MENT OF COMMERCE / National Oceanic and Atmospheric Administration

FEDERAL COORDINATOR FOR
METEOROLOGICAL SERVICES
AND SUPPORTING RESEARCH

National Winter Storms Operations Plan

FCM-P13-1983

Washington, D.C.
October 1983

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U. S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
FEDERAL COORDINATOR FOR
METEOROLOGICAL SERVICES AND SUPPORTING RESEARCH

NATIONAL WINTER STORMS
OPERATIONS PLAN

Washington, D. C.
October 1983

FCM-P13-1983

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FOREWORD

In a memorandum dated October 23, 1969, the Chairman, Interdepartmental Committee for Meteorological Services (ICMS), established a Working Group under the purview of the Committee on Basic Services (CBS) to develop an Operations Plan designed to furnish weather observations for use in predicting and providing adequate and timely warnings of severe and crippling winter storms along the East Coast of the United States.

The National East Coast Winter Storms Operations Plan was developed to meet this request. In 1978, the Plan was expanded to cover data requirements in the Gulf of Mexico. The Plan covers that part of the year (November 1 to April 15) having a relatively high incidence of winter storms along the East and Gulf Coasts and lists only those special weather observations for use in warning of severe winter storms along the Gulf and East Coasts.

This document is the 13th edition of the Plan and represents a general update of the previous edition published in October 1981, and page changes that constituted the 1982 Plan. Aerial reconnaissance tracks along the East and Southern Coasts are included as well as an update of the buoy and satellite information.

William S. Barney
Federal Coordinator for
Meteorological Services and
Supporting Research

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CHAPTER 1

RESPONSIBILITIES OF COOPERATING AGENCIES

1. The National Oceanic and Atmospheric Administration (NOAA) shall:

a. Provide basic surface, upper air, and radar observations from its network of stations making such observations.

b. Provide additional observations, when required, making available all reports to any requesting agency.

c. Provide basic analyses and forecasts through the National Meteorological Center (NMC), Camp Springs, Maryland.

d. Provide statements and warnings through Weather Service Forcast Offices (WSFO) and local Weather Service Offices (WSO) along the eastern seaboard and the Gulf of Mexico.

e. Provide advice on aircraft reconnaissance requirements forwarded through the WSFO Miami to the Chief, Aerial Reconnaissance Coordination, All Hurricanes (CARCAH), from the National Meteorological Center (NMC), Washington. NMC is the central coordinating office for this program for all reconnaissance requirements.

f. Operate satellite systems capable of providing coverage of the east coast of the United States and the Gulf of Mexico during the winter storms season.

g. Coordinate with the National Aeronautics and Space Administration (NASA) to obtain pertinent meteorological data from NASA research and development experimental satellites.

h. Coordinate with the DOD Services to obtain pertinent meteorological data from the Defense Meteorological Satellite Program.

i. Provide data in the form of satellite pictures for selected situations to authorized research facilities.

j. Furnish aircraft to support the operational reconnaissance and research objectives of the National Winter Storms Program.

(1) Primary objective is to participate and provide additional real-time meteorological data to operational forecasters in an attempt to improve the quality of forecasts associated with winter coastal storms.

(2) Secondary objective is to provide data that will permit analyses and a better understanding of the structure and dynamics of these winter storm systems.

l. Provide oceanographic and meteorological surface data obtained from offshore buoy deployment, if possible, within existing facilities.

m. Provide dissemination of weather observation data to appropriate agencies.

n. Reimburse the Air Force for the aircraft reconnaissance flown in support of this Plan in accordance with the NOAA/USAF Memorandum of Understanding dated 16 March 1976.

The National Weather Service is responsible for the issuance of winter weather forecasts, watches, and warnings to the public and various specialized user groups. Its responsibilities are documented in Weather Service Operations Manual, Chapter A-02, "Weather Service Mission," and Chapter C-42, "Winter Weather Warnings."

2. The Department of Defense (DOD) shall:

a. Make available to NOAA agencies through the Automated Weather Net (AWN) interface basic surface, upper air, and radar observations from those DOD stations making such observations and pilot reports (PIREPs) that become available.

b. Furnish to the National Weather Service: (1) aircraft reconnaissance observations that are within its capabilities and in accordance with established reconnaissance priorities established in ARRSR 55-6; and (2) special observations detailed in Chapter 3 of this Plan.

c. Designate CARCAH as the point of contact for coordination with NMC and Miami WSFO for aircraft reconnaissance required in support of this Plan.

d. Provide weather reconnaissance data monitor services to evaluate and disseminate reconnaissance reports.

e. Provide USAF aeronautical station communications to relay reconnaissance reports from the aircraft to the weather monitors.

f. Provide warnings to all DOD facilities and military units of weather factors which threaten to inhibit their operations or to damage their installations.

The U. S. Navy, through the Naval Oceanography Command (NAVOCEANCOM), is responsible for issuance of gale, storm, and high seas warnings for fleet operations and Navy shore installations, as elaborated in NAVOCEANCOM Instruction 3140.1 (series).

The U. S. Air Force, through the Air Weather Service, is responsible for the issuance of military weather warning advisories and point warnings to all Air Force and Army (including Reserve and National Guard) installations, facilities, and operations related to winter storms for those hazardous phenomena specified in Air Weather Service Regulation 105-8.

3. The Federal Aviation Administration (FAA) shall provide for:

a. Air traffic control (ATC) services as appropriate to support this Plan.

b. Dissemination of PIREPs.

c. Hourly weather and special weather observations at selected terminal and flight service station locations.

4. The U. S. Coast Guard shall:

a. Provide surface observations to NWS from its coastal facilities and vessels.

b. Interrogate surface ships of opportunity for special weather observations through the Automated Mutual-Assistance Vessel Rescue (AMVER) system.

c. Provide personnel, vessel, and communication support to the NOAA Data Buoy Office for development, deployment, and operation of environmental data buoy systems.

d. Provide communication circuits for relay of weather observations to NWS.

e. Provide coastal broadcast facilities at selected locations for dissemination of forecasts and warnings.

f. Provide primary guard AUTODIN support to OL-G, AWS.

WEATHER INSTRUMENTED USAF WC-130 AIRCRAFT
USED FOR WINTER STORM RECONNAISSANCE

CHAPTER 2

AIRCRAFT RECONNAISSANCE

1. Responsibility.

a. U. S. Air Force (USAF). The USAF WC-130 sorties will be conducted for storm and storm threat situations. All USAF sorties in support of this plan will be assigned by CARCAH in the Winter Storm Plan of the Day (WSPOD). Normally, DOD will be prepared to generate one reconnaissance sortie per day. Requirements exceeding this capability will be accomplished on a "resource permitting" basis. In times of national emergency or war, some or all DOD reconnaissance resources may not be available to fulfill DOC needs.

b. NOAA Research Facilities Center (RFC). The NOAA RFC aircraft flights will be available on request for a storm or storm threat situation and will be used when available as backup for USAF aircraft reconnaissance. Additionally, they may be flown on storms of research interest as desired by the Environmental Research Laboratories. All such flights will be assigned by CARCAH in the WSPOD.

2. Operational Control of Aircraft. Operational Control of reconnaissance aircraft will be exercised by the agency to which the aircraft is assigned.

3. Reconnaissance Planning and Flight Notification.

a. Requirements. NMC will forward sortie/alert needs to CARCAH through the Storm Coordination Center (SCC) Miami for tasking in the Winter Storm Plan of the Day (WSPOD) within responsibilities stated above. CARCAH will advise NMC of mission availability or nonavailability and expected responsiveness of USAF and RFC assets. NMC will be responsible for requesting all reconnaissance flights and will provide information as specified in paragraph 3.e. below.

(1) Reconnaissance Requirements. NMC will forward NWS mission requirements for the next 24-hour period (0500Z-0500Z) and an outlook for the succeeding 24 hours to CARCAH not later than 1430Z each day. Vertical observation positions will be identified by NMC through CARCAH and the WSPOD.

b. Change to Requirements. Changes to mission requirements will be accepted by the appropriate point of contact based on the following guidelines:

(1) Early departures will not be requested.

(2) When notification is received more than 2.5 hours prior to scheduled aircraft departure:

(a) Changes to tracks will be limited to substitution of one track for another.

(b) Departure delays will be accepted provided the delay plus the flight plan time does not exceed 13.5 hours.

(3) When notification is received more than 4 hours prior to scheduled aircraft departure time, departure delay requests will be evaluated in accordance with appropriate flight management directives. Delays exceeding that specified in paragraph 3b(2)(b) may be accepted in certain circumstances.

(4) Point of contact for all of the above changes will be CARCAH.

(5) Coordination of meteorological data requirements will be accomplished prior to each flight over the Gulf of Mexico. The flight meteorologist responsible for the mission will contact the Lead Forecaster (telephone 504-525-0823) at the Storm Coordination Center (SCC), New Orleans, approximately 2.5 hours prior to scheduled aircraft departure time. Since CARCAH publishes the WSPOD, all changes to the WSPOD will be made through CARCAH.

c. <u>Cancellation of Requirements</u>. Missions should be cancelled prior to aircraft departure and as much in advance as possible to allow maximum resource conservation. Cancellation after departure may result in degradation of follow-on mission capability.

d. <u>Satisfaction of Requirements</u>.

(1) Requirements are considered satisfied when an observation is or could have been taken (as in the case where aircraft are diverted from original track) at the specified location (control point) within the interval from 30 minutes prior, to 30 minutes after scheduled time.

(2) Requirements will be considered as satisfied "late" when an observation is or could have been taken at the specified location (control point) more than 30 minutes after the scheduled time but prior to the requirement expiration time.

(3) Normally, no credit will be given for early missions.

(4) The requesting agency (NMC and/or appropriate WSFO) will provide CARCAH a written assessment (Appendix 2C) of the weather reconnaissance mission any time its timeliness and quality are outstanding or substandard. Requirements levied as resources permitting will not be assessed for timeliness. These assessments should be mailed to:

OL G, HQS AWS
National Hurricane Center
Gables One Tower, Room 631
Coral Gables, FL 33146

(5) CARCAH will maintain monthly and seasonal reconnaissance summaries detailing missions actually flown to satisfy levied requirements.

e. <u>Reconnaissance Winter Storm Plan of the Day (WSPOD)</u>.

(1) Coordination. NMC will coordinate with the appropriate NWS field offices as needed and provide WSPOD information (Appendix 2D) to CARCAH through SCC Miami by 1430Z. Direct discussion in weather situations is also encouraged between the Navy and NMC with respect to storm or storm threat situations. Navy point of contact is the Naval Eastern Oceanography Center (NAVEASTOCEANCEN) Norfolk Command Duty Officer and the optimum time is 1330 local. The following data will be provided to CARCAH when applicable.

(a) Track and level desired. For mission altitude a second choice of level will be given in case level desired is not feasible due to probable icing or other operational constraints.

(b) Selected trackpoint (control point) and time aircraft is required at the point.

(c) Special observations or dropsonde release points.

(d) Expiration time of requirement (time mission is regarded as dropped).

(e) Succeeding day outlook (anticipated track, control point, control point time--not earlier than).

(2) Preparation. Utilizing requirements stated by NMC, CARCAH will prepare the WSPOD as required throughout the season in coordination with the Air Force and RFC to effect maximum useful data from available resources. Format for WSPOD is shown in Appendix 2B.

(3) Dissemination. The WSPOD will be made available in message form to all appropriate agencies that provide support to or exercise control of the missions. CARCAH will be responsible for disseminating the WSPOD as soon as possible after the DOC requirements (including changes) are received. Negative WSPODs will not be disseminated except to cancel a previously published requirement or outlook.

(4) Responsiveness.

(a) USAF/RFC notification of reconnaissance requirements should be made early enough to allow 16 hours plus enroute flying time to the control point.

(b) The Succeeding Day Outlook portion of the WSPOD is designed to allow advance notification.

(c) When circumstances do not allow the appropriate notification lead time, the mission will be levied as "resource permitting".

4. Reconnaissance Flights.

a. General Storm Tracks.

(1) Air Force tracks 01 through 15 (Appendix 2A) will normally be flown during storm or storm threat situations.

(2) Within operational limitations and with prior ARTCC approval, airborne diversions deemed advisable by the airborne meteorologist may be made from these tracks.

(3) Permanent changes to winter storm reconnaissance tracks must be coordinated with and approved by the appropriate FAA ARTCCs at least 30 days in advance of the implementation date.

b. Flight Plans. The flight plans for reconnaissance flights will be filed with FAA as soon as practicable before departure time.

c. Flight Levels. Reconnaissance aircraft will fly only at ARTCC assigned altitudes and will accept flight level changes when requested by FAA.

d. Dropsonde Releases. Dropsonde instrument releases will be coordinated with the appropriate ARTCC at least 10 minutes before drop time, except for those outside of controlled airspace which do not require coordination.

e. Air Traffic Control.

(1) Air traffic control (ATC) will provide air traffic control separation between all aircraft operating on storm missions and between storm mission aircraft and nonparticipating aircraft operating on Instrument Flight Rules (IFR) within controlled airspace. Mission commanders should be aware that nonparticipating aircraft may be operating near storm areas; thus, adherence to ATC clearance is mandatory for safety purposes.

(2) When storm aircraft cannot maintain assigned altitudes due to turbulence, ATC should be advised. Normal vertical separation of 1,000 feet at FL 290 and below and 2,000 feet above FL 290 will be provided by ATC to aircraft operating in the storm area. Unless otherwise coordinated with ATC, the altitudes between storm-mission aircraft may be used by ATC for nonparticipating aircraft.

(3) Any procedure desired by storm-mission commanders which is outside the above parameters must be coordinated with the appropriate ATC center.

f. Data Requirements. Data requirements are defined in Table 2-1. Data will be coded and transmitted in standard RECCO (flight level observations) (Appendix 2E) or WMO TEMP DROP (dropsonde soundings) format (Appendix 2F).

(1) Appended to the first observation will be plain language remarks stating departure station (ICAO four letter identifier), time of departure, and ETA at control point.

Example: AF 987 TRACK 01 0B01
97779 ... 93/// DPTD KBIX 10/0845Z ETA 37.3N 72.3W
10/1210Z

(2) Appended to the last observation will be plain language remarks stating ETA and intended arrival station (ICAO four letter identifier), number of observations, and monitor that copies observations.

Example: AF 968 TRACK 05 OB06
97779 ... 91///
95559 ... ETA KBIX 17/2300Z OBS 01 thru 06 to KMIA

TABLE 2-1

REQUIREMENT FOR AIRCRAFT RECONNAISSANCE DATA

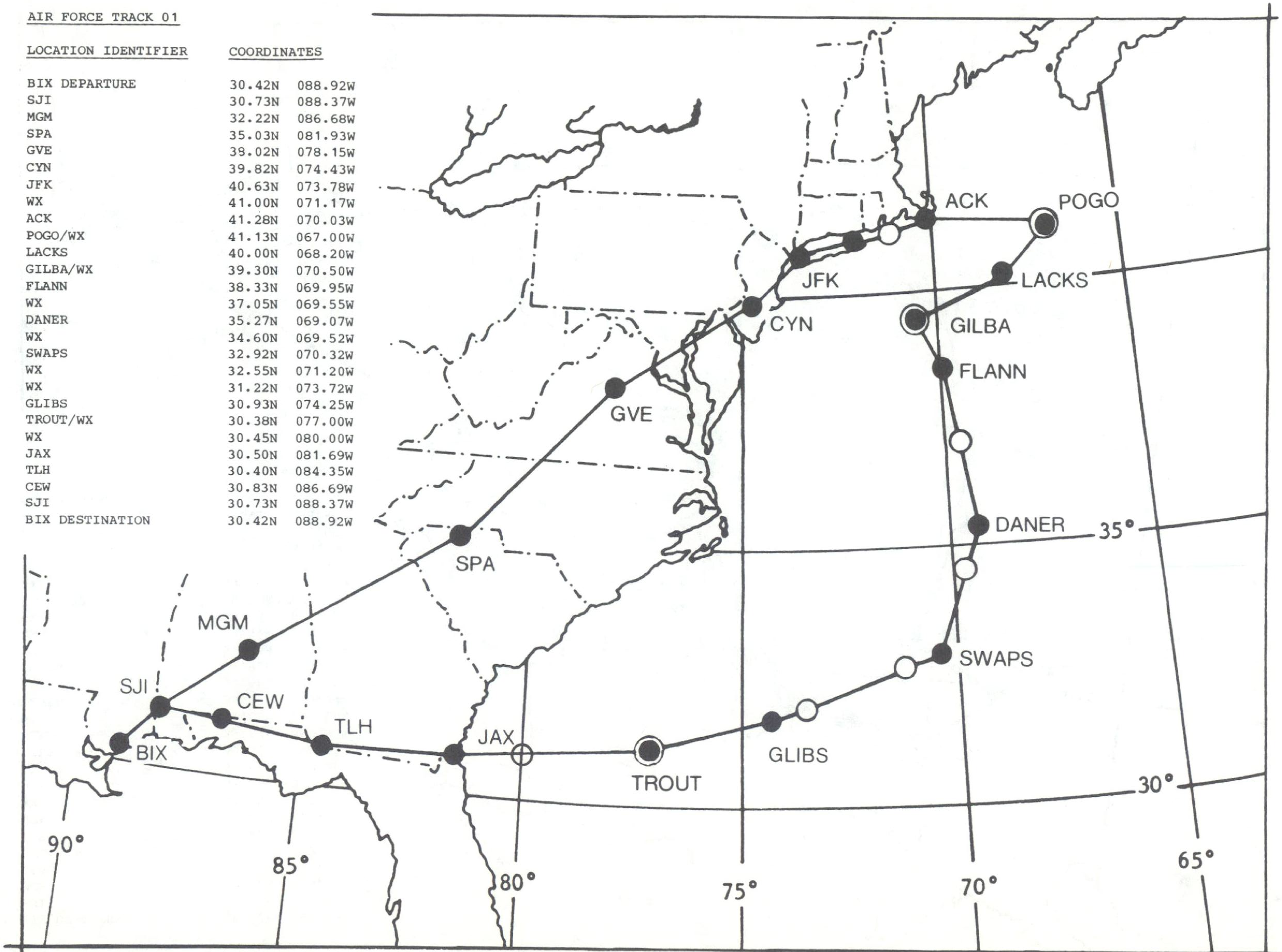
Data required	Altitudes at which data are required	Areal portion of cyclone or environment in which data are needed	Time and frequency of observations	Accuracy required
Synoptic data --pressure (heights), temperature, moisture, and winds--for national weather prediction and medium-range forecasting.	At altitudes indicated in the WSPOD.	Throughout the marine portion of area as defined in Chapter 1.	**Dropsondes as specified in Plan of the Day (drop interval approximately 200 nmi (370 km)). Horizontal observations are specified on the tracks. Intermediate observations will be appended to each horizontal observation. (No intermediate observations required on tracks 01-08.)	$\pm$ 5 kt (2.5 m/s) (wind speed) $\pm$ 10° (wind direction) $\pm$ 1°C $\pm$ 20 m $\pm$ 2 mb (200 Pa) Position within 20 nmi
Location and strength of radar echoes.	Any level.	All sectors	When available.	Position within 20 nmi (37 km)
*Ocean wave heights and wave lengths, sea surface wind estimates	Sea surface.	All quadrants.	Every horizontal observation at or below 700 mb (70 kPa).	$\pm$ 10% (Wave height) $\pm$ 10 ft (3 m) (wave length) 5 kt (2.5 m/s) (wind speed) 10° (wind direction)

* Ocean wave heights and wave lengths will not be reported by USAF aircraft.

**Includes dropwindsondes. If a sonde fails or vertical data are otherwise unobtainable at a specified position, make another release as soon as possible.

AIR FORCE TRACK 01

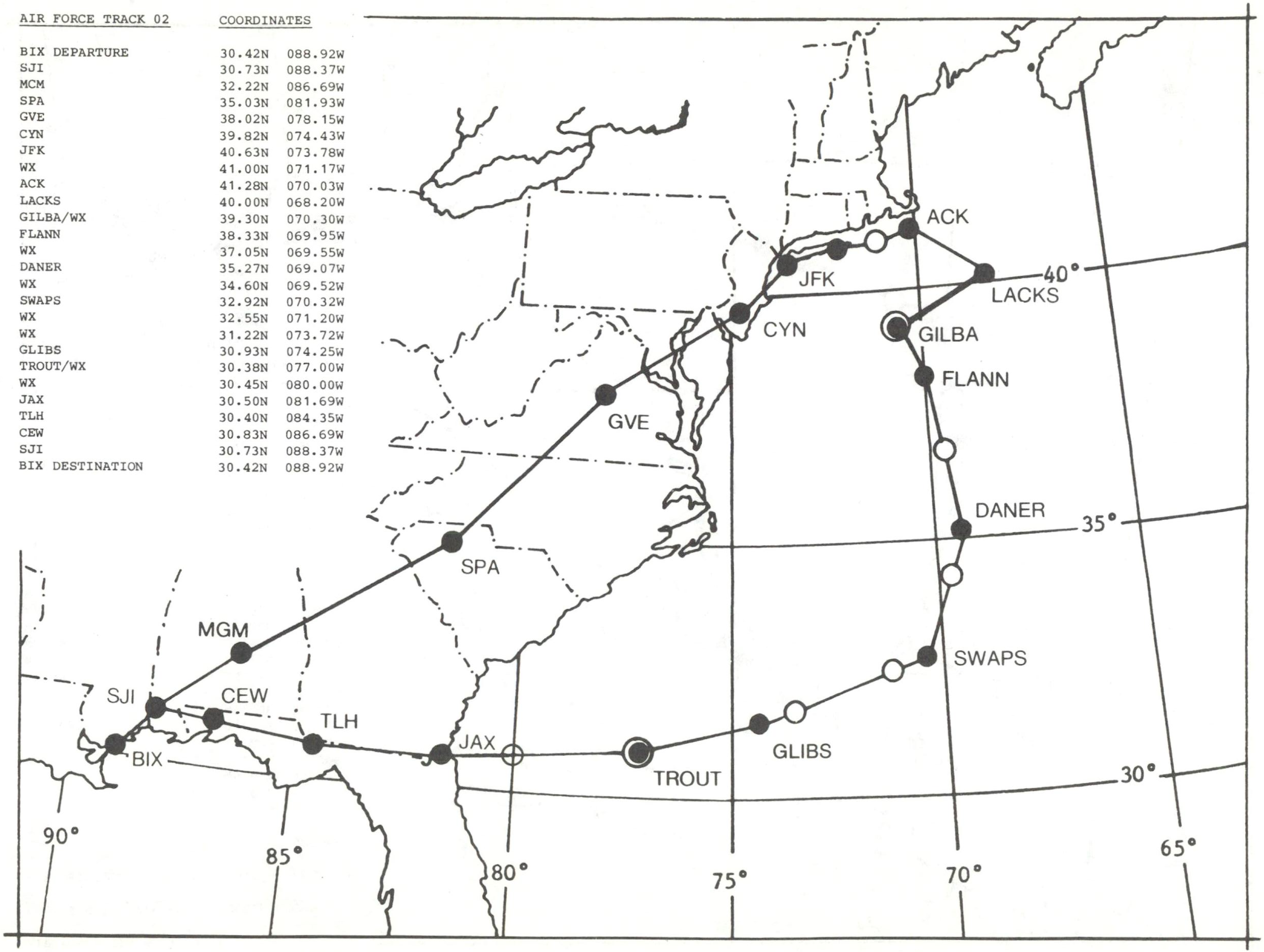
LOCATION IDENTIFIER	COORDINATES	
BIX DEPARTURE	30.42N	088.92W
SJI	30.73N	088.37W
MGM	32.22N	086.68W
SPA	35.03N	081.93W
GVE	38.02N	078.15W
CYN	39.82N	074.43W
JFK	40.63N	073.78W
WX	41.00N	071.17W
ACK	41.28N	070.03W
POGO/WX	41.13N	067.00W
LACKS	40.00N	068.20W
GILBA/WX	39.30N	070.50W
FLANN	38.33N	069.95W
WX	37.05N	069.55W
DANER	35.27N	069.07W
WX	34.60N	069.52W
SWAPS	32.92N	070.32W
WX	32.55N	071.20W
WX	31.22N	073.72W
GLIBS	30.93N	074.25W
TROUT/WX	30.38N	077.00W
WX	30.45N	080.00W
JAX	30.50N	081.69W
TLH	30.40N	084.35W
CEW	30.83N	086.69W
SJI	30.73N	088.37W
BIX DESTINATION	30.42N	088.92W



AIR FORCE TRACK 01

ATC Keesler 1-4473

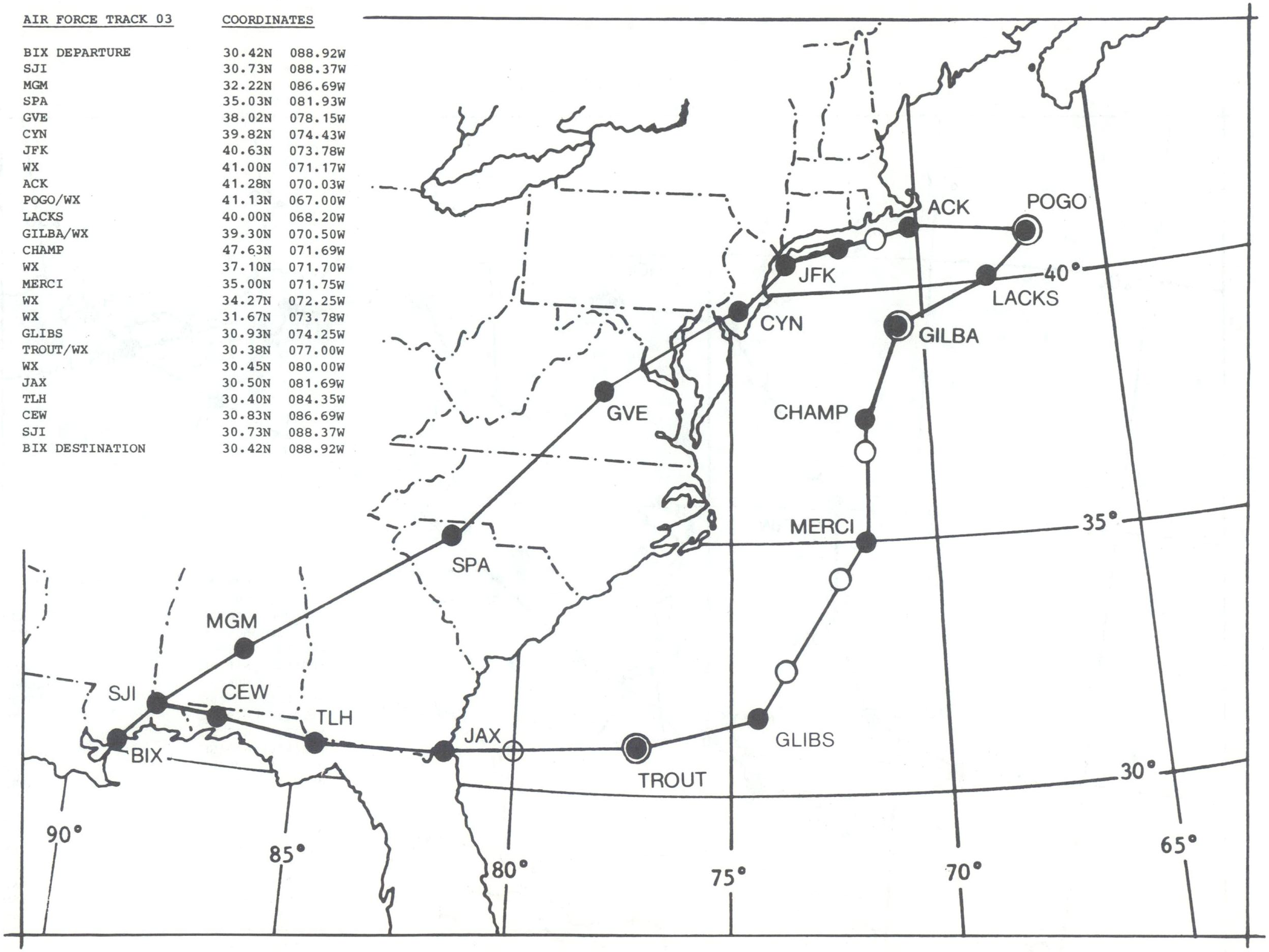
AIR FORCE TRACK 02	COORDINATES	
BIX DEPARTURE	30.42N	088.92W
SJI	30.73N	088.37W
MCM	32.22N	086.69W
SPA	35.03N	081.93W
GVE	38.02N	078.15W
CYN	39.82N	074.43W
JFK	40.63N	073.78W
WX	41.00N	071.17W
ACK	41.28N	070.03W
LACKS	40.00N	068.20W
GILBA/WX	39.30N	070.30W
FLANN	38.33N	069.95W
WX	37.05N	069.55W
DANER	35.27N	069.07W
WX	34.60N	069.52W
SWAPS	32.92N	070.32W
WX	32.55N	071.20W
WX	31.22N	073.72W
GLIBS	30.93N	074.25W
TROUT/WX	30.38N	077.00W
WX	30.45N	080.00W
JAX	30.50N	081.69W
TLH	30.40N	084.35W
CEW	30.83N	086.69W
SJI	30.73N	088.37W
BIX DESTINATION	30.42N	088.92W



AIR FORCE TRACK 02

ATC Keesler 1-4473

AIR FORCE TRACK 03	COORDINATES	
BIX DEPARTURE	30.42N	088.92W
SJI	30.73N	088.37W
MGM	32.22N	086.69W
SPA	35.03N	081.93W
GVE	38.02N	078.15W
CYN	39.82N	074.43W
JFK	40.63N	073.78W
WX	41.00N	071.17W
ACK	41.28N	070.03W
POGO/WX	41.13N	067.00W
LACKS	40.00N	068.20W
GILBA/WX	39.30N	070.50W
CHAMP	47.63N	071.69W
WX	37.10N	071.70W
MERCI	35.00N	071.75W
WX	34.27N	072.25W
WX	31.67N	073.78W
GLIBS	30.93N	074.25W
TROUT/WX	30.38N	077.00W
WX	30.45N	080.00W
JAX	30.50N	081.69W
TLH	30.40N	084.35W
CEW	30.83N	086.69W
SJI	30.73N	088.37W
BIX DESTINATION	30.42N	088.92W

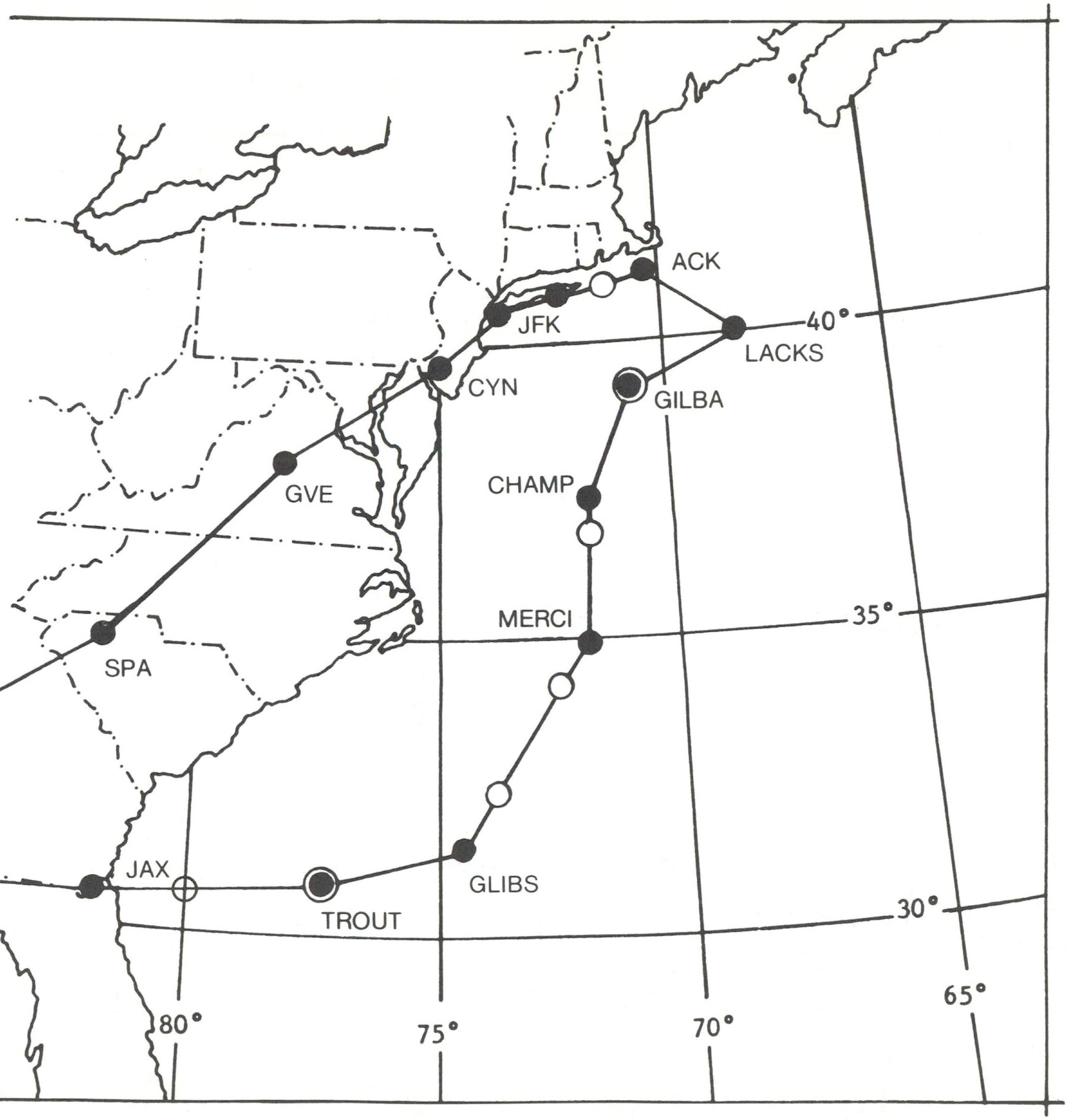


AIR FORCE TRACK 03

ATC Keesler 1-4473

AIR FORCE TRACK 04

LOCATION IDENTIFIER	COORDINATES	
BIX DEPARTURE	30.42N	088.92W
SJI	30.73N	088.37W
MGM	32.22N	086.69W
SPA	35.03N	081.93W
GVE	38.02N	078.15W
CYN	39.82N	074.43W
JFK	40.63N	073.78W
WX	41.00N	071.17W
ACK	41.28N	070.03W
LACKS	40.00N	068.20W
GILBA/WX	39.30N	070.50W
CHAMP	37.52N	071.69W
WX	37.10N	071.70W
MERCI	35.00N	071.75W
WX	34.27N	072.25W
WX	31.67N	073.69W
GLIBS	30.93N	074.25W
TROUT/WX	30.48N	077.00W
WX	30.45N	080.00W
JAX	30.50N	081.69W
TLH	30.40N	084.35W
CEW	30.83N	086.69W
SJI	30.73N	088.37W
BIX DESTINATION	30.42N	088.92W

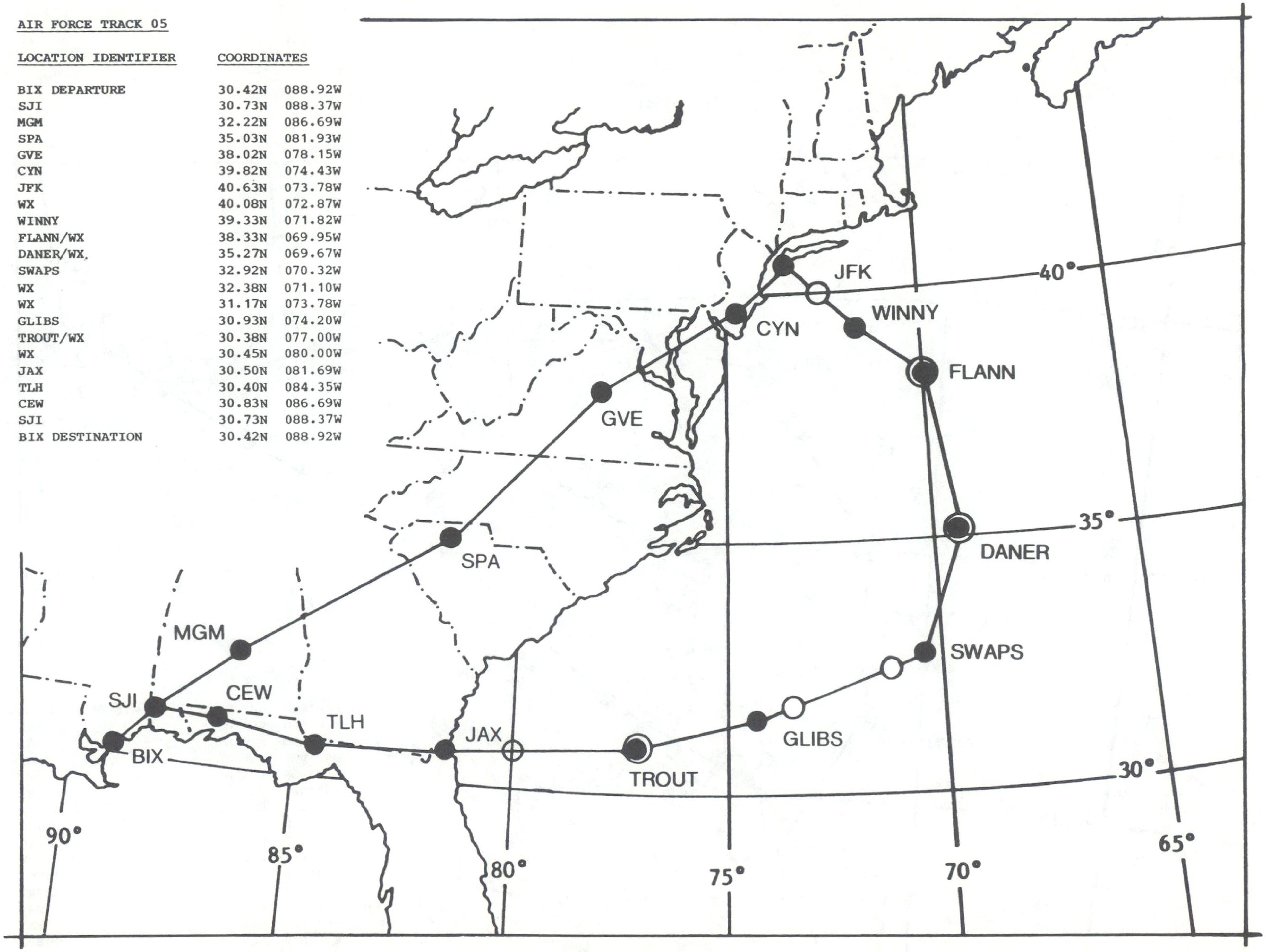


AIR FORCE TRACK 04

ATC Keesler 1-4473

AIR FORCE TRACK 05

LOCATION IDENTIFIER	COORDINATES	
BIX DEPARTURE	30.42N	088.92W
SJI	30.73N	088.37W
MGM	32.22N	086.69W
SPA	35.03N	081.93W
GVE	38.02N	078.15W
CYN	39.82N	074.43W
JFK	40.63N	073.78W
WX	40.08N	072.87W
WINNY	39.33N	071.82W
FLANN/WX	38.33N	069.95W
DANER/WX,	35.27N	069.67W
SWAPS	32.92N	070.32W
WX	32.38N	071.10W
WX	31.17N	073.78W
GLIBS	30.93N	074.20W
TROUT/WX	30.38N	077.00W
WX	30.45N	080.00W
JAX	30.50N	081.69W
TLH	30.40N	084.35W
CEW	30.83N	086.69W
SJI	30.73N	088.37W
BIX DESTINATION	30.42N	088.92W

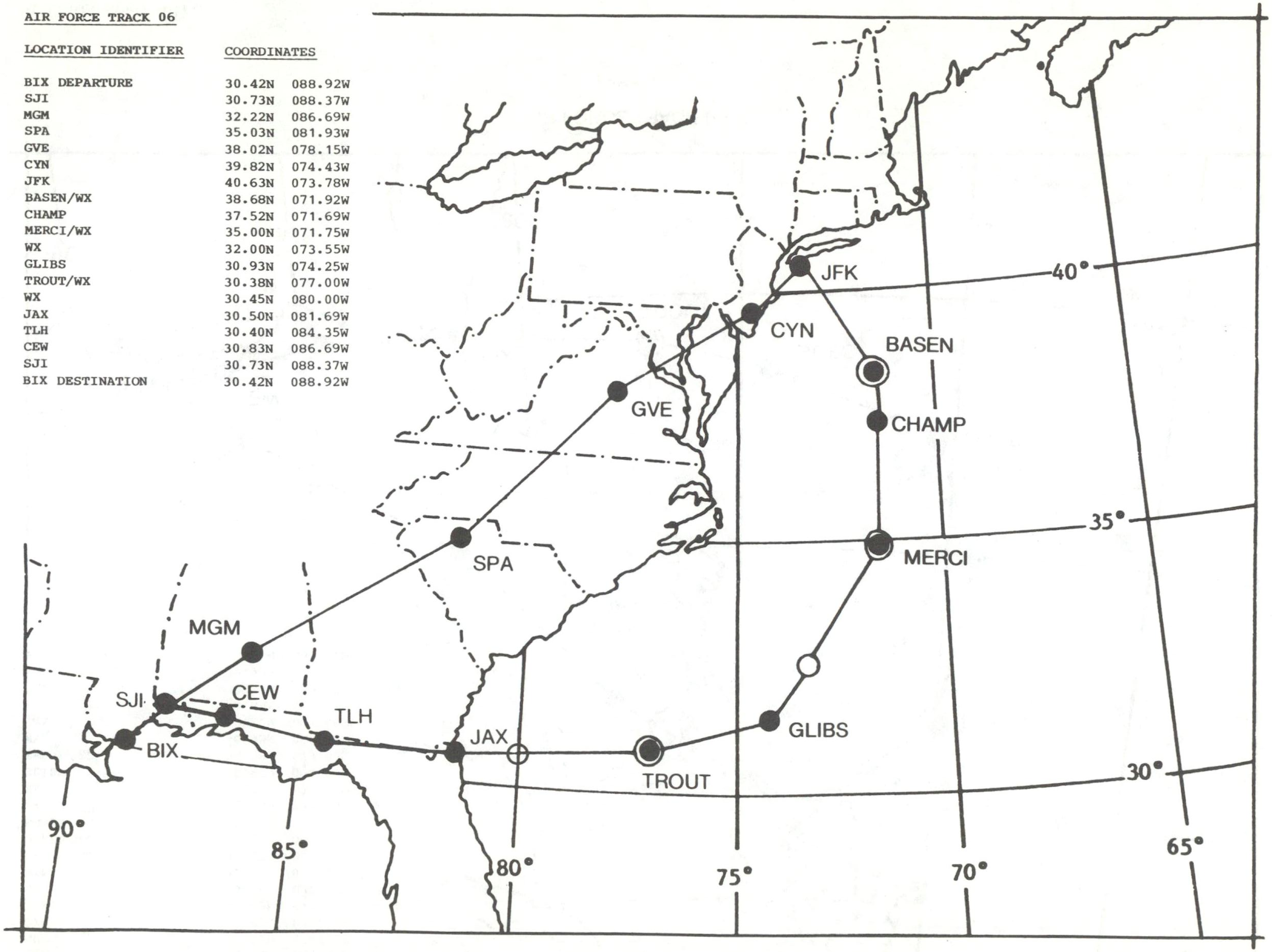


AIR FORCE TRACK 05

ATC Keesler 1-4473

AIR FORCE TRACK 06

LOCATION IDENTIFIER	COORDINATES	
BIX DEPARTURE	30.42N	088.92W
SJI	30.73N	088.37W
MGM	32.22N	086.69W
SPA	35.03N	081.93W
GVE	38.02N	078.15W
CYN	39.82N	074.43W
JFK	40.63N	073.78W
BASEN/WX	38.68N	071.92W
CHAMP	37.52N	071.69W
MERCI/WX	35.00N	071.75W
WX	32.00N	073.55W
GLIBS	30.93N	074.25W
TROUT/WX	30.38N	077.00W
WX	30.45N	080.00W
JAX	30.50N	081.69W
TLH	30.40N	084.35W
CEW	30.83N	086.69W
SJI	30.73N	088.37W
BIX DESTINATION	30.42N	088.92W

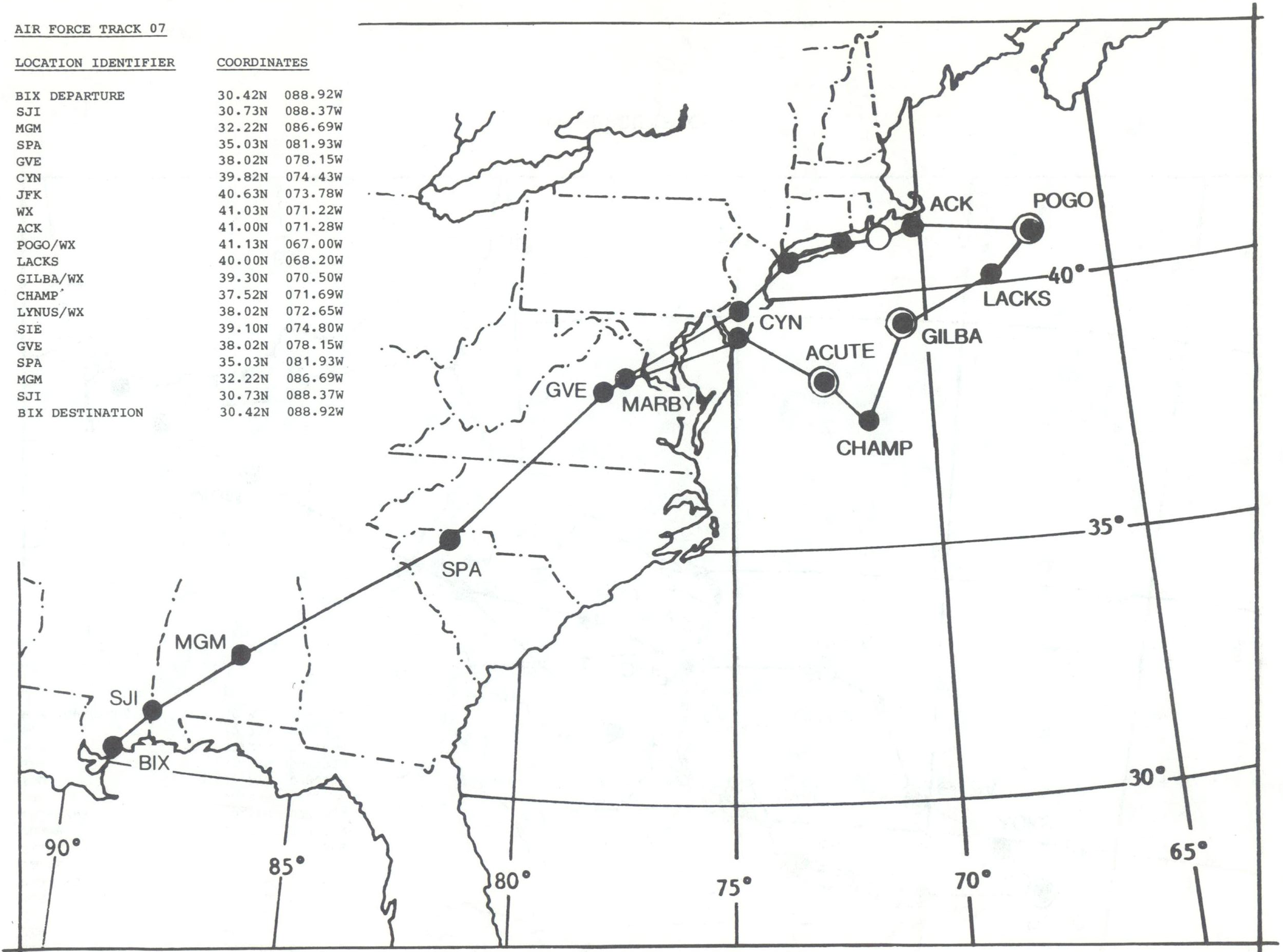


AIR FORCE TRACK 06

ATC Keesler 1-4473

AIR FORCE TRACK 07

LOCATION IDENTIFIER	COORDINATES	
BIX DEPARTURE	30.42N	088.92W
SJI	30.73N	088.37W
MGM	32.22N	086.69W
SPA	35.03N	081.93W
GVE	38.02N	078.15W
CYN	39.82N	074.43W
JFK	40.63N	073.78W
WX	41.03N	071.22W
ACK	41.00N	071.28W
POGO/WX	41.13N	067.00W
LACKS	40.00N	068.20W
GILBA/WX	39.30N	070.50W
CHAMP	37.52N	071.69W
LYNUS/WX	38.02N	072.65W
SIE	39.10N	074.80W
GVE	38.02N	078.15W
SPA	35.03N	081.93W
MGM	32.22N	086.69W
SJI	30.73N	088.37W
BIX DESTINATION	30.42N	088.92W

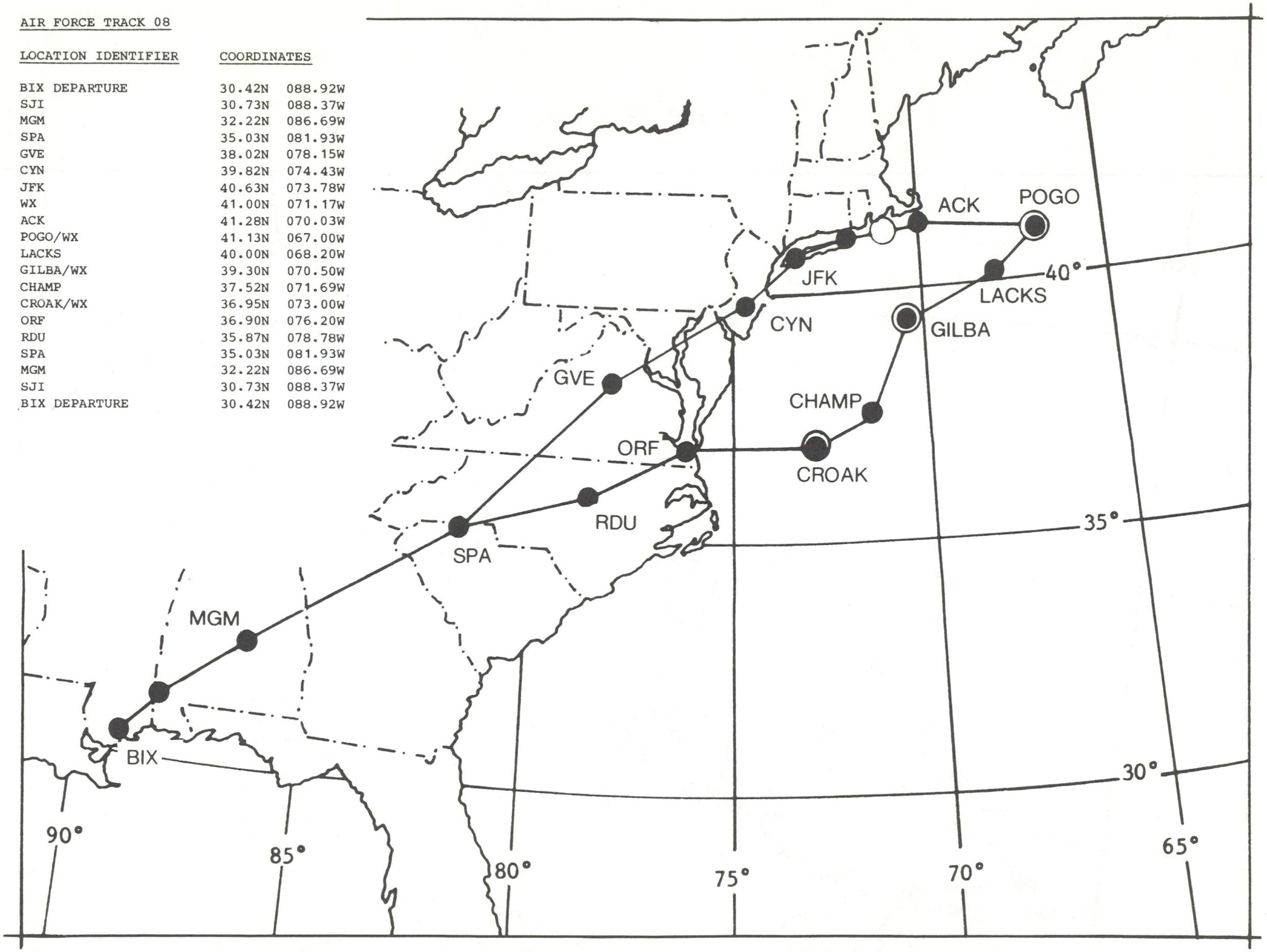


AIR FORCE TRACK 07

ATC Keesler 1-4473

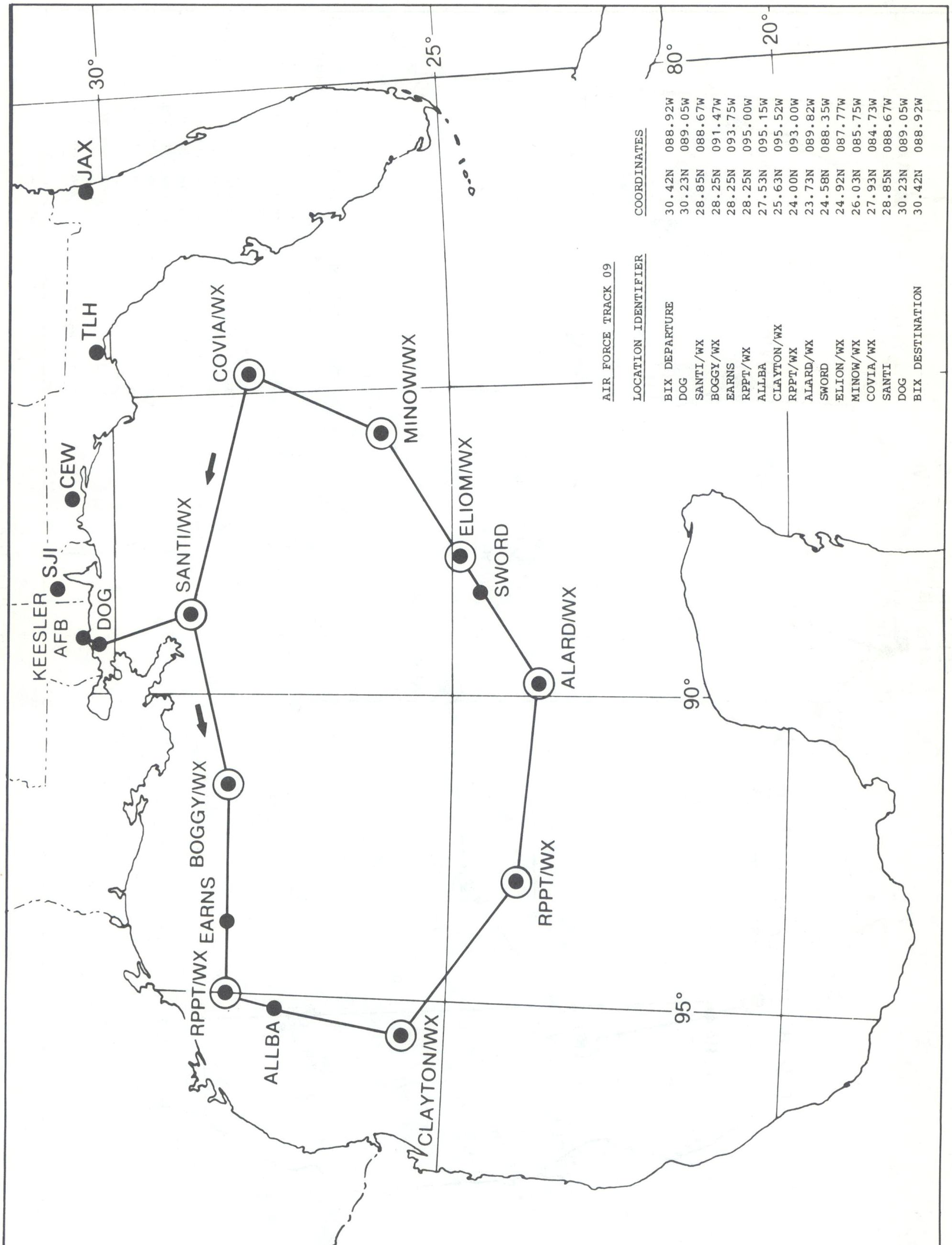
AIR FORCE TRACK 08

LOCATION IDENTIFIER	COORDINATES	
BIX DEPARTURE	30.42N	088.92W
SJI	30.73N	088.37W
MGM	32.22N	086.69W
SPA	35.03N	081.93W
GVE	38.02N	078.15W
CYN	39.82N	074.43W
JFK	40.63N	073.78W
WX	41.00N	071.17W
ACK	41.28N	070.03W
POGO/WX	41.13N	067.00W
LACKS	40.00N	068.20W
GILBA/WX	39.30N	070.50W
CHAMP	37.52N	071.69W
CROAK/WX	36.95N	073.00W
ORF	36.90N	076.20W
RDU	35.87N	078.78W
SPA	35.03N	081.93W
MGM	32.22N	086.69W
SJI	30.73N	088.37W
BIX DEPARTURE	30.42N	088.92W



AIR FORCE TRACK 08

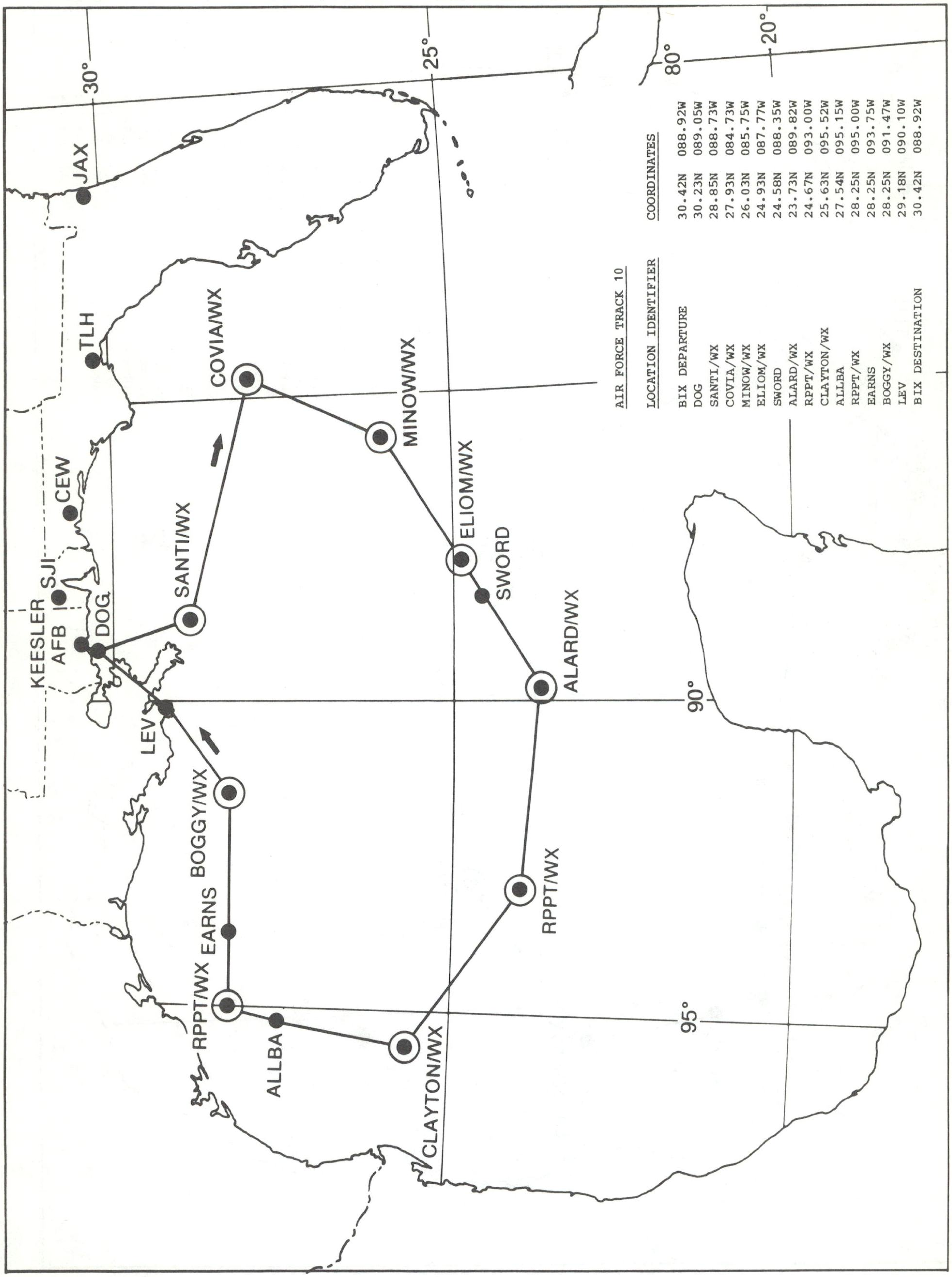
ATC Keesler 1-4473



AIR FORCE TRACK 09

LOCATION IDENTIFIER	COORDINATES	
BIX DEPARTURE	30.42N	088.92W
DOG	30.23N	089.05W
SANTI/WX	28.85N	088.67W
BOGGY/WX	28.25N	091.47W
EARNS	28.25N	093.75W
RPPT/WX	28.25N	095.00W
ALLBA	27.53N	095.15W
CLAYTON/WX	25.63N	095.52W
RPPT/WX	24.00N	093.00W
ALARD/WX	23.73N	089.82W
SWORD	24.58N	088.35W
ELION/WX	24.92N	087.77W
MINOW/WX	26.03N	085.75W
COVIA/WX	27.93N	084.73W
SANTI	28.85N	088.67W
DOG	30.23N	089.05W
BIX DESTINATION	30.42N	088.92W

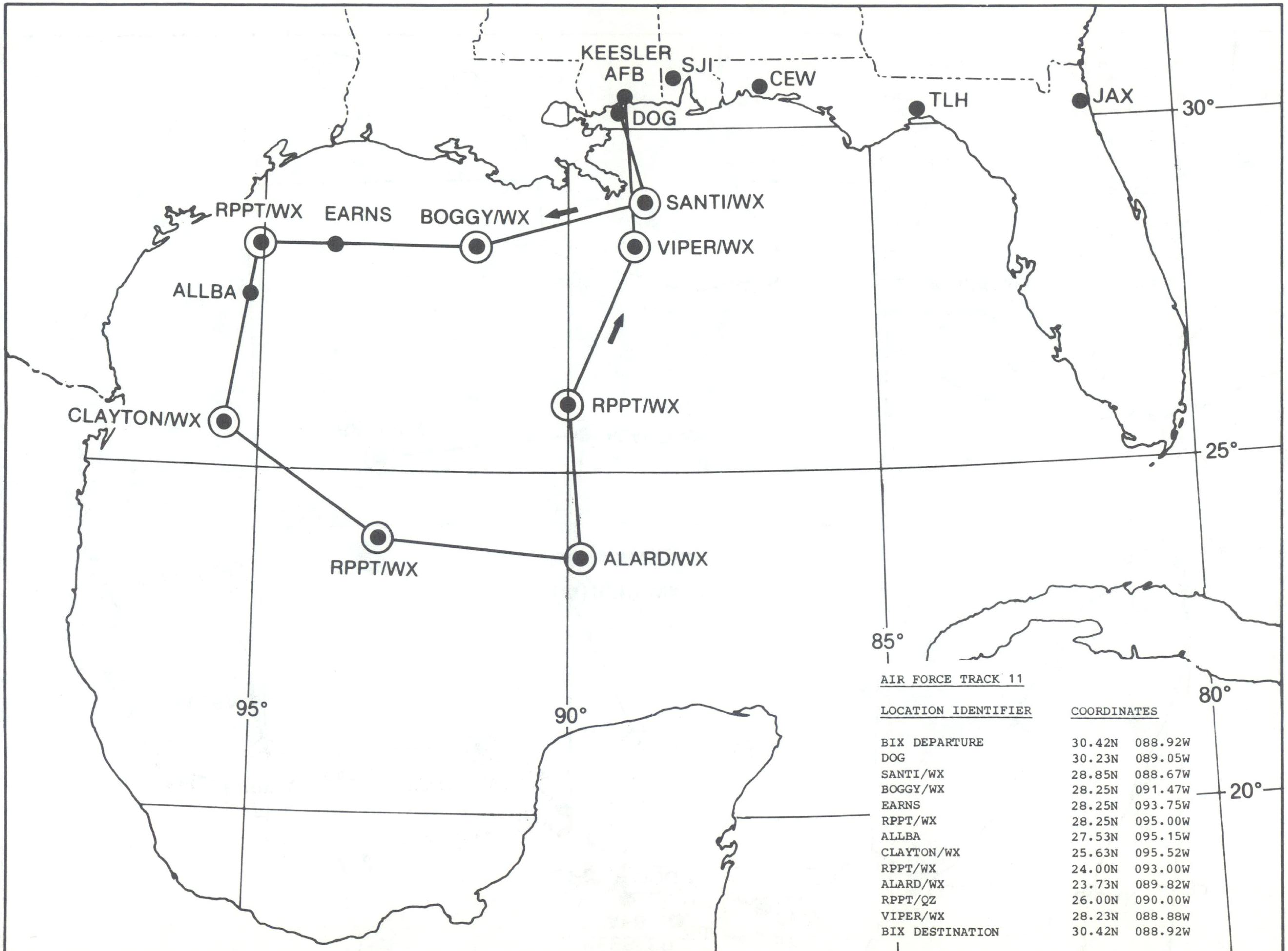
AIR FORCE TRACK 9



AIR FORCE TRACK 10

LOCATION IDENTIFIER	COORDINATES	
BIX DEPARTURE	30.42N	088.92W
DOG	30.23N	089.05W
SANTI/WX	28.85N	088.73W
COVIA/WX	27.93N	084.73W
MINOW/WX	26.03N	085.75W
ELIOM/WX	24.93N	087.77W
SWORD	24.58N	088.35W
ALARD/WX	23.73N	089.82W
RPPT/WX	24.67N	093.00W
CLAYTON/WX	25.63N	095.52W
ALLBA	27.54N	095.15W
RPPT/WX	28.25N	095.00W
EARNS	28.25N	093.75W
BOGGY/WX	28.25N	091.47W
LEV	29.18N	090.10W
BIX DESTINATION	30.42N	088.92W

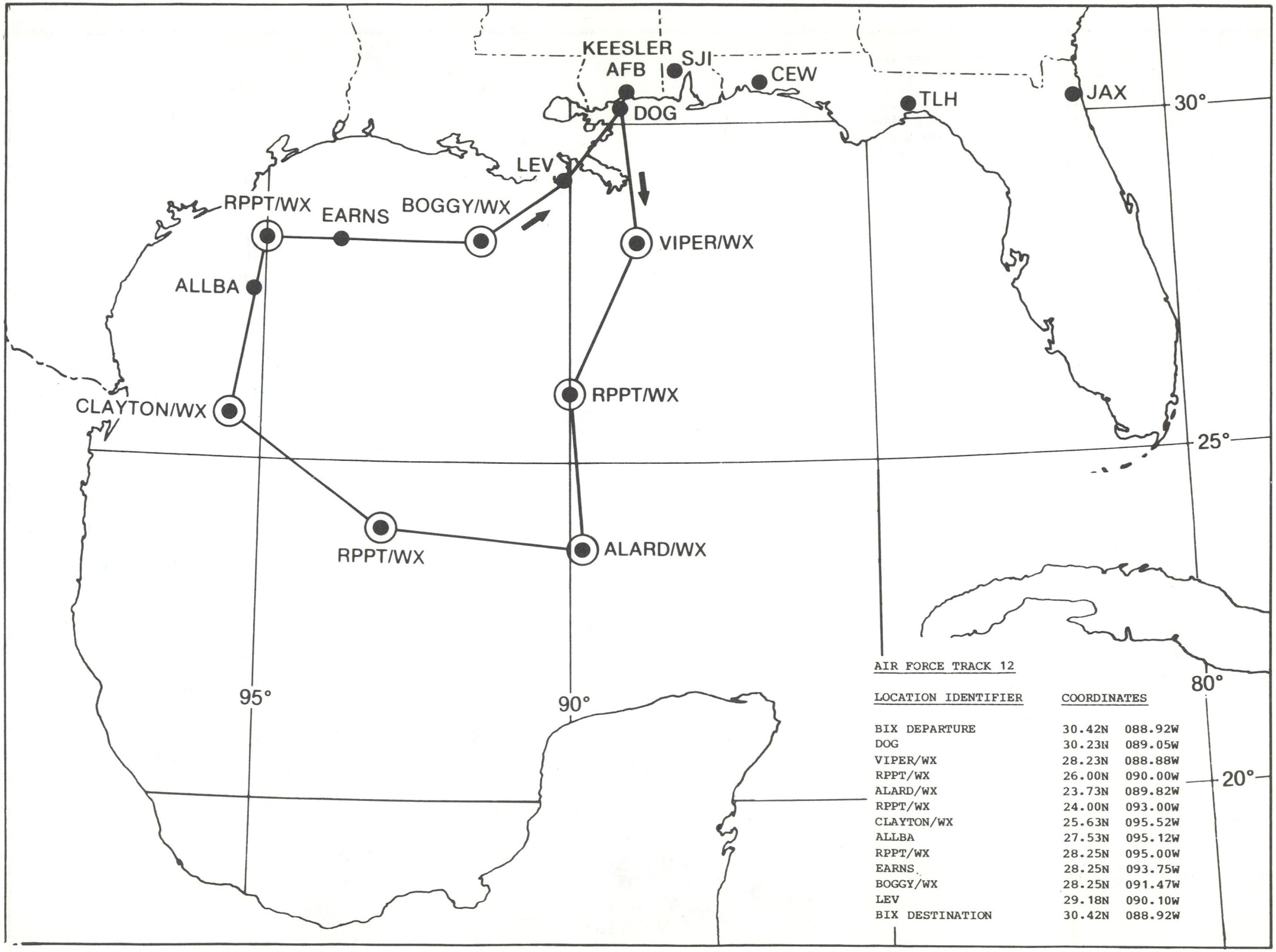
AIR FORCE TRACK 10



AIR FORCE TRACK 11

LOCATION IDENTIFIER	COORDINATES	
BIX DEPARTURE	30.42N	088.92W
DOG	30.23N	089.05W
SANTI/WX	28.85N	088.67W
BOGGY/WX	28.25N	091.47W
EARNS	28.25N	093.75W
RPPT/WX	28.25N	095.00W
ALLBA	27.53N	095.15W
CLAYTON/WX	25.63N	095.52W
RPPT/WX	24.00N	093.00W
ALARD/WX	23.73N	089.82W
RPPT/QZ	26.00N	090.00W
VIPER/WX	28.23N	088.88W
BIX DESTINATION	30.42N	088.92W

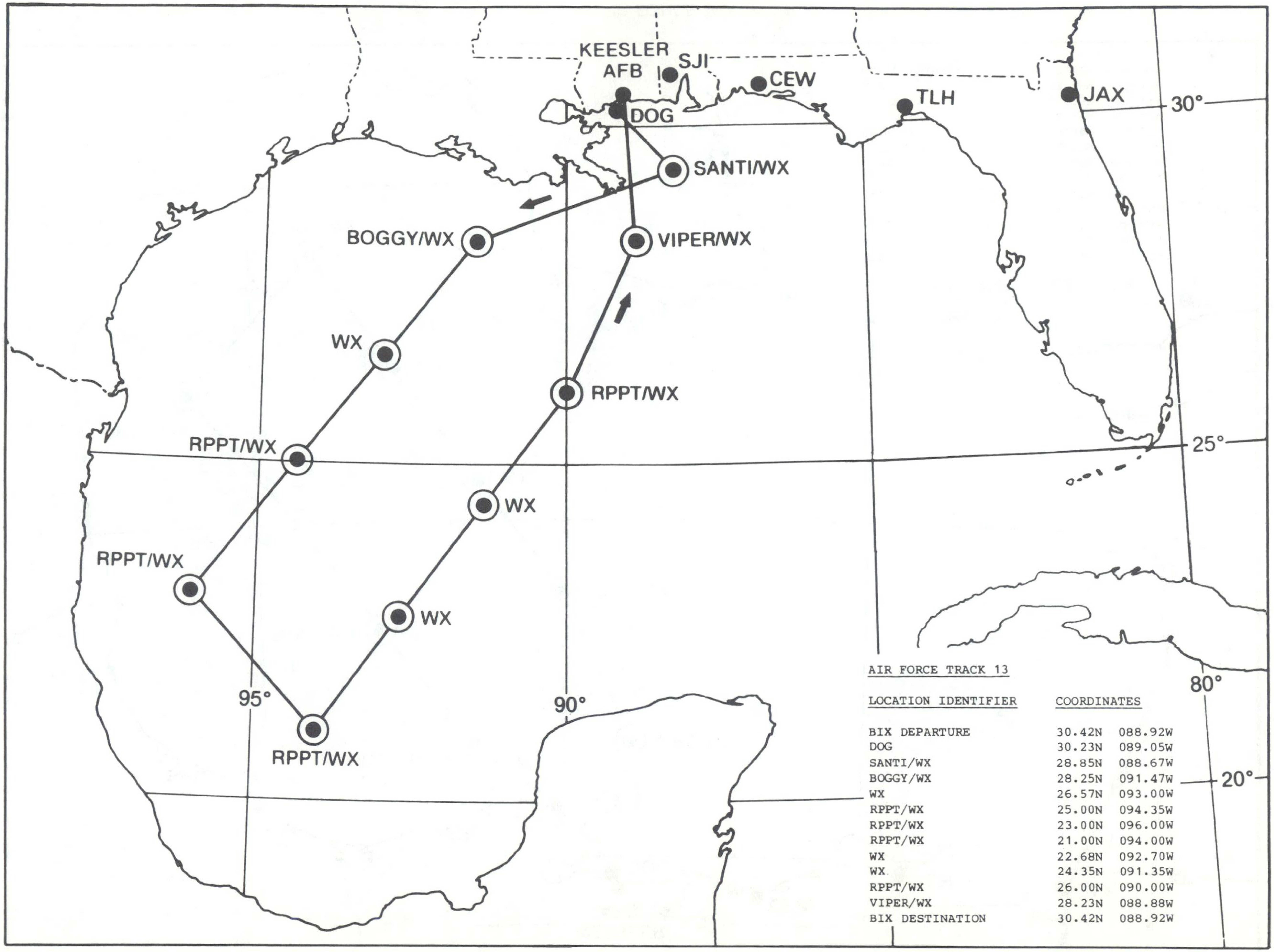
AIR FORCE TRACK 11



AIR FORCE TRACK 12

LOCATION IDENTIFIER	COORDINATES	
BIX DEPARTURE	30.42N	088.92W
DOG	30.23N	089.05W
VIPER/WX	28.23N	088.88W
RPPT/WX	26.00N	090.00W
ALARD/WX	23.73N	089.82W
RPPT/WX	24.00N	093.00W
CLAYTON/WX	25.63N	095.52W
ALLBA	27.53N	095.12W
RPPT/WX	28.25N	095.00W
EARNS	28.25N	093.75W
BOGGY/WX	28.25N	091.47W
LEV	29.18N	090.10W
BIX DESTINATION	30.42N	088.92W

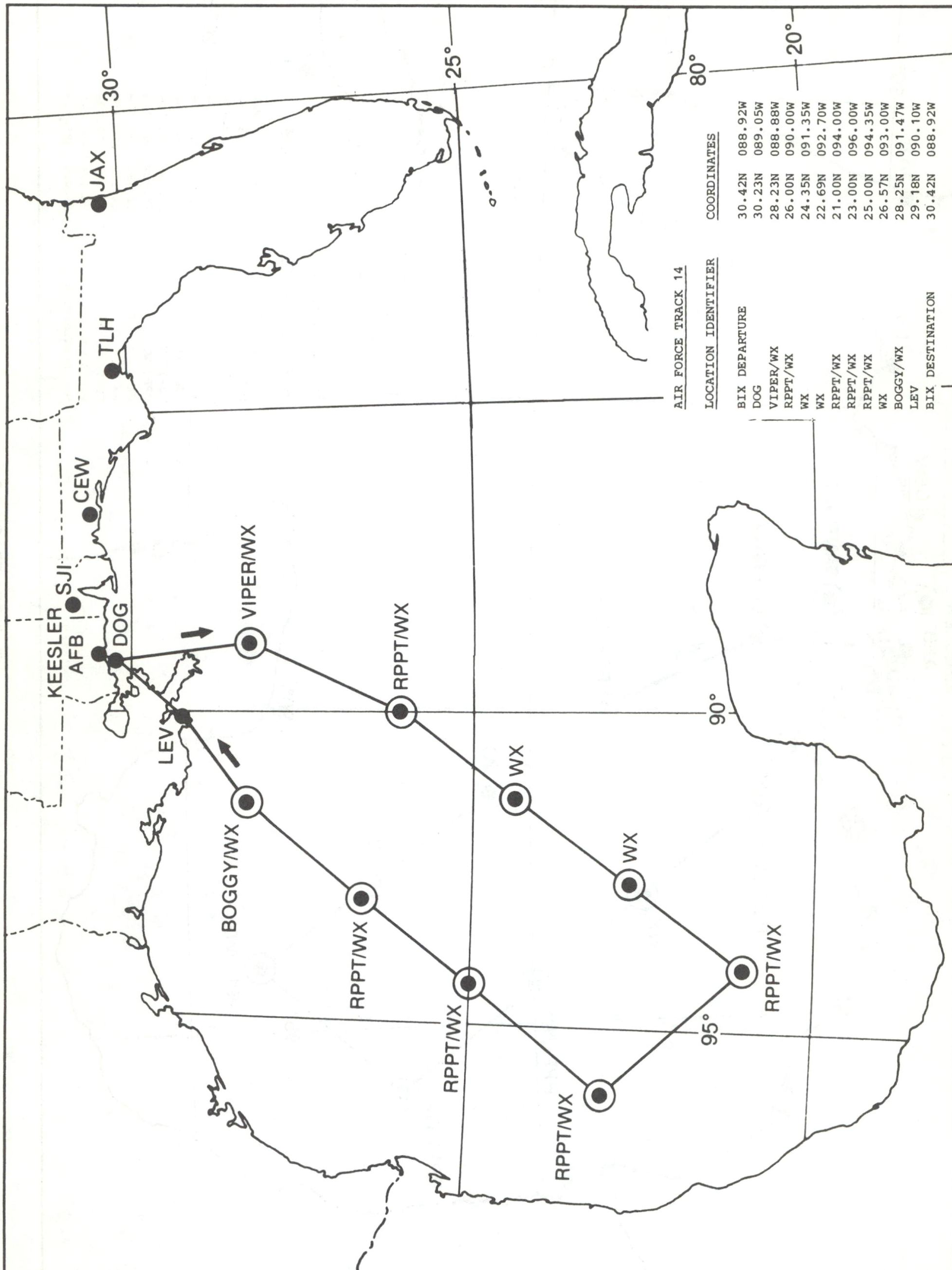
AIR FORCE TRACK 12



AIR FORCE TRACK 13

LOCATION IDENTIFIER	COORDINATES	
BIX DEPARTURE	30.42N	088.92W
DOG	30.23N	089.05W
SANTI/WX	28.85N	088.67W
BOGGY/WX	28.25N	091.47W
WX	26.57N	093.00W
RPPT/WX	25.00N	094.35W
RPPT/WX	23.00N	096.00W
RPPT/WX	21.00N	094.00W
WX	22.68N	092.70W
WX	24.35N	091.35W
RPPT/WX	26.00N	090.00W
VIPER/WX	28.23N	088.88W
BIX DESTINATION	30.42N	088.92W

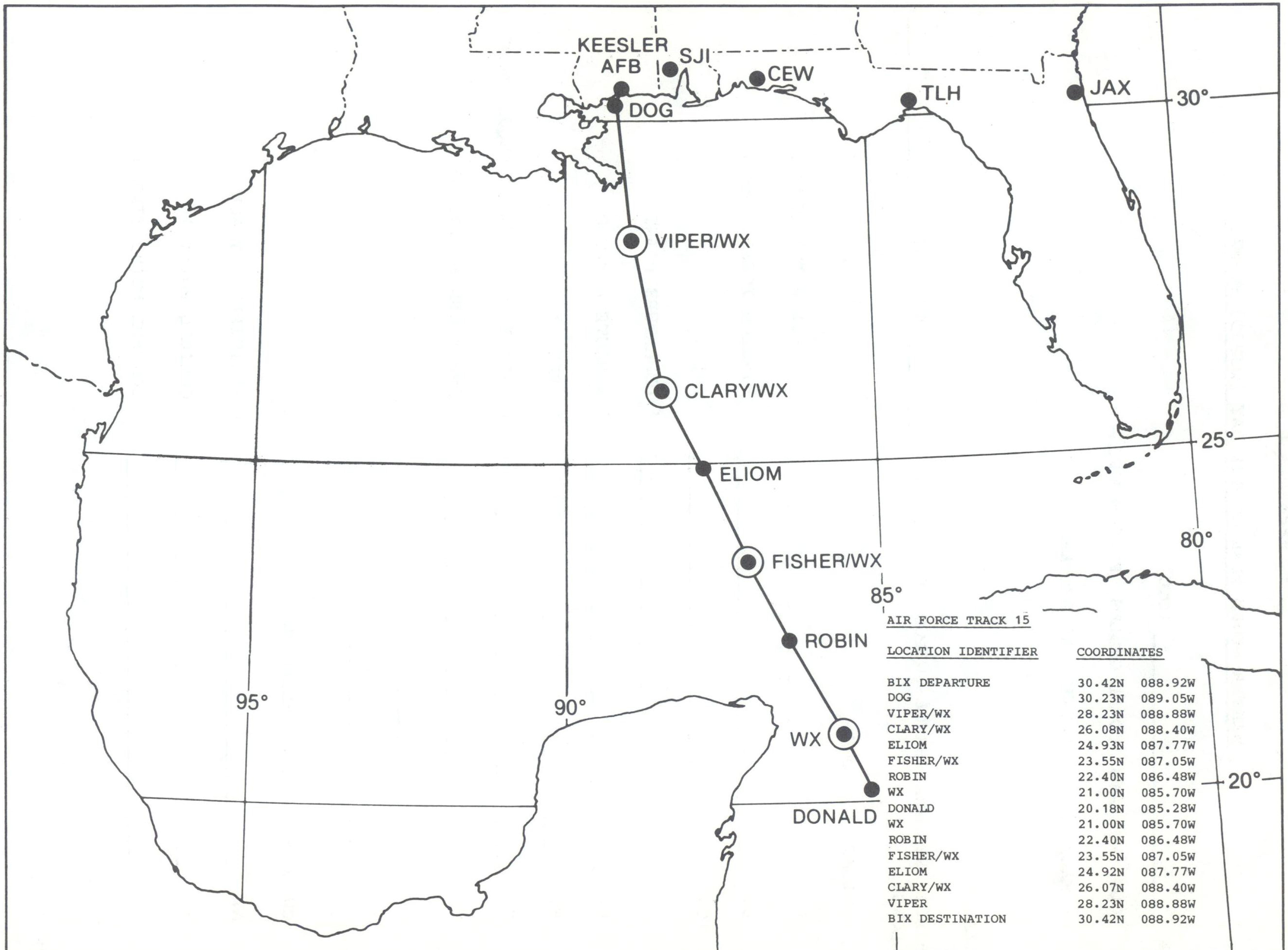
AIR FORCE TRACK 13



AIR FORCE TRACK 14

LOCATION IDENTIFIER	COORDINATES	
BIX DEPARTURE	30.42N	088.92W
DOG	30.23N	089.05W
VIPER/WX	28.23N	088.88W
RPPT/WX	26.00N	090.00W
WX	24.35N	091.35W
WX	22.69N	092.70W
RPPT/WX	21.00N	094.00W
RPPT/WX	23.00N	096.00W
RPPT/WX	25.00N	094.35W
WX	26.57N	093.00W
BOGGY/WX	28.25N	091.47W
LEV	29.18N	090.10W
BIX DESTINATION	30.42N	088.92W

AIR FORCE TRACK 14



AIR FORCE TRACK 15

LOCATION IDENTIFIER	COORDINATES	
BIX DEPARTURE	30.42N	088.92W
DOG	30.23N	089.05W
VIPER/WX	28.23N	088.88W
CLARY/WX	26.08N	088.40W
ELIOM	24.93N	087.77W
FISHER/WX	23.55N	087.05W
ROBIN	22.40N	086.48W
WX	21.00N	085.70W
DONALD	20.18N	085.28W
WX	21.00N	085.70W
ROBIN	22.40N	086.48W
FISHER/WX	23.55N	087.05W
ELIOM	24.92N	087.77W
CLARY/WX	26.07N	088.40W
VIPER	28.23N	088.88W
BIX DESTINATION	30.42N	088.92W

AIR FORCE TRACK 15

CHAPTER 2
APPENDIX B

WINTER STORM PLAN OF THE DAY (WSPOD) FORMAT

O/R ________________________ (DTG)

FM OLG HQ AWS CORAL GABLES FL/CARCAH

TO (MAC/NOAA APPROVED ADDRESSEES)

BT

UNCLAS

SUBJECT RECONNAISSANCE WSPOD FM (DTG) __________ TO (DTG) _______________ FOLLOWS:

1. FLIGHT NR ONE

   A. ____________________________________ (CONTROL POINT/TIME)

   B. ____________________________________ (MISSION IDENTIFIER)

   C. ____________________________________ (ETD)

   D. ____________________________________ (DEPARTURE POINT)

   E. ____________________________________ (ENROUTE ALTITUDE)

   F. ____________________________________ (TRACK)

   G. ____________________________________ (EXPIRATION TIME OF REQUIREMENT)

   H. ____________________________________ (DROPSONDE POSITIONS)

   I. ____________________________________ (REMARKS)

   ____

2. OUTLOOK FOR SUCCEEDING DAY

   A. ____________________________________ (ANTICIPATED TRACK)

   B. ____________________________________ (CONTROL POINT)

   C. ____________________________________ (CONTROL POINT TIME)

BT

NNNN

APPENDIX C
SAMPLE MISSION EVALUATION FORM

DATE:

TO: OL-G HQ AWS/CARCAH

FROM:

SUBJECT: MISSION ____________________ EVALUATION
(MISSION IDENTIFIER)

I. PUBLISHED REQUIREMENTS

1. CONTROL POINT AND TIME ____________________

2. FLIGHT TRACK ____________________

3. EXPIRATION TIME OF REQUIREMENT ____________________

4. MISCELLANEOUS (DROP PSNS, ALTITUDES, ETC.) ____________________

____

II. RECONNAISSANCE MISSION PERFORMANCE

1. CONTROL PT TIME: ________ON TIME ______ LATE ______ EARLY ______ MISSED

2. FLIGHT TRACK FLOWN: ______ COMPLETELY ______ PARTIALLY ______ OTHER

3. HORIZONTAL DATE COVERAGE: COMPLETE ______ TIMELY ______ ACCURATE _____
INCOMPLETE ____ UNTIMELY ____ INACCURATE ____

4. VERTICAL DATA COVERAGE: COMPLETE ______ TIMELY ______ ACCURATE _____
INCOMPLETE ____ UNTIMELY ____ INACCURATE ____

III. OVERALL MISSION EVALUATION

OUTSTANDING _______

UNSATISFACTORY _____ FOR: COMPLETENESS ____ ACCURACY _____ TIMELINESS____
EQUIPMENT _____ PROCEDURES _____ OTHER ______

IV. REMARKS (BRIEF BUT SPECIFIC) ____________________

____

V. REPLY BY INDORSEMENT ______ YES ______ NO

____
(Forecaster's Signature)

APPENDIX D

NWSOP COORDINATED REQUEST FOR AIRCRAFT RECONNAISSANCE

I. NMC REQUEST (ACCOMPLISH ITEMS 1 AND 3 OR 2 AND 3 AND FILL IN APPROPRIATE SPACES)

____ 1. FLIGHT IS DESIRED

A. CONTROL POINT AND CONTROL POINT TIME

____

B. TRACK NUMBER AND ALTITUDE

____

C. EXPIRATION TIME OF FLIGHT REQUEST

____

D. SPECIAL INSTRUCTIONS (SUCH AS DROPSONDE POSITIONS)

____

____

____ 2. NO FLIGHT IS DESIRED OR PREVIOUSLY REQUESTED FLIGHT IS CANCELLED

____ 3. SUCCEEDING DAY OUTLOOK

A. ANTICIPATED TRACK NUMBER ____________________________

B. CONTROL POINT AND CONTROL POINT TIME ____________________

____

II. SCC MIAMI/CARCAH COORDINATION

1. SCC MIAMI FORECASTER INITIALS ________

2. NMC FORECASTER INITIALS ________

3. CARCAH DUTY OFFICER INITIALS ________

4. DATE AND TIME ________________

III. SCC MIAMI DISTRIBUTION: PASS ALL AIRCRAFT RECON REQUESTS, CHANGES OR CANCELLATIONS TO CARCAH IMMEDIATELY.

RECCO RECORDING FORM

OBSERVATION NUMBER	DATE		ORGANIZATION			MISSION IDENTIFIER				TYPE AIRCRAFT		CALL SIGN
	9 RECCO INDICATOR GROUP SPECIFYING TYPE OF OBSERVATION Table 1	G TIME OF OBSERVATION (Hours and Minutes) (GMT)	Y DAY OF WEEK SUN–1	L_o LONGITUDE DEGREES AND TENTHS (Note 4)	h_a PRESSURE ALTITUDE OF AIRCRAFT REPORTED TO THE NEAREST DECAMETER	d WIND DIRECTION AT FLIGHT LEVEL	T TEMPERATURE WHOLE °C	/ INDICATOR	1 INDICATOR	C CLOUD TYPE Table 11	C CLOUD TYPE Table 11	C CLOUD TYPE Table 11
	X	G	Q OCTANT Table 3	L_o	h_a	d (Tens of deg. true.)	T (Note 6)	j INDEX TO HHH Table 9	k_n NR OF CLOUD LAYERS (Note 9)	h_s ALTITUDE OF BASE Table 12	h_s ALTITUDE OF BASE Table 12	h_s ALTITUDE OF BASE Table 12
	X	g	L_a LATITUDE DEGREES AND TENTHS	L_o	h_a	f WIND SPEED AT FLIGHT LEVEL (Knots)	T_d DEW POINT WHOLE °C (Note 6)	H GEO-POTENTIAL HEIGHT/ D-VALUE OR SLP PER INDEX j (Note 8)	N_s AMOUNT OF CLOUDS (Note 9) Table 10	h_s	h_s	h_s
	X	g	L_a	B TURBULENCE Table 4	d_t TYPE OF WIND Table 6	f	T_d	H	N_s	H_t ALTITUDE OF TOP Table 12	H_t ALTITUDE OF TOP Table 12	H_t ALTITUDE OF TOP Table 12
	9	i_d DEW POINT INDICATOR Table 2	L_a	f_c FLT COND Table 5 (Note 5)	d_a METHOD OF OBTAINING WIND Table 7	f	w PRESENT WEATHER (Note 7 Table 8)	H	N_s	H_t	H_t	H_t
	1	2	3	4	5	6	7	8	9	10	11	12

REMARKS

				METEOROLOGIST		RECCO RECORDING FORM							
1 INDICATOR	C CLOUD TYPE Table 11	C CLOUD TYPE Table 11	C CLOUD TYPE Table 11	4 INDICATOR	6 INDICATOR (Note 11)	6 INDICATOR (Note 11)	7 INDICATOR	7 INDICATOR	8 INDICATOR	8 INDICATOR	9 INDICATOR	REMARKS
K_n NR OF CLOUD LAYERS (Note 9)	h_s ALTITUDE OF BASE Table 12	h_s ALTITUDE OF BASE Table 12	h_s ALTITUDE OF BASE Table 12	d DIRECTION OF SFC WIND (Tens of deg. true)	W_s SIGNIFICANT WEA CHANGES Table 14	W_s SIGNIFICANT WEA CHANGES Table 14	I_r RATE OF ICING Table 17	h_i ALT OF BASE OF ICING STRATUM (Note 12) Table 12	d_r BEARING OF ECHO CENTER (Tens of Deg. True)	E_w ECHO WIDTH OR DIAM Table 19	V_i INFLIGHT VISIBILITY Table 23	
N_s AMOUNT OF CLOUDS (Note 9) Table 10	h_s	h_s	h_s	d	S_s DISTANCE OF OCCURRENCE OF Ws Table 15	S_s DISTANCE OF OCCURRENCE OF Ws Table 15	I_t TYPE OF ICING Table 18	h_i	d_r	E_l LENGTH OF MAJ AXIS Table 19	T_w SEA SURFACE TEMPERATURE DEGREES AND TENTHS	
N_s	H_t ALTITUDE OF TOP Table 12	H_t ALTITUDE OF TOP Table 12	H_t ALTITUDE OF TOP Table 12	f SURFACE WIND SPEED (knots) (Note10)	W_d DISTANT WEATHER Table 16	W_d DISTANT WEATHER Table 16	S_b DISTANCE TO BEGINNING OF ICING Table 15	H_i ALTITUDE OF TOP OF ICING STRATUM (Note 12) Table 12	S_r DISTANCE TO ECHO CEN Table 19	c_e CHARACTER OF ECHO Table 21	T_w	
N_s	H_t	H_t	H_t	f	d_w BEARING OF W_d Table 13	d_w BEARING OF W_d Table 13	S_e DISTANCE TO ENDING OF ICING Table 15	H_i	O_e ORIENTATION OF ELLIPSE Table 20	i_e INTENSITY OF ECHO Table 22	T_w	
13	14	15	16	17	18	19	20	21	22	23	24	

NOTES

1. At the time of the observation the aircraft observing platform is considered to be located on the axis of a right vertical cylinder with a radius of 30 nautical miles bounded by the earth's surface and the top of the atmosphere. Present weather, cloud amount and type, turbulence, and other subjective elements are reported as occuring within the cylinder. Flight level winds, temperature, dew point, and geopotential values are sensed or computed and reported as occuring at the center of the observation circle. Radar echoes, significant weather changes, distant weather, and icing are phenomena that may also be observed/reported. Code groups identifying these phenomena may be reported as necessary to adequately describe met conditions observed.

2. The intermediate observation (Section Three) is reported following Section One (or Section Two if appended to Section One) in the order that it was taken.

3. Plain language remarks may be added as appropriate. These remarks follow the last encoded portion of the horizontal or vertical observation and will clearly convey the intended message. Vertical observations will not include meteorological remarks. These remarks must begin with a letter or word– E.G. "FL TEMP" vice "700 MB FL TEMP". The last report plain language remarks are mandatory, i.e., "LAST REPORT. OBS 01 thru 08 to RJTY, OBS 09 and 10 to RPMK".

4. The hundreds digit of longitude is omitted for longitudes from 100° to 180°.

5. Describe conditions along the route of flight actually experienced at flight level by aircraft.

6. TT, T_dT_d. When encoding negative temperatures, 50 is added to the absolute value of the temperature with the hundreds figure, if any, being omitted. A temperature of –52°C is given as 02, the distinction between –52°C and 2°C being made from i_d. Missing unknown temperatures are reported as //. When the dew point is colder than –49.4°C, Code T_dT_d as // and report the actual value as a plain language remark – E.G. DEW POINT –52°C.

7. When two or more types of w co–exist, the type with the higher code figure will be reported. Code Figure 1, 2 and 3 are reported based on the total cloud amount through a given altitude, above or below the aircraft, and when other figures are inappropriate. The summation principle applies only when two or more cloud types share a given altitude.

8. When j is reported as a 9, HHH is encoded as ///.

9. If the number of cloud layers reported exceeds 3, k_n in the first 1–group reports the total number of cloud layers. The second 1–group reports the additional number of layers being reported exclusive of those previously reported. In those cases where a cloud layer(s) is discernible, but a descriptive cloud picture of the observation circle is not posible, use appropriate remarks such as "clouds blo" or As blo" to indicate the presence of lcouds. In such cases, coded entries are not made for group 9. The sequence in which cloud amounts are encoded depends upon type of cloud, cloud base, and vertical extent of the cloud. The cloud with the largest numerical value of cloud type code (C) is reported first, regardless of coverage, base, or vertical extent. Among clouds of the same cloud type code sharing a common base, the cloud of greatest vertical extent is reported first. The summation principle is not used; each layer is treated as though no other clouds were present. The total amount of clouds through one altitude shared by several clouds will not exceed 8 oktas. Only use code figure 0 as a place holder when you can determine that no additional cloud layers exist. In case of undercast, overcast, etc., use code figure 9 as a placeholder.

10. Due to limitations in the ability to distinguish sea state features representative of wind speeds above 130 knots, surface wind speeds in excess of 130 knots will not be encoded. Wind speeds of 100 to 130 knots inclusive will be encoded by deleting the hundreds figure and adding 50 to dd. For wind speeds above 130 knots, dd is reported without adding 50 and ff is encoded as // with a plain language remark added, I.E., –sfc wind above 130 knots.

11. Significant weather changes which have occurred since the last observation along the track are reported for Ws.

12. When aircraft encounters icing in level flight, the height at which the icing occurred will be reported for h_ih_i. The H_iH_i will be reported as //.

CODE TABLES

TABLE 1 XXX

222 Sec One Observation without radar capability
555 Sec Three (Intermediate) observation with or without radar capability
777 Sec One Observation with radar capability

TABLE 2 i_d

0 No dew point capability/acft below 10,000 meters
1 No dew point capability/acft at or above 10,000 meters
2 No dew point capability/acft below 10,000 meters and flight lvl temp $-50°C$ or colder
3 No dew point capability/acft at or above 10,000 meters and flight lvl temp $-50°C$ or colder
4 Dew point capability/acft below 10,000 meters
5 Dew point capability/acft at or above 10,000 meters
6 Dew point capability/acft below 10,000 meters and flight lvl temp $-50°C$ or colder
7 Dew point capability/acft at or above 10,000 meters and flight lvl temp $-50°C$ or colder

TABLE 3 Q

0	0° – 90° W	Northern
1	90° W – 180° W	Northern
2	180° – 90° E	Northern
3	90° – 0° E	Northern
4	Not Used	
5	0° – 90° W	Southern
6	90° – 180° W	Southern
7	180° – 90° E	Southern
8	90° – 0° E	Southern

TABLE 4 B

0 None
1 Light turbulence
2 Moderate turbulence in clear air, infrequent
3 Moderate turbulence in clear air, frequent
4 Moderate turbulence in cloud, infrequent
5 Moderate turbulence in cloud, frequent
6 Severe turbulence in clear air, infrequent
7 Severe turbulence in clear air, frequent
8 Severe turbulence in cloud, infrequent
9 Severe turbulence in cloud frequent

TABLE 5 f_c

0 In the clear
8 In and out of clouds
9 In clouds all the time (continous IMC)
/ Impossible to determine due to darkness or other cause

TABLE 6 d_t

0 Spot Wind
1 Average Wind
/ No wind reported

TABLE 7 d_a

0 Winds obtained using doppler radar or inertial systems
1 Winds obtained using other navigation equipment and/or techniques
/ Navigator unable to determine wind or wind not compatible

TABLE 8 w

0 Clear
1 Scattered (trace to 4/8 cloud coverage)
2 Broken (5/8 to 7/8 cloud coverage)
3 Overcast/undercast
4 Fog, thick dust or haze
5 Drizzle
6 Rain (continous or intermittent precip – from stratiform clouds)
7 Snow or rain and snow mixed
8 Shower(s) (continous or intermittent precip – from cumuliform clouds)
9 Thunderstorm(s)
/ Unknown for any cause including darkness

TABLE 9 j

0 Sea level pressure in whole millibars *(thousands fig if any omitted)*
1 Altitude 200 mb surface in geopotential decameters *(thousands fig if any omitted)*
2 Altitude 850 mb surface in geopotential meters *(thousands fig omitted)*
3 Altitude 700 mb surface in geopotential meters *(thousands fig omitted)*
4 Altitude 500 mb surface in geopotential decameters
5 Altitude 400 mb surface in geopotential decameters
6 Altitude 300 mb surface in geopotential decameters
7 Altitude 250 mb surface in geopotential decameters *(thousands fig if any omitted)*
8 D – Value in geopotential decameters; if negative 500 is added to HHH
9 No absolute altitude available or geopotential data not within ± 30 meters/4 mb accuracy requirements.

TABLE 10 N_s

0 No additional cloud layers (place holder)
1 1 okta or less, but not zero *(1/8 or less sky covered)*
2 2 oktas *(or 2/8 of sky covered)*
3 3 oktas *(or 3/8 sky covered)*
4 4 oktas *(or 4/8 of sky covered)*
5 5 oktas *(or 5/8 of sky covered)*
6 6 oktas *(or 6/8 of sky covered)*
7 7 oktas or more but not 8 oktas
8 8 oktas or sky completely covered
9 Sky obscured (place holder)

TABLE 11 C

0 Cirrus (Ci)
1 Cirrocumulus (Cc)
2 Cirrostratus (Cs)
3 Altocumulus (Ac)
4 Altostratus (As)
5 Nimbostratus (Ns)
6 Stratocumulus (Sc)
7 Stratus (St)
8 Cumulus (Cu)
9 Cumulonimbus (Cb)
/ Cloud type unknown due to darkness or other analogous phenomena

TABLE 12 $h_sh_sH_tH_th_ih_iH_iH_i$

00 Less than 100
01 100 ft
02 200 ft
03 300 ft
etc, etc
49 4,900 ft
50 5,000 ft
51– 55 Not used
56 6,000 ft
57 7,000 ft
etc, etc
79 29,000ft
80 30,000 ft
81 35,000 ft
82 40,000 ft
etc, etc
89 Greater than 70,000 ft
// Unknown

TABLE 13 d_w

0 No report
1 NE
2 E
3 SE
4 S
5 SW
6 W
7 NW
8 N
9 all directions

TABLE 14 W_s

0 No change
1 Marked wind shift
2 Beginning or ending of marked turbulence
3 Marked temperature change (not with altitude)
4 Precipitation begins or ends
5 Change in cloud forms
6 Fog or ice fog bank begins or ends
7 Warm front
8 Cold front
9 Front, type not specified

TABLE 15 $S_bS_eS_s$

0 No report
1 Previous position
2 Present position
3 30 nautical miles
4 60 nautical miles
5 90 nautical miles
6 120 nautical miles
7 150 nautical miles
8 180 nautical miles
9 More than 180 nautical miles
/ Unknown (not used for S_s)

TABLE 16 w_d

0 No report
1 Signs of a tropical cyclone
2 Ugly threatening sky
3 Duststorm or sandstorm
4 Fog or ice fog
5 Waterspout
6 Cirrostratus shield or bank
7 Altostratus or altocumulus shield or bank
8 Line of heavy cumulus
9 Cumulonimbus heads or thunderstorms

TABLE 17 I_r

7 Light
8 Moderate
9 Severe
/ Unknown or contrails

TABLE 18 I_t

0 None
1 Rime ice in clouds
2 Clear ice in clouds
3 Combination rime and clear ice in clouds
4 Rime ice in precipitation
5 Clear ice in precipitation
6 Combination rime and clear ice in precip
7 Frost (icing in clear air)
8 Nonpersistent contrails *(less than 1/4 nautical miles long)*
9 Persistent contrails

TABLE 19 S_r, E_w, E_1

0	0NM	5	50NM
1	10NM	6	60–80NM
2	20NM	7	80–100NM
3	30NM	8	100–150NM
4	40NM	9	Greater than 150NM
		/	Unknown

TABLE 20 O_e

0 Circular
1 NNE – SSW
2 NE – SW
3 ENE – WSW
4 E – W
5 ESE – WNW
6 SE – NW
7 SSE – NNW
8 S – N
/ Unknown

TABLE 21 c_e

1 Scattered Area
2 Solid Area
3 Scattered Line
4 Solid Line
5 Scattered, all quadrants
6 Solid, all quadrants
/ Unknown

TABLE 22 i_e

2 Weak
5 Moderate
8 Strong
/ Unknown

TABLE 23 V_i

1 Inflight visibility 0 to and including 1 nautical mile
2 Inflight visibility greater than 1 and not exceeding 3 nautical miles
3 Inflight visibility greater than 3 nautical miles

RECCO SYMBOLIC FORM

SECTION ONE (MANDATORY)
$9XXX9\ \ GGggi_d\ \ YQL_aL_aL_a\ \ L_oL_oL_oBf_c\ \ h_ah_ah_ad_td_a$
$ddfff\ \ TTT_dT_dw\ \ /iHHH$

SECTION TWO (ADDITIONAL)
$Ik_nN_sN_sN_s\ \ Ch_sh_sH_tH_t$ 4ddff
$6W_sS_sW_dd_w\ \ 7I_rI_tS_bS_e\ \ 7h_ih_i\ H_iH_i\ \ 8d_rd_rS_rO_e$
$8E_wE_1c_ei_e\ \ 9V_iT_wT_wT_w$

SECTION THREE (INTERMEDIATE)
$9XXX9\ \ GGggi_d\ \ YQL_aL_aL_a\ \ L_oL_oL_oBf_c\ \ h_ah_ah_ad_td_a$
$ddfff\ \ TTT_dT_dw\ \ /iHHH$

DROPSONDE CODE BREAKDOWN

PART A

1	2	3	4	5	6	7	8
XXAA	$YYGGI_d$	$99L_aL_aL_a$	$Q_cL_oL_oL_oL_o$	$MMMU_{la}U_{lo}$	99PPP	TTT_aDD	ddfff

9	10	11	12	13	14
PPhhh	TTT_aDD	ddfff	....	88999	77999

GP	IND	MEANING
1	XX	Dropsonde observation follows.
	AA	Part A follows.
2	YY	Day of the month (GMT), with 01 indicating the first day, 02 the second day, etc. YY is used to indicate the unit of wind speed in addition to indicating the day of the month. When wind speeds are given in knots, 50 is added to YY.
	GG	Actual time of observation, to the nearest whole hour (GMT).
	I_d	Highest level for which wind is available. 7=700mbs, 5=500mbs, 4=400mbs, etc. If I_d = /, the winds will NOT be reported in any part of the message.
3	$L_aL_aL_a$	Latitude, in tenths of a degree.
4	Q_c	Quadrant of the globe. 7=NW, 1=NE, 3=SW, 5=SE.
	$L_oL_oL_oL_o$	Longitude, in tenths of a degree.
5	MMM	Marsden square.
	U_{la}	Units digit in the reported latitude.
	U_{lo}	Units digit in the reported longitude.
6	99	Indicator for surface.
	PPP	Pressure, in whole millibars. If PPP is less than 800, add 1000 to PPP.
7	TT	Tens and units digits of the air temperature at the surface.
	T_a	Approximate tenths value and sign (plus or minus) of the air temperature. Even = plus. Odd = minus.
	DD	Depression of the dew point. 00-54 is in degrees and tenths. 60-80 is in whole degrees after subtracting 50. 55-59 is not used.
8	dd	True direction of the wind in tens of degrees.
	fff	Wind speed measured in the units specified in group 2.
9	PP	Pressure level indicator of the mandatory level. 00=1000mbs, 85=850mbs, 70=700mbs, etc.
	hhh	Height of the mandatory pressure level in geopotental meters or decameters above the surface. In meters up to 501mbs; in decameters above 501mbs. If the height of the 1000mb level is negative, 500 is added to hhh.
10	TT	See group 7.
	T_a	See group 7.
	DD	See group 7.
11	dd	See group 8.
	fff	See group 8.
12	.....	Groups 9-11 are repeated for each mandatory level.
13	88999	The tropopause data is missing.
14	77999	The maximum wind data is missing.

PART B

1	2	3	4	5	6	7	8
XXBB	YYGG/	$99L_aL_aL_a$	$Q_cL_oL_oL_oL_o$	$MMMU_{la}U_{lo}$	00PPP	$T_OT_OT_aDD$	ddfff

9	10	11	12	13	14	15	16	17
NNPPP	TTTaDD	ddfff	.....	21212	NNPPP	ddfff	51515	$101A_{df}A_{df}$

GP	IND	MEANING
1	XX	See PART A.
	BB	Part B follows.
GROUPS 2-5 are repeats of PART A.		
6	00	Indicator for the surface level.
	PPP	See PART A.
7	TTT	See PART A.
	T_a	See PART A.
	DD	See PART A.
8	dd	See PART A.
	fff	See PART A.
9	NN	Significant level indicator. 11-99 and then repeats. 00 is not used as it is reserved for surface.
	PPP	See group 6.
10	TT	See PART A.
	Ta	See PART A.
	DD	See PART A.
11	dd	See PART A.
	fff	See PART A.
12	.....	Groups 9-11 are repeated for each significant level.
13	21212	Significant wind data follows.
14	NN	Same as group 9.
	PPP	Same as group 9.
15	dd	See PART A.
	fff	See PART A.
16	51515	Additional data follows.
17	101	Indicator.
	$A_{df}A_{df}$	Coded number. 66=hgts doubtful. 90=extrapolated mandatory level. 91=extrapolated SLP.

NOTE: Any missing data will be reported with a diagonal (/).

CHAPTER 3

OTHER OBSERVATIONS

1. General. In addition to aerial reconnaissance data, the observational system used in support of the National Winter Storms Operations Plan includes land surface, ship, radar, buoy, upper air, and satellite data. The routine operations of these various data sources are detailed in the following series of Federal Handbooks and Plans:

Federal Meteorological Handbook No. 1, Surface Observations

Federal Meteorological Handbook No. 2, Synoptic Observations

Federal Meteorological Handbook No. 4, Radiosonde Code

Federal Meteorological Handbook No. 7, Weather Radar Observations

National Weather Service Weather Radar Manual

Operations of the National Weather Service

Federal Plan for Environmental Data Buoys

The GOES/SMS User's Guide and Operational Amendments

Procedures for obtaining special or nonroutine observations required in support of winter storm detection and forecasting, while covered to some extent in these documents, are described in detail in Weather Service Operations Manual Chapter B-90, Special Warning Program Observations. This chapter covers observational programs of several agencies involved.

The only observational programs which will be covered in any detail here are the two data sources (described in paragraph 2 below) which are still considered somewhat unique and/or were established particularly to help in the winter storm analysis and forecast problem.

2. Satellite Observations:

a. Department of Commerce, National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service (NESDIS).

(1) Geostationary Operational Environmental Satellite (GOES). The GOES system consists of two operational satellites located over the equator at 75W (GOES East) and 135W (GOES West). The principal GOES products (see Table 3-1) are one-half hourly pictures with implanted grids automatically applied to all sectors. During the daylight hours, one-half, one, and two-mile (0.9, 1.8, and 3.7 km) resolution fixed standard sectors are produced, and during the night equivalent one and two-mile (1.8 and 3.7 km) IR (infrared) standard sectors are produced. Additionally, certain IR pictures will be enhanced at specified times to emphasize various features, and floating sectors at one-half, one, and two-mile (0.9, 1.8, and 3.7 km) resolution may be produced as desired to augment standard sector coverage. Geographical coverage of standard sectors are indicated in the GOES/SMS User's Guide.

(2) NOAA Polar-Orbiting Satellites. NOAA-6 and NOAA-7 will provide data for direct read-out [Automatic Picture Transmission (APT)]. These two NOAA satellites will also provide data that are received, processed, and disseminated via NWS facsimile circuits. In some instances, the GOES distribution system will be utilized to disseminate data via the SFSSs to the WSFOs.

(3) Satellite Field Service Stations (SFSS's) and Synoptic Analysis Branch (SAB).

(a) Support Concept. Under the NESDIS support concept, satellite imagery in support of the Winter Storms Plan is distributed by the Central Data Distribution Facility at Camp Springs, Maryland, to the SFSS's, the SAB, and WSFO's.

1. NESDIS SAB. The SAB operates 24 hours to provide satellite data support to the National Meteorological Center (NMC). The SAB meteorologists provide satellite information to the NMC meteorologists concerning present locations and intensities of winter storms and the projected speed, direction, and future intensities of these storms. The possibility of turbulence, icing, and precipitation amounts are also discussed.

2. Satellite Field Services Stations. Satellite support to the NWS field offices is provided by the MIA SFSS, MKC SFSS, NEW SFSS, and DCA SFSS. In addition, the following support products are available to the meteorological community:

a. Satellite Interpretation Messages (SIM). SIM's are available through the FAA Request/Reply, RAWARC, and Service "C" teletype circuits. All WSFO's receive these automatically as transmitted from the SFSS's. However, other users such as those WSO's which are collocated with FAA-FSS may also have access to these SIM's by using the standard Request/ Reply teletypewriter capabilities of the FAA-FSS. The heading and issue times for the SIM's are as follows:

TBXX6 KWBC - Eastern Region - 0200Z, 0800Z, 1200Z, 2000Z

TBXX6 KMKC - Central and Southern Region - 0200Z, 0800Z, 1300Z, 2000Z

TBXX7 KNEW - Gulf of Mexico - 0320Z, 0820Z, 1120Z, 1400Z, 1700Z, 2000Z, 2320Z

(Times subject to change)

SIM's may be updated as required by weather conditions.

b. Satellite cloudtop and tropopause (SCAT) messages are prepared by DCA SFSS, and contain information on cloudtop heights and temperatures and tropopause heights over areas of interest throughout the eastern region. The heading for SCAT messages is TBXX10 KWBC. Issue times are 0530Z, 1130Z, 1730Z, and 2330Z.

c. The DCA SFSS prepares and issues a daily message on snow and ice cover within its area of responsibility. This message is a "verbal nephanalysis" of existing ground snow and river ice cover and any major changes (plus or minus) since the previous day. The message heading is TBXX11 KWBC and is issued approximately 2130Z daily.

(b) NESDIS Station Contact:

Miami SFSS	(305)350-4310 and 4460 FTS: 350-4310 and 4460	0630-1630 EST 1820-0230 EST
Kansas City SFSS	(816)374-2102 and 2103 FTS: 758-2102 and 2103	24h/day
Washington SFSS	(301)763-8424 and 8425 FTS: 763-8424 and 8425	24h/day
Satellite Analysis Branch	(301)763-8444 FTS: 763-8444	24h/day
New Orleans SFSS	(504)649-5130 FTS: 682-2807	24h/day

b. Department of Defense Meteorological Satellite Program (DMSP). The DMSP routinely has two satellites collecting meteorological imagery and vertical temperatuare profile data. One satellite is in an early morning/evening orbit, approximaely 0700/1900 local equator crossing time. The second is in a noon/midnight orbit, approximately 1200/2400 local equator crossing time. DMSP data capabilities in the area of concern ar provided in Table 3-1 to this chapter. Special requests for DMSP support will be addressed to OL-G, AWS.

3. Environmental Data Buoy Observations.

a. General. Environmental data buoys in the Gulf of Mexico and Great Lakes, and off the U. S. east and west coasts obtain data on meteorological and oceanographic parameters for operational and research purposes. (See Figure 3-1 for location of buoys.) The status and capability of data buoys can be obtained from the Data Systems Division, NOAA Data Buoy Center (NDBC), NSTL Station, MS 39529, telephone (601)688-2836 or FTS 494-2836.

b. Procedures. Environmental data buoys routinely acquire, store, and transmit data every hour. Data obtained operationally include sea-level pressure, wind direction and speed, air temperature, sea-surface temperature, and wave height spectral data. A description of the data from a typical moored buoy payload is provided in Table 3-2.

c. Communications. Buoy data are transmitted by UHF communications via the GOES satellite to NESDIS and then are relayed on to NMC, Suitland, Maryland, for processing and dissemination. Data are formatted into WMO FM24V synoptic code.

TABLE 3-1
SATELLITES AND SATELLITE DATA AVAILABILITY FOR NATIONAL WINTER STORMS OPERATIONS PLAN

Satellite	Type of Data	Local Time	Remarks
GOES East - 75.0 W GOES West - 135.0 W 4 Spacecraft (standby) limited operational capability	VISSR VAS	Every 30 minutes (24 hr/day) (Limited scan for short-interval viewing available)	1. 1, 2, and 4 km resolution visible standard sectors covering Western United States, Midwest, and Eastern United States (daylight). 2. 9 km resolution equivalent IR standard sectors for the entire United States (night). 3. Equivalent IR-enhanced imagery. 4. Floating sectors at 1, 2 and 4 km resolution (visible) (equivalent IR 7 km). 5. Full disc IR (day and night). 6. Movie loops 7. Wind analysis 8. Cloud top heights
NOAA-6	AVHRR GAC and LAC (recorded) HRPT and APT (direct) TOVS	0740 /1940	1. Mapped digitized data (cloud cover 2. Unmapped imagery (all data types) at DMSP sites. 3. Sea-surface temperature analysis 4. Moisture analysis 5. Soundings
NOAA-7		1430 /0230	
DMSP	LF	0700/1900	1. Unmapped imagery (LF only) 2. Mapped imagery (none)

GAC - Global Area Coverage (recorded reduced resolution data for Central Processing)
LAC - Local Area Coverage (recorded high resolution data, limited amount)
TOVS - TIROS Operational Vertical Sounder
HRPT - High Resolution Picture Transmission (1.1 km)
APT - Automatic Picture Transmission (4 km)
AVHRR - Advanced Very High Resolution Radiometer
VAS - VISSR Atmospheric Sounder
VISSR - Visible-Infrared Spin Scan Radiometer
LF - Light Fine (Visual Scanning Radiometer 0.3 nmi)

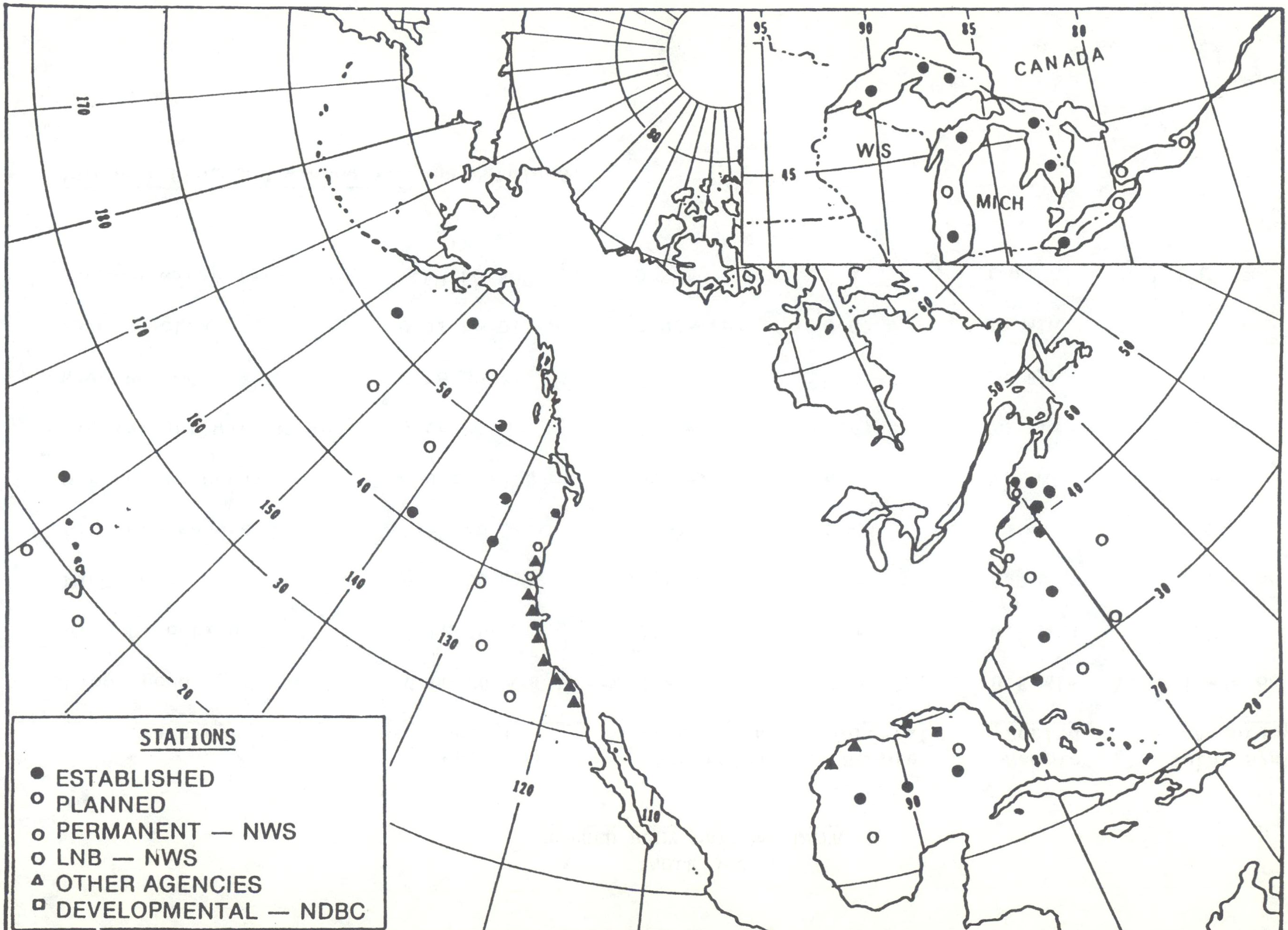


FIGURE 3-1 - NOAA DATA BUOY LOCATIONS

GDH-2 (2)

TABLE 3-2

MOORED BUOY PAYLOAD DATA

Parameter	Reporting Range	Reporting Resolution	Sample Interval	Sample Period	Total System Accuracy
Wind Speed	0 to 80 m/s	1 m/s	1 s	8.5 min	$\pm$ 1 m/s or 10%
Wind Direction	0 to 360^{o}	10^{o}	1 s	8.5 min	$\pm$ 10^{o}
Wind Gust	0 to 80 m/s	1 m/s	1 s	8.5 min*	$\pm$ 1 m/s or 5%
Air Temperature	-15^{o} to 50^{o}C	0.5^{o}C	90 s	90 s	$\pm$ 1^{o}C
Barometric Pressure	900 to 1100 mb	0.1 mb	4 s	8.5 min	$\pm$ 1 mb absolute
Significant Wave Height	0 to 20 m	0.5 m	0.67 s	20 min	$\pm$ 0.5 m
Wave Period	2 to 30 s	1 s	0.67 s	20 min	$\pm$ 1 s
Wave Spectra	0.01 to 0.5 Hz	0.005 Hz	0.67 s	20 min	--
Surface Water Temp	-15^{o} to 50^{o}C	0.5^{o}C	1 s	1 s	$\pm$ 1^{o}C

*Highest 8-second window average retained.

CHAPTER 4

COMMUNICATIONS

1. Department of Commerce.

a. National Weather Service. All of the communication systems in use by the National Weather Service are used in support of the data collection and warning program given in this Plan. These communication systems are described in the publication, Operations of the National Weather Service.

b. Research Facilities Center. The RFC will use the communications facilities of the Air Force described in Appendix 4-A.

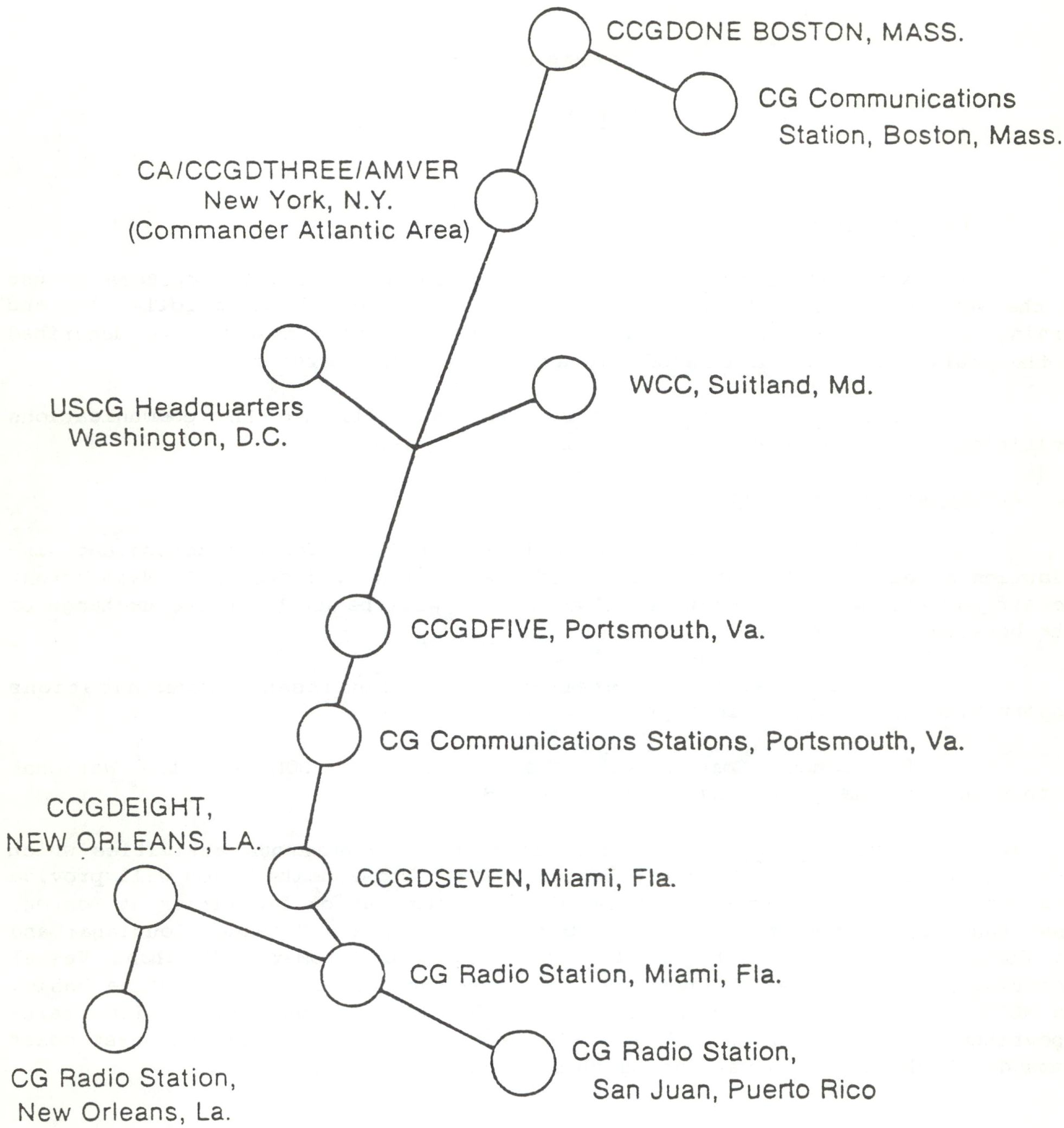
2. Department of Defense.

a. The Air Force's COMEDS circuit will be used for collection and distribution of east coast winter storms information received from WSFO Washington. The Air Force's Automated Weather Network (AWN) will be used for the exchange of data between NOAA and DOD.

b. The USAF National Winter Storms Reconnaissance Communications Support Plan is contained in Appendix 4-A.

c. The Common Communication Capabilities of DOD and the National Weather Service are contained in Appendix 4-B.

3. U. S. Coast Guard. The Coast Guard operates numerous activities which routinely report or collect meteorological data. Those units which will provide data inputs for this program are Coast Guard communication facilities at Boston, Massachusetts; Portsmouth, Virginia; Miami, Florida; New Orleans, Lousiana; and San Juan, Puerto Rico. These facilities collect Automatic Merchant Vessel Reporting (AMVER) and METEO messages from merchant vessels on a routine basis. The METEO data are then passed directly to the NMC Suitland over various teletypewriter circuits such as GT7990. Figure 4-1 shows the applicable east coast commands which have terminations on this circuit.



Note 1: All stations have send/receive capabilities.
Note 2: CCGD Commander, Coast Guard District.
Note 3: CA: Commander, Atlantic Area.

FIGURE 4-1. SEARCH AND RESCUE CIRCUIT (SARLANT) GT 7990

CHAPTER 4

APPENDIX A

AIRCRAFT RECONNAISSANCE COMMUNICATIONS

1. General. Except for aircraft-to-satellite data link equipped aircraft, weather reconnaissance observations will be transmitted using HF single sideband radio through the USAF aeronautical station complex to the appropriate weather reconnaissance data monitor. Weather monitors will evaluate these reports and disseminate them.

2. Air/Ground Communications. The USAF aeronautical station contact will depend upon aircraft location and radio propagation conditions. Initial frequencies are as published in appropriate enroute flight publications. After initial contact, aeronautical stations will provide a discrete frequency for mission use if possible. Aircrew relay of weather reconnaissance data will be by direct phone-patch to the weather monitor. Specific radio procedures and terminology will be as described in Allied Communications Publication (ACP) 125. USAF has authorized the use of "Immediate" precedence for transmission of winter storm reconnaissance data as follows:

PRIMARY	SECONDARY
Direct phone-patch between aircraft and the Miami Weather monitor through any aero station.	Direct phone-patch between aircraft and and weather monitor through any aero station.

RECONNAISSANCE ORGANIZATION COMMUNICATION CAPABILITIES

STATION	ADDRESS	TELETYPE	TELEPHONE
Federal Coordinator for Meteorology (OFCM)	Suite 300, 11426 Rockville Pike Rockville, MD 20852	-	AV 851-1460 CO 301-770-3464 FTS 443-8704
CARCAH/MIAMI Monitor	OL-G, AWS Coral Gables, FL	A B C	AV 894-3430 CO 305-666-4612 FTS 350-5547 AV 894-1150 (phone patch only)
Mather Weather Monitor	Det 7, 24 WS Mather AFB, CA	B	AV 828-4377
Hickam Weather Monitor	Det 4, 1 WW Hickam AFB, HI	B	AV 315-449-1279
National Hurricane Center	Nat'l. Hurricane Center Coral Gables, FL	A B C	CO 305-667-3108 FTS 350-5547
Alternate National Hurricane Center	WSFO Washington, DC	A C	CO 301-899-3152 FTS-763-8300
	WSFO New Orleans, LA	A C	CO 504-522-7330 FTS 682-6891
Eastern Pacific Hurricane Center	WSFO Redwood City, CA	C	CO 415-876-9381 FTS 463-7767
Central Pacific Hurricane Center	WSFO Honolulu, HI	C	CO 808-839-7692
Naval Eastern Oceanography Center, Norfolk	NAVEASTOCEANCEN Norfolk, VA	B	AV 690-7750
Naval Western Oceanography Center, Pearl Harbor	NAVWESTOCEANCEN Pearl Harbor, HI	B	AV 315-430-0111 (ask for 471-0004)
RFC	RFC Miami, FL	A	CO 305-526-2936
Det 5, AWS	Det 5, AWS Keesler AFB, MS		AV 868-2544
AF Global Weather Central	AFGWC Offutt AFB, NE	B	AV 271-2586 FTS 866-2586
CINCLANTFLT OAC	CINCLANTFLT OAC Ronkonkoma, NY	C	AV 938-1694
ARTCC Miami	ARTCC Miami, FL	C	AV 894-1910
53 WRS	53 WRS Keesler AFB, MS		AV 868-4540 CO 601-377-4540
920 WRG	920 WRG Keesler AFB, MS		AV 868-4318 CO 601-377-4318

A - GT7072
B - COMEDS
C - AFTN

CHAPTER 5

PUBLICITY

News media releases that concern the cooperative efforts in severe winter storms activities of the Department of Defense, National Weather Service, Federal Aviation Administration, and the U. S. Coast Guard should reflect the joint nature of these efforts by giving due credit to participating agencies. Copies of these releases should be forwarded to:

Deputy Director for Operations (Environmental Services)
The Joint Chiefs of Staff
Washington, DC 20301

Department of the Army
ATTN: DAMI-TST-I
Washington, DC 20310

Commander, Naval Oceanography Command
NSTL Station
Bay St. Louis, MS 39529

Military Airlift Command/PA
Scott AFB, IL 62225

Office of Public Affairs
National Oceanic and Atmospheric Administration
Washington, D. C. 20230

Federal Aviation Administration
800 Independence Avenue, S.W.
Washington, DC 20590

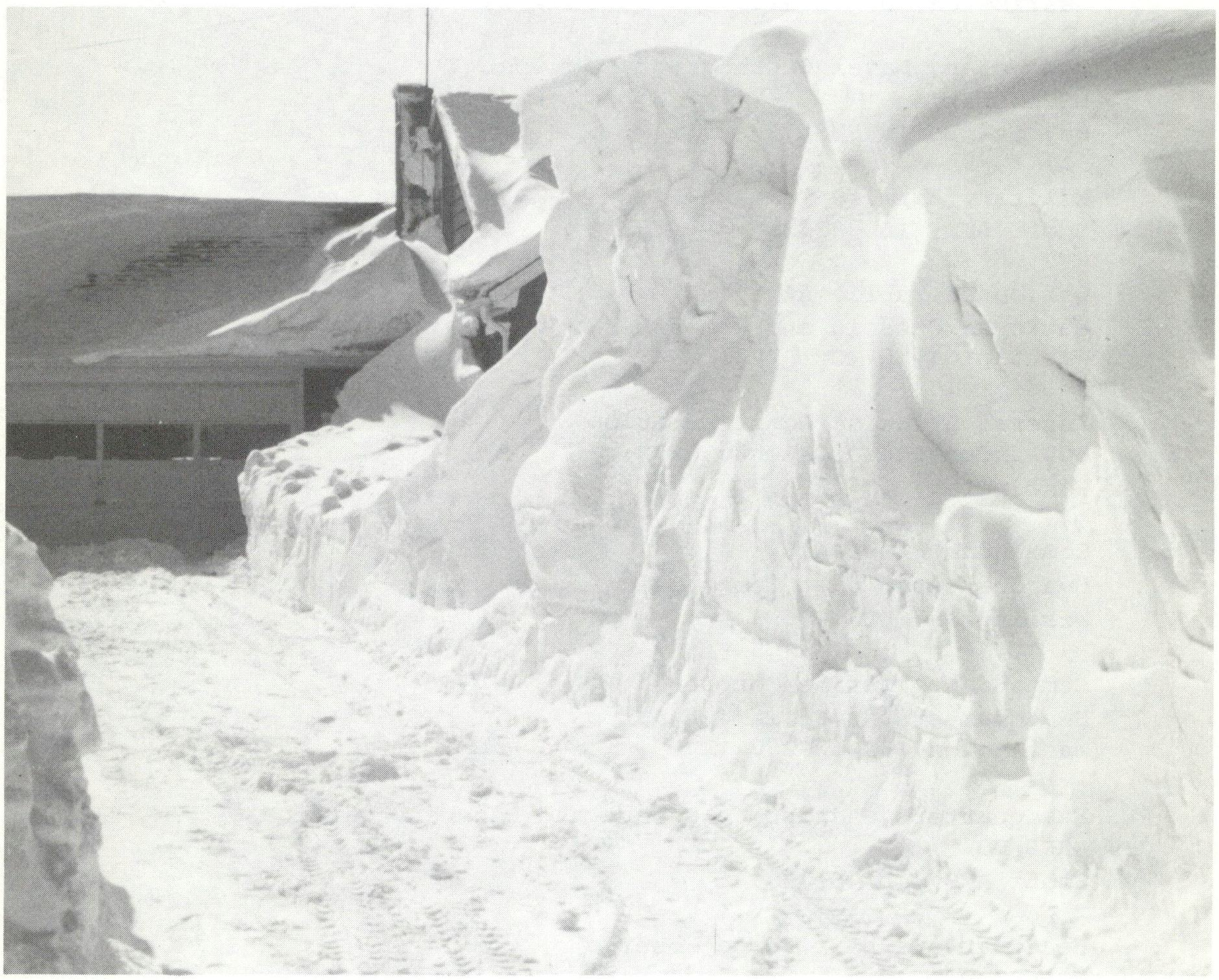
Commandant (G-BPA)
Headquarters, U.S. Coast Guard
Washington, DC 20593

Commandant, Marine Corps
Headquarters, U.S. Marine Corps
Washington, DC 20380

Headquarters, Aerospace Rescue and Recovery Service
ARRS/DO
Scott AFB, IL 62225

Headquarters, Air Force Reserve
AFRES/DO
Robins AFB, GA 31098

Headquarters, Air Weather Service
AWS/DO
Scott AFB, IL 62225



EXTREME SNOWFALL ACCUMULATION IS SHOWN IN
HAMBURG, NEW YORK, AS A RESULT OF WINTER STORMS

CHAPTER 6

DEFINITIONS

1. Blizzard Warning. A blizzard warning is a headline carried in NWS forecasts and special weather statements that serves notice to the public of a high probability for the occurrence of blizzard conditions (wind speeds of 35 mph or more, considerable falling and/or blowing snow causing poor visibilities frequently less than one-fourth mile).

2. Freezing Rain (or Drizzle). The freezing of rain or drizzle on objects as it strikes them. Winter storm warnings should be reserved for occasions when significant, and possibly damaging, accumulations of ice are expected. However, even small amounts are extremely dangerous to traffic when encountered unexpectedly, and these conditions frequently require the issuance of a travelers' advisory.

3. Heavy Snow Warning. A heavy snow warning is a headline carried in NWS forecasts and special weather statements that serves notice to the public of a high probability for the occurrence of heavy snow (four inches or more accumulation in 12 hours or six or more accumulation in 24 hours).

4. Reconnaissance Aircraft Sortie. A flight which meets the requirements of the winter storm plan of the day.

5. Sleet (one form of ice pellet). Generally, solid grains of ice which form from the freezing of raindrops or the refreezing of largely melted snowflakes. Sleet, like small hail, usually bounces when hitting a hard surface. Heavy sleet is a fairly rare event in which the ground is covered to a depth of significance to motorists and others.

6. Winter Storm Plan of the Day. A coordinated mission plan that tasks operational weather reconnaissance requirements during the next 05Z to 05Z day; describes reconnaissance flights committed to satisfy operational requirements, and identifies possible reconnaissance requirements for the succeeding 24-hour period.

7. Winter Storm Warning. A winter storm warning is a headline carried in NWS forecasts and special weather statements that serves notice to the public of a high probability for the occurrence of severe winter weather. The warning is issued for the same events (except for blizzard conditions) that serve as a basis for the issuance of a winter storm watch. An exception may be made in two special situations: one is the heavy snowfall that often occurs along the lee of the Great Lakes; the other is locally heavy orographic snowfall in mountainous terrain. When these conditions cannot be directly connected to a synoptic-scale winter storm, the term "Heavy Snow Warning" may be used as a headline in forecasts. The term "Winter Storm Warning" will still be used in these areas for heavy snows produced by synoptic-scale storm systems.

8. Winter Storm Watch. A winter storm watch is a headline carried in NWS forecasts and special weather statements to cover the possible occurrence of the following weather elements, either separately or in combination: blizzard conditions, heavy snow (or light in areas where snow is relatively rare), accumulations of freezing rain or freezing drizzle, and/or heavy sleet.

9. Winter Weather Advisories. Stockmen's and Travelers' Advisories are used to describe conditions which do not constitute a serious enough hazard to warrant a warning for the general public but, nevertheless, pose a significant threat to specified users. They are highlighted in forecasts and statements.

10. Area of Concern. The geographic area of concern covers the Gulf of Mexico extending about 150 miles inland along the U.S. Gulf Coast. In the Atlantic, the area of concern ranges from latitudes 30°N to 48°N, west of longitude 65°W, extending about 150 miles inland along the eastern coast of the United States.

11. Mission Identifier. The nomenclature assigned to winter storm aircraft reconnaissance missions for weather data identification. It comprises an agency-aircraft indicator followed by a Chief, Aerial Reconnaissance Coordination, All Hurricanes (CARCAH) assigned mission-system indicator.

CHAPTER 7

ACRONYMS AND ABBREVIATIONS

AFB	Air Force Base
AFGWC	Air Force Global Weather Central
AFRES	Air Force Reserve
A/G	Air Ground
AIRMET	Airmen's Meteorological Information Bulletin
AMVER	Automated Merchant Vessel Reporting
APT	Automatic Picture Transmission
ARINC	Aeronautical Radio, Inc.
ARRS	Aerosopace Rescue and Recovery Service
ARTCC	Air Route Traffic Control Center
AUTODIN	Automatic Digital Network
AUTOVON	Automatic Voice Network
AWN	Automated Weather Network
AWS	Air Weather Service
CARCAH	Chief, Aerial Reconnaissance Coordination, All Hurricanes
CBS	Committee for Basic Services
COMEDS	CONUS Meteorological Data System
DOC	Department of Commerce
DOD	Department of Defense
DMSP	Defense Meteorological Satellite Program
DRSP	Direct Readout Scanning Radiometer
ESSA	Environmental Survey Satellite
ETA	Estimated Time of Arrival
ETD	Estimated Time of Departure
FAA	Federal Aviation Administration
FSS	Flight Service Station
FTS	Federal Telecommunications System
GOES	Geostationary Operational Environmental Satellite
HF	High Frequency
ICMS	Interdepartmental Committee for Meteorological Services
kPa	Kilopascal
METEO	Cable Address for Ships
MSD	Meteorological Services Division
NASA	National Aeronautics and Space Administration
NAVEASTOCEANCEN	Naval Eastern Oceanography Center
NAVOCEANCOM	Naval Oceanography Command
NAWAS	National Warning System
NDBO	NOAA Data Buoy Office
NESS	National Earth Satellite Service
NHC	National Hurricane Center
NMC	National Meteorological Center
NOAA	National Oceanic and Atmospheric Administration
NSSFC	National Severe Storms Forecast Center
NSSL	National Severe Storms Laboratory
NWS	National Weather Service
OSV	Ocean Station Vessel
OWS	Ocean Weather Station

Pa	Pascal
PIREP	Pilot Report
RAREP	Radar Report
RAWARC	Internal RAREP Teletypewriter Circuit (NWS)
RECCO	Reconnaissance Code
RFC	Research Flight Center
SAR	Search and Rescue
SARLANT	Search and Rescue Atlantic Circuit
SCC	Storm Coordination Center
SFSS	Satellite Field Services Station
SIGMET	Significant Meteorological Information Bulletin
SMS	Synchronous Meteorological Satellite
SSB	Single Side Band
USAF	United States Air Force
USCG	United States Coast Guard
USN	United States Navy
UTC	Coordinated Universal Time (Z)
WMO	World Meteorological Organization
WRG	Weather Reconnaissance Group
WRS	Weather Reconnaissance Squadron
WSFO	Weather Service Forecast Office
WSO	Weather Service Office
WSPOD	Winter Storm Plan of the Day

CHAPTER 8

STANDARD METRIC CONVERSION TABLE

This appendix presents in capsular form a description of the International System of Units (SI) metric system and selected standard conversion factors commonly used in meteorology and hydrology. The American National Standard Institute/IEEE Standard 268-1982 Metric Practice has been approved for use by the Department of Defense, other Federal agencies, and by many industries. Users are encouraged to acquire and use the ANSI/IEEE 268-1982 Standard Metric Practice to ensure consistent conversion and implementation.

The first part of this appendix is the Federal Register Notice of February 26, 1982, titled: "Metric System of Measurement; Interpretation and Modification of the International System of Units for the United States." The table herein is a list of selected conversion factors by classification excerpted from the ANSI/IEEE Standard. Finally, the figure shows the relationships of SI units with names. It shows graphically how the 19 SI derived units with special names listed in Table 2 of the Federal Register Notice are derived in a coherent manner from the base and supplementary units. A description of the chart precedes the figure.

National Bureau of Standards

Metric System of Measurement; Interpretation and Modification of the International System of Units for the United States

Section 3 of Pub. L. 94–168, the Metric Conversion Act of 1975, declares that the policy of the United States shall be to coordinate and plan the increasing use of the metric system in the United States. Section 403 of Pub. L. 93–380, the Education Amendments of 1974, states the policy of the United States to encourage educational agencies and institutions to prepare students to use the metric system of measurement as part of the regular education program. Under both these acts, the "metric system of measurement" is defined as the International System of Units as established by the General Conference on Weights and Measures in 1960 and interpreted or modified for the United States by the Secretary of Commerce (sec. 4(4), Pub. L. 94–168; sec. 403(a)(3), Pub. L. 93–380). The Secretary has delegated his authority under these subsections to the Director of the National Bureau of Standards.

In implementation of this authority, tables and associated materials were published in the **Federal Register** of October 26, 1977 (42 FR 56513–56514), setting forth the interpretation and modification of the International System of Units (hereinafter "SI") for the United States.

In accordance with recent decisions of the International Committee for Weights and Measures of the General Conference on Weights and Measures, and to refine the earlier interpretation and modification, it is deemed appropriate to amend that interpretation and modification, as published in the above-cited **Federal Register** notice of October 26, 1977. To assist interested parties and encourage the proper use of SI, the entire interpretation and modification, as hereby amended, is republished. Accordingly, this notice supersedes the notice of October 26, 1977.

The amendments consist of the inclusion in table 2 of the sievert, a special name for the SI derived unit of dose equivalent, the inclusion in table 6 of the electronvolt and the unified atomic mass unit, and the inclusion in table 7 of the rem, a unit of dose equivalent. The unit "standard atmosphere" is no longer included in table 7. The amendments are indicated by a dagger symbol (†).

The SI is constructed from seven base units for independent quantities plus two supplementary units for plane angle and solid angle, listed in table 1.

TABLE 1.—SI BASE AND SUPPLEMENTARY UNITS

Quantity	Name	Symbol
SI base units:		
length	meter	m
mass [1]	kilogram	kg
time	second	s
electric current	ampere	A
thermodynamic temperature.	kelvin	K
amount of substance	mole	mol
luminous intensity	candela	cd
SI supplementary units:		
plane angle	radian	rad
solid angle	steradian	sr

[1] "Weight" in common parlance is often used to mean "mass."

Units for all other quantities are derived from these nine units. In table 2 are listed 19 SI derived units with special names which were derived from the base and supplementary units in a coherent manner, which means, in brief, that they are expressed as products and quotients of the nine base and supplementary units without numerical factors.

TABLE 2.—SI DERIVED UNITS WITH SPECIAL NAMES

Quantity	SI unit		
	Name	Symbol	Expression in terms of other units
frequency	hertz	Hz	s^{-1}
force	newton	N	$kg \cdot m/s^2$
pressure, stress	pascal	Pa	N/m^2
energy, work, quantity of heat.	joule	J	N·m
power, radiant flux	watt	W	J/s
electric charge, quantity of electricity.	coulomb	C	A·s
electric potential, potential difference, electromotive force.	volt	V	W/A
capacitance	farad	F	C/V
electric resistance	ohm	Ω	V/A
conductance	siemens	S	A/V
magnetic flux	weber	Wb	V·s
magnetic flux density	tesla	T	Wb/m^2
inductance	henry	H	Wb/A
luminous flux	lumen	lm	cd·sr
illuminance	lux	lx	lm/m^2
Celsius temperature [1]	degree Celsius.	°C	K
activity (of a radionuclide).	becquerel	Bq	s^{-1}
absorbed dose, specific energy imparted, kerma, absorbed dose index.	gray	Gy	J/kg
†dose equivalent, dose equivalent index.	sievert	Sv	J/kg

[1] In addition to the thermodynamic temperature (symbol T) expressed in kelvins (see table 1), use is also made of Celsius temperature (symbol t) defined by the equation

$$t = T - T_0$$

where $T_0 = 273.15$ K by definition. The unit "degree Celsius" is equal to the unit "kelvin," but "degree Celsius" is a special name in place of "kelvin" for expressing Celsius temperature. A temperature interval or a Celsius temperature difference can be expressed in degrees Celsius as well as in kelvins.

All other SI derived units, such as those in tables 3 and 4, are similarly derived in a coherent manner from the 28 base, supplementary, and special-name SI units.

TABLE 3.—EXAMPLES OF SI DERIVED UNITS EXPRESSED IN TERMS OF BASE UNITS

Quantity	SI unit	Unit symbol
area	square meter	m^2
volume	cubic meter	m^3
speed, velocity	meter per second	m/s
acceleration	meter per second squared.	m/s^2
wave number	1 per meter	m^{-1}
density, mass density	kilogram per cubic meter.	kg/m^3
specific volume	cubic meter per kilogram.	m^3/kg
current density	ampere per square meter.	A/m^2
magnetic field strength	ampere per meter	A/m
concentration (of amount of substance).	mole per cubic meter	mol/m^3
luminance	candela per square meter.	cd/m^2

TABLE 4.—EXAMPLES OF SI DERIVED UNITS EXPRESSED BY MEANS OF SPECIAL NAMES

Quantity	Name	Unit symbol
dynamic viscosity	pascal second	Pa·s
moment of force	newton meter	N·m
surface tension	newton per meter	N/m
heat flux density, irradiance.	watt per square meter.	W/m^2
heat capacity, entropy.	joule per kelvin	J/K
specific heat capacity, specific entropy.	joule per kilogram kelvin.	J/(kg·K)
specific energy	joule per kilogram	J/kg
thermal conductivity	watt per meter kelvin	W/(m·K)
energy density	joule per cubic meter	J/m^3
electric field strength	volt per meter	V/m
electric charge density.	coulomb per cubic meter.	C/m^3
electric flux density	coulomb per square meter.	C/m^2
permittivity	farad per meter	F/m
permeability	henry per meter	H/m
molar energy	joule per mole	J/mol
molar entropy, molar heat capacity.	joule per mole kelvin	J/(mol·K)
exposure (x and γ rays).	coulomb per kilogram	C/kg
absorbed dose rate	gray per second	Gy/s

For use with the SI units there is a set of 16 prefixes (see table 5) to form multiples and submultiples of these units. It is important to note that the kilogram is the only SI unit with a prefix. Because double prefixes are not to be used, the prefixes of table 5, in the case of mass, are to be used with gram (symbol g) and not with kilogram (symbol kg).

TABLE 5.—SI PREFIXES

Factor	Prefix	Symbol
10^{18}	exa	E
10^{15}	peta	P
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{2}	hecto	h
10^{1}	deka	da
10^{-1}	deci	d
10^{-2}	centi	c
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p
10^{-15}	femto	f
10^{-18}	atto	a

Certain units that are not part of the SI are used so widely that it is impractical to abandon them. The units that are accepted for continued use in the United States with the International System are listed in table 6.

TABLE 6.—UNITS IN USE WITH THE INTERNATIONAL SYSTEM

Name	Symbol	Value in SI unit
minute (time)	min	1 min = 60 s
hour	h	1 h = 60 min = 3 600 s
day	d	1 d = 24 h = 86 400 s
degree (angle)	°	$1° = (\pi/180)$ rad
minute (angle)	′	$1′ = (1/60)° = (\pi/10\,800)$ rad
second (angle)	″	$1″ = (1/60)′ = (\pi/648\,000)$ rad
liter	L*	$1\ L = 1\ dm^3 = 10^{-3}\ m^3$
metric ton	t	$1\ t = 10^3$ kg
hectare (land area)	ha	$1\ ha = 10^4\ m^2$
†electronvolt	eV	$1\ eV = 1.602 \times 10^{-19}$ J, approximately**
†unified atomic mass unit.	u	$1\ u = 1.660\ 57 \times 10^{-27}$ kg, approximately**

* Both L and l are international symbols for liter. Because "l" can easily be confused with the numeral "1" the symbol "L" is recommended for United States use.

** The values of these units in terms of SI units are obtained experimentally.

In those cases where their usage is already well established, the use, for a limited time, of the units in table 7 is accepted, subject to future review.

TABLE 7.—UNITS IN USE TEMPORARILY WITH THE INTERNATIONAL SYSTEM

nautical mile	angstrom	curie
knot	barn	roentgen
	bar	rad [2]
	gal [1]	†rem [3]

[1] Unit of acceleration.
[2] Unit of absorbed dose.
[3] Unit of dose equivalent.

Metric units, symbols, and terms that are not in accordance with the foregoing Interpretation and Modification are no longer accepted for continued use in the United States with the International System of Units. Accordingly, the following units and terms listed in the table of metric units in section 2 of the Act of July 28, 1866 that legalized the metric system of weights and measures in the United States are no longer accepted for use in the United States:

myriameter
stere
millier or tonneau
quintal
myriagram
kilo (for kilogram)

For more information regarding the International System of Units, contact Dr. David T. Goldman, National Measurement Laboratory, National Bureau of Standards, U.S. Department of Commerce, Washington, D.C. 20234, telephone (301) 921-3304.

Dated: February 2, 1982.

Ernest Ambler,

Director.

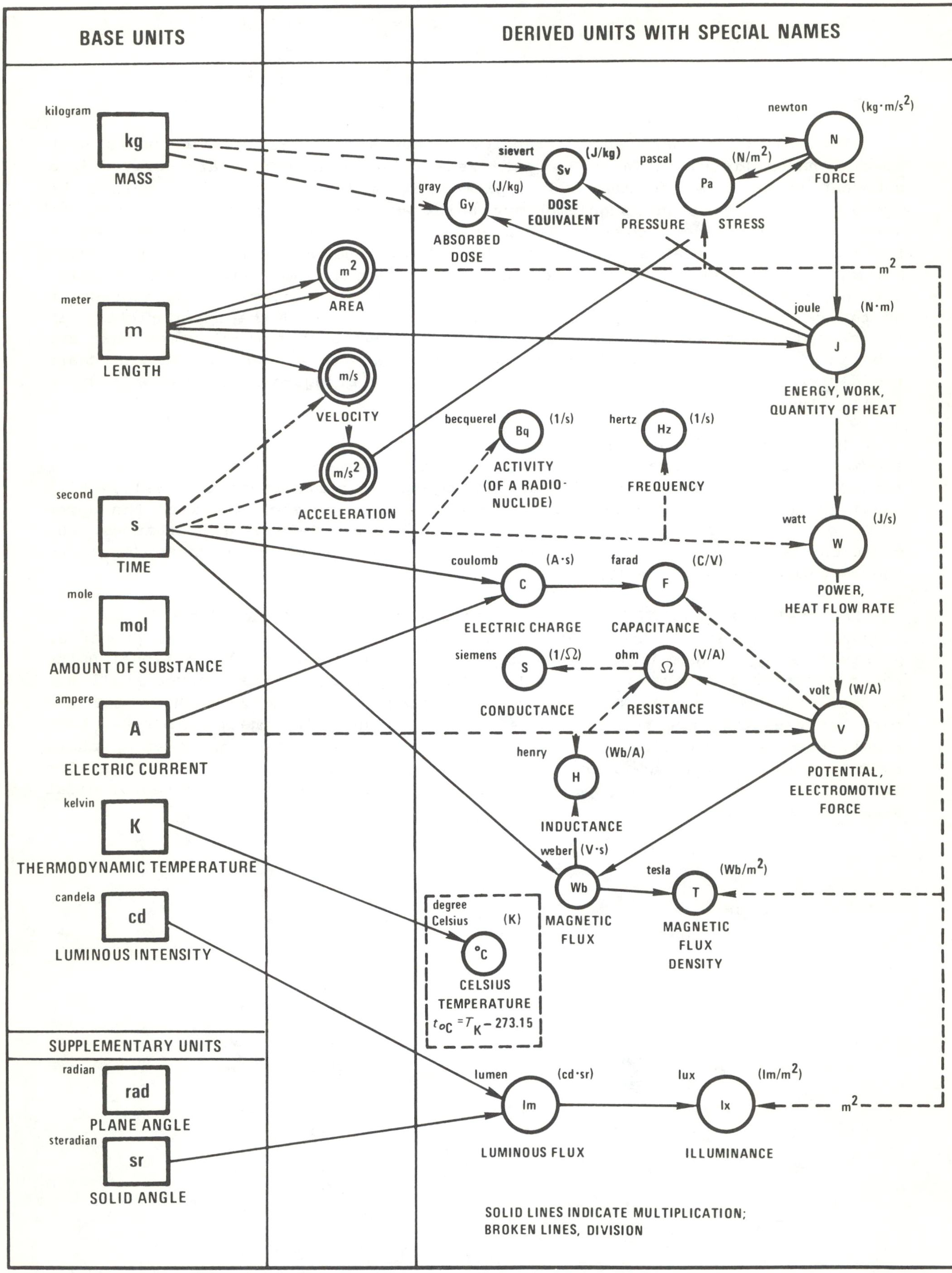
[FR Doc. 82-5150 Filed 2-25-82; 8:45 am]
BILLING CODE 3510-13-M

The following chart shows graphically how the 19 SI derived units with special names listed in Table 2 of the Federal Register Notice are derived in a coherent manner from the base and supplementary units. In the first column the symbols of the base and supplementary units are shown in rectangles, with the name of the unit shown toward the upper left of the rectangle and the name of the quantity (measurable attribute) shown below the rectangle. In the third column the symbols of the derived units with special names are shown in solid circles, with the name of the quantity shown below the circle, and an expression of the derived unit in terms of other units shown toward the upper right. In the second column are shown those derived units without special names that are used in the derivation of the derived units with special names. In the chart the derivation of each unit is indicated by arrows bringing in numerator factors (solid lines) and denominator factors (broken lines).

The degree Celsius, shown on the chart in a broken-line rectangle, is a special name for the kelvin, for use in expressing Celsius temperatures or temperature intervals. Where it is used to express temperature intervals, it is equal to the kelvin, as shown on the chart, with the symbol K toward the upper right of the ^{o}C circle; where it is used to express Celsius temperatures, the equation below "CELSIUS TEMPERATURE" relates Celsius temperature (t_{oC}) to thermodynamic temperature (T_K).

As stated in the ANSI/IEEE 268 Standard Metric Practice, "The SI unit of pressure and stress is the pascal (newton per square meter) and with proper SI prefixes is applicable to all such measurements. Old metric gravitational units for pressure and stress such as kilogram-force per square centimeter shall not be used. Widespread use has been made of other non-SI units such as bar and torr for pressure, but this use is strongly discouraged. The millibar has been widely used by meteorologists for communication within their profession; there is now some attempt to introduce the name hectopascal as a substitute for millibar. However, the kilopascal should be used in presenting meteorological data to the public."

RELATIONSHIPS OF SI UNITS WITH NAMES



SELECTED STANDARD CONVERSION FACTORS

Factors with an * are exact

Unit	=	SI Standard Unit
ACCELERATION		
1 ft/s^2	=	3.048 000*E-01 m/s^2
standard acceleration of free fall	=	9.806 650*E+00 m/s^2
ANGLE		
1 degree	=	1.745 329 E-02 rad
AREA		
1 acre	=	4.046 873 E+03 m^2
1 ft^2	=	9.290 304*E-02 m^2
1 hectare	=	1.000 000*E+04 m^2
1 in^2	=	6.451 600*E-04 m^2
BENDING MOMENT OR TORQUE		
1 dyne.cm	=	1.000 000*E-07 N.m
1 lbf.ft	=	1.355 818 E+00 N.m
ELECTRICITY AND MAGNETISM		
1 ampere hour	=	3.600 000*E+03 C
1 EMU of capacitance	=	1.000 000*E+09 F
1 EMU of current	=	1.000 000*E+01 A
1 EMU of electric potential	=	1.000 000*E-08 V
1 EMU of inductance	=	1.000 000*E-09 H
1 EMU of resistance	=	1.000 000*E-09
1 ESU of capitance	=	1.112 650 E-12 F
1 ESU of current	=	3.335 641 E-10 A
1 ESU of electric potential	=	2.997 925 E+02 V
1 ESU of inductance	=	8.987 554 E+11 H
1 ESU of resistance	=	8.987 554 E+11
ENERGY (Includes WORK)		
1 British thermal unit (International Table)	=	1.055 056 E+03 J
1 British thermal unit (thermochemical)	=	1.054 350 E+03 J
1 calorie (International Table)	=	4.186 800*E+00 J
1 calorie (thermochemical)	=	4.184 000*E+00 J
1 electronvolt	=	1.602 19 E-19 J
1 erg	=	1.000 000*E-07 J
1 kW.h	=	3.600 000*E+06 J
1 therm	=	1.054 804*E+08 J

ENERGY PER UNIT AREA TIME

1 Btu (International Table)/(ft^2.h)	=	3.154 591 E+00 W/m^2
1 erg/(cm^2.s)	=	1.000 000*E-03 W/m^2

FLOW (See MASS PER UNIT TIME or VOLUME PER UNIT TIME)

FORCE

1 dyne	=	1.000 000*E-05 N
1 kilogram-force	=	9.806 650*E+00 N
1 pound-force (lbf)	=	4.448 222 E+00 N

FORCE PER UNIT AREA (See PRESSURE)

FORCE PER UNIT LENGTH

1 lbf/ft	=	1.459 390 E+01 N/m

HEAT

1 Btu (International Table).ft/(h.ft^2.^oF) (thermal conductivity)	=	1.730 735 E+00 W/(m.K)
1 Btu (thermochemical).ft/(h.ft^2.^oF) (thermal conductivity)	=	1.729 577 E+00 W/(m.K)
1 Btu (Internatinal Table)/lb	=	2.326 000*E+03 J/kg
1 cal (thermochemical)/(cm.s.^oC)	=	4.184 000*E+02 W/(m.K)
1 cal (thermochemical)/s	=	4.184 000*E+00 W
1 ft^2/h (thermal diffusivity)	=	2.580 640*E-05 m^2/s

LENGTH

1 angstrom	=	1.000 000*E-10 m
1 astronomical unit	=	1.495 979 E+11 m
1 foot	=	3.048 000*E-01 m
1 inch	=	2.540 000*E-02 m
1 micron	=	1.000 000*E-06 m
1 mile (nautical)	=	1.852 000*E+03 m
1 mile (statute)	=	1.609 344*E+03 m

LIGHT

1 footcandle	=	1.076 391 E+01 lx
1 lambert	=	3.183 099 E+03 cd/m^2
1 lumen per ft^2	=	1.076 391 E+01 lm/m^2

MASS

1 gram	=	1.000 000*E-03 kg
1 pound (avoirdupois)	=	4.535 923 7*E-01 kg
1 tonne	=	1.000 000*E+03 kg

MASS PER UNIT TIME (Includes FLOW)

1 lb/min	=	7.559 873 E-03 kg/s

MASS PER UNIT VOLUME (Includes DENSITY and MASS CONCENTRATION)

1 g/cm^3	=	1.000 000*E+03 kg/m^3
1 lb/ft^3	=	1.601 846 E+01 kg/m^3

POWER

1 Btu (International Table)/h	=	2.930 711 E-01 W
1 Btu (thermochemical)/h	=	2.928 751 E+01 W
1 cal (thermochemical)/s	=	4.184 000*E+00 W
1 erg/s	=	1.000 000*E-07 W
1 horsepower (electric)	=	7.460 000*E+02 W
1 ton of refrigeration (12 000 Btu/h)	=	3.517 E+03 W

PRESSURE OR STRESS (FORCE PER UNIT AREA)

1 atmosphere (standard)	=	1.013 250*E+05 Pa
1 inch of mercury (60 $^{\circ}$F)	=	3.376 85 E+03 Pa
1 millibar	=	1.000 000*E+02 Pa
1 psi	=	6.894 757 E+03 Pa

RADIOLOGY

1 rem (dose equivalent)	=	1.000 000*E-02 Sv
1 roentgen	=	2.58 E-04 C/kg

TEMPERATURE

Celsius Temperature	=	$(t_{^{\circ}F}-32)/1.8$
Fahrenheit Temperature	=	$1.8t_{^{\circ}C}+32$
Kelvin Temperature	=	$t_{^{\circ}C}+273.15$

TIME

1 day (mean solar)	=	8.640 000*E+04 s
1 day (sidereal)	=	8.616 409 E+04 s
1 year (sidereal)	=	3.155 815 E+07 s
1 year (tropical)	=	3.155 693 E+07 s

VELOCITY (Includes SPEED)

1 ft/min	=	5.080 000*E-03 m/s
1 knot (international)	=	5.144 444 E-01 m/s
1 mi/h (international)	=	4.470 400*E-01 m/s
1 mi/h (international)	=	1.609 344*E+00 km/h

VISCOSITY

1 poise	=	1.000 000*E-01 Pa.s
1 lb/ft.s	=	[illegible].488 164 E+00 Pa.s

VOLUME (Includes CAPACITY)

1 acre-foot	=	1.233 5 E+03 m^3
1 barrel (oil, 42 gal)	=	1.589 873 E-01 m^3
1 in^3	=	1.638 7064*E-05 m^3
1 L (liter)	=	1.000 000*E-03 m^3

VOLUME PER UNIT TIME (Includes FLOW)

1 ft^3/min	=	4.719 474 E-04 m^3/s

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