AVIATION WEATHER STUDENT GUIDE

PRIMARY

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1. CNATRA P-304 (Rev 04-03) PAT, "Aviation Weather Student Guide, Primary is issued for information, standardization of instruction, and guidance of instructors and students in the Naval Air Training Command.

2. This publication will be used to support the curriculum at TRAWINGs FOUR, FIVE, and SIX.

3. Recommendation for changes shall be submitted via CNATRA TCR form CNATRA 1550/19 in accordance with CNATRAINST 1550.6E.

4. CNATRA P-304 (Rev.11-00) PAT is hereby cancelled and superseded.

R.E. BIRD
Assistant Chief of Staff for
Training and Operations

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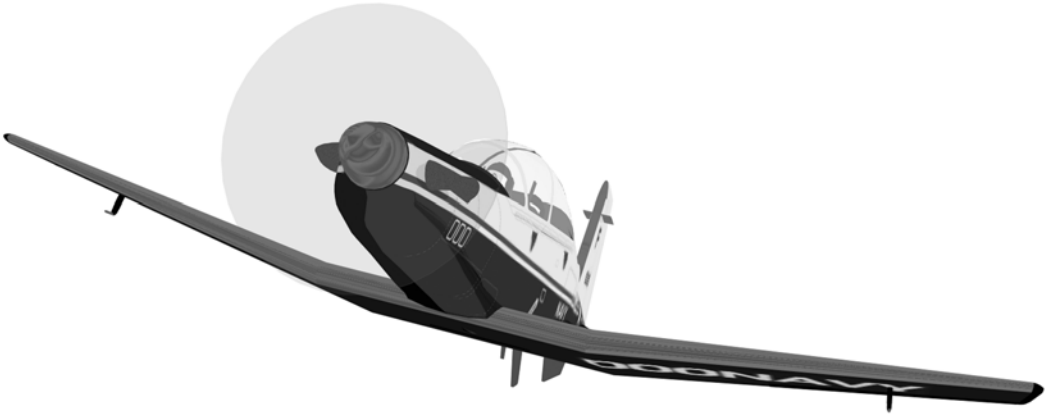
AVIATION WEATHER

STUDENT GUIDE

PRIMARY



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INTRODUCTION

In accordance with applicable military instructions, all pilots are responsible for reviewing and being familiar with weather conditions for their planned flight. Where Weather Services are available, a qualified forecaster shall conduct the weather briefings. They may be conducted either in person or via telephonic, autographic, weather vision, or approved Internet methods. In some cases pilots may have to complete the briefing and DD 175-1 Weather Briefing Forms on their own.

In preparing for a flight, aircrew should always make an analysis of the weather. The pilot is negligent in the performance of duties if a weather brief is accepted that is not completely understood. The object of such a pre-brief analysis is to give the aircrew a complete picture of the weather conditions and developments that will affect flight along the route. Additionally, it enables the aircrew to discuss intelligently any apparent discrepancies in the forecast given during the weather brief itself. Once in the air, a pilot cannot always consult the forecaster or the charts to understand the reasons for unexpected changes and choose the best corrective action. At these times, the aircrew must rely on knowledge, experience, and information obtained before departure.

Before going into a weather office to receive a flight weather briefing, the pilot and aircrew must know exactly what information is needed. The aircrew needs to know the local weather at the time of takeoff and during the climb to altitude, the weather to be expected while en route and the effect on aircraft performance, and the existing and forecast weather at destination and alternate airfield(s). The type of information needed will vary considerably depending upon whether the pilot is flying a jet aircraft, turboprop, piston-driven propeller aircraft (not covered in this text), or a helicopter.

So how can a pilot or navigator, whose specialty is flying aircraft, be able to carry on an intelligent discussion with a professional meteorologist? Better yet, how can the aircrew make intelligent decisions about dealing with the weather once airborne? The answer lies in learning a foundation of weather knowledge that continues to grow over the course of one's career through experience and personal study. Thus, the purpose of this course in Aviation Weather is not to produce meteorologists, but rather aviators who understand the basics of weather phenomena and the weather information systems in use.

Chapters One through Four, deal with the weather products available to aviators–from the codes and abbreviations used to communicate weather in a precise manner, to the charts and warnings, and finally to the Flight Weather Briefing Form itself, the DD 175-1.

The authors of this book hope you find this course informative and are able to use this book as a reference throughout your career.

WORKBOOK SCOPE

Upon completion of this unit of instruction, student aviators and flight officers will demonstrate knowledge of meteorological theory which will enable them to make intelligent decisions when confronted with various weather phenomena and hazards, as well as interpreting and using various weather products for flight planning.

TERMINAL OBJECTIVES

1.0 Describe displayed data in Aviation Routine Weather Reports (METARs) and Terminal Aerodrome Forecasts (TAFs).

2.0 Describe displayed data shown on various weather imagery products.

3.0 Describe displayed data on Severe Weather Watches, Military Weather Advisories, and In-Flight Weather Advisories, and state the use and requirements for Pilot Weather Reports (PIREPs).

4.0 Describe indicated data on the DD 175-1, "Flight Weather Briefing Form," and state the sources of hazardous weather information used to complete the form.

INSTRUCTIONAL MATERIALS

This course is designed to be taught by a winged Military Aviator instructor with the corresponding electronic classroom presentation.

HOW TO USE THIS WORKBOOK

1. Read and become familiar with the objectives of each chapter. These objectives state the purpose of this chapter of instruction in terms of WHAT YOU WILL BE ABLE TO DO as you complete the chapter. Most importantly, your end-of-course examination is developed directly from these objectives.

2. **Before the class presentation**, read the information in each chapter using the objectives as a guide. Develop a list of questions about material that is unclear to you at this point. This practice will allow you to ask questions when the topic is covered during the classroom presentation, or at a later time with the instructor in a one-on-one setting. You may also wish to consult your Weather for Aircrews handbook for further information.

3. **After the class presentation**, re-read each chapter to ensure your comprehension of the subject material. If you desire further information, explanation, or clarification, consult your instructor.

4. Answer the questions provided in the "Study Questions" sections. These questions will help you recall the information presented in each chapter, and they will also serve as a practice for the examination. Check your answers to the Study Questions with those provided in Appendix E. If your answer to a question is incorrect, review the objective and information covering that subject area prior to continuing to the next chapter. **"Good Luck."**

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CHAPTER ONE

AVIATION ROUTINE WEATHER REPORTS AND TERMINAL AERODROME FORECASTS

100. INTRODUCTION

This chapter introduces the student to the format and use of two meteorological products available to aviators, the Aviation Routine Weather Report (METAR) and the Terminal Aerodrome Forecast (TAF). The discussion will demonstrate the interpretation of each of these products, which use numerous codes and abbreviations, as well as the differences among military METARs and TAFs and those of the civilian and international community. Finally, this chapter will demonstrate how to apply this knowledge to various flight planning situations.

The METAR and TAF are the most widely used methods of disseminating weather observations and forecasts (respectively) to aircrew. They are also the quickest means, because they contain only letters and numbers. Years ago, when teletype was the quickest means of information dissemination, METARs and TAFs were distributed across the country and overseas by this method. Today, even though electronic communication is an important part of the existing military and civilian weather networks, the same basic character set is used, and these reports are still often called “teletype” products.

The METAR and TAF formats have not changed greatly over recent years, except to conform better to international standards. Thus, these formats contain certain codes, while they may be cumbersome at first, provide users with precise weather information because of their clear and exact nature.

Once the interpretation of a METAR has been discussed, the TAF format should then be easier to understand, since they use similar data groups. The TAF, however, is usually longer since it is a forecast covering a greater period of time. As such, the TAF format has additional rules that must be understood before an aviator can apply the forecast information to a particular situation. Following the discussion of these topics, this chapter will point out the major differences between the military TAF and its civilian and international counterparts. Finally, this chapter will demonstrate how to apply this knowledge to various flight planning situations.

101. LESSON TOPIC LEARNING OBJECTIVES

TERMINAL OBJECTIVE: Partially supported by this lesson topic:

1.0 Describe displayed data in Aviation Routine Weather Reports (METARs) and Terminal Aerodrome Forecasts (TAFs).

ENABLING OBJECTIVES: Completely supported by this lesson topic:

1.1 State the use of METARs.

1.2 State the letter identifies used to report various types of METARs.

1.3 Identify wind data in METARs.

1.4 Identify visibility in METARs.

1.5 Identify runway visual range in METARs.

1.6 Identify present weather in METARs.

1.7 Identify sky condition in METARs.

1.8 Identify temperature/dew point in METARs.

1.9 Identify altimeter setting in METARs.

1.10 Identify various manual and automated remarks in METARs.

1.11 State the use of TAFs in flight planning.

1.12 Identify data in a TAF.

1.13 Identify differences in U.S. Civil, Military, and International TAFs.

1.14 State the definition of a ceiling and identify the ceiling in METARs and TAFs.

1.15 State the IFR/VFR rules for flight planning in reference to OPNAV 3710.7.

1.16 State the OPNAV 3710.7 requirement for an alternate on an IFR flight plan.

102. REFERENCES

1. NAVMETOCCOMINST 3141.2 Series
2. DOD Flight Information Publication (FLIP) General Planning, Chapter 8
3. Air Force Instruction 11-202 (Vol. 3), General Flight Rules
4. Chief of Naval Operations Instruction 3710.7 series, NATOPS General Flight and Operating Instructions

103. STUDY ASSIGNMENT

Review Chapter One and answer the Study Questions.

1-2 AVIATION ROUTINE WEATHER REPORTS AND TERMINAL AERODROME FORECASTS

104. THE AVIATION ROUTINE WEATHER REPORT

METAR provide a rapid and efficient means of transmitting the latest observed weather information for various stations throughout the world. These reports are transmitted over available computer/teletype circuits.

A METAR example is shown below in Figure 1-1.

SAU55 KAWN 151800
METAR KALO 151756Z 14015KT 6SM BLDU OVC015 09/07 A3024 RMK SLP240 RADAT 80052
METAR KBAL 151758Z 35012KT 1 1/2SM R10/6000FT RA BR HZ BKN005 OVC010 08/06 A2978 RMK SLP085
METAR KRDR 151756Z 09009KT 15SM SCT050 BKN090 OVC200 M15/M18 A2997 RMK PSR09P SLP149
METAR KHAR 151757Z 05015G22KT 1 1/2SM RA BR BKN011 OVC015 07/05 A2986 RMK PK WND 05025/32 SLP112
METAR KNKX 151758Z 08012KT 8SM BKN007 OVC040 09/07 A2984 RMK BINOVC BKN TOPS 020 SLP105
METAR KCBM 151755Z 00000KT 10SM SCT012 BKN029 OVC120 M06/M07 A2998 RMK IR18 SLP156
METAR KPAM 151757Z 17015G22 5SM HZ SCT007 BKN040 OVC050 22/21 A2990 RMK SCT007VBKN SLP125
METAR KPHX 151756Z 33007KT 20SM SKC M14/M24 A3021 RMK SLP230
METAR KVPS 151758Z 18009KT 7SM OVC006 19/17 A2994 RMK CIG005V007 SLP139
METAR KOZR 151755Z 22012G16 15SM OVC017 23/17 A2987 RMK OVC TOPS 045/054 SLP115
METAR KBNA 151759Z 27003KT 1 1/2SM DZ BR SCT000 SCT017 OVC025 19/16 A2977 RMK VIS 1V2 CIG 023V027 BR SCT000 TOPS OVC 066

Figure 1-1 Sample METAR Printout

METARs are used to communicate the latest observed weather to meteorologists and aircrew so they can determine the existing weather at the destination or alternate, and whether a field is operating under conditions of instrument flight rules (IFR) or visual flight rules (VFR). These users can also use METARs to determine weather trends by checking the last several hours of reports to see if they indicate improving or deteriorating conditions. Additionally, METARs can provide a comparison between the observed and forecast weather, to determine if conditions are actually developing as originally forecast.

105. METAR FORMAT

A METAR example is shown below in Figure 1-2 with each coded group underlined and labeled for reference during the following discussion. METARs have two sections: the body of the report and the remarks section.

Group 1: Type of Report

The first word of the report line, either "METAR" or "SPECI," will indicate which of these two main types of observations was reported (Figure 1-3).

METAR: An hourly routine scheduled observation containing wind, visibility, runway visual range, present weather, sky condition, temperature/dew point, and altimeter setting. Additional coded data or plain language information that elaborates on the report may be included in the "Remarks" section.

SPECI: A SPECIal, unscheduled observation containing all the data elements found in a METAR whenever critical data have changed from the previous observation (reasons are too numerous to cover in this course). All SPECI are made as soon as possible after the element criteria are observed.

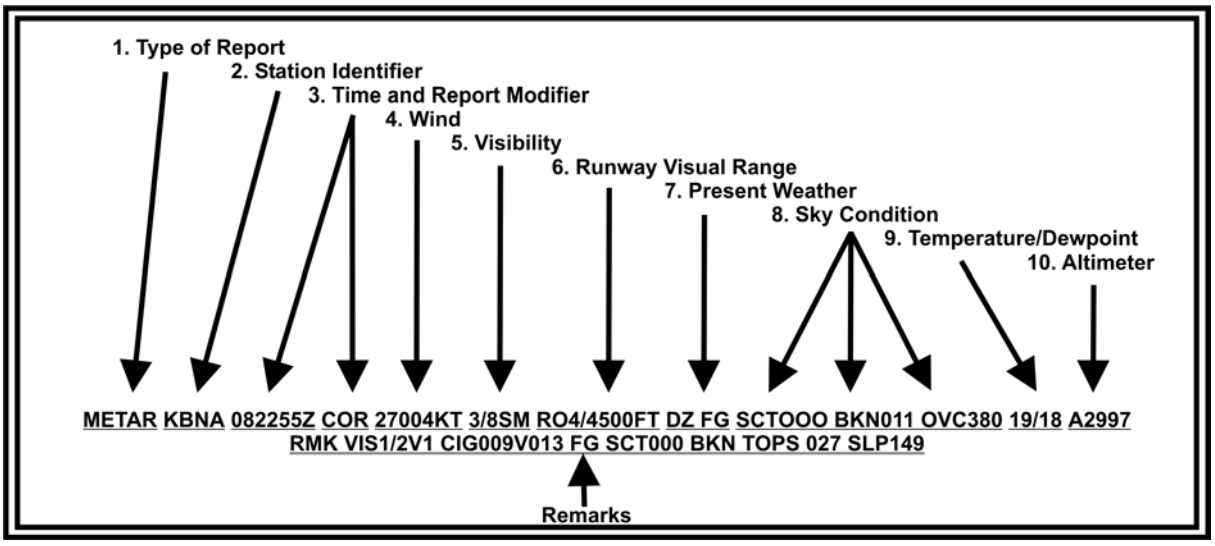

Figure 1-2 METAR Code Group

METAR KNPA 082255Z 27004KT 7/8SM R04/4500FT DZ FG SCT000 BKN011 OVC380
19/18 A2997 RMK VIS1/2V1 CIG009V013 FG SCT000 BKN TOPS 027 SLP149

SPECI KNPA 082317Z 31020G30KT 3/8SM R04/2500FT VCTS SCT000 BKN006 OVC380
17/17 A2993 RMK VIS1/8V1 CIG004V008 FG SCT000 BKN TOPS 350 SLP136

Figure 1-3 Type of Report: METAR or SPECI

1-4 AVIATION ROUTINE WEATHER REPORTS AND TERMINAL AERODROME FORECASTS

Group 2: Station Identifier

The METAR code format uses a 4-letter ICAO (International Civil Aviation Organization) identifier. In the continental U. S., all 3-letter identifiers are prefixed with a "K," e.g., KLAX for Los Angeles, and KBOS for Boston (Figure 1-4). Elsewhere, the first two letters of the ICAO identifier indicate what region of the world (e.g. K=USA, C=Canada, P=Pacific, E=Europe) and country the station is located. For example, PAFA is Fairbanks, Alaska, PHNA is Barber's Point, Hawaii, and CYUL is Montreal, Canada. Also, EG indicates a station in England, and LI indicates a station in Italy. U.S. locations identifiers are included in Appendix C. For a complete worldwide listing of all the identifiers, one must refer to the ICAO Document 7910 Location Identifiers.

METAR **KNPA** 082255Z 27004KT 7/8SM R04/4500FT DZ FG SCT000 BKN011 OVC380
19/18 A2997 RMK VIS1/2V1 CIG009V013 FG SCT000 BKN TOPS 027 SLP149

Figure 1-4 Station Identifier in METAR

Group 3: Date Time Group and Report Modifier

The time of observation will be included in all reports, using the standard date time group (DTG) format. Times are always given in Universal Coordinated Time (UTC) and therefore will end in "Z," indicating Zulu, or UTC, time. The first two numbers are the date, and the second four are the time of the report (Figure 1-5).

METAR KNPA **082255Z** 27004KT 7/8SM R04/4500FT DZ FG SCT000 BKN011 OVC380
19/18 A2997 RMK VIS1/2V1 CIG009V013 FG SCT000 BKN TOPS 027 SLP149

Figure 1-5 DTG in METAR

Manual METAR observations are required to be started no earlier than 15 minutes prior to the reporting time, which is a window between 55 and 59 minutes past the hour. Additionally, elements having the greatest rate of change are evaluated last. At automated stations, evaluations are based on sensor data taken within 10 minutes of the report time (although sky cover data is gathered over the preceding 30 minutes). Therefore, as an aviator, you can be assured you have the most up-to-date information available, assuming you are checking the weather at the top of the hour.

Of course, report times given for SPECI observations are the time at which the event requiring the SPECI report occurred.

Reports may also contain one of two modifiers, "COR," or "AUTO," which will appear after the DTG:

COR: Indicates a CORrected report, which is transmitted as soon as possible whenever an error is detected in a METAR or SPECI report. In this case, the DTG will be the same time used in the report being corrected.

AUTO: Indicates a routine scheduled observation was sent from a fully AUTOmated station with no human intervention. In the remarks section, either "AO1" or "AO2" will be present indicating the type of automatic precipitation measuring equipment. Sometimes, manual observations are reported using data gathered from automatic devices, in which case an "AO1" or "AO2" will be present in the remarks without an "AUTO" following the DTG.

Group 4: Wind

Winds are a two-minute average speed and direction report in knots and degrees true from which direction the wind is blowing. The wind direction is first and will be in tens of degrees, using three digits. A direction\s less than 100º is preceded by a zero to supply three digits. Speed is in whole knots, using two or three digits after the direction, without spaces, and speeds of less than 10 knots are preceded with a zero. The wind group will always end with the letters "KT" to indicate knots. Other countries may use different units of measurement, such as KM (kilometers), MPH (miles per hour), or MPS (meters per second) (Figure 1-6).

METAR KNPA 082255Z **27004KT** 7/8SM R04/4500FT DZ FG SCT000 BKN011 OVC380
19/18 A2997 RMK VIS1/2V1 CIG009V013 FG SCT000 BKN TOPS 027 SLP149

Figure 1-6 Wind Direction and Speed in METAR

Examples:

09008KT — Wind from 090º at 08 knots.

270112KT — Wind from 270º at 112 knots.

GUSTS: The letter "G" immediately following the average wind speed indicates the presence of gusts, which are rapid fluctuations in speeds of peaks and lulls of 10 knots or more. Wind speed for the most recent ten minutes is used to determine gusts, and the maximum peak is reported using two or three digits.

Examples:

14015G28KT — Wind from 140º at 15 knots with gusts to 28 knots.

33065G105KT — Wind from 330º at 65 knots with gusts to 105 knots.

1-6 AVIATION ROUTINE WEATHER REPORTS AND TERMINAL AERODROME FORECASTS

VARIABLE WINDS: If "VRB" is present in place of the wind direction, the direction cannot be determined (used with wind speeds of 6 knots or less). If the wind direction is variable with speeds greater than six knots, a special group will immediately follow the wind group using the letter “V” between two directions (listed clockwise).

Example:

22015KT 180V250 — Winds from 220º at 15 knots with direction varying from 180 to 250 degrees.

CALM WINDS: Calm winds are reported as 00000KT.

NOTES:

1. Peak winds and wind shifts will be reported in the RMK section of the METAR/SPECI. (See remarks section later in this chapter.)

2. A sudden increase in wind speed of at least 16 knots and sustained at 22 knots or more for at least one minute requires that Squalls (SQ) be reported in the present weather section of the report.

Group 5: Visibility

METAR uses the prevailing visibility, reported in statute miles (SM) in the United States and in meters at overseas stations (Figure 1-7). Any of the values in Figure 1-8 may be used. Automated stations may use "M" to indicate less than one-quarter statute mile when reporting visibility (think of “Minus”). If visibility is less than seven statute miles, then the weather/obstruction to vision will also be reported (using the abbreviations discussed later in the Present Weather section and shown in Figure 1-11).

METAR KNPA 082255Z 27004KT **7/8SM** R04/4500FT DZ FG SCT000 BKN011 OVC380
19/18 A2997 RMK VIS1/2V1 CIG009V013 FG SCT000 BKN TOPS 027 SLP149

Figure 1-7 Visibility in METAR

Examples:

1 1/8 SM — Visibility one and one-eighth statute miles.

5SM — Visibility five statute miles.

M1/4 — Visibility from an automated station less than one-quarter statute mile.

NOTE:

Other types of visibility are reported in the RMK portion of the METAR/SPECI (see the remarks section later in this chapter). At military stations tower visibility will be reported when either surface or tower visibility is four miles or less. This visibility will be a remark with the surface visibility remaining in the body of the report.

Source of Visibility Report							
Automated			Manual				
M1/4	2	9	0	5/8	1 5/8	4	12
1/4	2 1/2	10	1/16	3/4	1 3/4	5	13
1/2	3		1/8	7/8	1 7/8	6	14
3/4	4		3/16	1	2	7	15
1	5		1/4	1 1/8	2 1/4	8	20
1 1/4	6		5/16	1 1/4	2 1/2	9	25
1 1/2	7		3/8	1 3/8	2 3/4	10	30
1 3/4	8		1/2	1 1/2	3	11	35a
a. Further values in increments of 5 statute miles may be reported (i.e., 40, 45, 50, etc.)							

Figure 1-8 Visibility Values Reportable in METAR

Group 6: Runway Visual Range (RVR)

The runway visual range (RVR), defined in Chapter Five, is a measure of the horizontal visibility as determined from instruments (transmissometers) located alongside and about 14 feet higher than runway centerline. They are calibrated with reference to the sighting of either high-intensity runway lights or the visual contrasts of other targets, whichever yields the greater visual range. Only activities with operational equipment are allowed to report RVR.

RVR is reported whenever the prevailing visibility is one statute mile or less and/or the RVR for the designated instrument runway is 6000 feet or less. RVR is measured in increments of 200 feet through 3000 feet and in 500-foot increments above 3000 feet (Figure 1-9).

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METAR KNPA 082255Z 27004KT 7/8SM **R04/4500FT** DZ FG SCT000 BKN011 OVC380
19/18 A2997 RMK VIS1/2V1 CIG009V013 FG SCT000 BKN TOPS 027 SLP149

Figure 1-9 RVR in METAR

RVR is encoded with an "R" indicating runway, followed by a 2-digit group denoting runway number, and may be followed by an "R," "L," or "C," denoting right, left, or center runway. Next is a forward slash followed by the constant reportable value in four digits and ending with the letters "FT" for feet.

If RVR is varying, the coding will be the same as above, except the two reportable values will be separated by a "V." If RVR is less than its lowest reportable value, the 4-digit value will be preceded with an "M" (for Minus), and if greater than the highest reportable value, it is preceded with a "P" (for Plus).

Examples:

R33/1800FT — Runway 33 visual range 1800 feet.

R17R/3500FT — Runway 17 Right visual range 3500 feet.

R09/1000V4000FT — Runway 09 visual range 1000 feet variable to 4000 feet.

R28L/P6000FT — Runway 28 Left visual range greater than 6000 feet.

R02/M0800FT — Runway 02 visual range less than 800 feet.

NOTE:

RVR is not reported from USN/USMC stations. It will, however, be disseminated locally to arriving and departing aircraft.

Group 7: Present Weather

Present weather includes precipitation, well-developed dust or sand swirls, squalls, tornadic activity, sandstorms, and duststorms. It may be evaluated instrumentally, manually, or through a combination of methods. The present weather codes as seen below in Figures 1-10 and 1-11 are used throughout meteorology with one exception–the Radar Summary Chart–which has its own codes.

METAR KNPA 082255Z 27004KT 7/8SM R04/4500FT **DZ FG** SCT000 BKN011 OVC380
19/18 A2997 RMK VIS1/2V1 CIG009V013 FG SCT000 BKN TOPS 027 SLP149

Figure 1-10 Present Weather in METAR

In addition to the notes of Figure 1-11, the following are a few of the conventions used to report present weather conditions in METAR/SPECI observations.

1. Present weather given in the body of the report occurs at the point of observation or within five miles from the station. If the letters "VC" are used, the weather is in the vicinity of five to ten miles. Any reported weather occurring beyond ten miles of the point of observation will be included in the remarks portion of the METAR.

2. Intensity refers to the precipitation, not its descriptor (TS or SH).

3. TS may be coded by itself, or it may be coded with RA, SN, PL, GS, or GR.

QUALIFIER		WEATHER PHENOMENA[1]		
INTENSITY OR PROXIMITY 1	DESCRIPTOR 2	PRECIPITATION 3	OBSCURATION 4	OTHER 5
– Light Moderate[2] + Heavy VC In the Vicinity	MI Shallow PR Partial BC Patches DR Low Drifting BL Blowing SH Shower (s) TS Thunder-storm FZ Freezing	DZ Drizzle RA Rain SN Snow SG Snow Grains IC Ice Crystals[2] PL Ice Pellets GR Hail[2] GS Small Hail and/or Snow Pellets UP Unknown Precipitation	BR Mist FG Fog FU Smoke VA Volcanic Ash DU Widespread Dust SA Sand HZ Haze PY Spray	PO Well-Developed Dust/ Sand Whirls SQ Squalls FC Funnel Cloud(s) (Tornado or Waterspout)[3] SS Sandstorm DS Duststorm

1. Weather groups are constructed by considering columns one to five above in sequence, i.e., intensity, followed by description, followed by weather phenomena (e.g., heavy rain shower(s) is coded as +SHRA).
2. No symbol denotes moderate intensity. No intensity is assigned to Hail (GR) or Icing (IC).
3. Tornadoes and waterspouts in contact with the surface are coded +FC.

Figure 1-11 Present Weather Codes Reportable in METAR

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Group 8: Sky Condition

METAR KNPA 082255Z 27004KT 7/8SM R04/4500FT DZ FG **SCT000 BKN011 OVC380**
19/18 A2997 RMK VIS1/2V1 CIG009V013 FG SCT000 BKN TOPS 027
SLP149

Figure 1-12 Sky Condition in METAR

The sky condition group (Figure 1-12) gives a description of the appearance of the sky including the type of clouds, cloud layers, amount of sky coverage, height of their bases, and any obscuring phenomena. Cloud layer amounts for each layer indicate eighths of the sky that is covered, according to the abbreviations in Figure 1-13.

Reportable Contractions	Meaning	Amount of Sky Cover
SKC or CLR[1]	Sky Clear	0/8
FEW[2]	Few	> 0/8 - 2/8
SCT	Scattered	3/8 - 4/8
BKN	Broken	5/8 - 7/8
OVC	Overcast	8/8
VV	Obscured[3]	8/8 (surface based)

1. The abbreviation CLR is used at automated stations when no clouds at or below 12,000 feet are reported; the abbreviation SKC is used at manual stations when no clouds are reported.
2. Any amount less than 1/8 is reported as FEW.
3. The last 3 digits report the height of the vertical visibility into an indefinite ceiling.

Figure 1-13 Sky Coverage

In addition to the notes of Figure 1-13, the following are some of the cloud reporting rules used in METAR/SPECI.

1. All sky cover heights are reported in feet above the ground level (AGL).

2. Sky condition is annotated by a six-digit group, the first three digits (letters) describing the amount of sky cover (from figure 1-13), and the second three digits (numbers) the height of that layer in hundreds of feet. Layers will be reported in ascending order up to the first overcast. If the cloud layer is below the station (for mountain stations), the height will be coded as ///.

3. When the sky is totally obscured by a surface-based obscuration the only group in the sky condition section will be a five-digit group, the first two digits VV (Vertical Visibility) and the last three digits the height of the vertical visibility into the indefinite ceiling. Most always this height will be 000, as any surface-based phenomenon is (by definition of "surface-based") within 50 feet of the surface, and will be rounded down to the nearest hundred feet (i.e., zero).

4. When the sky is partially obscured by a surface-based obscuration, the amount of the sky cover hidden by the weather phenomena will be reported s FEW000, SCT000, or BKN000. A remark will then also be given to describe these details (see Remarks section).

5. At manual stations CB (cumulonimbus) or TCU (towering cumulus) will be appended to the layer if it can be determined.

Examples:

BKN000 — Partial obscuration of 5/8 to 7/8 (surface-based).

VV008 — Sky obscured, indefinite ceiling, vertical visibility 800 feet AGL.

SCT020CB — Scattered clouds (3/8 to 4/8 of the sky) at 2000 feet AGL composed of cumulonimbus clouds.

FEW011 BKN040 OVC120 — Few clouds (1/8 to 2/8) at 1100 feet AGL, broken clouds (5/8 to 7/8) at 4000 AGL, overcast clouds (8/8) at 12,000 feet AGL.

Group 9: Temperature/Dew Point

Temperature and dew point are reported as two 2-digit groups, rounded to the nearest whole degree Celsius, and separated with a (/) (Figure 1-14). Sub-zero temperatures or dew points will be prefixed with the letter "M" (for Minus). If the temperature and dew point are not available, the entire group is omitted. If only dew point is unavailable, then only temperature is coded, followed by the (/).

METAR KNPA 082255Z 27004KT 7/8SM R04/4500FT DZ FG SCT000 BKN011 OVC380
19/18 A2997 RMK VIS1/2V1 CIG009V013 FG SCT000 BKN TOPS 027
SLP149

Figure 1-14 Temperature and Dew Point in METAR

If necessary, convert between Fahrenheit and Celsius using the following formulas:

F = (C * 9/5) +32 C = (F - 32) * 5/9 (9/5 = 1.8)

or by using the conversion scale on the CR-2 circular slide rule.

Group 10: Altimeter Setting

The altimeter setting will be included in all reports. The altimeter group always starts with the letter "A", and will be followed with a 4-digit group using the tens, units, tenths, and hundredths of inches of mercury. For example, A2997 indicates an altimeter setting of 29.97 inches of Hg (Figure 1-15).

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METAR KNPA 082255Z 27004KT 7/8SM R04/4500FT DZ FG SCT000 BKN011 OVC380
19/18 **A2997** RMK VIS1/2V1 CIG009V013 FG SCT000 BKN TOPS 027
SLP149

Figure 1-15 Altimeter Setting in METAR

106. REMARKS SECTION

Remarks will be included in all METAR/SPECI reports if deemed appropriate. They will be separated from the body of the report by a space and the abbreviation RMK. If there are no remarks, then "RMK" is omitted (Figure 1-16). The remarks fall into three major categories:

1. Manual and Automated remarks,

2. Plain language remarks, and

3. Additive data and Maintenance remarks. Only the first two will be discussed in this chapter, as the last is of very little importance to an aviator.

METAR KNPA 082255Z 27004KT 7/8SM R04/4500FT DZ FG SCT000 BKN011 OVC380
19/18 A2997 **RMK VIS1/2V1 CIG009V013 FG SCT000 BKN TOPS 027**
SLP149

Figure 1-16 Remarks Section of METAR

Remarks are made in accordance with the following conventions.

1. Where plain language is called for, authorized abbreviations and symbols are used to conserve time and space.

2. Time entries will be in minutes past the hour if occurrence is during the same hour the observation is taken. If not, then hours and minutes will be used.

3. Present weather in the body of the report using VC (vicinity) may be further described, if known. DSNT (distant) indicates weather that is beyond 10 miles of the point of observation, and it will be followed by the direction.

4. Movement of clouds and weather indicates the direction toward which it is moving (remember wind is always from).

5. Directions use the eight points of the compass.

6. Insofar as possible, remarks are entered in the order they are presented in the following examples:

TORNADO B13 6 NE	Tornado began 13 minutes past the hour, 6 statute miles northeast of the station
AO2A	Automated station with precipitation measuring equipment, augmented by observer
PK WND 28045/15	Peak wind of 45 knots from 280 degrees occurred at 15 minutes past the hour
WSHFT 30 FROPA	Wind shift 30 minutes after the hour with frontal passage
TWR VIS 1 1/2	Tower visibility one and one-half statute miles
VIS 1/2V2	Visibility varying between 1/2 and 2 statute miles
VIS 2 1/2 RY11	Visibility at second sensor located on runway 11 is two and one-half statute miles
DVR/R11L/1000V5000FT	Dispatch visual range varying between 1000 and 5000 feet on runway 11 left (automated stations only)
DVR/P6000FT	Dispatch visual range not associated with a specific runway is greater than 6000 feet (automated stations only)
OCNL LTG	Occasional lightning
FRQ LTGCGIC	Frequent lightning cloud to ground in vicinity
LTG DSNT W	Lightning distant west (beyond 10 miles but less than 30 miles)
RAB05E30SNB20E55	Rain began 5 minutes past the hour and ended 30 minutes past the hour, snow began 20 minutes past the hour and ended 55 minutes past the hour
TSB0159E30	Thunderstorm began at 0159 and ended at 0230
CIG 005V010	Ceiling varying between 500 feet and 1000 feet
CIG 002 RY11	Ceiling at second location on runway 11 is at least broken at 200 feet
PRESRR	Pressure rising rapidly
PRESFR	Pressure falling rapidly
SLP982	Sea Level Pressure is 998.2 millibars
SLPNO	Sea Level Pressure not available
VIS NE 2 1/2	Visibility northeast two and one-half statute miles
TS SE MOV NE	Thunderstorm southeast moving northeast
GR 1 1/4	Hailstones one and one-quarter inch

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VIRGA SW	Precipitation southwest not reaching the ground
FG SCT000	Fog partially obscures 3/8 to 4/8 of the sky
BKN014 V OVC	Broken clouds at 1400 feet are variable to overcast
CB W MOV E	Cumulonimbus clouds west moving east
CBMAM E MOV S	Cumulonimbus mammatus clouds east moving south
TCU W	Towering cumulus clouds west
TOP OVC050	Tops of overcast are 5000 feet MSL
ACC NW	Altocumulus castellanus northwest (indicates turbulence)
ACSL SW-W	Altocumulus standing lenticular clouds southwest through west (indicates mountain wave turbulence)
APRNT ROTOR CLD NE	Apparent rotor cloud northeast (also indicates mountain wave turbulence)
CCL S	Cirrocumulus standing lenticularis south
FU BKN020	Smoke layer broken at 2000 feet
ACRFT MSHP	Aircraft mishap

Special Remarks That May be Appended to the Remarks Section

Runway Condition Reporting (RSC & RCR) — Runway condition, when reported, will include two parts, the RSC (runway surface condition), and the RCR (runway condition reading) as determined by the airfield manager or operations officer. The following RSCs describe the runway condition:

WR	Wet runway
SLR	Slush on the runway
LSR	Loose snow on the runway
PSR	Packed snow on the runway
IR	Ice on the runway
RCRNR	Base Operations closed

The RCR is a two-digit number giving an average decelerometer reading from 02 to 25 (Figure 1-17). Two slants (//) will be entered when the runway is wet, slush-covered, or when no decelerometer reading is available.

Runway Braking Action Reading	Equivalent Terminology	% Increase in Landing Roll
02 to 05	NIL	100% or more
06 to 12	POOR	99% to 46%
13 to 18	FAIR (MEDIUM)	45% to 16%
19 to 25	GOOD	15% to 0%

Figure 1-17 RCR Values and Corresponding Braking Action

The following will be added to the report when applicable:

1. "P" is appended to the RCR when there are patches of ice, snow, or slush on the runway.
2. "SANDED" is appended when runways have been treated with sand or other friction enhancing materials.
3. "P WET" or "P DRY" is appended whenever the rest of the runway is either wet or dry.
4. ICAO braking action remarks (such as BA GOOD, BA NIL) may be reported at airfields not equipped with decelerometers when required.

Examples:

PSR15	Packed snow on runway, RCR value 15
IR//	Ice on runway, no RCR value available
LSR08P DRY	Loose snow on runway, RCR value 08 patchy, rest of runway dry
WR//	Wet runway
RCRNR	Base Operations closed
PSR12 HFS IR08	Packed snow on runway, RCR value 12 on touchdown, on rollout portion of a high friction surface with ice on runway, RCR value 08
PSR//SANDED BA MEDIUM	Packed snow on runway, no RCR available, runway treated with friction enhancer, braking action medium

Freezing Level Data (RADATS) — Information beginning with the contraction RADAT gives freezing level data. (Think of RAdiosonde DATa. A radiosonde is a weather balloon.) RADAT is followed by the relative humidity (RH) at the freezing level and the height of the freezing level in hundreds of feet MSL. When multiple crossings are reported, the order will be the lowest crossing first, followed by the intermediate crossing with the highest RH, then the highest

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crossing. A letter “L” or “H” after the RH value will indicate to which altitude the RH corresponds. A single slash after these altitudes indicates that more than three crossings occur, and the number of additional crossings is noted after the slash. When a “00” appears for the RH, this indicates an RH of 100%. If “20” is coded, this indicates that the RH is the lowest that can be obtained. Two slashes, “//”, indicate RH data is missing.

Examples:

RADAT 63017	Freezing level at 1700 feet MSL with 63% RH
RADAT 91L028039061	Freezing levels at 2800, 3900, and 6100 feet MSL with 91%RH at 2800 feet
RADAT 84H008025085/1	Freezing levels at 800, 2500, and 8500 feet MSL with 84% RH at 8500 feet, and one additional crossing
RADAT ZERO	Freezing level at the surface
RADAT MISG	Unable to obtain, high winds, or equipment failure
RAICG 89MSL	Balloon iced up at 8900 feet MSL

107. THE TERMINAL AERODROME FORECAST

Terminal Aerodrome Forecasts (TAF) Use for Flight Planning

Any aviator planning a flight should know both the destination's existing and forecasted weather. Previously we learned the METAR provides existing weather. Now, we will discuss the surface forecasted weather conditions by learning how to read TAFs. This teletype information will also aid you in planning for the type of flight (IFR/VFR), type of approach you require, determining if an alternate is required, and selection of the best alternate.

Although there are many differences in TAF reporting between the military and civilian weather offices, as well as throughout the world, we will focus this discussion on the U.S. military TAF since the bulk of your training flights will commence from military bases. Once this has been accomplished, it will be much easier to point out differences existing among the TAFs of the U.S. military, civilian, and international communities.

TAF Sequence

It will become readily apparent that each line of the TAF forecast will follow the same basic sequence: message heading or change group, time, wind, visibility, weather and obstructions to vision, clouds, altimeter, and remarks. The only deviation that occurs is the addition of wind shear, temperature, icing, and turbulence groups when applicable. Figure 1-18 shows an example of a single line forecast with a breakdown of each group. Figure 1-19 shows an actual forecast for Navy Whiting Field.

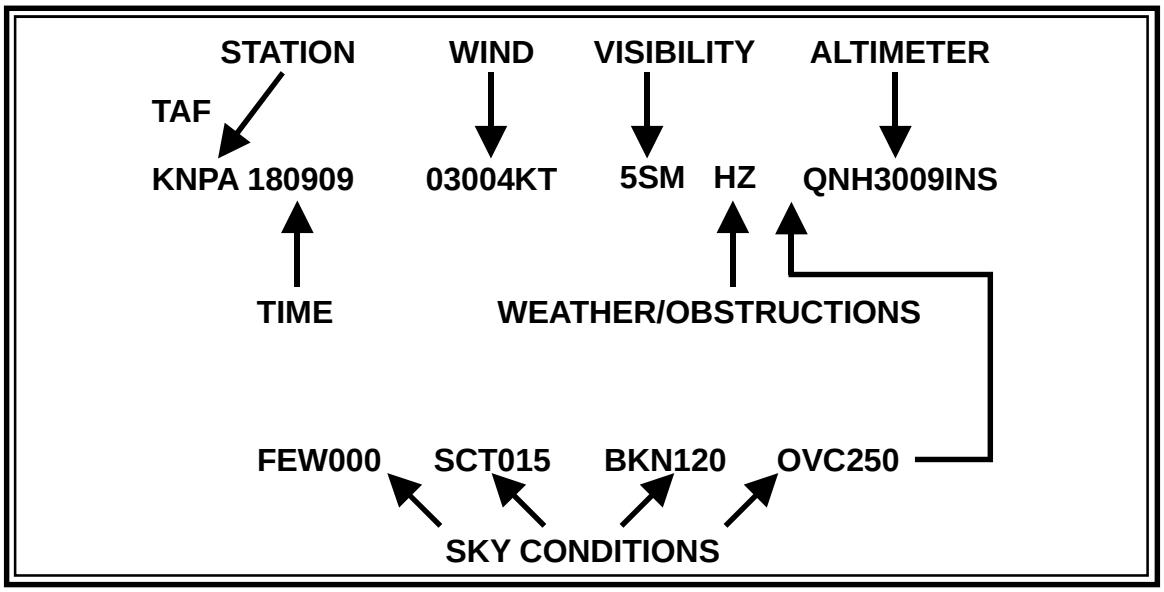

Figure 1-18 TAF Groups

KNSE TAF 260909 28004KT 9000 HZ SCT020 SCT200 QNH2998INS
FM1200 26007KT 9000 HZ SCT025 SCT080 BKN250 QNH2996INS VCSHRA
BECMG 1416 9999 SCT025CB SCT250
BECMG 1718 23015G25KT 530004
TEMPO 1902 8000 TSSHRA SCT010 BKN025CB
FM0200 27010KT 9999 SCT030 BKN080 BKN250 QNH3001INS 20/09Z

KMOB 262046Z 262121 00000KT 3200 BR VV004 QNH3012INS
BECMG 0607 14012 9999 SCT004 SCT025 QNH3016INS

Figure 1-19 TAF Example

Message Heading

The message heading begins with the 4-letter ICAO location identifier (e.g., KNSE for NAS Whiting Field) as shown in Figure 1-20. Next comes the letters "TAF" and any modifiers such as AMD, COR, or RTD, which stand for AMenDed, CORrected, or RouTine Delayed, unless the station is USN/USMC, in which case a remark will be appended to the last line of the forecast.

KNSE TAF 260909 28004KT 9000 HZ SCT020 SCT200 QNH2998INS

Figure 1-20 TAF Heading

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Forecast Times

The six-digit number following the message heading indicates the forecast period of the entire TAF, which is usually 24 hours (Figure 1-21). The first two digits represent the date of the forecast. The second two digits indicate the beginning hour of the forecast, and the final two digits indicate the ending hour of the forecast. For example, 260909 means that the forecast begins at 0900Z on the 26th day of the month and covers the 24-hour period up to but not including 0900Z the next day. U.S. civil stations include date and time of transmission prior to the forecast period (i.e., 091720Z 091818).

KNSE TAF **260909** 28004KT 9000 HZ SCT020 SCT200 QNH2998INS

Figure 1-21 TAF Time Group

Whenever the forecast is an AMD, COR, or RTD, the times may not be for a 24-hour period and will be indicated accordingly. When USN/USMC stations amend, correct, or have a routine delayed forecast, a remark will be appended to the last line of the forecast with the appropriate time (e.g., AMD2218).

Winds

Wind direction is forecasted to the nearest 10 degrees true, in the direction from which the wind will be blowing (Figure 1-22). If wind direction is expected to vary by 60 degrees or more, the limits of variability will be noted as a remark, e.g., WND 270V350. The contraction VRB can only be used to replace direction when forecasted wind speed is 6 knots or less, or in more rare cases when it is impossible to forecast a single wind direction, such as for thunderstorms.

KNSE TAF 260909 **28004KT** 9000 HZ SCT020 SCT200 QNH2998INS

Figure 1-22 TAF Winds

Forecasted wind speeds and gust data are given in whole knots; if the wind speed is over 100 knots, then three digits are used. Calm winds are represented by “00000” for the wind group. “G” will be included to indicate gusts when the peak wind exceeds the average wind by 10 knots or more. Presently all U.S. winds are in knots and the contraction KT will end these wind groups. Some overseas stations use KPH (kilometers per hour) or MPS (meters per second).

Visibility, Weather, and Obstructions to Vision

For TAFs, forecasted prevailing visibility is reported in meters and rounded down to the nearest reportable value (Figure 1-23). U.S. civil stations, however, will report visibility in statute miles (Figure 1-24). Whenever the prevailing visibility is forecasted to be 9000 meters or less (6 miles or less) the weather or obstructions to vision causing the reduced visibility will be included using

the same notation as the METAR present weather group, described above in Figure 1-11. A visibility code of "9999" indicates 7 miles visibility or greater is forecast, i.e. unlimited visibility. When appropriate, RVRs will follow immediately after the prevailing visibility.

KNSE TAF 260909 28004KT **9000 HZ** SCT020 SCT200 QNH2998INS

Figure 1-23 TAF Visibility Group

VISIBILITY CONVERSION TABLE - STATUE MILES TO METERS					
Statute Miles	Meters	Statue Miles	Meters	Statute Miles	Meters
0	0	3/4	1200	1 7/8	3000
1/16	100	7/8	1400	2	3200
1/8	200	1	1600	2 1/4	3600
3/16	300	1 1/8	1800	2 1/2	4000
1/4	400	1 1/4	2000	3	4800
5/16	500	1 3/8	2200	4	6000a
3/8	600	1 1/2	2400	5	8000
1/2	800	1 5/8	2600	6	9000b
5/8	1000	1 3/4	2800	7	9999
Notes: a Rounded down from 6400m; b Rounded down from 9600m.					

Figure 1-24 Reportable Visibility Values for TAFs

If any significant weather or an obstruction to vision is forecast (rain, snow, sleet, hail, blowing dust, etc.), it will be included after visibility, using the codes in Figure 1-11. If there is no significant weather, this group will be omitted.

Sky Condition Group

This group(s) will be included as often as necessary to indicate all forecast cloud layers–up to the first overcast layer (8/8ths)–in ascending order of cloud bases, with lowest layer first (Figure 1-25).

KNSE TAF 260909 28004KT 9000 HZ **SCT020 SCT200** QNH2998INS

Figure 1-25 TAF Sky Condition Group

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As with METARs, TAF sky conditions will consist of five or six characters. The first two or three letters indicate the amount of sky coverage, from Figure 1-20, above, and the last three digits indicate the height of the cloud bases in hundreds of feet AGL.

The types of clouds will not be forecast with the exception of cumulonimbus (CB), which will always be given as a separate layer (e.g., SCT005CB). In the event of a partial obscuration, it will be considered the first cloud layer and reported as FEW000, SCT000, or BKN000.

Special Wind Shear Group

An entry such as “WS020/22030KT” indicates the presence of wind shear. The three digits before the slash indicate the altitude (AGL), and the characters following the slash indicate wind direction and speed. North American stations will insert this special non-convective wind shear group immediately after the cloud group when it is forecast for altitudes 2000 feet AGL and below. However, if it cannot be forecast with accuracy, a less specific format of "WSCONDS" (wind shear conditions) may be used, and no further numeric data will be given. If no wind shear is forecast, then this group is omitted.

Icing Group

This group consists of six numbers only and begins with a “6.” It is used to forecast non-thunderstorm icing (the presence of thunderstorms implies moderate or greater icing), and is repeated as often as necessary to indicate multiple icing layers. The group is omitted if no icing is forecasted. The following example illustrates the decoding of the icing group: 641104

The “6” indicates that icing is forecasted. The next digit, “4,” is the type of forecasted icing from Figure 1-26 (moderate icing). If more than one type of icing is forecast within the same stratum of air, the highest code figure, the most severe, will be used. The next three digits, “110,” indicate the height of the base of the icing stratum in hundreds of feet AGL, which is 11,000 feet AGL in this case. If the numbers “000” are used, this would indicate icing occurring at or below 100 feet AGL. The last digit, “4,” is the thickness of the icing layer in thousands of feet (4000 feet here) using numbers 1 through 9. If layer is thicker than 9000 feet, the icing group is repeated so that the base of the repeated group coincides with the top of the first encoded icing group. If multiple layers not related to each other are forecasted, the layers are encoded in an ascending order.

IC	TYPE OF ICING	B	TYPE OF TURBULENCE
Code	Description	Code	Description
0	No icing	0	None
1	Light icing	1	Light turbulence
2	Light icing in cloud	2	Moderate turbulence in clear air, occasional
3	Light icing in precipitation	3	Moderate turbulence in clear air, frequent
4	Moderate icing	4	Moderate turbulence in cloud, occasional
5	Moderate icing in cloud	5	Moderate turbulence in cloud, frequent
6	Moderate icing in precipitation	6	Severe turbulence in clear air, occasional
7	Severe icing	7	Severe turbulence in clear air, frequent
8	Severe icing in cloud	8	Severe turbulence in cloud, occasional
9	Severe icing in precipitation	9	Severe turbulence in cloud, frequent
		X	Extreme turbulence

Figure 1-26 TAF Icing and Turbulence Codes

Turbulence Group

This group is similar to the icing group because it consists of six characters and follows the same format. The turbulence group, however, begins with a "5," and the second digit represents the turbulence intensity, also from Figure 1-26 (above). The turbulence group is used to forecast non-thunderstorm turbulence (the presence of thunderstorms implies moderate or greater turbulence) and repeated as often as necessary to indicate multiple turbulence layers. The group is omitted if no turbulence is forecasted. The example below illustrates the decoding of the turbulence group: 510302

Following the same rules as the icing group, above, one would expect light turbulence from 3000 to 5000 feet AGL.

Altimeter Group

This group forecasts the lowest expected altimeter setting in inches of Hg (Mercury) during the initial forecast period and each subsequent BECMG and FM group (to be discussed shortly) that follows. TEMPO groups (also to be discussed shortly) do not forecast the QNH group. This minimum altimeter setting becomes quite valuable when aircraft lose radio communications in IMC conditions and need a useful altimeter setting for the destination airfield (Figure 1-27).

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KNSE TAF 260909 28004KT 9000 HZ SCT020 SCT200 **QNH2998INS**

Figure 1-27 TAF Altimeter Group

The “QNH” indicates sea level pressure is being given. The next four digits indicate the lowest forecast altimeter setting in inches of Hg (and hundredths), without the decimal. “INS” simply indicates the unit of measurement is inches. Other standards, such as QNE and QFE, are also used in different circumstances. QNE is the standard datum plane, 29.92 in-Hg, and some countries use QFE, the actual station pressure not corrected to sea level. If QFE is set, the altimeter indicates actual elevation above the field, but does not ensure terrain clearance. Aircrews must exercise extreme caution if conducting operations at a location using QFE.

International stations report the altimeter in millibars (a.k.a. hectopascals, hPa) and use the letter “Q” for indicator. For example, “Q1013” indicates a forecast altimeter setting of 1013 millibars. U.S. civil stations generally will not forecast an altimeter setting.

REMARKS

Various remarks may be appended to the end of the initial forecast period and subsequent change groups. The contractions listed in Figure 1-11 are used for weather and obstructions to vision, while the FAA General Use Contractions will be used for other abbreviations.

The abbreviation “VC,” also from Figure 1-11, will only be used for air mass weather that is expected to occur within the forecast area. For example, “VCSHRA W” would indicate that rain showers are in the vicinity to the west. However, "VC" will not be used for weather expected to occur within a 5-mile radius of the runway complex, since that is considered to be “at the station.”

Temperature Group

This is an optional group; however, its usage is highly encouraged and should be included to meet the requirements of local operations, especially for helicopter and VSTOL aircraft, which require density altitude. The forecast maximum or minimum temperature, depending on the time of the day, is given in two digits Celsius, using "M" for minus temperatures. This is followed by the 2-digit hour during which the maximum or minimum is expected to occur. It will be on the last line of the TAF, unless the forecast was amended.

108. CHANGE GROUP TERMINOLOGY

The change groups of “FM,” “BECMG,” and “TEMPO” will be used whenever a change in some or all of the elements forecasted are expected to occur at some intermediate time during the 24-hour TAF period. A new line of forecasted text is started for each change group. More than one change group may be used to properly identify the forecast conditions (Figure 1-28).

FM (From) and BECMG (Becoming) are indicators of expected speed of change. FM is used when the change is expected to be quick, and BECMG is used when the change is expected to occur over a longer period of time. FM indicates a permanent, dramatic or relatively dramatic, change to a weather pattern is forecast to occur in a short period. All elements of the forecast conditions will be listed on that TAF line. BECMG indicates some forecast elements are going to change permanently, or possibly all of the forecast elements will change. TEMPO (Temporary) means just that: a temporary or non-permanent change to the overall weather pattern.

KNSE TAF 260909 28004KT 9000 HZ SCT020 SCT200 QNH2998INS
FM1200 26007KT 9000 HZ SCT025 SCT080 BKN250 QNH2996INS
VCSHRA
BECMG 1416 9999 SCT025CB SCT250
BECMG 1718 23015G25KT 530004
TEMPO 1902 8000 TSSHRA SCT010 BKN025CB
FM0200 27010KT 9999 SCT030 BKN080 BKN250 QNH3001INS 20/09Z

Figure 1-28 TAF Change Groups

FM Group

The heading "FM" followed immediately by a time (hours and minutes) indicates the forecast weather is expected to change rapidly to the conditions on that line. In other words, the time indicates the beginning of a significant and permanent change in the whole weather pattern, and all previously forecast conditions are superseded by the conditions forecasted on this line. Additionally, the "FM" line includes all elements of a normal forecast as discussed above.

Using Figure 1-28 as an example, the change group "FM1200" starts the change line, and indicates a change is forecasted to occur at 1200Z. All elements on that line will be in effect from 1200Z to the end of the original 24-hour period (0900Z in this example), unless changed later in the forecast by another change group (as is the case here).

BECMG Group

A line beginning with the heading "BECMG" indicates a change to forecast conditions is expected to occur slowly within the period designated in the time group immediately following the heading. In this time group of four digits, the first two indicate the beginning hour, and the last two represent the ending hour during which the change will take place. The duration of this change is normally about 2 hours, 4 at most.

The elements included in the BECMG line will supercede some of the previous TAF groups, but it is possible all the groups may change. Any group omitted in the BECMG line will be the same during the BECMG period as indicated in the main TAF line. These new conditions are

expected to exist until the end of the TAF forecast time period (unless changed later in the forecast by another change group).

KNSE TAF 260909 28004KT 9000 HZ SCT020 SCT200 QNH2998INS
FM1200 26007KT 9000 HZ SCT025 SCT080 BKN250 QNH2996INS
VCSHRA
BECMG 1416 9999 SCT025CB SCT250
BECMG 1718 23015G25KT 530004
TEMPO 1902 8000 TSSHRA SCT010 BKN025CB
FM0200 27010KT 9999 SCT030 BKN080 BKN250 QNH3001INS 20/09Z

Figure 1-29 TAF BECMG Group

From Figure 1-29, some aspects of the weather will begin to change slowly sometime between 1700 and 1800Z, specifically the winds and turbulence. These forecast winds of 230° at 15 kts, gusting to 25 kts, and the frequent, moderate CAT can be expected to last until superseded by the FM group at 0200Z.

TEMPO Group

The heading "TEMPO" followed by a 4-digit time group indicates the weather conditions on this line will occur briefly, and will not represent a permanent change in the overall forecast weather pattern. Rather, there will be a short-lived overlay to the base forecast occurring only between the beginning and ending hours (two digits for each) specified by the time group. Furthermore, only the elements listed are forecasted to be affected.

For example, in Figure 1-30, the temporary occurrence of thunderstorms and rain showers are forecast to exist only from 1900 up to, but not including, 0200. After this time, the conditions listed in the TEMPO line will be replaced by the forecast from other lines.

KNSE TAF 260909 28004KT 9000 HZ SCT020 SCT200 QNH2998INS
FM1200 26007KT 9000 HZ SCT025 SCT080 BKN250 QNH2996INS
VCSHRA
BECMG 1416 9999 SCT025CB SCT250
BECMG 1718 23015G25KT 530004
TEMPO 1902 8000 TSSHRA SCT010 BKN025CB
FM0200 27010KT 9999 SCT030 BKN080 BKN250 QNH3001INS 20/09Z

Figure 1-30 TAF TEMPO Group

PROB Group

Civilian stations will sometimes forecast the probability of occurrence of thunderstorms or other precipitation events. Such a line begins with "PROB," followed by a 2-digit percentage and the corresponding weather, as this example illustrates:

PROB40 1/2SM +TSRA OVC005CB

This station forecasts a 40% chance of heavy rain from thunderstorms, producing an overcast ceiling of cumulonimbus clouds at 500 feet, with visibility ½ mile. Additionally, a 4-digit time period group giving the beginning and ending time for the occurrence may follow this group. USN/USMC stations will not use this change group.

Change Groups and Times (FROM/TO)

In order to use a TAF effectively, one must know how long a given pattern of weather will last, as well as what that pattern will be. To do this, establish the FROM and TO times of that pattern.

NOTE:

In this text, TO will mean up TO, but not including that time.

The times on the first line of code, after the location, are the FROM and TO date and times for the entire forecast, and the beginning (FROM) time of the first forecast line.

The time listed immediately after a FM can be a beginning time of a new pattern of weather as well as a TO time of a previously defined pattern, depending upon where it falls in the forecast.

The first two digits of the 4-digit time group following BECMG will be the beginning (FROM) time of the new forecast elements, and the last two digits are the ending (TO) time of the previous pattern.

The first two digits of the 4-digit time group shown after a TEMPO are the beginning (FROM) time, and the last two digits are the ending (TO) time for that TAF line.

```
KNSE 200909 00000KT 0800 FG VV001 620106 QNH3000INS
TEMPO0912 00000KT 2400 BR SCT000 SCT005 SCT080 SCT250
FM1400 20005KT 6000 HZ SCT025 SCT080 SCT250 QNH3004INS
BECMG1617 9999 QNH3002INS
BECMG2022 23010KT 9999 SCT025 SCT080 BKN250 WSCONDS 531006 QNH2996INS
     VCTSSH
TEMPO2303 VRB15G30KT 1600 TSSH OVC010CB
```

Figure 1-31 From/To Example

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Using the example in Figure 1-31, the first forecast line (KNSE 200909) begins FROM 0900Z on the 20th and is good up TO 1400Z on the third line. (0900Z to 0900Z is also the 24 hour forecast period.) The second forecast line (TEMPO0912) begins FROM 0900Z and is forecast to occur up TO 1200Z. The third forecast line (FM1400) begins FROM 1400Z and is good up TO 1700Z, with some of these conditions changing by up TO 1700Z, the fourth line. The fourth forecast line (BECMG1617) begins FROM 1600Z and is good up TO 2200Z. The fifth forecast line (BECMG2022) begins FROM 2000Z and is forecast to occur up TO at least 0900Z, the end of the forecast period. The sixth line (TEMPO2303) begins FROM 2300Z and is forecast to occur up TO 0300Z.

109. SUMMARY OF U.S. CIVIL/MILITARY TAF DIFFERENCES

Civilian weather stations are required to adhere to slightly different formats than military stations, as has been discussed in the corresponding sections above. For reference, these differences are summarized below. An example follows in Figure 1-32.

1. U.S. civil stations will use statute miles instead of meters.

2. U.S. civil stations include date time group of transmission prior to the forecast period (e.g., 091720Z 081818).

3. When U.S. military stations amend, correct, or have a routine delayed forecast, a remark will be appended to the last line of the forecast with the appropriate time (e.g., AMD2218).

4. U.S. civil stations may include probability of precipitation occurrence.

KLCH TAF 032240Z 032323 01012G22KT 5SM HZ OVC006
BECMG 0002 01015G25KT 2SM -DZ BR OVC004 PROB40 0004 VRB25G35KT 2SM
TSRA VV002
FM0400 01012G20KT 2SM BR OVC004
BECMG 1516 01015G25KT 4SM HZ OVC008
FM1700 01010KT 5SM HZ OVC009;

KSHV TAF 032240Z 032323 36010KT 4SM BR OVC004 WS005/27050KT
TEMPO 2316 35015KT 2SM -FZDZ PL OVC020
FM1700 04008KT P6SM BKN025;

Figure 1-32 Civilian TAF Examples

Additionally, there are some differences between military TAFs and International TAFs, which are summarized in Figure 1-33.

TAF Differences			
U.S. Military TAF		International TAF	
Forecast Period	24 Hours	Forecast Period	Variable
Wind Speed	Knots	Wind Speed	Knots-, or Meters- or Kilometers-per-hour
CAVOK not used		CAVOK used	

Figure 1-33 Differences Between Military and International TAFs

The term CAVOK is similar to the term sometimes used among aviators, CAVU, which stands for "Clear Air, Visibility Unlimited." The term CAVOK stands for "Clear Air, Visibility O.K." and is not used in U.S. Military TAF reporting.

110. DETERMINATION OF CEILING IN METARS AND TAFS

We first introduced the concept of cloud layers and ceilings. As you may recall, the definition of a ceiling is the height above the ground (AGL) ascribed to the lowest broken or overcast layer; or the vertical visibility into an obscuring phenomenon (total obscuration). Remember partial obscurations, such as FEW000, or SCT000, do not constitute a ceiling.

Ceilings may be easy to determine in METAR, but more difficult in TAFs, since they usually have more than one line. Therefore, it is important to carefully evaluate the ceiling by using the appropriate time period, as will be discussed below in "Using TAFs for Flight Planning." Once the ceiling (and other cloud layers) has been determined, then one can move onward to determining the type of flight plan (IFR or VFR) as well as whether an alternate landing airfield is required.

111. IFR/VFR RULES FOR FLIGHT PLANNING

The governing service instructions mandate VFR flights maintain certain ceiling and visibility minimums. The Chief of Naval Operations Instruction 3710.7 series, NATOPS General Flight and Operating Instructions, referred to as OPNAV 3710.7, or as "the 3710", requires VFR flights to maintain ceiling and visibility minimums of at least 1000 feet and three statute miles. Air Force Instruction 11-202 (Vol. 3), General Flight Rules, requires VFR flights to maintain ceiling and visibility minimums of at least 1500 feet and three statute miles. In other words, existing and forecast weather must be such as to permit VFR operations for the entire duration of the flight and at the destination, including $\pm$1 hour of the ETA (both services). If this cannot be maintained, as determined by reference to the applicable METAR and TAF products, then one must file and fly an IFR flight plan.

112. REQUIREMENTS FOR AN ALTERNATE ON IFR FLIGHT PLANS

Each airfield has minimum ceiling requirements for commencing an approach and landing at that field. These minimums are found on the airfield's approach plates and play an important role in

the flight planning process. In particular, when filing an IFR flight plan, an alternate landing airfield may or may not be required to be included on the DD 175 Flight Plan.

Naturally, the OPNAV 3710.7 provides rules that determine when an alternate is required, as pictured in Figure 1-34.

<table>
<tr><th>DESTINATION WEATHER
ETA plus and minus 1 hour</th><th colspan="3">ALTERNATE WEATHER
ETA plus and minus 1 hour</th></tr>
<tr><td>0 - 0 up to but not including published minimums</td><td colspan="3">3,000 - 3 or better</td></tr>
<tr><td rowspan="2">Published minimums up to but not including 3,000 - 3 (single-piloted absolute minimums 200 - 1/2)</td><td rowspan="2">NON-PRECISION</td><td colspan="2">PRECISION</td></tr>
<tr><td>ILS</td><td>PAR</td></tr>
<tr><td></td><td>* Published minimums plus 300-1</td><td>* Published minimums plus 200-1/2</td><td>* Published minimums plus 200-1/2</td></tr>
<tr><td>3,000 - 3 or better</td><td colspan="3">No alternate required</td></tr>
<tr><td colspan="4">* In the case of single-piloted or other aircraft with only one operable UHF/VHF transceiver, radar approach minimums may not be used as the basis for selection of an alternate airfield.</td></tr>
</table>

Figure 1-34 OPNAV 3710.7 Determination of Requirement for Alternate

When filing a Navy IFR flight plan, an alternate is required if the destination is forecasting a ceiling below 3000 feet or if the visibility is less than three statute miles (referred to as 3000-3) for the time period of ±1 hour of the planned ETA. If the forecast ceiling for the destination airfield is "below minimums," then an alternate must be selected that has VFR weather, 3000-3, or better. However, if the destination has ceilings above the minimums but below 3000-3, then the alternate airfield must have forecast ceiling and visibility above the minimums for the planned approach by the appropriate margin (indicated on the right of Figure 1-34), either 300-1 for a non-precision approach, or 200-1/2 for a precision approach.

AFI 11-202 (Vol. 3) provides rules determining when an alternate is required, as pictured in Figures 1-35 and 1-36, depending on whether flying fixed wing or rotary wing aircraft.

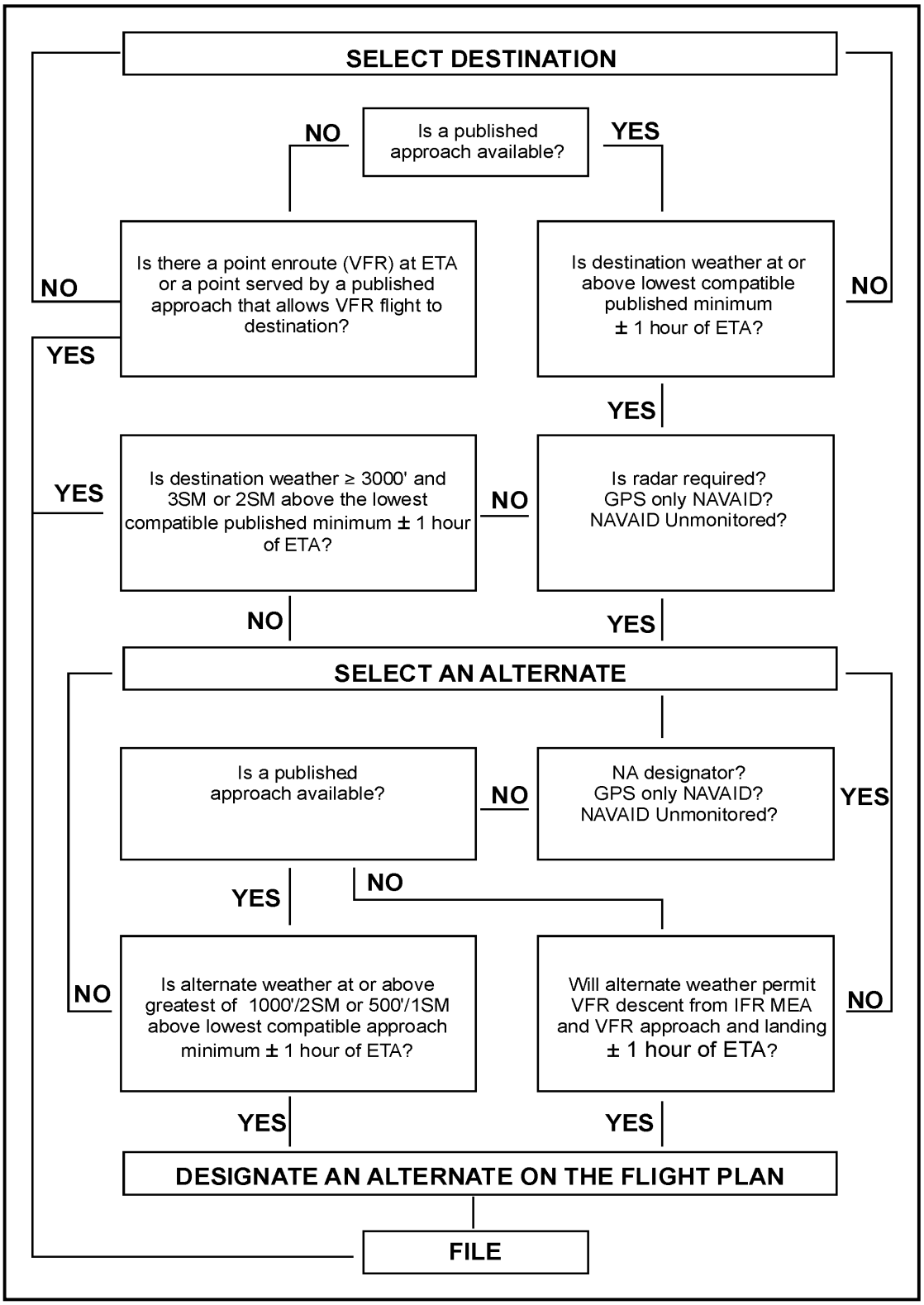

Figure 1-35 USAF Fixed Wing Determination of Requirement for Alternate

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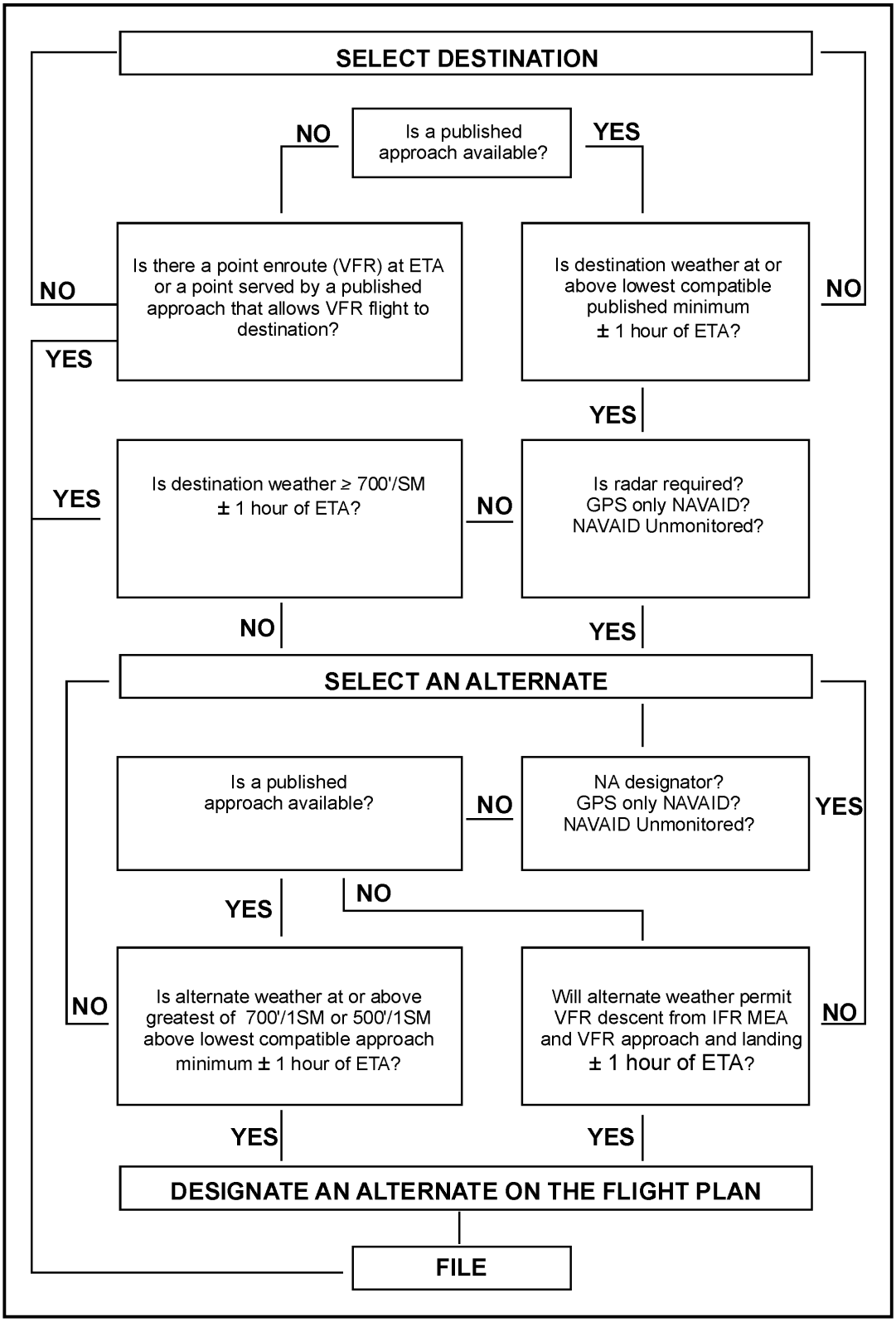

Figure 1-36 USAF Fixed Wing Determination of Requirement for Alternate

In summary, USAF pilots are required to designate an alternate if, for the ETA (±1 hour) for the first point of intended landing (or each point of intended landing on a stopover flight plan), the worst weather (TEMPO or prevailing) is forecast to be less than

For fixed wing aircraft:

- A ceiling of 3000 feet, or
- A visibility of 3 SMs or 2 SMs more than the lowest compatible published landing minimum visibility, whichever is greater.

For rotary wing aircraft:

- A ceiling of 700 feet, or
- A visibility of 1 SM.

EXAMPLE OF MILITARY TAF WITH DESCRIPTION OF ELEMENTS

KNSE TAF 260909 28004KT 9000 HZ SCT020 SCT200 QNH2998INS
FM1200 26007KT 9000 HZ SCT025 SCT080 BKN250 QNH2996INS
VCSHRA
BECMG 1416 9999 SCT025CB SCT250
BECMG 1718 23015G25KT 530004
TEMPO 1902 8000 TSSHRA SCT010 BKN025CB
FM0200 27010KT 9999 SCT030 BKN080 BKN250 QNH3001INS 20/09Z

Figure 1-37 Military TAF Example

1st line — Forecast for NAS Whiting field (KNSE) beginning at 0900Z (0909) and valid up to but not including 1200Z on the second line (FM1200), winds from 280 degrees and speed 4 knots (28004KT), visibility 6 miles (9000 meters), in haze (HZ), scattered clouds at 2000 feet AGL (SCT020), scattered clouds at 20,000 feet AGL (SCT200), altimeter setting 29.98 inches (QNH2998INS).

2nd Line — From 1200Z (FM1200), up to but not including 1600Z (BECMG 1416), winds from 260º at seven knots (26007KT), visibility six miles (9,000 meters), in haze (HZ), scattered clouds at 2500 feet AGL (SCT025), scattered clouds at 8000 feet AGL (SCT080), broken clouds at 25,000 feet AGL (BKN250), altimeter setting of 29.96 inches (QNH2996INS), and rain showers in the vicinity (VCSHRA), ceiling at 25,000 feet.

3rd Line — From 1400Z (BECMG 1416), up to but not including 1800Z (BECMG 1718), winds the same as 2nd line (26007KT), visibility greater than 6 miles (9999), scattered cumulonimbus clouds at 2500 feet AGL (SCT025CB), and scattered clouds at 25,000 feet AGL (SCT250), altimeter setting same as 2nd line (QNH2996INS); remarks same as 2nd line.

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4th Line — From 1700Z (BECMG 1718) up to but not including 0200Z (FM02), winds from 230º at 15 knots with gusts to 25 knots (23015G25KT), visibility same as 3rd line (9999), clouds same as 3rd line (SCT025CB, SCT250), moderate turbulence in clear air from surface up to 4000 feet (530004), altimeter setting same as 2nd line, 29.96 inches (QNH2996INS).

5th Line — Temporarily between 1900Z and 0200Z (TEMPO 1902), winds same as 4th line (23015G25KT), visibility five miles (8000 meters), with thunderstorms and rain showers (TSSHRA), scattered clouds at 1000 feet AGL (SCT010) and broken cumulonimbus clouds at 2500 feet AGL (BKN025CB), turbulence same as 4th line (530004), altimeter same as 2nd line (QNH2996INS), with ceiling at 2500 feet.

6th line — From 0200Z (FM0200) up to but not including 0900Z (end of TAF), winds from 270 degrees at 10 knots (27010KT), visibility greater than 6 miles (9999), scattered clouds at 3000 feet AGL (SCT030), broken clouds at 8000 feet AGL (BKN080), broken clouds at 25,000 feet AGL (BKN250), altimeter setting 30.01 inches (QNH3001INS), ceiling at 8000 feet AGL, minimum temperature forecasted for the day is 20 °C (68 °F) at 0900Z.

113. USING TAFS FOR FLIGHT PLANNING

For flight planning purposes, an aviator must consider the worst weather conditions that fall within the period of 1 hour prior to the planned estimated time of arrival (ETA) up to but not including one hour after ETA, for a total of a two hour window. As an example, assume an ETA of 1620Z at NAS Whiting, use the TAF in Figure 1-28, and follow these simple steps:

1. Determine the arrival window, which would be 1520 – 1720Z in this case.

2. Evaluate the whole TAF to determine the forecast time period to which each line applies. If any part of the two hour ETA window falls within the time period of that line, then the information in that line will be applicable. In this case, lines 2, 3, and 4 each cover part of the 1520 – 1720Z window.

3. Finally, mix and match the weather from each line for use in flight planning, building a set of the worst-case scenario for each group: strongest winds, lowest visibility, worst weather, lowest ceiling, and lowest altimeter.

Another technique is to lay out a timeline in order to dissect and categorize the applicability of the various lines of a TAF. By drawing labeled brackets around the times to which each line applies and around the two hour ETA window, it becomes easier to see which lines of the TAF are applicable. This technique is especially useful when planning a mission with numerous approaches or en route delays, or when the weather will be a deciding factor for the landing time. Figure 1-38 shows a diagram of this technique for our example.

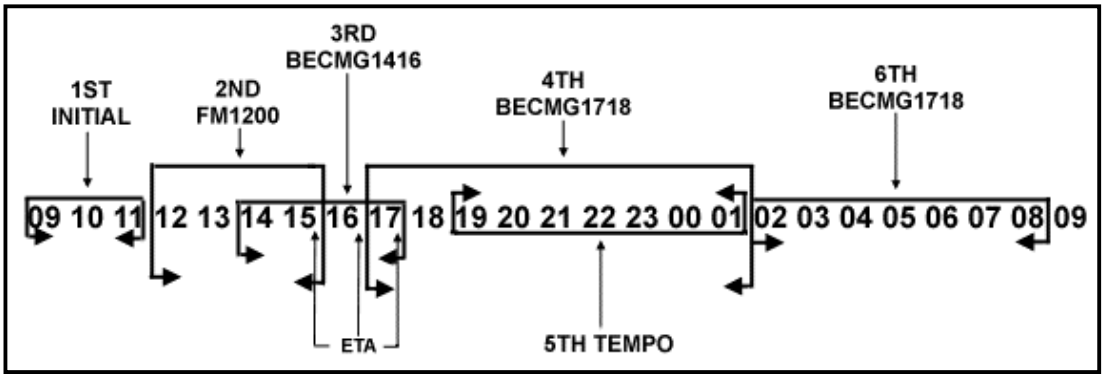

Figure 1-38 TAF Timeline Example

This technique also requires the aircrew to apply the 2nd, 3rd, and 4th lines of the forecast. Using either method, they would look for the worst weather among each of these lines and plan for:

1. Winds 230º at 15 knots gusting to 25 knots (23015G25)
2. Visibility 6 miles in haze (9000 HZ)
3. Scattered cumulonimbus at 2500 feet AGL, scattered clouds at 8000feet AGL, and broken clouds at 25,000 feet
4. AGL, with ceiling at 25,000 feet (SCT025CB, SCT080, BKN250)
5. Altimeter setting 29.96 inches (QNH2996INS)
6. Frequent moderate clear air turbulence from the surface up to 4000 feet (530004)
7. Rain showers in the vicinity (VCSHRA)

STUDY QUESTIONS

Aviation Routine Weather Reports (METAR)

Use Figure 1-39 for questions 1-6, as well as any other figures needed from the chapter.

KLEX 0359Z 19004KT 7SM BKN250 22/20 A3020 RMK SLP220
KPAH 0358Z 09008KT 15SM -RA BKN011 OVC060 22/20 A3007 RMK CB OVHD MOVG E SLP178
KAND 0357Z 09005KT 060V140 12SM SCT050 BKN250 30/22 A3015 RMK SLP204
KCAE 0356Z 00000KT 10SM FEW000 FEW050 SCT300 25/20 A3013 RMK CB N LTGIC SLP201
KAVL 0458Z 12004KT 2SM BR HZ SCT000 SCT060 BKN080 21/20 A3028 RMK FG HZ SCT000 PRESFR SLP226
KRDU 0456Z 13008KT 2SM HZ SCT000 24/22 A3017 RMK HZ SCT000 SLP208

Figure 1-39 METAR

1. The report for Anderson (AND) indicates_____.

   a. broken clouds at 25,000 feet
   b. the altimeter setting is 29.05 inches of mercury
   c. the wind is 200° at 40 miles per hour
   d. broken clouds at 5000 feet

2. The report for Lexington (LEX) indicates_____.

   a. the ceiling is reported at 25,000 feet
   b. the wind is from the south at 40 miles per hour
   c. no ceiling
   d. the station pressure reduced to sea level is 922.0 mb

3. The report for Paducah (PAH) indicates_____.

   a. the ceiling is 6000 feet
   b. the overcast is measured at 1100 feet
   c. the altimeter setting is 30.07 inches of mercury
   d. it is snowing

4. The report for Columbia (CAE) indicates_____.

   a. over 15 statute miles visibility
   b. there is no ceiling
   c. a mistake in the dew point
   d. a pilot would prefer to approach this station from the north

5. The report for Asheville (AVL) indicates_____.

   a. 20 statute miles visibility
   b. the wind was 210° at 4 miles per hour
   c. the visibility was restricted because of mist and haze
   d. the wind was 040° at 12 knots

6. The report for Raleigh (RDU) indicates_____.

   a. there was no ceiling
   b. the altimeter setting was 20.17 inches of mercury
   c. a partial obscuration
   d. A and C are correct

Use Figure 1-40 for questions 7-12, as well as any other figures needed from the chapter.

KTLH 0455Z 040412KT 6SM -RA DZ BKN015 OVC018 22/21 A2995 RMK -RA OCNLY RA SLP144
KAQQ 0456Z 22010KT 3SM R04/P6000FT FG SCT000 BKN008 BKN080 OVC250 19/18 A994 RMK FG SCT000 CIG 006V010 SLP142
KSUU 2157Z 16009KT 10SM BKN027 BKN200 30/26 A2999 RMK SLP190
KNGP 2158Z 18012KT 12SM SKC 20/12 A2964 RMK VSBY E 1 1/2FU SLP037
KTIK 2158Z 18015G25KT 7SM BKN012 OVC090 26/14 A2966 RMK CIG LWR N SLP044
KBAD 2057Z 19007KT 15SM SCT055 BKN180 26/15 A2996 RMK VSBY SE 3 FU SLP146

Figure 1-40 METAR

7. The report for Tallahassee (TLH) indicates_____.

   a. the light rain is occasionally heavy
   b. the ceiling is estimated to be 1800 feet AGL
   c. the present weather is light rain and drizzle
   d. the sea-level pressure is 1014.2 inches

8. The report for Appalachicola (AQQ) indicates_____.

   a. there are two ceilings
   b. on RWY 04, the visual range is greater than 6000 feet
   c. the ceiling varies between 6000 and 10,000 feet MSL
   d. fog obscures five-eighths of the sky

9. The report for Travis AFB (SUU) indicates_____.

   A. the wind is 160° at 9 miles per hour
   B. there was a ceiling
   C. the visibility is 10 nautical miles
   D. the altimeter setting is 29.99 mb

10. The report for NAS Corpus Christi (NGP) indicates_____.

   a. there is no ceiling
   b. the wind is 12 knots from the south
   c. the visibility in the area is restricted
   d. A and B are correct

11. The report for Tinker AFB (TIK) indicates_____.

   a. the ceiling is 900 feet and is overcast
   b. a pilot flying at 10,000 feet would be above all clouds
   c. the ceiling on an approach from the north may be lower
   d. there are squalls

12. The report for Barksdale AFB (BAD) indicates_____.

   a. the magnetic wind is 190° at 07 knots
   b. the visibility is 15 statute miles in all directions
   c. the temperature-dew point spread is 12 °C
   d. none of the above

Use Figure 1-41 for questions 13-19, as well as any other figures needed from the chapter.

KNQA SPECI 2056Z 36007KT 3/4SM FG VV004 22/21 A2976 RMK SLP078
KBWG 1357Z 13004KT 10SM TSRA PL SCT025CB SCT035 SCT100 BKN250 28/26 A2990
RMK TSSH ALQDS SLP125
KMEM 1356Z 04010KT 010V070 30SM BKN120 BKN250 30/17 A2995 RMK SLP142
KPAH 1358Z 17023G30KT 12SM SKC 34/24 A2990 RMK FEW CI SLP111
KSDF SPECI 1357Z 00000KT 1SM -RA FG BKN006 19/18 A2976 RMK SLP078
KTRI 1356Z 00000KT 20SM BKN065 A3010 RMK LSR08P DRY SLP193

Figure 1-41 METAR

13. The report of NAS Memphis (NQA) at 2100Z indicates_____.

    a. an overcast at 400 feet
    b. the visibility is 3 statute miles
    c. the ceiling was due to an obscuration
    d. the lowest cloud layer is at 300 feet

14. The 2100Z report from NAS Memphis (NQA) indicates_____.

    a. this was a special weather observation
    b. the visibility is unrestricted
    c. the wind information is missing
    d. no clouds

15. The report for Memphis (MEM) indicates_____.

    a. the wind is steady from 040° magnetic at 10 knots
    b. the ceiling is 12,000 feet
    c. there is another ceiling at 25,000 feet
    d. the altimeter setting is 29.95 hectopascals

16. The report for Bristol (TRI) indicates_____.

    a. the temperature and dew point are minus values
    b. the wind information is missing
    c. the temperature is missing
    d. two layers of clouds

17. The report for Bowling Green (BWG) indicates_____.

    a. the ceiling is 2500 feet
    b. ice pellets were falling at the time of the observation
    c. the wind is 130° at four miles per hour
    d. broken clouds at 10,000 feet

18. The report for Paducah (PAH) indicates_____.

    a. gusty winds
    b. the wind speed reached 30 miles per hour
    c. there are no clouds
    d. the barometric pressure is 911.1 mb

19. The report for Louisville (SDF) indicates_____.

    a. light rain and fog
    b. the wind is calm
    c. the height of the ceiling was 600 feet
    d. all of the above are correct

Use Figure 1-42 for questions 20-25, as well as any other figures needed from the chapter.

KADM SPECI 0958Z 32014KT 7SM SKC 21/18 A2970 RMK SLP057 RADAT 79100
KOKC 1008Z 108014KT 15SM SCT010 BKN025 28/23 A3006 RMK DSNT TSSH SLP219
KPWM 1055Z 30018KT 2SM R30/P6000FT -SN SCT000 OVC008 M01/M02 A2991 RMK SN SCT000 DRFTG SN PSR20 SLP118
KLUF 1356Z 18005KT 45SM SCT025 SCT050 BKN240 04/M06 A3017 RMK SHSN OBSCG MTNS N SLP217
KNFB SPECI 0123Z 01023G35 1/2SM R36R/1200FT -BLSN SCT000 OVC005 RMK VIS 3/8V5/8 BLSN SCT000 CIG 004V006
KNXX 0058Z COR 13008G15KT 100V170 8SM SCT005 BKN008 OVC012 06/M01 A2945 RMK BKN TOPS 070 SLP985

Figure 1-42 METAR

20. The report for Ardmore (ADM) indicates_____.

    a. the freezing level was observed to be at 10,000 feet MSL
    b. the time of the RADAT observation was 1008Z
    c. the freezing level was forecast to be at 10,000 feet MSL
    d. the freezing level was forecast to be at 10,000 feet AGL

21. The report for Oklahoma City (OKC) indicates_____.

    a. it is raining in sight of the field
    b. the temperature-dew point spread was 9ºC
    c. Oklahoma City was still able to transmit the report at the assigned time slot
    d. A and C are correct

22. The report for Portland (PWM) indicates_____.

    a. the sky is partially obscured by snow
    b. the runway visual range is greater than 6000 feet
    c. the ceiling was 800 feet
    d. all of the above are correct

23. Luke AFB (LUF) reported_____.

    a. a visibility of 45 statute miles
    b. no weather in the vicinity of the station
    c. an unlimited ceiling
    d. all of the above are correct

24. The report for NAS Grosse Isle (NFB) indicates_____.

    a. a partial obscuration due to blowing snow
    b. is in error, since RVR does not coincide with prevailing visibility
    c. a possible ceiling at 400 feet
    d. the conditions stated in A and C

25. NAS Willow Grove (NXX) reported_____.

    a. base of the overcast at 1200’ MSL, top of the overcast at 7000 feet MSL
    b. conditions which would point up the wisdom of monitoring reports for further weather developments at Willow Grove while en route to that terminal
    c. VFR conditions over the field
    d. wind steady from 310° at 8 knots with gusts at 15 knots

Terminal Aerodrome Forecasts (TAFs)

Use Figure 1-43 for questions 26-49, as well as any other figures needed from the chapter.

KNPA 201212 36005KT 0800 DZ FG VV002 QNH3001INS
FM1500 02011KT 8000 HZ BKN007 BKN020 BKN140 BKN300 641403 540209 QNH2995INS
TEMPO1822 16008KT 4800 SHRA SCT008 BKN020

KNTU 201212 02008KT 1600 RA BR OVC004 QNH3000INS
TEMPO1216 VRB05KT 0800 FG VV001
FM1600 02011KT 6000 HZ BKN007 BKN020 OVC300 670708 QNH2993INS
TEMPO1822 19006KT 4800 SHRA SCT009 BKN020

KDOV 201212 36007KT 0800 DZ FG VV002 QNH3001INS
FM1500 02011KT 8000 HZ BKN007 BKN020 BKN150 OVC300 621403 540209 QNH2995INS
TEMPO1822 16008KT 4800 SHRA SCT008 BKN020

KNBE 201212 VRB05KT 0800 DZ FG VV001 QNH3004INS
FM1300 12006KT 1600 BR OVC005 QNH3007INS VCRA
FM1700 17010KT 8000 HZ SCT007 BKN020 OVC300 650106 540209 QNH2991INS VCSHRA
TEMPO1823 18015KT 4800 SHRA BKN020
BECMG0102 VRB05KT 3200 BR BKN005 OVC020 QNH 3000INS

KTIK 201212 VRB05KT 1600 DZ BR OVC004 QNH2999INS
FM1500 15010KT 0800 DZ FG OVC006 QNH3001INS
BECMG2122 17010KT 2400 DZ BKN014 OVC025 QNH3005INS
FM0000 22012KT 9999 SCT030 OVC050 QNH3002INS
BECMG0608 24012KT SKC QNH3004INS

KSPS 201212 17010KT 4800 BR BKN008 OVC015 QNH2987INS
FM1500 17015KT 9999 OVC015 QNH2989INS
FM2000 19012KT 9999 BKN030 QNH2990INS
BECMG0204 19010KT SKC QNH2993INS

KNQA 201515 18008KT 9999 SKC QNH3016INS
FM1800 17012G20KT 9999 BKN025 611109 521103 QNH3012INS
FM0400 17015G22KT 9999 BKN020 BKN100 WSCONDS QNH3008INS
TEMPO0408 20025G35KT 1600 TSSHRA OVC008CB

KNBG 201515 13008KT 9999 SCT025 SCT100 651309 521303 QNH3025INS
TEMPO1500 13012KT 9999 BKN025 BKN100
FM0900 VRB04KT 2400 BR SCT015 QNH3021INS
TEMPO0913 00000KT 0800 FG OVC015
FM1300 17010KT 9999 SCT030 QNH3020INS

KNMM 201515 14005KT 8000 BR SCT025 QNH3028INS
FM1900 16005KT 8000 HZ SCT025 BKN080 651109 561203 QNH3024INS
TEMPO1902 18010KT 6000 HZ BKN025 OVC080
FM0200 00000KT 9999 SKC 562005 QNH3020INS
BECMG0809 1600 BR SCT000 QNH3018INS

Figure 1-43 TAF

26. What is the forecast period for the first line of code on the Navy Pensacola (NPA) forecast?

    a. 1200Z up to, but not including 1200Z
    b. 1200Z up to, but not including 2200Z
    c. 1200Z up to, but not including 1800Z
    d. 1200Z up to, but not including 1500Z

27. An aircraft with an ETA into NPA of 1715Z would expect a ceiling of no less than_____.

    a. 2000 feet MSL
    b. 2000 feet AGL
    c. 700 feet AGL
    d. 700 feet MSL

28. What is the highest visibility forecast throughout the forecast period at NPA?

    a. 3 SM
    b. 5 SM
    c. 1/2 SM
    d. >6 SM

29. Would a pilot flying over NPA during the hours of 1600Z to 2000Z expect icing?

    a. Yes b. No

30. Which lines of the forecast for Navy Oceana (NTU) would be necessary to look at to formulate the worst case scenario for an ETA of 1615Z?

    a. Line 3 only
    b. Lines 2 and 3 only
    c. All lines would be used
    d. Lines 1 thru 3

31. What minimum visibility would be expected at NTU for an ETA of 1300Z?

    a. 1 SM
    b. 1/2 SM
    c. 4 SM
    d. >6 SM

32. What type of turbulence is forecast over NTU at 2000Z?

    a. Severe turbulence in clear, frequent
    b. Severe turbulence in cloud, infrequent
    c. Severe turbulence in clear, infrequent
    d. None forecast at that time

33. What is the temporary forecast sky cover between 1200Z and 1600Z at NTU?

    a. 800 foot ceiling
    b. Nine-tenths cloud coverage
    c. Partial obscuration
    d. Total obscuration

34. What is the forecast period for the second line of code for Dover, DE (DOV)?

    a. 1500Z up to, but not including 1200Z
    b. 1200Z up to, but not including 1500Z
    c. 1500Z up to, but not including 2200Z
    d. 1500Z up to, but not including 1800Z

35. Between which altitudes would icing be expected at DOV, at any time, if at all?

    a. 14,000 - 17,000 feet
    b. 14,000 - 14,300 feet
    c. 2000 - 11,000 feet
    d. none is forecast for dav

36. What are the maximum forecast winds at DOV throughout the forecast period?

    a. 020° Mag at 11 mph
    b. 150° True at 16 knots
    c. 020° True at 11 knots
    d. 180° Mag at 22 knots

37. What is the forecast period for the TEMPO line on the Navy Dallas, TX (NBE) forecast?

    a. 1800z up to, but not including 0200z
    b. 1800z up to, but not including 1200z
    c. 1800z up to, but not including 0100z
    d. 1800z up to, but not including 2300z

38. The minimum expected ceiling throughout the forecast period for NBE is_____.

    a. 1000 feet AGL
    b. 100 meters MSL
    c. 100 feet AGL
    d. 500 feet MSL

39. What are the forecast winds for NBE for an ETA of 0315Z?

    a. 170/10
    b. Variable at 5 kts
    c. 180/15
    d. Calm

40. Was Navy Memphis expecting wind shear at anytime during the forecast period? (Yes or No)

For questions 41-45, provide the minimum ceilings and visibilities for the location and ETA listed.

41. NTU ETA 1300Z: ___/___; ETA 1900Z: ___/___; ETA 0900Z: ___/___
    (CIG) / (VSBY)

42. DOV ETA 1400Z: ___/___; ETA 1800Z: ___/___; ETA 0100Z: ___/___

43. NBE ETA 1415Z: ___/___; ETA 1920Z: ___/___; ETA 0130Z: ___/___

44. TIK ETA 1300Z: ___/___; ETA 1545Z: ___/___; ETA 0300Z: ___/___

45. SPS ETA 1310Z: ___/___; ETA 1730Z: ___/___; ETA 2300Z: ___/___

46. Fill in the forecast elements for the following table:

	NQA/ETA 0700Z	NBG/ETA 1600Z	NMM/ETA 0730Z
2 HOUR WINDOW	_____	_____	_____
CEILING (MIN)	_____	_____	_____
VISIBILITY (MIN)/WEATHER(S)	___/___	___/___	___/___
ALTIMETER (LOWEST)	_____	_____	_____
WINDS (MAX)	_____	_____	_____
ICING (TYPE/ALTITUDES)	_____/	_____/	_____/
	_____	_____	_____
TURB (TYPE/ALTITUDES)	_____/	_____/	_____/
	_____	_____	_____

Answer questions 47-49 for NQA, NBG, and NMM in regards to ceilings and visibilities only.

47. Is NQA, NBG or NMM forecast to be IFR for the ETA's listed in question 47 (circle yes or no for each station)?

a. NQA (Yes/No)
b. NBG (Yes/No)
c. NMM (Yes/No)

48. Would NQA, NBG or NMM require an alternate at the ETA (circle yes or no for each station)?

a. NQA (Yes/No)
b. NBG (Yes/No)
c. NMM (Yes/No)

49. Why would NQA, NBG or NMM require an alternate at the ETA, if at all?

a. NQA Ceilings and/or Visibilities? (Circle one or both)
b. NBG Ceilings and/or Visibilities? (Circle one or both)
c. NMM Ceilings and/or Visibilities? (Circle one or both)
d. No alternate required for either station

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CHAPTER TWO

DATA DISPLAYED ON WEATHER IMAGERY PRODUCTS

200. INTRODUCTION

This chapter will introduce a number of different weather products available from the local weather office or over other lines of communication. An understanding of these visual products, which are produced to show a national scale, will quickly provide an aviator a broader picture of the weather than can be gathered from METARs and TAFs.

New aviators may find these products to be the most often used weather documents for flight planning. Once a mission is assigned, whether for training or operational flying, the next stop is usually to find out the weather. Sometimes there will be a number of different possibilities for operating areas or routes of flight, and the weather may be the biggest factor in deciding which to choose. For instance, a Navy mission requiring a low-level visual navigation on a military training route requires weather to be greater than 3000 foot ceilings and five miles of visibility. If there are routes available to the north, east, and west, and areas of IFR to the north and east, then a western route would be preferred. A quick glance at a Weather Depiction Chart, Low-Level Significant Weather Prognostic Chart, or even a satellite image can provide the information to make such a decision. Other types of missions may require knowledge of the winds, and all aviators ought to know whether their flight will be affected by thunderstorms or other hazards. The other products discussed in this chapter can also provide such necessary information at a quick glance, because each type of chart is designed for a particular purpose. Once an aviator has a general knowledge of the purpose and use of each product, it becomes very easy to gather the required information.

201. LESSON TOPIC LEARNING OBJECTIVES

TERMINAL OBJECTIVE: Partially supported by this lesson topic:

2.0 Describe displayed data shown on various weather imagery products.

ENABLING OBJECTIVES: Completely supported by this lesson topic:

2.1 State the pilot's use of a Surface Analysis Chart.

2.2 Identify displayed data on Surface Analysis Charts.

2.3 Describe displayed data on Station Model Plots.

2.4 State the pilot's use of a Low Level Significant Weather Prognostic Charts.

2.5 Identify displayed data on Low Level Significant Weather Prognostic Charts.

2.6 Identify plotted data on Radar Summary Charts.

2.7 Identify various weather data on NEXRAD imagery.

2.8 Identify potential significant weather data on two types of satellite imagery.

2.9 Identify plotted data on Weather Depiction Charts.

2.10 Identify ceilings on Weather Depiction Charts.

2.11 State the use of Winds-Aloft Prognostic Charts.

2.12 State the meaning of valid time on Winds-Aloft Prognostic Charts.

2.13 Identify plotted data on Winds-Aloft Prognostic Charts.

2.14 State the teletype identifier of Winds-Aloft Forecasts.

2.15 Identify coded data on Winds-Aloft Forecasts.

2.16 State the rules of wind parameters and omission of temperature in Winds-Aloft Forecasts.

2.17 Select a flight altitude that results in the most favorable wind component using Winds-Aloft Forecasts and Winds-Aloft Prognostic Charts.

202. REFERENCES

1. Chief of Naval Operations Instruction 3710.7 series
2. NATOPS General Flight and Operating Instructions
3. Air Force Instruction 11-202 (Vol. 3), General Flight Rules

203. STUDY ASSIGNMENT

Review Chapter Two and answer the Study Questions.

2-2 DATA DISPLAYED ON WEATHER IMAGERY PRODUCTS

204. SURFACE ANALYSIS CHARTS

Weather forecasting, to a great extent, is dependent on weather charts showing the weather, its development, and movement from place to place. Regular scheduled observations (METAR) are taken throughout the world at selected times and compiled by computer at the Suitland, Maryland Weather Bureau Center. The computers analyze this information and produce a number of products, including the Surface Analysis Chart, which are transmitted to subscribers throughout the world.

At weather offices, two types of Surface Analysis Charts may be displayed. One is a computerized Surface Analysis Chart usually displayed on a computer monitor, or printed out and posted near the briefing desk. The other version is a less-common, locally prepared product drawn and plotted by hand.

The Surface Analysis Chart is used by pilots to obtain an overall facsimile picture of observed weather, including the location of pressure systems, winds, air masses, and fronts, in relation to their planned flight route (Figure 2-1). At this point, each of these features should be familiar from previous meteorology classes.

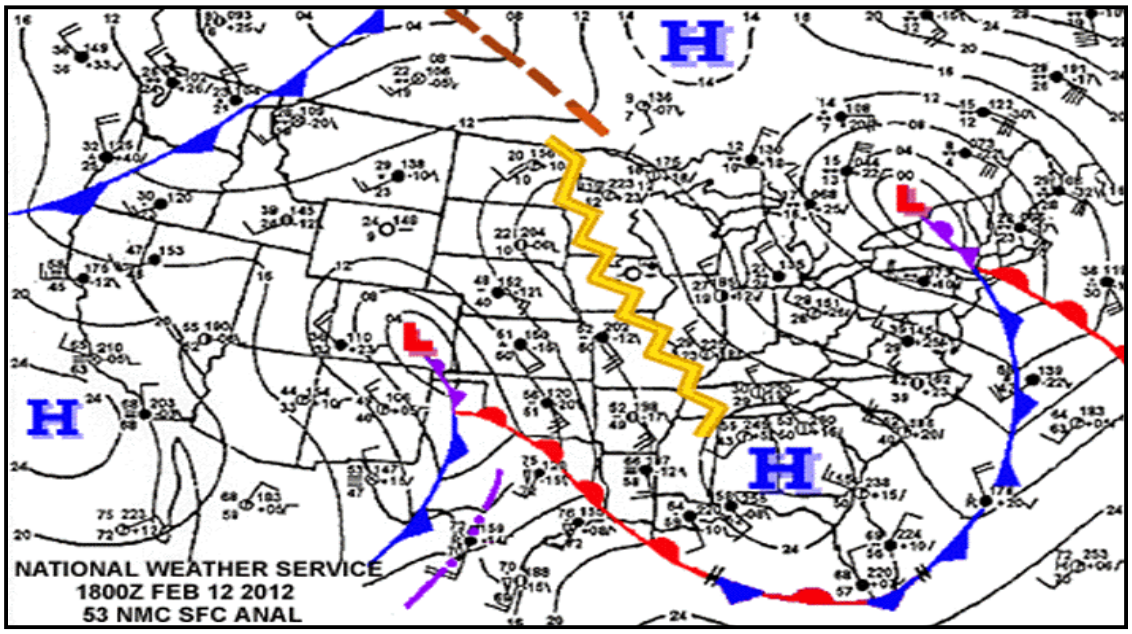


Figure 2-1 Surface Analysis Chart

The information displayed on the Surface Analysis Chart is observed weather, meaning the chart represents past history, and is not a forecast. The valid time (VT) of the chart is located in the lower left-hand corner. This is given in Coordinated Universal Time (UTC), and is the observation time of the information gathered to compile the chart.

The pressure systems mentioned are outlined by isobars drawn at 4-millibar intervals. When the pressure gradient is very shallow, intermediate isobars (short dashed lines) are sometimes drawn on the chart at one-half the standard interval. A two-digit number indicates the values of the isobars (e.g., 16, which would indicate 1016.0 milliards).

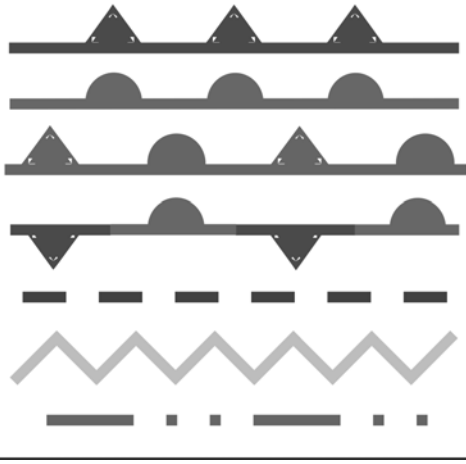
Type of Front	Color Scheme	Symbol
Cold Front	Blue	
Warm Front	Red	
Occluded Front	Purple	
Stationary Front	Blue and Red	
Trough	Brown or Black	
Ridge	Yellow or Black	
Squall Line	Purple	

Figure 2-2 Frontal Symbols

Station Model Plots

To build a Surface Analysis Chart, some of the information received is displayed around circles in the form of station models. The station model is a pictorial shorthand that provides the maximum data in a minimum amount of space. Figures 2-2 and 2-3 are provided as a review and reference for other charts that use the station model plot.

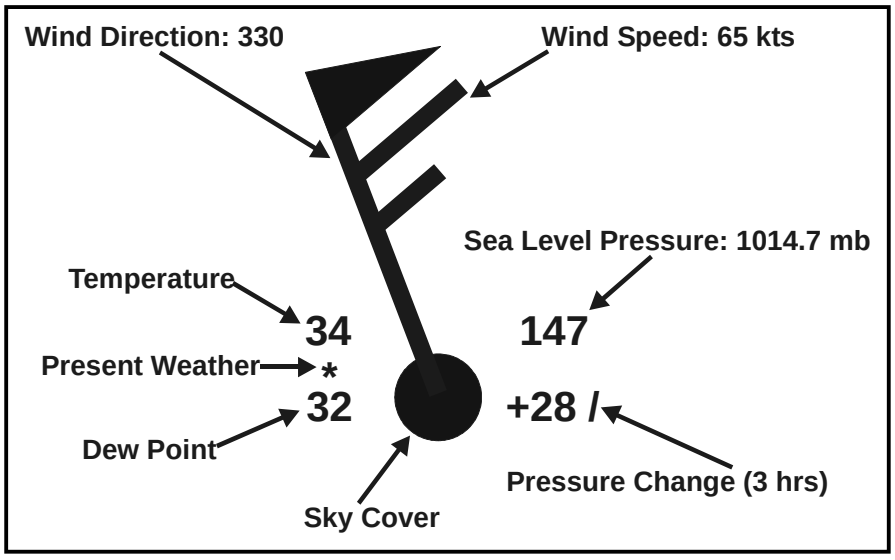


Figure 2-3 Station Model Explanation

2-4 DATA DISPLAYED ON WEATHER IMAGERY PRODUCTS

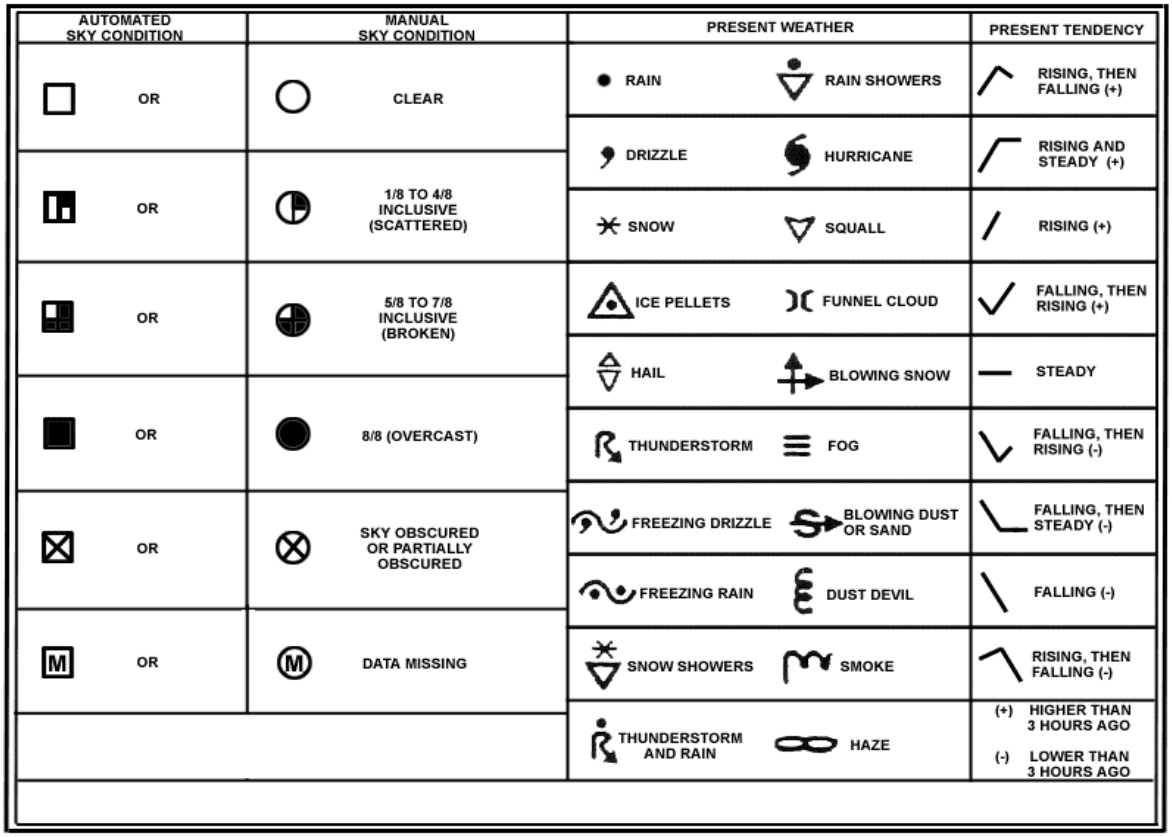


Figure 2-4 Major Station Model Symbols

205. LOW LEVEL SIGNIFICANT WEATHER PROGNOSTIC CHARTS

The Low Level Significant Weather Prognostic Chart (Figure 2-4) is composed of four panels that show a forecast of weather conditions affecting aviation from the surface to 24,000 feet MSL. Figure 2-5 is a simplified version of the chart, showing an expanded legend, as well as an explanation of each panel and their relation to each other.

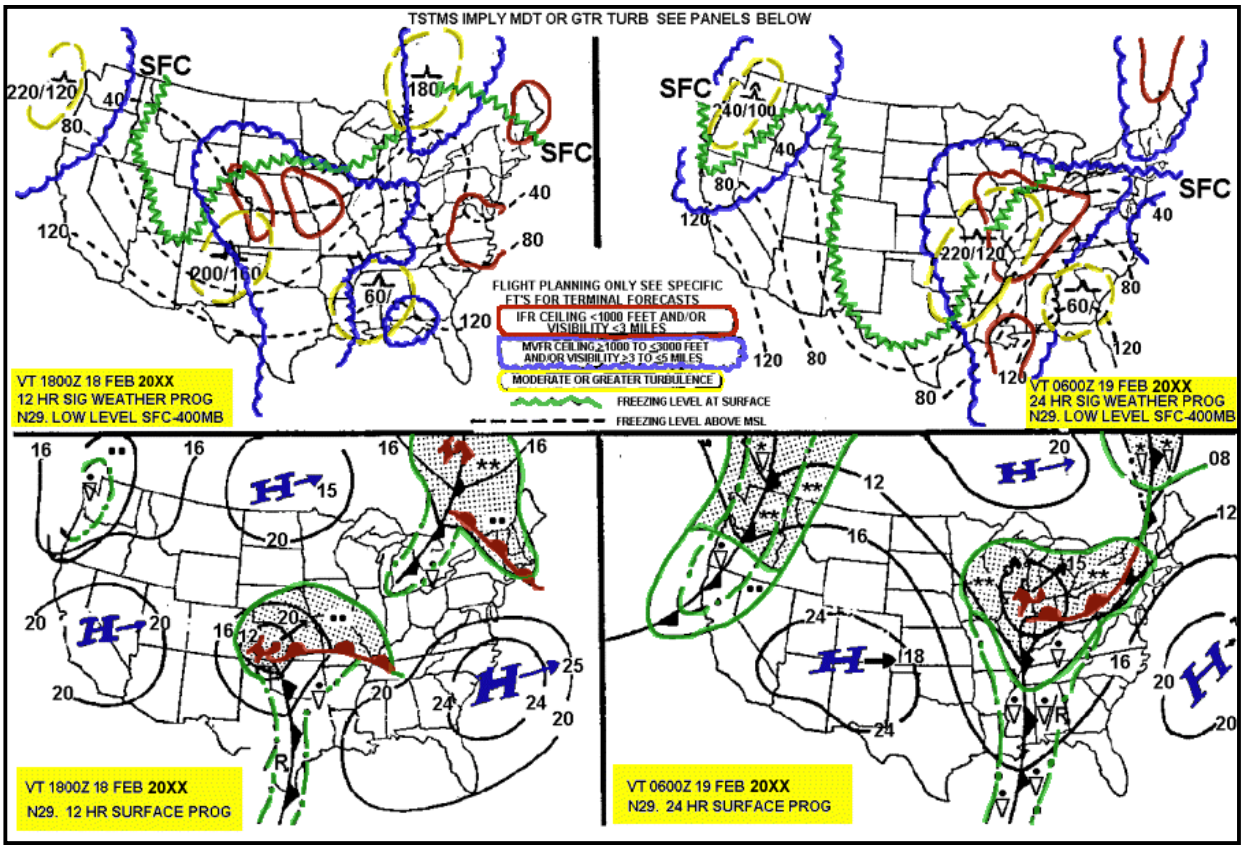


Figure 2-5 Low Level Significant Weather Prognostic Chart

The left two panels are a 12-hour forecast, while the right two are a 24-hour forecast. The bottom two panels are a surface prognosis, as indicated in the chart label in the lower part of each panel. These indicate the conditions forecast to occur on the surface, and can be thought of as the "cause" for the top two panels, the "effect." The top two panels show the significant weather that is a result of the forecast surface conditions, including areas of VFR, MVFR, and IFR, the locations of the freezing level, and areas of moderate or greater turbulence. Additionally, note the legend applies only to the top two panels, as those lines are not used in the bottom two. Each particular line will be labeled with its corresponding altitude, either "SFC" for the surface, or a two or three digit number representing the altitude in hundreds of feet MSL.

2-6 DATA DISPLAYED ON WEATHER IMAGERY PRODUCTS

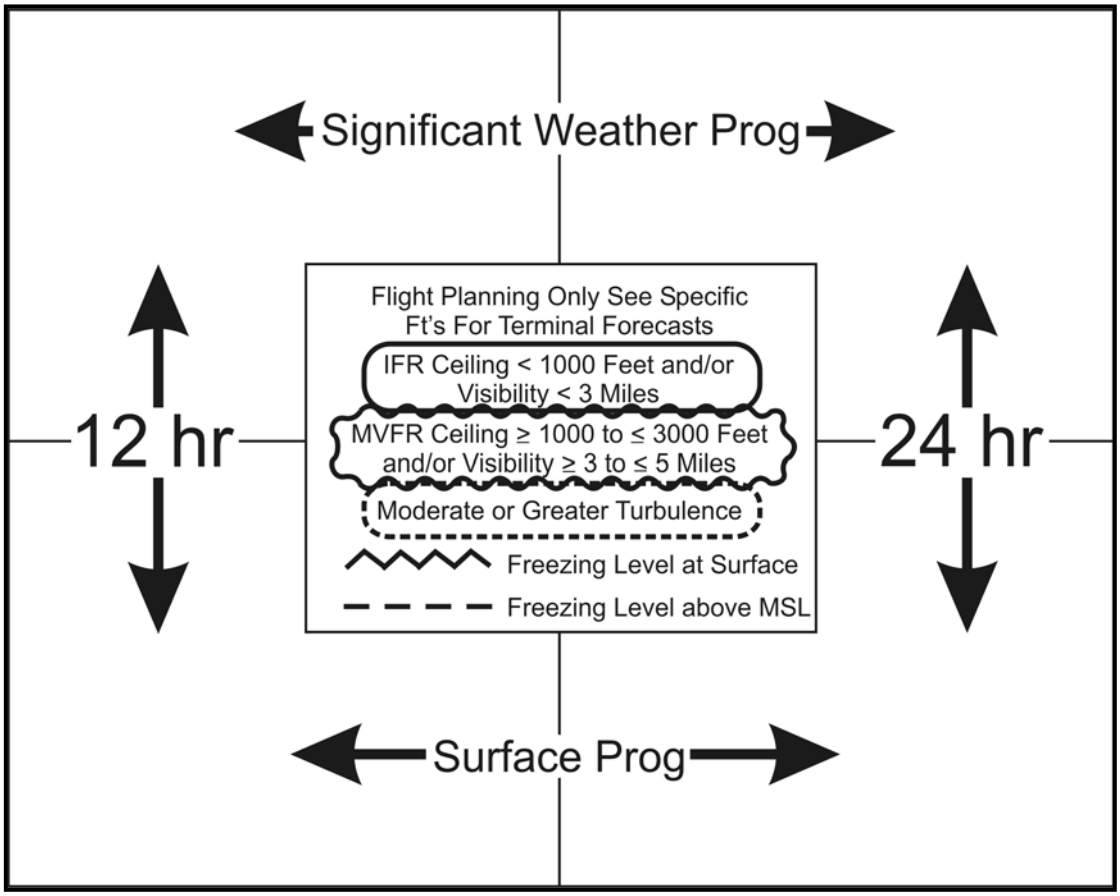


Figure 2-6 Significant Weather Prognostic Legend

The bottom two panels–the surface prognostic–use a different legend, as shown in Figure 2-6. These lines and shadings depict the type and coverage of precipitation forecast to occur. Areas enclosed by solid lines indicate steady precipitation, while broken lines (dash-dot) indicate areas of showery precipitation. The area will be shaded if precipitation is expected to cover 1/2 or more of the area. If not, there will be no shading. Additionally, a symbol will be included from the present weather column of Figure 2-3 to represent the particular type of precipitation, such as rain, drizzle, or snow. A single symbol denotes intermittent precipitation, while a double symbol denotes continuous precipitation.

Turbulence

Symbols shown in an area of turbulence denote intensity (Figure 2-6). The numbers to the left of a slash (/) indicate tops of forecasted turbulence, and numbers to the right indicate the base of the forecasted turbulence in hundreds of feet MSL. No figure to the right of the slash indicates turbulence from the surface upward, while absence of a figure to the left of the slash indicates turbulence above the limits of the chart (24,000 feet MSL).

Prognostic Symbols

Depiction	Meaning	Depiction	Meaning
	Moderate turbulence Severe turbulence		Showery Precipitation (thunderstorms/rain showers) covering 1/2 or more of the area
	Moderate icing Severe icing		Steady Precipitation (rain) covering 1/2 or more of the area
	Continuous rain Intermettent snow Continuous drizzle		Showery Precipitation (snow showers) covering less than 1/2 of the area

Figure 2-7 Surface Prognostic Legend

Freezing Level

Freezing level height contours are drawn on the charts for every 4000 foot interval. These contours are labeled in hundreds of feet MSL. The surface freezing level, however, is labeled SFC. An upper-level freezing contour crossing the surface freezing level line indicates multiple freezing levels due to an intermediate temperature inversion. Areas of structural icing are not specifically outlined on this chart, but icing can be inferred in clouds or precipitation above the freezing level.

206. RADAR SUMMARY CHARTS

The Radar Summary Chart (Figure 2-7) is a computer-produced facsimile presentation based on radar observations of echo activity (thunderstorms, rain, sleet, etc.). The Radar Summary Chart is used in flight planning to provide pilots with a pictorial display of echo activity along their planned route of flight. This chart is transmitted on a variable schedule, and the date-time group reflects the time the radar observations were taken.

2-8 DATA DISPLAYED ON WEATHER IMAGERY PRODUCTS

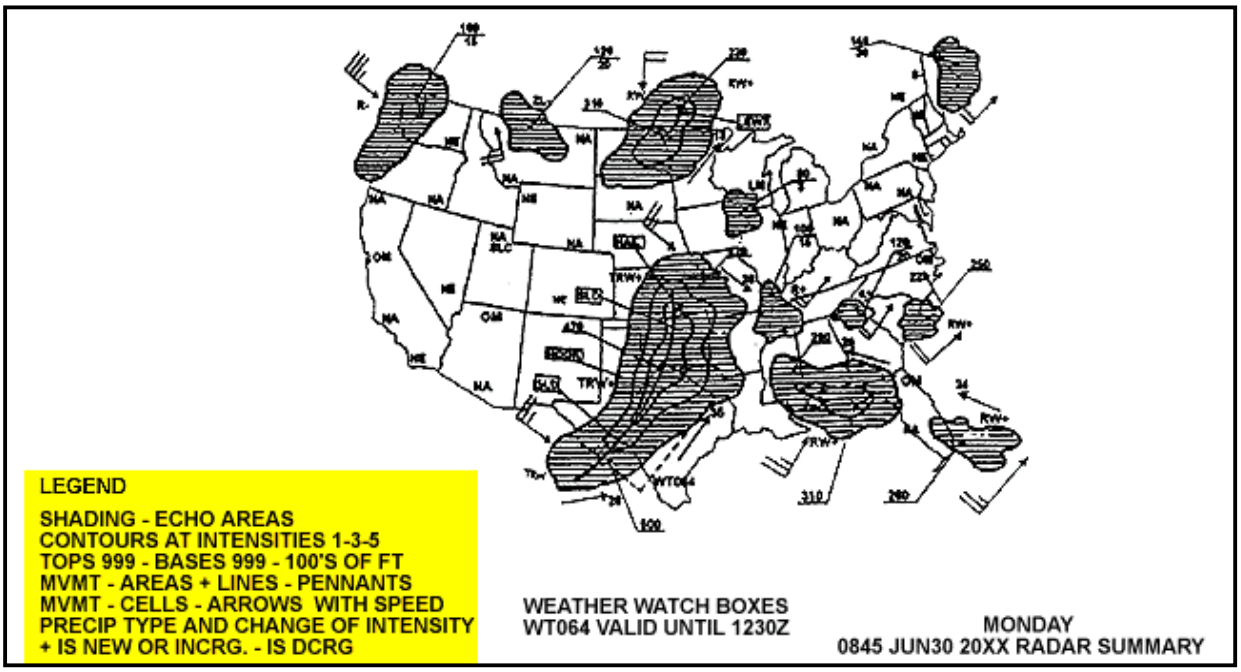
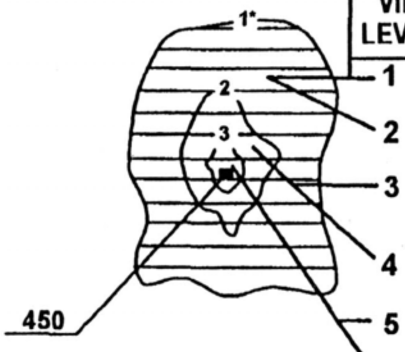


Figure 2-8 Radar Summary Chart

Graphic Display

Rather than plotting each echo on the chart, the computer will outline and shade areas where echoes were observed. When echoes can be identified as forming into an apparent line, the computer will indicate this as a solid line, which could be a front or squall line. As movement of the echoes is determined, this will also be indicated on the chart in one of two ways. An arrow showing the direction and a number indicating the knots of speed of the cell movement indicates individual cell movement. Larger areas or lines of thunderstorms also may move, and their directions may be different than individual cells. Thus, different symbology is used: an arrow indicates area or line movement with wind-barb notation for speed of movement. See Figure 2-8 for the particular details of other data that may be displayed on the Radar Summary Chart.

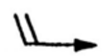


VIP LEVEL	ECHO INTENSITY	PRECIPITATION INTENSITY	CONDITIONS A PILOT SHOULD EXPECT
1	WEAK	LIGHT	(SELF-EXPLANATORY)
2	MODERATE	MODERATE	MODERATE TO SEVERE TURBULENCE
3	STRONG	HEAVY	SEVERE TURBULENCE POSSIBLE AND LIGHTNING
4	VERY STRONG	VERY HEAVY	SEVERE TURBULENCE PROBABLE AND LIGHTNING
5	INTENSE	INTENSE	SEVERE TURBULENCE, LIGHTNING, HAIL LIKELY AND ORGANIZED WIND GUSTS
6	EXTREME	EXTREME	SEVERE TURBULENCE, LIGHTNING, LARGE HAIL, AND EXTENSIVE WIND GUSTS

*The numbers representing the intensity level do not appear on the chart. Beginning from the first contour line, bordering the area, the intensity level is 1-2, second contour is 3-4, and the third contour is 5-6.

SYMBOLS USED ON CHARTS

SYMBOL	MEANING
R	RAIN
RW	RAIN SHOWER
HAIL	HAIL
S	SNOW
IP	ICE PELLETS
SW	SNOW SHOWER
L	DRIZZLE
T	THUNDERSTORM
ZR, ZL	FREEZING PRECIPITATION
NE	NO ECHOES OBSERVED
NA	OBSERVATIONS UNAVAILABLE
OM	OUT FOR MAINTENANCE
STC	STC ON - *all precipitation may not be seen*
ROBEPS	RADAR OPERATING BELOW PERFORMANCE STANDARDS
RHINO	RANGE HEIGHT INDICATOR NOT OPERATING

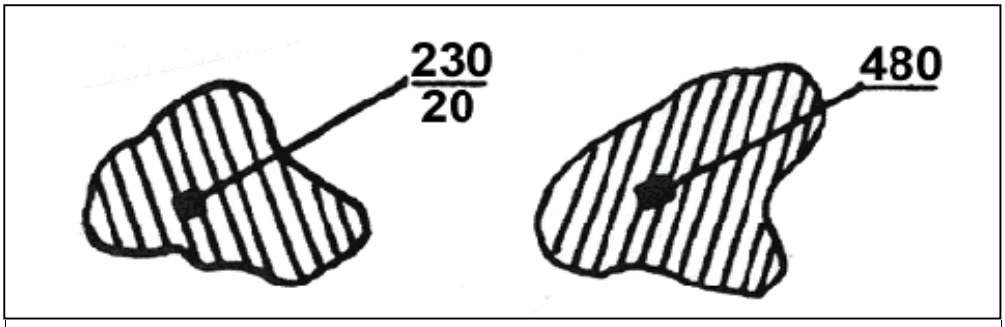
SYMBOL	MEANING
+	INTENSITY INCREASING OR NEW ECHO
-	INTENSITY DECREASING
NO SYMBOL	NO CHANGE IN INTENSITY
 35	CELL MOVEMENT TO NE AT 35 KNOTS
	LINE OR AREA MOVEMENT TO EAST AT 20 KNOTS
LM	LITTLE MOVEMENT
MA	ECHOES MOSTLY ALOFT
PA	*ECHOES PARTLY ALOFT*

SYMBOL	MEANING
	LINE OF ECHOES
SLD	8/10 OR GREATER COVERAGE IN A LINE
WS999	SEVERE THUNDERSTORM WATCH
WT999	TORNADO WATCH
LEWP	LINE ECHO WAVE PATTERN
HOOK	HOOK ECHO
BWER	BOUNDED WEAK ECHO REGION
PCLL	PERSISTENT CELL
FNLN	FINE LINE

Figure 2-9 Key to Radar Summary Chart

Tops And Bases

The radar set can determine tops and bases of clouds. These echo tops and bases will be included on the Radar Summary Chart whenever they are available. Echo tops and bases are indicated by the format in Figure 2-9.



Indicates average cloud echo contours are 23,000 feet MSL and the average bases are 2000 feet MSL.	Indicates a cloud echo top is located here with maximum cell top at 48,000 feet MSL.

Figure 2-10 Key to Radar Summary Chart

Intensity Levels

The levels of precipitation intensity determined by the Vertical Integrator Processor (VIP) range in value from 1 to 6 and are shown graphically by a set of up to three lines enclosing concentric shaded areas, where the middle areas have higher intensities (Figure 2-10).

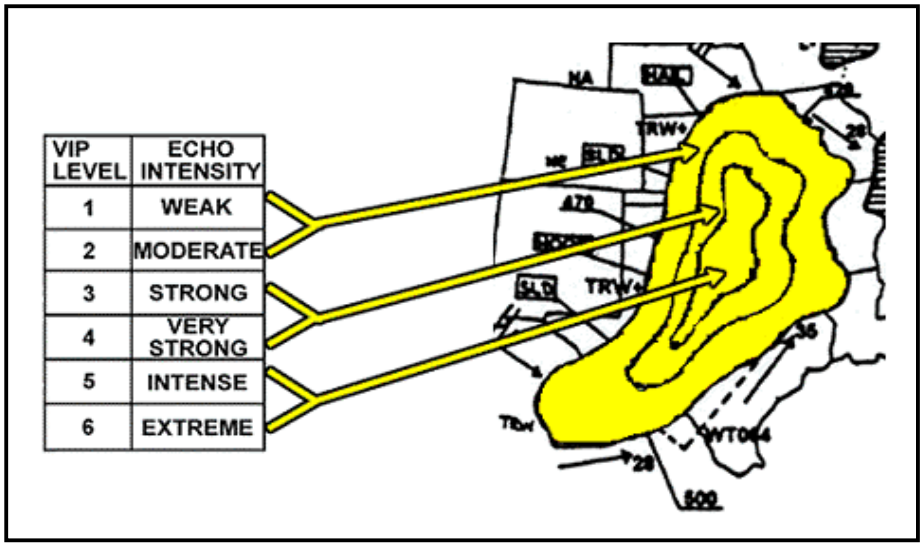


Figure 2-11 Precipitation Intensity Levels

Abbreviations

Although all abbreviations used are listed in Figure 2-8, some deserve additional explanation. For example, NE is used when no echoes were observed, from available radar information. NA is used when radar information is not available, thus one cannot determine whether precipitation is present. Likewise, OM indicates no radar information is available.

Severe Weather Boxes

When an Aviation Severe Weather Watch (WW) is in effect, the area covered will be outlined on the Radar Summary Chart by a dashed box. The valid time and number of the watch will also be shown on the chart. The letters "WT" denote a tornado watch while the letters "WS" denote a severe thunderstorm watch. This is the only forecast information displayed on the chart. This box should alert the pilot to the OPNAVINST 3710.7 or local Air Force command restrictions applying to military aircraft in association with Severe Weather Watches (to be covered in chapter 3).

207. NEXT GENERATION RADAR (NEXRAD)

Next Generation Radar (NEXRAD) images provide an excellent source of weather information for pilots. The computer monitor image seen in a weather office is a computer-generated compilation of radar data transmitted from a radar site.

Advantages

The NEXRAD system has significant advantages over conventional weather radar systems. The resolution of the display is improved, while the displays provide meteorologists and aircrew with numerous options for presentation of a wide variety of system products. For example, Figure 2-11 is a NEXRAD display of a storm track showing the northeasterly progress of a storm in the Oklahoma area.

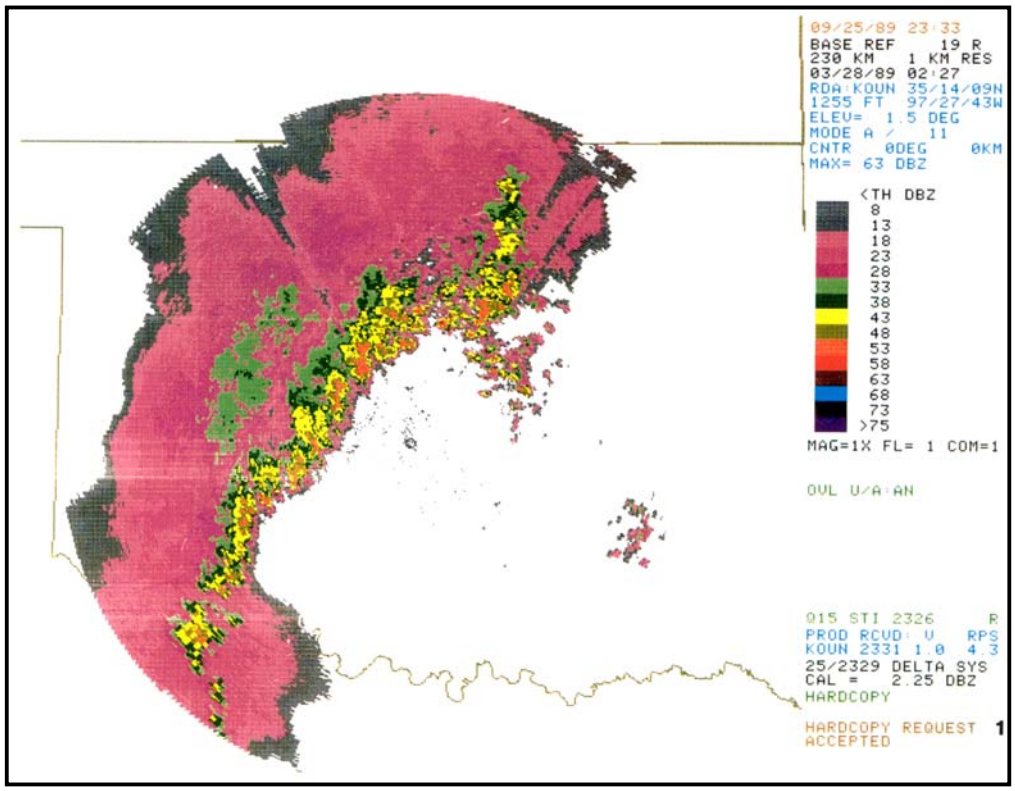


Figure 2-12 Oklahoma NEXRAD Display

While older weather radar show only basic displays, the NEXRAD system can display derived products, such as composite reflectivity. This is the type of precipitation display most commonly used in flight planning. A wind profile screen can also be displayed.

Precipitation Display

NEXRAD presentations show precipitation levels in the area scanned by the radar system. The NEXRAD does not measure the rate of precipitation directly; rather, it measures the energy return from the precipitation particles. The image seen on the screen is actually a computer-generated compilation of returned energy shown in varying colors. This display is referred to as the reflectivity presentation.

The intensity of precipitation can be determined by using the graduated scale shown in the legend area of the screen (Figure 2-11). The maximum radar return strength at the time of the presentation is listed above the scale. This is measured in “dbz,” or strength in decibels, of the energy received by the radar. Through use of this scale, precipitation strength can quickly be deciphered for a given area by comparing the color of the area to the color-coded legend. Higher precipitation levels are farther down the color scale. During flight planning, a pilot should carefully analyze the higher intensity areas in relation to the planned route of flight or operating area.

Other Features

Other unique features of the NEXRAD provide the capability to display areas of hail, tornadoes, wind shear, and microbursts (Figure 2-12). This type of information is particularly useful in planning a flight around known areas of potentially dangerous weather conditions.

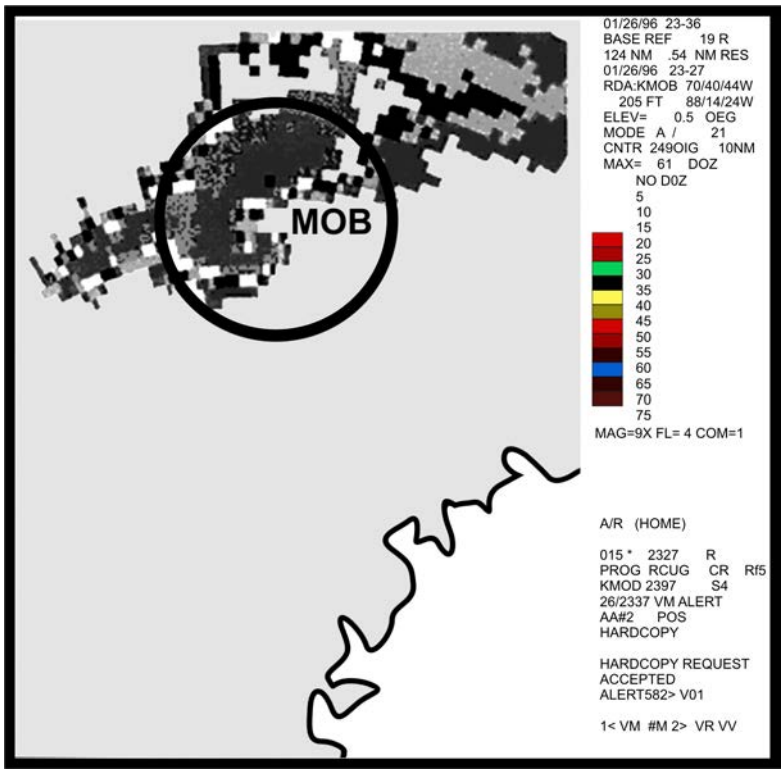


Figure 2-13 Hook Echo on NEXRAD

Hail

The structure of a storm can provide clues to the potential for hail. Hailstorms have intense cores, generally between 2 and 5 NM in diameter, and usually begin developing at higher altitudes and descend toward the base of a storm. Very high reflectivity values (over 55 dbz) may also indicate that the precipitation is in the form of hail. Thunderstorms with strong updrafts, extensive vertical height, high liquid water content, and large cloud drop sizes are favorable conditions for the formation of hail.

Tornadoes

The NEXRAD system does not directly observe tornadic circulation; however, the system can display what is referred to as a “hook echo” that is considered indicative of a tornado. In Figure 2-12, a dark shaded hook echo is evident just west-southwest of MOB. This echo actually resulted in a tornado that caused severe property damage and injuries to personnel. A pilot

looking at a NEXRAD display should plan around areas of red on the color-coded scale, as these are generally considered danger areas and should be avoided.

Wind Shear

A major hazard to aviation is the presence of low-level wind shear and frontline wind shear. Although wind shear can occur at any altitude, it is particularly hazardous when it develops over a short period of time within 2000 feet of the ground. The primary concern for aircraft at low altitudes is a rapid change in wind direction that could affect the aircraft's handling characteristics. There are several display and data analysis options available to indicate possible wind shear.

Microbursts

Microbursts are detectable by NEXRAD because of the density gradient of the descending air, the particulate matter contained therein, or both. However, because of the shallow vertical extent of the outflow from a microburst, the phenomenon will usually not be detected beyond a range of 20 NM from the radar site.

Satellite Imagery

For general-purpose use, there are two types of satellite imagery available. When combined they provide a great deal of information about clouds to a pilot. Through interpretation, one can determine the type and height of clouds as well as the temperature and the thickness of cloud layers. From this information, the pilot can get a good idea of possible associated weather along the planned route of flight.

Visible Imagery

One type of imagery is the visible satellite (Figure 2-13). With a visible satellite picture, we are looking at clouds and the Earth reflecting sunlight back to the satellite sensors. The greater the reflected sunlight reaching the sensors, the brighter white the object is on the picture. The amount of reflectivity reaching the sensors 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 clouds from shape and texture. Due to the obvious lack of sunlight at night, there are no visible pictures available during this period.

Figure 2-14 Visible Satellite Imagery

Infrared Imagery

The second type of imagery is the infrared (IR) satellite (Figure 2-14). With an IR picture, we are looking at heat radiation being emitted by the clouds and earth. The images show temperature differences between cloud tops and the ground, as well as temperature gradations of cloud tops over the surface of the Earth. Ordinarily, cold temperatures are displayed as light gray or white. High clouds appear the whitest, middle clouds appear light gray, and low clouds appear dark gray.

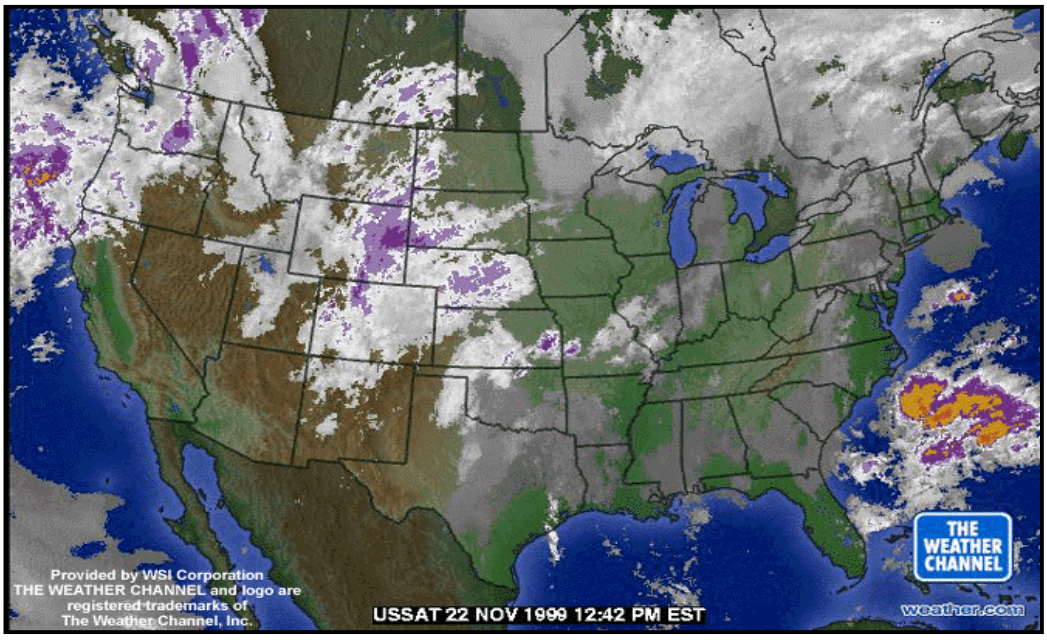


Figure 2-15 Infrared Satellite Imagery

208. WEATHER DEPICTION CHARTS

The Weather Depiction Chart is a facsimile presentation of the surface METARs, valid as of the time indicated on the chart (Figure 2-15). It is used in flight planning to determine areas of IFR/VFR and to determine the minimum ceilings en route. To help the pilot better understand the cause of low ceilings and/or poor visibilities, the chart will also include the positions of fronts from the previous hour. The station models depicted represent individual station observations, but they are different from the general station model presented in chapter 2. Because of the purpose of the chart, information presented is kept to a minimum for simplicity. Therefore, these models have no wind, temperature, or pressure, and indicate only (1) sky coverage, (2) ceilings or the height (AGL) of the lowest cloud layer (SCT or greater), (3) visibilities of six miles or less, and (4) weather and obstructions to visibility, each of which are described below.

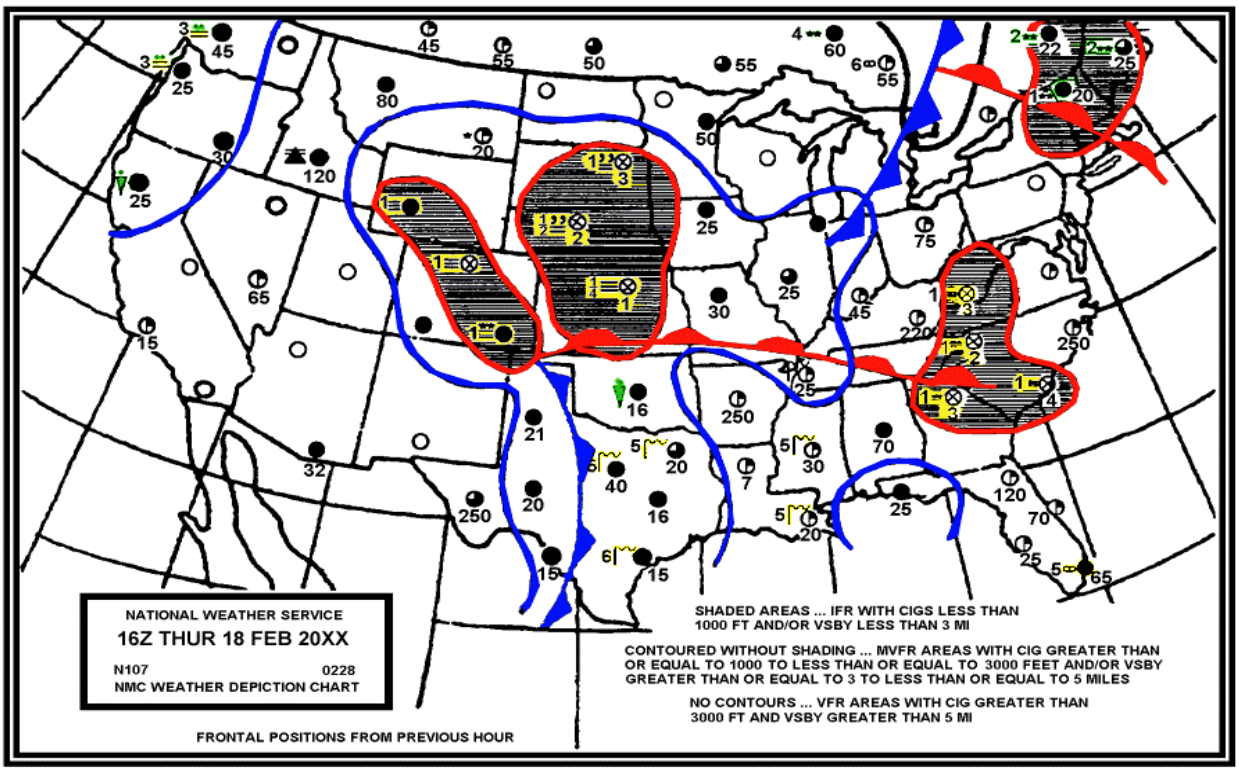


Figure 2-16 Weather Depiction Chart

Sky Cover Symbols

Total sky cover is reported in the station models of the Weather Depiction Chart using the same methods listed in Figure 2-3. Additionally, a right bracket (]) to the right of the symbol indicates the METAR is from an automated station.

Ceiling Heights

The height of the sky cover is plotted in the 6 o'clock position of the station model. Heights are given in hundreds of feet AGL. Recall the definition of a ceiling, because it also applies to the Weather Depiction Chart. If the sky cover is broken, overcast, or if the sky cover is an obscuration, the height will represent the height of the ceiling. If the sky cover is scattered, the height represents the height of the lowest scattered layer of clouds. When a broken or greater sky cover is plotted without a height entry, the clouds are thin. If an obscuration is plotted without a height entry, it indicates a partial obscuration.

Visibilities and Obstructions to Vision

Visibilities of 6 statute miles or less will be entered at the 9 o'clock position of the station model and will be indicated in miles and fractions of miles. Visibility of greater than 6 statute miles will be omitted. Precipitation and obstructions to vision will follow the visibility, using the same weather symbols as presented in Figure 2-3. When several types are occurring simultaneously, only the most significant one or two types will be entered. One symbol unique to the Weather Depiction Charts is used when clouds are topping the ridges of mountains, as shown in Figure 2-16.

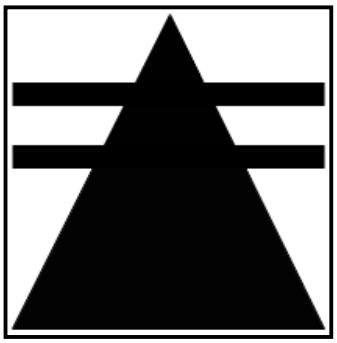


Figure 2-17 Clouds Topping Ridges Symbol

Legend

In addition to the frontal symbols on the Weather Depiction Chart, three areas associated with ceilings and visibilities are also depicted by a set of lines and shadings. The legend on the lower right-hand corner of the chart describes each of these three areas, which is summarized in Figure 2-17. A solid line enclosing a shaded area indicates IFR conditions: ceilings below 1000 feet and/or visibilities below three miles. A line enclosing an unshaded area indicates marginal VFR (MVFR) conditions: ceilings between 1000 and 3000 feet and/or visibility between three and five miles. The portion of the chart that is not enclosed by lines–shaded or unshaded–indicates VFR conditions: ceilings of greater than 3000 feet and visibilities over five miles.

Figure 2-18 Weather Depiction Chart Legend

Color Coding

Weather Depiction Charts are sometimes color-coded by personnel in USN/USMC weather offices. IFR areas are colored RED and MVFR areas are colored BLUE. This color-coding gives the pilot a quick indication of areas of observed IFR weather and MVFR weather.

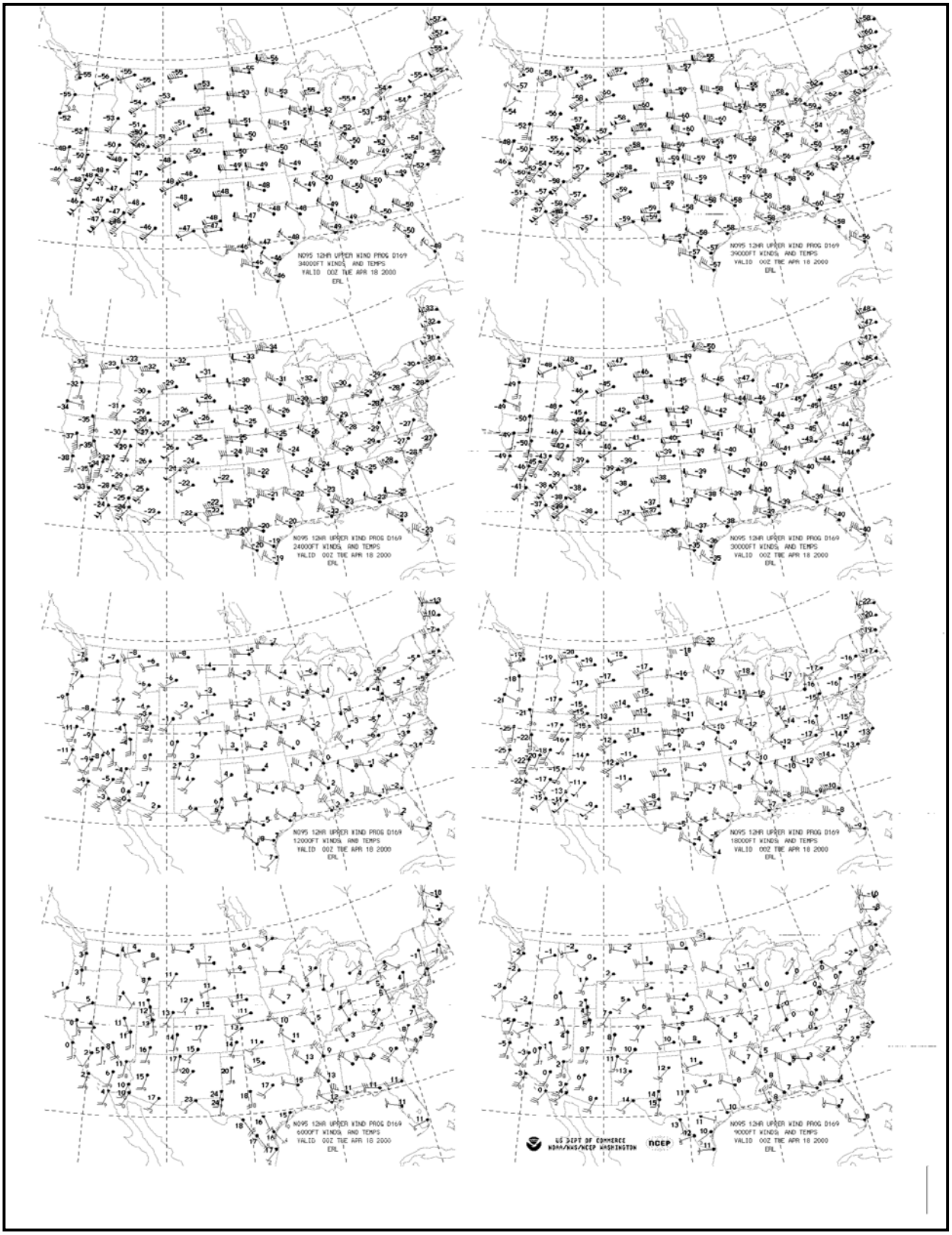


Figure 2-19 Winds-Aloft Prognostic Charts

2-20 DATA DISPLAYED ON WEATHER IMAGERY PRODUCTS

The Winds-Aloft Prognostic Charts (Figure 2-18, preceding page) are facsimile presentations that present the average forecast flight level winds and temperatures aloft, in whole degrees Celsius. These charts are computer constructed and are transmitted by the Weather Bureau two times daily–at 1200Z and 0000Z.

These charts are constructed for a range of eight altitudes within the continental United States and are displayed in a series of eight panels, one for each altitude: 6, 9, 12, 18, 24, 30, 34, and 39 thousand feet. The first three altitudes (below 18,000 feet MSL) are true altitudes, but for 18,000 feet and above, the altitudes given are simply more useful approximations for the pressure altitudes at which the winds and temperatures were actually measured (18,000 = 500 mb, 24,000 = 400 mb, 30,000 = 300 mb, 34,000 = 250 mb, and 39,000 = 200 mb).

Station Models in Winds-Aloft Prognostic Charts

Winds-Aloft Prognostic Charts use station models to show forecast wind speed, direction, and temperature for a given location. Much like the station models used in Weather Depiction Charts, these models are customized from detailed models in order to simplify the chart, presenting only the relevant information. As depicted in Figure 2-19, wind speed and direction is plotted in the same manner as the basic station model. The station itself, however, is simply a filled-in circle, and in some versions of the chart, the station circle is left off completely (Figure 2-20, next page). Since temperature is the only other data needed, it is shown adjacent to the station circle (or at the base of the wind shaft) in whole degrees Celsius.

Because wind is the main purpose of the chart, the tens digit of the actual wind direction, rounded to the nearest ten degrees, is given at the speed-end of the wind symbol. Thus, with the shaft indicating the general direction or quadrant, the specific direction can be easily determined, as shown in Figure 2-19. A “99” to the lower left of the station circle with no wind shaft would indicate calm or light and variable winds.

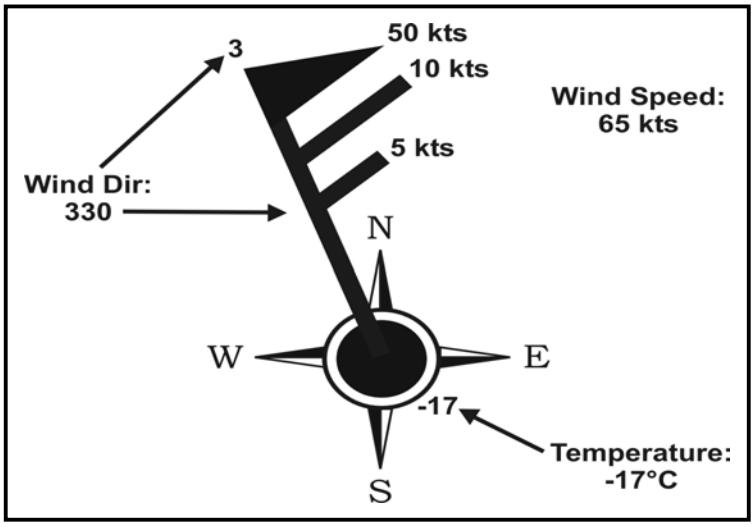


Figure 2-20 Winds-Aloft Prognostic Chart Station Model

Valid Time

The computer constructs the Winds-Aloft Prognostic Charts based on observed winds and temperatures recorded at a particular valid time. Figure 2-20 shows four panels with enlarged legends for easier viewing. These charts represent forecast winds and temperatures for a specific time, rather than a period of time. Since wind speeds generally change slowly in the upper atmosphere, these winds and temperatures are considered to be representative forecast averages until the next set of charts is received. Therefore, the information shown is theoretically accurate for the valid time of the chart only.

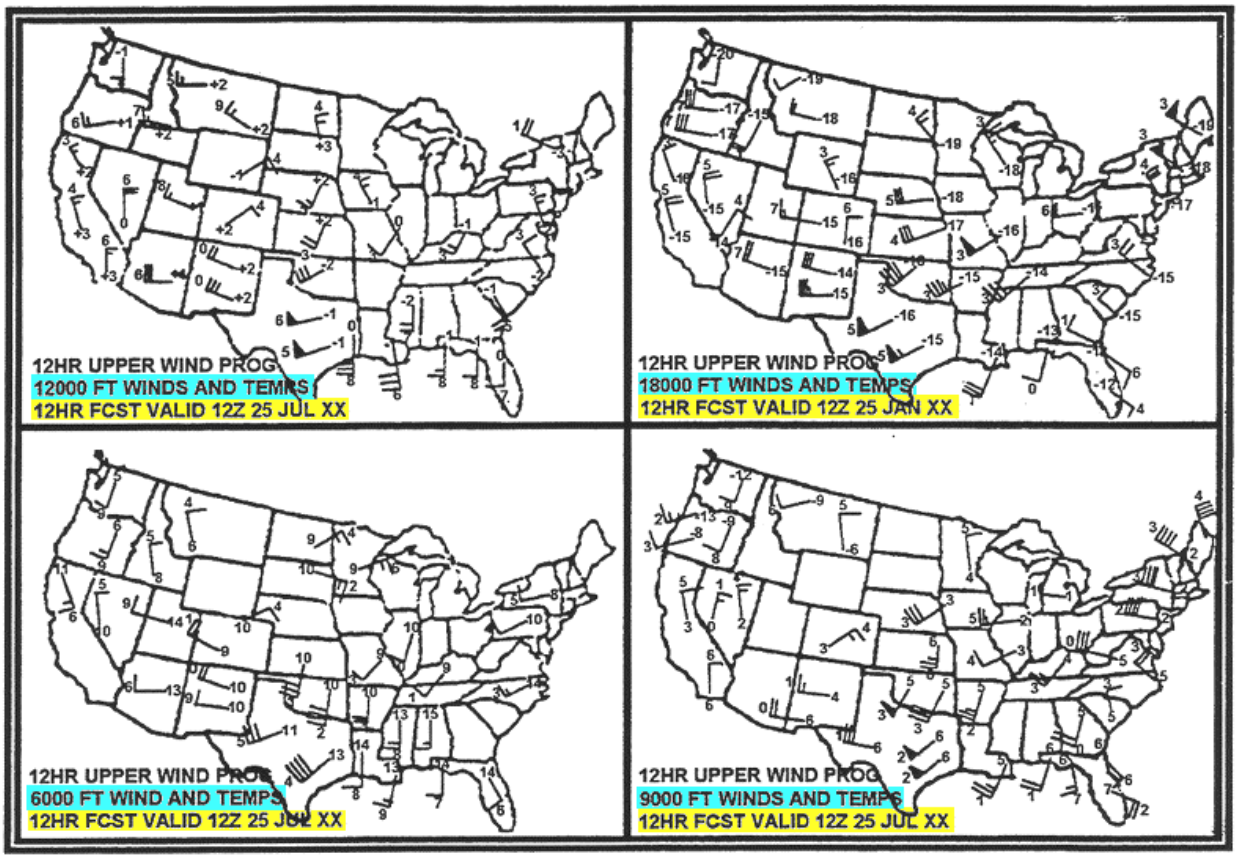


Figure 2-21 Legend of Winds-Aloft Prognostic Charts

209. WINDS-ALOFT FORECASTS

Winds-Aloft Forecasts are teletype forecasts of upper winds and temperatures for selected stations within the continental United States (Figure 2-21). They are transmitted twice a day and the teletype identifier "FD" appears in the heading. Additionally, they are broken into two segments. Each segment gives a valid time and a for-use time (the forecast period) at the beginning of each segment; the total forecast is usable for a period of 15 hours. The forecast represents conditions both as they should occur specifically at the valid time and also the average conditions as they should occur during the for-use time.

2-22 DATA DISPLAYED ON WEATHER IMAGERY PRODUCTS

FDUS1 KWBC 180545Z
DATA BASED ON 180000Z

VALID 181200Z FOR USE 0600Z - 1500Z, TEMPS NEG ABV 24000

FT	3000	6000	9000	12000	18000	24000	30000	34000	39000
JAX	1008	1005+08	9900+04	9900-01	3016-15	3027-28	305042	296749	296552
TLH	1110	1207+09	9900+04	9900+00	2816-14	2832-26	295641	297049	296653
PIE	1113	1110+09	1007+05	9900+00	3118-13	3037-26	306040	296948	296252
MIA	1118	1218+10	1010+06	0505+02	3222-13	3141-25	306040	306147	304852
TRI		3010+05	2920+00	2931-05	2946-18	2953-30	297044	298852	299156
GRW	1615	1914+08	2216+03	2421-03	2632-17	2639-29	276243	289052	289557
MEM	1723	1925+09	2024+04	2124-02	2429-16	2537-28	265942	268351	269256
LIT	1829	2034+10	2033+04	2131-02	2333-16	2443-28	256242	258650	750056
SGF	1732	2038+09	2038+04	2136-03	2337-17	2446-29	246644	259851	751357
OKC	1730	1940+11	2043+05	2142-01	2245-01	2358-28	237843	730450	732055
AMA		1925	2140+05	2146-03	2156-18	2271-30	229244	721551	721553

VALID 181800Z FOR USE 1500-2100Z. TEMPS NEG ABV 24000

FT	3000	6000	9000	12000	18000	24000	30000	34000	39000
JAX	1512	1611+08	1708+04	1705-01	2913-14	3029-26	315641	317249	316743
TLH	1514	1614+08	1712+04	1811-01	2716-14	2934-25	295639	306547	296354
PIE	1313	1513+09	1511+04	1408+00	3012-13	3035-24	315938	316647	306053
MIA	1017	1219+09	1113+05	0909+01	3317-12	3241-24	326339	316546	315251
TRI		2411+06	2618+01	2827-04	2841-17	2847-29	286744	299452	790256
GRW	1822	2028+12	2128+06	2226-03	2532-17	2642-28	275943	278649	770856
MEM	1828	2134+10	2133+05	2133-02	2335-16	2546-27	266342	268748	761456
LIT	1832	2142+10	2141+04	2139-02	2241-16	2453-27	257141	259348	751756
SGF	1835	2144+10	2145+04	2145-02	2248-17	2359-28	247543	259549	751556
OKC	1832	2044+11	2149+05	2149-02	2256-17	2273-28	239241	730548	731154
AMA		2026	2242+02	2247-06	2258-21	2278-30	710243	721049	229951

Figure 2-22 Winds-Aloft Forecasts

Wind Coding/Decoding Rules

While the Winds-Aloft Forecast may seem like nothing more than a bunch of numbers, it presents wind information similar to that found in Winds-Aloft Prognostic Charts in an organized series of four or six-digit groups. The left column lists the reporting station, and the top row lists the corresponding altitudes for which wind and temperature data are given, referenced to feet MSL.

Wind information on the Winds-Aloft Forecast is given with a series of four digits. The first two represent the true wind direction to the nearest ten degrees true, and the last two digits represent the speed in knots. For example, 2435 indicates a wind from 240º T at 35 knots.

For most altitudes, the temperature follows the wind information in a set of two digits that may or may not include a sign for positive or negative. For example, 2435 + 07 indicates the wind will be 240°T at 35 knots with a temperature of +7° Celsius. Notice that all temperatures are negative above 24,000 feet as indicated in the heading information by the phrase "TEMPS NEG ABV 24000." At these altitudes, all the digits are run together, eliminating the redundant minus sign between the wind and the temperature. For example, 274650 forecasts a wind from 270° T at 46 KIAS with a temperature of –50°Celsius.

Special Circumstances

The above procedures are used for all "normal" wind information; however, there are exceptions for unusual wind conditions. A direction of “99” indicates a variable wind direction. When forecast wind speeds are less than 5 knots, direction is difficult to determine, and the winds are called “light and variable,” and the code “9900” will be listed.

When a wind speed of 100 knots or greater is forecast, the simple four-digit wind code no longer works satisfactorily and an additional set of rules is used. For example, if the winds are forecast to be 230 at 145 knots, the normal code would require five digits, requiring a change to the format of the entire Winds-Aloft Forecast. Therefore, if you see a direction that would translate to be greater than 360°T, it was not a mistake; it is this extra rule. The wind was encoded by adding 500° to the direction and subtracting 100 knots from the speed, thus requiring a total of only four digits again. To decode such winds, then, one must subtract 50 from “unrealistic” direction codes and add 100 to the indicated speed. For example, a code of 7345 would forecast winds of 230°T at 145 knots. If winds are forecasted to be 200 knots or greater, the wind group is coded as 199 knots. For example, 8299 would be decoded as 320°T at 199 knots or greater.

Additionally, it is sometimes impractical to forecast the temperature and wind. This is particularly true for conditions near the surface, where the temperature is more likely to deviate from the standard lapse rate, and where the winds are more likely to be gusty and variable due to thermal or mechanical turbulence. So, for the following conditions, wind and temperature are omitted from the Winds-Aloft Forecast.

1. Wind information is never forecast for altitudes within 1500 feet of the surface.
2. Temperature information is never forecast within 2500 feet of the surface.
3. Temperature information is never forecast for the 3000-foot level.

210. FLIGHT ALTITUDE SELECTION

Pilots planning a flight can use winds-aloft information to their advantage. When the wind appears to be a tailwind component, they should generally try to take advantage of the situation by filing for an altitude with the fastest wind speed. When the wind would be a headwind component, they should generally try to minimize the disadvantage by filing for an altitude with the least wind speed. However, they must keep in mind several other factors and potential hazards that may influence the selection of an altitude such as clouds at flight level, visibility at flight level, icing and the minimum freezing level, thunderstorms, turbulence, and precipitation. For general planning purposes, Winds-Aloft Prognostic Charts are the most useful, as they give a pictorial representation of the winds. They can quickly narrow the search for generally favorable winds, or provide a fast solution to finding an alternate route that avoids unfavorable winds. The FDs may also be consulted as additional information in selecting the best particular altitude for which to file the flight plan, or when the Winds-Aloft Prognostic Charts are not available. Often, the wind information will not be forecast for the exact altitude for which a pilot may wish to file. In this case, one must interpolate to find the desired information.

STUDY QUESTIONS

Data Displayed on Weather Imagery Products

1. Which one of the following would NOT be found on a Surface Analysis Chart?

   a. Fronts

   b. Station models

   c. Areas of moderate or greater turbulence

   d. Isobars

2. Which one of the following is a true statement about the Surface Analysis Chart?

   a. It transmits teletype information describing observed weather for use by meteorologists and aircrew.

   b. Pilots use the chart is used to obtain an overall facsimile picture of forecast weather.

   c. The chart is a computer-produced facsimile presentation based on radar observations of echo activity.

   d. The information displayed on the Surface Analysis Chart is observed weather and is NOT a forecast.

3. What would a square indicate on a station model plot?

   a. An automated station has reported the depicted weather.

   b. A manned station has reported the depicted weather.

   c. The sky condition indicated constitutes a ceiling.

   d. Ice pellets have been observed on the Surface Analysis Chart.

4. Where is the temperature data located on a Surface Analysis Station Model Plot?

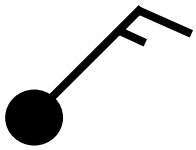
   a. Left side

   b. Right side

   c. Bottom

   d. Station Model Plots cannot indicate temperature

5. What type of winds would be indicated by the following Station Model Plot?



a. Northwest winds at 15 knots
b. Northeast winds at 15 knots
c. Southwest winds at 15 knots
d. Southwest winds at 55 knots

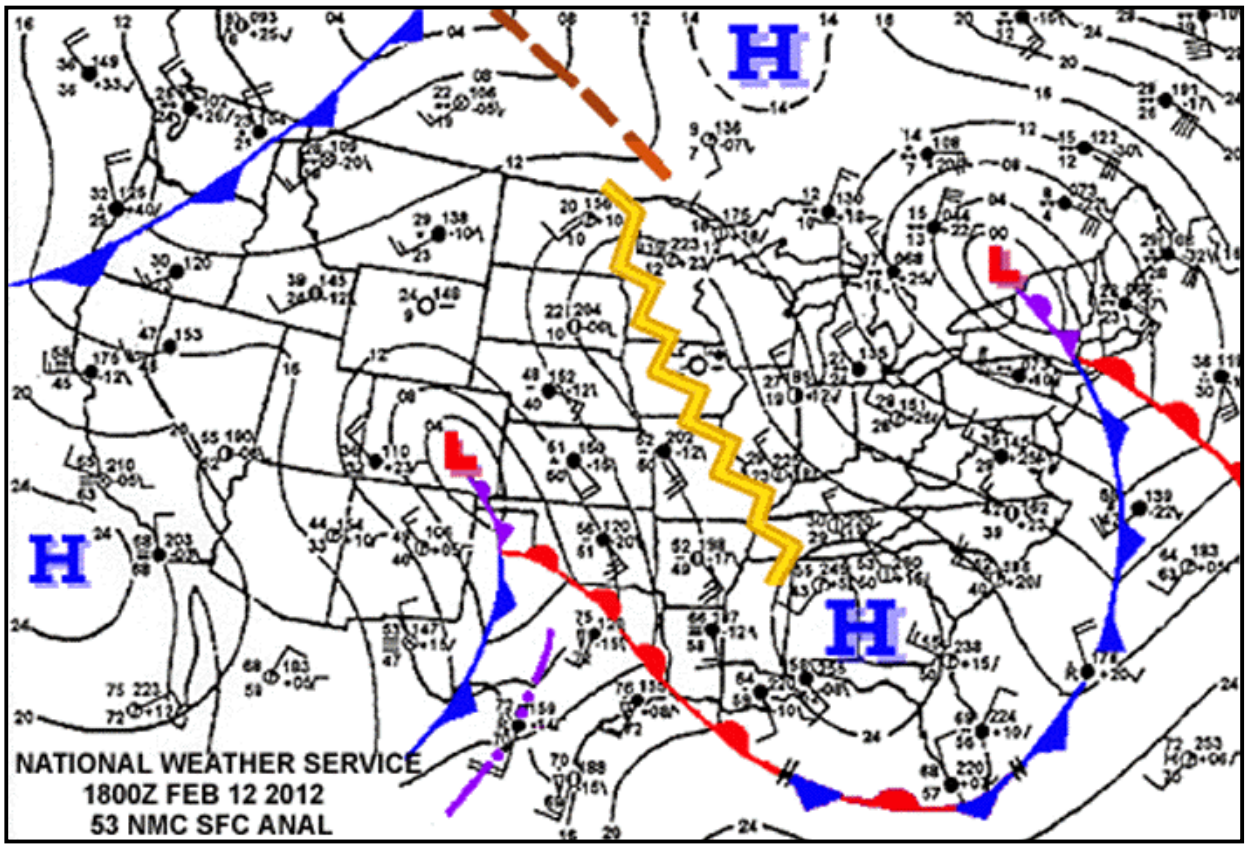


Figure 2-23 Surface Analysis Chart for Questions 6-9

6. The Pensacola area is under the influence of _____ pressure.

a. Steep
b. High
c. Low
d. Moderate

7. The sky cover in California is predominantly_____.

a. clear
b. scattered
c. broken
d. overcast

8. The line symbol in southern Canada extending west-northwest to east-southeast is called a _____, and the line symbol from Minnesota south-southeast to western Tennessee is called a _____.

a. warm front; cold front
b. occlusion; front
c. trough; ridge
d. ridge; trough

9. Which one of the following weather products could be used to determine areas of forecast IFR weather?

a. Surface Analysis Chart
b. Low Level Significant Weather Prognostic Chart
c. Visible Satellite Imagery
d. Winds-Aloft Forecasts

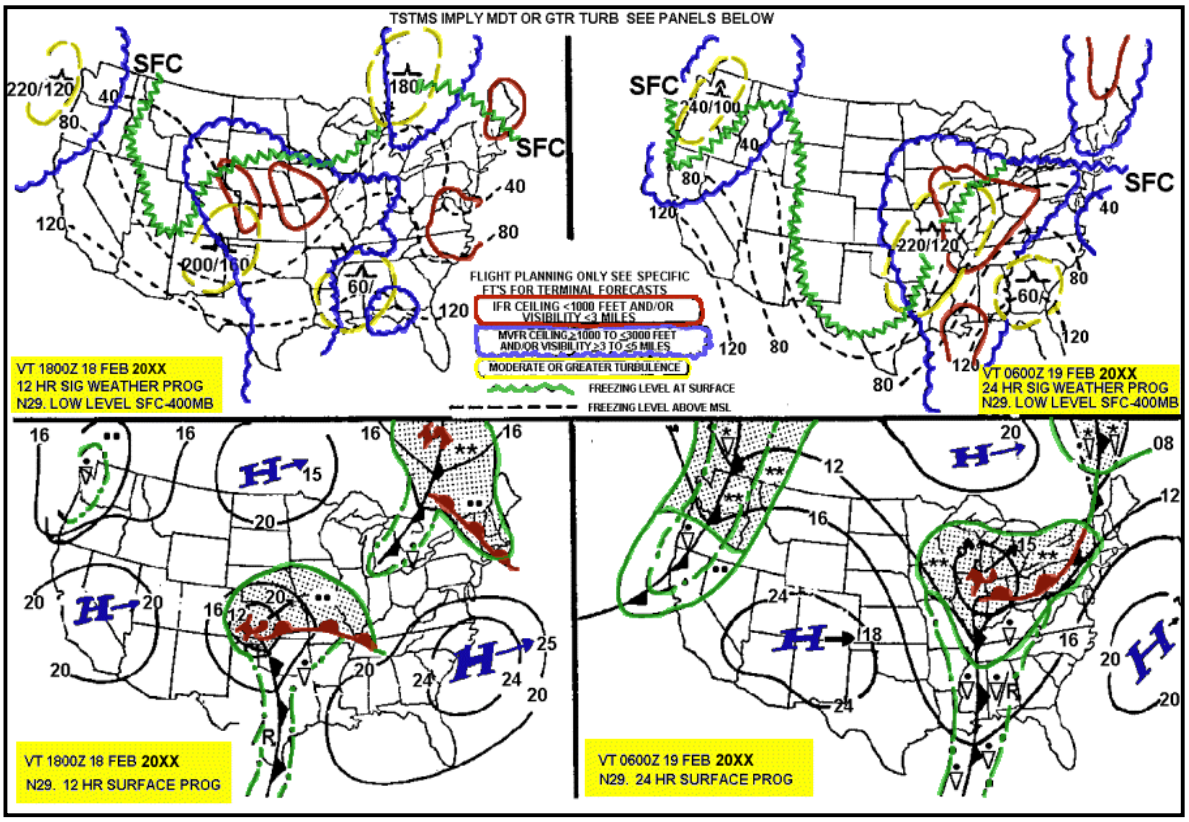


Figure 2-24 Low Level Significant Weather Prognostic Chart for Questions 10-13

10. Which panel of the Low Level Significant Weather Prognostic Chart shows the 24-hour significant weather forecast?

a. Upper left
b. Upper right
c. Lower left
d. Lower right

11. What type of weather is forecast to occur over the state of Michigan in 24 hours?

    a. Showery precipitation covering over half the area
    b. Showery precipitation covering less than half the area
    c. Steady precipitation covering over half the area
    d. Steady precipitation covering less than half the area

12. What does the dashed line circling Louisiana, Mississippi, and Alabama indicate for flight conditions in the next 12 hours?

    a. IFR conditions, with ceilings of 600 feet and visibilities of zero
    b. Widespread MVFR, with ceilings less than 3000 feet and visibility less than five miles
    c. Moderate turbulence from the surface to 6000 feet
    d. Rain showers and thunderstorms

13. Which one of the following flight conditions could be expected during a flight over Illinois at 0600Z?

    a. Moderate turbulence
    b. IFR
    c. Steady precipitation
    d. All of the above

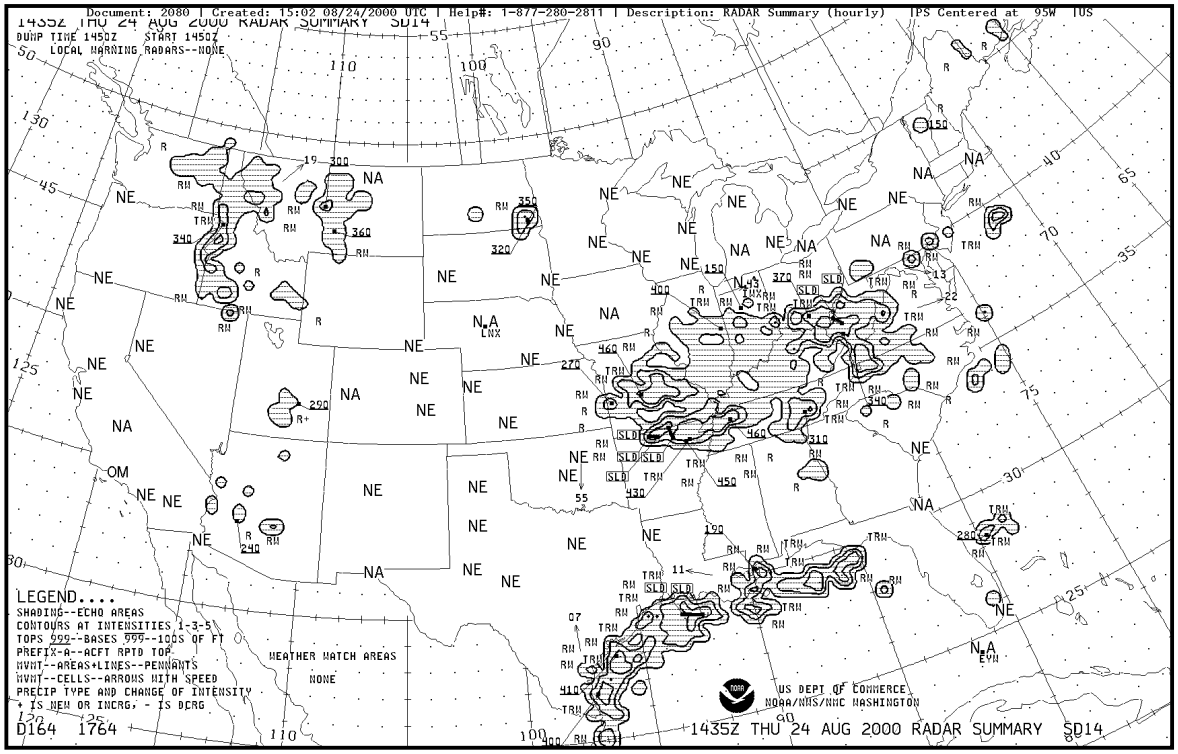


Figure 2-25 Radar Summary Chart for Questions 14-17

14. Which one of the following symbols would be used on a Radar Summary Chart to indicate a thunderstorm cell moving to the east at 20 knots?

a. 

b. 

c. 

d. **ROBEPS**

15. What are the maximum tops of the echoes reported over western Tennessee?

a. 31,000 feet MSL
b. 43,000 feet MSL
c. 45,000 feet MSL
d. 46,000 feet MSL

16. The area of echoes over Utah is precipitation that consists of _____ that is _____ in intensity during the last hour?

a. rain; increased
b. rain showers; moved 290° T
c. rain showers; built to level 3
d. rain; decreased

17. The area north of Los Angeles, California could expect no echo activity. True or False, and why?

a. False. The echoes over Arizona are moving quickly to the west.
b. True. There are no echoes indicated on the chart.
c. False. The radar stations are out for maintenance or observations are unavailable.
d. True. It’s Southern California; it never rains there.

18. Which one of the following weather products may be used to identify areas where an Aviation Severe Weather Watch is in effect?

a. Low Level Significant Weather Prognostic Chart
b. Radar Summary Chart
c. NEXRAD
d. Weather Depiction Chart

19. Which one of the following weather products would NOT be helpful in determining the intensity of a severe thunderstorm?

a. Radar Summary Chart
b. NEXRAD
c. IR Satellite
d. Weather Depiction Chart

20. Which one of the following weather phenomena is NOT normally determined by using NEXRAD?

a. Formation of a tornado
b. Intensity of precipitation
c. Height of cloud tops
d. Differential wind speeds

21. A/an _____ shows sunlight reflected from clouds and the Earth.

a. visible satellite image
b. infrared image
c. NEXRAD display
d. water vapor satellite image

22. Which one of the following would give the brightest return on a satellite image?

a. The ocean
b. Low clouds
c. Clouds that are higher relative to the others
d. Clouds that are warmer relative to the others

23. The Weather Depiction Chart is a_____.

a. teletype presentation of TAFs, valid for the period indicated in the heading in the lower left-hand corner of the chart
b. flight planning tool used by pilots that depicts wind data and frontal locations
c. forecast representation of the Surface Analysis Chart
d. facsimile presentation of the surface METARs, valid as of the time indicated on the chart

24. The Weather Depiction Chart will not indicate visibility if_____.

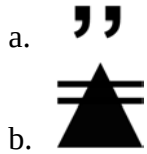
a. the airfield is IFR

b. visibility is reduced to 5 statute miles or less

c. visibility is greater than 5 statute miles

d. obstructions to visibility are indicated

25. Which one of the following symbols is unique to the Weather Depiction Chart?

a. 

b.

c. 

d. 

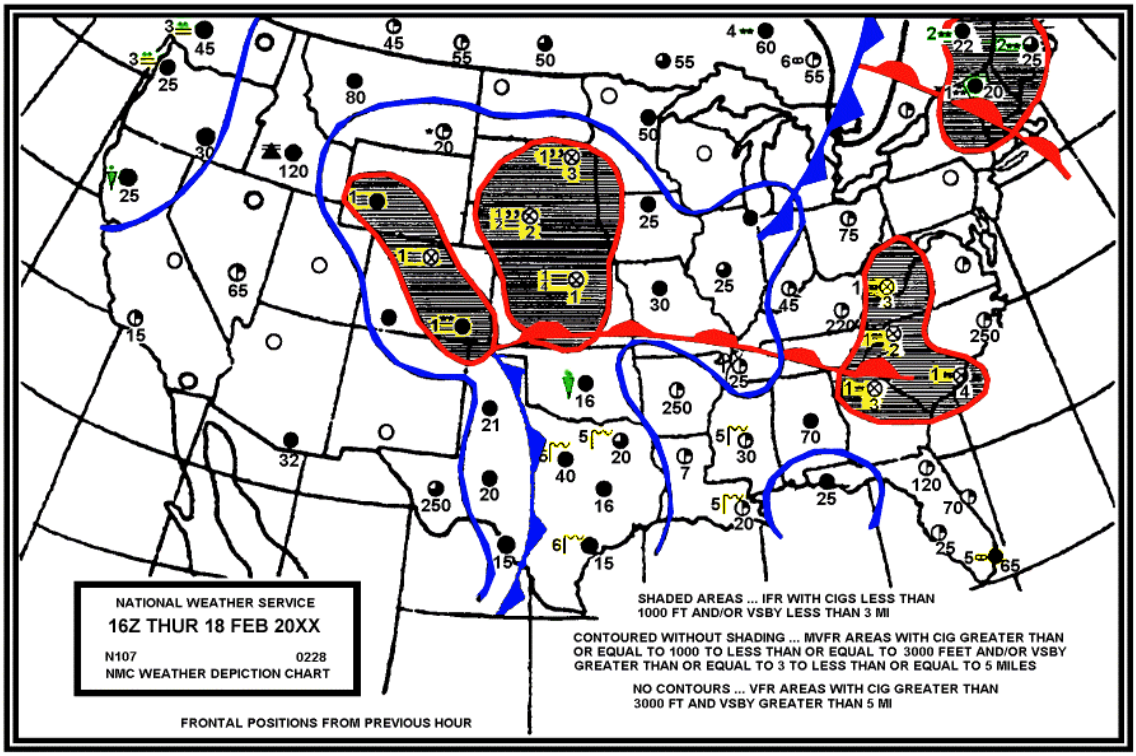


Figure 2-26 Weather Depiction Chart for Questions 26 - 29

26. The area from West Virginia to Georgia is under _____ conditions due to _____ skies and _____.

a. IFR; obscured, fog

b. VFR; scattered, smoke

c. Warm front; dark, visibility zero

d. MVFR; overcast, visibility > six miles

27. What is the reported visibility in northwest Florida and Alabama?

a. Zero
b. Two and one-half miles
c. Five miles
d. > Six miles

28. What type of cloud cover is reported in southern Nevada?

a. Scattered
b. Broken
c. Overcast
d. Obscured

29. What is the height of the cloud cover reported in southern Nevada?

a. 65 feet AGL
b. 650 feet MSL
c. 6500 feet MSL
d. 6500 feet AGL

30. Which one of the following is a graphic representation of the winds forecasted at various flight levels?

a. Weather Depiction Chart
b. Winds-Aloft Forecast
c. Winds-Aloft Prognostic Chart
d. Doppler Radar Summary

31. Which one of the following correctly lists the data presented on a Winds-Aloft Prognostic Chart?

a. Wind speed, wind direction, air temperature at altitude
b. Wind speed, wind direction, surface temperature and dew point
c. Wind speed and direction, sky cover, present weather
d. Wind speed and direction, areas of turbulence, location of freezing level

32. How long is the forecast period for a Winds-Aloft Prognostic Chart?

a. 6 hours
b. 12 hours
c. 24 hours
d. The Winds-Aloft Prognostic Chart is technically not forecast for a period; it is accurate for the valid time only.

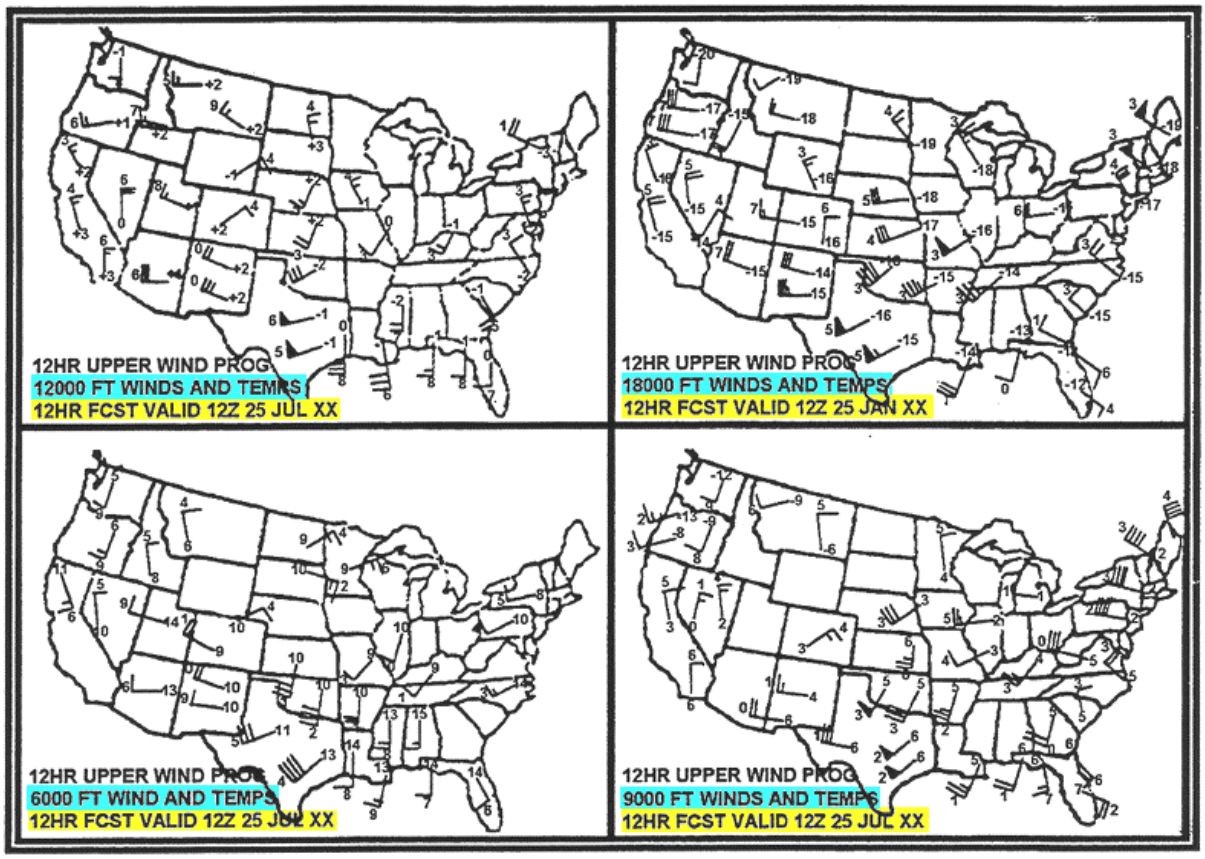


Figure 2-27 Winds-Aloft Prognostic Chart for Questions 33-34

33. Which one of the following altitudes would provide the most favorable winds for a flight from San Francisco to Los Angeles, California?

a. 6000
b. 9000
c. 12,000
d. 18,000

34. What are the winds and temperatures as plotted on the 9000-foot chart over southeastern Texas?

a. 060° at 50 knots, 2°C
b. 250° at 55 knots, –15°C
c. 220° at 50 knots, 6°C
d. 260° at 50 knots, 2°C

35. Winds-Aloft Forecasts are_____.

a. facsimile presentations that present the average forecast winds and temperatures aloft, in whole degrees Celsius

b. constructed for a range of eight altitudes within the continental United States and are displayed in a series of eight panels, one for each altitude

c. transmitted twice a day and the teletype identifier "FW" appears in the heading

d. teletype forecasts of upper winds and temperatures for selected stations within the continental United States

36. Which one of the following situations would cause the 6,000-foot level winds and temperatures to be omitted from a Winds-Aloft Forecast?

a. Stations located at mean sea level

b. A mountain station with an elevation of 4,800’ MSL

c. A station with a temperature below –24 °C

d. A mountain station with an elevation of 3,000’ MSL

37. Which one of the following is NOT a consideration in the selection of a flight level?

a. Headwind/tailwind component

b. Turbulence

c. Potential icing conditions

d. Microburst activity

VALID 181800Z FOR USE 1500-2100Z. TEMPS NEG ABV 24000

FT	3000	6000	9000	12000	18000	24000	30000	34000	39000
JAX	1512	1611+08	1708+04	1705-01	2913-14	3029-26	315641	317249	316743
TLH	1514	1614+08	1712+04	1811-01	2716-14	2934-25	295639	306547	296354
PIE	1313	1513+09	1511+04	1408+00	3012-13	3035-24	315938	316647	306053
MIA	1017	1219+09	1113+05	0909+01	3317-12	3241-24	326339	316546	315251
TRI		2411+06	2618+01	2827-04	2841-17	2847-29	286744	299452	790256
GRW	1822	2028+12	2128+06	2226-03	2532-17	2642-28	275943	278649	770856
MEM	1828	2134+10	2133+05	2133-02	2335-16	2546-27	266342	268748	761456
LIT	1832	2142+10	2141+04	2139-02	2241-16	2453-27	257141	259348	751756
SGF	1835	2144+10	2145+04	2145-02	2248-17	2359-28	247543	259549	751556
OKC	1832	2044+11	2149+05	2149-02	2256-17	2273-28	239241	730548	731154
AMA		2026	2242+02	2247-06	2258-21	2278-30	710243	721049	229951

Figure 2-28 Winds Aloft Forecasts for Questions 38 - 40

38. What are the strongest flight level winds forecast to exist over PIE at 1800Z?

a. 306° at 53 knots
b. 300° at 60 knots
c. 310° at 66 knots
d. 260° at 166 knots

39. Which one of the following altitudes over MIA is the freezing level predicted to be located?

a. 12,000 feet MSL
b. 12,000 feet AGL
c. 39,000 feet MSL
d. 24 to 30,000 feet

40. Which one of the following altitudes would provide the most favorable winds for a flight over AMA on a heading of 215 °T?

a. FL 240
b. FL 300
c. FL 340
d. FL 390

CHAPTER THREE

Severe Weather Watches, Military Advisories, and PIREPs

300. INTRODUCTION

While the weather products described in the previous two chapters presented the means of determining basic present and forecast weather conditions, this chapter introduces the systems for dissemination of weather warnings, watches, and advisories. When aviators begin their flight planning routine, checking for any severe weather should be the very first step. Changes to missions are a commonplace occurrence due to quickly changing weather conditions, and new aviators will soon appreciate the ability to plan around the weather, when able.

As might be expected, the Severe Weather Watch, Military Weather Advisory, and In-Flight Weather Advisories pass massive amounts of critical weather information to a variety of civil and military stations, and every aviator needs a solid foundation in the understanding of these messages. This can be possible only via a thorough understanding of the fundamentals of weather mechanics and related hazards to aviation. Additionally, a great deal of information regarding severe weather can only be gathered through Pilot Weather Reports, especially when operating over less-populated areas or overseas. Again, this necessitates that aviators have a solid understanding of weather phenomena and reporting systems.

All of the severe weather watches, warnings, and advisories are transmitted in text, or teletype, format. Additionally, some are available in both text and graphic, or facsimile format. As technology advances, more and more of the text weather messages are transformed by computer and available as graphic images. Some are even available in plain-language translations over the Internet. Still, the message format presented here will be used for a number of years to come, as brevity and accuracy continue to be paramount in ensuring timeliness of distribution to the greatest number of stations.

301. LESSON TOPIC LEARNING OBJECTIVES

TERMINAL OBJECTIVE: Partially supported by this lesson topic:

3.0 Describe displayed data on Severe Weather Watches, Military Weather Advisories, and In-Flight Weather Advisories, and state the importance of Pilot Reports (PIREPs).

ENABLING OBJECTIVES: Completely supported by this lesson topic:

3.1 State the Severe Weather Watch's two-letter teletype identifier.

3.2 State the requirements for issuing a Severe Weather Watch.

3.3 Read and identify data on a Severe Weather Watch message.

3.4 State the OPNAVINST 3710.7 requirements for flight planning regarding a Severe Weather Watch.

3.5 Describe displayed data on a Military Weather Advisory (MWA).

3.6 State the use of In-Flight Weather Advisories.

3.7 State the teletype letter identifiers of each of the In-Flight Weather Advisories.

3.8 State the criteria used for issuing each of the In-Flight Weather Advisories.

3.9 Read and identify data from In-Flight Weather Advisories.

3.10 State the requirements for and the importance and use of Pilot Weather Reports (PIREPs).

302. REFERENCES

1. Air Force Manual 15-125, Weather Station Operations
2. Aeronautical Information Manual, Section 7
3. Aviation Weather Center, Kansas City, Missouri (http://www.awc-kc.noaa.gov)
4. Chief of Naval Air Training Instruction 3710.8 series, Restriction of Flight Into, Through, or Within Aviation Severe Weather Areas
5. Chief of Naval Operations Instruction 3710.7 series, NATOPS General Flight and Operating Instructions
6. DoD Flight Information Publication (En route) Flight Information Handbook, Section C
7. FAA Contractions Manual

303. STUDY ASSIGNMENT

Review Chapter Three and answer the Study Questions.

304. SEVERE WEATHER WATCHES

Aviation Severe Weather Watch Bulletins are teletype presentations identified by the letters "WW" in the heading. WWs originate from the National Storm Prediction Center, and are sometimes referred to as Severe Weather Forecasts.

WWs are not issued on a scheduled basis, but rather as required by the progress and development of severe weather. The forecast period is also variable, again depending on the particular weather. All times are given in local time, as indicated in the warning itself. When possible, the area of coverage is limited in size to 10,000 square miles to provide increased accuracy. Aviators may also encounter a Severe Weather Forecast Alert Message (AWW), which is a preliminary message issued to alert users that a (WW) is being issued.

WW Format

The heading of the Aviation Severe Weather Watch Bulletins consists of a few lines of information including the station identifier of the message originator (KMKC), the teletype identifier (WW), the date-time group of issue (181845), the bulletin number (29), and the time of issue (1245 PM CST).

The bulletin is arranged in several paragraphs giving such information as the area of coverage, the effective time of the watch, the expected type of severe weather, the mean wind vector, and any amplifying remarks deemed necessary.

Whenever possible, wording in teletype presentations is shortened by abbreviating words or phrases according to the FAA Contractions Manual. Omitting the vowels usually shortens words or phrases. For further information on word or phrase contractions, refer to Appendix B of this text.

WW Issuing Requirements

Aviation Severe Weather Watch Bulletins (Figure 3-1) are issued for two types of expected severe weather conditions:

1. Funnel clouds or tornadoes.
2. Severe thunderstorms, defined by frequent lightning and one or more of the following:
    a. 50 knots of wind or greater;
    b. 3/4 inch diameter hail or larger

305. MILITARY RESTRICTIONS REGARDING SEVERE WEATHER WATCHES

Since WWs restrict the operation of military aircraft, aviators should always first check for WWs when beginning the flight planning process. Otherwise, you may plan a flight and find out during the weather brief that you are unable to fly that plan.

WWUS 9 KMKC 181845
MKC WW 181845

BULLETIN - IMMEDIATE BROADCAST REQUESTED
SEVERE THUNDERSTORM WATCH NUMBER 29
NATIONAL WEATHER SERVICE KANSAS CITY MO
1245 PM CST THUR FEB 18 20XX

A...THE STORM PREDICTION CENTER HAS ISSUED A SEVERE THUNDERSTORM WATCH FOR

SOUTH CENTRAL KANSAS
CENTRAL OKLAHOMA
NORTH CENTRAL TEXAS
EAST TEXAS

EFFECTIVE FROM 1 PM CST UNTIL 6 PM CST THIS THURSDAY AFTERNOON

LARGE HAIL...DANGEROUS LIGHTNING…AND DAMAGING THUNDERSTORM WINDS ARE POSSIBLE IN THESE AREAS.

THE SEVERE THUNDERSTORM WATCH AREA IS ALONG AND 70 STATUTE MILES EITHER SIDE OF A LINE FROM 70 MILES WEST OF AUSTIN TEXAS TO 35 MILES WEST OF WICHITA KANSAS.

REMEMBER...A SEVERE THUNDERSTORM WATCH MEANS CONDITIONS ARE FAVORABLE FOR 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.

B...OTHER WATCH INFORMATION...THIS SEVERE THUNDERSTORM WATCH REPLACES SEVERE THUNDERSTORM WATCH NUMBER 28. WATCH NUMBER 28 WILL NOT BE IN EFFECT AFTER 1 PM CST.

C...A FEW SVR TSTMS WITH HAIL SFC AND ALF TO 2 IN. EXTRM TURBC AND SFC WND GUSTS TO 70 KT. SCTD CBS WITH MAX TOPS TO 500 PSBL. MEAN WIND VECTOR 22040KT.

D...WITH CLD FNT MOVG SEWD FM WRN KS N CNTRL TX AND DVLPG LOW OK PANHANDLE MOVG EWD STG CNVRGNC SHLD DVLP ALG CLD FNT AND NR INTERSECTION WITH WRM FNT. CONTD STG INFLOW OF UNSTABLE AMS.

Figure 3-1 Aviation Severe Weather Watch Bulletin

3-4 SEVERE WEATHER WATCHES, MILITARY ADVISORIES, AND PIREPS

OPNAVINST 3710.7 Restrictions

The OPNAVINST 3710.7 Series restrictions for USN/USMC aircraft regarding WWs is listed as follows:

Except for operational necessity, emergencies, flights involving all-weather research projects or weather reconnaissance, pilots shall not file into or through areas the National Weather Service (NWS) has issued a WW unless one of the following exceptions applies:

1. Storm development has not progressed as forecast for the planned route. In such situations:

   a. VFR filing is permitted if existing and forecast weather for the route permits such flights.

   b. IFR flight may be permitted if aircraft radar is installed and operative, thus permitting detection and avoidance of isolated thunderstorms.

   c. IFR flight is permissible in positive control areas if visual meteorological conditions (VMC) can be maintained, thus enabling aircraft to detect and avoid isolated thunderstorms.

2. Performance characteristics of the aircraft permit an en route flight altitude above existing or developing severe storms.

NOTES:

1. It is not the intent to restrict flights within the areas encompassed by or adjacent to a WW area unless storms have actually developed as forecast.

2. Only a qualified forecaster can make the determination as to whether storm development has progressed as forecast.

CNATRA WW (CAWW)

The Chief of Naval Air Training (CNATRA) may also issue warnings in the form of a CNATRA Aviation Weather Warning (CAWW) for the local operating areas in the absence of WWs and/or SIGMETs and when conditions warrant such action. These warnings will be issued when one or more of the following criteria have been reported, detected by radar, or are imminently expected within 100 miles of the station and WW coverage is inadequate or nonexistent:

1. Embedded thunderstorms
2. Severe thunderstorms
3. Tornadoes

When flying aircraft under operational control of CNATRA, pilots are prohibited from filing or flying into areas covered by a CAWW in the same manner as if a WW had been issued. Although National Weather Service WWs (and SIGMETs, to be discussed later) are provided at non-Navy airfields, CAWWs may not be available. However, CAWW remarks are appended to Naval Training Meteorology and Oceanography Facility (NAVTRAMETOC) hourly observations when a CAWW is issued. Aircrew should request the servicing weather facility provide pertinent NAVTRAMETOC observations available via the civilian weather communication network.

Local Weather Warnings

For weather similar to a WW, local Navy airfields will issue a Thunderstorm Condition warning, which may restrict flight and ground operations, such as aircraft refueling, depending on the level of Thunderstorm Condition and local regulations. Although governed by local base instructions, the following conditions have generally been standardized throughout USN bases:

Thunderstorm Condition 2 – Thunderstorm conditions are possible within 6 hrs or within 25 miles of the airfield.

Thunderstorm Condition 1 – Thunderstorm conditions are possible within 1 hr or within 10 miles of the airfield.

Severe Thunderstorm 1 or 2 – Same as above including the possibility of:
Hail of 3/4 in or greater
Winds of 50 kts or greater
Tornadic activity

USAF Restrictions

Air Force aviators should be familiar with local command instructions for restrictions regarding WWs and other types of severe weather.

Military Weather Advisories

Military Weather Advisories (MWA), issued by US Air Force meteorologists, are graphical depictions of forecast weather used to warn aircrews about areas of thunderstorms, strong surface winds, heavy precipitation, and freezing precipitation.

These advisories should be used for flight planning in the event that WWs are not available. USAF bases generally use the MWA in place of other severe weather advisories. Thus, if you require information about WWs or other In-Flight Weather Advisories, you may need to request the forecaster provide these products.

The valid time of the MWA chart can be found with the heading information at the bottom left-hand corner of the chart (Figure 3-2, next page). This particular MWA is valid from 1600Z on the 3rd to 0400Z on the 4th.

3-6 SEVERE WEATHER WATCHES, MILITARY ADVISORIES, AND PIREPS

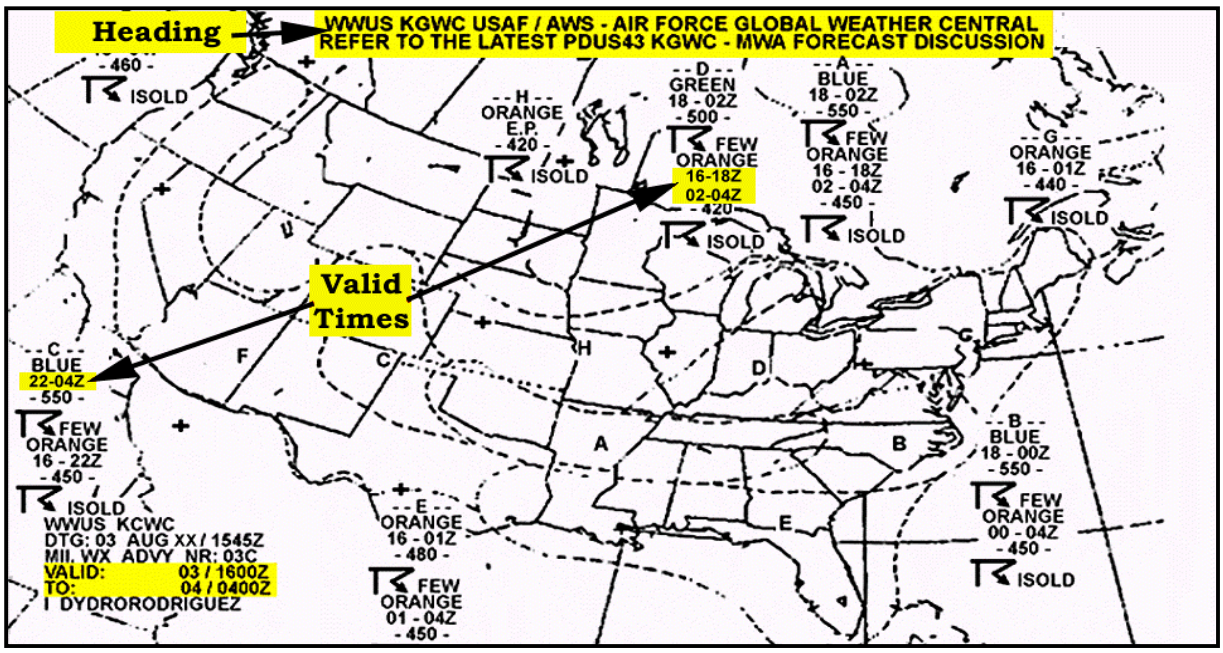


Figure 3-2 Military Weather Advisories (MWA) Area Valid Times

Advisory areas are enclosed by dashed lines and identified by block letters. Each area has a color associated with it to indicate the type of hazard to flight, for ease of identification:

RED	TORNADOES AND SEVERE THUNDERSTORMS
BLUE	SEVERE THUNDERSTORMS
GREEN	MODERATE THUNDERSTORMS
ORANGE	THUNDERSTORMS
BLACK	GUSTY SURFACE WINDS
PURPLE	HEAVY RAIN
HATCHED PURPLE	HEAVY SNOW
BROWN	FREEZING PRECIPITATION

The RED, BLUE, GREEN, and ORANGE correspond to the intensity of the thunderstorms based on wind speed and hail size. For example, MWA RED and BLUE areas correspond to conditions for which the NWS would issue a WW.

Each individual advisory area will be listed along the outer edge of the chart with its corresponding valid time(s) and maximum tops expected. Areas forecast to have liquid or freezing precipitation will include amounts expected. Additionally, MWAs use standard weather abbreviations to describe coverage for a forecast area, as listed in Appendix C.

306. AREA FORECASTS

The Area Forecast (FA) is a teletype presentation that provides an overview of weather conditions that could impact flight operations within the United States and adjacent waters. These forecasts serve primarily for use in preflight planning the en route portion of flights by general aviation pilots, civil and military operations, and the NWS and Federal Aviation Administration (FAA) pilot briefers (Figure 3-3).

FAUS5 KMIA 131745
FA4W
MIAC FA 131745
SYNOPSIS AND VFR CLDS/WX
SYNOPSIS VALID UNTIL 141200
CLDS/WX VALID UNTIL 140600 … OTLK VALID 140600-141200
NC SC GL FL 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 … CDFNT XTNDS E/W FM NE GLF ACRS FL ALG A MLB PIE LN AND INTO ATLC WILL BCMG STNRY
DURG PD. LRG HI PRES CNTR OVR UPR MI WILL MOV SEWD LE BY 12Z.

NC
NRN PTN … SCT 050 SCT 100 23Z CLR OCNL SCT045 MTNS. OTLK … VFR.

SC SCT-BKN 045-050 TOPS FL150. ISOLD -SHRA. AFT 01Z ERN PTNS BCMG CLR.
WRN PTNS BCMG SCT045. OTLK … VFR.

GA
NRN PTN … AGL SCT-BKN 030-040 BKN 100. ISOLD -SHRA. CU TOPS FL150. AFT 01Z SCT045 SCT100. OTLK … VFR.

SRN PTN … CIG BKN020-025 CU TOPS FL150. WDLY SCT TSRA/SHRA. TS TOPS FL350. AFT 01Z SCT-BKN100.
OTLK … VFR.

FL
CIG BKN010 SCT TSRA. AFT 01Z SCT020-030 SCT-BKN100 ISOLD TSRA AND SHRA CU TOPS FL150. TS TOPS
FL450. OTLK … VFR.

CSTL WTRS
NC/SC WTRS SCT045-050 BCMG CLR. OTLK … VFR.
GA WTRS CIG BKN020. ISOLD TSRA/SHRA. TS TOPS FL350. OTLK … VFR.
FL WTRS CIG BKN010 SCT TSRA. TS TOPS FL450. OTLK … VFR.

Figure 3-3 Area Forecast Example

FA Format

The FA consists of two sections, the synopsis and VFR clouds/weather. Additionally every FA will always have the following three lines listed after the heading, before the synopsis and clouds/weather sections.

1. SEE AIRMET SIERRA FOR IFR CONDS AND MTN OBSCN.
2. TSTMS IMPLY SVR OR GTYR TURB SVR ICG LLWS AND IFR CONDS.
3. NON MSL HGTS NOTED BY AGL OR CIG.

A six-hour categorical outlook follows each 12-hour specific clouds/weather forecast. At a minimum, the category of the expected prevailing condition–IFR, MVFR, or VFR–and the cause of the condition is stated in the outlook. These categorical terms correspond with those used elsewhere (such as the Weather Depiction Chart, Chapter Two), and they are not used otherwise in the FA.

The FA is generally straightforward and easy to understand. Each uses only approved abbreviations and contractions, and the weather and obstructions to vision abbreviations are the same as those used in METARs. All times in the body of the forecasts are stated in two digits using whole hours of UTC and qualifiers such as BY, UNTIL, AFTER, THRU, and BYD (beyond). All distances are in nautical miles, speeds in knots, and visibilities in statute miles. Locations are described by using geographical locations, two-letter state and Great Lakes identifiers, and three-letter location identifiers. The altitude reference is MSL unless otherwise noted by the terms AGL or ceiling (CIG).

307. IN-FLIGHT WEATHER ADVISORIES

The Aviation In-Flight Weather Advisory program provides information for pilots of en route aircraft via voice communications of the possibility of encountering weather phenomena–which may not have been forecast at the time of the preflight briefing of sufficient extent and/or intensity as to be potentially hazardous to aircraft operations. It is intended to serve the needs of both civilian and military aviation as a "common-system" aviation weather safety program.

There are five types of in-flight messages:

1. Severe Weather Forecast Alerts (AWW)
2. Convective SIGMETs (WST)
3. Non-Convective SIGMETs (WS)
4. Center Weather Advisories (CWA)
5. AIRMETs (WA)

When these advisories are issued, they describe potentially hazardous forecast weather conditions. For this reason, you should always check the current WAs, WSs, and WSTs during your preflight planning, in addition to the WW (an indirect component of the Aviation In-Flight Weather Advisory system). CWAs and AWWs are used mainly by Air Traffic Control (ATC) agencies for dissemination of advisories to aircraft in flight, so they are not as readily available as the other three advisories.

Within the conterminous US, the National Aviation Weather Advisory Unit (NAWAU) at Kansas City, MO, has the responsibility for issuing the five warnings. The Weather Service Forecast Offices (WSFO) will issue them for Hawaii, Alaska, and Puerto Rico. These advisories take into account weather conditions up to and including 45,000 feet. All heights are referenced to MSL, except low clouds, where a ceiling layer designated by CIG is referenced to AGL. All distance measurements are in nautical miles, and directions reference a 16-point compass. All abbreviations are from the FAA Contractions Manual, while weather elements and obstructions to vision are the same as those used in METARs.

Severe Weather Forecast Alert (AWW)

The AWW is a preliminary message issued in order to alert pilots that a WW is being issued. These messages are unscheduled and are issued as required. Normally, pilots will have access to WWs during preflight planning, and thus will not need to reference AWWs.

Convective SIGMET (WST)

WSTs are issued only for thunderstorms and related convective phenomena (as described below) over the conterminous US. Appended to each WST is an outlook valid for up to four hours beyond the end of the WST (Figure 3-4). They are not scheduled, but rather issued as needed, when any of the following occurs and/or is forecast to occur for more than 30 minutes of the valid period regardless of the size of the area affected (i.e., including isolated areas):

1. Tornadoes
2. Lines of thunderstorms
3. Embedded thunderstorms
4. Thunderstorm areas greater than or equal to thunderstorm intensity (VIP level) of four or greater with an area of coverage of 40% or more.
5. Hail greater than or equal to 3/4 inch in diameter or greater and/or wind gusts to 50 knots or greater.

WSUS41 KMKC 221855Z
WSTC
MKCC WST 221855
CONVECTIVE SIGMET 20C
VALID UNTIL 2055Z
ND SD
FROM 90W MOT-GFK-ABR-90W MOT
INTSFYG AREA SEV TS MOV FROM 24045KT. TS TOPS ABV FL450.
WIND GUSTS TO 60 KT RPRTD. +FC…HAIL TO 2 IN…WIND GUSTS
TO 65 KT POSS ND PTN.

CONVECTIVE SIGMET 21C
VALID UNTIL 2055Z
TX
50SE CDS
ISOLD SEV TS D30 MOV FROM 24020KT. TS TOP ABV FL450.
HAIL 2 IN…WIND GUSTS TO 65 KT POSS.

OUTLOOK VALID 222055-230055
AREA 1…FROM INL-MSP-ABR-MOT-INL
SEV TS CONT TO DVLP IN AREA OVR ND. AREA IS EXP TO RMN SEV AND SPRD
INTO MN AS STG PVA MOV OVR VERY UNSTBL AMS WTH -12 LI.

AREA 2…FROM CDS-DEW-LRD-ELP-CDS
ISOLD STG SEV TS WILL DVLP OVR SWRN TX AND WRN TX THRU FCST PD AS
UPR LVL TROF MOV NEWD OVR VERY UNSTBL AMS. LI RMNS IN -8 TO -10
RANGE. DRY LN WILL BE THE FOCUS OF TS DVLPMT.

Figure 3-4 WST Example

For WSTs, a line of thunderstorms is defined as being at least 60 miles long with thunderstorms affecting at least 40 percent of its length. Embedded thunderstorms, for the purpose of WSTs, are defined as occurring within and obscured by haze, stratiform clouds, or precipitation from stratiform clouds. WSTs for embedded thunderstorms are intended to alert pilots that avoidance by visual or radar detection of the thunderstorm could be difficult or impossible. Note that the presence of thunderstorms implies the associated occurrence of severe or greater turbulence, severe icing, and low-level wind shear.

All issued and valid WSTs for a specified geographic area are collected and listed in one place: a Convective SIGMET Bulletin. The three Convective SIGMET bulletin areas are the Eastern (E), Central (C), and Western (W) US, separated by the 87 and 107° W lines of longitude (with sufficient overlap to cover most cases when a phenomenon crosses the boundaries). These area letters can be found in the heading portion of the message, after the message type (e.g., WSTC), and after the WST bulletin number (e.g., 20C). Each of these three bulletins is transmitted hourly (at +55 minutes) and is valid for up to 2 hours. If there are no conditions within a region meeting Convective SIGMET criteria at the time of issuance, then a negative bulletin is sent.

Non-Convective SIGMET (WS)

A SIGMET advises of SIGnificant METeorological information other than convective activity that is potentially hazardous to all aircraft. WSs are issued for the conterminous US by NAWAU and are valid for up to 4 hours when any of the following weather phenomena occur or are forecast over an area of at least 3000 square miles (Figure 3-5):

1. Severe or extreme non-convective turbulence, or CAT not associated with thunderstorms
2. Severe icing not associated with thunderstorms
3. Widespread dust storms or sandstorms, lowering surface and/or flight visibilities to less than three miles
4. Volcanic eruption and ash clouds

Training Wing commanders are responsible for establishing local guidelines to ensure safety of flight in and through areas where SIGMETs are in effect.

DFWP WS 051700
SIGMET PAPA 2 VALID UNTIL 052100
AR LA MS
FROM MEM TO 30N MEI TO BTR TO MLU TO MEM
MDT OCNL SEV ICE ABV FRZLVL EXP. FRZLVL 080 TO 120 W. CONDS CONTG BYD 2100Z

Figure 3-5 WS Example

The first issuance of any non-convective SIGMET will always be identified as an Urgent SIGMET (UWS). Any subsequent issuance will be identified as WS unless the forecaster feels the situation warrants using UWS to trigger more expeditious communications handling.

Each SIGMET is assigned a unique header to ensure computer systems can distribute and replace the proper messages as required. Only the phonetic alphabet designators November, Oscar, Papa, Quebec, Romeo, Uniform, Victor, Whiskey, X-ray, and Yankee are used for non-convective SIGMETs (excludes those designators reserved for scheduled AIRMETs (Sierra, Tango, and Zulu)). These designators will follow the area designator (SFO, SLC, CHI, DFW, BOS, and MIA), which is used for distribution. It does not denote the office issuing the forecast; it denotes the geographical area affected (e.g., DFWP in Figure 3-5).

The first time a SIGMET is issued for a phenomenon associated with a particular weather system, it is given the next alphabetic designator in the series and is numbered as the first for that designator (e.g., PAPA 1). Subsequent messages are numbered consecutively, using the same designator (e.g., PAPA 2, PAPA 3, etc.) until the phenomenon ends or no longer meets SIGMET criteria. In the conterminous US, this means a phenomenon assigned an alphabetic designator in one area will retain that designator even if it moves into another area. For example, the first issuance for a SIGMET moving into the DFW area from the SLC area might be SIGMET PAPA 4.

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While this is indeed the first SIGMET issued for this phenomenon in the DFW area, it is actually the fourth issuance for the phenomenon since it met SIGMET criteria, and the previous three issuances occurred in the SLC area.

While SIGMETs may be issued up to two hours before the onset of any condition forecast to meet a criterion, note the time in line 1 (Figure 3-5) is the issuance time, not the onset time. The time indicated in the VALID UNTIL 052100 statement is the SIGMET expiration time. The difference between the two will not exceed four hours. If it is expected to persist beyond four hours, a statement to this effect will be included in the remarks of the text. If the conditions do persist beyond the forecast period, then the SIGMET will be updated and reissued. However, if conditions end, a SIGMET cancellation will be transmitted.

Center Weather Advisory (CWA)

CWAs are unscheduled in-flight, flow control, air traffic, and aircrew advisory. By nature of its short lead-time, the CWA is not a flight-planning product. It is generally a nowcast for conditions beginning within the next two hours. CWAs will be issued:

1. As supplement to an existing SIGMET, Convective SIGMET, AIRMET, or FA.

2. When an In-flight Advisory has not been issued, but observed or expected weather conditions meet SIGMET/AIRMET criteria based on current PIREPs and reinforced by other sources of information about existing meteorological conditions.

3. When observed or developing weather conditions do not meet SIGMET, Convective SIGMET, or AIRMET criteria; e.g., in terms of intensity or area of coverage, but current Pilot Weather Reports or other weather information sources indicate existing or anticipated meteorological phenomena will adversely affect the safe flow of air traffic within the Air Route Control Center (ARTCC) area of responsibility.

The following example (Figure 3-6) is a CWA issued from the Kansas City, Missouri ARTCC. The "3" after ZKC indicates this CWA has been issued for the third weather phenomenon to occur for the day. The "301" in the second line denotes the phenomenon number again (3) and the issuance number, "01," for this phenomenon. The CWA was issued at 2140Z and is valid until 2340Z.

ZKC3 CWA 032140
ZKC CWA 301 VALID UNTIL 032340
ISOLD SVR TSTM OVER KCOU MOVG SWWD 10KTS

Figure 3-6 CWA Example

AIRMET (WA)

AIRMETs also advise of significant weather phenomena other than convective activity but indicate conditions at intensities lower than those that trigger SIGMETs. Both are intended for dissemination to all pilots in the en route phase of flight to enhance safety, and are available for preflight planning, as well.

WAUS1 KDFW 210745
DFWS WA 210745
AIRMET SIERRA FOR IFR AND MTN OBSCN VALID UNTIL 211400

AIRMET IFR...TN KY
FROM 30E TRI TO 20S CHA TO 40SW ABY TO MOB TO IGB TO MEM TO DYR TO 30E TRI
OCNL CIG BLW010/VIS BLW 3SM -RA/BR. CONDS SPRDG EWD AND CONTG BYD 14Z AND IMPVG EXC ERN TN BY 20Z.

AIRMET MTN OBSCN...TN KY
FROM HNN TO 30E TRI TO 30E CHA TO CHA TO HNN
MTNS OCNL OBSCD IN CLDS/PCPN/FG. CONDS CONTG BYD 14A THRU 20Z.

DFWT WA 210745
AIRMET TANGO FOR TURB VALID UNTIL 211400

AIRMET TURB...AR OK TX TN MS LA AND CSTL WTRS
FROM 40S ICT TO ARG TO 20S BWG TO 80S LCH TO LRD TO 40S ICT
LGT OCNL MDT TURB FL140-FL350 ASSOCD WTH STG WNDSHR. CONDS CONTG BYD 14Z IMPVG BY 20Z.

ELSW...NO SGFNT TURB EXC VC CNVTV ACT

DFWZ WA 210745
AIRMET ZULU FOR ICE AND FRZLVL VALID UNTIL 211400

AIRMET ICE...TN MS OK
OCNL LGT ISOLD MDT RIME ICGICIP FRZLVL TO ARND 120 MS AL AND TN. CONDS CONTG BYD 14Z IMPVG BY 20Z.

Figure 3-7 WA Example

AIRMET bulletins, each containing one or more AIRMET messages, are issued on a scheduled basis every six hours beginning at 0145 UTC, and are effective for six hours, beginning at 0200 UTC. Unlike FAs, scheduled AIRMET bulletin issuances occur at the same UTC time, regardless of their area designator (Figure 3-7). Unscheduled amendments and corrections are issued as necessary, due to changing weather conditions or issuance/cancellation of a SIGMET.

There are three types of AIRMET messages that may be issued within a WA. An AIRMET is issued when one or more of the following listed conditions occurs (or is expected to occur) and affects an area of at least 3000 square miles:

AIRMET Sierra – For widespread IFR conditions (ceilings less than 1000 feet and/or visibility less than three miles) affecting over 50% of the area or for extensive mountain obscuration.

AIRMET Tango – For moderate turbulence or for sustained surface winds of 30 knots or more.

AIRMET Zulu – For moderate icing or freezing level data.

3-14 SEVERE WEATHER WATCHES, MILITARY ADVISORIES, AND PIREPS

Even though these AIRMET items are issued for widespread phenomena at least 3000 square miles at any one time if the total area to be affected during the forecast period is very large, it could be that only a small portion of this total area would be affected at any one time.

As with SIGMETs, the AIRMETs have unique headings that contain the bulletin type letter following the area designator. For example, when an AIRMET for turbulence is issued, the communications header might read “DFWT WA 210745,” where "T" indicated it is an AIRMET Tango bulletin. Also in the heading is the valid period expiration time, which is 6 hours after the scheduled "valid beginning" time, or 6 hours and 15 minutes after the scheduled issuance time. Each section begins with a text description of the type of AIRMET and a list of states and/or geographical areas affected. As a minimum, each bulletin may indicate no significant weather of that type is expected, and AIRMET Zulu always contains a freezing level line.

There are a few specific rules meteorologists follow when producing WAs that may be helpful for understanding what weather is and is not forecast. Whenever a SIGMET is in effect, the AIRMET bulletins for the same phenomena (in the same area) will contain a reference to the appropriate SIGMET series. For example, “SEE SIGMET XRAY SERIES FOR SEV TURB AREA.” Additionally, when non-convective low-level wind shear (LLWS–wind shear below 2000 feet AGL) is affecting or expected to affect an area of at least 3000 square miles, the AIRMET Tango includes an LLWS potential statement as a separate line.

308. TRANSMISSION OF IN-FLIGHT WEATHER ADVISORIES

Since In-Flight Weather Advisories are designed primarily for en route information of changes in the forecasts, an initial alert is normally transmitted over ATC frequencies. These alert announcements give the type of advisory and frequency instruction, which indicates where further information can be obtained, such as through the Hazardous In-Flight Weather Advisory Service (HIWAS). Upon hearing an alert notice, if you are not familiar with the advisory or are in doubt, you should tune in the appropriate frequency or contact the nearest FAA Flight Service Station (FSS) or pilot-to-forecaster service (PMSV) to check whether the advisory is pertinent to your flight. These advisories are broadcast during the valid periods, when they pertain to the area within 150NM of the FSS. Times, frequencies, and further information can be found in the DOD Flight Information Publication (En Route) Flight Information Handbook, Section C, and other en route publications, as taught in the Instrument Flight Rules course.

309. PIREPS

Pilot Weather Reports (PIREPs) are a valuable source of information used to supplement ground station weather observations. Air traffic facilities are required to solicit PIREPs whenever the following conditions are reported or forecasted: ceilings at or below 5,000 feet, visibility at or below 5 miles, thunderstorms and related phenomena, icing of a light degree or greater, turbulence of moderate degree or greater, and wind shear. All pilots are urged to cooperate and promptly volunteer reports on these conditions, and any other conditions pertinent to aviation, such as: cloud bases, tops, and layers; flight visibility; precipitation; visibility restrictions; winds at altitude; and temperatures aloft. Pilots are required to submit a PIREP under the following conditions:

1. In-flight when requested
2. When unusual or unforecast weather conditions are encountered
3. When weather conditions on an IFR approach differ from the latest observation
4. When a missed approach is executed due to weather
5. When a wind shear is encountered on departure or arrival

Your observed PIREPs should be given to any ground facility with which you have established communication (e.g., FSS, ARTCC, EFAS-En route Flight Advisory Service, etc.). After passing the immediately pertinent information, you should follow up with a radio call to a Meteorology Office (METRO) to ensure rapid dissemination to other using agencies. If you are not able to report while in the air, you should make a report to the nearest FSS or Weather Service Office upon landing, especially if weather encountered was different than forecast.

When airborne, you would consult the Flight Information Handbook for the proper format, which includes aircraft identification, location, time (UTC), altitude (MSL), type aircraft, sky cover, visibility and weather, temperature, wind, turbulence, icing, and remarks. Even though your pilot report should be as complete and accurate as possible, do not be overly concerned with strict format and phraseology. The important thing is that your PIREP is relayed so others may benefit from your report (Figure 3-8).

"Pensacola METRO, Rocket 501, a single T-39 Sabreliner at one-six thousand feet, 200 KIAS indicated, holding 20 miles south of Navy Pensacola, at 2100Z experiencing IFR in stratus clouds, temperature –15 °C, winds 330 at 25, no turbulence, Light Rime Icing."

Figure 3-8 PIREP Example

STUDY QUESTIONS

WWUS 9 KMKC 181845
MKC WW 181845

BULLETIN - IMMEDIATE BROADCAST REQUESTED
SEVERE THUNDERSTORM WATCH NUMBER 29
NATIONAL WEATHER SERVICE KANSAS CITY MO
1245 PM CST THUR FEB 18 20XX

A. THE STORM PREDICTION CENTER HAS ISSUED A SEVERE THUNDERSTORM WATCH FOR

SOUTH CENTRAL KANSAS
CENTRAL OKLAHOMA
NORTH CENTRAL TEXAS
EAST TEXAS

EFFECTIVE FROM 1 PM CST UNTIL 6 PM CST THIS THURSDAY AFTERNOON

LARGE HAIL...DANGEROUS LIGHTNING…AND DAMAGING THUNDERSTORM WINDS ARE POSSIBLE IN THESE AREAS.

THE SEVERE THUNDERSTORM WATCH AREA IS ALONG AND 70 STATUTE MILES EITHER SIDE OF A LINE FROM 70 MILES WEST OF AUSTIN TEXAS TO 35 MILES WEST OF WICHITA KANSAS.

REMEMBER...A SEVERE THUNDERSTORM WATCH MEANS CONDITIONS ARE FAVORABLE FOR 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.

B. OTHER WATCH INFORMATION...THIS SEVERE THUNDERSTORM WATCH REPLACES SEVERE THUNDERSTORM WATCH NUMBER 28. WATCH NUMBER 28 WILL NOT BE IN EFFECT AFTER 1 PM CST.

C. A FEW SVR TSTMS WITH HAIL SFC AND ALF TO 2 IN. EXTRM TURBC AND SFC WND GUSTS TO 70 KT. SCTD CBS WITH MAX TOPS TO 500 PSBL. MEAN WIND VECTOR 22040KT.

D. WITH CLD FNT MOVG SEWD FM WRN KS N CNTRL TX AND DVLPG LOW OK PANHANDLE MOVG EWD STG CNVRGNC SHLD DVLP ALG CLD FNT AND NR INTERSECTION WITH WRM FNT. CONTD STG INFLOW OF UNSTABLE AMS.

Figure 3-9 WW for Questions 1 - 3

1. What is the effective time period for this WW?

   a. 181900Z to 190000Z
   b. 181300 CST to 181800 CST
   c. 1 p.m. CST to 6 p.m. CST
   d. All of the above are correct

2. Which one of the following would be the best altitude to enable flight above the cloud tops in this WW?

   a. FL 280
   b. FL 350
   c. FL 510
   d. FL 700

3. Which one of the following conditions would allow a Naval Aviator to file for an IFR flight through the area covered by this WW?

   a. The assigned aircraft has operable weather radar, enabling detection and avoidance of the line of thunderstorms.
   b. The assigned aircraft has operable weather radar, and the weather brief, given by a NAVMETOC Forecaster at 5 p.m. CST, indicates that there is no line of severe thunderstorms, and that VMC should prevail.
   c. No tornadoes have been reported.
   d. No hail or lightning has been reported.

4. Which one of the following lists the conditions for issuing a WW?

   a. Turbulence and hail
   b. Hail and lightning
   c. Tornadoes and severe thunderstorms
   d. Icing and gusty surface winds

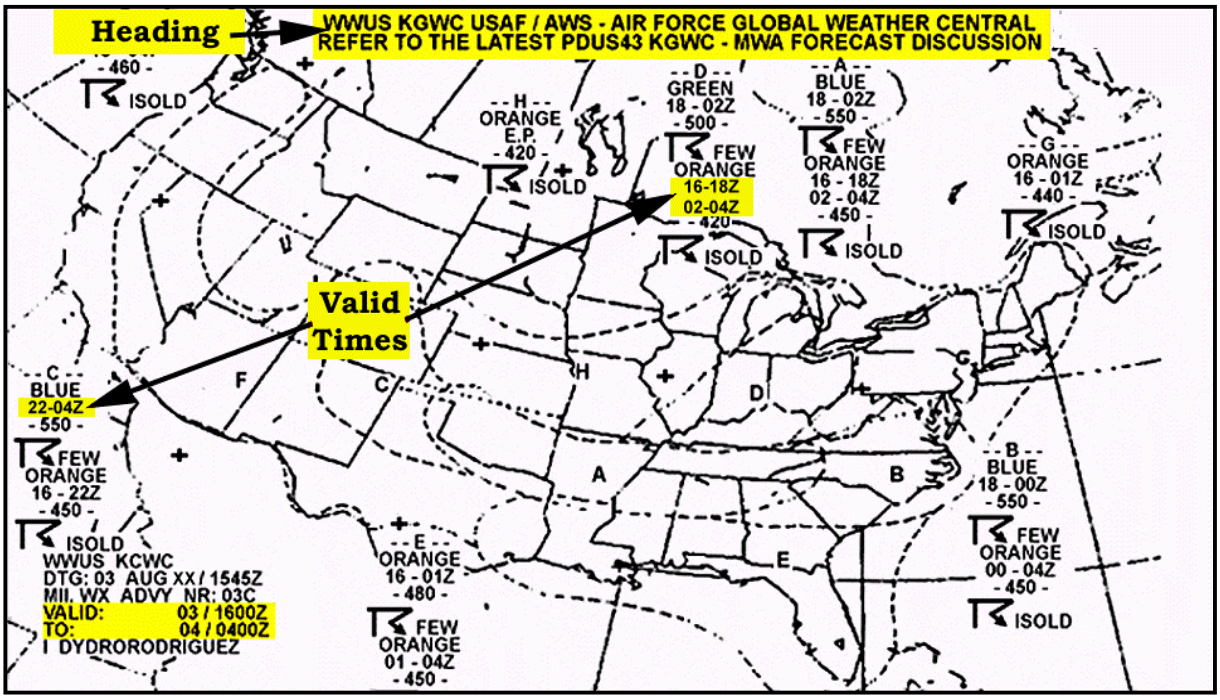

Figure 3-10 MWA for Questions 5 - 6

5. Which one of the following indicates the correct type of weather and its valid time for the Louisiana area?

a. Thunderstorms, 1600-0100Z
b. Severe thunderstorms, 2200-0400Z
c. Isolated heavy rain, 0100-0400Z
d. Tornadoes, 1600-0400Z

6. What are the maximum expected tops of thunderstorms for the Colorado/New Mexico/Texas area?

a. 45,000 feet
b. 48,000 feet
c. 50,000 feet
d. 55,000 feet

7. Which one of the following is NOT a teletype identifier for an In-Flight Weather Advisory?

a. WST
b. FA
c. WS
d. WA

8. Which one of the following conditions would warrant the issuance of a Convective SIGMET?

a. Tornadoes
b. Severe icing
c. Clear air turbulence
d. Extensive mountain obscuration

WSUS41 KMKC 221855Z
WSTC
MKCC WST 221855
CONVECTIVE SIGMET 20C
VALID UNTIL 2055Z
ND SD
FROM 90W MOT-GFK-ABR-90W MOT
INTSFYG AREA SEV TS MOV FROM 24045KT. TS TOPS ABV FL450.
WIND GUSTS TO 60 KT RPRTD. +FC…HAIL TO 2 IN…WIND GUSTS
TO 65 KT POSS ND PTN.

CONVECTIVE SIGMET 21C
VALID UNTIL 2055Z
TX
50SE CDS
ISOLD SEV TS D30 MOV FROM 24020KT. TS TOP ABV FL450.
HAIL 2 IN…WIND GUSTS TO 65 KT POSS.

OUTLOOK VALID 222055-230055
AREA 1…FROM INL-MSP-ABR-MOT-INL
SEV TS CONT TO DVLP IN AREA OVR ND. AREA IS EXP TO RMN SEV AND SPRD INTO MN AS STG PVA MOV OVR VERY UNSTBL AMS WTH -12 LI.

AREA 2…FROM CDS-DEW-LRD-ELP-CDS
ISOLD STG SEV TS WILL DVLP OVR SWRN TX AND WRN TX THRU FCST PD AS UPR LVL TROF MOV NEWD OVR VERY UNSTBL AMS. LI RMNS IN -8 TO -10 RANGE. DRY LN WILL BE THE FOCUS OF TS DVLPMT.

Figure 3-11 WST for Questions 9 - 11

9. WST 21C will be valid until _____ Z.

a. 1855
b. 1955
c. 2055
d. 2155

10. Which one of the following times could one expect the next bulletin regarding WST 21C to be issued?

a. 1855
b. 1955
c. 2055
d. 2155

11. Which one of the following locations should one expect to be affected by the future movement of the severe weather described in WST 21C?

a. 100 miles north of CDS
b. 100 miles east of CDS
c. 100 miles south of CDS
d. 100 miles west of CDS

DFWP WS 051700
SIGMET PAPA 2 VALID UNTIL 052100
AR LA MS
FROM MEM TO 30N MEI TO BTR TO MLU TO MEM
MDT OCNL SEV ICE ABV FRZLVL EXP. FRZLVL 080 TO 120 W. CONDS CONTG BYD 2100Z

Figure 3-12 WS for Questions 12 - 13

12. Which one of the following correctly indicates the expected duration of the severe weather?

a. Two hours
b. Three hours
c. Four hours
d. More than four hours

13. Which one of the following correctly indicates the type of severe weather?

a. Moderate icing
b. Severe icing
c. Moderate, occasionally severe icing above the freezing level
d. Freezing conditions between 0800 and 1200 local

14. Which one of the following conditions would warrant the issuance of a Non-Convective SIGMET?

a. Severe thunderstorms
b. Moderate icing
c. Severe CAT
d. Extensive mountain obscuration

15. Which one of the following conditions would warrant the issuance of an AIRMET?

a. Tornadoes
b. Light icing
c. Light clear air turbulence
d. Extensive mountain obscuration

WAUS1 KDFW 210745
DFWS WA 210745
AIRMET SIERRA FOR IFR AND MTN OBSCN VALID UNTIL 211400

AIRMET IFR...TN KY
FROM 30E TRI TO 20S CHA TO 40SW ABY TO MOB TO IGB TO MEM TO DYR TO 30E TRI
OCNL CIG BLW010/VIS BLW 3SM -RA/BR. CONDS SPRDG EWD AND CONTG BYD 14Z AND IMPVG EXC ERN TN BY 20Z.

AIRMET MTN OBSCN...TN KY
FROM HNN TO 30E TRI TO 30E CHA TO CHA TO HNN
MTNS OCNL OBSCD IN CLDS/PCPN/FG. CONDS CONTG BYD 14A THRU 20Z.

DFWT WA 210745
AIRMET TANGO FOR TURB VALID UNTIL 211400

AIRMET TURB...AR OK TX TN MS LA AND CSTL WTRS
FROM 40S ICT TO ARG TO 20S BWG TO 80S LCH TO LRD TO 40S ICT
LGT OCNL MDT TURB FL140-FL350 ASSOCD WTH STG WNDSHR. CONDS CONTG BYD 14Z IMPVG BY 20Z.

ELSW...NO SGFNT TURB EXC VC CNVTV ACT

DFWZ WA 210745
AIRMET ZULU FOR ICE AND FRZLVL VALID UNTIL 211400

AIRMET ICE...TN MS OK
OCNL LGT ISOLD MDT RIME ICGICIP FRZLVL TO ARND 120 MS AL AND TN. CONDS CONTG BYD 14Z IMPVG BY 20Z.

Figure 3-13 WA for Questions 16 - 18

16. Which one of the following types of weather has caused an AIRMET Sierra (IFR) to be issued for TN and KY?

a. Blowing snow

b. Light occasionally moderate turbulence associated with strong wind shear

c. Light rain and mist

d. Occasional light and isolated moderate rime icing in clouds and in precipitation

17. The turbulence in the AIRMET should improve by _____ Z.

a. 210745
b. 211345
c. 211400
d. 212000

18. Which one of the following types of weather has caused an AIRMET Zulu to be issued for TN, MS, and OK?

a. Blowing snow
b. Light occasionally moderate turbulence associated with strong wind shear
c. Light rain and mist
d. Occasional light and isolated moderate rime icing in clouds and in precipitation

19. Which one of the following systems or services would provide an aviator with the means to receive an In-Flight Weather Advisory?

a. FSS
b. HIWAS
c. Any ATC frequency
d. All of the above

20. Which one of the following situations would require an aviator to submit a PIREP?

a. Encountering unforecast IFR conditions on a VFR flight plan
b. Breaking out of an IFR layer on final 500 feet below the last reported ceiling
c. Flying through a microburst on final approach
d. All of the above

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CHAPTER FOUR

Flight Weather Briefing Form, DD Form 175-1

400. INTRODUCTION

In general, military aviators are required to submit an appropriate flight plan to the local air traffic control facility for all flights by using the DD 175 Military Flight Plan. The only exceptions allowed are use of the daily flight schedule, FAA Flight Plan, or an international flight plan. Since most training flights will use the daily flight plan, you may not learn about the DD 175 in detail until the instrument flight rules course. However, this flight plan will be the type–other than the daily flight schedule–used most often for military flights. Thus, it provides a realistic background for the introduction of its counterpart, the DD 175-1, the Flight Weather Briefing Form.

When embarking on flights outside the local area, you will most likely be required to file a DD 175. Flights of this nature also require an increased amount of preflight planning, as these flights tend to be unique, one-time events. While this provides aviators with a great deal of latitude in the selection of routes, it also increases the requirements for ensuring the plan includes sufficient alternative courses of action. Naturally, one of the major areas that require planning for alternatives is the weather.

This last chapter introduces a simple flight plan for which you will need a weather brief. For most situations, the local meteorology office will provide this briefing, but there may be situations when the pilot may need to fill out the DD 175-1, such as when overseas, or when conducting a telephone briefing. In all situations, though, the aircrew will need to take an active part in the process of determining the weather. In marginal weather conditions, aircrew will check the weather before planning, before submitting the planned flight, before takeoff, and during the flight.

The aircrew should review the weather and build an overall picture prior to the formal weather brief by a meteorologist. In this manner, aircrew will have more time to consider how the weather conditions may affect their flight, and they will be better prepared to ask questions of the briefer, enabling a two-way conversation to occur. While meteorologists are certainly the most knowledgeable source for weather information, the aircrew is the most knowledgeable about their mission. The briefer can best prepare the aircrew for their flight only when aviators ask questions during the briefing about areas they would like further information or explanation.

401. LESSON TOPIC LEARNING OBJECTIVES

TERMINAL OBJECTIVE: Partially supported by this lesson topic:

4.0 Describe indicated data on the DD 175-1, “Flight Weather Briefing Form,” and state the sources of hazardous weather information used to complete the form.

ENABLING OBJECTIVES: Completely supported by this lesson topic:

4.1 List the five sections of the DD 175-1 and the information contained in each.

4.2 State the requirements for completing the takeoff data section of the DD 175-1.

4.3 State the first weather source that should be checked when flight planning.

4.4 State the teletype/facsimile sources for information on thunderstorm activity en route.

4.5 State the teletype/facsimile sources for information on turbulence en route.

4.6 State the teletype/facsimile sources for information on icing and the minimum freezing level.

4.7 State the teletype/facsimile sources for winds aloft and temperature en route.

4.8 State the considerations in the selection of a flight level.

4.9 Determine if an alternate is required and state the source used for selecting the best possible alternate.

4.10 State the OPNAV 3710.7 requirements for the assignment of a Void Time on a DD 175-1.

4.11 State who maintains the ultimate responsibility for the weather briefing.

402. REFERENCES

1. Chief of Naval Operations Instruction 3710.7 series
2. NATOPS General Flight and Operating Instructions
3. Aeronautical Information Manual

403. STUDY ASSIGNMENT

Review Chapter Four and answer the Study Questions.

404. DD 175 MILITARY FLIGHT PLAN

A partially completed DD 175 is pictured below in Figure 4-1. The form is used to provide ATC agencies with the planned route of flight, for easier handling and direction of aircraft. It contains basic information on the top-right, such as the date, aircraft call sign, and type of aircraft. The center section presents the route, including departure point, time, destination, and estimated time en route (ETE), as well as requested altitude and route(s) of flight. At the bottom, above the list of crewmembers/passengers, the DD 175 provides space for other important details, such as the selected alternate landing field and an indication of a review of the weather.

4-2 FLIGHT WEATHER BRIEFING FORM, DD FORM 175-1

AUTHORITY: 10 USC 8012 and EO 9397
PRINCIPAL PURPOSE: To aid in accurate identification of personnel participating in the filed flight
PRIVACY ACT STATEMENT
ROUTINE USES: To provide data required to process flight plans with appropriate air traffic service authorities. A file is retained by the agency processing the flight plan.
DISCLOSURE: Voluntary; however, failure to provide the SSN could result in denial of flight plan processing.

DATE	AIRCRAFT CALL SIGN	AIRCRAFT DESG AND TD CODE
25 JUL 20XX	VV3E276	T-6 / R

BASE OPERATIONS USE

	TYPE FLT PLAN	TRUE AIRSPEED	POINT OF DEPARTURE	PROPOSED DEPARTURE TIME (Z)	ALTITUDE	ROUTE OF FLIGHT	TO	ETE
	I	200	NQA	1230	**	NQA-1 MEM V54 LIT V74 FSM V74S		
						OKM V210 MAMBA TIK	TIK	2+12

REMARKS

RANK AND HONOR CODE

FUEL ON BD	ALTN AIRFIELD	ETE TO ALTN	NOTAMS	WEATHER	WT AND BALANCE	AIRCRAFT SERIAL NUMBER, UNIT AND HOME STATION
3+00	**	0+38	✓	**	ON FILE NSE	135276/VT-3/NSE

SIGNATURE OF APPROVAL AUTHORITY	CREW/PASSENGER LIST			ACTUAL DEP TIME (Z)	BASE OPERATIONS USE
I. Am Instructor		ATTACHED	SEE PSGR MANIFEST		

DUTY	NAME AND INITIALS	RANK	SSN	ORGANIZATION AND LOCATION
PILOT IN COMMAND	I. AM. INSTRUCTOR	LT	999-99-9999	VT-3/NSE
STUD	R. U. READY	ENS	000-00-0000	VT-3/NSE
	**(TO BE DETERMINED IN THE SEMINAR)			

DD Form 175, MAY 86 0102-LF-001-7500 *Previous editions are obsolete.* MILITARY FLIGHT PLAN

Figure 4-1 DD Form 175, Military Flight Plan

For this chapter, you will use the following scenario, which began as an assignment to fly from NAS Memphis, Tennessee (NQA), to Tinker AFB, Oklahoma (TIK). Before choosing the route of flight, our aviators first check for any weather warnings/watches. Remember, the first step for any flight planning should always be to check for any WW, MWA, or In-Flight Weather Advisory that may affect the flight, because severe weather or a valid WW may result in a change of plans or the cancellation of the flight (as stated in Chapter Three).

Our aviators found no weather warnings affecting these bases or the area in between them. However, at this point, they determined the weather was not unmistakably VFR, so two possible alternate airfields were chosen, along with the following data, which has already been entered on the DD 175 above:

Planned route–KNQA to KTIK

Departure time/date–1230Z, 25 July 20XX

ETE–2 hours, 12 minutes

Possible alternates–KSPS and KTUL

ETE to either alternate–38 minutes

Aircraft category/type–“B,” T-6 T/A

It is at this point we join the scenario to see how weather fits into the preflight planning process. As stated above, this DD 175 is partially filled out. Notice there are three blocks containing asterisks (**). Normally, when flight planning, the DD 175 can be completed to the point of

leaving these three blocks empty, until the time of the weather brief. At this point–just before the weather briefing–a final check of the weather can be made, and two of those three blocks can be filled in. The alternate airfield block is selected according to the procedures described in Chapter One and the altitude block will be discussed shortly. Then, a copy of the DD 175 is given to the weather office for a briefer to prepare a DD 175-1. After receiving the weather briefing, the last block can be filled in (the weather briefing number), and the flight plan can be turned in to Base Operations or the local ATC agency for filing and entering in to the ATC computer system.

405. DD 175-1 FLIGHT WEATHER BRIEFING FORM

The DD 175-1 Flight Weather Briefing Form provides a common format for all military (and DoD) aircrew to receive a weather briefing from the local meteorology office regardless of location. However, when using other types of flight plans, such as the daily flight schedule, the DD 175-1 might not be filled out, but a substitute presenting this information must still be used to give the aircrew a complete picture of the expected weather. For this reason, OPNAVINST 3710.7 states the following requirements regarding the use of the Flight Weather Briefing form:

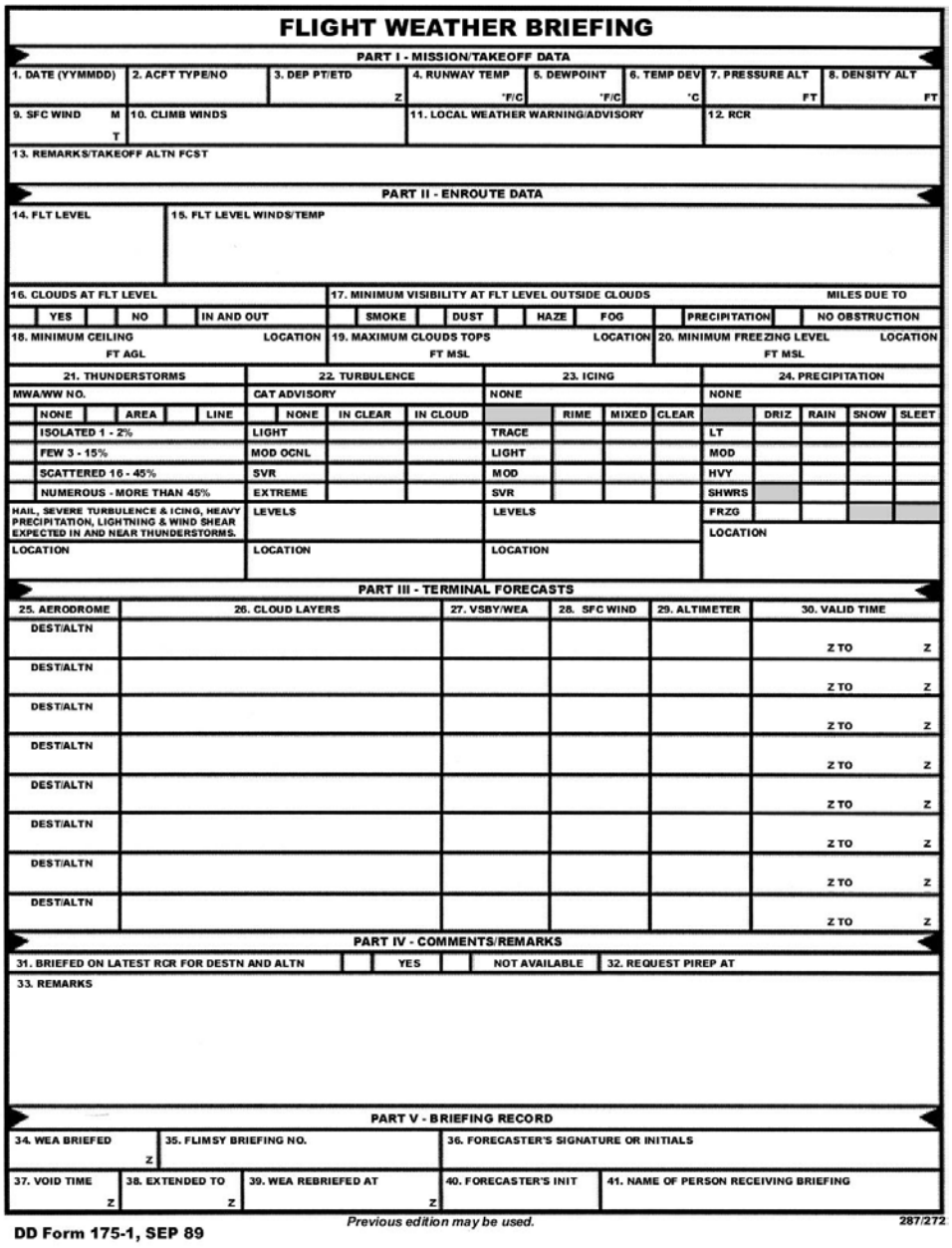
A DD 175-1, flight weather briefing, shall be completed for all flights to be conducted in Instrument Meteorological Conditions (IMC). For VFR flights using the DD 175, the following certification on the flight plan may be used in lieu of a completed DD 175-1:

> BRIEFING VOID _____Z, FLIGHT AS PLANNED CAN BE CONDUCTED UNDER VISUAL FLIGHT RULES. VERBAL BRIEFING GIVEN AND HAZARDS EXPLAINED. FOLLOWING SIGMETS ARE KNOWN TO BE CURRENTLY IN EFFECT ALONG PLANNED ROUTE OF FLIGHT_____. HAZARDS_____.
>
> _____
> (SIGNATURE OF FORECASTER)

The above certification is known as the VFR Certification Stamp. In order to use the VFR Stamp, the pilot must file VFR for the entire planned route, the pilot must request the stamp, and the stamp is available only at the forecaster's discretion.

The flight weather briefing may be accomplished by a meteorological forecaster, when available, or through an autographic, telephonic, weather vision, or certified Internet/intranet system when no forecasters are available.

Figure 4-2 shows a blank Flight Weather Briefing Form divided into five sections: Mission/Takeoff Data, En Route Data, Terminal Forecasts, Comments/Remarks, and the Briefing Record. In fact, the DD 175-1 was designed to provide specific information corresponding to the three phases of any flight–takeoff, en route, and landing as found in the first, second, and third sections.



FLIGHT WEATHER BRIEFING

PART I - MISSION/TAKEOFF DATA

1. DATE (YYMMDD)	2. ACFT TYPE/NO	3. DEP PT/ETD Z	4. RUNWAY TEMP °F/C	5. DEWPOINT °F/C	6. TEMP DEV °C	7. PRESSURE ALT FT	8. DENSITY ALT FT
9. SFC WIND M T	10. CLIMB WINDS		11. LOCAL WEATHER WARNING/ADVISORY			12. RCR	

13. REMARKS/TAKEOFF ALTN FCST

PART II - ENROUTE DATA

14. FLT LEVEL	15. FLT LEVEL WINDS/TEMP

16. CLOUDS AT FLT LEVEL: YES NO IN AND OUT

17. MINIMUM VISIBILITY AT FLT LEVEL OUTSIDE CLOUDS: SMOKE DUST HAZE FOG — MILES DUE TO: PRECIPITATION NO OBSTRUCTION

18. MINIMUM CEILING FT AGL / LOCATION	19. MAXIMUM CLOUDS TOPS FT MSL / LOCATION	20. MINIMUM FREEZING LEVEL FT MSL / LOCATION

21. THUNDERSTORMS	22. TURBULENCE			23. ICING				24. PRECIPITATION				
MWA/WW NO.	CAT ADVISORY			NONE				NONE				
NONE AREA LINE	NONE	IN CLEAR	IN CLOUD		RIME	MIXED	CLEAR		DRIZ	RAIN	SNOW	SLEET
ISOLATED 1 - 2%	LIGHT			TRACE				LT				
FEW 3 - 15%	MOD OCNL			LIGHT				MOD				
SCATTERED 16 - 45%	SVR			MOD				HVY				
NUMEROUS - MORE THAN 45%	EXTREME			SVR				SHWRS				
HAIL, SEVERE TURBULENCE & ICING, HEAVY PRECIPITATION, LIGHTNING & WIND SHEAR EXPECTED IN AND NEAR THUNDERSTORMS.	LEVELS			LEVELS				FRZG				
LOCATION	LOCATION			LOCATION				LOCATION				

PART III - TERMINAL FORECASTS

25. AERODROME	26. CLOUD LAYERS	27. VSBY/WEA	28. SFC WIND	29. ALTIMETER	30. VALID TIME
DEST/ALTN					Z TO Z
DEST/ALTN					Z TO Z
DEST/ALTN					Z TO Z
DEST/ALTN					Z TO Z
DEST/ALTN					Z TO Z
DEST/ALTN					Z TO Z
DEST/ALTN					Z TO Z
DEST/ALTN					Z TO Z

PART IV - COMMENTS/REMARKS

31. BRIEFED ON LATEST RCR FOR DESTN AND ALTN: YES NOT AVAILABLE — 32. REQUEST PIREP AT

33. REMARKS

PART V - BRIEFING RECORD

34. WEA BRIEFED Z	35. FLIMSY BRIEFING NO.	36. FORECASTER'S SIGNATURE OR INITIALS
37. VOID TIME Z	38. EXTENDED TO Z	39. WEA REBRIEFED AT Z / 40. FORECASTER'S INIT / 41. NAME OF PERSON RECEIVING BRIEFING

Previous edition may be used. 287/272

DD Form 175-1, SEP 89

Figure 4-2 DD 175-1 Flight Weather Briefing Form

While Figure 4-2 shows a blank form, from now on, this chapter will use a filled-out DD 175-1 so that you may become more familiar with the data presented therein. As might be expected, winds, altitudes, and other data will be presented in the common weather formats used throughout this book. For example, winds are given in a three-digit heading, two- (or three-) digit speed format, and altitudes are given in three digits, representing hundreds of feet MSL or the corresponding flight level.

406. PART I: MISSION/TAKEOFF DATA SECTION

The briefer uses the data from the DD 175 to complete the Mission/Takeoff Data section of the DD 175-1. This section identifies the flight for which the form is being prepared (first three blocks) and the forecast conditions for takeoff and climb out. Completion of the remaining takeoff data blocks is not normally required unless the pilot or person receiving the brief specifically states this information is needed or desired. However, local weather warnings that apply to the takeoff airfield, such as a CAWW or MWA, are always entered. This type of entry consists of the name of the warning and time that the warning is valid (e.g., TSTM COND II until 13Z). Although they are not required, the remaining blocks are usually filled in with data gathered from TAFs, FDs, and weather warning sources. Notice in Figure 4-3 that data from the DD 175 appears in Part I. The date, aircraft type, and departure point correspond with the flight plan submitted to METRO.

PART I - MISSION / TAKEOFF DATA							
1. DATE (YYMMDD)	2. ACFT TYPE / NO.	3. DEP PT / ETD	4. RUNWAY TEMP	5. DEWPOINT	6. TEMP DEV	7. PRESSURE ALT	8. DENSITY ALT
00-07-25	T-6A/VV3E276	KNPA/12:30 Z	52F/11C °F/C	50F/10C °F/C	-4C °C	+50 FT	+100 FT
9. SFC WIND M	10. CLIMB WINDS		11. LOCAL WEATHER WARNINGS / ADVISORY			12. RCR	
05009 Ⓣ	18010		NONE			WET	
13. REMARKS / TAKEOFF ALTN FCST							

Figure 4-3 Part I: Mission/Takeoff Data Section

407. PART II: EN ROUTE DATA SECTION

The En Route Data section of the DD 175-1 provides space for information about expected weather conditions within a range of 25 nautical miles of the intended route, and 5,000 feet above and below the intended flight path, plus destination conditions at altitude. (Note: 25 nautical miles and 5000 feet are guidelines only–each mission is briefed on any phenomena that could occur, considering aircraft capability, mobility, versatility, and mission variations.) To avoid confusion among the various boxes in this section, briefers generally use different indicator marks to correlate entries, such as the club and diamond symbols in blocks 22 and 24 of Figure 4-4. Also, an up arrow (↑) indicates conditions during the climb, and a down arrow (↓) relates to the descent.

PART II - ENROUTE DATA

14. FLT LEVEL	15. FLT LEVEL WINDS / TEMP
080	KTIK 23025(+07)

16. CLOUDS AT FLT LEVEL	17. MINIMUM VISIBILITY AT FLT LEVEL OUTSIDE CLOUDS	5 MILES DUE TO
YES: ☐ NO: ☐ IN AND OUT: ☒	SMOKE: ☐ DUST: ☐ HAZE: ☐ FOG: ☐ PRECIPITATION: ☒	NO OBSTRUCTION: ☐

18. MINIMUM CEILING	LOCATION	19. MAXIMUM CLOUD TOPS	LOCATION	20. FREEZING LEVEL	LOCATION
003 FT AGL	KLIT-KTIK	075/080 FT MSL	KNQA-KTIK	105 FT MSL	TN-OK

21. THUNDERSTORMS		22. TURBULENCE			23. ICING				24. PRECIPITATION				
MWA / WW NO. SIGMET 19C		CAT ADVISORY AIRMET TANGO			NONE NONE				NONE				
NONE ☐	AREA ☒ LINE ☒	NONE ☐	IN CLEAR	IN CLOUD		RIME	MIXED	CLEAR		DRIZ	RAIN	SNOW	SLEET
ISOLATED 1 - 2%		LIGHT	♣	♣	TRACE				LT				
FEW 3 - 15%		MOD	♣	♣	LIGHT				MOD	♦	♣		
☒ SCATTERED 16 - 45%	MT 35000	SVR			MOD				HVY				
☒ NUMEROUS - MORE THAN 45%	MT 42000	EXTREME			SVR				SHWRS		♦		
HAIL, SEVERE TURBULENCE & ICING, HEAVY PRECIPITATION, LIGHTNING & WIND SHEAR EXPECTED IN AND NEAR THUNDERSTORMS		LEVELS ♣(SFC-25000)			LEVELS				FRZG				
LOCATION NQA-OKM / ERN OK		LOCATION ♣(KNQA-KTIK)			LOCATION				LOCATION ♣(KNQA-KLIT) ♦(KLIT-KTIK)				

Figure 4-4 Part II: En Route Data Section

Blocks 14 and 15: Flight Level Winds/Temperature

This block is filled in with data from the Winds-Aloft Forecasts (FDs) and Winds-Aloft Prognostic Charts. However, forecasters will generally not choose a flight altitude for you; that is your decision to make before handing in the DD 175 to METRO. Thus, the sources used to fill in the following blocks should be given an overview by the aircrew before the flight weather brief in order to select a flight altitude, as will be discussed in the next section, Selection of a Flight Level.

Blocks 16 and 17: Clouds and Visibility at Flight Level

Clouds at flight level and minimum visibility at flight level will generally be apparent from the overall weather picture provided during the weather briefing. This information may be supplemented with Pilot Weather Reports, which are also useful in obtaining other information not readily accessible in other specific charts and reports. These are available in Teletype format under the heading “UA.”

Notice there are three boxes within Block 16 that may be checked. A check in the "YES" box represents a forecast for greater than 45% of the time spent in clouds at the flight level in Block 14. A check in the "NO" box indicates less than 1% of the time will be spent in clouds, while a check in the "IN AND OUT" box indicates between 1% and 45% of the flight will be through clouds. If it is more practical to check more than one block to better represent cloud conditions, then the corresponding locations will be entered above the additional blocks.

Block 18: Minimum Ceiling

Information regarding the minimum ceiling can be derived quickly from the pictorial presentation of the Weather Depiction Chart. Additionally, the Area Forecasts (FA) and any AIRMET Sierras (WA) will also indicate conditions of IFR.

Block 19: Maximum Cloud Tops

The cloud tops indicated in Block 19 are given for clouds located around the aircraft's flight level. For observed data, maximum tops can be determined from the Radar Summary Chart. Pilot Reports are also a good source, when they are available. Forecasters may refer to satellite imagery to determine which observed clouds would be moving into the flight area, thus providing a forecast of tops. The Area Forecasts (FA) may also be used to provide forecast information.

Block 20: Freezing Level

To determine the minimum freezing level en route, there are a number of products available to meteorologists and aircrew. These include observed data from Winds-Aloft Prognostic Charts, and RADAT information from METARs, plus forecast data from AIRMETs Zulu (WA), Winds-Aloft Forecasts (FD), and Low Level Significant Weather Prognostic Charts. Recall that the AIRMET Zulu will always include freezing level information, even when icing is not forecast.

Notice that Blocks 18 through 24 will include a location as part of the information presented in each box, and that these locations are not required to coincide with each other, to give forecasters maximum flexibility in describing the weather. For example, while the flight is planned for NQA to TIK, the minimum ceiling will be found between LIT and TIK, while the maximum cloud tops should be experienced throughout the route, and the freezing level of 10,500' MSL extends beyond the route of flight, from Tennessee to Oklahoma.

Block 21: Thunderstorms

Thunderstorms will be one of the patterns most obvious when building an overview of the weather. Of course, the Radar Summary Chart, as well as national NEXRAD composites and satellite imagery, give a pictorial view of observed thunderstorm activity. Other sources, such as the Surface Prognostic Chart, Low Level Significant Weather Prognostic Chart, WW, MWA, and WST also provide thunderstorm information. A look at any one or more of these can give an instant indication when thunderstorms are present along the route of flight. Determining the extent of their severity and coverage, however, will likely be best described during the weather brief.

Block 21 provides means for communicating all pertinent facets of thunderstorm activity, starting with any thunderstorm warnings applicable to the route of flight (in addition to Block 11 in Part I, which is for warnings applicable to the local airfield). Any warnings listed here should also

have comments made in the remarks section (Part IV) to elaborate on the warning. The next set of boxes can be checked to indicate the type and amount of coverage, in addition to providing the maximum cloud tops of the thunderstorms, when that information is available, along with the geographic location where the aircrew can expect to encounter the indicated thunderstorm activity. More than one box may be checked to indicate various possible conditions, so aircrew should be sure to ask for further details if the explanation given during the brief is unclear.

Finally, observe the typed notice above the location box that reads, "Hail, severe turbulence and icing, heavy precipitation, lightning and wind shear [can be] expected in and near thunderstorms." This is yet another reminder of the extremely hazardous nature of thunderstorms. Even though there is little extra space on the DD 175-1, some experienced aviators and meteorologist thought that it was very important for aviators to read this message every time their attention is focused on Block 21 (Figure 4-5).

PART II - ENROUTE DATA

14. FLT LEVEL	15. FLT LEVEL WINDS / TEMP
080	KTIK 23025(+07)

16. CLOUDS AT FLT LEVEL	17. MINIMUM VISIBILITY AT FLT LEVEL OUTSIDE CLOUDS											
YES	NO	X IN AND OUT		SMOKE		DUST		HAZE		FOG	X PRECIPITATION		NO OBSTRUCTION	5 MILES DUE TO

18. MINIMUM CEILING	LOCATION	19. MAXIMUM CLOUD TOPS	LOCATION	20. FREEZING LEVEL	LOCATION
003 FT AGL	KLIT-KTIK	075/080 FT MSL	KNQA-KTIK	105 FT MSL	TN-OK

21. THUNDERSTORMS			22. TURBULENCE			23. ICING				24. PRECIPITATION				
MWA / WW NO. SIGMET 19C			CAT ADVISORY AIRMET TANGO			NONE NONE				NONE				
NONE	X AREA	X LINE	NONE	IN CLEAR	IN CLOUD		RIME	MIXED	CLEAR		DRIZ	RAIN	SNOW	SLEET
ISOLATED 1 - 2%			LIGHT	♣	♣	TRACE				LT				
FEW 3 - 15%			MOD	♣	♣	LIGHT				MOD	♦	♣		
X SCATTERED 16 - 45% MT 35000			SVR			MOD				HVY				
X NUMEROUS - MORE THAN 45% MT 42000			EXTREME			SVR				SHWRS		♦		
HAIL, SEVERE TURBULENCE & ICING, HEAVY PRECIPITATION, LIGHTNING & WIND SHEAR EXPECTED IN AND NEAR THUNDERSTORMS			LEVELS ♣(SFC-25000)			LEVELS				FRZG				
LOCATION NQA-OKM / ERN OK			LOCATION ♣(KNQA-KTIK)			LOCATION				LOCATION ♣(KNQA-KLIT) ♦(KLIT-KTIK)				

Figure 4-5 Part II: En Route Data Section

Block 22: Turbulence

The format of the Turbulence Block is similar to that of the Thunderstorm Block, beginning with a section for advisories, any of which should also have further remarks made in Part IV. Since turbulence will be experienced in all thunderstorms, this section is only for turbulence not associated with thunderstorms. Good sources of forecast information include the WS, WA (Tango), Surface Prognostic Chart, and Low-Level Significant Weather Prognostic Chart. PIREPs, when available, are also an excellent source of observed information on turbulence.

Blocks 23 and 24: Icing and Precipitation

Much like the sources for turbulence, the icing sources include the WS, WA (Zulu), Surface Prognostic Chart, and Low-Level Significant Weather Prognostic Chart, and PIREPs. Also, like

the other blocks, Block 23 includes spaces for indicating types, intensities, and locations of icing. Neither Block 23 nor Block 24 includes an area for advisories or warnings, as any that may be applicable to icing or precipitation would be listed in other areas of the DD 175-1. Expected precipitation for Block 24 can be determined from any or all surface weather products, including the Surface Prognostic Chart, Low-Level Significant Weather Prognostic Chart, Radar Summary Chart, MWA, and possibly even the WA (Sierra).

408. SELECTION OF A FLT LEVEL

Now that we have described the various weather sources used by meteorologists to fill out the Part II, En route Data section of the DD 175-1, it will be easier to discuss the various considerations in the selection of an en route flight level. When building an overview of the weather after preflight planning, before turning in the flight plan to METRO, an aviator should strive to build a good idea of where the most hazardous conditions exist, in order to avoid them, when possible. Depending on the mission of the flight, and whether intending to fly IFR or VFR, the location, severity, and intensity of the following aspects of the weather will guide the selection of a flight level:

1. Wind component
2. Minimum ceilings/maximum cloud tops
3. Visibility at flight level
4. Minimum freezing level
5. Thunderstorms
6. Turbulence
7. Icing
8. Precipitation

Notice this list of considerations corresponds with the set of Blocks 15 through 24 in Part II of the DD 175-1. Taking into account all the hazards associated with the foregoing conditions, an aviator can make an informed decision to select a group of altitudes that excludes as many of these hazards as possible.

409. PART III: TERMINAL FORECASTS SECTION

The Terminal Forecast section of the DD 175-1 provides space for information about forecast weather conditions at both the destination and alternate airfield, plus any planned intermediate stops. The format follows closely the TAF format from which the information is gathered, except that it is presented in columns for easier reading (Figure 4-6).

PART III - TERMINAL FORECASTS					
25. AIRDROME	26. CLOUD LAYERS	27. VSBY / WEA	28. SFC WIND	29. ALTIMETER	30. VALID TIME
(DEST) ALTN INFO KTIK	OVC004	1/2HZ FG	15010	2999 INS	13:42 Z TO 15:42 Z
DEST (ALTN) INFO KSPS	BKN008 OVC015	4BR	17015	2987 INS	14:20 Z TO 16:20 Z
DEST (ALTN) INFO KTUL	OVC009	2BR	14015	2986 INS	14:20 Z TO 16:20 Z
DEST ALTN INFO	TEMPO VV005CB	1/2 +TSRA	18020G35	2983 INS	15:00 Z TO 16:20 Z

Figure 4-6 Part III: Terminal Forecasts Section

Notice, though, that Part III does not list the whole TAF for the particular aerodrome. It will only list the one line (or more, including applicable change groups) that applies to the required valid time, based on the ETA stated on the DD 175 flight plan. As described in Chapter One, the military requires that destination (and alternate) weather be forecast for the flight to include the period of $\pm$1 hour of the planned ETA.

Another feature of Part III is that the cloud layers are listed immediately after the airfield identifier, because ceilings are the primary weather factor used to determine whether an alternate is required. The next column lists the visibility at the field, as this is the other factor in the requirement for an alternate. Using Figure 4-6, which airfield, SPS or TUL, would be the best choice for an alternate (assuming all airfields have minimums of 200-1/2)? Review Chapter One if necessary, because when the weather is problematic, it will be at this point in the preflight process that the determination of the alternate is made. An aviator can wait until after the DD 175-1 is briefed to select an alternate, but it must be indicated by the time the DD 175 flight plan is submitted to Base Operations. The instructor will conduct a discussion of this decision during class.

To build a weather overview before the weather brief, an aviator would be duplicating the efforts of the meteorologist to leaf through the many lists of TAFs available. However, an overview of destination weather can be quickly gathered from the facsimile sources. Aviators can check the Surface Analysis Chart for observed pressure systems and fronts, and the Surface Prognostic Chart for a forecast of the same information. Additionally, since TAFs are transmitted less often than METARs, the reliability of a forecast can be determined during the weather briefing by comparing existing weather conditions with forecast weather conditions at the destination (or by comparing the METAR to the TAF).

For your convenience, a summary of the sources that may be used to forecast the weather for Parts II and III are shown in Figure 4-7.

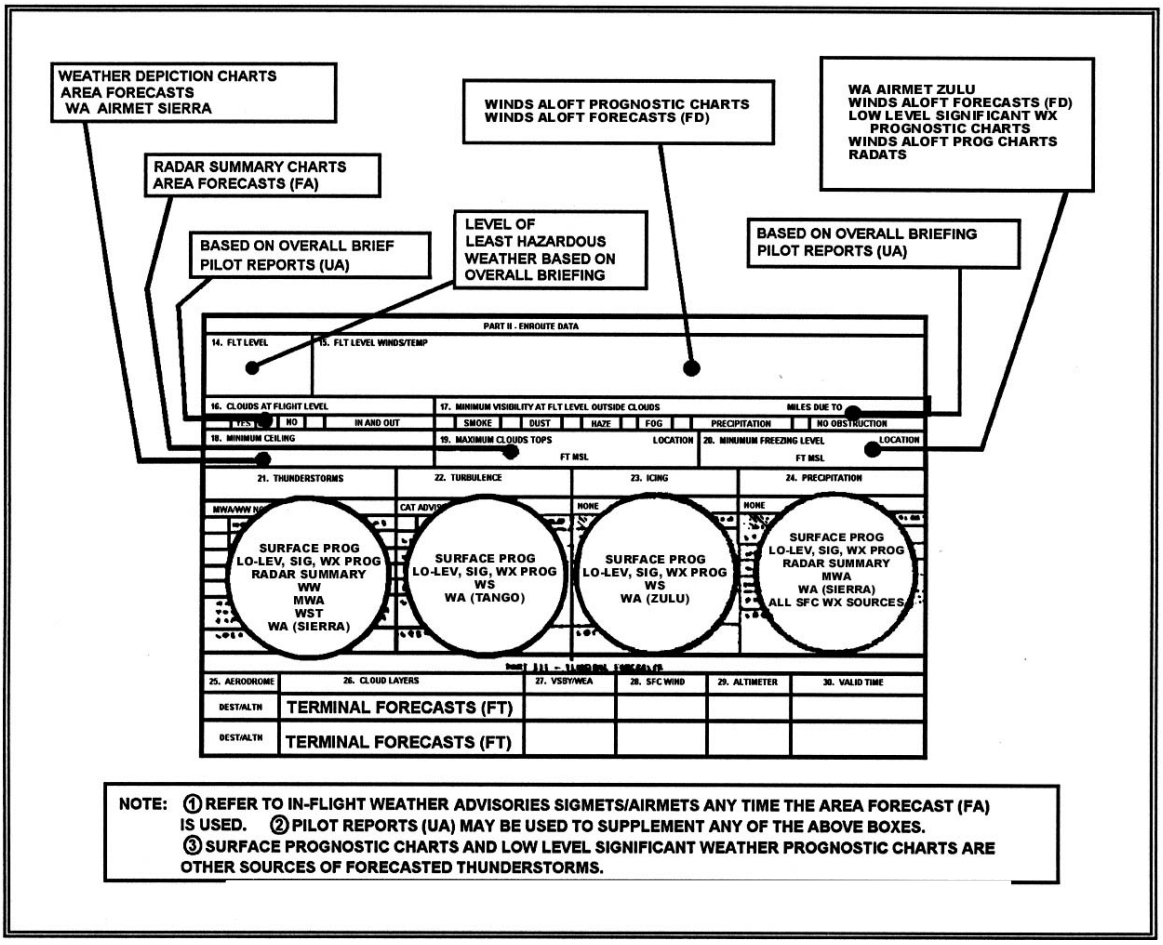
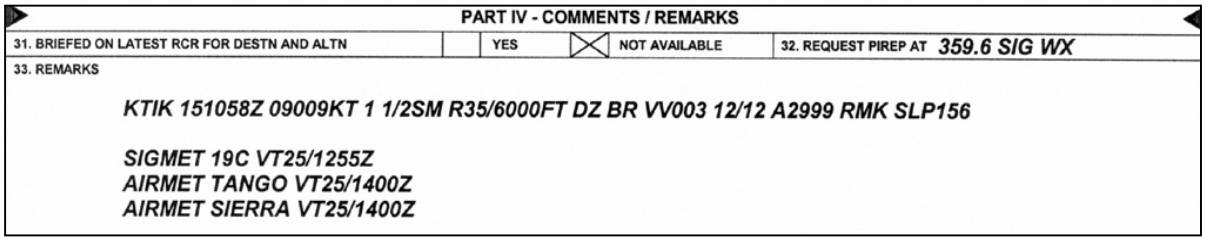


Figure 4-7 Sources for the En Route Data and Terminal Forecast Sections

410. PART IV: COMMENTS/REMARKS SECTION

This section provides space for miscellaneous information concerning any portion of the flight (Figure 4-8). Remarks include any significant details or data not covered elsewhere and deemed pertinent, such as low-level wind shear, and runway conditions. When applicable and available, the latest braking action code will be given in Block 31. Weather personnel may request that you make a PIREP for a specific location along your route of flight where data is unavailable through other means. If so, the appropriate location, type weather, and METRO frequency will be listed in Block 32. Amplifying remarks on any WWs, SIGMETs, AIRMETs, or similarly issued warnings or advisories are required in Block 33. The latest hourly surface observation for the destination may also be included here. If space is a problem, an additional DD 175-1 will be used as a continuation sheet.


PART IV - COMMENTS / REMARKS

31. BRIEFED ON LATEST RCR FOR DESTN AND ALTN		YES	X	NOT AVAILABLE	32. REQUEST PIREP AT 359.6 SIG WX

33. REMARKS

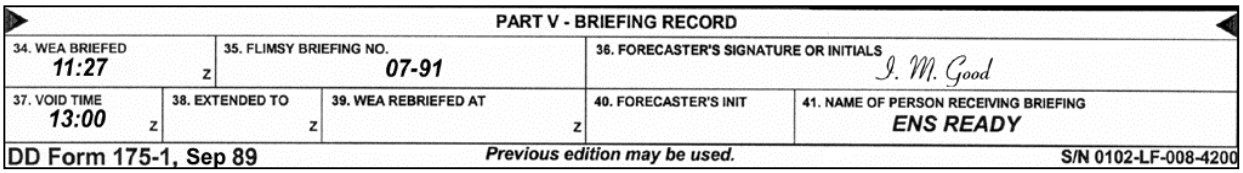
KTIK 151058Z 09009KT 1 1/2SM R35/6000FT DZ BR VV003 12/12 A2999 RMK SLP156

SIGMET 19C VT25/1255Z
AIRMET TANGO VT25/1400Z
AIRMET SIERRA VT25/1400Z

Figure 4-8 Part IV: Comments/Remarks Section

411. PART V: BRIEFING RECORD SECTION

The actual time the briefing is completed is entered in Block 34 of Part V (Figure 4-9). Block 35 provides the flimsy briefing number, which is the number identifying that particular weather brief. It is made up of a two-digit month, followed by a sequential number for that month (e.g., 02-35 indicates the 35th DD Form 175-1 completed in February). This flimsy briefing number should be transferred to the DD 175 flight plan before submitting it to Base Operations, to indicate the aircrew has received a weather brief from a qualified forecaster.


PART V - BRIEFING RECORD

34. WEA BRIEFED	35. FLIMSY BRIEFING NO.	36. FORECASTER'S SIGNATURE OR INITIALS		
11:27 Z	07-91	I. M. Good		
37. VOID TIME	**38. EXTENDED TO**	**39. WEA REBRIEFED AT**	**40. FORECASTER'S INIT**	**41. NAME OF PERSON RECEIVING BRIEFING**
13:00 Z	Z	Z		ENS READY

DD Form 175-1, Sep 89 *Previous edition may be used.* S/N 0102-LF-008-4200

Figure 4-9 Part V: Briefing Record Section

Assignment of Void Time

Block 37 will show the void time of the weather brief. In accordance with OPNAVINST 3710.7, Navy and Marine Corps forecasters are required to provide flight weather briefings (DD 175-1 or VFR stamps) within 2 hours of ETD and to assign briefing void times that do not exceed ETD plus one-half hour. For example, for an ETD of 2200Z, the weather must be briefed no earlier than 2000Z, and actual departure must be no later than 2230Z.

If it appears that takeoff will occur outside this window of time (a total of 2 ½ hours after the brief time in Block 34) the weather brief needs to be updated. This can be accomplished via telephone before walking for the flight, or from the cockpit via radio before takeoff. If the weather brief as first given is still applicable, then it may be extended, and the aircrew should indicate this in Blocks 38 - 40. Depending on conditions, however, it may have to be rebriefed completely. In either case, the new valid time for a rebriefed forecast is subject to the same limitations as the original void time: one-half hour after the new ETD (provided to the forecaster so that the appropriate weather could be determined). This new void time needs to be entered into Block 38 by the aircrew, and the time in Block 39 should reflect the time at which the re-briefing is completed. Block 40 is provided for aircrew to indicate the initials of the forecaster who updated the weather brief. Finally, Block 41 is filled in at the time of the original brief to indicate the rank and last name of the person receiving the briefing, noted for METRO records.

Responsibility for the Brief

The ultimate responsibility for obtaining a complete weather briefing rests with the pilot in command. A forecaster will usually be present to provide the weather briefing, but this in no way relieves the pilot of the responsibility for the safe conduct of the flight. A recommended procedure for the professional pilot is to review pertinent weather information to build an overall picture of the weather and consult with the forecaster for a complete briefing. A pilot using this technique can communicate with the forecaster on a two-way basis rather than relying on the forecaster to provide all the relevant information. In case conditions do not develop as forecast, a pilot will then be able to make an intelligent decision based on information gained during the preflight weather briefing. Upon completion of this unit, it is recommended that you visit your local meteorological office to get a feel for how it operates and how the staff displays weather information or otherwise makes data available to aviators.

STUDY QUESTIONS

Flight Weather Briefing Form, DD Form 175-1

1. Which one of the following correctly lists the five sections of the DD 175-1?

   a. Takeoff Data, En route Data, Landing Data, Flight Level Data, Void Time
   b. Mission Data, Takeoff Data, En route Data, Terminal Forecasts, Briefing Record
   c. Mission/Takeoff Data, En route Data, Terminal Forecasts, Comments/Remarks, Briefing Record
   d. Mission/Takeoff Data, En route Data, Terminal Forecasts, Briefing Record, Void Time

2. All information in Part I of the DD 175-1 must always be completed for all IFR flights.

   a. True b. False

3. Which one of the following should be the first source to check when beginning the flight planning process?

   a. WW c. FD
   b. WD d. FA

4. Which one of the following sources of information would be the best for determining the flight level winds and temperatures en route?

   a. Winds-Aloft Prognostic Charts c. Weather Depiction Chart
   b. Winds-Aloft Forecasts d. Radar Summary Chart

5. Which one of the following sources of information would be the best for determining minimum ceilings en route?

   a. Weather Depiction Chart c. METAR
   b. TAF d. PIREP

6. Which one of the following sources of information would be the best for determining the maximum cloud tops en route?

   a. Weather Depiction Chart c. FD
   b. METAR d. Radar Summary Chart

7. Which one of the following sources of information would be the best for determining the minimum freezing level en route?

a. Weather Depiction Chart
b. AIRMET Sierra
c. Low Level Sig Weather Prog Chart
d. Radar Summary Chart

8. Which one of the following sources of information would be the best for determining the intensity and coverage of thunderstorms en route?

a. Weather Depiction Chart
b. AIRMET Sierra
c. Low Level Sig Weather Prog Chart
d. Radar Summary Chart

9. Which one of the following sources of information would NOT be used for determining the intensity and location of turbulence en route?

a. SIGMET
b. AIRMET Tango
c. Low Level Sig Weather Prog Chart
d. Surface Analysis Chart

10. Which one of the following sources of information would be the best for determining if any icing will be encountered en route?

a. CWA
b. AIRMET Zulu
c. Weather Depiction Chart
d. Surface Analysis Chart

11. Which one of the following sources of information would NOT be used for determining the type of precipitation that may be encountered en route?

a. METAR
b. Surface Prognostic Chart
c. Low Level Sig Weather Prog Chart
d. Radar Summary Chart

12. Which one of the following types of information would NOT be a main consideration in the selection of the best flight level?

a. Wind component
b. Thunderstorms
c. RCR
d. Icing

13. Which one of the following would be the best choice for an alternate landing airfield, given the information presented throughout this chapter and the section discussing Figure 4-6?

a. An alternate is not required
b. KSPS
c. KTUL
d. KTIK

14. Which one of the following sources of information would be the best for determining whether an alternate is required?

a. METAR
b. TAF
c. FA
d. Weather Depiction Chart

15. Which one of the following correctly states the maximum length of time after the ETD that a DD 175-1 can be valid, according to OPNAVINST 3710.7?

a. ½ hour
b. 1 hour
c. 1 ½ hours
d. 2 ½ hours

16. Which one of the following correctly states the maximum overall length of time a DD 175-1 can be valid, according to OPNAVINST 3710.7?

a. ½ hour
b. 1 hour
c. 1 ½ hours
d. 2 ½ hours

17. Which one of the following people maintains the ultimate responsibility for the weather briefing?

a. Meteorologist
b. Navigator/co-pilot
c. Commanding Officer
d. Pilot in command

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APPENDIX A

GLOSSARY

ACTUAL TIME OF OBSERVATION – For METAR reports, it is the time the last element of the report is observed or evaluated. For SPECI reports, it is the time that the criteria for a SPECI were met or noted.

ADIABATIC – The word applied in the science of thermodynamics to a process during which no heat is communicated to or withdrawn from the body or system concerned. Adiabatic changes of atmospheric temperatures are those that occur only in consequence of compression or expansion accompanying an increase or a decrease of atmospheric pressure.

AIRCRAFT MISHAP – An inclusive term to denote the occurrence of an aircraft accident or incident.

ALTIMETER SETTING – Pressure of the reporting station converted in order to produce a reading on altimeters of field elevation at 10 feet above the runway (normal installation height of the altimeter). Altimeter settings are given in inches of mercury and represent sea level pressure.

ATMOSPHERIC PRESSURE – The force exerted by the weight of the atmosphere from the level of measurement to its outer limits.

AUGMENTED REPORT – A meteorological report prepared by an automated surface weather observing system for transmission with certified weather observers signed on to the system to add information to the report.

AUTOMATED REPORT – A meteorological report prepared by an automated surface weather observing system for transmission, and with no certified weather observers signed on to the system.

BLOWING DUST – Dust raised by the wind to moderate heights above the ground and restricting horizontal visibility to less than seven miles. If visibility reduced to between 5/8 and 5/16 then a duststorm; if less than 5/16, a severe duststorm.

BLOWING SAND – Sand raised by the wind to moderate heights above the ground and restricting horizontal visibility to less than seven miles. If visibility reduced to between 5/8 and 5/16 then a Sandstorm; if less than 5/16, a severe Sandstorm.

BLOWING SNOW – Snow particles raised and stirred violently by the wind to moderate or great heights. Visibility is poor (six miles or less) and the sky may become obscured when the particles are raised to great heights.

BLOWING SPRAY – Spray raised in such quantities as to reduce the visibility at eye level (6 feet on shore, 33 feet at sea) to six miles or less.

BROKEN LAYER – A cloud layer covering whose summation amount of sky cover is 5/8 through 7/8.

CALM – A condition when no motion of the air is detected.

CEILING – The height above the earth's surface (field elevation or ground elevation) of the lowest non-surface based layer that is reported as broken or overcast, or the vertical visibility into an indefinite ceiling.

CEILOMETER – A device used to evaluate the height of clouds or the vertical visibility into a surface-based obscuration.

CELSIUS – The ninth General Conference of Weights and Measures, held in October 1948, adopted the name Celsius in place of centigrade in honor of its originator, Anders Celsius (1704-1744), a Swedish astronomer who devised the scale.

CLEAR-AIR TURBULENCE (CAT) – Turbulence encountered when flying through air devoid of clouds, produced primarily by thermals and wind shear, including proximity to the jet stream.

CLEAR SKY (SKC) – The state of the sky when it is cloudless.

CLOUD-AIR LIGHTNING (CA) – Streaks of lightning, which pass from a cloud to the air, but do not strike the ground.

CLOUD-CLOUD LIGHTNING (CC) – Streaks of lightning reaching from one cloud to another.

CLOUD-GROUND LIGHTNING (CG) – Lightning occurring between cloud and ground.

CLOUD HEIGHT – The height of the base of a cloud or cloud layer above the surface of the Earth.

CONTOUR LINE – A line connecting points of equal (constant) height on a Constant-Pressure Chart.

COORDINATED UNIVERSAL TIME (UTC) – The time in the zero meridian time zone.

CUMULUS – A principal cloud type in the form of individual, detached elements that are generally dense and possess sharp non-fibrous outlines.

CUMULONIMBUS – An exceptionally dense and vertically developed cloud, occurring either isolated or as a line or wall of clouds with separated upper portions. These clouds appear as mountains or huge towers, at least a part of the upper portions of which are usually smooth, fibrous, or striated, and almost flattened.

DESIGNATED RVR RUNWAY – A runway at civilian airports designated by the FAA for reporting RVR in long-line transmissions.

DEW POINT – The temperature to which a given parcel of air must be cooled at constant pressure and constant water-vapor content in order for saturation to occur.

DISPATCH VISUAL RANGE – A visual range value derived from an automated visibility sensor.

DRIZZLE – Fairly uniform precipitation composed exclusively of fine drops (diameter less than 0.02 inch or 0.5 mm) very close together. Drizzle appears to float while following air current, although unlike fog droplets, it falls to the ground.

DRY ADIABATIC LAPSE RATE – The rate of decrease of temperature with height, approximately equal to 3 °C per 1000 feet. This is close to the rate at which an ascending body of unsaturated air will cool by adiabatic expansion.

DUSTSTORM – An unusual, frequently severe weather condition characterized by strong winds and dust-filled air over an extensive area.

FEW – A layer whose summation amount of sky cover is 1/8 through 2/8.

FIELD ELEVATION – The elevation above sea level of the highest point on any of the runways of the airport.

FOG – A visible aggregate of minute water particles (droplets) which are based at the Earth's surface and reduce horizontal visibility to less than 5/8 statute mile and, unlike drizzle, it does not fall to the ground.

FREEZING – A descriptor, FZ, used to describe drizzle and/or rain that freezes on contact with the ground or exposed objects, and used also to describe fog that is composed of minute ice crystals.

FREEZING DRIZZLE – Drizzle that freezes upon impact with the ground, or other exposed objects.

FREEZING FOG – A suspension of numerous minute ice crystals in the air, or water droplets at temperatures below 0°Celsius, based at the Earth's surface, which reduces horizontal visibility. Also called ice fog.

FREEZING PRECIPITATION – Any form of precipitation that freezes upon impact and forms a glaze on the ground or exposed objects.

FREEZING RAIN – Rain that freezes upon impact and forms a glaze on the ground or exposed objects.

FROZEN PRECIPITATION – Any form of precipitation that reaches the ground in solid form (snow, small hail and/or snow pellets, snow grains, hail, ice pellets, and ice crystals).

FUNNEL CLOUD – A violent, rotating column of air which does not touch the ground, usually appended to a cumulonimbus cloud (see tornado and waterspout).

GLAZE – Ice formed by freezing precipitation covering the ground or exposed objects.

GRAUPEL – Granular snow pellets, also called soft hail.

GUST – Rapid fluctuations in wind speed with a variation of 10 knots or more between peaks and lulls.

HAIL – Precipitation in the form of small balls or other pieces of ice falling separately or frozen together in irregular lumps.

HAZE – A suspension in the air of extremely small, dry particles invisible to the naked eye and sufficiently numerous to give the air an opalescent appearance.

HECTOPASCAL – A unit of measure of atmospheric pressure equal to 100 newtons per square meter, abbreviated hPa.

ICE CRYSTALS (DIAMOND DUST) – A fall of unbranched (snow crystals are branched ice crystals in the form of needles, columns, or plates.

ICE PELLETS (PL) – Precipitation of transparent or translucent pellets of ice, which are round or irregular, rarely conical, and which have a diameter of 0.2 inch (5 mm), or less. There are two main types:

a. Hard grains of ice consisting of frozen raindrops, or largely melted and refrozen snowflakes.

b. Pellets of snow encased in a thin layer of ice which have formed from the freezing of either droplets intercepted by the pellets or of water resulting from the partial melting of the pellets.

IN-CLOUD LIGHTNING (IC) – Lightning which takes place within the thundercloud.

INDEFINITE CEILING – The ceiling classification applied when the reported ceiling value represents the vertical visibility upward into surface-based obscuration.

INSOLATION – INcoming SOLar radiATION. The total amount of energy radiated by the Sun that reaches the Earth's surface. Insolation is the primary source for all weather phenomena on the Earth.

INTENSITY QUALIFIER – Intensity qualifiers are used to describe whether a phenomenon is light (–), moderate (no symbol used), or heavy (+).

ISOBAR – A line on a chart or diagram drawn through places or points having the same barometric pressure. (Isobars are customarily drawn on weather charts to show the horizontal distribution of atmospheric pressure reduced to sea level or the pressure at some specified altitude.)

ISOTACH – A line joining points of equal wind speed.

ISOTHERM – A line on a chart or diagram drawn through places or points having equal temperature.

LOW DRIFTING – A descriptor, DR, used to describe snow, sand, or dust raised to a height of less than six feet above the ground.

LOW DRIFTING DUST – Dust raised by the wind to less than six feet above the ground; visibility is not reduced below seven statute miles at eye level, although objects below this level may be veiled or hidden by the particles moving nearly horizontal to the ground.

LOW DRIFTING SAND – Sand raised by the wind to less than six feet above the ground; visibility is not reduced below seven statute miles at eye level, although objects below this level may be veiled or hidden by the particles moving nearly horizontal to the ground.

LOW DRIFTING SNOW – Snow raised by the wind to less than six feet above the ground; visibility is not reduced below seven statute miles at eye level, although objects below this level may be veiled or hidden by the particles moving nearly horizontal to the ground.

MANUAL STATION – A station, with or without an automated surface weather observing system, where the certified observers are totally responsible for all meteorological reports that are transmitted.

METAR/SPECI – An evaluation of select weather elements from a point or points on or near the ground according to a set of procedures. It may include type of report, station identifier, date and time of report, a report modifier, wind, visibility, runway visual range, weather and obstructions to vision, sky condition, temperature and dew point, altimeter setting, and Remarks.

MILLIBAR – (Bar – a unit of pressure equal to 1,000,000 dynes per square centimeter.) A millibar is equal to 1/1000 of a bar.

MIST – A hydrometer consisting of an aggregate of microscopic and more-or-less hygroscopic water droplets or ice crystals suspended in the atmosphere that reduces visibility to less than six statute miles but greater than or equal to 5/8 statute mile.

MOIST ADIABATIC LAPSE RATE – See Saturated Adiabatic Lapse Rate.

NON-UNIFORM SKY CONDITION – A localized sky condition which varies from that reported in the body of the report.

NON-UNIFORM VISIBILITY – A localized visibility which varies from that reported in the body of the report.

OBSCURED SKY – The condition when the entire sky is hidden by a surface-based obscuration.

OBSCURATION – Any aggregate of particles in contact with the earth's surface that is dense enough to be detected from the surface of the earth. Also, any phenomenon in the atmosphere, other than precipitation, that reduces the horizontal visibility.

OVERCAST – A layer of clouds whose summation amount of sky cover is 8/8.

PARTIAL – A descriptor, PR, used only to report fog that covers part of the airport.

PARTIAL FOG – Fog covering part of the station and which extends to at least six feet above the ground and apparent visibility in the fog is less than 5/8 SM. Visibility over parts of the station is less than or equal to 5/8 SM.

PARTIAL OBSCURATION – The portion of the sky cover (including higher clouds, the moon, or stars) hidden by weather phenomena in contact with the surface.

PATCHES – A descriptor, BC, used only to report fog that occurs in patches at the airport.

PATCHES (OF) FOG – Fog covering part of the station which extends to at least six feet above the ground and the apparent visibility in the fog patch or bank is less than 5/8 SM. Visibility in parts of the observing area is greater than or equal to 5/8 SM, when the fog is close to the point of observation, the minimum visibility reported will be less than 5/8 SM.

PEAK WIND SPEED – The maximum instantaneous wind speed since the last METAR that exceeded 25 knots.

PRECIPITATION DISCRIMINATOR – A sensor, or array of sensors, that differentiates between different types of precipitation (liquid, freezing, frozen).

PRESSURE FALLING RAPIDLY – A decrease in station pressure at a rate of 0.06 inch of mercury or more per hour which totals 0.02 inch or more.

PRESSURE RISING RAPIDLY – An increase in station pressure at a rate of 0.06 inch of mercury or more per hour which totals 0.02 inch or more.

PREVAILING VISIBILITY – The visibility considered representative of conditions at the station; the greatest distance that can be seen throughout at least half the horizon circle, not necessarily continuous.

RADIOSONDE – A balloon-borne instrument used to measure the temperature, pressure and humidity aloft.

RAIN – Precipitation of liquid water particles, either in the form of drops larger than .02 inch (0.5 mm) or smaller drops which, in contrast to drizzle, are widely separated.

ROTOR CLOUD – A turbulent cloud formation found in the lee of some large mountain barriers. The air in the cloud rotates around an axis parallel to the mountain range.

RUNWAY VISUAL RANGE (RVR) – An instrumentally derived value, based on standard calibrations, that represents the horizontal distance a pilot may see down the runway from the approach end.

SANDSTORM – Particles of sand ranging in diameter from 0.008 to 1 mm that are carried aloft by a strong wind. The sand particles are mostly confined to the lowest ten feet, and rarely rise more than fifty feet above the ground.

SATURATED ADIABATIC LAPSE RATE – A rate of decrease of temperature with height equal to the rate at which an ascending body of saturated air will cool during adiabatic expansion. This value will vary, but is considered to average about 1.5ºC per 1000 feet.

SCATTERED – A layer whose summation amount of sky cover is 3/8 through 4/8.

SCHEDULED TIME OF REPORT – The time a schedule report is required to be available for transmission.

SEA-LEVEL PRESSURE – The pressure value obtained by the theoretical reduction or increase of barometric pressure to sea-level; measured in hectopascals (millibars).

SECTOR VISIBILITY – The visibility in a specified direction that represents at least a 45º arc of the horizon circle.

SHALLOW – A descriptor, MI, used only to describe fog when the visibility at six feet above the ground is 5/8 statute mile or more and the apparent visibility in the fog layer is less than 5/8 statute mile.

SHALLOW FOG – Fog in which the visibility at six feet above ground level is 5/8 statute mile or more and the apparent visibility in the fog layer is less than 5/8 statute mile.

SHOWER(S) – A descriptor, SH, used to qualify precipitation characterized by the suddenness with which they start and stop, by the rapid changes of intensity, and usually by rapid changes in the appearance of the sky.

SIGNIFICANT CLOUDS – Cumulonimbus, cumulonimbus mammatus, towering cumulus, altocumulus castellanus, and standing lenticular or rotor clouds.

SKY CONDITION – The state of the sky in terms of such parameters as sky cover, layers and associated heights, ceiling, and cloud types.

SKY COVER – The amount of the sky, which is covered by clouds or partial obscurations in contact with the surface.

SMOKE – A suspension in the air of small particles produced by combustion. A transition to haze may occur when smoke particles have traveled great distances (25 to 100 statute miles or more) and when the larger particles have settled out and the remaining particles have become widely scattered through the atmosphere.

SNOW – Precipitation of snow crystals, mostly branched in the form of six-pointed starts; for automated stations, any form of frozen precipitation other than hail.

SNOW GRAINS – Precipitation of very small, white opaque grains of ice; the solid equivalent of drizzle.

SNOW PELLETS – Precipitation of white, opaque grains of ice. The grains are round or sometimes conical. Diameters range from about 0.08 to 0.2 inch (two to five mm).

SPRAY – An ensemble of water droplets torn by the wind from an extensive body of water, generally from the crests of waves, and carried up into the air in such quantities that it reduces the horizontal visibility.

SPECI – A surface weather report taken to record a change in weather conditions that meets specified criteria or is otherwise considered to be significant.

SQUALL – A strong wind characterized by a sudden onset in which wind speeds increase to at least 16 knots and are sustained at 22 knots or more for at least one minute.

STANDARD ATMOSPHERE – A hypothetical vertical distribution of the atmospheric temperature, pressure, and density, which by international agreement is considered to be representative of the atmosphere for pressure-altimeter calibrations and other purposes (29.92 in-Hg or 1013 Pa).

STANDING LENTICULAR CLOUD – A more or less isolated cloud with sharp outlines that is generally in the form of a smooth lens or almond. These clouds often form on the lee side of and generally parallel to mountain ranges. Depending on their height above the surface, they may be reported as stratocumulus standing lenticular cloud (SCSL), altocumulus standing lenticular (ACSL), or cirrocumulus standing lenticular cloud (CCSL).

STATION ELEVATION – The officially designated height above sea level to which station pressure pertains. It is generally the same as field elevation at an airport station.

STATION IDENTIFIER – A four-alphabetic character code group used to identify the observing location.

STATION PRESSURE – Atmospheric pressure computed for the level of the station elevation.

SUMMATION LAYER AMOUNT – A categorization of the amount of sky cover at and below each reported layer of cloud.

SUMMATION PRINCIPLE – This principle states that the sky cover at any level is equal to the summation of the sky cover of the lowest layer, plus the additional sky cover present at all successively higher layers up to and including the layer being considered.

SURFACE VISIBILITY – The prevailing visibility determined from the usual point of observation.

SYNOPTIC CHART – A chart, such as the ordinary weather map, which shows the distribution of meteorological conditions over an area at a given moment.

THUNDERSTORM – A descriptor, TS, used to qualify precipitation produced by a cumulonimbus cloud that is accompanied by lightning and thunder, or for automated systems, a storm detected by lightning detection systems.

TIME OF OCCURRENCE – A report of the time weather begins and ends.

TORNADIC ACTIVITY – The occurrence or disappearance of tornadoes, funnel clouds, or waterspouts.

TORNADO – A violent, rotating column of air touching the ground; funnel cloud touches the ground (see funnel cloud and water spout).

TOWER VISIBILITY – The prevailing visibility determined from the airport traffic control tower when the surface visibility is determined from another location.

TOWERING CUMULUS – A descriptive term for a cloud with generally sharp outlines and with moderate to great vertical development, characterized by its cauliflower or tower appearance.

UNKNOWN PRECIPITATION – Precipitation type that is reported if the automated station detects the occurrence of light precipitation but the precipitation discriminator cannot recognize the type.

VARIABLE CEILING – A ceiling of less than 3000 feet which rapidly increases or decreases in height by established criteria during the period of observation.

VARIABLE LAYER AMOUNTS – A condition when the reportable amount of a layer varies by one or more reportable values during the period it is being evaluated (variable sky condition).

VARIABLE PREVAILING VISIBILITY – A condition when the prevailing visibility is less than three statute miles and rapidly increases and decreases by 1/2 mile or more during the period of observation.

VARIABLE WIND DIRECTION – A condition when (1) the wind direction fluctuates by 60º or more during the two-minute evaluation period and the wind speed is greater than six knots; or (2) the direction is variable and the wind speed is six knots or less.

VERTICAL VISIBILITY – A subjective or instrumental evaluation of the vertical distance into a surface-based obscuration that an observer would be able to see.

VICINITY – A proximity qualifier, VC, used to indicate weather phenomena observed between five and ten statute miles of the usual point of observation but not at the station.

VIRGA – Visible wisps or strands of precipitation falling from clouds that evaporate before reaching the surface.

VISIBILITY – The greatest horizontal distance at which selected objects can be seen and identified or its equivalent derived from instrumental measurements.

VOLCANIC ASH – Fine particles of rock powder that originate blown out from a volcano and that may remain suspended in the atmosphere for long periods. The ash is a potential hazard to aircraft operations and may be an obscuration.

VOLCANIC ERUPTION – An explosion caused by the intense heating of subterranean rock which expels lava, steam, ashes, etc., through vents in the earth's crust.

WATERSPOUT – A violent, rotating column of air that forms over a body of water, and touches the water surface; tornado or funnel cloud that touches a body of water (see funnel cloud and tornado).

WELL-DEVELOPED DUST/SAND WHIRL – An ensemble of particles of dust or sand, sometimes accompanied by small litter, raised from the ground in the form of a whirling column of varying height with a small diameter and an approximately vertical axis.

WIDESPREAD DUST – Fine particles of earth or other matter raised or suspended in the air by the wind that may have occurred at or far away from the station.

WIND SHIFT – A change in the wind direction of 45º or more in less than 15 minutes with sustained wind speeds of 10 knots or more throughout the wind shift.

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APPENDIX B

COMMON WEATHER CONTRACTIONS

A

ABT ..... about
ABV ..... above
AC ..... altocumulus
ACS ..... across
ACFT ..... aircraft
ACRS ..... across
ACTVTY/ACT ..... activity
ADJ ..... adjacent
ADVY ..... advisory
AFT ..... after
AGL ..... above ground level
AHD ..... ahead
ALF ..... aloft
ALG ..... along
ALQDS ..... all quadrants
AMS ..... air mass
AOB ..... at or below
APRNT ..... apparent
AR ..... Arkansas
ARPT ..... airport
ATLC ..... Atlantic
AUTO ..... automated weather report

B

B ..... began
BA ..... breaking action
BC ..... patches
BCM ..... become
BCMG ..... becoming
BGNG ..... beginning
BHND ..... behind
BINOVC ..... breaks in overcast
BKN ..... broken
BL ..... blowing
BLDPS ..... buildups
BLO/BLW ..... below
BNDRY ..... boundary
BR ..... mist
BRFLY ..... briefly

BTWN ..... between
BYD ..... beyond

C

C ..... ceiling
CA ..... clear above
CAT ..... clear air turbulence
CBS/CB ..... cumulonimbus
CDFNT/CFP ..... cold front
CDT ..... Central Daylight Time
CHC ..... chance
CI ..... cirrus
CIG ..... ceiling
CIGS ..... ceilings
CLD ..... cold
CLDS ..... clouds
CLR ..... clear (used at automated stations)
CLSD ..... closed
CNCL ..... cancel
CNTRD/CNTR ..... centered
CNTRL/CTRL ..... central
CNSDBLY ..... considerably
CNVGNC ..... convergence
CNVTV ..... convective
CO ..... Colorado
CONDS ..... conditions
CON/CONTD ..... continue
CONS ..... continuous
CONTG ..... continuing
COR ..... correction
CST ..... Central Standard Time
CSTL ..... coastal
CTC ..... contact
CU ..... cumulus
CUFA ..... cumulofractus

D

D ..... dust
DCRG ..... decreasing
DEP ..... depth
DMSHG ..... diminishing
DR ..... dropping rapidly

B-2 COMMON WEATHER CONTRACTIONS

DR ..... low drifting
DRFTG ..... drifting
DS ..... dust storm
DSIPTG ..... dissipating
DSNT ..... distant
DU ..... (widespread) dust
DURG ..... during
DURCG ..... during climb
DURGD ..... during descent
DVLP/DVLPG ..... develop/developing
DVR ..... dispatch visual range
DZ ..... drizzle

E

E ..... ended/east
EBND ..... eastbound
ELSW ..... elsewhere
ELY ..... easterly
EMBDD ..... embedded
ERN ..... eastern
EST ..... estimated
EWD ..... eastward
EXCP/EXC ..... except
EXPCD/EXPCTD/EXPTD/EXP ..... expected
EXTM/EXTRM ..... extreme
EXTDS ..... extends

F

FAP ..... final approach
FEW ..... few clouds
FC ..... funnel cloud(s)
FCST ..... forecast
FG ..... fog
FIBI ..... filed but impractical to transmit
FL ..... flight level/Florida
FLT ..... flight
FM ..... from
FNT ..... front
FNTL ..... frontal
FRQ ..... frequent
FQTLY ..... frequently

FRMG ..... forming
FROPA ..... frontal passage

FRMG..... forming
FROPA..... frontal passage
FRTHR..... further

FRZLVL..... freezing level
FT..... feet
FU..... smoke
FXD..... fixed
FVRBL..... favorable
FZ..... freezing
FZRNO..... freezing rain sensor not available

G

G..... gust/gusting
GA..... Georgia
GND..... ground
GR..... hail (graupel)
GRT/GTR..... greater
GS..... small hail/snow pellets
GULFMEX/GLF..... Gulf of Mexico

H

H/HZ..... haze
HALF..... haze aloft
HGTS..... heights
HI..... high
HLSTO/GR/GS..... hailstone
HZ..... haze

I

IA..... Iowa
IC..... icing/ice crystals
ICGIC..... icing in clouds
ICGICIP..... icing in clouds & in precipitation
ID..... Idaho
IFR..... Instrument Flight Rules
IL..... Illinois
IMPVG/IPVG..... improving
INC..... in clouds
IN..... inch
IN..... Indiana

INCRG ..... increasing
INTMT ..... intermittent
INTSFYG ..... intensifying
INSTBY ..... instability
INVOF ..... in vicinity of

ISLTD/ISOLD ..... isolated

J

JSTR ..... jet stream

K

K/FU ..... smoke
KALF ..... smoke aloft
KOCTY ..... smoke over city
KS ..... Kansas
KT ..... knot
KTS ..... knots

L

LCL ..... local
LCLY ..... locally
LE ..... Lake Erie
LGT ..... light
LI ..... lifted index
LLWS ..... low level wind shear
LN ..... line
LOC ..... location identifier
LO ..... low
LRG ..... large
LTG ..... lightning
LTGCA ..... lightning cloud to air
LTGCCCG ..... lightning cloud to cloud and cloud to ground
LTGCG ..... lightning cloud to ground
LTGIC ..... lightning in cloud
LTL ..... little
LTLCHG ..... little change
LVL ..... level
LWR ..... lower
LWRG ..... lowering
LYR/LYRD ..... layer/layered

M

M ..... minus; less than
MALSR ..... medium intensity approach lighting system
MAX ..... maximum
MDT/MOD ..... moderate

MEGG ..... merging
METAR ..... aviation routine weather report
MI ..... Michigan
MI ..... miles
MI ..... shallow
MO ..... Missouri
MOGR ..... moderate or greater
MOV ..... move
MOVD ..... moved
MOVG\MVG ..... moving
MS ..... Mississippi
MSL ..... mean sea level
MST ..... most
MSTLY ..... mostly
MSTR ..... moisture
MT ..... mountains/Montana
MTN/MTNS ..... mountain/mountains
MULTILYRD ..... multi layered
MVFR ..... Marginal Visual Flight Rules
MXD ..... mixed

N

N ..... north
ND ..... North Dakota
NE ..... Nebraska or northeast
NEG ..... negative
NEWD ..... northeastward
NJ ..... New Jersey
NMRS ..... numerous
NNEWD ..... north-northeastward
NR ..... near
NRLY ..... nearly
NRN ..... northern
NW ..... northwest
NWD ..... northward
NWLY ..... northwesterly

O

OBSCD.....obscured
OBSCG..... obscuring
OBSCN.....obscuration
OCNL..... occasional
OCNLY ..... occasionally

OMTS..... over mountains
OR ..... Oregon
OTLK .....outlook
OTRW .....otherwise
OTS ..... out of service
OVC .....overcast
OVHD .....overhead
OVR ..... over

P

P.....plus; greater than
PCPN.....precipitation
PE ..... ice pellets
PNHDL.....panhandle
PK.....peak
PK WND .....peak wind
PO..... well-developed dust/sand whirls
PR.....partial
PRCTN.....precautions
PRD.....period
PRES .....pressure
PRESFR ..... pressure falling rapidly
PRESRR.....pressure rising rapidly
PSBL/POSS.....possible
PTN/PTNS ..... portion/portions
PY.....spray

R

R ..... runway
RA .....rain
RDG ..... reading
REPTD/RPRTD/RPTD.....reported
RGD ..... ragged
RMN.....remain

RMNDR ..... remainder
RQR ..... require
RTD ..... routine delayed observation
RVR ..... runway visual range
RVRNO ..... RVR not available
RWU ..... rain shower intensity unknown
RWY/RY ..... runway

S

S ..... south
SA ..... sand
SCSL ..... stratocumulus standing lenticular cloud
SCT ..... scattered
SD ..... South Dakota
SE ..... southeast
SECS ..... sections
SERN ..... southeastern
SEWD ..... southeastward
SEV/SVR ..... severe
SFC ..... surface
SG ..... snow grains
SGFNT/SIG ..... significant
SH ..... shower(s)
SHD/SHLD ..... should
SHFTG ..... shifting
SHLW ..... shallow
SHWRS ..... showers
SIG CLD ..... significant cloud
SKC ..... sky clear
SLD ..... solid
SLGT ..... slight
SLP ..... sea level pressure
SLPG ..... sloping
SLPNO ..... sea level pressure not available
SLY ..... southerly
SM ..... statute miles
SMTH ..... smooth
SN ..... snow
SNBXX ..... snow began xx minutes after the hour
SPECI ..... a special observation
SPRDG ..... spreading
SQ ..... squalls
SQLN ..... squall line

SRN ..... southern
SS ..... sand storm
ST ..... stratus
STFRA ..... stratofractus
STG ..... strong
STN ..... station
STNRY ..... stationary
SVRL ..... several
SWD/SWRD/SWWD ..... southwestward

SW ..... snow showers or southwest
SYNS ..... synopsis

T

TAF ..... terminal aerodrome forecast
TCU ..... towering cumulus
TE ..... thunder ended
TEMPS ..... temperatures
THN ..... thin
THRU ..... through
THSD ..... thousand
TIL ..... until
TS/TSTMS ..... thunderstorms
TURB ..... turbulence
TWR ..... tower

U

UP ..... unknown precipitation
UPR ..... upper
UTC ..... Coordinated Universal Time
UDDF ..... updrafts and downdrafts
UNK/UNKN ..... unknown
UNSTBL ..... unstable
UP ..... unknown precipitation

V

V ..... variable
VA ..... volcanic ash
VC/VCNTY ..... vicinity
VFR ..... Visual Flight Rules
VIS ..... visibility
VLYS ..... valleys

VOR .....Very high frequency/Omni-directional Range
VR .....visual range
VRB/VRBL..... variable
VRY ..... very
VSBYDR.....visibility decreasing rapidly
VV .....vertical visibility

W

W .....west
WA .....Washington
WBND.....westbound
WDLY ..... widely
WL.....will
WM ..... warm
WND ..... wind
WRN .....western
WS.....wind shear
WSCONDS ..... wind shear conditions
WSHFT ..... wind shift
WTRS.....waters
WX .....weather

X

XCP/XCPT.....except
XTNDG..... extending

Z

Z .....Zulu Time (UTC)

WIND DIRECTIONS (8 POINTS)

N	NORTH	000° or 360°
NE	NORTHEAST	045°
E	EAST	090°
SE	SOUTHEAST	135°
S	SOUTH	180°
SW	SOUTHWEST	225°
W	WEST	270°
NW	NORTHWEST	315°

For additional contractions, acronyms, and locations not found in this Appendix, consult Section 14 of the AC 00-45E, Aviation Weather Services, available at the following location: http://www.faa.gov/avr/afs/afs400

B-10 COMMON WEATHER CONTRACTIONS

APPENDIX C

LOCATION IDENTIFIERS

KABI ..... Abilene, TX
KABQ ..... Albuquerque, NM
KABR ..... Aberdeen, SD
KABY ..... Albany, GA
KACT ..... Waco, TX
KACY ..... Atlantic City, NJ
KADM ..... Ardmore, OK
KAEX ..... England AFB, LA
KAGS ..... Augusta, GA
KALO ..... Waterloo, IA
KAMA ..... Amarillo, TX
KANB ..... Anniston, AL
KAND ..... Anderson, SC
KAQQ ..... Apalachicola, FL
KARG ..... Walnut Ridge, AR
KART ..... Watertown, NY
KATL ..... Atlanta, GA
KAUG ..... Augusta, TA
KAUS ..... Austin, TX
KAVL ..... Asheville, NC
KBAD ..... Barksdale AFB LA
KBAL ..... Baltimore, MD
KBFM ..... Brookley VOR, AL
KBGS ..... Big Springs, TX
KBHM ..... Birmingham, AL
KBIS ..... Bismarck, ND
KBIX ..... Biloxi, MS
KBLD ..... Boulder City, NV
KBLH ..... Blythe, CA
KBNA ..... Nashville, TN
KBOI ..... Boise, ID
KBOS ..... Boston, MA
KBPT ..... Beaumont, TX
KBRO ..... Brownsville, TX
KBSM ..... Bergstrom AFB, TX
KBTR ..... Baton Rouge, LA
KBWG ..... Bowling Green KY
KCAE ..... Columbia, SC
KCBM ..... Columbus, MS
KCDW ..... Caldwell, NJ
KCDS ..... Childress, TX
KCEW ..... Crestview, FL
KCHA ..... Chattanooga, TN
KCHI ..... Chicago, IL
KCHS ..... Charleston, SC
KCID ..... Cedar Rapids, IA
KCLL ..... College Station, TX
KCLT ..... Charlotte, NC
KCNU ..... Chanute, KS
KCOT ..... Cotulla, TX
KCOU ..... Columbia, MO
KCRP ..... Corpus Christi, TX
KCSV ..... Crossville, TN

KCTY ..... Cross City, FL
KCVG ..... Cincinnati, OH
KDAB ..... Daytona Beach, FL
KDAL ..... Dallas, TX
KDCA ..... Washington, DC
KDDC ..... Dodge City, KS
KDFW ..... Fort Worth, TX
KDHN ..... Dothan, AL
KDLF ..... Loughlin AFB, TX
KDOV ..... Dover AFB, DE
KDRT ..... Del Rio, TX
KDUA ..... Durant, OK
KDYR ..... Dyersburg, TN
KDYS ..... Dyess AFB, TX
KEFD ..... Ellington AFB, TX
KELP ..... El Paso, TX
KEND ..... Enid, OK
KEUG ..... Eugene, OR
KFAT ..... Fresno, CA
KFBG ..... Fort Bragg, NC
KFDY ..... Findley, OH
KFFO ..... Wright Patterson AFB, OH
KFLO ..... Florence, SC
KFMN ..... Farmington, NM
KFMY ..... Fort Myers, FL
KFOD ..... Fort Dodge, IA
KFSI ..... Fort Sill, OK
KFSM ..... Fort Smith, AR
KFTY ..... Fulton County VOR, GA
KFWH ..... Carswell AFB, TX
KFYV ..... Fayetteville, AR
KGAG ..... Gage, OK
KGCK ..... Garden City, KS
KGFA ..... Great Falls, MT
KGFK ..... Grand Forks, ND
KGGG ..... Longview, TX
KGLS ..... Galveston, TX
KGPT ..... Gulfport, MS
KGRI ..... Grand Island, NE
KGRK ..... Gray AAF, TX
KGSO ..... Greensboro, NC
KGUS ..... Grissom AFB, IN
KGUY ..... Guymon, OK
KGWO ..... Greenwood, MS
KHAR ..... Harrisburg, PA
KHAT ..... Cape Hatteras, NC
KHLR ..... Fort Hood AAF, TX
KHNN ..... Henderson, WV
KHOT ..... Hot Springs, AR
KHOU ..... Houston, TX
KHQM ..... Hoquiam, WA
KIAH ..... Houston, TX
KICT ..... Wichita, KS
KIGB ..... Columbus, MS
KILM ..... Wilmington, NC
KINK ..... Wink, TX

KINL ..... International Falls, MN
KJAN ..... Jackson, MS
KJAX ..... Jacksonville, FL
KLBE ..... Latrobe, PA
KLBF ..... North Platte, NE
KLBL ..... Liberal, KS
KLCH ..... Lake Charles, LA
KLEX ..... Lexington, KY
KLFK ..... Lufkin, TX
KLIT ..... Little Rock, AR
KLRD ..... Laredo, TX
KLRF ..... Little Rock, AR
KLTS ..... Altus, OK
KLUF ..... Luke AFB, AZ
KMCB ..... McComb, MS
KMEI ..... Meridian, MS
KMEM ..... Memphis, TN
KMGM ..... Montgomery, AL
KMIA ..... Miami, FL
KMKC ..... Kansas City, MO
KMLB ..... Melbourne, FL
KMLU ..... Monroe, LA
KMOB ..... Mobile, AL
KMOT ..... Minot, ND
KMRB ..... Martinsburg, WV
KMSP ..... Minneapolis, MN
KMSY ..... New Orleans, LA
KMXF ..... Maxwell AFB, AL
KNBE ..... Navy Dallas, TX
KNBU ..... Navy Glenview, IL
KNBG ..... New Orleans, LA
KNFB ..... Navy Detroit, MI
KNFL ..... NAS Fallon, NV
KNGZ ..... NAS Alameda, CA
KNID ..... NAF China Lake, CA
KNIP ..... Navy Jacksonville, FL
KNKT ..... MCAS Cherry Point, NC
KNKX ..... NAS Miramar, CA
KNMM ..... Navy Meridian, MS
KNPA ..... Navy Pensacola, FL
KNQA ..... Navy Memphis, TN
KNSE ..... Navy Whiting Field, FL
KNSU ..... NALF Monterey, CA
KNTD ..... NAS Pt Mugu, CA
KNTU ..... Navy Oceana, VA
KNUN ..... NAS Saufley Field, FL
KNUW ..... NAS Whidbey Island, WA
KNXX ..... Navy Willow Grove, PA
KNZY ..... NAS North Island, CA
KOFF ..... Offutt AFB, NE
KOKC ..... Oklahoma City, OK
KOKM ..... Okmulgee, OK
KOMA ..... Omaha, NE
KONP ..... Newport, OR
KORF ..... Norfolk, VA
KORL ..... Orlando, FL

KOUN ..... Norman, OK
KOZR ..... Cairns AFB, AL
KPAH ..... Paducah, KY
KPAM ..... Tyndall AFB, FL
KPBI ..... Palm Beach, FL
KPDX ..... Portland, OR
KPIE ..... St. Petersburg, FL
KPHL ..... Philadelphia, PA
KPHX ..... Phoenix, AZ
KPIT ..... Pittsburgh, PA
KPKB ..... Parkersburg, WV
KPNS ..... Pensacola, FL
KPOE ..... Fort Polk, LA
KPRC ..... Prescott, AZ
KPRX ..... Paris, TX
KPSB ..... Philipsburg, PA
KPUB ..... Pueblo, CO
KPWM ..... Portland, ME
KRAP ..... Rapid City, SD
KRDR ..... Grand Forks, ND
KRDU ..... Raleigh, NC
KRIV ..... March AFB, CA
KRND ..... Randolph AFB, TX
KRNO ..... Reno, NV
KRWI ..... Rocky Mount, NC
KSAN ..... San Diego, Ca
KSAT ..... San Antonio, TX
KSBA ..... Santa Barbara, CA
KSDF ..... Louisville, KY
KSEA ..... Seattle, WA
KSEM ..... Craig AFB, AL
KSFO ..... San Francisco, CA
KSGF ..... Springfield, MO
KSHV ..... Shreveport, LA
KSJT ..... San Angelo, TX
KSKF ..... Kelly AFB, CA
KSLC ..... Salt Lake City, UT
KSLN ..... Salina, KS
KSPS ..... Sheppard AFB, TX
KSTL ..... St. Louis, MO
KSUU ..... Travis AFB, CA
KSVN ..... Hunter AFB, GA
KTLH ..... Tallahassee, FL
KTIK ..... Tinker AFB, OK
KTOL ..... Toledo, OH
KTOP ..... Topeka, KS
KTPL ..... Temple, TX
KTRI ..... Bristol, TN
KTUL ..... Tulsa, OK
KTUS ..... Tucson, AZ
KVAD ..... Moody AFB, GA
KVPS ..... Eglin AFB, FL
KVRB ..... Vero Beach, FL
KWRB ..... Warner-Robbins AFB, GA
KWRI ..... McGuire AFB, NJ

INTERNATIONAL IDENTIFIERS

EGLL ..... Gatwick, England
PGUA ..... Andersen AFB, Guam, Mariana Islands
LEMD ..... Madrid, Spain
EDAH ..... Amsterdam, Holland

STATE ABBREVIATIONS

Alabama ..... AL
Alaska ..... AK
Arizona ..... AZ
Arkansas ..... AR
American Samoa ..... AS
California ..... CA
Colorado ..... CO
Connecticut ..... CT
Delaware ..... DE
District of Columbia ..... DC
Florida ..... FL
Georgia ..... GA
Guam ..... GU
Hawaii ..... HI
Idaho ..... ID
Illinois IL
Indiana ..... IN
Iowa ..... IA
Kansas ..... KS
Kentucky ..... KY
Louisiana ..... LA
Maine ..... ME
Maryland ..... MD
Massachusetts ..... MA
Michigan ..... MI
Minnesota ..... MN
Mississippi ..... MS
Missouri ..... MO
Montana ..... MT
Nebraska ..... NE
Nevada ..... NV
New Hampshire ..... NH
New Jersey ..... NJ
New Mexico ..... NM
New York ..... NY
North Carolina ..... NC

North Dakota ..... ND
Northern Mariana Island ..... CM
Ohio ..... OH
Oklahoma ..... OK
Oregon ..... OR
Pennsylvania ..... PA
Puerto Rico ..... PR
Rhode Island ..... RI
South Carolina ..... SC
South Dakota ..... SD
Tennessee ..... TN
Trust Territory ..... TT
Texas ..... TX
Utah ..... UT
Vermont ..... VT
Virginia ..... VA
Virgin Islands VI
Washington ..... WA
West Virginia ..... WV
Wisconsin ..... WI
Wyoming ..... WY

APPENDIX D

SELECTED WEATHER INFORMATION RESOURCES

Current as of November 2002

Aviation Weather Center
Homepage
http://www.aviationweather.gov

Frequently Asked Questions
http://www.awc-kc.gov/info/faq.html

Contractions frequently used in National Weather Service products
http://www.awc-kc.gov/info/domestic_contractions.html

Direct User Access Terminal Service – Free access to GTE DUATS is available to U.S. pilots and student pilots who hold current medical certificates, flight instructors without current medicals, aviation ground instructors, glider/balloon pilots, and other approved users in the U.S. aviation community.
http://www1.duats.com/

Landings.com Aviation Weather Information
http://www.landings.com/_landings/pages/wthr/av_weather.html

National Hurricane Center/Tropical Prediction Center
http://www.nhc.noaa.gov

National Oceanographic and Atmospheric Administration – Home Page
http://www.noaa.gov/

National Weather Service
Home Page
http://www.nws.noaa.gov/

Storm Prediction Center
http://www.spc.noaa.gov/

USA Today Aviation Weather links
http://www.usatoday.com/weather/wpilots0.htm

The Weather Channel – Home Page
http://www.weather.com

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APPENDIX E

ANSWERS TO STUDY QUESTIONS

CHAPTER 1

METAR Questions

1.	A	8.	B	15.	B	22.	D
2.	A	9.	B	16.	C	23.	A
3.	C	10.	D	17.	B	24.	D
4.	B	11.	C	18.	A	25.	B
5.	C	12.	D	19.	D		
6.	D	13.	C	20.	A		
7.	C	14.	A	21.	A		

TAF QUESTIONS

26.	D	30.	D	34.	A	38.	C
27.	C	31.	B	35.	A	39.	B
28.	B	32.	D	36.	C	40.	Yes
29.	A	33.	D	37.	D		

41. **NTU** ETA 1300Z: 100 / 1/2; ETA 1900Z: 700/3; ETA 0900Z: 700/4 (CIG)/(VSBY)

42. **DOV** ETA 1400Z: 200 / 1/2; ETA 1800Z: 700/3; ETA 0100Z: 700/5

43. **NBE** ETA 1415Z: 500 / 1; ETA 1920Z: 2000/3; ETA 0130Z: 500/2

44. **TIK** ETA 1300Z: 400 / 1; ETA 1545Z: 400/1/2; ETA 0300Z: 5000/>6

45. **SPS** ETA 1310Z: 800/3; ETA 1730Z: 1500/>6; ETA 2300Z: 3000/>6

46.

	NQA/ETA 0700Z	**NBG**/ETA 1600Z	**NMM**/ETA 0730Z
2 HOUR WINDOW	06-08Z	15-17Z	0630-0830Z
CEILING (MIN)	800	2500	NONE
VISIBILITY(MIN) /WEATHER(S)	1/TSHRA	>6 / None	1 / BR
ALTIMETER (LOWEST)	30.08	30.25	30.18
WINDS (MAX)	200/25G35	130/12	CALM
ICING (TYPE/ALTITUDES)	NONE/ N/A	MOD IN CLD/ 13-22K FT	NONE/ N/A
TURB (TYPE/ALTITUDES)	NONE/ N/A	MOD IN CLR OCNL/ 13-16K FT	SEV INCLR/ 20-25K FT

47. NQA - Yes
NBG - No
NMM - Yes

48. NQA - Yes
NBG - Yes
NMM - Yes

49. NQA - Ceilings and visibility
NBG - Ceilings only
NMM - Visibility only

CHAPTER 2

1. C	9. B	17. C	25. B	33. D
2. D	10. B	18. B	26. A	34. C
3. A	11. C	19. D	27. D	35. D
4. A	12. C	20. C	28. A	36. B
5. B	13. D	21. A	29. D	37. D
6. B	14. B	22. C	30. C	38. C
7. D	15. D	23. D	31. A	39. A
8. C	16. A	24. C	32. D	40. A

CHAPTER 3

1.	D	5.	A	9.	C	13.	C	17.	D
2.	C	6.	D	10.	B	14.	C	18.	D
3.	B	7.	B	11.	B	15.	D	19.	D
4.	C	8.	A	12.	D	16.	C	20.	D

CHAPTER 4

1.	C	5.	A	9.	D	13.	B	17.	D
2.	B	6.	D	10.	B	14.	B		
3.	A	7.	C	11.	A	15.	A		
4.	A	8.	D	12.	C	16.	D		

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APPENDIX F

FIGURES FOR EXAMINATION

KCBM 151755Z 00000KT 10SM SCT012 BKN029 OVC120 M06/M07 A2998 RMK IR18 SLP156

KFFO 100056Z 01023G35KT 1/2SM -SN BLSN SCT000 OVC005 M01/M03 A2964 RMK VIS3/8V5/8 BLSN SCT000 CIG004V006 SLP034

KHAR 151757Z 05015G22KT 1 1/2SM RA BR BKN011 OVC015 07/05 A2986 RMK PK WND 05025/32 SLP112

KNBU 202258Z 28017G27KT 3/4SM SHSN BLSN VV008 M14/M17 A2952 RMK PK WND 28037/47 SNB30 SLP997

KOZR 081255Z 22012G16KT 15SM OVC017 23/17 A2987 RMK TOPS OVC045 SLP115 RADAT 87052

KPAM 151757Z 17015G22KT 5SM HZ SCT007 BKN040 OVC050 22/21 A2998 RMK SCT007VBKN SLP125

KRDR 151756Z 09009KT 15SM SCT050 BKN090 OVC200 M15/M18 A2997 RMK PSR09P SLP149

KTIK 150856Z 09009KT 1 1/4SM R22L/600V1000FT DZ BR VV003 A2999 RMK SLP156

Figure F-1 Sample METAR Printout

TYPE OF ICING	B	TYPE OF TURBULENCE
Description	Code	Description
No icing	0	None
Light icing	1	Light turbulence
Light Icing In Cloud	2	Moderate turbulence in clear air, occasional
Light icing in precipitation	3	Moderate turbulence in clear air, frequent
Moderate icing	4	Moderate turbulence in cloud, occasional
Moderate icing in cloud	5	Moderate turbulence in cloud, frequent
Moderate icing in precipitation	6	Severe turbulence in clear air, occasional
Severe icing	7	Severe turbulence in clear air, frequent
Severe icing in cloud	8	Severe turbulence in cloud, occasional
Severe icing in precipitation	9	Severe turbulence in cloud, frequent
	X	Extreme turbulence

Figure F-2 TAF Icing and Turbulence Codes

KLAX 302012Z 302018 27010KT 3SM HZ SCT009
TEMPO 2202 BKNO15
FM0200 27008KT 3SM BR OVC015
FM0600 13005KT 2SM BR OVC009

KLFI 1818 02008KT 1600 RA FG OVC004 640806 QNH3000INS
TEMPO1822 VRB05KT 0800 FG VV001
BECMG 2223 02011KT 6000 HZ BXN007 BKN020 OVC300 650806 QNH29931NS OCNL RA
TEMPO 0004 19006KT 4800 SHRA SCT009 BKN020

KNBG 1818 01005KT 3200 BR OVC006 ONH3013INS
FM0300 02008KT 0800 FG VV002 QNH3016INS
FM1400 05010KT 4800 RA BKN005 OVC012 QNH3009INS

KOAK 301730Z 301818 26010KT P6SM SCT250
BECMG 2021 28016G24FT
FM0400 27010KT P6SM SKC
FM1000 24006KT P6SM SKC

KPDQ 301941Z 301818 26015G22KT P6SM -SHRA SCT020 BKN040 OVC070
TEMPO 2022 5SM -SHRA BKN020
FM2200 29012G20KT P6SM SCT030 BKN050
TEMPO 2203 4SM -SHRA BKN030
FM0300 26012G20KT P6SM SCT020 BKN040
TEMPO 0309 -SHRA BKN030

KPDX 301737Z 301818 27008KT P6SM SCT025 BKN045
TEMPO 1802 4SM -SHRA BKN025CB OVC040
FM0200 25006KT P6SM SCT030 BKN050
TEMPO 0206 -SHRA BKN030
FM0600 25005KT P6SM SCT030 BKN060 PROB40 0610 -SHRA
FM1000 25005KT P6SM BKN035 OVC050 PROB40 1018 -SHRA

KSAN 301958Z 302018 21010KT P6SM SCT018
TEMPO 2023 BKN015
FM0200 19007KT P6SM BKN015
FM0800 16005KT P6SM OV0009
FM1200 18006KT 4SM BR OVC015
FM1700 20006KT 5SM HZ SCT015

KSEA 301747Z 301818 17007KT P6SM -SHRA FEW009 SCT011 OVC030
TEMPO 1822 SCT009 BKN011 OVC020
FM2200 22008KT P6SM -SHRA SCT020 OVC045
TEMPO 2206 SCT010 OVC025
FM0600 19008KT P6SM BKN018 OVC030
TEMPO 0618 -SHRA BKN011 OVC020

KTVL 301730Z 301818 20012G20KT P6SM SKC
BECMG 2022 19015G25KT
FMO200 19012KT P6SM SKC
BECMG 0406 VRB03KT

Figure F-3 Sample TAF Printout

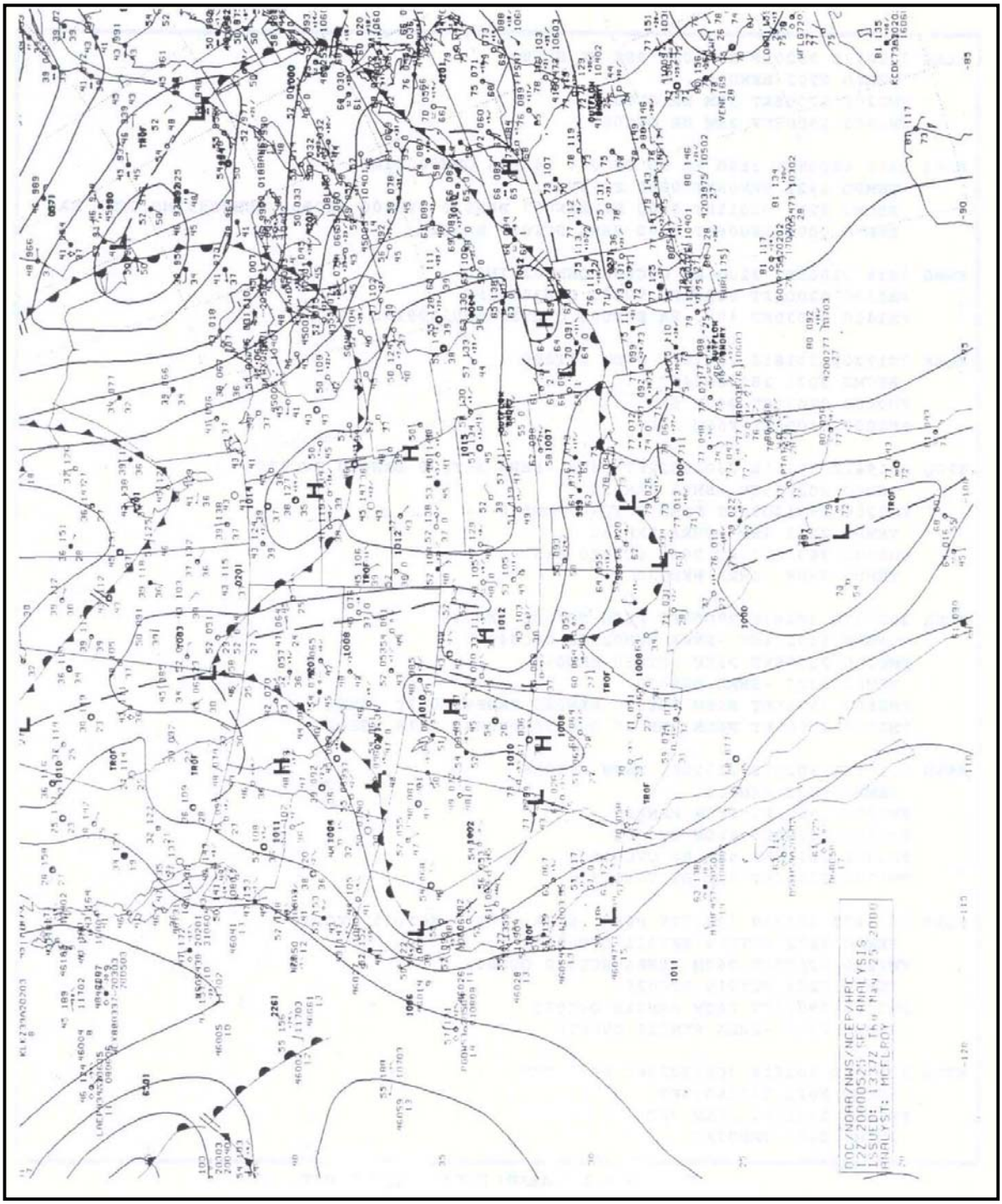


Figure F-4 Surface Analysis Chart

F-4 FIGURES FOR EXAMINATIONS

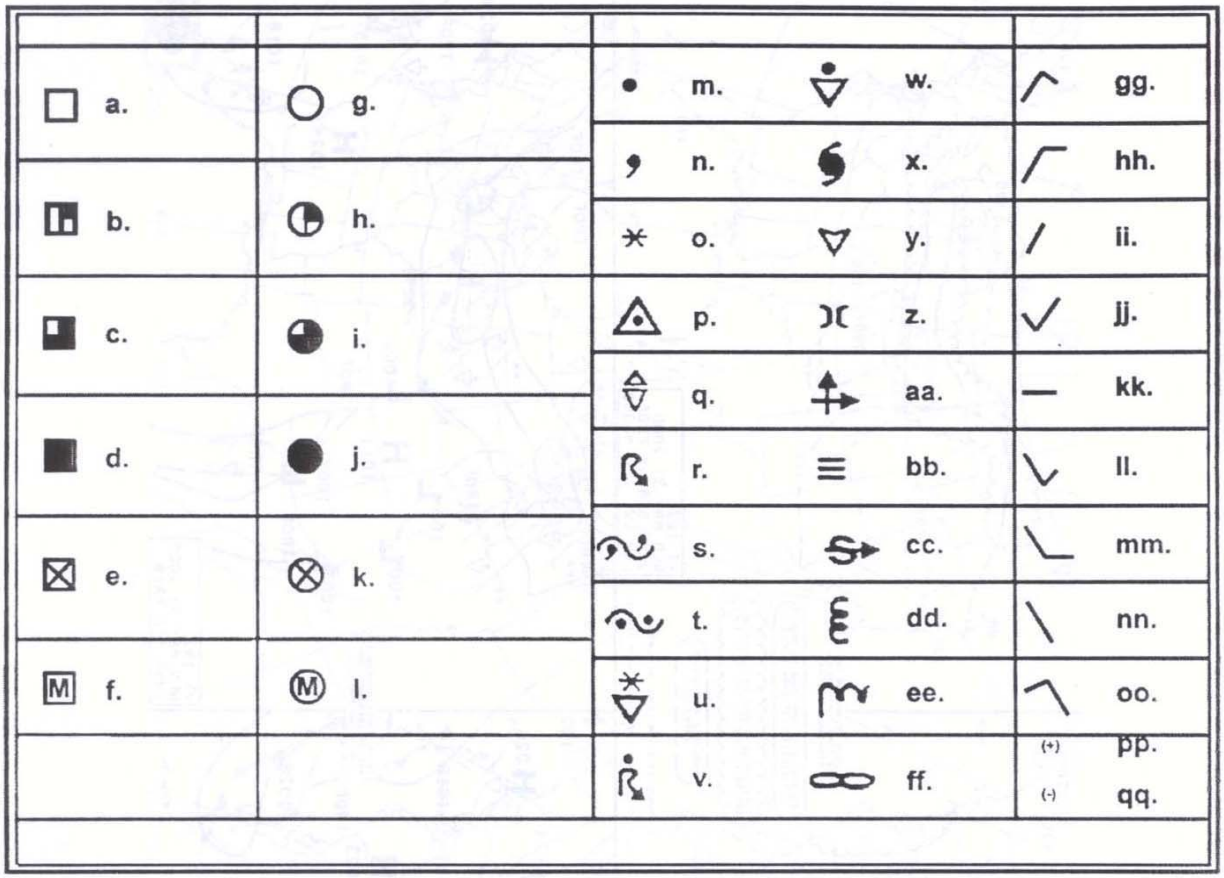


Figure F-5 Major Station Model Symbols

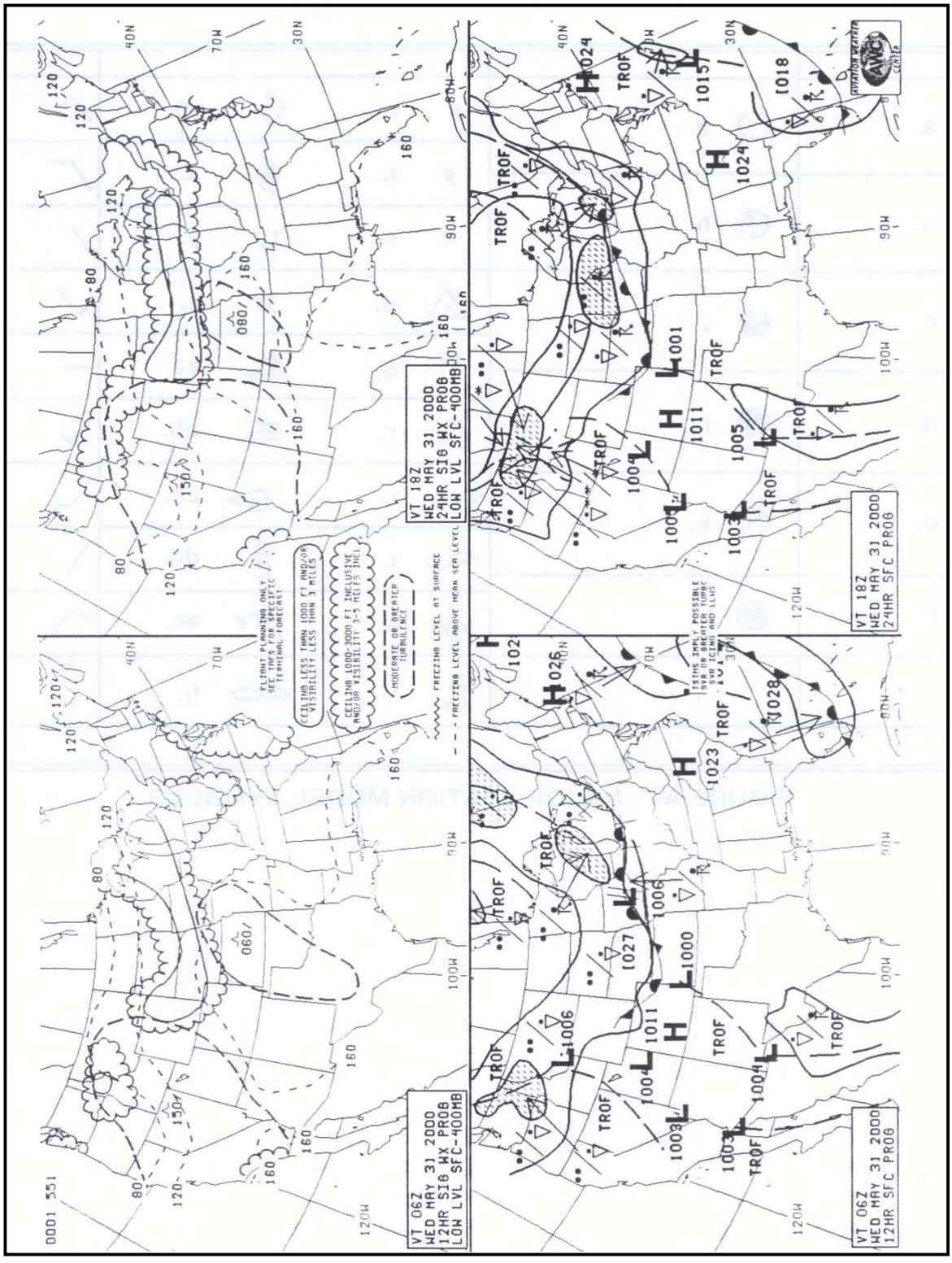


Figure F-6 Low Level Significant Weather Prognostic Chart

F-6 FIGURES FOR EXAMINATIONS

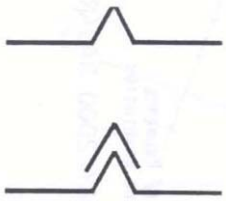
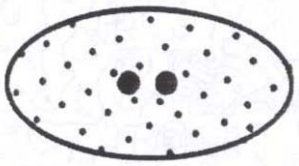
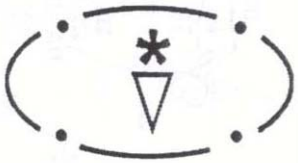
Depiction	Meaning	Depiction	Meaning
	**rr.** **ss.**		**yy.**
	**tt.** **uu.**		**zz.**
	**vv.** **ww.** **xx.**		**aaa.**

Figure F-7 Surface Prognostic Legend

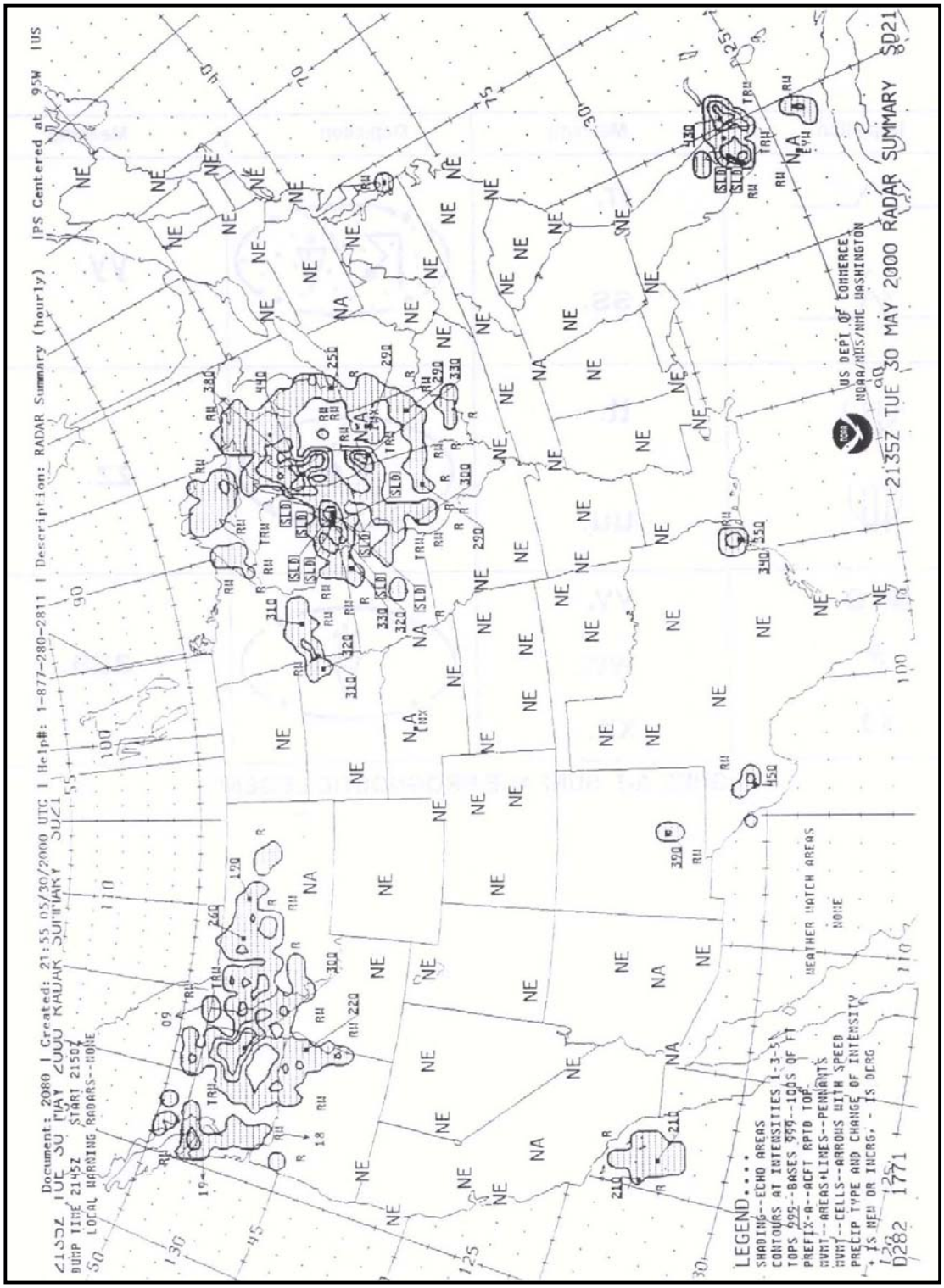


Figure F-8 Radar Summary Chart

F-8 FIGURES FOR EXAMINATIONS

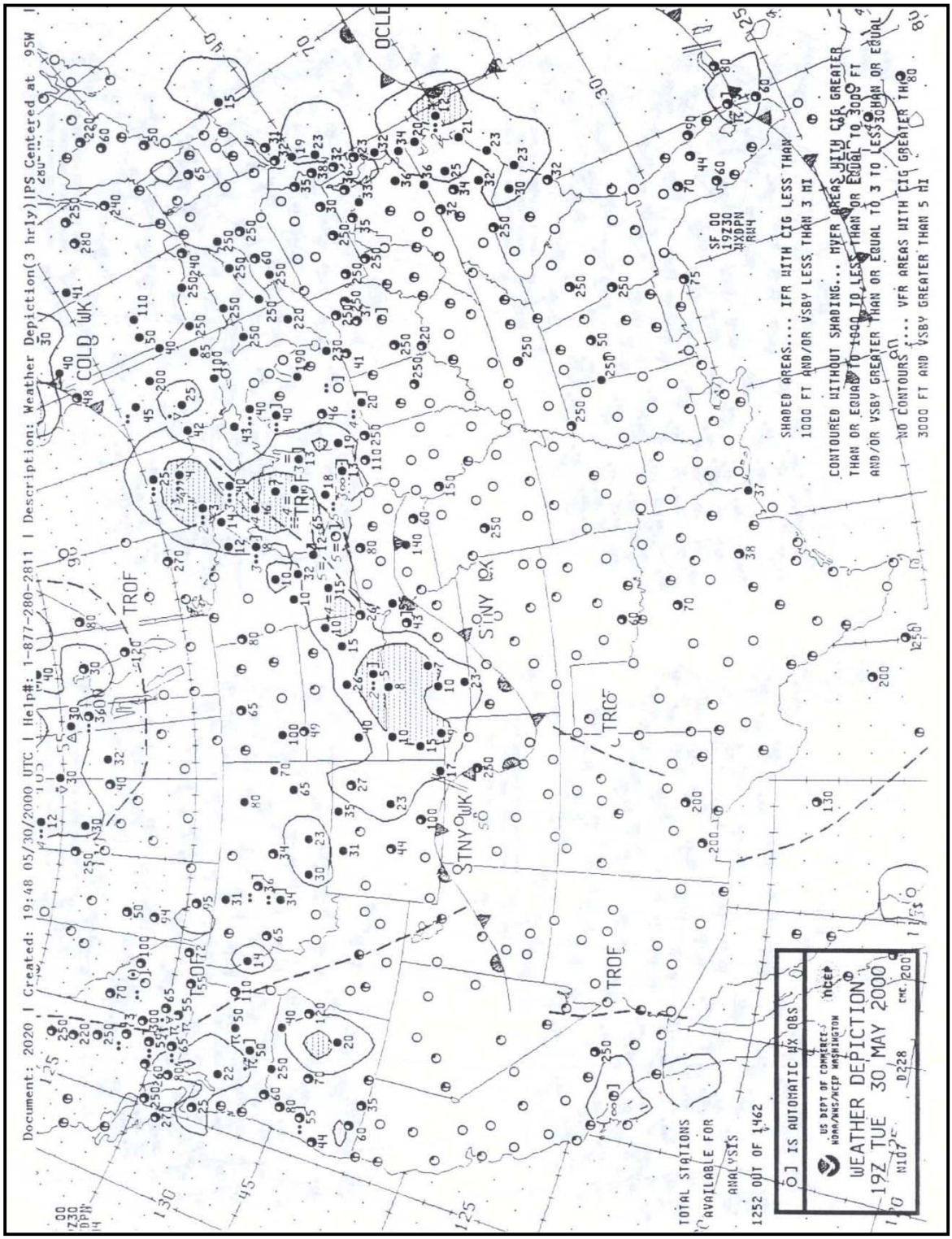


Figure F-9 Weather Depiction Chart

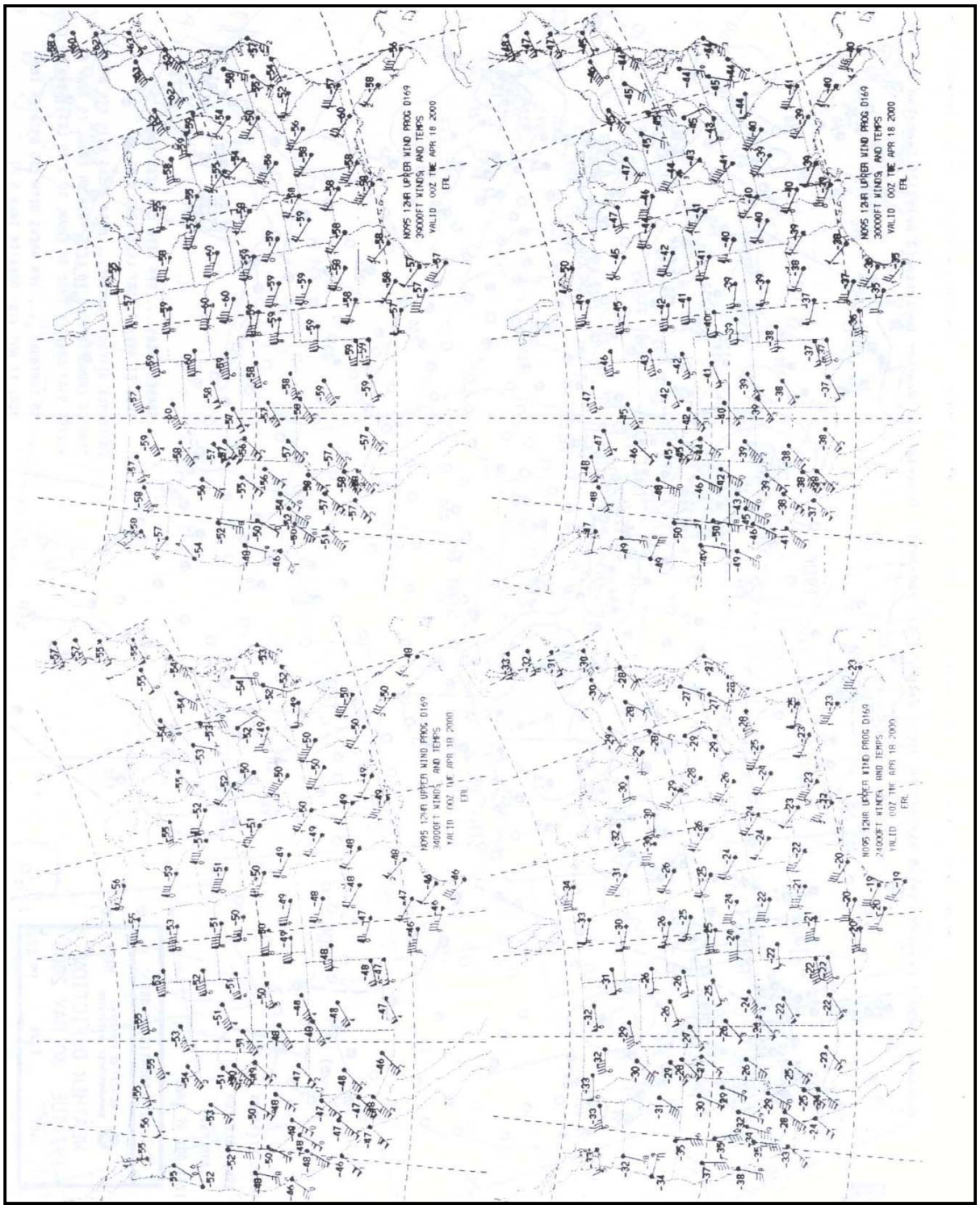


Figure F-10 Winds-Aloft Prognostic Charts

F - 10 FIGURES FOR EXAMINATIONS

25 14AY 2000 - 15:00:05 UTC

FDUM04 KWBC 251438
DATA BASED ON 251200Z
VALID 260000Z FOR USE 2100-0600Z. TEMPS NEG ABV 24000

FT	3000	6000	9000	12000	18000	24000	30000	34000	39000
BHM	2614	2617+16	2721+09	2824+05	2828-07	2930-18	304634	315344	315656
HSV	2909	2713+15	2721+09	2825+04	2933-07	2940-18	305835	306545	306856
MGM	2521	2719+16	2820+10	2724+06	2822-07	3022-19	323334	324044	324255
MOB	2320	2514+16	2513+11	2517+05	2818-06	3216-18	352333	353143	353754
FSM	1413	1915+16	2219+11	2418+07	2520-08	2529-19	264134	275544	277056
LIT	2005	2313+16	2420+10	2620+05	2818-07	2625-18	253533	274444	285556
LCH	1825	1921+17	1919+14	2019+07	2417-06	2906-16	341231	331942	332955
MSY	2021	2115+16	2113+12	2314+06	2717-06	3313-17	361832	352542	353254
SHV	1924	2024+17	2219+13	2319+07	2519-06	2620-17	273032	293843	304855
JAN	2120	2319+16	2519+11	2624+06	2922-06	2816-17	302233	313543	324855
GAG		1614+16	2119+12	2221+06	2335-07	2339-19	245134	246145	257557
OKC	1415	1821+17	2025+12	2224+08	2434-08	2534-18	254733	265744	277156
TUL	1317	1818+16	2018+12	2216+07	2421-08	2529-19	254434	266045	277756
BNA	3510	3010+13	2821+08	2929+03	2841-08	2953-19	307436	308346	308656
MEM	9900	2611+15	2719+09	2820+04	2923-07	2731-18	274234	285445	296656
TRI		3118+12	2927+07	2838+02	2846-10	2854-20	286137	286346	286656
TYS	3315	3015+13	2825+08	2834+03	2844-09	2854-19	296636	296946	296955
ABI		1823+22	2117+16	2419+09	2424-06	2530-16	244233	254843	265953
AMA		1512	2116+12	2425+07	2338-08	2344-19	236035	247045	257755
BRO	1629	1719+21	1712+16	1707+09	1806-05	9900-14	031131	361842	352554
CLL	1730	1825+18	1917+15	2018+08	2316-05	2511-15	251632	272342	293455
CRP	1628	1721+20	1812+16	2008+09	2310-05	2406-14	990031	310942	312254
DAL	1826	1928+19	2020+14	2114+08	2315-06	2620-16	263533	264443	275355
DRT	1415	1611+24	2405+16	2610+08	2417-06	2323-15	243132	253241	263751
ELP		2519	2520+14	2319+06	2238-10	2257-20	237933	238443	238352
HOU	1729	1825+18	1920+14	1920+08	2218-05	2208-15	300531	321542	322855
INK		2010+26	2213+17	2319+09	2242-09	2249-18	236334	247144	247652
LBB		1714+23	2116+15	2426+08	2339-08	2345-18	236134	247044	257854
LRD	1419	1710+21	9900+17	9900+09	2710-05	2508-15	231431	261341	312053
MRF			2513+18	2318+09	2238-08	2245-17	235634	246443	246651
PSX	1729	1824+19	1817+15	1915+08	2215-05	2307-15	990031	311242	312554
SAT	1523	1717+19	1909+16	2108+08	2610-04	2610-15	231531	251642	292254
SPS	1716	1923+19	2124+14	2225+09	2429-07	2532-17	254733	265444	276655

Figure F-11 Winds-Aloft Forecasts

WWUS 9 KMKC 181845
MKC WW 181845

BULLETIN - IMMEDIATE BROADCAST REQUESTED
SEVERE THUNDERSTORM WATCH NUMBER 29
NATIONAL WEATHER SERVICE KANSAS CITY MO
1245 PM CST THUR FEB 18 20XX

A…THE STORM PREDICTION CENTER HAS ISSUED A SEVERE THUNDERSTORM WATCH FOR

SOUTH CENTRAL KANSAS
CENTRAL OKLAHOMA
NORTH CENTRAL TEXAS
EAST TEXAS

EFFECTIVE FROM 1 PM CST UNTIL 6 PM CST THIS THURSDAY AFTERNOON

LARGE HAIL...DANGEROUS LIGHTNING…AND DAMAGING THUNDERSTORM WINDS ARE POSSIBLE IN THESE AREAS.

THE SEVERE THUNDERSTORM WATCH AREA IS ALONG AND 70 STATUTE MILES EITHER SIDE OF A LINE FROM 70 MILES WEST OF AUSTIN TEXAS TO 35 MILES WEST OF WICHITA KANSAS.

REMEMBER…A SEVERE THUNDERSTORM WATCH MEANS CONDITIONS ARE FAVORABLE FOR 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.

B…OTHER WATCH INFORMATION…THIS SEVERE THUNDERSTORM WATCH REPLACES SEVERE THUNDERSTORM WATCH NUMBER 28. WATCH NUMBER 28 WILL NOT BE IN EFFECT AFTER 1 PM CST.

C…A FEW SVR TSTMS WITH HAIL SFC AND ALF TO 2 IN. EXTRM TURBC AND SFC WND GUSTS, TO 70 KT. SCTD CBS WITH MAX TOPS TO 500 PSBL. MEAN WIND VECTOR 22040KT.

D…WITH CLD FNT MOVG SEWD FM WRN KS N CNTRL TX AND DVLPG LOW OK PANHANDLE MOVG EWD STG, CNVRGNC SHLD DVLP ALG CLD FNT AND NR INTERSECTION WITH WRM FNT CONTL STG INFLOW OF UNSTABLE AMS.

Figure F-12 WW

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NCEP/AWC - CENTRAL U.S. CONVECTIVE SIGMET

30 MAY 2000 - 22:03:02 UTC

WSUS41 KMKC 302157
MKCC WST 302155

CONVECTIVE SIGMET 70C
VALID UNTIL 2355Z
WI
FROM 20N BAE-DLL
LINE TS 20 NM WIDE NOV FROM 28030KT. TOPS TO FL400.

CONVECTIVE SIGMET 71C
VALID UNTIL 2355Z
TX
FROM 70WSW INK-80ESE MRF-50SSW MRF-70WSW INK
AREA TS MOV FROM 17010KT. TOPS TO FL430.

OUTLOOK VALID 302355-310355
AREA 1...FROM 50NNE MSP-ASP-ROD-30NE IRK-50ENE HLC-FSD-50NNE
MSP
SCT TS ARE EXPD ALG/NORTH OF QUASI-STNRY FNT FM CNTRL NEB THRU
IA TO CNTRL WI. OUTLFLOW BOUNDARIES FM EARLIER CNVCTN WILL ALSO
FOCUS INSTABILITY AND AID TS DVLPMT. SOME TS MAY BE STG-
SEV..ESPECIALLY OVR ERN NEB/IA WHERE INSTABILITY WILL BE GREATEST.
WST ISSUANCES ARE LIKELY THRU MOST OF THE PERIOD.

AREA 2...FROM BOY-DDY-50WNW BFF-50NE PUB-50WNW PUB-DBL-30N
CHE-BOY
FNTL BNDRY ACRS CNTRL CO WILL REMAIN NEARLY STNRY THRU THE PERIOD.
INCRG LOW LVL UPSLOPE FLOW WILL TRANSPORT RATHER MOIST AIR WWD INTO
ERN CO/ERN WY. MARGINAL INSTABILITY IS EXPD TO PRODUCE WDLY SCT TS.
OCNL WST ISSUANCES MAY BE REQUIRED.

MAHONY/CARLE
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Figure F-13 WST

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30 MAY 2000 - 22:20:04 UTC

SLCS WA 301945
AIRMET SIERRA UPDT 4 FOR IFR AND MTN OBSCN VALID UNTIL 3102[30
.
AIRMET IFR…WY
FROM 80NW RAP TO 40E CYS TO CYS TO SHR TO 80NW RAP
OCNL CIG BLW 010/VIS BLW 3SM PCPN/BR/FG. CONDS ENDG 21-23Z BUT DVLPG AGAIN 04-06Z
CONTG THRU 08Z.
.
AIRMET MTN OBSCN...MT WY ID
FROM YQL TO SHR TO CYS TO 70N MTU TO JAC TO 30E BKE TO 60WSW
YXC TO YQL
MTNS OCNLY OBSCD OLDS/PCPN BR/FG. CONDS CONTG BYD 02Z THRU 08Z.
. . . .
SLCT WA 301945
AIRMET TANGO UPDT 4 FOR TURB VALID UNTIL 310200
.
AIRMET TURB...ID MT WY NV UT CO AZ NM
FROM 80NW RAP TO BFF TO GLD TO TXO TO BZA TO EED TO 40SW FMG TO
40SE LKV TO 40SE REO TO DN3 TO 80NW RAP
OCNL MOD TURB BLW FL180 DUE TO GUSTY LOW LVL WNDS AND WLY WNDS ALF.
STG UDDFS OMTNS. CONDS CONTG BYD 02Z ENDG 06-08Z.
.
AIRMET TURB...ID MT
FROM 60WSW YXC TO 40N GGW TO MLS TO 40W BOI TO 60WSW YXC
LGT OCNL MOD TURB BTN FL240 AND FL370 DUE TO WNDSHR ASSOCD WITH
JTST. CONDS ENDG 02Z.
                                    . . . .
SLCZ WA 301945
AIRMET ZULU UPDT 3 FOR ICE AND FRZLVL VALID UNTIL 310200
.
NO SGFNT ICE EXP OUTSIDE CNVTV ACT.
.
FRZLVL ...075-110 N OF 40N FMG-TWF-DLN-90SW DIK LN SLPG 140-160 OAL-
SLC-RAP LN.
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Figure F-14 WA