Section 1
THE AVIATION WEATHER SERVICE PROGRAM

Providing weather service to aviation is a joint effort of the National Weather Service (NWS), the Federal Aviation Administration (FAA), the Department of Defense (DOD), and other aviation-oriented groups and individuals. This section discusses the civilian agencies of the U.S. Government and their observation and communication services to the aviation community.

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)

The National Oceanic and Atmospheric Administration (NOAA) is an agency of the Department of Commerce. NOAA is one of the leading scientific agencies in the U.S. Government. Among its six major divisions are the National Environmental Satellite Data and Information Service (NESDIS) and the NWS.

NATIONAL ENVIRONMENTAL SATELLITE DATA AND INFORMATION SERVICE (NESDIS)

The National Environmental Satellite Data and Information Service (NESDIS) is located in Washington, D.C., and directs the weather satellite program. Figures 3-2 and 3-3 are examples of Geostationary Operational Environmental Satellite (GOES) images. These images are available to NWS meteorologists and a wide range of other users for operational use.

Satellite Analysis Branch (SAB)

The Satellite Analysis Branch (SAB) coordinates the satellite and other known information for the NOAA Volcanic Hazards Alert program under an agreement with the FAA. SAB works with the NWS as part of the Washington D.C. Volcanic Ash Advisory Center (VAAC).

NATIONAL WEATHER SERVICE (NWS)

The National Weather Service (NWS) collects and analyzes meteorological and hydrological data and subsequently prepares forecasts on a national, hemispheric, and global scale. The following is a description of the NWS facilities tasked with these duties.

National Centers for Environmental Prediction (NCEP)

There are nine separate national centers under National Centers for Environmental Prediction (NCEP), each with its own specific mission. They are the Climate Prediction Center, Space Environment Center, Marine Prediction Center, Hydrometeorological Prediction Center, Environmental Modeling Center, NCEP Center Operations, Storm Prediction Center, Aviation Weather Center, and the Tropical Prediction Center.

National Center Operations (NCO)

Located in Washington, D.C., the National Center Operations (NCO) is the focal point of the NWS's weather processing system. From worldwide weather reports, NCO prepares automated weather analysis charts and guidance forecasts for use by NWS offices and other users.

Some NCO products are specifically prepared for aviation, such as the winds and temperatures aloft forecast. Figure 4-9 is the network of forecast winds and temperatures aloft for the contiguous 48 states. Figure 4-10 shows the Alaskan and Hawaiian network.

NCO is part of VAAC, which runs an ash dispersion model. NCO works with SAB to fulfill the VAAC responsibilities to the aviation communities regarding potential volcanic ash hazards to aviation.

Storm Prediction Center (SPC)

The Storm Prediction Center (SPC) is charged with monitoring and forecasting severe weather over the 48 continental United States. Its products include convective outlooks and forecasts, as well as severe weather watches. The center also develops severe weather forecasting techniques and conducts research. The SPC is located in Norman, Oklahoma, near the heart of the area most frequently affected by severe thunderstorms.

Hydrometeorological Prediction Center (HPC)

The Hydrometeorological Prediction Center (HPC) prepares weather charts which include basic weather elements of temperature, fronts and pressure patterns.

Aviation Weather Center (AWC)

The Aviation Weather Center (AWC), located in Kansas City, Missouri, issues warnings, forecasts, and analyses of hazardous weather for aviation interests. The center identifies existing or imminent weather hazards to aircraft in flight and creates warnings for transmission to the aviation community. It also produces operational forecasts of weather conditions expected during the next 2 days that will affect domestic and international aviation interests. As a Meteorological Watch Office (MWO) under regulations of the International Civil Aviation Organization (ICAO), meteorologists in this unit prepare and issue aviation area forecasts (FAs) and inflight weather advisories (Airman's Meteorological Information [AIRMET], Significant Meteorological Information [SIGMET], and Convective SIGMETs) for the contiguous 48 states.

Tropical Prediction Center (TPC)

The Tropical Prediction Center (TPC) is located in Miami, Florida. The National Hurricane Center, as an integral part of TPC, issues hurricane advisories for the Atlantic, the Caribbean, the Gulf of Mexico, the eastern Pacific, and adjacent land areas. The center also develops hurricane forecasting techniques and conducts hurricane research. The Central Pacific Hurricane Center in Honolulu, Hawaii, issues advisories for the central Pacific Ocean.

TPC prepares and distributes tropical weather, aviation and marine analyses, forecasts, and warnings. As an MWO, TPC meteorologists prepare and issue aviation forecasts, SIGMETs, and Convective SIGMETs for their tropical Flight Information Region (FIR).

Weather Forecast Office (WFO)

A Weather Forecast Office (WFO) issues various public and aviation forecast and weather warnings for its area of responsibility. In support of aviation, WFOs issue terminal aviation forecasts (TAFs) and transcribed weather broadcasts (TWEBs). As MWOs, the Guam and Honolulu Hawaii WFOs issue aviation area forecasts and inflight advisories (AIRMETs, and international SIGMETs). Figures 4-1 through 4-4 show locations for which TAFs are issued. Figure 4-8 shows the TWEB routes.

Alaskan Aviation Weather Advisory Unit (AAWU)

The Alaskan Aviation Weather Unit (AAWU) is a regional aviation forecast unit located in Anchorage, Alaska. As an MWO, AAWU meteorologists prepare and issue International SIGMETs within the Alaskan FIR, as well as domestic FAs and AIRMETs for Alaska and the adjacent coastal waters. The AAWU prepares and disseminates to the FAA and the Internet a suite of graphic products, including a graphic FA and a 24- and 36-hour forecast of significant weather. The AAWU is one of nine VAACs worldwide, preparing Volcanic Ash Advisory Statements (VAAS) for the Anchorage FIR.

FEDERAL AVIATION ADMINISTRATION (FAA)

The Federal Aviation Administration (FAA) is a part of the Department of Transportation. The FAA provides a wide range of services to the aviation community. The following is a description of those FAA facilities which are involved with aviation weather and pilot services.

FLIGHT SERVICE STATIONS (FSSs)

The FAA is in the process of modernizing its Flight Service Station (FSS) program. The older, manual (or nonautomated) FSS is being consolidated into the newer, automated FSS (AFSS). With about one per state and with lines of communications radiating out from it, these new AFSSs are referred to as “hub” facilities. Pilot services provided previously by the older FSSs have been consolidated into facilities with new technology to improve pilot weather briefing services.

The FSS or AFSS provides more aviation weather briefing service than any other U.S Government service outlet. The FSS or AFSS provides preflight and inflight briefings, transcribed weather briefings, scheduled and unscheduled weather broadcasts, and furnishes weather support to flights in its area.

As a starting point for a preflight weather briefing, a pilot may wish to listen to one of the recorded weather briefings provided by an FSS or AFSS. For a more detailed briefing, pilots can contact the FSS or AFSS directly.

Transcribed Weather Broadcast (TWEB)

The transcribed weather broadcast (TWEB) provides continuous aeronautical and meteorological information on low/medium frequency (L/MF) and very high frequency (VHF) omni-directional radio range (VOR) facilities.

At TWEB equipment locations controlling two or more VORs, the one used least for ground-to-air communications, preferably the nearest VOR, may be used as a TWEB outlet simultaneously with the nondirectional radio beacon (NDB) facility.

The sequence, source, and content of transcribed broadcast material shall be:

1. Introduction.
2. Synopsis. Prepared by selected WFOs and stored in Weather Message Switching Center (WMSC).
3. Adverse Conditions. Extracted from inflight weather advisories, center weather advisories (CWAs), and alert severe weather watch bulletins (AWWs).
4. TWEB Route Forecasts. Includes the valid time of forecasts prepared by WFOs and stored in the WMSC.
5. Winds Aloft Forecast. Broadcast for the location nearest to the TWEB. The broadcast should include the levels for 3,000 to 12,000 feet, but shall always include at least two forecast levels above the surface.
6. Radar Reports. Local or pertinent radar weather reports (SDs) are used. If there is access to real-time weather radar equipment, the observed data is summarized using the SDs to determine precipitation type, intensity, movement, and height.
7. Surface Weather Reports (METARs). Surface/special weather reports are recorded, beginning with the local reports, then the remainder of the reports beginning with the first station east of true north and continuing clockwise around the TWEB location.
8. Density Altitude. Includes temperature and the "check density altitude" statement for any station with a field elevation at or above 2,000 feet MSL and meets a certain temperature criteria.
9. Pilot Weather Reports (PIREPs). PIREPs are summarized. If the weather conditions meet soliciting requirements, a request for PIREPs will be appended.
10. Alert Notices (ALNOT), if applicable.
11. Closing Statement.

Items 2, 3, 4, and 5 are forecasts and advisories prepared by the NWS and are discussed in detail in Section 4. The synopsis and route forecasts are prepared specifically for the TWEB by WFOs. Adverse conditions, outlooks, and winds/temperature aloft are adapted from inflight advisories, area forecasts, and the winds/temperature aloft forecasts. Radar reports and pilot reports are discussed in Section 3. Surface reports are discussed in Section 2.

Pilots' Automatic Telephone Weather Answering System (PATWAS)

Pilots' automatic telephone weather answering system (PATWAS) provides a continuous telephone recording of meteorological information. At PATWAS facilities where the telephone is connected to the TWEB, the information contained in the broadcast shall be in accordance with the TWEB format. PATWAS messages are recorded and updated at a minimum of every 5 hours beginning at 0600 and ending at 2200 local time using the following procedures:

1. Introduction (describing PATWAS area).
2. Adverse Conditions. Summarized inflight weather advisories, center weather advisories, alert severe weather watch bulletins, and any other available information that may adversely affect flight in the PATWAS area.
3. VFR Flight Not Recommended Statement (VNR). When current or forecast conditions, surface-based or aloft, would make visual flight doubtful.
4. Synopsis. Should be a reflection of current and forecast conditions using synopsis products prepared by selected WFOs or extracted from the synopsis section of the area forecast.
5. Current Conditions. Summarized current weather conditions over the broadcast area.
6. Surface Winds. Provided from local reports.
7. Forecast. Summarized forecast conditions over the PATWAS area.
8. Winds Aloft. Summarized winds aloft as forecast for the local station or as interpolated from forecasts of adjacent stations for levels 3,000 through 9,000 feet or a minimum of at least two forecast levels above the highest terrain.
9. Request for PIREPs, if applicable.
10. Alert Notices (ALNOT), if applicable.
11. Closing Announcement.

The PATWAS service holds high operational priority . This ensures the information is current and accurate. If service is reduced during the period of 2200-0600 local time, a suspension announcement is recorded including a time when the broadcast will be resumed. The Airport Facility Directory lists PATWAS telephone numbers for FSS briefing offices.

Telephone Information Briefing Service (TIBS)

Telephone information briefing service (TIBS) is provided by AFSSs and provides continuous telephone recordings of meteorological and/or aeronautical information. TIBS shall contain area and/or route briefings, airspace procedures, and special announcements, if applicable.

TIBS should also contain, but not limited to, METARs, aviation terminal forecasts (TAFs), and winds/ temperatures aloft forecasts.

Each AFSS shall provide at least four route and/or area briefings. Area briefings should encompass a 50-NM radius. Each briefing should require the pilot to access no more than two channels which shall be route- and/or area-specific. Pilots shall have access to NOTAM data through an area or route briefing on a separate channel designated specifically for NOTAMs or by access to a briefer.

TIBS service is provided 24 hours a day. Recorded information shall be updated as conditions change. Area and route forecast channels shall be updated whenever material is updated.

The order and content of the TIBS recording is as follows:

1. Introduction. Includes the preparation time and the route and/or the area of coverage.
2. Adverse Conditions. A summary of inflight weather advisories, center weather advisories, alert severe weather watch bulletins, and any other available information that may adversely affect flight in the route/area.
3. VFR Not Recommended Statement (VNR). Included when current or forecast conditions, surface or aloft, would make the flight under visual flight rules doubtful.
4. Synopsis. A brief statement describing the type, location, and movement of weather systems and/or masses which might affect the route or the area.
5. Current Conditions. A summary of current weather conditions over the route/area.
6. Density Altitude. A "check density altitude" statement will be included for any weather reporting point with a field elevation at or above 2,000 feet MSL and meets certain temperature criteria.
7. En Route Forecast. A summary of appropriate forecast data in logical order; i.e., climb out, en route, and descent.
8. Winds Aloft. A summary of winds aloft forecast for the route/area for levels through 12,000 feet.
9. Request for PIREPs, if applicable.
10. NOTAM information that affects the route/area as stated above.
11. Military Training Activity. Included in the closing announcement.
12. ALNOT Alert Announcement. If applicable.
13. Closing Announcement. Shall be appropriate for the facility equipment and the mode of operation.

Service may be reduced during the hours of 2200 and 0600 local time. During the period of reduced service, an announcement must be recorded. The Airport Facility Directory lists TIBS telephone numbers for AFSS briefing offices. A touch-tone telephone is necessary to access the TIBS program.

For those pilots already in flight and needing weather information and assistance, the following services are provided by flight service stations. They can be accessed over the proper radio frequencies printed in flight information publications.

Hazardous Inflight Weather Advisory Service (HIWAS)

The hazardous inflight weather advisory service (HIWAS) is a continuous broadcast of inflight weather advisories; i.e., SIGMETs, Convective SIGMETs, AIRMETs, AWWs, CWAs, and urgent PIREPs.

The HIWAS broadcast area is defined as the area within 150 NM of HIWAS outlets. HIWAS broadcasts shall not be interrupted/delayed except for emergency situations. The service shall be provided 24 hours a day.

An announcement shall be made if there are no hazardous weather advisories. Hazardous weather information shall be recorded if it is occurring within the HIWAS broadcast area. The broadcast shall include the following elements:

1. A statement of introduction including the appropriate area(s) and a recording time.
2. A summary of inflight weather advisories, center weather advisories, and alert severe weather watch bulletins, and any other weather not included in a current hazardous weather advisory.
3. A request for PIREPs, if applicable.
4. A recommendation to contact AFSS/FSS/FLIGHT WATCH for additional details concerning hazardous weather.

Once the HIWAS broadcast is updated, an announcement will be made once on all communications/NAVAID frequencies except emergency, and En Route Flight Advisory Service (EFAS). In the event that a HIWAS broadcast area is out of service, an announcement shall be made on all communications/NAVAID frequencies except emergency and EFAS.

En Route Flight Advisory Service (EFAS)

The en route flight advisory service (EFAS), or "Flight Watch," is a service from selected FSSs or AFSSs on a common frequency 122.0 mHz below flight level (FL) 180 and on assigned discrete frequencies to aircraft at FL180 and above. The purpose of EFAS is to provide en route aircraft with timely and pertinent weather data tailored to a specific altitude and route using the most current available sources of aviation meteorological information. Additionally, EFAS is a focal point for rapid receipt and dissemination of pilot reports. Figure 1-1 indicates the sites where EFAS and associated outlets are located. To use this service, call for flight watch. Example, "(Oakland) FLIGHT WATCH, THIS IS…"

The following paragraphs describe other FAA facilities which provide support to the aviation community.

Air Traffic Control System Command Center (ATCSCC)

The Air Traffic Control System Command Center (ATCSCC), also known as "central flow control," is located in Herndon, Virginia. ATCSCC has the mission of balancing air traffic demand with system capacity. This ensures maximum safety and efficiency for the National Airspace System while minimizing delays. The ATCSCC utilizes the Traffic Management System, aircraft situation display, monitor alert, the follow-on functions, and direct contact with the air route traffic control center (ARTCC) and terminal radar approach control facility (TRACON) traffic management units to manage flow on a national as well as local level.

Because weather is the most common reason for air traffic delays and re-routings, the ATCSCC is supported full-time by Air Traffic Control System Command Center Weather Unit Specialists (ATCSCCWUS). These specialists are responsible for the dissemination of meteorological information as it pertains to national air traffic flow management.

Air Route Traffic Control Center (ARTCC**)**

An air route traffic control center (ARTCC) is a facility established to provide air traffic control service to aircraft operating on IFR flight plans within controlled airspace and principally during the en route phase of flight. When equipment capabilities and controller workload permit, certain advisory/assistance services may be provided to VFR aircraft.

En route controllers become familiar with pertinent weather information and stay aware of current weather information needed to perform air traffic control duties. En route controllers shall advise pilots of hazardous weather that may impact operations within 150 NM of the controller's assigned sector or area of jurisdiction.

Center Weather Service Unit (CWSU)

The purpose of the center weather service unit (CWSU) is to provide weather consultation, forecasts, and advice to managers and staff within ARTCCs and to other supported FAA facilities. The CWSU is a joint agency aviation weather support team located at each ARTCC. The unit is composed of NWS meteorologists and FAA traffic management personnel, the latter being assigned as Weather

Coordinators. The CWSU meteorologist provides FAA traffic managers with accurate and timely weather information. This information is based on monitoring, analysis, and interpretation of real-time weather data at the ARTCC through the use of all available data sources including radar, satellite, PIREPs, and various NWS products such as TAFs and area forecasts, inflight advisories, etc. The flow or exchange of weather information between the CWSU meteorologists and the FAA personnel in the ARTCC is the responsibility of the Weather Coordinator.

Air Traffic Control Tower (ATCT)

An air traffic control tower (ATCT) is a terminal facility that uses air/ground communications, visual signaling, and other devices to provide ATC services to aircraft operating in the vicinity of an airport or on the movement area. It authorizes aircraft to land or take off at the airport controlled by the tower or to transit the Class D airspace area regardless of flight plan or weather conditions (IFR or VFR). A tower may also provide approach control services.

Terminal controllers become familiar with pertinent weather information and stay aware of current weather information needed to perform air traffic control duties. Terminal controllers shall advise pilots of hazardous weather that may impact operations within 150 NM of the controller's assigned sector or area of jurisdiction. Tower cab and approach control facilities may opt to broadcast hazardous weather information alerts only when any part of the area described is within 50 NM of the airspace under the ATCT's jurisdiction.

The responsibility for disseminating weather information is shared with the NWS at many ATCT facilities. If the responsibility is not shared, the controllers are properly certified and acting as official weather observers for the elements being reported.

An automatic terminal information service (ATIS) is a continuous broadcast of recorded information in selected terminal areas. Its purpose is to improve controller effectiveness and to relieve frequency congestion by automating the repetitive transmission of noncontrol airport/terminal area and meteorological information.

Direct User Access Terminal Service (DUATS)

The direct user access terminal system (DUATS) provides current FAA weather and flight plan filing services to U.S. Coast Guard and certified civil pilots. The computer-based system receives and stores up-to-date weather and NOTAM data from the FAA's WMSC. Pilots using a personal computer, modem, and a telephone line can access the system and request specific types of weather briefings and other pertinent data for planned flights. The pilot can also file, amend, or cancel flight plans while dialed into the system. Further information about DUATS can be obtained from any AFSS or FAA Flight Standards District Office (FSDO).

OBSERVATIONS

Weather observations are measurements and estimates of existing weather conditions both at the surface and aloft. When recorded and transmitted, an observation becomes a report; and reports are the basis of all weather analyses, forecasts, advisories, and briefings. The following paragraphs briefly describe the observation programs of the NWS and the FAA. More detailed information on each program follows.

SURFACE AVIATION WEATHER OBSERVATIONS (METARs)

Surface aviation weather observations (METARs) include weather elements pertinent to flying. A network of airport stations provides routine up-to-date surface weather information. For more information on surface aviation observation, see Section 2.

UPPER-AIR OBSERVATIONS

Upper-air weather data is received from sounding balloons (known as radiosonde observations) and pilot weather reports (PIREPs). Upper-air observations are taken twice daily at specified stations. These upper-air observations furnish temperature, humidity, pressure, and wind data, often to heights above 100,000 feet. In addition, pilots are a vital source of upper-air weather observations. In fact, aircraft in flight are the only means of directly observing turbulence, icing, and height of cloud tops. For more information on PIREPs, see Section 3. Recently some US and other international airlines have equipped their aircraft with instruments that automatically send weather observations via a satellite downlink. These are important observations which are used by NCEP in their production of forecasts.

RADAR OBSERVATIONS

The weather radar provides detailed information about precipitation, winds, and weather systems. Doppler technology allows the radar to provide measurements of winds through a large vertical depth of the atmosphere, even within "clear air." This information helps support public and aviation warning and forecast programs. Figure 7-2 shows the weather radar network across the United States.

FAA terminal doppler weather radars (TDWRs) are being installed near a number of major airports around the country. The TDWRs will be used to alert and warn airport controllers of approaching wind shear, gust fronts, and heavy precipitation which could cause hazardous conditions for landing or departing aircraft.
Also installed at major airports are the FAA airport surveillance radars. With this radar, specific locations of six different precipitation intensity levels are available for the routing of air traffic in and about a terminal location. However, the radar's primary function is for aircraft detection.

LOW-LEVEL WIND SHEAR ALERT SYSTEM (LLWAS)

The low-level wind shear alert system (LLWAS) provides pilots and controllers with information on hazardous surface wind conditions (on or near the airport) that create unsafe landing or departure conditions. LLWAS evaluates wind speed and direction from sensors on the airport periphery with center field wind data. During the time that an alert is posted, air traffic controllers provide wind shear advisories to all arriving and departing aircraft.

SATELLITE IMAGERY

Visible, infrared (IR), and other types of images (or pictures) of clouds are taken from weather satellites in orbit. These images are then made available on a near-real-time basis to NWS and FAA facilities. Satellite pictures are an important source of weather information. For more information on satellite products, see Section 3.

COMMUNICATION SYSTEM

High speed communications and automated data processing have improved the flow of weather data and products through the nation's weather network. The flow of weather information within and between agencies is becoming faster as computers and satellites are being used to facilitate the exchange of data. A new computer-based advanced weather interactive processing system (AWIPS) workstation is being deployed for the NWS. This system is replacing the current system and will allow quicker dissemination of weather information. AWIPS will be linked with the weather radars to provide better detection, observing, and forecasting of weather systems, especially severe weather.

The flow of alphanumeric weather information to the FAA service outlets is accomplished through leased lines to computer-based equipment. The NWS and FAA service outlets exchange weather information through the use of graphic products and alphanumeric information. Graphic products (weather maps) are received by FAA service outlets from NCEP through a private sector contractor. Alphanumeric information exchanged through telecommunication gateways at NWS and FAA switching centers serves to pass data between the various FAA facilities, NWS, and other users.

USERS

The ultimate users of the aviation weather service are pilots and dispatchers. Maintenance personnel may use the service to keep informed of weather that could cause possible damage to unprotected aircraft. Pilots contribute to, as well as use, the service. Pilots should send PIREPs to help fellow pilots, briefers, and forecasters. The service can be no better or more complete than the information that goes into it.
In the interest of safety and in compliance with Title 14, Code of Federal Regulations, all pilots should get a complete weather briefing before each flight. It is the responsibility of the pilot to ensure he/she has all the information needed to make a safe flight.

OBTAINING A GOOD WEATHER BRIEFING

When requesting a briefing, pilots should identify themselves as pilots and give clear and concise facts about their flight:

1. Type of flight (VFR or IFR)
2. Aircraft identification or pilot's name
3. Aircraft type
4. Departure point
5. Proposed time of departure
6. Flight altitude(s)
7. Route of flight
8. Destination
9. Estimated time en route (ETE)

With this background, the briefer can proceed directly with the briefing and concentrate on weather relevant to the flight. The weather information received depends on the type of briefing requested. A "standard" briefing should include:

1. Adverse conditions. Meteorological or aeronautical conditions reported or forecast that may influence a pilot to alter the proposed flight.
2. VFR flight not recommended (VNR). VFR flight is proposed and sky conditions or visibilities are present or forecast, surface or aloft, that, in the judgment of the AFSS/FSS briefer, would make flight under visual flight rules doubtful.
3. Synopsis. A brief statement describing the type, location, and movement of weather systems and/or air masses which might affect the proposed flight.
4. Current conditions. A summary from all available sources reporting weather conditions applicable to the flight.
5. En Route forecast. A summary from appropriate data forecast conditions applicable to the proposed flight.
6. Destination forecast. Destination forecast including significant changes expected within 1 hour before and after the ETA.
7. Winds aloft. Forecast winds aloft for the proposed route; temperature information on request.
8. NOTAMs. Provides NOTAMs pertinent to the flight.
9. ATC delays. Informs the pilot of any known ATC delays and/or flow control advisories that may affect the proposed flight.
10. Request for PIREPs. A request is made if a report of actual inflight conditions would be beneficial or when conditions meet the criteria for solicitation of PIREPs.
11. EFAS. Informs pilots of the availability of Flight Watch for weather updates.
12. Any other information the pilot requests; e.g., military training routes, etc.

An "abbreviated" briefing will be provided at the user's request:

1. To supplement mass disseminated data.
2. To update a previous briefing.
3. To request that the briefing be limited to specific information.

An "outlook" briefing will be provided when the proposed departure is 6 hours or more from the time of the briefing. Briefing will be limited to applicable forecast data needed for the proposed flight.

The FSS/AFSS's purpose is to serve the aviation community. Pilots should not hesitate to ask questions and discuss factors they do not fully understand. The briefing should be considered complete only when the pilot has a clear picture of what weather to expect. It is also advantageous for the pilot to make a final weather check immediately before departure if at all possible.

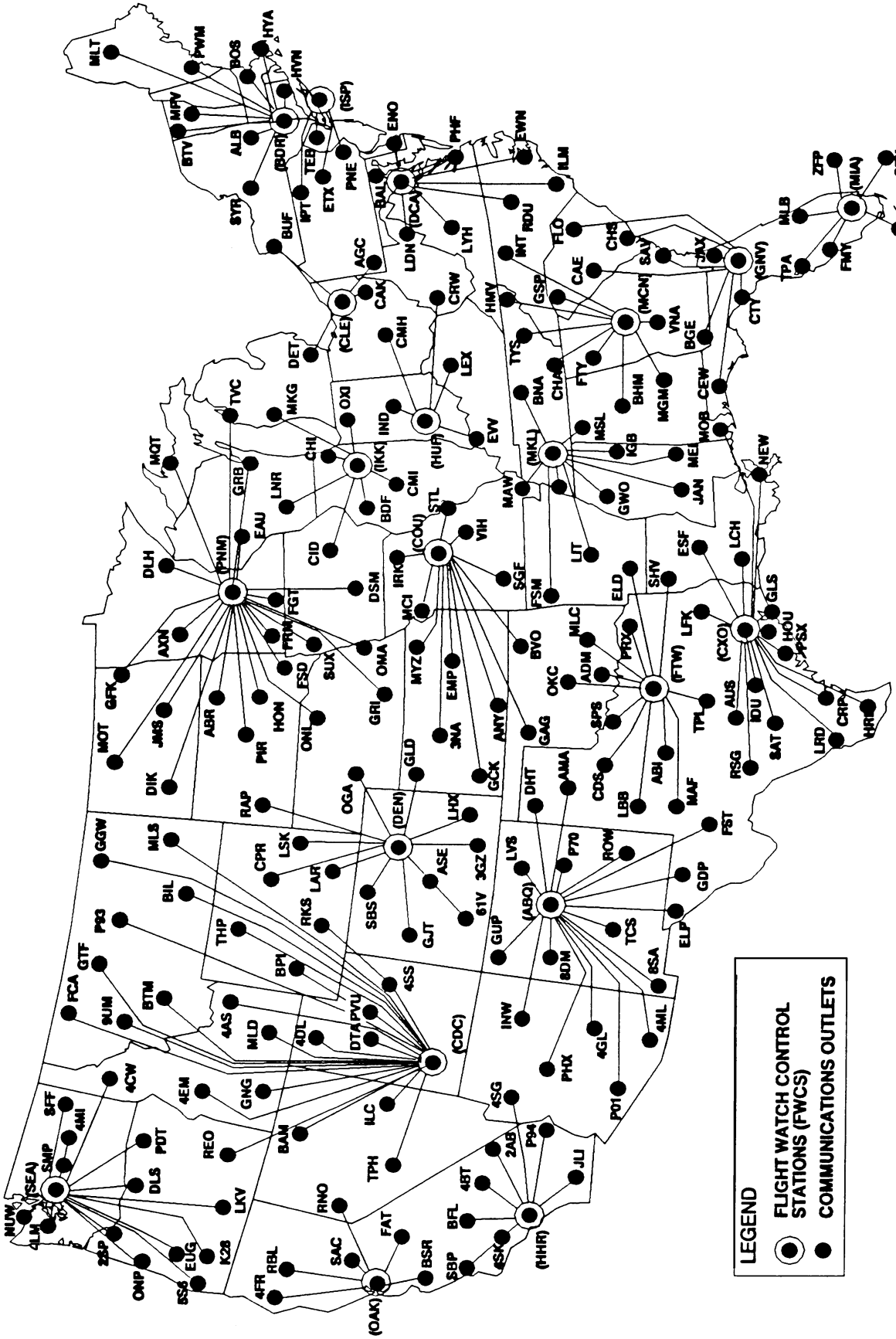


Figure 1-1. EFAS Sites and Communication Outlets.

Section 2
AVIATION ROUTINE WEATHER REPORT (METAR)

The aviation routine weather report (METAR) is the weather observer's interpretation of the weather conditions at a given site and time. The METAR is used by the aviation community and the National Weather Service (NWS) to determine the flying category - visual fight rules (VFR), marginal VFR (MVFR), or instrument flight rules (IFR) - of the airport, as well as produce the Aviation Terminal Forecast (TAF). (See Section 4.)

Although the METAR code is being adopted worldwide, each country is allowed to make modifications or exceptions to the code for use in that particular country. The U.S.A. reports temperature and dew point in degrees Celsius and continues to use current units of measurement for the remainder of the report.

The elements in the body of a METAR report are separated with a space. The only exception is temperature and dew point that are separated with a solidus **(/)**. When an element does not occur, or cannot be observed, the preceding space and that element are omitted from that particular report. A METAR report contains the following elements in order as presented:

1. Type of report
2. ICAO station identifier
3. Date and time of report
4. Modifier (as required)
5. Wind
6. Visibility
7. Runway visual range (RVR) (as required)
8. Weather phenomena
9. Sky condition
10. Temperature/dew point group
11. Altimeter
12. Remarks (RMK) (as required)

The following paragraphs describe the elements in a METAR report. A sample report will accompany each element with the subject element highlighted.

TYPE OF REPORT

METAR KLAX 140651Z AUTO 00000KT 1SM R35L/4500V6000FT -RA BR BKN030 10/10 A2990 RMK AO2

There are two types of reports: The METAR and the aviation selected special weather report (SPECI). The METAR is observed hourly between 45 minutes after the hour till the hour and transmitted between 50 minutes after the hour till the hour. It will be encoded as a METAR even if it meets SPECI criteria. The SPECI is a non-routine aviation weather report taken when any of the SPECI criteria have been observed. The criteria are listed in Table 2-1, "SPECI Criteria."

Table 2-1 SPECI Criteria

Report Element	Criteria
Wind	**Wind direction changes by 45 degrees or more in less than 15 minutes and the wind speed is 10 knots or more throughout the windshift.**
Visibility	**Surface visibility as reported in the body of the report decreases to less than, or if below, increases to equal or exceeds: 3,2, or 1mile or the lowest standard instrument approach procedure minimum as published in the National Ocean Service U.S Instrument Procedures. If none is published use ½ mile.**
RVR	**Changes to above or below 2,400 feet**
Tornado, Funnel Cloud, Waterspout	**When observed or when disappears from sight (ends)**
Thunderstorm	**Begins or ends**
Precipitation	**When freezing precipitation or ice pellets begin, end, or change intensity or hail begins or ends**
Squalls	**When they occur**
Ceilings	**The ceiling forms or dissipates below, decreases to less than, or if below, increases to equal or exceeds: 3,000, 1,500, 1,000, or 500 feet or the lowest standard instrument approach procedure minimum as published in the National Ocean Service U.S Instrument Procedures. If none is published use 200 feet.**
Sky Condition	**A layer of clouds or obscuring phenomenon aloft that forms below 1,000 feet**
Volcanic Eruption	**When an eruption is first noted**
Aircraft Mishap	**Upon notification of an aircraft mishap, unless there has been an intervening observation**
Miscellaneous	**Any other meteorological situation designated by the agency, or which, in the opinion of the observer, is critical**

ICAO STATION IDENTIFIER

METAR **KLAX** 140651Z AUTO 00000KT 1SM R35L/4500V6000FT -RA BR BKN030 10/10 A2990 RMK AO2

The METAR code uses International Civil Aviation Organization (ICAO) four-letter station identifiers that follow the type of report. In the conterminous United States, the three-letter identifier is prefixed with K. For example SEA (Seattle) becomes KSEA. Elsewhere, the first one or two letters of the ICAO identifier indicate in which region of the world and country (or state) the station is located. Pacific locations such as Alaska, Hawaii, and the Mariana Islands start with P followed by an A, H, or G respectively. The last two letters reflect the specific reporting station identification. If the location's three-letter identification begins with an A, H, or G, the P is added to the beginning. If the location's three-letter identification does not begin with an A, H, or G, the last letter is dropped and the P is added to the beginning.

Examples:
ANC (Anchorage, AK) becomes PANC.
OME (Nome, AK) becomes PAOM.
HNL (Honolulu, HI) becomes PHNL.
KOA (Keahole Point, HI) becomes PHKO.
UAM (Anderson AFB, Guam) becomes PGUA.

Canadian station identifiers start with C.

Example:
Toronto, Canada, is CYYZ.

Mexican and western Caribbean station identifiers start with M.

Examples:
Mexico City, Mexico, is MMMX.
Guantanamo, Cuba, is MUGT.
Santo Domingo, Dominican Republic, is MDGM.
Nassau, Bahamas, is MYNN.

The identifier for the eastern Caribbean is T, followed by the individual country's letter.

Example:
San Juan, Puerto Rico, is TJSJ.

For a complete worldwide listing, see ICAO Document 7910, "Location Indicators."

DATE AND TIME OF REPORT

METAR KLAX **140651Z** AUTO 00000KT 1SM R35L/4500V6000FT -RA BR BKN030 10/10 A2990 RMK AO2

The date and time the observation is taken are transmitted as a six-digit date/time group appended with **Z** to denote Coordinated Universal Time (UTC). The first two digits are the date followed with two digits for hour and two digits for minutes. If a report is a correction to a previously disseminated erroneous report, the time entered on the corrected report shall be the same time used in the report being corrected.

MODIFIER (AS REQUIRED)

METAR KLAX 140651Z **AUTO** 00000KT 1SM R35L/4500V6000FT -RA BR BKN030 10/10 A2990 RMK AO2

The modifier element, if used, follows the date/time element. The modifier, **AUTO**, identifies a METAR/SPECI report as an automated weather report with no human intervention. If AUTO is shown in the body of the report, AO1 or AO2 will be encoded in the remarks section of the report to indicate the type of precipitation sensor used at the station. A remark of AO1 indicates a report from a station that does not have a precipitation discriminator, and an AO2 remark indicates a report from a station

which has a precipitation discriminator. The absence of AUTO indicates that the report was made manually or the automated report had human augmentation/backup.

The modifier, **COR**, identifies a corrected report that is sent out to replace an earlier report with an error.

Example:
METAR KLAX 140651Z **COR**…

WIND

METAR KLAX 140651Z AUTO **00000KT** 1SM R35L/4500V6000FT -RA BR BKN030 10/10 A2990 RMK AO2

The wind element is reported as a five-digit group (six digits if speed is over 99 knots). The first three digits are the direction from which the wind is blowing in tens of degrees referenced to true north. Directions less than 100 degrees are preceded with a zero. The next two digits are the average speed in knots, measured or estimated, or if over 99 knots, the next three digits.

Example:
340105KT

If the wind speed is less than 3 knots, the wind is reported as calm, 00000KT. If the wind is gusty, 10 knots or more between peaks and lulls, **G** denoting gust is reported after the speed followed by the highest gust reported. The abbreviation **KT** is appended to denote the use of knots for wind speed. Other countries may use kilometers per hour or meters per second.

If the wind direction is variable by 60 degrees or more and the speed is greater than 6 knots, a variable group consisting of the extremes of the wind directions separated by **V** will follow the wind group.

Example:
08012G25KT 040V120

The wind direction may also be considered variable if the wind speed is 6 knots or less and is varying in direction (60-degree rule does not apply). This is indicated with the contraction **VRB**.

Example:
VRB04KT

WIND REMARKS

At facilities that have a wind recorder or at automated weather reporting systems, whenever the peak wind exceeds 25 knots, **PK WND** will be included in the Remarks element in the next report. The peak wind remark includes three digits for direction and two or three digits for speed followed by the time in hours and minutes of occurrence. If the hour can be inferred from the report time, only the minutes are reported.

Example:
PK WND 28045/15

When a windshift occurs, **WSHFT** will be included in the Remarks element followed by the time the windshift began (with only minutes reported, if the hour can be inferred from the time of observation). A windshift is indicated by a change in wind direction of 45 degrees or more in less than 15 minutes with sustained winds of 10 knots or more throughout the windshift. The contraction, **FROPA**, may be entered following the time if the windshift is the result of a frontal passage.

Example:
WSHFT 30 FROPA

VISIBILITY

METAR KLAX 140651Z AUTO 00000KT **1SM** R35L/4500V6000FT -RA BR BKN030 10/10 A2990 RMK AO2

Prevailing visibility is reported in statute miles followed by a space, fractions of statute miles, as needed, and the letters **SM**. Other countries may use meters or kilometers. Prevailing visibility is considered representative of the visibility conditions at the observing site. Prevailing visibility is the greatest visibility equaled or exceeded throughout at least half the horizon circle, which need not be continuous. When visibilities are less than 7 miles, the restriction to visibility will be shown in the weather element. The only exception to this rule is that if volcanic ash, low drifting dust, sand, or snow is observed, it is reported, even if it does not restrict visibility to less than 7 miles.

VISIBILITY REMARKS

If tower or surface visibility is less than 4 statute miles, the lesser of the two will be reported in the body of the report; the greater will be reported in the Remarks element.

Example:
TWR VIS 1 1/2 or SFC VIS 1 1/2

Automated reporting stations will show visibility less than 1/4 statute mile as **M1/4SM** and visibility 10 or greater than 10 statute miles as **10SM**.

For automated reporting stations having more than one visibility sensor, site-specific visibility (which is lower than the visibility shown in the body) will be shown in the Remarks element.

Example:
VIS 2 1/2 RWY 11

When the prevailing visibility rapidly increases or decreases by 1/2 statute mile or more during the observation, and the average prevailing visibility is less than 3 statute miles, the visibility is variable. Variable visibility is shown in the Remarks element with the minimum and maximum visibility values separated by a V.

Example:
VIS 1/2V2

Sector visibility is shown in the Remarks element when it differs from the prevailing visibility and either the prevailing or sector visibility is less than 3 miles.

Example:
VIS NE 2 1/2

RUNWAY VISUAL RANGE (RVR) (AS REQUIRED)

METAR KLAX 140651Z AUTO 00000KT 1SM **R35L/4500V6000FT** -RA BR BKN030 10/10 A2990 RMK AO2

Runway visual range (RVR) follows the visibility element. RVR, when reported, is in the following format: **R** identifies the group; followed by the runway heading and, if needed, the parallel runway designator; next is a solidus (**/**); last is the visual range in feet (meters in other countries) indicated by "**FT**." RVR is shown in a METAR/SPECI if the airport has RVR equipment and whenever the prevailing visibility is 1 statute mile or less and/or the RVR value is 6,000 feet or less. When the RVR varies by more than one reportable value, the lowest and highest values are shown with **V** between them.

Example:
R35L/4500V6000FT

When the observed RVR is above the maximum value which can be determined by the system, it should be reported as P6000 where 6,000 is the maximum value for this system. When the observed RVR is below the minimum value which can be determined by the system, it should be reported as M0600 where 600 is the minimum value for this system.

Example:
R27/P6000FT and R12C/M0600FT

WEATHER PHENOMENA

METAR KLAX 140651Z AUTO 00000KT 1SM R35L/4500V6000FT **-RA BR** BKN030 10/10 A2990 RMK AO2

Weather phenomena is broken into two categories: qualifiers and weather phenomena.

QUALIFIERS

Intensity

Intensity may be shown with most precipitation types.

A "-"denotes a light intensity level, no symbol denotes a moderate intensity level, and a "+" denotes a heavy intensity level. When more than one type of precipitation is present, the intensity refers to the first precipitation type (most predominant). (See Table 2-2.)

Example:
+SHRASN indicates heavy rainshowers and snow.

Table 2-2 Intensity Qualifiers

Intensity Qualifiers	
-	**Light**
	Moderate
+	**Heavy**

Proximity

Proximity is applied to and reported only for weather phenomena occurring in the vicinity of the airport. Vicinity of the airport is defined to be between 5 and 10 miles of the usual point of observation for obscuration and just beyond to point of observation to 10 miles for precipitation. It is denoted by **VC**. Intensity and VC will never be shown in the same group.

Examples:
VCSH indicates showers in the vicinity of the airport.
VCFG indicates fog in the vicinity of the airport.

Descriptor

The eight descriptors shown in Table 2-3 further identify weather phenomena and are used with certain types of precipitation and obscurations. Although **TS** and **SH** are used with precipitation and may be preceded with an intensity symbol, the intensity still applies to the precipitation and not the descriptor.

Example:
+TSRA is a thunderstorm with heavy rain and not a heavy thunderstorm with rain.

Table 2-3 Descriptor Qualifiers

Descriptor	
MI[1]	**Shallow**
BC[2]	**Patches**
DR[3]	**Low drifting**
BL[4]	**Blowing**
SH	**Showers**
TS	**Thunderstorm**
FZ	**Freezing**
PR	**Partial**

[1]MI shall be used only to further describe fog that has little vertical extent (less than 6 feet).
[2]BC shall be used only to further describe fog that has little vertical extent and reduces horizontal visibility.
[3]DR shall be used when dust, sand, or snow is raised by the wind to less than 6 feet.
[4]BL shall be used when dust, sand, snow, and/or spray is raised by the wind to a height of 6 feet or more.

WEATHER PHENOMENA

If more than one significant weather phenomenon is observed, entries will be listed in the following order: Tornadic activity, thunderstorms, and weather phenomena in order of decreasing predominance (i.e., the most dominant type is reported first).

If more than one significant weather phenomenon is observed, except precipitation, separate weather groups will be shown in the report. No more than three weather groups will be used to report weather phenomena at or in the vicinity of the station. If more than one type of precipitation is observed, the appropriate contractions are combined into a single group with the predominant type being reported first. In such a group, any intensity will refer to the first type of precipitation in the group.
Refer to Table 2-4 while reading the rest of this section.

Examples:
TSRA indicates thunderstorm with moderate rain.
+SHRA indicates heavy rainshowers.
-FZRA indicates light freezing rain.

Precipitation

The types of precipitation in the METAR code are shown in Table 2-4. Precipitation is any form of water particle, whether liquid or solid, that falls from the atmosphere and reaches the ground.

Examples:
GR is used to indicate hail ¼ inch in diameter or larger.
GS is used to indicate hail less than ¼ inch in diameter.
UP is unknown precipitation and is used only at automated sites. This occurs when light precipitation is falling but the precipitation discriminator cannot determine the precipitation type. This situation usually occurs when rain and snow are falling at the same time.

Obscurations

The types of obscuration phenomena in the METAR code are shown in Table 2-4. They are any phenomena in the atmosphere, other than precipitation, that reduce horizontal visibility.

Examples:
BR is used to indicate mist restricting visibility and is used only when the visibility is from 5/8 mile to 6 miles.
FG is used to indicate fog restricting visibility and is used only when visibility is less than 5/8 mile.

Other

The other weather phenomena, shown in the table, are reported when they occur.

Examples:
SQ is a sudden increase in wind speed of at least 16 knots, the speed rising to 22 knots or more, and lasting at least 1 minute.
+FC is used to denote a tornado or waterspout.
FC is used to denote a funnel cloud.

Table 2-4 Weather Phenomena

Precipitation	Obscuration	Other
DZ Drizzle	**BR Mist**	**PO Dust/Sand whirls**
RA Rain	**FG Fog**	**SQ Squalls**
SN Snow	**DU Dust**	**FC Funnel cloud**
SG Snow grains	**SA Sand**	**+FC Tornado or Waterspout**
IC Ice crystals	**HZ Haze**	**SS Sandstorm**
PL Ice pellets	**PY Spray**	**DS Dust storm**
GR Hail	**VA Volcanic ash**	
GS Small hail or Snow pellets	**FU Smoke**	
UP Unknown precipitation		

Weather Begins/Ends

When weather begins or ends, the Remarks element will show the beginning and ending times of any type of precipitation or thunderstorms. Types of precipitation may be combined if beginning or ending times are the same.

Example:
RAB05E30SNB30E45 This means that rain began at 5 minutes past the hour and ended at 30 minutes past the hour, snow began at 30 minutes past the hour and ended at 45 minutes past the hour.

Example:
TSB05E45 This means a thunderstorm began at 5 minutes past the hour and ended at 45 minutes past the hour.

Hailstone Size

When hailstones, **GR**, are shown in the body of a report, the largest hailstone size is shown in the Remarks element in 1/4-inch increments and identified with the contraction GR. Hailstones less than 1/4 inch are shown in the body of a report as **GS** and no remarks are entered indicating hailstone size.

Example:
GR 1 ¾

SKY CONDITION

METAR KLAX 140651Z AUTO 00000KT 1SM R35L/4500V6000FT -RA BR **BKN030** 10/10 A2990 RMK AO2

Sky condition is reported in the following format:

Amount/Height/Type (as required) or Indefinite Ceiling/Height (Vertical Visibility)

AMOUNT

A clear sky, a layer of clouds, or an obscuring phenomenon is reported by one of the six sky cover contractions. (See Table 2-5.) When more than one layer is reported, they are reported in ascending order of height. For each layer above a lower layer or layers, the sky cover for that higher layer will be the total sky cover that includes that higher layer and all lower layers. In other words, the summation of the cloud layers from below and at that higher level determines what sky cover is reported. This summation includes both clouds and obscuration. The amount of sky cover is reported in eighths of the sky, using the contractions in Table 2-5.

Table 2-5 Reportable Contractions for Sky Cover

Reportable Contractions	Meaning	Summation Amount
***SKC or CLR**	**Clear**	**0 or 0 below 12,000**
FEW	**Few**	**>0 but ≤ 2/8**
SCT	**Scattered**	**3/8-4/8**
BKN	**Broken**	**5/8-7/8**
OVC	**Overcast**	**8/8**
VV	**Vertical Visibility (indefinite ceiling)**	**8/8**

***SKC** will be reported at manual stations. The abbreviation **CLR** shall be used at automated stations when no clouds below 12,000 feet are detected.

Note: For aviation purposes, the ceiling is defined as the height (AGL) of the lowest broken or overcast layer aloft or vertical visibility into an obscuration.

HEIGHT

Cloud bases are reported with three digits in hundreds of feet above ground level.

Example:
SCT020

Clouds above 12,000 feet cannot be detected by automated reporting systems. At reporting stations located in the mountains, if the cloud layer is below the station level, the height of the layer will be shown as three solidi (**///**).

Example:
SCT///

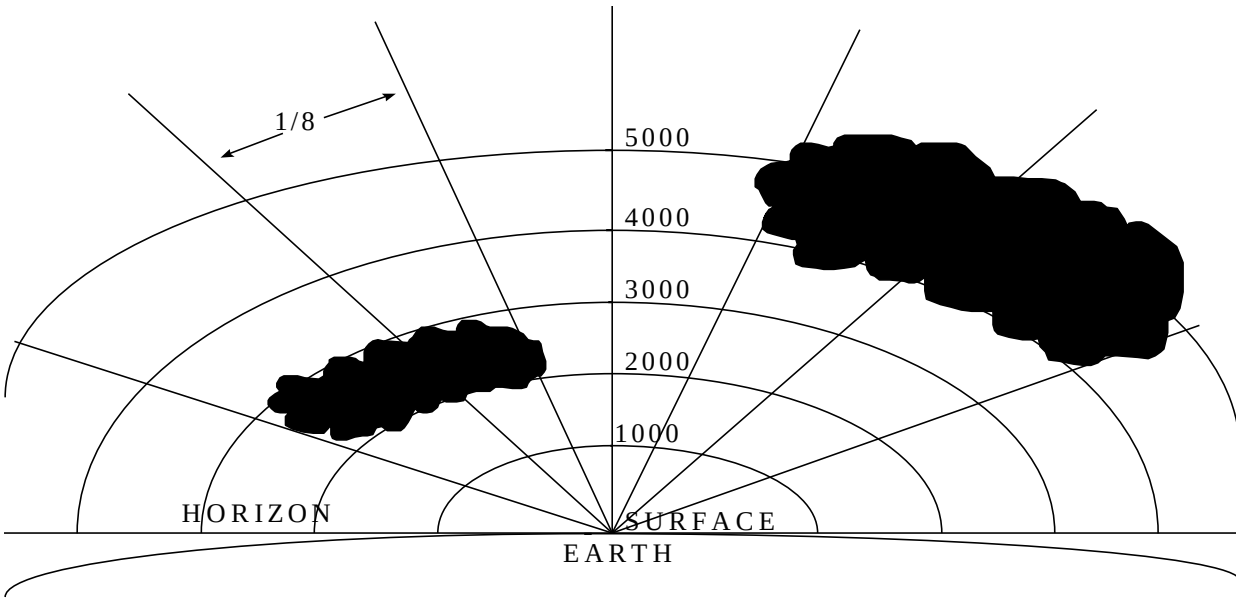


Figure 2-1. Few sky cover at 2,000 feet (2/8) and scattered sky cover at 4,000 feet (4/8). The summation of sky cover would be coded as FEW020 SCT040.

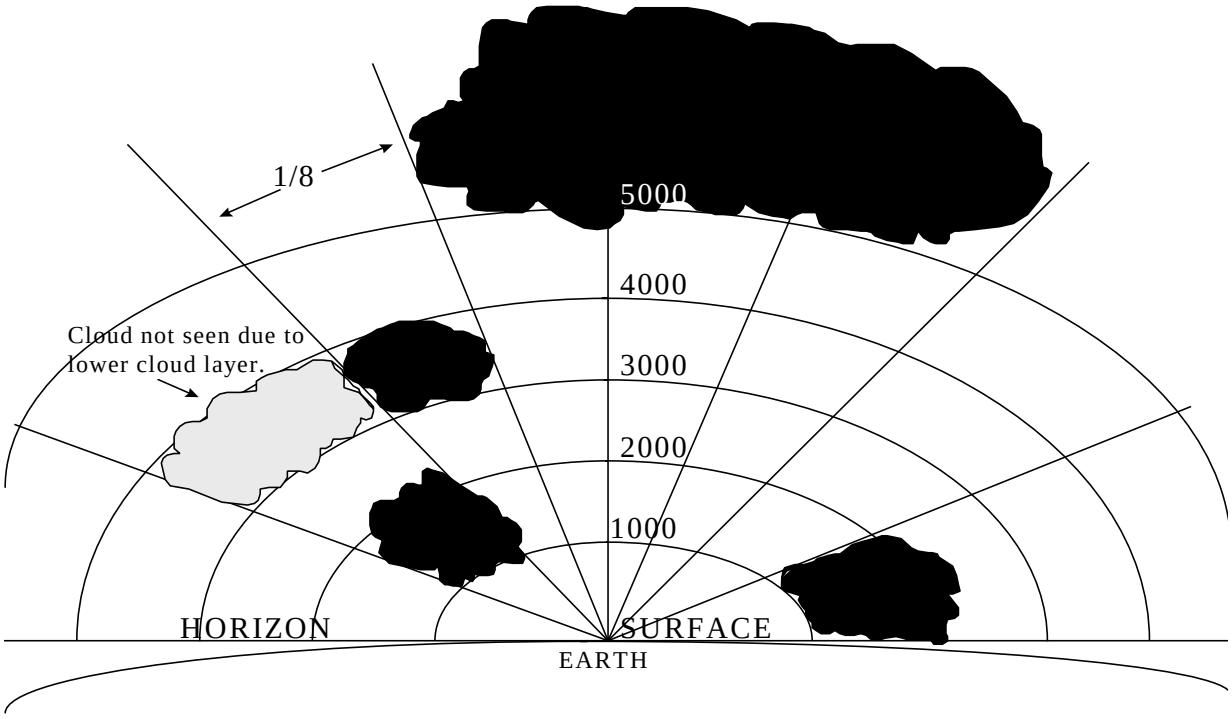


Figure 2-2. The sky cover consists of few clouds at 1,000 feet (2/8), scattered clouds at 3,000 feet (3/8), and broken clouds at 5,000 feet (6/8). This is coded as FEW010 SCT030 BKN050.

TYPE (AS REQUIRED)

If towering cumulus clouds, **TCU**, or cumulonimbus clouds, **CB**, are present, they are reported after the height that represents their base.

Example:
BKN025CB or SCT040TCU

Figure 2-3. Towering Cumulus (TCU). The significance of this cloud is that it indicates the atmosphere in the lower altitudes is unstable and conducive to turbulence. (Photo courtesy of National Severe Storms Laboratory/University of Oklahoma.)

Figure 2-4. Cumulonimbus (CB). The anvil portion of a CB is composed of ice crystals. The CB or thunderstorm cloud contains most types of aviation weather hazards, particularly turbulence, icing, hail, and low-level wind shear (LLWS). (Photo courtesy of Doug Streu.)

INDEFINITE CEILING/HEIGHTS (VERTICAL VISIBILITY)

The height into an indefinite ceiling is preceded with VV followed by three digits indicating the vertical visibility in hundreds of feet above ground level. The layer is spoken as “indefinite ceiling” and indicates total obscuration.

Example:
VV002

Partial Obscurations

The amount of obscuration is reported in the body of the METAR when the sky is partially obscured by a surface-based phenomenon by indicating the amount of obscuration as **FEW**, **SCT**, or **BKN** followed with three zeros **(000)**. The type of obscuring phenomenon is stated in the Remarks element and precedes the amount of obscuration and three zeros. For example, if fog is hiding >1/8 to 2/8 of the sky, it will be coded in the body of the METAR as “FEW000.” Because the fog is partially obscuring the sky, a remark is required. (See Figure 2-5.)

Example of Remark:
FG FEW000.

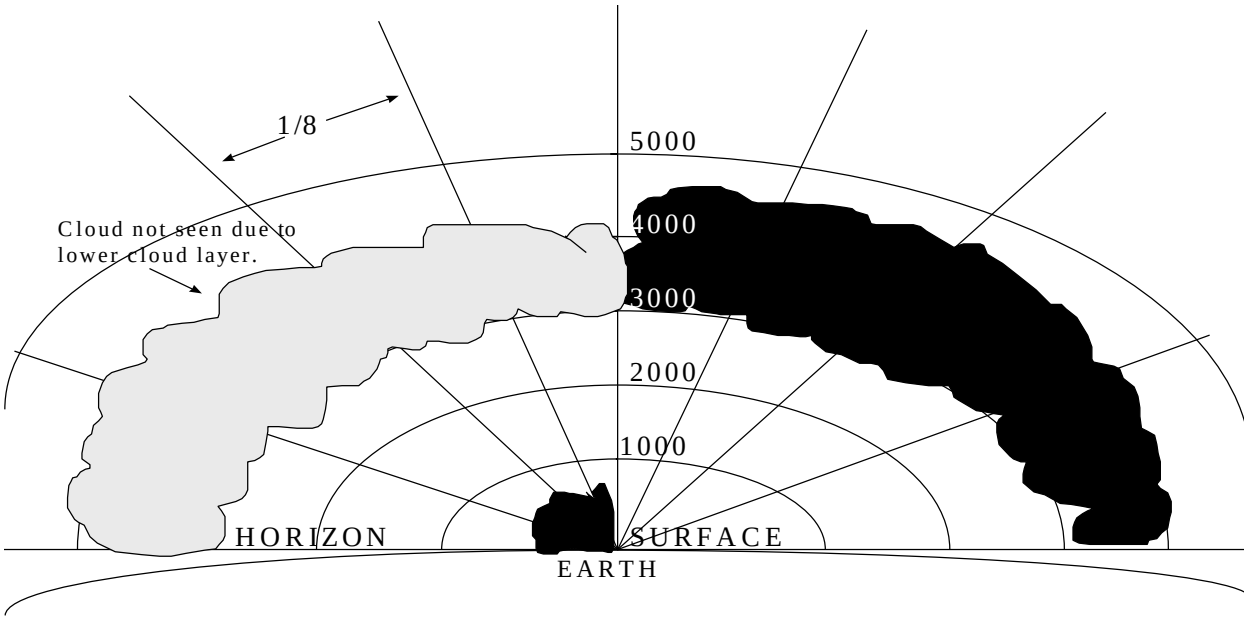


Figure 2-5. The sky cover consists of surface-based obscuration and an overcast layer at 3,000 feet. This is coded as SCT000 OVC030 with FG SCT000 in remarks.

The sky cover and ceiling, as determined from the ground, represent as nearly as possible what the pilot should experience in flight. In other words, a pilot flying at or above a reported ceiling layer (BKN-OVC) should see less than half the surface below. A pilot descending through a surface-based total obscuration should first see the ground directly below from the height reported as vertical visibility into the obscuration. However, due to the differing viewing points of the pilot and the observer, the observed values and what the pilot sees do not always exactly agree. Figure 2-6 illustrates the effect of an obscured sky on the vision from a descending aircraft.

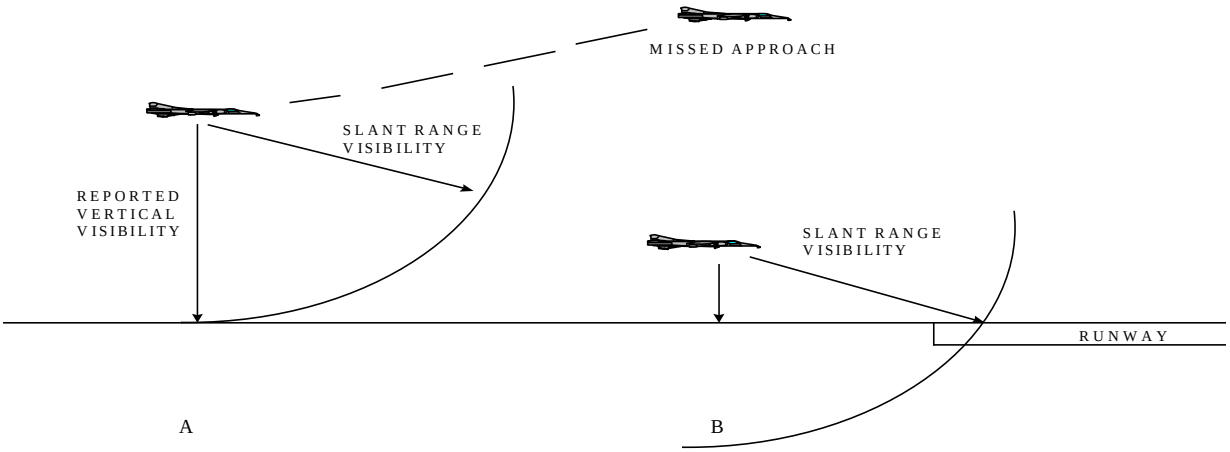


Figure 2-6. The obscuration limits runway acquisition due to slant range effects (A). This pilot would be able to see the ground but not the runway. The pilot will not be able to see the runway until position B, which is at a much lower altitude. If position A represented approach minimums, the approach could not be continued and a missed approach must be executed.

ADDITIONAL SKY CONDITION REMARKS

Whenever the ceiling is below 3,000 feet and is variable, the remark **CIG** will be shown in the Remarks element followed with the lowest and highest ceiling heights separated with a **V**.

Example:
CIG 005V010

When an automated station uses meteorological discontinuity sensors, site-specific sky conditions that differ from the ceiling height in the body of the report will be shown in the Remarks element.

Example:
CIG 002 RWY 11

When a layer is varying in sky cover, the variability range will be shown in the Remarks element. If there is more than one cloud layer of the same coverage, the variable layer will be identified by including the layer height.

Example:
BKN014 V OVC

When significant clouds are observed, they are shown in the Remarks element. The following cloud types are shown:

Towering cumulus, **TCU**, and direction from the station.

Example:
TCU W

Cumulonimbus, **CB**; or cumulonimbus mammatus, **CBMAM;** direction from the station; and direction of movement (if known). If the clouds are beyond 10 miles from the airport, **DSNT** will indicate that they are distant. (See Figure 2-7.)

Examples:
CB DSNT E or CBMAM E MOV NE
(For TCU and CB see Figures 2-3 and 2-4.)

Figure 2-7. Cumulonimbus Mammatus (CBMAM). This characteristic cloud can result from violent up- and downdrafts. This cloud type indicates possible severe or greater turbulence.
(Photo courtesy of Grant Goodge taken at Asheville, NC on 4/15/87.)

Altocumulus castellanus, **ACC**; standing lenticular (stratocumulus, **SCSL**; altocumulus, **ACSL**; or cirrocumulus, **CCSL**); or rotor clouds, **ROTOR CLD,** will show a remark describing the clouds (if needed) and the direction from the station.

Examples:
ACC NW or ACSL SW
(Figure 2-8 for ACC; see Figure 2-9 for standing lenticular clouds.)

Figure 2-8. Altocumulus Castellanus (ACC). ACC indicates unstable conditions aloft, but not necessarily below the base of the cloud. (Photo courtesy of National Severe Storms Laboratory/University of Oklahoma.)

Figure 2-9. Standing Lenticular Altocumulus (ACSL). These clouds are characteristic of the standing or mountain wave. Similar clouds are rotor clouds and standing lenticular cirrocumulus (CCSL). The rotor clouds are usually at a lower altitude than the ACSL. CCSL are whiter and at a higher altitude. All three cloud types are indicative of possible severe or greater turbulence. (Photo courtesy of Grant Goodge taken at Concord, CA in 1970.)

TEMPERATURE/DEW POINT GROUP

METAR KLAX 140651Z AUTO 00000KT 1SM R35L/4500V6000FT -RA BR BKN030 **10/10** A2990 RMK AO2

Temperature/dew point are reported in a two-digit form in whole degrees Celsius separated by a solidus (**/**). Temperatures below zero are prefixed with **M**. If the temperature is available but the dew point is missing, the temperature is shown followed by a solidus. If the temperature is missing, the group is omitted from the report.

ALTIMETER

METAR KLAX 140651Z AUTO 00000KT 1SM R35L/4500V6000FT -RA BR BKN030 10/10 **A2990** RMK AO2

The altimeter element follows the temperature/dew point group and is the last element in the body of a METAR or SPECI report. It is reported in a four-digit format representing tens, units, tenths, and hundredths of inches of mercury prefixed with **A**. The decimal point is not reported or stated.

ALTIMETER REMARKS

When the pressure is rising or falling rapidly at the time of observation, Remarks element will show **PRESRR** or **PRESFR** respectively.

Some stations also include the sea-level pressure (which is different from altimeter). It is shown in the Remarks element as **SLP** being the remark identifier followed by the sea-level pressure in hectopascals (h/Pa), a unit of measurement equivalent to millibar (mb).

Example:
SLP982

REMARKS (RMK) (AS REQUIRED)

METAR KLAX 140651Z AUTO 00000KT 1SM R35L/4500V6000FT -RA BR BKN030 10/10 A2990
RMK AO2

Remarks will be included in all observations, when appropriate, in the order as presented in Table 2-6. The contraction **RMK** follows the altimeter in the body and precedes the actual remarks. Time entries will be shown as minutes past the hour if the time reported occurs during the same hour the observation is taken. If the hour is different, hours and minutes will be shown. Location of phenomena within 5 statute miles of the point of observation will be reported as at the station. Phenomena between 5 and 10 statute miles will be reported as in the vicinity, **VC**. Phenomena beyond 10 statute miles will be shown as distant, **DSNT**. Direction of phenomena will be indicated with the eight points of the compass (i.e., N, NE, E, SE, S, SW, W, NW). Distance remarks are in statute miles except for automated lightning remarks that are in nautical miles. Movement of clouds or weather will be indicated by the direction toward which the phenomenon is moving.

There are two categories of remarks: automated, manual, and plain language; and additive and automated maintenance data.

AUTOMATED, MANUAL, AND PLAIN LANGUAGE REMARKS CATEGORY

This group of remarks may be generated from either manual or automated weather reporting stations and generally elaborate on parameters reported in the body of the report. (See Table 2-6.)

Table 2-6 Automated, Manual, and Plain Language Remarks

Remarks	Examples of Remarks
1. Volcanic Eruptions	MT. AUGUSTINE VOLCANO 70 MILES SW ERUPTED 231505 LARGE ASH CLOUD EXTENDING TO APRX 30000 FEET MOVING NE
2. Tornado, Funnel Cloud, or Waterspout	TORNADO B13 6 NE
3. Automated Station Type	AO1 or AO2
4. Peak Wind	PK WND 28045/15
5. Windshift	WSHFT 30 FROPA
6. Tower Visibility or Surface Visibility	TWR VIS 1 ½ or SFC VIS 1 ½
7. Variable Prevailing Visibility	VIS 1/2V2
8. Sector Visibility	VIS NE 2 ½
9. Visibility at Second Site	VIS 2 ½ RWY 11
10. Lightning	OCNL LTGICCG OHD or FRQ LTGICCCCG W
11. Beginning and Ending of Precipitation	RAB05E30SNB20E55
12. Beginning and Ending of Thunderstorm	TSB05E30
13. Thunderstorm Locations	TS SE MOV NE
14. Hailstone Size	GR 1 ¾
15. Virga	VIRGA NE (See Figure 2-10.)
16. Variable Ceiling Height	CIG 005V010
17. Obscurations	FU BKN000
18. Variable Sky Condition	BKN014 V OVC
19. Significant Cloud Types	CB W MOV E or CBMAM S MOV E or TCU W or ACC NW or ACSL SW-W
20. Ceiling Height at Second Location	CIG 002 RWY 11
21. Pressure Rising or Falling Rapidly	PRESRR or PRESFR
22. Sea-Level Pressure	SLP982
23. Aircraft Mishap	(ACFT MSHP)
24. No SPECI Report Taken	NOSPECI
25. Snow Increasing Rapidly	SNINCR 2/10
26. Other Significant Information	Any other information that will impact aviation operations

FIGURE 2-10. Virga. Virga is precipitation falling from a cloud but evaporating before reaching the ground. Virga results when air below the cloud is very dry and is common in the western part of the country. Virga associated with showers suggests strong downdrafts with possible moderate or greater turbulence. (Photo courtesy of Grant Goodge.)

ADDITIVE AND AUTOMATED MAINTENANCE DATA REMARKS CATEGORY

Additive data groups are reported only at designated stations. The maintenance data groups are reported only from automated weather reporting stations. The additive data and maintenance groups are not used by the aviation community

EXAMPLES OF METAR REPORTS AND EXPLANATIONS:

METAR KMKL 021250Z 33018KT 290V360 1/2SM R31/2600FT SN BLSN FG VV008 00/M03 A2991 RMK RAESNB42 SLPNO T00111032

METAR	aviation routine weather report
KMKL	Jackson, TN
021250Z	date 02, time 1250 UTC
33018KT	wind 330 at 18 knots
290V360	wind direction variable between 290 and 360 degrees
1/2SM	visibility one-half statute mile
R31/2600FT	runway 31, RVR 2600
SN	moderate snow
BLSN FG	blowing snow and fog
VV008	indefinite ceiling 800
00/M03	temperature 0°C, dew point -3°C
A2991	altimeter 2991
RMK	remarks
RAESNB42	rain ended at four two, snow began at four two
SLPNO	sea-level pressure not available
T00111032	temperature 1.1°C, dew point -3.2°C

The following is an example of the phraseology used to relay this report to a pilot. Optional phrases or words are shown in parentheses.

"Jackson (Tennessee), (one two five zero observation), wind three three zero at one eight, wind variable between two niner zero and three six zero, visibility one-half, runway three one RVR, two thousand six hundred, heavy snow, blowing snow, fog, indefinite ceiling eight hundred, temperature zero, dew point minus three, altimeter two niner niner one."

METAR KSFO 031453Z VRB02KT 7SM MIFG SKC 15/14 A3012 RMK SLP993 6//// T01500139 56012

METAR	aviation routine weather report
KSFO	San Francisco, CA
031453Z	date 03, time 1453 UTC
VRB02KT	wind variable at 2 knots
7SM	visibility 7 statute miles
MIFG	shallow fog
SKC	clear
15/14	temperature 15°C, dew point 14°C
A3012	altimeter 3012
RMK	remarks
SLP993	sea-level pressure 999.3 hectopascals
6////	an indeterminable amount of precipitation has occurred over the last 3 hours
T01500139	temperature 15.0°C, dew point 13.9°C
56012	atmospheric pressure lower since previous 3 hours ago

The following is an example of the phraseology used to relay this report to a pilot. Optional phrases or words are shown in parentheses.

"San Francisco (one four five three observation), wind variable at two, visibility seven, shallow fog, clear, temperature one five, dew point one four, altimeter three zero one two."

SPECI KCVG 312228Z 28024G36KT 3/4SM +TSRA SQ BKN008 OVC020CB 28/23 A3000 RMK TSB24 TS OHD MOV E

SPECI	aviation selected special weather report
KCVG	Covington, KY
312228Z	date 31, time 2228 UTC
28024G36KT	wind 280 at 24, gusts 36 knots
3/4SM	visibility three-quarters statute mile
+TSRA SQ	thunderstorm with heavy rain and squalls
BKN008 OVC020CB	ceiling 800 broken, 2,000 overcast, cumulonimbus
28/23	temperature 28°C, dew point 23°C
A3000	altimeter 3000
RMK	remarks
TSB24	thunderstorm began at two four
TS OHD MOV E	thunderstorm overhead moving east

The following is an example of the phraseology used to relay this report to a pilot. Optional phrases or words are shown in parentheses.

"Covington (Kentucky), special report, two eight observation, wind two eight zero at two four, gusts three six, visibility three-quarters, thunderstorm, heavy rain, squall, ceiling eight hundred broken, two thousand overcast, cumulonimbus, temperature two eight, dew point two three, altimeter three zero zero zero, thunderstorm began two four, thunderstorm overhead, moving east."
More examples without phraseology:

METAR KLAX 140651Z AUTO 00000KT 10SM -RA SCT080 12/05 A2990 RMK AO2

METAR	aviation routine weather report
KLAX	Los Angeles, CA
140651Z	date 14, time 0651 UTC
AUTO	automated site
00000KT	calm winds
10SM	visibility 10 statute miles
-RA	light rain
SCT080	8,000 scattered
12/05	temperature 12°C, dew point 5°C
A2990	altimeter 2990
RMK	remarks
AO2	automated observation with precipitation discriminator

SPECI KDEN 241310Z 09014G35KT 1/4SM +SN FG VV002 01/01 A2975 RMK AO2 TWR VIS ½ RAE08SNB08

SPECI	aviation selected special weather report
KDEN	Denver, CO
241310Z	date 24, time 1310 UTC
09014G35KT	wind 090 at 14, gusts to 35 knots
1/4SM	visibility one-quarter statute mile
+SN FG	heavy snow and fog
VV002	indefinite ceiling 200
01/01	temperature 1°C, dew point 1°C
A2975	altimeter 2975
RMK	remarks
AO2	automated observation with precipitation discriminator
TWR VIS 1/2	tower visibility one-half
RAE08SNB08	rain ended and snow began at 08 minutes after the hour

METAR KSPS 301656Z 06014KT 020V090 3SM -TSRA FEW040 BKN060CB 12/ A2982 RMK OCNL LTGICCG NE TSB17 TS E MOV NE PRESRR SLP093

METAR	aviation routine weather report
KSPS	Wichita Falls, TX
301656Z	date 30, time 1656 UTC
06014KT 020V090	wind 060 at 14 knots varying between 020 and 090 degrees
3SM	visibility 3 statute miles
-TSRA	thunderstorm with light rain
FEW040 BKN060CB	few clouds at 4,000, ceiling 6,000 broken, cumulonimbus
12/	temperature 12°C (dew point is missing)
A2982	altimeter 2982
RMK	remarks
OCNL LTGICCG NE	occasional lightning in cloud, cloud-to-ground northeast
TSB17	thunderstorm began 17
TS E MOV NE	**t**hunderstorm east moving northeast
PRESRR	pressure rising rapidly
SLP093	sea-level pressure 1009.3 hectopascals

SPECI KBOS 051237Z VRB02KT 3/4SM R15R/4000FT BR OVC004 05/05 A2998 RMK AO2 CIG 002V006

SPECI	aviation selected special weather report
KBOS	Boston, MA
051237Z	date 5, time 1237 UTC
VRB02KT	variable wind at 2 knots
3/4SM	visibility three-quarters statute mile
R15R/4000FT	runway visual range on runway 15R 4,000 feet
BR	mist
OVC004	ceiling 400 overcast
05/05	temperature 5°C, dew point 5°C
A2998	altimeter 2998
RMK	remarks
AO2	automated observation with precipitation discriminator
CIG 002V006	ceiling variable 200 to 600

Section 3
PILOT AND RADAR REPORTS, SATELLITE PICTURES, AND RADIOSONDE ADDITIONAL DATA (RADATs)

The preceding section explained the decoding of METAR reports. However, these "spot" reports are only one facet of the total current weather picture. Pilot and radar reports, satellite pictures, and radiosonde additional data (RADATs) help to fill the gaps between stations.

PILOT WEATHER REPORTS (PIREPs)

No observation is more timely than the one made from the flight deck. In fact, aircraft in flight are the only means of observing icing and turbulence. Other pilots welcome pilot weather reports (PIREPs) as well as do the briefers and forecasters. A PIREP always helps someone and becomes part of aviation weather. Pilots should report any observation that may be of concern to other pilots. Also, if conditions were forecasted but were not encountered, a pilot should also provide a PIREP. This will help the NWS to verify forecast products and create accurate products for the aviation community. Pilots should help themselves, the aviation public, and the aviation weather forecasters by providing PIREPs.

A PIREP is transmitted in a prescribed format (see Table 3-1). Required elements for all PIREPs are type of report, location, time, flight level, aircraft type, and at least one weather element encountered. When not required, elements without reported data are omitted. All altitude references are mean sea level (MSL) unless otherwise noted. Distance for visibility is in statute miles and all other distances are in nautical miles. Time is in universal coordinated time (UTC).

Table 3-1 PIREP Format

PIREP Format	
UUA/UA	**Type of report**
OV	**Location**
TM	**Time**
FL	**Altitude/Flight level**
TP	**Aircraft type**
SK	**Sky cover**
WX	**Flight visibility and weather**
TA	**Temperature**
WV	**Wind**
TB	**Turbulence**
IC	**Icing**
RM	**Remarks**

Table 3-2 Encoding PIREPs

UUA/UA	**Type of report:** **URGENT (UUA) - Any PIREP that contains any of the following weather phenomena: tornadoes, funnel clouds, or waterspouts; severe or extreme turbulence, including clear air turbulence (CAT); severe icing; hail; volcanic ash: low-level wind shear (LLWS) (pilot reports air speed fluctuations of 10 knots or more within 2,000 feet of the surface); any other weather phenomena reported which are considered by the controller to be hazardous,** **or potentially hazardous, to flight operations.** **ROUTINE (UA) - Any PIREP that contains weather phenomena not listed above, including low-level wind shear reports with air speed fluctuations of less than 10 knots**.
/OV	**Location: Use VHF NAVAID(s) or an airport using the three- or four-letter location identifier. Position can be over a site, at some location relative to a site, or along a route. Ex: /OV ABC; /OV KFSM090025; /OV OKC045020-DFW; /OV KABR-KFSD**
/TM	**Time: Four digits in UTC. Ex: /TM 0915**
/FL	**Altitude/Flight level: Three digits for hundreds of feet with no space between FL and altitude. If not known, use UNKN. Ex: /FL095; /FL310; /FLUNKN**
/TP	**Aircraft type: Four digits maximum; if not known, use UNKN. Ex: /TP L329; /TP B737; /TP UNKN**
/SK	**Sky cover: Describes cloud amount, height of cloud bases, and height of cloud tops. If unknown, use UNKN. Ex: /SK SCT040-TOP080;** **/SK BKNUNKN-TOP075; /SK BKN-OVC050-TOPUNKN;** **/SK SCT030-TOP060/OVC120; /SK FEW030; /SK SKC**
/WX	**Flight visibility and weather: Flight visibility (FV) reported first in standard METAR weather symbols. Intensity (- for light, no qualifier for moderate, and + for heavy) shall be coded for all precipitation types except ice crystals and hail. Ex: /WX FV05SM -RA; /WX FV01SM SN BR; /WX RA**
/TA	**Temperature (Celsius): If below zero, prefix with an "M." Temperature shall also be reported if icing is reported. Ex: /TA 15; /TA M06**
/WV	**Wind: Direction from which the wind is blowing coded in tens of degrees using three digits. Directions of less than 100 degrees shall be preceded by a zero. The wind speed shall be entered as a two- or three-digit group immediately following the direction, coded in whole knots using the hundreds, tens, and units digits.** **Ex: /WV 27045KT; /WV 280110KT**
/TB	**Turbulence: Use standard contractions for intensity and type (CAT or CHOP when appropriate). Include altitude only if different from FL. (See Table 3-3.)** **Ex: /TB EXTRM; /TB OCNL LGT-MOD BLW 090;** **/TB MOD-SEV CHOP 080-110**
/IC	**Icing: Describe using standard intensity and type contractions. Include altitude only if different from FL. (See Table 3-4.) Ex: /IC LGT-MOD RIME; /IC SEV CLR 028-045**
/RM	**Remarks: Use free form to clarify the report putting hazardous elements first.** **Ex: /RM LLWS -15 KT SFC-030 DURC RWY22 JFK**

Icing and turbulence reports state intensities using standard terminology when possible. To lessen the chance of misinterpretation, report icing and turbulence in standard terminology. If a PIREP stated,

"...PRETTY ROUGH AT 6,500, SMOOTH AT 8,500 PA24...," there could be many interpretations of the strength of the turbulence at 6,500 feet. A report of "light," "moderate," or "severe" turbulence at 6,500 feet would have been more concise and understandable. If a pilot's description of an icing or turbulence encounter cannot readily be translated into standard terminology, the pilot's description should be transmitted verbatim.

TURBULENCE

The following table classifies each turbulence intensity according to its effect on aircraft control, structural integrity, and articles and occupants within the aircraft.

Pilots should report location(s), time (UTC), altitude, aircraft type, whether in or near clouds, intensity, and when applicable, type (CHOP/clear air turbulence [CAT]), and duration of turbulence. Duration may be based on the time the pilot is flying between two locations or over a single location.

High-level turbulence (normally above 15,000 feet AGL) that is not associated with cumuliform clouds (including thunderstorms) shall be reported as CAT.

Table 3-3 Turbulence Reporting Criteria

Intensity	Aircraft Reaction	Reaction Inside Aircraft
Light	**Turbulence that momentarily causes slight, erratic changes in altitude and/or attitude (pitch, roll, yaw). Report as light turbulence or light CAT.** **or** **Turbulence that causes slight, rapid and somewhat rhythmic bumpiness without appreciable changes in altitude or attitude. Report as light CHOP.**	**Occupants may feel a slight strain against belts or shoulder straps. Unsecured objects may be displaced slightly. Food service may be conducted and little or no difficulty is encountered in walking.**
Moderate	**Turbulence that causes changes in altitude and/or attitude occurs but the aircraft remains in positive control at all times. It usually causes variations in indicated airspeed. Report as moderate turbulence or moderate CAT.** **or** **Turbulence that is similar to light CHOP but of greater intensity. It causes rapid bumps or jolts without appreciable changes in aircraft or attitude. Report as moderate CHOP.**	**Occupants feel definite strains against seat belts or shoulder straps. Unsecured objects are dislodged. Food service and walking are difficult.**
Severe	**Turbulence that causes large, abrupt changes in altitude and/or attitude. It usually causes large variations in indicated airspeed. Aircraft may be momentarily out of control. Report as severe turbulence or severe CAT.**	**Occupants are forced violently against seat belts or shoulder straps. Unsecured objects are tossed about. Food service and walking are impossible.**
Extreme	**Turbulence in which the aircraft is violently tossed about and is practically impossible to control.** **It may cause structural damage.** **Report as extreme turbulence or extreme CAT.**	

ICING

The following table classifies each icing intensity according to its operational effects on aircraft.

Pilots should report location(s), time (UTC), altitude, aircraft type, temperature, and icing intensity and type (rime, clear, or mixed). Rime ice is rough, milky, opaque ice formed by the instantaneous freezing of small supercooled water droplets. Clear ice is a glossy, clear, or translucent ice formed by the relatively slow freezing of large supercooled water droplets. Mixed ice is a combination of rime and clear ice.

Table 3-4 Icing Intensities, Airframe Ice Accumulation, and Pilot Report

Intensity	Airframe Ice Accumulation	Pilot Report
Trace	**Ice becomes perceptible. Rate of accumulation slightly greater than rate of sublimation. It is not hazardous even though deicing/anti-icing equipment is not used unless encountered for an extended period of time (over 1 hour).**	**Location, time, altitude/FL, aircraft type, temperature, and icing intensity and type**
Light	**The rate of accumulation may create a problem if flight is prolonged in this environment (over 1 hour). Occasional use of deicing/anti-icing equipment removes/prevents accumulation. It does not present a problem if the deicing/anti-icing equipment is used.**	**Location, time, altitude/FL, aircraft type, temperature, and icing intensity and type**
Moderate	**The rate of accumulation is such that even short encounters become potentially hazardous and use of deicing/anti-icing equipment or diversion is necessary.**	**Location, time, altitude/FL, aircraft type, temperature, and icing intensity and type**
Severe	**The rate of accumulation is such that deicing/anti-icing equipment fails to reduce or control the hazard. Immediate diversion is necessary.**	**Location, time, altitude/FL, aircraft type, temperature, and icing intensity and type**

EXAMPLES AND EXPLANATIONS (REFER TO TABLE 3-2):

UUA /OV ORD/TM 1235/FLUNKN/TP B727/TB MOD/RM LLWS +/- 20KT BLW 003 DURD RWY27L

Urgent UA over Chicago O'Hare Airport, Chicago, IL, at 1235Z. Flight level is unknown but the information is from a Boeing 727. Turbulence was moderate and on descent to runway 27 left, low-level wind shear was detected below 300 feet. Airspeed fluctuations were plus and minus 20 knots.

UUA /OV ABQ090045/TM 1430/FL130/TP BE30/TB SEV/RM BROKE ALL THE BOTTLES IN THE BAR

An urgent UA 45 miles east of Albuquerque, NM, a pilot of a Beech King Air 300 reported severe turbulence at 13,000 feet. The pilot remarked the turbulence was so severe it broke all the bottles in the passenger cabin bar.

UA /OV KMRB-KPIT/TM 1600/FL100/TP BE55/SK BKN024-TOP032/BKN-OVC043-TOPUNKN /TA M12/IC LGT-MOD RIME 055-080

This PIREP is decoded as follows: UA, Martinsburg to Pittsburgh, Pennsylvania (PA), at 1600 UTC at 10,000 feet MSL. Type of aircraft is a Beechcraft Baron. First cloud layer is broken with a base at 2,400 feet MSL broken and tops at 3,200 feet MSL. The second cloud layer is broken to occasionally overcast with a base at 4,300 feet MSL, and tops unknown. Outside air temperature is -12 degrees Celsius. Light to moderate rime icing is reported between 5,500 and 8,000 feet MSL.

UA /OV KOKC090064/TM 1522/FL080/TP C172/SK SCT090-TOPUNKN/WX FV05SM HZ/TA M04/WV 24540KT/TB LGT/RM IN CLR.

This PIREP is decoded as follows: UA, 64 nautical miles east of Oklahoma City VOR at 1522 UTC, flight level 8,000 feet MSL. Type of aircraft is a Cessna 172. There is a scattered cloud layer with bases at 9,000 feet MSL and unknown tops. Flight visibility is restricted to 5 statute miles due to haze. Outside air temperature is -4 degrees Celsius, wind is 245 degrees at 40 knots, light turbulence, and the aircraft is in clear skies.

UA /OV KLIT-KFSM/TM 0310/FL100/TP BE36/SK SCT070-TOP110/TA M03/WV 25015KT.

This PIREP is decoded as follows: UA between Little Rock and Fort Smith, Arkansas (AR), at 0310 UTC. A Beech 36 is at 10,000 feet MSL. There is a scattered cloud layer with bases at 7,000 feet MSL, and tops at 11,000 feet MSL. The outside air temperature is -3 degrees Celsius. Winds are from 250 degrees at 15 knots.

UA /OV KABQ/TM 1845/RM TIJERAS PASS CLSD DUE TO FG AND LOW CLDS UNA VFR RTN ABQ.

The PIREP is over Albuquerque at 1845 UTC. The remark section indicates the Tijeras pass is closed due to fog and low clouds. The pilot also mentions that she/he could not continue VFR and returned to Albuquerque.

UA /OV KTOL/TM 2200/FL310/TP B737/TB MOD CAT 350-390.

This PIREP is decoded as follows: UA over Toledo, Ohio, at 2200 UTC and flight level 310, a Boeing 737 reported moderate clear air turbulence between 35,000 and 39,000 feet MSL.

Nonmeteorological PIREPs sometimes help air traffic controllers. This “plain language” report stated:

…/RM 3N PNS LARGE FLOCK OF BIRDS HDG GEN N MAY BE SEAGULLS FRMN …

This PIREP alerted pilots and controllers to a bird hazard.

RADAR WEATHER REPORT (SD)

General areas of precipitation, including rain, snow, and thunderstorms, can be observed by radar. The radar weather report (SD) includes the type, intensity, and location of the echo top of the precipitation. (The intensity trend of precipitation is no longer coded on the SD.) It is important to remember that all heights are reported above MSL. Table 3-5 explains symbols denoting intensity. Radar stations report each hour at H+35.

Example of an SD:

TLX 1935	LN	8	TRW++	86/40 164/60	20W	C2425	MTS 570 AT 159/65	AUTO
a.	**b.**	**c.**	**d.**	**e.**	**f.**	**g.**	**h.**	**i.**

^MO1 NO2 ON3 PM34 QM3 RL2 =
j.

Above SD report decoded as follows:

a. Location identifier and time of radar observation (Oklahoma City SD at 1935 UTC).
b. Echo pattern (LN in this example). The echo pattern or configuration may be one of the following:
    1. Line (LN) is a line of convective echoes with precipitation intensities that are heavy or greater, at least 30 miles long, at least 4 times as long as it is wide, and at least 25% coverage within the line.
    2. Area (AREA) is a group of echoes of similar type and not classified as a line.
    3. Cell (CELL) is a single isolated convective echo such as a rain shower.
c. Coverage, in tenths, of precipitation in the defined area (8/10 in this example).
d. Type and intensity of weather (thunderstorm [T] with very heavy rainshowers [RW++]).

Table 3-5 Precipitation Intensity

Symbol	Intensity
-	Light
(none)	Moderate
+	Heavy
++	Very Heavy
X	Intense
XX	Extreme

Table 3-6 Symbols Used in SD

Symbol	Meaning
R	Rain
RW	Rain shower
S	Snow
SW	Snow shower
T	Thunderstorm

Example of an SD:

TLX 1935 LN 8 TRW++ 86/40 164/60 20W C2425 MTS 570 AT 159/65 AUTO
a. b. c. d. e. f. g. h. i.

^MO1 NO2 ON3 PM34 QM3 RL2 =
j.

e. Azimuth, referenced to true north, and range, in nautical miles (NM) from the radar site, of points defining the echo pattern (86/40 164/60 in this echo). For lines and areas, there will be two azimuth and range sets that define the pattern. For cells, there will be only one azimuth and range set. (See the examples that follow for elaboration of echo patterns.)
f. Dimension of echo pattern (20 NM wide in this example). The dimension of an echo pattern is given when azimuth and range define only the center line of the pattern. (In this example, "20W" means the line has a total width of 20 NM, 10 miles either side of a center line drawn from the points given in item "e" above.)
g. Cell movement (cells within line moving from 240 degrees at 25 knots in this example). Movement is only coded for cells; it will not be coded for lines or areas.
h. Maximum top and location (57,000 feet MSL on radial 159 degrees at 65 NM in this example). Maximum tops may be coded with the symbols "MT" or "MTS." If it is coded with "MTS" it means that satellite data as well as radar information was used to measure the top of the precipitation.
i. The report is automated from WSR-88D weather radar data.
j. Digital section is used for preparing radar summary chart.

To aid in interpreting SDs, the five following examples are decoded into plain language.

GRB 1135 AREA 4TRW+ 9/100 130/75 50W C2425 MT 310 at 45/47 AUTO

Green Bay, WI, Automated SD at 1135 UTC. An area of echoes, 4/10 coverage, containing thunderstorms and heavy rain showers. Area is defined by points (referenced from GRB radar site) at 9 degrees, 100 NM and 130 degrees, 75 NM. These points, plotted on a map and connected with a straight line, define the center line of the echo pattern. The width of the area is 50 NM; i.e., 25 NM either side of the center line. The cells are moving from 240 degrees at 25 knots. Maximum top is 31,000 feet MSL located at 45 degrees and 47 NM from GRB.

ICT 1935 LN 9TRWX 275/80 210/90 20W C2430 MTS 440 AT 260/48 AUTO

Wichita, KS, Automated SD at 1935 UTC. A line of echoes, 9/10 coverage, containing thunderstorm with intense rain showers. The center of the line extends from 275 degrees, 80 NM to 210 degrees, 90 NM. The line is 20 NM wide. NOTE: To display graphically, plot the center points on a map and connect the points with a straight line; then plot the width. Since the thunderstorm line is 20 miles wide, it extends 10 miles either side of your plotted line. The thunderstorm cells are moving from 240 degrees at 30 knots. The maximum top is 44,000 feet MSL at 260 degrees, 48 NM from ICT.

GGW 1135 AREA 3S- 90/120 150/80 34W MT 100 at 130/49

Glasgow, MT, Automated SD at 1135 UTC. An area, 3/10 coverage, of light snow. The area's centerline extends from points at 90 degrees, 120 NM to 150 degrees, 80 NM. The area is 34 NM wide. No movement was reported. The maximum top is 10,000 feet MSL, at 130 degrees, 49 NM.

MAF 1135 AREA 2TRW++6R- 67/130 308/45 105W C2240 MT 380 AT 66/54

Midland/Odessa, TX, Automated SD at 1135 UTC. An area of echoes, total coverage 8/10, with 2/10 of thunderstorms with very heavy rainshowers and 6/10 coverage of light rain. (This suggests that the thunderstorms are embedded in an area of light rain.) The area lies 52½ miles either side of the line defined by the two points, 67 degrees, 130 NM and 308 degrees, 45 NM.

When an SD is transmitted but does not contain any encoded weather observation, a contraction is sent which indicates the operational status of the radar.

Example:
TLX 1135 PPINE AUTO

It is decoded as Oklahoma City, OK's, radar at 1135 UTC detects no echoes.

Table 3-7 Operational Status Contractions

Contraction	Operational Status
PPINE	**Radar is operating normally but there are no echoes being detected.**
PPINA	**Radar observation is not available.**
PPIOM	**Radar is inoperative or out of service.**
AUTO	**Automated radar report from WSR-88D.**

All SDs also contain groups of digits.

Example:
^MO1 NO1 ON3 PM34 QM3 RL2 SL1=

These groups of digits are the final entry on the SD. This digitized radar information is used primarily in preparing the radar summary chart. However, by using a proper grid overlay chart for the corresponding radar site, this code is also useful in determining more precisely where the precipitation is occurring within an area as well as the intensity of the precipitation. (See Figure 3-1 for an example of a digital code plotted from the Oklahoma City, OK, SD.)

The digit assigned to a box represents the intensity of precipitation as determined by the WSR-88D and is the maximum precipitation intensity found within the grid box. (See Table 7-2 for definitions of precipitation intensities associated with digits 1 through 6.) These digits were once commonly referred to as VIP levels because precipitation intensity, and therefore the digits, was derived using a video integrator processor (VIP). Since the WSR-88D and not the video integrator processor is now used to determine precipitation intensity, it is suggested that the term VIP should no longer be used when describing precipitation intensity. For example, if a specific grid has the number 2 associated with it, that grid would be described as having moderate precipitation, not VIP level 2 precipitation.

A box is identified by two letters, the first representing the row in which the box is found and the second letter representing the column. For example "MO1" identifies the box located in row M and column O as containing light precipitation. A code of "MO1234" indicates precipitation in four consecutive boxes in the same row. Working from left to right box MO = 1, box MP = 2, MQ = 3 and box MR = 4.

When using hourly SDs in preflight planning, note the location and coverage of echoes, the type of weather reported, the intensity, and especially the direction of movement.

It is important to remember that the SD contains information pertaining to the location of particles in the atmosphere that are of precipitation size or larger. It does not display locations of cloud-size particles, and, therefore, neither ceilings nor restrictions to visibility. An area may be blanketed with fog or low stratus, but the SD would not include information about it. Pilots should use SDs along with METARs, satellite photos, and forecasts when planning a flight.

The SDs help pilots plan ahead to avoid thunderstorm areas. Once airborne, however, pilots must depend on contact with Flight Watch, which has the capability to display current radar images, airborne radar, or visual sighting to evade individual storms.

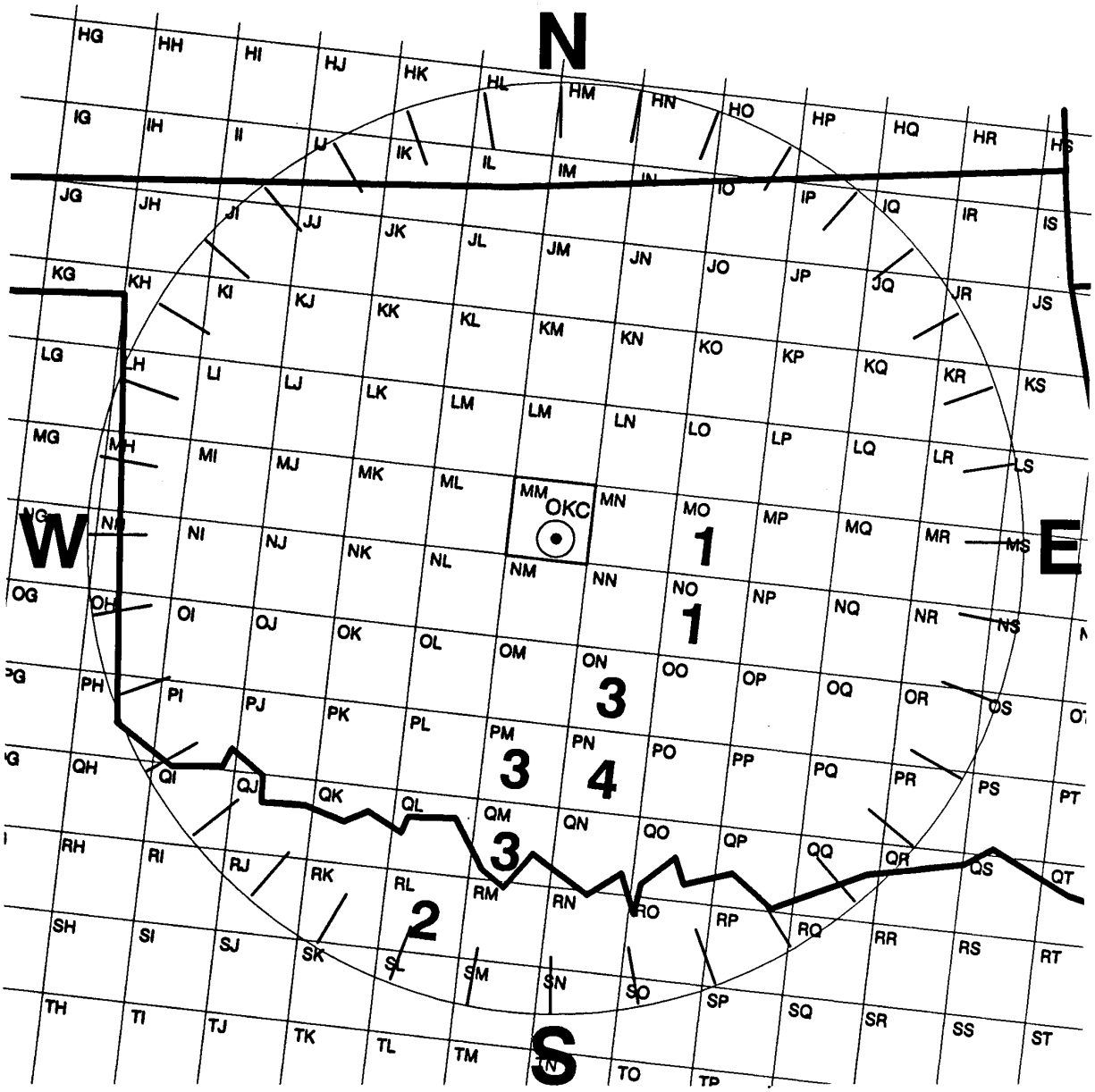


Figure 3-1. Digital Radar Report Plotted on a PPI Grid Overlay Chart.
(Note: See Table 7-2 for Intensity Level Codes 1 through 6.)

SATELLITE WEATHER PICTURES

Prior to weather satellites, weather observations were made only at distinct points within the atmosphere and supplemented by PIREPs. These PIREPs gave a "sense" of weather as viewed from above. However, with the advent of weather satellites, a whole new dimension to weather observing and reporting has emerged. There are two types of weather satellites in use by the U. S. today: Geostationary Operational Environmental Satellite (GOES), which is a geostationary satellite, and the Polar Orbiter Environmental Satellite (POES). Additional satellite imagery is available from the European Meteosat and the Japanese GMS geostationary satellites.

Two U.S. GOES satellites are used for imaging. One is stationed over the equator at 75 degrees west longitude and is referred to as GOES EAST since it covers the eastern U.S. The other is positioned at 135 degrees west longitude and is referred to as GOES WEST since it covers the western U.S. Together they cover North and South America and surrounding waters. They normally transmit an image of Earth, pole to pole, every 15 minutes. When disastrous weather threatens the U.S., the satellites can scan small areas rapidly so that a picture can be received as often as every 1 minute. Data from these rapid scans are used at NWS offices.

Since the GOES satellite is stationary over the equator, the images poleward of about 50 degrees latitude become greatly distorted. For images above 50 degrees latitude, polar orbiting satellites are employed. The NOAA satellite is a polar orbiter and orbits the earth on a track that nearly crosses the North and South poles. A high resolution picture is produced about 500 miles either side of its track on the journey from pole to pole. The NOAA pictures are essential to weather personnel in Alaska and Canada.

Two types of imagery are available from satellites, and, when combined, give a great deal of information about clouds. Through interpretation, the analyst can determine the type of cloud, the temperature of cloud tops (from this, the approximate height of the cloud can be determined), and the thickness of cloud layers. From this information, the analyst gets a good idea of the associated weather.

One type of imagery is visible (Figure 3-2). A visible image shows clouds and Earth reflecting sunlight to the satellite sensor. The greater the reflected sunlight reaching the sensor, the whiter the object is on the picture. The amount of reflectivity reaching the sensor depends upon the height, thickness, and ability of the object to reflect sunlight. Since clouds are much more reflective than most of the Earth, clouds will usually show up white on the picture, especially thick clouds. Thus, the visible picture is primarily used to determine the presence of clouds and the type of cloud from shape and texture. Due to the obvious lack of sunlight, there are no visible images available at night.

The second type of imagery is infrared (IR) (Figure 3-3). An IR picture shows heat radiation being emitted by clouds and Earth. The images show temperature differences between cloud tops and the ground, as well as temperature gradations of cloud tops and along the Earth's surface. Ordinarily, cold temperatures are displayed as light gray or white. High clouds appear the whitest. However, various computer-generated enhancements are sometimes used to sharply illustrate important temperature contrasts. IR images measure cloud top temperatures and are used to approximate the height of clouds. From this, one can see the importance of using visible and IR imagery together when interpreting clouds. IR images are available both day and night.

Satellite images are processed by the NWS as well as by many private companies. Therefore, they can be received from many different sources. Depending upon the source, satellite images may be updated anywhere from every 15 minutes to every hour; therefore, it is important to note the time on the images when interpreting them. By viewing satellite images, the development and dissipation of weather can be seen and followed over the entire country and coastal regions.

NESDIS is developing the capability to provide derived products useful to aviation from satellite data. These experimental products are available via the Internet and include:

1. Fog and low cloud coverage and depth.
2. Volcanic ash detection.
3. Microburst products.
4. Soundings.
5. Clear air turbulence.
6. Aircraft icing potential.

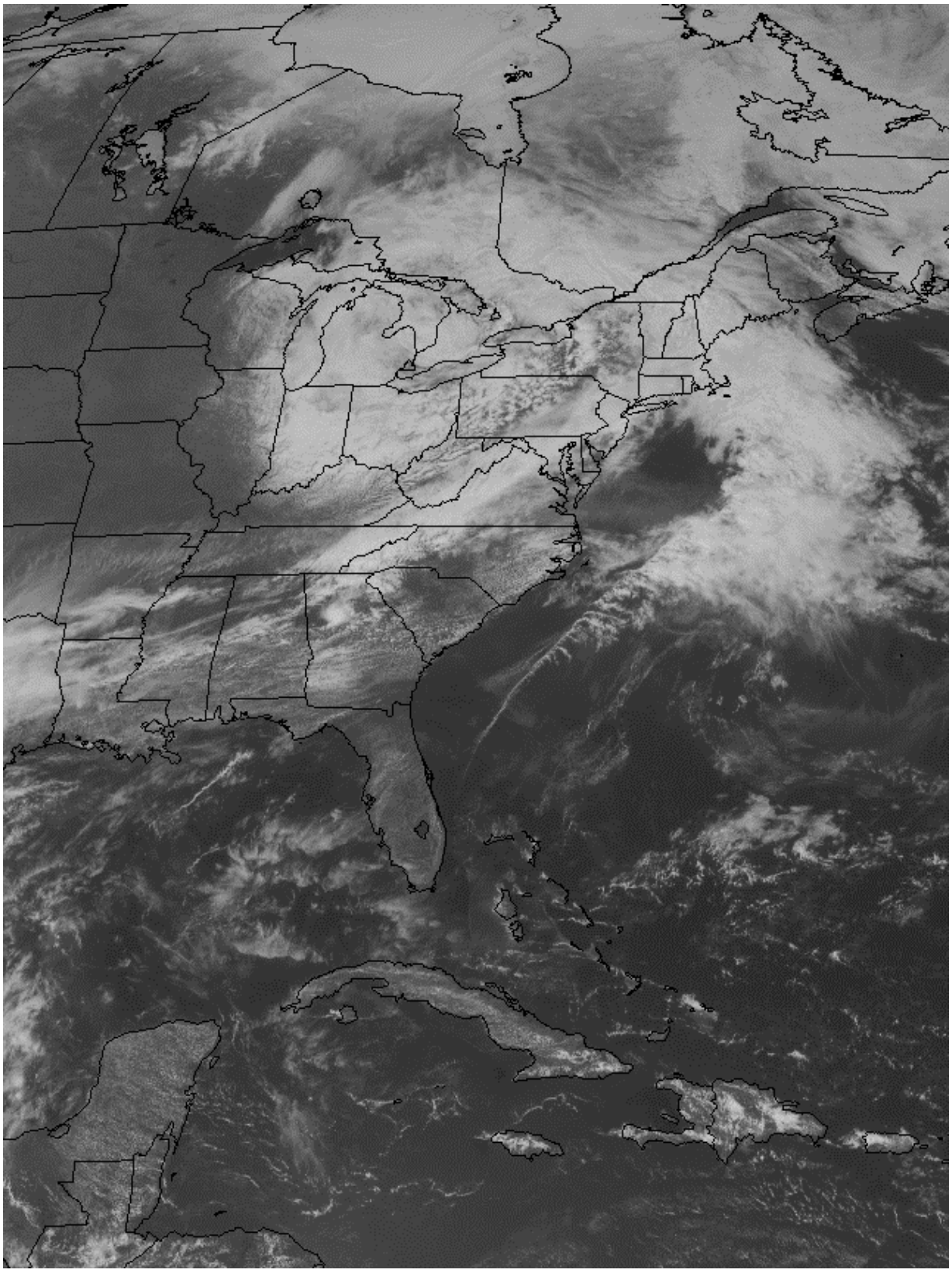


Figure 3-2. Visible Satellite Imagery.

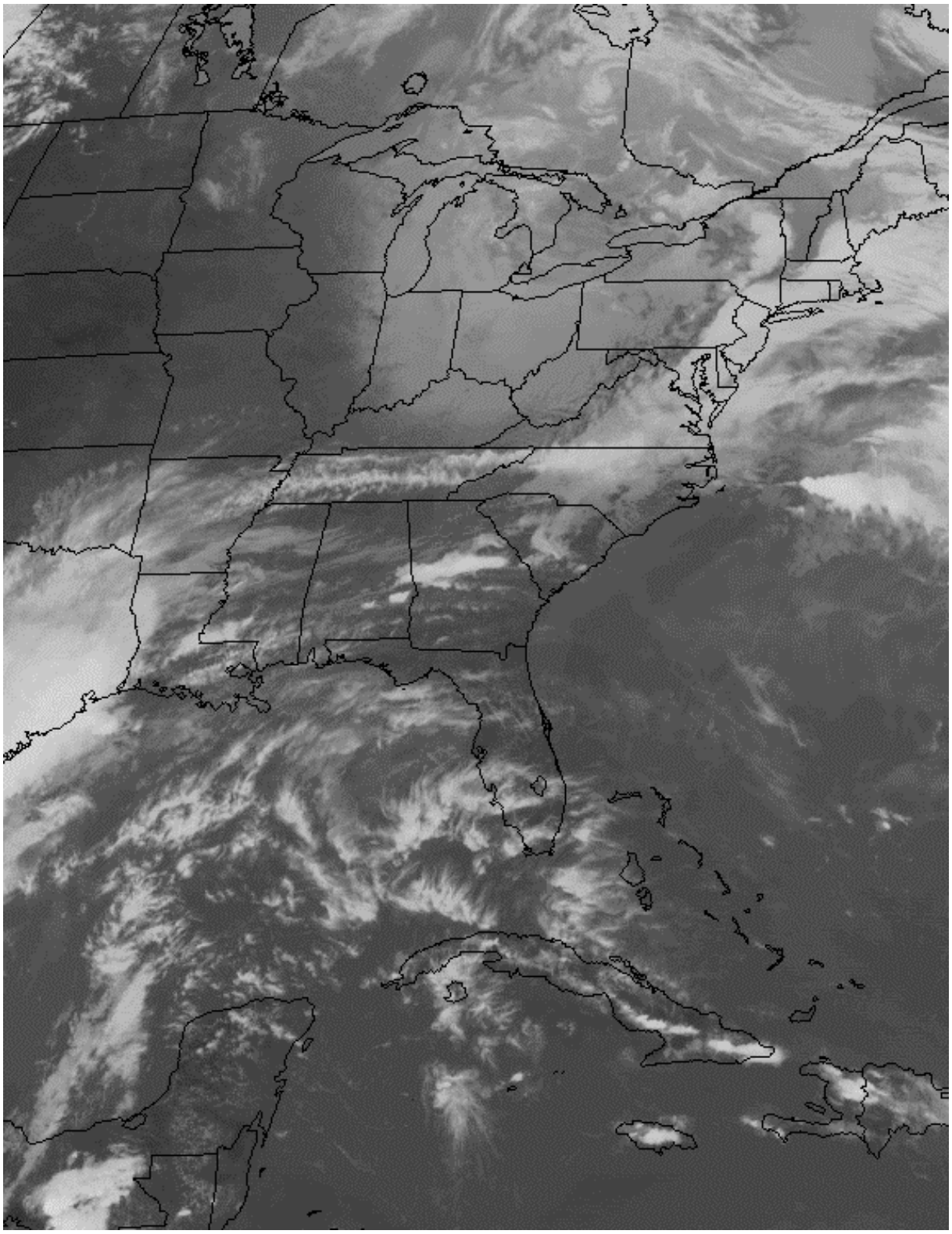


Figure 3-3. Infrared Satellite Imagery.

RADIOSONDE ADDITIONAL DATA (RADATs)

Radiosonde Additional Data (RADATs) information is obtained from the radiosonde observations that are conducted twice a day at 00 and 12Z. The information contained in a RADAT is the observed freezing level and the relative humidity associated with the freezing level. The freezing level is the height above MSL at which the temperature is zero degrees Celsius.

The format associated with the RADAT is as follows:
Stn ID Time RADAT UU (D) (hhh)(hhh)(hhh)(/n)

Explanation:
Stn ID and Time - standard three-letter identifier and observation time in UTC.

RADAT - a contraction identifying the data as "freezing-level data."

UU - relative humidity at the freezing level in percent. When more than one level is identified, "UU" is the highest relative humidity observed at any of the levels transmitted.

(D) - a coded letter "L," "M," or "H." used in the event of multiple freezing levels to identify which level has the highest relative humidity, "L – lowest," "M – middle," "H – highest." This letter is omitted when only one level is coded.

(hhh) – height of the freezing level in hundreds of feet. Up to three freezing levels can be specified in the event of multiple freezing levels. If there are more than three freezing levels, the levels coded are the lowest, highest, and the intermediate level with the highest relative humidity.

(/n) – an indicator to show the number of freezing levels in addition to the three which are coded. The number is omitted when all observed freezing levels are coded (three or less.)

Examples:
SJU 1200 RADAT 87160
The San Juan, Puerto Rico, RADAT indicates that the freezing level was 16,000 feet MSL and the relative humidity was 87% at the freezing level.

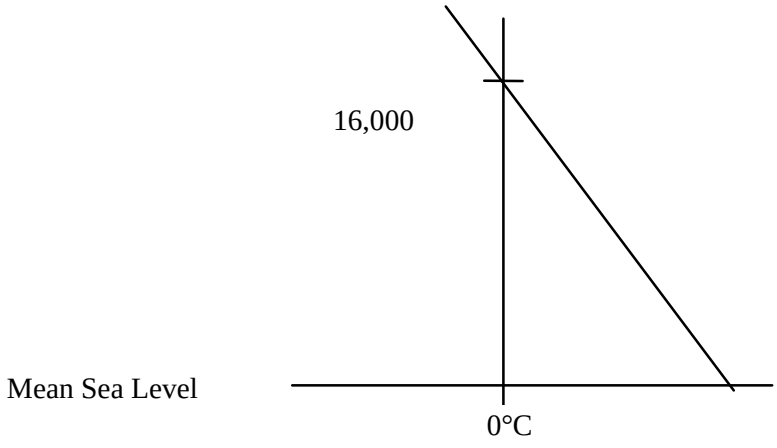


Figure 3-4. SJU RADAT.

OUN 0000 RADAT 87L024105

The Norman, Oklahoma, RADAT indicates that the freezing level was crossed twice. The two crossings occurred at 2,400 feet MSL and at 10,500 feet MSL. The 87L indicates that the relative humidity was 87% at the lowest crossing (indicated by the L).

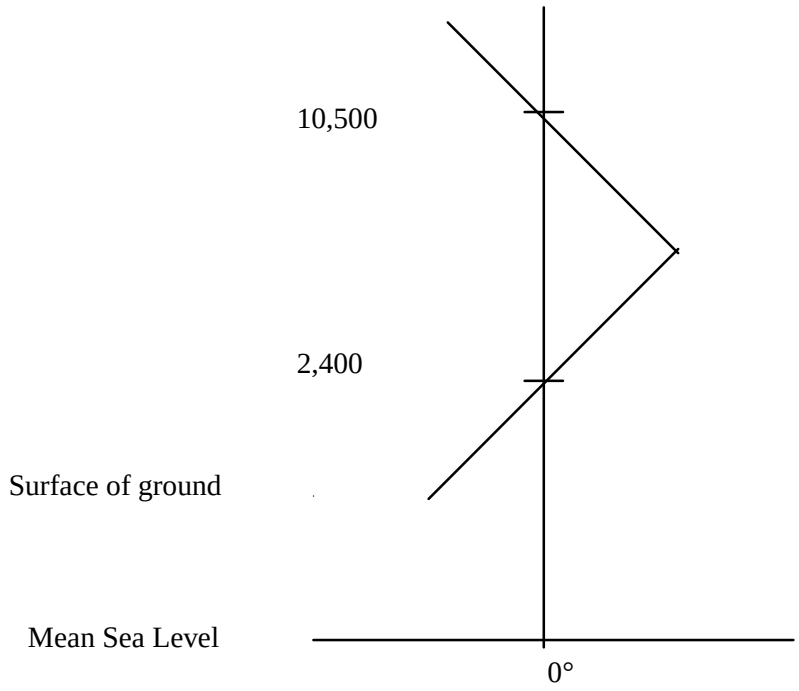


Figure 3-5. OUN RADAT.

ALB 1200 RADAT 84M019045051

The Albany, New York, RADAT indicates three crossings of the freezing level. The three crossings of the zero-degree Celsius isotherm occurred at 1,900 feet MSL, 4,500 feet MSL, and at 5,100 feet MSL. The relative humidity was 84% at the middle crossing which was 4,500 feet MSL.

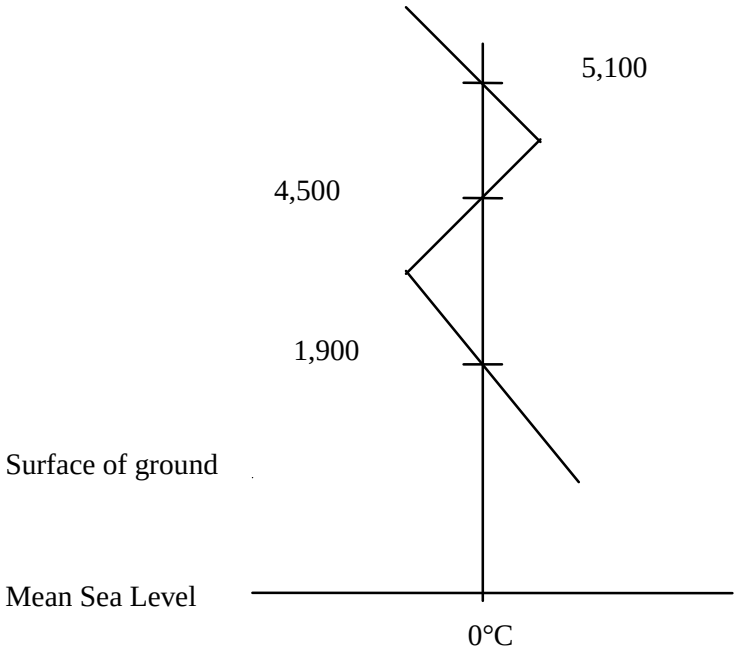


Figure 3-6. ALB RADAT.

DNR 1200 RADAT ZERO

The Denver, Colorado, RADAT indicates that the entire RADAT information was below zero degrees Celsius.

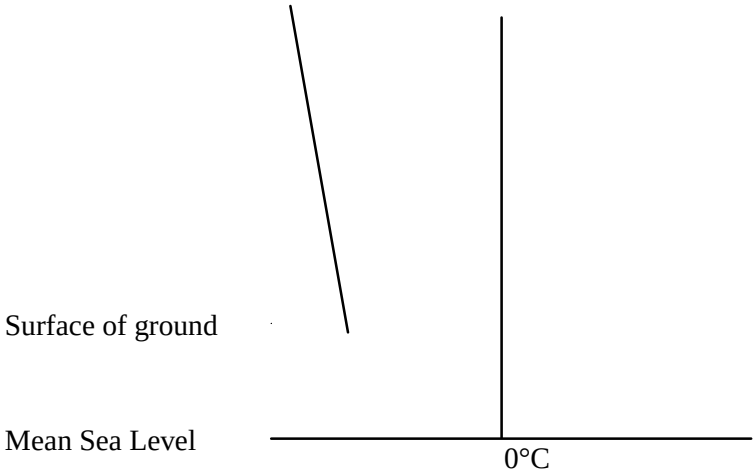


Figure 3-7. DEN RADAT.

ABR 0000 RADAT MISG
The Aberdeen, South Dakota, RADAT was terminated before the first crossing of the zero-degree Celsius isotherm. All temperatures were above freezing.

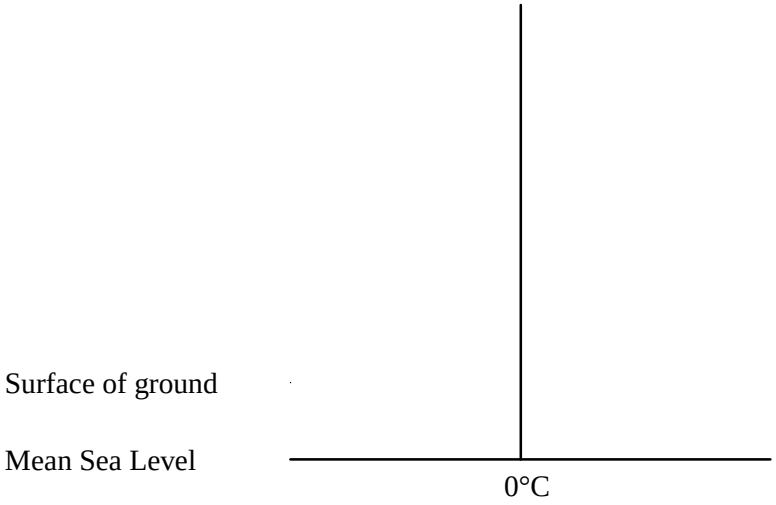


Figure 3-8. ABR RADAT.

Section 4
AVIATION WEATHER FORECASTS

Good flight planning involves considering all available weather information, including weather forecasts. This section explains the following aviation forecasts:

1. Aviation Terminal Forecast (TAF)
2. Aviation Area Forecast (FA)
3. Inflight Aviation Weather Advisories
4. Alaska, Gulf of Mexico, and International Area Forecasts (FAs)
5. Transcribed Weather Broadcasts (TWEB) Text Products
6. Winds and Temperatures Aloft Forecast (FD)
7. Center Weather Service Unit (CWSU) Products

Also discussed are the following general forecasts that may aid in flight planning:

1. Hurricane Advisory (WH)
2. Convective Outlook (AC)
3. Severe Weather Watch Bulletins (WW) and Alert Messages (AWW)

AVIATION TERMINAL FORECAST (TAF)

An Aviation Terminal Forecast (TAF) is a concise statement of the expected meteorological conditions within a 5-statute-mile radius from the center of an airport's runway complex during a 24-hour time period.

The TAFs use the same weather code found in METAR weather reports. Detailed explanations of the code are found only in Section 2.

The National Weather Service (NWS) requires an airport to have two consecutive METAR observations, not less than 30 minutes apart nor more than 1 hour apart, before a TAF will be issued. After the TAF has been issued, the forecaster will use all available weather data sources to maintain the TAF. If during this time a METAR is missing or part of the METAR is missing, the forecaster can use other weather sources to obtain the necessary data to maintain the TAF. However, if the forecaster feels that the other weather sources cannot provide the necessary information, the forecaster will discontinue the TAF.

A TAF contains the following elements in the order listed:

1. Type of report
2. ICAO station identifier
3. Date and time of origin
4. Valid period date and time
5. Wind forecast
6. Visibility forecast
7. Significant weather forecast
8. Sky condition forecast
9. Nonconvective low-level wind shear forecast (optional data)
10. Forecast change indicators
11. Probability forecast

International and U.S. military TAFs also contain forecasts of maximum and minimum temperature, icing, and turbulence. These three elements are not included in NWS-prepared TAFs. For forecast icing and turbulence, see page 4-23, Inflight Aviation Weather Advisories.

The following paragraphs describe the elements in a TAF report. A sample report will accompany each element with the subject element in bold letters.

TYPE OF REPORT

TAF
KPIR 111140Z 111212 13012KT P6SM BKN100 WS020/35035KT TEMPO 1214 5SM BR
FM1500 16015G25KT P6SM SCT040 BKN250
FM0000 14012KT P6SM BKN080 OVC150 PROB40 0004 3SM TSRA BKN030CB
FM0400 14008KT P6SM SCT040 OVC080 TEMPO 0408 3SM TSRA OVC030CB
BECMG 0810 32007KT=

The report type header will always appear as the first element in the TAF. There are two types of TAF reports: a routine forecast, **TAF**; and an amended forecast, **TAF AMD**. An amended TAF is issued when the forecaster feels the TAF is not representative of the current or expected weather conditions. An equal sign at the end of the TAF signifies the end of the report.

ICAO STATION IDENTIFIER

TAF
KPIR 111140Z 111212 13012KT P6SM BKN100 WS020/35035KT TEMPO 1214 5SM BR
FM1500 16015G25KT P6SM SCT040 BKN250
FM0000 14012KT P6SM BKN080 OVC150 PROB40 0004 3SM TSRA BKN030CB
FM0400 14008KT P6SM SCT040 OVC080 TEMPO 0408 3SM TSRA OVC030CB
BECMG 0810 32007KT=

The TAF code uses ICAO four-letter location identifiers as described in Section 2. TAF locations are in Figures 4-1, 4-2, 4-3, and 4-4 located on pages 4-13 through 4-16.

DATE AND TIME OF ORIGIN

TAF
KPIR **111140Z** 111212 13012KT P6SM BKN100 WS020/35035KT TEMPO 1214 5SM BR
FM1500 16015G25KT P6SM SCT040 BKN250
FM0000 14012KT P6SM BKN080 OVC150 PROB40 0004 3SM TSRA BKN030CB
FM0400 14008KT P6SM SCT040 OVC080 TEMPO 0408 3SM TSRA OVC030CB
BECMG 0810 32007KT=

This element is the date and universal coordinated time (UTC) the forecast is actually prepared. The format is a two-digit date and four-digit time followed without a space by the letter **Z**. Routine TAFs are prepared and filed approximately one-half hour prior to scheduled issuance times.

Examples:
111140Z Forecast prepared on the eleventh day of the month at 1140Z.
050530Z Forecast prepared on the fifth day of the month at 0530Z.

VALID PERIOD DATE AND TIME

TAF
KPIR 111140Z **111212** 13012KT P6SM BKN100 WS020/35035KT TEMPO 1214 5SM BR
FM1500 16015G25KT P6SM SCT040 BKN250
FM0000 14012KT P6SM BKN080 OVC150 PROB40 0004 3SM TSRA BKN030CB
FM0400 14008KT P6SM SCT040 OVC080 TEMPO 0408 3SM TSRA OVC030CB
BECMG 0810 32007KT=

The valid period of the forecast is a two-digit date followed by the two-digit beginning and two-digit ending hours in UTC. Routine TAFs are valid for 24 hours and are issued four times daily at 0000Z, 0600Z, 1200Z, and 1800Z. All ending times throughout the TAF of 00Z are indicated by the number 24.

Examples:
111212 Forecast valid from the eleventh at 12Z to the twelfth at 12Z.
300024 Forecast valid from the thirtieth at 00Z to the first at 00Z.

Amended, canceled, or delayed forecasts may have valid periods less than 24 hours.

Examples:
231512 Forecast valid from the twenty-third at 15Z to the twenty-fourth at 12Z.
091006 Forecast valid from the ninth at 10Z to the tenth at 06Z.

For airports with less than 24-hour observational coverage for which part-time terminal forecasts are provided, the TAF will be valid until the end of the scheduled forecast even if the observations have ceased before that time. **AMD NOT SKED** (amendment not scheduled) or **NIL AMD** (no amendment) will be issued after the forecast information. **AMD NOT SKED AFT (closing time)Z** (amendment not scheduled after [closing time]Z) will be used if the times of the observations are known and judged reliable. During the time the station is closed and a TAF is issued, there will be no forecast as indicated by **NIL** (no TAF) after the valid date and time group. Only after two METARs observations have been disseminated will a TAF be issued. **AMD LTD TO CLD VIS AND WIND** (amendment limited to clouds, visibility, and wind) is used at observation sites that have part-time manual augmentation. This remark means that there will be amendments only for clouds, visibility, and wind. There will be no amendments for thunderstorms or freezing/frozen precipitation.

WIND FORECAST

TAF
KPIR 111140Z 111212 **13012KT** P6SM BKN100 WS020/35035KT TEMPO 1214 5SM BR
FM1500 16015G25KT P6SM SCT040 BKN250
FM0000 14012KT P6SM BKN080 OVC150 PROB40 0004 3SM TSRA BKN030CB
FM0400 14008KT P6SM SCT040 OVC080 TEMPO 0408 3SM TSRA OVC030CB
BECMG 0810 32007KT=

The surface wind forecast is the wind direction in degrees from true north (first three digits) and mean speed in knots (last two or three digits if 100 knots or greater). The contraction, **KT**, denotes the units of wind speed in knots. Wind gusts are noted by the letter **G** appended to the mean wind speed followed by the highest expected gust (two or three digits if 100 knots or greater). Calm winds are encoded as **00000KT**. A variable wind is encoded as **VRB** when wind direction fluctuates due to convective activity or low wind speeds (3 knots or less).

Examples:
13012KT, 18010KT, 35012G26KT, or VRB16G28KT

VISIBILITY FORECAST

TAF
KPIR 111140Z 111212 13012KT **P6SM** BKN100 WS020/35035KT TEMPO 1214 5SM BR
FM1500 16015G25KT P6SM SCT040 BKN250
FM0000 14012KT P6SM BKN080 OVC150 PROB40 0004 3SM TSRA BKN030CB
FM0400 14008KT P6SM SCT040 OVC080 TEMPO 0408 3SM TSRA OVC030CB
BECMG 0810 32007KT=

The prevailing visibility is forecasted in whole and fractions of statute miles followed by **SM** to note the units of measurement. Statute miles followed by fractions of statute miles are separated with a space; for example, 1 1/2SM. Forecasted visibility greater than 6 statute miles is indicated by coding **P6SM**. If prevailing visibility is 6 statute miles or less, one or more weather phenomena must be included in the significant weather forecast. If volcanic ash is forecasted, the visibility must also be forecasted even if the visibility is greater than 6 statute miles. Sector or variable visibility is not forecasted.

Examples:
1/2SM, 2 1/4SM, 5SM, or P6SM

SIGNIFICANT WEATHER FORECAST

TAF
KPIR 111140Z 111212 13012KT P6SM BKN100 WS020/35035KT TEMPO 1214 5SM BR
FM1500 16015G25KT P6SM SCT040 BKN250
FM0000 14012KT P6SM BKN080 OVC150 PROB40 0004 3SM **TSRA** BKN030CB
FM0400 14008KT P6SM SCT040 OVC080 TEMPO 0408 3SM TSRA OVC030CB
BECMG 0810 32007KT=

The expected weather phenomenon or phenomena are coded in TAF reports using the same format, qualifiers, and phenomena contractions as METAR reports (except UP). (See Section 2.)

Obscurations to vision will be forecasted whenever the prevailing visibility is forecasted to be 6 statute miles or less. Precipitation and volcanic ash will always be included in the TAF regardless of the visibility forecasted.

Examples:
FM2200 18005KT 1SM BR SKC
FM0100 12010KT P6SM -RA BKN020
FM1500 22015KT P6SM VA SCT100

If no significant weather is expected to occur during a specific time period in the forecast, the weather group is omitted for that time period. However, if after a time period in which significant weather has been forecasted, a change to a forecast of "no significant weather" occurs, the contraction **NSW** (no significant weather) will appear as the weather included in BECMG or TEMPO groups. NSW will not be used in the initial time period of a TAF or in FM groups.

Example:
FM0600 16010KT 3SM RA BKN030 BECMG 0810 P6SM NSW

If the forecaster determines that in the vicinity of the airport there could be weather that impacts aviation, the forecaster will include those conditions after the weather group. The letters **VC** describe conditions that will occur within the vicinity of an airport (5-10 SM) and will be used only with fog, showers, or thunderstorms (FG, SH, or TS).

Examples:
P6SM VCFG - fog in the vicinity.
5SM BR VCSH - showers in the vicinity .
P6SM VCTS - thunderstorms in the vicinity.

SKY CONDITION FORECAST

TAF
KPIR 111140Z 111212 13012KT P6SM **BKN100** WS020/35035KT TEMPO 1214 5SM BR
FM1500 16015G25KT P6SM SCT040 BKN250
FM0000 14012KT P6SM BKN080 OVC150 PROB40 0004 3SM TSRA BKN030CB
FM0400 14008KT P6SM SCT040 OVC080 TEMPO 0408 3SM TSRA OVC030CB
BECMG 0810 32007KT=

TAF sky condition forecasts use the METAR format described in Section 2. Cumulonimbus clouds (**CB**) are the only cloud type forecasted in TAFs.

Examples:
BKN100, SCT040 BKN030CB, or FEW008 BKN015

When the sky is obscured due to a surface-based phenomenon, vertical visibility (**VV**) into the obscuration is forecasted. The format for vertical visibility is **VV** followed by a three-digit height in hundreds of feet. Partial obscurations are not forecasted. Remember a ceiling is the lowest broken or overcast layer or vertical visibility.

Example:
VV008

NONCONVECTIVE LOW-LEVEL WIND SHEAR FORECAST (OPTIONAL DATA)

TAF
KPIR 111140Z 111212 13012KT P6SM BKN100 **WS020/35035KT** TEMPO 1214 5SM BR
FM1500 16015G25KT P6SM SCT040 BKN250
FM0000 14012KT P6SM BKN080 OVC150 PROB40 0004 3SM TSRA BKN030CB
FM0400 14008KT P6SM SCT040 OVC080 TEMPO 0408 3SM TSRA OVC030CB
BECMG 0810 32007KT=

A forecast of nonconvective low-level wind shear is included immediately after the cloud and obscuration group when wind shear criteria have been or will be met. The forecast includes the height of the wind shear followed by the wind direction and wind speed at the indicated height. Height is given in hundreds of feet above ground level (AGL) up to and including 2,000 feet. Wind shear is encoded with the contraction **WS**, followed by a three-digit height, solidus (**/**), and winds at the height indicated in the same format as surface winds. The wind shear element is omitted if not expected to occur.

Example:
WS020/36035KT

FORECAST CHANGE INDICATORS

TAF
KPIR 111140Z 111212 13012KT P6SM BKN100 WS020/35035KT **TEMPO 1214** 5SM BR
FM1500 16015G25KT P6SM SCT040 BKN250
FM0000 14012KT P6SM BKN080 OVC150 PROB40 0004 3SM TSRA BKN030CB
FM0400 14008KT P6SM SCT040 OVC080 TEMPO 0408 3SM TSRA OVC030CB
BECMG 0810 32007KT=

If a significant change in any of the elements is expected during the valid period, a new time period with the changes is included. The following change indicators are used when either a rapid, gradual, or temporary change is expected in some or all of the forecasted meteorological conditions.

From (FM) Group

The **FM** group is used when a rapid and significant change, usually occurring in less than 1 hour, in prevailing conditions is expected. Appended to the FM indicator is the four-digit hour and minute the change is expected to begin. The forecast is valid until the next change group or until the end of the current forecast.

The FM group will mark the beginning of a new line in a TAF report. Each FM group shall contain a forecast of wind, visibility, weather (if significant), sky condition, and wind shear (if warranted). FM groups will not include the contraction NSW.

Examples:
FM1500 16015G25KT P6SM SCT040 BKN250
FM0200 32010KT 3SM TSRA FEW010 BKN030CB

Becoming (BECMG) Group

The **BECMG** group is used when a gradual change in conditions is expected over a period not to exceed 2 hours. The time period when the change is expected to occur is a four-digit group containing the beginning and ending hours of the change that follows the BECMG indicator. The gradual change will occur at an unspecified time within the time period. Only the changing forecasted meteorological conditions are included in **BECMG** groups. Omitted conditions are carried over from the previous time group.

Example:
FM2000 18020KT P6SM BKN030 BECMG 0103 OVC015

This BECMG group describes a gradual change in sky condition from BKN030 to OVC015. The change in sky conditions occurs between 01Z and 03Z. Refer back to the FM2000 group for the wind and visibility conditions. The forecast after 03Z will be: 18020KT P6SM OVC015.

Example:
FM0400 14008KT P6SM SCT040 OVC080 TEMPO 0408 3SM TSRA OVC030CB
BECMG 0810 32007KT=

This BECMG group describes a gradual change in wind direction only beginning between 08Z and 10Z. Refer back to the previous forecast group, in this case the FM0400 group, for the prevailing visibility, weather, and sky conditions. The forecast after 10Z will be: 32007KT P6SM SCT040 OVC080.

Temporary (TEMPO) Group

The **TEMPO** group is used for temporary fluctuations of wind, visibility, weather, or sky condition that are expected to last for generally less than an hour at a time (occasional), and expected to occur during less than half the time period. The **TEMPO** indicator is followed by a four-digit group giving the beginning and ending hours of the time period during which the temporary conditions are expected. Only the changing forecasted meteorological conditions are included in **TEMPO** groups. The omitted conditions are carried over from the previous time group.

Example:
FM1000 27005KT P6SM SKC TEMPO 1216 3SM BR

This temporary group describes visibility and weather between 12Z and 16Z. The winds and sky condition have been omitted. Go back to the previous forecast group, FM1000, to obtain the wind and sky condition forecast. The forecast between 12Z and 16Z is: 27005KT 3SM BR SKC.

Example:
FM0400 14008KT P6SM SCT040 OVC080 TEMPO 0408 3SM TSRA OVC030CB
BECMG 0810 32007KT=

This temporary group describes visibility, weather, and sky condition between 04Z and 08Z. The winds have been omitted. Go back to the previous forecast group, FM0400, to obtain the wind forecast. The forecast between 04Z and 08Z is: 14008KT 3SM TSRA OVC030CB.

PROBABILITY (PROB30 or PROB40) FORECAST

TAF
KPIR 111140Z 111212 13012KT P6SM BKN100 WS020/35035KT TEMPO 1214 5SM BR
FM1500 16015G25KT P6SM SCT040 BKN250
FM0000 14012KT P6SM BKN080 OVC150 **PROB40 0004** 3SM TSRA BKN030CB
FM0400 14008KT P6SM SCT040 OVC080 TEMPO 0408 3SM TSRA OVC030CB
BECMG 0810 32007KT=

The probability forecast describes the probability or chance of thunderstorms or other precipitation events occurring, along with associated weather conditions (wind, visibility, and sky conditions). The probability forecast will <u>not</u> be used in the first 6 hours of the TAF.

The **PROB30** or **PROB40** group is used when the occurrence of thunderstorms or precipitation is in the 30% to less than 40% or 40% to less than 50% range, respectively. If the thunderstorms or precipitation chance is greater than 50%, it is considered a prevailing weather condition and is included in the significant weather section or the TEMPO change indicator group. PROB30 or PROB40 is followed by a four-digit time group giving the beginning and ending hours of the time period during which the thunderstorms or precipitation is expected.

Example:
FM0600 0915KT P6SM BKN020 PROB30 1014 1SM RA BKN015

This example depicts a 30% to less than 40% chance of 1statute mile, moderate rain, and a broken cloud layer (ceiling) at 1,500 feet between the hours of 10-14Z.

Example:
FM0000 14012KT P6SM BKN080 OVC150 PROB40 0004 3SM TSRA BKN030CB

In this example, there is a 40% to <50% chance of visibility 3 statute miles, thunderstorms with moderate rain showers, and a broken cloud layer (ceiling) at 3,000 feet with cumulonimbus between the hours of 00-04Z.

EXAMPLES OF TAF REPORTS

TAF
KPIR 111140Z 111212 13012KT P6SM BKN100 WS020/35035KT TEMPO 1214 5SM BR
FM1500 16015G25KT P6SM SCT040 BKN250
FM0000 14012KT P6SM BKN080 OVC150 PROB40 0004 3SM TSRA BKN030CB
FM0400 14008KT P6SM SCT040 OVC080 TEMPO 0408 3SM TSRA OVC030CB
BECMG 0810 32007KT=

TAF	Aviation terminal forecast
KPIR	Pierre, South Dakota
111140Z	prepared on the 11th at 1140Z
111212	valid period from the 11th at 1200Z until the 12th at 1200Z
13012KT	wind 130 at 12 knots
P6SM	visibility greater than 6 statute miles
BKN100	ceiling 10,000 broken
WS020/35035KT	wind shear at 2,000 feet, wind (at 2,000 feet) from 350 at 35 knots
TEMPO 1214	temporary conditions between 1200Z and 1400Z
5SM	visibility 5 statute miles
BR	mist
FM1500	from 1500Z
16015G25KT	wind 160 at 15 knots gusting to 25 knots
P6SM	visibility greater than 6 statute miles
SCT040 BKN250	4,000 scattered, ceiling 25,000 broken
FM0000	from 0000Z
14012KT	wind 140 at 12 knots
P6SM	visibility greater than 6 statute miles
BKN080 OVC150	ceiling 8,000 broken, 15,000 overcast
PROB40 0004	40% probability between 0000Z and 0400Z
3SM	visibility 3 statute miles
TSRA	thunderstorm with moderate rain showers
BKN030CB	ceiling 3,000 broken with cumulonimbus
FM0400	from 0400Z
14008KT	wind 140 at 8 knots
P6SM	visibility greater than 6 statute miles
SCT040 OVC080	4,000 scattered, ceiling 8,000 overcast
TEMPO 0408	temporary conditions between 0400Z and 0800Z
3SM	visibility 3 statute miles
TSRA	thunderstorms with moderate rain showers
OVC030CB	ceiling 3,000 overcast with cumulonimbus
BECMG 0810	becoming between 0800Z and 1000Z
32007KT=	wind 320 at 7 knots; the equal sign signifies the end of the TAF

TAF AMD
KEYW 131555Z 131612 VRB03KT P6SM VCTS SCT025CB BKN250 TEMPO 1618 2SM TSRA BKN020CB
FM1800 VRB03KT P6SM SCT025 BKN250 TEMPO 2024 1SM TSRA OVC010CB
FM0000 VRB03KT P6SM VCTS SCT020CB BKN120 TEMPO 0812 BKN020CB=

TAF AMD	**A**mended aviation terminal forecast
KEYW	Key West, Florida
131555Z	prepared on the 13th at 1555Z
131612	valid period from the 13th at 1600Z until the 14th at 1200Z
VRB03KT	wind variable at 3 knots
P6SM	visibility greater than 6 statute miles
VCTS	thunderstorms in the vicinity
SCT025CB BKN250	2,500 scattered with cumulonimbus, ceiling 25,000 broken
TEMPO 1618	temporary conditions between 1600Z and 1800Z
2SM	visibility 2 statute miles
TSRA	thunderstorms with moderate rain showers
BKN020CB	ceiling 2,000 broken with cumulonimbus
FM1800	from 1800Z
VRB03KT	wind variable at 3 knots
P6SM	visibility greater than 6 statute miles
SCT025 BKN250	2,500 scattered, ceiling 25,000 broken
TEMPO 2024	temporary conditions between 2000Z and 0000Z
1SM	visibility 1 statute mile
TSRA	thunderstorms with moderate rain showers
OVC010CB	ceiling 1,000 overcast with cumulonimbus
FM0000	from 0000Z
VRB03KT	variable wind at 3 knots
P6SM	visibility greater than 6 statute miles
VCTS	thunderstorms in the vicinity
SCT020CB BKN120	2,000 scattered with cumulonimbus, ceiling 12,000 broken
TEMPO 0812	temporary conditions between 0800Z and 1200Z
BKN020CB=	ceiling 2,000 broken with cumulonimbus; the equal sign signifies the end of the TAF

TAF
KCRP 111730Z 111818 19007KT P6SM SCT030 TEMPO 1820 BKN040
FM2000 16011KT P6SM VCTS FEW030CB SCT250
FM0200 14006KT P6SM FEW025 SCT250
FM0800 VRB03KT 5SM BR SCT012 TEMPO 1012 1/2SM FG BKN001
FM1500 17007KT P6SM SCT025=

TAF	Aviation terminal forecast
KCRP	Corpus Christi, Texas
111730Z	prepared on the 11th at 1730Z
111818	valid period from the 11th at 1800Z until the 12th at 1800Z
19007KT	wind 190 at 7 knots
P6SM	visibility greater than 6 statute miles
SCT030	3,000 scattered
TEMPO 1820	temporary conditions between 1800Z and 2000Z
BKN040	ceiling 4,000 broken
FM2000	from 2000Z
16011KT	wind 160 at 11 knots
P6SM	visibility greater than 6 statute miles
VCTS	thunderstorms in the vicinity
FEW030CB SCT250	3,000 few with cumulonimbus, 25,000 scattered
FM0200	from 0200Z
14006KT	wind 140 at 6 knots
P6SM	visibility greater than 6 statute miles
FEW025 SCT250	2,500 few, 25,000 scattered
FM0800	from 0800Z
VRB03KT	wind variable at 3 knots
5SM	visibility 5 statute miles
BR	mist
SCT012	1,200 scattered
TEMPO 1012	temporary conditions between 1000Z and 1200Z
1/2SM	visibility ½ statute mile
FG	fog
BKN001	ceiling 100 broken
FM1500	from 1500Z
17007KT	wind 170 at 7 knots
P6SM	visibility greater than 6 statute miles
SCT025=	2,500 scattered; the equal sign signifies the end of the TAF

TAF
KACK 112340Z 120024 29008KT P6SM SKC BECMG 1618 22015KT=

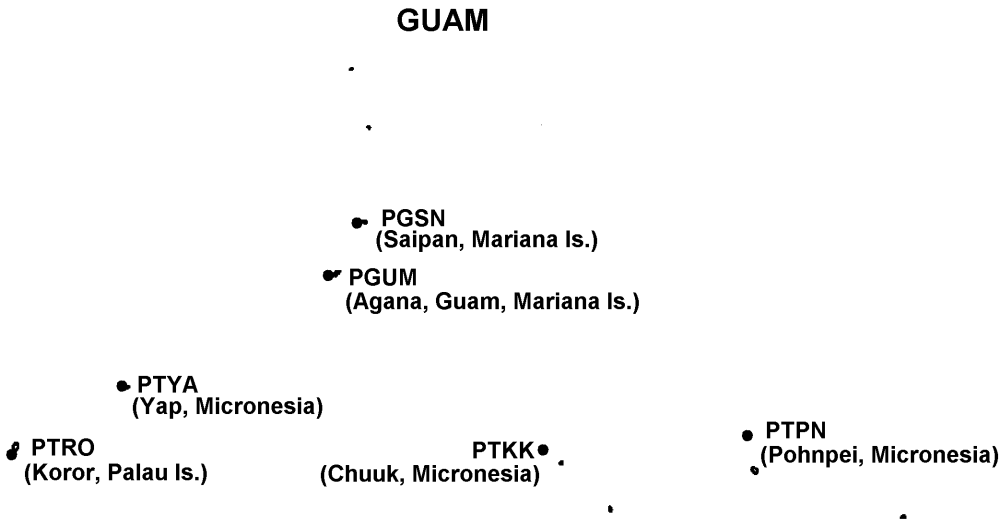
TAF	Aviation terminal forecast
KACK	Nantucket, Massachusetts
112340Z	prepared on the 11th at 2340Z
120024	valid period from the 12th at 0000Z until the 13th at 0000Z
29008KT	wind 290 at 8 knots
P6SM	visibility greater than 6 statute miles
SKC	sky clear
BECMG 1618	becoming between 1600Z and 1800Z
22015KT=	wind 220 at 15 knots; the equal sign signifies the end of the TAF

TAF
KMWH 200535Z 200606 NIL=

TAF	Aviation terminal forecast
KMWH	Moses Lake, Washington
200535Z	prepared on the 20th at 0535Z
200606	valid period from the 20th at 0600Z to the 21st at 0600Z
NIL=	no TAF; the equal sign signifies the end of the TAF

Figure 4-1. TAF Locations - Western Contiguous United States.

Figure 4-2. TAF Locations - Eastern Contiguous United States.



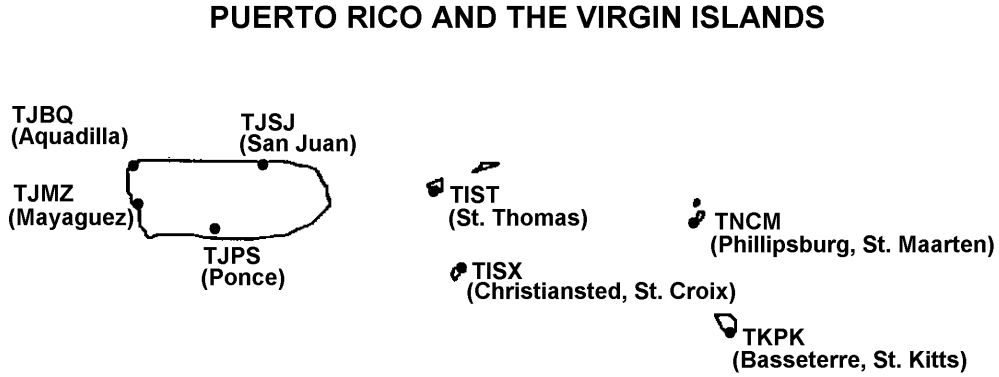


Figure 4-3. TAF Locations - Guam and Puerto Rico.

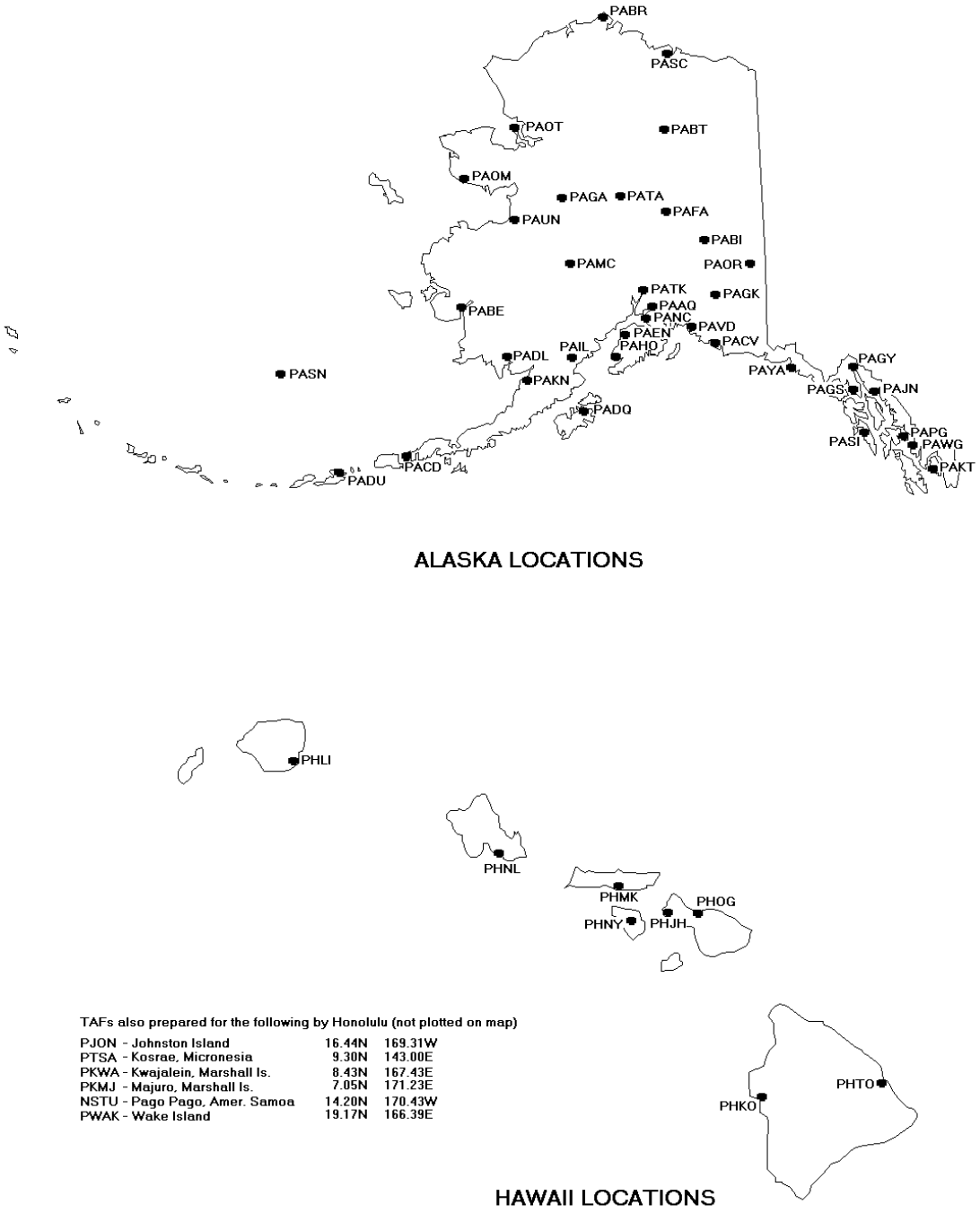


Figure 4-4. TAF Locations - Alaska and Hawaii.

AVIATION AREA FORECAST (FA)

An Aviation Area Forecast (FA) is a forecast of visual meteorological conditions (VMC), clouds, and general weather conditions over an area the size of several states. To understand the complete weather picture, the FA must be used in conjunction with the inflight aviation weather advisories. Together, they are used to determine forecast en route weather and to interpolate conditions at airports for which no TAFs are issued. Figure 4-5 on page 4-21 maps the FA areas. The FAs are issued 3 times a day by the Aviation Weather Center (AWC) in Kansas City, Missouri, for each of the 6 areas in the contiguous 48 states. The weather forecast office (WFO) in Honolulu issues FAs for Hawaii as shown in Figure 4-6 on page 4-22. Alaska FA information is on page 4-27. There are also two specialized FAs, one for the Gulf of Mexico and one for international airspace.

This is a partial example of an FA which will be used in this section:

DFWC FA 120945
SYNOPSIS AND VFR CLDS/WX
SYNOPSIS VALID UNTIL 130400
CLDS/WX VALID UNTIL 122200...OTLK VALID 122200-130400 OK TX AR TN LA MS AL AND CSTL WTRS
.
SEE AIRMET SIERRA FOR IFR CONDS AND MTN OBSCN.
TS IMPLY SEV OR GTR TURB SEV ICE LLWS AND IFR CONDS.
NON MSL HGTS DENOTED BY AGL OR CIG.
.
SYNOPSIS...LOW PRES TROF 10Z OK/TX PNHDL AREA FCST MOV EWD INTO CNTRL-SWRN OK BY 04Z. WRMFNT 10Z CNTRL OK-SRN AR-NRN MS FCST LIFT NWD INTO NERN OK-NRN AR XTRM NRN MS BY 04Z.
.
S CNTRL AND SERN TX
AGL SCT-BKN010. TOPS 030. VIS 3-5SM BR. 14-16Z BECMG AGL SCT030. 19Z AGL SCT050. OTLK...VFR.
.
OK
PNHDL AND NW...AGL SCT030 SCT-BKN100. TOPS FL200. 15Z AGL SCT040 SCT100. AFT 20Z SCT TSRA DVLPG..FEW POSS SEV. CB TOPS FL450. OTLK...VFR.
SWRN OK...CIG BKN020. TOPS 050. VIS 3-5SM BR. 14Z AGL SCT-BKN040. 18Z CIG BKN060. TOPS FL180. 22Z SCT TSRA DVLPG..FEW POSS SEV. CB TOPS ABV FL450. OTLK...VFR.
NERN QTR...CIG BKN020 OVC050. VIS 3-5SM NMRS TSRA..FEW POSS SEV. CB TOPS ABV FL450. 15Z AGL SCT030 SCT-BKN100. TOPS FL250. 18Z AGL SCT040. OTLK...VFR.
SERN QTR...AGL SCT-BKN020. TOPS 050. 18Z AGL SCT040. OTLK...VFR.
.
CSTL WTRS
LA MS AL WTRS...SCT025 SCT-BKN080. TOPS 150. ISOL -TSRA. CB TOPS FL350. OTLK...VFR.
TX WTRS...SCT CI. OCNL SCT030. OTLK...VFR. ....

The FA is comprised of four sections: a communications and product header section, a precautionary statements section, and two weather sections - a synopsis section and a visual flight rules (VFR) clouds/weather section.

COMMUNICATIONS AND PRODUCT HEADER

The communications and product header identifies the office for which the FA is issued, the date and time of issue, the product name, the valid times, and the states and/or areas covered by the FA. The following shows the communications and product header for the example FA shown on page 4-17:

DFWC FA 120945
SYNOPSIS AND VFR CLDS/WX
SYNOPSIS VALID UNTIL 130400
CLDS/WX VALID UNTIL 122200...OTLK VALID 122200-130400 OK TX AR TN LA MS AL AND CSTL WTRS

In the first line, "DFW" indicates the area for which the FA is valid. The "**C**" indicates VFR clouds and weather while the FA indicates what type of forecast message it is. The "120945" indicates the date and time the FA was issued. The next line "SYNOPSIS AND VFR CLDS/WX" states what information is contained in this forecast message. "SYNOPSIS VALID UNTIL 130400" means the synopsis section of the FA is valid until the thirteenth at 0400Z. The "CLDS/WX VALID UNTIL 122200...OTLK VALID 122200-130400" statement indicates the forecast section is valid until the twelfth at 2200Z, while the outlook portion is valid from the twelfth at 2200Z until the thirteenth at 0400Z. "OK TX AR TN LA MS AL AND CSTL WTRS" describes the area for which this FA forecast is valid.

PRECAUTIONARY STATEMENTS

Between the communications/product header and the body of the forecast are three precautionary statements. (See example FA on page 4-17.) The first statement in the example, "SEE AIRMET SIERRA FOR IFR CONDS AND MTN OBSCN," is included to alert users that IFR conditions and/or mountain obscurations may be occurring or may be forecasted to occur in a portion of the FA area. The user shall <u>always</u> check the latest AIRMET Sierra for the FA area.

The second statement in the example, "TS IMPLY SEV OR GTR TURB SEV ICE LLWS AND IFR CONDS," is included as a reminder of the hazards existing in all thunderstorms. Thus, these thunderstorm-associated hazards are not spelled out within the body of the FA.

The purpose of the third statement in the example, "NON MSL HGTS DENOTED BY AGL OR CIG," is to alert the user that heights, for the most part, are mean sea level (MSL). All heights are in hundreds of feet. For example, "BKN030. TOPS 100. HYR TRRN OBSCD," means bases of the broken clouds are 3,000 feet MSL with tops 10,000 feet MSL. Terrain above 3,000 feet MSL will be obscured. The tops of the clouds, turbulence, icing, and freezing level heights are <u>always</u> MSL.

Heights AGL are noted in either of two ways:

1. Ceilings by definition are above ground. Therefore, the contraction "CIG" indicates above ground. For example, 'CIG BKN-OVC015," means that ceilings are expected to be broken to overcast sky cover with bases at 1,500 feet AGL.
2. The contraction "AGL" means above ground level. Therefore, "AGL SCT020" means scattered clouds with bases 2,000 feet AGL.

Thus, if the contraction "AGL" or "CIG" is not denoted, height is automatically above MSL.

SYNOPSIS

The synopsis is a brief summary of the location and movements of fronts, pressure systems, and other circulation features for an 18-hour period. References to low ceilings and/or visibilities, strong winds, or any other phenomena the forecaster considers useful may also be included. The following synopsis is taken from the example on page 4-17.

SYNOPSIS...LOW PRES TROF 10Z OK/TX PNHDL AREA FCST MOV EWD INTO CNTRL-SWRN OK BY 04Z. WRMFNT 10Z CNTRL OK-SRN AR-NRN MS FCST LIFT NWD INTO NERN OK-NRN AR XTRM NRN MS BY 04Z.

This paragraph states that a low pressure trough at 10Z was over the Oklahoma (OK)/Texas (TX) panhandle area. The area is forecasted to move eastward into central-southwestern OK by 04Z. At 10Z a warm front was located from central OK to southern Arkansas (AR) to northern Mississippi (MS). This warm front is forecasted to lift into northeastern OK, northern AR, to extreme northern MS by 04Z.

VFR CLOUDS AND WEATHER (VFR CLDS/WX)

This section contains a 12-hour specific forecast, followed by a 6-hour categorical outlook giving a total forecast period of 18 hours, and it is usually several paragraphs in length. The breakdown may be by states or by well-known geographical areas. (See Figure 4-11.) The specific forecast section gives a general description of clouds and weather which cover an area greater than 3,000 square miles and are significant to VFR flight operations.

Surface visibility and obstructions to vision are included when the forecast visibility is 3 to 5 statute miles. Precipitation, thunderstorms, and sustained winds of 20 knots or more will always be included when forecasted. The conditional term OCNL (occasional) is used to describe clouds and visibilities that may affect VFR flights. It is used when there is a greater than 50% probability of a phenomenon occurring, but for less than ½ the forecast period. The areal coverage terms ISOL (isolated), WDLY SCT (widely scattered), SCT or AREAS (scattered), and NMRS or WDSPRD (numerous or widespread) are used to indicate the area coverage of thunderstorms or showers. The term ISOL may also be used to describe areas of ceilings or visibilities that are expected to affect areas less than 3,000 square miles. Table 4-1 defines the areal coverage terms.

Table 4-1 Areal Coverage of Showers and Thunderstorms

Terms	Coverage
Isolated (ISOL)	**Single cells (no percentage)**
Widely scattered (WDLY SCT)	**Less than 25% of area affected**
Scattered or Areas (SCT or AREAS)	**25 to 54% of area affected**
Numerous or Widespread (NMRS or WDSPRD)	**55% or more of area affected**

Example from the FA on page 4-17:
CSTL WTRS
LA MS AL WTRS...SCT025 SCT-BKN080. TOPS 150. ISOL -TSRA. CB TOPS FL350. OTLK...VFR
TX WTRS...SCT CI. OCNL SCT030. OTLK...VFR. ....

This part of the VFR clouds/weather section is the forecast for the coastal waters of Louisiana (LA), Mississippi (MS), Alabama (AL), and Texas (TX). For the coastal waters of LA, MS, and AL, the base of the scattered layer is 2,500 feet MSL. The second layer is scattered to broken at 8,000 feet MSL with tops at 15,000 feet MSL. Also during this time, isolated (ISOL) thunderstorms with light rain showers are expected with the tops of the thunderstorms (CB) at flight level (FL) 350. FL is used only for altitudes 18,000 feet MSL and higher. The visibility is expected to be greater than 6 statute miles and winds less than 20 knots, both by omission. The weather conditions along the TX coastal waters are expected to be scattered cirrus with occasional (OCNL) scattered layers at 3,000 feet MSL.

A categorical outlook, identified by "OTLK," is included for each area breakdown. A categorical outlook of instrument flight rules (IFR) and marginal VFR (MVFR) can be due to ceilings only (CIG), restriction to visibility only (TSRA, FG, etc.), or a combination of both. In the example, the coastal areas have outlooks of VFR conditions.

The statement, "OTLK…VFR BCMG MVFR CIG F AFT 09Z," means the weather is expected to be VFR, becoming MVFR due to low ceiling, and visibilities restricted by fog after 0900Z. "WND" is included in the outlook if winds, sustained or gusty, are expected to be 20 knots or greater.

Hazardous weather (i.e., IFR, icing, and turbulence conditions) is <u>not</u> included in the FA but are included in the Inflight Aviation Weather Advisories (see page 4-23).

AMENDED AVIATION AREA FORECAST

Amendments to the FA are issued as needed. An amended FA is identified by **AMD** that is located on the first line after the date and time. The entire FA is transmitted again with the word **UPDT** after the state to indicated what sections have been amended/updated. FAs are also amended and updated by inflight aviation weather advisories (AIRMETs, SIGMETs, and Convective SIGMETs). A corrected FA is identified by **COR** and a delayed FA is identified by **RTD** which are located in the first line after the time and date.

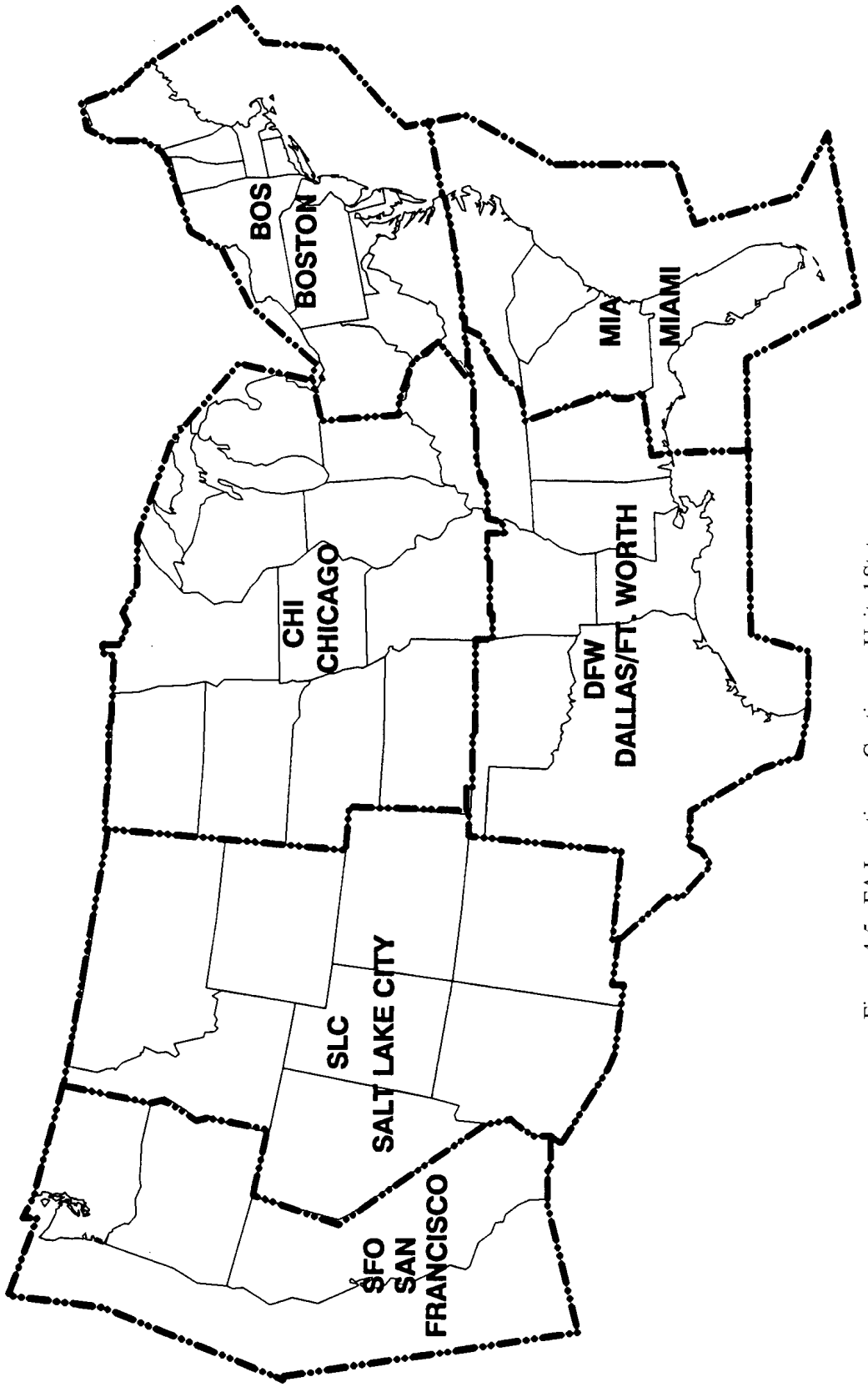


Figure 4-5. FA Locations - Contiguous United States.

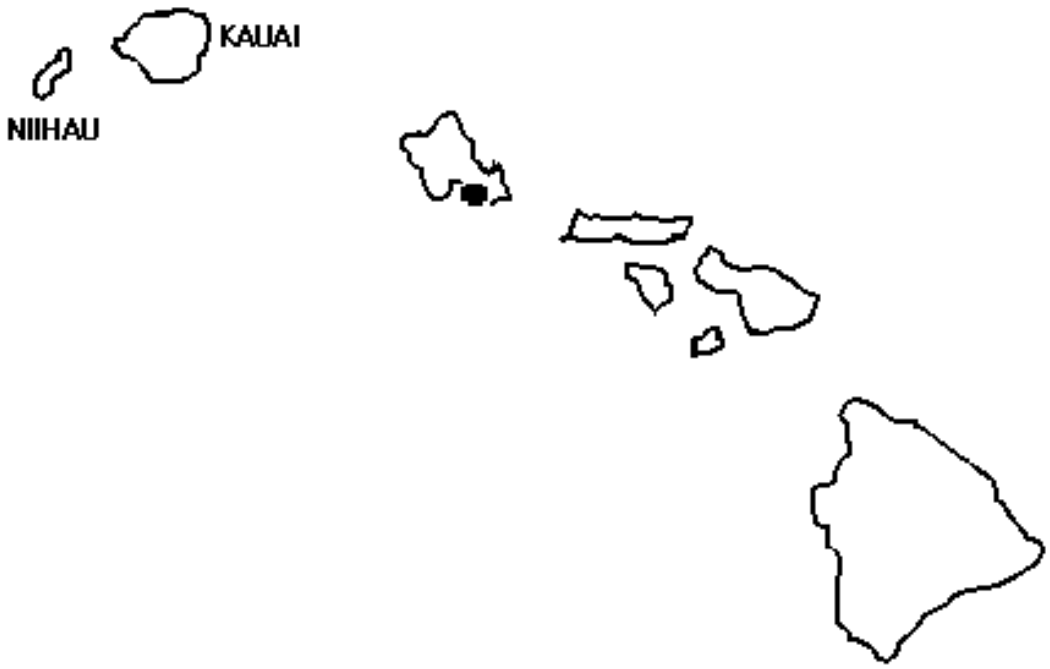


Figure 4-6. FA Locations - Hawaii.

INFLIGHT AVIATION WEATHER ADVISORIES

Inflight Aviation Weather Advisories are forecasts to advise en route aircraft of development of potentially hazardous weather. All inflight aviation weather advisories in the conterminous U.S. are issued by the Aviation Weather Center (AWC) in Kansas City, Missouri. The WFO in Honolulu issues advisories for the Hawaiian islands. In Alaska, the Alaska Aviation Weather Unit (AAWU) issues inflight aviation weather advisories. All heights are referenced MSL, except in the case of ceilings CIG, which indicate AGL.

There are three types of inflight aviation weather advisories - the Significant Meteorological Information (SIGMET), the Airman's Meteorological Information (AIRMET), and Convective SIGMET. All of these advisories use the same location identifiers (either VORs, airports, or well-known geographic areas) to describe the hazardous weather areas (see Figures 4-11 and 4-12 on pages 4-45 and 4-46).

SIGMET (WS)/AIRMET (WA)

SIGMETs/AIRMETs are issued corresponding to the FA areas (see Figures 4-5 and 4-6). The maximum forecast period is 4 hours for SIGMETs and 6 hours for AIRMETs. Both advisories are considered "widespread" because they must be either affecting or be forecasted to affect an area of at least 3,000 square miles at any one time. However, if the total area to be affected during the forecast period is very large, it could be that in actuality only a small portion of this total area would be affected at any one time.

SIGMET (WS)

A SIGMET advises of nonconvective weather that is potentially hazardous to all aircraft. SIGMETs are unscheduled products that are valid for 4 hours. However, conditions that are associated with hurricanes are valid for 6 hours. Unscheduled updates and corrections are issued as necessary. In the conterminous U.S., SIGMETs are issued when the following phenomena occur or are expected to occur:

1. Severe icing not associated with thunderstorms
2. Severe or extreme turbulence or clear air turbulence (CAT) not associated with thunderstorms
3. Dust storms or sandstorms lowering surface or inflight visibilities to below 3 miles
4. Volcanic ash

In Alaska and Hawaii, SIGMETs are also issued for:

1. Tornadoes
2. Lines of thunderstorms
3. Embedded thunderstorms
4. Hail greater than or equal to ¾ inch in diameter

SIGMETs are identified by an alphabetic designator from November through Yankee excluding Sierra and Tango. (Sierra, Tango, and Zulu are reserved for AIRMETs.) The first issuance of a SIGMET will be labeled as UWS (Urgent Weather SIGMET). Subsequent issuances are at the forecaster's discretion. Issuance for the same phenomenon will be sequentially numbered, using the original designator until the phenomenon ends. For example, the first issuance in the Chicago (CHI) FA area for phenomenon moving from the Salt Lake City (SLC) FA area will be SIGMET Papa 3, if the previous two issuances, Papa 1 and Papa 2, had been in the SLC FA area. Note that no two different phenomena across the country can have the same alphabetic designator at the same time.

Example of a SIGMET:
BOSR WS 050600
SIGMET ROMEO 2 VALID UNTIL 051000
ME NH VT
FROM CAR TO YSJ TO CON TO MPV TO CAR
MOD TO OCNL SEV TURB BLW 080 EXP DUE TO STG NWLY FLOW. CONDS CONTG BYD 1000Z.

International SIGMET

Some NWS offices have been designated by the ICAO as Meteorological Watch Offices (MWOs). These offices are responsible for issuing International SIGMETs for designated areas that include Alaska, Hawaii, portions of the Atlantic and Pacific Oceans, and the Gulf of Mexico. The offices which issue International SIGMETs are the Alaskan Aviation Weather Unit in Anchorage, Alaska (AK);the Tropical Prediction Center in Miami, Florida (FL); the WFO in Honolulu, Hawaii (HI); the Aviation Weather Center in Kansas City, MO; and the WFO on Guam Island in the Pacific Ocean. These SIGMETs are considered "widespread" because they must be either affecting or be forecasted to affect an area of at least 3,000 square miles at any one time. The International SIGMET is issued for 12 hours for volcanic ash events, 6 hours for hurricanes and tropical storms, and 4 hours for all other events. Like the domestic SIGMETs, International SIGMETs are also identified by an alphabetic designator from Alpha through Mike and are numbered sequentially until that weather phenomenon ends. The criteria for an International SIGMET are:

1. Thunderstorms occurring in lines, embedded in clouds, or in large areas producing tornadoes or large hail
2. Tropical cyclones
3. Severe icing
4. Severe or extreme turbulence
5. Dust storms and sandstorms lowering visibilities to less than 3 miles
6. Volcanic ash

Example of an International SIGMET:
ZCZC MIASIGA1L
TTAA00 KNHC 121600

KZNY SIGMET LIMA 5 VALID 121600/122000 UTC KNHC-

ACT TS OBS BY SATELLITE WI AREA BOUNDED BY 30N69W 31N64.6W 26.4N66.4W 27.5N69.4W 30N69W. CB TOPS TO FL480. MOV ENE 15 KT. INTSF.

AIRMET (WA)

AIRMETs (WAs) are advisories of significant weather phenomena but describe conditions at intensities lower than those which require the issuance of SIGMETs. AIRMETs are intended for dissemination to all pilots in the preflight and en route phase of flight to enhance safety. AIRMET Bulletins are issued on a scheduled basis every 6 hours beginning at 0145 UTC during Central Daylight Time and at 0245 UTC during Central Standard Time. Unscheduled updates and corrections are issued as necessary. Each AIRMET Bulletin contains any current AIRMETs in effect and an outlook for conditions expected after the AIRMET valid period. AIRMETs contain details about IFR, extensive mountain obscuration, turbulence, strong surface winds, icing, and freezing levels.

There are three AIRMETs - Sierra, Tango, and Zulu. AIRMET Sierra describes IFR conditions and/or extensive mountain obscurations. AIRMET Tango describes moderate turbulence, sustained surface winds of 30 knots or greater, and/or nonconvective low-level wind shear. AIRMET Zulu describes moderate icing and provides freezing level heights. After the first issuance each day, scheduled or unscheduled bulletins are numbered sequentially for easier identification.

Example of AIRMET Sierra issued for the Chicago FA area:
CHIS WA 121345
AIRMET SIERRA UPDT 3 FOR IFR AND MTN OBSCN VALID UNTIL 122000 .
AIRMET IFR...SD NE MN IA MO WI LM MI IL IN KY
FROM 70NW RAP TO 50W RWF TO 50W MSN TO GRB TO MBS TO FWA TO CVG TO HNN TO TRI TO ARG TO 40SSW BRL TO OMA TO BFF TO 70NW RAP
OCNL CIG BLW 010/VIS BLW 3SM FG/BR. CONDS ENDG 15Z-17Z.
.
AIRMET MTN OBSCN...KY TN
FROM HNN TO TRI TO CHA TO LOZ TO HNN
MTNS OCNL OBSC CLDS/PCPN/BR. CONDS ENDG TN PTN AREA 18Z- 20Z..CONTG KY BYD 20Z..ENDG 02Z.
....

Example of AIRMET Tango issued for the Salt Lake City FA area:
SLCT WA 121345
AIRMET TANGO UPDT 2 FOR TURB VALID UNTIL 122000 .
AIRMET TURB...NV UT CO AZ NM
FROM LKV TO CHE TO ELP TO 60S TUS TO YUM TO EED TO RNO TO LKV
OCNL MOD TURB BLW FL180 DUE TO MOD SWLY/WLY WNDS. CONDS CONTG BYD 20Z THRU 02Z.
.
AIRMET TURB...NV WA OR CA CSTL WTRS
FROM BLI TO REO TO BTY TO DAG TO SBA TO 120W FOT TO 120W TOU TO BLI
OCNL MOD TURB BTWN FL180 AND FL400 DUE TO WNDSHR ASSOCD WITH JTSTR. CONDS CONTG BYD 20Z THRU 02Z.
....

Example of AIRMET Zulu issued for the San Francisco FA area:
SFOZ WA 121345
AIRMET ZULU UPDT 2 FOR ICE AND FRZLVL VALID UNTIL 122000 .
AIRMET ICE...WA OR ID MT NV UT
FROM YQL TO SLC TO WMC TO LKV TO PDT TO YDC TO YQL
LGT OCNL MOD RIME/MXD ICGICIP BTWN FRZLVL AND FL220. FRZLVL 080-120. CONDS CONTG BYD 20Z THRU 02Z.
.
AIRMET ICE...WA OR
FROM YDC TO PDT TO LKV TO 80W MFR TO ONP TO TOU TO YDC
LGT OCNL MOD RIME/MXD ICGICIP BTWN FRZLVL AND FL180. FRZLVL 060-080. CONDS CONTG BYD 20Z THRU 02Z.
.
FRZLVL...WA...060 CSTLN SLPG 100 XTRM E.
OR...060-070 CASCDS WWD. 070-095 RMNDR.
NRN CA...060-100 N OF A 30N FOT-40N RNO LN SLPG 100-110 RMNDR.

CONVECTIVE SIGMET (WST)

Convective SIGMETs are issued in the conterminous U.S. for any of the following:

1. Severe thunderstorm due to:
   a. surface winds greater than or equal to 50 knots
   b. hail at the surface greater than or equal to ¾ inches in diameter
   c. tornadoes
2. Embedded thunderstorms
3. A line of thunderstorms
4. Thunderstorms producing precipitation greater than or equal to heavy precipitation affecting 40% or more of an area at least 3,000 square miles

Any convective SIGMET implies severe or greater turbulence, severe icing, and low-level wind shear. A convective SIGMET may be issued for any convective situation that the forecaster feels is hazardous to all categories of aircraft.

Convective SIGMET bulletins are issued for the western (W), central (C), and eastern (E) United States. (Convective SIGMETs are not issued for Alaska or Hawaii.) The areas are separated at 87 and 107 degrees west longitude with sufficient overlap to cover most cases when the phenomenon crosses the boundaries. Bulletins are issued hourly at H+55. Special bulletins are issued at any time as required and updated at H+55. If no criteria meeting convective SIGMET requirements are observed or forecasted, the message "CONVECTIVE SIGMET…NONE" will be issued for each area at H+55. Individual convective SIGMETs for each area (W, C, E) are numbered sequentially from number one each day, beginning at 00Z. A convective SIGMET for a continuing phenomenon will be reissued every hour at H+55 with a new number. The text of the bulletin consists of either an observation and a forecast or just a forecast. The forecast is valid for up to 2 hours.

Example of a convective SIGMET:
MKCC WST 251655
CONVECTIVE SIGMET 54C
VALID UNTIL 1855Z
WI IL
FROM 30E MSN-40ESE DBQ
DMSHG LINE TS 15 NM WIDE MOV FROM 30025KT. TOPS TO FL450. WIND GUSTS TO 50 KT POSS.

CONVECTIVE SIGMET 55C
VALID UNTIL 1855Z
WI IA
FROM 30NNW MSN-30SSE MCW
DVLPG LINE TS 10 NM WIDE MOV FROM 30015KT. TOPS TO FL300.

CONVECTIVE SIGMET 56C
VALID UNTIL 1855Z
MT ND SD MN IA MI
LINE TS 15 NM WIDE MOV FROM 27020KT. TOPS TO FL380.

OUTLOOK VALID 151855-252255
FROM 60NW ISN-INL-TVC-SBN-BRL-FSD-BIL-60NW ISN

IR STLT IMGRY SHOWS CNVTV CLD TOP TEMPS OVER SRN WI HAVE BEEN WARMING STEADILY INDCG A WKNG TREND. THIS ALSO REFLECTED BY LTST RADAR AND LTNG DATA. WKNG TREND OF PRESENT LN MAY CONT…HWVR NEW DVLPMT IS PSBL ALG OUTFLOW BDRY AND/OR OVR NE IA/SW WI BHD CURRENT ACT.

A SCND TS IS CONTG TO MOV EWD THRU ERN MT WITH NEW DVLPMT OCRG OVR CNTRL ND. MT ACT IS MOVG TWD MORE FVRBL AMS OVR THE WRN DAKS WHERE DWPTS ARE IN THE UPR 60S WITH LIFTED INDEX VALUES TO MS 6. TS EXPD TO INCR IN COVERAGE AND INTSTY DURG AFTN HRS.

WST ISSUANCES EXPD TO BE RQRD THRUT AFTN HRS WITH INCRG PTNTL FOR STGR CELLS TO CONTAIN LRG HAIL AND PSBLY DMGG SFC WNDS.

ALASKA, GULF OF MEXICO, AND INTERNATIONAL AREA FORECASTS (FAs)

ALASKA AREA FORECAST (FA)

The Alaska Aviation Weather Unit in Anchorage, Alaska, produces the FA for the entire state of Alaska. The Alaska FA combines the FA, SIGMETs, and AIRMETs into one product. Each FA contains a regional synopsis, 12-hour geographic specific forecasts, and an 18-hour outlook for each geographic area. Forecast weather elements are sky condition, cloud height, mountain obscuration, visibility, weather and/or obstructions to visibility, strong surface winds (direction and speed), icing, freezing level, and mountain pass conditions. Hazards and flight precautions, including AIRMETs and SIGMETs, may be found in their respective geographic area. AIRMETs and SIGMETs are also issued as separate products.

Partial example of Alaska FA:
JNUH FA 191445
.
EASTERN GULF COAST AND SE AK…
.
AIRMET VALID UNTIL 230300
TS IMPLY POSSIBLE SEV OR GREATER TURB SEV ICE LLWS AND IFR CONDS.
NON MSL HEIGHTS NOTED BY AGL OR CIG
.
SYNOPSIS…VALID UNTIL 231500
990 MB LOW VCY PACV DRFTG E AND WKN. CDFNT S FM LOW BCMG STNR AND WK ICY BAY SWD BY 15Z. E PACIFIC LOW S 50N MOV N TO 975 MB CNTR 50 SM W PASI AT 15Z WI OCFNT SWD.
.
LYNN CANAL AND GLACIER BAY JB…VALID UNTIL 230900
…CLOUDS/WX…
…AIRMET MT OBSC…TEMPO MT OBSC INCLDS. NC…
SCT030 SCT-BKN050 BKN100 TOP 160. TEMPO HI LYRS TOP FL250. TEMPO BKN030 ISOL -RA. SFC WND S 15 KT G25 KT LYNN CANAL.
OTLK VALID 230900-240300…VFR RA. 18Z MVFR CIG RA.
PASSES…WHITE AND CHILKOOT…MVFR CIG RASN.
…TURB…
LYNN CANAL…ISOL MOD TURB BLW 060. ELSW..NIL SIG.
…ICE AND FZLVL…
TEMPO LGT RIME ICEIC 050-120. FZLVL 030.

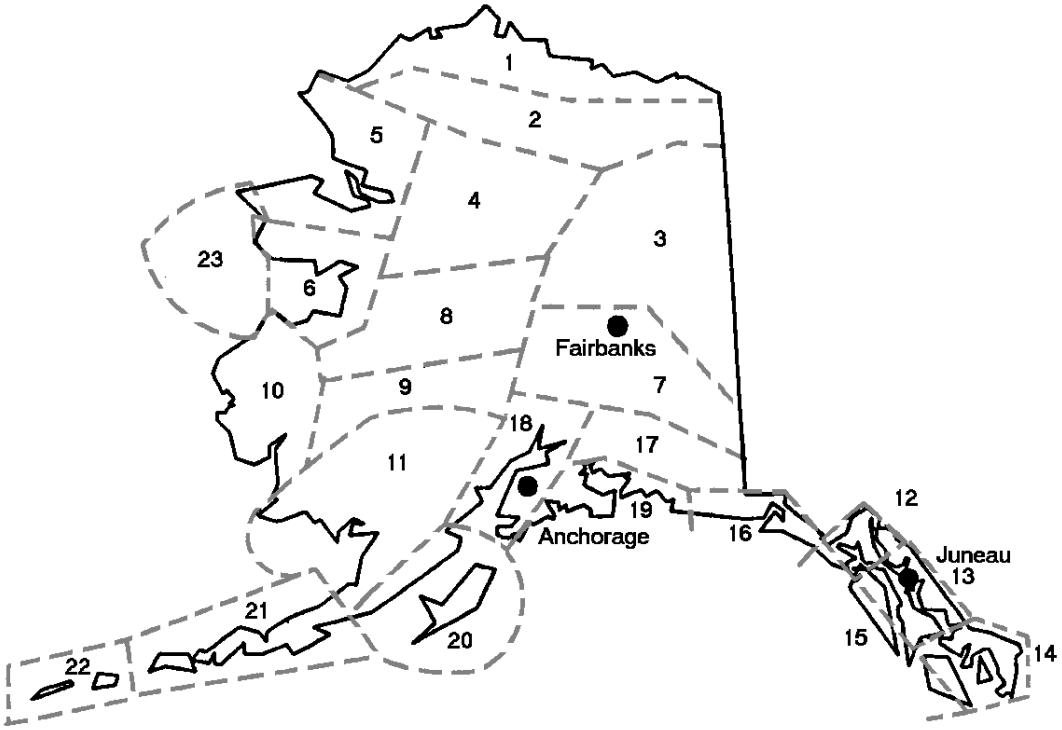


Figure 4-7. Alaska Area Forecast Sectors.

GULF OF MEXICO AREA FORECAST

A specialized FA for the Gulf of Mexico is issued by the Tropical Prediction Center in Miami, Florida. The product combines the FA, inflight aviation weather advisories, and marine precautions. This product is intended to support both offshore heliport and general aviation operations. The Gulf of Mexico FA focuses on an area which includes the coastal plains and coastal waters from Apalachicola, Florida, to Brownsville, Texas, and the offshore waters of the Gulf of Mexico, in an area west of 85W longitude and north of 27N latitude. Each section of the FA describes the weather conditions expecting to impact the area and will include the descriptor none if no significant weather is forecast to occur. Amendments to this FA are issued the same as amendments to the domestic FAs.

Partial example of Gulf of Mexico FA:
FAGX01 KNHC 151030
151100Z-152300Z
OTLK…152300Z-161100Z
AMDT NOT AVBL 0200Z-1100Z
TROPICAL ANALYSIS AND FORECAST BRANCH
TROPICAL PREDICTION CENTER MIAMI FLORIDA

GLFMEX N OF 27N W OF 85W…CSTL PLAINS CSTL WTRS AQQ-BRO. HGTS MSL UNLESS NOTED.

TS IMPLY POSS SEV OR GTR TURB…SEV ICE…LOW LVL WS AND STG SFC WND…HIGH WAVES…CIG BLW 010…AND VIS BLW 3SM.

01 SYNS…
WK SFC TROUGH FM 31N84W TO 26N88W AT 11Z DRIFTING E THROUGH 23Z. WK HIGH PRES ACRS RMNDER GLFMEX THRU FCST AND OTLK PD.
…
02 FLT PRCTNS…
NONE.
…

03 MARINE PRCTNS…
NONE.
…
04 SGFNT CLD/WX…
CSTL PLAINS CSTL WTRS BRO-LCH AND OFSHR WTRS W OF 94W… FEW040. OTLK…VFR.
…
CSTL PLAINS LCH-AQQ…
FEW015. OCNL VIS 3-5SM BR. AFT 14Z SCT100. AFT 19Z SCT/BKN020-030 BKN/SCT070-090. WIDELY SCT TSRA/ISOL +TSRA.
…
05 ICE AND FZ LEVEL BLW 120…
NONE. FZ LEVEL ABV 120.
…
06 TURB BLW 120…
NONE.
…

07 WND BLW 120…
CSTL PLAINS CSTL WTRS LCH-GPT AND OFSHR WTRS 94W-89W…SFC-120 NE-E 10-15 KT. OTLK…NOSIG.
…
08 WAVES…
CSTL WTRS BRO-AQQ…1-2 FT. OTLK…NOSIG.
NNNN

INTERNATIONAL AREA FORECASTS

FAs from the surface to 25,000 feet are also prepared in international format for areas in the Atlantic Ocean, Caribbean Sea, and the Gulf of Mexico. Moreover, significant weather forecasts for 25,000 feet to 60,000 feet are prepared in chart form and in international text format for the Northern and Western hemispheres.

Example of an International FA from the surface to FL250:
FANT2 KWBC 091600
091800Z TO 100600Z

ATLANTIC OCEAN WEST OF A LINE FROM 40N 67W TO 32N 63W. SFC TO FL250.

SYNOPSIS.
RIDGE OVER AREA MOVING TO EAST. FRONTAL SYSTEM MOVING OFF COAST BY 06Z.

SIGNIFICANT CLDS/WX.
N OF 34N AND W OF 71W…PATCHES OVC005/015 TOP 030/040 OTHERWISE BKN/OVC015/025 BKN/OVC200/240. BY 06Z INCREASING IMC IN SHRA/TS SPREADING ACROSS AREA FROM WEST. TS TOPS ABOVE 240.

S OF 34N AND W OF 75W…SCT/BKN 015/250. BY 06Z INCREASING IMC IN SHRA/TS SPREADING ACROSS AREA FROM WEST. TS TOPS ABOVE 240.

ELSEWHERE…CLR OCNL SCT015/025. BY 06Z INCREASING BKN080/100.

ICE.
FZ LVL 080/090 N SLOPING TO 120/130 S. MOD IN SHRA. SEV IN TS.

TURB.
MOD IN SHRA. SEV IN TS.

OUTLOOK.
100600Z TO 101800Z
FRONT CONTINUING SLOWLY EWD. INCREASING IMC IN SHRA/TS SPREADNG E OVER AREA. SHRA/TS ENDING SW PORTION AFTER FRONTAL PASSAGE.

Example of international significant weather forecast for FL250 to FL600:
FAPA1 KWBC 141610
SIG WX PROG FL250-FL600 VALID 150600Z
ISOL EMBD CB TOPS 400 NE OF 11N173W 14N166W 11N164W 01N174W
ISOL EMBD CB TOPS 400 07N158W 08N137W 11N137W 12N158W 07N158W
ISOL EMBD CB TOPS 400 19N157W 32N143W 22N162W 15N162W
MDT OR GRTR TURB AND ICG VCNTY ALL CBS
MDT TURB 310-410 19N145W 25N144W 19N163W 15N162W 19N145W

The groups of numbers and letters are the boundary points of the areas in latitude and longitude. For example, "11N173W" is latitude 11 degrees north and longitude 173 degrees west.

TRANSCRIBED WEATHER BROADCAST (TWEB) TEXT PRODUCTS

NWS offices prepare transcribed weather broadcast (TWEB) text products for the contiguous U.S., including synopsis and forecast for more than 200 routes and local vicinities. (See Figure 4-8.) (Not all NWS forecast offices issue all three of these products.) These products may be used in the Telephone Information Briefing Service (TIBS), Pilot's Automatic Telephone Weather Answering Service (PATWAS), Low/Medium Frequency (L/MF) and VHF omni-directional radio range (VOR) facilities as described in Section 1. TWEB products are valid for 12 hours and are issued 4 times a day at 0200Z, 0800Z, 1400Z, and 2000Z. A TWEB route forecast or vicinity forecast will not be issued if the TAF for that airport has not been issued. A NIL TWEB will be issued instead.

A TWEB route forecast is for a 50-nautical-mile wide corridor along a line connecting the end points of the route. A TWEB local vicinity forecast covers an area with a radius of 50 nautical miles. The route and vicinity forecasts describe specific information on sustained surface winds (25 knots or greater), visibility, weather and obscuration to vision, sky conditions (coverage and ceiling/cloud heights), mountain obscurement, and nonconvective low-level wind shear. If visibility of 6SM or less is forecast, obstructions to vision and/or weather will be included. Thunderstorms and volcanic ash will always be included regardless of the visibility. Cloud bases can be described either in MSL or AGL (CIGS or BASES). It depends on which statement is used: "ALL HGTS MSL XCP CIGS." or "ALL HGTS AGL XCP TOPS." Use of "AGL," "CIGS," and "BASES" should be limited to cloud bases within 4,000 feet of the ground. Cloud tops, referenced to MSL, should also be forecasted following the sky cover when expected to be below 15,000 MSL using the sky cover contractions FEW, SCT, or BKN. Nonconvective low-level wind shear will be included when the TAF for the airport involved has issued a nonconvective low-level wind shear forecast. Expected areas of icing and turbulence will not be included.

Example of TWEB route forecast:
249 TWEB 251402 KISN-KMOT-KGFK. ALL HGTS AGL XCP TOPS. KISN-50NM E KISN TIL 00Z P6SM SKC…AFT 00Z P6SM SCT050 LCL P6SM -TSRA BKN050. 50NM E KISN-KDVL TIL 20Z P6SM SCT070…AFT 20Z P6SM SCT070 LCL SFC WNDS VRB35G45KT 3-5SM TSRA CIGS OVC030-040. KDVL-KGFK TIL 16Z P6SM SCT-BKN020 AREAS 3-5SM BR…AFT 16Z P6SM SCT040.

Explanation of route forecast:
249 - route number
TWEB - TWEB route forecast
25 - twenty-fifth day of the month
1402 - valid 14Z on the twenty-fifth to 02Z on the twenty-sixth (12 hours)
KISN-KMOT-KGFK - route: Williston, North Dakota (ND), to Minot, ND, to Grand Forks, ND
Remainder of the message explained: All heights AGL except cloud tops. KISN-50NM E KISN until 00Z, visibility greater than 6SM with clear skies. After 00Z, visibility greater than 6SM with scattered clouds at 5,000 feet AGL. Local areas of visibility greater than 6SM, thunderstorm with light rain showers, and broken clouds at 5,000 feet AGL. 50 NM E KISN-KDVL (Devil's Lake, ND) until 20Z, visibility greater than 6SM, scattered clouds at 7,000 feet AGL. After 20Z, visibility greater than 6SM, scattered clouds at 7,000 feet AGL, local surface winds variable at 35 gusting to 45 knots, visibility 3-5SM, thunderstorm with moderate rain showers, overcast ceilings 3,000-4,000 feet AGL. KDVL-KGFK until 16Z, visibility greater than 6SM, scattered to broken clouds at 2,000 feet AGL, areas of visibility 3-5SM with mist. After 16Z, visibility greater than 6SM, scattered clouds at 4,000 feet AGL.

An example of TWEB vicinity forecast:
431 TWEB 021402 LAX BASIN. ALL HGTS MSL XCP CIGS. TIL 18Z P6SM XCP 3SM BR VLYS BKN020…18Z-22Z P6SM SCT020 SCT-BKN100…AFT 22Z P6SM SKC.

Explanation of vicinity forecast:
431 - TWEB vicinity number
TWEB - TWEB forecast
02 - second day of the month
1402 - valid 14Z on the second to 02Z on the third (12 hours)
LAX BASIN - The weather conditions in the Los Angeles basin until 18Z, visibility greater than 6SM except 3SM due to mist in the valleys and broken clouds at 2,000 feet MSL. Between 18Z and 22Z, visibility greater than 6SM and scattered clouds at 2,000 feet AGL; also scattered to broken clouds at 10,000 feet MSL. After 22Z, visibility greater than 6SM and sky clear.

A TWEB synopsis forecast is a brief description of the weather systems affecting the route during the forecast valid period. The synopsis describes movement of pressure systems, movement of fronts, upper air disturbances, or air flow.

An example of a TWEB synopsis:
BIS SYNS 250820. LO PRES TROF MVG ACRS ND TDA AND TNGT. HI PRES MVG SEWD FM CANADA INTO NWRN ND BY TNGT AND OVR MST OF ND BY WED MRNG.

Explanation of synopsis:
BIS - Bismarck, ND, WFO issuing the synopsis and route forecast
SYNS - Synopsis for the area covered by the route forecast
25 - twenty-fifth day of the month
0820 - Valid from 08Z on the twenty-fifth to 20Z on the twenty-fifth (12 hours)
The remainder of message explained: Low pressure trough moving across North Dakota today and tonight. High pressure moving southeastward from Canada into northwestern North Dakota by tonight and over most of North Dakota by Wednesday morning.

An example of another TWEB synopsis:
CYS SYNS 101402 STG UPSLP WNDS OVR WY TIL 01Z WITH WDSPRD IFR CONDS IN LGT SN AND BLOWING SN. CONDS WL IPV FM N TO S ACRS WY AFT 01Z WITH DCRG CLDS.

Explanation of synopsis:
CYS - Cheyenne, WY, WFO issuing the synopsis and route forecast
SYNS - Synopsis for the area covered by the route forecast
10 - tenth day of the month
1402 - Valid from 14Z on the tenth to 02Z on the eleventh (12 hours)
The remainder of the message explained: Strong upslope winds over Wyoming until 01Z with widespread IFR conditions in light snow and blowing snow. Conditions will improve from north to south across Wyoming after 01Z with decreasing clouds.

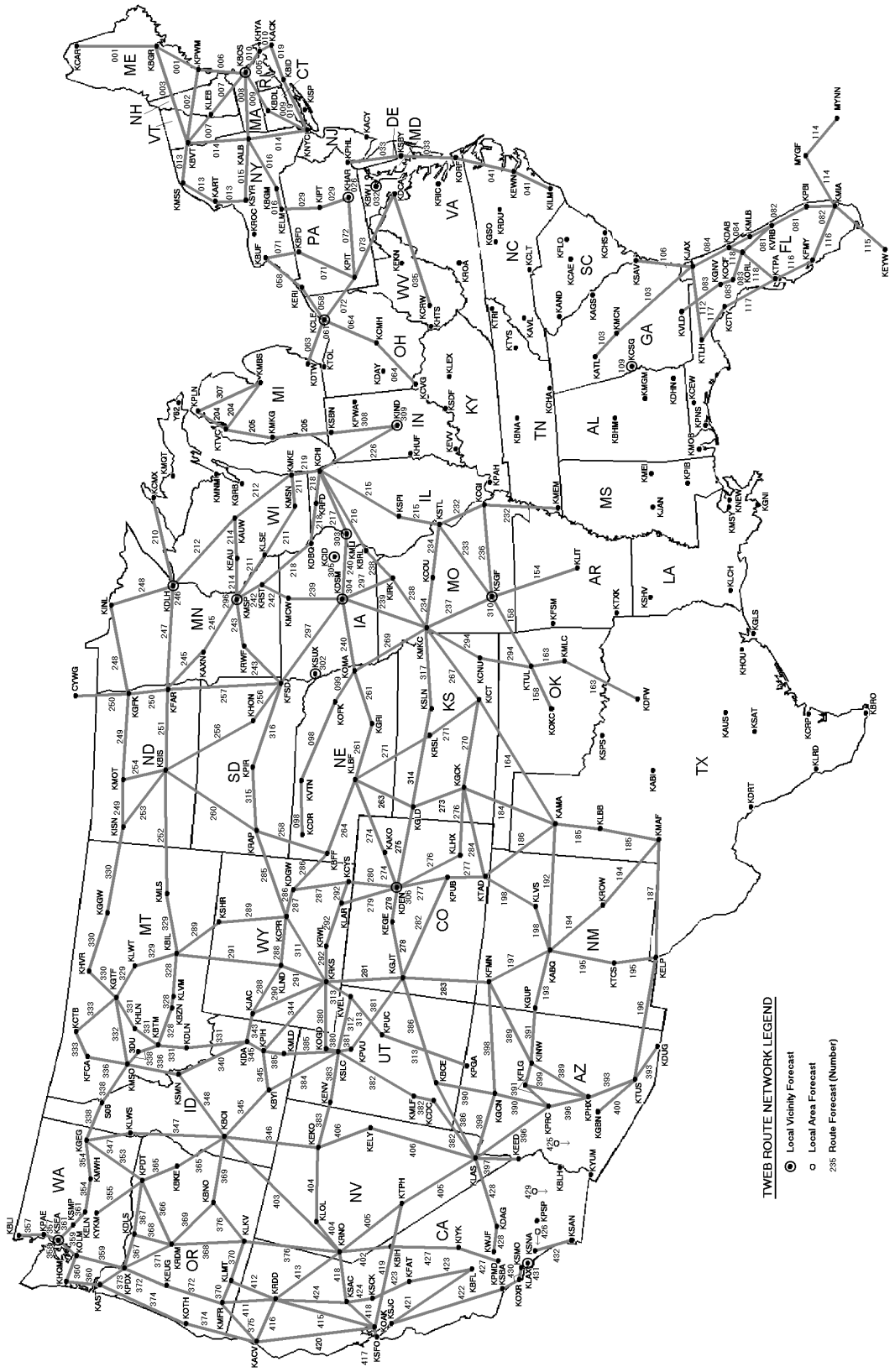


Figure 4-8. TWEB Route Map.

WINDS AND TEMPERATURES ALOFT FORECAST (FD)

Winds and temperatures aloft are forecasted for specific locations in the contiguous U.S., as shown in Figure 4-9. The FD forecasts are also prepared for a network of locations in Alaska and Hawaii as shown in Figure 4-10. Forecasts are made twice daily based on the 00Z and 12Z radiosonde data for use during specific time intervals.

Below is a sample FD message containing a heading and two FD locations. The heading always includes the time during which the FD may be used (0500-0900Z in the example) and a notation "TEMPS NEG ABV 24000." Since temperatures above 24,000 feet are always negative, the minus sign is omitted.

Example of FD report:

```
DATA BASED ON 010000Z
VALID 010600Z FOR USE 0500-0900Z. TEMPS NEG ABV 24000
FT     3000    6000     9000     12000    18000    24000    30000    34000    39000
MKC    2426    2726-09  2826-14  2930-21  2744-32  2751-41  275550   276050   731960
ABQ                     1912+15  1914+07  1917-06  1820-17  172132   171942   192054
```

Explanation of FD:

The data are based on the radiosonde information from the 1st day of the month at 00Z. The second line describes the valid time. In this example, the valid time is the 1st at 06Z for use on the 1st between 05-09Z. Temperatures are negative above 24,000 feet. The line labeled "FT" indicates the levels of the wind and temperature data. Through 12,000, feet the levels are true altitude. From 18,000 feet and above, the levels are pressure altitude. The 45,000-foot and 53,000-foot levels are also available. The pilot may request these levels from the FSS briefer. A six-digit group shows wind direction, in reference to true north, wind speed in knots, and temperature in degrees Celsius.

Note the Kansas City, MO (MKC), forecast for 3,000 feet. The group "2426" means the wind is from 240 degrees at 26 knots. The first two digits give direction in tens of degrees and the second two digits are the wind speed in knots. In the MKC forecast, the coded group for 9,000 feet is "2826-14." The wind is from 280 degrees at 26 knots and the temperature is negative 14 degrees Celsius. Note in the Albuquerque (ABQ) 3,000- and 6,000-foot examples that the wind group is omitted. No winds are forecasted within 1,500 feet of station elevation. Also, no temperatures are forecasted for any level within 2,500 feet of station elevation. (See MKC 3000 example.)

If a wind direction is coded between 51 and 86, the wind speed is 100 knots or greater. For example, the MKC forecast for 39,000 feet is "731960." To decode this, subtract 50 from the wind direction and add 100 knots to the wind speed. Thus, the wind direction is from 230 degrees (73-50=23) and the speed is 119 knots (100+19=119). The temperature is minus 60 degrees Celsius. If the wind speed is forecasted to be 200 knots or greater, the wind group is coded as 99 knots. For example, "7799" is decoded as 270 degrees at 199 knots or greater. When the forecast speed is less than 5 knots, the coded group is "9900" and read, "LIGHT AND VARIABLE."

Examples of decoding FDs:

Coded	Decoded
9900+00	Wind light and variable, temperature 0 degrees Celsius
2707	270 degrees at 7 knots
850552	350 degrees (85-50=35) at 105 knots (100+05=105), temperature -52 degrees Celsius

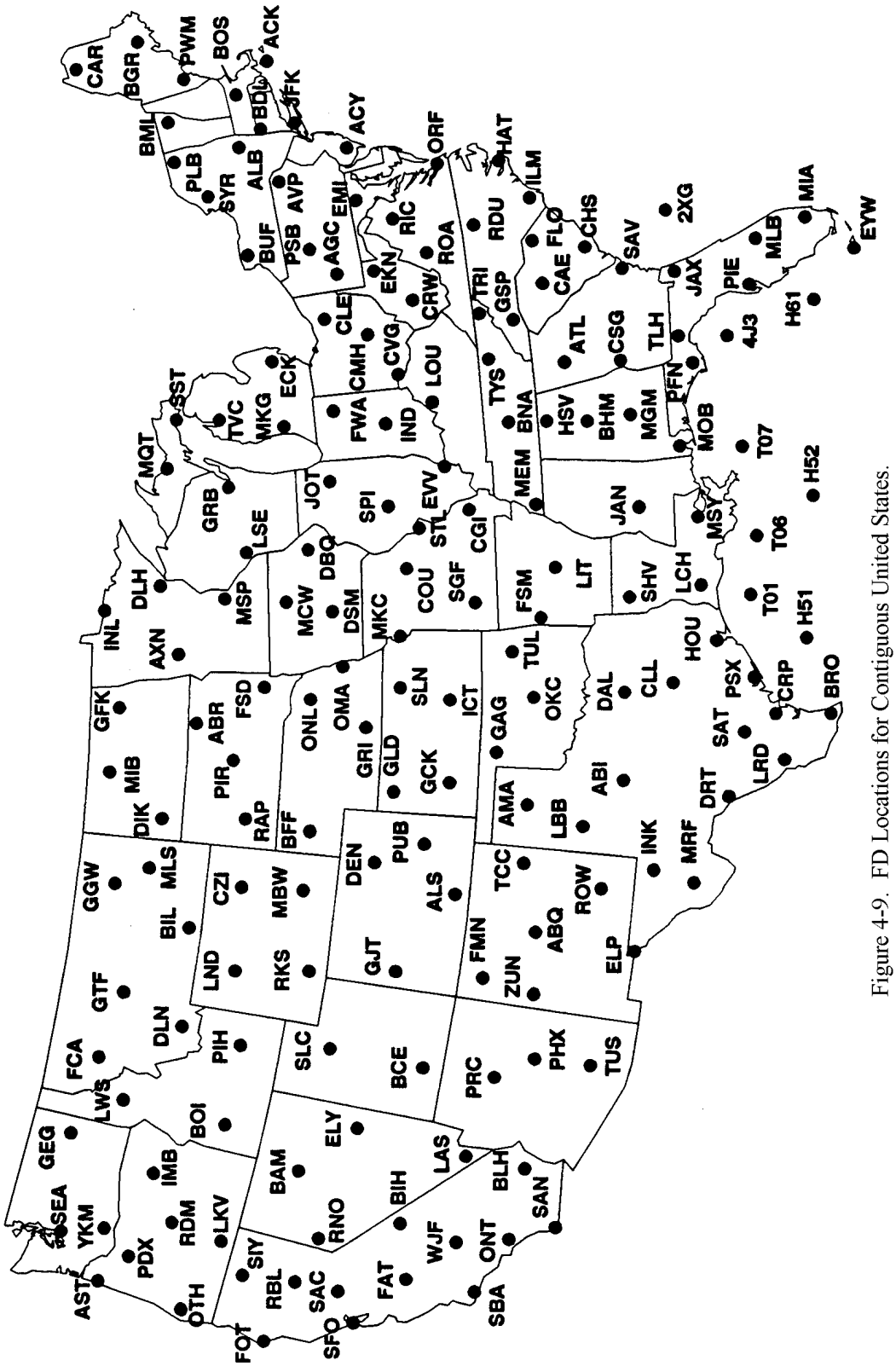


Figure 4-9. FD Locations for Contiguous United States.

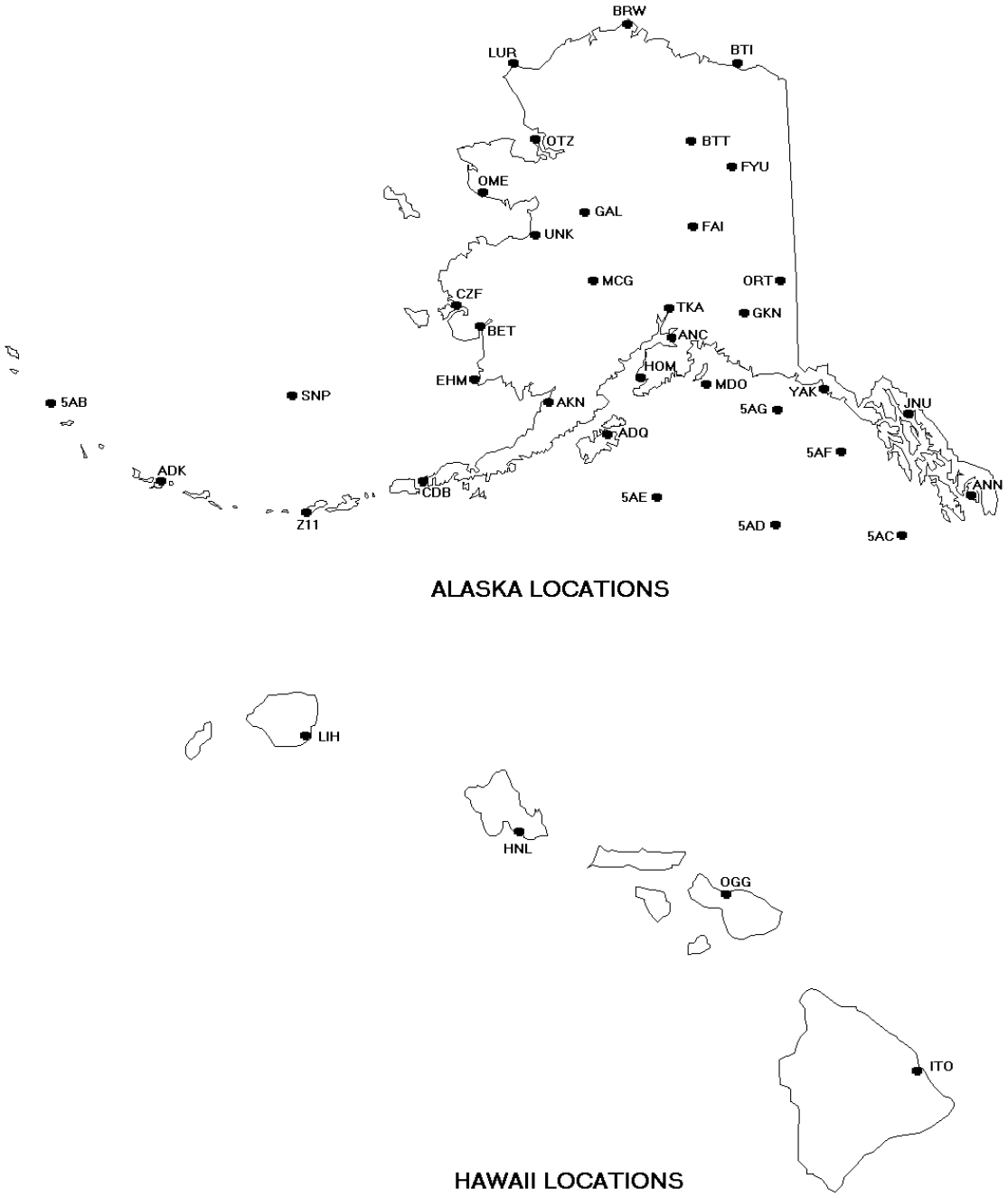


Figure 4-10. FD Locations for Alaska and Hawaii.

CENTER WEATHER SERVICE UNIT (CWSU) PRODUCTS

Center Weather Service Unit (CWSU) products are issued by the CWSU meteorologists located in the Air Route Traffic Control Centers (ARTCCs). Coordination between the CWSU meteorologist and other NWS facilities is extremely important since both can address the same event. If time permits, coordination should take place before the CWSU meteorologist issues a product.

METEOROLOGICAL IMPACT STATEMENT (MIS)

A Meteorological Impact Statement (MIS) is an unscheduled flow control and flight operations planning forecast. The MIS can be valid between 2 to 12 hours after issuance. This enables the impact of expected weather conditions to be included in air traffic control decisions in the near future. The MIS will be issued when the following three conditions are met:

1. If any one of the following conditions occur, are forecasted to occur, and if previously forecasted, are no longer expected to occur:
   a. convective SIGMET criteria
   b. moderate or greater icing and/or turbulence
   c. heavy or freezing precipitation
   d. low IFR conditions
   e. surface winds/gusts 30 knots or greater
   f. low-level wind shear within 2,000 feet of the surface
   g. volcanic ash, dust or sandstorm
2. If the impact occurs on air traffic flow within the ARTCC area of responsibility
3. If the forecast lead time (the time between issuance and onset of a phenomenon), in the forecaster's judgment, is sufficient to make issuance of a Center Weather Advisory (CWA) unnecessary

Example of a MIS:
ZOA MIS 01 VALID 041415-041900
…FOR ATC PLANNING PURPOSES ONLY…
FOR SFO BAY AREA
DNS BR/FG WITH CIG BLO 005 AND VIS OCNL BLO 1SM TIL 19Z.

This MIS from the Fremont, California (CA), ARTCC is the first issuance of the day. It was issued at 1415Z on the fourth and is valid until 1900Z on the fourth. This forecast is for the San Francisco Bay area. The forecast is of dense fog/mist with ceilings below 500 feet and visibilities occasionally below 1SM until 19Z.

Example:
ZOA MIS 02 VALID 041650
…FOR ATC PLANNING PURPOSES ONLY…
FOR SFO BAY AREA
CANCEL ZOA MIS 01. DNS BR/FG CONDS HAVE IPVD ERYR THAN FCST.

This MIS is from the Fremont, CA, ARTCC and cancels the previously issued MIS. Specifically it states dense fog/mist conditions have improved earlier than forecasted.

Example:
ZID MIS 03 VALID 041200-042330
…FOR ATC PLANNING PURPOSES ONLY…
FROM IND TO CMH TO LOZ TO EVV TO IND
FRQ MOD TURBC FL310-390 DUE TO JTSTR…CONDS DMSHG IN INTSTY AFT 21Z.

This MIS from the Indianapolis, Indiana (IN), ARTCC was issued at 1200Z on the fourth and valid until the fourth at 2330Z. This forecast describes an area from Indianapolis, IN, to Columbus, Ohio (OH), to London, Kentucky (KY), to Evansville, IN, and back to Indianapolis, IN. The MIS describes frequent moderate turbulence between flight levels 310-390 caused by the jet stream. Conditions will diminish in intensity after 21Z.

CENTER WEATHER ADVISORY (CWA)

A Center Weather Advisory (CWA) is an aviation warning for use by air crews to anticipate and avoid adverse weather conditions in the en route and terminal environments. The CWA is not a flight planning product; instead it reflects current conditions expected at the time of issuance and/or is a short-range forecast for conditions expected to begin within 2 hours of issuance. CWAs are valid for a maximum of 2 hours. If conditions are expected to continue beyond the 2-hour valid period, a statement will be included in the CWA.

A CWA may be issued for the following three situations:

1. As a supplement to an existing inflight aviation weather advisory for the purpose of improving or updating the definition of the phenomenon in terms of location, movement, extent, or intensity relevant to the ARTCC area of responsibility. This is important for the following reason. A SIGMET for severe turbulence was issued by AWC, and the outline covered the entire ARTCC area for the total 4-hour valid time period. However, the forecaster may issue a CWA covering only a relatively small portion of the ARTCC area at any one time during the 4-hour period.
2. When an inflight aviation weather advisory has not yet been issued but conditions meet the criteria based on current pilot reports and the information must be disseminated sooner than the AWC can issue the inflight aviation weather advisory. In this case of an impending SIGMET, the CWA will be issued as urgent (UCWA) to allow the fastest possible dissemination.
3. When inflight aviation weather advisory criteria are not met but conditions are or will shortly be adversely affecting the safe flow of air traffic within the ARTCC area of responsibility.

Example of a CWA:
ZME1 CWA 081300
ZME CWA 101 VALID UNTIL 081500
FROM MEM TO JAN TO LIT TO MEM
AREA SCT VIP 5-6 (INTENSE/EXTREME) TS MOV FROM 26025KT. TOPS TO FL450.

This CWA was issued by the Memphis, Tennessee (TN), ARTCC. The 1 after the ZME in the first line denotes this CWA has been issued for the first weather phenomenon to occur for the day. It was written on the eighth at 1300Z. The 101 in the second line denotes the phenomenon number again (1) and the issuance number (01) for this phenomenon. The CWA is until the eighth at 1500Z. The area is bounded from Memphis, TN, to Jackson, MS, to Little Rock, AR, and back to Memphis, TN. Within the CWA is an area with scattered VIP 5-6 (intense/extreme) thunderstorms moving from 260 degrees at 25 knots. Tops of the thunderstorms are at FL450.

HURRICANE ADVISORY (WH)

When a hurricane threatens a coastline, but is located at least 300NM offshore, a Hurricane Advisory (WH) is issued to alert aviation interests. The advisory gives the location of the storm center, its expected movement, and the maximum winds in and near the storm center. It does not contain details of associated weather, as specific ceilings, visibilities, weather, and hazards that are found in the FAs, TAFs, and inflight aviation weather advisories.

Example of a WH:
ZCZC MIATCPAT4
TTAA00 KNHC 190841
BULLETIN
HURRICANE DANNY ADVISORY NUMBER 13
NATIONAL WEATHER SERVICE MIAMI FL
4 AM CDT SAT JUL 19 1997

…DANNY STILL MOVING LITTLE…ANY NORTHWARD DRIFT WOULD BRING THE CENTER ONSHORE…

HURRICANE WARNINGS ARE IN EFFECT FROM GULFPORT MISSISSIPPI TO APALACHICOLA FLORIDA. SMALL CRAFT SOUTHWEST OF GULFPORT SHOULD REMAIN IN PORT UNTIL WINDS AND SEAS SUBSIDE.

AT 4 AM CDT…0900Z…THE CENTER OF HURRICANE DANNY WAS LOCATED BY NATIONAL WEATHER SERVICE RADAR AND RECONNAISSANCE AIRCRAFT NEAR LATITUDE 30.2 NORTH…LONGITUDE 88.0 WEST…VERY NEAR THE COAST ABOUT 25 MILES SOUTH-SOUTHEAST OF MOBILE ALABAMA.

DANNY HAS MOVED LITTLE DURING THE PAST FEW HOURS. WHILE SOME ERRATIC MOTION CAN BE EXPECTED DURING THE NEXT FEW HOURS…A GRADUAL TURN TOWARD THE NORTHEAST IS EXPECTED TODAY. ON THIS COURSE…THE CENTER IS EXPECTED TO MAKE LANDFALL IN THE WARNING AREA TODAY. HOWEVER ANY DEVIAITON TO THE NORTH OR THE TRACK WOULD BRING THE CENTER ONSHORE WITHIN THE WARNING AREA AT ANYTIME.
MAXIMUM SUSTAINED WINDS ARE NEAR 75 MPH WITH HIGHER GUSTS. SOME STRENGTHENING IS STILL POSSIBLE PRIOR TO LANDFALL. DAUPHIN ISLAND RECENTLY REPORTED GUSTS TO 66 MPH AND THE PRESSURE DROPPED TO 989MB…29.20 INCHES.

DANNY HAS A RELATIVELY SMALL WIND FIELD. HURRICANE FORCE WINDS EXTEND OUTWARD UP TO 25 MPH FROM THE CENTER AND TROPICAL STORM FORCE WINDS EXTEND OUTWARD UP TO 70 MILES.

LATEST MINIMUM CENTRAL PRESSURE REPORTED BY A RECONNAISSANCE AIRCRAFT WAS 986 MB…29.11 INCHES.

RADAR SHOWS RAIN BANDS AFFECTING THE AREA FROM SOUTHERN MISSISSIPPI TO THE FLORIDA PANHANDLE. TOTALS OF 10 TO 20 INCHES…LOCALLY HIGHER…COULD OCCUR NEAR THE TRACK OF DANNY DURING THE NEXT FEW DAYS.

STORM SURGE FLOODING OF 4 TO 5 FEET ABOVE NORMAL TIDES IS POSSIBLE ALONG THE GULF COAST EAST OF THE CENTER.

Example of WH forecast/advisory:
ZCZC MIATCMAT4
TTAA00 KNHC 190845
HURRICANE DANNY FORECAST/ADVISORY NUMBER 13
NATIONAL WEATHER SERVICE MIAMI FL AL0497
0900Z SAT JUL 19 1997

HURRICANE WARNINGS ARE IN EFFECT FROM GULFPORT MISSISSIPPI TO APALACHICOLA FLORIDA. SMALL CRAFT SOUTHWEST OF GULFPORT SHOULD REMAIN IN PORT UNTIL THE WINDS AND SEAS SUBSIDE.

HURRICANE CENTER LOCATED NEAR 30.2 N 88.0 W AT 19/0900Z POSITION ACCURATE WITHIN 30 NM.

PRESENT MOVEMENT NEARLY STATIONARY

ESTIMATED MINIMUM CENTRAL PRESSURE 986 MB
MAX SUSTAINED WINDS 65 KTS WITH GUSTS TO 80 KT

64 KT	15NE	20SE	0SW	0NW
50 KT	20NE	30SE	30SW	0NW
34 KT	30 E	60SE	60SW	30NW
12FT SEAS	30NE	60SE	60SW	30NW

ALL QUADRANT RADII IN NAUTICAL MILES

FORECAST VALID 19/1800Z 30.2N 87.4W
MAX WIND 70 KT…GUSTS 85 KT

64 KT	20NE	20SE	20SW	20NW
50 KT	25NE	30SE	30SW	25NW
34 KT	30NE	75SE	75SW	30NW

CONVECTIVE OUTLOOK (AC)

A Convective Outlook (AC) is a national forecast of thunderstorms. There are two forecasts: Day 1 Convective Outlook (first 24 hours) and Day 2 Convective Outlook (next 24 hours). These forecasts describe areas in which there is a slight, moderate, or high risk of severe thunderstorms, as well as areas of general (non-severe) thunderstorms. The severe thunderstorm criteria are: Winds equal to or greater than 50 knots at the surface, or hail equal to or greater than ¾ inch in diameter at the surface, or tornadoes. The Refer to the Convective Outlook Chart (Section 12) for risk definitions. Forecast reasoning is also included in all ACs. Outlooks are produced by the Storm Prediction Center (SPC) located in Norman, OK. The times of issuance for Day 1 are 0600Z, 1300Z, 1630Z, 2000Z, and 0100Z. The initial Day 2 issuance is at 0830Z during standard time and 0730Z during daylight time. It is updated at 1730Z. The AC is a flight planning tool used to avoid thunderstorms.

Example:
MKC AC 291435
CONVECTIVE OUTLOOK…REF AFOS NMCGPH94O.
VALID 291500Z-301200Z

THERE IS A SLGT RISK OF SVR TSTMS TO THE RIGHT OF A LINE FROM 10 NE JAX 35 NNW AYS AGS 15 E SPA 30 NE CLT 25 N FAY 30 ESE EWN.

GEN TSTMS ARE FCST TO THE RIGHT OF A LINE FROM 55 ESE YUM 30 NE IGM 15 S CDC 30 SW U24 25 ESE ELY 40 W P38 DRA 50 SW DRA 50 NW NID SAC 30 E ACV 25 E ONP 40 E BLI.

...SEVERE THUNDERSTORM FORECAST DISCUSSION...
.SERN U.S...

COOL FRONT CONTS SC/NC BORDER. VERY MOIST AND UNSTBL AMS ALONG AND S OF FRONT E OF APLCHNS WITH CAPES TO REACH TO 4000 J/KG WITH AFTN HEATING. ALTHOUGH WIND PROFILES ARE WK...COMB OF FRONTAL CNVGNC COUPLED WITH SEA BREEZE FRONT WILL INITIATE PULSE SVR TSTMS VCNTY AND S OF FRONT THIS AFTN/EVE. PRIMARY SVR EVENTS WILL BE WET DOWNBURST TO PUSH SWD FROM CNTRL RCKYS EWD TO MID ATLC CST. E OF APLCNS FRONT NOW LCTD VCNTY WND DMG.

...GENERAL THUNDERSTORM FORECAST DISCUSSION...
...GULF CST AREA INTO SRN PLNS...

SFC FNT CURRENTLY LOCATED FM THE CAROLINAS WWD INTO PARTS OF OK WL CONT TO SAG SLOWLY SWD ACRS THE SRN APLCNS/LWR MS VLY THRU THE REMAINDER OF THE PD. S OF THE BNDRY...A VRY MOIST AMS RMNS IN PLACE AS DWPNTS ARE IN THE MID TO UPR 70S. WHILE SOME CLDNS IS PRESENT ACRS THE AREA...SUF HEATING SHOULD OCR TO ALLOW FOR MDT TO STG AMS DSTBLZN DURG THE LATE MRNG/ERY AFTN. AS A RESULT...SFC BASED CAPE VALUES SHOULD BE AOA 2000 J/KG THIS AFTN. BNDRYS FM OVERNIGHT CNVTN AS WELL AS SEA BREEZE CIRCULATIONS SHOULD BE SUF TO INITIATE SCT TO NMRS TSTMS ACRS THE AREA. MID TO UPR LVL FLOW IS RELATIVELY WK...SO THIS SUG ORGANIZED SVR TSTM ACTVTY IS NOT LIKELY.

SEVERE WEATHER WATCH BULLETINS (WWs) and ALERT MESSAGES (AWWs)

A Severe Weather Watch Bulletin (WW) defines areas of possible severe thunderstorms or tornado activity. The bulletins are issued by the SPC in Norman, OK. WWs are unscheduled and are issued as required.

A severe thunderstorm watch describes areas of expected severe thunderstorms. (Severe thunderstorm criteria are ¾-inch hail or larger and/or wind gusts of 50 knots [58 mph] or greater.) A tornado watch describes areas where the threat of tornadoes exists.

In order to alert the WFOs, CWSUs, FSSs, and other users, a preliminary notification of a watch called the Alert Severe Weather Watch bulletin (AWW) is sent before the WW. (WFOs know this product as a SAW).

Example of an AWW:
MKC AWW 011734
WW 75 TORNADO TX OK AR 011800Z-020000Z
AXIS..80 STATUTE MILES EAST AND WEST OF A LINE..60ESE DAL/DALLAS TX/ - 30 NW ARG/ WALNUT RIDGE AR/
..AVIATION COORDS.. 70NM E/W /58W GGG - 25NW ARG/
HAIL SURFACE AND ALOFT..1 ¾ INCHES. WIND GUSTS..70 KNOTS. MAX TOPS TO 450.
MEAN WIND VECTOR 24045.

Soon after the AWW goes out, the actual watch bulletin itself is issued. A WW is in the following format:

1. Type of severe weather watch, watch area, valid time period, type of severe weather possible, watch axis, meaning of a watch, and a statement that persons should be on the lookout for severe weather
2. Other watch information; i.e., references to previous watches
3. Phenomena, intensities, hail size, wind speed (knots), maximum CB tops, and estimated cell movement (mean wind vector)
4. Cause of severe weather
5. Information on updating ACs

Example of a WW:
BULLETIN - IMMEDIATE BROADCAST REQUESTED
TORNADO WATCH NUMBER 381
STORM PREDICTION CENTER NORMAN OK
556 PM CDT MON JUN 2 1997

THE STORM PREDICTON CENTER HAS ISSUED A TORNADO WATCH FOR PORTIONS OF

NORTHEAST NEW MEXICO
TEXAS PANHANDLE

EFFECTIVE THIS MONDAY NIGHT AND TUESDAY MORNING FROM 630 PM UNTIL MIDNIGHT CDT.

TORNADOES…HAIL TO 2 ¾ INCHES IN DIAMETER…THUNDERSTORM WIND GUSTS TO 80 MPH…AND DANGEROUS LIGHTNING ARE POSSIBLE IN THESE AREAS.

THE TORNADO WATCH AREA IS ALONG AND 60 STATUTE MILES NORTH AND SOUTH OF A LINE FROM 50 MILES SOUTHWEST OF RATON NEW MEXICO TO 50 MILES EAST OF AMARILLO TEXAS.

REMEMBER…A TORNADO WATCH MEANS CONDITIONS ARE FAVORABLE FOR TORNADOES AND SEVERE THUNDERSTORMS IN AND CLOSE TO THE WATCH AREA. PERSONS IN THESE AREAS SHOULD BE ON THE LOOKOUT FOR THREATENING WEATHER CONDITIONS AND LISTEN FOR LATER STATEMENTS AND POSSIBLE WARNINGS.

OTHER WATCH INFORMATION… CONTINUE…WW 378…WW 379…WW 380

DISCUSSION…THUNDERSTORMS ARE INCREASING OVER NE NM IN MOIST SOUTHEASTERLY UPSLOPE FLOW. OUTFLOW BOUNDARY EXTENDS EASTWARD INTO THE TEXAS PANHANDLE AND EXPECT STORMS TO MOVE ESE ALONG AND NORTH OF THE BOUNDARY ON THE N EDGE OF THE CAP. VEERING WINDS WITH HEIGHT ALONG WITH INCREASGING MID LVL FLOW INDICATE A THREAT FOR SUPERCELLS.

AVIATION…TORNADOES AND A FEW SEVERE THUNDERSTORMS WITH HAIL SURFACE AND ALOFT TO 2 ¾ INCHES. EXTREME TURBULENCE AND SURFACE WIND GUSTS TO 70 KNOTS. A FEW CUMULONIMBI WITH MAXIMUM TOPS TO 550. MEANS STORM MOTION VECTOR 28025.

Status reports are issued as needed to show progress of storms and to delineate areas no longer under the threat of severe storm activity. Cancellation bulletins are issued when it becomes evident that no severe weather will develop or that storms have subsided and are no longer severe.

When tornadoes or severe thunderstorms have developed, the local WFO office will issue the warnings covering those areas.

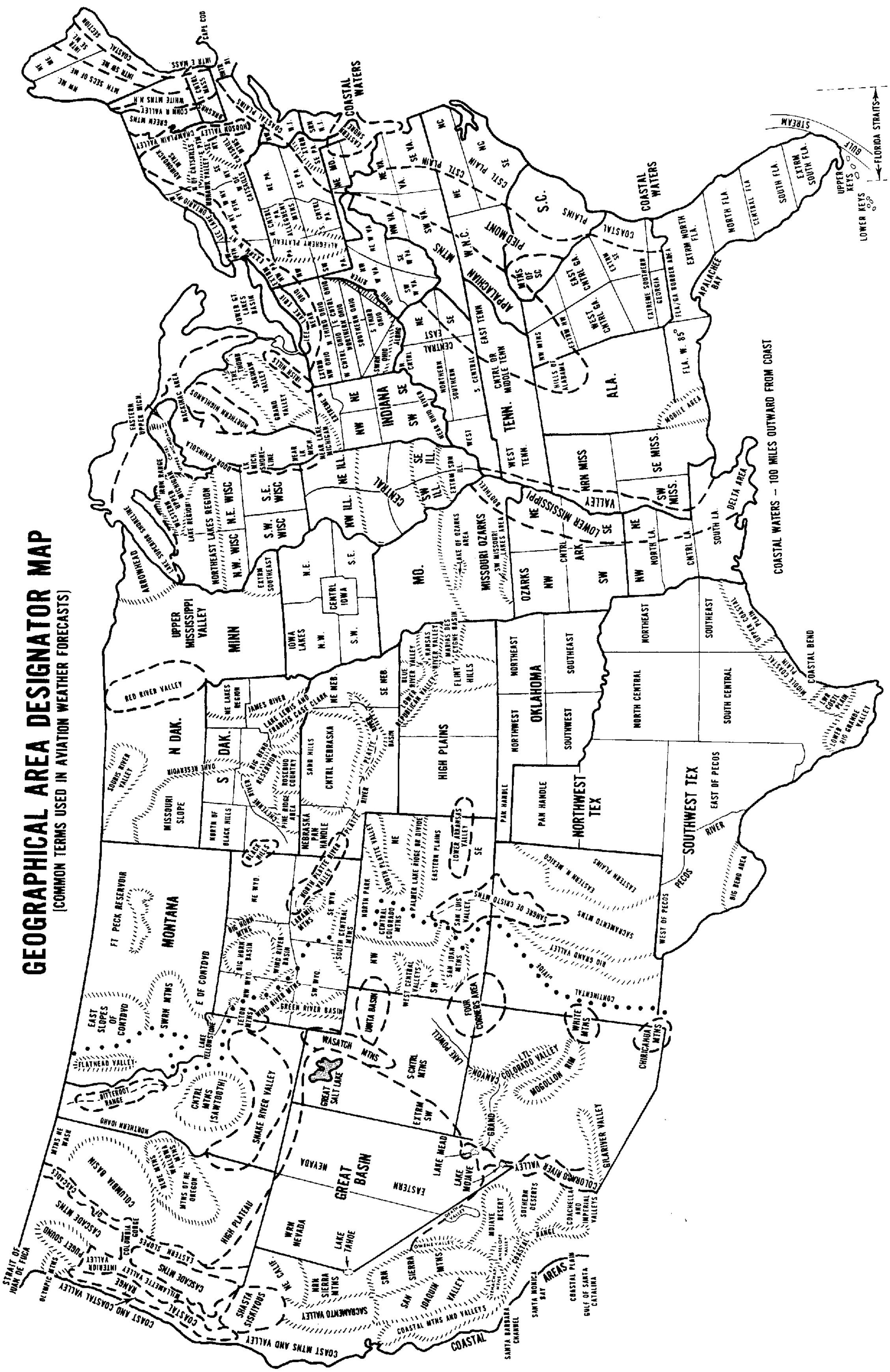


Figure 4-11. Geographical Areas and Terrain Features.

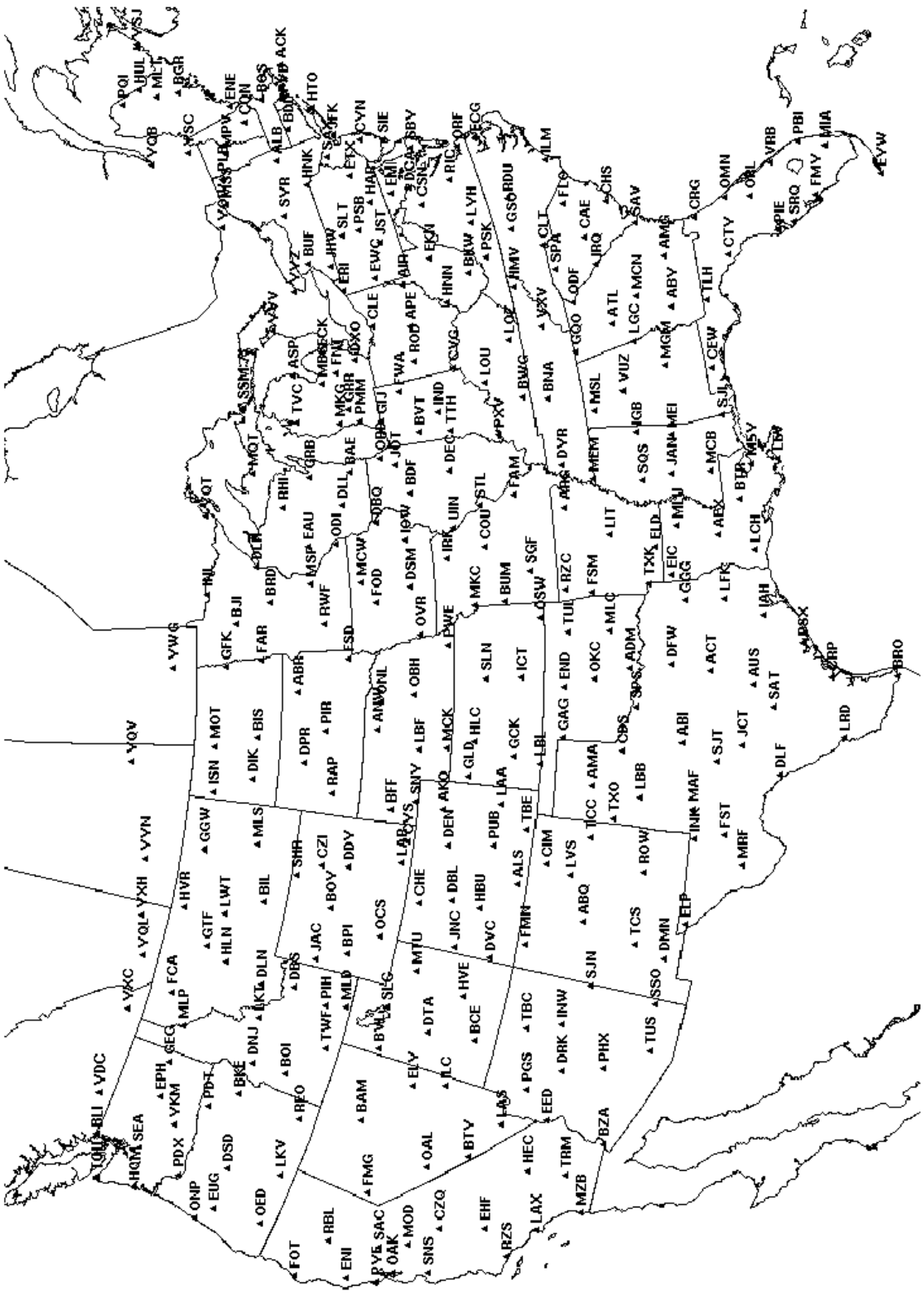


Figure 4-12. Inflight Advisory Plotting Chart.

Section 5
SURFACE ANALYSIS CHART

The surface analysis chart is a computer-generated chart, with frontal analysis by HPC forecasters, transmitted every 3 hours covering the contiguous 48 states and adjacent areas. Figure 5-1 is a surface analysis chart, and Figure 5-2 illustrates the symbols depicting fronts and pressure centers.

VALID TIME

Valid time of the chart corresponds to the time of the plotted observations. A date-time group in Universal Coordinated Time (UTC) tells the user when conditions portrayed on the chart occurred.

ISOBARS

Isobars are solid lines depicting the sea-level pressure pattern and are usually spaced at intervals of 4 millibar (mb), or hectoPascals (hPa) in metric units (1 millibar = 1 hectoPascal). Each isobar is labeled. For example, 1032 signifies 1,032.0 mb (hPa); 1000 signifies 1,000.0 mb (hPa); and 992 signifies 992.0 mb (hPa).

PRESSURE SYSTEMS

The letter "L" denotes a low pressure center, and the letter "H" denotes a high pressure center. The pressure of each center is indicated by a three- or four-digit number that is the central pressure in mb (hPa).

FRONTS

The analysis shows positions and types of fronts by the symbols in Figure 5-2. The symbols on the front indicate the type of front and point in the direction toward which the front is moving. If the front has arrowhead-shaped symbols, it is a cold front. If the front has half-moon symbols, it is a warm front. A three-digit number near a front classifies it as to type (see Table 5-1), intensity (see Table 5-2), and character (see Table 5-3). A bracket ([or]) before or after the number "points" to the front to which the number refers. For example, in Figure 5-1, the front extends from eastern Montana into central North Dakota south through South Dakota and Nebraska into northwestern Kansas. The front is labeled "027" which means a quasi-stationary front ("0" from Table 5-1); weak, little, or no change ("2" from Table 5-2); and with waves ("7" from Table 5-3).

Two short lines across a front indicate a change in classification. In figure 5-1, note that two lines cross the front in central Montana (adjacent to the Low). To the left of the Low the front is numbered "450" which is a cold front; moderate, little, or no change; and no specification. The front to the right of the Low is numbered "027" which is a quasi-stationary front; weak, little, or no change; and with waves.

TROUGHS AND RIDGES

A trough of low pressure with significant weather will be depicted as a thick, dashed line running through the center of the trough and identified with the word "TROF." The symbol for a ridge of high pressure is very rarely, if at all, depicted (Figure 5-2).

OTHER INFORMATION

The observations from a number of stations are plotted on the chart to aid in analyzing and interpreting the surface weather features. These plotted observations are referred to as station models. There are two primary types of station models plotted on the chart. Those with a round station symbol are observations taken by observers. The locations with a square station symbol indicate the sky cover was determined by an automated system. Other plotting models that appear over water on the chart are data from ships, buoys, and offshore oil platforms. Figure 5-3 is an example of a station model that shows where the weather information is plotted. Figures 5-4 through Figure 5-7 help explain the decoding of the station model.

An outflow boundary will be depicted as a thick, dashed line with the word "OUTBNDY."

A dry line will be depicted as a line with unshaded pips or a through symbol. It will also be identified with the words "DRY LINE."

A legend is printed on each chart stating its name, valid date and valid time.

USING THE CHART

The surface analysis chart provides a ready means of locating pressure systems and fronts. It also gives an overview of winds, temperatures, and dew point temperatures at chart time. When using the chart, keep in mind that weather moves and conditions change. Using the surface analysis chart in conjunction with other information gives a more complete weather picture.

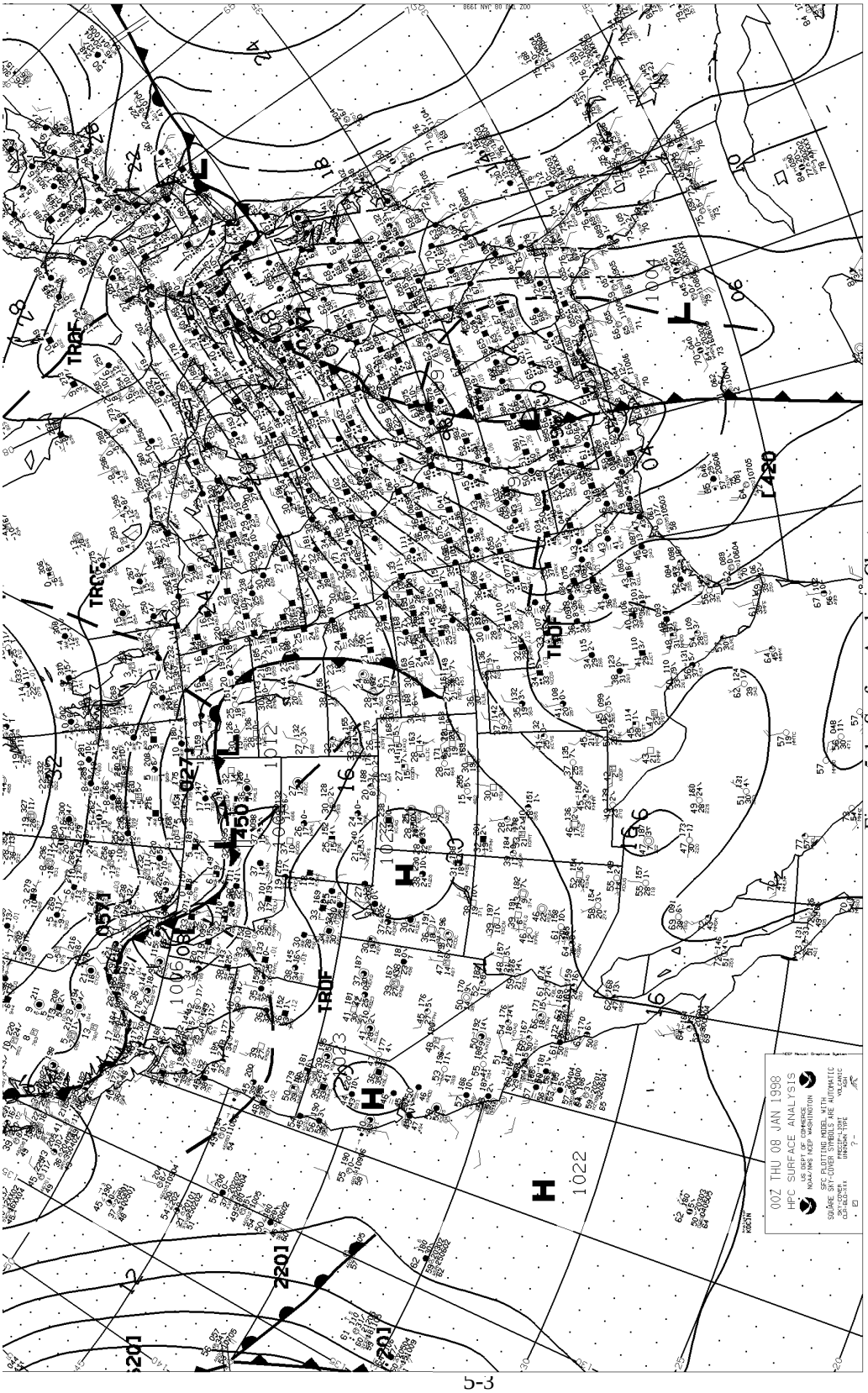


Figure 5-1. Surface Analysis Chart.

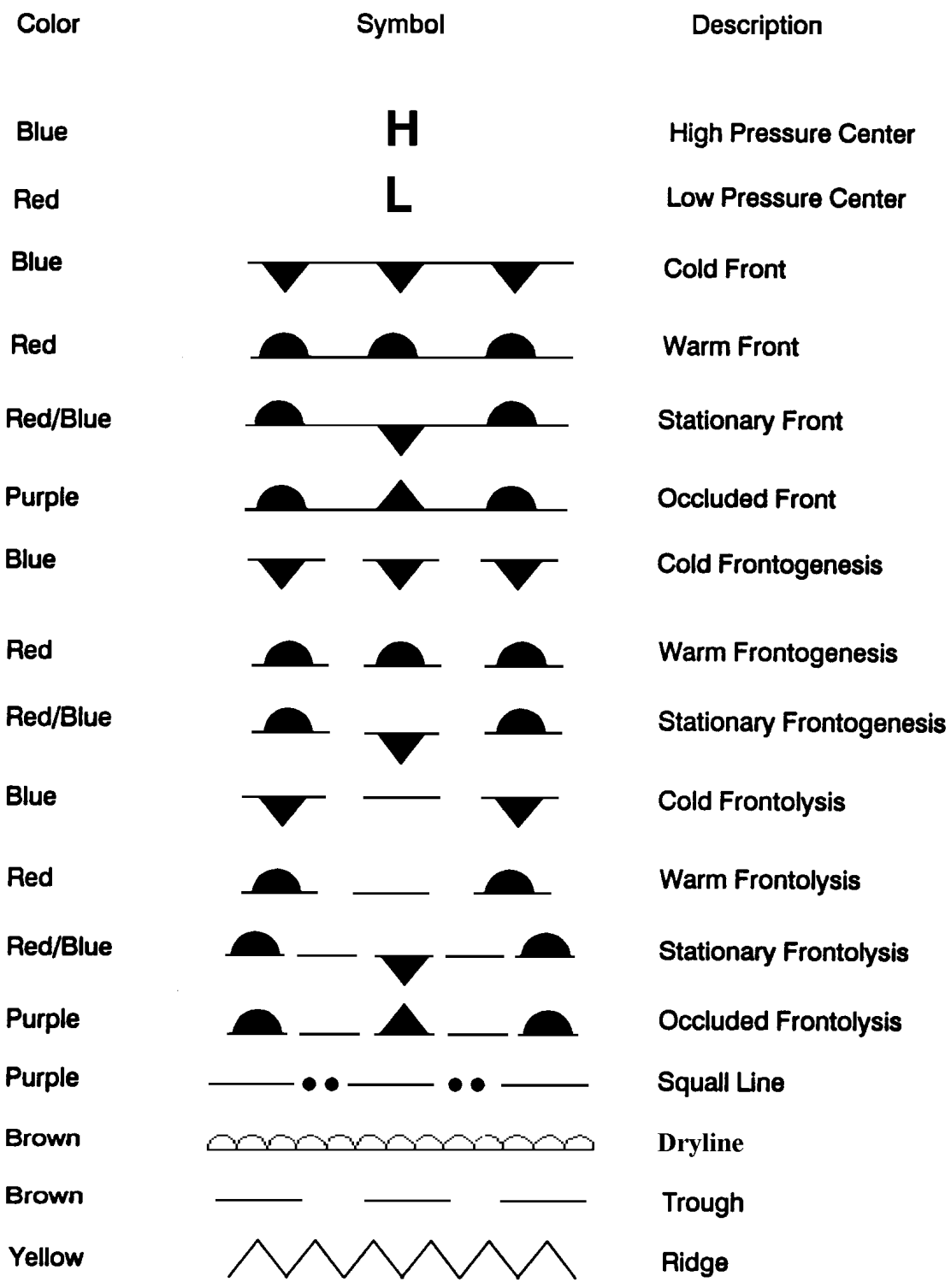
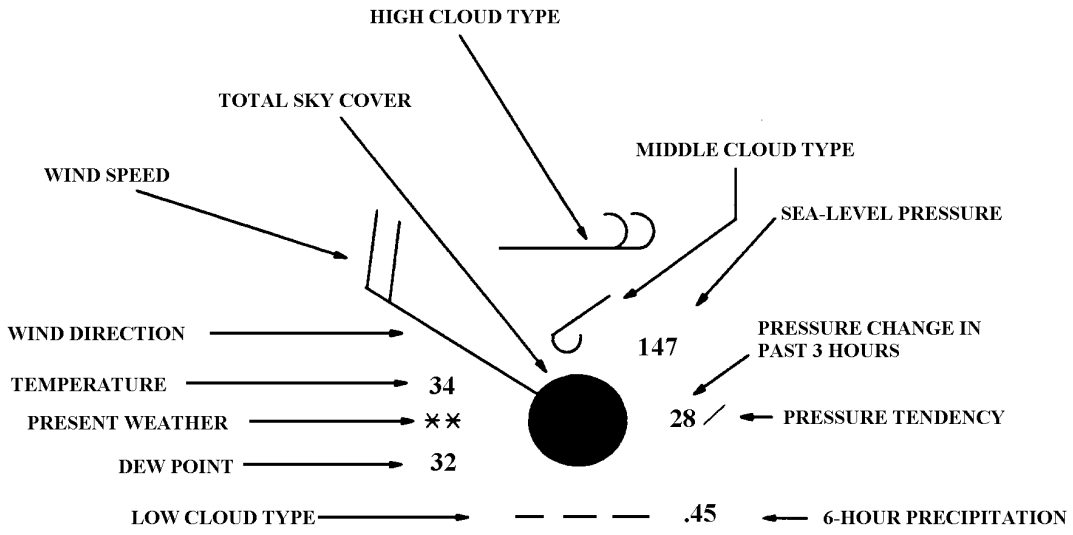
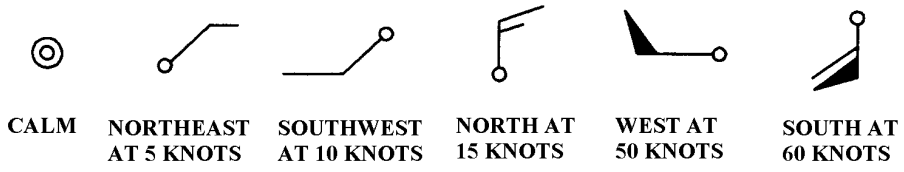


Figure 5-2. Symbols on Surface Analysis Chart.



1. **Total sky cover: Overcast.**
2. **Temperature: 34 degrees F, Dew Point: 32 degrees F.**
3. **Wind: From the northwest at 20 knots (relative to true north).**

Examples of wind direction and speed



4. **Present Weather: Continuous light snow.**
5. **Predominate low, middle, high cloud reported: Strato fractus or cumulus fractus of bad weather, altocumulus in patches, and dense cirrus.**
6. **Sea-level pressure: 1,014.7 millibars (mbs).**
   NOTE: Pressure is always shown in three digits to nearest tenth of an mb. For 1,000 mbs or greater, prefix a "10" to the three digits. For less than 1,000 mbs, prefix a "9" to the three digits.
7. **Pressure change in the past 3 hours: Increased steadily or unsteadily by 2.8 mbs. The actual change is in tenths of a mb.**
8. **6 - hour precipitation in hundredths of an inch: 45 hundredths of an inch.**

Figure 5-3. Station Model and Explanation.

Table 5-1. Type of Front

Code Figures	Descriptions
0	Quasi-stationary at surface
2	Warm front at surface
4	Cold front at surface
6	Occlusion
7	Instability line

Table 5-2. Intensity of Front

Code Figures	Descriptions
0	No specification
1	Weak, decreasing
2	Weak, little, or no change
3	Weak, increasing
4	Moderate, decreasing
5	Moderate, little, or no change
6	Moderate, increasing
7	Strong, decreasing
8	Strong, little, or no change
9	Strong, increasing

Table 5-3. Character of Front

Code Figures	Descriptions
0	No specification
5	Forming or existence expected
6	Quasi-stationary
7	With waves
8	Diffuse

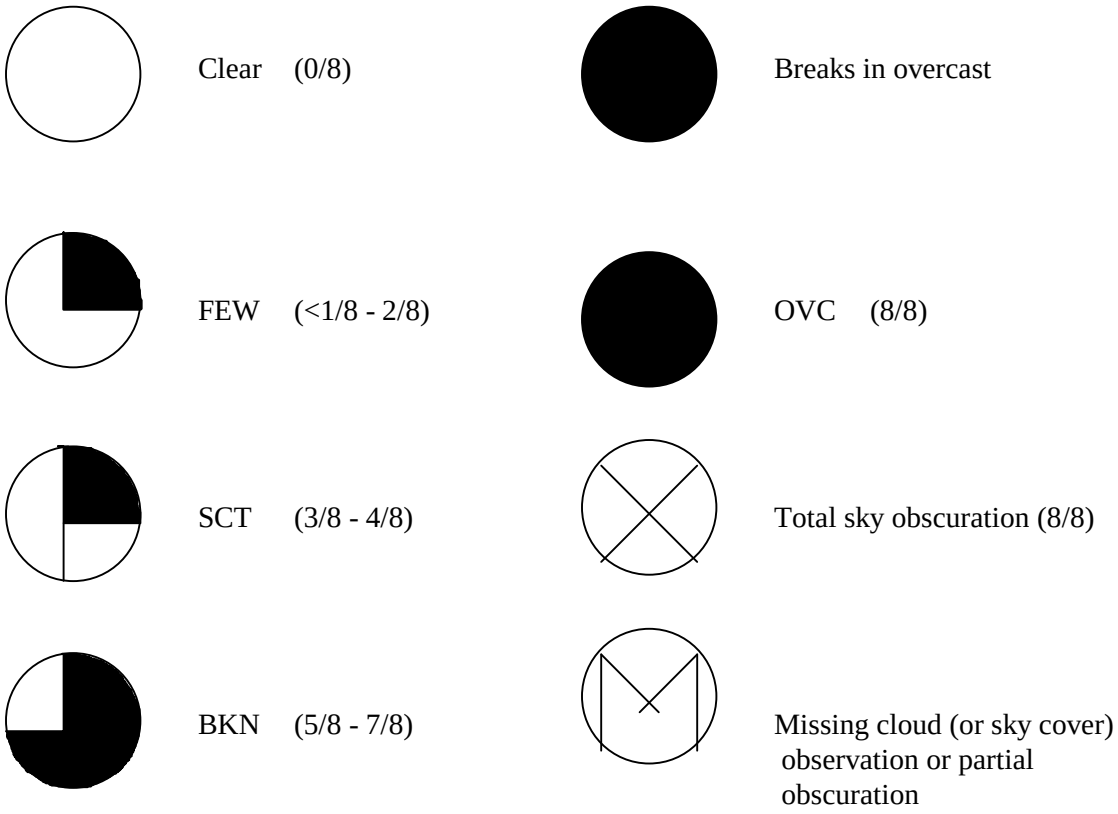


Figure 5-4. Sky Cover Symbols.

Description of Characteristic			
Primary Requirements	**Additional Requirements**	**Graphic**	**Code Figure**
Higher **Atmospheric pressure now higher than 3 hours ago.**	**Increasing, then decreasing**		**0**
	Increasing, then steady; or		**1**
	Increasing, then increasing more slowly		
	Increasing; steadily or unsteadily		**2**
	Decreasing; or steady, then increasing; or **Increasing, then increasing more rapidly**		**3**
Same **Atmospheric pressure now same as 3 hours ago.**	**Increasing, then decreasing**		**0**
	Steady		**4**
	Decreasing, then increasing		**5**
Lower **Atmospheric pressure now lower than 3 hours ago.**	**Decreasing, then increasing**		**5**
	Decreasing, then steady; or		**6**
	Decreasing, then decreasing more slowly		
	Decreasing; steadily or unsteadily		**7**
	Steady; or increasing, then decreasing; or **Decreasing, then decreasing more rapidly**		**8**

Figure 5-5. Pressure Tendencies.

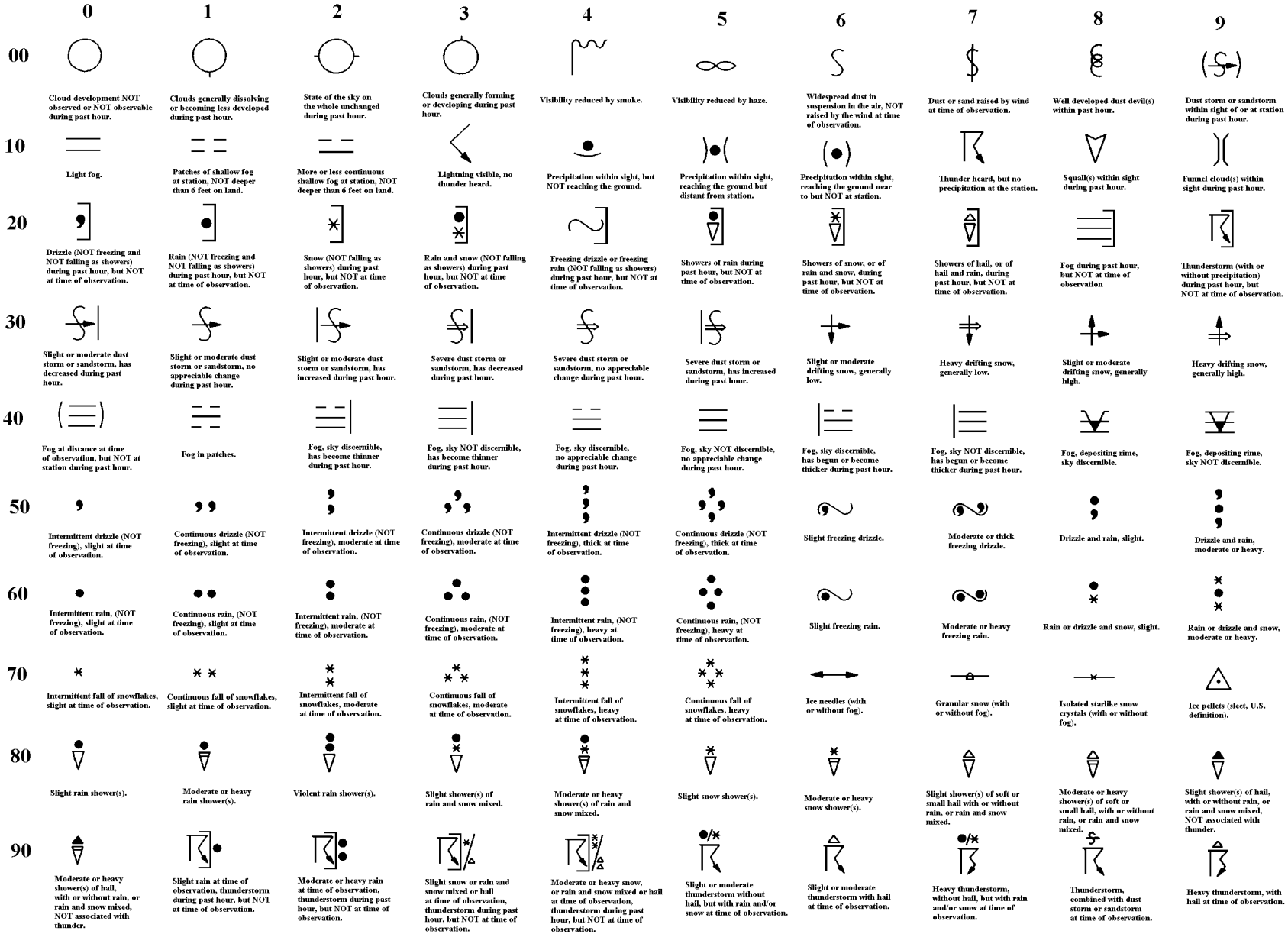


Figure 5-6. Present Weather Symbols.

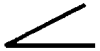
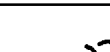
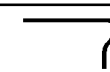
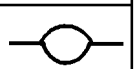
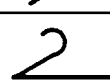
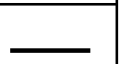
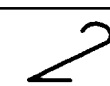
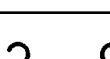
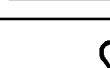
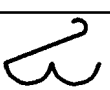
CLOUD ABBREVIATION		C_L	DESCRIPTION (Abridged from W.M.O. Code)		C_M	DESCRIPTION (Abridged from W.M.O. Code)		C_H	DESCRIPTION (Abridged from W.M.O. Code)
St or Fs - Stratus or Fractostratus	1		Cu, fair weather, little vertical development and flattened	1		Thin As (most of cloud layer is semitransparent)	1		Filaments of Ci, or "mares tails," scattered and not increasing
Ci - Cirrus	2		Cu, considerable development, towering with or without other Cu or Sc bases at same level	2		Thick As, greater part sufficiently dense to hide sun (or moon), or Ns	2		Dense Ci in patches or twisted sheaves, usually not increasing, sometimes like remains of Cb; or towers tufts
Cs - Cirrostratus	3		Cb with tops lacking clearcut outlines, but distinctly not cirroform or anvil shaped; with or without Cu, Sc, or St	3		Thin Ac, mostly semitransparent; cloud elements not changing much at a single level	3		Dense Ci, often anvil shaped derived from or associated Cb
Cc - Cirrocumulus	4		Sc formed by spreading out of Cu; Cu often present also	4		Thin Ac in patches; cloud elements continually changing and/or occurring at more than one level	4		Ci, often hook shaped gradually spreading over the sky and usually thickening as a whole
Ac - Altocumulus	5		Sc not formed by spreading out of Cu	5		Thin Ac in bands or in a layer gradually spreading over sky and usually thickening as a whole	5		Ci and Cs, often in converging bands or Cs alone; generally overspreading and growing denser; the continuous layer not reaching 45 altitude
As - Altostratus	6		St or Fs or both, but no Fs of bad weather	6		Ac formed by the spreading out of Cu	6		Ci and Cs, often in converging bands or Cs alone; generally overspreading and growing denser; the continuous layer exceeding 45 altitude
Sc - Stratocumulus	7		Fs and/or Fc of bad weather (scud)	7		Double-layered Ac, or a thick layer of Ac, not increasing; or Ac with As and/or Ns	7		Veil of Cs covering the entire sky
Ns - Nimbostratus Cu or Fc - Cumulus or Fractocumulus	8		Cu and Sc (not formed by spreading out of Cu) with bases at different levels	8		Ac in the form of Cu-shaped tufts or Ac with turrets	8		Cs not increasing and not covering the entire sky
Cb - Cumulonimbus	9		Cb having a clearly fibrous (cirroform) top, often anvil shaped, with or without Cu, Sc, St, or scud	9		Ac of chaotic sky, usually at different levels; patches of dense Ci are usually present	9		Cc alone or Cc with some Ci or Cs but the Cc being the main cirroform cloud

Figure 5-7. Cloud Symbols.