

AD-A102 209 FEDERAL AVIATION ADMINISTRATION WASHINGTON DC SYSTEM--ETC F/6 4/2
IMPROVED WEATHER SERVICES FOR HELICOPTER OPERATIONS IN THE GULF--ETC(U)
JUN 81 A HILSENROD
UNCLASSIFIED FAA/RD-81/40 NL

1 of 1
AD-A
10/209

END
DATE
FILMED
8-81
DTIC

AD A102209

LEVEL II

12

14/ ~~FAA~~/FAA/RD-81/40

61

Improved Weather Services for Helicopter Operations in the Gulf of Mexico.

10 Arthur Hilsenrod

11
June 1981

Final Report

12 24

This document is available to the U.S. public
through the National Technical Information
Service, Springfield, Virginia 22161.



U.S. Department of Transportation
Federal Aviation Administration
Systems Research & Development Service
Washington, D.C. 20590

DTIC
ELECTE
JUL 30 1981

D

DTIC FILE COPY

34517
81 7 30 014

NOTICE

This document is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its contents or use thereof.

Technical Report Documentation Page

1. Report No. DOT/FAA/RD-81/40	2. Government Accession No. <i>AD-A102 209</i>	3. Recipient's Catalog No.
4. Title and Subtitle Improved Weather Services for Helicopter Operations in the Gulf of Mexico		5. Report Date June 1981
7. Author's Arthur Hilsenrod *		6. Performing Organization Code
9. Performing Organization Name and Address U.S. Department of Transportation Federal Aviation Administration Systems Research and Development Service Washington, D.C. 20591		8. Performing Organization Report No.
12. Sponsoring Agency Name and Address U.S. Department of Transportation Federal Aviation Administration Systems Research and Development Service Washington, D.C. 20591		10. Work Unit No. (TRAIS)
15. Supplementary Notes * The report contains information from a variety of sources. The acknowledgement page recognizes personnel that contributed to this report.		11. Contract or Grant No.
		13. Type of Report and Period Covered Final
		14. Sponsoring Agency Code FAA/ARD-400, ARD-300
16. Abstract Current weather services in support of the more than 800 helicopters operating in the Gulf of Mexico is reviewed and the limitations noted. Means of improving these services based on currently available facilities and ongoing research and development efforts are presented. Immediate improvements in weather services can be attained by the implementation of a plan agreed upon by personnel of the FAA, NWS and helicopter operators. Near-term (to 1986) and longer-term (beyond 1986) developments in observations, forecasts, and communications that can improve weather services are presented.		
17. Key Words Weather, helicopters, Gulf of Mexico forecasts, observations, communications		18. Distribution Statement Document is available to the U.S. public through the National Technical Information Service, Springfield, Virginia 22161.
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 27
		22. Price

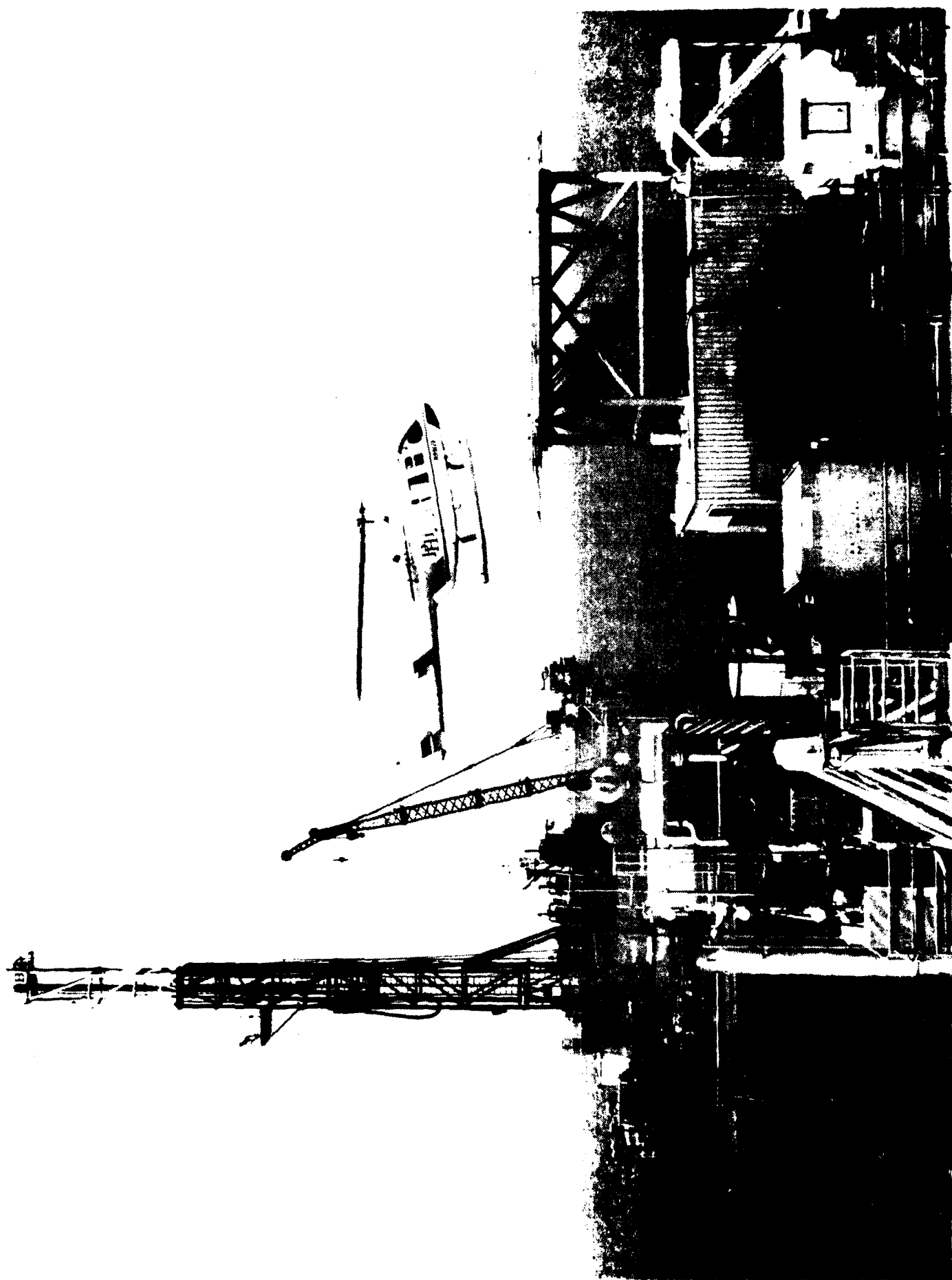


TABLE OF CONTENTS

	<u>PAGE</u>
I. INTRODUCTION AND BACKGROUND	1
A. Purpose of Report	1
B. Background - Helicopters	1
C. Background - Weather Environment	2
D. Unique Weather Problems	3
1. Cruising Altitudes	3
2. Range of Helicopter Flights	4
3. Weather Effects	5
E. VFR/IFR Operating Regulations - Weather	6
II. OPERATIONS IN GULF OF MEXICO	11
A. Background	11
B. Weather Requirements	14
III. GULF OF MEXICO CLIMATOLOGY	16
IV. CURRENT WEATHER SERVICES IN GULF	24
A. Observations	24
1. Aviation Weather Surface Observations	25
2. Thunderstorm and Precipitation	29
3. Satellites	29
4. Upper Air Observations	33
5. Pilot Reports	33
B. Forecasts	35
1. Terminal	35
2. Area	36
3. Sea State	40
C. Communications	40
1. Gulf Observations	40
2. Forecasts	42
3. PIREPS	42
4. The Flight Service Station	44

	<u>PAGE</u>
V. NEAR TERM IMPROVEMENT - WITHIN 5 YEARS	46
A. Observations	46
1. Network of Observations - Current Implementation	46
2. SAWRS	46
3. Automated Weather Observation System	47
4. Thunderstorm Detection - Lightning Positioning and Tracking System	48
5. Gulf Offshore Weather Observing Network	49
6. Pilot Reports	50
B. Forecasts	50
1. Approaches to Improved Forecasts	50
2. Gulf Environmental Forecasts	52
3. Thunderstorm Forecasts	53
4. Terminal Forecasts	53
C. Communications	54
1. Gulf Circuit - Initial Plan	54
2. Automation of Field Operations and Services	54
3. Aviation Weather System	55
4. Flight Service Station	55
5. Aviation Route Forecasts	56
VI. LONG TERM IMPROVEMENTS - AFTER 1986	57
A. Observations	57
1. Automated Terminal Observations	57
2. Lightning (thunderstorm) Positioning and Tracking System	57
3. Satellites	57
B. Forecasts	58
1. Automated Forecasts	58
2. Very Short Range Forecasts of Ceiling and Visibility	58
3. Thunderstorms	58
C. Communications	58
VII. RECOMMENDATIONS	60
ACKNOWLEDGEMENTS	61

ACRONYMS - ABBREVIATIONS

AFOS	Automation of Field Operations and Services
AIRMET	Airmen's Meteorological Information
ALWOS	Automated Low-Cost Weather Observing System
BLM	Bureau of Land Management (Water Power Resources Service)
DOD	Department of Defense
EFAS	Enroute Facility Advisory Service
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
FSS	Flight Service Station
GLS	Galveston
GOES	Geostationary Operational Environmental Satellite
GOWAN	Gulf Offshore Weather Observation Network
HEDA	Helicopter Descent Area
HSVFR	Helicopter Special VFR
ILS	Instrument Landing System
in	inches
JAWOS	Joint Automatic Weather Observation System
LCH	Lake Charles
mb	millibars
mph	miles per hour
MSY	New Orleans
NAS	National Airspace System
NESS	National Environmental Satellite
NEW	Lakefront (New Orleans)
nm	nautical miles
NOAA	National Oceanographic and Atmospheric Administration
NOSS	National Oceanic Satellite System
NOTAM	Notice to Airmen
NMC	National Meteorological Center
NSSFC	National Severe Storms Forecast Center
NWS	National Weather Service
PHI	Petroleum Helicopters, Inc.
PIREPS	Pilot Reports

RAMOS	Remote Automatic Meteorological Observing Systems
RAWARC	Radar Reporting and Warning Coordination Circuit
SAWRS	Supplementary Aviation Weather Reporting Station
SFAR	Special Federal Air Regulation
SIGMET	Significant Meteorological Information
SIM	Satellite Interpretation Message
TERPS	United States Standard For Terminal Instrument Procedures
WMSC	Weather Message Switching Center
WSFO	Weather Service Forecast Office
WSO	Weather Service Office
VFR	Visual Flight Rules
VORTAC	Very High Frequency Omni-Directional Radio Range (VOR) and Ultra High Frequency Tactical Air Navigation Aid (TACAN)

EXECUTIVE SUMMARY

Currently, there are many companies using more than 800 helicopters for offshore operations in the Gulf of Mexico. They conduct nearly 300,000 flight operations a month and transport more than 8,000 personnel a day. The number of helicopters and personnel transported are expected to increase dramatically over the next several years as oil and gas exploration and extraction increases in the Gulf of Mexico.

Current weather services over the Gulf of Mexico in support of helicopter operations are examined and the limitations of these services noted. Plans for improving weather services for the support of Gulf helicopter operations over the next five years and after 1986 are presented. The near term improvements include a Gulf observation, forecast and dissemination program that could be implemented before the end of 1981, and development of a) an automated aviation weather reporting system, b) a lightning (thunderstorm) positioning and tracking system, c) automatic terminal weather forecasts for forecaster's guidance and d) improved communication of weather information.

IMPROVED WEATHER SERVICES
FOR HELICOPTER OPERATIONS IN THE
GULF OF MEXICO

I. INTRODUCTION AND BACKGROUND

A. Purpose of Report

This report will:

1. Review the weather services that currently support the offshore helicopter operations in the Gulf of Mexico.
2. Identify the near-term (within 5 years) efforts that can be made to improve these services.
3. Provide a longer term plan for improvements in Gulf weather services. The manner in which the Federal Aviation Administration (FAA), the National Weather Service (NWS), the oil companies, and the helicopter operators can contribute to these improvements will be explored.

B. Background - Helicopters

¹ The use of the helicopters in a wide variety of applications has increased dramatically in recent years. This trend is forecast to continue for the foreseeable future. Helicopters are currently the fastest growing segment of commercial aviation with 20,000 helicopters projected to be in operation within the U.S. by 1990. Helicopters:

- have become vital to the efficient exploration and development of energy resources in remote and offshore areas;
- are frequently used to support law enforcement, emergency medical airlift, disaster relief and other civil operations;

¹ Based on Department of Transportation, Helicopter Operations Research and Development Plan, Report No. FAA-ED-04-2, to be issued.

- have enhanced the air transportation systems by providing city-center, intra-airport and short-haul industrial service; and
- have significantly increased the efficiency of the industrial lumber operations while reducing the ecological damage resulting as a by-product of some lumbering operations.

In order for this segment of civil aviation to operate in a safe and productive manner, current Federal regulations, standards, procedures, and support systems are being reviewed and modified or, where necessary, new ones developed. The specific intent of these activities is to improve civil helicopter operations while ensuring safe integration into the National Airspace System (NAS).

C. Background - Weather Environment

The general upgrading of weather service by both the NWS and the FAA that is currently taking place to support all aircraft operations will also be beneficial to helicopters. However, the helicopter has a number of flight characteristics which present unique weather service requirements (see section D below).

The NWS is responsible for weather observation standards, certification of observers and of some observing instruments. The NWS also takes approximately 230 observations either manually or semi-automatically. The NWS also is responsible for the weather forecasts for U.S. civil aviation. The FAA also takes nearly 360 aviation weather observations. In addition, at certain commercial airports the operators of the aircraft or the airport make observations, usually in connection with an instrument landing system (ILS) facility where weather observations are needed for making instrument approaches. These observations are made at

certified facilities called Supplementary Aviation Weather Reporting Stations (SAWRS). The Department of Commerce manual, "Operations of the National Weather Service," provides a detailed description of weather services in the U.S. Appendices A, B, and C from that manual provide some detail on the observation and forecast systems. Appendix D provides information to the pilot on observing and forecasting symbology and terminology.

The FAA has the responsibility for determining the new or additional aviation weather information needed for implementing safe and extensive helicopter operations under Visual Flight Rules (VFR) and Instrument Flight Rules (IFR) within the NAS. The need for new weather equipment and innovative procedures, supporting the special needs of this important activity, is of prime importance to helicopter pilots. They, as well as pilots of other aircraft, require timely, accurate and comprehensive weather information, forecasts and briefings in a useable format.

D. Unique Weather Problems

1. Cruising Altitudes

Helicopter cruising altitudes seldom exceed 10,000 feet MSL and most flights are below 5,000 feet MSL. There are several reasons for this:

- The decrease of air density with altitude accentuates the phenomenon of retreating blade stall; this reduces the allowable maximum speed of conventional helicopters by 2 to 3 knots per thousand feet of altitude. Thus, the helicopter's efficiency is reduced substantially above 5,000 to 7,000 feet.
- Helicopters are not pressurized; few, if any, carry oxygen systems.

- Most helicopter flights are relatively short and climbs to altitudes above 5,000 feet are not normally cost effective.
- Because of their relatively high loading per square foot of blade area, as well as the flexibility designed into their main rotor, helicopters tend to ride much smoother than fixed-wing aircraft. Thus, a flight through low-altitude turbulence that would be quite uncomfortable in a light fixed-wing aircraft would be more comfortable in a helicopter.
- Because of the lack of deicing capability in nearly all helicopters, the normal decrease of temperature with altitude forces these aircraft to remain at comparatively low altitudes below the freezing level when flying through clouds or precipitation.
Alternatively, if weather reports indicate that icing conditions cannot be avoided, the flight must be delayed to await favorable conditions.

2. Range of Helicopter Flights

Compared to fixed-wing aircraft, the typical helicopter is a relatively short-range vehicle. Most IFR helicopters have a range of 175-300 miles; some have a range of 500 miles. Because of the large dimensions of some weather systems which can extend for several hundred miles, this short-range may be insufficient to fly to an IFR destination, then to another airport with weather good enough to meet the published weather minima requirements for an alternate airport, and to get there with the required minimum of reserve fuel.

The feasibility of relaxing alternate airport weather standards for helicopters is being studied because:

- Flights are relatively short. Thus, weather at the destination or alternate airport is probably less likely to deteriorate below the forecast conditions.
- Except in an emergency, the helicopter is never committed

to land; the pilot can start a go-around at any time, without changing the aircraft configuration (flap settings, gear retraction, turbine spool-up, etc.)

- The slow approach speed of the helicopter gives the pilot much more time to get oriented once he achieves visual contact; also, the field of vision from the cockpit of a helicopter is generally much greater than that from the cockpit of an airplane.
- As it can decelerate to hover speed in the air, the helicopter does not need to be perfectly aligned with a runway, to make a safe landing.

Special Federal Air Regulation (SFAR) 29.2 reduces the helicopter reserve fuel requirement from 45 to 30 minutes for IFR flights.

3. Weather Effects

Because the helicopter operates in a lower speed regime than most fixed-wing aircraft, low-level winds will have correspondingly greater effect on elapsed time, range and drift angle. With a combination of low air speed and short-range, strong headwinds may force cancellation of certain comparatively long-range flights.

Icing

Icing of helicopters includes all the critical effects encountered in the icing of airplanes, notably a decrease in thrust and lift, with an increase in drag and weight. For Gulf operational altitudes, icing is rarely a problem.

Thunderstorms

Just as with conventional airplanes, thunderstorms are a serious hazard to helicopters and must be avoided.

Helicopters frequently do not have enough range to circumnavigate thunderstorms. This places special emphasis on the requirement for good thunderstorm reporting and forecasting.

E. VFR/IFR Operating Regulations - Weather

The Federal Aviation Regulations (FARs) are issued by the FAA to insure the highest level of safe operation of aircraft.

All transport category aircraft and most helicopters operating over the Gulf of Mexico, must operate under FAR Part 135 - Air Operators and Commercial Operators. Subpart D - VFR/IFR Operating Limitations and Weather Conditions - of Part 135 sets forth the weather conditions under which helicopters must operate. These conditions include limits for which observations and forecasts are required for VFR and IFR flights. Of special importance to these operations are:

1. The weather observations used for IFR operations must be those issued by the NWS, from a source approved by the NWS, or from a source approved by the FAA Administrator (FAR 135-213). Supplemental Aviation Weather Reporting Stations (SAWRS) on offshore platforms are intended to meet this requirement.
2. Before an IFR flight can be initiated, the flight must have a weather observation or forecast that indicates the destination airport will be at or above landing minimums at the estimated time of arrival (FAR 135-219).
3. Prior to beginning an instrument approach to an airport (platform) that airport (platform) must have an approved weather reporting facility, and the latest weather observation at that airport (platform) must show that the weather is at or above landing minimums (FAR 135-225).

The FAA has issued operational specifications for specific operations (in accordance with FAR 135-213b) authorizing the use of SAWRS weather observations for an IFR offshore destination platform within a 10 nautical mile radius of the observing station. The FAA's New Orleans Flight Standards District Office later expanded that authorization to include platforms within 20 nautical miles of at least two SAWRS that are on opposite sides of the destination offshore platform. See FIGURE 1.

The minimums for approaches under IFR are given on the approach charts which are an extension of FAR 97. Category I minimums for helicopters may be as low as 200 feet and 1/2 mile. The United States Standard for Terminal Instrument Procedures (TERPS) describes conditions under which the helicopters may operate down to 1/4 mile. Chapter 11 of TERPS, which applies to helicopters, is currently being reviewed for possible revision. The helicopter descent area (HEDA) minimums for offshore platforms in the Gulf of Mexico are 400 feet and 1 mile visibility at night and 400 feet and 1/2 mile visibility during daylight (FAR 125.205).

Helicopter en route descent areas are authorized in the Gulf by the FAA to provide as many instrument operations as possible with the available weather reporting stations.

An alternate destination is required to be filed by a pilot when the weather report at the destination is less than 2,000 feet ceiling and less than 3 miles visibility (FAR 135.2236).

The specified alternate minimums are (FAR 91.83 and 135.221):

- a) Precision approach alternate - 600 feet ceiling and 2 miles visibility.

- b) Non-precision approach alternate - 800 foot ceiling and 2 miles visibility.

The offshore helicopter operators also issue directives for the safety of their aircraft. These directives include:

- a) Helicopter pilots are required to designate an onshore terminal as the alternate airport.
- b) When a two engine helicopter loses an engine, the pilot, whenever practical, is required to fly the helicopter to an onshore terminal.

Typical IFR Offshore Operation in Gulf of Mexico

1. Operator files an IFR flight plan to an offshore platform which has approved weather observations.
2. Helicopter departs on an established route to platform and descends in a helicopter descent area (HEDA).
3. After reaching VFR conditions, the pilot often cancels IFR and flies VFR to another platform which could not be used as an IFR destination airport because it lacked approved weather reports.
4. VOR, OMEGA and Loran C are used for en route navigation to HEDA. Airborne weather and mapping radar is used to provide approach guidance.
5. HEDAS are used because platforms lack IFR navigational aids.
6. Specific VORTAC intersections have been established approximately 40 nautical miles offshore to allow helicopter returning to shore from offshore platforms to the NAS IFR System.

The predominant areas of interest for helicopter operations in the Gulf of Mexico are from the coast of Louisiana and Texas to approximately 125 miles offshore.

Approximately 85% of the platforms are within this area. Oil rigs and platforms and thus helicopter operations are expected to extend to an area 300 miles south of the Louisiana and Texas coast and areas south of Mississippi and the panhandle of Florida within a few years.

II. OPERATIONS IN GULF OF MEXICO

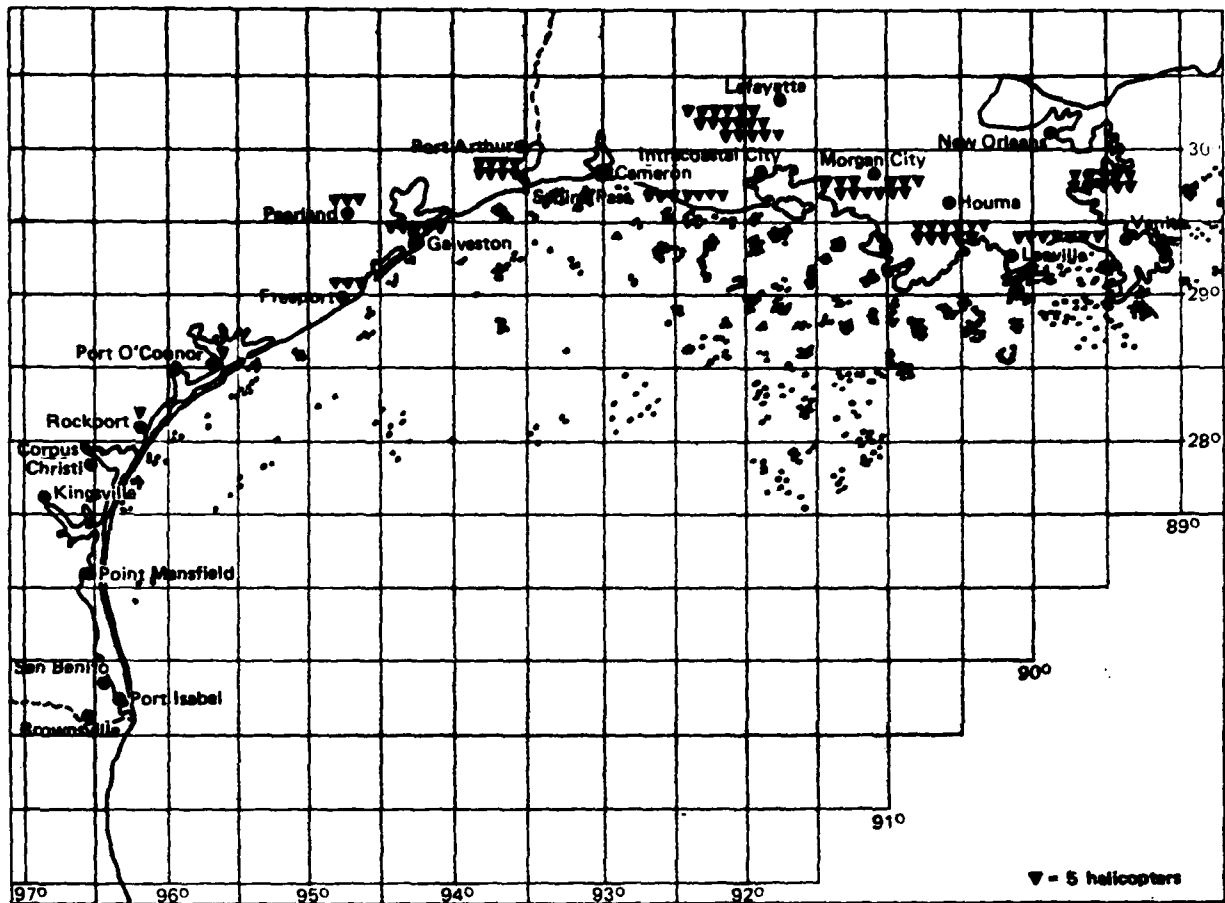
A. Background

Currently, the most extensive and concentrated domestic civil helicopter operations are conducted in the Gulf of Mexico/offshore coastal area of the U.S. See FIGURE 2 for the area and cities of greatest helicopter activity. Each day over 8,000 people are moved to energy production sites in these versatile aircraft. A single Louisiana based helicopter operator transports more people daily than the most active of all U.S. commuter airlines and owns more aircraft than almost all of the world's largest air carriers.

The number of helicopters operating in the Gulf has increased from about 420 at the end of 1978 to more than 800 in April 1981, flying to more than 2,400 drilling offshore platforms and oil rigs. This number is expected to increase to more than 900 helicopters by the end of 1981. Approximately 60 helicopters are stationed on offshore platforms at any one time. FIGURE 3 shows an area of dense platform population off the coast of Louisiana.

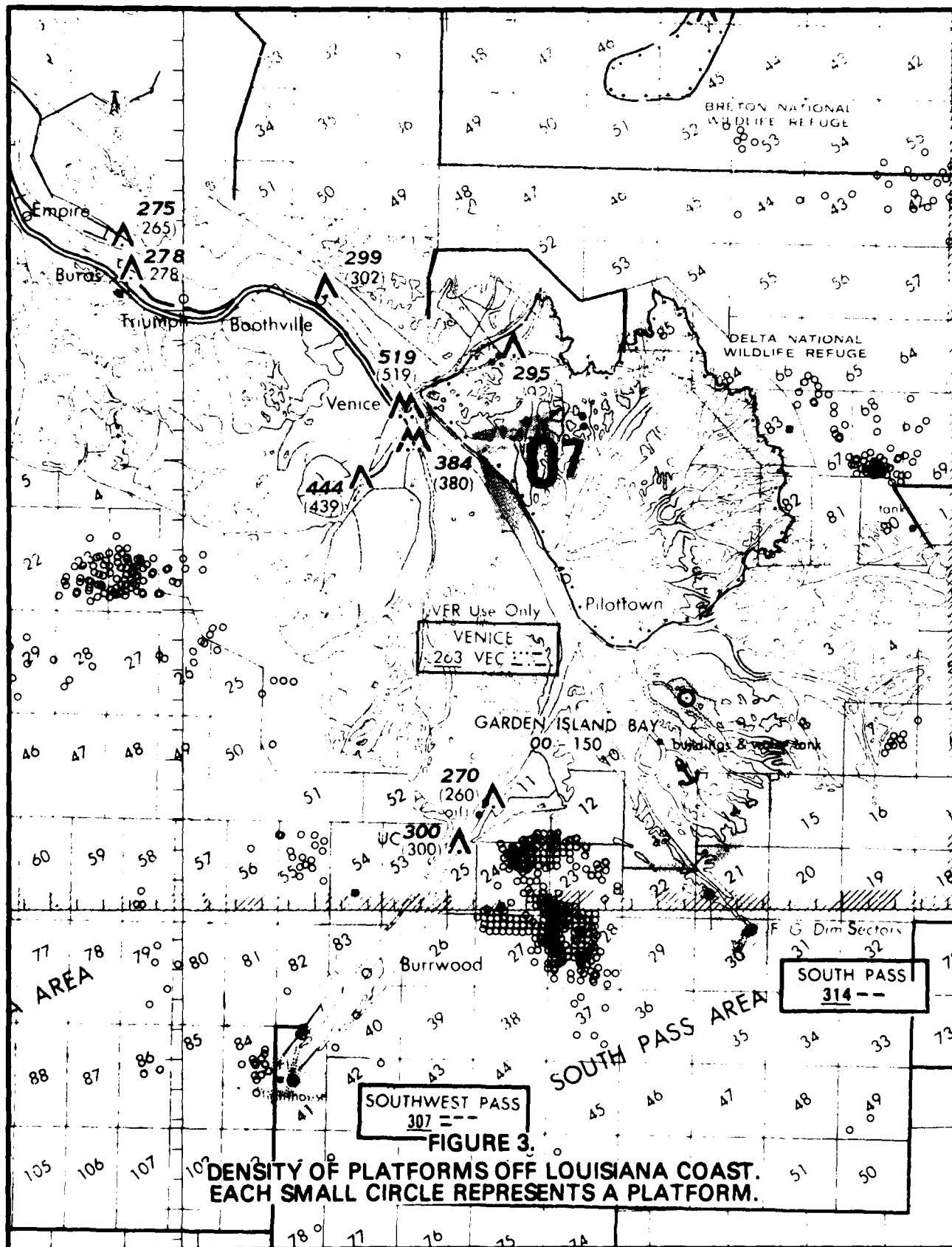
Instrument flight operations are conducted in the Gulf under IFR or Helicopter Special VFR (HSVFR). 368 IFR operations were recorded during a 30 day period from mid-January to mid-February 1981. It is probable that number could grow to 2,000 per month by 1982. At the present time helicopters conduct nearly 300,000 operations a month.

On occasion, when the home base is "fogged-in", a returning flight must make a full ILS approach to the closest ILS-equipped airport. Therefore, the Gulf Coast helicopter instrument pilot is also occasionally forced into a high traffic density environment that is often associated with



Copyright. Business and Commercial Aviation, Jan. 1979. Reproduced with permission of B/CA.

FIGURE 2.
COASTAL POINTS ON GULF OF MEXICO HIGHLIGHTS HIGHEST DENSITY
HELICOPTER OPERATIONS. MORE THAN 800 HELICOPTERS CURRENTLY
SUPPORT THE OIL AND GAS EXPLORATION AND EXTRACTION OVER A
60,000 SQUARE MILE AREA.



holding en route, flying in heavily controlled airspace and maneuvering with other airplane traffic in order to complete his approach. Thus, IFR helicopters are faced with identical situations prevailing for fixed wing aircraft at busy airports.

The organizations operating the helicopters are listed in Appendix E.

B. Weather Requirements

Improved weather services can be expected to benefit the users of the information by enhancing safety, saving time and money, and expediting air traffic. The helicopter pilots, dispatchers, air traffic controllers, and FAA flight service specialists use the information for flight planning and support of en route and terminal operations.

The proper use of forecasts result in the following favorable courses of action:

<u>Forecast</u>	<u>Course of Action</u>
a. Terminal visibility and ceiling	Avoid delays in helicopter operations. Selection of best alternate airport.
b. Terminal wind and wind shear	Reduce terminal delays. Prevent missed approaches.
c. Thunderstorms, clear air turbulence, and wake turbulence	Avoid adverse effects on helicopters and passengers.

d. En route winds

Minimize fuel
consumption and time
en route.

The acceptability of these forecasts by the user depends on their timeliness, accuracy and reliability. The NWS strives to make these forecasts suitable and acceptable to the users.

Weather services for helicopter operations can be improved by providing in the near term (within 5 years):

1. More frequent aviation weather observations at more locations.
2. Improved detection and tracking of thunderstorms.
3. Terminal aviation weather forecasts for selected platforms.
4. Improved thunderstorm and area forecasts to 125 miles offshore.
5. PIREPS expeditiously disseminated.

Longer term improvements (after 1986)

1. Area and terminal forecasts to 300 miles offshore
2. Forecasts updated hourly.
3. Installation of Automated Weather Observation Systems.
4. Implementation of thunderstorm (spherics) detection for the location of thunderstorms up to 300 miles offshore.
5. Implementation of improved satellite weather detection systems.
6. More frequent and detailed upper air soundings to 10,000 feet.

Details of the near and long term plans are provided in this report.

III. GULF OF MEXICO CLIMATOLOGY

A. General Description²

The climate of the northern Gulf of Mexico and adjacent coastal region is determined by four major factors; the North American Continental land mass, the Azores-Bermuda high pressure cell, subtropical latitude, and the relatively warm waters of the Gulf of Mexico itself. The principal influence is the Gulf, resulting in a maritime tropical climate for the region.

During the winter, polar continental air masses move southward into the Gulf of Mexico causing occasional sudden drops in temperature. As these cold fronts reach the Gulf of Mexico, the maritime tropical air flowing northward causes the fronts to abate and become stationary. These stationary fronts are favorable for the formation of low centers that often move west to east along the Gulf Coast or move inland producing low clouds and rain. The cold continental air masses have a tendency to lower the sea surface temperature offshore. The cold water temperatures cause the formation of advective fog in coastal areas from November to March.

By spring, the Bermuda high develops its influence over the region thus improving the weather considerably. The ridge of high pressure usually blocks the movement of storm systems from the west. Occasionally, tropical disturbances and easterly waves will appear in the Gulf of Mexico by early summer.

² U.S. Department of Interior Environmental Statement - Proposed Oil and Gas Lease Sale 58A.

During the summer, southerly winds of the Bermuda high bring warm moist tropical air onshore. Daily shower activity occurs in near shore waters and along the coast with most activity in the afternoon. Westerly and northerly winds generally bring periods of hotter and drier weather into the region.

Easterly waves and tropical storms appear in the Gulf during late summer and early fall. The principal paths of tropical storms into the Gulf are through the Yucatan Channel and Straits of Florida. Over half of these tropical storms become hurricanes during this season. During October and November, the Bermuda High loses its strength and allows continental air to again exert influence on the Gulf of Mexico and coastal region.

B. Pressure, Temperature, and Relative Humidity

1. Pressure. The western extension of the Bermuda high pressure cell dominates circulation throughout the year, weakening in winter and strengthening in summer. The average monthly pressure reaches a minimum in summer ranging from 1,014 to 1,016 millibars from west to east over the northern Gulf of Mexico. The average monthly pressure reaches a maximum of 1,021 millibars during the winter in this region. The maximum average monthly pressures result from the influence of continental cold air present during winter. The minimum pressures occur during the summer when the equatorial trough shifts northward influencing the region.
2. Temperature. Average temperatures at coastal locations vary with latitude and exposure. In winter they depend on the frequency and intensity of penetration by polar

air masses from the north. These incursions, when they bring strong northerly winds, are called "northers" and may occur some 15 to 30 times between November through March.

Air temperatures over the open Gulf exhibit narrower limits of variations both on a daily and seasonal basis. In the summer, average temperature over the center of the Gulf is about 29 degrees C. Winter air temperatures in the Gulf of Mexico near the coastal areas average 17-20 degrees C.

3. Relative Humidity. Over the entire region, the relative humidities are high throughout the year. Maximum humidities occur during the spring and summer months when prevailing southerly winds bring warm moist air into the area. Minimum humidities occur when cold continental air masses bring dry air into the northern Gulf of Mexico during the late fall and winter. For recording stations from Brownsville, Texas, to Apalachicola, Florida, the relative humidity annually varies from a high of 87% at 6 a.m. to a low of 63% at 12 noon. This variation in a 6-hour period is caused by daily warming.

- D. 1. Precipitation. Average annual precipitation along the Gulf coast ranges from approximately 25 in. at Brownsville, Texas, 40 in. at Galveston, Texas, and 54 in. at New Orleans, Louisiana. Rainfall is fairly evenly distributed throughout the year, with the greatest amounts occurring during the months when the winds are predominantly out of the southeast and south, namely June, July and August. This is not to imply a continuity of precipitation for the South Texas region.

Along the Central Gulf area precipitation is frequent and abundant throughout the year but does show distinct seasonal variation. At New Orleans, October is the only month with a precipitation average less than 3.2 inches. July, the wettest month, receives just under 7.1 inches. Stations along the entire coast record the highest precipitation values during the warmer months of the year. The month of maximum rainfall for most locations is July. However, at Brownsville, the record maximum is in September. Winter rains are associated with the frequent passage of frontal systems through the area. Rainfalls are generally slow, steady and relatively continuous, often lasting several days. Snowfalls are rare, and when frozen precipitation does occur it usually melts upon contact with the ground. Incidence of frozen precipitation decreases with distance offshore and rapidly reaches zero.

The warmer months usually have convective cloud systems which produce showers and thunderstorms; however, thunderstorms of this type rarely cause any damage or have attendant hail.

2. Cloudiness. Along the Texas and Louisiana Gulf coast cloudiness averages between $\frac{3}{8}$ to $\frac{5}{8}$ sky cover with relatively small seasonal variation. The cloudier season is winter and early spring with summer and fall being generally clearer. The Climatic Atlas of the U.S. shows that the central Gulf Coast received the highest percentage of possible sunshine in the summer and fall, ranging between 60% and 70%, with the high in October. The percentage of possible sunshine declines to a low in December and January (50% or less) and increases

gradually through the spring and early summer into the 60% range.

During the warm season, May through September, cumulus clouds begin developing over northern Gulf waters about 3 AM local time and larger clouds may produce scattered showers which dissipate when carried onshore during the morning by the sea breeze. Onshore cumulus development occurs during the day reaching maximum in late afternoon, often accompanied by rainfall. Much of the summer clouds are either convective cumuli or high, relatively transparent clouds.

3. Visibility. Warm, moist Gulf air blowing slowly over chilled land or water surfaces brings about the formation of the fog. The period from November through April has the highest frequencies of low visibilities. On the south Texas coast, fog reduces visibility to less than 5/8 of a mile on an average of 28 days a year. Very dense fog in Galveston makes visibilities of 3/8 of a mile about 16 days a year. Port Arthur has an average of 42 days each year in which visibility is less than 3/8 of a mile. Visibility around the Mississippi Delta may be lowered by industrial pollution from New Orleans or smoke from burning marshlands.

Fog occurrence does decrease seaward but there have been visibilities less than 1/2 mile due to fog offshore.

Generally, coastal fogs last three or four hours although particularly dense sea fogs may persist for several days. Visibility offshore Louisiana is reduced to less than 3 miles on a monthly average of 4% of the time. Poorest

visibility conditions occur during winter and early spring when visibility is reduced to less than 3 miles between 8% and 10% of the time.

E. Severe Storms

1. Tropical Cyclones. The largest and most destructive storms affecting the Gulf of Mexico and adjacent coastal zones are tropical cyclones. These have their origin over the warm tropical waters of the central Atlantic Ocean, Caribbean Sea or southeastern Gulf of Mexico. They occur most frequently between June and late October and there is a relatively high probability that tropical cyclones will cause damage in the Gulf of Mexico each year. Statistics for hurricanes and tropical cyclones are often lumped together since it is often difficult, especially in the older records, to determine the storm intensity while at sea.

Hurricanes vary considerably in intensity, track patterns and behavior upon crossing land. The storm approach is marked by rising tides and increased wind velocities; generally the longer a storm lingers in the Gulf, the larger the bulge of water it pushes ashore as it approaches land. These storm tides are commonly higher in the bays than on Gulf sea beaches, although flooding and pounding waves affect both areas.

There is no common route of hurricane tracks although early season cyclones approach generally from the southeast while later ones are more out of the south. In spite of the fact that most hurricanes form in tropical ocean areas, a few are generated in the Gulf of Mexico.

During the period 1901-1971, seven hurricanes and seven tropical storms formed in the Gulf north of 25 N and east of 85 W.

Damage from hurricanes results from high winds and, particularly in the coastal areas, the storm surge or tide which is an abnormally high rise in the water level. Maximum surge height at any location is dependent on many factors including bottom topography, coastline configuration and storm intensity. The storm surge associated with "Betsy" in 1965 reached nearly 20 feet at Bayou Lafourche; Hurricane "Carla" in 1961, produced 23 foot tides in Lavaca Bay, Texas. Hurricane "Camille" was the most severe hurricane in recent Gulf history, with top winds estimated at 324 km/hr, and barometric pressure in her eye as low as 26.6 in. (900.82 mb) of mercury. Anita, of late August 1977, came ashore just south of the U.S. border in Mexico after tracking through the Gulf, bringing storm surges to various parts of the Texas and Louisiana coasts. In the same week, "Babe," just strong enough to be termed a hurricane, developed and caused no significant offshore damage. It came ashore near Morgan City, Louisiana three days later.

2. Extratropical Cyclones. In addition to the tropical cyclones, extratropical cyclones that may vary greatly in intensity occur in this area primarily during the winter months. These storms have attained wind speeds as great as 34 to 60 mph. They originate in middle and high latitudes forming on the fronts that separate different air masses. The Gulf of Mexico is an area of cyclone development during the cooler months due to the contrast in temperatures of the warm air over Gulf waters and the

cold continental air over the United States. These storms rapidly dissipate, or move on, after entering the Gulf of Mexico.

3. Polar Outbreaks. A phenomenon known as "norther" is quite common in the area in question during the winter months. A norther occurs when cold, polar air moves southward from the cold interior of the North American continent out over the warm waters of the Gulf. This unstable cold air mass, when heated from below, develops strong gusty winds, with considerable cloudiness and showers.

During a typical winter as many as 30 such polar outbreaks reach the Gulf Coast. The majority of these cold outbreaks, spilling out over the Gulf, produce winds in the 17-23 mph range but approximately one-third of these cold outbreaks have winds over 40 mph with approximately half of these being vigorous enough to reach 55 mph.

IV. CURRENT WEATHER SERVICES IN GULF

A. Observations

Weather observations are required to characterize the local and upper atmospheric environment in three dimensions for helicopter operations and for the development of weather forecasts for a variety of operators, e.g., helicopter, ships, etc. These observations include:

- surface
 - aviation weather (time, ceiling, visibility, present weather, etc.)
 - sea state
 - ship reports
- upper air
 - wind, temperature, relative humidity
- thunderstorms
 - radar
 - atmospheric (spherics)
- pilot reports
- satellite data (visual and infrared)

These observations will be examined as they apply to the improvement of the aviation weather services in the Gulf.

1. Aviation Weather Surface Observations

At the present time there are a limited number of observations that meet the requirements for helicopter operations. See Appendix F for plans for implementing a network of observations during 1981.

Aviation weather observations on a platform are required not only for the conduct of landings and takeoff under IFR conditions but for aviation weather forecasts. If an aviation weather forecast is to be available on a 24-hour per day basis, the observations must be taken 24 hours per day.

For forecasts less than 24 hours, e.g., 18 hours, at least 2 consecutive hourly observations are required prior to issuing a forecast.

It is the U.S. Government policy that all weather observations required for the support of private operations be purchased, operated and maintained by the private operator. The use of Supplementary Aviation Weather Reporting Stations (SAWRS) is the approved way for providing these observations. The NWS provides self-study training materials, certification of observers, forms and instructions to any operator wishing to establish a SAWRS. There are currently 7 SAWRS in the Gulf of Mexico. The observations at these stations are usually taken three times a day, (sunrise, noon, and sunset) to meet the requirements of local helicopter

METEOROLOGICAL OBSERVATIONS IN GULF OF MEXICO AVAILABLE FOR ROUTINE DISTRIBUTION

POINT	ID	OPERATOR	LAT	LONG	OBS PER DAY	PARAMETERS					WAVE SEA	SEA TEMP	PCPN	COMMS
						VISUAL	PRESSURE	TEMP	DEW PT.	WIND				
A	P00	RAMOS	28.0	93.0	8		X	X	X	X		X	S	
B	P92	RAMOS	29.6	90.5	8		X	X	X	X		X	S	
C	P21	MOBIL	29.7	88.9	8		X	X	X	X			C	
D	P26	MOBIL	28.5	90.1	8		X	X	X	X			C	
E	VUW	MOBIL	28.2	91.8	8		X	X	X	X			C	
F	P25	MOBIL	28.7	92.3	8			X	X	X			C	
G	P22	MOBIL	29.1	92.2	8		X	X	X	X			C	
H	P30	MOBIL	28.3	93.0	8		X	X	X	X			C	
I	42001	NDBC	25.9	85.7	8		X	X	X	X	X		S	
J	42002	NDBC	26.0	93.5	8		X	X	X	X	X		S	
K	42003	NDBC	26.0	86.0	8		X	X	X	X	X		S	
L	42007	NDBC	30.1	88.9	8		X	X	X	X	X		S	
M	42008	NDBC	28.7	95.3	8		X	X	X	X	X		S	
N	42009	NDBC	29.3	87.5	8		X	X	X	X	X		S	
O	42010	NDBC	29.7	93.4	8		X	X	X	X	X		S	
P		CONOCO	29.3	94.3	8		X	X	X	X	X		S	
Q		CONOCO	29.8	93.0	8		X	X	X	X	X	X	C	
R		CONOCO	29.5	92.8	8		X	X	X	X	X	X	C	
S		CONOCO	29.3	92.7	8		X	X	X	X	X	X	C	
T		CONOCO	29.2	92.9	8		X	X	X	X	X	X	C	
U		CONOCO	29.1	92.5	8		X	X	X	X	X	X	C	
V		CONOCO	28.5	91.8	8		X	X	X	X	X	X	C	
W	5R0	PHI SAWRS	28.2	93.7	3		X	X	X	X	X	X	T	
X	7T6	PHI SAWRS	28.4	92.6	3		X	X	X	X	X	X	T	
Y	7R8	PHI SAWRS	28.3	92.0	3		X	X	X	X	X	X	T	
Z	19R	PHI SAWRS	28.7	91.2	3		X	X	X	X	X	X	T	
ZZ	T49	PHI SAWRS	28.0	95.9	3		X	X	X	X	X	X	T	

NOTES:

OBS PER DAY - Those shown as 8 per day can be hourly on demand

VISUAL - Includes Ceiling and Visibility

COMMS - S Satellite, C Company Communications, T Telephone

NDBC - National Data Buoy Center

TABLE 1

operations. When the weather begins to adversely affect operations the observations are taken more frequently.

On land a single observation is usually representative of the surrounding area within a 5 mile radius of the location. In the Gulf as was pointed out in section E, a single observation is representative of a 10 mile radius (FIGURE 1).

The justification for the larger area to represent an observation is based on less irregularities of offshore weather, no localized topographical differences and more uniform surface temperature. This allows for fewer observations required and allows platforms and drilling rigs within a dense area to be more readily accessible by helicopters.

To obtain improved area forecasts, at least seven SAWRS operating 18 hours a day are required. These SAWRS would represent equal area of approximately 125 miles radius south of Lake Charles. See FIGURE 4.

Along the coast there are several SAWRS that provide aviation weather observations on an infrequent basis. The latter include Venice (7R1), Leeville (7R2), Amelia (7R3), Intracoastal City (7R4), Cameron (7R5), Sabine (28T), and Houma (HVM).

There are other weather observations which are utilized in the weather support system. The RAMOS (Remote Automated Meteorological Observations) located at platforms A & B and the data buoys at locations I, J and K of FIGURE 3 provide the observations indicated in

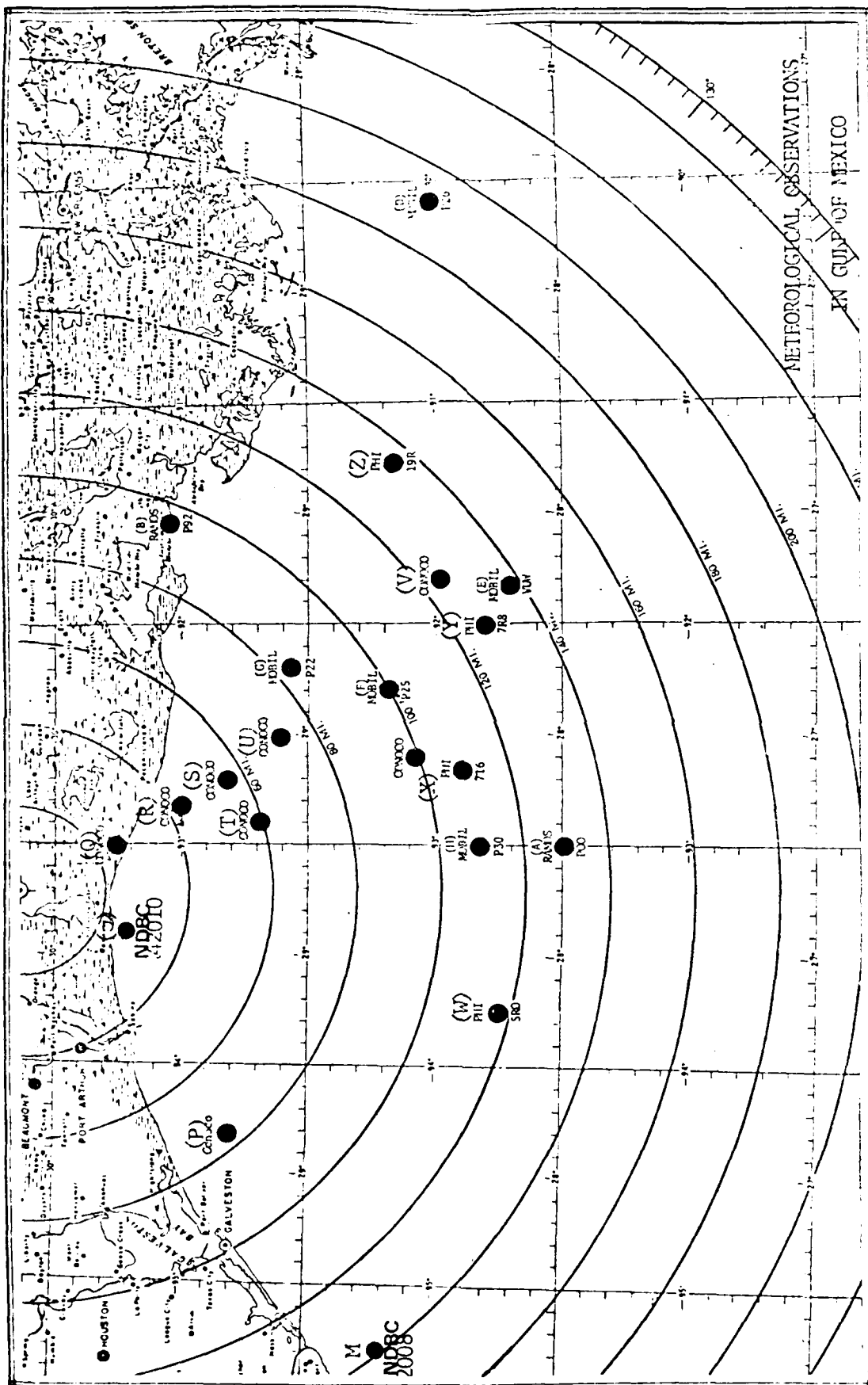


FIGURE 4. Portion of Gulf Offshore Weather Observing Network

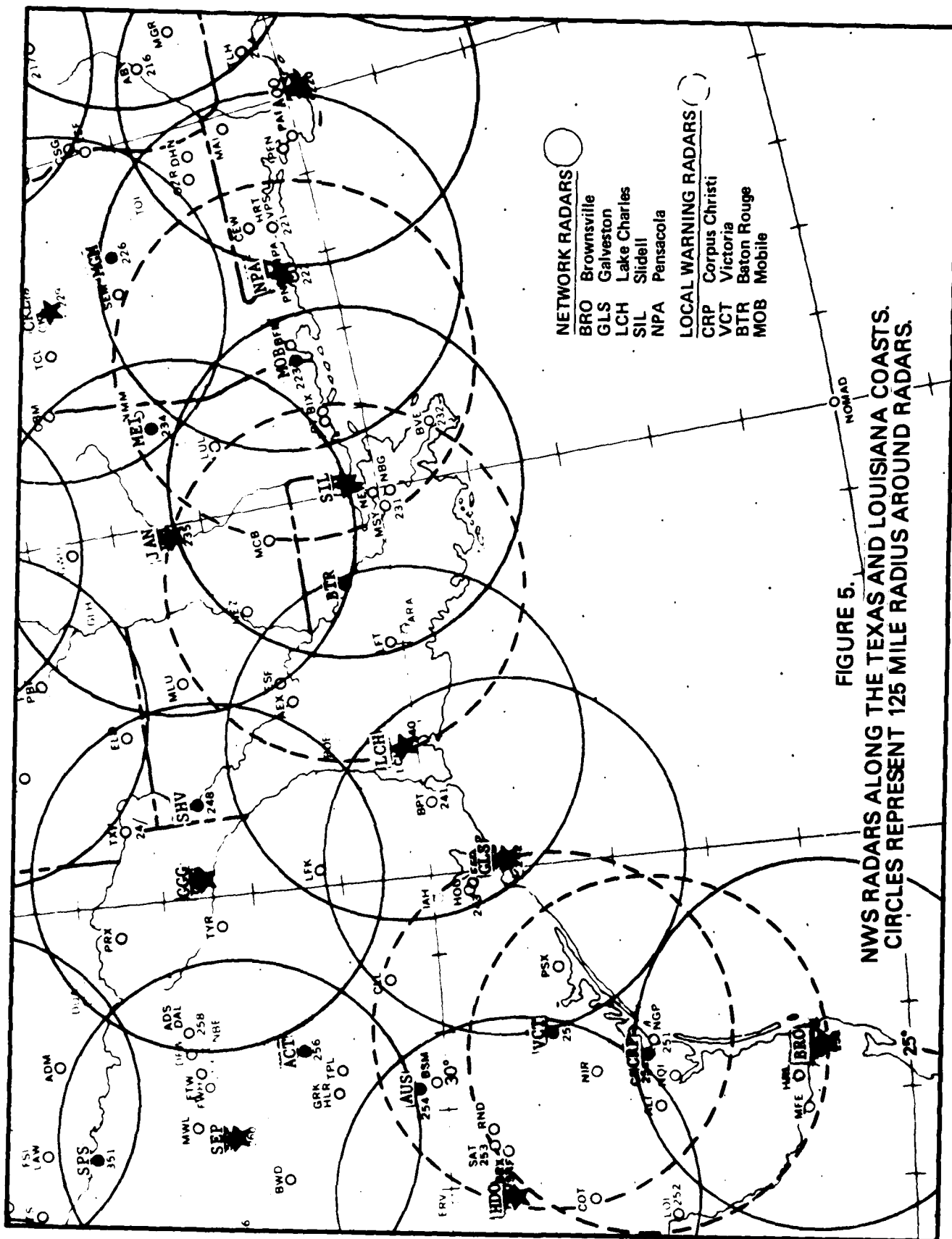
Table 1 to the National Meteorological Center every 3 hours via a satellite communications link. These observations are used in developing the synoptic weather charts which are used by the meteorologist in making a forecast. The observations of CONOCO and Mobil (Table 1) as well as PHI SAWRS are made available for public use via the Weather Message Switching Center (WMSC) at Kansas City. Service A provides the weather information stored at the WMSC. (See Section V, C. 1. for a brief description of Service A).

2. Thunderstorm and Precipitation

Weather radars are distributed along the Texas and Louisiana coasts as shown in FIGURE 5. These radars provide coverage out to 125 nm. Processing of the radar returns (reflectivity data) provides information on the relative intensity, size, direction and speed of movement of active precipitation areas. At the longer ranges, e.g., greater than 125 nm, the wider radar beam spread and lack of low altitude coverage prevents detection of many precipitation events. Although the radars at the 125 nm range cover areas that include the majority of platforms, they do not provide adequate coverage for many other platforms and oil drilling rigs. As the oil rigs and platforms increase and expand to 300 miles offshore a new technique is necessary to provide thunderstorm information. Section V A describes such a technique for detecting thunderstorms.

3. Satellites

The Geostationary Operational Environmental Satellite



(GOES) maintains a nearly continuous surveillance of the entire Gulf of Mexico. Infrared and visual photographs are made available every 30 minutes from the satellite to the Satellite Field Service Station and the Weather Service Forecast Office. Interpretation of pictures provides information on cloud cover, convective activity, e.g., thunderstorms and arc clouds (which are often accompanied by strong gusty winds) and the movement of weather systems.

The National Earth Satellite Service (NESS) has established a Gulf support unit that is located at the Slidell, LA WSFO, for the purpose of providing improved satellite weather interpretation over the Gulf. They currently offer Satellite Interpretation Messages (SIM) with the photographs that are made available on local receivers. Thus, the Gulf SIMs are available to the Flight Service Stations for use as a briefing tool.

The Gulf SIM will include future (1-3 hour) positions of significant weather systems. The SIM is issued approximately every 3 hours. FIGURE 6 is an example of a SIM. The SIM will utilize track names, block numbers and well known geographic names as indicated in FIGURE 7. Limitations in the use of satellite information for helicopter operations in the Gulf include:

1. The photographs are made available 30 minutes after observation, and
2. The resolution of the visible imagery in the Gulf is 1 km (1/2 nm) at the surface and the infrared imagery only 8 km (4nm).

NNNN A
 ZCZC WBC608
 TBXX7 KMKC 091700
 SFSS MKC GULF OF MEXICO SIM BASED ON DATA THRU 1600Z

 GLF FLOATER HLF MI VSB CONTRD 25N 91 W. JF CURVE AT NGT.

 MESOSCALE FEATURES...CSTL WATERS AQQ...BRO OUT TO 150NM

 CLDNS IN THE SIM AREA IS S OF A LN FM 10S AQQ...160SE CRP...
 80S FREEPORT...CRP. THIS CLDNS IS MAINLY MID/LOW CLDNS WITH
 A FEW TSIMS NOTED IN THE AREA 150S PNS. THE CLDNS MOVG NEWD
 OFF THE LWR TX CST IS MAINLY MID LVL CLDNS.

 RMDR OF THE AREA IS CLR.

 SYNOPTIC FEATURES...WSHFT LN APPEARS IN VSB IMAGERY IM 160S
 AQQ... 190NW MID...NR MTT. DRIER AIR/DEWPOINT FNT IS LCTD ALG

 SCT TSIMS ARE NOTED ALG THE WSHFT LN FM 180S PAM TO 240 S BVE
 AND IN THE SW GULF ABT 140WNW CPE. MOSER

FIGURE 6. SAMPLE SATELLITE INTERPRETATION MESSAGE FOR THE GULF
 OF MEXICO AREA.

4. Upper Air Observations

At selected stations, the NWS launches a balloon borne instrument, a radiosonde, which has temperature, pressure and humidity sensors. The data thus collected provides three dimensional information on the distribution of constant pressure surfaces, temperature, water vapor and wind. The radiosonde telemeters data to the ground station for processing and distribution. The winds are obtained by electronically tracking the ascending radiosonde.

The limitations of these radiosonde data for helicopter operations in the Gulf include:

1. There are only four radiosonde stations along the Texas and Louisiana Coast.
2. The radiosonde runs are made only twice a day (0000 and 1200 GMT).
3. The forecasts of wind speed and direction along the Gulf coast are only for the 3,000, 6,000 and 9,000 foot levels. See Section V.B for discussions on improving the forecasts for helicopter operations.

5. Pilot Reports

Pilot reports (PIREPs) of weather conditions encountered in flight are infrequent in the Gulf at this time. These reports are one of the most reliable ways of updating the weather conditions for pilots about to fly over the same route and for the meteorologist in updating the forecasts.

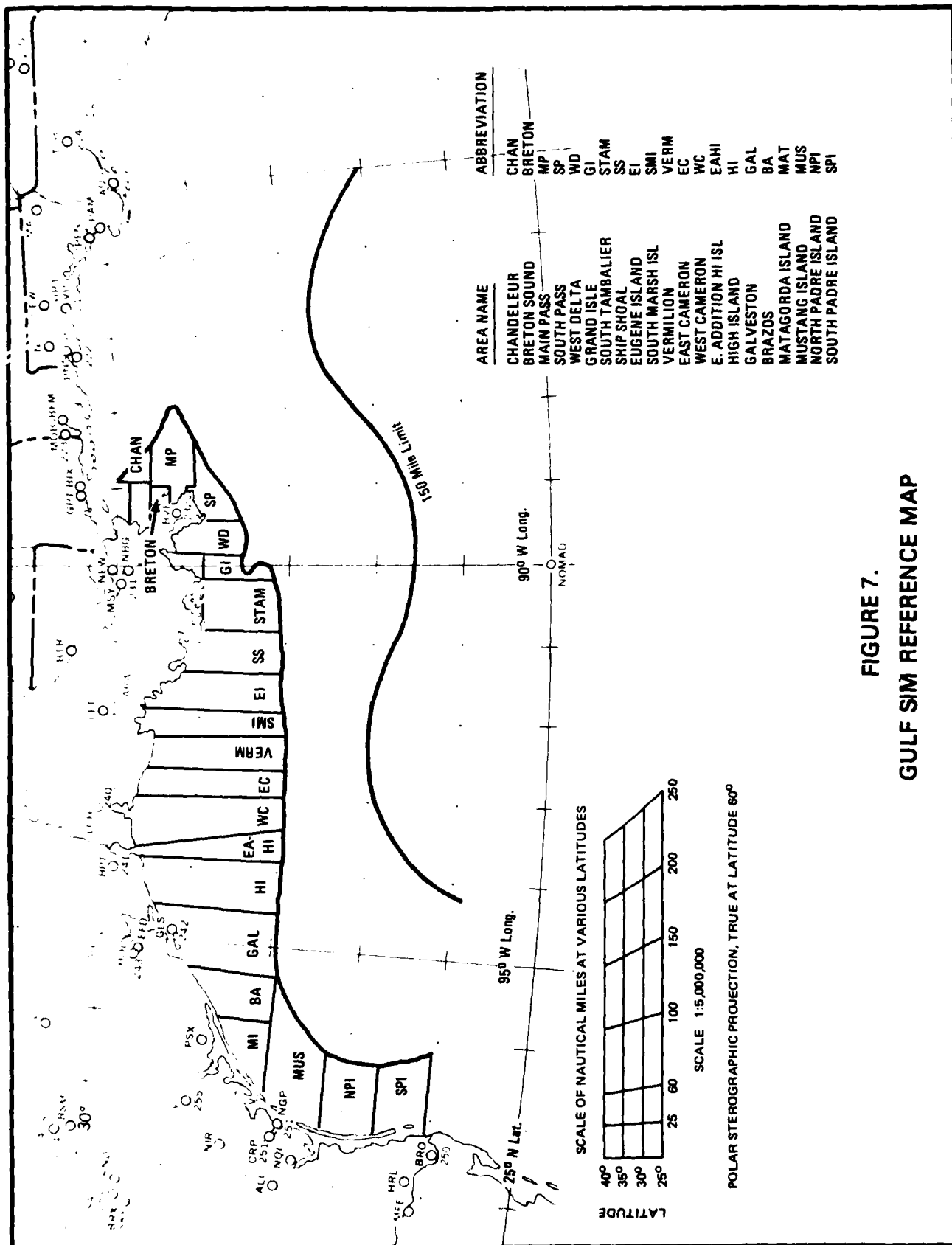


FIGURE 7.
GULF SIM REFERENCE MAP

The FAA has an inflight position at the Lakefront (New Orleans) FSS that monitors pilot reports and requests over 122.6 MHz from a communications facility established on Vermilion 245 C. Plans for obtaining and utilizing PIREPs for the improvement of weather services are detailed in Section V.6. and Appendix F.

B. Forecasts

1. Terminal

The Weather Service Forecast Office (WSFO) is responsible for providing aviation weather forecasts. The forecasters rely on weather information from all useful sources to make these forecasts. The WSFO at Slidell is responsible for aviation weather forecasts in support of helicopter operations to and from the cities and towns along the Gulf coast as well as over the Gulf itself.

Currently, the terminal aviation weather/forecasts are provided for the following cities which have a significant number of helicopter flights.

Houston (HOU)
Galveston (GLS)
Lake Charles (LCH)
Lafayette (LFT)
Baton Rouge (BTR)
New Orleans (MSY)
Brownsville (BRO)
Corpus Christi (CRP)

Terminal forecasts are not currently being made for the following coastal cities which also have a large number of helicopter operations:

Intracoastal City (7R4)
Amelia (Morgan City) (7R3)
Leeville (7R2)
Boothville (BVE)
Freeport (8R8)

All forecasts, terminal and area, are issued by the WSFO three times a day. The meteorologist utilizes the NMC guidance forecasts, which are distributed 3 to 4 hours after the last observation, and the latest aviation weather observations to provide reliable forecasts.

2. Area

Area forecasts are based to considerable extent on the guidance offered by the National Meteorological Center (NMC). The guidance material includes:

1. Twice a day winds and temperature aloft forecasts, with amendments generated by the WSFO as required. The forecasting of flight level winds applicable to Gulf helicopter operations, are made for the 3,000 and 6,000 foot levels. The next level for which the forecast is made is 9,000 feet. Temperature forecasts are not generally available for the 3,000 foot level.
2. Low-level significant aviation weather prognoses for 12 and 24 hour periods are prepared 4 times daily.

See FIGURE 8. This guidance material provides low-level information in cloud-ceiling-visibility combinations, turbulence and height of the freezing level.

3. A four panel chart for the conterminous U.S. is transmitted twice daily from NMC. These provide forecasts of surface winds, cloud amounts, three categories of visibility and ceiling, and flight weather for 134 stations. The surface wind is presented to the nearest 10 degrees in direction and to nearest 5 knots in speed. Cloud amounts are shown in four categories - clear, scattered, broken and overcast. Flight weather is given in three combinations of ceiling and visibility - Instrument Flight Rules (IFR), Marginal Visual Flight Rules (MVFR) and Visual Flight Rules (VFR).

The WSFO aviation area forecaster is also responsible for significant meteorological information (SIGMETs) and airmen's meteorological information and forecasts of severe weather conditions of significance to all aircraft. These conditions include icing, thunderstorms, turbulence, dust storms, and high winds among others.

The National Severe Storms Forecast Center (NSSFC) at Kansas City issues convective SIGMETs covering areas of significant thunderstorm activity.

AIRMETS provide warnings of less severe conditions which may be hazardous to smaller aircraft or inexperienced pilots. The weather conditions are monitored continuously with forecasts and warnings updated whenever

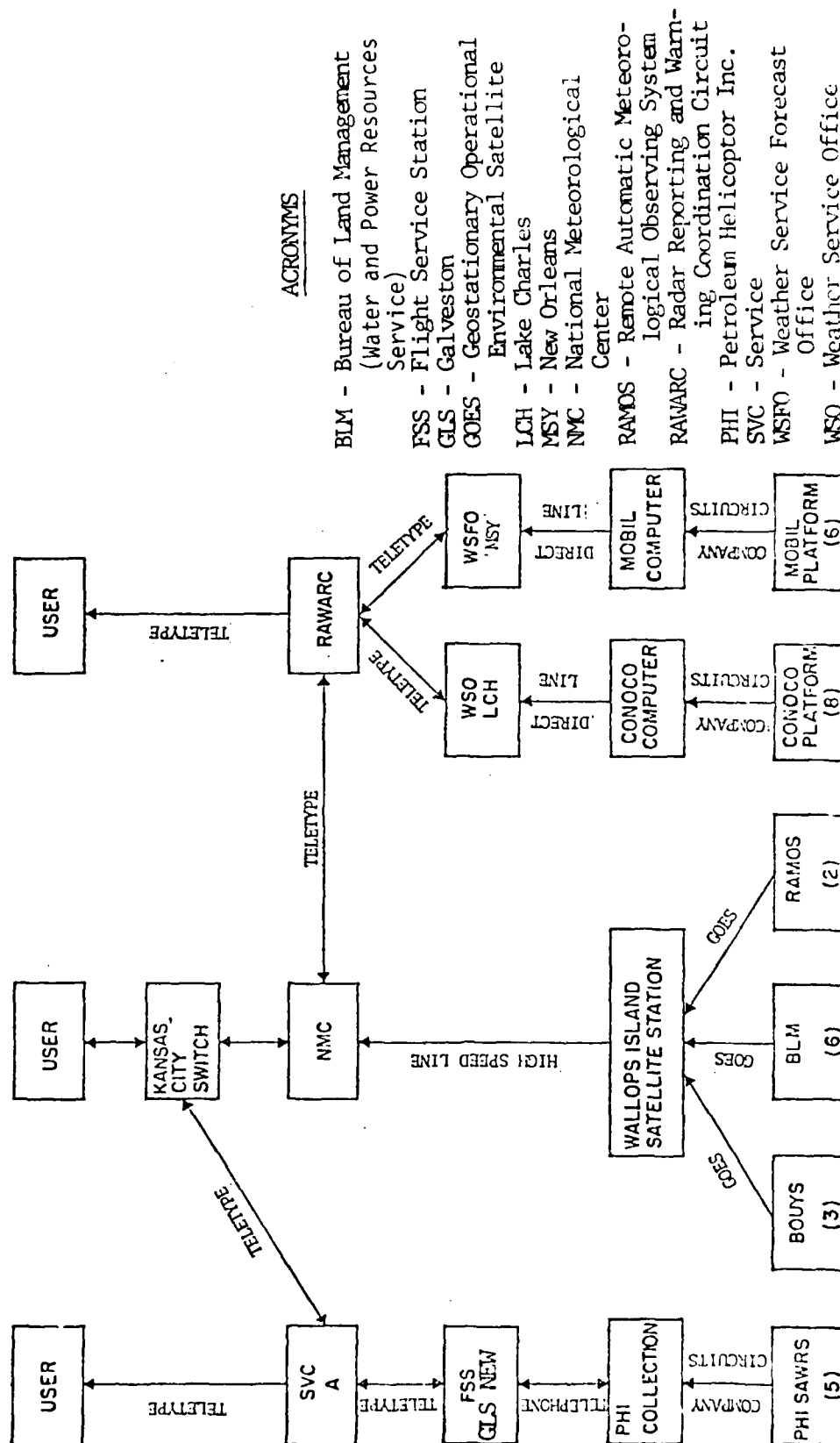


FIGURE 9. Communication Routes of Some Gulf Observations.

changes in the weather occur that are significant to aircraft operations.

The SIM resulting from analysis of satellite information was discussed in Section V.A.3.

3. Sea State

The state of the sea affects drilling operations and the movement of ships carrying cargo in support of the offshore drilling and helicopter operations. The waves are generated and grow as a result of the transfer of energy from the wind to the sea. The accurate determination of the wind over the entire Gulf is necessary for the accurate predicting of sea conditions. The frequent observations of wind and barometric pressure over the Gulf will contribute to more accurate forecasts of wind and wave conditions.

C. Communications

1. Gulf Observations

The Gulf observations taken by different operators are transmitted in several ways.

- Petroleum Helicopters Inc. (PHI) personnel take SAWRS observations at six (6) locations. Observations from four locations are telephoned into a recorder at the Lakefront FSS, where they are extracted, placed in proper format, and transmitted to the Weather Message Switching Center (WMSC) in Kansas City. Observations from two PHI SAWRS locations are telephoned to the

Galveston FSS, then retransmitted to WMSC. As the number of SAWRS increase, difficulties can be expected to develop with this communication system if it continues without change.

- The automatic observations from Mobil are transmitted by direct line from the Mobil computer to the Slidell WSFO where they are put into the Radar Reporting and Warning Coordination Circuit (RAWARC). From this circuit they are forwarded to the user, WMSC and the National Meteorological Center (NMC).
- The automatic observations from CONOCO platforms go by direct line to the Lake Charles Weather Service Office (WSO), and then into RAWARC, NMC, and WMSC respectively. This type of computer-to-computer link works satisfactorily.
- Several observations in the Gulf are transmitted via the GOES satellite. These observations originate from the NOAA Data Buoys, Bureau of Land Management Buoys (deployed to monitor oil spills and currently not operational) and the Remote Automatic Meteorological Observing Systems (RAMOS). These observations are retransmitted from the GOES satellite to the Wallops Island receiving station where they are processed and placed on a high speed communication circuit connected with the National Meteorological Center. See FIGURE 9 for communication routes of some of the observations.

All the foregoing observations are placed on Service A teletypewriter system for distribution to users via the WMSC. Service A is a land line teletypewriter system operated by the FAA in all 50 states. It is computer

controlled by the Weather Message Switching Center (WSMC) at Kansas City, MO, and consists of 4 subsystems which serve the FAA, NWS, the airlines and the Military. Anyone requiring aviation weather information can lease a Service A land line to obtain this data.

2. Forecasts

The forecasts made by the WSFOs are transmitted via a dedicated line to the Weather Message Switching Center. These forecasts are available on Service A. The Center Weather Service Unit at the Houston ARTCC provides weather advisories for distribution to units under its jurisdiction. These include the following FSSs: Lakefront, Lafayette, Lake Charles, Houston, Hobby and San Antonio.

3. PIREPs

Pilot reports can be transmitted through the communication outlets operated by the FAA. See FIGURE 10. One communication facility is on Vermilion 245A and is monitored by the Lakefront (New Orleans) FSS. Another one is on a Galveston building and is monitored by the Galveston FSS. They are intended for transfer of weather information or other information that may be important to the pilot. The facility on Vermilion 245A operates on a frequency of 122.6 MHz and is currently underutilized. The one in Galveston operates on a frequency of 122.15 MHz and is utilized regularly at a high volume of traffic.

EXPANDED IFR/VFR OFFSHORE COMMUNICATIONS GULF OF MEXICO AIR/GROUND COMMUNICATIONS

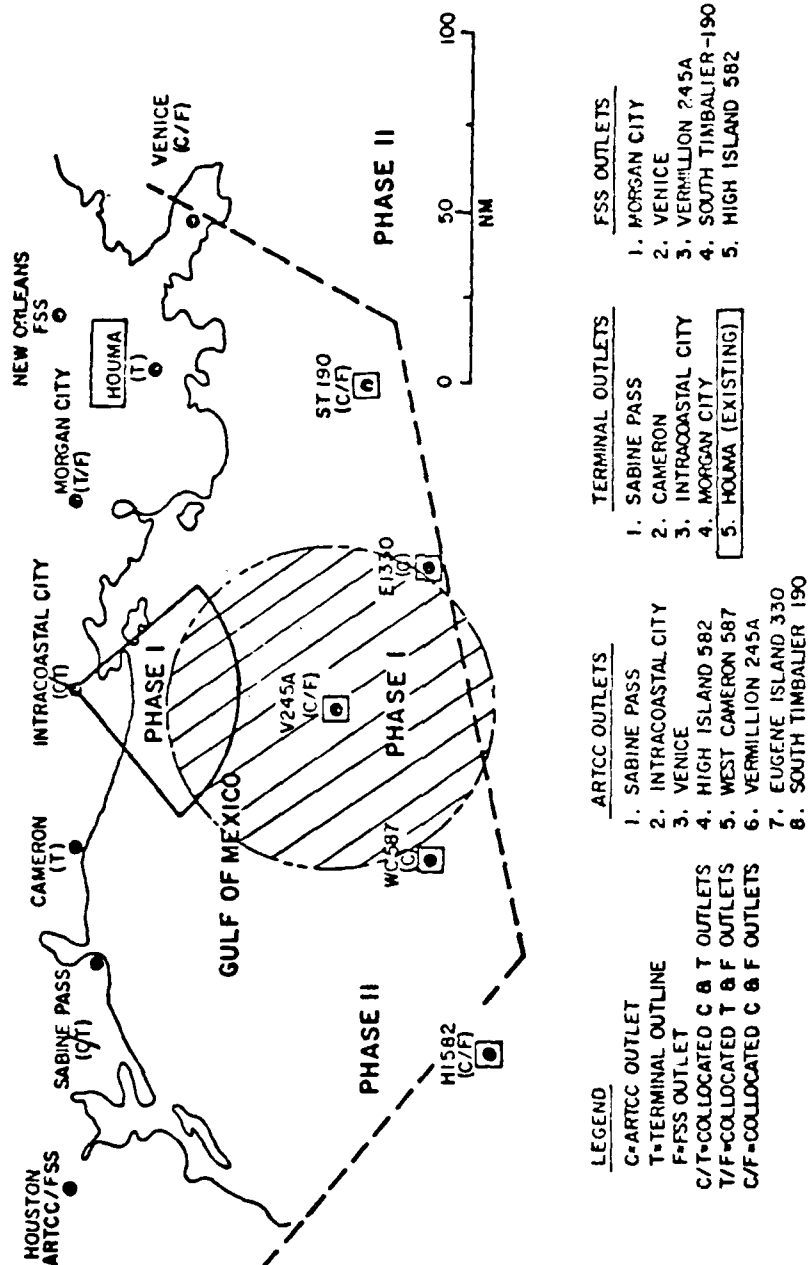


FIGURE 10.

4. The Flight Service Station

The Flight Service Station (FSS) System provides major flight services. They are: preflight and inflight weather briefings; acceptance of both instrument flight rule (IFR) and visual flight rule (VFR) flight plans for relay to the proper destination; providing emergency inflight location assistance; coordination of search and rescue operation; and the preparation and distribution of notices to airmen (NOTAMS) reporting the operational status of air traffic control facilities, navigation aids, and airports. Many FSS's take aviation weather observations.

Until recently, Flight Service System operations relied upon teletypewriter distribution of the data used for pilot briefings. "Leased Service A" eliminated the teletypewriter as the source for briefing data required by the specialist at 150 of the 318 Flight Service Stations. The "Leased Service A" provides access to the Weather Message Switching Center (WMSC). Access to the WMSC depends on circuit loading which may cause up to 15 minute delays. The data received are displayed on a cathode ray tube. At the remaining stations the FSS specialist must search through a myriad of teletypewriter paper to retrieve the data needed to perform his job. Processing of flight plans is also a tedious manual effort at existing FSS's. Such operations are slow, error prone, and expensive. The current response to the demand for flight services is not timely, telephone callers are placed on hold and some of the calls are lost. This service demand is forecast to more than double by the year 1995. Expansion of the system to meet this demand using the current operating mode would result

in an annual operating cost approaching \$360 million.
The solution is the automation of the existing operations
through the application of high-speed data communication
and computer processing techniques.

V. NEAR-TERM IMPROVEMENTS

Within the next 5 years, based on current and planned developments, there will be available new systems for improved observations and forecasts in the Gulf of Mexico. Many of these improvements can only be achieved through the cooperation of government and industry. It is again noted that under current government policy, private operators must supply their own weather observing equipment.

A. Observations

1. Current Plans

A plan has been developed to obtain surface observations from as many as 50 locations offshore and onshore. SAWRS and several automated observations from oil companies' platforms are expected to make up this initial network of observations. The oil company automated observations would provide temperature, pressure and wind data every three hours while a number of SAWRS will provide hourly observations 16 hours a day and others at alternate hours. This network should insure a base for making detailed Gulf forecasts and verification of these forecasts. This network of observations would subsequently expand as helicopter operations expand. See Appendix F for details of the plan.

2. SAWRS

The number of SAWRS can be expected to increase over the Gulf. The automated observations of the oil companies which report wind, temperature, and barometric pressure at platforms could be enhanced by ceiling, visibility and current weather observations at these platforms. Pilots and other platform personnel should be trained to make these observations. These enhanced observations will contribute to improving aviation weather forecasts.

3. Automated Weather Observation System

Federal agencies (DOT, DOC, DOD) have formulated plans to develop a Joint Automatic Weather Observation System (JAWOS). The Automated Weather Observation System (AWOS) will be capable of observing, processing and disseminating aviation weather parameters. These parameters include sky condition, ceiling, visibility, weather, obstructions to vision, sea level pressure, pressure tendency, temperature, dew point, wind direction, speed and gusts, altimeter setting, density altitude, runway visibility and runway visual range. See paragraph VI.B.2 for a technique that can be made part of an AWOS to provide very short range forecasts.

The Automated Low-Cost Weather Observation System (ALWOS) will have the capability of measuring a range of surface weather parameters consisting of wind speed, wind direction and wind gusts, temperature, dew point, pressure, visibility and cloud height/ceiling. The ALWOS system also includes automated data entry, data display, data recording, remote maintenance monitoring and failure reporting; both voice and microwave communication outputs.

The ALWOS consists of the following six major subsystems and components:

1. Sensors and Field Electronics
2. Sensor Processors
3. System Processor
4. Voice Output
5. Communication Processor
6. Remote Maintenance Monitoring and Data Recording

An ALWOS will be demonstrated and tested on the offshore platform Vermilion 245C during 1981. The observations of the ALWOS will be compared with those taken by a trained observer.

4. Thunderstorm Detection - Lightning Positioning and Tracking System (LPATS)

Since thunderstorms are to be avoided by helicopters, a lightning positioning and tracking system would assist the pilot to plan his flight to avoid these hazards. LPATS locates thunderstorm lightning by identifying the part of the return stroke that is within about 100 feet of the ground. The unit is capable of distinguishing between intra-cloud and ground discharges and retains only data pertaining to ground discharges. This is done by monitoring the magnetic field signature from a discharge with a broadband (2 kHz to 3 MHz) receiver, detecting and comparing known characteristics under microprocessor control. Once this part of the discharge is recognized, a bearing is calculated from data collected by crossed orthogonal loop antennas, one N-S and one E-W. The azimuth and intensity of each flash is quantified and transmitted to a central analyzer.

The quantified position data, consisting of time, latitude and longitude, is forwarded via telephone data link to a color cathode ray tube (CRT) display.

The system which is currently being tested consists of four receivers, one at Michoud, New Orleans, one at Lafayette Airport, Louisiana, on the offshore platforms, Ship Shoal 198 (28.6 N latitude, 91.3 W longitude) and East Cameron 281 (28.4 N latitude, 93.0 W longitude). This system provides lightning location and tracking for a 15,000 square mile area to 150 miles offshore from a line from Lafayette to New Orleans, Louisiana. The central analyzer is at Lakefront Airport, New Orleans with displays at Lakefront and Lafayette Flight Service Station, and at the Slidell NWS Forecast Office.

With each CRT color display is a small interface computer called a Peripheral Intelligent Communications Adapter (PICA). These units receive data from the central analyzer at Lakefront and store such information for over 30 minutes. They have battery backup to retain

memory if power fails. In the event of a power outage, the computer has the capability of self-initiating a restart on return of the primary power. An operator can interrogate the PICA to monitor stroke frequency and movement within 5 minute time periods up to 30 minutes. He can also determine bearing and range to a particular storm. The PICA provides a replay capability of all position data received in the proceeding 30 minutes. The display has the capability of depicting various size geographical areas with internally generated maps. The position data are automatically correlated to a selected video map and only data within the bounds of that particular video map are utilized.

At the end of a 9-month test period, the test data will be analyzed and specifications developed for an LPAT system that will be compatible with the offshore environment. If it is found that the FAA should provide this service, a national program will be established to provide LPATS to all regions requiring such systems.

5. Gulf Offshore Weather Observing Network (GOWON)

GOWON is expected to have more than 100 weather observation stations as part of the network by 1985. Many SAWRS and a few ALWOS's could be added to the number of stations described in paragraph IV.A.1. It is not anticipated that there will be any change in the policy of the operator supplying weather observations at privately owned bases. However, the cost of an ALWOS, which is expected to be over \$100,000, may limit the number that will be purchased and deployed by the private operators.

The MMS Remote Sensing Land-Ocean Experiment (ARSLOE) could result in improved observations of wind, surface sea temperatures and air temperatures along coastal areas. This effort together with GOWON will be directed toward improving forecasts of waves and storm surges over the Gulf.

6. Pilot Reporting

a. Surface Reporting

Helicopter pilots and personnel working on platforms can be utilized after a short training course to take surface observations. The ceiling, visibility and current weather observations that pilots or others can provide on platforms that have automatic wind, temperature, and barometric pressure observations can contribute to an increase in the number of aviation weather type observations that are utilized in the aviation forecasts.

b. En Route Pilot Reports (PIREPS)

The number of pilot reports (PIREPS) can be expected to increase utilizing the air-ground communications facilities available in the Gulf for the transmission of the PIREPS to the FSS's. A systematic collection of the PIREPS and distribution over a Gulf circuit is planned for early implementation. See Appendix F for details.

A major improvement in the utilization of pilot reports will result when the large amount of PIREPS that are expected to be available are entered into a computer, processed and made available to the user, e.g., pilots, the FSS specialist or the WSFO meteorologist, in a form that can be readily utilized by them.

8. Forecasts

Weather forecasts at the end of this period will be required for an area from Brownsville to Mobile to 300 nm off the coast as oil drilling and pumping expand into the area. By 1985 about 30% of the oil drilling rigs will be located 101-220 nm from shore and about 5% beyond 222 nm.

1. Approaches to Improved Forecasts

The NWS, in conjunction with other laboratories of NOAA, is

developing techniques to improve weather forecasts by taking advantage of modern equipment that provides and processes weather data at very high speed, and provides sophisticated color displays that are easily manipulated and understood by the forecaster. Some of the approaches that integrate the observations, forecasts and communications into a reliable system that is expected to provide improved weather information over the next several years include:

a. Local AFOS Application (LAMP) - LAMP is intended to adapt computer facilities to the local forecast problem. Under LAMP the forecaster could have capabilities of preparing automatic short-range terminal forecasts for each hour up to 12 hours within seconds after an observation (see paragraph V.B.4.b this section). It would also have the capability of comparing the terminal forecast with the latest observation and alerting the forecaster of errors as part of a terminal alerting procedure (TAP). If there are discrepancies, a new short-term forecast can be generated automatically.

b. Computer Storms Interactive System (CSIS) - The National Severe Storms Forecast Center is planning to establish a Computer Storms Interactive System (CSIS) that is directed at improving the diagnostic capabilities of the forecaster to forecast severe weather conditions. The forecaster could have the capability of displaying and overlaying in color on cathode ray tubes the latest observations and forecasts to include digitized radar data, satellite data, forecast analyses, etc.

c. Prototype Regional Observation and Forecast System (PROFS) - PROFS is a portion of the NOAA effort to integrate the transfer and display of the weather information available in the local area to the forecasters. The initial integration of National Meteorological Center (NMC) products, satellite data, local observations, upper air data, etc. is currently under way in the Denver area.

d. Boundary Layer Model (BLM) - The boundary layer model has a high resolution in the lower levels of the atmosphere and this will be useful in providing detailed forecasts of wind, temperature, low level wind shear, freezing level, type of precipitation, etc. This

numerical dynamical model is currently on a quasi-operational basis.

e. Aviation Route Forecast (ARF) System - Aviation route forecast system is being developed by NWS and FAA which is intended to provide detailed route forecasts of storm conditions, observations and other aviation forecast information along a route selected by a pilot. See paragraph V.C.4 this section for details.

There is no plan at the present time to replace the forecaster with automatic forecast products. The meteorologist will still be responsible for integrating all available weather information and issuing the forecast.

2. Gulf Environmental Forecasts

The availability of observations from SAWRS and automatic stations on oil platforms would allow the Weather Service Forecast Office (WSFO) at Slidell (New Orleans) to issue detailed environmental forecasts. The initial Gulf forecast would be one of 12 hours with an additional 12-hour outlook at 1040Z (7:40 a.m. CST) and 1740Z (2:40 p.m. CST). It would cover an area west of 88.5 degrees and north of 27.5 degrees. The forecast would provide a synopsis of the current weather situation, flight precautions, and significant weather from the surface to 10,000 feet including turbulence and winds at selected altitudes from the surface to 10,000 feet, marine precautions, and wave height forecasts. See Appendix F for more detailed information.

The forecast utilizes tract names, block numbers and well known geographic names similar to the Satellite Interpretation Messages (SIM) (FIGURE 7).

Upon the initiation of these forecasts a determination would be made whether they have the accuracy and reliability to be used operationally in lieu of platform (terminal) forecasts. A group of FAA and NWS personnel would make an evaluation of these area forecasts

based on appropriate test data obtained over a period of several months. If the committee recommends adoption of the environmental forecasts for flight planning to terminals and the recommendations are accepted by the FAA, a SFAR could be issued authorizing the use of area type forecasts for planning flights to offshore platforms.

The Center Weather Service Unit at Houston ARTCC will continue to issue center weather advisories within the center's area of jurisdiction.

3. Thunderstorm Forecasts

Thunderstorm forecasts can be expected to be improved by the integration of data from the surface, satellite, radar, lightning (thunderstorm) position and tracking system and pilot reports. These forecasts would be updated as required.

4. Terminal Forecasts

a. The WSFO - With the availability of regular terminal aviation observations from SAWRS and pilot reports, terminal forecasts for an area within 10 miles radius of the observation could be made by the forecasters at the WSFO. However, these terminal forecasts are not expected to be implemented until additional manpower is made available in the WSFO.

b. Hourly Automatic Aviation Weather Forecasts

At those stations that have regular hourly and special observations, forecasts for each hour up to 12 hours after the last observation could be available in the mid-80's. Statistical techniques have been developed that will provide hourly forecasts of every element of the aviation surface observation. Every element of the observation is used as predictor. Although these forecasts can be expected to be more reliable and accurate than current terminal forecasts, they will be presented as guidance to the forecaster.

The computer program now being tested to develop these forecasts requires no historical data and can be applied to any terminal that provides hourly surface observations. Thus the coastal stations along the Gulf listed in paragraph IV.B are candidates for this technique.

C. Communications

1. Gulf Circuit - Initial Plan

As part of the current plan to speed the transmission of weather forecasts, observations, pilot reports, etc., the FAA plans to establish a Gulf teletypewriter circuit as part of the Service "A". This circuit is planned to become operational during 1981. The helicopter operators can lease access to this circuit. The Gulf circuit would provide products to cover the Gulf area and approximately 100 miles inland. The planned list of products includes hourly observations, pilot reports, radar reports, forecasts, etc. See Appendix F for additional information on the communications network.

2. Automation of Field Operations and Service (AFOS)

The AFOS system is being installed by the NWS at Weather Service Forecast Offices and Weather Service Offices. 200 automated weather offices will be linked in an 11,620 mile circuit. AFOS will do away with the present system of teletypewriters and facsimile machines and the enormous quantities of paper they generate. AFOS is an all-electronic system in which weather information will be displayed on TV screens. A weather map will arrive at a station in 1/40 the time it takes to arrive on paper; messages will arrive 30 times as fast. A message will go from one station on the main circuit to the station most remote from it in about 30 seconds with error checks at an average of 24 places between them. Eventually the transmission of weather observations from the Gulf to the pilot, dispatcher and WSFO at Slidell can also be expected to be sped up.

3. Aviation Weather System (AWES)

The FAA is directing a major effort to integrate data acquisition, dataprocessing and communications performed in support of aviation into a consolidated system. The new system which will be developed and implemented over the next 10 years will speed the transmission of hazardous weather information 1) from aircraft pilot to another pilot, 2) from pilots to the air traffic control system, and 3) to forecaster for updating the forecast. The FSS will be the principal source of information for the Gulf pilot. Observations and pilot reports generated in the Gulf will be transmitted to the user through the FSS.

4. Flight Service Station

Under the FSS's modernization plan 318 existing FSS's will be consolidated into 61 automated facilities by 1989. Based on current plans, by 1985 there will be two automated FSS's in the FAA Southwest region; one at Hobby Airport, Houston, Texas, and another at Lakefront, (New Orleans) Louisiana. After 1985 automated facilities available to helicopter pilots and dispatchers will be established at Fort Worth (Meacham Field), and San Antonio (International).

The FSS will be automated through the application of high-speed data communication and computer processing techniques. It will provide direct user access capabilities so that pilots can essentially brief themselves without the intervention of a specialist.

Attributes of the modernization include the Voice Response System (VRS) which is currently being tested. It will provide weather products to the pilot via a TOUCH-TONE telephone. The latter may be accompanied by a VuSet terminal which has a small CRT screen for display of the weather information obtained from a central computer.

Other self-briefing systems being developed include voice response systems and direct user terminals (DUAT) which permit the

pilot to enter the computer base and obtain weather information without recourse to the Flight Service Station.

The utility of these developments to helicopter operations in the Gulf could be attained when Gulf observation and forecasts are systematized into standard formats and distributed regularly.

Despite the sophistication of the Aviation Weather System (AWES) development plan, the key to the development of improved weather services for helicopter operations is the availability of weather observations.

5. Aviation Route Forecasts (ARF)

ARF is intended to provide detailed aviation forecasts via a computer over the specific routes requested by the pilots. All the information required for the forecasts is placed in the computer in grid form. It will, when implemented, provide viewable, quantified area type weather data, route oriented aviation forecasts and other flight planning data such as NOTAMs (notices to airmen), PIREPs, density altitudes, etc. for pilot self-briefings. This is intended to provide pilots real-time aviation weather via direct user access terminals (DUAT) and computer voice response systems (VRS).

Tight budgetary constraints and high inflation rates can be expected to limit not only AWES and NWS system developments that are directed toward improved forecasts of icing, winds aloft and terminal weather, and improved detection of hazardous weather; but also the accommodation of and the extension of weather services to the large number of helicopters that is expected to be flying in the National Airspace System within the next several years.

Cooperation and cost sharing among FAA, NWS, and the operators may be required to achieve the desired improvements in weather support.

VI. LONG-TERM IMPROVEMENTS - MORE THAN 5 YEARS (AFTER 1986)

There is a variety of research and development currently (1981) underway or planned that are directed toward improving aviation weather forecasts and developing low cost and effective automated weather observation systems. If the systems developed by 1985 are implemented in the Gulf of Mexico, the observation and forecast products will be at least as good as those currently provided for land based operations.

A. Observations

1. Automated Terminal Observations

Reliable ALWOS's and AWOS's developed in the early eighties could be available for deployment. The cost of these systems, as noted earlier, will have to be borne by the private companies.

2. Lightning (Thunderstorm) Position and Tracking System (LPATS)

LPATS can be expected to extend over the areas of the Gulf where helicopters operate.

3. Satellites

A new instrument, Visual Infrared Spin-Scan Radiometer Atmospheric Sounder (VAS), can be expected to operate as an integral part of the Geostationary Operational Environmental Satellite (GOES) system after 1985. The VAS will provide day and night two-dimensional cloud-mapping capability with a resolution of approximately 900 meters (0.5 nm) in daylight and approximately 6.9 km (3.7 nm) at night. The VAS will also have the capability of determining the three-dimensional structure of temperature and humidity. It will provide atmospheric data as frequently as every hour and be used as input to the National Weather Service numerical forecast models for the improvement of short-range (0-6 hour) forecasts. An experimental VAS was launched on a GOES satellite in September 1980.

B. Forecasts

1. Automated Forecasts

Automated aviation weather forecasts could play a significant role in providing site specific forecasts instead of detailed Gulf area forecasts. The hourly aviation weather forecasts could be made available whenever there are hourly observations.

2. Very Short Range Forecasts of Ceiling and Visibility

With the availability of ALWOS's and AWOS's after 1986, forecasts of ceiling and visibility of 1 hour or less, e.g., 5 or 30 minutes, immediately after a series of local observations can be made using statistical techniques. In this technique, as with the hourly statistical forecasts (Paragraph V.B.4.b), every element of the observation can be used as a predictor and every element a predictand. Thus, 5, 10, and 20 minute forecasts of ceiling, visibility, wind speed, wind direction, or any other observed parameters can be provided. Observations recorded every minute are required in order to provide these very short range forecasts.

A 30-minute forecast would offer a pilot of a 200 mph helicopter information for a decision to continue to his destination or proceed to an alternate up to 100 miles from the intended destination.

3. Thunderstorms

Forecasts of the location, development, size, movement and dissipation of thunderstorms and severe weather can be expected to be more accurate for helicopter operations. The high density of surface observations, LPATS and satellite data would be integrated at the forecast office to provide the more accurate forecasts.

C. Communications

The communications network established earlier for the

transmission of observations in the Gulf should be improved to transmit the observations to the user immediately after the observation. These reports would be made available to the FSS's serving the helicopter pilots, the Center Weather Service Unit at the Houston Air Route Traffic Control Center which controls the IFR pilots over the Gulf, helicopter dispatchers and the Slidell WSFO which would use the communications network forecast transmissions over the Gulf. This earlier network has been developed through combined efforts of the NWS, FAA, and operators in the Gulf. The improved communication system is essential to the transfer of the large amount of much needed weather information to and from pilots operating to and from platforms. Plans for AFOS and AWES should be modified to meet the requirements for improved communications for helicopter operations.

VII. RECOMMENDATIONS

To achieve the goal of improved weather services in the Gulf of Mexico it is necessary, as part of NWS, FAA and industry effort, to:

- . Establish aviation weather observations on as many offshore platforms as required for safe operations and improved forecasts using SAWRS, ALWOS, and AWOS systems.
- . Insure the prompt communication of pilot reports to all users (other pilots, NWS and FSS specialists).
- . Evaluate the use of lightning (thunderstorm) positioning and tracking systems for locating thunderstorms over all portions of the Gulf where there are helicopter operations. Implement as required.
- . Evaluate a Gulf weather forecast system for use as platform forecasts.
- . Provide improved forecasts of thunderstorms, critical wind speeds, hurricanes, state-of-the-sea, inflight weather (icing, turbulence) as well as ceiling, visibility and present weather.
- . Implement communications system for the expeditious transfer of weather information to the user.

ACKNOWLEDGEMENTS

The following organizations and personnel contributed to the completion of this report:

National Weather Service: Edward Gross for his direction on the development of Gulf Observation, Forecast and Dissemination Program (Appendix F), and for helpful comments on the text.

FAA Southwest Region: Henry J. Christianson and his staff for a critical review of the report.

Systems Research and Development Service: James R. Nelson and Frank C. Coons for their helpful discussion and comments on the report.

The Institute for Storm Research, Houston, Texas: John C. Freeman and James J. Schnebelt for portions of the text, providing figures, and typing the final report.

METEOROLOGICAL FORECASTS AND SERVICES

The public and special meteorological forecast and service activities include:

1. Acquisition of raw data and the preparation of basic analyses and prognoses and other guidance material.
2. Refinement of guidance material into products suitable for the public and for special user groups.
3. Dissemination of products to users.

As necessary, severe weather warnings are issued as far in advance as the present state of the science permits and are given immediate and widespread public dissemination by all possible media.

This section covers first the basic forecast organization on which the various forecast and service activities depend, then it considers the individual activities.

Forecast Organization

The basic meteorological organization of NWS is composed of three echelons:

1. The **National Meteorological Center (NMC)** is the backbone of the entire organization. The **National Severe Storms Forecast Center (NSSFC)**, the **National Hurricane Center (NHC)**, and the **Hurricane Warning Centers** at San Francisco and Honolulu may also be considered in this echelon. NMC is responsible for the preparation of much of the synoptic scale guidance material and long-range forecasts used by lower echelons, providing a single source for hemispheric analyses and prognoses. It is not considered a field operation in the same sense as the rest of the forecast organization and reports directly to the Director of NWS. NSSFC provides a single source for severe local storm watches. NHC serves the same function for hurricane forecasts in the Atlantic, Caribbean, and Gulf of Mexico, whereas San Francisco provides this service for the eastern Pacific and Honolulu for the central Pacific. These units are described in more detail on the following pages.

2. The **52 Weather Service Forecast Offices (WSFOs)** are the backbone of the field forecasting operation. These offices are responsible for warnings and forecasts for States, or large portions of the States and assigned zones. WSFO State forecasts are issued twice daily for the period out to 48 hours. An extended outlook is issued once daily out to 5 days for the same areas. Area- or statewide warnings are issued to the public in critical weather situations, as are various special forecasts and warnings. This echelon provides the main field forecast support for the marine and aviation programs as well as guidance for the agricultural and fire weather programs.

3. The **Weather Service Offices (WSOs)** represent the third echelon of the system. They issue local forecasts which are adaptations of the zone forecasts. They meet local requirements but do not extend beyond the period covered by the forecasts. This echelon also has important county warning issuance and distribution responsibilities.

This three-echelon system is a part of the basic NWS program, since its function is to provide the meteorological information and products required by the other service programs. As indicated on the following pages, the offices comprising the three-echelon system play a vital role in the various public and specialized service activities.

Domestic Aviation Weather Services Program

Objective: To provide aviation area, route, and terminal weather information for safe and efficient flight operations within the United States. Also, to provide service for flights from the continental United States (including Alaska) to Canada, and for most flights to Mexico and short-range Caribbean flights.

Description of Program: Aviation forecasts come from our 52 WSFOs, using guidance products produced by NMC, NSSFC, and NHC; observations from over 1,300 locations in the United States, Canada, and Mexico, plus pilot reports, radar reports, balloon soundings, and satellite information. WSFOs prepare and distribute 482 Terminal Forecasts (FTs) three times a day for specific airports in the United States and the Caribbean. They also prepare 331 Route Forecasts and 40 Weather Synopses for the conterminous United States. Twelve WSFOs also prepare Aviation Area Forecasts (FAs), covering designated geographical areas and issue in-flight advisories to warn pilots of potentially hazardous weather. SIGMETs (WSs) describe weather severe enough to concern all aircraft, while AIRMETs (WAs) describe weather phenomena of lesser severity affecting mainly small aircraft, but could be of concern to all aircraft. Convective SIGMETs (WSTs), describing thunderstorms, are issued hourly for the conterminous United States by NSSFC. A constant weather watch is maintained, and forecasts and warnings are updated and amended when there is a significant change in weather conditions affecting safe aircraft operations. Winds and Temperature Aloft Forecasts (FDs) are prepared by the NMC, but when necessary, amendments to FDs are prepared by designated WSFOs.

Briefings for domestic flights are handled in person, by telephone, or by mass dissemination methods (recorded telephone and radio). National Weather Service offices cooperate with the FAA Flight Service Stations (FSSs) in providing weather briefing services. Pilots may call NWS field offices for preflight briefing information, using telephone numbers listed in the FAA's "Airport Facility Directory" and other publications for pilots. The main mass dissemination media for our products are the Pilot's Automatic Telephone Weather Answering Service (PATWAS) and the Transcribed Weather Broadcast (TWEB). These continuous recordings are preflight weather briefings for local or limited cross-country flights and are updated when necessary. TWEB also has the advantage of being used while airborne to receive updated observations and forecasts. There are 75 PATWAS locations with a total of 119 telephone numbers, and 197 TWEB outlets in the conterminous United States. Combined FAA/NWS briefing services, referred to as "one-call/one-stop," are developed, if feasible, wherever a Flight Service Station and Weather Service Office are collocated in the same community. There are 116 on-call locations in the conterminous United States.

NWS meteorologists staff 21 of the 22 FAA Air Route Traffic Control Centers (ARTCCs) and the Central Flow Control Facility (CFCF) at the FAA Headquarters in Washington, D.C. The ARTCC Center Weather Service Units (CWSUs) and CFCF are designed to promote the safe and efficient flow of aircraft within the National Airspace System by providing real-time weather information.

A.M. WEATHER, the first national daily 15-minute TV program with NWS and NESS meteorologists, is devoted exclusively to covering the weather. This program is carried on approximately 200 public television stations as of October 16, 1990. Designed primarily for aviation, A.M. WEATHER also presents weather for agriculture and marine interests and for the varied interests of the general audience.

The Alaska AVIATION WEATHER TV show, in its third year, is carried over the Public Broadcast System stations throughout the state. The 5-evening per week 30-minute show is oriented to aviation and meteorological education for pilots.

Other Activities Include: Presentation of aviation weather seminars and weather training programs for pilots; training and certification of all NWS and FAA pilot weather briefers; service for special aviation events; publication of educational material, assisting commercial radio/TV stations with the programming of aviation weather information for broadcasts; and supervision of the State Aviation Liaison Official Program.

What Does It All Mean?: The aviation industry is a vital segment of the American economy, employing thousands of people and moving millions of passengers and tons of freight each year. No other industry is as interested in, and affected by, weather than aviation. This is why we, in the NWS aviation weather program, are dedicated to providing the best possible service, 24 hours a day—from the smallest two-seater to the largest jet transport. We take pride in knowing that the results of our efforts are helping to "keep 'em flying"—safely and efficiently—in the National Airspace System.

DATA ACQUISITION

The NWS provides a wide variety of service functions as described in other sections. However, before those services can be provided, present weather must be determined; that is the primary goal of NWS data acquisition programs. These data are also used by the Environmental Data Service for climatology; by travelers for air and sea navigation and local operations; for short- and long-range monitoring of the environment; and by research laboratories.

To gather these data, the NWS relies on a wide variety of stations and observing systems. Surface weather conditions are observed and reported at 1,000 land stations, about 280 of which are manned by NWS personnel. Other stations are manned by other government agencies such as FAA or by private citizens or companies in cooperation with the NWS. AMOS (Automatic Meteorological Observing System) is used to obtain data at locations where it is unfeasible to have observations made by humans. Observations over the ocean are made by volunteer cooperative observers and transmitted from more than 2,000 ships.

The National Substation Program consists of 11,650 cooperative weather stations that provide daily precipitation totals and temperature extremes for climatic, hydrologic, agricultural, and other service programs.

From the surface up to about 100,000 feet, profiles of temperature and moisture are determined and reported by meteorological instruments carried aloft by balloons. Data for the layer between 100,000 and 300,000 feet are obtained by meteorological rockets; although these data are more useful for research and special studies than for operational service programs.

These data are supplemented by reports from hundreds of aircraft in flight across the country. Satellites are used to monitor weather conditions at, and above, the surface of the earth. Radar provides information on the type, extent, intensity, and movement of areas of precipitation, severe thunderstorms, tornadoes, and hurricanes.

Observing programs and systems are organized into various network configurations, some providing data almost continuously while others may provide data on a monthly, or even seasonal basis. The networks and programs are described on the following pages of this section.

Surface Weather Observational Programs

Objective: To provide weather data for synoptic meteorologists, climatologists, and specialized users, such as aviation, marine, forestry, agriculture, etc.; and to provide weather observations for support of international commerce.

Description of Program: A wide variety of meteorological data is required by users. Because of this, the observation program is divided into the Synoptic Weather Network, designed to serve forecast programs and provide data for international exchange, and the Basic Weather Network, which is the larger of the two programs and the one that serves nearly all users. These observations are usually referred to as Aviation Weather Observations.

The Synoptic Observation Program provides observations at the world standard synoptic times 0000, 0600, 1200, and 1800 GMT. The code used to transmit the data is entirely numerical. Synoptic reports normally include amount of sky cover, type of clouds, wind, visibility, weather, temperature, dewpoint, and pressure. Without considerable experience tables are needed for decoding the synoptic message.

The Basic Observation Program provides data at hourly intervals, with special reports during the intervening periods to report significant weather events. These reports consist of the same elements as synoptic observations and also include cloud height and altimeter setting for aircraft operations. The code used to disseminate the observations is a combination of codes, symbols, abbreviations, and contractions. The code can be read with little practice and without the aid of tables.

LOCATION IDENTIFIER TYPE AND TIME OF REPORT*	SKY AND CEILING	VISIBILITY WEATHER AND OBSTRUCTION TO VISION	SEA LEVEL PRESSURE	TEMPERATURE AND DEW POINT	WIND	ALTITUDE METER SETTING	REMARKS AND CODED DATA
MIC SA #758	15 SCT M25 OVC	10-K	132	/58/66	/1807	/893/	254LVR2FV46
SKY AND CEILING Sky cover contractions are in ascending order. Figures preceding contractions are heights in hundreds of feet above station. Sky cover contractions are: CLR Clear: Less than 1/8 sky cover. SCT Scattered: 1/8 to 3/8 sky cover. BKN Broken: 3/8 to 5/8 sky cover. OVC Overcast: More than 5/8 sky cover. —Thin (When prefixed to SCT, BKN, OVC) —X Partial obscuration: 1/8 or less of sky hidden by precipitation or obstruction to vision (bases at surface). X Obscuration: 1/8 sky hidden by precipitation or obstruction to vision (bases at surface). Letter preceding height of layer identifies ceiling layer and indicates how ceiling height was obtained. Thus: E Estimated height M Measured W Indefinite V=Immediately following numerical value, indicates a variable ceiling.		VISIBILITY Reported in statute miles and fractions. (V=Variable) WEATHER AND OBSTRUCTION TO VISION SYMBOLS A Mist C Ice crystals S Snow BD Blowing dust F Ice fog SG Snow grains BR Blowing sand P Ice pellets SP Snow pellets DS Blowing snow WH Ice pellets showers SW Snow showers D Dust X Smoke T Thunderstorm F Fog L Drizzle T- Severe thunderstorm GF Greasy fog R Rain ZL Freezing drizzle H Haze RW Rain showers ZR Freezing rain Precipitation intensities are indicated thus: — Light; no sign) Moderate — Heavy WIND Direction in tens of degrees from true north, speed in knots. 9999 indicates calm. G indicates gusty. Peak speed of gusts follows G or Q when gusts or squall are reported. The contraction WSHFT followed by GMT time group in remarks indicates windshift and its time of occurrence. (Knots X 1.15 = statute mi/hr) EXAMPLES: 3627=368 Degrees, 27 knots. 3627G40=360 Degrees, 27 knots, peak speed in gusts 40 knots ALTIMETER SETTING The first figure of the actual altimeter setting is always omitted from the report.		RUNWAY VISUAL RANGE (RVR) RVR is reported from some stations. Extreme values during 10 minutes prior to observation are given in hundreds of feet. Runway identification precedes RVR report. PILOT REPORTS (PIREPS) When available, PIREPS, in fixed-formats are appended to weather observations. The PIREP is designated by UA. DECODED REPORT Kansas City: Record observation taken at 0758 GMT 1508 feet scattered clouds, measured ceiling 2500 feet overcast visibility 1 mile, light rain, smoke, sea-level pressure 1013.2 millibars, temperature 58 F, dewpoint 56 F, wind 180 at 7 knots altimeter setting 29.93 inches. Runway 84 left, visual range 2000 feet variable to 4000 feet. *TYPE OF REPORT SA—a scheduled record observation SP—an unscheduled special observation indicating a significant change in one or more elements RS—a scheduled record observation that also qualifies as a special observation. All three types of observations (SA, SP, RS) are followed by a 24-hour-clock-time-group in GMT.			

U.S. DEPARTMENT OF COMMERCE — NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION — NATIONAL WEATHER SERVICE

KEY TO AVIATION WEATHER FORECASTS

TERMINAL FORECASTS contain information for specific airports on expected ceiling, cloud heights, cloud amounts, visibility, weather, and obstructions to vision and surface wind. They are issued 3 times/day and are valid for 24 hours. The last six hours of each forecast are covered by a categorical statement indicating whether VFR, MVFR, IFR or LIFR conditions are expected (L in LIFR and M in MVFR indicate "low" and "marginal"). Terminal forecasts will be written in the following form: CEILING: Identified by the letter "C" CLOUD HEIGHTS: In hundreds of feet above the station (ground) CLOUD LAYERS: Stated in ascending order of height VISIBILITY: In statute miles but omitted if over 6 miles WEATHER AND OBSTRUCTION TO VISION: Standard weather and obstruction to vision symbols are used SURFACE WIND: In tens of degrees and knots; omitted when less than 10 EXAMPLE OF TERMINAL FORECAST DCA 221818: DCA Forecast 22nd day of month—valid time 18Z-18Z 19 SCT C18 BKN 55W-3415G25 OCNL CB X 1/2SW: Scattered clouds at 1000 feet, ceiling 1800 feet broken, visibility 5 miles, light snow showers, surface wind 340 degrees 15 knots. Gusts to 25 knots, occasional ceiling 8 hundred feet sky obs- scured, visibility 1/2 mile in moderate snow showers. 12Z C58 BKN 3312G22: At 12Z becoming ceiling 5000 feet broken, surface wind 330 degrees 12 knots. Gusts to 22 84Z MVFR C1G: Last 6 hours of FT after 84Z marginal VFR due to ceiling		SIGMET or AIRMET messages broadcast by FAA on NAVDID voice channels warn pilots of potentially hazardous weather. SIGMET concerns severe and extreme conditions of importance to all aircraft (i.e. severe turbulence, and duststorms/sandstorms). Convective SIGMETs are issued for thunderstorms by the Severe Storms Forecast Center at Kansas City for the conterminous U.S. AIRMETS concern less severe conditions which may be hazardous to some aircraft or to relatively inexperienced pilots. WINDS AND TEMPERATURES ALOFT (FD) FORECASTS are 12-hour forecasts of wind direction (nearest 10° true N) and speed (knots) for selected flight levels. Temperatures aloft (°C) are included for all but the 3820-foot level. EXAMPLES OF WINDS AND TEMPERATURES ALOFT (FD) FORECASTS FD WBC 121745 BASED ON 121200Z DATA VALID 130000Z FOR USE 1800-0300Z. TEMPS NEG ABV 24000 FT 3000 6000 9000 12000 18000 24000 30000 34000 39000 BOS 3127 3425-07 3420-11 3421-16 3516-27 3512-38 311649 292451 283451 JFK 3026 3327-08 3324-12 3322-16 3120-27 2923-38 284248 285150 285749 At 6000 feet ASL over JFK wind from 330° at 27 knots and temperature minus 8°C. TWEB (CONTINUOUS TRANSMIBED WEATHER BROADCAST) —Individual route forecasts covering a 25-nautical mile zone either side of the route. By requesting a specific route number, detailed en route weather for a 12- or 18-hour period (depending on forecast issuance) plus synopses can be obtained. PILOTS . . . report inflight weather to nearest FSS. The latest surface weather reports are available by phone at the nearest pilot weather briefing office by calling at H-10.	
AREA FORECASTS are 18-hour aviation forecasts plus a 12-hour categorical outlook prepared 2 times/day giving general descriptions of cloud cover, weather and frontal conditions for an area the size of several states. Heights of cloud tops and cirgs are referenced ABOVE SEA LEVEL ASL; ceiling heights, ABOVE GROUND LEVEL (AGL); bases of cloud layers are ASL unless indicated. Each SIGMET or AIRMET affecting an FA area will also serve to amend the Area Forecast.			

U.S. DEPARTMENT OF COMMERCE — NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION — NATIONAL WEATHER SERVICE — REVISED OCTOBER 1977

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 per 100 copies: Stock No. 003-G18-00093-3

APPENDIX D. KEY TO AVIATION WEATHER OBSERVATION AND FORECASTS

APPENDIX E

ORGANIZATIONS OPERATING

HELICOPTERS IN THE GULF OF MEXICO

Petroleum Helicopter, Inc. (owns about 50% of helicopters)	Bentel Aviation Service
Tenneco Inc.	Augusta American
Shell Oil Co.	Helicopter Medical Evacuation, Inc.
Exxon Oil Co.	AMOCO
Chevron Oil Co.	Sun Oil Co.
Mobile Oil Corp.	MESA Petroleum Co.
Offshore Helicopters, Inc.	DOT
Evergreen Helicopters	USCG
ERA Helicopters Inc.	USN
United Helicopters	Ellington AFB
Bristow Offshore Helicopters	Pennzoil Co.
Columbia Helicopters, Inc.	Houston Helicopters
Air Logistics	Conoco Inc.
Corpus Christi Gas and Oil	Rotor-Aids
Tennessee Gas Transmission	Airwest Offshore Inc.
Southern Natural Gas	Energy Helicopters
High Life Helicopters	Helicopter Charter
Texas Eastern Transmission	Omni Flight
Horizon Helicopters	Transco Gas Pipeline

APPENDIX F

GULF OBSERVATION, FORECAST AND

DISSEMINATION PROGRAM - MARCH 1981

The representatives of the National Weather Service, Federal Aviation Administration and the helicopter operators at a meeting in March 1981 have agreed to the following plan to improve Gulf weather observations and forecasts, and determined a method for the dissemination of this information.

The Observation Program

Observations from approximately 50 sites have been identified for the initial observation network.

Offshore

Approximately 10 offshore sites surface observations from 09Z-00Z. All sites will provide hourly observations plus specials as required at 09-10Z, 16-17Z and 23Z. During the hours 12-15Z, 18-22Z, and 00Z, an odd-even hour arrangement for transmission has been developed. Platforms from which helicopter operators have agreed to provide observations include:

Brazos A 70	Vermilion 397
High Island A 511	South Marsh Island 130
High Island A 232	South Marsh Island 146
High Island 313	Ship Shoal 154
West Cameron 617	South Pelto 13
Vermilion 245 - ALWOS Site	Mississippi Canyon 355

Identifiers for the sites will be reviewed. The meeting recommended that five character identifiers be developed using two alpha characters and associated block number, e.g., Ship Shoal 154 would be designated SS154.

The following are onshore locations from which NWS, FAA and helicopter operators (PHI and Air Logistics) have agreed to provide the following observations on the proposed Gulf circuit:

Galveston	Houma
Sabine (287)	Patterson
Cameron (7R5)	Freeport
Intercoastal City (7R3)	Mobile
Morgan City	Lafayette
Leeville (7R2)	Jackson
Lake Charles	Corpus Christi
Boothville	San Antonio
Venice	Houston

Automated Observations

Automated observation sites without ceiling, visibility, and present weather capabilities were identified as being important to the overall observation program and should be transmitted hourly on the Gulf circuit. They are:

<u>6 Mobile Sites</u>	<u>Latitude/Longitude</u>	
	N	W
P21	29.7	88.9
P26	28.5	90.1
VUW	28.2	81.8
P25	28.7	92.3
P22	29.1	92.2
P30	28.3	93.0

11 CONOCO SitesLatitude/Longitude

	N	W
Mustang Island A85	27.7	96.2
High Island 110	29.3	94.2
West Cameron 66	29.7	93.1
Grand Cheniere	29.8	93.0
East Cameron 97	29.2	92.8
" " 42	29.5	92.8
Vermilion 242	29.6	92.6
" 119	29.1	92.5
South Marsh Island 108	28.4	92.0
Ship Shoal 158	28.7	91.0
Main Pass 311	29.2	88.7

The FAA and NWS will take action for the quality control of these observations.

Pilot Reporting (PIREPS)

A plan to systematically collect pilot reports (PIREPS) was agreed upon. Designated helicopters selected by the users would transmit pilot reports to the Houston and New Orleans FSS's. The attached pilot reporting form (Attachment 1) will be utilized. The helicopters would report the location/OV* using the offshore block designators, e.g., VCNTY HI285 as depicted on U.S. Gulf Coast VFR aeronautical charts.

Every half hour at H+15 and H+45 two bulletins would be transmitted by the FSS's using the headers:

UBUS1 Gulf HOU

UBUS2 Gulf MSY

* OV: In pilot reporting, OV refers to location of phenomena, time, and flight level.

Urgent PIREPS would be disseminated as received using the designators:

ZHU for Houston FSS origin

HUM for New Orleans FSS origin

They will also be included in UBUS summaries.

Communications Networks

The Communications Network will be lowspeed (110 BAUD-ASCII) full-duplex uncontrolled circuit. The FAA will provide the computer port from the Kansas City's Weather Message Switching Center (WMSC), and the backbone circuit to:

Morgan City, LA
Intercoastal City, LA
Lake Charles, LA
Houma, LA
Freeport, TX
Patterson, LA
Beaumont, TX

The service could begin by July 1981. The users will have to order their own circuit extensions and terminal (TTY) equipment. The equipment required will be Teletype Corporation Model 43.

A time schedule will be established for each input station to enter its data. All input will be relayed back to the circuit.

The NWS will develop a list of that data to be disseminated on this circuit. It will be forwarded to all users for their review and

comments. This list should be finalized two weeks prior to circuit implementation. Data coverage will cover the Gulf area and approximately 100 miles inland.

A preliminary list of the Gulf circuit products:

- Hourly observations (40-60 per hour)
- Pilot reports
- Selected terminal forecasts
- Area forecasts
- In flight advisories relevant to Gulf area
- The new Gulf forecast
- Selected marine products
- 17 wind and temperature aloft (FD) forecasts (See attachment 2)
- Gulf Satellite Interpretation Message (SIM)
- Radar reports

The data disseminated can be modified on a weekly basis. WMSC will accept changes from the circuit coordinator only. Vernon Albert of PHI was elected as the circuit coordinator.

FAA will train operators on communication procedures and formats.

The Forecast Program

A Gulf forecast for aviation and marine operations would be issued twice per day at 1040Z and 1740Z and amended as required. It will be a 12-hour forecast and additional 12-hour outlook. The following is an example of the Gulf forecast format to be issued by WSFO Slidell, LA.

Example of the Gulf Forecast format:

ZCZC
GULF FCST DDTTTT
DDTTTT - DDTTTT
OTLK DDTTTT - DDTTTT
1740Z - AMDS NOT AVBL 0200-1040Z
Issuance HGTS MSL
Only TSTMS IMPLY PSBL SVR OR GRT TURBC SVC ICG LOW LVL WIND
SHEAR HI SFC WINDS/WAVES

AREA - Gulf of Mexico west of 88.5 degrees, north of 27.5 degrees

01 SYNS
02 FLT PRCTN(S)
03 SIGCLD AND WX SFC-100
04 ICG AND FRZLVL BLO 100
05 TURBC BLO 100
06 WNDS SFC-100 ... OTLK
07 MRN PRCTN
08 WAVES ... OTLK

Amendments - WSFO New Orleans will not be able to issue separate AIRMETs, SIGMETs, etc., for the Gulf Fcst but will amend portions of Gulf Fcst at the discretion of the forecaster whenever the weather improves or deteriorates. The synopsis portion should also be amended when a significant change in the synoptic pattern develops or is expected to develop. Amendment guidelines will be established for this program.

Gulf Forecast Domain

Gulf of Mexico west of 88.5 degrees, north of 27.5 degrees and 100

miles inland from Mobile to Brownsville. (See attachment 3.)

Procedures and orders must be developed for supporting elements of this program as they impact NWS and FAA operations, e.g., a new chapter in the NWS operations manual must be published prior to start up of program.

Prior to the beginning of this activity, education information pertaining to this program must be developed.

Program Startup Date

The startup time of the program is planned for summer 1981. Decisions made by the participating organizations and the program reduction within NOAA could have an impact on the startup time.

Developed under the direction of Ed Gross, NWS

PIREP FORM

(U)UA→/OV→		FL	
ASCT	LOCATION OF PHENOMENA	3-LTR IDENT	RADIAL DISTANCE
TIME (Z)		FLT LVL	
/TP→		/SK→	
TYPE AIRCRAFT	SKY COVER	BASE	AMOUNT TOP
/TA→		/WV→	
TEMPERATURE-CELSIUS	WIND-DIRECTION	SPEED	
/TB→		/IC→	
TURBULENCE-INTENSITY	TYPE*	ALTITUDE**	ICING-INTENSITY TYPE ALTITUDE**
/RM→			
REMARKS (MOST HAZARDOUS ELEMENT REPORTED FIRST)			

LEGEND: → SPACE SYMBOL * = ONLY FOR CAT ** = ONLY IF DIFFERENT FROM FL

FAA Form 7110-2 9-76 SUPERSEDES FAA FORM 7110-2 TEST

☆ U.S. GOVERNMENT PRINTING OFFICE 771-762

ENCODE

UA /OV FRR 275045 1745 FL330 /TP B727 /SK 185 BKN 220/280 BKN 310
/TA -53 /WV 290120 /TB LGT-MDT-CAT ABV-310

DECODE

Pilot report. Front Royal VORTAC 275 radial 45nm, at 1745Z, flight level 33000; Boeing 727; cloud base 18500 broken, tops 22000, second layer 28000 broken tops 31000, air temperature minus 53 degrees Celsius; wind 290 degrees 120 knots, light to moderate clear air turbulence above 31000.

ENCODE

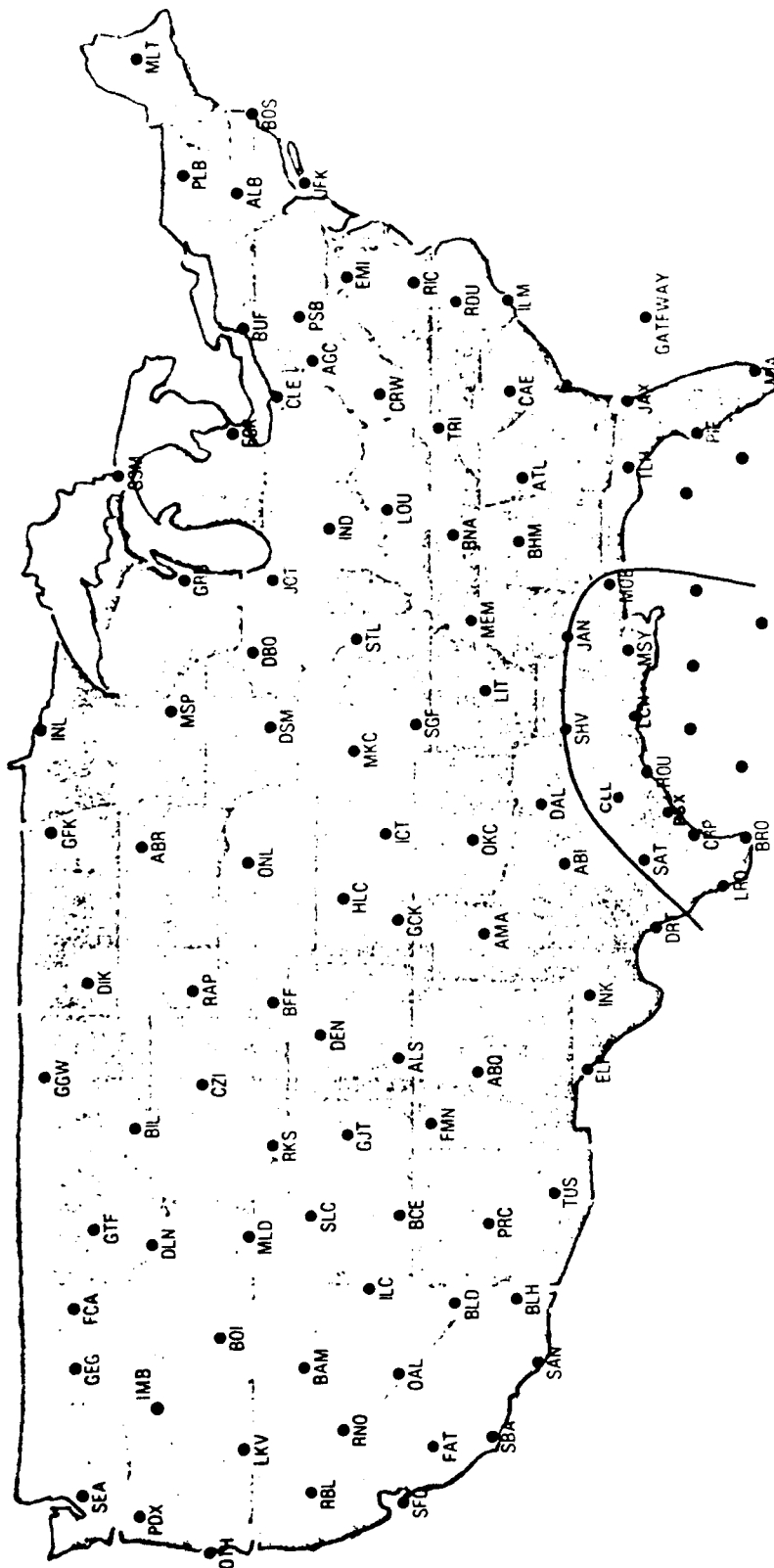
UA /OV MBB-PIT 1600 FLO80 /TP BE55 /SK 004 BKN 012/022 BKN-OVC
/TA 01 /IC LGT-MDT RIME 035-060 /RM WIND COMP HEAD 020 MH310
TAS 180

DECODE

Pilot report, Martinsburg to Pittsburg at 1600Z at 8000 feet; a Beechcraft Baron; cloud base 400 broken tops 1200, second layer 2200 broken variable overcast; air temperature 1 degree Celsius; light to moderate rime icing 3500-6000 feet; headwind 20 knots. magnetic heading 310, true air speed 180 knots.

PILOT REPORT FORMS USED AT FLIGHT SERVICE STATIONS

NEW WIND AND TEMPERATURE FORECASTS (Effective March 1981)

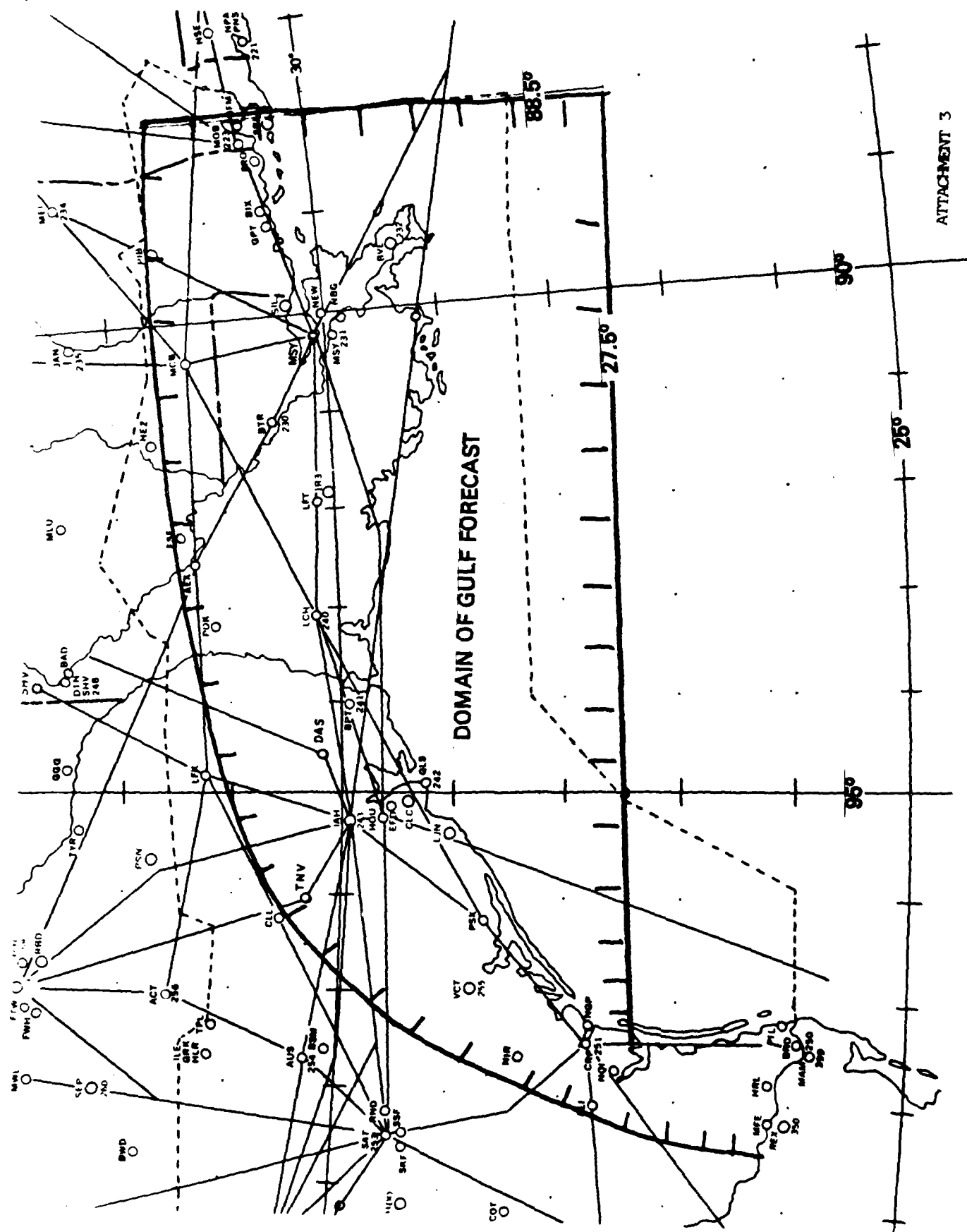


Gulf of Mexico	LAT.	LONG
T01 West Cameron	28 30	93 30
T06 Ship Shoal	28 30	91 00
T07 S Mobile South	28 30	88 00
4J3 S Appalachicola South	28 30	85 00
H51 Bay City	26 30	95 00
H52 Mid Gulf	26 00	89 30
H61 W Fort Myers West	26 30	84 00

Forecast Winds and Temperatures Aloft (FD) Network

6, 12, & 24 Hour Forecast

9 LVLS-3, 9, 12, 18, 24, 30, 34, 39
Thousand Feet



ATTACHMENT 3

DATE
FILMED
-8