/OCD/WS) graph; and only Stage "X" Category 2, 3 or 4 cyclones may be classified as storms or hurricanes/typhoons.

(b) Stage A, B or C may be classified as tropical distrubances, waves, or depressions.

1.6.3 Satellite Weather Bulletin ABXX2-Western Pacific and Indian Ocean (DOD)

DISCUSSION: DOD representatives pointed out that Satellite Weather Bulletins are useful alerts to new tropical cyclone development. Air Weather Service units that use these bulletins believe the utility of ABXX2 (see Attachment 8) can be increased by:

(1) Differentiating between upper-level cyclones building downward and surface lows building upward.

(2) Lower wind estimates from tropical cyclones with sustained winds below 75 knots (A Joint Typhoon Warning Center (JTWC) evaluation indicates cyclones with 35 to 40 knots sustained actual winds were estimated, in NESC satellite weather bulletins, to have 60 knots sustained winds.)

(3) Increased accuracy of center fixes in early development stages of cyclones.

CONCLUSION: The committee merely took note of this informational item from DOD representatives in the Pacific.

1.7 Naming Tropical Storms.

1.7.1 Use of Satellite Pictures Alone for Naming Tropical Storms (ESSA)

DISCUSSION: NHC pointed out that on at least one occasion during the 1968 season they were asked by ROTA to name a tropical storm on the strength of "considerable external banding" reported in a Satellite Weather Bulletin. NHC stated that satellite observations should be used to name storms only when the classification category clearly indicates an intensity of tropical storm or greater.

RECOMMENDATION: That a tropical storm may be named on the basis of satellite data alone when a tropical cyclone meets the criteria of Stage X Category 2, 3, or 4. The decision to name or not to name a storm in the Atlantic west of longitude 30°W will be reached after consultation and agreement between NHC and NESC.

1.7.2 Tropical Cyclone Names (DOD)

DISCUSSION: During the past three seasons, on occasion, FLEWEACEN (FWC) Rota has issued tropical storm warnings in its area of responsibility and has requested a name via Jacksonville. In each instance, NHC evaluated these circulations as not tropical storm intensity and declined to provide a name, thus, leaving the Navy with an unnamed tropical storm. After considerable discussion, the committee could not reach agreement on this item and it was forwarded to the Steering Committee for resolution. This committee resolved the matter with the following recommendation.

RECOMMENDATION: That paragraph 3, page 75 of the Manual be amended as follows:

"Storms and/or hurricanes which occur east of 30°W longitude or which move from west to east across this meridian will be assigned an appropriate identifier by FWC Rota. When these storms pass westward across the 30th meridian, the responsibility for advices will be transferred to the NHC which will assign a name to the tropical cyclone."

1.8 Collection of Reconnaissance Data for the Atlantic-Gulf-Caribbean, and Eastern Pacific Region (ESSA

DISCUSSION: NESC pointed out that summaries now prepared independently by the Navy and NHC contain only a small part of the data obtained by the Research Flight Facility (RFF), Air Force and Navy reconnaissance. Researchers often turn to the Annual Tropical Storm Reports for data on storms for any given year. Thus, in the Atlantic area, data of considerable potential value to researchers is either lost or does not receive adequate distribution. To tabulate all of the data collected by the RFF, Air Force, and Navy would be too costly and too bulky to include in the annual reports, however, a summary of all recon fixes similar to that prepared by the Joint Typhoon Warning Center, Guam would preserve much of the data which is now lost.

The Weather Bureau believes that the same is true of radar pictures, satellite pictures and ship reports that could be collected for each storm.

ESSA pointed out that budgetary restrictions presently preclude this request, but notes its desirability.

CONCLUSION: This Committee took note: That ESSA is considering the preparation and publishing of a report of the hurricane season to include reconnaissance reports, radar pictures, satellite pictures, and other special information which would not ordinarily find its way into scientific publications.

1.9 Annual Trip to Caribbean (ESSA)

DISCUSSION: Several years ago an item was placed in the Plan stating that the Navy will conduct a training flight to various islands in the Caribbean. It was also stated that Weather Bureau personnel will accompany this flight to inspect meteorological reporting activities and evaluate the effectiveness of the hurricane warning services in the Caribbean Islands. Last year the Air Force offered an aircraft for a trip through the Caribbean and Gulf of Mexico areas. The Weather Bureau is also investigating the possibility of using RFF aircraft for these flights. The following was agreed to by all members of the committee.

RECOMMENDATION: That the Plan state that ESSA and DOD (SAES) will cooperate in arranging an annual trip to the Caribbean and Gulf of Mexico area to carry out a continuing and effective liaison with the Directors of Meteorological Services and disaster prevention agencies on the warning service.

1.10 National Hurricane Operations Plan and Storm Fury Plan

1.10.1 Printing and Distribution of the National Hurricane Operations Plan (ESSA)

DISCUSSION: The Plan does not significantly change from year to year. Changes to the Plan could be handled by a yearly reissuance and distribution of certain pages. Reorganization of the manual would require a new issuance.

RECOMMENDATIONS:

(1) That the National Hurricane Operations Plan be published in loose leaf form and only page changes be made as required.

(2) That the publication contain a change sheet.

(3) That the year be deleted from the title.

1.10.2 Distribution of the National Hurricane Operations Plan and Storm Fury Plan (FAA)

DISCUSSION: The FAA pointed out that last year many of their offices received these plans about a month after the hurricane season was underway.

RECOMMENDATION: That distribution be made before May 1 yearly directly to the using agencies.

The Reconnaissance Committee concurred with this recommendation.

1.11 Areas of Responsibility for Issuing Tropical Warnings in the Eastern North Atlantic (DOD)

DISCUSSION: The Navy has recently revised their area of responsibility boundaries to better respond to fleet requirements. Essentially, the Western Boundary for Environmental Forecasting Responsibilities of Fleet Weather Central Rota was moved from 35 degrees West to 30 degrees West. The present National Hurricane Operations Plan Boundary separating Tropical Warning Responsibility in the Eastern Atlantic is 35 degrees West. It is the desire of the Navy to move this line to 30 degrees West. ESSA concurs with this change.

RECOMMENDATION: That the line separating areas of responsibility between FLEWEACEN Rota and National Hurricane Center/ FLEWEAFAC Jacksonville be adjusted to 30 degrees West vice 35 degrees West and that all references to this boundary in the 1969 Operations Plan reflect this change.

1.12 Tropical Weather Bulletin Format (DOD)

DISCUSSION: With the increasing use of computers to transmit, process, and display weather data, standardization of bulletins from Atlantic and Pacific areas become more essential. Air Force Global Weather Center (AFGWC) already has one Command and Control System (CCS) requirement for display of hurricane/ typhoon information; other CCSs are expected to be added to the AFGWC capability in the near future. All significant storm data would be included. Furthermore, with the increased use of advisories in CCSs, USAF requires the radius of 50-knot winds in all forecasts and extended outlooks.

RECOMMENDATIONS: That the following changes be made in the Plan:

(1) Delete from paragraph 10, Chapter 2, National Hurricane Operations Plan 1968, "Not used in Central Pacific" after definition of excellent.

(2) Delete "Atlantic only" from paragraph 2b (10)(a)2), 2b (10)(b)2), and 2b (13)(a)2), Chapter 2.

(3) Add paragraph 2b (13)(b)2), Chapter 2, to read "Radius of 50-kt winds in 72 hours."

1.13 Digital Tropical Warnings (DOD)

DISCUSSION: Processing and display of weather information by computers dictates standardization wherever possible to optimize the potential of automation. Plain-language bulletins will be with us for the foreseeable future, but requirements for digital bulletins exist now. This item proposes digital bulletins be transmitted to AFGWC and other users. DOD presented a digital tropical weather warning work sheet (see Attachment 9) but pointed out a few refinements are still needed.

ESSA stated that they are willing to supply the requested digital advisory but pointed out problems regarding manpower, money, equipment and time with proposed solutions. It was pointed out that because of manpower and time considerations, it would be impossible to prepare the digital advisory by hand, but a completely automated procedure is feasible. A hand-prepared version is very vulnerable to human error. Preparation time is estimated at 30 minutes or somewhat more. Yearly cost would total about $3,000.

DOD stressed the need for maintaining the present release time of the Military Advisory (656-6). DOD indicated that the 30 minute delay would be acceptable.

ESSA stated that work would be done toward perfecting the code and automation procedure.

RECOMMENDATION: That ESSA undertake the task of refining the proposed code and implementing the digitized military advisory on an experimental basis for the 1969 Hurricane Season in the Atlantic and possibly the East and Central North Pacific at a later date. The product will be made available to other interested government agencies such as the FAA.

1.14 Storm Surge Data (DOD)

DISCUSSION: The USAF Armament Development and Test Center (ADTC) at Eglin AFB, Florida requires information on storm surges within the Eglin Gulf Test Range and Eglin Test Complex. Where telemetry and tracking equipment, both optical and electronic, are located on beaches, a long, lead time is required in order to disconnect cabling and protect equipment that are subject to damage by water pressure and/or corrosion by salt water.

ESSA pointed out the degree of skill on such a forecast is fairly limited and would be mainly climatological in nature. ESSA stated that CARCAH would be the communications link in this matter.

RECOMMENDATION: That NHC provide the best available 48-hour storm surge outlook when a request is made by Det. 10, 6th Weather Wing through CARCAH's telephone.

1.15 Retirement of Names from the Hurricane Lists (ESSA)

DISCUSSION: Although Hurricane INEZ did not cause a great amount of damage in the United States, it is considered a great hurricane. Since this will be the subject of a considerable amount of research the name should be retired. NHC also feels that on the basis that CAROL, EDNA, and HAZEL are still subjects of considerable research that these names should be retired permanently. The committee agreed to the proposals.

RECOMMENDATION: That CAROL, EDNA, HAZEL and INEZ be replaced in the list of Tropical Cyclone Names.

1.16 Post Flight Summary Report (DOD)

DISCUSSION: The Post Flight Summary Report is required by Chapter 3, paragraph 6 of the National Hurricane Operations Plan but no standard format has been established. The present reports are varied in content and order of information depending upon who submits the report.

The committee agreed that the post flight summary is redundant in many cases. The purpose of this message is to report significant additional information not previously reported. The term summary should not be used.

RECOMMENDATION: That Paragraph 6, Page 13 of the National Hurricane Plan be revised to read: Post Flight Report - All investigative/tropical cyclone flights will file a post flight report. This report will contain all significant additional information not previously transmitted. This report will be transmitted as soon as feasible.

The Reconnaissance Committee concurred with this recommendation.

1.17 First Light Fixes (DOD)

DISCUSSION: DOD pointed out the desirability of first light fixes, indicating that direct observation in daylight enhances knowledge of the characteristics of a particular cyclone. These fixes would provide maximum information at the earliest possible time.

NHC stated the advantages of synoptic fixes for purposes of objective forecasts and verification.

RECOMMENDATION: That renewed emphasis be placed on that position of paragraph 4a, Chapter 3 which pertains to first light fixes.

The Reconnaissance Committee concurred with the recommendation.

2. AIRCRAFT RECONNAISSANCE

2.1 Reconnaissance in the Atlantic (ESSA)

DISCUSSION: NHC summary of fixes indicates the Navy missed three critical fixes during the 1968 season. These were near land and involved coastal warnings. These figures are in agreement with those presented by the Navy (see Attachment 2).

DOD assured NHC that the problems were unique during 1968 and were not indicative of a trend.

CONCLUSION: That a letter, on this subject from DOC to DOD, is not required.

2.2 Reconnaissance in the Eastern Pacific (ESSA)

DISCUSSION: ESSA reported that reconnaissance support in the Eastern Pacific was about the same as the previous season. The limited range and high altitude operation of the aircraft available severely restricts reconnaissance support in the Eastern Pacific. The support provided served less than one-fifteenth of San Francisco's area of tropical storm responsibility and there was no low level (700 mb) capability. A letter has been forwarded from DOC to DOD and to Headquarters, Air Weather Service requesting more realistic hurricane reconnaissance support in the Eastern Pacific.

DOD stated that they are presently studying the problem and will reply to the Department of Commerce after completion of the study.

CONCLUSION: That this item is presently under consideration by the Joint Chiefs of Staff (SAES/JCS). No action can be taken at this time.

2.3 Aerial Photographs by Reconnaissance - Eastern Pacific (ESSA)

DISCUSSION: NESC needs detailed and comprehensive reports of the cloud cover, distribution and organization associated with tropical storms and hurricanes in the Eastern North Pacific. The present RECCO code appears to be adequate, but it is not always clear that the observer makes full use of the options (alpha-numeric and plain language) available to him. A few aerial photographs taken as the aircraft approaches the periphery of the storm, at several locations, to indicate the cloud structure such as spiral bands, cirrus outflow, etc., would be most useful if properly documented and annotated. A concerted effort, over two or three seasons, to obtain comprehensive reports of Eastern North Pacific storms would permit NESC to test the validity of the present satellite storm classification criteria in this region and amend these criteria as necessary. These criteria were developed from and tested on data obtained primarily from storm reconnaissance in the Atlantic, Caribbean, Gulf of Mexico and Western Pacific.

DOD stated that they will request that all significant weather data be transmitted with RECCO reports. They pointed out that the WB-47 aircraft does not have a photographic capability, however, the Air Weather Service will research the resources available to satisfy photographic and other special requirements.

RECOMMENDATIONS:

(1) That reconnaissance aircraft transmit all applicable items in RECCO code with emphasis on plain language remarks.

(2) That Air Weather Service will coordinate with ESSA to determine how they may satisfy the exact photographic and special requirements of NESC.

2.4 Standard Reconnaissance Tracks - Atlantic (ESSA)

DISCUSSION: NHC stated that a large percentage of the weather disturbances followed each summer are of the Tropical Wave type. These are best defined in the lower half of the troposphere having maximum amplitude near 700 mb and frequent the trade wind belt between 10°N to 20°N. During the past summer a high priority India track was flown in lieu of a Hotel track several times when a wave was located east of the Antilles. There were also a few occasions when a wave was located just east of the standard Kilo or Hotel tracks. This suggests the standard tracks need to be re-evaluated.

Air Force and Navy representatives stated that they would fly any route coordinated through CARCAH and within aircraft performance capability.

The consensus of the committee was that it would not be advantageous to establish new standard tracks.

RECOMMENDATIONS:

(1) That the Hotel track have higher priority than the India track during the period from June 1 to November 30.

(2) That the outbound leg of the Hotel track be changed to 700-mbs.

(3) That special flights be scheduled through CARCAH, in lieu of establishing new standard tracks, to fill specific NHC requirements. Priority for these special tracks would be higher than standard tracks and lower than Investigative/Tropical Cyclone missions. The weather mission identifier will be Gull/ Navy Special.

2.5 Detailed Eye/Center Data Message (DOD)

DISCUSSION: DOD representations recommended that a standard format be adopted for the Atlantic and Pacific. The committee agreed to adopt the Pacific (CINCPAC) format with minor changes (see Attachment 10).

RECOMMENDATION: That the Eye/Center Data Message Form and amplifying notes, adopted by this committee, replace the present form and notes on pages 20 and 21 of the Plan.

2.6 Flights at 300 mbs to Obtain Equivalent Potential Temperature Data (ESSA)

DISCUSSION: The committee noted Dr. Simpson's presentation on the importance of Equivalent Potential Temperature measurements. He requested that a 300 mb profile of these temperatures be obtained either on storm penetration or exit. Temperature readings in clouds (saturated air) at 10 nm intervals in the forward sectors of storm movement (30° to the left 120° to the right) would suffice. It is believed that this information will allow the forecasters to make a judgement on the change of intensity of a tropical cyclone.

The Air Force personnel noted that this area is the most potentially hazardous insofar as icing is concerned.

RECOMMENDATION: That NHC submit a detailed letter request to Air Weather Service for Equivalent Potential Temperature measurements.

2.7 Routine Gull Flights (FAA)

DISCUSSION: FAA stated that information on the routine Gull Flight

tracks was not received until the Gull Flights had been flight planned and flown via routes other than those on file with the New York Center. This applies to both Gull Bravo 2 and Gull Charlie 2 routes.

Air Force representatives coordinated with FAA representatives concerning this problem and the following recommendations was presented to and adopted by the committee.

RECOMMENDATION: That the Air Force advise FAA of changes in routine Gull Flight tracks by forwarding planned changes to the following air traffic control centers; Miami, Houston, Jacksonville, New York, San Juan, allowing 30 days notice prior to implementation of the changes.

2.8 Gull Flights Acceptance of Flight Level Changes (FAA)

DISCUSSION: FAA pointed out that Gull flights requesting multiple flight levels across busy oceanic routes are refusing in some cases to temporarily accept flight levels other than as programmed even when not operating on a priority basis.

RECOMMENDATION: That Gull flights accept flight level changes.

2.9 BOMEX Reconnaissance (ESSA)

DISCUSSION: ESSA (RFF), Air Force and Navy will supply aircraft in support of BOMEX. The aircraft are to be used by BOMEX for three periods during the hurricane season: June 1-10, June 19-July 2, and July 11-28. A priority system needs to be established (storm investigative, BOMEX, daily). The priorities and a recall system for reconnaissance aircraft should be developed between NHC, CARCAH, and BOMEX.

DOD stated that BOMEX will receive maximum support from the Air Force and Navy but this is dependent upon mission commitments and relative priorities.

RECOMMENDATION: That Navy and Air Force aircraft be supplied for BOMEX consistent with the established priorities.

2.10 Pacific Tropical Cyclone Reconnaissance Coordinator (TCRC)

DISCUSSION: During the past year, AWS approved the designation of the Commander 57 WRS, Hickam AFB, as the Tropical Cyclone Reconnaissance Coordinator (TCRC) for the Central North Pacific region. To align liaison procedures among the Pacific regions, the Chief of the 9WRW Recon Command Post (McClellan AFB) has been designated as the TCRC for the Eastern North Pacific. This will allow direct telephone contact between HWO-SFO and the TCRC-MCC to arrange for aircraft reconnaissance. Other duties of the AFHLO-MCC remain unchanged.

RECOMMENDATION: That the required amendments, due to this change, be made in the Plan.

3. COMMUNICATIONS

3.1 Navy Reconnaissance Aircraft Call Sign (DOD)

DISCUSSION: The Navy stated that the Plan directs the Navy reconnaissance aircraft to use "NAVY" followed by the five(5) digits of the bureau number for an aircraft call sign when on a reconnaissance mission. They suggested that the Navy reconnaissance aircraft use the call sign "NAV HURRECO" followed by the last three digits of the bureau number.

FAA stated that in order to meet the requirements and limitations of the present and future automated FAA facilities, it becomes necessary to limit the number of digits to be used in the call signs of aircraft. This necessitates, in some instances, a reduction in the number of digits presently being used.

RECOMMENDATION: That in the interest of standarization and clarification the Navy Reconnaissance aircraft (Plan of Day assigned flights) when filing flight plans with FAA facilities use NAVH followed by the last three digits of the bureau number of the aircraft. In no case will more than seven (7) digits appear in the call sign.

Example: "NAVH789"

3.2 Addressing of Plan of Day (POD) (DOD)

DISCUSSION: CARCAH is responsible for disseminating the "Reconnaissance Plan of the Day (POD)" by 1800Z on the day preceding the planned missions to the USAF, USN, NHC and FAA. Approximately 12 addressees currently receive the POD in a multiple addressed message from CARCAH via the Homestead AFB FL Communications Center.

RECOMMENDATION: That CARCAH use an address indicating group (AIG) for dissemination of the Plan of Day to DOD agencies. USAF will promulgate an AIG for this purpose.

3.3 Navy Communications Plan, Chapter 3, Appendix B (DOD)

DISCUSSION: The proposed Navy communications plan updates the present plan and includes new procedures for activating the AUTOVON/NEDN phone "patch" capability between Fleet Weather Facility Jacksonville and Fleet Weather Central Rota.

RECOMMENDATION: That the revised Navy communications plan be included in the 1969 Plan.

3.4 U.S. Navy Transfer Plan, Chapter 8 (DOD)

DISCUSSION: The proposed U. S. Navy Transfer Plan and associated communications diagrams submitted to this conference updates the present plan.

RECOMMENDATION: That the revised U. S. Navy transfer plan and diagrams be included in the 1969 Plan.

3.5 Priorities to be Utilized for ATC Communications by Hurricane Reconnaissance Flights (FAA)

DISCUSSION: At the request of FAA the Air Force submitted a list of priorities to be utilized for ATC communications by hurricane reconnaissance flights in the Atlantic.

RECOMMENDATIONS:

(1) That the following be added to the Plan as paragraph 10 on page 18:

USAF Air Traffic Control Communications - Atlantic. USAF Aircraft operating within the San Juan and Miami FIR areas will conduct ATC A/G communications with the following facilities in priority as listed:

(a) USAF Aeronautical Stations (MacDill, Andrews, Albrook)

(b) FAA Stations - 6567 KHZ (Miami, San Juan, New York)

(c) USN SSB Stations - 6723 KHZ (Primary), 4711 KHZ (Secondary), (Navy JAX)

(d) ARINC Stations as contained in current DOD Flight Information Publications Enroute-Supplement.

(2) That the present paragraph 10 on page 18 become paragraph 11 in the Plan.

(3) That the revisions requested by the Air Force to Chapter 3, including Appendix A and C be included in the Plan.

ATTACHMENT 1

SUMMARY OF 1968 UNITED STATES AIR FORCE
RECONNAISSANCE OPERATIONS AND CAPABILITY FOR 1969 SEASON
ATLANTIC AND EASTERN PACIFIC

Air Weather Service uses three types of aircraft in providing weather reconnaissance off the east and west coasts of the United States.

The WB-47 is configured for both weather reconnaissance and aerial sampling. We provide complete horizontal weather observations from this aircraft but have no dropsonde capbility. Although we can provide weather tracks in excess of 2500 N.M. at high altitudes, with this aircraft, it has a very short range when operated below 20,000 feet.

We have found the WC-130 aircraft to be an extremely versatile performer and very well suited to storm work. It is our only aircraft that has a storm penetration capability. With a range of well over 3000 N.M., a true airspeed of approximately 280 knots we find that unless a storm is extremely far from our operating base, we can make two six-hourly fixes per sortie. The crew includes a weather officer and dropsonde operator and, according to comments of both NHC and JTWC, weather observations from this aircraft are highly useful. It is a very reliable aircraft, a stable platform and behaves very well in storms. It is capable of work from the surface to 300 mbs. We wish that we had more of them.

The WC-135 aircraft is by far the best and most versatile that we have. It has extremely good range both above 300 mbs and, because of its fan-jet engines, it has excellent range at 700 mbs. It is also both meteorological and sampling modified. It has our most sophisticated meteorological gear including a computer which reduces the raw data to virtually finished form, cuts a tape and transmits the data to almost any air-ground radio station. Unfortunately this aircraft is not storm penetration capable.

Our 1968 activity in the Atlantic reflects the relatively inactive storm year. All fixes were by penetration except one.

Looking forward to the coming season, the 53rd Weather Reconnaissance Squadron (WRS) at Ramey AFB will possess six WB-47's and five WC-130's. We anticipate no crew limitation and, quite significantly, none of the WC-130's are scheduled for IRAN this year. We can therefore routinely provide four fixes per day and can if necessary provide six fixes per day on a spurt basis.

Atlantic Activity 1968

Synoptic Sorties Flown	340	
Synoptic Hours Flown	3124	
Investigative Sorties Levied	25	
Investigative Sorties Flown	25	
Storm Fixes Levied	32	
Storm Fixes Made	32	(1 Radar)

1969 Capability - Atlantic

6 WB-47
5 WC-130
No Crew Limitations
Six Fixes/Day

The following statistics indicates the 1968 Activity and 1969 Capability by the 55th Weather Reconnaissance Squadron, McClellan AFB.

Pacific Activity 1968

Synoptic Sorties Flown	444
Synoptic Hours Flown	2681.4
Storm Sorties Levied	29
Storm Sorties Flown	14

1969 Capability - Pacific

6 WB-47
5 WC-135
Daily India or Delta
Daily Bravo
WB-47 Radar Fixes

ATTACHMENT 2

SUMMARY OF 1968 UNITED STATES NAVY ATLANTIC
RECONNAISSANCE OPERATION AND CAPABILITY FOR 1969 SEASON

WEARECONRON FOUR (VW-4) 1968 Hurricane Summary

Started season with 6 WC-121 aircraft

June 1 -- Established a detachment at Roosevelt Roads, P.R. with one aircraft

June 2-6 -- ABBY

June 21-26-- BRENDA

June 23 -- CANDY

Aug.5,6,7 -- Storm Fury dry run at Roosevelt Roads,4 aircraft

Aug. 8-21 -- Barbados experiment, 2 aircraft, Roosevelt Roads

Aug.12-15 -- DOLLY

Sept. 18 -- EDNA

Oct.2,3,4 -- Storm Fury cloudline experiment

Oct.9-14 -- Apollo 7

Oct.15-21 -- GLADYS

Nov. 20 -- Dis-established Detachment at Roosevelt Roads

Flight hours ---	Storm reconnaissance ---	165	23 fixes made
	Investigative ----------	120	
	Kilo tracks ------------	516	
		801	

Average flight was 10.1 hours

1969 Hurricane Season

An additional aircraft and personnel to be assigned for total of 7 aircraft. Flight hours as requirements dictate.

Aircraft age and supply priority will be a continuing problem.

Training in squadron must be maintained and requies 100 flight hours per month.

ATTACHMENT 2 (Continued)

1968 Storm Season

DATE	STORM	USN#	POD T.O.	ACT T.O.	POD SCHED FIXES	ACT FIXES MADE
JUNE	ABBY	1	022000Z	022348Z	030000Z	030545Z
		2	032100Z	040150Z	040000Z	Missed, late T.O., mech.
					040600Z	040600Z
		3	041930Z	Cancelled ABBY over land.		
		3	051030Z	051559Z	051200Z	Missed, late T.O., mech.
					051800Z	051800Z
		4	06100Z	061037Z	061200Z 061800Z	061128Z Eye over land.
JUNE	BRENDA	1	211500Z	211537Z	211800Z 212100Z	211815Z 212059Z
		2	220800Z	220759Z	221200Z 221800Z	221200Z 221815Z
		3	231000Z	230949Z	231200Z 231800Z	231215Z Missed, lost RADAR.
		4	240500Z	240500Z	241200Z	241143Z
		5	250700Z	250702Z	251200Z	251135Z
		6	260600Z	Cancelled, storm dissipated.		
JUNE	CANDY	1		230701Z		ALFA track invest. that found CANDY.
AUGUST	DOLLY	1	120900Z	120857Z	121200Z	121240Z
		2	122200Z	Aborted Mech.	130300Z 130600Z	None None
		2	132200Z	131719Z	140000Z	140000Z
		3	141730Z	141910Z	142300Z	150000Z
		4	151830Z	151702Z	152200Z	152200Z
SEPT.	EDNA	1	180530Z	180527Z	181130Z	No eye, area check out.
OCT.	GLADYS	1	150630Z	150612Z	Invest.	151200Z
		2	172200Z	172150Z	180000Z	172250Z

ATTACHMENT 2 (Continued)

DATE	STORM	USN#	POD T.O.	ACT T.O.	POD SCHED FIXES	ACT FIXES MADE
OCT.	GLADYS (Cont'd)	3	181030Z	181130Z	181200Z 181800Z	181340Z Missed, lost eng. in eye.
		4	192230Z	200018Z	200000Z 200600Z	200215Z 200556Z
		5	202100Z	201610Z	210000Z 210600Z	210120Z 210530Z 210210Z

SUMMARY

Missions aborted..... 1 Missed fixes..... 2

Fixes missed on missions 4

Of the above, late takeoffs due to mechanical problems accounted for 2 missed fixes. Subsequent assigned fixes on each mission made.

Lost engine and lost RADAR accounted for one each fix missed. Earlier assigned fixes made.

3 fixes were late due to late takeoffs.

3 fixes were made by significant early takeoffs due to storm being further along than planned.

3 bonus fixes made.

Missions assigned 22
Missions made 21

Fixes assigned 29
Fixes made ..... 23 (plus 3 not assigned)

ATTACHMENT 3

PROGRAMS FOR IMPROVING DIAGNOSTIC AND PROGNOSTIC TOOLS AT NHC

The following programs will be pursued by NHC:

A. Automation - Strive to automate most plotting and computation tasks. The computer and Cal-comp is now being used to printout the four tropospheric mean shear charts, pressure change charts, time cross sections used by NHC.

B. Climatology by $2\frac{1}{2}$ Degree Marsden Squares - A machine program will be set up to printout the 72 hour projected climatological track for a given storm position.

C. Probability Ellipses from Climatology - The probability ellipses will be developed for the 24 and 36 hour forecast positions based upon history or skill of the objective techniques. This will give a good indication of the population centers or major installations for which a watch/warning should be issued.

D. Storm Tide Program - This program will be divided among the five hurricane specialists so that each section of the coast will be assigned to a specialist. They will develop programs to better understand and predict storm tides along their coastal section.

E. Tropospheric Mean Shear Charts - Develop a method for prediction of these charts out to 72 hours.

F. Proposed Computer Program -

(1) Radial transport of momentum or radial mass transport.
(2) Precipitable water.
(3) Ventilation of the hurricane.
(4) Analyze ocean temperature anomalies.

ATTACHMENT 4

THE 1968 HURRICANE SEASON IN THE EASTERN NORTH PACIFIC*

Six hurricanes and 13 tropical storms were followed with numbered advisories. Another five tropical cyclones were only depressions. The season lasted from June 20 to October 28. A total of 326 hurricane and storm advisories and 164 depression bulletins were issued.

The advisories had wide distribution as in previous years, including broadcast by radio amateur Julio Ereneta of San Diego. His broadcast of advisories on hurricanes Pauline and Naomi elicited expressions of appreciation from Mexican officials. These included a letter to the MIC at San Diego from the Mayor of Navojoa on his own behalf and for the Governor of Sonora.

Naomi and Pauline were destructive hurricanes for parts of Mexico. Tropical storms Hyacinth, Annette, and Simone may also have been damaging as they moved onto the mainland and dissipated. Press accounts told of the evacuation of 20,000 residents of small towns in four Mexican states due to the wind driven rains of Naomi. Naomi went inland about 40 miles northwest of Mazatlan producing winds estimated up to 80 knots in the Mazatlan area, and made widespread heavy rains. Pauline made winds reported up to 100 knots at Magdalena Bay, Baja California, Mexico as she crossed the peninsula between there and La Paz heading toward Navojoa on the mainland.

A 40 foot sailboat, the Tiare, carrying four or five persons from San Diego to Puerto Vallarta, Mexico, was lost in the vicinity of Magdalena Bay about the time hurricane Pauline hit there and was the object of an extended search by the U. S. Coast Guard.

Several ships encountered hurricane force winds during the season, but no report as to damage was received. The tuna fleet was successful in evasive action to avoid serious damage, but was reported to have lost considerable time from fishing while waiting out storms at a safe anchorage.

DATA ACQUISITION

APT: APT continued to be the number one tool for detection, tracking and evaluation. Improved picture quality from a better antenna site and acquisition of a Muirhead photo-process printer have contributed to improved forecaster interpretation of storm intensity and location. The report submitted to Monthly Weather Review tells of the delineation of cool, stable, low level inflow by stratus and stratocumulus, and tells of stoppage of the convective chimney being revealed by the cirrus cap moving off lower parts of the storm cloud system.

*A detailed report will appear in the March 1969 issue of the Monthly Weather Review.

Subjective interpretation in terms of physical processes had useful application not only to forecast intensity, but also to present intensity estimates. Typical failures of the semi-objective intensity estimates through accepted Weather Bureau techniques (Timchalk et al, Fett) included too weak due to very active cirrus outflow obscuring completely the spiral bands of a young small storm, and too strong due to persistence of a spiral overcast long after stoppage of the convective chimney sustaining the warm core.

SATELLITE COMPUTER DIGITIZED MOSAICS: The computer pictures were quite useful for center location but not for intensity. Detail is inadequate. National Environmental Satellite Center intensity estimates from this product were in frequent conflict with other information available, including continuity from 3 to 6 hour old APT pictures.

USAF RECONNAISSANCE: Requests for reconnaissance were honored regularly when the storm was within the aircraft range, 1200 nautical miles from home base at Sacramento. Our hopes for low level reconnaissance with increased range have not been realized. All reconnaissance was again conducted at or near the 300 millibar level. The need is acute for measured information as to winds and central pressure in these unique eastern North Pacific storms when they are weakening under the influence of cold water; it is acute from an operational standpoint and also in connection with research to relate actual winds to storm appearance on satellite pictures.

Full application of whatever reconnaissance is made requires establishment of communications through which the forecaster can ask for and promptly get verification, clarification, or elaboration of reports made in the standard form. There were several instances of apparently ambiguous and garbled information, or unexplained conclusions in 1968 reconnaissance reports which might have been salvaged through convenient direct communication between forecaster and reconnaissance observer.

SHIP REPORTS: Ship reports continued very sparse, and particularly so at 0600 and 1200 GMT when no satellite or reconnaissance information was available. It was the usual condition to have a blank map around tropical storms at those times, even when the storm center was near coastal shipping lanes and requests for special weather reports had been broadcast for the preceding two or three days.

Radar fixes were provided on the very small intense hurricane Rebecca by two ships, one Dutch and the other Japanese, while they avoided the strong winds. The Dutch ship was apparently able to determine eye movement with reasonable precision. American mariners should certainly be informed as to the usefulness and manner of application of their radar in avoiding such small intense hurricanes and in making reports for the safety of others.

MEXICAN LAND STATIONS: Reports this year seemed even more sparse and irregular than in 1967, and there were instances of key stations in storm areas not reporting. Throughout the season there were no reports from Tres Marias Islands in the mouth of the Gulf of California, and there were only one or two from the Magdalena Bay-Puerto Cortez area.

Radiosonde information for upper air analysis over Mexico was usually unavailable.

Land based radar observations are not made over any part of the tropical Eastern North Pacific.

ATTACHMENT 5

1968 TROPICAL CYCLONES, CENTRAL NORTH PACIFIC

The Honolulu Weather Bureau Forecast Office serves as the Hurricane Warning Office (HWO) for the Central North Pacific, 140° W to 180°, and 0° to 50° N.

The Honolulu HWO issued bulletins on seven different tropical cyclones, but only one of these posed any threat to land: Tropical Depressions (T.D.) 18, which passed within 120 miles of Johnston Island.

Of the seven, five were storms which originated in the eastern Pacific and by the time they migrated into the Honolulu area of forecast responsibility had already reached or were rapidly approaching their final stage of degeneration. On two of these five the first bulletin issued by Honolulu was the final bulletin for the depression and on another, the second bulletin issued by Honolulu was the final bulletin.

The other two of the seven tropical cyclones had different histories. One (T.D. 18) was first located by satellite south-southwest of Honolulu (east-southeast of Johnston Island); the other (Virginia) was first located by Guam just west of the dateline and moved northeastward into the Honolulu area.

All seven of these storms were followed by the use of satellite data and, for several, supplementary information was furnished by recon flights out of Hickam AFB by the 57th Recon Squadron. Information from these flights gave data on wind velocities, weather, etc., which could only be estimated from the satellite pictures.

The reason that so many of the final bulletins were issued just after the depressions or storms were turned over to HWO Honolulu from HWO San Francisco is that at the beginning of the season following a hurricane drill by personnel from Fleet Weather Central Pearl Harbor, Air Force Det. 4, 1st Weather Wing, Hickam AFB, and Weather Bureau Hurricane Warning Office Honolulu, agreed that a tropical depression not expected to reach tropical storm intensity within 48 hours would not require a bulletin. Since most of the depressions turned over to Honolulu were already weakening, the application of the above agreement called for a discontinuance of further bulletins.

Many of these tropical depressions would have been lost before they reached the Honolulu area of responsibility if it had not been for satellite pictures. Information from this source came from direct readout APT pictures at Honolulu, bulletins from the satellite center in Washington based on other satellite pictures, and digitized mosaics received both by facsimile and via ATS-1 and APT ground equipment.

For the most part forecast movements which were the result of telephone conference discussions by the three aforementioned forecast offices were quite good.

The present procedures worked very smoothly this year and at the present time no suggestions are at hand for improvement of the system.

ATTACHMENT 6

REPORT OF RESEARCH ACTIVITIES AT THE NATIONAL HURRICANE RESEARCH LABORATORY AND STORM FURY ACTIVITIES DURING 1968

Dr. Gentry, in discussing the verification in Tables 1 and 2, pointed out that (1) the accuracy of the forecasts was about the same as last year. (2) improved objective technique forecasts also improves the subjective forecasts. He then discussed the Sanders' Prediction Model and stated that it did a fairly good job until it ran into difficulties with hurricane Gladys. Dr. Gentry then stated that NHRL will continue to support the work on the Sander's model and will attempt to combine NMC prognostic products and NHRL statistical forecasts.

Dr. Miller pointed out that NHRL is working on (1) development of improved statistical techniques for use in forecasting motion and intensity of hurricanes, and (2) development of a 7 level primitive equation dynamic prediction model. He reviewed the development and use of NHC-64 and NHC-67 and pointed out that the Prediction Development Branch will work with Paul Hebert (NHC) in developing a statistical set of equations for the Gulf of Mexico.

Dr. Gentry then noted that this was the least active storm or hurricane season since 1922 with respect to the period when Storm Fury was operational. The Storm Fury group did conduct a dry run on August 5-7, 1968 and a cloud line seeding experiment on October 2-4, 1968.

HOMOGENEOUS SAMPLE

1968 HURRICANE FORECASTS

MEAN ERRORS (n. mi.)

Period (hrs) AREA	No. of FCSTS	WB	NHC-67	NHC-64	PERS
24_A	8	96	156	190	140
24_B	15	117	110	124	132
24_C	15	142	177	199	173
24_{ALL}	38	122	146	168	150
48_A	6	258	358	516	294
48_B	15	229	301	313	309
48_C	11	330	439	444	421
48_{ALL}	32	269	359	396	344
72_{ALL}	12	308	425	473	502

TABLE 1

MEAN ERRORS

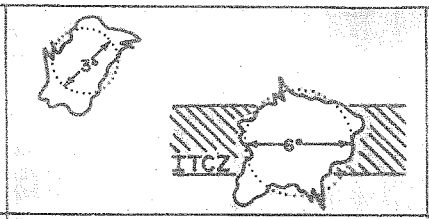
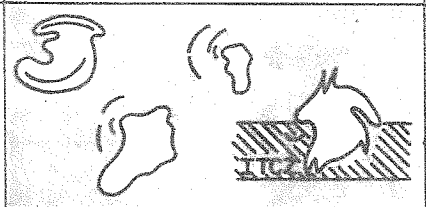
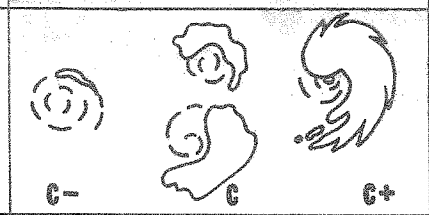
OFFICIAL HURRICANE FORECASTS (1968)

AREA	24 Hr. No. of FCSTS	24 Hr. MEAN (n. mi.)	48 Hr. No. of FCSTS	48 Hr. MEAN (n. mi.)	72 Hr. No. of FCSTS	72 Hr. MEAN (n. mi.)
A	34	113	21	218	8	228
B	34	99	32	136	27	323
C	29	139	22	303	14	531
ALL	97	116	75	243	49	367

TABLE 2

ATTACHMENT 7A

TROPICAL AND SUBTROPICAL DISTURBANCE CLASSIFICATION FROM SATELLITE DATA

A NO CURVED CLOUD LINES OR BANDS		Stage A is a dense amorphous cloud mass composed of cumuliform, cirriform, and layered middle cloud in any combination. Some cirrus outflow is usually present. The cloud mass must have an average diameter of 3° latitude or more. Exceptions: (1) If the cloud mass is contiguous to or within the ITCZ in the Atlantic, Pacific, or south Indian Ocean, it must have an average diameter of 6° latitude or more and be partially isolated by breaks from the general cloudiness. (2) In the Arabian Sea and the Bay of Bengal, the cloud mass must be 8° latitude or more in diameter.
B POORLY ORGANIZED CURVED CLOUD LINES AND BANDS ILL-DEFINED CENTER		Stage B is a dense cloud mass with adjacent curved cumulus cloud lines and/or curved bands of middle cloud which are either detached from, or form part of, the major overcast area. The curved cloud lines and bands are often poorly organized. The pattern produced by the curved lines and bands is poorly defined--it does not appear to have one definite center. Along the ITCZ, the cloud mass and associated curved cumulus cloud lines and/or bands must be separated from the ITCZ cloudiness on at least one side and cirrus outflow must be evident.
C WELL ORGANIZED CURVED CLOUD LINES AND BANDS WELL DEFINED CENTER OUTSIDE DENSE CLOUD MASS		Stage C has well organized, curved cumulus cloud lines and/or broad curved bands of middle and high cloud. The pattern produced by the various curved lines and bands has a well defined single center. The center of the pattern generally lies outside but adjacent to an associated dense cloud mass, but it can be on the edge or as much as one-half degree latitude within the cloud mass. A C- has no associated dense cloud mass. A C+ appears very well organized with a large amount of curved cirrus outflow.
X CAT. 1 POORLY ORGANIZED SPIRAL BANDS ILL-DEFINED CENTER OF ORGANIZATION WITHIN CENTRAL CLOUD MASS		Category 1 has a bright generally circular central overcast which is cirriform in appearance. Curved cirrus outflow is often restricted to one quadrant. Poorly organized, slightly curved cumuliform cloud bands appear near the periphery of the central overcast and cross into it at a large angle. This banding remains close to the overcast edge; away from the overcast, organized curved bands are usually absent. An eye is not visible. The center of the spiral pattern can be located approximately by extrapolating inward along the curved peripheral bands. This estimated center must be more than one-half degree latitude within the central cloud mass.
X CAT. 2 WELL ORGANIZED BANDS SPIRAL BANDS DEFINE CENTER WITHIN CENTRAL CLOUD MASS		Category 2 has a bright, often asymmetrical central overcast. Cirrus outflow is curved and more extensive. At least one long, major, well organized band spirals at a large angle into the central cloud mass. A linear curved break accompanies this band. Within the central cloud mass, the break is covered by thin cirrus but is readily detectable. Minor peripheral bands outside the overcast are poorly organized. An eye is not visible. The central tip of the major spiral band defines the center. This center must be more than one-half degree latitude within the central cloud mass.
X CAT. 3 MODERATE DEGREE OF CONCENTRICITY TO CLOUD BANDS IRREGULARLY SHAPED EYE WITHIN CENTRAL CLOUD MASS		Category 3 has a bright central overcast that is compact and tends to be circular. There is considerable curved cirrus outflow visible at the edge of the central overcast. Curved striations within the central cloud mass define spiral cloud bands which are moderately concentric about a visible eye. Well organized peripheral bands, some with well developed cirrus, are present. A ragged and irregularly shaped eye is normally visible. This defines the storm center.
X CAT. 4 HIGH DEGREE OF CONCENTRICITY TO CLOUD BANDS ROUND EYE NEAR CENTER OF CENTRAL CLOUD MASS		Category 4 has a very circular bright central overcast. The edge is often sharp and smooth over one or two quadrants, otherwise, it is striated cirrus. Highly concentric striations appear within the central overcast. Banding outside the central overcast is very well organized and circular. The entire cloud system is very symmetrical in appearance. A well defined eye appears as a small dark circular area surrounded by a bright ring. This defines the storm center.

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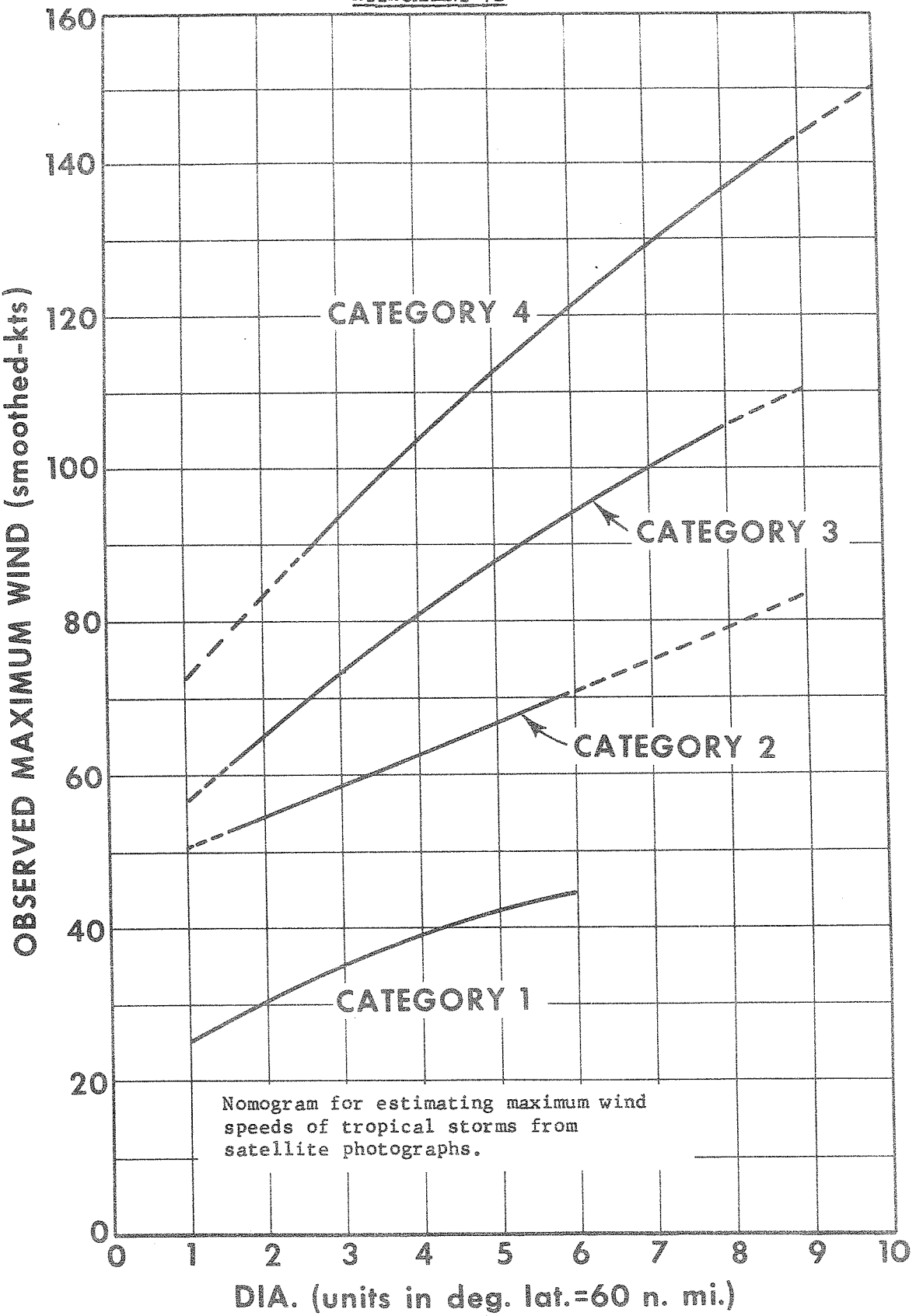
Note: Stage X Category 1 will not be used during the 1969 season. Disturbances which meet this criteria will be called a Stage B with a parenthetical remark to indicate the location of the cloud curvature more than half a degree within the associated cloud mass.

ATTACHMENT 7B



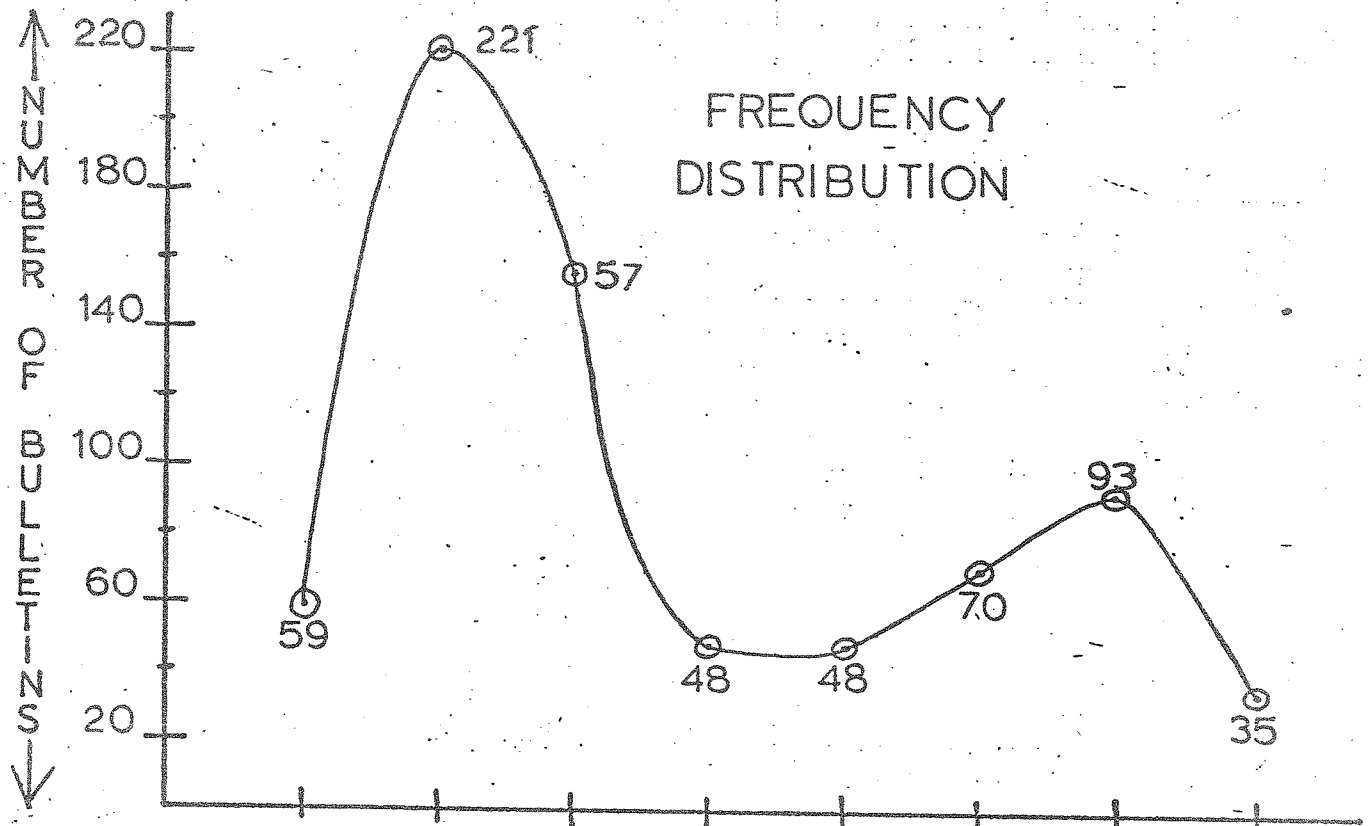
Nomogram for estimating maximum wind speeds of tropical storms from satellite photographs.

ATTACHMENT 7C

SATELLITE WEATHER BULLETINS

JANUARY 1, 1968 - NOVEMBER 20, 1968

WESTERN PACIFIC	401
EASTERN PACIFIC	188
ATL., GULF, CARIB.,	152
Total	741 Bltns



	A	B	C	C+	1	2	3	4
%Cases T/S, Typh., Hur.	0	3	17	67	39	96	99	100
%Cases Typh. or Hur.	0	0	1	6	4	16	52	100

SATELLITE	TYPE OF DATA	TIME OF OBSERVATION	NESC PRODUCTS	PRODUCT DISTRIBUTION
ESSA 9 (Feb. 26) ESSA 7 ESSA 5	AVCS (Stored)	1500 ↑ 1500 ↑ 1800 ↑ or 0600 ↙ (not both)	1. Gridded Analog Pictures 2. Mapped digitized video 3. Manually annotated mosaics or nephs 4. Tropical Wind Analyses 5. Moisture Analyses 6. Satellite Weather Bulletins	1. Facsimile 2. Telephone 3. Teletype 4. WEFAX
ESSA 8 ESSA 6 (tilted) ESSA 2	APT (Direct)	0900 ↙ 1100 ↙ 0600 ↙ or 1800 ↑ (not both)	1. Satellite Weather Bulletins 2. APT Video Signal	1. Teletype 2. Telephone 3. FOFAX
TIROS - M (mid-Summer)	AVCS (Stored) APT (Direct) IR (Stored) DRIR (Direct)	1500 ↑ 1500 ↑ 0300 ↙ 0300 ↙	1. Same as above plus similar products from IR data and the DRIR Signal	1. Facsimile 2. Telephone 3. Teletype 4. WEFAX 5. FOFAX
Nimbus III (Spring)	APT (DRID) HRIR (Stored) DRIR (Direct)	1200 ↑ 0000 ↙ 0000 ↙	1. Satellite Weather Bulletins	1. Teletype 2. Telephone 3. FOFAX
ATS I 151W	ESSA (NESC) will cooperate with NASA in experiment to obtain SSCC picture data and schedule WEFAX transmissions.		1. Mapped digitized video (one picture daily) 2. Wind analyses from movies 3. Synoptic time neph 4. Satellite Weather Bulletins	1. Facsimile 2. Teletype 3. WEFAX
ATS III 75W	ESSA (NESC) is preparing the capability for acquiring picture data from ATS III and expanding its cooperation with NASA beyond ATS I. Some data receipt and limited processing similar to that of ATS I is expected.			

ATTACHMENT 7D

ATTACHMENT 8

ABXX-1 KWBC
ABXX-2

SATELLITE WEATHER BULLETIN

(Satellite) (Area) (Bulletin #)

(Day) (Month) (Year) (Hour Min) Z

(Lat Location Long) STAGE DIA CAT

(Remarks about eye) (Storm name) *(Trend in development)

*Past _____ Hour Movement

APPROX TIME NEXT OBS (Month/Day/Hour)

(Remarks)

*Not to be used in the Caribbean, Gulf of Mexico and Atlantic west of 30°W longitude. However, in these areas pertinent information, especially regarding trends as indicated by the appearance of the disturbance, will be placed in the remarks section.

ATTACHMENT 9

DIGITAL TROPICAL WEATHER WARNING

(WORKSHEET)

INSTRUCTIONS

Group 1	Tropical weather warning indicator.
2	Up to six letters of name/number.
3	t_p – storm type. 1 – hurricane 2 – typhoon 3 – tropical storm 4 – tropical depression. NN – advisory number F – fix quality. 1 – excellent 2 – good 3 – fair 4 – greater than 40 n.m. t_f – fix type 1 – reconnaissance 2 – land-based radar 3 – aircraft radar 4 – satellite 5 – ships 6 – synoptic reports 7 – extrapolation
Group 4	Date-time (GMT) of initial position reported.
5 and similar groups	99 – WMO indicator. $L_aL_aL_a$ – Latitude *(tenth of degree)*.
6 33, 45, 57, 69	Q_c – WMO quadrant. 1 – 0–180° E } North 7 – 0–180° W } 3 – 0–180° E } South 5 – 0–180° W } $L_oL_oL_oL_o$ – Longitude *(tenth of degree)*
7 34, 46, 58, 70	O – initial position report. 1 – 12-hour prognosis 2 – 24-hour prognosis 4 – 48-hour prognosis 7 – 72-hour prognosis WWW – max wind (kts) RR – min radius of max wind *(tens of n.m.)* *(00 = near center)*
Group 8 and similar groups	O – same as 7. Q1 – NE quadrant Q2 – SE quadrant Q3 – SW quadrant Q4 – NW quadrant RR – radius if reported wind *(tens of n.m.)*
12 17, 22, 27, 39, 51, 63, 75	O – same as 7. WWW – Wind speed required by local directive (100, 65, 50, 30 kt) RR – same as 7.
80	Clarifying remarks deemed necessary by issuing agency.

FORMAT NOTES

1. *( ) Enclosed group number. Use group as required by regional directive.*
2. *◯ Encircled group number. Use group if appropriate.*
3. *Line out unneeded groups.*

Bulletin ID	1. HH HH	2. AAAAAA	(3) t_p NNF t_f	4. dd tttt			
ANALYSIS	5. 99LaLaLa 99	6. Q_c LoLoLoLo	7. OWWWRR 0	(8) 0Q1RR ONE	(9) 0Q2RR OSE	(10) 0Q3RR OSW	(11) 0Q4RR ONW
	(12) OWWWRR 0100	(13) 0Q1RR ONE	(14) 0Q2RR OSE	(15) 0Q3RR OSW	(16) 0Q4RR ONW		
	(17) OWWWRR 0065	(18) 0Q1RR ONE	(19) 0Q2RR OSE	(20) 0Q3RR OSW	(21) 0Q4RR ONW		
	(22) OWWWRR 0050	(23) 0Q1RR ONE	(24) 0Q2RR OSE	(25) 0Q3RR OSW	(26) 0Q4RR CNW		
	(27) OWWWRR 0030	(28) 0Q1RR ONE	(29) 0Q2RR OSE	(30) 0Q3RR OSW	(31) 0Q4RR ONW		
12-hr Prog	32. 99LaLaLa 99	33. Q_c LoLoLoLo	34. 1WWWRR 1	(35) 1Q1RR 1NE	(36) 1Q2RR 1SE	(37) 1Q3RR 1SW	(38) 1Q4RR 1NW
	(39) 1WWWRR 1050	(40) 1Q1RR 1NE	(41) 1Q2RR 1SE	(42) 1Q3RR 1SW	(43) 1Q4RR 1NW		
24-hr Prog	44. 99LaLaLa 99	45. Q_c LoLoLoLo	46. 2WWWRR 2	(47) 2Q1RR 2NE	(48) 2Q2RR 2SE	(49) 2Q3RR 2SW	(50) 2Q4RR 2NW
	(51) 2WWWRR 2050	(52) 2Q1RR 2NE	(53) 2Q2RR 2SE	(54) 2Q3RR 2SW	(55) 2Q4RR 2NW		
48-hr Prog	56. 99LaLaLa 99	57. Q_c LoLoLoLo	58. 4WWWRR 4	(59) 4Q1RR 4NE	(60) 4Q2RR 4SE	(61) 4Q3RR 4SW	(62) 4Q4RR 4NW
	(63) 4WWWRR 4050	64. 4Q1RR 4NE	(65) 4Q2RR 4SE	(66) 4Q3RR 4SW	(67) 4Q4RR 4NW		
72-hr Prog	68. 99LaLaLa 99	69. Q_c LoLoLoLo	70. 7WWWRR 7	(71) 7Q1RR 7NE	(72) 7Q2RR 7SE	(73) 7Q3RR 7SW	(74) 7Q4RR 7NW
	(75) 7WWWRR 7050	(76) 7Q1RR 7NE	(77) 7Q2RR 7SE	(78) 7Q3RR 7SW	(79) 7Q4RR 7NW		
REMARKS	(80) REMARKS						

ATTACHMENT 10

DETAILED EYE/CENTER DATA MESSAGE			ADDRESSEE:
MISSION NUMBER:	DATE:	SCHEDULE FIX TIME Z	
AIRCRAFT COMMANDER:	AIRCRAFT NUMBER:	WEATHER OBSERVER:	
SIMULTANEOUS FIX WITH OTHER AIRCRAFT: ☐ YES ☐ NO	TRANSMISSION TIME: Z	GROUND STATION RECEIPT TIME Z	PRECEDENCE: ☐ IMMEDIATE ☐ PRIORITY
MESSAGE HEADING:			

A. SQUADRON CALL SIGN / MISSION NUMBER / CYCLONE/STORM NAME / OBS NUMBER	
B.	EYE OR CENTER FIXED BY: (Note 1)
C. / N S	LATITUDE CENTER FIX. (DEG./MIN.)
D. / E W	LONGITUDE CENTER FIX. (DEG./MIN.)
E. ZULU	DATE AND TIME OF FIX.
F.	CENTER DETERMINATION: 1.POSITIVE, 2.FAIR, 3.POOR. (Note 2)
G.	NAVIGATION FIX ACCURACY IN NAUTICAL MILES.
H.	MINIMUM COMPUTED SEA LEVEL PRESSURE OR COMPUTED DROPSONDE. (MILLIBARS)
I. / N W/E ZULU	CONFIRMATION OF FIX. POSITION (DEG./MIN.) DATE, TIME.
J.	ESTIMATE OF MAXIMUM SURFACE WIND OBSERVED. (KNOTS)
K. /	BEARING AND RANGE FROM CENTER OF MAXIMUM SURFACE WINDS. (DEG. AND NM)
L. /	EYE SHAPE AND DIAMETER (CIRCULAR, OVAL, CONCENTRIC). ORIENTATION OF MAJOR AND MINOR AXIS (TENS OF DEGREES/ NM). (Note 3)
M. /	MINIMUM HEIGHT AT STANDARD LEVEL. (MBS./METERS)
N. /	MAXIMUM FLIGHT LEVEL/TEMPERATURE INSIDE THE EYE. (METERS) (DEGREES CENTIGRADE)
O. /	MAXIMUM FLIGHT LEVEL/TEMPERATURE OUTSIDE THE EYE. (METERS) (DEGREES CENTIGRADE)
P. / /	ABSOLUTE ALTITUDE OF AIRCRAFT (METERS) MAXIMUM FLIGHT LEVEL WINDS NEAR CENTER (DEG AND KNOTS)
Q.	BEARING AND RANGE OF MAXIMUM OBSERVED FLIGHT LEVEL WINDS FROM CENTER. (DEG. AND NM)
R.	PRIMARY MEANS OF NAVIGATION: (Note 4)
S.	EYE CHARACTER: CLOSED WALL, POORLY DEFINED, OPEN SW, ETC.
T.	COMM ON CENTER DETER: COMBINE POSITIVE, FAIR, OR POOR WITH WIND TEMPERATURE PRESSURE. (Note 5)
U. / / / E W	AIRCRAFT POSITION IF RADAR FIX. (DEG./MIN.)
V.	REMARKS: TRAIN FEEDER BANDS, CLOUDS IN EYE, ETC. (All After Item S are Optional.)
W.	
X.	
Y.	
Z.	

ITEMS K - V MAY BE DELAYED IF TIME IS CRITICAL.

Note 1. Transmit Number in accordance with the following code:

1. Wind
2. Pressure
3. Radar
4. Penetration
5. Temperature
6. Cloud
7. Spiral Overlay
8. Triangulation
9. Radar Hole in Sea Return

Note 2. Center Determination:

1. Positive (0-9 NM)
2. Fair (10-19 NM)
3. Poor (20 NM or greater)

The aircraft may send this information in code figures 1, 2 or 3 or may indicate the accuracy of the center fix in nautical miles. Example: Figure 1 would indicate Positive Center Determination with accuracy of 0 to 9 nautical miles. Figure 5 would indicate center determination within 5 nautical miles.

Note 3. Eye Shape will be transmitted: C=Circular, CO=Concentric, E=Elliptical. Orientation of Major Axis in tens of degrees, i.e., 01-010 to 190; 17-170 to 350; etc. Diameter in NM.

EXAMPLES: C8 - Circular eye 8 miles in diameter.
E09/15/5 = Elliptical eye, major axis 090-270, length of major axis 15 NM, length of minor axis 5 NM.
C08/14 = Concentric eye, diameter inner eye 8 NM, outer eye 14 NM.

Note 4. Transmit Number in accordance with the following code:

1. LORAN
2. Radar
3. Doppler
4. Celestial
5. Dead Reckoning
6. TACAN

Note 5. Transmit in code as follows: W=Wind, T=Temperature, P=Pressure, R=Radar, 1=Positive, 2=Fair, 3=Poor. Example: W2P1T1 = Wind Fair, Pressure Positive, Temperature Positive.

Items W-Z will be as determined by the specific agency with Storm Warning Responsibility, i.e., JTWC in Western Pacific, NHC in Atlantic, HWO San Francisco in Eastern North Pacific; and HWO Honolulu in Central North Pacific.