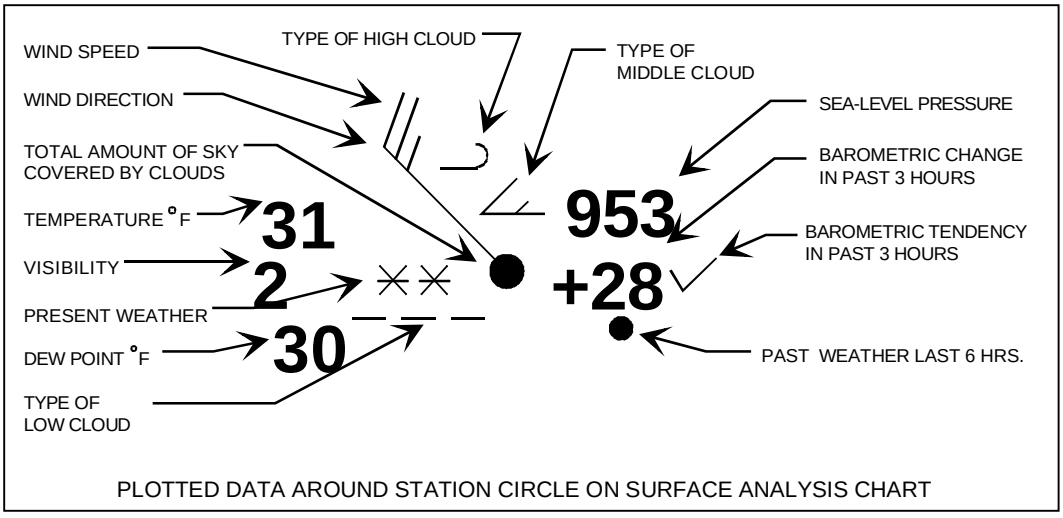
NAVAL AIR TRAINING COMMAND

NAS CORPUS CHRISTI, TEXAS **CNATRA P-1246 (REV. 7-97) PAT**

METEOROLOGY



PLOTTED DATA AROUND STATION CIRCLE ON SURFACE ANALYSIS CHART

LESSON GUIDE
T-45TS and ADV

1997

T-45 LESSON GUIDE

CHANGE SUMMARY PAGE

CHANGE NUMBER	DATE ENTERED	CHANGE DESCRIPTION	INITIALS
1	9/99	Incorporated	TSC
2	1/27/04	Incorporated	FTSC

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LIST OF EFFECTIVE PAGES

EFFECTIVE PAGES	PAGE NUMBERS
FRONT MATTER	
Change 2	i thru iv
METRO-01	
Change 1	Title page(s)
Original	1-1 thru 1-20
Change 1	1-21
Original	1-22 thru 1-38
METRO-02	
Change 2	Title page(s)
Original	2-1 thru 2-18
Change 2	2-19
Original	2-20
Change 2	2-21
Original	2-22 thru 2-119
METRO-03	
Change 2	Title page(s)
Original	3-1 thru 3-13
Change 1	3-14
Original	3-15 thru 3-33
Change 2	3-34
Original	3-35 thru 3-57

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METRO-03	
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Change 1	3-14
Original	3-15 thru 3-33
Change 2	3-34
Original	3-35 thru 3-57

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LESSON GUIDE

COURSE/STAGE: Meteorology

LESSON TITLE: Review of Basic Meteorological Principles

LESSON IDENTIFIER: Metro-01

LEARNING ENVIRONMENT: CAI

ALLOTTED LESSON TIME: 1 hr

TRAINING AIDS:

* Meteorology CD-ROM
* Figures
  - Fig 1: Cold Front
  - Fig 2: Warm Front
  - Fig 3: Cold Front Occlusion
  - Fig 4: Warm Front Occlusion
  - Fig 5: Duration Characteristics of Microbursts
  - Fig 6: Microbursts
  - Fig 7: Microburst Windshear Probability Guidelines
  - Fig 8: Structural Icing
  - Fig 9: Polar and Subtropical Jet Streams
  - Fig 10: Jet Stream Profile
  - Fig 11: Polar Jet Stream
  - Fig 12: Multiple Jet Streams
  - Fig 13: Jet Stream Clear Air Turbulence (CAT)
  - Fig 14: Areas of Probable Clear Air Turbulence in Jet Stream
  - Fig 15: Mountain Wave

(7-97) CHANGE 1

STUDY RESOURCES:

* Meteorology for Naval Aviators, NAVAIR 00-8OU-24
* Meteorological Theory Workbook I, CNAT P-303

LESSON PREPARATION: N/A

REINFORCEMENT: N/A

LESSON EXAMINATION:

The objectives in this lesson will be tested in Meteorology 04X.

LESSON OBJECTIVES

1.1.1.2.4
Recall definition of frontal systems

1.1.1.2.5
Recall weather associated with frontal systems

1.1.1.2.5.1
Recall reasons for and effects of direction and velocity of surface winds

1.1.1.4
Recall meanings of severe weather hazards

1.1.1.4.5
Recall hazards associated with thunderstorms

1.1.1.4.1.2
Remember meaning of microbursts

1.1.1.4.2
Recall causes and dangers of ice formation

1.1.1.4.3
Recall causes and dangers of fog formation

1.1.1.3.5
Recall features and hazardous conditions associated with jet streams

1.1.1.4.1.1
Remember meaning of clear air turbulence (CAT)

1.1.1.4.4
Recall causes and hazards of wake turbulence phenomena

MOTIVATION

As a Naval aviator, you will become acutely aware of the impact of weather phenomena on your mission planning and implementation. You will develop a natural routine in flight planning that takes weather into account. By consistently using weather information when you plan your flights, you improve your odds of not becoming another "weather statistic."

OVERVIEW

After reviewing the meteorological phenomena and hazards contained in this lesson, you will be able to relate them to the information found in the weather maps and forecasts you will see in Metro-02. A better understanding of this relationship will help you in your flight planning.

In this lesson, we will review:

* Meteorological definitions (in Lesson Guide only)
* Frontal systems and resulting winds
* Meteorological phenomena and hazards
  - Thunderstorms
  - Microbursts
  - Structural ice
  - Fog
  - Jet stream
  - Clear air turbulence (CAT)
  - Wake turbulence

PRESENTATION

I. Meteorological definitions

A. Altitude

1. Indicated altitude: altitude read on an altimeter with current barometric setting

2. Calibrated altitude: indicated altitude corrected for instrument error

3. True altitude (QNH): height above mean sea level (MSL)

4. Absolute altitude: height above terrain (AGL)

5. Density altitude: pressure altitude corrected for temperature

NOTE: Density altitude is used to calculate takeoff roll, available thrust, and power settings. To compensate for it, the pilot uses the NATOPS performance charts by entering the chart with temperature deviation and pressure altitude.

6. Pressure altitude (QNE): altitude read on an altimeter with a barometric setting of 29.92

COMMON ERROR: Confusing pressure altitude with density altitude.

B. Coriolis force: deflective force created by the difference in rotational velocity between the equator and the poles of the earth

1. In the northern hemisphere, winds flow clockwise around areas of high pressure and counterclockwise around areas of low pressure

2. In the southern hemisphere, winds flow counterclockwise around areas of high pressure and clockwise around areas of low pressure

NOTE: In this lesson, descriptions are of weather phenomena occurring in the northern hemisphere.

C. Frontal system: discontinuity formed between two contrasting airmasses of different characteristics **1.1.1.2.4**

1. Fronts affect ground speed, wind correction, and other planning factors

2. Several associated weather hazards

II. Fronts and resulting winds **1.1.1.2.5, 1.1.1.2.5.1**

Fig 1: *Cold Front*

A. Cold front

1. Characteristics

a. Predominantly cumuliform-type clouds

b. Thunderstorms and occasional squall lines (seasonal)

c. Turbulence and unstable air

d. Strong, gusty winds

e. Showery precipitation

f. Clearing skies and good visibility after frontal passage

2. Wind changes

a. Before passage, wind flows parallel to (along) the front

b. After passage, wind flows perpendicular to front

(1) Follows prevailing wind in same direction as front movement (perpendicular to front)

(2) Generally stronger due to steeper pressure gradient of colder airmass

Fig 2: *Warm Front*

B. Warm front

1. Characteristics

a. Predominantly cirriform- and stratiform-type clouds

b. Predominantly stable air and little turbulence

c. Continuous precipitation ahead of front in wide area

d. Poor visibility from haze or fog

e. Icing conditions

2. Wind changes

a. Before passage, wind flows parallel to front from higher to lower pressure

b. After passage, wind flows perpendicular to front

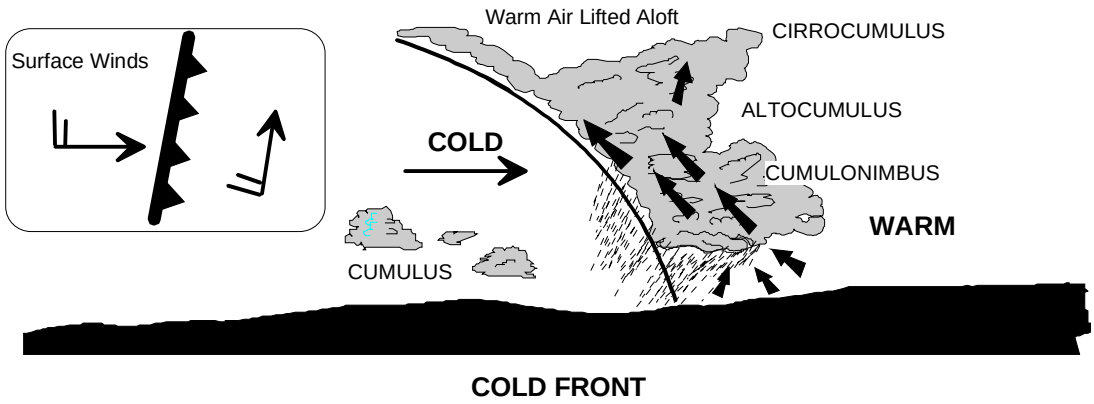


Figure 1: COLD FRONT

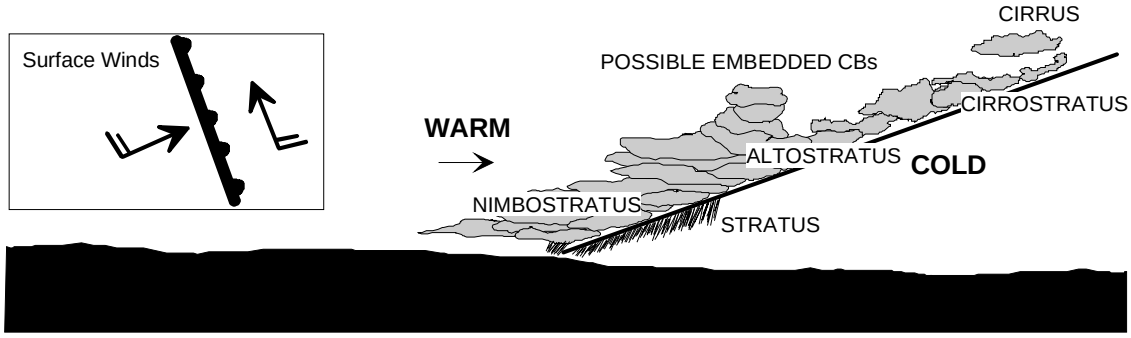


Figure 2: WARM FRONT

C. Stationary front

1. Characteristics: same as warm front, only less intense—can persist in an area for many days

2. Winds flow parallel to the front, but in opposite direction to each other—no prevailing wind to push front in any direction

D. Occluded fronts: form when faster-moving front overtakes a slower front

1. Cold front occlusion

Fig 3: Cold Front Occlusion

a. Characteristics

(1) Rain or freezing rain

(2) Poor visibility from fog and low ceilings

(3) Embedded thunderstorms

b. Formation

(1) Forms when cold front contains air colder than the airmasses on both sides of the warm front and slides under the entire warm front

(2) Produces warm and cold front systems aloft, with the cold front extending to the surface

(3) Forms predominantly over land

c. Wind changes

(1) Before passage, wind flows parallel to the front from higher to lower pressure

(2) After passage of overtaking cold front, wind flows perpendicular to overtaking front

2. Warm front occlusion

Fig 4: Warm Front Occlusion

a. Characteristics

(1) Rain or freezing rain

(2) Poor visibility from fog and low ceilings

(3) Embedded thunderstorms

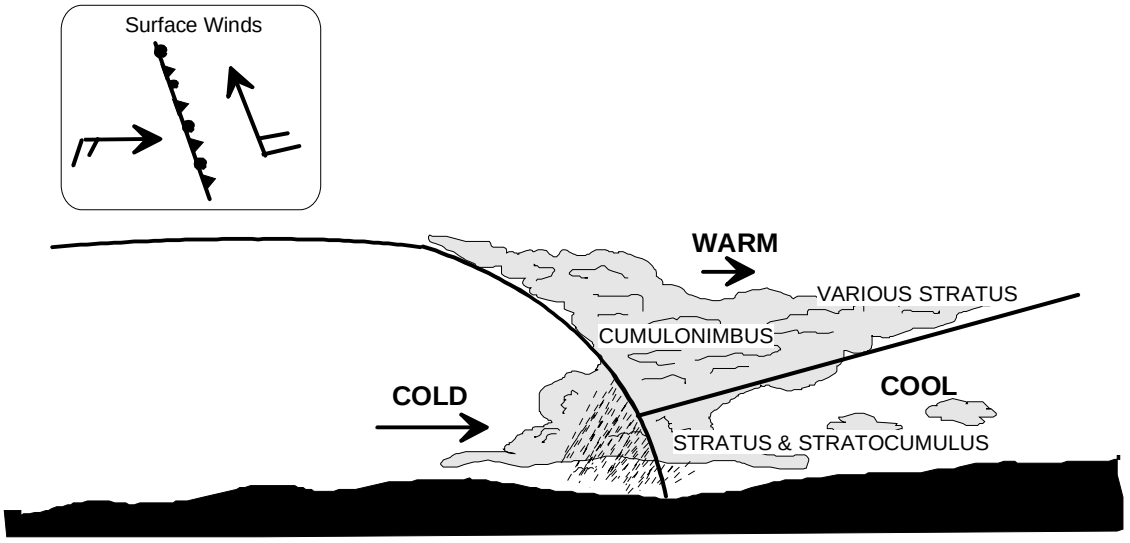


Figure 3: COLD FRONT OCCLUSION

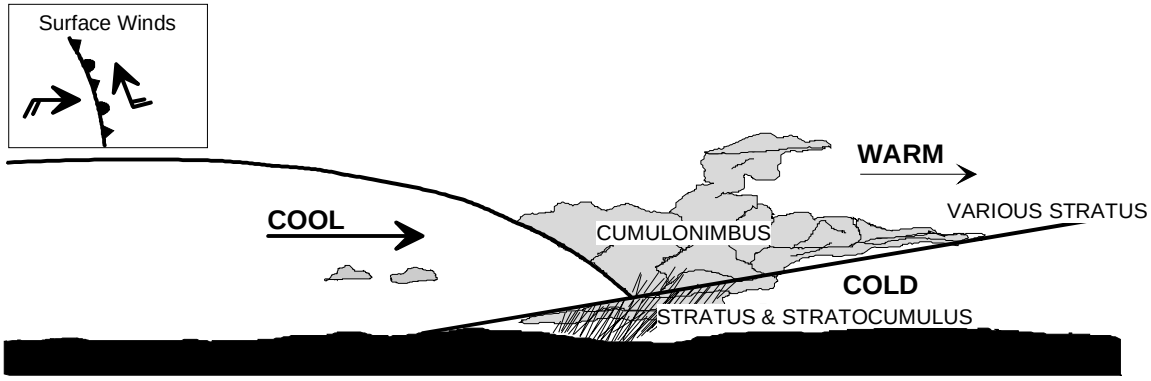


Figure 4: WARM FRONT OCCLUSION

b. Formation

(1) Forms when cold front contains air warmer than the "cold air side" of the warm front; cool air from the overtaking cold front slides under the warm air and over the cold air between the warm front airmasses

(2) Produces warm and cold front systems aloft, with the warm front extending to the surface

(3) Form predominantly over water

c. Wind changes

(1) Before passage, wind flows parallel to the front from higher to lower pressure

(2) Behind warm front, wind flows perpendicular to the front, following prevailing wind in same direction as front

III. Meteorological phenomena and hazards **1.1.1.4**

A. Thunderstorms

1. Types

a. Airmass thunderstorms

(1) Convective airmass

(a) Generated by solar convection within unstable, moist airmass

(b) Generally isolated and scattered over wide area

(2) Orographic airmass

(a) Generated when unstable and moist airmass is lifted over hills or mountains

(b) Usually scattered among individual mountain peaks, but can cover larger areas

b. Frontal thunderstorms

(1) Cold front

(a) Generated by cold air sliding under moist warmer air, forcing it aloft—resulting in violent thunderstorms

(b) Usually narrow bands—50 to 100 miles along the front

(c) Often develop into uninterrupted lines that are difficult to circumnavigate

(2) Warm front

(a) Generated when a warm and moist airmass is lifted (slides over) a cold airmass

(b) Less common and less violent than cold front due to more stability and less lifting force within the airmass

(c) Often embedded or obscured in stratiform clouds, making them difficult to see and avoid

c. Squall line: band or line of severe thunderstorms

(1) Usually associated with fast-moving cold fronts

(a) Usually form 50 to 300 miles ahead of the front—but can also form in most unstable airmasses

(b) Generally caused by upper airflow disturbance

(c) Build rapidly and are most severe in late afternoon and early evening

(2) Uninterrupted lines of cells often too long and wide to avoid--can be too high to fly over (more than 55,000 ft)

(3) Characterized by severe steady-state thunderstorms or “supercells” that can contain tornadoes, hail, and other severe hazards to aviation

2. Thunderstorm hazards **1.1.1.4.5**

a. Turbulence

(1) Hazardous turbulence present in all thunderstorms

(a) Up and down drafts can obtain speeds of 200 ft per second

(b) Up drafts are usually stronger than down drafts

(2) Aircraft control difficult to impossible

(3) Can be severe enough to cause structural damage or failure

NOTE: The storms that create the most violent turbulence are often producers of hail.

b. Hail

(1) Can occur in any thunderstorm at all altitudes

(2) Can occur beneath or up to 20 miles in front of the anvil top of large thunderstorms--denoted by a distinct shade of blue

(a) Under the anvil is particularly hazardous

(b) Can be found anywhere around the storm (in clear air)

(3) Can cause severe structural damage

NOTE: The largest recorded hail stone was 17 inches in circumference and weighed 1.5 lbs.

c. Tornadoes

(1) Occur most often with steady-state thunderstorms associated with cold fronts or squall lines

(2) Very intense local phenomena with windshears clocked at more than 26,000 fpm (260 kts)

(3) Can be embedded in thunderstorm and thus invisible to pilot

(4) Mostly a low-level phenomenon, does not penetrate the storm more than 1,000 to 2,000 ft up into the bottom of the clouds

NOTE: "Waterspouts" are tornadoes that occur over bodies of water.

d. Lightning

(1) Can cause temporary or permanent loss of vision

(2) Can puncture aircraft skin

(3) Can damage electronic equipment and compass

(4) Probability of strikes to aircraft

(a) Probability is highest near the tops of thunderstorms (near the anvil region), decreasing rapidly with altitude

(b) Highly electrified clouds can be advected many miles from the parent storm

NOTE: Avoid <u>any</u> clouds downwind of thunderstorms.

(c) Areas of low precipitation and/or low turbulence indicate high probability of lightning; conversely, in areas of high precipitation and/or turbulence, the probability of lightning is low

NOTE: Storms with high rates of natural lightning indicates a low probability of aircraft strikes.

(d) There is a greater probability of lightning strikes to aircraft during storm's decaying stages

(e) The highest probability for direct lightning strikes to aircraft are in those parts of the storm where ambient temperature is lower than -40 degrees C (pressure altitude off 38,000 ft to 40,000 ft)

(f) Most lightning strikes to aircraft are triggered by the aircraft itself

NOTE: When flying in or around thunderstorms, the probability of lightning strikes exist at all altitudes. Therefore, the only proven way to avoid lightning strikes is to avoid thunderstorms by a wide margin when possible.

3. Operational considerations regarding penetration of thunderstorms

NOTE: Thunderstorms present many hazards and should be avoided whenever possible. In the event penetration cannot be avoided, the following NATOPS procedures should be utilized to minimize the danger.

a. Before penetration

(1) Plan a course to take you through the storm in a minimum amount of time, and do not alter it

(2) Penetrate at an altitude where the outside air temperature (OAT) is colder than -15 degrees C or warmer than +15 degrees C

(3) HALT

(a) Heat

i. Pitot heat switch - CHECK ON

(b) Airspeed/Attitude

i. Maintain turbulence penetration airspeed of 250 KIAS

ii. Go on instruments and stabilize airspeed and attitude prior to penetrating the storm

iii. Adjust ADI reference

iv. Fly on a heading calculated to provide the quickest passage through the storm at an altitude affording the least turbulence and icing while clearing all ground obstacles by a wide margin

v. Avoid the upper 2/3 of a mature cell (turbulence and hail) and freezing level +/- 2,000 ft (lightning)

(c) Light

i. Turn all cockpit lights to bright including floodlights

(d) Tight

i. Lower the seat to the bottom to prevent striking the head against the canopy and to reduce the blinding effect of lightning and do not look outside of cockpit

ii. Tighten lap belts

b. Upon penetration

(1) Fly constant power and pitch attitude by referencing the ADI; chasing the altitude or airspeed could result in unusual flight attitudes and/or structural overstress. Use the smallest pitch corrections possible

(2) Keep eyes on flight instrumentation and avoid looking outside because lightning flashes can cause temporary or permanent loss of vision

(3) Fly constant heading and do not attempt to turn around because the fastest way through a storm is a straight line, which also lessens the chance of becoming disoriented

(4) Be prepared for turbulence, hail, rain, and pitot static failure due to icing

Fig 5: *Duration Characteristics of Microbursts*

B. Microbursts **1.1.1.4.1.2**

1. Description and composition

a. Intense and localized downburst of air that descends from a thunderstorm and, upon reaching ground, spreads horizontally

b. Usually found beneath thunderstorms with visible rain or virga

Fig 6: *Microbursts*

c. Usually 1 to 2 miles in diameter; wind speeds can exceed 100 kts (10,000 fpm) and be accompanied by rain or other obscuring phenomena; usually last less than 10 minutes

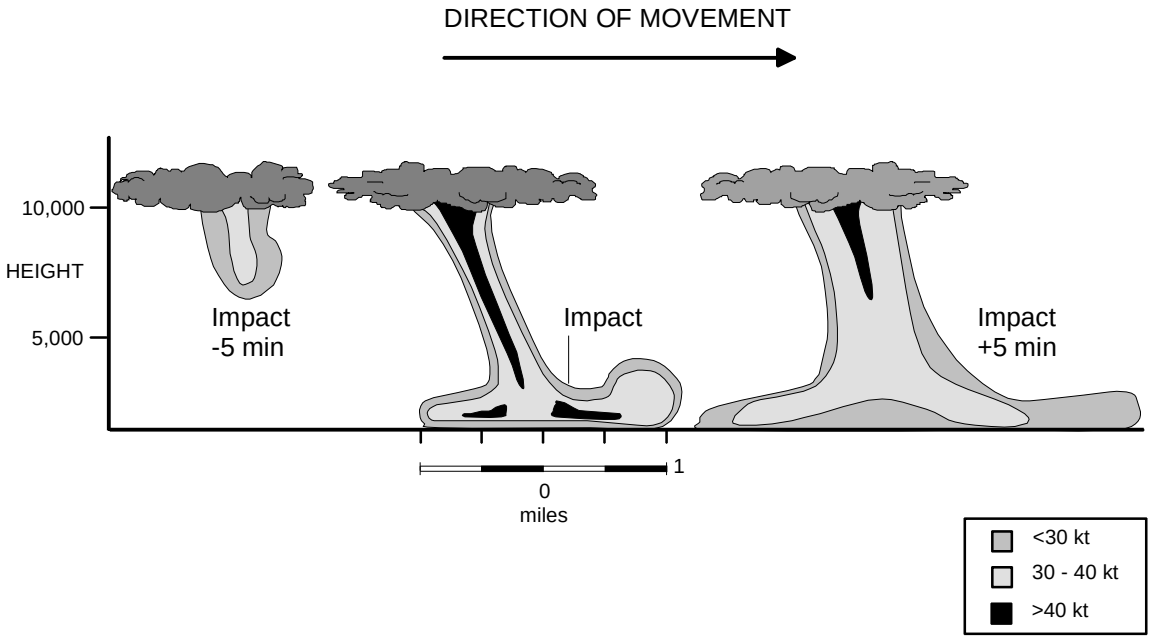


Figure 5: DURATION CHARACTERISTICS OF MICROBURSTS

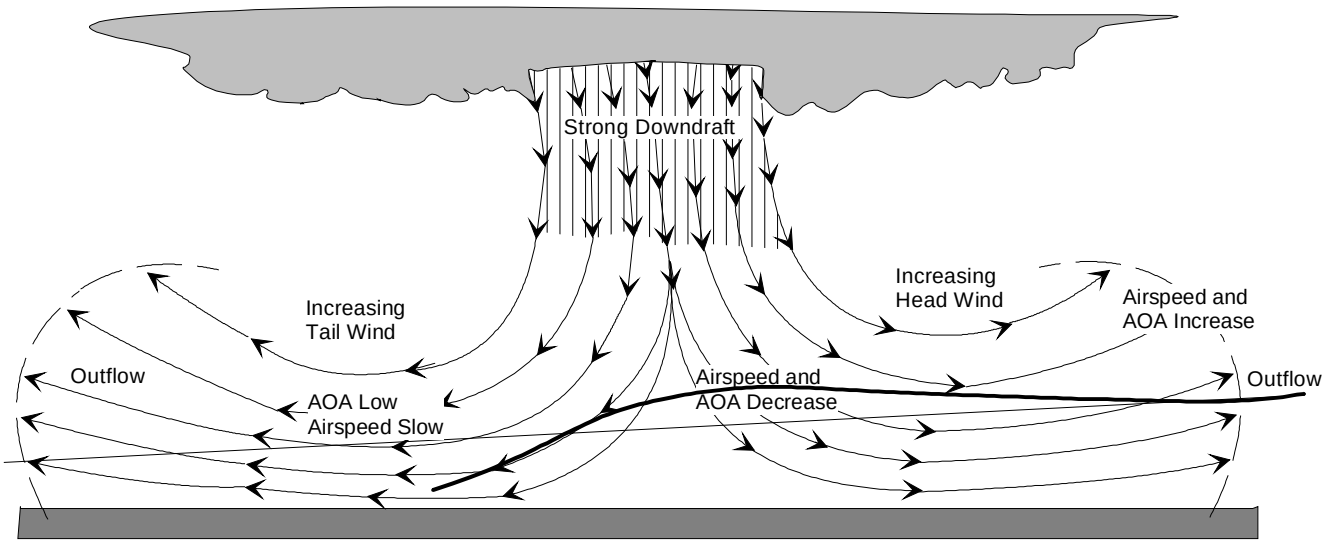


Figure 6: MICROBURSTS

d. Intense horizontal outflows at low altitudes result in extreme head wind to tail wind differentials that have been recorded in excess of 200 kts

e. Experience has shown that microbursts are not isolated, but usually occur in groups

2. Effects: a microburst approach scenario

Note: Microbursts can be encountered in the head wind, downdraft, or tail wind phase. The scenario below exemplifies an approach in which the aircraft enters a fully developed microburst at the rolling outflow. Pilot reactions depicted in the sequence are based on cockpit indications -- with pilot unaware of the microburst.

a. Initial entry of aircraft into microburst (head wind and updraft)

(1) Conditions: airspeed and AOA increase, producing more lift and causing the aircraft to pitch nose high and to go high

(2) Indications: AOA indexer displays “slow” and glideslope shows high

(3) Normal pilot response: reduces power and AOA

(4) Effects: stops the climb and reestablishes descent rate and on-speed AOA

b. Outflow area prior to microburst core (head wind shifting to downdraft)

(1) Conditions

(a) Airspeed and AOA decrease due to shift in airmass movement, reducing lift

(b) Descent rate increases

(2) Indications: AOA indexer “fast,” VSI shows increased rate of descent, and airspeed begins to fall

(3) Normal pilot response

(a) Raises nose attitude to correct for “fast”

(b) Delays power application due to continued high indication

(4) Effects: energy loss is undetected

c. Microburst core (predominantly downdraft)

(1) Conditions

(a) Airspeed continues to drop and AOA continues to decrease due to continuing shift in airmass movement

(b) Descent rate continues to accelerate

(2) Indications

(a) High on glideslope and correcting

(b) “Fast” despite continued back stick

(3) Pilot response: continues to raise nose to arrest descent rate and to achieve on-glideslope and on-speed with minimum use of power

(4) Effects: continues unarrested descent in “fast” condition despite high nose attitude—pilot response is insufficient to keep up with shift of wind direction

d. Outflow area beyond to microburst core (predominantly tail wind)

(1) Conditions

(a) Rapid wind shift from downdraft to tail wind causes sudden decrease in airspeed

(b) Aircraft “blows through” glideslope in a nose-high attitude

(2) Indications

(a) AOA rapidly changes from “fast” to “slow” due to excessively high nose attitude and loss of vertical component of wind—pilot “feels the bottom drop out”

(b) Airspeed continues to decrease

(c) Excessive descent rate

(3) Pilot response: pilot gauges altitude loss and realizes danger of situation—abandons approach, applies full power, and holds AOA above normal in effort to arrest descent

(4) Effects: airspeed and descent rate may stabilize; however, altitude loss will continue until aircraft accelerates to an airspeed that will yield a positive rate of climb (if possible)

Fig 7: *Microburst Windshear Probability Guidelines*

MICROBURST WINDSHEAR PROBABILITY GUIDELINES

KEY: Low Probability– Consider the observation, but a decision to avoid is not generally indicated.
Medium Probability–Weight of observation is significant. Seriously consider decision to avoid.
High Probability– This observation requires critical attention. Decision to avoid is appropriate.

PILOT OBSERVATION	Probability of Windshear
Presence of convective weather near intended flightpath:	
With localized strong winds (tower reports or observed blowing dust, rings of dust, tornado-like features, etc.)	**High**
With heavy precipitation (observed or radar indications of contour, red, or attenuation shadow)	**High**
With rainshower	**Medium**
With lightning	**Medium**
With virga	**Medium**
With moderate or greater turbulence (reported or radar indications)	**Medium**
With temperature/dew-point spread between 30 and 50 degrees Fahrenheit	**Medium**
Onboard windshear-detection system alert (reported or observed)	**High**
Pirep of airspeed loss or gain	
15 knots or greater	**High**
Less than 15 knots	**Medium**
LLWAS alert or wind velocity change	
20 knots or greater	**High**
Less than 20 knots	**Medium**
Forecast of convective weather	**Low**

Note: These guidelines apply to operations in the airport vicinity (within three miles of the point of takeoff or landing along the intended flightpath and below 1,000 feet altitude). The clues should be considered cumulative. If more than one is observed, the probability weighting should be increased. The hazard increases with proximity to the convective weather. Weather assessment should be made continuously.

Caution: No quantitative means now exist for determining the presence or intensity of microburst windshear. Pilots are urged to exercise caution in determining a course of action.

There is a program underway to install Doppler Radar at major airfields. Doppler Radar can provide early warning by detecting microbursts.

Figure 7: MICROBURST WINDSHEAR PROBABILITY GUIDELINES

3. Indications of microburst activity

   a. Blowing dust, dust devils, and gust fronts (downbursts will occasionally generate distinctive circular dust patterns)

   b. Thunderstorms in vicinity with visible areas of intense downdrafts indicated by rain or virga

   c. Sudden and unexplained increase in airspeed as noted on airspeed indicator accompanied by increased AOA—indicative of rolling outflow

   d. Sudden increase in rate of descent accompanied by a lower AOA--indicative of entry into microburst core

   e. Extreme variations in wind velocity and direction in short time

   f. Significant differences between winds at 1,500 to 2,000 ft AGL surface winds

   g. LLWAS (Low-Level Windshear Alert System) alert

      NOTE: The LLWAS is comprised of a series of wind sensors located at various positions on the airport. The system senses windshear occurrences through comparison of readings from the various wind sensors. LLWASs are installed at several major airports around the U.S. Unfortunately, some microbursts are so small that they can fit between the sensors. Doppler radar has proven effective in detecting microbursts and is being installed at major airports.

   h. PIREP of windshear or airspeed gain or loss

      NOTE: Although PIREPs are important to alert other pilots of microbursts, microburst intensity can change rapidly, so even recent PIREPs may not reflect the true strength of a microburst—listen to the aircraft ahead or ask for PIREP information from ATC. Report any airspeed fluctuations of 5 kts or more as soon as possible.

4. Avoidance

   a. Takeoff: delay departure

   b. Landing: delay approach or use alternate runway/approach or proceed to nearby alternate

5. Response during landing

   a. Execute a missed approach immediately—response time is critical

b. Recognize that excess airspeed is necessary to maintain flight beyond core of microburst--don't pull power

c. Report encounter to ATC as soon as possible

NOTE: With proper technique, high performance aircraft will be able to fly out of some microbursts, but not out of all. Avoidance is the best course of action, but if a microburst is encountered, recognition and reaction prior to being caught "low and slow" are the only safeguards.

C. Structural ice **1.1.1.4.2**

Fig 8: Structural Icing

WARNING: All structural ice, including frost, should be removed from all surfaces of the aircraft prior to takeoff.

1. Conditions of formation

a. Visible moisture must be present

b. Occurs most commonly near freezing level

c. Can form when flying through areas of

(1) Supercooled water droplets

(2) Freezing rain

(3) Wet snow

2. Types

a. Clear ice

(1) Found predominantly in convective/cumuliform clouds with large water droplets such as in thunderstorms

(2) Most common between 0 degrees C and -10 degrees C, but can occur as low as -25 degrees C

NOTE: In thunderstorms, icing can be found at any altitude above the freezing level, creating an additional known hazard.

(3) Also formed by freezing rain

(4) Smooth, clear appearance—very hard and heavy

(5) Very dangerous

(a) Accumulates rapidly

(b) Resistant to deicing systems

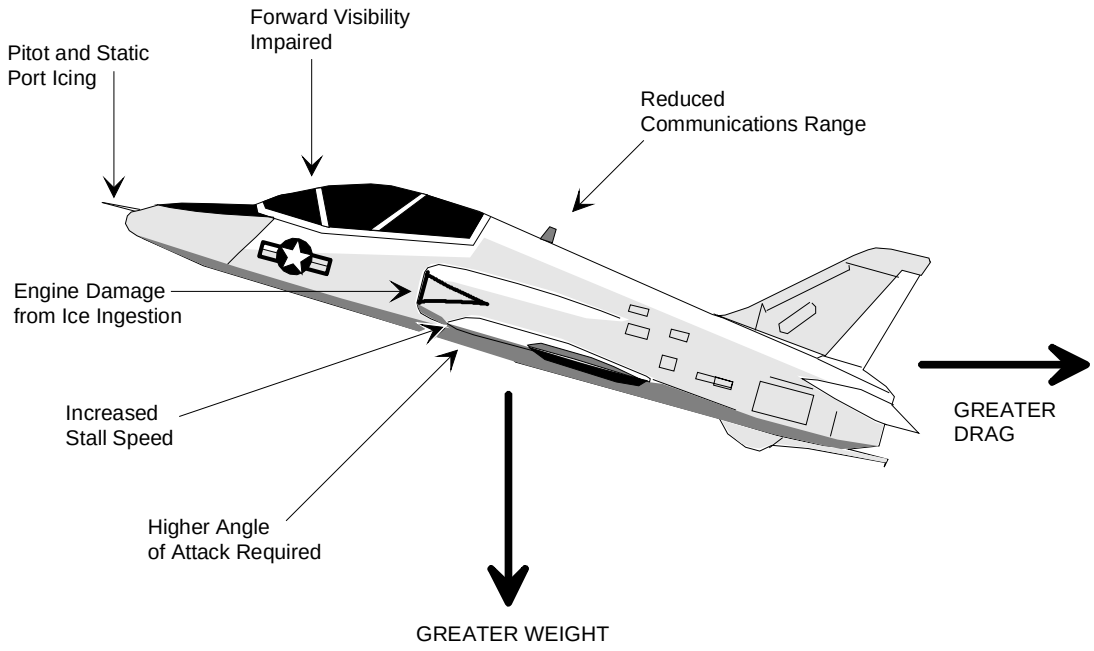


Figure 8: STRUCTURAL ICING

(c) Slow to sublimate or melt in non-icing environment

(d) Alters shape of wing--decreases lift, increases drag

b. Rime ice

(1) Found predominantly in stratus cloud formations

(2) Most common between -10 degrees C and -20 degrees C

(3) Results from instantaneous freezing of water droplets

(4) Opaque and rough appearance

(5) Continuous icing in these conditions

(6) Tends to erode or blow off quicker than clear ice in non-icing environment

(7) Dangerous—alters shape of wing surfaces, decreasing lift and increasing drag

c. Mixed Icing

(1) Forms in mixed atmospheric conditions that contain both clear and rime ice

(2) Forms from water droplets of different sizes or when droplets intermingle with snow or ice particles

(3) Occurs at high altitudes within thunderstorms

(4) Conglomerate appearance, with adverse qualities of both rime and clear ice

d. Frost

(1) Forms on aircraft at night when temperature and dew point are within a few degrees of each other and temperature falls below freezing

(2) Can form during a rapid descent from subfreezing temperatures

(3) Rough texture greatly inhibits smooth airflow over wing surface, especially when present on leading edge of wing

(4) Any disruptions of laminar airflow over wing surface create the effect of a completely new airfoil

(5) Reduces lifting surface of the wing and adds drag

3. Hazards

   a. Increases drag and weight

   b. Decreases lift and increases stall speed: level flight requires higher angle of attack (AOA)

   c. Effects on thrust production

      (1) Propeller-driven aircraft

         (a) Ice destroys smooth airflow over propeller surface, reducing propeller efficiency

         (b) In some engine designs, induction system icing limits available air, therefore reducing available thrust

      (2) Jet aircraft: large pieces of ice thrown free by airflow or deicing systems can be ingested by engines, resulting in engine damage or failure

   d. Other considerations

      (1) Pitot and static sources can clog, affecting reliability of Mach/airspeed indicator, altimeter, and vertical speed indicator (VSI)

      (2) Visibility impaired due to windshield icing

      (3) Engine sensors can clog, resulting in improper throttle and fuel control

      (4) Radio range reduced

D. Fog **1.1.1.4.3**

1. Common conditions when fog can form: temperature and dewpoint must be within 3 degrees C/5 degrees F of each other

2. Fog might not form even under conductive conditions

3. Types

   a. Radiation (ground fog): forms in saturated air when the temperature nears dew point and a light breeze is present

      (1) Usually dissipates or “burns off” 1 to 4 hours after sunrise

      (2) Wind more than 8 kts prevents or dissipates fog

         NOTE: Radiation fog is common to NAS Meridian.

b. Advection: forms when moist air moves over surface cool enough to reduce temperature to near dew point (more frequent in winter than summer)

(1) Occurs usually near coastal regions of the southeastern United States, the Gulf Coast, and the Pacific Northwest

(2) Intensity increases rather than lessens with wind

NOTE: Advection fog is common to NAS Kingsville.

c. Precipitation: formed by rain or drizzle evaporating and adding moisture to air

(1) Usually associated with warm front where warm rain falls into colder air

(2) Can form quickly and cover a wide area

(3) Can be very dense and can continue for several days

d. Upslope (closely related to advection fog)

(1) Occurs along windward slopes of mountain ranges when saturated air ascends up a mountain slope and condenses

(2) The wider the spread between temperature and dew point at the base of the mountain, the farther up the slope it will form

e. Steam—forms when cold air moves over much warmer water, causing intense evaporation and raising dew point to near ambient temperature

f. Ice

(1) Formed by ice crystals suspended in air

(2) Decreases visibility in bright sunlight

(3) Most common in arctic regions

4. Hazards

(1) Low to extremely low visibility

(2) Can form quickly

(3) Can affect a widespread area

Fig 9: *Polar and Subtropical Jet Streams*

E. Jet stream **1.1.1.3.5**

1. Forms in tropopause - the boundary between the troposphere and the stratosphere

   a. Height varies from 65,000 ft at the equator to 20,000 ft or less at the poles

   b. Tropopause drops by steps between arctic and polar airmasses and another drop between the polar and tropical airmasses

   c. Between the polar and arctic "layers," the Polar Front Jet Stream forms; between the polar and tropical "layers," the Subtropical Jet Stream is formed

      (1) Polar jet stream is the primary North American jet stream

      (2) Subtropical jet stream found between 25 degrees and 30 degrees North latitude

      NOTE: From the Hawaiian Islands eastward to southern Florida, the Subtropical Jet Stream sometimes drifts north and merges with the Polar Jet Stream.

Fig 10: *Jet Stream Profile*

2. Jet stream characteristics

   a. They are a narrow, shallow band of strong westerly winds of 50 kts or more

      (1) Strength of the jet stream is stronger in the winter than in the summer

      (2) Wind speeds up to 300 kts have been recorded

         (a) Summer: average 75-100 kts

         (b) Winter: average 150-225 kts

Fig 11: *Polar Jet Stream*

   b. Jet streams wander vertically and horizontally around the hemisphere in wave-like patterns

      (1) Jet streams in northern hemisphere are matched in southern hemisphere

      (2) They are stronger in some areas than others

      (3) They rarely encircle entire globe as a continuous river of wind

         (a) Most frequently found in 1,000- to 3,000-mile segments

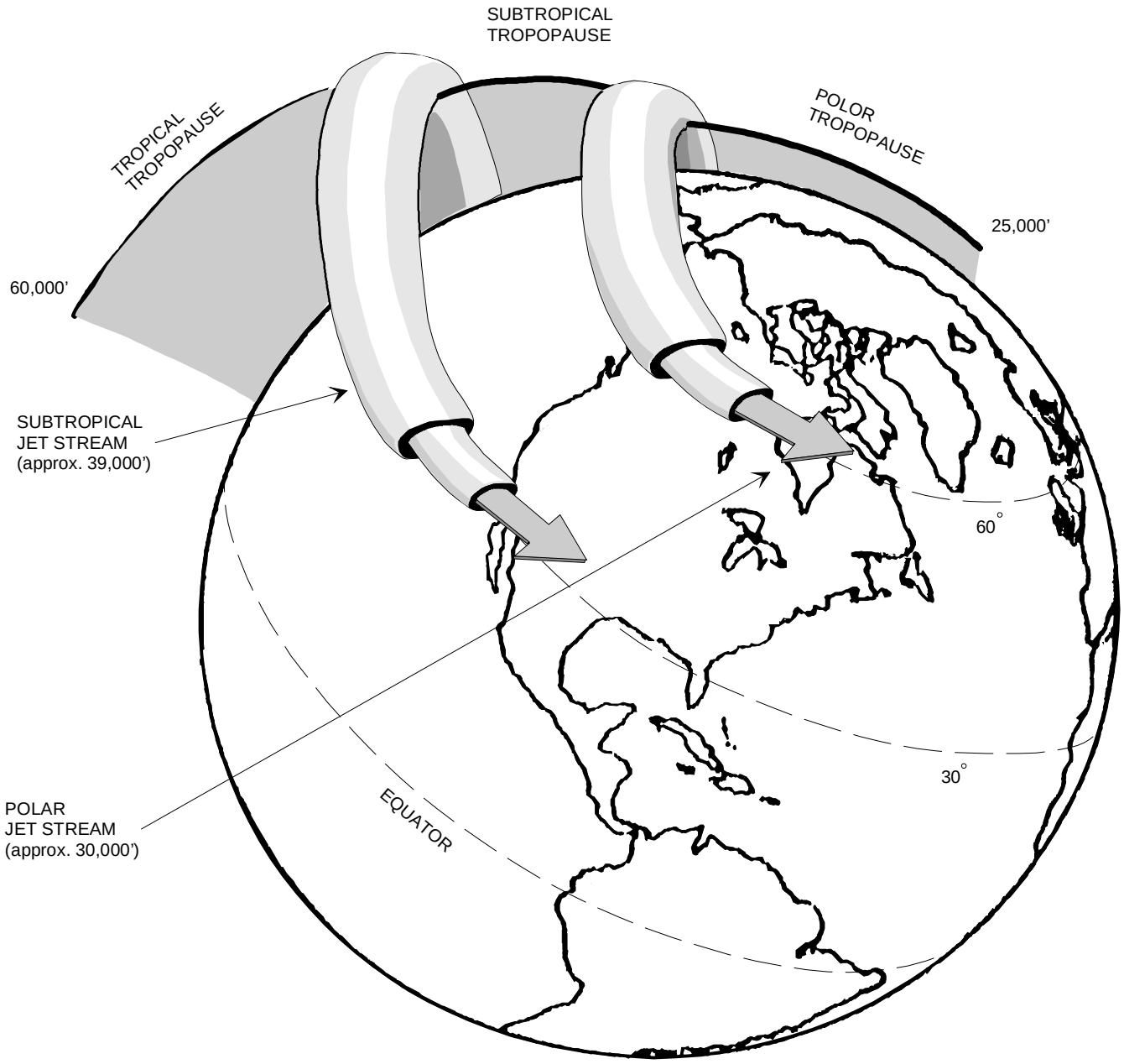


Figure 9: POLAR AND SUBTROPICAL JET STREAMS

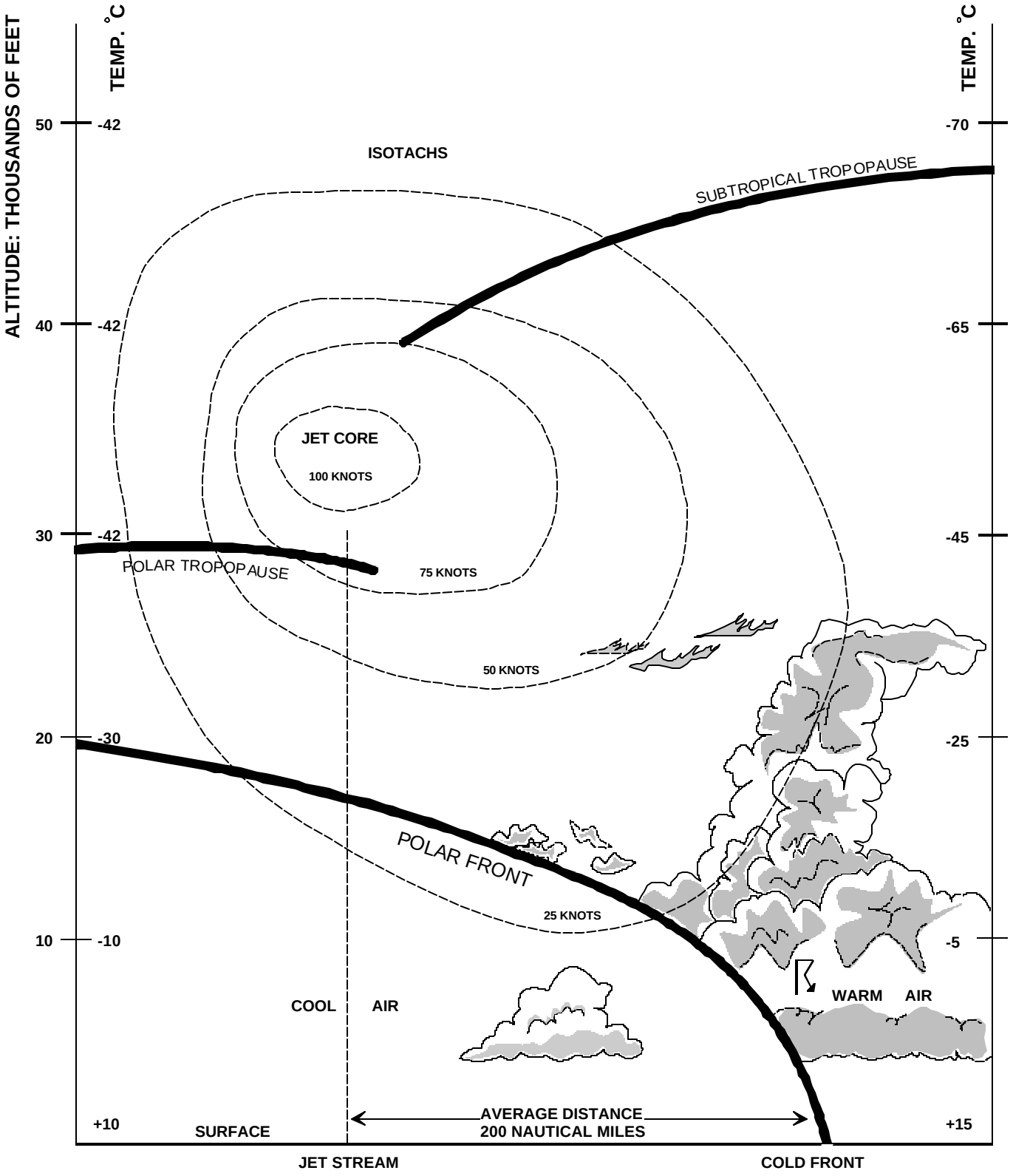
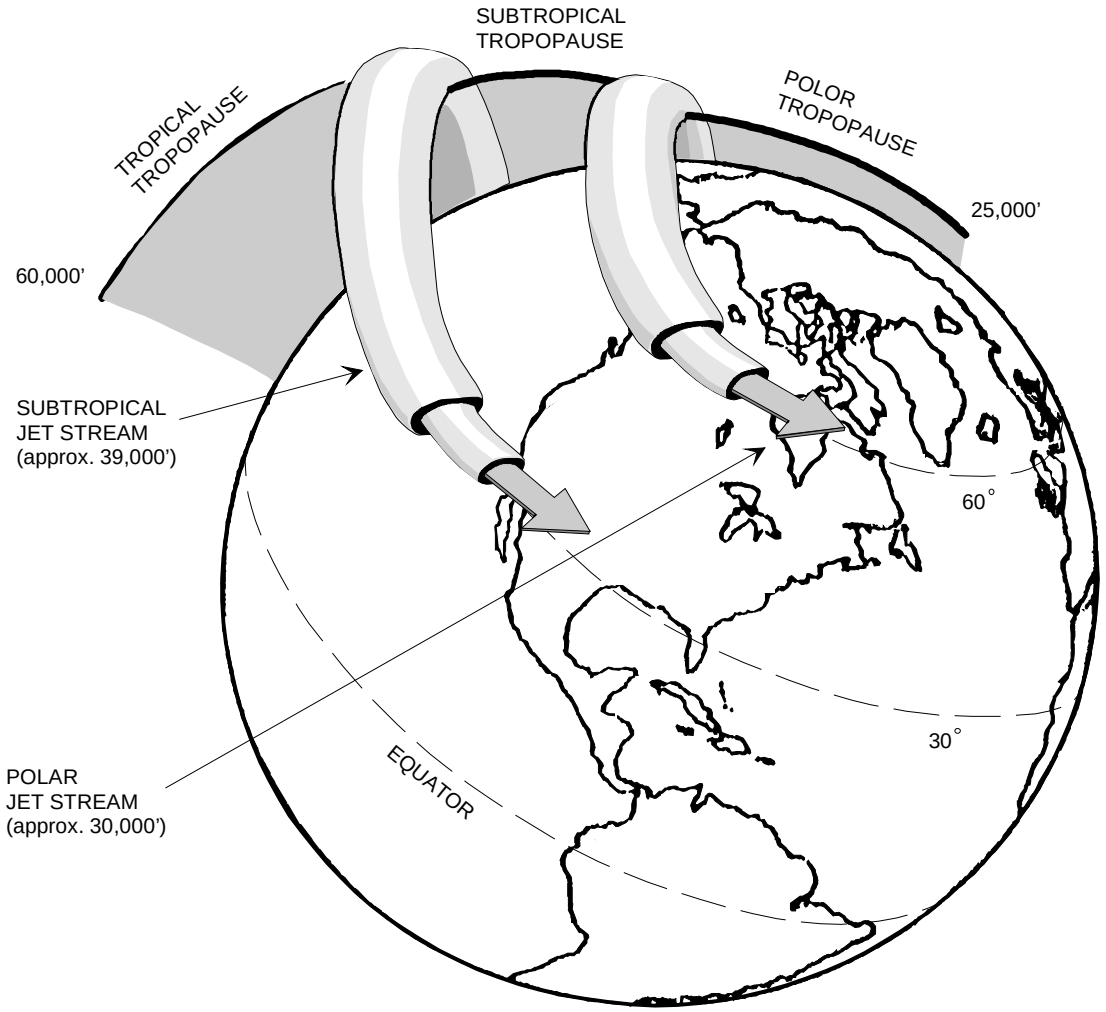


Figure 10: JET STREAM PROFILE



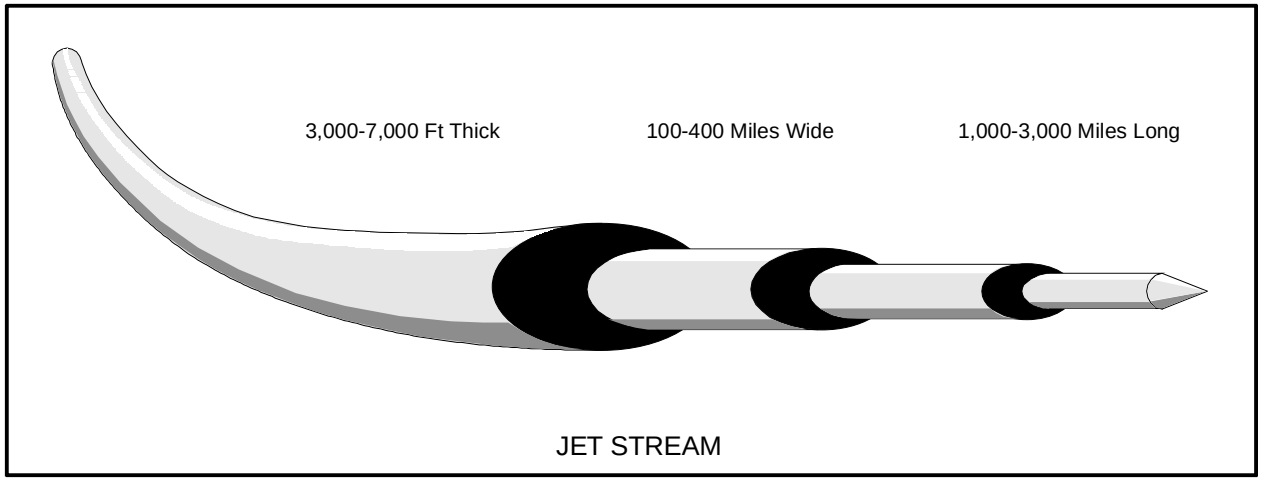


Figure 11: POLAR JET STREAM

(b) 100- to 400-mile width

(c) 3,000 to 7,000 ft in depth

(4) Mean position of Polar Jet Stream shifts south in winter and north in summer with polar front

(5) As polar front moves south, jet stream cores rise to higher altitudes and average speed increases

NOTE: The Polar Jet Stream appears to have a life cycle of formation, intensification, movement, and dissipation related to the polar front. The core of the strongest winds is generally found between 25,000 ft and 40,000 ft depending on latitude and season.

c. There are as many jet stream occurrences in the summer as in the winter

Fig 12: *Multiple Jet Streams*

d. Two jet streams can exist over the continental United States simultaneously

NOTE: When two are present, the southern one will usually be higher and have the strongest winds.

3. Flying the jet stream

a. Flying from west to east, speed and range can be greatly increased

b. Flying east to west decreases range and ground speed

(1) If caught in adverse wind flow, climb or descend to a colder airmass or take a more northerly track

(a) Wind speeds decrease rapidly on the north (polar) side and slowly on the south

NOTE: The average rate of change in wind speed is 100 kts for every 100 miles to the north of the core and 25 kts for every 100 miles to the south of the core.

(b) A decrease of 30 to 40 kts in 1,000 ft above or below the core of maximum winds is not uncommon

4. Jet Stream Meteorology

a. 200-millibar (summer) and 300-millibar (winter) constant pressure charts are analyzed for lines of equal wind speeds (isotachs)

(1) Areas of 70 kts or greater are shaded and are equivalent to the horizontal limits of the jet stream

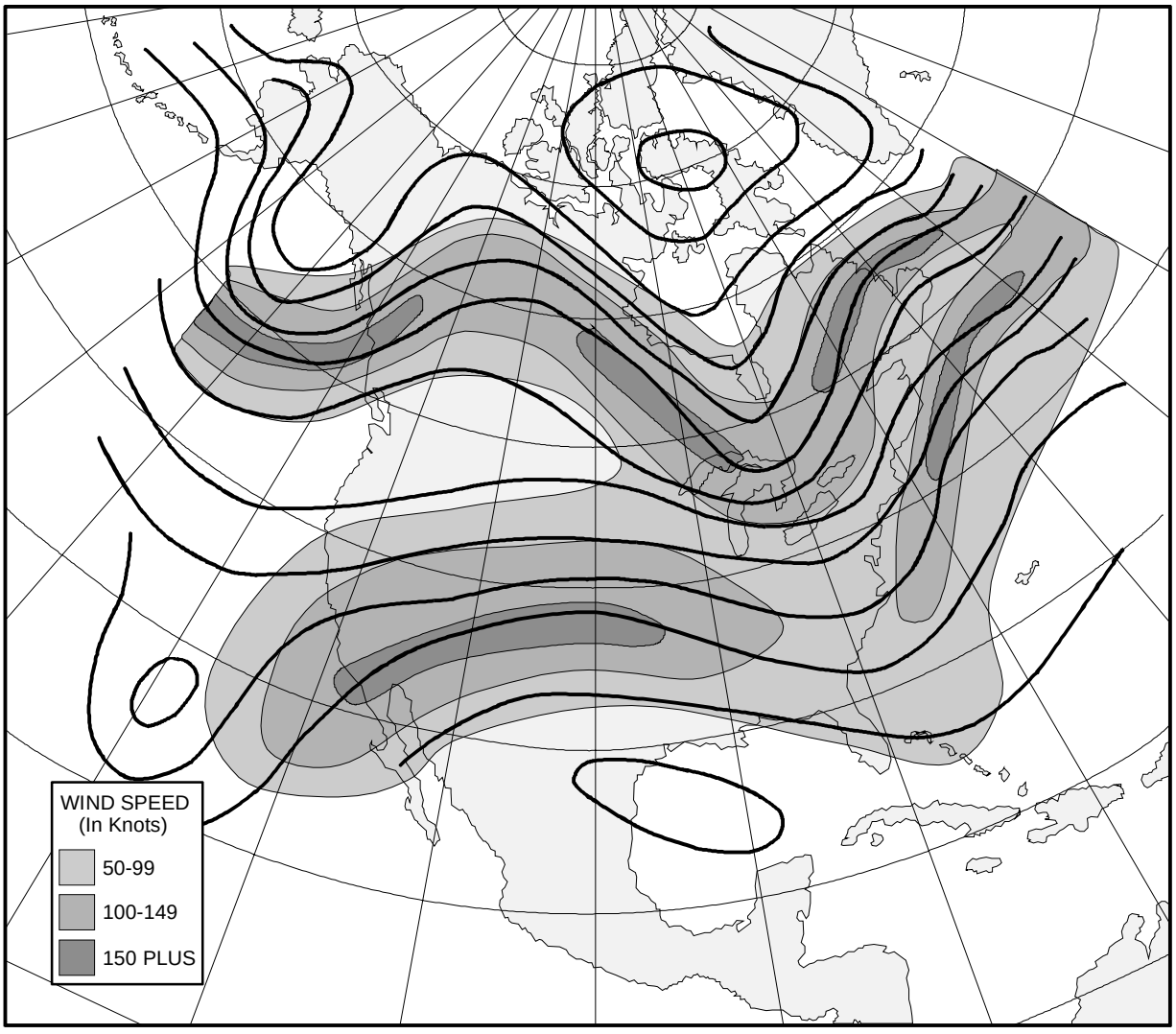


Figure 12: MULTIPLE JET STREAMS

(2) Highest winds running through the axis of this area is the core

(a) Vertical limits of the highest winds are usually 3,000 to 4,000 ft above and below the jet stream core

b. Satellite photos can give strong clues as to the jet stream locations

NOTE: Although there are few clouds at the jet stream core level, there is often considerable cloudiness below. These clouds are long and strung out along the jet stream.

F. Clear air turbulence (CAT) **1.1.1.4.1.1**

1. Types

a. Jet stream CAT

(1) CAT external to jet stream

(a) Especially severe when jet stream interacts with large mountain range or deep low-pressure system

(b) Can be anticipated when curving jet stream occurs on polar side of deep low-pressure system--greatest turbulence found on low-pressure side of jet stream and when wind speed exceeds 110 kts

(c) Can be anticipated along the jet stream north and northeast of a rapidly deepening low-pressure system

(d) Occurs frequently on inside of curve where jet stream turns sharply

Fig 13: *Jet Stream Clear Air Turbulence (CAT)*

(2) CAT internal to jet stream

(a) Can be found most often in areas of rapidly changing wind speeds

(b) Common near areas of highest wind velocity within jet stream, on polar side and below core

NOTE: Remember that the jet stream moves north in summer and south in winter.

Fig 14: *Areas of Probable (CAT) in Jet Stream*

b. Mountain wave CAT

(1) High velocity airflow over mountain range is disrupted and causes turbulence over and downwind of range

2) Produces large “waves” of air with strong updrafts and downdrafts

Fig 15: *Mountain Wave*

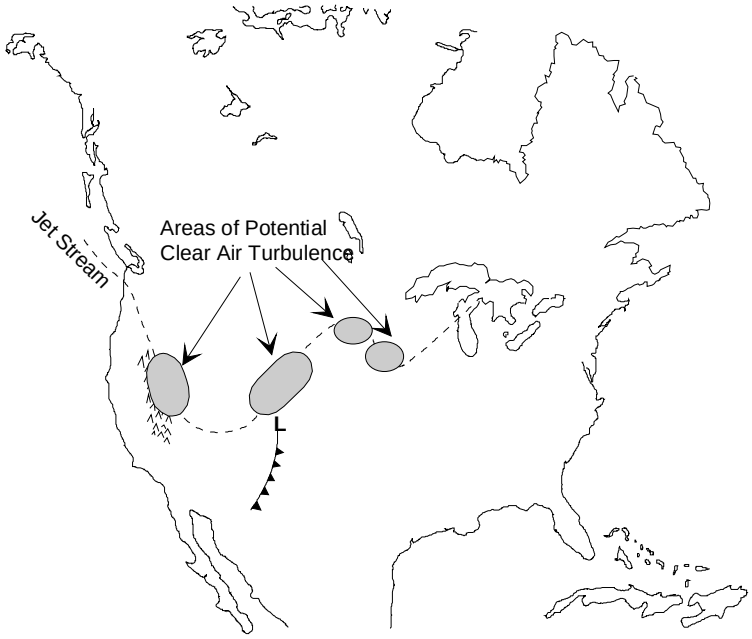


Figure 13: JET STREAM CLEAR AIR TURBULENCE (CAT)

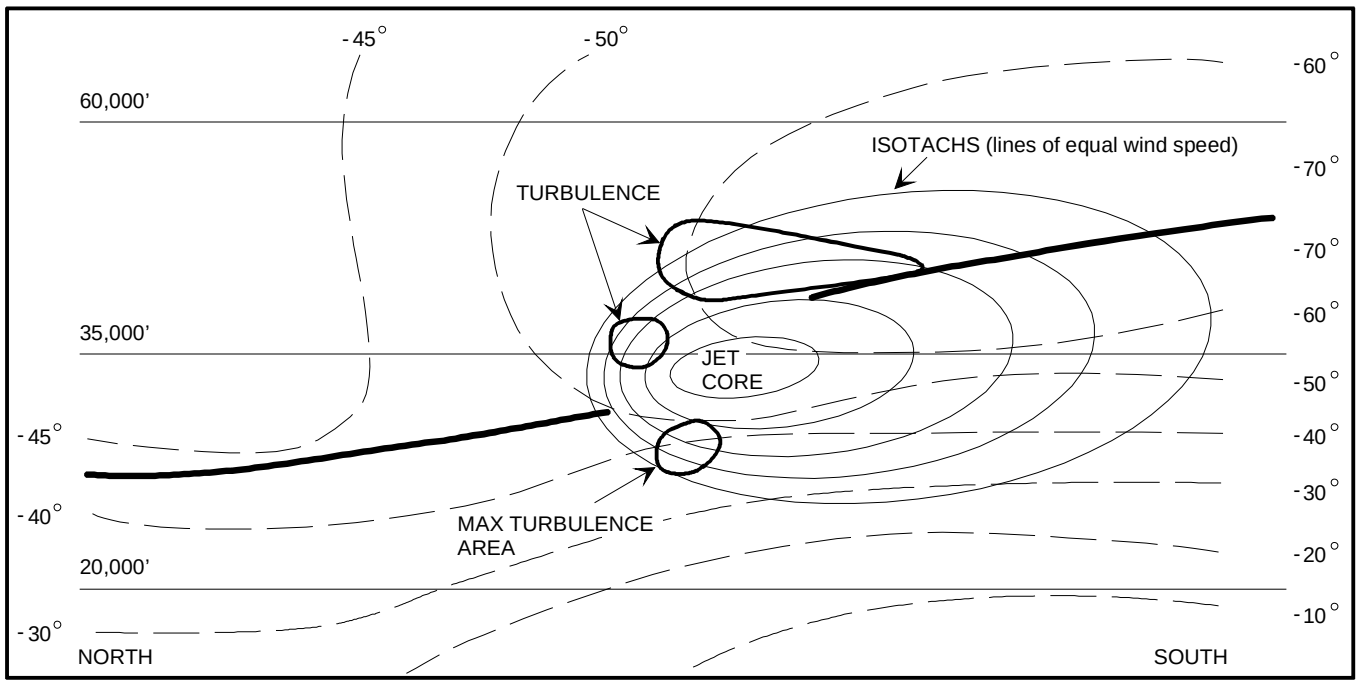


Figure 14: AREAS OF PROBABLE CLEAR AIR TURBULENCE IN JET STREAM

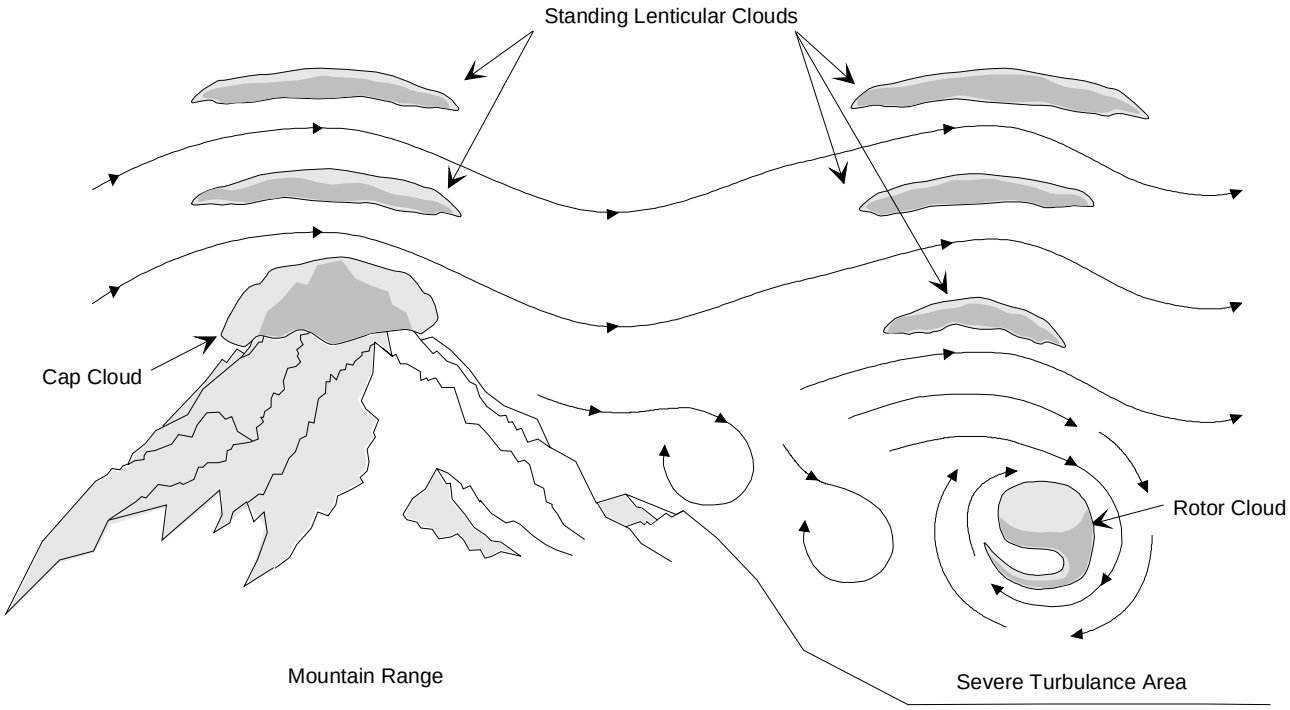


Figure 15: MOUNTAIN WAVE

(3) Can extend to 5,000 ft above tropopause and to 300 miles or more downwind of range

(4) Rotor turbulence very severe below tops of mountains, especially near rotor cloud formation--similar to turbulence associated with thunderstorms but much stronger

(5) Can be identified by cap clouds on mountain top or standing lenticular clouds along the crests of the flow if moisture is sufficient

c. Other areas: can develop in areas where large differences exist in airmass temperature (e.g., inversions)

2. Operational considerations

a. To prevent structural damage, maintain appropriate speed (250 KIAS)

b. Severe downdrafts require higher terrain clearance minimums

c. Avoid rotor clouds, which have enough strength to literally break aircraft apart

G. Wake turbulence **1.1.1.4.4**

1. Characteristics

a. By-product of lift as aircraft takes off or before aircraft touches down, generated by pressure differential between upper and lower wind surfaces, causing air under wing to “roll up” around end of the wing, forming a vortex

NOTE: During landing, wingtip vortex disappears as the aircraft touches down.

b. Heavy and slow aircraft generate greatest vortex strength

NOTE: Tangential velocities of wingtip vortices have reached 133 kts in tests.

c. Vortices spread downward at approximately 400 to 500 fpm from the flight path and outward at approximately 5 kts, leveling off about 900 ft below flight path

d. Persists several minutes after generating aircraft is out of sight

e. Calm or light surface wind can carry vortices into next aircraft’s flight path—light quartering tail wind requires maximum caution

2. Operational considerations

   a. Plan a landing approach above approach path of previous aircraft and land beyond touchdown point

   b. Plan to touch down before lift-off point of departing aircraft

   c. Plan your lift-off point to occur before lift-off point of previous aircraft and climb out above its flight path

   d. Delay your lift-off until beyond touchdown point of landing aircraft

SUMMARY

* Meteorological definitions
* Weather patterns associated with frontal systems
* Meteorological hazards and their effects on flight and flight planning

CONCLUSION

As aviators, we experience the meteorological environment in a unique and potentially hazardous way. To operate effectively and safely within that environment, we must understand weather phenomena and the hazards to flight they may represent. Don't become a "weather statistic"!

LESSON GUIDE

COURSE/STAGE: Meteorology

LESSON TITLE: Meteorology and Flight Planning

LESSON IDENTIFIER: Metro-02

LEARNING ENVIRONMENT: Classroom

ALLOTTED LESSON TIME: 2.3 hr

TRAINING AIDS:

* Figures
  - Fig 1: Weather Minimums Required IAW OPNAVINST 3710.7
  - Fig 2: Surface Analysis Chart
  - Fig 3: Standard Chart Symbols
  - Fig 4: Major Station Model Symbols
  - Fig 5: Weather Depiction Chart
  - Fig 6: Radar Summary Chart
  - Fig 7: Low-Level Prognostic Chart
  - Fig 8: Winds Aloft Prognostic Chart
  - Fig 9: METAR
  - Fig 10: Terminal Aerodrome Forecast (TAF)
  - Fig 11: METAR Abbreviations
  - Fig 12: METAR (SPECI or Special Report)
  - Fig 13: Area Forecast Coverage
  - Fig 14: Area Forecast (FA)
  - Fig 15: Winds Aloft Forecast (FD)
  - Fig 16: Convective SIGMET (WST)
  - Fig 17: SIGMET (WS)
  - Fig 18: AIRMET (WA)
  - Fig 19: Military Weather Advisory (MWA)

(7-97) CHANGE 2

TRAINING AIDS (cont.):

STUDY RESOURCES:

Meteorology Flight Planning Workbook II CNAT P-304-PAT

LESSON PREPARATION:

Complete:

* CAI lesson for Metro-01

Read:

* FLIP Flight Information Handbook, Section C
* FLIP General Planning (GP) Chapter 8

REINFORCEMENT: N/A

EXAMINATION:

The objectives in this lesson will be tested in Meteorology 04X.

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LESSON OBJECTIVES

1.1.1.1
Determine weather minimums

1.1.1.1.1.1
Recall weather minimums required IAW OPNAVINST 3710.7

1.1.1.3
Recall information contained/displayed on weather charts

1.1.1.3.1
Interpret surface charts (analysis/prognostic)

1.1.1.3.3
Interpret weather depiction charts

1.1.1.3.2
Interpret radar summary charts

1.1.1.3.4
Interpret prognostic charts

1.1.1.5
Recall information contained in forecasts

1.1.1.5.4
Recall information contained in METARs

1.1.1.5.1
Recall information contained in terminal aerodrome forecasts

1.1.1.5.3
Recall information contained in area forecasts

1.1.1.5.2
Recall information provided in winds aloft forecasts

1.1.1.4.6
Recall information contained in severe weather forecasts

1.1.1.4.7
Recall OPNAVINST severe weather restrictions

1.1.1.4.8
Recall CNATRA severe weather restrictions

1.1.1.11
Recall aviation in-flight weather advisories

1.1.1.11.1
Recall information provided in AIRMETs

1.1.1.11.2
Recall information provided in SIGMETs

1.1.1.2.1
Recall requirements IAW OPNAVINST 3710.7 for obtaining DD-175-1

1.1.1.2.1.1
Recall the five sections of the DD-175-1

1.1.1.2.1.1.1
Interpret data contained on DD-175-1

1.1.1.9.1
Recall enroute facilities/procedures for weather information and reporting

1.1.1.11.3
Recall information provided in PIREPs

1.1.1.11.3.1
Recall PIREP information to provide controlling agency

1.1.1.11.4
Recall information provided by flight weather packet

1.1.1.11.5
Recall information provided by Optimum Path Aircraft Routing System (OPARS)

1.1.1.11.6
Recall information provided by satellite imagery

MOTIVATION

For pilots, correctly interpreting weather information is as important as understanding weather phenomena. Understanding weather minimum requirements and visualizing the weather symbolized on charts, reports, and briefings are important flight planning skills that you must obtain and refine as you continue in your flying career.

OVERVIEW

After reviewing information concerning weather minimums and weather charts and reports, you will be able to interpret weather phenomena as they relate to flight planning.

This lesson covers:

* Weather minimums
* Weather charts
* Printed reports and forecasts
* Flight weather briefing
* Enroute procedures
* Flight weather packets
* OPARS
* Satellite imagery

REFRESHER

Recall the:

* Characteristics of fronts and the wind changes and flight hazards associated with them
* Meteorological hazards associated with thunderstorms, including turbulence, hail, squall lines, tornadoes, micro-bursts, windshear, and lightning
* Types of structural icing, their formation, and their effects on aircraft performance
* Hazards associated with fog formation
* Hazards and probable location of clear air turbulence (CAT)
* Hazards of wake turbulence and procedures to avoid it

PRESENTATION

I. Weather minimums **1.1.1.1**

Sg 1, fr 3
Lesson Organization

LESSON NOTES

All projected graphics in this lesson are reproduced in the Lesson Guide, except for the projected graphics of a severe weather watch bulletin (WW) and a CNATRA severe weather warning (CAWW).

A. OPNAVINST 3710.7 destination weather **1.1.1.1.1.1**

Sg 1, fr 4
Fig 1: *Weather Minimums Required IAW OPNAVINST 3710.7*

NOTE: Weather at ETA +/-1 hour dictates alternate weather requirements.

1. If destination is 0-0, up to but not including published minimums, then alternate must be 3,000-3 or better

2. If destination is at published minimums, up to but not including 3,000-3 (single-piloted absolute minimums 200-1/2)

   a. Then for <u>non-precision</u> approaches, alternate must be published minimums plus 300-1

   b. Then for <u>precision</u> approaches, alternate must be published minimums plus 200-1/2

      NOTE: ILS only authorized precision approach that can be used at an alternate, i.e., not a PAR.

<table>
<tr><td>DESTINATION WEATHER
ETA plus and minus one (1) hour</td><td colspan="3">ALTERNATE WEATHER
ETA plus and minus one (1) hour</td></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="3">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>* 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: WEATHER MINIMUMS REQUIRED IAW OPNAVINST 3710.7

NOTE: In the case of single-piloted aircraft, 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.

3. If destination is 3,000-3 or better, no alternate is required

NOTE: CNATRA requires an alternate be filed for all cross-country flights, regardless of destination weather.

PROGRESS CHECK

Question 1 — 1.1.1.1.1.1
The weather at your destination is forecast to be greater than published minimums but less than 3,000-3. For a non-precision approach, what are your alternate airport weather requirements?

ANSWER: 300-1 above precision approach minimums

Sg 2, fr 3
Lesson Organization

II. Weather charts **1.1.1.3**

A. Observed-weather charts

1. Surface analysis charts **1.1.1.3.1**

Sg 2, fr 4
Fig 2: *Surface Analysis Chart*

a. Based on hourly observed weather information

b. Provide ready means of locating pressure systems, fronts, and stations with potentially poor weather conditions

c. Disseminated every 3 hrs

d. Symbology

Fig 3: *Standard Chart Symbols*

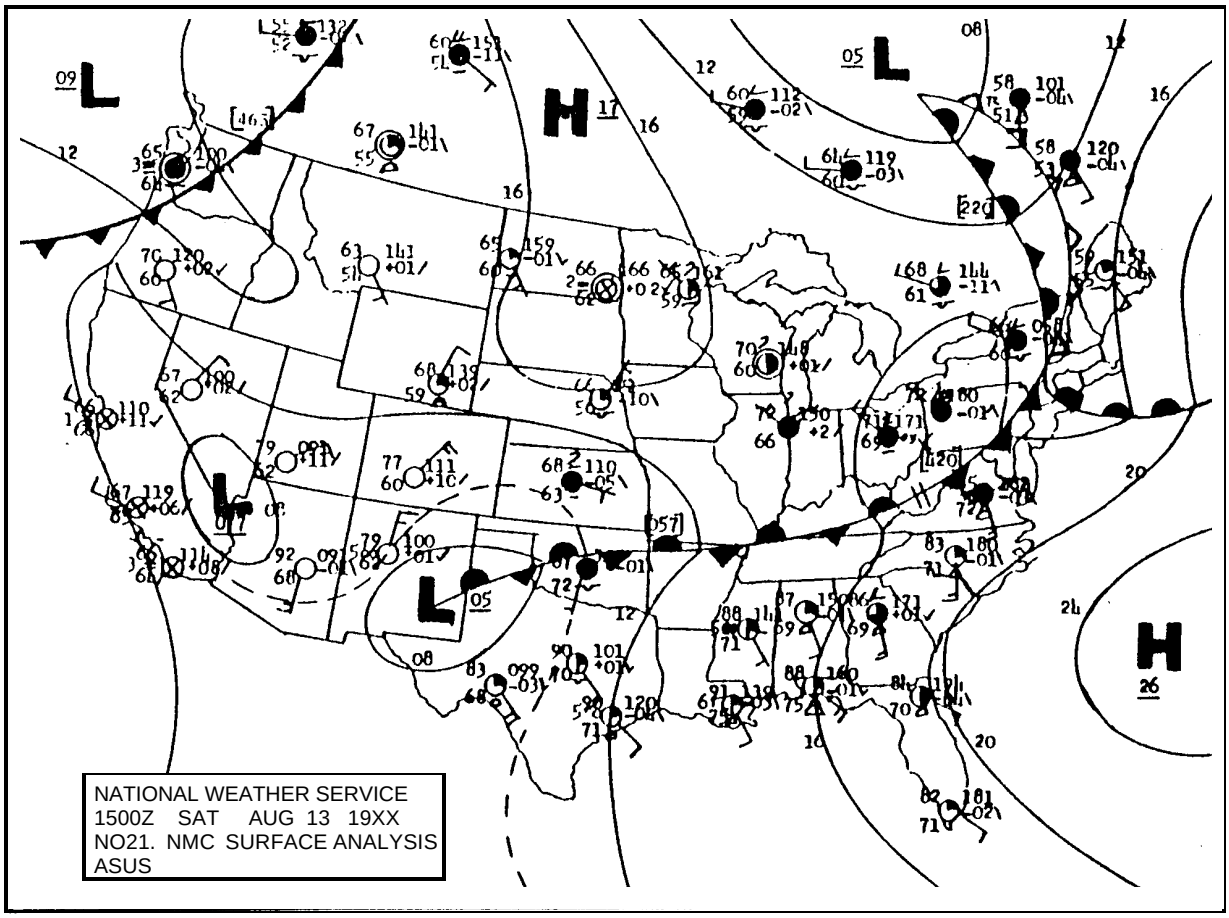


Figure 2: SURFACE ANALYSIS CHART

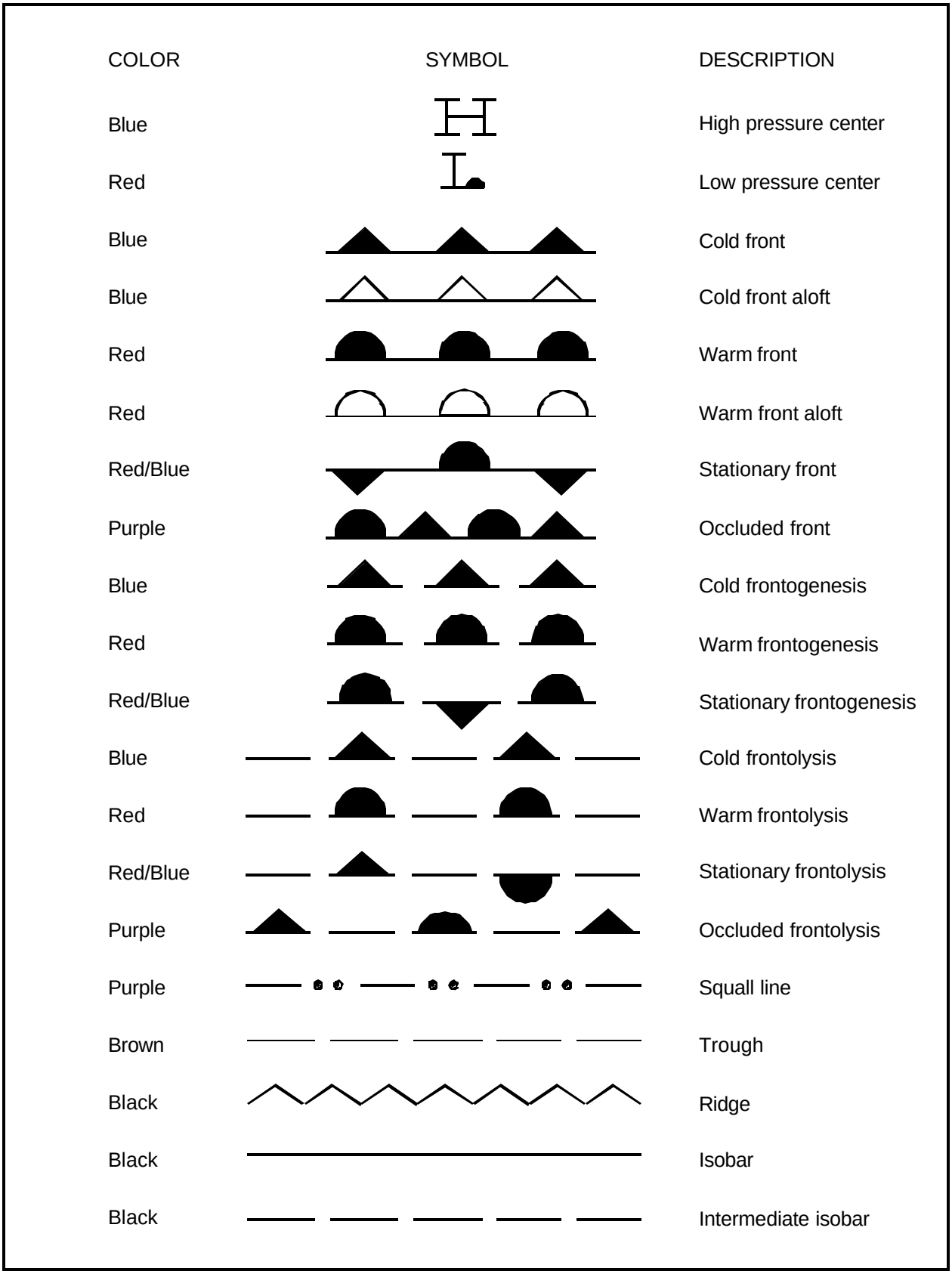


Figure 3: STANDARD CHART SYMBOLS

LESSON NOTES

Point out the various chart symbols as they are discussed for each of the weather charts.

(1) Standard symbols depict fronts

(2) "H" or "L" and isobars denote pressure systems

(3) Station model includes information on sky coverage, wind direction and speed, temperature, dew point, precipitation, and other related information

Sg 2, fr 5
Fig 4: *Major Station Model Symbols*

Sg 2, fr 6
Fig 2: *Surface Analysis Chart*

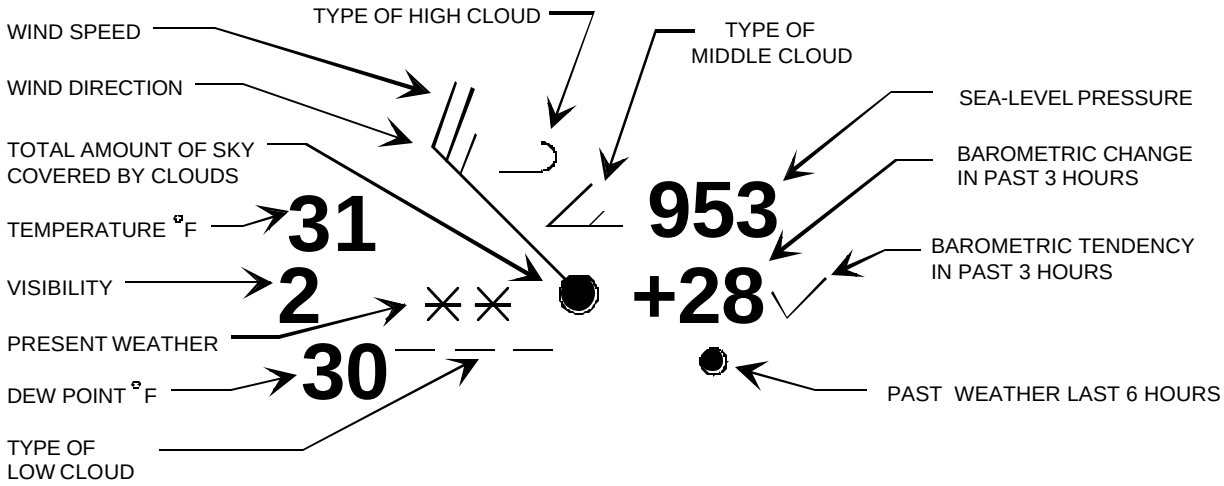
LESSON NOTES

On the chart, trace the course a flight would take from Chicago to Miami.

PROGRESS CHECK

Question 2 — 1.1.1.3.1
Refer to the simplified surface analysis chart (Figure 2). You are planning a flight from Chicago to Miami. What type of weather are you likely to experience?

ANSWER: A stationary front approximately halfway through the trip



PLOTTED DATA AROUND STATION CIRCLE ON SURFACE ANALYSIS CHART

SKY CONDITION	PRESENT WEATHER		PRESSURE TENDENCY	CLOUDS
CLEAR	RAIN	RAIN SHOWER	RISING, THEN FALLING (+)	St
1/10 OR LESS	DRIZZLE	HURRICANE	RISING AND STEADY (+)	Sc
2/10 TO 3/10	SNOW	SQUALL	RISING (+)	Ns
4/10	ICE PELLETS	FUNNEL CLOUD	FALLING, THEN RISING (+)	Cu
5/10	HAIL	BLOWING SNOW	STEADY	Cb
6/10	THUNDERSTORM	FOG	FALLING, THEN RISING (-)	Ac
7/10 TO 8/10	FREEZING DRIZZLE	BLOWING DUST OR SAND	FALLING, THEN STEADY (-)	As (THIN)
9/10	FREEZING RAIN	DUST DEVIL	FALLING (-)	Cl
COMPLETE OVERCAST	SNOW SHOWER	SMOKE	RISING, THEN FALLING (-)	Cc
OBSCURATION	THUNDERSTORM AND RAIN	HAZE	(+) HIGHER THAN 3 HOURS AGO (-) LOWER THAN 3 HOURS AGO	Cs

MAJOR STATION MODEL SYMBOLS

Figure 4: MAJOR STATION MODEL SYMBOLS

Sg 2, fr 7
Fig 5: *Weather Depiction Chart*

2. Weather depiction charts **1.1.1.3.3**

   a. Compiled from hourly surface aviation reports

   b. Quickly identify positions of fronts and areas of VFR, marginal VFR (MVFR), and IFR weather

      (1) MVFR (marginal visual flight rules) weather between 1,000 ft ceiling/3 miles visibility and 3,000 ft ceiling/5 miles visibility

      (2) MVFR has no bearing on the civilian or military pilot but warns of poor flying conditions

      (3) Chart contains a legend for clarity

   c. Disseminated eight times a day, every 3 hrs starting at 0100Z

   d. Symbology

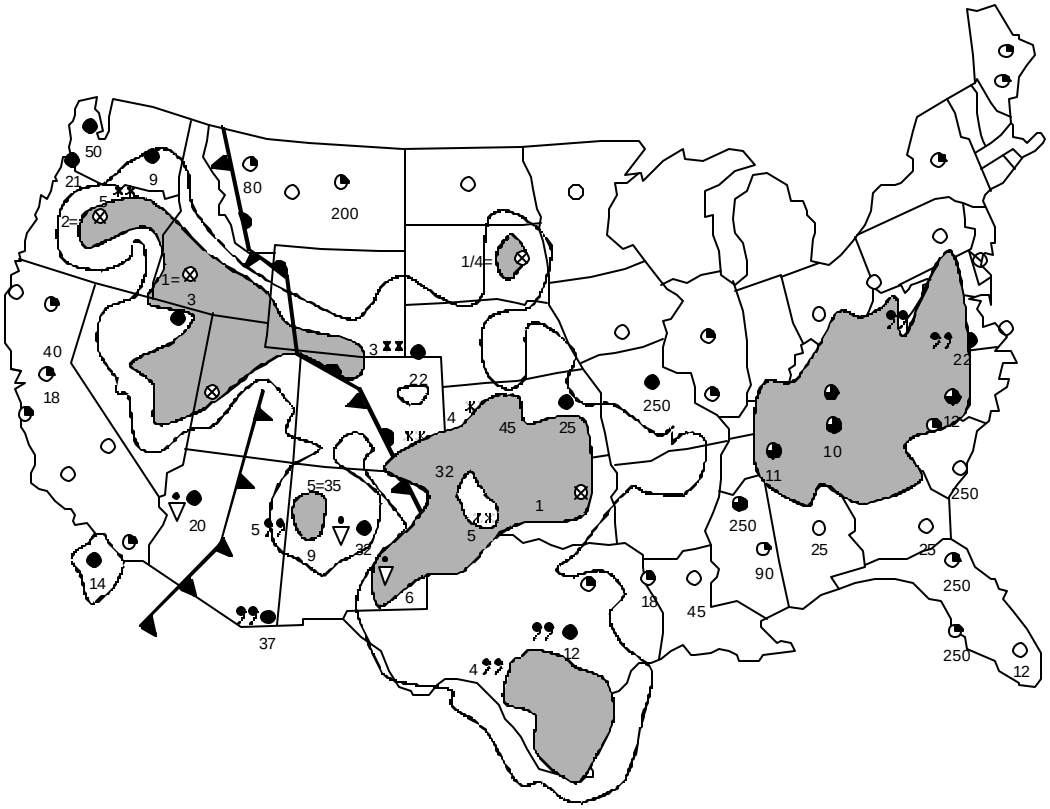
      (1) Standard symbols depict fronts (as on surface analysis chart)

      (2) Contoured unshaded areas indicate MVFR weather with ceilings of 1,000-3,000 ft AGL and/or visibilities of 3-5 sm

      (3) Contoured shaded areas indicate IFR weather with ceilings of less than 1,000 ft AGL and/or visibility of less than 3 sm

      (4) The weather depiction chart station model contains no wind, temperature, or pressure information.

      NOTE: The following items are depicted: sky coverage, height of lowest cloud layer (or ceiling height, if present) in ft AGL, visibility if 6 sm or less, and form of weather obscuring the visibility (as in Figure 5).



10Z MON 25 JULY 19XX

56. NMC WEATHER DEPICTION

SHADED AREAS...IFR WITH CIGS LESS THAN 1,000 FT AND/OR VSBY LESS THEN 3 MI.

CONTOURED WITHOUT SHADING...MVFR AREAS WITH CIG GREATER THAN OR EQUAL TO 1,000 TO LESS THAN OR EQUAL TO 3,000 FT AND/OR VSBY GREATER OR EQUAL TO 3 MI LESS THAN OR EQUAL TO 5 MI.

NO CONTOURS...VFR AREAS WITH CIG GREATER THAN 3,000 FT AND VSBY GREATER THAN 5 MI.

Figure 5: WEATHER DEPICTION CHART

(5) Sky coverage symbols are different from those used for the surface analysis charts

(6) Some weather symbols used on the surface analysis are used on the weather depiction chart

LESSON NOTES

For the following progress check, point to the station in South Dakota on the chart.

Although the test question for this objective will require a response with only VFR, IFR, or MVFR conditions, we have presented additional information on station models for your use.

PROGRESS CHECK

Question 3 — 1.1.1.3.3
Refer to the station in South Dakota (Figure 5). What are the weather conditions at this station?

ANSWER: IFR. The station model depicts a 1/4-mile visibility, fog, and no ceiling

Sg 2, fr 8
Fig 6: *Radar Summary Chart*

3. Radar summary charts **1.1.1.3.2**

a. Derived from radar returns from National Weather Service (NWS), terminal, and Air Route Traffic Control Center (ARTCC) weather radar stations across the U.S.

(1) Weather radar used is primarily X-band (UHF), which is more sensitive to weather echoes

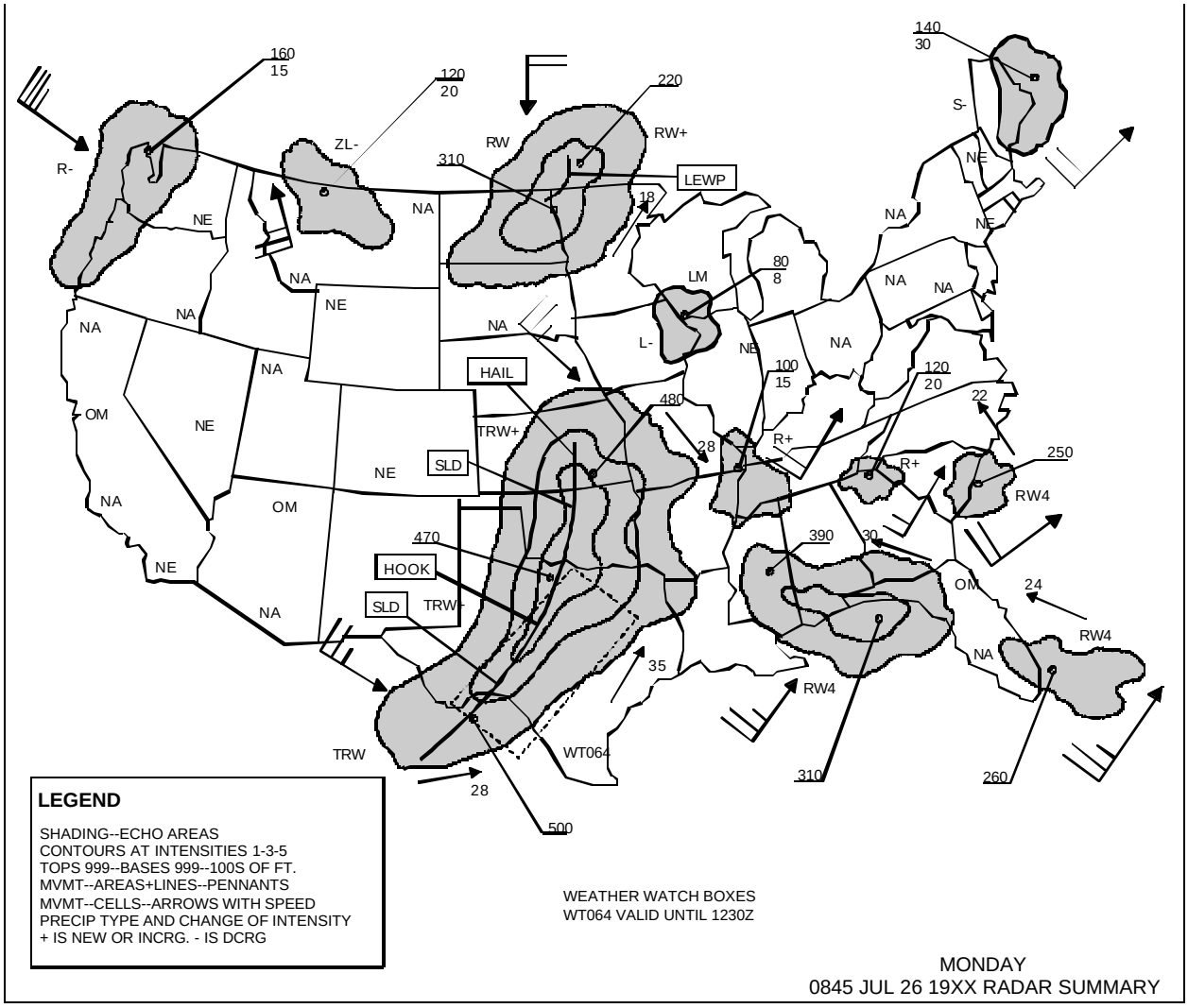


Figure 6: RADAR SUMMARY CHART

(2) Computer-produced facsimile presentation from radar returns

b. Identify general areas and movement of precipitation and thunderstorms for preflight planning purposes

c. Disseminated once an hour, 35 minutes past the hour

d. Symbology

(1) Areas of echoes are marked with a solid outline and crosshatched

(a) 6 different levels of intensity

(b) Only contours for levels 1,3,5 are plotted; levels 2,4,6 are interpolated between them

(c) Intensities

i) Weak

ii) Moderate (moderate to severe turbulence possible)

iii) Strong (severe turbulence possible and lightning)

iv) Very strong (severe turbulence probable and lightning)

v) Intense (severe turbulence, lightning, hail likely, and organized wind gusts)

vi) Extreme (severe turbulence, lightning, large hail, and extensive wind gusts and turbulence)

(d) Line of echoes (such as a squall line) indicated by a solid line

(2) Display tops and bottoms of radar echoes, if known, in hundreds of feet

NOTE: Actual cloud tops and/or bottoms may be several thousand feet higher or lower.

(3) Direction arrows

(a) Arrows with barbs or flags indicate area or line movement

(b) Arrows with numbers indicate direction and speed of individual cell within a line or area

NOTE: Arrows are oriented to eight cardinal points of compass.

(4) Contractions and letters depict the type of surface weather associated with the echoes

NOTE: A "+" (plus) symbol indicates the intensity of the echoes are increasing. A "-" (minus) symbol indicates decreasing intensity.

(5) Dashed line box indicates a forecast weather watch (WW) area

(a) Valid time and ID number of WW displayed alongside

(b) "WT" denotes tornado watch, "WS" indicates severe thunderstorms

NOTE: Only forecast information is on the RADAR Summary Chart; all other information is observed.

(6) If for any reason no echoes were observed, the following symbols are used to indicate why:

(a) "NE" - No Echo - echo information but none observed

(b) "NA" - Observation Not Available

NOTE: If plotted with station call letters, a report is available but received too late to plot.

(c) "OM" - Equipment Out for Maintenance

(d) "ROBEPS" - Radar Operating Below Performance Standards

PROGRESS CHECK

Question 4 — 1.1.1.3.2
Refer to the radar summary chart (Figure 6). Regarding the area of precipitation off the Florida coast, what information can be derived?

ANSWER: The information presented on the chart includes: Radar echoes to 26,000 MSL, level 1 to 2 intensity, cell movement to the northwest at 24 kts.

B. Prognostic charts **1.1.1.3.4**

NOTE: Remember to correlate forecast flight conditions. to scheduled flight time.

1. Low-Level Significant Weather Prognostic Chart

Sg 2, fr 9
Fig 7: *Low-Level Prognostic Chart*

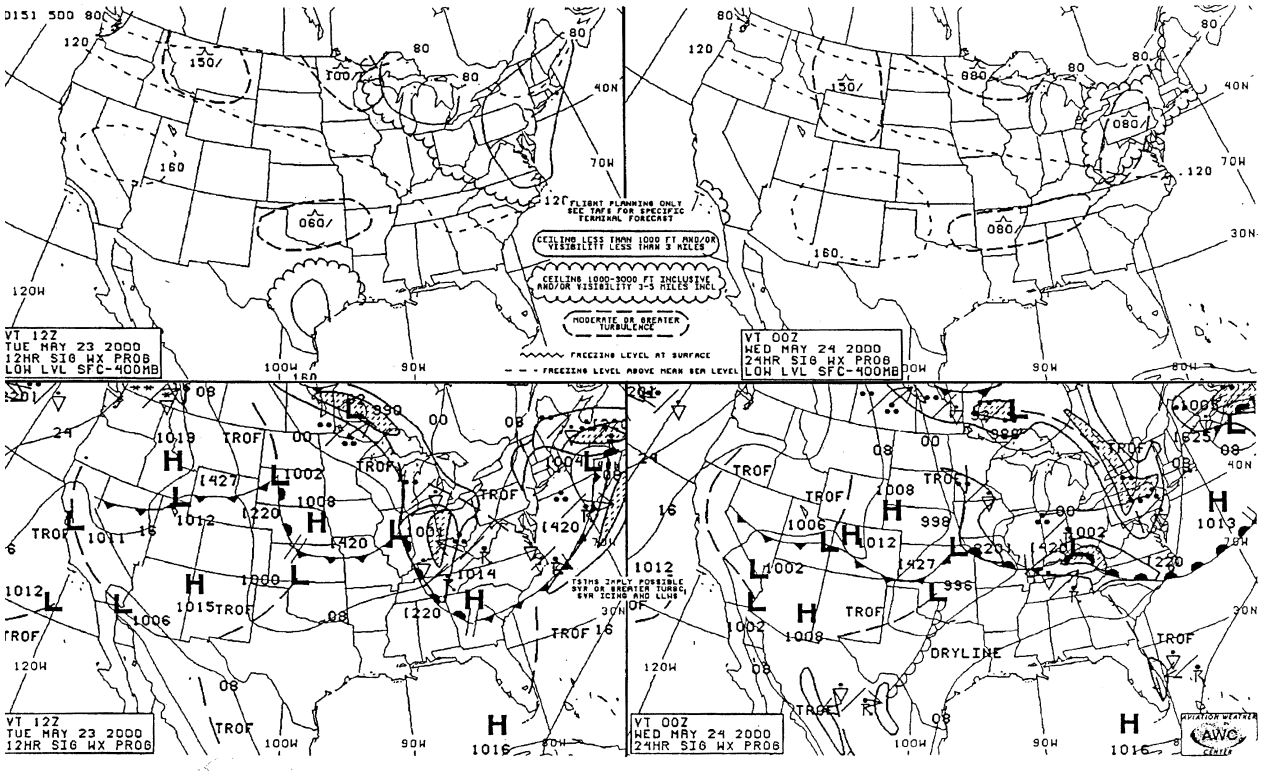


Figure 7: LOW-LEVEL PROGNOSTIC CHART

a. Manually produced facsimile prognostic charts providing depictions of various surface and low-level (up to 24,000 ft MSL) significant weather features out to 48 hrs

b. The 12- and 24-hour forecasts are produced on one chart, 4 times a day

NOTE: Separate panels depict the surface weather prognosis, and a second panel depicts the "significant weather" for each forecast time.

c. The 36- and 48-hour forecasts are on a separate chart produced twice daily

NOTE: A single panel depicts both surface features and significant weather. Underneath the panel, a forecast discussion about which guidance was used to prepare the chart, and why it was used, is written in plain language with many abbreviations.

d. Chart intended for general flight planning, see specific TAFs for terminal aerodrome forecasts

e. Chart shares some symbology and coloration with the Surface Analysis (SA) chart

f. Frontal type and position shown using standard symbols

(1) High- and low-pressure centers indicated by Hs and Ls with the pressure value (underlined) to the nearest whole millibar

(2) Pressure center movement is indicated by an arrow for direction, and the forecast speed of movement at the valid time of the chart is entered in knots at the head of the arrow

NOTE: The term "STNRY" is used to indicate little movement.

(3) Isobars will be depicted by a thin, solid line at an 8-millibar interval, labeled in tens and units of millibars

g. Chart always contains a legend in the middle of the top two panels

Sg 2, fr 10
Prognostic Chart Legend

(1) Solid line indicates terminal areas with ceilings less than 1,000 ft and/or visibility less than 3 miles (IMC) - colored red

(2) Scalloped line indicates terminal areas with ceiling between 1,000 ft but less than 3,000 ft and/or visibility greater than 3 miles but less than 5 miles (MVFR) - colored blue

(3) Bold long-dashed lines indicate areas of moderate or greater turbulence

NOTE: The chart does not depict light turbulence. Moderate turbulence is symbolized by an inverted V, severe turbulence uses the same inverted V with a second inverted V above.

(a) The numbers to the left of a slash (/) indicate tops of forcasted turbulance, and numbers to the right indicate the base of the forcasted turbulance in hundreds of feet MSL

(b) No figure to the right of the slash indicates turbulance from surface upward, while absence of a figure to the left of the slash indicates turbulance above the limits of the chart (24,000 feet MSL)

(4) The surface 32-degree isotherm is depicted with a dotted line and is labeled

(5) Freezing level aloft indicated with a short dashed line and labeled in hundreds of feet MSL at 4,000-ft intervals

NOTE: If an upper level freezing contour crosses the surface freezing line, multiple freezing levels aloft are indicated.

NOTE: Areas of icing are not specifically outlined on the chart; however, a pilot should know that icing is implied in clouds or areas of precipitation above the freezing level.

PROGRESS CHECK

Question 5 — 1.1.1.3.1
Refer to the low-level prognostic chart. Regarding the southeastern U.S., what information can be derived?

ANSWER: The area is forecast to be dominated by IFR weather.

2. High-level significant weather prognostic—above 24,000 ft MSL

   a. Manually prepared by NWS forecasters

   b. Display 12- and 24-hour forecasts for significant weather conditions

   c. Disseminated 4 times daily

   d. Symbology

      (1) Scalloped lines depict areas of widespread or embedded thunderstorms

(2) Broken lines display areas of CAT

(3) Depicts location of weather hazards, including widespread sandstorms or dust storms, squall lines, and tropical storms

(4) Arrows and wind flags show position and speed of jet stream

(5) Square boxes show height of the tropopause

NOTE: Meteorologists utilize the low-level significant Wx Prog chart more than the high-level. All high-level information is available from other sources, e.g., constant pressure charts. Many weather offices choose to not receive this facsimile from the National Weather Service.

3. Winds Aloft Prognostic charts

Sg 2, fr 11
Fig 8: *Winds Aloft Prognostic Chart*

a. Computer-prepared forecasts of wind speed and direction and outside air temperature (OAT) for true altitudes of 6,000 ft, 9,000 ft, and 12,000 ft

NOTE: Charts are also available for the true altitudes of 18,000 ft (500 mbs), 24,000 ft (400 mbs), 30,000 ft (300 mbs), 34,000 ft (250 mbs), 39,000 ft (200 mbs), which approximate the constant pressure charts.

b. Flight planning applications include computation of ground speed, time en route, and other performance figures

NOTE: Although winds aloft prognostic charts are considered accurate for a quick ready reference, the winds aloft forecast (FA) teletype report is considered to be more accurate.

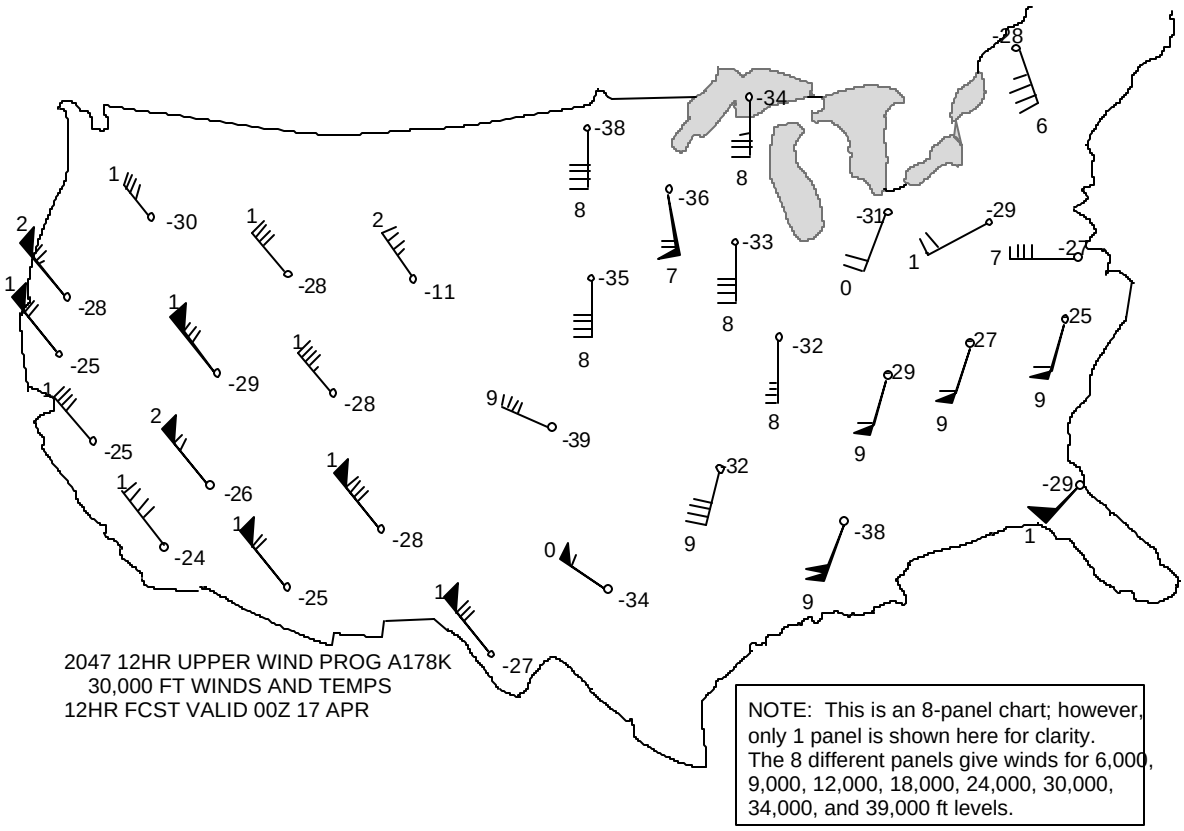


Figure 8: WINDS ALOFT PROGNOSTIC CHART

c. Disseminated 2 times daily in 12-hour prognostics

(1) 8-panel chart

(2) Chart does not forecast winds and temperature for a given time but considered average winds for the period of the chart, for use until next chart received

d. Symbology

(1) Wind shaft - depicts the quadrant from which the wind is blowing

(a) To 8 cardinal points of compass

(b) Number near the end of the shaft indicates direction to nearest 10 degrees

(2) Wind velocity indicated at top of shaft

(a) Flag for 50 kts

(b) Barb for 10 kts

(c) Half barb for 5 kts

(d) Accuracy to nearest 5 kts

(e) If calm or light and variable, wind will be shown as "99" to the lower left corner of station model

(3) Temperature depicted in degrees Celsius near base of wind flag

LESSON NOTES

Point to the station in Florida (-29) and the station in northern Minnesota (-38) on the winds aloft chart.

PROGRESS CHECK

Question 6 — 1.1.1.3.4
Refer to the winds aloft prognostic chart (Figure 8). When planning a flight from Florida to northern Minnesota, what wind pattern(s) should you for the most part expect?

ANSWER: Tail winds (or southerly)

? **Using prognostic charts, how can you detect a forecast area of severe turbulence?**

ANSWER: On low- and high-level prognostic charts, broken lines enclose areas of turbulence.

Sg 3, fr 3
Lesson Organization

Sg 3, fr 4
Introduction to METAR/TAF

Sg 3, fr 5
Figure 9: *METAR*

III. Printed reports and forecasts **1.1.1.5**

A. METAR **1.1.1.5.4**

NOTE: METAR/TAF weather codes became effective July 1, 1996, at 0800 UTC. The following information is current as of April 1996. However, check the Aeronautical Information Manual and latest publications for more complete information and possible differences between the format and definitions presented here.

METAR (or SPECI for Special Report) KPIT 201955Z (AUTO for automated observation) (COR for correction to observation) 22015G25KT 3/4 SM R28R/2600FT TSRA OVC010CB 18/16 A2992 RMK SLP013 T01760158

Figure 9: METAR

1. Beginning July 1, 1996, at 0800 UTC, the United States converted airport surface observations (SAs and SPs) and airport terminal weather forecasts to the International Civil Aviation Organization (ICAO) formats

    a. The surface observations and terminal forecast formats and coding changed

    b. Other weather products such as winds aloft (FD), area forecasts (FA), and pilot reports (PIREPs) changed little except to incorporate the new weather coding and station identifiers

2. The hourly surface observations (SA) are referred to as METAR (Aviation Routine Weather Report), and the airport terminal forecast are referred to as TAF (Aerodrome Forecast). Pilots will notice some differences in the sequence in which information is presented, formatted (e.g., winds and cloud cover), and the abbreviations used

3. With a little practice, pilots will find it easy to understand the new code and will find the additional information in the forecasts (TAF) very useful

    a. Those who use DUATs (Direct User Access Terminal) or commercially provided weather services will find that all have included a plain language interpreter just as before

    b. In flight service briefings, the sequence of information may be different, and the temperature and dew point will be in degrees Celsius

    NOTE: When METAR data is missing from the body of the report (e.g., dew point), it is simply omitted; the user must know the sequence to recognize this. Some exceptions apply in remarks such as RVRNO, or SLPNO, when RVR or SLP are normally reported but not currently available.

4. To help remember the sequence, think of 3 W's at the beginning -- Where, When, and Wind. This works for both METAR and TAF

   a. Where

      (1) KPIT is the ICAO station identifier

         (a) 3-letter identifiers are preceded by a "K" for the contiguous United States

         (b) Alaska and Hawaii use 4-letter identifiers, beginning with "PA" and "PH," respectively

         (c) Changes are planned to incorporate alphabetic identifiers for those weather reporting stations where numbers and letters are now used (e.g., W10 to KHEF)

   b. When

      (1) **20**1955Z is the **20th** day of the month

      (2) 20**1955Z** at **1955Z** time

   c. Wind

      (1) **220**15G25KT -- reported as the 3-digit *true* direction to the nearest 10 degrees

      NOTE: ATC towers, ATIS and airport advisory service report wind as *magnetic.*

      (2) 220**15**G25KT -- the 2- or 3-digit speed

      (3) 22015**G**25KT -- if the wind is gusting

      (4) 22015G**25KT** -- 2- or 3-digit maximum speed and units

      NOTE: 00000KT -- calm winds.

(5) 22015KT **180V260** -- wind direction varies 60 degrees or more, and wind is greater than 6 kts

(6) **VRB** -- wind direction is variable, and speed is less than or equal to 6 kts

(7) RMK - peak wind is one element reported in the remarks section whenever the maximum instantaneous speed is greater than 25 kts. **22030/15** means a maximum *instantaneous* wind of **30** kts occurred **15** minutes past the hour from **220** degrees. **PK WND 22030/15**

d. Visibility

(1) 3/4SM -- 3/4 statute mile visibility. Miles and fractions are also reported (e.g., **2 3/4SM** for 2 and 3/4 sm visibility)

(2) R28R/2600FT -- Runway Visual Range (RVR). Signifies that the runway visual range for runway **28 Right is 2,600** ft. The format is **R**(XXX) Runway Designator including (**L**)eft (**C**)enter or (**R**)ight/(**XXXX**) 4-digit visibility in ft

(3) Some coding pilots may also see for RVR include:

(a) M -- indicates that RVR is less than lowest reportable sensor value (e.g., **M0600FT**)

(b) P -- indicates RVR greater than highest reportable sensor value (e.g., **P6000FT**)

(c) V -- variable. If the RVR is variable between 2,000 and 4,000 ft for runway 6L: (**R06L/2000V4000FT**). May contain up to four RVR reports

e. Significant Present Weather

(1) TSRA (Thunderstorm/Moderate Rain) Format is a 2-character descriptor (e.g., TS, SH, DR) sometimes followed by a 2-character weather phenomenon (e.g., RA, SN, FG)

(2) Intensity or proximity of weather phenomenon:

(a) "-" -- Light

(b) "+" -- Heavy

(c) "no sign" -- Moderate

(d) "VC" -- in the vicinity

f. Clouds

(1) OVC010CB -- specifies cloud amount, height, and type. Overcast clouds are present at 1,000 ft consisting of cumulonimbus clouds

(2) Cloud height is reported in hundreds of feet. When clouds are composed of towering cumulus or cumulonimbus, TCU or CB will follow cloud height

(3) Clouds are categorized based on eighths (octas) of the sky

(a) SKC -- Sky clear

(b) FEW -- >0-2 octas

(c) SCT -- 3-4 octas

(d) BKN -- 5-7 octas

(e) OVC -- 8 octas

(4) Vertical Visibility (VV) -- may be listed here for indefinite ceiling such as "VV004" for Vertical Visibility 400 ft

(5) Temperature/Dew Point -- listed in degrees Celsius

NOTE: When temperatures are below 0 degrees C, they are preceded by "M" for minus (e.g., 10/M06 for temperature 10 degrees C, dew point -6 degrees C).

(6) Altimeter Setting -- (ex. A2992) "A" indicates setting in inches of mercury for United States. Consists of 4 digits: inches and hundredths

(7) Remarks (RMK) come last

(a) RMK **SLP013** T01760158 -- Selected stations will contain SLP for sea level pressure reported as the last 3 digits in hectoPascals (millibars) to the nearest tenth (e.g., 1001.3 is reported as SLP013)

(b) RMK SLP013 **T01760158** -- 9-character code breaks down the temperature and dew point to the nearest 1/10th of a degree Celsius (selected stations)

(i) The "T" stands for temperature

(ii) The "0" means positive temperature

(iii) A "1" in place of the "0" stands for negative temperature

(iv) Other temperature codes, such as 10142, 20012, or 401120084, may appear to document temperatures not related to aviation (selected stations)

B. METAR On ASOS/AWOS **1.1.1.5.4**

1. ASOS/AWOS reports will also use METAR/SPECI code formats. An ASOS/AWOS report can be identified by the term A01 or A02 in the remarks (RMK) section. Example:

   METAR KOFP 251955Z AUTO 30008KT 10SM CLR 22/10 A3010 RMK AO2 SLP138 T02180096

2. Some ASOS/AWOS sites are attended

   a. The term AUTO is not included in the report (A01 or A02 remain)

   b. An attended site may contain information that has been manually provided by the observer

3. Only a fully automated site without human intervention will contain the word AUTO

4. When ASOS/AWOS reported sky condition is clear (CLR), it means no clouds at or below 12,000 ft

C. TAF **1.1.1.5.1**

1. TAF contains a definitive forecast for specific time periods and will replace the terminal forecast

   TAF (TAF AMD -- Amended Forecast, when included)

   KPIT 091730Z 091818 22020KT 3SM -SHRA BKN020

   FM2030 30015G25KT 3SM SHRA OVC015 TEMPO 2022 1/2SM TSRA OVC008CB

   FM0100 27008KT 5SM -SHRA BKN020 OVC040 PROB40 0407 00000KT 1SM -RA BR

   FM1000 22010KT 5SM -SHRA OVC020 BECMG 1315 20010KT P6SM NSW SKC

Sg 3, fr 6
Fig 10: *Terminal Aerodrome Forecast*

KNQI TAF 191515 16018G28KT 8000 FEW015SCT025CB BKN040 BKN250
52005 QNH2990INS VCTSSHRA
TEMPO 1900 VRB20G35KT 3200 TSSHRA BKN 015CB OVC025
BECMG 0102 17013G22KT 9999 SCT020 SCT250 QNH2995INS
BECMG 091014005KT 4800BR SCT010 SCT250 QNH3000INS
TEMPO 1013 0800FG VV002
BECMG 1415 16010KT 9000 HZ SCT020 SCT100 BKN250 QNH2992INS

Figure 10: TERMINAL AERODROME FORECAST (TAF)

2. Once you know how to pick out the TAF forecast time periods, the same logical sequence that we saw in METAR will follow. Below, a TAF is broken down to highlight its individual segments. Key words (and their definitions) indicating a new time period has started are in boldface

   TAF
   KPIT 091730Z 091818 22020KT 3SM -SHRA BKN020

   FM2030 30015G25KT 3SM SHRA OVC015 WS015/30045KT **TEMPO 2022** 1/2SM TSRA OVC008CB

   FM2300 27008KT 5SM -SHRA BKN020 OVC040 **PROB40 0407** 00000KT 1SM -RA BR

   FM1000 22010KT 5SM -SHRA OVC020 **BECMG 1315** 20010KT P6SM NSW SKC

3. The **Where**, **When**, and **Wind** trick works with TAF; however, here's a little twist with the "when"

   TAF
   KPIT 091730Z 091818 22020KT

   a. Where

      (1) KPIT is the ICAO station identifier.

      (2) The usual 3-letter identifiers are preceded by a "K" for the contiguous United States.

      (3) Alaska and Hawaii will use 4-letter identifiers beginning with "PA" and "PH" respectively.

      (4) Changes are planned to incorporate 3-letter identifiers for those weather reporting stations where numbers and letters are now used (e.g., W10 to KHEF)

b. When

(1) 091730Z -- the forecast for the 9th day of the month with an issuance time of 1730Z or UTC (2-digit date and 4-digit time)

(2) **09**1818 --the valid period with the first 2 digits containing the day of the month (09)

(3) 09**18**18 -- the second 2 digits specify the hour beginning the forecast period (1800Z)

(4) 0918**18** -- the last 2 digits are the hour ending the forecast period (1800Z on the next day, the 10th)

c. Wind

(1) WS015/30045KT means at 1,500 ft, we expect wind to be 300 degrees at 45 kts. This indicates low-level wind shear not associated with convective activity

d. Time Periods, Etc.

(1) FM2030 -- From 2030Z or UTC time (indicates hours and minutes)

(2) TEMPO 2022 -- Temporary changes expected between 2000Z and 2200Z

(3) FM2300 -- From 2300Z

(4) PROB40 0407 -- There is a 40% probability of this condition occurring between 0400Z and 0700Z

(5) FM1000 -- From 1000Z

(6) BECMG 1315 -- Conditions becoming as described between 1300Z and 1500Z

(7) Once the specific time periods can be discerned, the sequence of wind, visibility, significant weather, cloud cover and cloud height follows and is repeated for each time block

(a) The only exception is after qualifiers such as PROB40, TEMPO, and BECMG, some of the components may be omitted if these are not expected to change

(b) Notice that after TEMPO 2022, there is no wind given, and after PROB40 0407, there is no cloud cover listed

NOTE: When no significant weather (NSW) appears, it only indicates obstruction to visibility or precipitation previously noted has ended.

D. METAR/TAF **1.1.1.5.4, 1.1.1.5.1**

1. International Differences

a. Pilots and operators who fly to international destinations are cautioned to be alert to differences between U.S. METAR/TAF and international METAR/TAF. The following are some key differences:

(1) Altimeter Setting

(a) The United States reports the altimeter setting in inches of mercury
(e.g., A2992)

(b) Internationally, it will reported in hectoPascals (millibars) (e.g., Q1016)

(2) Wind

(a) Internationally, wind may be reported in kts (KT), kilometers per hour (KMH), or meters per second (MPS). Appropriate units are indicated on both METAR and TAF

(3) Wind Shear

(a) Low-level wind shear, not associated with convective activity (e.g., WS015/30045KT, see TAF) will appear in TAFs in the United States, Canada, and Mexico only

(4) Visibility

(a) Internationally, visibility is reported in 4 digits, using meters, with the direction of the lowest visibility sector (e.g., 6000SW -- meaning visibility is lowest at 6,000 meters to the southwest)

(b) In the United States, we use prevailing visibility in statute miles, not the lowest visibility, so the same conditions would be reported differently

(c) International visibility reports also contain a trend, such as:

i) D -- Down

ii) U -- Up

iii) N -- No change

iv) V -- Variable

2. Other

   a. Remarks (RMK) included in U.S. METAR are transmitted to only Canada and Mexico and no other international stations

   b. Pilots may also see the following notation on International METAR/TAF: CAVOK (Ceiling and Visibility OK)

      (1) CAVOK is used to replace weather and clouds if visibility is 10 km or more, and there are no clouds below 1,500 meters (5,000 ft) or below the highest minimum air traffic control sector altitude, whichever is greater

      (2) Also, there must be no other significant weather. NSC means no significant clouds

   c. International TAFs may include temperature, turbulence, and icing forecasts

Fig 11: *METAR Abbreviations*

Fig 12: *METAR (SPECI or Special Report)*

E. Area Forecast (FA) **1.1.1.5.3**

1. General - provides overview of aviation weather conditions over the United States and adjacent coastal waters

   a. Used for flight planning and a weather briefing aid

   b. Intended for use by General Aviation pilots, Civil and Military operations, National Weather Service (NWS), and Federal Aviation Administration (FAA) briefers

   c. Consists of two sections:

      (1) HAZARDS/FLIGHT PRECAUTIONS

      (2) SYNOPSIS AND VFR CLOUDS/ WEATHER

Sg 3, fr 7
Fig 13: *Area Forecast Coverage*

AO1	Automated Observation without precipitation discriminator (rain/ snow)
AO2	Automated Observation with precipitation discriminator (rain/ snow)
AMD	Amended Forecast (TAF)
BECMG	Becoming (expected between 2-digit beginning hour and 2-digit ending hour
BKN	Broken 5-7 octas (eighths) cloud coverage
CLR	Clear at or below 12,000 ft (ASOS/ AWOS report)
COR	Correction to the observation
FEW	>0-2 octas (eighths) cloud coverage
FM	From (4-digit beginning time in hours and minutes)
LDG	Landing
M	In temperature field, means "minus" or below zero
M	In RVR listing, indicates visibility less than lowest reportable sensor value (e.g., M0600)
NO	Not available (e.g., SLPNO, RVRNO)
NSW	No Significant Weather NOTE: NSW only indicates obstruction to visibility or precipitation previously noted has ended. Low ceilings, wind shear, and other weather conditions may still exist.
OVC	Overcast 8 octas (eighths) cloud coverage
P	In RVR, indicates visibility greater than highest reportable sensor value (e.g., P6000FT)
P6SM	Visibility greater than 6 SM (TAF only)
PK WND	Peak wind
PROB40	Probability 40 percent
R	Runway (used in RVR measurement)
RMK	Remark
RY/RWY	Runway
SCT	Scattered 3-4 octas (eighths) cloud coverage
SKC	Sky Clear
SLP	Sea Level Pressure (e.g., 1001.3 reported as 013)
SM	Statute mile(s)
SPECI	Special Report
TEMPO	Temporary changes expected (between 2-digit beginning hour and 2-digit ending hour)
TKOF	Takeoff
T01760158, 10142, 20012 and 401120084	In Remarks -- examples of temperature information
V	Varies (wind direction and RVR)
VC	Vicinity
VRB	Variable wind direction when speed is less than or equal to 6 kts
VV	Vertical Visibility (Indefinite Ceiling)
WS	Wind shear (In TAFs, low-level and not associated with convective activity)

DESCRIPTORS

BC	Patches
BL	Blowing
DR	Low Drifting
FZ	Supercooled/freezing
MI	Shallow
PR	Partial
SH	Showers
TS	Thunderstorm

WEATHER PHENOMENA

BR	Mist
DS	Dust Storm
DU	Widespread Dust
DZ	Drizzle
FC	Funnel Cloud
+FC	Tornado/Water Spout
FG	Fog
FU	Smoke
GR	Hail
GS	Small Hail/Snow Pellets
HZ	Haze
IC	Ice Crystals
PE	Ice Pellets
PO	Dust/Sand Whirls
PY	Spray
RA	Rain
SA	Sand
SG	Snow Grains
SN	Snow
SQ	Squall
SS	Sandstorm
UP	Unknown Precipitation (Automated Observations)
VA	Volcanic Ash

CLOUD TYPES

CB	Cumulonimbus
TCU	Towering Cumulus

INTENSITY VALUES

-	Light
no sign	Moderate
+	Heavy

Figure 11: METAR ABBREVIATIONS

NOTE: When METAR data is missing (e.g., dew point), it is simply omitted, and the user must know the sequence to recognize this. Some exceptions apply in remarks such as RVRNO or SLPNO, when RVR or SLP are normally reported but not currently available.

METAR KPIT 201955Z 22015G25KT 3/4SM R28R/2600FT TSRA OVC010CB 18/16 A2992 RMK SLP013 T01760158

Where:	**KPIT**
When:	**201955Z** 20th day of month at 1955Z
Wind:	**22015G25KT 220** degrees at 15 gusting to 25 kts
V:	Variable direction, e.g., 20015KT 220V280
VRB:	Variable direction, when speed is less than or equal to 6 kts
Visibility:	**3/4SM** 3/4 statute miles; typical: 2 3/4 SM, 1 SM

RVR **R28R/2600FT** Runway 28 Right visibility 2,600 ft

M:	Used for RVR less than lowest reportable sensor value (e.g., **M0600FT**)
P:	Used for RVR greater than highest reportable sensor value (e.g., **P6000FT**)
V:	Variable
Significant Weather:	**TSRA** -- thunderstorm/moderate rain
Sky Condition:	**OVC010CB** -- overcast clouds at 1,000 ft consisting of cumulonimbus
Typical:	**SCK, FEW, SCT, BKN, VV004** indefinite ceiling (Vertical Visibility) 400 ft
Temperature/Dew Point:	**18/16** -- 18 degrees Celsius/dew point 16 degrees Celsius (M=Minus or below zero)
Altimeter:	**A2992** inches of mercury and preceded by an "A"

RMK SLP013 T01760158 10142 20012 401120084 -- At selected stations, sea level pressure is reported as the last 3 digits in hectoPascals (millibars) (e.g., 1001.3 is reported as **SLP013**). Codes such as T01760158 10142 20012 and 401120084 are climate temperature information.

TAF (**TAF AMD is Amended Forecast** when included)

KPIT 091730Z 091818 22020KT 3SM -SHRA BKN020 WS015/30045KT

FM2030 30015G25KT 3SM SHRA OVC015 TEMPO 2022 1/2 TSRA OVC008CB

FM2300 27008KT 5SM -SHRA BKN020 OVC040 PROB40 0407 00000KT 1SM -RA BR

FM1000 22010KT 5SM -SHRA OVC020 BECMG 1315 20010KT P6SM NSW SKC

Where:	**KPIT**
When:	**091730Z** --issuance day and time (9th day at 1730Z) **091818** valid period (9th day at 1800Z to next day, 10th at 1800Z
Wind:	**22020KT**-- 220 degrees at 20 kts
Visibility:	**3SM** -- 3 statute miles, typical - **2 3/4SM, 1SM**
P6SM:	Greater than 6 statute miles
Significant Wx:	**-SHRA** light rain showers
Sky Condition:	**BKN020** -- broken clouds at 2,000 ft
Typical:	**FEW, SCT, BKN, OVC** **VV004** indefinite ceiling (Vertical Visibility) 400 ft. **CB** and **TCU** clouds noted when present..
Wind Shear:	**WS015/30045KT** --Low-level wind shear at 1,500 ft forecast to be 300 degrees at 45 kts (only nonconvective, low-level, wind shear is forecast)

Sequence of Wind, Visibility, Significant Weather and Sky Condition repeats preceded by:

FM2030:	From 2030Z
TEMPO 2022:	Temporarily between 2000Z and 2200Z
FM2300:	From 2300Z
PROB40 0407:	There is a 40% probability between 0400Z and 0700Z
FM1000:	From 1000Z
BECMG 1315:	Becoming between 1300Z and 1500Z

NOTE: Weather conditions such as wind and sky condition may be omitted after **PROB40, TEMPO, and BECMG,** if no change is expected from those same conditions given in the previous time block.

Figure 12: METAR (SPECI OR SPECIAL REPORT)

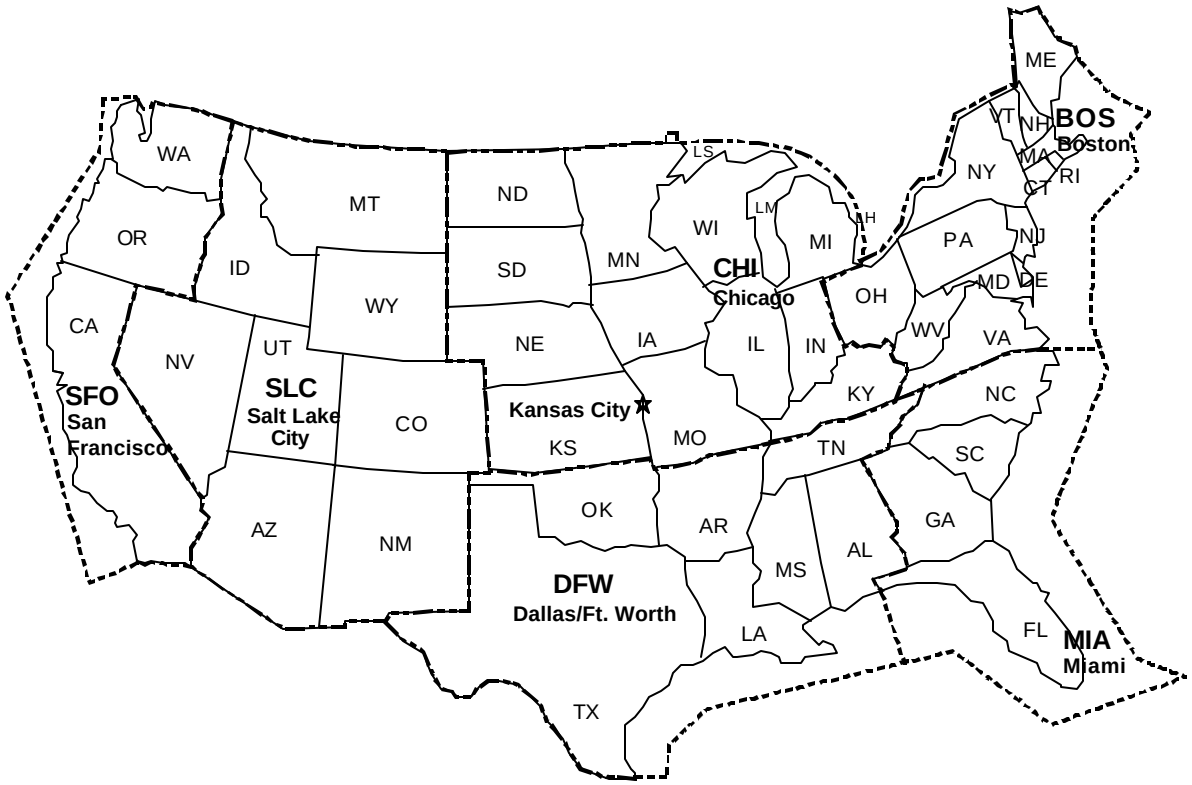


Figure 13: AREA FORECAST COVERAGE

d. Communications headers contain unique information for routing purposes, as well as allowing individual sections to be replaced, rather than appended

e. In-flight advisories (AIRMETs, SIGMETs, Convective SIGMETs) amend or update the FA; however, the appropriate section of the FA should be amended or corrected as soon as practical

2. Responsibility - Issued by the National Aviation Weather Advisory Unit (NAWAU) in Kansas City, Missouri, for the conterminous United States and coastal waters

a. Pacific Coast (SFO)

b. Rocky Mountain (SLC)

c. North-Central (CHI)

d. Northeast (BOS)

e. South-Central (DFW)

f. Southeast (MIA)

g. Four additional FAs issued by the Weather Service Forecast Offices (WSFO) in Anchorage, Fairbanks, and Juneau for Alaska and in Honolulu for Hawaii

h. A specialized FA for the Gulf of Mexico shall be issued by the National Hurricane Center in Miami

(1) Combines aviation and marine information in support of offshore helicopter operations

(2) Addresses an area including the coastal plains and coastal waters from Appalachicola, Florida, to Brownsville, Texas, and the Gulf west of 85W and north of 27N

3. Issuance and Valid Times

   a. Prepared 3 times a day in the contiguous states and Alaska, 4 times a day in Hawaii

   b. Valid beginning the hour after the scheduled issue time

   c. The Gulf FA is prepared twice daily

Sg 3, fr 8
Fig 14: *Area Forecast (FA)*

4. Preparation of the Area Forecast

   a. Only authorized contractions (see FAA Handbook 7340.1) should be used

      NOTE: Observed weather abbreviations (R, S, F, etc.), 2-letter state and Great Lake designators and location identifiers should be used.

   b. All times stated in whole hours (2 digits), using UCT and qualifiers such as BY, UNTIL, AFT, THRU, BYD

   c. Visibilities in statute miles, all other distances in nautical miles, speeds in knots

   d. Commas or colons in a sentence indicated by three dots (...)

5. Hazards/Flight Precautions section

   a. Covers 12-hour period beginning with one valid time

   b. Section depicts weather impacting the area or a negative report

   c. Section serves only as a flag alerting user that conditions are meeting, or are expected to meet, AIRMET, SIGMET, or convective SIGMET criteria

      NOTE: Detail needed for preflight or flight resides in the appropriate in-flight advisory.

som (start of message indicator)
SFOH FA 191045
HAZARDS VALID UNTIL 192300
WA OR CA AND CSTL WTRS
*
FLT PRCTNS...MTN OBSCN...WA OR CA
*
TSTMS IMPLY PSBL SVR OR GRT TURBC SVR ICG LLWS AND IFR CONDS.
NON MSL HGTS ARE DENOTED BY AGL OR CIG.
eom (end of message indicator)

SFOC FA 191045
SYNOPSIS AND VFR CLOUDS/WX
SYNOPSIS VALID UNTIL 200500
CLDS/WX VALID UNTIL 192300...OTLK VALID 192300-200500
*
SYNOPSIS...WEAK CDFNT ALG CSTL SXNS MOVG TO CASCDS AND BCHG STNRY.
WK HI PRES BLDG INTO CSTL SXNS BY 02Z. ALF...MOIST WLY FLOW WL CONT
OVER WA OR AND GENLY WK SWLY FLOW OVER CA.
*
WA OR CASCDS WWD
SEE AIRMET SIERRA FOR MTN OBSCN.
WA NRN OR...15-25 SCT-BKN 35-45 BKN-OVC 100-120. WDLY SCT RW-. 17Z-20Z
BCHG 20 SCT-BKN 50 BKN 80-100. WDLY SCT RW-. TOPS 180. OTLK...VFR.

SRN OR...CLR. OTLK...VFR.
*
WA OR E OF CASCDS
WA...50-70 SCT 120 SCT. WRN SXNS WDLY SCT RW-. TOPS 180. OTLK...VFR.
OR...CLR. OTLK...VFR.
*
CA
SEE AIRMET SIERRA FOR MTN OBSCN.
CSTL SXNS OF NRN CA...10-15 BKN 25. AFT 21Z...CLR. OTLK...VFR.
LAX BASIN...15 BKN 25. VSBYS 3-5FH. AFT 16Z...CLR. VSBYS LAX BASIN 3-5FH.
OTLK...MVFT CIG F.
RMNDR AREA...CLR. OTLK...VFR.
*
WA OR CA CSTL WTRS
ALG CST 10-25 SCT-BKN 30 OTHERWISE CLR. OTLK...MVFR CIG F.
eom

Figure 14: AREA FORECAST (FA)

d. Hazards section always has a Flight Precautions entry; if none expected, "NONE EXPT" shall be stated

e. Every HAZARDS section will conclude with the statement "TSTMS IMPLY PSBL SVR OR GTR TURBC ICG LLWS AND IFR CONDS"

f. The reference plane within the FA sections is mean sea level (MSL) unless otherwise noted

NOTE: The statement "NON MSL HGTS DENOTED BY AGL OR CIG" shall be included in the hazards section.

6. Synopsis and VFR Clouds/Weather section

a. Section contains an 18-hour synopsis, consisting of a 12-hour specific forecast, followed by a 6-hour categorical outlook giving a total forecast period of 18 hrs

b. All or parts of the SYNOPSIS AND VFR CLOUDS/WEATHER section may be delayed if the forecaster determines that available information is inadequate to support a quality FA product

c. The following specific items, if applicable, should by included for each 12-hour specific forecast in the SYNOPSIS AND VFR CLOUDS/ WEATHER section

(1) Sky condition (cloud height, amount, and tops) if bases are at or below 18,000 ft MSL

(2) Surface visibilities and associated obstructions when visibility is between 3 and 6 miles (if coverage is 3,000 square miles or greater)

(3) Weather (precipitation, including thunder-storms, fog, haze, blowing dust, etc.), if it results in surface visibilities of 3 to 6 miles

(4) Thunderstorms, if expected to be more than isolated

(5) Surface wind if sustained winds of 20 kts or more

(a) Wind directions use 8-point compass

(b) Gusts are reported if expected to be 10 kts over sustained speed

7. OUTLOOK - 6-hour categorical forecast to follow 12-hour specific clouds and weather forecasts

a. As a minimum "IFR," "MVFR," or "VFR"

b. If IFR or MVFR due to ceiling, use "CIG"

c. If due to visibility, use standard weather and obstruction to visibility symbols

d. VFR should stand alone except for wind (WND), thunderstorms (TRW), and precipitation (without intensities)

LESSON NOTES

For the following progress check, the turbulence forecast (answer) is located near the center of the area forecast.

PROGRESS CHECK

Question 7 — 1.1.1.5.3
Refer to the area forecast (Figure 14). Using the Area Forecast (FA), what is the altitude of the top of the clouds in Washington, Oregon, and the Cascades?

ANSWER: 18,000 ft

Sg 3, fr 9
Fig 15: *Winds Aloft Forecast (FD)*

F. Winds Aloft Forecast (FD) **1.1.1.5.2**

1. Teletype report, based on observed (balloon) information transmitted twice a day

   a. Teletype identifier is "FD"

   b. The total forecast is usable for 15 hrs

   c. Broken into two segments with the forecast periods given at the beginning of each segment

      (1) Valid time indicates that these conditions should exist specifically at this time

      (2) "For use" times mean that these conditions should exist through this period as the average conditions

2. Wind and Temperature coding/decoding rules

   a. Wind normally given with a series of 4 digits

      (1) First 2 digits indicate direction wind is from (true)

      (2) Second 2 digits depict the wind speed in knots

   b. Temperature follows wind information in degrees Celsius

FD WBC 250550
BASED ON 25000Z DATA
VALID 251200Z FOR USE 0600Z-1500Z. TEMPS NEG ABV 24000

FT	3000	6000	9000	12000	18000	24000	30000	34000	39000
XQP									
CAE	3410	3320 - 07	3133 - 08	3147-09	3067-18	3076-30	308544	298853	298961
ATL	9900	3110 - 05	3023 - 06	3036-07	3056-16	3063-28	307143	307453	297863
BHM	0805	2907 - 03	3018 - 04	3029-06	3046-16	3054-28	306443	296752	297363
JAN	1109	2708+ 01	2814 - 01	2819-04	2931-15	2939-27	294742	295251	295762
ZQP									
SHV	1714	2417+ 04	2620+ 01	2621-03	2827-14	2835-27	284442	284751	285061
DAL	1912	2325+ 07	2425+ 03	2524-01	7201-14	7702-26	771242	782450	782061
ABI		2320+ 09	2422+ 06	2522-00	2724-14	2732-26	264141	274650	275260
ZPZ									
INK		2512+ 10	2714+ 07	2717+01	2825-14	2733-26	274241	274750	265560
ELP		2609	2833+ 07	2717+01	2866-13	2886-20	780641	770451	268761
TUS		1822+ 12	2329+ 07	2536+01	2758-13	2879-26	780341	780151	288361
BLH	1311	1708+ 11	2219+ 06	2433+00	2743-13	2960-25	800041	309551	308561

Figure 15: WINDS ALOFT FORECAST (FD)

(1) Above or below 0 degrees indicated with a "+" or "-"

(2) All temperatures above 24,000 ft MSL are below zero so the minus sign is dropped

c. Exceptions

(1) Variable winds indicated by "99" for direction

(2) Forecast winds less than 5 kts indicated by "9900" and read as "light and variable"

(3) If wind speeds exceed 100 kts, 100 is subtracted from the wind speed and 50 is added to the direction; e.g., a wind from 230 at 145 kts would be encoded as 7345

(4) Wind speeds in excess of 200 kts would be encoded at 199 kts; e.g., 7399 would be 230 degrees at 199 kts

3. Temperature decoding/encoding rules

a. Temperature and wind are sometimes omitted from the forecast

(1) Wind information is never forecast for altitudes within 1,500 ft of the surface

(2) Temperature information is never forecast at any altitude within 2,500 ft of the surface

(3) Temperature information is never forecast for the 3,000 ft level

4. Interpolation--Often the wind information will not be forecast for the altitude which the pilot wishes to file. In this case, they must interpolate for the desired information

PROGRESS CHECK

Question 8 — 1.1.1.5.2
For what period is the winds aloft forecast in Figure 15 valid?

ANSWER: 0600Z to 1500Z.

Question 9 — 1.1.1.5.2
Appearing on a winds aloft forecast, what does the code 1569-12 mean?

ANSWER: Wind is from 150 degrees at 69 kts; temperature is -12 degrees Celsius.

G. National Weather Service (NWS) Severe Weather Reports and Forecasts **1.1.1.4.6**

NOTE: Flight is not specifically prohibited in the areas where convective outlooks, AIRMETs, SIGMETs, and convective SIGMETs are active, but common sense and experience should help determine your flight decision making. However, Severe Weather Watch bulletins (WW) and CNATRA Weather Warnings (CAWW) do prohibit flight in the areas covered.

1. Convective Outlooks (AC)

   a. Issued by the National Severe Storm Forecast Center (NSSFC) in Kansas City

   b. Outlines potential general thunderstorm activity and areas where thunderstorm intensity may approach severe limits

   c. Disseminated 3 times daily (2 times daily between September 1 and January 31) -- 24-hr forecast period

d. Format - Narrative presents affected region and rationale of the forecast

NOTE: ACs can alert a pilot several hours in advance of possible severe or widespread convective activity.

Sg 3, fr 10
Severe Weather Watch Bulletin (WW)

2. Severe Weather Watch bulletin (WW)

a. Issued by the NSSFC in Kansas City

b. Defines areas of possible severe thunderstorms and tornadoes; describes level of intensity, hail size, wind speeds, CB tops, estimated cell movement, cause of severe weather, and updates convective outlooks (AC)

c. Disseminated as needed

d. Format - Report contains the type and location of severe weather expected

e. Hazards

(1) Thunderstorms with surface winds of 50 kts or more

(2) Thunderstorms containing hail 3/4-inch diameter or greater at surface

(3) Tornadoes

f. Flight restrictions as stated in OPNAVINST 3710.7

(1) Navy pilots will not file into or fly through WW areas

(2) Exceptions to OPNAVINST severe weather restrictions **1.1.1.4.7**

(a) Operational necessity

(b) Research/weather reconnaissance

(c) Emergencies

(d) Storm development has not progressed as forecast and when flight

i) Remains in VFR conditions, or

ii) If in IFR conditions, aircraft has operable weather radar

(e) Aircraft capable of flying above existing or developing severe storms

3. CNATRA Weather Warning (CAWW) **1.1.1.4.8**

Sg 3, fr 11
CNATRA Weather Warning (CAWW)

a. Issued by forecasters at the Chief of Naval Air Training (CNATRA)

b. Defines areas of hazardous weather pertinent to all Naval Air Training Command activities

c. Disseminated as needed

d. Format - Report lists hazards and affected areas

e. Hazards

(1) Severe thunderstorms (wind gusts 50 kts or more or hail 3/4" diameter or larger)

(2) Embedded thunderstorms

(3) Line of thunderstorms

(4) Severe or extreme turbulence

(5) Severe icing

(6) Widespread sandstorms or dust storms limiting visibility to 2 sm or less

f. Flight restrictions

(1) Training activities suspended in CAWW area

(2) Exceptions to CNATRA severe weather restrictions (same as OPNAVINST 3710.7)

(a) Operational necessity

(b) Research/weather reconnaissance

(c) Emergencies

(d) Storm development has not progressed as forecast and when flight

i) Remains in VFR conditions, or

ii) If in IFR conditions, aircraft has operable weather radar

(e) Aircraft capable of flying above existing or developing severe storms

H. National Weather Service (NWS) Aviation In-flight Weather Advisories **1.1.1.11, 1.1.1.11.1, 1.1.1.11.2**

1. Provides information for enroute aircraft

2. Designed to serve both civilian and military pilots

3. Types

a. Significant Meteorological (SIGMET) Advisories

(1) Convective SIGMETs (WST)

(2) Nonconvective SIGMETs (WS)

b. Airman's Meteorological (AIRMET) Advisories (WA)

4. Latest revisions to program designed to meet overlapping requirements of large versus small aircraft, aircraft operating under visual flight rules (VFR) and instrument flight rules (IFR), small aircraft operating higher, and larger aircraft sometimes operating lower

5. Responsibility for Issuance - The National Aviation Weather Advisory Unit (NAWAU) in Kansas City, Missouri, has the responsibility for issuing WAs, WSTs, and WSs for the conterminous United States

    a. Designated forecaster(s) maintain watch on weather developments using weather radar, surface observations, PIREPs, and satellite image information

    b. Additional information used consists of information from the National Meteorological Center (NMC), products from the NMC National Severe Storms Forecast Center, Hurricane advisories, and forecasts from Weather Service Field Offices (WSFO)

6. Standardizations - The following standardizations shall apply to all In-Flight Advisories

    a. All heights or altitudes shall be stated with reference to mean sea level (MSL), except in the case of low ceilings which shall be referenced to "above ground level" and indicated by "CIGS," e.g., CIGS BLO 10

    b. Domestic In-Flight Advisories shall describe designated weather conditions up to and including 45,000 ft (150 millibars)

    c. Any abbreviations or contractions used in the advisories shall conform with FAA Contractions Handbook 7340.1

    d. Weather and obstructions to visibility shall be indicated by using the weather abbreviations used for METARs (see FLIP GP Chapter 8)

Sg 3, fr 12
Fig 16: *Convective SIGMET (WST)*

7. Convective SIGMETs (WST) at 55 minutes past the hour (H+55) **1.1.1.11.2**

   a. Issued hourly

      (1) As thunderstorms are likely to be accompanied by severe or greater turbulence, severe icing, and low-level wind shear, these conditions shall not be specified in the advisory

      (2) "NONE" shall be used as the text if appropriate

      (3) Valid for up to 2 hrs or until superseded by the next hourly issuance

      (4) Special WSTs as required

      (5) Three bulletins issued for eastern (E), central (C), and western (W) regions

         (a) Boundaries at 87 and 107 degrees west

   b. WSTs shall be issued when either 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)

      (1) Severe thunderstorms

         (a) May include specific information on tornadoes and/or hail 3/4-inch or greater and/or wind gusts of 50 kts or greater

      (2) Embedded thunderstorms

         (a) Occurring within and obscured by haze, stratiform clouds, or precipitation from stratiform clouds

MKCC WST 221855
CONVECTIVE SIGMET 20C
VALID UNTIL 2055Z
ND SD
FROM 90W MOT-GFK-ABR-90W MOT
INTSFYG AREA SVR TSTMS MOVG FROM 2445. TOPS ABV 450.
WIND GUSTS TO 60 KT RPRTD. TORNADOES...HAIL TO 2 IN...WIND GUSTS
TO 65 KT PSBL ND PTN.

CONVECTIVE SIGMET 21C
VALID UNTIL 2055Z
T X
50SE CDS
ISOLD SVR TSTM D30 MOVG FROM 2420. TOP ABV 450.
HAIL TO 2 IN...WIND GUSTS TO 65 KT PSBL.

OUTLOOK VALID 222055-230055
AREA 1...FROM INL-MSP-ABR-MOT-INL
SVR TSTMS CONT TO DVLP IN AREA OVR ND. AREA IS XPCD TO RMN SVR AND
SPRD INTO MN AS STG PVA MOVS OVR VERY UNSTBL AMS CHARACTERIZED
BY -12 LIFTED INDEX.

AREA 2...FROM CDS-DFW-LRD-ELP-CDS
ISOLD STG TSTMS WILL DVLP OVR SWRN AND WRN TX THRUT FCST PD AS
UPR LVL TROF MOVS NEWD OVR VERY UNSTBL AMS. LIFTED INDEX RMNS
IN THE -8 TO -10 RANGE. DRY LINE WILL BE THE FOCUS OF TSTM DVLPMT.

Figure 16: CONVECTIVE SIGMET (WST)

(b) Intended to alert pilots that avoidance by visual or radar detection could be difficult or impossible

(3) A line of thunderstorms

(a) At least 60 miles long with thunderstorms affecting at least 40% of the length

(4) An area of active thunderstorms affecting at least 3,000 square miles

(a) Thunderstorms having a reflectivity intensity (VIP LVL) of 4 or greater and/or having significant satellite signature affecting at least 40% of the area outlined

8. Special Convective SIGMETs - A WST special shall be issued at any time when either of the following criteria are met and/or forecast to be met for more than 30 minutes of the scheduled WST's valid period

a. Tornado, hail 3/4-inch or greater, or wind gusts to 50 kts or greater reported to the NAWAU forecaster or indicated when previous WST did not mention severe thunderstorms

b. Indications of rapidly changing conditions if in the forecaster's judgment, not sufficiently described in existing SIGMET

Sg 3, fr 13
Fig 17: *SIGMET (WS)*

9. Nonconvective SIGMETs (WS)

a. Not issued on a regular scheduled basis

b. Issued whenever any of the following weather phenomena occur or are forecast to occur and affect an area of at least 3,000 square miles

DFWP UWS 051700
SIGMET PAPA 1 VALID UNTIL 052100
AR LA MS
FROM MEM TO 30N MEI TO BTR TO MLU TO MEM
MDT TO OCNL SVR ICG ABV FRZLVL XPCD. FRZLVL 80 E TO 120 W. CONDS CONTG BYD 2100Z.

SFOX WS 030130
SIGMET XRAY 2 VALID UNTIL 030530
OR WA
FROM SEA TO PDX TO EUG TO ONP TO HQM TO SEA
MDT TO OCNL SVR TURBC BTWN 280 AND 350 XPCD DUE TO WINDSHEAR ASSOCD WITH JTSTR. CONDS BGNG AFT 0200Z CONTG BYD 0530Z AND SPRDG OVR CNTRL ID BY 0400Z.

Example of a multi-area issuance SIGMET:

CHIO WS 051700
SIGMET OSCAR 2 VALID UNTIL 052100
KS
FROM PWE TO OSW TO 40W LBL TO PWE
OCNL SVR TURBC BLO 60. CONDS DUE TO STG NWLY FLOW BHD CDFNT AND XPCD TO CONT BYD 2100Z.

DFWO WS 051700
SIGMET OSCAR 2 VALID UNTIL 052100
OK
FROM OSW TO ADM TO 40W LBL TO OSW
OCNL SVR TURBC BLO 60. CONDS DUE TO STG NWLY FLOW BHD CDFNT AND XPCD TO CONT BYD 2100Z.

Example of a multi-area issuance SIGMET cancelled in one area and continued in another:

CHIO WS 052100
CANCEL SIGMET OSCAR 2. CONDS HAVE DMSHD.

DFWO WS 052100
SIGMET OSCAR 3 VALID UNTIL 060100
FROM OSW TO TXK TO SPS TO GAG TO OSW
OCNL SVR TURBC BLO 60. CONDS XPCD TO GRDLY DMSH AFT 00Z.

Figure 17: SIGMET (WS)

(1) Severe or extreme turbulence or clear air turbulence (CAT) not associated with thunderstorms (see Turbulence Reporting Tables in FLIP Flight Information Handbook (FIH) Section C)

(2) Severe icing not associated with thunderstorms (see Icing Tables in FLIP FIH Section C)

(3) Widespread dust storms, sandstorms, or volcanic ash lowering surface and/or in-flight visibilities to less than 3 miles

(4) Volcanic Eruption

Sg 3, fr 14
Fig 18: *AIRMET (WA)*

10. AIRMETs (WA) **1.1.1.11.1**

a. Issued on a scheduled basis every 6 hrs (beginning at 0200 UTC)

NOTE: Scheduled issuance times are 15 minutes prior to valid time.

b. Unscheduled amendments and corrections issued as necessary and are valid beginning at the time of issuance

c. Issued by NAWAU using the Area Forecast (FA) designators (SFO, SLC, CHI, DFW, BOS, MIA) to denote the area covered, not the issuing office

d. AIRMET bulletins shall contain details of conditions within their designated geographical areas when one or more of the following conditions occur or are expected to occur, and affect an area of at least 3,000 square miles:

(1) Moderate icing

(2) Moderate turbulence

(3) Sustained surface wind of 30 kts or more

```
ZCZC MKCWA4Z ALL 190200
WAUS1 KDFW 190200
DFWZ WA 190200
AIRMET ZULU FOR ICG AND FRZLVL VALID UNTIL 190800
*
NO SGFNT ICG XPCD.
*
FRZLVL...90-120 E OF DYR-MSL-ATL LN SLPG TO 120-140 OVR RMNDR.
****
NNNN

ZCZC MKCWA4T ALL 191400
WAUS1 KDFW 191400
DFWT WA 191400
AIRMET TANGO FOR TURBC...STG SFC WNDS AND LLWS VALID UNTIL 192000
*
AIRMET TURBC...OK TX
FROM OSW TO LRD TO PEQ TO 40W LBL TO OSW
OCNL MDT TURBC BLO 60 DUE TO STG AND GUSTY LOW LVL WINDS.
CONDS CONTG BYD 2000Z.
*
AIRMET STG SFC WINDS...TX
FROM CDS TO DFW TO SAT TO MAF TO CDS
AFT 18Z...SUSTAINED SFC WINDS GTR THAN 30 KTS XPCD.  CONDS CONTG BYD 20000Z.
*
LLWS BLO 20 AGL DUE TO STG WINDS DMSHG BY 16-18Z.
*
OTLK VALID 2000-0200Z...OK TX AR
MDT TURBC BLO 60 CONTG OVER OK/TX AND SPRDG INTO AR BY 2200-0200Z CONTG ENTR
AREA BYD 0200Z.
****
NNNN

ZCZC MKCWA5S ALL 191400
WAUS1 KSLC 191400
SLCS WA 191400
AIRMET SIERRA FOR IFR AND MTN OBSCN VALID UNTIL 192000
*
AIRMET IFR...WY CO
FROM 70ENE GCC TO GLD TO FMN TO 60N JAC TO 70ENE GCC
OCNL CIGS BLO 10 AND OR FSBYS BLO 3 IN PCPN AND F.  CONDS CONTG BYD 2000Z AND
GRDLY DMSHG.
*
AIRMET MTN OBSCN...MT WY CO
FROM YXC TO YXH TO AKO TO TBE TO FMN TO LKT TO YXC
MTNS OCNL OBSCD IN CLDS/PCPN.  CONDS CONTG BYD 2000Z.
*
OTLK VALID 2000-0200Z...MTN OBSCN MT WY CO
CONDS CONTG BYD 0200Z IN WY/CO BUT ENDING IN MT BTWN 2200-0200Z.
****
NNNN
```

Figure 18: AIRMET (WA)

(4) Ceilings less than 1,000 ft and/or visibility less than 3 miles affecting over 50% of an area at any one time

(5) Extensive mountain obscuration precluding VFR flight

e. AIRMET message texts

(1) Text portion of each AIRMET message within a bulletin shall contain the available details about the phenomenon conditions which have met or are expected to meet AIRMET or significance criteria

(2) Details shall include whether conditions are occurring or forecast to occur, their causes, their vertical extent, any changes expected during the AIRMET valid period, and remarks concerning the time of onset and/or cessation of conditions

Sg 3, fr 15
Fig 19: *Military Weather Advisory (MWA)*

11. Military Weather Advisory (MWA)

a. Prepared and issued by the Air Force Global Weather Center (AFGWC)

b. Transmitted twice a day with a 12-hour Military Weather Advisory, which is a forecast of possible severe weather

c. Two versions produced

(1) Teletype

(2) Facsimile

d. The forecast is coded as follows:

(1) Red - tornadoes, waterspouts, or funnel clouds

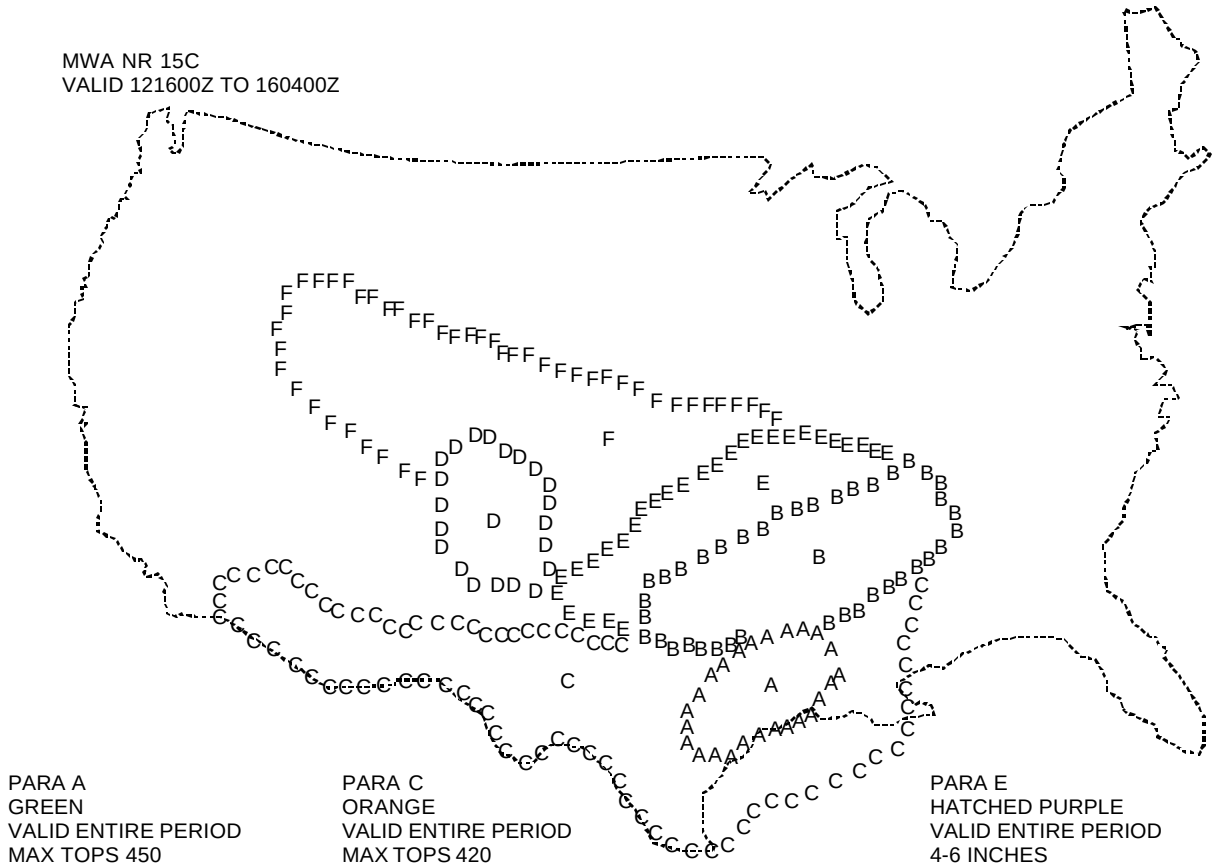


Figure 19: MILITARY WEATHER ADVISORY (MWA)

(2) Blue - severe thunderstorms (maximum wind gusts of 50 kts or greater and/or hail, if any, 3/4-inch or greater in diameter) and locally damaging windstorms

(3) Green - moderate thunderstorms (maximum wind gusts of 35 kts or greater, but less than 50 kts; and/or hail, if any, 1/2-inch or greater in diameter, but less than 3/4-inch in diameter)

(4) Orange - thunderstorms (maximum wind gusts less than 35 kts and/or hail, if any, less than 1/2-inch in diameter)

(5) Black - strong surface winds (35 kts or more and not associated with thunderstorms)

(6) Purple - heavy rain (2 inches or more in 12 hrs or less)

(7) Hatched purple - heavy snow (2 or more inches in 12 hrs or less)

(8) Brown - freezing precipitation

e. Other abbreviations

(1) MIC (maximum instantaneous coverage) - the percent of the area which will be covered by thunderstorm cells at time of maximum activity

(2) TAA (total area affected) - the percent of the area which will experience one or more thunderstorms during the applicable valid period

(3) EP (entire period) - used if the phenomena are expected for the entire period instead of a particular time period

f. Maximum thunderstorm tops

(1) The percentages of MIC and TAA will be entered in the thunderstorm areas as MIC/TAA (such as 3/25)

(2) The advisory areas will be enclosed by solid lines with a letter designator within the area

(3) Forecast areas depict the worst conditions expected during period noted

g. Teletype bulletin - This bulletin contains information identical to the facsimile product

NOTE: It also serves to amend and correct both the facsimile and teletype product.

h. Using the chart

(1) Use the contents of this advisory strictly as a preflight aid to help plan your route of flight to avoid possible severe weather

(2) Compare the MWA forecast with the existing or latest weather in the available weather charts and teletype reports

PROGRESS CHECK

Question 10 — 1.1.1.4.7, 1.1.1.4.8
What are the exceptions to the OPNAVINST restriction prohibiting flight in WW and CAWW areas?

ANSWER:
1. Operational necessity
2. Research/weather reconnaissance
3. Emergencies
4. Storm development has not progressed as forecast, and
   a. when flight remains in VFR conditions, or
   b. operable weather radar is installed in the aircraft
5. The aircraft is capable of flying above the hazard

Question 11 — 1.1.1.4.7, 1.1.1.4.8
Aside from the exceptions laid forth in OPNAVINST 3710.7, what areas are you prohibited from filing into or flying through?

ANSWER: Severe weather watch (WW) and CNATRA weather watch (CAWW) areas.

Sg 4, fr 3
Lesson Organization

IV. Flight weather briefing (DD-175-1) **1.1.1.2.1**

A. Responsibility for brief (OPNAV 3710.7 series)

1. Ultimate responsibility for reviewing and becoming familiar with weather conditions for the area in which the flight is contemplated rests with the pilot-in-command

2. Where Naval Oceanographic Services are available, weather briefings shall be conducted by a qualified meteorological forecaster

3. Briefings can be conducted in person, via telephone, autograph, or weather vision

B. Preflight Weather Brief

1. VFR flights utilizing a DD-175 must either have a completed DD-175-1 (weather briefing form) certifying that the flight can be conducted under VFR conditions, or the forecaster can use a special VFR stamp on the DD-175

   NOTE: The brief can be conducted no more than 2 hrs prior to the ETD with a void time no more than 30 minutes after the ETD.

2. All flights to be conducted in IMC, or on an IFR flight plan, will have a flight weather briefing and a DD-175-1 will be completed

   a. The forecaster will complete the form if the briefing is in person or via autograph

   b. It is the pilot's responsibility to complete the form for telephone or weather vision briefings

C. Requesting the Weather Brief

1. Prebrief - Pilot should avail himself of any and all information available prior to requesting the formal brief

   a. Pilots planning an IFR flight are primarily interested in ceiling and visibility conditions at point of departure, destination, and possible alternates, as well as enroute weather pertaining to icing, turbulence and winds aloft

   b. VFR flight primarily concerned with ceiling and visibility so he can see and be seen by other aircraft

2. Provide forecaster with completed DD-175

3. If brief is to be conducted via telephone, be prepared to provide the briefer:

   a. Name of person calling

Sg 4, fr 4
Fig 20: *DD-175-1*

FLIGHT WEATHER BRIEFING

PART I - MISSION/TAKEOFF DATA

DATE	ACFT TYPE/NO	DEP PT/ETD Z	RUNWAY TEMP °F/C	DEWPOINT °F/C	TEMP DEV °C	PRESSURE ALT FT	DENSITY ALT FT

SFC WIND M T	CLIMB WINDS	LOCAL WEA WRNG/MET WATCH ADV	RCR

REMARKS/TAKEOFF ALTN FCST

PART II - ENROUTE DATA

FLT LEVEL	FLT LEVEL WINDS/TEMP

CLOUDS AT FLT LEVEL ☐ YES ☐ NO ☐ IN AND OUT

MINIMUM VISIBILITY AT FLT LEVEL OUTSIDE CLOUDS ☐ SMOKE ☐ DUST ☐ HAZE ☐ FOG ☐ PRECIPITATION MILES DUE TO ☐ NO OBSTRUCTION

MINIMUM CEILING FT AGL	LOCATION	MAXIMUM CLOUD TOPS FT MSL	LOCATION	MINIMUM FREEZING LEVEL FT MSL	LOCATION

THUNDERSTORMS	TURBULENCE	ICING	PRECIPITATION
MWA/WW NO.	CAT ADVISORY Z	NONE	NONE

	THUNDERSTORMS	TURBULENCE			ICING				PRECIPITATION				
	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%	SVR			MOD				HVY				
	NUMEROUS - MORE THAN 45%	EXTREME			SVR				SHWRS				
	HAIL, SVR., TURB., SEVERE, ICING, PRECIPITATION AND LIGHTNING EXPECTED IN AND NEAR TSTMS.	LEVELS			LEVELS				FRZG				
	LOCATION	LOCATION			LOCATION				LOCATION				

PART III - TERMINAL FORECASTS

AIRDROME	CLOUD LAYERS	VSBY/WEA	SFC WIND	ALTIMETER	VALID TIME
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z

PART IV - COMMENTS/REMARKS

BRIEFED ON LATEST RCR FOR DESTN AND ALTN ☐ YES ☐ NOT AVAILABLE

REQUEST PIREP AT

PART V - BRIEFING RECORD

WEA BRIEFED Z	FLIMSY BRIEFING NO.	FORECASTER'S SIGNATURE OR INITIALS

VOID TIME Z	EXTENDED TO Z	WEA REBRIEFED AT Z	FORECASTER'S INIT	NAME OF PERSON RECEIVING BRIEFING

DD Form 175-1, FEB 87

Figure 20: THE DD-175-1

b. Aircraft identification (call sign), and type of aircraft

c. Departure point, destination and proposed alternate

d. Type of flight plan (IFR/VFR) and proposed altitude

e. ETD, ETE, and ETE to alternate

f. Intended route

g. Enroute stops, or delay en route, if applicable, with appropriate ETA and ETD of enroute delay

4. Some airfields do not provide 24-hour forecaster service

NOTE: Most civilian airfields do not have NWS briefers. Military pilots can either call the nearest military facility or a tie-in FSS.

NOTE: The FLIP Flight Information Handbook provides a list of tie-in military weather stations with autovon and/or commercial (call collect) telephone numbers.

D. Content of the Weather Briefing - The following list of key items should be checked:

NOTE: Aircrew should not be hesitant to ask the person giving the briefing about any particular item.

1. Weather at Takeoff:

a. Bases and tops of cloud layers

b. Visibility and obstructions to vision

c. Type and intensity of precipitation

d. Freezing level

e. Temperature and climb winds up to flight altitude

f. Runway temperature, wind, and pressure/ density altitude

g. Condition of runway (if affected by weather)

2. Weather En Route

a. Bases, tops, types, and amount of each cloud layer

b. Visibility at the surface and aloft

c. Type, location, intensity, and directions/speed of fronts

d. Freezing level

e. Areas of severe weather (thunderstorms, icing, turbulence)

f. Areas of good weather

3. Weather at Destination and Alternate

a. Bases, tops, types, and amount of each cloud layer

b. Visibility and obstructions to vision

c. Type and intensity of precipitation, and icing

d. Freezing level

e. Turbulence

f. Surface wind direction and velocity

g. Condition of runways (if affected by weather)

4. If no forecaster is available at the departure point, but current charts and teletype are displayed, the aircrew member should:

   a. Look around and see what information is available

   b. Read and plan. Look over the charts

      (1) Look for weather hazards and low ceilings -- observed and forecast

      (2) Read your destination current and forecast weather

      (3) Determine if an alternate is required and, if so, where would be suitable

      (4) Check the wind charts for your planned route

      (5) Plan the flight

      NOTE: You should be weatherwise enough to select your route, destination, and alternate and figure your ETD, ETEs, and ETAs to alternate(s).

   c. Call the nearest weather facility

      NOTE: Provide the forecaster with the previously mentioned information and have a blank DD-175-1 at the ready to be completed during the brief.

   d. Listen and ask!

      (1) Listen to what the forecaster has to say

      (2) Ask questions during the brief

      (3) Make sure you have "the big picture"

Sg 4, fr 5
Fig 21: *Weather Minima Criteria Flow Chart*

Sg 4, fr 6
DD-175-1

E. DD-175-1 Requirement and Description **1.1.1.2.1.1**

1. In accordance with OPNAV 3710.7, DD Form 175-1 Flight Briefing shall be completed for all flights to be conducted in instrument flight conditions

2. This briefing may be accomplished in person by a meteorological forecaster, when available, or by autographic, telephonic, or weather vision systems when no forecasters are immediately available

3. The weather briefing form, DD-175-1, is divided into five separate parts:

   a. Mission/takeoff data

   b. Enroute data

   c. Terminal forecast

   d. Comments/remarks

   e. Briefing record

   NOTE: Parts are divided by a solid triangle in the margin.

4. The DD-175-1 is not completed in the same order as it is shown on the form

   a. Flight level not chosen until information on thunderstorms, turbulence, icing, and winds has been investigated

   b. Determinations concerning icing require first investigating cloud layers, freezing levels, and RADAT data

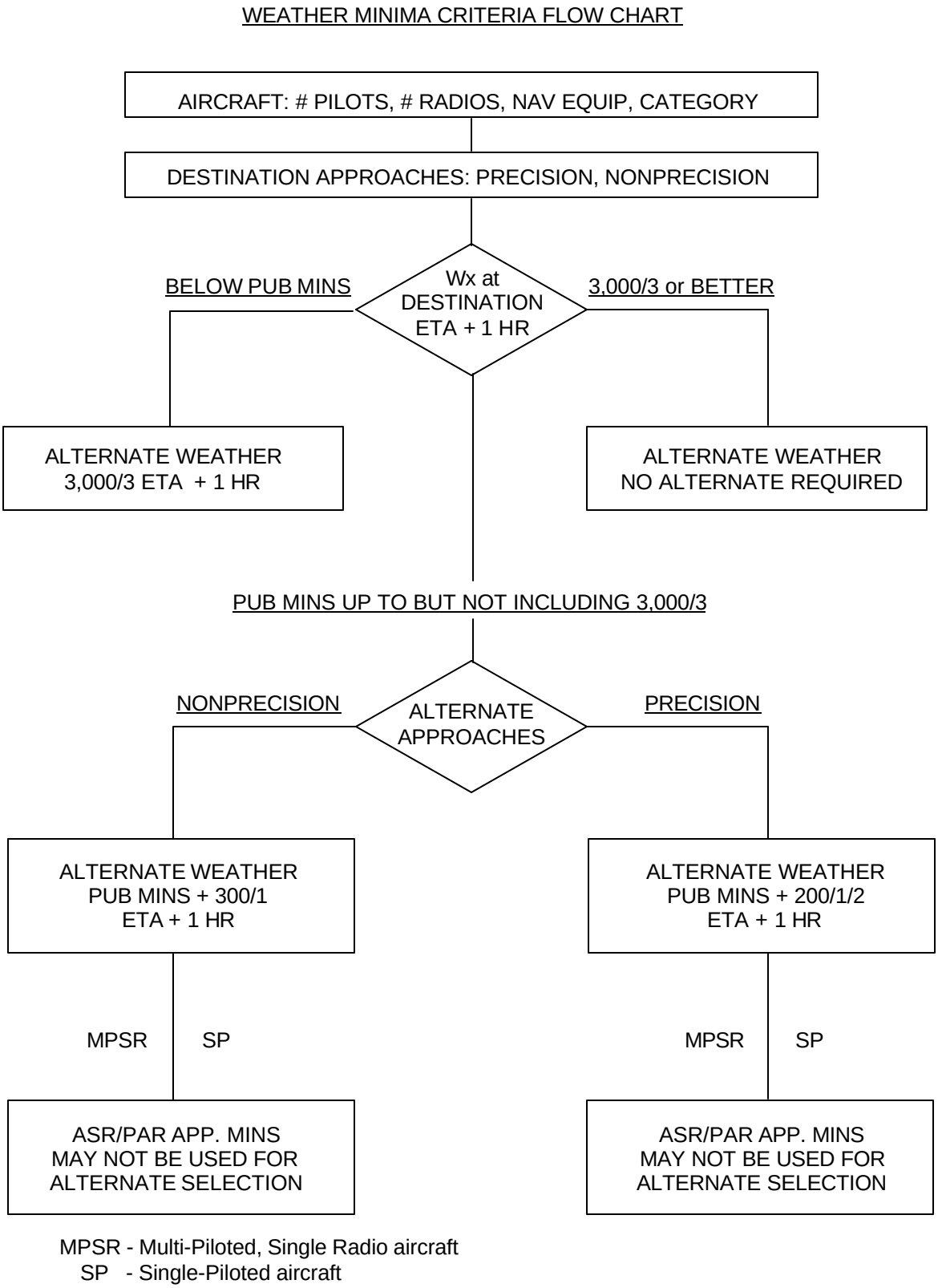


Figure 21: WEATHER MINIMA CRITERIA FLOW CHART

Sg 4, fr 7
Fig 22: *Data Sources*

Sg 4, fr 8
Fig 23: *Mission/ Takeoff Section (Part I)*

F. Explanation of Data Sources/Uses

1. Mission/Takeoff section (Part I)

a. First three boxes specify date (local), aircraft type(s) and bureau number(s), departure point and ETD

b. Remaining boxes specify forecast conditions for takeoff and climb out

NOTE: Meteorologist normally will not fill in this information, unless the pilot indicates he needs or desires this information.

c. Local Weather Warnings such as WWs, CAWWs, thunderstorm conditions, or MET Watch advisories (MWAs, AIRMETs, SIGMETs, Convective SIGMETs) are <u>always</u> entered

Sg 4, fr 9
Fig 24: *Enroute Data Section (Part II)*

2. Enroute data (Part II)

a. Before checking any other information, check first for any valid Aviation Severe Weather Watch Bulletins (WWs) or any Met Watch Advisories (MWAs), because severe weather may cause a change in route

b. Information entered is expected weather conditions within a minimum of 25 nm of the intended route, 5,000 ft above or below the intended flight altitude, and destination let down conditions

NOTE: 25 nm and 5,000 ft are guidelines only.

c. Minimum ceilings - usually the first block marked

(1) First check the Weather Depiction Chart for a pictorial presentation, then cross-check observed information by referring the Area Forecasts (FA)

DATA SOURCES/USES

REPORT	FACSIMILE	TELETYPE	TELETYPE IDENTIFIER	OBSERVED	FORECAST	USE IN FLIGHT PLANNING
SURFACE ANALYSIS CHART	X			X		LOCATIONS OF PRESSURE SYSTEMS & FRONTS
SEVERE WEATHER WATCH BULLETIN		X	WW		X	TORNADOES & SEVERE THUNDERSTORMS (NO-FLY AREAS)
RADAR SUMMARY CHART	X			X		THUNDERSTORMS & MAXIMUM CLOUD TOPS
WEATHER DEPICTION CHART	X			X		IFR/VFR AREAS & MINIMUM CEILINGS EN ROUTE
AREA FORECAST		X	FA		X	PREFLIGHT PLANNING FOR EN ROUTE PORTION OF FLIGHT
IN-FLIGHT WEATHER ADVISORY		X	WA WS/WST		X	EN ROUTE PLANNING FOR HAZARDOUS WEATHER
PILOT REPORT		X	UUA UA	X		SUPPLEMENT GROUND STATIONS' WEATHER OBSERVATIONS
WINDS ALOFT FORECAST		X	FD		X	WINDS & TEMPERATURES INSIDE CONTINENTAL U.S.
WINDS ALOFT PROGNOSTIC CHART	X				X	WINDS & TEMPERATURES INSIDE CONTINENTAL U.S.
CONSTANT PRESSURE CHART	X			X		WIND, TEMPERATURE, DEW POINT, ICING, PRESSURE
METAR		X	METAR	X		DESTINATION AND ALTERNATE OBSERVED WEATHER
TERMINAL AERODROME FORECAST (TAF)		X	TAF		X	DESTINATION AND ALTERNATE FORECAST WEATHER
LOW LEVEL SIGNIFICANT WEATHER PROGNOSTIC CHART	X				X	FORECAST OF PRESSURE SYSTEMS, FRONTS, SIGNIFICANT WEATHER, TURBULENCE, FREEZING LEVELS, & IFR/MVFR AREAS

Figure 22: DATA SOURCES

FLIGHT WEATHER BRIEFING

PART I - MISSION/TAKEOFF DATA

DATE	ACFT TYPE/NO	DEP PT/ETD	RUNWAY TEMP	DEWPOINT	TEMP DEV	PRESSURE ALT	DENSITY ALT
31 Oct	(2) A-7/164542 164583	NPA/1600 Z	82 °F/X	68 °F/X	+23 °C	-150 FT	+1600 FT

SFC WIND	CLIMB WINDS	LOCAL WEA WRNG/MET WATCH ADV	RCR
1210	2520	TSTM COND I TIL 18Z	

REMARKS/TAKEOFF ALTN FCST

ISOL CBs LOCATED NW-N OF NPA, MOVG SE @ 5 KT

MISSION/TAKEOFF DATA

ENTRY	SOURCE
DATE	DD-175
AFCT TYPE/NO	DD-175
DEP PT/ETD	DD-175
RUNWAY TEMP	Forecaster and current conditions
DEW POINT	
TEMP DEV	
PRESSURE ALT	
DENSITY ALT	
SFC WIND	
CLIMB WINDS	Winds Aloft Charts and Teletype Winds Aloft Forecasts (FD), AIRMETs (WA) AND SIGMETs (WS), AND Weather Warnings (WW) & (CAWW)
LOCAL WEA WRNG/MET WATCH ADV	Terminal Aerodrome Forecasts
RCR	
REMARKS/TAKEOFF ALTN FCST	

Figure 23: MISSION/TAKEOFF SECTION (PART I)

PART II - ENROUTE DATA

FLT LEVEL
250 → NBE
390 → NZY

FLT LEVEL WINDS/TEMP
3120/-24 → LIT; 2235/-25 → TUL;2450/-25 → NBE
2555/-55 → ABI; 2565/-55 → INK;3040/-55 → NKX

CLOUDS AT FLT LEVEL ELSW
[X] YES [ ] NO [X] IN AND OUT

MINIMUM VISIBILITY AT FLT LEVEL OUTSIDE CLOUDS 7 MILES DUE TO XCPT1/2 ↑↓ NBE
[ ] SMOKE [ ] DUST [ ] HAZE [ ] FOG [X] PRECIPITATION [ ] NO OBSTRUCTION

MINIMUM CEILING 004 FT AGL LOCATION LIT

MAXIMUM CLOUD TOPS 430 FT MSL LOCATION OK,TX

MINIMUM FREEZING LEVEL 120 FT MSL LOCATION TUL

THUNDERSTORMS

MWA/WW NO. 31C/WW*136
[ ] NONE [X] AREA [X] LINE

X	ISOLATED 1 - 2%
	FEW 3 - 15%
X	SCATTERED 16 - 45%
X	NUMEROUS - MORE THAN 45%

HAIL, SVR., TURB., SEVERE, ICING, PRECIPITATION AND LIGHTNING EXPECTED IN AND NEAR TSTMS.

LOCATION ISOL - LA & AR
SCTD - OK & TX

TURBULENCE

CAT ADVISORY Z

	NONE	IN CLEAR	IN CLOUD
LIGHT		X	X
MOD			X
SVR			
EXTREME			

LEVELS SFC - 060

LOCATION TUL → NBE

ICING

NONE

		RIME	MIXED	CLEAR
TRACE				
LIGHT		✓	X	
MOD				
SVR				

LEVELS 120 - 180

LOCATION ✓ = NPA - NBE
X = ↑↓ NBE/TIK

PRECIPITATION

NONE

		DRIZ	RAIN	SNOW	SLEET
LT		✓	✓		
MOD		X	X		
HVY		X	X		
SHWRS			X		
FRZG					

LOCATION ✓ = NPA → LIT
X = LIT → NBE

ENROUTE DATA

ENTRY	SOURCE
FLT LEVEL	DD-175
FLT LEVEL WINDS/TEMP	Winds Aloft Forecasts (FT)
CLOUDS AT FLT LEVEL	High Level Significant Weather Prognostic Chart
MINIMUM VISIBILITY AT FLT LEVEL OUTSIDE CLOUDS	High Level Significant Weather Prognostic Chart
MINIMUM CEILING/LOCATION	Surface Weather Depiction Chart
MAXIMUM CLOUD TOPS/LOCATION	Radar Summary Chart
MINIMUM FREEZING LVL/LOCATION	"Icing Section" of the Area Forecasts (FA) and Freezing Level Chart
THUNDERSTORMS	Radar Summary Chart and Area Forecast (FA)
TURBULENCE	High Level Significant Weather Prognostic Chart, PIREPs (UA), and Inflight Weather Advisories (WA/WS)
ICING	"Icing Section" of the Area Forecasts (FA) and the Constant Pressure Chart
PRECIPITATION	From most of the charts except the Winds Aloft Charts and Winds Aloft Forecast (FD)

Figure 24: ENROUTE DATA SECTION (PART II)

(2) Always check for in-flight advisories (AIRMETs and SIGMETs) anytime you check the area forecasts

d. Maximum Cloud Tops - Significant cloud tops (excluding thunderstorms) along the route and their location

(1) Refer to the Radar Summary Chart for observed data and Area Forecasts for forecast information

(2) Check In-flight Weather Advisories for updates to the FA, and PIREPs if available

e. Thunderstorms - While checking for thunderstorms, also look for maximum cloud tops associated with them

(1) Check Radar Summary Chart for a pictorial view of thunderstorm and precipitation location, cross-checked with Area Forecasts and Convective SIGMETs for forecast conditions

(2) On the "MWA/WW No." line, list any current WW, MWA, or Convective SIGMET that applies

(3) Amplify these in the remarks section

(4) If more than one area of thunderstorms is applicable, they should be indicated

f. Precipitation - Area Forecasts and Weather Depiction Charts should provide the required information; however, any of the weather products with the exception of Winds Aloft and Constant Pressure Charts can provide useful information

g. Turbulence - Since turbulence is found in all thunderstorms, this section deals with turbulence not associated with thunderstorms

(1) The Area Forecast is a good source of forecast teletype information supplemented by SIGMETs and AIRMETs

(2) Low-Level Significant Weather Prognostic Chart is a good facsimile source

(3) PIREPs are an excellent source of observed information

(4) Any CAT advisory DTG should be entered

h. Minimum Freezing Level - Numerous sources:

(1) Winds Aloft Forecast

(2) Low-Level Significant Weather Prognosis Chart

(3) Winds Aloft Prognosis Chart

(4) Constant Pressure Charts

(5) RADAT reports attached to the Aviation Weather Hourly Reports

i. Icing - From the nonconvective SIGMET reports, with supporting information from the Constant Pressure Charts

NOTE: Look for shaded station models, which indicate a temperature/dew point spread of 5 degrees or less. If temperatures are in the icing range, supercooled moisture is probable.

NOTE: Another good source would be PIREPs, if available.

j. Selecting Flight Level - Analyzing the information you have determined up to this point, you now have information on:

(1) Minimum ceilings

(2) Maximum cloud tops

(3) Thunderstorms

(4) Turbulence

(5) Minimum freezing level

(6) Icing

(7) Precipitation

NOTE: Considering all the hazards associated with the forgoing conditions, you are now ready to select an altitude or altitudes, as appropriate, which EXCLUDE as many of these hazards as possible.

k. Flight Level Winds/Temperatures - Considering only the altitudes determined to be free of the most hazardous weather, and considering the FAA cruising altitudes for direction of flight, select an altitude which provides the most favorable winds

NOTE: Wind sources include the Winds Aloft Forecast (FD), the Winds Aloft Prognostic Charts, and the Constant Pressure Charts (especially for possible jet streams along your path). The Constant Pressure Charts provide information for overwater flights. If requested far enough in advance, OPARS is an excellent source of information. All these charts will also provide temperature information at altitude.

NOTE: Enter as many increments of winds and temperature as are necessary to accurately describe the enroute wind and temperature conditions. Computer-generated flight plans (with winds) may be requested via OPARS (Optimum Path Aircraft Routing System). In this case the entry will be "OPARS #" in place of the specific wind data.

l. Clouds and visibility at flight level - Clouds and minimum visibility at flight level will generally be apparent from the overall weather picture

NOTE: This information may be supplemented with PIREPs if available.

NOTE: A check in the "IN AND OUT" box represents a forecast of between 1% and 45% of the flight through clouds while the "NO" box indicates less than 1%. The "YES" box indicates more than 45%. If it would be more practical to check more than one block to better represent cloud conditions, then enter locations above the additional blocks.

3. Terminal Forecast Section (Part III)

Sg 4, fr 10
Fig 25: *Terminal Forecast Section (Part III)*

a. Provides space for information on forecast weather at your destination and alternate, plus any intermediate points on a stopover flight plan

b. Can be completed any time during the brief but if done early on it will indicate the feasibility of planned destination and the necessity of an alternate

c. Terminal Aerodrome Forecasts (TAFs) will provide the required information for 1 hour prior to 1 hour after the planned ETA

d. Any change groups (TEMPO, GRADU, INTERMITTENT, etc.) applicable to the valid time will be entered on the next line preceded by the change group indicator

e. Although not required by the weather briefing form, a study of the existing weather from the METAR will indicate the reliability of the Terminal Aerodrome Forecast by comparing existing weather with forecast conditions

PART III - TERMINAL FORECASTS					
AIRDROME	CLOUD LAYERS	VSBY/WEA	SFC WIND	ALTIMETER	VALID TIME
DEST/~~ALTN~~ NBE	5 SCT 10 BKN 15 OVC	4RW	3415/25	29.92 INS	1630 Z TO 1830 Z
~~DEST/ALTN~~ TEMPO	5 BKN 10 OVC	1/2TRW	G45	— INS	— Z TO — Z
~~DEST~~/ALTN TIK	10 SCT 20 OVC	5RW	3412/25	29.92 INS	1655 Z TO 1855 Z
~~DEST/ALTN~~ TEMPO	5 BKN 10 OVC	1TRW	G40	— INS	— Z TO — Z
DEST/~~ALTN~~ NZY	25 BKN 250 BKN	5H	0305	30.00 INS	2010 Z TO 2210 Z
~~DEST~~/ALTN NKX	25 SCT 250 BKN	5H	0305	30.00 INS	2020 Z TO 2220 Z
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z

TERMINAL FORECAST

ENTRY	SOURCE
AIRDROME	DD-175
CLOUD LAYERS	Terminal Aerodrome Forecasts (TAFs)
VSBY/WEA	Terminal Aerodrome Forecasts (TAFs)
SFC WIND	Terminal Aerodrome Forecasts (TAFs)
ALTIMETER	Terminal Aerodrome Forecasts (TAFs)
VALID TIME	Terminal Aerodrome Forecasts (TAFs)

Figure 25: TERMINAL FORECAST SECTION (PART III)

4. Comments/Remarks (Part IV) can include:

   a. Latest braking action code

   b. Pertinent PIREPs

   c. Latest METAR of first destination

   d. Any significant data not covered elsewhere, i.e., SIGMETs/AIRMETs/warnings, low-level windshear, and runway conditions

Sg 4, fr 11
Fig 26: *Comments/ Remarks Section (Part IV)*

5. Briefing Record (Part V)

   a. Actual time of brief

   b. Flimsy briefing number (2-digit month code followed by sequential number of this briefing)

   c. Signature of forecaster (legible)

   d. Void time: Two and a half hours from the time of the brief but cannot exceed 30 minutes after your "Expected Time of Departure (ETD)"

   e. Extensions: new time based on a new ETD

   f. Forecaster's initials and name of the person being briefed

Sg 4, fr 12
Fig 27: *Briefing Record Section (Part V)*

LESSON NOTES

Use each of the following Figures (28-31) to highlight critical information as required. These may also be used in a manner analogous to progress checks.

G. Interpreting data contained on DD-175-1 **1.1.1.2.1.1.1**

COMMENTS/REMARKS

ENTRY	SOURCE
BRIEFED	Forecaster to include any significant information not covered in the regular areas of the DD-175-1
REQUEST PIREP AT	Forecaster based on necessity

Figure 26: COMMENTS/REMARKS SECTION (PART IV)

PART V - BRIEFING RECORD				
WEA BRIEFED 1440 Z	FLIMSY BRIEFING NO. 10 - 505		FORECASTER'S SIGNATURE OR INITIALS AG1 W. W. FORECASTER	
VOID TIME 1630 Z	EXTENDED TO 1700 Z	WEA REBRIEFED AT 1610 Z	FORECASTER'S INIT WWF/JJF	NAME OF PERSON RECEIVING BRIEFING LT FLYIT

DD Form 175-1, FEB 87

BRIEFING RECORD

ENTRY	SOURCE
WEA BRIEFED	Forecaster (Time of forecast)
FLIMSY BRIEFING #	Forecaster, if flimsy briefing has been previously provided.
VOID TIME	Based on 2 hrs after actual weather briefing per OPNAVINST 3710.7
EXTENDED TO	Forecaster per OPNAVINST 3710.7
WEA REBRIEFED AT	Forecaster per OPNAVINST 3710.7
FORECASTER'S INIT	Forecaster
NAME OF PERSON BRIEFED	DD-175 and pilot

Figure 27: BRIEFING RECORD SECTION (PART V)

Fig 28: *Interpreting the DD-175-1 (Example 1)*

1. EXAMPLE 1—turbulence and icing level: The flight plan states that your flight will be going from SPS to ABQ at FL350, departing at 1900Z.

   NOTE: Be aware that the plane could encounter icing from SPS to CDS at 1,000 ft AGL to 12,000 ft MSL on climbout and will encounter severe turbulence from TXO to ABQ between FL230 and FL390. These phenomena affect how you decide to proceed with your flight plan.

Fig 29: *Interpreting the DD-175-1 (Example 2)*

2. EXAMPLE 2—destination forecast requires an alternate: The flight plan states that your flight will be going from NQI to NPA with PAM as an alternate, departing at 1730Z and flying at FL370.

   NOTE: The alternate airfield is required because the weather at the primary is below 3,000-3, overcast at 500 and 1,400, thunderstorms and winds at 20 kts gusting to 45.

Fig 30: *Interpreting the DD-175-1 (Example 3)*

3. EXAMPLE 3—The proposed takeoff time very close to void time of 175-1: flight plan states that your flight will be going from NIR to ELP at FL350 departing at 0000Z. You have been delayed for maintenance.

   NOTE: Be aware that because your revised takeoff time of 0100Z will be after the VOID time, pilot(s) will need to contact METRO to extend the VOID time and perhaps receive a new briefing. In this case, the forecaster rebriefs the pilot(s) at 0030Z and sets a new void time of 0130Z.

Fig 31: *Interpreting the DD-175-1 (Example 4)*

4. EXAMPLE 4—route of flight has a severe weather warning (WW): The flight plan says your flight will be going from NIR to TIK at FL370 departing at 2200Z.

   NOTE: The pilot(s) should be aware that a severe weather warning (WW #25) is in effect between ALT and ADM and should divert a portion of the flight path west. Pilot(s) should ask forecaster about the extent of the warning.

FLIGHT WEATHER BRIEFING

PART I - MISSION/TAKEOFF DATA

DATE	ACFT TYPE/NO	DEP PT/ETD	RUNWAY TEMP	DEWPOINT	TEMP DEV	PRESSURE ALT	DENSITY ALT
2 FEB	T45/168055	SPS/1900 Z	35 °F/C	31 °F/C	-5 °C	600 FT	800 FT

SFC WIND	CLIMB WINDS	LOCAL WEA WRNG/MET WATCH ADV	RCR
0407 (T)	2765	WX ADV SVR ICG 020-060	WR

REMARKS/TAKEOFF ALTN FCST: PTCHS OF ICE ON RWY

PART II - ENROUTE DATA

FLT LEVEL	FLT LEVEL WINDS/TEMP
350	SPS 2895/-55

CLOUDS AT FLT LEVEL: ☐ YES ☐ NO ☒ IN AND OUT

MINIMUM VISIBILITY AT FLT LEVEL OUTSIDE CLOUDS: ☐ SMOKE ☐ DUST ☐ HAZE ☐ FOG ☐ PRECIPITATION

MILES DUE TO: ☒ NO OBSTRUCTION

MINIMUM CEILING	LOCATION	MAXIMUM CLOUD TOPS	LOCATION	MINIMUM FREEZING LEVEL	LOCATION
010 FT AGL	SPS	130 FT MSL	SPS	010 FT MSL	SPS

THUNDERSTORMS			TURBULENCE			ICING				PRECIPITATION				
MWA/WW NO.			CAT ADVISORY Z			NONE				NONE				
X 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	X			MOD				
SCATTERED 16 - 45%			SVR	X	X	MOD	X			HVY				
NUMEROUS - MORE THAN 45%			EXTREME			SVR				SHWRS				X
HAIL, SVR., TURB., SEVERE, ICING, PRECIPITATION AND LIGHTNING EXPECTED IN AND NEAR TSTMS.			LEVELS FL230 - 390			LEVELS SFC - 100				FRZG				
LOCATION ISOL - LA & AR SCTD - OK & TX			LOCATION TXO - ABQ			LOCATION SPS				LOCATION SPS - CDS				

PART III - TERMINAL FORECASTS

AIRDROME	CLOUD LAYERS	VSBY/WEA	SFC WIND	ALTIMETER	VALID TIME
DEST/ALTN ABQ	100 OVC		2625	30.25 INS	1855 Z TO 2055 Z
DEST/ALTN ELP	50 SCT 100 OVC		2515	30.25 INS	1955 Z TO 2155 Z
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z

PART IV - COMMENTS/REMARKS

BRIEFED ON LATEST RCR FOR DESTN AND ALTN: ☒ YES ☐ NOT AVAILABLE

REQUEST PIREP AT: TXO

ABQ RCR - DRY
WW # 136 - VALID UNTIL 2200Z FOR TX0 - ABQ RTE
WW # 251 - IN EFFECT UNTIL 2200Z SVR RIME ICE 010 - 120

PART V - BRIEFING RECORD

WEA BRIEFED	FLIMSY BRIEFING NO.	FORECASTER'S SIGNATURE OR INITIALS
1815 Z	02 - 21	AG1 R. LOUS

VOID TIME	EXTENDED TO	WEA REBRIEFED AT	FORECASTER'S INIT	NAME OF PERSON RECEIVING BRIEFING
2000 Z	Z	Z	RBL	D. BROWNING

DD Form 175-1, FEB 87

Figure 28: INTERPRETING THE DD-175-1 (EXAMPLE 1)

FLIGHT WEATHER BRIEFING

PART I - MISSION/TAKEOFF DATA

DATE	ACFT TYPE/NO	DEP PT/ETD	RUNWAY TEMP	DEWPOINT	TEMP DEV	PRESSURE ALT	DENSITY ALT
2 FEB	T45/168056	NQI/1730 Z	75 °F/~~C~~	65 °F/~~C~~	+10 °C	+200 FT	1280 FT

SFC WIND	CLIMB WINDS	LOCAL WEA WRNG/MET WATCH ADV	RCR
~~M~~ T 0410	1420		

REMARKS/TAKEOFF ALTN FCST: LGT TURB SFC - 050

PART II - ENROUTE DATA

FLT LEVEL	FLT LEVEL WINDS/TEMP
370	NQI - NPA SAT 3541/-56 TLH 2425/-50 LCH 2530/-56 MSY 2618/-52

CLOUDS AT FLT LEVEL: ☐ YES ☒ NO ☐ IN AND OUT

MINIMUM VISIBILITY AT FLT LEVEL OUTSIDE CLOUDS: ☐ SMOKE ☐ DUST ☐ HAZE ☐ FOG ☐ PRECIPITATION

MILES DUE TO: ☒ NO OBSTRUCTION

MINIMUM CEILING	MAXIMUM CLOUD TOPS	MINIMUM FREEZING LEVEL
FT AGL LOCATION	FT MSL LOCATION	FT MSL LOCATION

THUNDERSTORMS	TURBULENCE	ICING	PRECIPITATION
MWA/WW NO.	CAT ADVISORY Z	NONE	NONE

	THUNDERSTORMS		TURBULENCE	IN CLEAR	IN CLOUD		ICING	RIME	MIXED	CLEAR		PRECIPITATION	DRIZ	RAIN	SNOW	SLEET
	NONE X AREA LINE		NONE				NONE					NONE				
	ISOLATED 1 - 2%		LIGHT		X		TRACE					LT		X		
X	FEW 3 - 15% TOPS 310		MOD		X		LIGHT		X			MOD		X		
	SCATTERED 16 - 45%		SVR				MOD					HVY				
	NUMEROUS - MORE THAN 45%		EXTREME				SVR					~~SHWRS~~		X		
	HAIL, SVR., TURB., SEVERE, ICING, PRECIPITATION AND LIGHTNING EXPECTED IN AND NEAR TSTMS.		LEVELS				LEVELS 080 - 140					FRZG				
	LOCATION LCH - NPA		LOCATION LCH - NPA				LOCATION LCH					LOCATION LCH - NPA				

PART III - TERMINAL FORECASTS

AIRDROME	CLOUD LAYERS	VSBY/WEA	SFC WIND	ALTIMETER	VALID TIME
DEST/~~ALTN~~ NPA	5 OVC 14 OVC	2TRW	2920G45	29.89 INS	1800 Z TO 2000 Z
~~DEST~~/ALTN PAM	050 OVC	2R	2810	29.92 INS	1830 Z TO 2030 Z
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z

PART IV - COMMENTS/REMARKS

BRIEFED ON LATEST RCR FOR DESTN AND ALTN: ☐ YES ☒ NOT AVAILABLE

REQUEST PIREP AT:

SJI - NPA OCNL C 0X1/2 TRWR+F

PART V - BRIEFING RECORD

WEA BRIEFED	FLIMSY BRIEFING NO.	FORECASTER'S SIGNATURE OR INITIALS
1630 Z	02 - 25	AG1 RON THOMPSON

VOID TIME	EXTENDED TO	WEA REBRIEFED AT	FORECASTER'S INIT	NAME OF PERSON RECEIVING BRIEFING
1800 Z	Z	Z	RPT	B. MIDDLETON

DD Form 175-1, FEB 87

Figure 29: INTERPRETING THE DD-175-1 (EXAMPLE 2)

FLIGHT WEATHER BRIEFING

PART I - MISSION/TAKEOFF DATA

DATE	ACFT TYPE/NO	DEP PT/ETD	RUNWAY TEMP	DEWPOINT	TEMP DEV	PRESSURE ALT	DENSITY ALT
2 FEB	T45/168057	NIR/0000 Z	65 °F/X	40 °F/X	+15 °C	-300 FT	23 FT

SFC WIND	CLIMB WINDS	LOCAL WEA WRNG/MET WATCH ADV	RCR
1210 X T	2520		

REMARKS/TAKEOFF ALTN FCST: ISOL CBS ARE N-NE OF FST MOV NE @ 5 KT

PART II - ENROUTE DATA

FLT LEVEL	FLT LEVEL WINDS/TEMP
350	SAT 3120/-48 FST 2535/-50

CLOUDS AT FLT LEVEL: ☐ YES ☒ NO ☐ IN AND OUT

MINIMUM VISIBILITY AT FLT LEVEL OUTSIDE CLOUDS: ☐ SMOKE ☐ DUST ☒ HAZE ☐ FOG ☐ PRECIPITATION — 7 MILES DUE TO ☐ NO OBSTRUCTION

MINIMUM CEILING	LOCATION	MAXIMUM CLOUD TOPS	LOCATION	MINIMUM FREEZING LEVEL	LOCATION
FT AGL		FT MSL		FT MSL	

THUNDERSTORMS				TURBULENCE			ICING				PRECIPITATION				
MWA/WW NO.				CAT ADVISORY Z			NONE				NONE				
	NONE		AREA		LINE		NONE	IN CLEAR	IN CLOUD		RIME	MIXED	CLEAR		DRIZ	RAIN	SNOW	SLEET
X	ISOLATED 1 - 2%					LIGHT	X			TRACE				LT				
	FEW 3 - 15%					MOD				LIGHT				MOD				
	SCATTERED 16 - 45%					SVR				MOD				HVY				
	NUMEROUS - MORE THAN 45%					EXTREME				SVR				SHWRS				
HAIL, SVR., TURB., SEVERE, ICING, PRECIPITATION AND LIGHTNING EXPECTED IN AND NEAR TSTMS.				LEVELS 240 - 350			LEVELS							FRZG				
LOCATION FST				LOCATION SAT - FST			LOCATION							LOCATION				

PART III - TERMINAL FORECASTS

AIRDROME	CLOUD LAYERS	VSBY/WEA	SFC WIND	ALTIMETER	VALID TIME
DEST/~~ALTN~~ ELP	250 SCT	25	2705	29.98 INS	0300 Z TO 0230 Z
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z

PART IV - COMMENTS/REMARKS

BRIEFED ON LATEST RCR FOR DESTN AND ALTN: ☐ YES ☒ NOT AVAILABLE — REQUEST PIREP AT

PART V - BRIEFING RECORD

WEA BRIEFED	FLIMSY BRIEFING NO.	FORECASTER'S SIGNATURE OR INITIALS
2315 Z	02 - 26	AG2 SAMUEL MARTINEZ

VOID TIME	EXTENDED TO	WEA REBRIEFED AT	FORECASTER'S INIT	NAME OF PERSON RECEIVING BRIEFING
0100 Z	0130 Z	0030 Z	SRM	J. BROWN

DD Form 175-1, FEB 87

Figure 30: INTERPRETING THE DD-175-1 (EXAMPLE 3)

FLIGHT WEATHER BRIEFING

PART I - MISSION/TAKEOFF DATA

DATE	ACFT TYPE/NO	DEP PT/ETD	RUNWAY TEMP	DEWPOINT	TEMP DEV	PRESSURE ALT	DENSITY ALT
2 JUL	T45/168058	NIR/2200 Z	95 °F/~~°C~~	80 °F/~~°C~~	23 °C	+160 FT	2950 FT

SFC WIND	CLIMB WINDS	LOCAL WEA WRNG/MET WATCH ADV	RCR
~~M~~ T 1415	2520		

REMARKS/TAKEOFF ALTN FCST

LGT TURBC SFC - 050 ISOL CB'S LOCATED NW-N OF AUS MOVG SE @ 10 KT

PART II - ENROUTE DATA

FLT LEVEL	FLT LEVEL WINDS/TEMP
370	AUS 2025/-38 ADM 2735/-55 DFW 2540/-45

CLOUDS AT FLT LEVEL: ☐ YES ☐ NO ☒ IN AND OUT

MINIMUM VISIBILITY AT FLT LEVEL OUTSIDE CLOUDS: ☐ SMOKE ☐ DUST ☐ HAZE ☐ FOG ☐ PRECIPITATION

MILES DUE TO: ☐ NO OBSTRUCTION

MINIMUM CEILING	LOCATION	MAXIMUM CLOUD TOPS	LOCATION	MINIMUM FREEZING LEVEL	LOCATION
500 FT AGL	DFW	FL500 FT MSL	OK, TX	120 FT MSL	TUL

THUNDERSTORMS				TURBULENCE			ICING				PRECIPITATION				
MWA/WW NO.				CAT ADVISORY Z			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	X	X	LIGHT	X	X		MOD				
	SCATTERED 16 - 45%			SVR	X	X	MOD	X	X		HVY		X		
X	NUMEROUS - MORE THAN 45%			EXTREME			SVR				SHWRS		X		
HAIL, SVR., TURB., SEVERE, ICING, PRECIPITATION AND LIGHTNING EXPECTED IN AND NEAR TSTMS.				LEVELS VCTY OF CBS			LEVELS VCTY OF CBS				FRZG				
LOCATION TX and OK				LOCATION ALT→ADM			LOCATION ALT→DFW				LOCATION ALT→ADM				

PART III - TERMINAL FORECASTS

AIRDROME	CLOUD LAYERS	VSBY/WEA	SFC WIND	ALTIMETER	VALID TIME
DEST/~~ALTN~~ TIK	30 SCT 100 OVC	6	3007	29.95 INS	2210 Z TO 0110 Z
DEST/~~ALTN~~ DFW	5 BKN 10 OVC	1/2TRW	2915G50	—— INS	—— Z TO —— Z
~~DEST~~/ALTN DYS	25 BKN 250 BKN	5H	1315	30.01 INS	—— Z TO —— Z
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z

PART IV - COMMENTS/REMARKS

BRIEFED ON LATEST RCR FOR DESTN AND ALTN: ☐ YES ☐ NOT AVAILABLE

REQUEST PIREP AT:

TIK RCR - DRY
WW # 25 IN EFFECT TIL 0300Z FOR ACT → ADM RTE
DIVERSION WEST OF PLANNED ROUTE RECOMMENDED

PART V - BRIEFING RECORD

WEA BRIEFED	FLIMSY BRIEFING NO.	FORECASTER'S SIGNATURE OR INITIALS
2130 Z	02 - 26	AG1 ROBERT FITZIMONS

VOID TIME	EXTENDED TO	WEA REBRIEFED AT	FORECASTER'S INIT	NAME OF PERSON RECEIVING BRIEFING
2230 Z	Z	Z	RPF	MOLETTA

DD Form 175-1, FEB 87

Figure 31: INTERPRETING THE DD-175-1 (EXAMPLE 4)

V. Enroute procedures **1.1.1.9.1**

Sg 5, fr 3
Lesson Organization

? **Once you are airborne, where can you get current weather information?**

ANSWER:
1. Pilot-to-Metro facilities
2. Flight Watch facilities (EFAS)
3. Flight Service Stations
4. ARTCC (center)
5. Transcribed Weather Broadcasts

A. Sources of in-flight weather information

NOTE: The sources below are listed in the order in which they should be used.

Sg 5, fr 4 (7 Overlays)
Pilot-to-Metro Service

1. Pilot-to-Metro Service (PMSV)

   a. Operated out of NASs, MCASs, and USAF bases—call name example: "Kingsville Metro" or "Metro"

   b. Normally, pilots can directly access weather forecasters

      (1) In some cases, USN or USMC forecasting has been centralized to support outlying satellite detachments during off-peak hours when a forecaster is not on duty

      (2) Most USN and USMC stations are manned 24 hrs with observers maintaining a basic weather watch

      NOTE: Observers can provide basic services, e.g., read latest field conditions or read a TAF (terminal) report.

(3) For forecaster services, e.g., DD-175-1 updates or extensions, the observer can act as an intermediary with the Sub-Regional Forecast Center (SRFC) forecaster or advise the pilot who to call

(4) Advise forecaster/observer of ETA when terminal weather is requested

(5) A listing of the SRFC can be found in FLIP Flight Information Handbook

c. Operates on UHF frequencies

d. Listed in the FLIP Flight Information Handbook and the Enroute Supplement under "Metro"

Overlay 1
Enroute Flight Advisory Service

2. Enroute Flight Advisory Service (EFAS)

a. Operated by FAA—call name example: “San Antonio Flight Watch” or “Flight Watch”

b. Provides updated enroute weather information

(1) Not intended for preflight weather brief or random weather reports and forecast, contact nearest FSS for this information

(2) Specifically designed to provide enroute aircraft with timely and meaningful weather advisories pertinent to the type of flight intended, route of flight, and altitude

c. Usually accessible anywhere over continental US above 5,000 ft AGL, generally 6:00 am to 10:00 pm; however, hours of operation are expanding at some facilities

d. Operates on VHF frequencies—122.0

e. Also available on specific frequencies reserved for high altitude traffic (for aircraft flying above 18,000 ft)

3. Flight Service Station (FSS)

Overlay 2
Flight Service Station

NOTE: The FSS system has recently been consolidated into approximately one facility per state. Regional FSS denoted on FLIP High Altitude Charts with a shadow box.

a. Operated by FAA—call name example: "San Angelo Radio"

b. Provides enroute weather information as part of its service

NOTE: FSS operators can read METARs, Area and Terminal Aerodrome Forecasts, PIREPs, AIRMETs and SIGMETs, but they are not trained forecasters.

c. FSS available frequencies are 255.4, 122.2, selected discrete frequencies and emergency 243.0 and 121.5

NOTE: When calling Metro, Flight Watch, or FSS, advise the service of your approximate location to receive transmissions from the proper remote transmitter. At the completion of the dialogue, the service often appreciates a PIREP including aircraft type, altitude/flight level, and conditions of flight.

4. Air Route Traffic Control Center (ARTCC)

Overlay 3
Air Route Traffic Control Center

a. Can provide weather information and updating as requested, but weather dissemination is not a primary service

b. Can provide real-time weather avoidance assistance through use of current ATC radar and weather radar

NOTE: ARTCC will not routinely provide updated weather briefings for route, as provided by Metro and Flight Watch.

Overlay 4
Transcribed Weather Broadcasts

5. Transcribed Weather Broadcasts (TWEB)

    a. Recorded weather information transmitted over selected NDB and VOR stations

    b. Amount and type of weather information vary from station to station, but can include local weather, route weather, winds aloft, and terminal aerodrome forecasts

Overlay 5
Hazardous In-flight Weather Advisory Service

6. Hazardous In-flight Weather Advisory Service (HIWAS)

    a. Broadcasts continuously over selected VOR stations

    b. Contains summary of any AIRMETs, SIGMETs, convective SIGMETs, CWAs and PIREPs

Overlay 6
Automated Weather Observation System

7. Automated Weather Observation System (AWOS)

    a. AWOS is a real-time system consisting of various sensors, a processor, a computer-generated voice subsystem, and transmitter to broadcast local minute-by-minute weather directly to the aircraft

        (1) AWOS observations derived from an automated system will include the prefix "AWOS"

        (2) Some AWOS locations will be augmented by certified observers who will provide weather and obstruction to visibility information in the remarks of the report when the reported visibility is less than 3 miles. Augmentation is identified as "OBSERVER WEATHER"

        (3) The reported visibility is derived from a sensor near the touchdown of the primary instrument runway

NOTE: The AWOS visibility is reported as a runway visibility range and may differ from the prevailing visibility.

(4) The reported sky condition/ceiling is derived from the ceilometer located next to the visibility sensor and may differ from the observed sky condition, because the AWOS is totally dependent on clouds over the sensor site

b. There are four operational levels of AWOS

(1) AWOS-A - reports only altimeter setting

(2) AWOS-1 - reports altimeter setting, wind data, temperature, dew point, and density altitude

(3) AWOS-2 - reports information in AWOS-1 plus visibility

(4) AWOS-3 - reports information in AWOS-2 plus cloud and ceiling data

(5) AWOS information is transmitted over a discrete frequency or the voice portion of a local NAVAID

NOTE: The system transmits a 20- to 30-second weather message each minute. The messages are updated each minute and are receivable within 25 nm of the AWOS site, at or above 3,000 ft AGL.

c. AWOS broadcasts phraseology generally follows that used in other weather broadcasts. The following are explanations of exceptions:

(1) The word "TEST" is added when the system is not in commissioned status

(2) The phrase "TEMPORARILY INOPERATIVE" is added when the system is inoperative

(3) Ceiling is announced as either "CEILING" or "INDEFINITE CEILING"

NOTE: All automated ceiling heights are measured ceilings except indefinite ceilings.

(4) The word "CLEAR" is not used in AWOS due to limitations in height ranges of the sensors

NOTE: No clouds detected is announced as "NO CLOUDS BELOW" or "CLEAR BELOW."

(5) "SKY CONDITION MISSING" is announced only if the system level is able to report ceiling/sky condition, and the data is not available

NOTE: Ceiling/sky conditions are not announced if the system level is not able to report them.

(6) "VISIBILITY LESS THAN ONE QUARTER" is the lowest visibility reported

NOTE: "VISIBILITY MISSING" is announced only if the system level is able to report visibility, and the data is not available. Visibility is not announced if the system level is not able to report it.

(7) If remarks are included, the word "REMARKS" is announced after the altimeter setting in the following priority:

(a) Automated remarks

i) Density altitude

ii) Variable visibility

iii) Variable wind direction

(b) Manual remarks (prefaced with "OBSERVER WEATHER")

i) Type and intensity of precipitation

ii) Direction and intensity of thunderstorms

iii) Obstructions to visibility when 3 miles or less

8. Automatic Terminal Information Service (ATIS)

Overlay 7
Automatic Terminal Information Service

NOTE: ATIS frequencies are incorporated on individual FLIP Terminal Instrument Approach Procedures and aerodrome listings in the Enroute Supplement. Where this service is available, listing will be found on the COMMUNICATIONS line, e.g., (ATIS 276.2). Pilots will be expected to listen to ATIS broadcasts, when in operation, to obtain essential but routine terminal information.

a. ATIS broadcasts are recorded, and the pilot should notify controllers that he has received the broadcast by repeating the alphabetical code word appended to the broadcast. Example: "INFORMATION ECHO RECEIVED"

b. When the pilot acknowledges that he has received the ATIS broadcast, controllers may omit those items contained on the broadcast if they are current

NOTE: Rapidly changing conditions will be issued by Air Traffic Control, and the ATIS will contain words as follows: "LATEST CEILING/ VISIBILITY/ALTIMETER/(OTHER CONDITIONS) WILL BE ISSUED BY APPROACH CONTROL/TOWER."

c. The absence of a sky condition/ceiling and/or visibility on ATIS indicates a sky condition/ ceiling of 5,000 ft or above and visibility of 5 miles or more

NOTE: A remark may be made in the broadcast, "THE WEATHER IS BETTER THAN 5,000 AND 5," or the existing weather may be broadcast.

d. Controllers will automatically issue pertinent information to pilots who do not acknowledge receipt of the ATIS broadcast or who acknowledge receipt of a broadcast which is not current

Sg 5, fr 12
(3 Overlays)
Pilot Weather Reports

B. Pilot weather reports (PIREPs) **1.1.1.11.3**, **1.1.1.11.3.1**

Overlay 1

1. Issued by pilot to ATC or weather disseminating agencies (PMSV, EFAS, FSS, etc.)

2. Reports filed when

   a. Requested

   b. Unusual and unforecast weather is encountered (mandatory voice report)

   c. Weather conditions on IFR approach differ from latest observation (mandatory voice report after landing)

   d. Missed approach is executed due to weather

   e. Hazardous or potentially hazardous weather is encountered (windshear, microburst, icing, severe turbulence, etc.) particularly on arrival or departure

Overlay 2

3. Relay time-critical information directly to ATC

4. All PIREPs can be given to Metro, Flight Watch, or other weather dissemination agencies on the frequency of the outlet closest to the aircraft position. See your Flight Information Handbook.

Overlay 3

5. Format (also available in FLIP Flight Information Handbook)

a. Aircraft location or area of occurrence

b. Time (UTC)

c. Altitude (MSL)

d. Type aircraft

e. Sky cover (bases, tops, amount)

f. Temperature

g. Wind

h. Turbulence (see turbulence tables in FIH)

i. Icing (see icing tables in FIH)

j. Remarks

NOTE: Pilots should use standardized terminology as indicated in the FLIP Flight Information Handbook when making a pilot report (e.g., “trace,” “light,” “moderate,” or “heavy icing”). Also, use "frequency" table as appropriate.

VI. Flight Weather Packet **1.1.1.11.4**

Sg 8, fr 3
Lesson Organization

NOTE: OPNAV 3710.7 encourages the use of flight weather packets for extended flights.

A. Should be requested at least 2 hrs prior to the weather brief, preferably 24 to 48 hrs prior

Sg 8, fr 4
(2 Overlays) *Flight Weather Packet*

1. Can be prepared in less than 2 hrs, but probably will not be as complete

B. Contents

Overlay 1
Contents

1. Folder

2. Horizontal Weather Depiction Chart

a. Prepared for your proposed flight time and path

b. Depicts atmospheric conditions from surface to 5,000 ft above the proposed flight level for the entire route and includes:

(1) Areas of 5/8 or more of cloud coverage

(2) All areas of cumulonimbus (CB), towering cumulus (TCU), in eighths coverage, along with tops and bottoms

(3) Heights of freezing level

(4) Fronts and pressure centers with movements

(5) Significant weather and obstructions to visibility

(6) Hazards to flight

(7) Proposed route of flight

(8) Any miscellaneous entries deemed operationally significant

3. Completed DD-175-1

a. Pilot shall receive a verbal briefing as well as the weather briefing form

4. Upper wind charts for proposed flight level(s) or OPARS customized flight plan

Overlay 2
Use

C. Use

1. Folder contents serve as reminders of weather expected to encounter en route and stopover terminals

2. Pilot should note any deviations from weather

3. Pilots should turn in folder at final destination and if possible debrief with the forecaster actual conditions encountered in flight

VII. Optimum Path Aircraft Routing System (OPARS) **1.1.1.11.5**

Sg 9, fr 3
Lesson Organization

A. General

1. Primary purpose of OPARS is to provide computer-prepared flight planning service to the Naval Aviation community

Sg 9, fr 4 (1 Overlay)
Fig 32: *OPARS Kneeboard Output (1 of 2)*

2. Service provides customized flight plan which can be used in many different ways

a. Amount of fuel required to arrive with a specific reserve

b. Maximum cargo/stores that can be carried for a particular flight/mission

c. Amount of fuel required to "top off" for in-flight refueling

d. Maximum time on station

e. Mandatory overwater reporting positions for overseas flights

f. Fuel usage for a specific route and/or altitude

g. Other options available due to crew requirements and/or recommendations

B. Program Description

Overlay 1
Fig 32:
OPARS Kneeboard Output (2 of 2)

1. Data bases

a. Aircraft performance data from appropriate NATOPS manual for over 80 different Navy and Marine aircraft

OPTION: 2KB - KNEEBOARD 2

FLIGHT PLAN FOR JOHNSON COMPUTED 1849Z

BASED UPON 9607191200 WEATHER DATA

LEG01 STANDARD KNQI TO KMAF 20 JUL 96

ACFT TYPE T45FNF DRAG: 0 EFF: 100

PLANNED FOR ETD 1900Z INITIAL CRUISE FLIGHT LEVEL 190

	FUEL	TIME	DIST	ARRIVE	RAMP	LAND	CARGO	OPNLWT
POA	001235	1/06	0380	2006Z	013512	012277	000000	010500
ALT	...							
RES	001777	0/24						
TOT	003012	2/30						

FUEL BIAS: 200 DBIAS: 0 ABIAS: 0 IBIAS: 0

ROUTING USED FOR THIS LEG
KNQI .. CRIMP J25 SAT J2 JCT J15 LOWGO .. KMAF

CPT	F/L	TMP	WIND	T/C	T/H	M/H	TAS	G/S	ZD	CD	ETE	ETR	EFU	EFR
KNQI	11	00	00000	000	000	*****	***	***	001	0001	00/01	01/05	002	0028
KNQI	N27304W097486													
CRIMP	320	P11	12514	342	342	337.7	***	***	059	0060	00/11	00/54	004	0024
CRIMP	N28265W098089													
TOC	390	P02	13021	347	347	343.1	***	***	018	0078	00/04	00/50	000	0023
TOC	N28444W098135													
SAT	390	P02	14518	347	347	340.6	410	426	056	0134	00/43	00/50	001	0022
SAT	N29386W098277													
JCT	390	P02	16516	309	309	300.1	410	426	091	0225	00/13	00/30	002	0020
JCT	N30359W099491													
SDP	390	P02	17015	294	294	283.1	411	420	035	0260	00/05	00/25	000	0019
SDP	N30498W100260													
LOWGO	145	P16	34003	294	294	285.6	***	***	089	0349	00/17	00/08	001	0018
LOWGO	N31260W102014													
KMAF	29	P17	04503	343	343	335.3	***	***	032	0381	00/08	00/00	000	0017
KMAF	N31565W102121													

TOC = TOP OF CLIMB
SDP = START DESCENT POINT

TOTAL WIND FACTOR 11KTS

==========

Figure 32: OPARS KNEEBOARD OUTPUT

NOTE: Several sets of data for one aircraft may be entered for different drag conditions, e.g., TA4 with drop tanks and without drop tanks.

(1) Climb (usually normal rate of climb)

(2) Cruise (usually maximum range)

(3) Descent (usually flight idle)

b. Forecast winds and temperatures derived by computer at the Fleet Numerical Oceanography Center (FNOC) located at Monterey, CA

(1) Input includes land and shipboard surface and upper wind data

(2) Computer analyzes on the basis of historical data and current information which produces wind and temperature forecasts for the next 48 hrs

(3) Forecast model is run and OPARS data is updated every 12 hrs

c. High altitude airways, NAVAIDs, and waypoints, along with all airfields with 5,000 ft or longer is entered for the entire Northern Hemisphere and updated every 4 weeks

d. ADIZ zones, international boundaries, and prohibited airspace is entered

C. Request Procedures

1. Computer terminals located at Naval Oceanography Command Detachments and facilities (NOCD or NOCF) and some squadron/wing operations spaces (mostly VP squadrons/wings)

NOTE: Found in NOCD/NOCF and Marine weather offices from Japan to Spain.

a. Lead time of 2-3 hrs normally required; actual process, however, only takes ten minutes or less

b. Best service provided if requested a day in advance of flight

2. Secondary method is through DOD message system (AUTODIN)

a. This method allows access at any military base or aircraft carrier

b. Message process takes 8-10 hrs (minimum) from the time the request is sent

Sg 9, fr 7 (3 Overlays)
Fig 33 & 34: *OPARS Request Form (Top front)*

Overlay 1 *(Bottom front)*

Overlay 2 *(Top back)*

Overlay 3 *(Bottom back)*

D. For a single leg flight plan (no intermediate stops), the following input data is required

NOTE: Examples for a flight from NAS Kingsville to Hill AFB are included in the following:

1. Pilot/unit - (optional entry)

2. Leg - 1 (no intermediate stops)

3. POD - KNQI (ICAO for Point Of Departure)

NOTE: In CONUS, "NQI" would be sufficient.

4. POA - CUS (Point Of Arrival, Hill AFB)

5. Routing

a. $J (computer select best jet route)

b. $R (fly jet routes or direct legs)

c. $C (canned tracks, i.e., IR routes)

d. ..., OLM, J126, RBL, J1, OAK, ... (route desired by pilot)

OPARS FLIGHT PLANNING

ALL ENTRIES ARE LIMITED TO ONE LINE AND MUST BEGIN IMMEDIATELY FOLLOWING THE PROMPT. REFER TO SECTION 2 OF THE OPARS USER'S MANUAL FOR A DETAILED DESCRIPTION OF EACH DATA ITEM.

NOTES

* 17 DC REQUIRED ONLY ON CERTAIN AIRCRAFT TYPES.
* 19 SPERF REQUIRES 5 PARAMETERS.
* 21 SPERF ALT CAN ACCEPT UP TO 3 PARAMETERS.

REQUIRED INPUT

LEG - 1

02 PILOT/UNIT >
11 LEG >
12 POD >
44 POA >
24 ROUTING >

13 TOD/TOA >
51 TOG >
08 OMODE >
05 ACTYPE >
14 OPWT >
18 CARGOCH >
15 FUEL/RES >
49 REFUEL >
*17 DC >

SPECIAL PERFORMANCE (SPERF)

*19 SPERF >
20 SPERF BIAS >
*21 SPERF ALT >

LEG - 2

44 POA >
24 ROUTING >

13 TOD/TOA >
51 TOG >
18 CARGOCH >
15 FUEL/RES >
49 REFUEL >
*17 DC >

LEG - 3

44 POA >
24 ROUTING >

13 TOD/TOA >
18 CARGOCH >
15 FUEL/RES >
* 17 DC >

REQUEST TAKEN BY

REQUEST TRANSMITTED BY

RECEIVED (DTG (Z))

JOB NAME

NASKINGS 3140/18 (Rev 3-89) (Over)

Figure 33: OPARS REQUEST FORM

OPTIONAL INPUT

	LEG - 1	LEG - 2	LEG - 3
03 DATE	>		
06 EFF	>		
09 WARNPT	>		
10 FLTDATE	>		
16 BIAS	>		
*17 DC	>		
25 RTARND	>		
26 UPPRALT	>		
27 LOWRALT	>		
28 INCRUALT	>		
29 INFLTRF1	>		
30 INFLTRF2	>		
31 INFLTRF3	>		
32 DBIAS	>		
33 ABIAS	>		
34 OVERA	>		
35 OVERB	>		
36 OVERC	>		
37 OVERD	>		
38 OVERE	>		
43 IBIAS	>		
6 MBF	>		
47 ATALT	>		
48 ALTRNAT	>		

REQUIRED INPUT - MISSION LEG

53 EOM > _____ 55 INALT > _____ 56 OUTALT > _____

OPTIONAL INPUT - MISSION LEG

52 BOM > _____ 57 LOM > _____ 59 TIMEOUT > _____
54 FUELCH > _____ 58 TIMEIN > _____ 60 MINENG > _____

ADDITIONAL REMARKS

NASKINGS 3140/18 (Rev 3-89) (Back)

Figure 34: OPARS REQUEST FORM

e. Several other options

6. TOD/TOA - 2000 (Time Of Departure. Time Of Arrival could be entered if desirous of arriving at a specified time)

7. OMOD - 1KB (1 Kneeboard output format)

   NOTE: Ten formats available, kneeboard is the most common request.

8. AC Type - T45A (aircraft type and model)

9. OPWT - 10493 (no fuel, no cargo weight in lbs)

10. CARGOCH - 0 (cargo weight in lbs)

11. Fuel/Reserve - 600 (desire 600 lbs fuel reserve at POA)

    NOTE: OPARS will calculate amount of fuel to load at POD.

Sg 10, fr 3
Lesson Organization

VIII. Satellite imagery **1.1.1.11.6**

A. Background and introduction

1. U.S. Congress established system in 1961

   a. Operated by National Oceanic and Atmospheric Administration (NOAA)

   b. Utilizes "Geostationary Operational Environmental Satellites" (GOES) and others that operate in a similar manner

Sg 10, fr 4
Fig 35: *GOES Satellite*

      (1) First one launched 5 May 1974; by 1983, seven had been launched

          NOTE: By 1992, at least two had ceased to function.

      (2) GOES satellites now provide virtual worldwide coverage

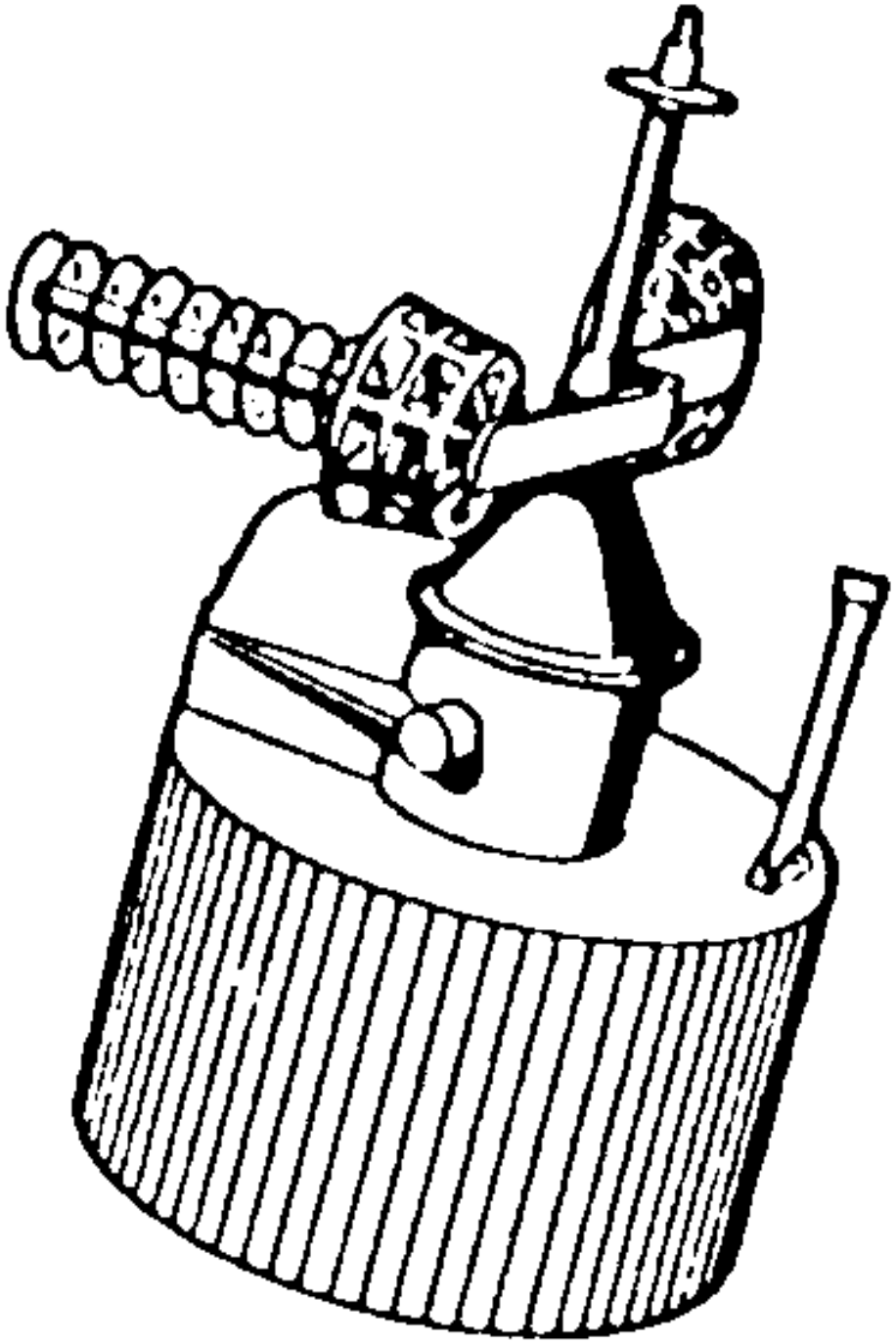


Figure 35: GOES SATELLITE

(3) CONUS covered by GOES-East located at 75 degrees west and GOES-West at 135 degrees west

NOTE: A third satellite, GOES-Central, is located at 107 degrees west and is used for weather facsimile broadcasts.

Sg 10, fr 5
Fig 36: *GOES Coverage*

(4) Scanners provide information on reflected visible light and thermal infrared portions of the spectrum

B. Visual pictures

Fig 37: *Visual Picture*

1. Resemble standard black and white photographs

a. Reconstructed on Earth by line processing similar to television, from digital data collected by the satellite sensors

b. Picture is the result of reflected sunlight

(1) Clouds are an excellent reflector of sunlight

(2) Neither the Earth's atmosphere nor empty space reflects sunlight; therefore, the background will always be black

(3) Reflectivity table: (thick clouds appear white, thin clouds appear darker)

(a) Cumulonimbus - 92%

(b) Thick Cirrostratus - 74%

(c) Thick Stratocumulus - 68%

(d) Thin Stratus - 42%

(e) Sand, No Foliage - 27%

(f) Sand and Brushwood - 17%

(g) Water Surfaces - 9%

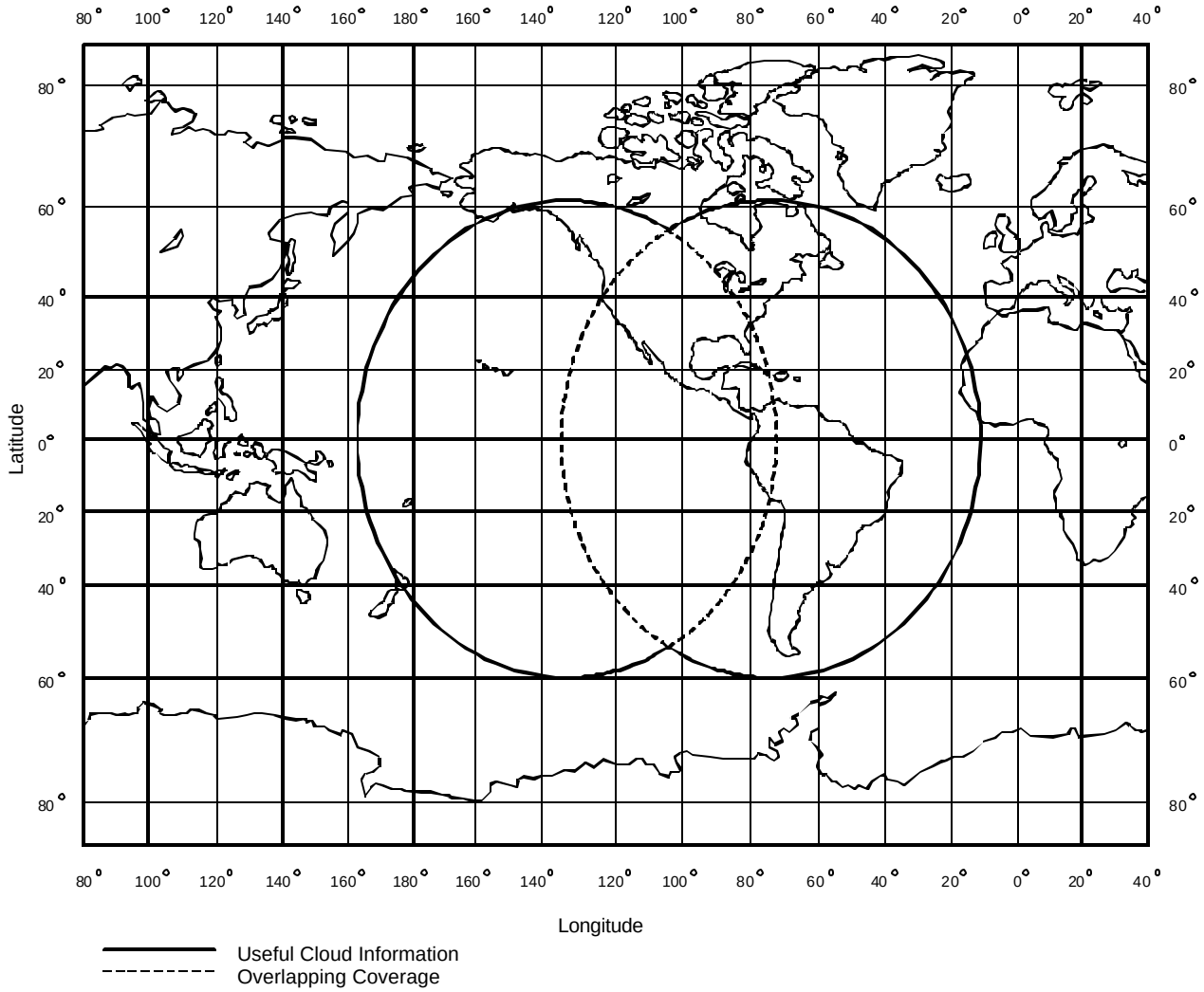


Figure 36: GOES COVERAGE

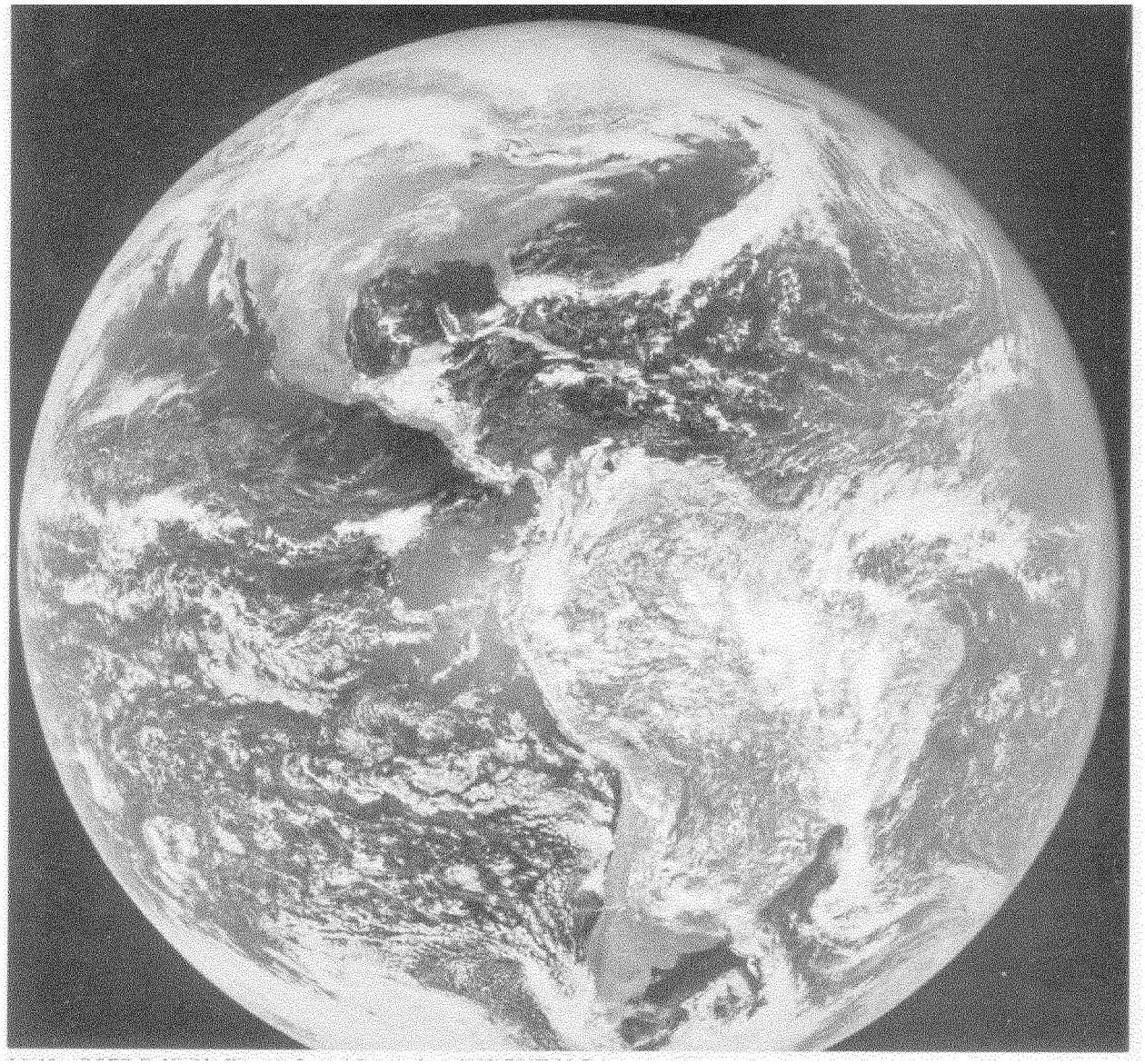


Figure 37: VISUAL PICTURE

NOTE: Terrain has intermediate to low reflectivity and will appear as some shade of grey. Water appears almost black. Land/water contrast will normally be good.

C. Infrared pictures

Fig 38: *Infrared Picture*

1. Everything with a temperature above absolute zero radiates energy

2. Wave length of energy varies with temperature

3. GOES measures energy level at specific wave lengths

4. Earth receivers convert energy measurements to temperatures

   a. IR imagery portrays different temperatures as black (very warm), white (very cold), or some shade of grey

   b. High clouds are very cold, so they appear white; mid-level clouds are warmer, so they appear as some shade of grey; low clouds and/or fog often are the same temperature as the surrounding terrain and cannot be distinguished at all

5. Enhanced IR Pictures

   a. Meteorologist has the option of assigning shades of grey to specific temperatures which allows specific items, i.e., thunderstorms, to be highlighted

   b. Operationally enhanced IR used quite often

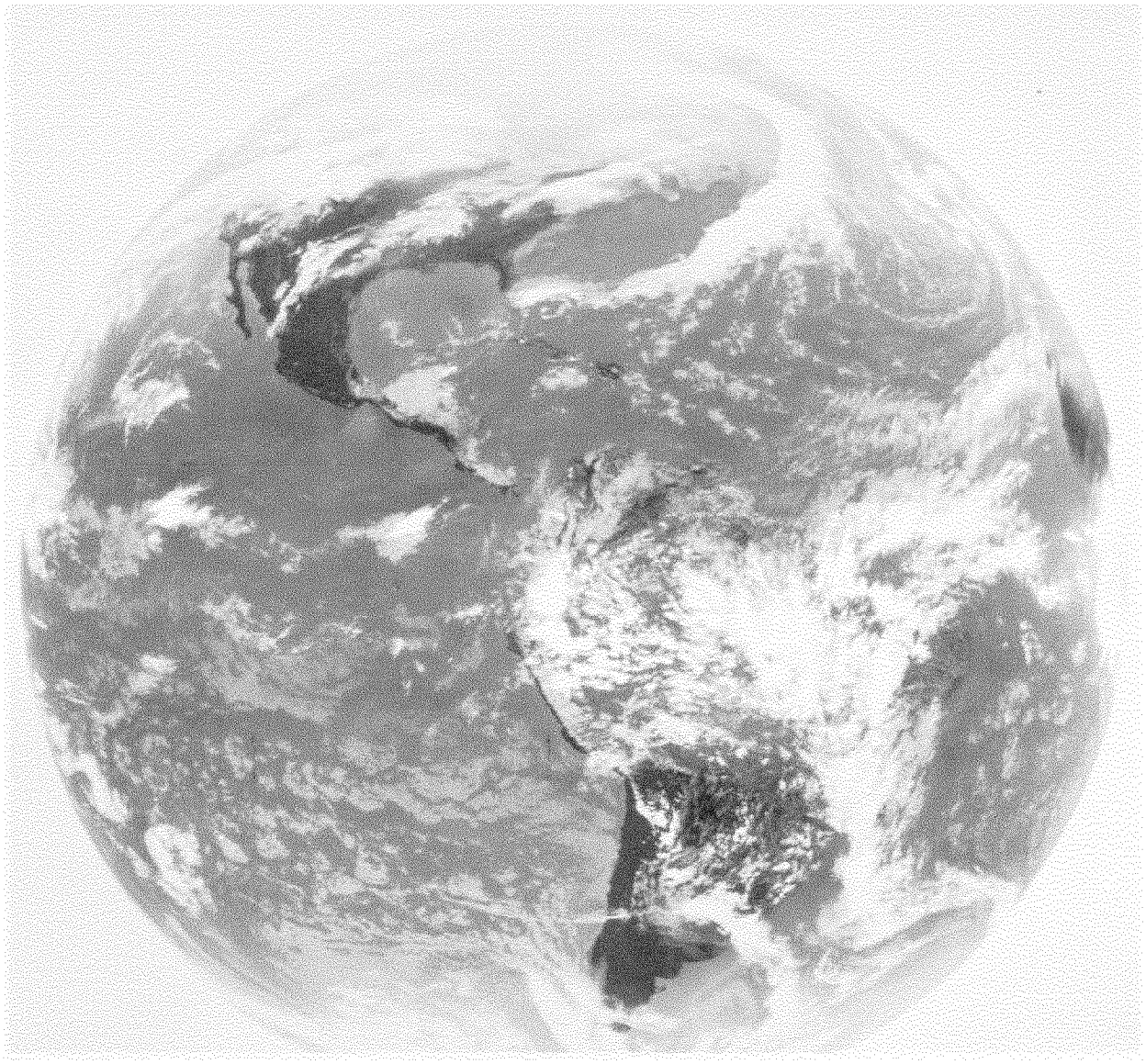


Figure 38: INFRARED PICTURE

Fig 39: *Picture with Date/Time Data*

D. Date/Time data

1. As with all weather products, checking the currency of the product can be important

2. Some weather briefing facilities can provide real-time CRT imagery, direct from the appropriate satellite

3. Printed product will display DTG legend

   a. First four numbers UCT (Z) time - indicates time of picture transmission start

   b. Second group calendar day, month, year

   c. Last group indicates sector

E. Use of the pictures

1. Low-pressure areas and fronts

   a. Primary characteristic is "question mark" or "comma" shaped cloud pattern

   b. Center of low pressure located near center of vortex

   c. Tail of the "comma" denotes the location of the cold front

   d. Warm fronts often hard to define without the use of surface data

   e. Enhanced IR very helpful in determining locations of thunderstorms in the cloud pattern

2. Mountain Wave Turbulence

   a. Caused by winds in excess of 25 kts blowing perpendicular to rough or mountainous terrain causing moderate to severe turbulence

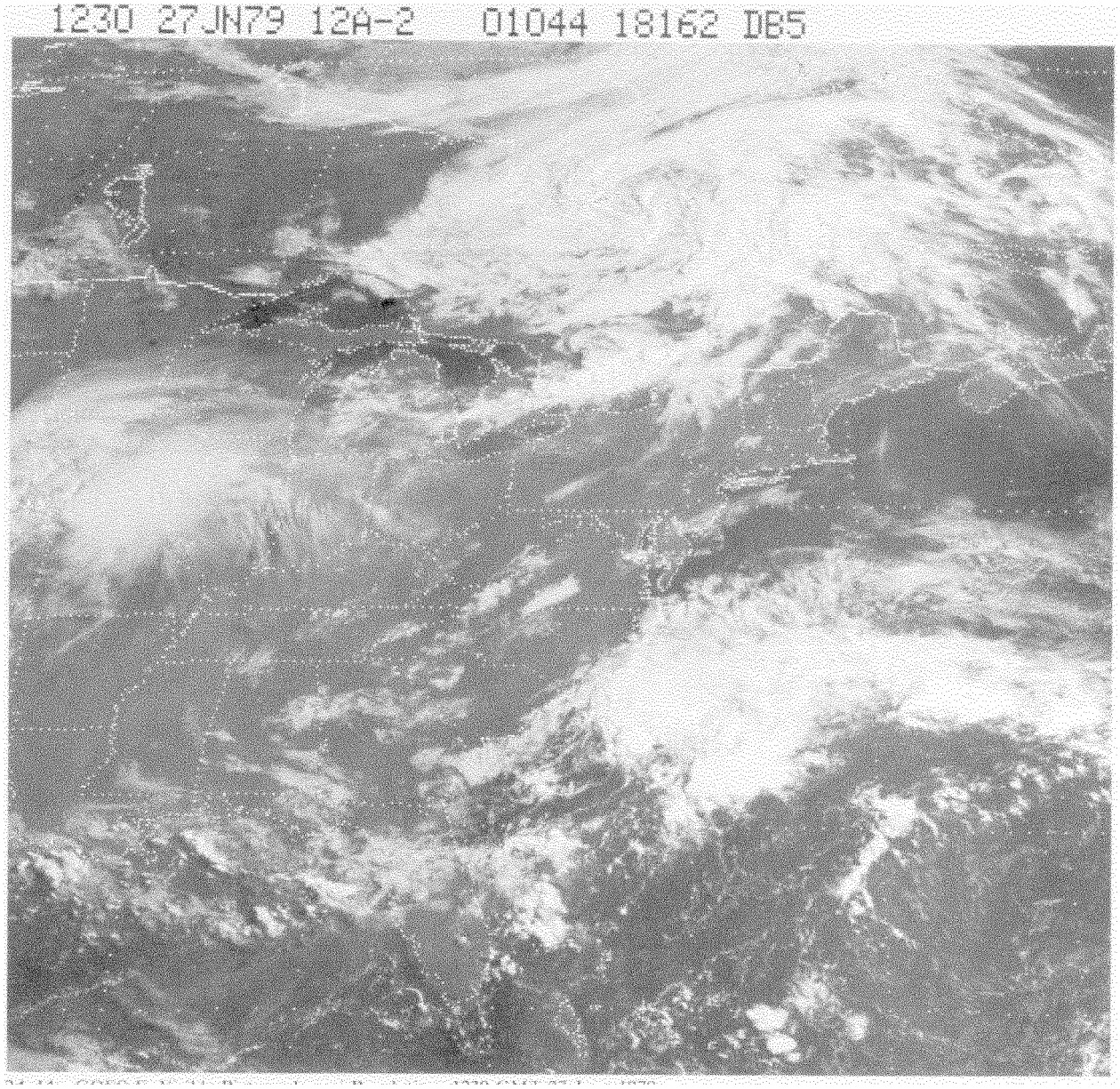


Figure 39: PICTURE WITH DATE/TIME DATA

b. Satellite imagery of wavy cloud pattern

NOTE: The tighter the waves, the more severe the turbulence.

Fig 40: *Satellite Picture of Jet Stream*

3. Jet Streams

a. Indicated by narrow bands of cirrus clouds

b. Almost always marked by very sharp northern and southern boundaries

4. Fog and Low Clouds

a. Show up on visual pictures only (reflective sunlight)

b. Not enough contrast to show on IR

Sg 10, fr 6
Fig 41: *The GOES Mission*

F. Other uses of the GOES

1. IR radiation in any of several bands

2. Atmospheric temperature sounding capability

3. Solar X-ray emissions and the near earth space environment

4. Provides selected data for research-oriented environmental scientists

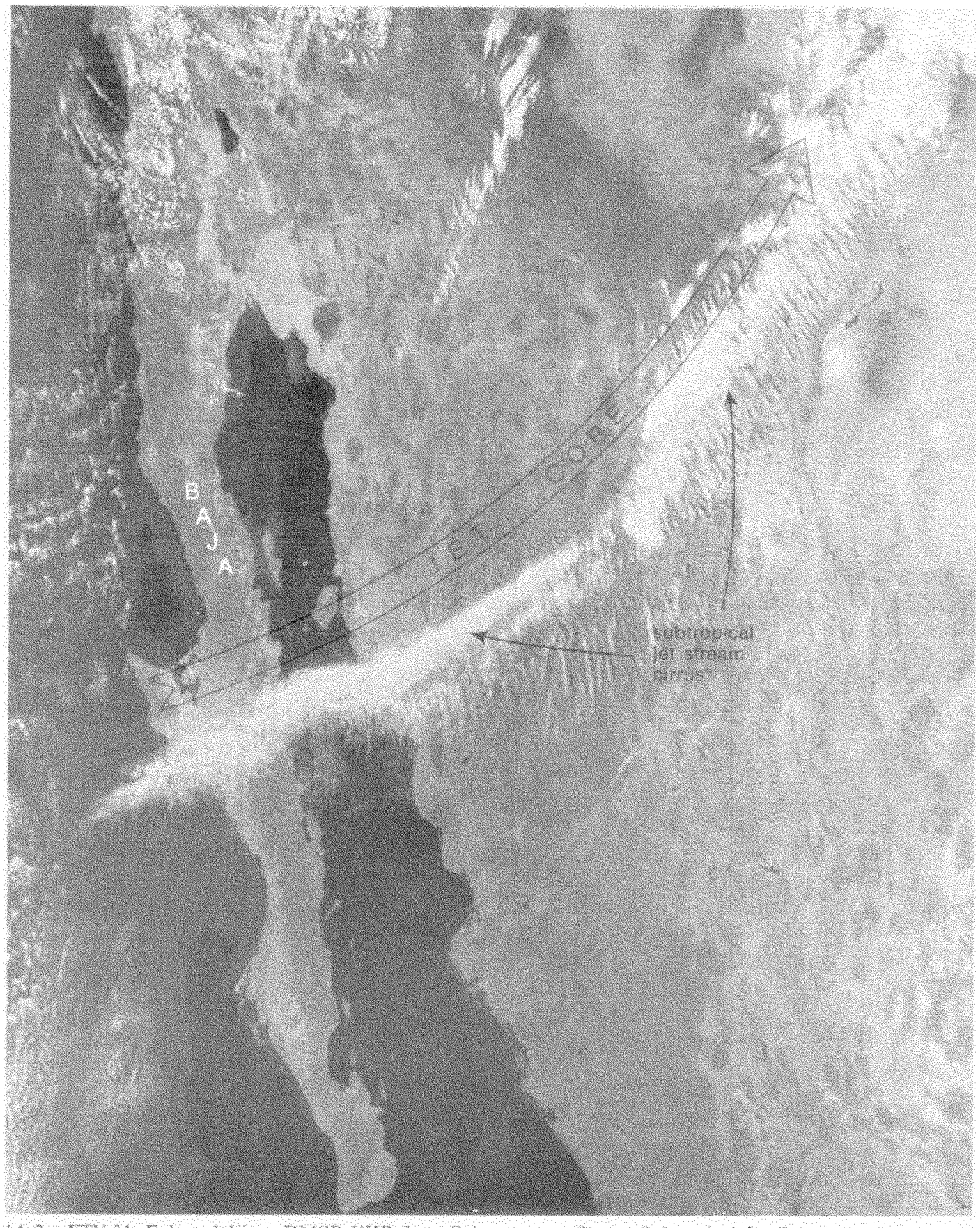


Figure 40: SATELLITE PICTURE OF JET STREAM

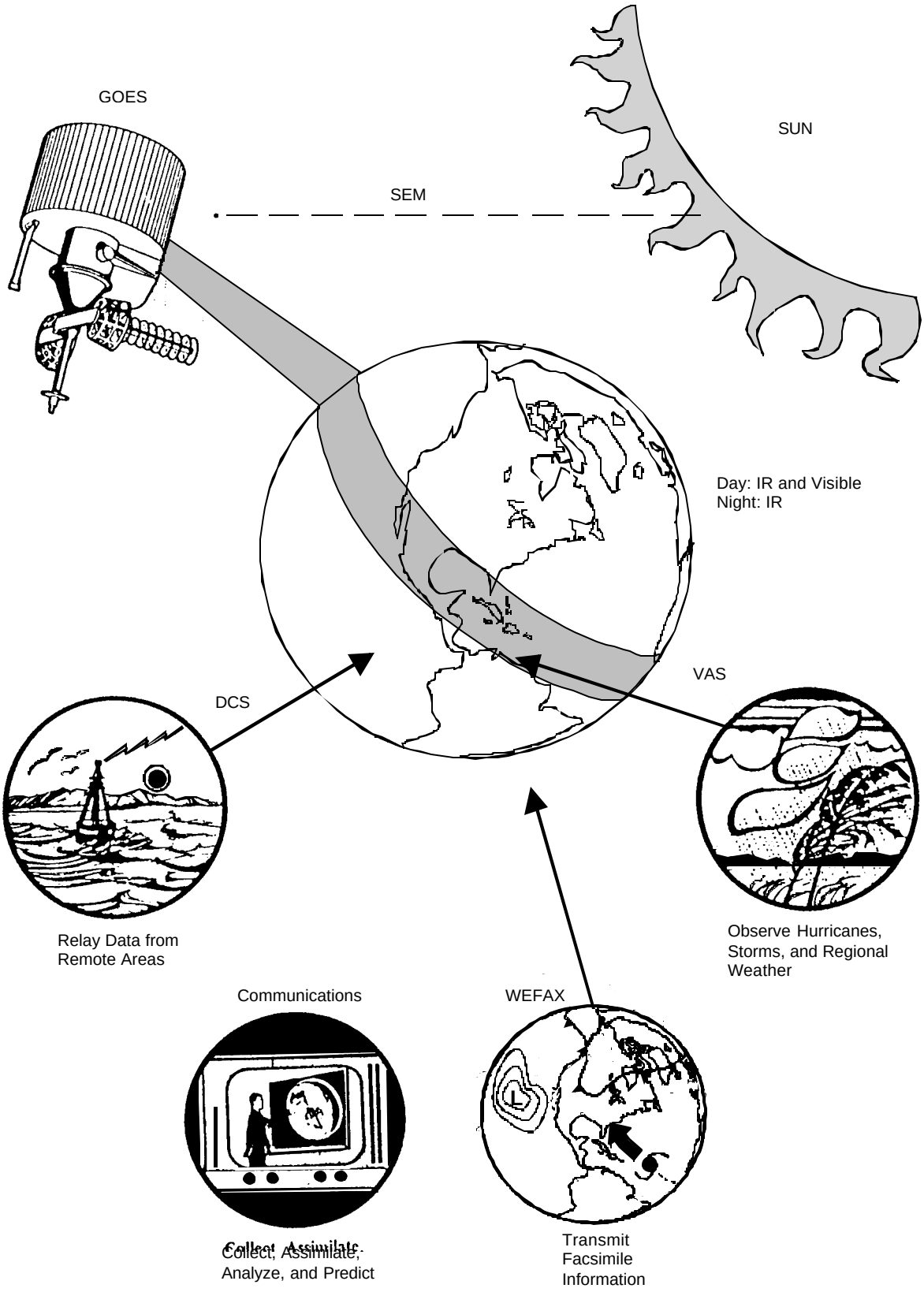


Figure 41: THE GOES MISSION

SUMMARY

Sg 7, fr 3
Review Menu

This lesson has focused on the following topics:

* Weather minimums
* Weather charts
* Printed reports and forecasts
* Flight weather briefing
* Enroute procedures
* Flight weather packets
* OPARS
* Satellite imagery

CONCLUSION

Reviewing the different weather charts, reports, and advisories will increase your ability to predict weather phenomena that can affect your planned flight.

LESSON GUIDE

COURSE/STAGE: Meteorology

LESSON TITLE: Meteorology Review

LESSON IDENTIFIER: Metro-03

LEARNING ENVIRONMENT: Classroom

ALLOTTED LESSON TIME: .5 hr

TRAINING AIDS:

- Meteorology CD-ROM
- Figures
  - Fig 1: Cold Front
  - Fig 2: Warm Front
  - Fig 3: Cold Front Occlusion
  - Fig 4: Warm Front Occlusion
  - Fig 5: Microbursts
  - Fig 6: Structural Icing
  - Fig 7: Jet Stream Clear Air Turbulence (CAT)
  - Fig 8: Jet Stream Clear Air Turbulence (CAT)
  - Fig 9: Mountain Wave Phenomenon
  - Fig 10: Wake Turbulence Avoidance
  - Fig 11: Weather Minimums Required IAW OPNAVINST 3710.7
  - Fig 12: Surface Analysis Chart
  - Fig 13: Weather Depiction Chart
  - Fig 14: Radar Summary Chart
  - Fig 15: Low-Level Prognostic Chart
  - Fig 16: Winds Aloft Prognostic Chart
  - Fig 17: METAR
  - Fig 18: Area Forecast (FA)
  - Fig 19: Terminal Aerodrome Forecast (TAF)
  - Fig 2: Winds Aloft Forecast (FD)

(7-97) CHANGE 1

FIGURES (cont.):

STUDY RESOURCES:

- Lesson Guides for Metro-01 and Metro-02 lessons

LESSON PREPARATION:

Review:

* Metro-01 and Metro-02 Lesson Guides

REINFORCEMENT:

Review:

* Material from the previous lessons in this block as you feel necessary to prepare for the exam

EXAMINATION:

The objectives in this lesson will be tested in Meteorology 04X.

LESSON OBJECTIVES

Metro-01 Weather Theory and Hazards

1.1.1.2.5
Recall weather associated with frontal systems

1.1.1.2.5.1
Recall reasons for and effects of direction and velocity of surface winds

1.1.1.2.4
Recall definition of frontal systems

1.1.1.4
Recall meanings of severe weather hazards

1.1.1.4.5
Recall hazards associated with thunderstorms

1.1.1.4.1.2
Remember meaning of microbursts

1.1.1.4.2
Recall causes and dangers of ice formation

1.1.1.4.3
Recall causes and dangers of fog formation

1.1.1.4.1.1
Remember meaning of clear air turbulence (CAT)

1.1.1.3.5
Recall features and hazardous conditions associated with jet streams

1.1.1.4.4
Recall causes and hazards of wake turbulence phenomenon

Metro-02 Weather Minimums, Restrictions, and Data Interpretation

1.1.1.1
Determine weather minimums

1.1.1.1.1.1
Recall weather minimums required IAW OPNAVINST 3710.7

1.1.1.3
Recall information contained/displayed on weather charts

1.1.1.3.1
Interpret surface charts (analysis/prognostic)

1.1.1.3.3
Interpret weather depiction charts

1.1.1.3.2
Interpret radar summary charts

1.1.1.3.4
Interpret prognostic charts

1.1.1.5
Recall information contained in forecasts

1.1.1.5.4
Recall information contained in METARs

1.1.1.5.3
Recall information contained in area forecasts

1.1.1.5.1
Recall information contained in terminal aerodrome forecasts

1.1.1.5.2
Recall information provided in winds aloft forecasts

1.1.1.4.6
Recall information contained in severe weather forecasts

1.1.1.11
Recall aviation in-flight weather advisories

1.1.1.4.7
Recall OPNAVINST severe weather restrictions

1.1.1.4.8
Recall CNATRA severe weather restrictions

1.1.1.11.2
Recall information provided in SIGMETs

1.1.1.11.1
Recall information provided in AIRMETs

1.1.1.2.1
Recall requirements IAW OPNAVINST 3710.7 for obtaining DD-175-1

1.1.1.2.1.1
Recall the five sections of the DD-175-1

1.1.1.9.1
Recall enroute facilities/procedures for weather information and reporting

1.1.1.11.3
Recall information provided in PIREPs

1.1.1.11.3.1
Recall PIREP information to provide controlling agency

MOTIVATION

Your thorough understanding of the material covered in the Metro block is important, not only to pass the Metro-04X and instrument exams, but also to apply meteorological information correctly to flight planning and instrument flight operations.

OVERVIEW

This lesson prepares you for the exam in the next lesson, Metro-04X.

We will review content from the lessons in the block to include:

* Overview of the test
* Fronts and resulting winds
* Meteorological hazards
* Weather minimums
* Weather charts
* Printed reports and forecasts
* Flight weather briefing DD-175-1
* Enroute procedures

PRESENTATION

I. Overview of Meteorology test

Sg 1, fr 3
Lesson Organization

A. Grading criterion: 80%

B. Length of test: 40 questions

C. Questions

1. General questions concerning weather theory and application toward flight planning and IFR flight

2. Situational applications regarding prediction of surface wind direction, fog formation, wake turbulence avoidance, alternate weather minimums, interpretation of weather charts, forecasts, and the use of PIREPs

D. Formats appearing on test

1. Multiple choice (single answer)

2. True/false

E. Content

1. Frontal systems

2. Meteorological hazards

a. Thunderstorms

b. Structural ice

c. Fog

d. Jet streams

e. Clear air turbulence (CAT)

f. Wake turbulence avoidance

3. Weather minimums

    a. IFR alternate airport weather minimums as required in OPNAVINST 3710.7

4. Weather charts

5. Printed reports and forecasts

6. Severe weather restrictions

7. Flight weather briefing

    a. Components and requirements for filing DD-175-1

    b. Interpretation of DD-175-1 for flight planning purposes

8. Content and use of PIREPs

Sg 2, fr 3
Lesson Organization

II. Fronts and resulting winds **1.1.1.2.5, 1.1.1.2.5.1**

A. Frontal system: discontinuity formed between two contrasting airmasses of different characteristics **1.1.1.2.4**

LESSON NOTES

Some embedded questions in this review lesson introduce outline material, while others sum it up. Some questions call for multiple answers and may elicit a variety of responses. For this reason, you may wish to familiarize yourself with the questions and answers prior to class.

? **What are some of the differences between weather associated with a cold front and weather associated with a warm front?**

ANSWER:
1. Cold front weather is usually associated with unstable air, cumulus clouds, and thunderstorms.
2. Warm front weather is usually more stable, bringing low clouds and continuous or steady precipitation.

B. Cold front

Sg 2, fr 4
Fig 1: *Cold Front*

1. Characteristics

   a. Predominantly cumulus clouds

   b. Thunderstorms and occasional squall lines (seasonal)

   c. Turbulence and unstable air

   d. Strong, gusty winds

   e. Showery precipitation

   f. Clearing skies and good visibility after frontal passage

2. Wind changes

   a. Before passage, wind flows parallel to (along) the front

   b. After passage, wind flows perpendicular to front

      (1) Follows prevailing wind in same direction as front movement (perpendicular to front)

      (2) Generally stronger due to steeper pressure gradient of colder airmass

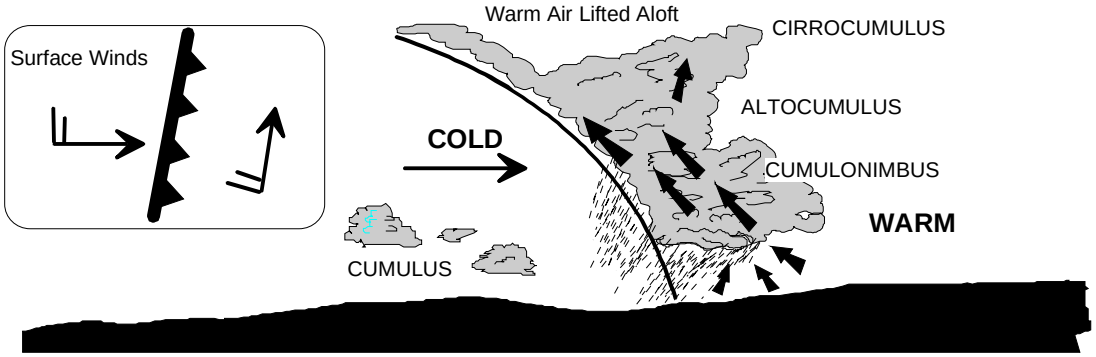


Figure 1: COLD FRONT

C. Warm front

Sg 2, fr 5
Fig 2: *Warm Front*

1. Characteristics

   a. Predominantly cirriform and stratiform type clouds

   b. Predominantly stable air and little turbulence

   c. Continuous precipitation ahead of front in wide area

   d. Poor visibility from haze or fog

   e. Icing conditions

2. Wind changes

   a. Before passage, wind flows parallel to front from higher to lower pressure

   b. After passage, wind flows perpendicular to front

D. Stationary front

1. Characteristics: same as warm front, only less intense—can persist in an area for many days

2. Winds flow parallel to frontal line, but in opposite direction—no prevailing wind to push front in any direction

E. Occluded fronts: form when faster-moving cold front overtakes slower warm front

1. Cold front occlusion

Sg 2, fr 6
Fig 3: *Cold Front Occlusion*

   a. Characteristics

      (1) Rain or freezing rain

      (2) Poor visibility from fog and low ceilings

      (3) Embedded thunderstorms

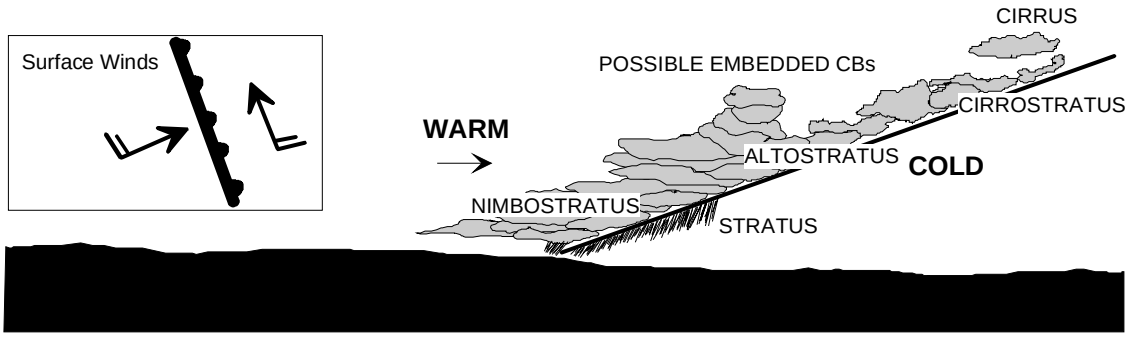


Figure 2: WARM FRONT

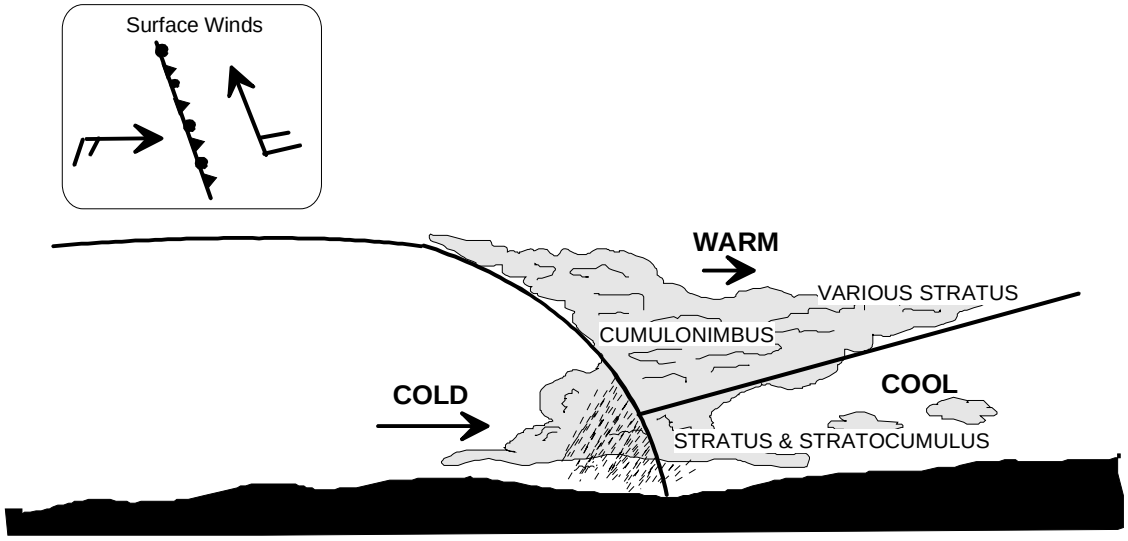


Figure 3: COLD FRONT OCCLUSION

Sg 2, fr 7
Fig 4: *Warm Front Occlusion*

2. Warm front occlusion characteristics

   a. Rain or freezing rain

   b. Poor visibility from fog and low ceilings

   c. Embedded thunderstorms

? **What are the characteristics of a cold front occlusion?**

ANSWER:
1. Freezing rain
2. Poor visibility
3. Embedded thunderstorms

? **With which front or fronts does the surface wind blow parallel to the frontal line prior to passing and perpendicular to the front in the direction of the front movement after passage?**

ANSWER: Cold front, warm front, and occluded

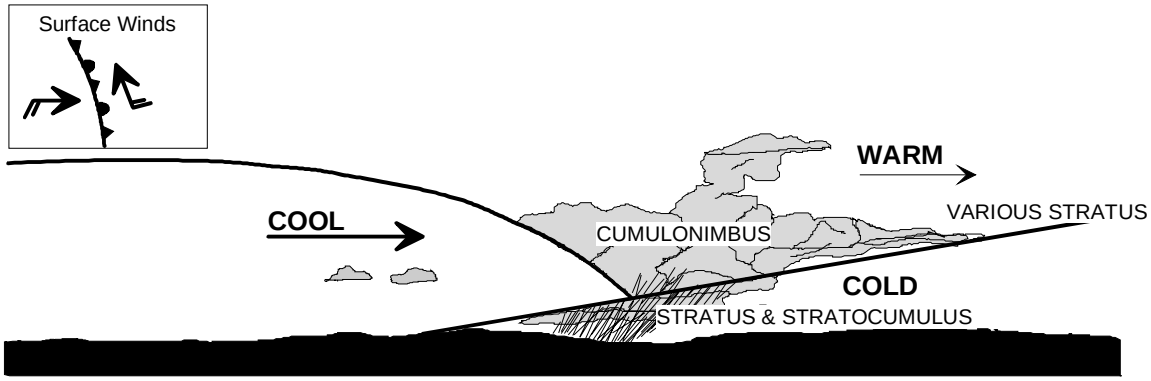


Figure 4: WARM FRONT OCCLUSION

Sg 3, fr 3
Lesson Organization

III. Meteorological hazards **1.1.1.4**

? List six flight hazards common to thunderstorms.

ANSWER:
1. Severe turbulence
2. Hail
3. Tornadoes
4. Lightning
5. Microbursts
6. Icing

A. Thunderstorms **1.1.1.4.5**

1. Turbulence
2. Hail
3. Tornadoes
4. Lightning
5. Surviving a thunderstorm penetration
6. Microbursts **1.1.1.4.1.2**

Sg 3, fr 4
Fig 5: *Microbursts*

LESSON NOTES

The following training aid depicts a microburst video sequence that begins with a still frame. To begin the action sequence, press the mouse again.

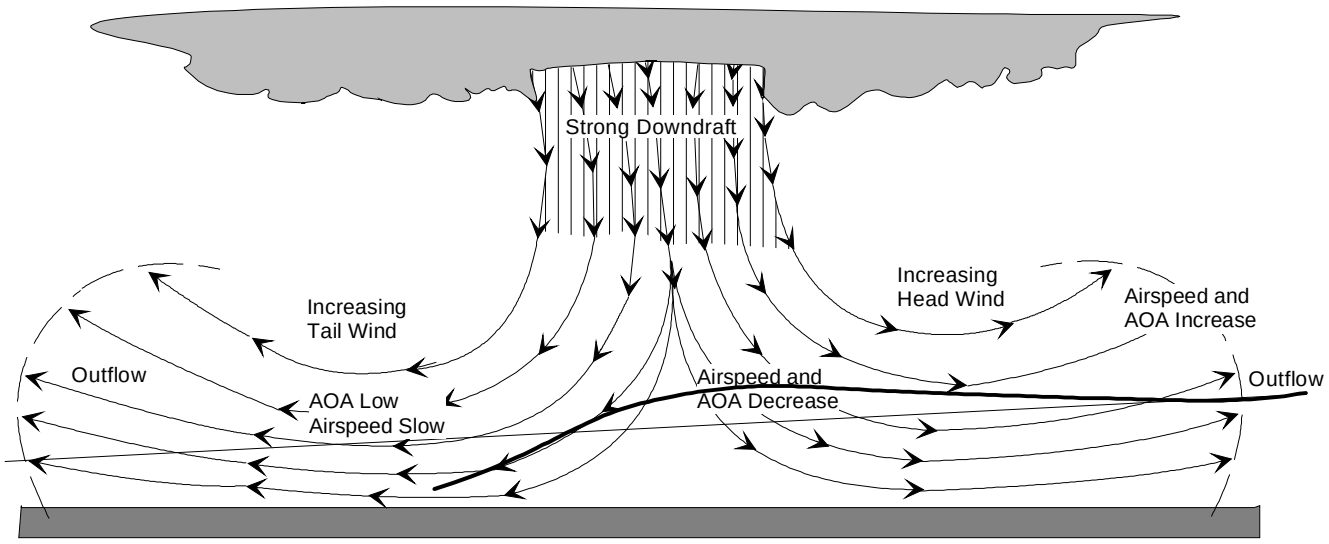


Figure 5: MICROBURSTS

a. Description and composition

(1) Intense and localized downburst of air that descends from a thunderstorm and, upon reaching the ground, spreads horizontally

(2) Usually found beneath thunderstorms with visible rain or virga

(3) Usually 1 to 2 miles in diameter; wind speeds can exceed 100 kts (10,000 fpm) and be accompanied by rain or other obscuring phenomena; usually last less than 10 minutes

(4) Intense horizontal outflows at low altitudes result in extreme head wind to tail wind differentials that have been recorded in excess of 200 kts

(5) Experience has shown that microbursts are not isolated but usually occur in groups

b. Indications

(1) Blowing dust, dust devils, and gust fronts (downbursts will occasionally generate distinctive circular dust patterns)

(2) Thunderstorms in vicinity with visible areas of downdrafts indicated by rain or virga

(3) Sudden and unexplained increase in airspeed as noted on airspeed indicator accompanied by increased AOA—indicative of rolling outflow

(4) Sudden increase in rate of descent accompanied by a lower AOA--indicative of entry into microburst core

(5) Extreme variations in wind velocity and direction in short time

(6) Significant differences between winds at 1,500-2,000 ft AGL and surface winds

(7) LLWAS (Low-Level Windshear Alert System) alert

(8) PIREP of windshear or airspeed gain or loss

NOTE: Although PIREPs are important to alert other pilots of microbursts, microburst intensity can change rapidly, so even recent PIREPs may not reflect the true strength of a microburst--listen to the aircraft ahead or ask for PIREP information from ATC. Report any airspeed fluctuations of 5 kts or more as soon as possible.

c. Avoidance

(1) Takeoff: delay departure

(2) Landing: delay approach or use alternate runway/approach/airfield

d. Response during landing

(1) Execute a missed approach immediately—response time is critical

(2) Recognize that excess airspeed is necessary to maintain flight beyond core of microburst--don't pull power

(3) Report encounter to ATC as soon as possible

NOTE: With proper technique, high performance aircraft will be able to fly out of some microbursts, but not out of all. Avoidance is the best course of action but if a microburst is encountered, recognition and reaction prior to being caught “low and slow” are the only safeguards.

Sg 3, fr 6
Fig 6: *Structural Icing*

B. Structural ice **1.1.1.4.2**

1. Increases drag and weight

2. Decreases lift and increases stall speed: level flight requires higher angle of attack (AOA)

3. Affects thrust production on jet aircraft: large pieces of ice thrown free by airflow or deicing systems can be ingested by engines, resulting in engine damage or failure

4. Other considerations

   a. Pitot and static sources can clog, affecting reliability of Mach/airspeed indicator, altimeter, and vertical speed indicator (VSI)

   b. Vision impaired due to windshield icing

   c. Engine sensors can clog, resulting in improper throttle and fuel control

C. Fog can form when temperature and dew point within 3 degrees C/5 degrees F of each other **1.1.1.4.3**

? **Name two phenomena that can produce clear air turbulence.**

ANSWER:
1. Jet streams
2. Mountain wave

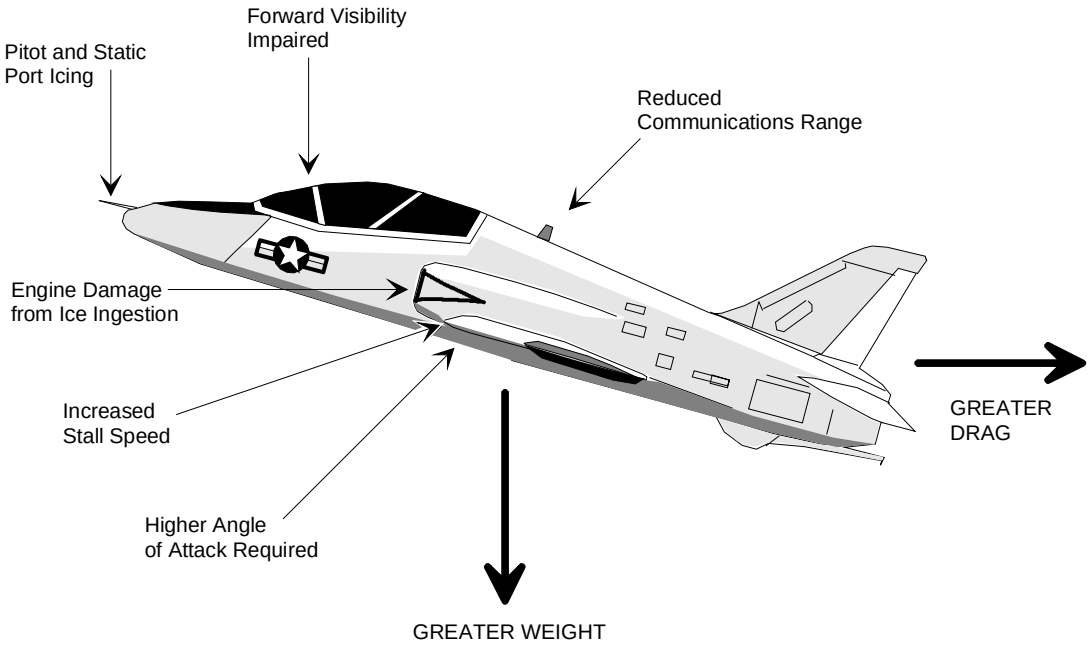


Figure 6: STRUCTURAL ICING

Sg 3, fr 7
Fig 7 & 8:
Jet Stream Clear Air Turbulence (CAT)

D. Clear air turbulence (CAT) **1.1.1.4.1.1**

1. Jet Stream CAT **1.1.1.3.5**

   a. Caused by shear zones associated with the movement of wind within the jet stream

   b. Most common when wind speed increases or decreases rapidly between altitudes

   c. Common near areas of highest wind velocity within the jet stream, on the polar side and below the core

? Where is the most severe turbulence in a mountain wave phenomenon?

ANSWER: Near rotor cloud formations

Sg 3, fr 8
Fig 9: *Mountain Wave Phenomenon*

2. Mountain wave CAT

   a. High velocity airflow over mountain range is disrupted and causes turbulence over and downwind of range

   b. Produces large “waves” of air with strong updrafts and downdrafts

   c. Rotor turbulence very severe below wave, tops of mountains, and especially near rotor clouds—similar to turbulence found near thunderstorms

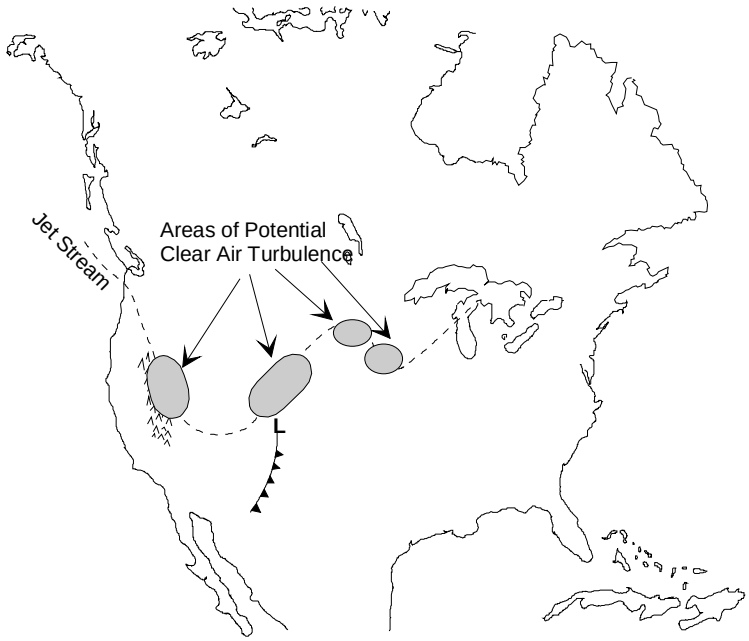


Figure 7: JET STREAM CLEAR AIR TURBULENCE (CAT)

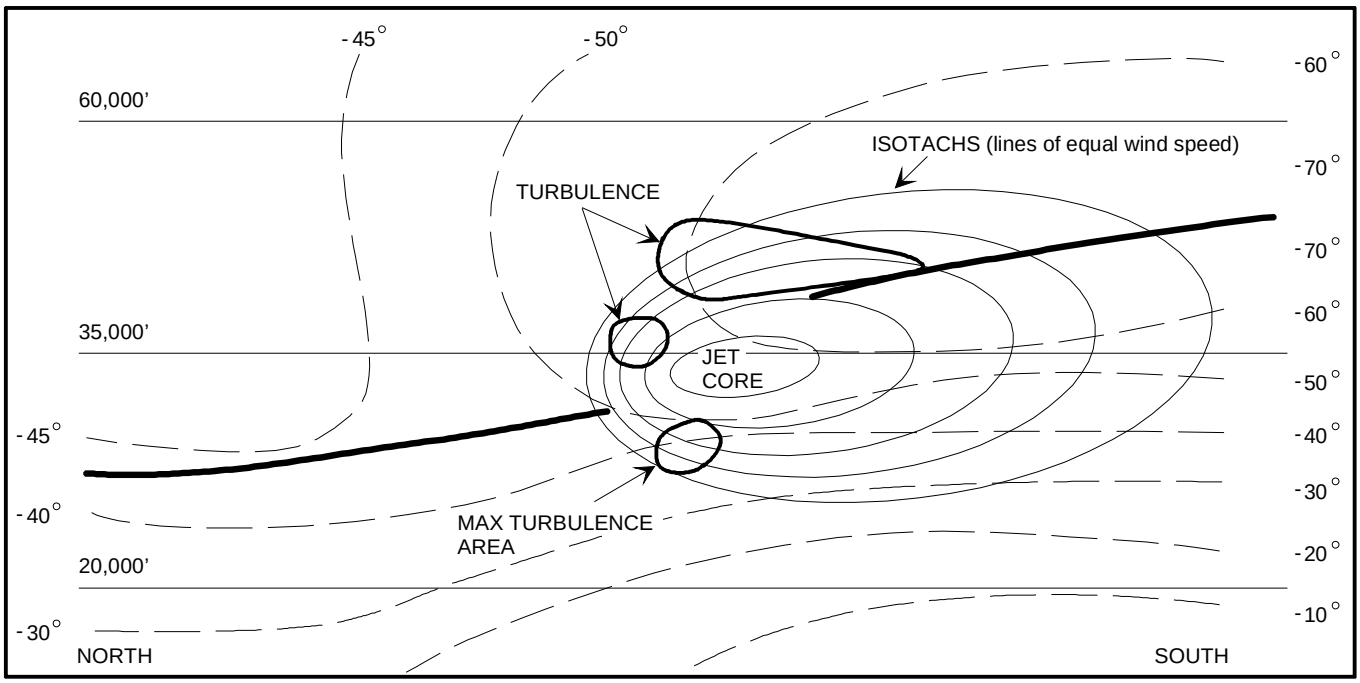


Figure 8: JET STREAM CLEAR AIR TURBULENCE (CAT)

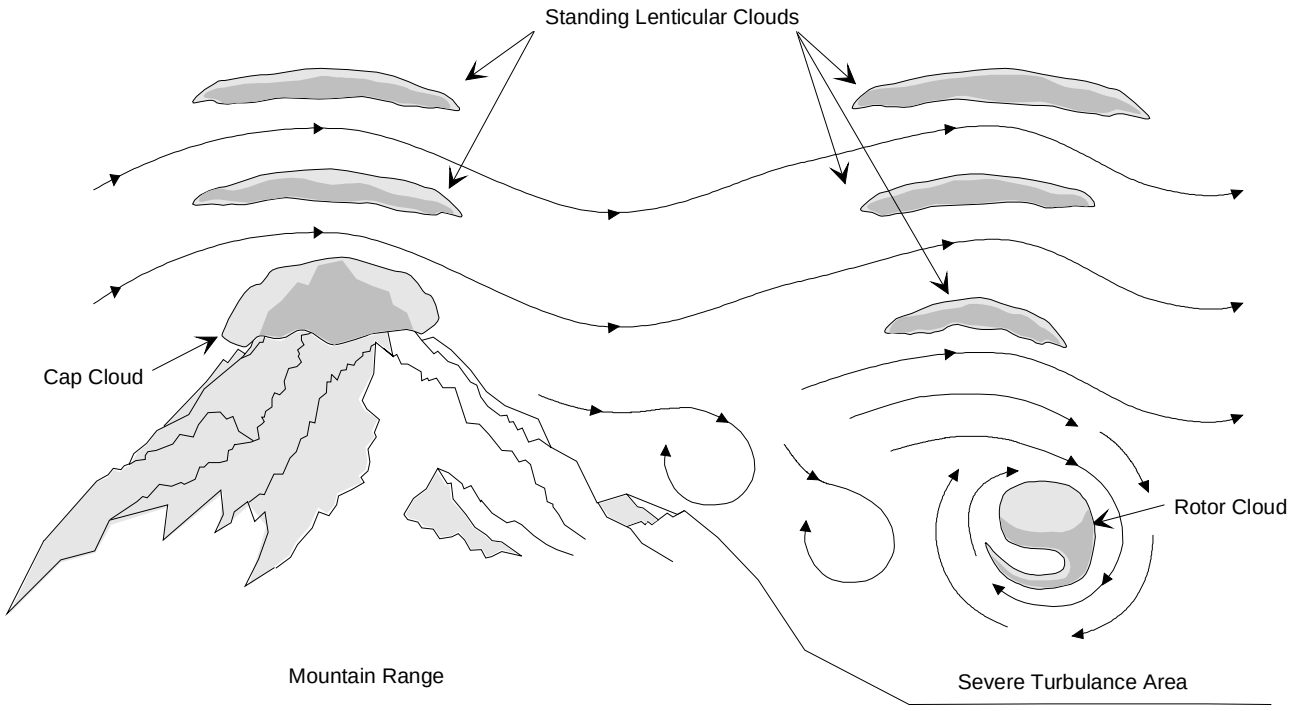


Figure 9: MOUNTAIN WAVE PHENOMENON

E. Wake turbulence **1.1.1.4.4**

1. Characteristics

   a. Heavy and slow aircraft generate greatest vortex strength

   b. During landing, wingtip vortex disappears as the aircraft touches down

? To avoid wake turbulence when departing behind a heavier aircraft, what procedures should you employ?

ANSWER: Delay takeoff and then lift off prior to the previous aircraft's lift-off point and climb above its flight path.

2. Operational considerations

   a. Plan flight path above previous aircraft's flight path

   b. Take off before previous aircraft's lift-off point

   c. Land beyond touchdown point of previous aircraft

Sg 3, fr 9
Fig 10: *Wake Turbulence Avoidance*

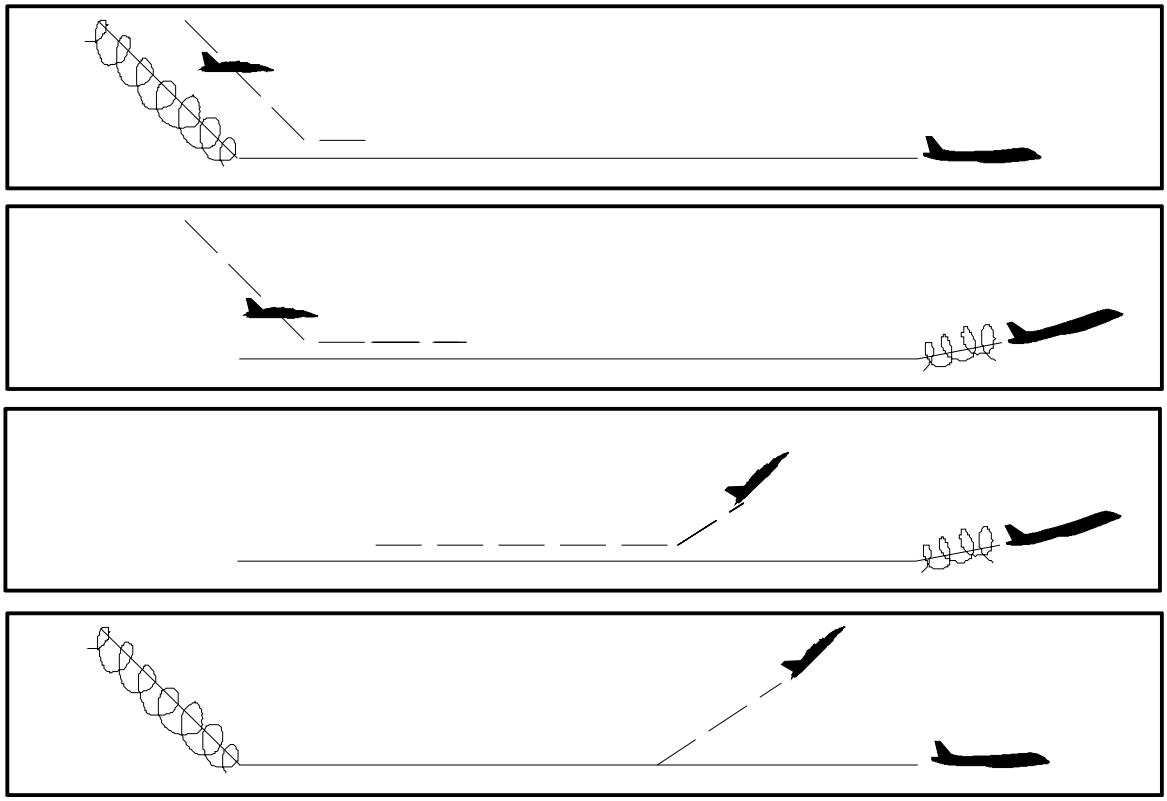


Figure 10: WAKE TURBULENCE AVOIDANCE

Sg 4, fr 3
Lesson Organization

Sg 4, fr 4
Fig 11: *Weather Minimums Required IAW OPNAVINST 3710.7*

IV. Weather minimums (OPNAVINST 3710.7) **1.1.1.1, 1.1.1.1.1.1**

NOTE: Weather at ETA +/- 1 hr dictates alternate weather requirements.

A. If destination is 0-0, up to but not including published minimums, then alternate must be 3,000-3 or better

B. If destination is at published minimums, up to but not including 3,000-3 (single-piloted absolute minimums 200-1/2)

1. Then for non-precision, alternate must be published minimums plus 300-1

2. Then for precision, alternate must be published minimums plus 200-1/2

NOTE: For a single-piloted, single radio aircraft, the only precision approach available is an ILS.

C. If destination is 3,000-3 or better, no alternate is required

NOTE: CNATRA requires an alternate be filed for all cross-country flights.

? **The weather at your destination is forecast to be greater than published minimums but less than 3,000-3. For a precision approach, what are your alternate airport weather requirements?**

ANSWER: 200-1/2 above precision approach minimums

<table>
<tr><td>DESTINATION WEATHER
ETA plus and minus one (1) hour</td><td colspan="3">ALTERNATE WEATHER
ETA plus and minus one (1) hour</td></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="3">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>* 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 11: WEATHER MINIMUMS REQUIRED IAW OPNAVINST 3710.7

Sg 5, fr 3
Lesson Organization

V. Weather charts **1.1.1.3**

A. Observed-weather charts

LESSON NOTES

Point out the various chart symbols and embedded question answers as they are discussed for each of the weather charts.

Sg 5, fr 4
Fig 12: *Surface Analysis Chart*

1. Surface analysis chart symbology **1.1.1.3.1**

   a. Standard symbols depict fronts

   b. "H" or "L" and isobars denote pressure systems

   c. Station models also represent sky coverage, wind direction and speed, temperature, dew point, precipitation, and other related information

? **According to the surface analysis chart, where in the U.S. could you expect the worst weather?**

ANSWER: Low ceilings and poor weather in the pacific northwest, overcast skies along the California coast. Generally poor weather in the northeast along a stationary and occluded front.

Sg 5, fr 5
Fig 13: *Weather Depiction Chart*

2. Weather depiction chart symbology **1.1.1.3.3**

   a. Standard symbols depict fronts (as on surface analysis chart)

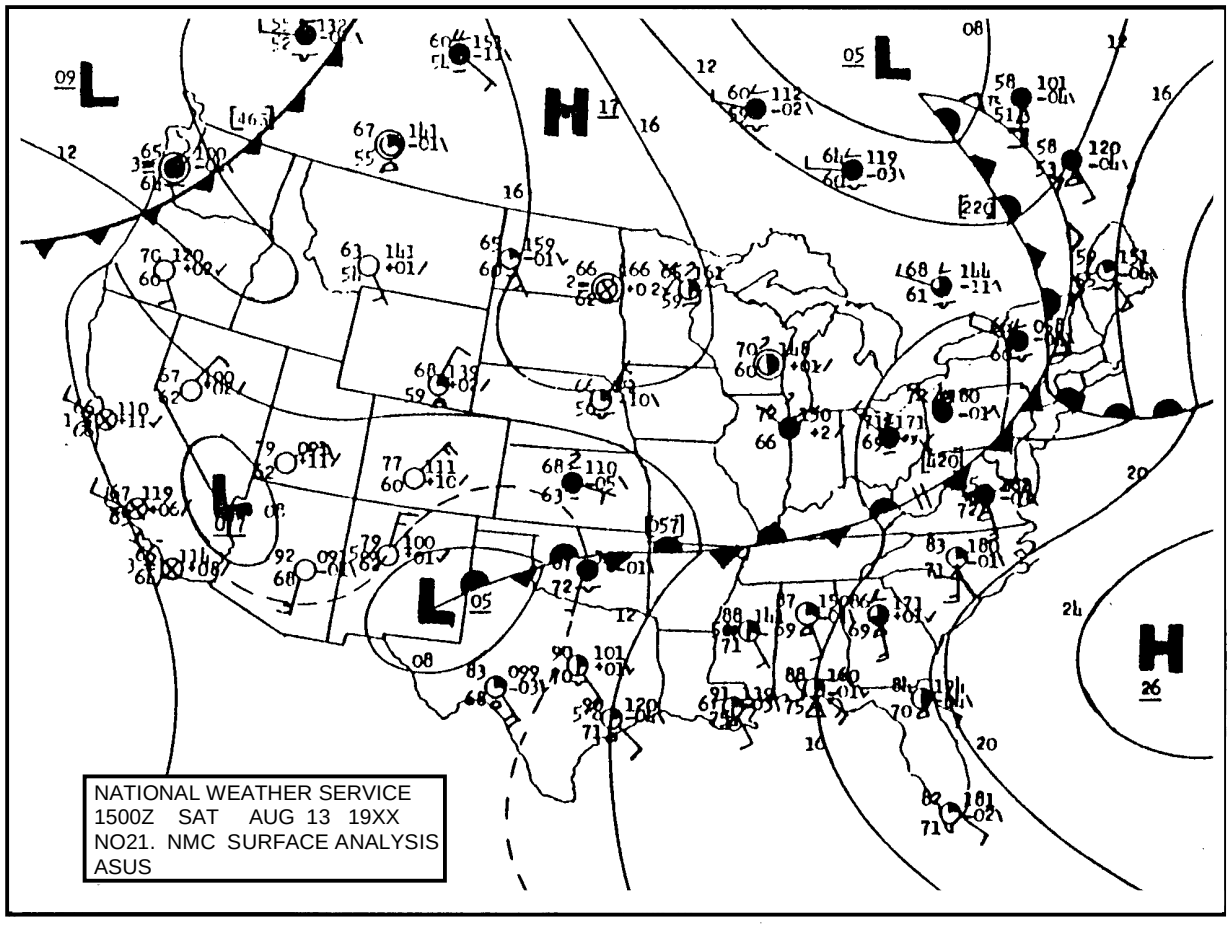
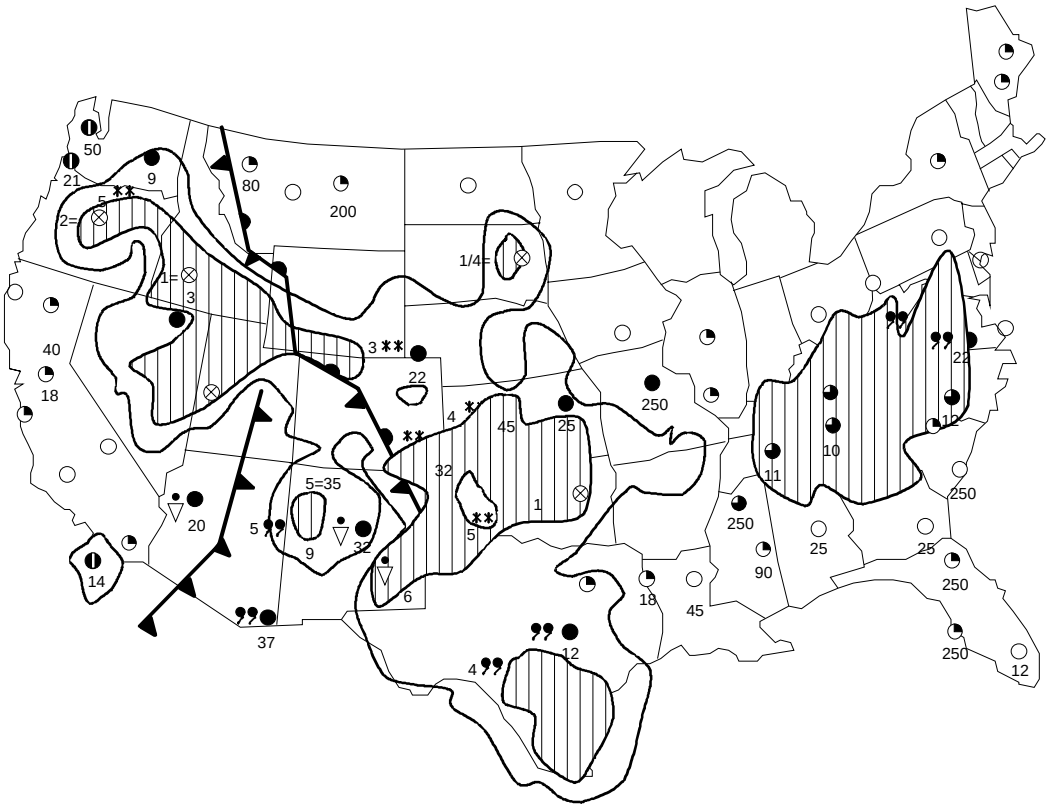


Figure 12: SURFACE ANALYSIS CHART



10Z MON 25 JULY 19XX

56. NMC WEATHER DEPICTION

SHADED AREAS...IFR WITH CIGS LESS THAN 1,000 FT AND/OR VSBY LESS THEN 3 MI.

CONTOURED WITHOUT SHADING...MVFR AREAS WITH CIG GREATER THAN OR EQUAL TO 1,000 TO LESS THAN OR EQUAL TO 3,000 FT AND/OR VSBY GREATER OR EQUAL TO 3 MI LESS THAN OR EQUAL TO 5 MI.

NO CONTOURS...VFR AREAS WITH CIG GREATER THAN 3,000 FT AND VSBY GREATER THAN 5 MI.

Figure 13: WEATHER DEPICTION CHART

b. Contoured, unshaded areas indicate marginal VFR (MVFR) weather with ceilings of 1,000-3,000 ft AGL and/or visibilities of 3-5 sm

c. Contoured, shaded areas indicate IFR weather with ceilings less than 1,000 ft AGL and/or visibility of less than 3 sm

d. Station models also represent: sky coverage, height of lowest cloud layer or ceiling height if present in ft AGL, visibility if 6 sm or less, and form of weather obscuring the visibility

LESSON NOTES

Point to the south Texas area on the chart.

? According to the weather depiction chart, what are the predominant conditions in south Texas?

ANSWER: IFR conditions with 400- to 600-ft overcast ceilings and drizzle to light rain.

3. Radar summary chart symbology **1.1.1.3.2**

Sg 5, fr 6
Fig 14: *Radar Summary Chart*

a. Three levels of contoured lines display areas and intensity of precipitation; remaining three levels are interpolated

b. Display cloud tops in hundreds of feet, identified with the top of the radar return

c. Direction arrows show movement of precipitation areas

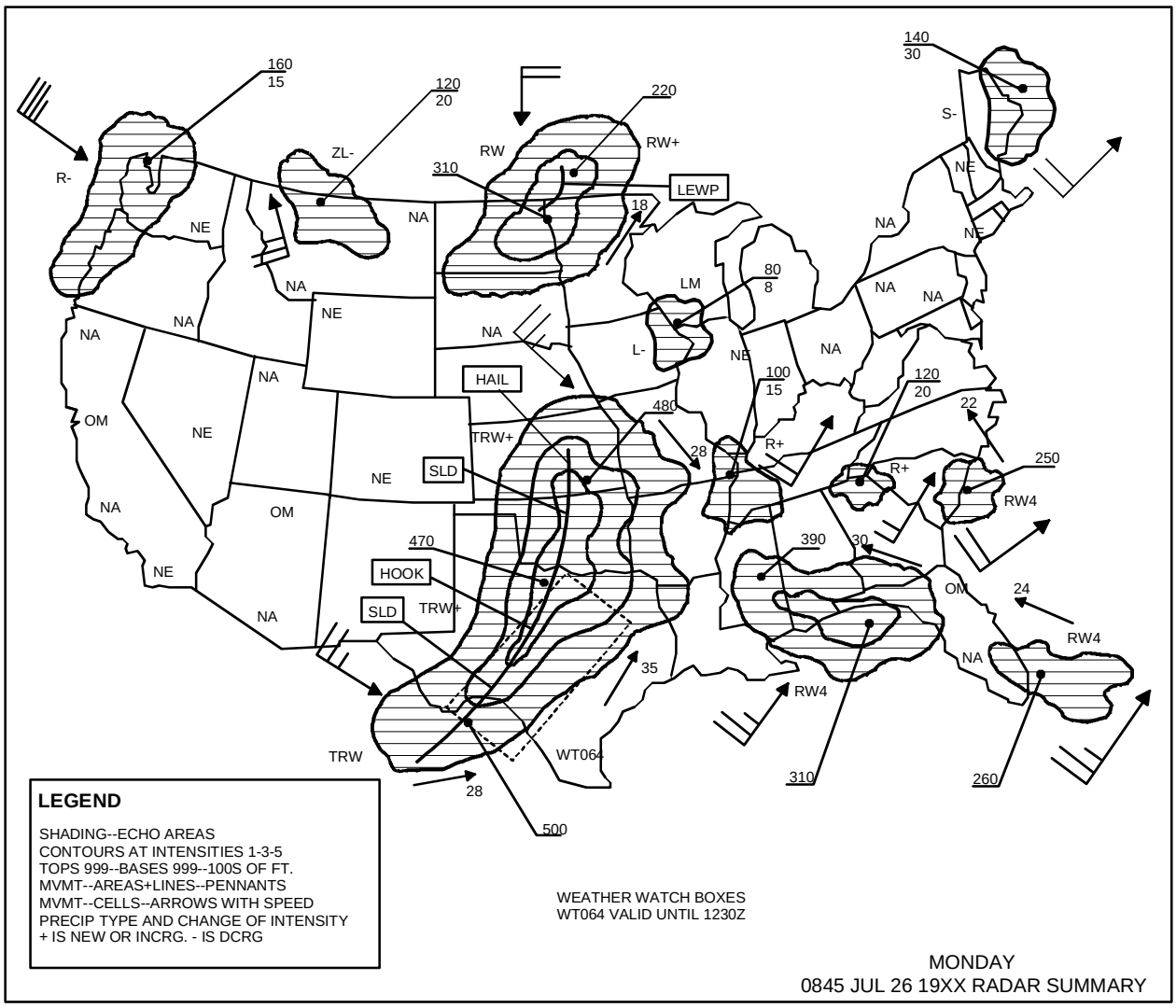


Figure 14: RADAR SUMMARY CHART

d. Letter symbols depict type of precipitation -- rain, hail, snow, ice pellets, etc.

e. Dashed boxes indicate severe thunderstorm and tornado watch areas

LESSON NOTES

Point to the weather watch area in central Texas on the chart.

? Refer to the Radar Summary Chart (Figure 14). Regarding the area of precipitation in central Texas, what information can be derived?

ANSWER: The precipitation is within a weather watch area with severe thunderstorms, a squall line, possible tornadoes, a radar return of 50,000 ft MSL, and cell movement to the northeast at 35 kts.

B. Prognostic charts

Sg 5, fr 7
Fig 15: *Low-Level Prognostic Chart*

1. Low-level significant weather prognostic chart symbology—surface to 24,000 ft MSL

   a. Smooth lines enclose forecast areas of IFR conditions; scalloped lines enclose marginal VFR (MVFR) conditions

   b. Broken line depicts areas of moderate or greater turbulence—numbers with bars denote altitude

   c. Dashed lines display the freezing level at altitudes of 4,000, 8,000, 12,000, and 16,000 ft

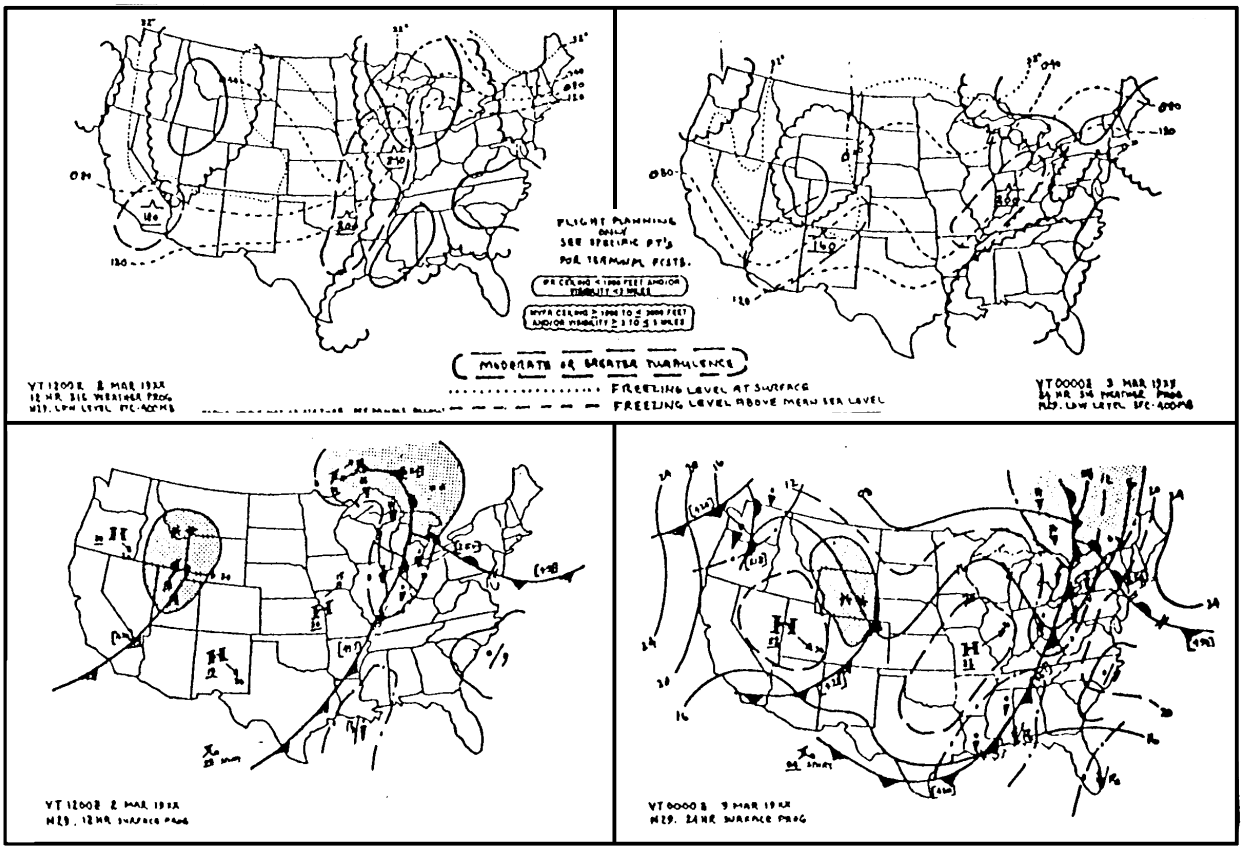


Figure 15: LOW-LEVEL PROGNOSTIC CHART

NOTE: Dotted line indicates freezing level at surface.

d. Chart contains legend for clarity

2. High-level significant weather prognostic chart **1.1.1.3.1**

NOTE: Meteorologists utilize the low-level significant Wx Prog chart more than the high-level. All of the high-level information is available from other sources, e.g., constant pressure charts. Many weather offices choose to not receive this facsimile from the National Weather Service.

LESSON NOTES

Point to southern California on Figure 15.

Refer to the Low-Level Prognostic Chart (Figure 15). Regarding the south Texas area, what weather information can be derived?

ANSWER: The offshore and coastal areas are forecast to be MVFR. Expect improving weather with cold frontal passage.

3. Winds aloft prognostic chart symbology **1.1.1.3.4**

Sg 5, fr 8
Fig 16: *Winds Aloft Prognostic Chart*

a. Wind shafts indicate wind direction

b. Wind flags, barbs, and half-barbs mounted on arrow display wind speed

c. Temperature depicted in degrees C near base of wind flag

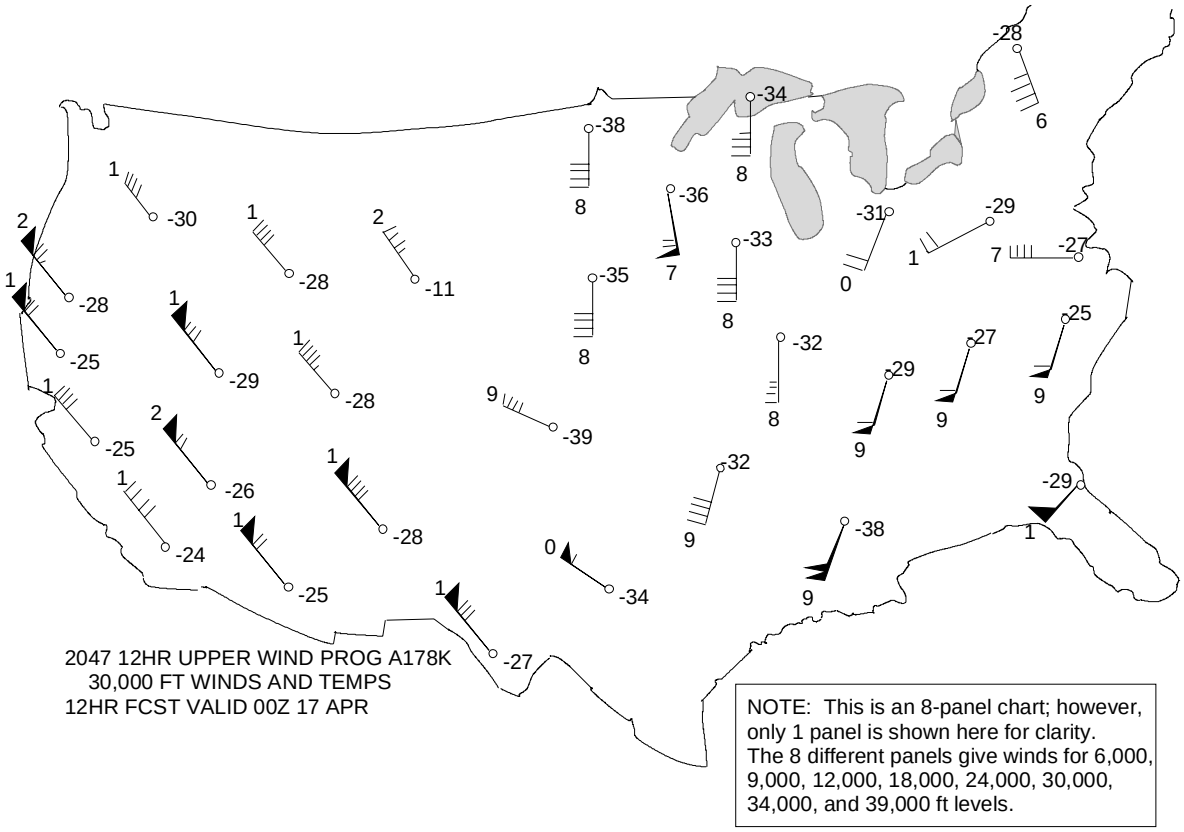


Figure 16: WINDS ALOFT PROGNOSTIC CHART

VI. Printed reports and forecasts **1.1.1.5**

Sg 6, fr 3
Lesson Organization

LESSON NOTES

During this portion of the lecture, consider choosing an example of a selected report or forecast from the screen and reading it. Encourage students to bring up any specific problems or points of confusion.

A. METAR **1.1.1.5.4**

B. Area Forecast (FA) **1.1.1.5.3**

Sg 6, ft 4
Fig 17: *METAR*

Sg 6, fr 5
Fig 18: *Area Forecast (FA)*

1. Provides general description of regional forecast weather phenomena in a specified multi-state region, including flight hazards such as icing, thunderstorms, and large areas of IFR weather

2. Plain language and FAA-approved codes identify hazards/flight precautions, icing and freezing level, pressure systems and fronts, turbulence, significant clouds, and weather

C. Terminal Aerodrome Forecasts **1.1.1.5.1**

Sg 6, fr 7
Fig 19: *Terminal Aerodrome Forecast (TAF)*

1. Provides 24-hour forecast for a specific station

2. Codes (in order) identify valid times of forecast, wind speed and direction, visibility, significant weather, clouds, expected variations from prevailing conditions, and, if appropriate, temperature, icing, and turbulence

3. Breakdown in FLIP planning (GP)

METAR (or SPECI for Special Report) KPIT 201955Z (AUTO for automated observation) (COR for correction to observation) 22015G25KT 3/4 SM R28R/2600FT TSRA OVC010CB 18/16 A2992 RMK SLP013 T01760158

Figure 17: METAR

som (start of message indicator)
SFOH FA 191045
HAZARDS VALID UNTIL 192300
WA OR CA AND CSTL WTRS
*
FLT PRCTNS...MTN OBSCN...WA OR CA
*
TSTMS IMPLY PSBL SVR OR GRT TURBC SVR ICG LLWS AND IFR CONDS.
NON MSL HGTS ARE DENOTED BY AGL OR CIG.
eom (end of message indicator)

SFOC FA 191045
SYNOPSIS AND VFR CLOUDS/WX
SYNOPSIS VALID UNTIL 200500
CLDS/WX VALID UNTIL 192300...OTLK VALID 192300-200500
*
SYNOPSIS...WEAK CDFNT ALG CSTL SXNS MOVG TO CASCDS AND BCHG STNRY. WK HI PRES BLDG INTO CSTL SXNS BY 02Z. ALF...MOIST WLY FLOW WL CONT OVER WA OR AND GENLY WK SWLY FLOW OVER CA.
*
WA OR CASCDS WWD
SEE AIRMET SIERRA FOR MTN OBSCN.
WA NRN OR...15-25 SCT-BKN 35-45 BKN-OVC 100-120. WDLY SCT RW-. 17Z-20Z BCHG 20 SCT-BKN 50 BKN 80-100. WDLY SCT RW-. TOPS 180. OTLK...VFR.

SRN OR...CLR. OTLK...VFR.
*
WA OR E OF CASCDS
WA...50-70 SCT 120 SCT. WRN SXNS WDLY SCT RW-. TOPS 180. OTLK...VFR.
OR...CLR. OTLK...VFR.
*
CA
SEE AIRMET SIERRA FOR MTN OBSCN.
CSTL SXNS OF NRN CA...10-15 BKN 25. AFT 21Z...CLR. OTLK...VFR.
LAX BASIN...15 BKN 25. VSBYS 3-5FH. AFT 16Z...CLR. VSBYS LAX BASIN 3-5FH.
OTLK...MVFT CIG F.
RMNDR AREA...CLR. OTLK...VFR.
*
WA OR CA CSTL WTRS
ALG CST 10-25 SCT-BKN 30 OTHERWISE CLR. OTLK...MVFR CIG F.
eom

Figure 18: AREA FORECAST (FA)

KNQI TAF 191515 16018G28KT 8000 FEW015SCT025CB BKN040 BKN250
52005 QNH2990INS VCTSSHRA
TEMPO 1900 VRB20G35KT 3200 TSSHRA BKN 015CB OVC025
BECMG 0102 17013G22KT 9999 SCT020 SCT250 QNH2995INS
BECMG 091014005KT 4800BR SCT010 SCT250 QNH3000INS
TEMPO 1013 0800FG VV002
BECMG 1415 16010KT 9000 HZ SCT020 SCT100 BKN250
QNH2992INS

Figure 19: TERMINAL AERODROME FORECAST (TAF)

D. Winds Aloft Forecast (FD) **1.1.1.5.2**

Sg 6, fr 8
Fig 20: *Winds Aloft Forecast (FD)*

1. Provides teletype forecast wind direction and speed for specified altitudes ranging from 1,500 ft AGL through 39,000 ft MSL and temperatures from 2,500 ft AGL through 39,000 ft MSL

2. Coding contains wind direction and speed in first 4 digits, followed by temperature figure in degrees C

   NOTE: If wind speeds exceed 100 kts, 100 is subtracted from the wind speed, and 50 is added to the direction.

EXAMPLE: 621960 =	wind direction	120 deg
	wind speed	119 kts
	temperature	-60 deg C

EXAMPLE: 850552 =	wind direction	350 deg
	wind speed	105 kts
	temperature	-52 deg C

E. Severe weather reports, advisories, and forecasts **1.1.1.4.6, 1.1.1.11**

Sg 6, fr 9
Severe Weather Watch Bulletin (WW)

1. Severe Weather Watch bulletin (WW) **1.1.1.4.7**

   a. Defines areas of possible severe thunderstorms and tornadoes; describes level of intensity, hail size, wind speeds, CB tops, estimated cell movement, cause of severe weather; and updates convective outlooks (AC)

   b. Hazards include thunderstorms with winds of 50 kts or more, 3/4 inches hail, or tornadoes

   c. Flight restrictions

      (1) Navy pilots will not file into or fly through WW areas

FD WBC 250550
BASED ON 25000Z DATA
VALID 251200Z FOR USE 0600Z-1500Z. TEMPS NEG ABV 24000

FT	3000	6000	9000	12000	18000	24000	30000	34000	39000
XQP									
CAE	3410	3320 - 07	3133 - 08	3147-09	3067-18	3076-30	308544	298853	298961
ATL	9900	3110 - 05	3023 - 06	3036-07	3056-16	3063-28	307143	307453	297863
BHM	0805	2907 - 03	3018 - 04	3029-06	3046-16	3054-28	306443	296752	297363
JAN	1109	2708+ 01	2814 - 01	2819-04	2931-15	2939-27	294742	295251	295762
ZQP									
SHV	1714	2417+ 04	2620+ 01	2621-03	2827-14	2835-27	284442	284751	285061
DAL	1912	2325+ 07	2425+ 03	2524-01	7201-14	7702-26	771242	782450	782061
ABI		2320+ 09	2422+ 06	2522-00	2724-14	2732-26	264141	274650	275260
ZPZ									
INK		2512+ 10	2714+ 07	2717+01	2825-14	2733-26	274241	274750	265560
ELP		2609	2833+ 07	2717+01	2866-13	2886-20	780641	770451	268761
TUS		1822+ 12	2329+ 07	2536+01	2758-13	2879-26	780341	780151	288361
BLH	1311	1708+ 11	2219+ 06	2433+00	2743-13	2960-25	800041	309551	308561

Figure 20: WINDS ALOFT FORECAST (FD)

(2) Exceptions to OPNAVINST 3710.7 severe weather restrictions

(a) Operational necessity

(b) Research/weather reconnaissance

(c) Emergencies

(d) Storm development has not progressed as forecast, and

i) When flight remains in VFR conditions, or

ii) If in IFR conditions, aircraft has operable weather radar

(e) Aircraft capable of flying above existing or developing severe storms

2. CNATRA Weather Warning (CAWW) **1.1.1.4.8**

Sg 6, fr 10
CNATRA Weather Warning (CAWW)

a. Hazards include thunderstorms with 50-kt winds or greater, embedded and lines of thunderstorms, 3/4 inches or larger hail, severe icing and turbulence, widespread areas of limited visibility

b. Flight restrictions

(1) Training activities suspended in CAWW area

(2) Exceptions to OPNAVINST 3710.7 severe weather restrictions: same as WW

? What are the exceptions to the OPNAVINST 3710.7 restriction prohibiting flight in WW and CAWW areas?

ANSWER:
1. Operational necessity
2. Research/weather reconnaissance
3. Emergencies
4. Storm development has not progressed as forecast, and
   a. when flight remains in VFR conditions, or
   b. if in IFR conditions, operable weather radar is installed in the aircraft
5. The aircraft is capable of flying above the hazard

Sg 6, fr 11
Fig 21: *Convective SIGMET (WST)*

3. Convective SIGMETs (WST)

   a. In-flight advisory alerts pilots to convective activity and related hazards posing danger to all types of aircraft

   b. Hazards include lines and large areas of thunderstorms, tornadoes, and embedded thunderstorms

Sg 6, fr 12
Fig 22: *SIGMET (WS)*

4. SIGMETs (WS) **1.1.1.11.2**

   a. In-flight advisory alerts pilots to weather hazards that pose danger to all types of aircraft

   b. Hazards include severe icing and turbulence and large areas of IFR conditions

Sg 6, fr 13
Fig 23: *AIRMET (WA)*

5. AIRMETs (WA): in-flight and teletype advisory alerting pilots to hazards that are not as severe as SIGMETs and/or convective SIGMETs **1.1.1.11.1**

MKCC WST 221855
CONVECTIVE SIGMET 20C
VALID UNTIL 2055Z
ND SD
FROM 90W MOT-GFK-ABR-90W MOT
INTSFYG AREA SVR TSTMS MOVG FROM 2445. TOPS ABV 450.
WIND GUSTS TO 60 KT RPRTD. TORNADOES...HAIL TO 2 IN...WIND GUSTS
TO 65 KT PSBL ND PTN.

CONVECTIVE SIGMET 21C
VALID UNTIL 2055Z
TX
50SE CDS
ISOLD SVR TSTM D30 MOVG FROM 2420. TOP ABV 450.
HAIL TO 2 IN...WIND GUSTS TO 65 KT PSBL.

OUTLOOK VALID 222055-230055
AREA 1...FROM INL-MSP-ABR-MOT-INL
SVR TSTMS CONT TO DVLP IN AREA OVR ND. AREA IS XPCD TO RMN SVR AND
SPRD INTO MN AS STG PVA MOVS OVR VERY UNSTBL AMS CHARACTERIZED
BY -12 LIFTED INDEX.

AREA 2...FROM CDS-DFW-LRD-ELP-CDS
ISOLD STG TSTMS WILL DVLP OVR SWRN AND WRN TX THRUT FCST PD AS
UPR LVL TROF MOVS NEWD OVR VERY UNSTBL AMS. LIFTED INDEX RMNS
IN THE -8 TO -10 RANGE. DRY LINE WILL BE THE FOCUS OF TSTM DVLPMT.

Figure 21: CONVECTIVE SIGMET (WST)

DFWP UWS 051700
SIGMET PAPA 1 VALID UNTIL 052100
AR LA MS
FROM MEM TO 30N MEI TO BTR TO MLU TO MEM
MDT TO OCNL SVR ICG ABV FRZLVL XPCD. FRZLVL 80 E TO 120 W. CONDS CONTG BYD 2100Z.

SFOX WS 030130
SIGMET XRAY 2 VALID UNTIL 030530
OR WA
FROM SEA TO PDX TO EUG TO ONP TO HQM TO SEA
MDT TO OCNL SVR TURBC BTWN 280 AND 350 XPCD DUE TO WINDSHEAR ASSOCD WITH JTSTR. CONDS BGNG AFT 0200Z CONTG BYD 0530Z AND SPRDG OVR CNTRL ID BY 0400Z.

Example of a multi-area issuance SIGMET:

CHIO WS 051700
SIGMET OSCAR 2 VALID UNTIL 052100
KS
FROM PWE TO OSW TO 40W LBL TO PWE
OCNL SVR TURBC BLO 60. CONDS DUE TO STG NWLY FLOW BHD CDFNT AND XPCD TO CONT BYD 2100Z.

DFWO WS 051700
SIGMET OSCAR 2 VALID UNTIL 052100
OK
FROM OSW TO ADM TO 40W LBL TO OSW
OCNL SVR TURBC BLO 60. CONDS DUE TO STG NWLY FLOW BHD CDFNT AND XPCD TO CONT BYD 2100Z.

Example of a multi-area issuance SIGMET cancelled in one area and continued in another:

CHIO WS 052100
CANCEL SIGMET OSCAR 2. CONDS HAVE DMSHD.

DFWO WS 052100
SIGMET OSCAR 3 VALID UNTIL 060100
FROM OSW TO TXK TO SPS TO GAG TO OSW
OCNL SVR TURBC BLO 60. CONDS XPCD TO GRDLY DMSH AFT 00Z.

Figure 22: SIGMET (WS)

ZCZC MKCWA4Z ALL 190200
WAUS1 KDFW 190200
DFWZ WA 190200
AIRMET ZULU FOR ICG AND FRZLVL VALID UNTIL 190800
*
NO SGFNT ICG XPCD.
*
FRZLVL...90-120 E OF DYR-MSL-ATL LN SLPG TO 120-140 OVR RMNDR.
****
NNNN

ZCZC MKCWA4T ALL 191400
WAUS1 KDFW 191400
DFWT WA 191400
AIRMET TANGO FOR TURBC...STG SFC WNDS AND LLWS VALID UNTIL 192000
*
AIRMET TURBC...OK TX
FROM OSW TO LRD TO PEQ TO 40W LBL TO OSW
OCNL MDT TURBC BLO 60 DUE TO STG AND GUSTY LOW LVL WINDS.
CONDS CONTG BYD 2000Z.
*
AIRMET STG SFC WINDS...TX
FROM CDS TO DFW TO SAT TO MAF TO CDS
AFT 18Z...SUSTAINED SFC WINDS GTR THAN 30 KTS XPCD. CONDS CONTG BYD 20000Z.
*
LLWS BLO 20 AGL DUE TO STG WINDS DMSHG BY 16-18Z.
*
OTLK VALID 2000-0200Z...OK TX AR
MDT TURBC BLO 60 CONTG OVER OK/TX AND SPRDG INTO AR BY 2200-0200Z CONTG ENTR AREA BYD 0200Z.
****
NNNN

ZCZC MKCWA5S ALL 191400
WAUS1 KSLC 191400
SLCS WA 191400
AIRMET SIERRA FOR IFR AND MTN OBSCN VALID UNTIL 192000
*
AIRMET IFR...WY CO
FROM 70ENE GCC TO GLD TO FMN TO 60N JAC TO 70ENE GCC
OCNL CIGS BLO 10 AND OR FSBYS BLO 3 IN PCPN AND F. CONDS CONTG BYD 2000Z AND GRDLY DMSHG.
*
AIRMET MTN OBSCN...MT WY CO
FROM YXC TO YXH TO AKO TO TBE TO FMN TO LKT TO YXC
MTNS OCNL OBSCD IN CLDS/PCPN. CONDS CONTG BYD 2000Z.
*
OTLK VALID 2000-0200Z...MTN OBSCN MT WY CO
CONDS CONTG BYD 0200Z IN WY/CO BUT ENDING IN MT BTWN 2200-0200Z.
****
NNNN

Figure 23: AIRMET (WA)

Sg 6, fr 14
Fig 24: *Military Weather Advisory (MWA)*

6. Military Weather Advisory (MWA)

   a. Used as a preflight aid to help plan your route of flight to avoid possible severe weather

   b. Hazards include tornadoes, waterspouts, funnel clouds, thunderstorms, strong surface winds, heavy rain, heavy snow, and freezing precipitation

Sg 7, fr 3
Lesson Organization

Sg 7, fr 4
Fig 25: *Weather Minima Criteria Flow Chart*

VII. Flight weather briefing (DD-175-1) **1.1.1.2.1**

A. IAW OPNAVINST 3710.7 (series) **1.1.1.2.1.1**

1. Required for all IFR flights

2. Exceptions for CNATRA scheduled local flights

Sg 7, fr 5
Fig 26: *DD-175-1*

Sg 7, fr 6
Mission/Takeoff Data (Part I)

Sg 7, fr 7
Enroute Data (Part II)

B. Five sections of the DD-175-1

1. Mission/takeoff data: first three boxes identify date, aircraft type and bureau number; remaining boxes specify forecast conditions for takeoff and climbout

2. Enroute data

   a. Weather conditions within a minimum of 25 nm either side of intended route of flight, 5,000 ft above and below, and destination letdown conditions

   b. Minimum ceilings, maximum cloud tops, and minimum freezing levels

   c. Pertinent information on thunderstorms, turbulence, icing, and precipitation

Sg 7, fr 8
Terminal Forecast (Part III)

3. Terminal forecasts: forecast information (cloud layers, visibility, surface wind, altimeter, and valid time of forecasts) $\pm$ 1 hour of ETA at destination and/or alternate

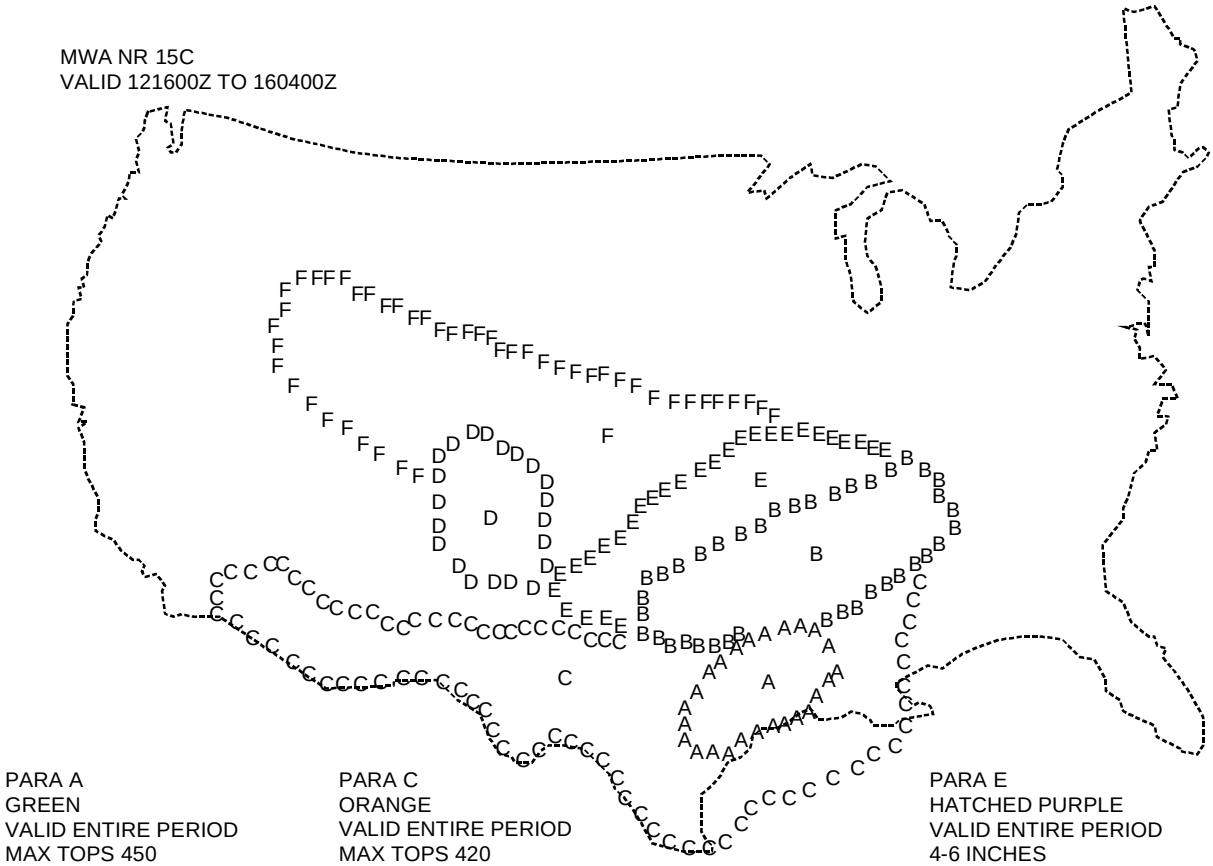


Figure 24: MILITARY WEATHER ADVISORY (MWA)

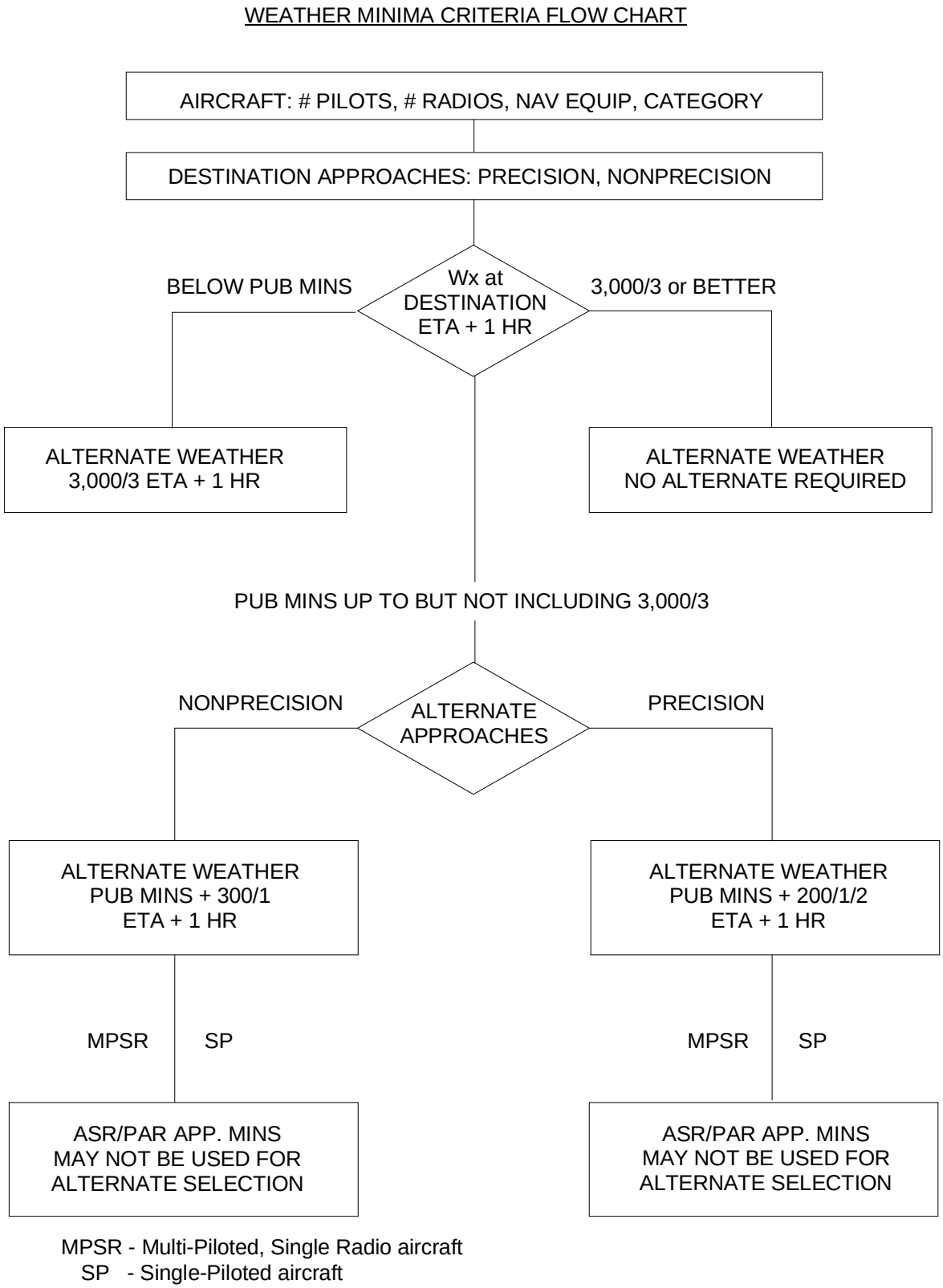


Figure 25: WEATHER MINIMA CRITERIA FLOW CHART

FLIGHT WEATHER BRIEFING

PART I - MISSION/TAKEOFF DATA

DATE	ACFT TYPE/NO	DEP PT/ETD Z	RUNWAY TEMP ^{o}F/C	DEWPOINT ^{o}F/C	TEMP DEV ^{o}C	PRESSURE ALT FT	DENSITY ALT FT
SFC WIND M T	CLIMB WINDS	LOCAL WEA WRNG/MET WATCH ADV				RCR	
REMARKS/TAKEOFF ALTN FCST							

PART II - ENROUTE DATA

FLT LEVEL	FLT LEVEL WINDS/TEMP

CLOUDS AT FLT LEVEL	MINIMUM VISIBILITY AT FLT LEVEL OUTSIDE CLOUDS	MILES DUE TO
☐ YES ☐ NO ☐ IN AND OUT	☐ SMOKE ☐ DUST ☐ HAZE ☐ FOG ☐ PRECIPITATION	☐ NO OBSTRUCTION

MINIMUM CEILING FT AGL	LOCATION	MAXIMUM CLOUD TOPS FT MSL	LOCATION	MINIMUM FREEZING LEVEL FT MSL	LOCATION

THUNDERSTORMS		TURBULENCE			ICING				PRECIPITATION				
MWA/WW NO.		CAT ADVISORY Z			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%		SVR			MOD				HVY				
NUMEROUS - MORE THAN 45%		EXTREME			SVR				SHWRS				
HAIL, SVR., TURB., SEVERE, ICING, PRECIPITATION AND LIGHTNING EXPECTED IN AND NEAR TSTMS.		LEVELS			LEVELS				FRZG				
LOCATION		LOCATION			LOCATION				LOCATION				

PART III - TERMINAL FORECASTS

AIRDROME	CLOUD LAYERS	VSBY/WEA	SFC WIND	ALTIMETER	VALID TIME
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z
DEST/ALTN				INS	Z TO Z

PART IV - COMMENTS/REMARKS

BRIEFED ON LATEST RCR FOR DESTN AND ALTN ☐ YES ☐ NOT AVAILABLE	REQUEST PIREP AT

PART V - BRIEFING RECORD

WEA BRIEFED Z	FLIMSY BRIEFING NO.	FORECASTER'S SIGNATURE OR INITIALS		
VOID TIME Z	EXTENDED TO Z	WEA REBRIEFED AT Z	FORECASTER'S INIT	NAME OF PERSON RECEIVING BRIEFING

DD Form 175-1, FEB 87

Figure 26: THE DD-175-1

Sg 7, fr 9
Comments/Remarks (Part IV)

4. Comments/remarks—can include

   a. Latest braking action code

   b. PIREPs

   c. Latest METAR of first destination

   d. Any significant data not covered elsewhere, i.e., SIGMETs/AIRMETs/warnings, low-level windshear, and runway conditions

5. Briefing record

Sg 7, fr 10
Briefing Record (Part V)

   a. Actual time of brief

   b. Flimsy Briefing No. (2-digit month code followed by sequential number of this briefing)

   c. Signature of forecaster

   d. Void time: 30 minutes after ETD time

   e. Extensions: new time based on a new ETD

   f. Forecaster's initials and name of the person being briefed

VIII. Enroute procedures **1.1.1.9.1**

Sg 8, fr 3
Lesson Organization

? Once you are airborne, where can you get current weather information?

ANSWER:
1. Pilot-to-Metro facilities
2. Flight Watch facilities (EFAS)
3. Flight Service Stations
4. ARTCC (center)
5. Transcribed Weather Broadcasts

A. Sources of in-flight weather information

Sg 8, fr 4
In-Flight Weather Information Sources

NOTE: The sources below are listed in the order in which they should be used.

1. Pilot-to-Metro Service (PMSV)

   a. Operated out of NASs, MCASs, and USAF bases—call name example: “Kingsville Metro” or “Metro”

   b. Pilots can directly access weather forecasters; however, check FLIP Flight Information Handbook for specific availability times and/or locations

2. Enroute Flight Advisory Service (EFAS)

   a. Operated by FAA on VHF frequencies—call name example: “San Antonio Flight Watch” or “Flight Watch”

   b. Provides updated enroute weather information

3. Flight Service Station (FSS)

    a. Operated by FAA—call name example: “Houston Radio”

    b. Provides enroute weather information as part of its service

        NOTE: Operators are qualified weather "briefers," not forecasters.

4. Air Route Traffic Control Center (ARTCC)

    a. Can provide weather information and updating as requested, but weather dissemination not primary service

    b. Can provide real-time weather avoidance assistance through use of current ATC radar and weather radar

    c. Do have forecasters available

5. Hazardous In-flight Weather Advisory Service (HIWAS)

    a. Broadcasts continuously over selected VOR stations

    b. Contains summary of any AIRMETs, SIGMETs, convective SIGMETs, CWAs and PIREPs

6. Automated Weather Observation System (AWOS)

    a. AWOS is a real-time system consisting of various sensors, a processor, a computer-generated voice subsystem, and transmitter to broadcast local minute-by-minute weather directly to the aircraft

7. Automatic Terminal Information Service (ATIS)

   a. ATIS broadcasts are recorded, and the pilot should notify controllers that he has received the broadcast by repeating the alphabetical code word appended to the broadcast. Example: "INFORMATION ECHO RECEIVED"

   b. When the pilot acknowledges that he has received the ATIS broadcast, controllers may omit those items contained on the broadcast if they are current

   c. The absence of a sky condition/ceiling and/or visibility on ATIS indicates a sky condition ceiling of 5,000 ft or above and visibility of 5 miles or more

B. Pilot weather reports (PIREPs) **1.1.1.11.3, 1.1.1.11.3.1**

Sg 8, fr 5
PIREPs

1. Issued by pilot to ATC or weather disseminating agencies (PMSV, EFAS, FSS, etc.)

2. Reports filed when

   a. Requested

   b. Unusual and unforecast weather is encountered

   c. Weather conditions on an IFR approach differ from latest observation

   d. Missed approach is executed due to weather

   e. Hazardous or potentially hazardous weather is encountered (windshear, microburst, icing, severe turbulence, etc.)

3. Relay time-critical information directly to ATC

4. All PIREPs can be given to METRO, Flight Watch, or other weather dissemination agencies on the frequency of the outlet closest to aircraft position (see Flight Information Handbook and Enroute Supplement)

5. Format: available in FLIP Flight Information Handbook

IX. Post-instructional activities: students with specific questions will be directed to the following resources as appropriate

A. Meteorology Lesson Guides

B. NAVAIR 00-8OU-24, Meteorology for Naval Aviators

C. CNAT P-303, Meteorological Theory Workbook I

D. CNAT P-304, Meteorology Flight Planning Workbook II

E. DOD FLIP, Flight Information Handbook, Section C

SUMMARY

Sg 10, fr 2
Review Menu

This lesson has focused on the following topics:

* Overview of the test
* Fronts and resulting winds
* Meteorological hazards
* Weather minimums
* Weather charts
* Printed forecasts
* Flight weather briefing DD-175-1
* Enroute procedures

CONCLUSION

Having reviewed the material from the previous lessons, you are now prepared to take the exam for this block of instruction.