

**NAVAL AIR TRAINING COMMAND**



**NAS CORPUS CHRISTI, TEXAS**

**CNATRA P-1246 (Rev. 04-10)**

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# **FLIGHT SUPPORT LESSON GUIDE**



## **METEOROLOGY T-45 STRIKE**

**2010**



**DEPARTMENT OF THE NAVY**

CHIEF OF NAVAL AIR TRAINING  
CNATRA  
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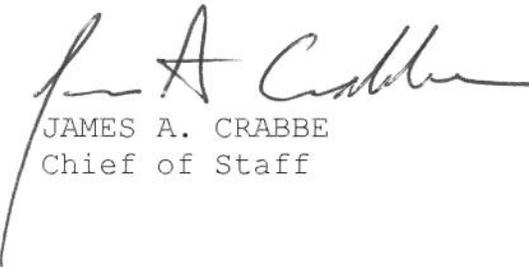
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Subj: FLIGHT SUPPORT LESSON GUIDE, METEOROLOGY T-45 STRIKE

1. CNATRA P-1246 (Rev. 04-10) PAT, "Flight Support Lesson Guide, Meteorology T-45 Strike" is issued for information, standardization of instruction, and guidance for all flight instructors and student aviators within the Naval Air Training Command.
2. This publication shall be used as an explanatory aid to support the T-45 Strike Curricula. It will be the authority for the execution of all flight procedures and maneuvers herein contained.
3. Recommendations for changes shall be submitted via CNATRA TCR form 1550/19 in accordance with CNATRAININST 1550.6E.
4. CNATRA P-1246 (01-04) PAT is hereby cancelled and superseded.

  
JAMES A. CRABBE  
Chief of Staff

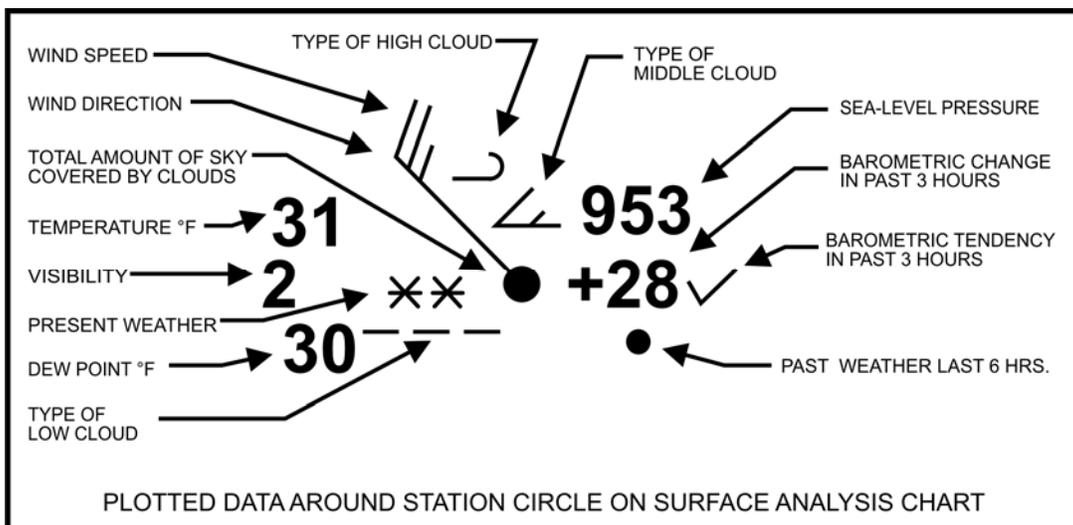
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CNATRA N7 (5) Plus Original  
COMTRAWING ONE (200)  
COMTRAWING TWO (200)

# FLIGHT SUPPORT LESSON GUIDE

FOR

## METEOROLOGY T-45 STRIKE

P-1246





## INTERIM CHANGE SUMMARY

*The following Changes have been previously incorporated in this manual:*

CHANGE NUMBER	REMARKS/PURPOSE

*The following interim Changes have been incorporated in this Change/Revision:*

INTERIM CHANGE NUMBER	REMARKS/PURPOSE	ENTERED BY	DATE

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**CHAPTER ONE**  
**REVIEW OF BASIC METEOROLOGICAL PRINCIPLES**

**100. INTRODUCTION – N/A**

**COURSE/STAGE:**

- Meteorology

**LESSON TITLE:**

- Review of Basic Meteorological Principles

**LESSON IDENTIFIER:**

- Metro-01

**LEARNING ENVIRONMENT:**

- CAI

**ALLOTTED LESSON TIME:**

- 1.0 hr

**TRAINING AIDS:**

1. Meteorology CD-ROM
2. Figures

**STUDY RESOURCES:**

1. Meteorology for Naval Aviators, NAVAIR 00-80U-24
2. Meteorological Theory Workbook I, CNATRA P-303

**LESSON PREPARATION:**

- N/A

**REINFORCEMENT:**

- N/A

**EXAMINATION:**

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

**101. LESSON OBJECTIVES**

1. Recall definition of frontal systems
2. Recall weather associated with frontal systems
3. Recall reasons for and effects of direction and velocity of surface winds
4. Recall meanings of severe weather hazards
5. Recall hazards associated with thunderstorms
6. Remember meaning of microbursts
7. Recall causes and dangers of ice formation
8. Recall causes and dangers of fog formation
9. Recall features and hazardous conditions associated with jet streams
10. Remember meaning of clear air turbulence (CAT)
11. Recall causes and hazards of wake turbulence phenomena

**102. 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.”

**103. 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:

1. Meteorological definitions (in Lesson Guide only)
2. Frontal systems and resulting winds

**1-2 REVIEW OF BASIC METEOROLOGICAL PRINCIPLES**

3. Meteorological phenomena and hazards
  - a. Thunderstorms
  - b. Microbursts
  - c. Structural ice
  - d. Fog
  - e. Jet stream
  - f. Clear air turbulence (CAT)
  - g. Wake turbulence

#### 104. PRESENTATION

##### Meteorological Definitions

1. Altitude
  - a. Indicated altitude: altitude read on an altimeter with current barometric setting
  - b. Calibrated altitude: indicated altitude corrected for instrument error
  - c. True altitude (QNH): height above mean sea level (MSL)
  - d. Absolute altitude: height above terrain (AGL)
  - e. 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.

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

**COMMON ERROR:** Confusing pressure altitude with density altitude.

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

- a. In the northern hemisphere, winds flow clockwise around areas of high pressure and counterclockwise around areas of low pressure
- b. In the southern hemisphere, winds flow counterclockwise around areas of high pressure and clockwise around areas of low pressure

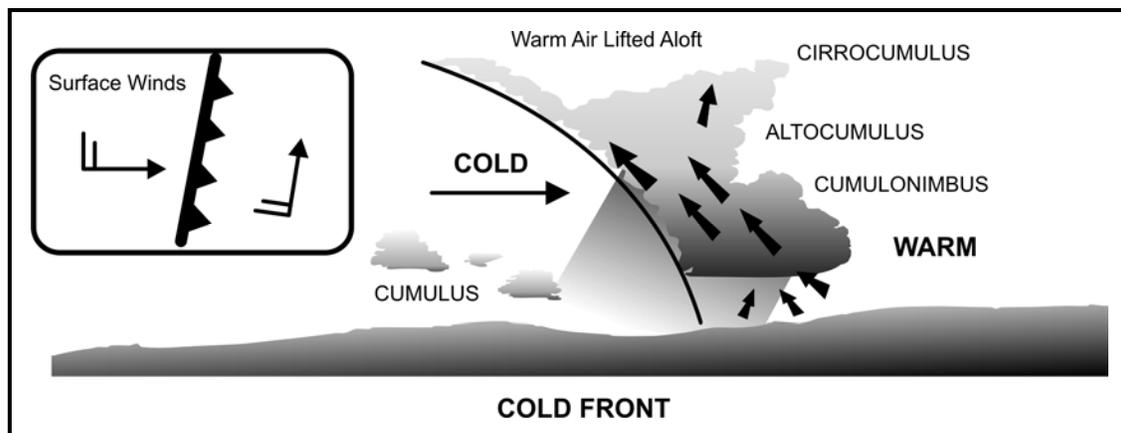
#### NOTE

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

3. Frontal system: discontinuity formed between two contrasting air masses of different characteristics
  - a. Fronts affect ground speed, wind correction, and other planning factors
  - b. Several associated weather hazards

### Fronts and Resulting Winds

1. Cold front

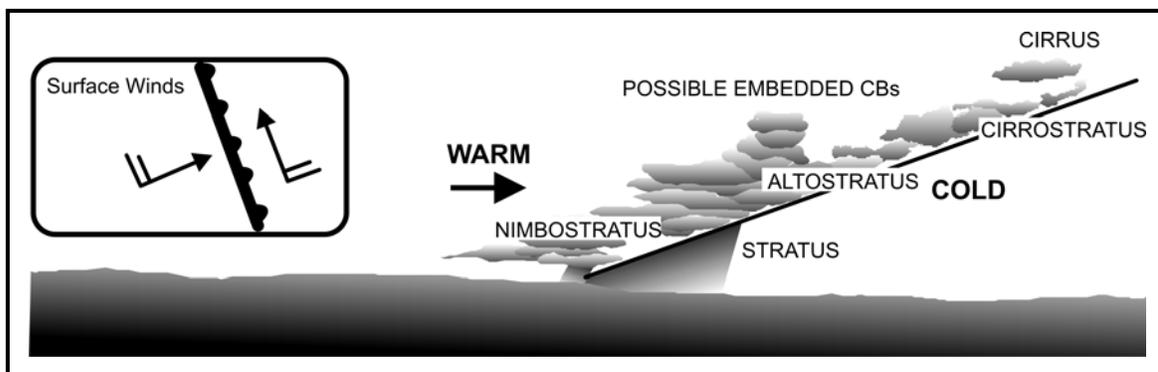


**Figure 1-1 Cold Front**

- a. Characteristics
  - i. Predominantly cumuliform-type clouds
  - ii. Thunderstorms and occasional squall lines (seasonal)
  - iii. Turbulence and unstable air

- iv. Strong, gusty winds
  - v. Showery precipitation
  - vi. Clearing skies and good visibility after frontal passage
- b. Wind changes
- i. Before passage, wind flows parallel to (along) the front
  - ii. After passage, wind flows perpendicular to front
    - (a). Follows prevailing wind in same direction as front movement (perpendicular to front)
    - (b). Generally stronger due to steeper pressure gradient of colder airmass

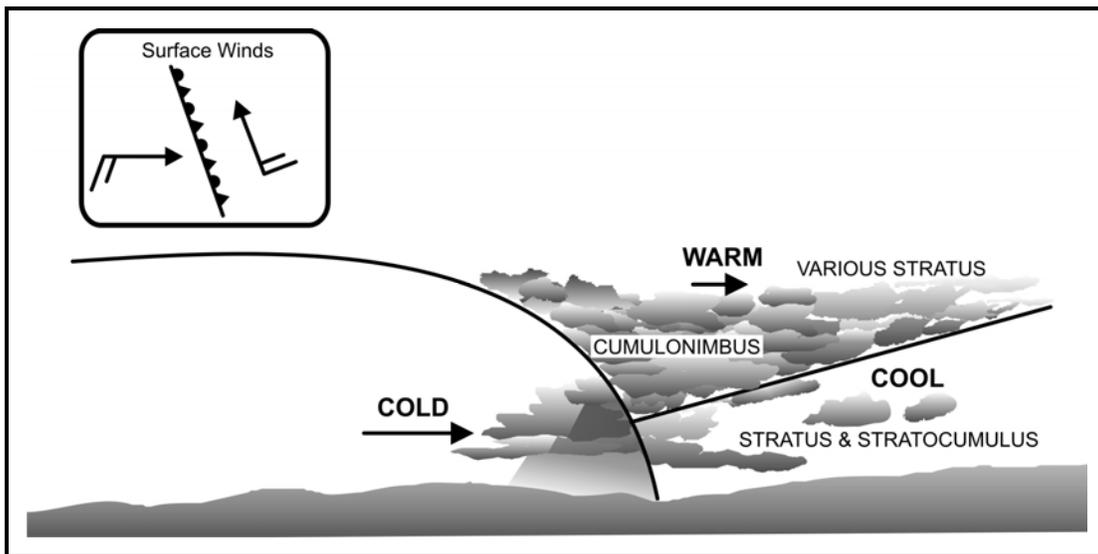
2. Warm front



**Figure 1-2 Warm Front**

- a. Characteristics
- i. Predominantly cirriform- and stratiform-type clouds
  - ii. Predominantly stable air and little turbulence
  - iii. Continuous precipitation ahead of front in wide area
  - iv. Poor visibility from haze or fog
  - v. Icing conditions
- b. Wind changes

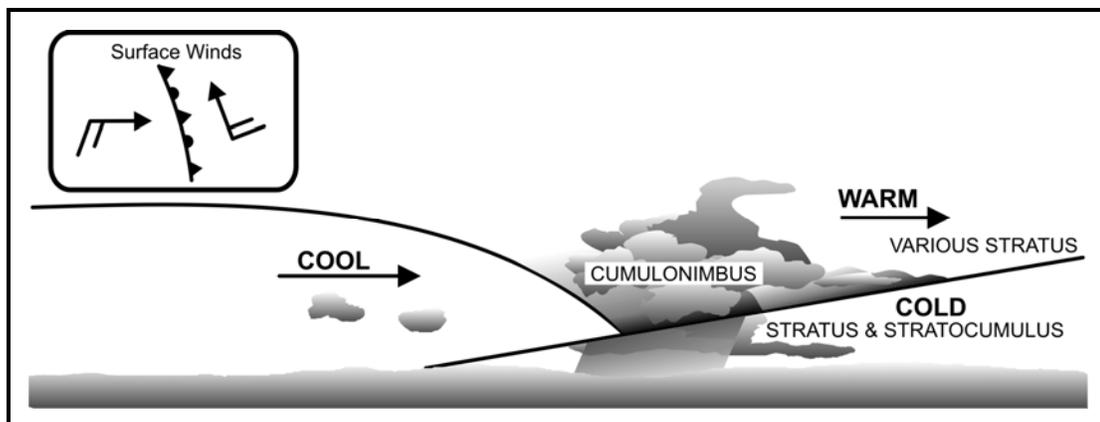
- i. Before passage, wind flows parallel to front from higher to lower pressure
  - ii. After passage, wind flows perpendicular to front
3. Stationary front
- a. Characteristics: same as warm front, only less intense—can persist in an area for many days
  - b. Winds flow parallel to the front, but in opposite direction to each other—no prevailing wind to push front in any direction
4. Occluded fronts: form when faster-moving front overtakes a slower front
- a. Cold front occlusion



**Figure 1-3 Cold Front Occlusion**

- i. Characteristics
  - (a). Rain or freezing rain
  - (b). Poor visibility from fog and low ceilings
  - (c). Embedded thunderstorms
- ii. Formation

- (a). Forms when cold front contains air colder than the airmasses on both sides of the warm front and slides under the entire warm front
  - (b). Produces warm and cold front systems aloft, with the cold front extending to the surface
  - (c). Forms predominantly over land
- iii. Wind changes
- (a). Before passage, wind flows parallel to the front from higher to lower pressure
  - (b). After passage of overtaking cold front, wind flows perpendicular to overtaking front
- b. Warm front occlusion



**Figure 1-4 Warm Front Occlusion**

- i. Characteristics
  - (a). Rain or freezing rain
  - (b). Poor visibility from fog and low ceilings
  - (c). Embedded thunderstorms
- ii. Formation

- (a). 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
- (b). Produces warm and cold front systems aloft, with the warm front extending to the surface
- (c). Form predominantly over water
- iii. Wind changes
  - (a). Before passage, wind flows parallel to the front from higher to lower pressure
  - (b). Behind warm front, wind flows perpendicular to the front, following prevailing wind in same direction as front

### **Meteorological Phenomena and Hazards**

#### 1. Thunderstorms

##### a. Types

##### i. Airmass thunderstorms

##### (a). Convective airmass

- (1). Generated by solar convection within unstable, moist airmass
- (2). Generally isolated and scattered over wide area

##### (b). Orographic airmass

- (1). Generated when unstable and moist airmass is lifted over hills or mountains
- (2). Usually scattered among individual mountain peaks, but can cover larger areas

##### ii. Frontal thunderstorms

##### (a). Cold front

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

- (2). Usually narrow bands—50 to 100 miles along the front
- (3). Often develop into uninterrupted lines that are difficult to circumnavigate
- (b). Warm front
  - (1). Generated when a warm and moist airmass is lifted (slides over) a cold airmass
  - (2). Less common and less violent than cold front due to more stability and less lifting force within the airmass
  - (3). Often embedded or obscured in stratiform clouds, making them difficult to see and avoid
- iii. Squall line: band or line of severe thunderstorms
  - (a). Usually associated with fast-moving cold fronts
    - (1). Usually form 50 to 300 miles ahead of the front—but can also form in most unstable airmasses
    - (2). Generally caused by upper airflow disturbance
    - (3). Build rapidly and are most severe in late afternoon and early evening
  - (b). Uninterrupted lines of cells often too long and wide to avoid--can be too high to fly over (more than 55,000 ft)
  - (c). Characterized by severe steady-state thunderstorms or “supercells” that can contain tornadoes, hail, and other severe hazards to aviation
- b. Thunderstorm hazards
  - i. Turbulence
    - (a). Hazardous turbulence present in all thunderstorms
      - (1). Up and down drafts can obtain speeds of 200 ft per second
      - (2). Up drafts are usually stronger than down drafts
    - (b). Aircraft control difficult to impossible

- (c). Can be severe enough to cause structural damage or failure

**NOTE**

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

ii. Hail

- (a). Can occur in any thunderstorm at all altitudes
- (b). Can occur beneath or up to 20 miles in front of the anvil top of large thunderstorms--denoted by a distinct shade of blue
  - (1). Under the anvil is particularly hazardous
  - (2). Can be found anywhere around the storm (in clear air)
- (c). Can cause severe structural damage

**NOTE**

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

iii. Tornadoes

- (a). Occur most often with steady-state thunderstorms associated with cold fronts or squall lines
- (b). Very intense local phenomena with windshears clocked at more than 26,000 fpm (260 kts)
- (c). Can be embedded in thunderstorm and thus invisible to pilot
- (d). 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.

iv. Lightning

- (a). Can cause temporary or permanent loss of vision

- (b.) Can puncture aircraft skin
- (c.) Can damage electronic equipment and compass
- (d.) Probability of strikes to aircraft
  - (1). Probability is highest near the tops of thunderstorms (near the anvil region), decreasing rapidly with altitude
  - (2). Highly electrified clouds can be advected many miles from the parent storm

**NOTE**

Avoid any clouds downwind of thunderstorms.

- (3). 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.

- (4). There is a greater probability of lightning strikes to aircraft during storm's decaying stages
- (5). 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)
- (6). Most lightning strikes to aircraft are triggered by the aircraft itself

**NOTE**

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

- c. 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.

- i. Before penetration
  - (a). Plan a course to take you through the storm in a minimum amount of time, and do not alter it
  - (b). Penetrate at an altitude where the outside air temperature (OAT) is colder than -15 degrees C or warmer than +15 degrees C
  - (c). HALT
    - (1). Heat
      - Pitot heat switch - CHECK ON
    - (2). 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)
    - (3). Light
      - Turn all cockpit lights to bright including floodlights

(4). 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

## ii. Upon penetration

- (a). 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
- (b). Keep eyes on flight instrumentation and avoid looking outside because lightning flashes can cause temporary or permanent loss of vision
- (c). 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
- (d). Be prepared for turbulence, hail, rain, and pitot static failure due to icing

## 2. Microbursts

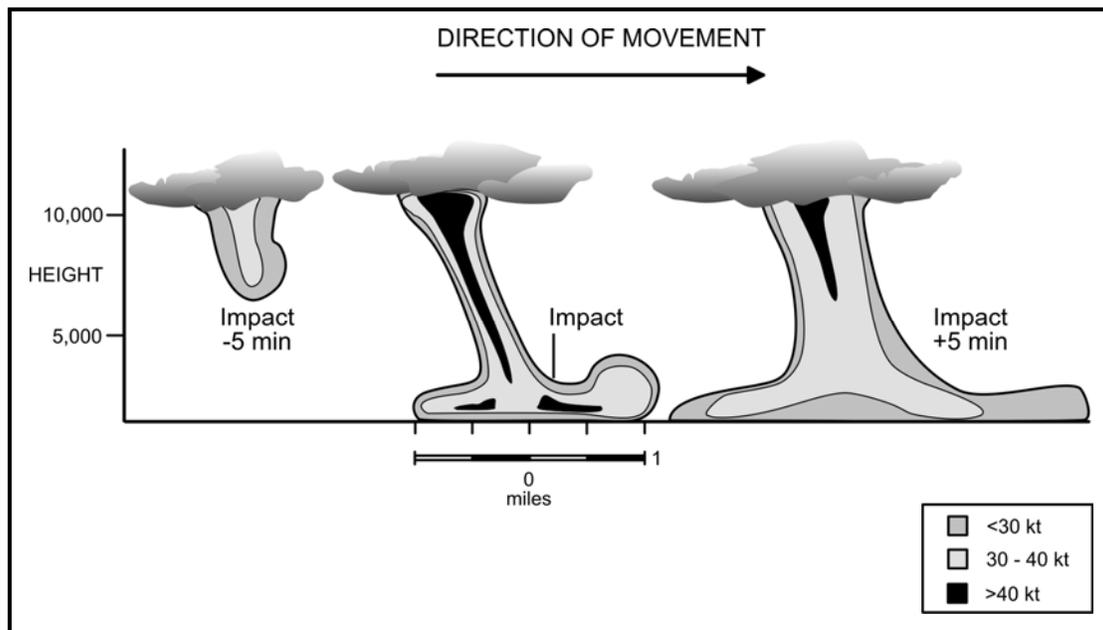
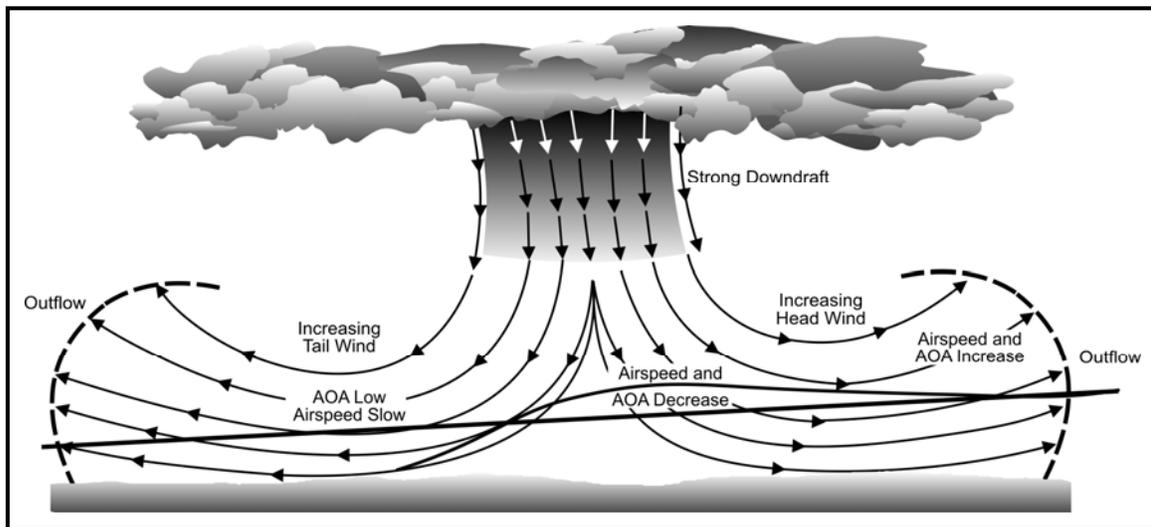


Figure 1-5 Duration Characteristics of Microbursts

- a. Description and composition
  - i. Intense and localized downburst of air that descends from a thunderstorm and, upon reaching ground, spreads horizontally
  - ii. Usually found beneath thunderstorms with visible rain or virga
  - iii. 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 1-6 Microbursts**

- iv. Intense horizontal outflows at low altitudes result in extreme head wind to tail wind differentials that have been recorded in excess of 200 kts
  - v. Experience has shown that microbursts are not isolated, but usually occur in groups
- b. Effects: a microburst approach scenario

#### NOTE

Microbursts can be encountered in the head wind, down-draft, 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.

- i. Initial entry of aircraft into microburst (head wind and updraft)
  - (a). Conditions: airspeed and AOA increase, producing more lift and causing the aircraft to pitch nose high and to go high
  - (b). Indications: AOA indexer displays “slow” and glideslope shows high
  - (c). Normal pilot response: reduces power and AOA
  - (d). Effects: stops the climb and reestablishes descent rate and on-speed AOA
- ii. Outflow area prior to microburst core (head wind shifting to downdraft)
  - (a). Conditions
    - (1). Airspeed and AOA decrease due to shift in airmass movement, reducing lift
    - (2). Descent rate increases
  - (b). Indications: AOA indexer “fast,” VSI shows increased rate of descent, and airspeed begins to fall
  - (c). Normal pilot response
    - (1). Raises nose attitude to correct for “fast”
    - (2). Delays power application due to continued high indication
  - (d). Effects: energy loss is undetected
- iii. Microburst core (predominantly downdraft)
  - (a). Conditions
    - (1). Airspeed continues to drop and AOA continues to decrease due to continuing shift in airmass movement
    - (2). Descent rate continues to accelerate
  - (b). Indications
    - (1). High on glideslope and correcting
    - (2). “Fast” despite continued back stick

- (c). Pilot response: continues to raise nose to arrest descent rate and to achieve on-glide slope and on-speed with minimum use of power
  - (d). Effects: continues unarrested descent in “fast” condition despite high nose attitude—pilot response is insufficient to keep up with shift of wind direction
- iv. Outflow area beyond to microburst core (predominantly tail wind)
- (a). Conditions
    - (1). Rapid wind shift from downdraft to tail wind causes sudden decrease in airspeed
    - (2). Aircraft “blows through” glide slope in a nose-high attitude
  - (b). Indications
    - (1). 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”
    - (2). Airspeed continues to decrease
    - (3). Excessive descent rate
  - (c). 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
  - (d). 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)

<b>MICROBURST WINDSHEAR PROBABILITY GUIDELINES</b>	
<b>KEY:</b> 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
<b>Presence of convective weather near intended flightpath:</b>	
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
<b>Onboard windshear-detection system alert (reported or observed) .....</b>	<b>High</b>
<b>Pirp of airspeed loss or gain</b>	
15 knots or greater .....	High
Less than 15 knots .....	Medium
<b>LLWAS alert or wind velocity change</b>	
20 knots or greater .....	High
Less than 20 knots .....	Medium
<b>Forecast of convective weather .....</b>	<b>Low</b>
<p><small>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.</small></p> <p><small>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.</small></p>	

**Figure 1-7 Microburst Windshear Probability Guidelines**

- c. Indications of microburst activity
  - i. Blowing dust, dust devils, and gust fronts (downbursts will occasionally generate distinctive circular dust patterns)
  - ii. Thunderstorms in vicinity with visible areas of intense downdrafts indicated by rain or virga
  - iii. Sudden and unexplained increase in airspeed as noted on airspeed indicator accompanied by increased AOA—indicative of rolling outflow
  - iv. Sudden increase in rate of descent accompanied by a lower AOA--indicative of entry into microburst core
  - v. Extreme variations in wind velocity and direction in short time
  - vi. Significant differences between winds at 1,500 to 2,000 ft AGL surface winds

- vii. 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.

- viii. 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.

- d. Avoidance
  - i. Takeoff: delay departure
  - ii. Landing: delay approach or use alternate runway/approach or proceed to nearby alternate
- e. Response during landing
  - i. Execute a missed approach immediately—response time is critical
  - ii. Recognize that excess airspeed is necessary to maintain flight beyond core of microburst--don't pull power
  - iii. Report encounter to ATC as soon as possible

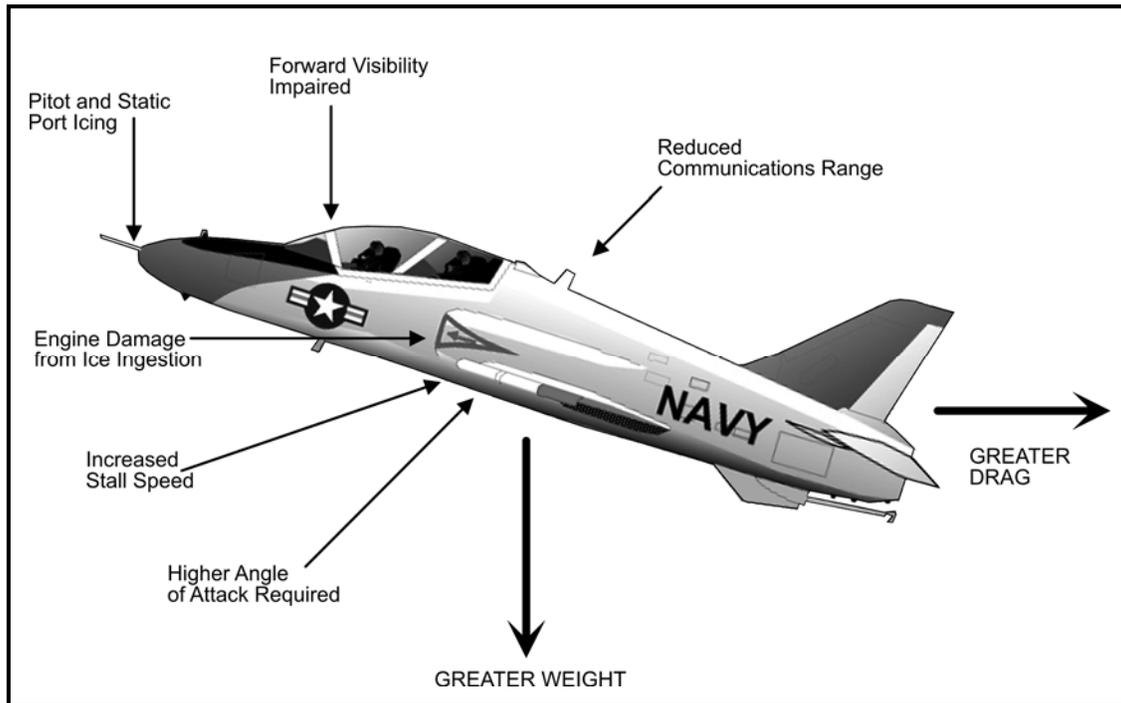
**NOTE**

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.

## 3. Structural ice

**WARNING**

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



**Figure 1-8 Structural Icing**

- a. Conditions of formation
  - i. Visible moisture must be present
  - ii. Occurs most commonly near freezing level.
  - iii. Can form when flying through areas of
    - (a). Supercooled water droplets
    - (b). Freezing rain
    - (c). Wet snow
- b. Types

- i. Clear ice
  - (a). Found predominantly in convective/cumuliform clouds with large water droplets such as in thunderstorms
  - (b). 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.**

- (c). Also formed by freezing rain
- (d). Smooth, clear appearance—very hard and heavy
- (e). Very dangerous
  - (1). Accumulates rapidly
  - (2). Resistant to deicing systems
  - (3). Slow to sublimate or melt in non-icing environment
  - (4). Alters shape of wing--decreases lift, increases drag
- ii. Rime ice
  - (a). Found predominantly in stratus cloud formations
  - (b). Most common between -10 degrees C and -20 degrees C
  - (c). Results from instantaneous freezing of water droplets
  - (d). Opaque and rough appearance
  - (e). Continuous icing in these conditions
  - (f). Tends to erode or blow off quicker than clear ice in non-icing environment
  - (g). Dangerous—alters shape of wing surfaces, decreasing lift and increasing drag
- iii. Mixed Icing

- (a). Forms in mixed atmospheric conditions that contain both clear and rime ice
  - (b). Forms from water droplets of different sizes or when droplets intermingle with snow or ice particles
  - (c). Occurs at high altitudes within thunderstorms
  - (d). Conglomerate appearance, with adverse qualities of both rime and clear ice
- iv. Frost
- (a). Forms on aircraft at night when temperature and dew point are within a few degrees of each other and temperature falls below freezing
  - (b). Can form during a rapid descent from subfreezing temperatures
  - (c). Rough texture greatly inhibits smooth airflow over wing surface, especially when present on leading edge of wing
  - (d). Any disruptions of laminar airflow over wing surface create the effect of a completely new airfoil
  - (e). Reduces lifting surface of the wing and adds drag
- c. Hazards
- i. Increases drag and weight
  - ii. Decreases lift and increases stall speed: level flight requires higher angle of attack (AOA)
  - iii. Effects on thrust production
    - (a). Propeller-driven aircraft
      - (1). Ice destroys smooth airflow over propeller surface, reducing propeller efficiency
      - (2). In some engine designs, induction system icing limits available air, therefore reducing available thrust
    - (b). Jet aircraft: large pieces of ice thrown free by airflow or deicing systems can be ingested by engines, resulting in engine damage or failure

- iv. Other considerations
  - (a). Pitot and static sources can clog, affecting reliability of Mach/airspeed indicator, altimeter, and vertical speed indicator (VSI)
  - (b). Visibility impaired due to windshield icing
  - (c). Engine sensors can clog, resulting in improper throttle and fuel control
  - (d). Radio range reduced
- 4. Fog
  - a. Common conditions when fog can form: temperature and dewpoint must be within 3 degrees C/5 degrees F of each other
  - b. Fog might not form even under conducive conditions
  - c. Types
    - i. Radiation (ground fog): forms in saturated air when the temperature nears dew point and a light breeze is present
      - (a). Usually dissipates or “burns off” 1 to 4 hours after sunrise
      - (b). Wind more than 8 kts prevents or dissipates fog
    - NOTE**

Radiation fog is common to NAS Meridian.
    - ii. Advection: forms when moist air moves over surface cool enough to reduce temperature to near dew point (more frequent in winter than summer)
      - (a). Occurs usually near coastal regions of the southeastern United States, the Gulf Coast, and the Pacific Northwest
      - (b). Intensity increases rather than lessens with wind
    - NOTE**

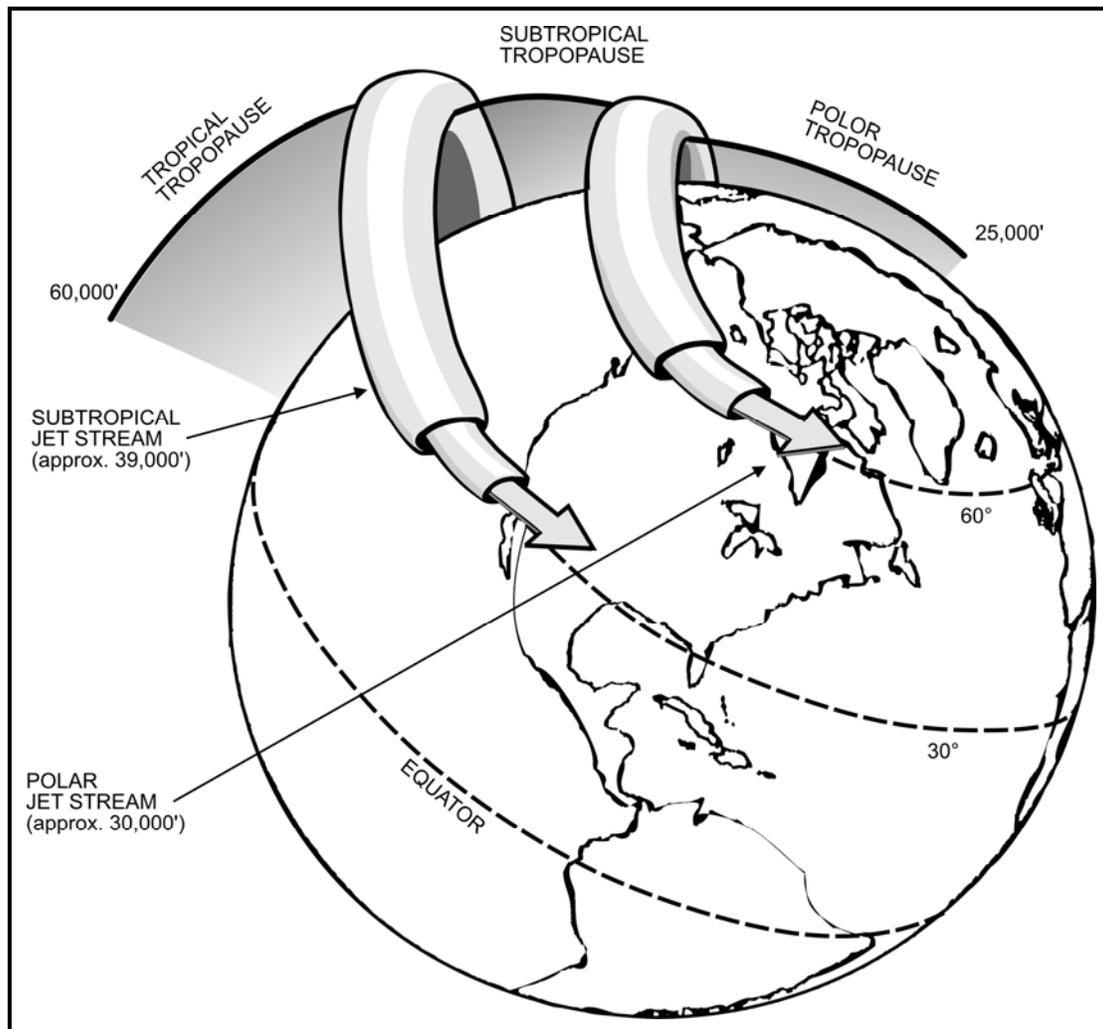
Advection fog is common to NAS Kingsville.
    - iii. Precipitation: formed by rain or drizzle evaporating and adding moisture to air
      - (a). Usually associated with warm front where warm rain falls into colder air

- (b). Can form quickly and cover a wide area
    - (c). Can be very dense and can continue for several days
  - iv. Upslope (closely related to advection fog)
    - (a). Occurs along windward slopes of mountain ranges when saturated air ascends up a mountain slope and condenses
    - (b). The wider the spread between temperature and dew point at the base of the mountain, the farther up the slope it will form
  - v. Steam—forms when cold air moves over much warmer water, causing intense evaporation and raising dew point to near ambient temperature
  - vi. Ice
    - (a). Formed by ice crystals suspended in air
    - (b). Decreases visibility in bright sunlight
    - (c). Most common in arctic regions
  - d. Hazards
    - i. Low to extremely low visibility
    - ii. Can form quickly
    - iii. Can affect a widespread area
- 5. Jet stream
  - a. Forms in tropopause - the boundary between the troposphere and the stratosphere
    - i. Height varies from 65,000 ft at the equator to 20,000 ft or less at the poles
    - ii. Tropopause drops by steps between arctic and polar airmasses and another drop between the polar and tropical airmasses
    - iii. Between the polar and arctic "layers," the Polar Front Jet Stream forms; between the polar and tropical "layers," the Subtropical Jet Stream is formed
      - (a). Polar jet stream is the primary North American jet stream

- (b). 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.



**Figure 1-9 Polar and Subtropical Jet Streams**

- b. Jet stream characteristics
  - i. They are a narrow, shallow band of strong westerly winds of 50 kts or more
    - (a). Strength of the jet stream is stronger in the winter than in the summer

- (b). Wind speeds up to 300 kts have been recorded
  - (1). Summer: average 75-100 kts
  - (2). Winter: average 150-225 kts

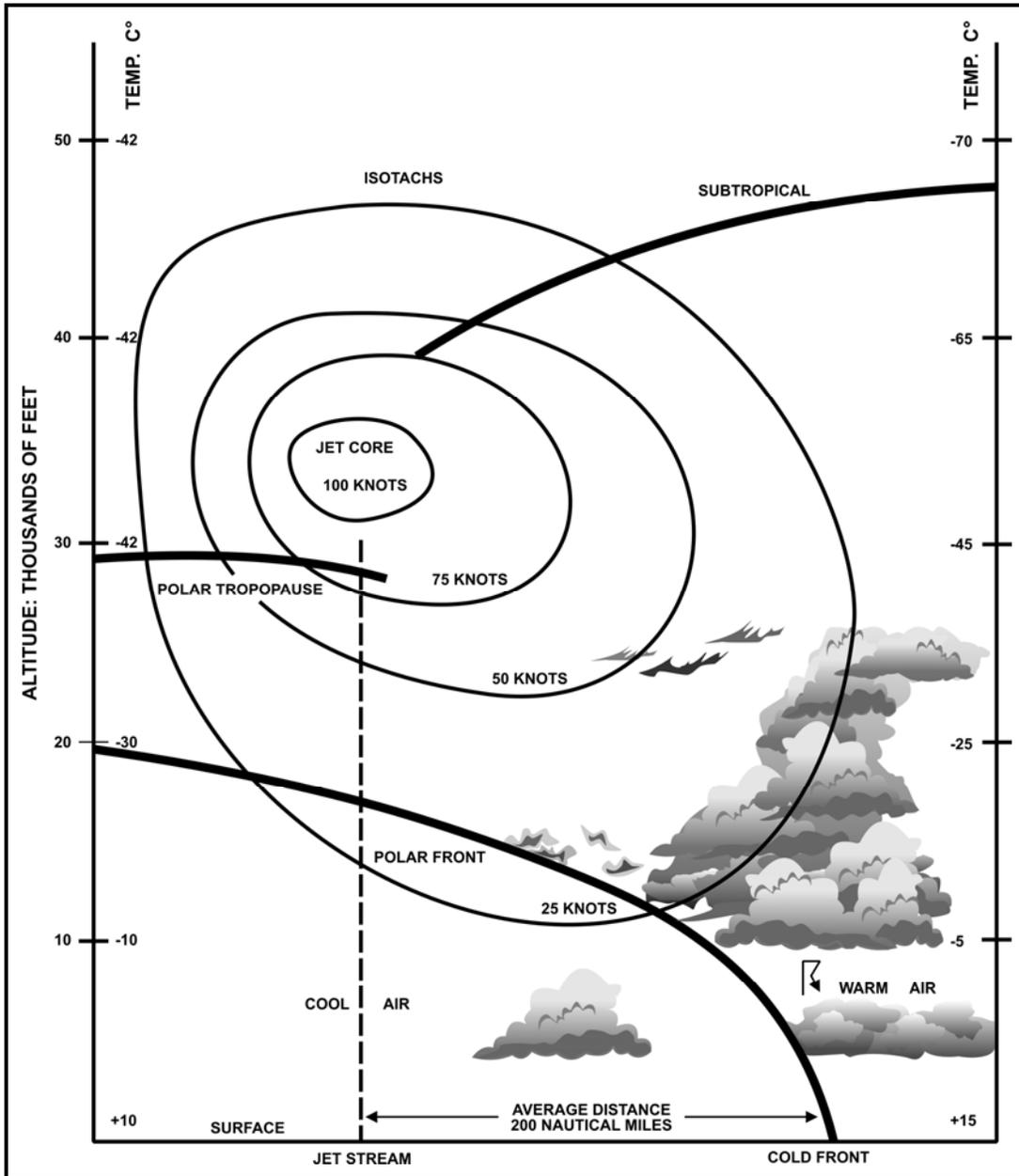


Figure 1-10 Jet Stream Profile

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

- (a). Jet streams in northern hemisphere are matched in southern hemisphere
- (b). They are stronger in some areas than others
- (c). They rarely encircle entire globe as a continuous river of wind
  - (1). Most frequently found in 1,000- to 3,000-mile segments
  - (2). 100- to 400-mile width
  - (3). 3,000 to 7,000 ft in depth
- (d). Mean position of Polar Jet Stream shifts south in winter and north in summer with polar front
- (e). As polar front moves south, jet stream cores rise to higher altitudes and average speed increases

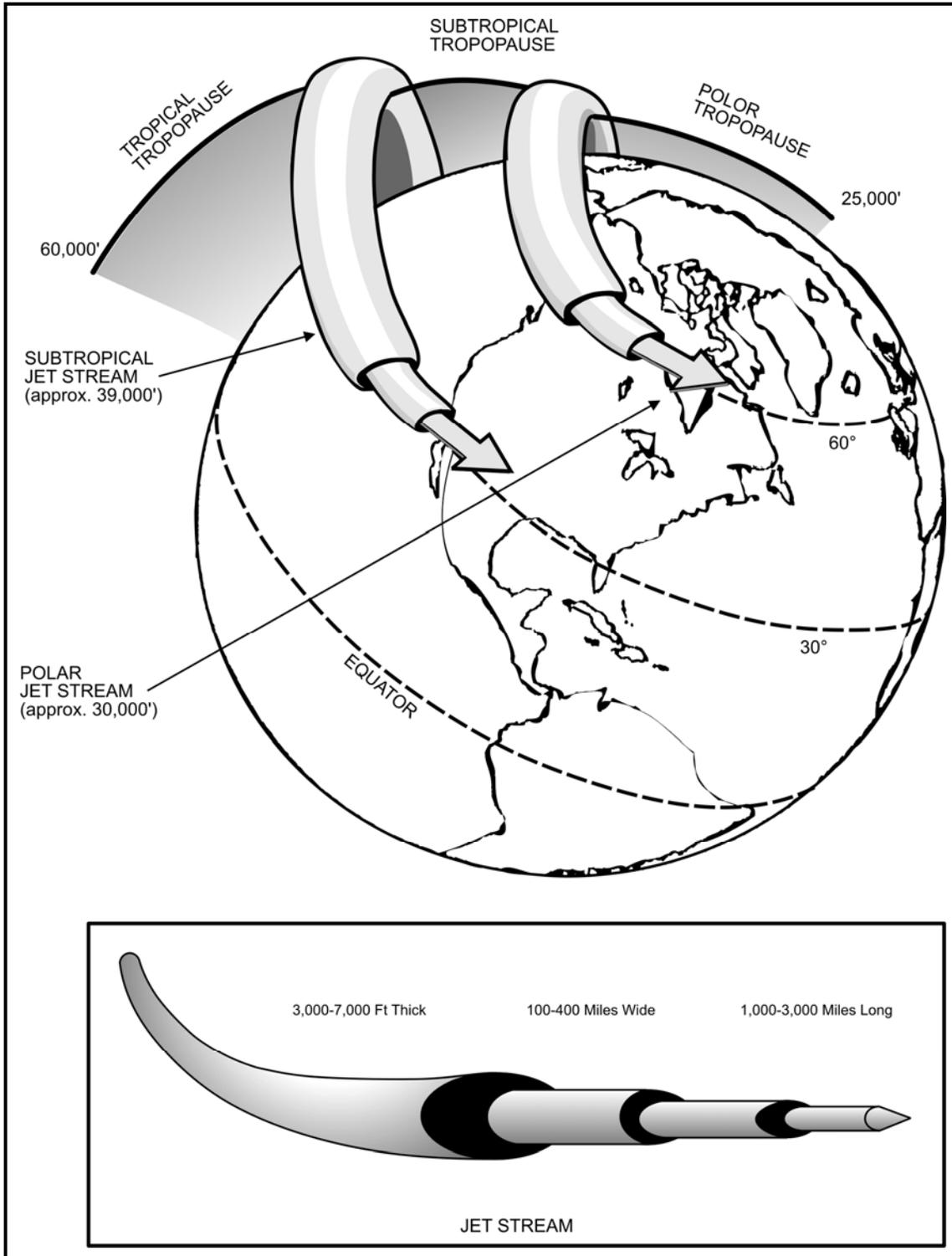


Figure 1-11 Polar Jet Stream

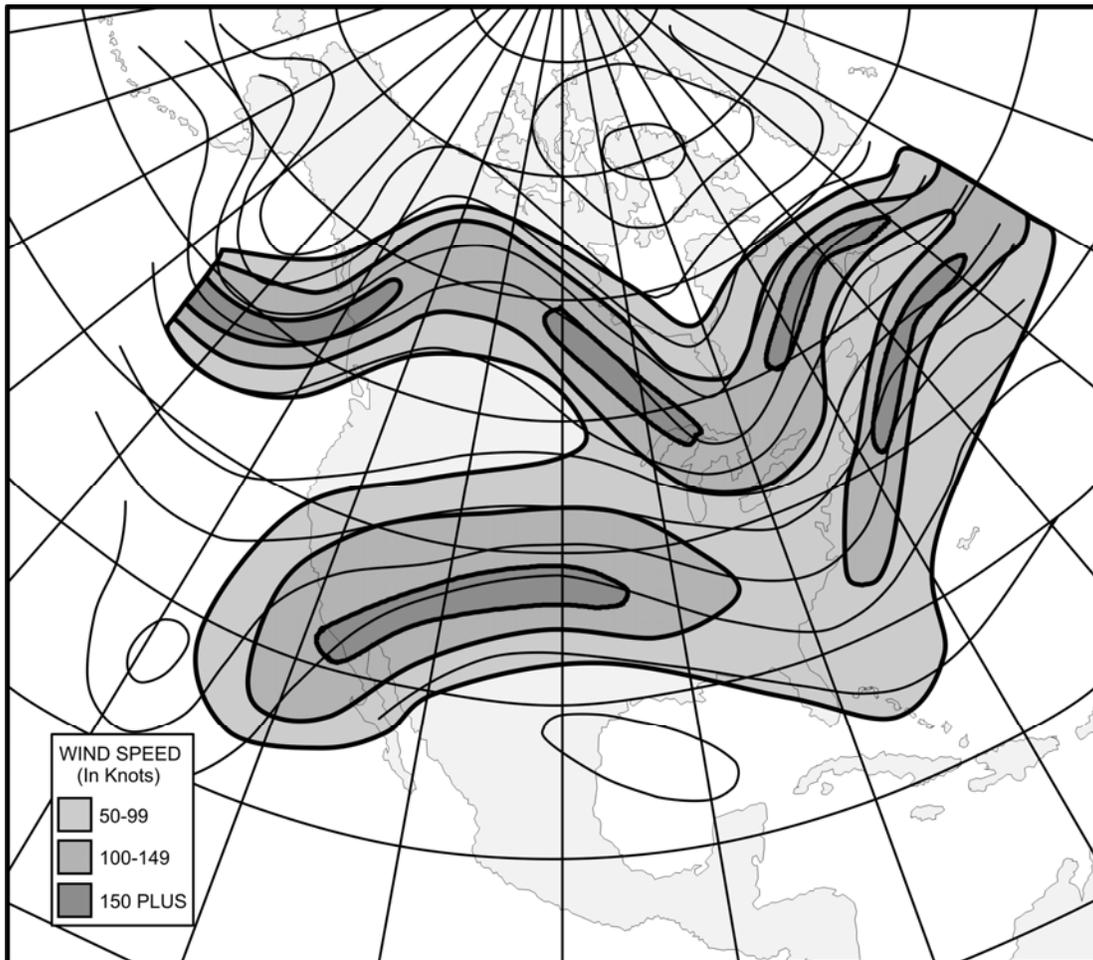
**NOTE**

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.

- iii. There are as many jet stream occurrences in the summer as in the winter
- iv. 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.



**Figure 1-12 Multiple Jet Streams**

- c. Flying the jet stream
  - i. Flying from west to east, speed and range can be greatly increased
  - ii. Flying east to west decreases range and ground speed
    - If caught in adverse wind flow, climb or descend to a colder airmass or take a more northerly track
    - (1). 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.

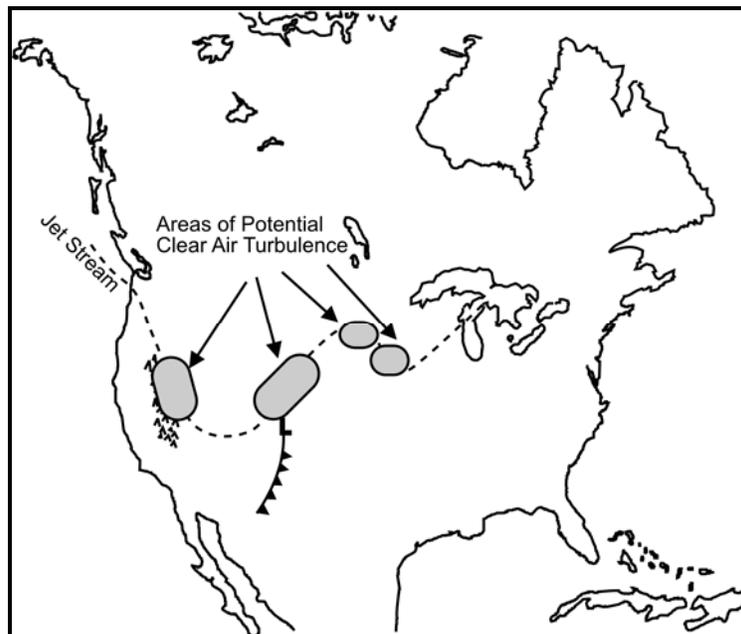
- (2). A decrease of 30 to 40 kts in 1,000 ft above or below the core of maximum winds is not uncommon
- d. Jet Stream Meteorology
  - i. 200-millibar (summer) and 300-millibar (winter) constant pressure charts are analyzed for lines of equal wind speeds (isotachs)
    - (a). Areas of 70 kts or greater are shaded and are equivalent to the horizontal limits of the jet stream
    - (b). Highest winds running through the axis of this area is the core
      - Vertical limits of the highest winds are usually 3,000 to 4,000 ft above and below the jet stream core
  - ii. 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.

- 6. Clear air turbulence (CAT)
  - a. Types

- i. Jet stream CAT
  - (a). CAT external to jet stream
    - (1). Especially severe when jet stream interacts with large mountain range or deep low-pressure system
    - (2). 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
    - (3). Can be anticipated along the jet stream north and northeast of a rapidly deepening low-pressure system
    - (4). Occurs frequently on inside of curve where jet stream turns sharply

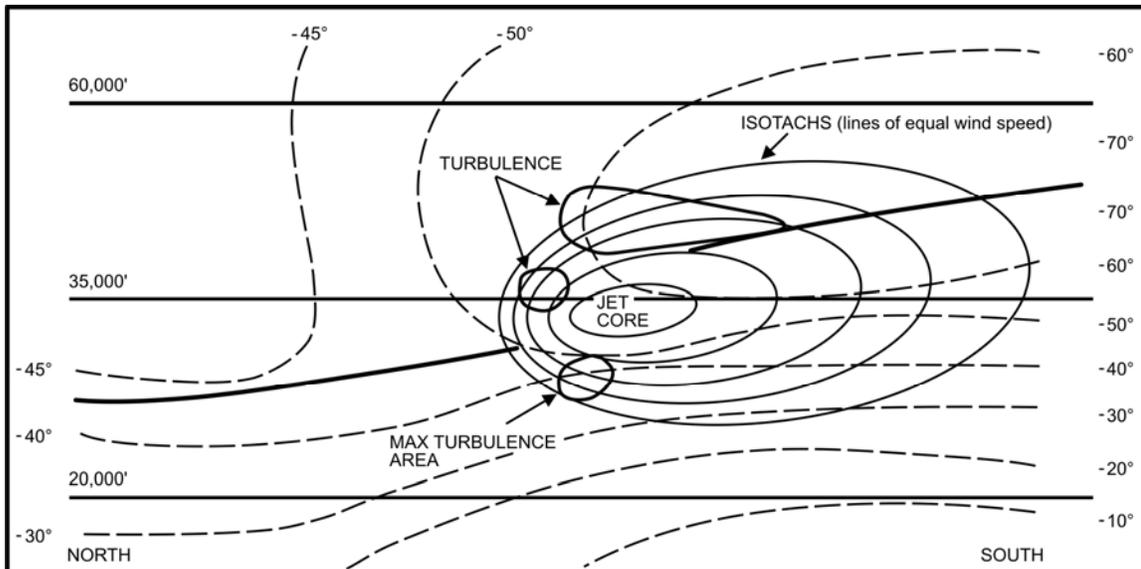


**Figure 1-13 Jet Stream Clear Air Turbulence (CAT)**

- (b). CAT internal to jet stream
  - (1). Can be found most often in areas of rapidly changing wind speeds
  - (2). Common near areas of highest wind velocity within jet stream, on polar side and below core

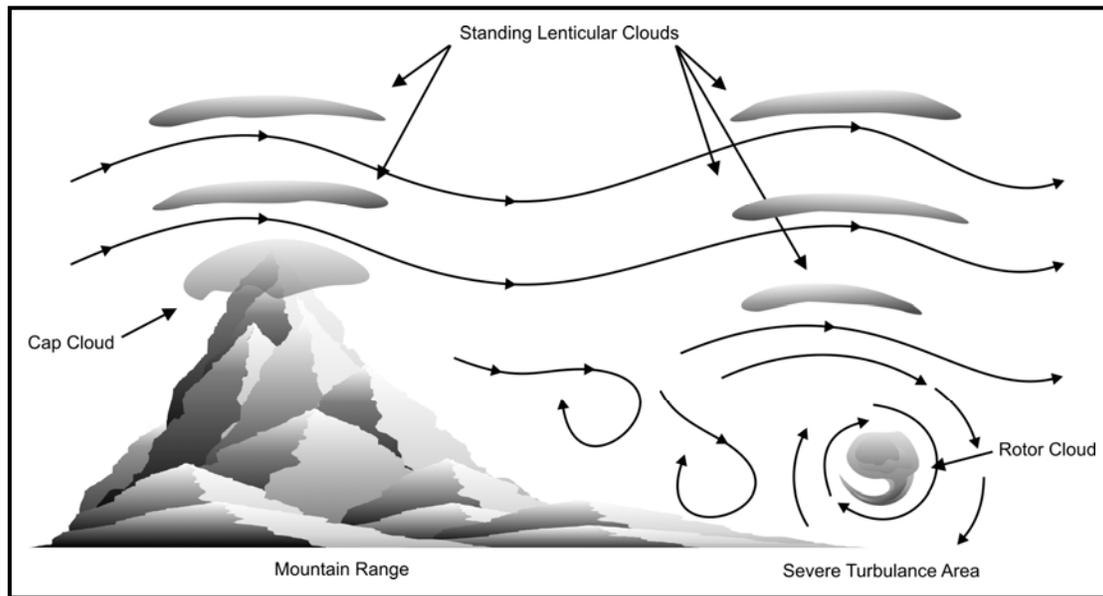
## NOTE

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



**Figure 1-14 Areas of Probable Clear Air Turbulence in Jet Stream**

- ii. 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). Can extend to 5,000 ft above tropopause and to 300 miles or more downwind of range
  - (d). Rotor turbulence very severe below tops of mountains, especially near rotor cloud formation--similar to turbulence associated with thunderstorms but much stronger
  - (e). Can be identified by cap clouds on mountain top or standing lenticular clouds along the crests of the flow if moisture is sufficient
- iii. Other areas: can develop in areas where large differences exist in airmass temperature (e.g., inversions)



**Figure 1-15 Mountain Wave**

- b. Operational considerations
  - i. To prevent structural damage, maintain appropriate speed (250 KIAS)
  - ii. Severe downdrafts require higher terrain clearance minimums
  - iii. Avoid rotor clouds, which have enough strength to literally break aircraft apart

7. Wake turbulence

- a. Characteristics
  - i. 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.

- ii. Heavy and slow aircraft generate greatest vortex strength

**NOTE**

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

- iii. 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
  - iv. Persists several minutes after generating aircraft is out of sight
  - v. Calm or light surface wind can carry vortices into next aircraft's flight path—light quartering tail wind requires maximum caution
- b. Operational considerations
- i. Plan a landing approach above approach path of previous aircraft and land beyond touchdown point
  - ii. Plan to touch down before lift-off point of departing aircraft
  - iii. Plan your lift-off point to occur before lift-off point of previous aircraft and climb out above its flight path
  - iv. Delay your lift-off until beyond touchdown point of landing aircraft

**105. SUMMARY**

- 1. Meteorological definitions
- 2. Weather patterns associated with frontal systems
- 3. Meteorological hazards and their effects on flight and flight planning

**106. 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"!

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**CHAPTER TWO  
METEOROLOGY AND FLIGHT PLANNING**

**200. INTRODUCTION – N/A**

**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

**STUDY RESOURCES:**

- Meteorology Flight Planning Workbook II CNATRA P-304-PAT

**LESSON PREPARATION:**

1. Complete:
  - CAI lesson for Metro-01
2. Read:
  - a. FLIP Flight Information Handbook, Section C
  - b. FLIP General Planning (GP) Chapter 8

**REINFORCEMENT:**

- N/A

**EXAMINATION:**

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

**201. LESSON OBJECTIVES**

1. Determine weather minimums
2. Recall weather minimums required IAW OPNAVINST 3710.7
3. Recall information contained/displayed on weather charts
4. Interpret surface charts (analysis/prognostic)
5. Interpret weather depiction charts
6. Interpret radar summary charts
7. Interpret prognostic charts
8. Recall information contained in forecasts
9. Recall information contained in METARs
10. Recall information contained in terminal aerodrome forecasts
11. Recall information contained in area forecasts
12. Recall information provided in winds aloft forecasts
13. Recall information contained in severe weather forecasts
14. Recall OPNAVINST severe weather restrictions
15. Recall CNATRA severe weather restrictions
16. Recall aviation in-flight weather advisories
17. Recall information provided in AIRMETs
18. Recall information provided in SIGMETs
19. Recall requirements IAW OPNAVINST 3710.7 for obtaining DD-175-1
20. Recall the five sections of the DD-175-1

**2-2 METEOROLOGY AND FLIGHT PLANNING**

21. Interpret data contained on DD-175-1
22. Recall enroute facilities/procedures for weather information and reporting
23. Recall information provided in PIREPs
24. Recall PIREP information to provide controlling agency
25. Recall information provided by flight weather packet
26. Recall information provided by Optimum Path Aircraft Routing System (OPARS)
27. Recall information provided by satellite imagery

## **202. 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.

## **203. 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:

1. Weather minimums
2. Weather charts
3. Printed reports and forecasts
4. Flight weather briefing
5. Enroute procedures
6. Flight weather packets
7. OPARS
8. Satellite imagery

**204. REFRESHER**

Recall the:

1. Characteristics of fronts and the wind changes and flight hazards associated with them
2. Meteorological hazards associated with thunderstorms, including turbulence, hail, squall lines, tornadoes, microbursts, windshear, and lightning
3. Types of structural icing, their formation, and their effects on aircraft performance
4. Hazards associated with fog formation
5. Hazards and probable location of clear air turbulence (CAT)
6. Hazards of wake turbulence and procedures to avoid it

**205. PRESENTATION****Weather Minimums****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 (CA WW).*

1. OPNAVINST 3710.7 destination weather

**NOTE**

Weather at ETA +/-1 hour 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)
  - i. Then for non-precision approaches, alternate must be published minimums plus 300-1
  - ii. Then for precision 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.

DESTINATION WEATHER ETA plus and minus one (1) hour	ALTERNATE WEATHER ETA plus and minus one (1) hour		
0-0 up to but not including published minimums	3,000-3 or better		
Published minimums up to but not including 3,000-3 (single-piloted absolute minimums 200-1/2)	NON- PRECISION	PRECISION	
		ILS	PAR
	* Published minimums plus 300-1	Published minimums plus 200-1/2	*Published minimums plus 200-1/2
3,000-3 or better	No alternate required		
*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.			

**Figure 2-1 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.

- 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, regardless of destination weather.

## PROGRESS CHECK

**Question 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 non-precision approach minimums

## Weather Charts

1. Observed-weather charts
  - a. Surface analysis charts
    - i. Based on hourly observed weather information
    - ii. Provide ready means of locating pressure systems, fronts, and stations with potentially poor weather conditions
    - iii. Disseminated every 3 hrs
    - iv. Symbology

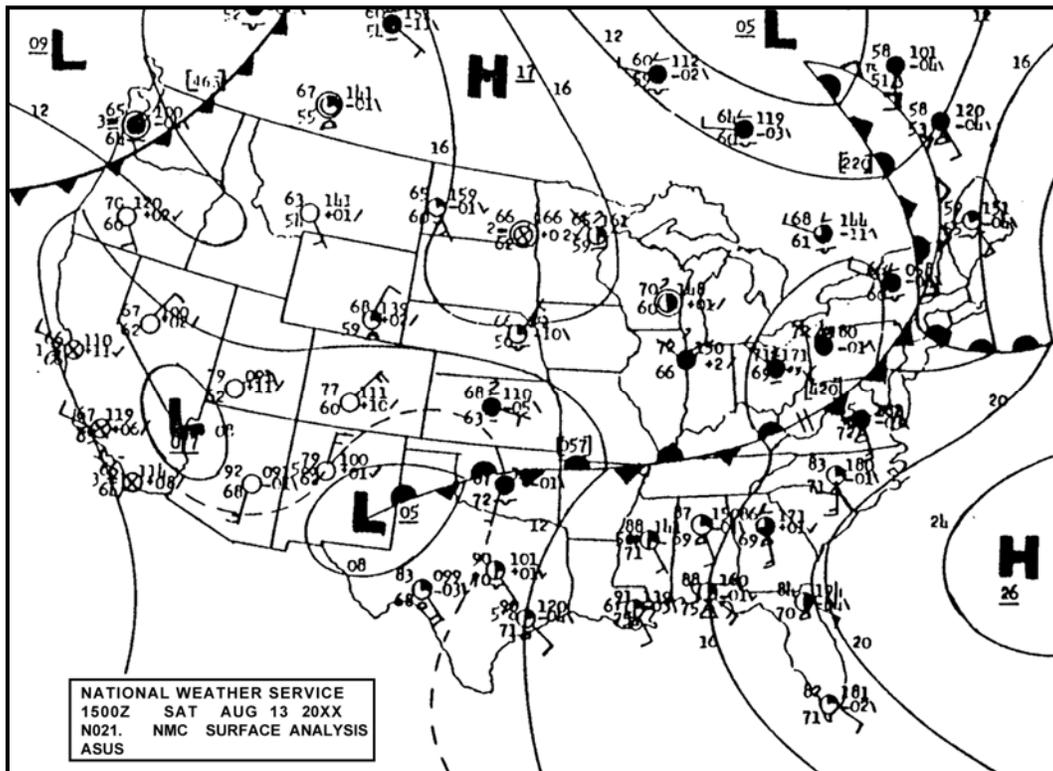


Figure 2-2 Surface Analysis Chart

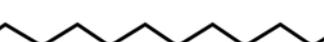
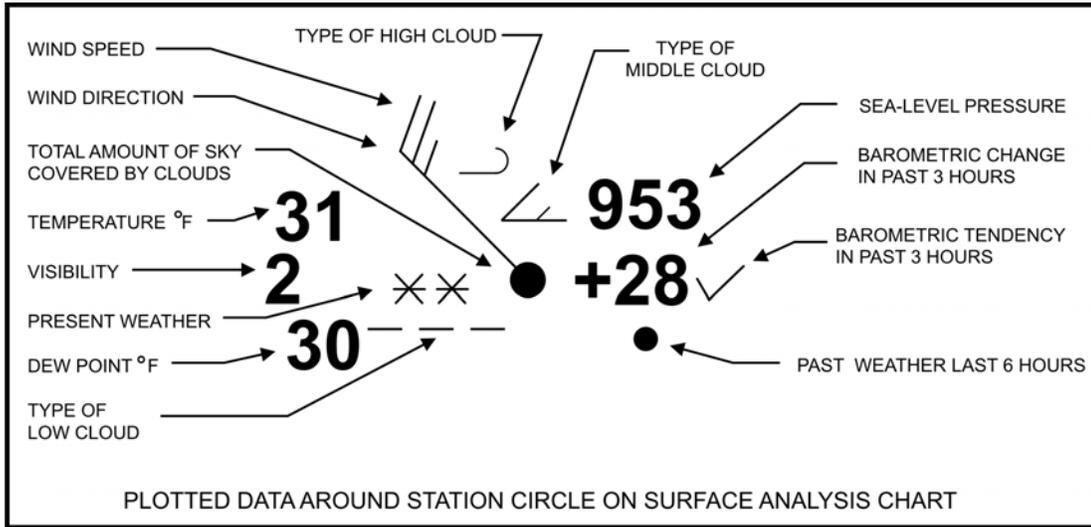
COLOR	SYMBOL	DESCRIPTION
Blue	H	High pressure center
Red	L	Low pressure center
Blue		Cold front
Blue		Cold front aloft
Red		Warm front
Red		Warm front aloft
Red/Blue		Stationary front
Purple		Occluded front
Blue		Cold frontogenesis
Red		Warm frontogenesis
Red/Blue		Stationary frontogenesis
Blue		Cold frontolysis
Red		Warm frontolysis
Red/Blue		Stationary frontolysis
Purple		Occluded frontolysis
Purple		Squall line
Brown		Trough
Black		Ridge
Black		Isobar
Black		Intermediate isobar

Figure 2-3 Standard Chart Symbols

**LESSON NOTES**

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

- (a). Standard symbols depict fronts
- (b). “H” or “L” and isobars denote pressure systems
- (c). Station model includes information on sky coverage, wind direction and speed, temperature, dew point, precipitation, and other related information



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 2-4 Major Station Model Symbols

**LESSON NOTES**

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

**PROGRESS CHECK**

**Question 2—Refer to the simplified surface analysis chart (Figure 2-2). 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

- b. Weather depiction charts
  - i. Compiled from hourly surface aviation reports
  - ii. Quickly identify positions of fronts and areas of VFR, marginal VFR (MVFR), and IFR weather
    - (a). MVFR (marginal visual flight rules) weather between 1,000 ft ceiling/3 miles visibility and 3,000 ft ceiling/5 miles visibility
    - (b). MVFR has no bearing on the civilian or military pilot but warns of poor flying conditions
    - (c). Chart contains a legend for clarity
  - iii. Disseminated eight times a day, every 3 hrs starting at 0100Z
  - iv. Symbology
    - (a). Standard symbols depict fronts (as on surface analysis chart)
    - (b). Contoured unshaded areas indicate 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 of less than 1,000 ft AGL and/or visibility of less than 3 sm
    - (d). 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 2-5).

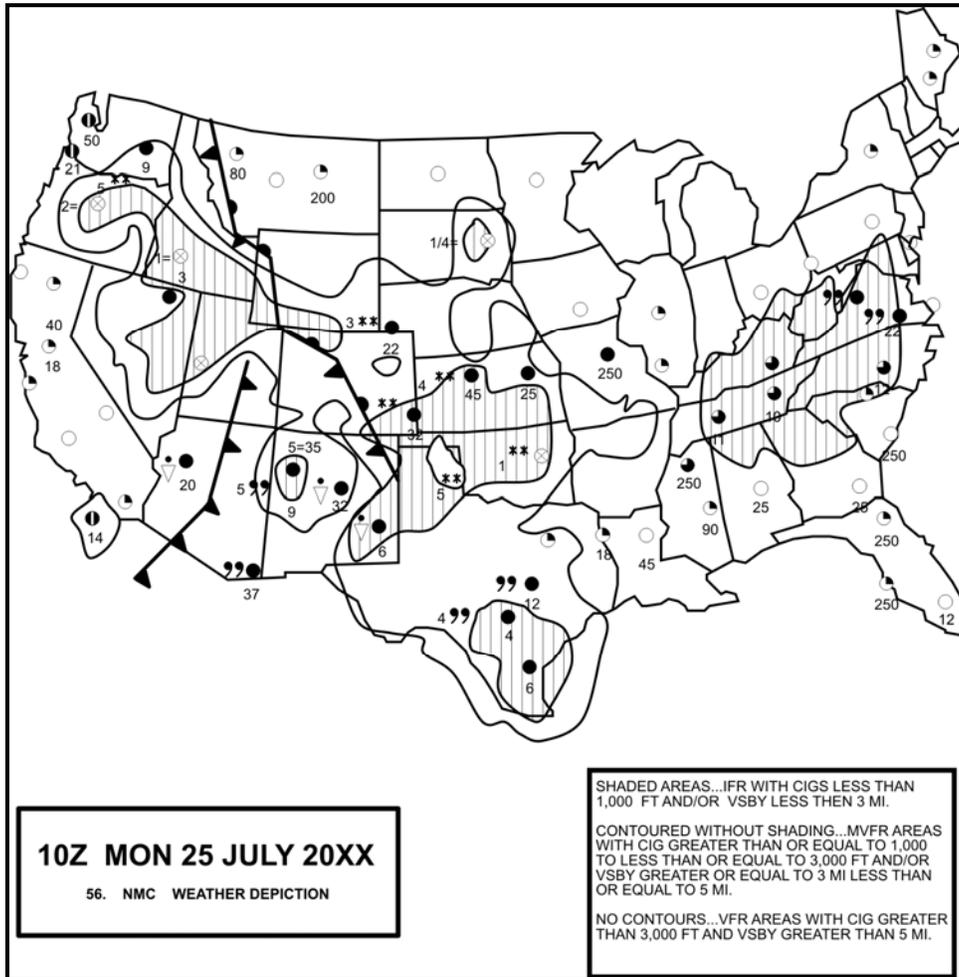


Figure 2-5 Weather Depiction Chart

- (e). Sky coverage symbols are different from those used for the surface analysis charts
- (f). Some weather symbols used on the surface analysis are used on the weather depiction chart

**LESSON NOTES**

1. For the following progress check, point to the station in South Dakota on the chart.
2. 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—Refer to the station in South Dakota (Figure 2-5). What are the weather conditions at this station?**

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

- c. Radar summary charts
  - i. Derived from radar returns from National Weather Service (NWS), terminal, and Air Route Traffic Control Center (ARTCC) weather radar stations across the U.S.
    - (a). Weather radar used is primarily X-band (UHF), which is more sensitive to weather echoes



- (3). 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)
- (4). Line of echoes (such as a squall line) indicated by a solid line
- (b). 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.

- (c). Direction arrows
  - (1). Arrows with barbs or flags indicate area or line movement
  - (2). 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.

- (d). 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.

- (e). Dashed line box indicates a forecast weather watch (WW) area

- (1). Valid time and ID number of WW displayed alongside
- (2). "WT" denotes tornado watch, "WS" indicates severe thunderstorms

#### NOTE

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

- (f). If for any reason no echoes were observed, the following symbols are used to indicate why:
  - (1). "NE" - No Echo - echo information but none observed
  - (2). "NA" - Observation Not Available

#### NOTE

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

- (3). "OM" - Equipment Ot for Maintenance
- (4). "ROBEPS" - Radar Operating Below Performance Standards

### PROGRESS CHECK

**Question 4 — Refer to the radar summary chart (Figure 2-6). Regarding the area of precipitation off the Florida coast, what information can be derived?**

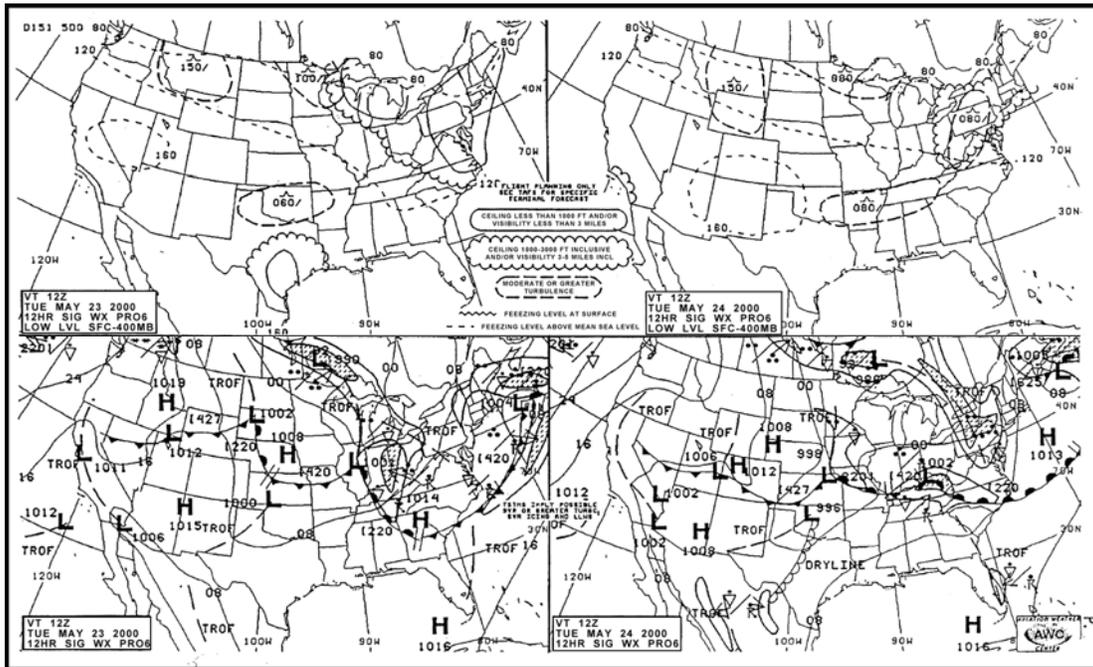
ANSWER: The information presented on the chart includes: Radar echoes to 26,000 MSL, level 1 to 2 intensity, cell movement to the northwest at 24 kts.

2. Prognostic charts

#### NOTE

Remember to correlate forecast flight conditions to scheduled flight time.

- a. Low-Level Significant Weather Prognostic Chart



**Figure 2-7 Low-Level Prognostic Chart**

- i. 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
- ii. 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.

- iii. 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.

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

- v. Chart shares some symbology and coloration with the Surface Analysis (SA) chart
- vi. Frontal type and position shown using standard symbols
  - (a). High- and low-pressure centers indicated by Hs and Ls with the pressure value (underlined) to the nearest whole millibar
  - (b). 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.

- (c). Isobars will be depicted by a thin, solid line at an 8-millibar interval, labeled in tens and units of millibars
- vii. Chart always contains a legend in the middle of the top two panels
  - (a). Solid line indicates terminal areas with ceilings less than 1,000 ft and/or visibility less than 3 miles (IMC) - colored red
  - (b). 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
  - (c). 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.

- (1). The numbers to the left of a slash (/) indicate tops of forecasted turbulence, and numbers to the right indicate the base of the forecasted turbulence in hundreds of feet MSL
- (2). No figure to the right of the slash indicates turbulence from surface upward, while absence of a figure to the left of the slash indicates turbulence above the limits of the chart (24,000 feet MSL)
- (d). The surface 32-degree isotherm is depicted with a dotted line and is labeled

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

### NOTES

1. If an upper level freezing contour crosses the surface freezing line, multiple freezing levels aloft are indicated.
2. 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 — 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.

- b. High-level significant weather prognostic—above 24,000 ft MSL
  - i. Manually prepared by NWS forecasters
  - ii. Display 12- and 24-hour forecasts for significant weather conditions
  - iii. Disseminated 4 times daily
  - iv. Symbology
    - (a). Scalloped lines depict areas of widespread or embedded thunderstorms
    - (b). Broken lines display areas of CAT
    - (c). Depicts location of weather hazards, including widespread sandstorms or dust storms, squall lines, and tropical storms
    - (d). Arrows and wind flags show position and speed of jet stream
    - (e). 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.

- c. Winds Aloft Prognostic charts
  - i. 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

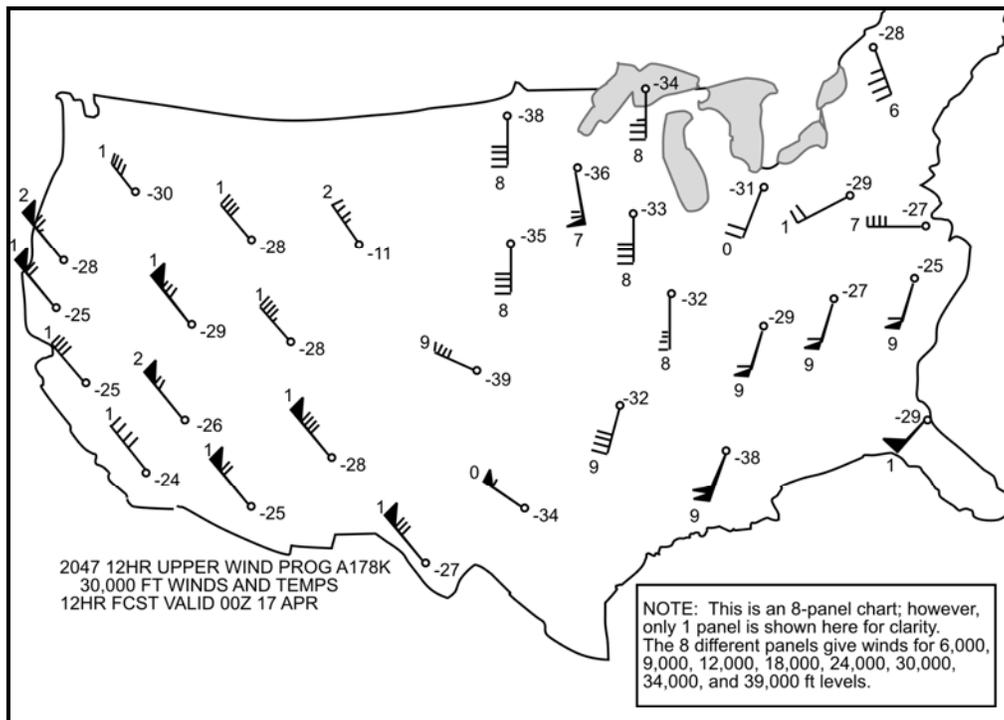
**NOTE**

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.

- ii. 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 2-8 Winds Aloft Prognostic Chart**

- iii. Disseminated 2 times daily in 12-hour prognostics

- (a). 8-panel chart
  - (b). 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
- iv. Symbology
- (a) Wind shaft - depicts the quadrant from which the wind is blowing
    - (1). To 8 cardinal points of compass
    - (2). Number near the end of the shaft indicates direction to nearest 10 degrees
  - (b). Wind velocity indicated at top of shaft
    - (1). Flag for 50 kts
    - (2). Barb for 10 kts
    - (3). Half barb for 5 kts
    - (4). Accuracy to nearest 5 kts
    - (5). If calm or light and variable, wind will be shown as "99" to the lower left corner of station model
  - (c). 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 — Refer to the winds aloft prognostic chart (Figure 2-8). 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.

**Printed Reports and Forecasts**

## 1. METAR

**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 2-9 METAR**

- a. 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
  - i. The surface observations and terminal forecast formats and coding changed
  - ii. 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
- b. 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
- c. 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
  - i. 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

- ii. 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.

- d. To help remember the sequence, think of 3 W's at the beginning - Where, When, and Wind. This works for both METAR and TAF
  - i. Where
    - KPIT is the ICAO station identifier
    - (1). 3-letter identifiers are preceded by a "K" for the contiguous United States
    - (2). Alaska and Hawaii use 4-letter identifiers, beginning with "PA" and "PH," respectively
    - (3). Changes are planned to incorporate alphabetic identifiers for those weather reporting stations where numbers and letters are now used (e.g., W10 to KHEF)
  - ii. When
    - (a). **201955Z** is the **20th** day of the month
    - (b). **201955Z** at **1955Z** time
  - iii. Wind
    - (a). **22015G25KT** -- reported as the 3-digit *true* direction to the nearest 10 degrees

#### NOTE

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

- (b). **22015G25KT** - the 2- or 3-digit speed

- (c). 22015G25KT - if the wind is gusting
- (d). 22015G**25KT** - 2- or 3-digit maximum speed and units

#### NOTE

00000KT - calm winds.

- (e). 22015KT **180V260** - wind direction varies 60 degrees or more, and wind is greater than 6 kts
- (f). **VRB** - wind direction is variable, and speed is less than or equal to 6 kts
- (g). **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**

#### iv. Visibility

- (a). 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)
- (b). 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
- (c). Some coding pilots may also see for RVR include:
  - (1). **M** - indicates that RVR is less than lowest reportable sensor value (e.g., **M0600FT**)
  - (2). **P** - indicates RVR greater than highest reportable sensor value (e.g., **P6000FT**)
  - (3). **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

#### v. Significant Present Weather

- (a). **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**)

- (b). Intensity or proximity of weather phenomenon:
  - (1). "-" – Light
  - (2). "+" – Heavy
  - (3). "no sign" – Moderate
  - (4). "VC" -- in the vicinity
  
- vi. Clouds
  - (a). OVC010CB - specifies cloud amount, height, and type. Overcast clouds are present at 1,000 ft consisting of cumulonimbus clouds
  - (b). Cloud height is reported in hundreds of feet. When clouds are composed of towering cumulus or cumulonimbus, TCU or CB will follow cloud height
  - (c). Clouds are categorized based on eighths (octas) of the sky
    - (1). SKC - Sky clear
    - (2). FEW - >0-2 octas
    - (3). SCT - 3-4 octas
    - (4). BKN - 5-7 octas
    - (5). OVC - 8 octas
  - (d). Vertical Visibility (VV) - may be listed here for indefinite ceiling such as "VV004" for Vertical Visibility 400 ft
  - (e). 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).

- (f). Altimeter Setting - (ex. A2992) "A" indicates setting in inches of mercury for United States. Consists of 4 digits: inches and hundredths
- (g). Remarks (RMK) come last

- (1). 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)
- (2). 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)

## 2. METAR On ASOS/AWOS

- a. 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
```

- b. Some ASOS/AWOS sites are attended
  - i. The term AUTO is not included in the report (A01 or A02 remain)
  - ii. An attended site may contain information that has been manually provided by the observer
- c. Only a fully automated site without human intervention will contain the word AUTO
- d. When ASOS/AWOS reported sky condition is clear (CLR), it means no clouds at or below 12,000 ft

## 3. TAF

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

TAF (TAF AMD - Amended Forecast, when included)

KPIT 091730Z 0918/1018 22020KT 3SM -SHRA BKN020

FM092030 30015G25KT 3SM SHRA OVC015  
TEMPO 0920/0922 1/2SM TSRA OVC008CB

FM100100 27008KT 5SM -SHRA BKN020 OVC040 PROB40 1004/1007 00000KT  
1 SM -RA BR

FM101000 22010KT 5SM -SHRA OVC020  
BECMG 1013/1015 20010KT P6SM NSW SKC

KNQI TAF 1915/2015 16018G28KT 8000 FEW015 SCT025CB BKN040 BKN250  
52005 QNH2990INS VCTSSHRA  
TEMPO 1919/2000 VRB20G35KT 3200 TSSHRA BKN 015CB OVC025  
BECMG 2001/2002 17013G22KT 9999 SCT020 SCT250 QNH2995INS  
BECMG 2009/2010 14005KT 4800BR SCT010 SCT250 QNH3000INS  
TEMPO 2010/2013 0800FG VV002  
BECMG 2014/2015 16010KT 9000 HZ SCT020 SCT100 BKN250 QNH2292INS

**Figure 2-10 Terminal Aerodrome Forecast (TAF)**

- b. 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 0918/1018 22020KT 3SM -SHRA BKN020

**FM092030** 30015G25KT 3SM SHRA OVC015 WS015/30045KT  
**TEMPO 0920/0922** 1/2SM TSRA OVC008CB

**FM092300** 27008KT 5SM -SHRA BKN020 OVC040 **PROB40 1004/1007** 00000KT  
1 SM -RA BR

**FM101000** 22010KT 5SM -SHRA OVC020  
**BECMG 1013/1015** 20010KT P6SM NSW SKC

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

TAF

KPIT 091730Z 0918/1018 22020KT

- i. Where

- (a). KPIT is the ICAO station identifier.
  - (b). The usual 3-letter identifiers are preceded by a "K" for the contiguous United States.
  - (c). Alaska and Hawaii will use 4-letter identifiers beginning with "PA" and "PH" respectively.
  - (d). 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)
- ii. When
- (a). 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). This date/time group is only included in civilian TAFs.
  - (b). **09**18/1018 - the valid period with the first 2 digits containing the day of the month (09)
  - (c). 09**18**/1018 - the second 2 digits specify the hour beginning the forecast period (1800Z)
  - (d). 0918/**10**18 – the first two digits after the / are the ending day of the forecast period (10)
  - (e). 0918/10**18** - the last 2 digits are the hour ending the forecast period (1800Z)
- iii. Wind
- 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
- iv. Time Periods, Etc.
- (a). FM092030 - From 2030Z or UTC time on the 9<sup>th</sup> (indicates day, hours and minutes)
  - (b). TEMPO 0920/0922- Temporary changes expected between 2000Z and 2200Z on the 9<sup>th</sup>
  - (c). FM092300 - From 2300Z on the 9<sup>th</sup>

- (d). PROB40 1004/1007 - There is a 40% probability of this condition occurring between 0400Z and 0700Z on the 10<sup>th</sup>
- (e). FM10100 - From 1000Z on the 10<sup>th</sup>
- (f). BECMG 1013/1015- Conditions becoming as described between 1300Z and 1500Z on the 10<sup>th</sup>
- (g). 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
  - (1). 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
  - (2). Notice that after TEMPO 0920/0922, there is no wind given, and after PROB40 1004/1007, 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.

#### 4. METAR/TAF

##### a. International Differences

- 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:

##### (a). Altimeter Setting

- (1). The United States reports the altimeter setting in inches of mercury (e.g., A2992)
- (2). Internationally, it will reported in hectopascals (millibars) (e.g., Q1016)

##### (b). Wind

- 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

- (c). Wind Shear
  - 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
- (d). Visibility
  - (1). 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)
  - (2). In the United States, civilian forecasters encode visibility in statute miles (SM). Military forecasts are in meters, up to 9999 (visibility forecast greater than 9000 meters or 7 SM)
  - (3). International visibility reports also contain a trend, such as:
    - i) D – Down
    - ii) U – Up
    - iii) N -- No change
    - iv) Variable
- b. Other
  - i. Remarks (RMK) included in U.S. METAR are transmitted to only Canada and Mexico and no other international stations
  - ii. Pilots may also see the following notation on International METAR/TAF: CAVOK (Ceiling and Visibility OK)
    - (a). 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

AO1	Automated Observation without precipitation discriminator (rain/snow)	VC	Vicinity
AO2	Automated Observation with precipitation discriminator (rain/snow)	VRB	Variable wind direction when speed is less than or equal to 6 kts
AMD	Amended Forecast (TAF)	W	Vertical Visibility (Indefinite Ceiling)
BECMG	Becoming (expected between 2-digit beginning hour and 2-digit ending hour)	WS	Wind shear (In TAFs, low-level and not associated with convective activity)
BKN	Broken 5-7 octas (eighths) cloud coverage	DESCRIPTORS	
CLR	Clear at or below 12,000 ft (ASOS/AWOS report)	BC	Patches
COR	Correction to the observation	BL	Blowing
FEW	>0-2 octas (eighths) cloud coverage	DR	Low Drifting
FM	From (4-digit beginning time in hours and minutes)	FZ	Supercooled/freezing
LDG	Landing	MI	Shallow
M	In temperature field, means "minus" or below zero	PR	Partial
M	In RVR listing, indicates visibility less than lowest reportable sensor value (e.g., M0600)	SH	Showers
NO	Not available (e.g., SLPNO, RVRNO)	TS	Thunderstorm
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.	WEATHER PHENOMENA	
OVC	Overcast 8 octas (eighths) cloud coverage	BR	Mist
P	In RVR, indicates visibility greater than highest reportable sensor value (e.g., P6000FT)	DS	Dust Storm
P6SM	Visibility greater than 6 SM (TAF only)	DU	Widespread Dust
PK WND	Peak wind	DZ	Drizzle
PROB40	Probability 40 percent	FC	Funnel Cloud
R	Runway (used in RVR measurement)	+FC	Tornado/Water Spout
RMK	Remark	FG	Fog
RY/RWY	Runway	FU	Smoke
SCT	Scattered 3-4 octas (eighths) cloud coverage	GR	Hail
SKC	Sky Clear	GS	Small Hail/Snow Pellets
SLP	Sea Level Pressure (e.g., 1001.3 reported as 013)	HZ	Haze
SM	Statute mile(s)	IC	Ice Crystals
SPECI	Special Report	PE	Ice Pellets
TEMPO	Temporary changes expected (between 2-digit beginning hour and 2-digit ending hour)	PO	Dust/Sand Whirls
TKOF	Takeoff	PY	Spray
T01760158, 10142, 20012 and 401120084	In Remarks -- examples of temperature information	RA	Rain
V	Varies (wind direction and RVR)	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 2-11 METAR Abbreviations

- (b). Also, there must be no other significant weather. NSC means no significant clouds
- iii. International TAFs may include temperature, turbulence, and icing forecasts

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 OVC10CB 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: **OVC10CB** -- 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 0918/1018 22020KT 3SM -SHRA BKN020 WS015/30045KT**

**FM092030 30015G25KT 3SM SHRA OVC015 TEMPO 0920/0922 1/2 TSRA OVC008CB**

**FM092300 27008KT 5SM -SHRA BKN020 OVC040 PROB40 1004/1007 00000KT 1SM -RA BR**

**FM10100 22010KT 5SM -SHRA OVC020 BECMG 1013/1015 20010KT P6SM NSW SKC**

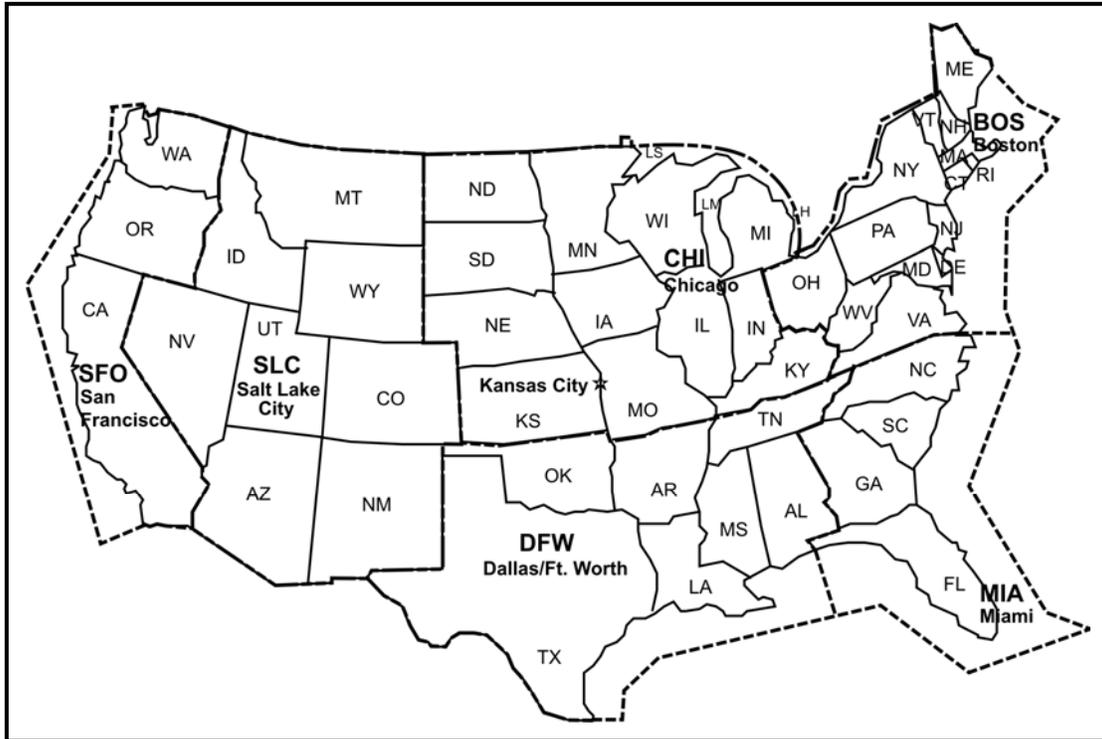
Where: **KPIT**  
 When: **091730Z** --issuance day and time (9th day at 1730Z)  
**0918/1018** valid period (9th day at 1800Z to next day, 10th at 1800Z)  
 Wind: **22020KT**-- 220 degrees at 20 kts  
 Visibility: **3SM** -- 3 statute miles, typical - **2 3/4SM, 1SM**  
**P6SM:** Greater than 6 statute 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:  
**FM092030:** From 2030Z on the 9<sup>th</sup>  
**TEMPO 0920/0922:** Temporarily between 2000Z and 2200Z on the 9<sup>th</sup>  
**FM092030:** From 2300Z on the 9<sup>th</sup>  
**PROB40 1004/1007:** There is a 40% probability between 0400Z and 0700Z on the 10<sup>th</sup>  
**FM10100:** From 1000Z on the 10<sup>th</sup>  
**BECMG 1013/1015:** Becoming between 1300Z and 1500Z on the 10<sup>th</sup>

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 2-12 METAR (SPECI or Special Report)

5. Area Forecast (FA)
  - a. General - provides overview of aviation weather conditions over the United States and adjacent coastal waters



**Figure 2-13 Area Forecast Coverage**

- i. Used for flight planning and a weather briefing aid
- ii. Intended for use by General Aviation pilots, Civil and Military operations, National Weather Service (NWS), and Federal Aviation Administration (FAA) briefers
- iii. Consists of two sections:
  - (a). HAZARDS/FLIGHT PRECAUTIONS
  - (b). SYNOPSIS AND VFR CLOUDS/WEATHER
- iv. Communications headers contain unique information for routing purposes, as well as allowing individual sections to be replaced, rather than appended

- v. 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
- b. Responsibility - Issued by the National Aviation Weather Advisory Unit (NAWAU) in Kansas City, Missouri, for the conterminous United States and coastal waters
  - i. Pacific Coast (SFO)
  - ii. Rocky Mountain (SLC)
  - iii. North-Central (CHI)
  - iv. Northeast (BOS)
  - v. South-Central (DFW)
  - vi. Southeast (MIA)
  - vii. Four additional FAs issued by the Weather Service Forecast Offices (WSFO) in Anchorage, Fairbanks, and Juneau for Alaska and in Honolulu for Hawaii
  - viii. A specialized FA for the Gulf of Mexico shall be issued by the National Hurricane Center in Miami
    - (a). Combines aviation and marine information in support of offshore helicopter operations
    - (b). Addresses an area including the coastal plains and coastal waters from Apalachicola, Florida, to Brownsville, Texas, and the Gulf west of 85W and north of 27N
- c. Issuance and Valid Times
  - i. Prepared 3 times a day in the contiguous states and Alaska, 4 times a day in Hawaii
  - ii. Valid beginning the hour after the scheduled issue time
  - iii. The Gulf FA is prepared twice daily
- d. Preparation of the Area Forecast
  - i. 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.

- ii. All times stated in whole hours (2 digits), using UCT and qualifiers such as BY, UNTIL, AFT, THRU, BYD
- iii. Visibilities in statute miles, all other distances in nautical miles, speeds in knots
- iv. Commas or colons in a sentence indicated by three dots ( ... )
- e. Hazards/Flight Precautions section
  - i. Covers 12-hour period beginning with one valid time
  - ii. Section depicts weather impacting the area or a negative report
  - iii. 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 2-14 Area Forecast (FA)**

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

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

- f. Synopsis and VFR Clouds/Weather section
  - i. 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
  - ii. 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
  - iii. The following specific items, if applicable, should be included for each 12-hour specific forecast in the SYNOPSIS AND VFR CLOUDS/ WEATHER section
    - (a). Sky condition (cloud height, amount, and tops) if bases are at or below 18,000 ft MSL
    - (b). Surface visibilities and associated obstructions when visibility is between 3 and 6 miles (if coverage is 3,000 square miles or greater)
    - (c). Weather (precipitation, including thunderstorms, fog, haze, blowing dust, etc.), if it results in surface visibilities of 3 to 6 miles
    - (d). Thunderstorms, if expected to be more than isolated
    - (e). Surface wind if sustained winds of 20 kts or more
      - (1). Wind directions use 8-point compass
      - (2). Gusts are reported if expected to be 10 kts over sustained speed
- g. OUTLOOK - 6-hour categorical forecast to follow 12-hour specific clouds and weather forecasts
  - i. As a minimum "IFR," "MVFR," or "VFR"
  - ii. If IFR or MVFR due to ceiling, use "CIG"

- iii. If due to visibility, use standard weather and obstruction to visibility symbols
- iv. 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 — Refer to the area forecast (Figure 2-14). 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

- 6. Winds Aloft Forecast (FD)
  - a. Teletype report, based on observed (balloon) information transmitted twice a day
    - i. Teletype identifier is "FD"
    - ii. The total forecast is usable for 15 hrs
    - iii. Broken into two segments with the forecast periods given at the beginning of each segment
      - (a). Valid time indicates that these conditions should exist specifically at this time
      - (b). "For use" times mean that these conditions should exist through this period as the average conditions
  - b. Wind and Temperature coding/decoding rules
    - i. Wind normally given with a series of 4 digits
      - (a). First 2 digits indicate direction wind is from (true)
      - (b). Second 2 digits depict the wind speed in knots
    - ii. 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 2-15 Winds Aloft Forecast (FD)**

- (a). Above or below 0 degrees indicated with a "+" or "-"
  - (b). All temperatures above 24,000 ft MSL are below zero so the minus sign is dropped
- iii. Exceptions
- (a). Variable winds indicated by "99" for direction
  - (b). Forecast winds less than 5 kts indicated by "9900" and read as "light and variable"
  - (c). 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
  - (d). Wind speeds in excess of 200 kts would be encoded at 199 kts; e.g., 7399 would be 230 degrees at 199 kts
- c. Temperature decoding/encoding rules
- Temperature and wind are sometimes omitted from the forecast
    - (a). Wind information is never forecast for altitudes within 1,500 ft of the surface
    - (b). Temperature information is never forecast at any altitude within 2,500 ft of the surface

- (c). Temperature information is never forecast for the 3,000 ft level
- d. 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 — For what period is the winds aloft forecast in Figure 2-15 valid?**

ANSWER: 0600Z to 1500Z.

**Question 9 — 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.

### 7. National Weather Service (NWS) Severe Weather Reports and Forecasts

#### 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.

- a. Convective Outlooks (AC)
  - i. Issued by the National Severe Storm Forecast Center (NSSFCC) in Kansas City
  - ii. Outlines potential general thunderstorm activity and areas where thunderstorm intensity may approach severe limits
  - iii. Disseminated 3 times daily (2 times daily between September 1 and January 31) - 24-hr forecast period
  - vi. 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.

- b. Severe Weather Watch bulletin (WW)
  - i. Issued by the NSSFCC in Kansas City

- ii. 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)
- iii. Disseminated as needed
- iv. Format - Report contains the type and location of severe weather expected
- v. Hazards
  - (a). Thunderstorms with surface winds of 50 kts or more
  - (b). Thunderstorms containing hail 3/4-inch diameter or greater at surface
  - (c). Tornadoes
- vi. Flight restrictions as stated in OPNAVINST 3710.7
  - (a). Navy pilots will not file into or fly through WW areas
  - (b). Exceptions to OPNAVINST severe weather restrictions
    - (1). Operational necessity
    - (2). Research/weather reconnaissance
    - (3). Emergencies
    - (4). 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
    - (5). Aircraft capable of flying above existing or developing severe storms
- c. CNATRA Weather Warning (CAWW)
  - i. Issued by forecasters at the Chief of Naval Air Training (CNATRA)
  - ii. Defines areas of hazardous weather pertinent to all Naval Air Training Command activities
  - iii. Disseminated as needed

- iv. Format - Report lists hazards and affected areas
- v. Hazards
  - (a). Severe thunderstorms (wind gusts 50 kts or more or hail 3/4" diameter or larger)
  - (b). Embedded thunderstorms
  - (c). Line of thunderstorms
  - (d). Severe or extreme turbulence
  - (e). Severe icing
  - (f). Widespread sandstorms or dust storms limiting visibility to 2 sm or less
- vi. Flight restrictions
  - (a). Training activities suspended in CAWW area
  - (b). Exceptions to CNATRA severe weather restrictions (same as OPNAVINST 3710.7)
    - (1). Operational necessity
    - (2). Research/weather reconnaissance
    - (3). Emergencies
    - (4). 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
    - (5). Aircraft capable of flying above existing or developing severe storms
- 8. National Weather Service (NWS) Aviation In-flight Weather Advisories
  - a. Provides information for enroute aircraft
  - b. Designed to serve both civilian and military pilots
  - c. Types

- i. Significant Meteorological (SIGMET) Advisories
  - (a). Convective SIGMETs (WST)
  - (b). Nonconvective SIGMETs (WS)
- ii. Airman's Meteorological (AIRMET) Advisories (WA)
- d. 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
- e. 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
  - i. Designated forecaster(s) maintain watch on weather developments using weather radar, surface observations, PIREPs, and satellite image information
  - ii. 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)
- f. Standardizations - The following standardizations shall apply to all In-Flight Advisories
  - i. 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
  - ii. Domestic In-Flight Advisories shall describe designated weather conditions up to and including 45,000 ft (150 millibars)
  - iii. Any abbreviations or contractions used in the advisories shall conform with FAA Contractions Handbook 7340.1
  - iv. Weather and obstructions to visibility shall be indicated by using the weather abbreviations used for METARs (see FLIP GP Chapter 8)
- g. Convective SIGMETs (WST) at 55 minutes past the hour (H+55)

**WSUS33 KPCI 081655**  
**SIGW**  
**CONVECTIVE SIGMET 8W**  
**VALID UNTIL 1855Z**  
**AZ CA**  
**FROM 30S EED-10NNE PHX**  
**DVLPG LINE TS 30 NM WIDE MOV FROM 18015KT. TOPS TO FL340.**

**OUTLOOK VALID 081855-082255**  
**FROM PGS-40NNW ABQ-40W ELP-TUS-BZA-40ESE HEC-PGS**  
**WST ISSUANCES EXPD. REFER TO MOST RECENT ACUS01 KWNS FROM STORM**  
**PREDICTION CENTER FOR SYNOPSIS AND METEOROLOGICAL DETAILS.**

**WSUS31 KPCI 081655**  
**SIGE**  
**CONVECTIVE SIGMET 14E**  
**VALID UNTIL 1855Z**  
**NC AND CSTL WTRS**  
**FROM 50ESE ECG-130SE ECG-140SSE ECG-60ENE ILM-50ESE ECG**  
**AREA SEV TS MOV LTL. TOPS ABV FL450**  
**TORNADOES....HAIL TO 1 IN....WIND GUSTS TO 50KT POSS**

**OUTLOOK VALID 081855-082255**  
**AREA 1....FROM 90E ECG-170ESE ECG-170SE ECG-30SW CEW-40NE MSL-90E ECG**  
**WST ISSUANCES EXPD. REFER TO MOST RECENT ACUS01 KWNS FROM STORM**  
**PREDICTION CENTER FOR SYNOPSIS AND METEOROLOGICAL DETAILS.**

**Figure 2-16 Convective Sigmet (WST)**

- i. Issued hourly
  - (a). 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
  - (b). "NONE" shall be used as the text if appropriate
  - (c). Valid for up to 2 hrs or until superseded by the next hourly issuance
  - (d). An "OUTLOOK" may be included that may be valid for up to 6 hours
    - (1). Provided by the Storm Prediction Center in Norman, Oklahoma

- (2). Provides some information in the text, but refers reader to the most recent ACUS01 KWNS (“ACUS01 is the one-day (01) anticipated convection (AC) report; “KWNS” is the station ID for Norman, Oklahoma Storm Prediction Center”).
- (e). Special WSTs as required
- (f). Three bulletins issued for eastern (E), central (C), and western (W) regions
  - Boundaries at 87 and 107 degrees west
- ii. 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)
  - (a). Severe thunderstorms
    - May include specific information on tornadoes and/or hail 3/4-inch or greater and/or wind gusts of 50 kts or greater
  - (b). Embedded thunderstorms
    - (1). Occurring within and obscured by haze, stratiform clouds, or precipitation from stratiform clouds
    - (2). Intended to alert pilots that avoidance by visual or radar detection could be difficult or impossible
  - (c). A line of thunderstorms
    - At least 60 miles long with thunderstorms affecting at least 40% of the length
  - (d). An area of active thunderstorms affecting at least 3,000 square miles
    - 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
- h. 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

- i. 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
  - ii. Indications of rapidly changing conditions if in the forecaster's judgment, not sufficiently described in existing SIGMET
- i. Nonconvective SIGMETs (WS)
- i. Not issued on a regular scheduled basis
  - ii. 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 2-17 SIGMET (WS)**

- (a). 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)
  - (b). Severe icing not associated with thunderstorms (see Icing Tables in FLIP FIH Section C)
  - (c). Widespread dust storms, sandstorms, or volcanic ash lowering surface and/or in-flight visibilities to less than 3 miles
  - (d). Volcanic Eruption
- j. AIRMETs (WA)
- i. Issued on a scheduled basis every 6 hrs (beginning at 0200 UTC)

**NOTE**

Scheduled issuance times are 15 minutes prior to valid time.

- ii. Unscheduled amendments and corrections issued as necessary and are valid beginning at the time of issuance
- iii. Issued by NAWAU using the Area Forecast (FA) designators (SFO, SLC, CHI, DFW, BOS, MIA) to denote the area covered, not the issuing office
- iv. 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:
  - (a). Moderate icing
  - (b). Moderate turbulence
  - (c). 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

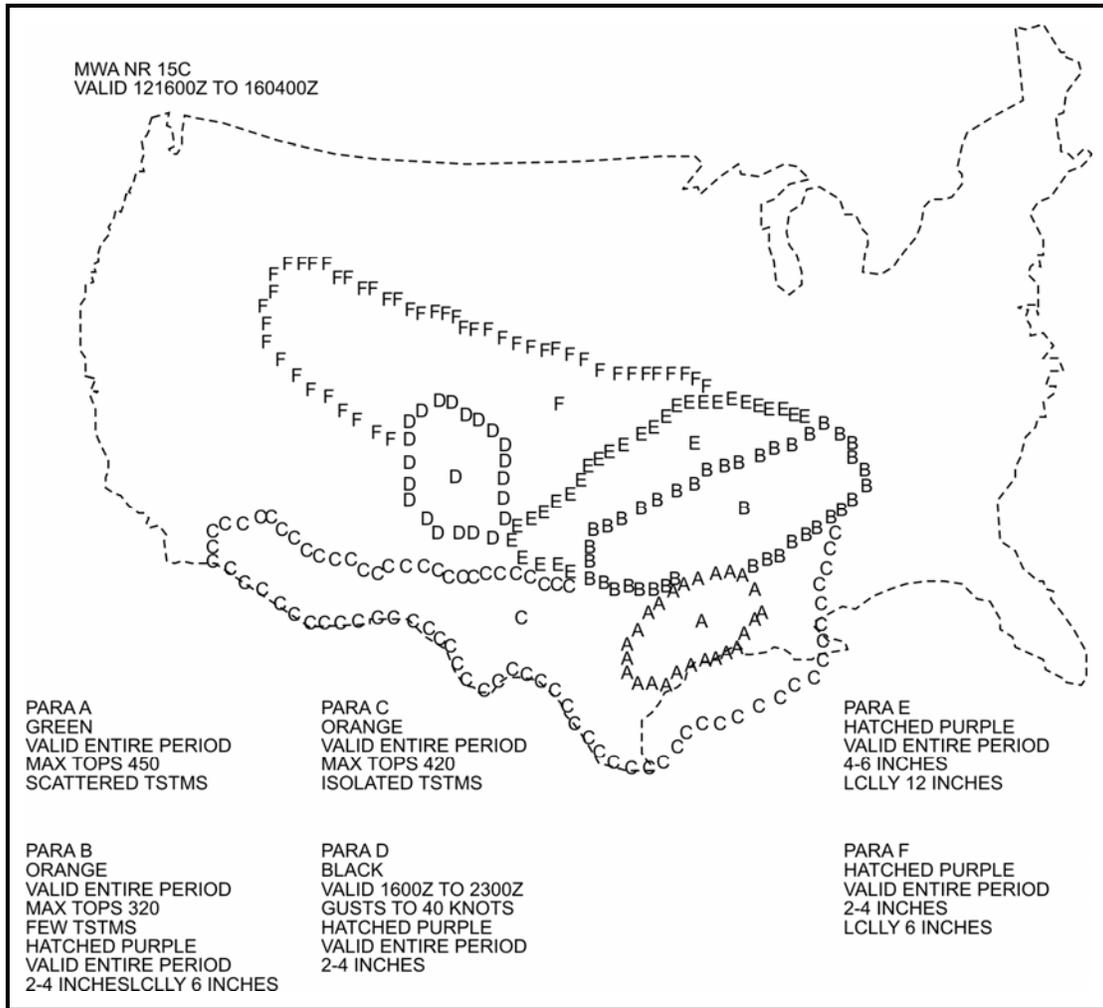
ZCZC MKCWA4T ALL 191400
WAUS1 KDFW 191400
DFWT WA 191400
AIRMET TANGO FOR TURBC...STG SFC WNDZ AND LLWS VALID UNTIL 192000
*
AIRMET TURBC...OK TX
FROM OSW TO LRD TO PEQ TO 40W LBL TO OSW
OCNL MDT TURBC BLO 60 DUE TO STG AND GUSTY LOW LVL WINDS.
CONDS CONTG BYD 2000Z.
*
AIRMET STG SFC WINDS...TX
FROM CDS TO DFW TO SAT TO MAF TO CDS
AFT 18Z...SUSTAINED SFC WINDS GTR THAN 30 KTS XPCD. CONDS CONTG BYD 2000Z.
*
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 2-18 AIRMET (WA)**

- (d). Ceilings less than 1,000 ft and/or visibility less than 3 miles affecting over 50% of an area at any one time
- (e). Extensive mountain obscuration precluding VFR flight
- v. AIRMET message texts
  - (a). 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
  - (b). 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
- k. Military Weather Advisory (MWA)
  - i. Prepared and issued by the Air Force Global Weather Center (AFGWC)
  - ii. Transmitted twice a day with a 12-hour Military Weather Advisory, which is a forecast of possible severe weather
  - iii. Two versions produced
    - (a). Teletype
    - (b). Facsimile
  - iv. The forecast is coded as follows:
    - (a). Red - tornadoes, waterspouts, or funnel clouds
    - (b). 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
    - (c). 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)
    - (d). Orange - thunderstorms (maximum wind gusts less than 35 kts and/or hail, if any, less than 1/2-inch in diameter)
    - (e). Black - strong surface winds (35 kts or more and not associated with thunderstorms)



**Figure 2-19 Military Weather Advisory (MWA)**

- (f). Purple - heavy rain (2 inches or more in 12 hrs or less)
- (g). Hatched purple - heavy snow (2 or more inches in 12 hrs or less)
- (h). Brown - freezing precipitation
- v. Other abbreviations
  - (a). MIC (maximum instantaneous coverage) – the percent of the area which will be covered by thunderstorm cells at time of maximum activity
  - (b). TAA (total area affected) - the percent of the area which will experience one or more thunderstorms during the applicable valid period

- (c). EP (entire period) - used if the phenomena are expected for the entire period instead of a particular time period
- vi. Maximum thunderstorm tops
  - (a). The percentages of MIC and TAA will be entered in the thunderstorm areas as MIC/TAA (such as 3/25)
  - (b). The advisory areas will be enclosed by solid lines with a letter designator within the area
  - (c). Forecast areas depict the worst conditions expected during period noted
- vii. 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.

- viii. Using the chart
  - (a). Use the contents of this advisory strictly as a preflight aid to help plan your route of flight to avoid possible severe weather
  - (b). Compare the MWA forecast with the existing or latest weather in the available weather charts and teletype reports

#### PROGRESS CHECK

**Question 10 — 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 — 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.

**Flight Weather Briefing (DD-175-1)**

1. Responsibility for brief (OPNAV 3710.7 series)
  - a. 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
  - b. Where Naval Oceanographic Services are available, weather briefings shall be conducted by a qualified meteorological forecaster
  - c. Briefings can be conducted in person, via telephone, autograph, or weather vision
2. Preflight Weather Brief

FLIGHT WEATHER BRIEFING										
PART I - TAKEOFF DATA										
1. DATE	2. ACFT TYPE/NO.	3. DEP PT/ETD	4. RWY TEMP	5. DEWPOINT	6. TEMP DEV	7. PRES ALT	8. DENSITY ALT			
		Z	°F/C	°F/C		FT	FT			
9. SFC WIND	10. CLIMB WINDS	11. LOCAL WEATHER WATCH/WARNING/ADVISORY					12. RSC/RCR			
M	T									
13. REMARKS/TAKEOFF ALTN FCST										
PART II - ENROUTE & MISSION DATA										
14. FLT LEVEL/WINDS/TEMP			15. SPACE WEATHER			16. SOLAR/LUNAR		LOCATION		
<input type="checkbox"/> SEE ATTACHED			NO IMPACT MARGINAL SEVERE			BMNT Z				
			FREQ			SR		Z MR Z		
			GPS			SS		Z MS Z		
			RAD			EENT		Z ILLUM %		
17. CLOUDS AT FLT LEVEL					18. OBSCURATIONS AT FLT LEVEL RESTRICTING VISIBILITY					
<input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> IN AND OUT					<input type="checkbox"/> YES <input type="checkbox"/> NO TYPE					
19. MINIMUM CEILING - LOCATION				20. MAXIMUM CLOUD TOPS - LOCATION			21. MINIMUM FREEZING LVL - LOCATION			
FT AGL				FT MSL			FT MSL			
22. THUNDERSTORMS			23. TURBULENCE			24. ICING			25. PRECIPITATION	
CHART			CHART			CHART			CHART	
NONE AREA LINE			NONE IN CLEAR IN CLOUD			NONE RIME MIXED CLEAR			NONE DRIZZLE RAIN SNOW PELLET	
ISOLATED 1 - 2%			LIGHT			TRACE			LIGHT	
FEW 3 - 15%			MODERATE			LIGHT			MODERATE	
SCATTERED 16 - 45%			SEVERE			MODERATE			HEAVY	
NUMEROUS - MORE THAN 45%			EXTREME			SEVERE			SHOWERS	
HAIL, SEVERE TURBULENCE & ICING, HEAVY PRECIPITATION, LIGHTNING & WIND SHEAR EXPECTED IN AND NEAR THUNDERSTORMS.			LEVELS			LEVELS			FREEZING	
LOCATION			LOCATION			LOCATION			LOCATION	
PART III - AERODROME FORECASTS										
26.	27. VALID TIME	28. SFC WIND	29. VSBY/WEA	30. CLOUD LAYERS			31. ALTIMETER	RWY TEMP	PRES ALT	
DEST/ALTN	Z TO Z	M					INS	°F/C	FT	
		T								
DEST/ALTN	Z TO Z	M					INS	°F/C	FT	
		T								
DEST/ALTN	Z TO Z	M					INS	°F/C	FT	
		T								
DEST/ALTN	Z TO Z	M					INS	°F/C	FT	
		T								
DEST/ALTN	Z TO Z	M					INS	°F/C	FT	
		T								
DEST/ALTN	Z TO Z	M					INS	°F/C	FT	
		T								
DEST/ALTN	Z TO Z	M					INS	°F/C	INS	
		T								
PART IV - COMMENTS/REMARKS										
32. BRIEFED RSC/RCR		YES	NOT AVAILABLE	33. PMSV		34. ATTACHMENTS		YES	NO	
35. REMARKS										
PART V - BRIEFING RECORD										
36. WX BRIEFED TIME		37. FLIMSY BRIEFING NO.		38. FORECASTER'S INITIALS			39. NAME OF PERSON RECEIVING BRIEFING			
Z		Z		Z			Z			
40. VOID TIME		41. EXTENDED TO/INITIALS		42. WX REBRIEF TIME/INITIALS			43. WX DEBRIEF TIME/INITIALS			
Z		Z		Z			Z			

DD FORM 175-1, OCT 2002

PREVIOUS EDITION MAY BE USED.

Adobe Professional 7.0

Figure 2-20 DD-175-1

- a. 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

Weather briefings may be conducted at any time prior to departure and will include briefing number and void time. However, briefing-void time cannot exceed 3.0 hours past briefing time or ETD plus one-half hour. Briefings received more than 3.0 hours prior to takeoff will be void and require rebriefing prior to departure.

- b. 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
  - i. The forecaster will complete the form if the briefing is in person or via autograph
  - ii. It is the pilot's responsibility to complete the form for telephone or weather vision briefings
3. Requesting the Weather Brief
  - a. Prebrief - Pilot should avail himself of any and all information available prior to requesting the formal brief
    - i. 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
    - ii. VFR flight primarily concerned with ceiling and visibility so he can see and be seen by other aircraft
  - b. Provide forecaster with completed DD-175
  - c. If brief is to be conducted via telephone, be prepared to provide the briefer:
    - i. Name of person calling
    - ii. Aircraft identification (call sign), and type of aircraft
    - iii. Departure point, destination and proposed alternate
    - iv. Type of flight plan (IFR/VFR) and proposed altitude

- v. ETD, ETE, and ETE to alternate
  - vi. Intended route
  - vii. Enroute stops, or delay en route, if applicable, with appropriate ETA and ETD of enroute delay
- d. Some airfields do not provide 24-hour forecaster service

### NOTES

1. Most civilian airfields do not have NWS briefers. Military pilots can either call the nearest military facility or a tie-in FSS.
  2. The FLIP Flight Information Handbook provides a list of tie-in military weather stations with autovon and/or commercial (call collect) telephone numbers.
4. 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.

- a. Weather at Takeoff:
  - i. Bases and tops of cloud layers
  - ii. Visibility and obstructions to vision
  - iii. Type and intensity of precipitation
  - iv. Freezing level
  - v. Temperature and climb winds up to flight altitude
  - vi. Runway temperature, wind, and pressure/density altitude
  - vii. Condition of runway (if affected by weather)
- b. Weather En Route
  - i. Bases, tops, types, and amount of each cloud layer
  - ii. Visibility at the surface and aloft

- iii. Type, location, intensity, and directions/speed of fronts
  - iv. Freezing level
  - v. Areas of severe weather (thunderstorms, icing, turbulence)
  - vi. Areas of good weather
- c. Weather at Destination and Alternate
- i. Bases, tops, types, and amount of each cloud layer
  - ii. Visibility and obstructions to vision
  - iii. Type and intensity of precipitation, and icing
  - iv. Freezing level
  - v. Turbulence
  - vi. Surface wind direction and velocity
  - vii. Condition of runways (if affected by weather)
- d. If no forecaster is available at the departure point, but current charts and teletype are displayed, the aircrew member should:
- i. Look around and see what information is available
  - ii. Read and plan. Look over the charts
    - (a). Look for weather hazards and low ceilings -- observed and forecast
    - (b). Read your destination current and forecast weather
    - (c). Determine if an alternate is required and, if so, where would be suitable
    - (d). Check the wind charts for your planned route
    - (e). 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).

- iii. 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.

- iv. Listen and ask!
  - (a). Listen to what the forecaster has to say
  - (b). Ask questions during the brief
  - (c). Make sure you have "the big picture"

5. DD-175-1 Requirement and Description

- a. 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
- b. 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
- c. The weather briefing form, DD-175-1, is divided into five separate parts:
  - i. Mission/takeoff data
  - ii. Enroute data
  - iii. Terminal forecast
  - iv. Comments/remarks
  - v. Briefing record

**NOTE**

Parts are divided by a solid triangle in the margin.

- d. The DD-175-1 is not completed in the same order as it is shown on the form
  - i. Flight level not chosen until information on thunderstorms, turbulence, icing, and winds has been investigated
  - ii. Determinations concerning icing require first investigating cloud layers, freezing levels, and RADAT data

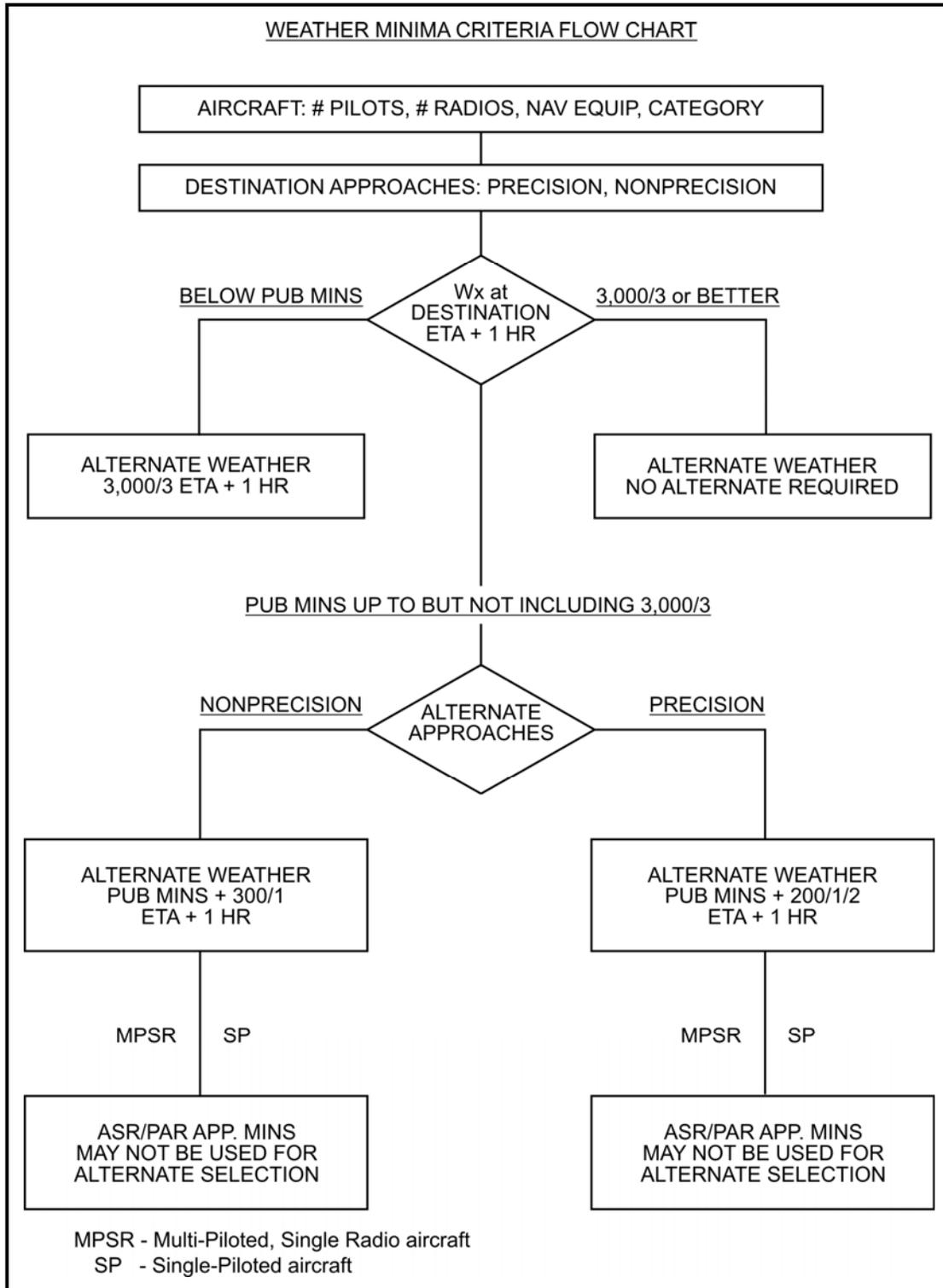


Figure 2-21 Weather Minima Criteria Flow Chart

- 6. Explanation of Data Sources/Uses
  - a. Mission/Takeoff section (Part I)
    - i. First three boxes specify date (local), aircraft type(s) and bureau number(s), departure point and ETD
    - ii. 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.

- iii. Local Weather Warnings such as WWs, CAWWs, thunderstorm conditions, or MET Watch advisories (MWAs, AIRMETs, SIGMETs, Convective SIGMETs) are always entered

**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 2-22 Data Sources**

FLIGHT WEATHER BRIEFING							
PART I - TAKEOFF DATA							
1. DATE 2 FEB	2. ACFT TYPE/NO. T45/160055	3. DEP PT/ETD NPA/1600	4. RWY TEMP Z 28 °C	5. DEWPOINT 23 °C	6. TEMP DEV +4C	7. PRES ALT -150 FT	8. DENSITY ALT +1600 FT
9. SFC WIND 1210	10. CLIMB WINDS T 2520	11. LOCAL WEATHER WATCH/WARNING/ADVISORY TSTM COND 1 TIL 18Z				12. RSC/RCR	
13. REMARKS/TAKEOFF ALTN FCST ISOL CBs LOCATED NW-N OF NPA, MOVG SE @ 5 KT							

MISSION/TAKEOFF DATA

<u>ENTRY</u>	<u>SOURCE</u>
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 2-23 Mission/Takeoff Section (Part I)**

- b. Enroute data (Part II)
  - i. 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
  - ii. 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.

- iii. Minimum ceilings - usually the first block marked
  - (a). First check the Weather Depiction Chart for a pictorial presentation, then cross-check observed information by referring the Area Forecasts (FA)

PART II - ENROUTE & MISSION DATA											
14. FLT LEVEL/WINDS/TEMP 250/3120/-24				15. SPACE WEATHER				16. SOLAR/LUNAR		LOCATION	
<input type="checkbox"/> SEE ATTACHED				NO IMPACT    MARGINAL    SEVERE				BMNT    Z			
				FREQ				SR    Z		MR    Z	
				GPS				SS    Z		MS    Z	
				RAD				EENT    Z		ILLUM    %	
17. CLOUDS AT FLT LEVEL						18. OBSCURATIONS AT FLT LEVEL RESTRICTING VISIBILITY 7					
<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> IN AND OUT						<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO    TYPE					
19. MINIMUM CEILING - LOCATION 004 - LIT FT AGL				20. MAXIMUM CLOUD TOPS - LOCATION 430 - OK, TX FT MSL				21. MINIMUM FREEZING LVL - LOCATION 120 - TUL FT MSL			
22. THUNDERSTORMS			23. TURBULENCE			24. ICING			25. PRECIPITATION		
CHART			CHART			CHART			CHART		
NONE <input checked="" type="checkbox"/> AREA <input checked="" type="checkbox"/> LINE			NONE    IN CLEAR    IN CLOUD			NONE    RIME    MIXED    CLEAR			NONE    DRIZZLE    RAIN    SNOW    PELLET		
<input checked="" type="checkbox"/> ISOLATED 1 - 2%			LIGHT <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>			TRACE <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			LIGHT <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		
<input type="checkbox"/> FEW 3 - 15%			MODERATE <input type="checkbox"/> <input checked="" type="checkbox"/>			LIGHT <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>			MODERATE <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		
<input checked="" type="checkbox"/> SCATTERED 16 - 45%			SEVERE <input type="checkbox"/> <input type="checkbox"/>			MODERATE <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			HEAVY <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		
<input type="checkbox"/> NUMEROUS - MORE THAN 45%			EXTREME <input type="checkbox"/> <input type="checkbox"/>			SEVERE <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			SHOWERS <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		
HAIL, SEVERE TURBULENCE & ICING, HEAVY PRECIPITATION, LIGHTNING & WIND SHEAR EXPECTED IN AND NEAR THUNDERSTORMS.			LEVELS    SFC - 060			LEVELS    120 - 180			FREEZING		
LOCATION ISOL-LA & AR SCTD-OK & TX			LOCATION    TUL → NBE			LOCATION    NPA → NBE			LOCATION <input checked="" type="checkbox"/> = NPA → LIT <input checked="" type="checkbox"/> = LIT → NBE		

ENROUTE DATA

<u>ENTRY</u>	<u>SOURCE</u>
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 2-24 Enroute Data Section (Part II)

- (b). Always check for in-flight advisories (AIRMETs and SIGMETs) anytime you check the area forecasts
- iv. Maximum Cloud Tops - Significant cloud tops (excluding thunderstorms) along the route and their location
  - (a). Refer to the Radar Summary Chart for observed data and Area Forecasts for forecast information
  - (b). Check In-flight Weather Advisories for updates to the FA, and PIREPs if available
- v. Thunderstorms - While checking for thunderstorms, also look for maximum cloud tops associated with them
  - (a). Check Radar Summary Chart for a pictorial view of thunderstorm and precipitation location, cross-checked with Area Forecasts and Convective SIGMETs for forecast conditions
  - (b). On the "MWA/WW No." line, list any current WW, MWA, or Convective SIGMET that applies
  - (c). Amplify these in the remarks section
  - (d). If more than one area of thunderstorms is applicable, they should be indicated
- vi. 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
- vii. Turbulence - Since turbulence is found in all thunderstorms, this section deals with turbulence not associated with thunderstorms
  - (a). The Area Forecast is a good source of forecast teletype information supplemented by SIGMETs and AIRMETs
  - (b). Low-Level Significant Weather Prognostic Chart is a good facsimile source
  - (c). PIREPs are an excellent source of observed information
  - (d). Any CAT advisory DTG should be entered
- viii. Minimum Freezing Level - Numerous sources:

- (a). Winds Aloft Forecast
  - (b). Low-Level Significant Weather Prognosis Chart
  - (c). Winds Aloft Prognosis Chart
  - (d). Constant Pressure Charts
  - (e). RADAT reports attached to the Aviation Weather Hourly Reports
- ix. Icing - From the nonconvective SIGMET reports, with supporting information from the Constant Pressure Charts

### NOTES

1. 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.
  2. Another good source would be PIREPs, if available.
- x. Selecting Flight Level - Analyzing the information you have determined up to this point, you now have information on:
- (a). Minimum ceilings
  - (b). Maximum cloud tops
  - (c). Thunderstorms
  - (d). Turbulence
  - (e). Minimum freezing level
  - (f). Icing
  - (g). 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.

- xi. 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

#### NOTES

1. 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.
  2. 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.
- xii. Clouds and visibility at flight level - Clouds and minimum visibility at flight level will generally be apparent from the overall weather picture

#### NOTES

1. This information may be supplemented with PIREPs if available.
  2. 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.
- c. Terminal Forecast Section (Part III)
    - i. Provides space for information on forecast weather at your destination and alternate, plus any intermediate points on a stopover flight plan
    - ii. 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

- iii. Terminal Aerodrome Forecasts (TAFs) will provide the required information for 1 hour prior to 1 hour after the planned ETA
- iv. 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
- v. 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 - AERODROME FORECASTS							
26.	27. VALID TIME	28. SFC WIND	29. VSBY/WEA	30. CLOUD LAYERS	31. ALTIMETER	RWY TEMP	PRES ALT
DEST/ALT NBE	Z TO Z 1630 1830	3415/25	X 4RW	5 SCT 10 BKN 15 OVC	29.92 INS	82 °F/°C	378 FT
<del>DEST/ALT</del> TEMPO	Z TO Z	G45	X 1/2TRW	5 BKN 10 OVC	INS	°F/°C	FT
<del>DEST/ALT</del> TIK	Z TO Z 1655 1855	3412/25	X 5RW	10 SCT 20 OVC	29.92 INS	79 °F/°C	400 FT
<del>DEST/ALT</del> TEMPO	Z TO Z	G40	X 1TRW	5 BKN 10 OVC	INS	°F/°C	FT
DEST/ALT NZY	Z TO Z 2010 2210	0305	X 5H	25 BKN 250 BKN	30.00 INS	80 °F/°C	350 FT
<del>DEST/ALT</del> NKX	Z TO Z 2020 2220	0305	X 5H	25 SCT 250 BKN	30.00 INS	80 °F/°C	400 FT
DEST/ALT	Z TO Z		M T		INS	°F/°C	FT
DEST/ALT	Z TO Z		M T		INS	°F/°C	INS

<u>TERMINAL FORECAST</u>	
<u>ENTRY</u>	<u>SOURCE</u>
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 2-25 Terminal Forecast Section (Part III)

- d. Comments/Remarks (Part IV) can include:
  - i. Latest braking action code
  - ii. Pertinent PIREPs

- iii. Latest METAR of first destination
- iv. Any significant data not covered elsewhere, i.e., SIGMETs/AIRMETs/warnings, low-level windshear, and runway conditions

PART IV - COMMENTS/REMARKS					
32. BRIEFED RSC/RCR	YES	<input checked="" type="checkbox"/>	NOT AVAILABLE	33. PMSV 359.6	34. ATTACHMENTS
		YES			<input checked="" type="checkbox"/> NO
35. REMARKS NBE 1400 35015G25KT 5 SM TSRA OVC010CB 18/14 A2992					

<u>COMMENTS/REMARKS</u>	
<p><u>ENTRY</u></p> <p>BRIEFED</p> <p>REQUEST PIREP AT</p>	<p><u>SOURCE</u></p> <p>Forecaster to include any significant information not covered in the regular areas of the DD-175-1</p> <p>Forecaster based on necessity</p>

**Figure 2-26 Comments/Remarks Section (Part IV)**

- e. Briefing Record (Part V)
  - i. Actual time of brief
  - ii. Flimsy briefing number (2-digit month code followed by sequential number of this briefing)
  - iii. Signature of forecaster (legible)
  - iv. 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)"
  - v. Extensions: new time based on a new ETD
  - vi. Forecaster's initials and name of the person being briefed

PART V - BRIEFING RECORD			
36. WX BRIEFED TIME 1440	37. FLIMSY BRIEFING NO. 10-505	38. FORECASTER'S INITIALS AGI W.W. FORECASTER	39. NAME OF PERSON RECEIVING BRIEFING CAPTAIN R.B. ROBERTS
40. VOID TIME 1630	41. EXTENDED TO/INITIALS 1700/WWF	42. WX REBRIEF TIME/INITIALS 1610/WWF	43. WX DEBRIEF TIME/INITIALS
Z	Z	Z	Z

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BRIEFING RECORD

<u>ENTRY</u>	<u>SOURCE</u>
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 2-27 Briefing Record Section (Part V)**

**LESSON NOTES**

Use each of the following Figures (2-28-2-31) to highlight critical information as required. These may also be used in a manner analogous to progress checks.

7. Interpreting data contained on DD-175-1
  - a. **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.

FLIGHT WEATHER BRIEFING							
PART I - TAKEOFF DATA							
1. DATE 2 FEB	2. ACFT TYPE/NO. T45/168055	3. DEP PT/ETD SPS/1900	4. RWY TEMP 35 °F/°C	5. DEWPOINT 31 °F/°C	6. TEMP DEV -5	7. PRES ALT 600 FT	8. DENSITY ALT 800 FT
9. SFC WIND 0407	10. CLIMB WINDS T 2765		11. LOCAL WEATHER WATCH/WARNING/ADVISORY WX ADV SVR ICG 020-060			12. RSC/RCR WR	
13. REMARKS/TAKEOFF ALTN FCST PTCHS OF ICE ON RWY							
PART II - ENROUTE & MISSION DATA							
14. FLT LEVEL/WINDS/TEMP 350/2895/-55		15. SPACE WEATHER		16. SOLAR/LUNAR		LOCATION	
		NO IMPACT MARGINAL SEVERE		BMNT Z			
		FREQ		SR Z MR			
		GPS		SS Z MS			
		RAD		EENT Z ILLUM			
17. CLOUDS AT FLT LEVEL <input type="checkbox"/> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> IN AND OUT				18. OBSCURATIONS AT FLT LEVEL RESTRICTING VISIBILITY <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO TYPE			
19. MINIMUM CEILING - LOCATION 010 - SPS FT AGL			20. MAXIMUM CLOUD TOPS - LOCATION 130 - SPS FT MSL			21. MINIMUM FREEZING LVL - LOCATION 010 - SPS FT MSL	
22. THUNDERSTORMS		23. TURBULENCE		24. ICING		25. PRECIPITATION	
CHART		CHART		CHART		CHART	
<input checked="" type="checkbox"/> NONE AREA LINE		NONE IN CLEAR IN CLOUD		NONE RIME MIXED CLEAR		NONE DRIZZLE RAIN SNOW PELLET	
ISOLATED 1 - 2%		LIGHT		TRACE		LIGHT	
FEW 3 - 15%		MODERATE		LIGHT <input checked="" type="checkbox"/>		MODERATE	
SCATTERED 16 - 45%		SEVERE <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		MODERATE <input checked="" type="checkbox"/>		HEAVY	
NUMEROUS - MORE THAN 45%		EXTREME		SEVERE		SHOWERS <input checked="" type="checkbox"/>	
HAIL, SEVERE TURBULENCE & ICING, HEAVY PRECIPITATION, LIGHTNING & WIND SHEAR EXPECTED IN AND NEAR THUNDERSTORMS.				LEVELS FL230 - 390		LEVELS SFC - 100	
LOCATION		LOCATION TXO - ABQ		LOCATION SPS		LOCATION SPS - CDS	
PART III - AERODROME FORECASTS							
26. DEST/ALTN	27. VALID TIME	28. SFC WIND	29. VSBY/WEA	30. CLOUD LAYERS	31. ALTIMETER	RWY TEMP	PRES ALT
ABQ	Z TO 1855 2055	2625 <input checked="" type="checkbox"/> T	5	100 OVC	30.25 INS	28 °F/C	378 FT
ELP	Z TO 1955 2155	2515 <input checked="" type="checkbox"/> T	6	50 SCT 100 OVC	30.25 INS	26 °F/C	400 FT
DEST/ALTN	Z TO Z	M T			INS	°F/C	FT
DEST/ALTN	Z TO Z	M T			INS	°F/C	FT
DEST/ALTN	Z TO Z	M T			INS	°F/C	FT
DEST/ALTN	Z TO Z	M T			INS	°F/C	FT
DEST/ALTN	Z TO Z	M T			INS	°F/C	FT
DEST/ALTN	Z TO Z	M T			INS	°F/C	INS
PART IV - COMMENTS/REMARKS							
32. BRIEFED RSC/RCR		YES <input checked="" type="checkbox"/> NOT AVAILABLE		33. PMSV	34. ATTACHMENTS		YES <input checked="" type="checkbox"/> NO
35. REMARKS ABO RCR - DRY WW# 136 - VALID UNTIL 2200Z FOR TXO - ABQ RTE WW # 251 - IN EFFECT UNTIL 2200Z SVR RIME ICE 010 - 120							
PART V - BRIEFING RECORD							
36. WX BRIEFED TIME 1815		37. FLIMSY BRIEFING NO. 02 - 21		38. FORECASTER'S INITIALS RL		39. NAME OF PERSON RECEIVING BRIEFING CAPTAIN R.B. ROBERTS	
40. VOID TIME 2000		41. EXTENDED TO/INITIALS Z		42. WX REBRIEF TIME/INITIALS Z		43. WX DEBRIEF TIME/INITIALS Z	

Figure 2-28 Interpreting the DD-175-1 (Example 1)

**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.

- b. **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.

- c. **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 0045Z. You have been delayed for maintenance.

FLIGHT WEATHER BRIEFING							
PART I - TAKEOFF DATA							
1. DATE 2 FEB	2. ACFT TYPE/NO. T45/168055	3. DEP PT/ETD NIR/0045	4. RWY TEMP Z 35 °F/°C	5. DEWPOINT 31 °F/°C	6. TEMP DEV -5	7. PRES ALT 600 FT	8. DENSITY ALT 800 FT
9. SFC WIND 1210	10. CLIMB WINDS T 2520	11. LOCAL WEATHER WATCH/WARNING/ADVISORY				12. RSC/RCR	
13. REMARKS/TAKEOFF ALTN FCST ISOL CBS ARE N-NE OF FST MOV NE @ 5KT							
PART II - ENROUTE & MISSION DATA							
14. FLT LEVEL/WINDS/TEMP 350/3120/-48		15. SPACE WEATHER		16. SOLAR/LUNAR		LOCATION	
		NO IMPACT MARGINAL SEVERE		BMNT Z			
		FREQ		SR Z		MR	
		GPS		SS Z		MS	
		RAD		EENT Z		ILLUM	
17. CLOUDS AT FLT LEVEL <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO <input type="checkbox"/> IN AND OUT			18. OBSCURATIONS AT FLT LEVEL RESTRICTING VISIBILITY 7 <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO TYPE HAZE				
19. MINIMUM CEILING - LOCATION 010 - NIR FT AGL			20. MAXIMUM CLOUD TOPS - LOCATION 130 - NIR FT MSL			21. MINIMUM FREEZING LVL - LOCATION FT MSL	
22. THUNDERSTORMS		23. TURBULENCE		24. ICING		25. PRECIPITATION	
CHART		CHART		CHART		CHART	
NONE AREA LINE		NONE IN CLEAR IN CLOUD		NONE RIME MIXED CLEAR		NONE DRIZZLE RAIN SNOW PELLET	
<input checked="" type="checkbox"/> ISOLATED 1 - 2%		LIGHT		<input checked="" type="checkbox"/> TRACE		LIGHT	
FEW 3 - 15%		MODERATE		LIGHT		MODERATE	
SCATTERED 16 - 45%		SEVERE		MODERATE		HEAVY	
NUMEROUS - MORE THAN 45%		EXTREME		SEVERE		SHOWERS	
HAIL, SEVERE TURBULENCE & ICING, HEAVY PRECIPITATION, LIGHTNING & WIND SHEAR EXPECTED IN AND NEAR THUNDERSTORMS.		LEVELS 240 - 350		LEVELS		FREEZING	
LOCATION FST		LOCATION SAT - FST		LOCATION		LOCATION	
PART III - AERODROME FORECASTS							
26. DEST/ALTN ELP	27. VALID TIME Z TO Z 0300 0500	28. SFC WIND 2705	29. VSBY/WEA <input checked="" type="checkbox"/> 5	30. CLOUD LAYERS 250 SCT	31. ALTIMETER 29.98 INS	RWY TEMP 28 °F/°C	PRES ALT 378 FT
DEST/ALTN RBR	Z TO Z 0315 0515	2810	<input checked="" type="checkbox"/> 6	250 SCT	29.92 INS	26 °F/°C	400 FT
DEST/ALTN	Z TO Z		M		INS	°F/°C	FT
DEST/ALTN	Z TO Z		M		INS	°F/°C	FT
DEST/ALTN	Z TO Z		M		INS	°F/°C	FT
DEST/ALTN	Z TO Z		M		INS	°F/°C	FT
DEST/ALTN	Z TO Z		M		INS	°F/°C	FT
DEST/ALTN	Z TO Z		M		INS	°F/°C	INS
PART IV - COMMENTS/REMARKS							
32. BRIEFED RSC/RCR	YES	<input checked="" type="checkbox"/> NOT AVAILABLE	33. PMSV	34. ATTACHMENTS	YES	<input checked="" type="checkbox"/> NO	
35. REMARKS							
PART V - BRIEFING RECORD							
36. WX BRIEFED TIME 2315	37. FLIMSY BRIEFING NO. 02 - 21	38. FORECASTER'S INITIALS AGI T. LOUS		39. NAME OF PERSON RECEIVING BRIEFING CAPTAIN R.B. ROBERTS			
40. VOID TIME 0100	41. EXTENDED TO/INITIALS 0130	42. WX REBRIEF TIME/INITIALS 0100/RBL		43. WX DEBRIEF TIME/INITIALS			
Z	Z	Z	Z	Z	Z	Z	Z

Figure 2-30 Interpreting the DD-175-1 (Example 3)

**NOTE**

Be aware that because your revised takeoff time of 0110Z 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 0100Z and sets a new void time of 0130Z.

- d. **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.

FLIGHT WEATHER BRIEFING								
PART I - TAKEOFF DATA								
1. DATE 2 JUL	2. ACFT TYPE/NO. T45/168055	3. DEP PT/ETD NIR/2200 Z	4. RWY TEMP 35 °F/°C	5. DEWPOINT 28 °F/°C	6. TEMP DEV 5C	7. PRES ALT 160 FT	8. DENSITY ALT 2950 FT	
9. SFC WIND 1415 T	10. CLIMB WINDS 2520		11. LOCAL WEATHER WATCH/WARNING/ADVISORY			12. RSC/RCR		
13. REMARKS/TAKEOFF ALTN FCST LGT TURBC SFC - 050 ISOL CB'S LOCATED NW - N OF AUS MOVG SE @ 10 KT								
PART II - ENROUTE & MISSION DATA								
14. FLT LEVEL/WINDS/TEMP 370/2025/-38			15. SPACE WEATHER			16. SOLAR/LUNAR	LOCATION	
			NO IMPACT MARGINAL SEVERE			BMNT Z		
			FREQ			SR Z	MR Z	
			GPS			SS Z	MS Z	
			RAD			EENT Z	ILLUM %	
17. CLOUDS AT FLT LEVEL <input type="checkbox"/> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> IN AND OUT			18. OBSCURATIONS AT FLT LEVEL RESTRICTING VISIBILITY 7 <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO TYPE HAZE					
19. MINIMUM CEILING - LOCATION 050 - DFW FT AGL			20. MAXIMUM CLOUD TOPS - LOCATION 500 - OK, TX FT MSL			21. MINIMUM FREEZING LVL - LOCATION 120 - TUL FT MSL		
22. THUNDERSTORMS		23. TURBULENCE		24. ICING		25. PRECIPITATION		
CHART		CHART		CHART		CHART		
NONE AREA LINE		NONE IN CLEAR IN CLOUD		NONE RIME MIXED CLEAR		NONE DRIZZLE RAIN SNOW PELLET		
ISOLATED 1 - 2%		LIGHT		TRACE		LIGHT		
FEW 3 - 15%		MODERATE		LIGHT		MODERATE		
SCATTERED 16 - 45%		SEVERE		MODERATE		HEAVY		
<input checked="" type="checkbox"/> NUMEROUS - MORE THAN 45%		EXTREME		SEVERE		SHOWERS		
HAIL, SEVERE TURBULENCE & ICING, HEAVY PRECIPITATION, LIGHTNING & WIND SHEAR EXPECTED IN AND NEAR THUNDERSTORMS.		LEVELS VCTY OF CBS		LEVELS VCTY OF CBS		FREEZING LOCATION		
LOCATION TX, OK		LOCATION ALT → DFW		LOCATION ALT → DFW		ALT → ADM		
PART III - AERODROME FORECASTS								
26. DEST/ALTN TIK	27. VALID TIME Z TO Z 2210 0010	28. SFC WIND 3007	29. VSBY/WEA 5	30. CLOUD LAYERS 30 SCT 100 OVC		31. ALTIMETER 29.98 INS	RWY TEMP 28 °F/°C	PRES ALT 378 FT
DEST/ALTN DYS	Z TO Z 2240 0040	1315	6	25 BKN 250 BKN		29.92 INS	26 °F/°C	400 FT
DEST/ALTN	Z TO Z		M			INS	°F/°C	FT
DEST/ALTN	Z TO Z		M			INS	°F/°C	FT
DEST/ALTN	Z TO Z		M			INS	°F/°C	FT
DEST/ALTN	Z TO Z		M			INS	°F/°C	FT
DEST/ALTN	Z TO Z		M			INS	°F/°C	FT
DEST/ALTN	Z TO Z		M			INS	°F/°C	INS
PART IV - COMMENTS/REMARKS								
32. BRIEFED RSC/RCR		YES <input checked="" type="checkbox"/> NOT AVAILABLE		33. PMSV		34. ATTACHMENTS		YES <input checked="" type="checkbox"/> NO
35. REMARKS TIK RCR - DRY WW #25 IN EFFECT TILL 0300Z FOR ALT → ADM RTE DIVERSION WEST OF PLANNED ROUTE RECOMMENDED								
PART V - BRIEFING RECORD								
36. WX BRIEFED TIME 2130 Z		37. FLIMSY BRIEFING NO. 02 - 21		38. FORECASTER'S INITIALS AGI T. LOUS		39. NAME OF PERSON RECEIVING BRIEFING CAPTAIN R.B. ROBERTS		
40. VOID TIME 2230 Z		41. EXTENDED TO/INITIALS		42. WX REBRIEF TIME/INITIALS		43. WX DEBRIEF TIME/INITIALS		
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Figure 2-31 Interpreting the DD175-1 (Example 4)

**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.

**Enroute Procedures****Once you are airborne, where can you get current weather information?**

ANSWER:

- a. Pilot-to-Metro facilities
  - b. Flight Watch facilities (EFAS)
  - c. Flight Service Stations
  - d. ARTCC (center)
  - e. Transcribed Weather Broadcasts
1. Sources of In-Flight Weather Information

**NOTE**

The sources below are listed in the order in which they should be used.

- a. Pilot-to-Metro Service (PMSV)
  - i. Operated out of NASs, MCASs, and USAF bases—call name example: “Kingsville Metro” or “Metro”
  - ii. Normally, pilots can directly access weather forecasters
    - (a). 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
    - (b). 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.

- (c). 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
- (d). Advise forecaster/observer of ETA when terminal weather is requested
- (e). A listing of the SRFC can be found in FLIP Flight Information Handbook
- iii. Operates on UHF frequencies
- iv. Listed in the FLIP Flight Information Handbook and the Enroute Supplement under "Metro"
- b. Enroute Flight Advisory Service (EFAS)
  - i. Operated by FAA—call name example: “San Antonio Flight Watch” or “Flight Watch”
  - ii. Provides updated enroute weather information
    - (a). Not intended for preflight weather brief or random weather reports and forecast, contact nearest FSS for this information
    - (b). Specifically designed to provide enroute aircraft with timely and meaningful weather advisories pertinent to the type of flight intended, route of flight, and altitude
  - iii. 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
  - iv. Operates on VHF frequencies—122.0
  - v. Also available on specific frequencies reserved for high altitude traffic (for aircraft flying above 18,000 ft)
- c. Flight Service Station (FSS)

#### 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.

- i. Operated by FAA—call name example: “San Angelo Radio”

- ii. 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.

- iii. 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.

- d. Air Route Traffic Control Center (ARTCC)
  - i. Can provide weather information and updating as requested, but weather dissemination is not a primary service
  - ii. 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.

- e. Transcribed Weather Broadcasts (TWEB)
  - i. Recorded weather information transmitted over selected NDB and VOR stations
  - ii. Amount and type of weather information vary from station to station, but can include local weather, route weather, winds aloft, and terminal aerodrome forecasts
- f. Hazardous In-flight Weather Advisory Service (HIWAS)
  - i. Broadcasts continuously over selected VOR stations
  - ii. Contains summary of any AIRMETs, SIGMETs, convective SIGMETs, CWAs and PIREPs

- g. Automated Weather Observation System (AWOS)
  - i. 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
    - (a). AWOS observations derived from an automated system will include the prefix "AWOS"
    - (b). 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"
    - (c). 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.

- (d). 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
- ii. There are four operational levels of AWOS
  - (a). AWOS-A - reports only altimeter setting
  - (b). AWOS-1 - reports altimeter setting, wind data, temperature, dew point, and density altitude
  - (c). AWOS-2 - reports information in AWOS-1 plus visibility
  - (d). AWOS-3 - reports information in AWOS-2 plus cloud and ceiling data
  - (e). 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.

- iii. AWOS broadcasts phraseology generally follows that used in other weather broadcasts. The following are explanations of exceptions:
  - (a). The word "TEST" is added when the system is not in commissioned status
  - (b). The phrase "TEMPORARILY INOPERATIVE" is added when the system is inoperative
  - (c). Ceiling is announced as either "CEILING" or "INDEFINITE CEILING"

**NOTE**

All automated ceiling heights are measured ceilings except indefinite ceilings.

- (d). 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."

- (e). "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.

- (f). "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.

- (g). If remarks are included, the word "REMARKS" is announced after the altimeter setting in the following priority:
  - (1). Automated remarks

- i) Density altitude
  - ii) Variable visibility
  - iii) Variable wind direction
- (2). 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
- h. Automatic Terminal Information Service (ATIS)

**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.

- i. 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"
- ii. 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."

- iii. 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.

- iv. 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
2. Pilot weather reports (PIREPs)
- a. Issued by pilot to ATC or weather disseminating agencies (PMSV, EFAS, FSS, etc.)
  - b. Reports filed when
    - i. Requested
    - ii. Unusual and unforecast weather is encountered (mandatory voice report)
    - iii. Weather conditions on IFR approach differ from latest observation (mandatory voice report after landing)
    - iv. Missed approach is executed due to weather
    - v. Hazardous or potentially hazardous weather is encountered (windshear, microburst, icing, severe turbulence, etc.) particularly on arrival or departure
  - c. Relay time-critical information directly to ATC
  - d. 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.
  - e. Format (also available in FLIP Flight Information Handbook)
    - i. Aircraft location or area of occurrence
    - ii. Time (UTC)
    - iii. Altitude (MSL)
    - iv. Type aircraft
    - v. Sky cover (bases, tops, amount)

- vi. Temperature
- vii. Wind
- viii. Turbulence (see turbulence tables in FIH)
- ix. Icing (see icing tables in FIH)
- x. 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.

#### Flight Weather Packet

#### NOTE

OPNAV 3710.7 encourages the use of flight weather packets for extended flights.

1. Should be requested at least 2 hrs prior to the weather brief, preferably 24 to 48 hrs prior
  - Can be prepared in less than 2 hrs, but probably will not be as complete
2. Contents
  - a. Folder
  - b. Horizontal Weather Depiction Chart
    - i. Prepared for your proposed flight time and path
    - ii. Depicts atmospheric conditions from surface to 5,000 ft above the proposed flight level for the entire route and includes:
      - (a). Areas of 5/8 or more of cloud coverage
      - (b). All areas of cumulonimbus (CB), towering cumulus (TCU), in eighths coverage, along with tops and bottoms
      - (c). Heights of freezing level

- (d). Fronts and pressure centers with movements
  - (e). Significant weather and obstructions to visibility
  - (f). Hazards to flight
  - (g). Proposed route of flight
  - (h). Any miscellaneous entries deemed operationally significant
- c. Completed DD-175-1
    - Pilot shall receive a verbal briefing as well as the weather briefing form
  - d. Upper wind charts for proposed flight level(s) or OPARS customized flight plan
3. Use
- a. Folder contents serve as reminders of weather expected to encounter en route and stopover terminals
  - b. Pilot should note any deviations from weather
  - c. Pilots should turn in folder at final destination and if possible debrief with the forecaster actual conditions encountered in flight

### **Optimum Path Aircraft Routing System (OPARS)**

- 1. General
  - a. Primary purpose of OPARS is to provide computer-prepared flight planning service to the Naval Aviation community
  - b. Service provides customized flight plan which can be used in many different ways
    - i. Amount of fuel required to arrive with a specific reserve
    - ii. Maximum cargo/stores that can be carried for a particular flight/mission
    - iii. Amount of fuel required to "top off" for in-flight refueling
    - iv. Maximum time on station
    - v. Mandatory overwater reporting positions for overseas flights
    - vi. Fuel usage for a specific route and/or altitude

vii. Other options available due to crew requirements and/or recommendations

2. Program Description

- Data bases

i. 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 2-32 OPARS Kneeboard Output (1 of 2)

**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.

- (a). Climb (usually normal rate of climb)
  - (b). Cruise (usually maximum range)
  - (c). Descent (usually flight idle)
  - ii. Forecast winds and temperatures derived by computer at the Fleet Numerical Oceanography Center (FNOC) located at Monterey, CA
    - (a). Input includes land and shipboard surface and upper wind data
    - (b). Computer analyzes on the basis of historical data and current information which produces wind and temperature forecasts for the next 48 hrs
    - (c). Forecast model is run and OPARS data is updated every 12 hrs
  - iii. 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
  - iv. ADIZ zones, international boundaries, and prohibited airspace is entered
3. Request Procedures
- a. 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.

- i. Lead time of 2-3 hrs normally required; actual process, however, only takes ten minutes or less
  - ii. Best service provided if requested a day in advance of flight
- b. Secondary method is through DOD message system (AUTODIN)

- i. This method allows access at any military base or aircraft carrier
  - ii. Message process takes 8-10 hrs (minimum) from the time the request is sent
4. 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:

- a. Pilot/unit - (optional entry)
- b. Leg - 1 (no intermediate stops)
- c. POD - KNQI (ICAO for Point Of Departure)

**NOTE**

In CONUS, "NQI" would be sufficient.

- d. POA - CUS (Point Of Arrival, Hill AFB)
- e. Routing
  - i. \$J (computer select best jet route)
  - ii. \$R (fly jet routes or direct legs)
  - iii. \$C (canned tracks, i.e., IR routes)
  - iv. ..., 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	LEG - 3
44 POA > _____ 24 ROUTING > _____  13 TOD/TOA > _____ 51 TOG > _____ 18 CARGOCH > _____ 15 FUEL/RES > _____ 49 REFUEL > _____ *17 DC > _____	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 2-33 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 2-34 OPARS Request Form

- v. Several other options
- f. TOD/TOA - 2000 (Time Of Departure. Time Of Arrival could be entered if desirous of arriving at a specified time)
- g. OMOD - 1 KB (1 Kneeboard output format)

**NOTE**

Ten formats available, kneeboard is the most common request.

- h. AC Type - T45A (aircraft type and model)
- i. OPWT - 10493 (no fuel, no cargo weight in lbs)
- j. CARGOCH - 0 (cargo weight in lbs)
- k. Fuel/Reserve - 600 (desire 600 lbs fuel reserve at POA)

**NOTE**

OPARS will calculate amount of fuel to load at POD.

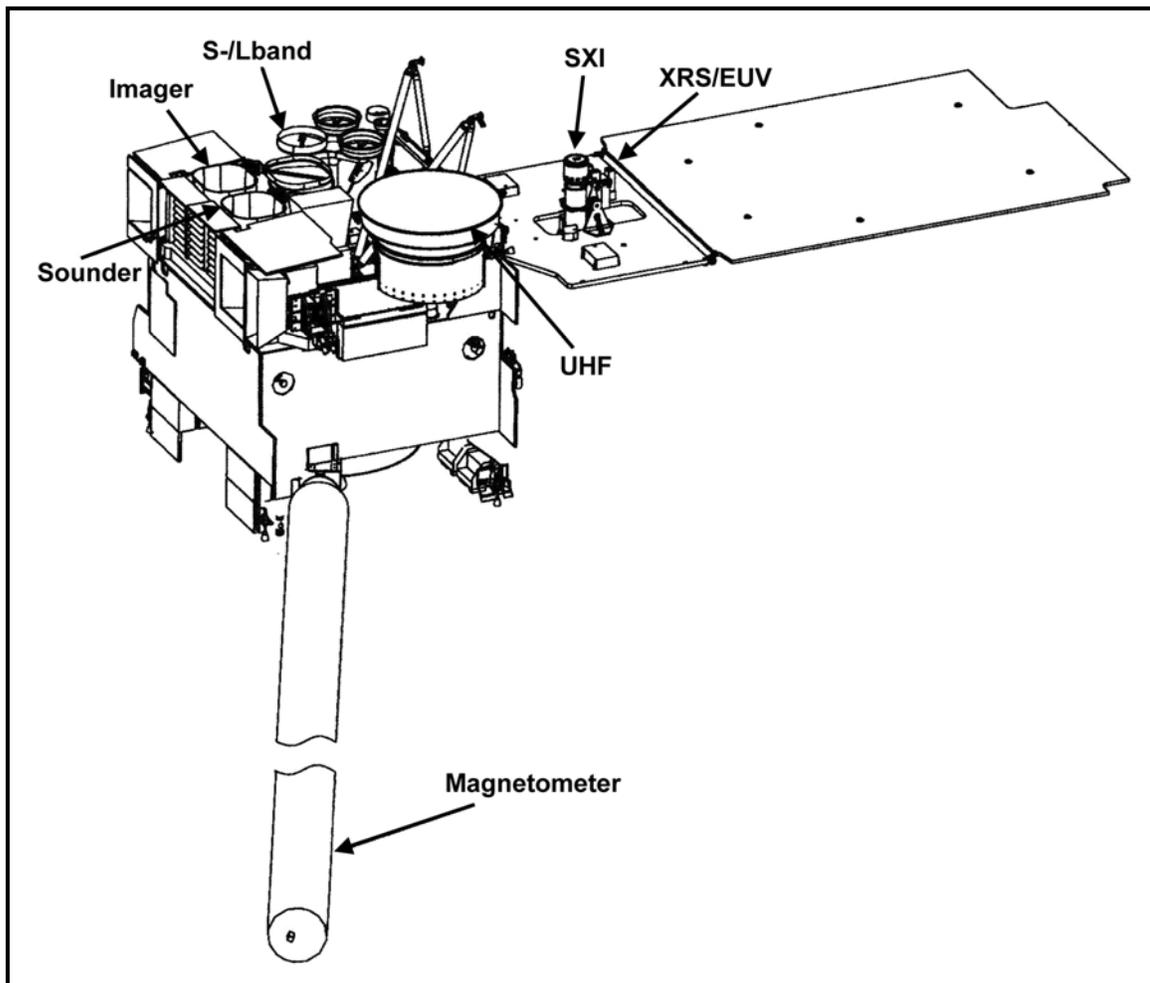
### Satellite Imagery

- 1. Background and introduction
  - U.S. Congress established system in 1961
    - i. Operated by National Oceanic and Atmospheric Administration (NOAA)
    - ii. Utilizes "Geostationary Operational Environmental Satellites" (GOES) and others that operate in a similar manner
      - (a). First one launched 5 May 1974; by 1983, seven had been launched

**NOTE**

By 1992, at least two had ceased to function.

- (b). GOES satellites now provide virtual worldwide coverage



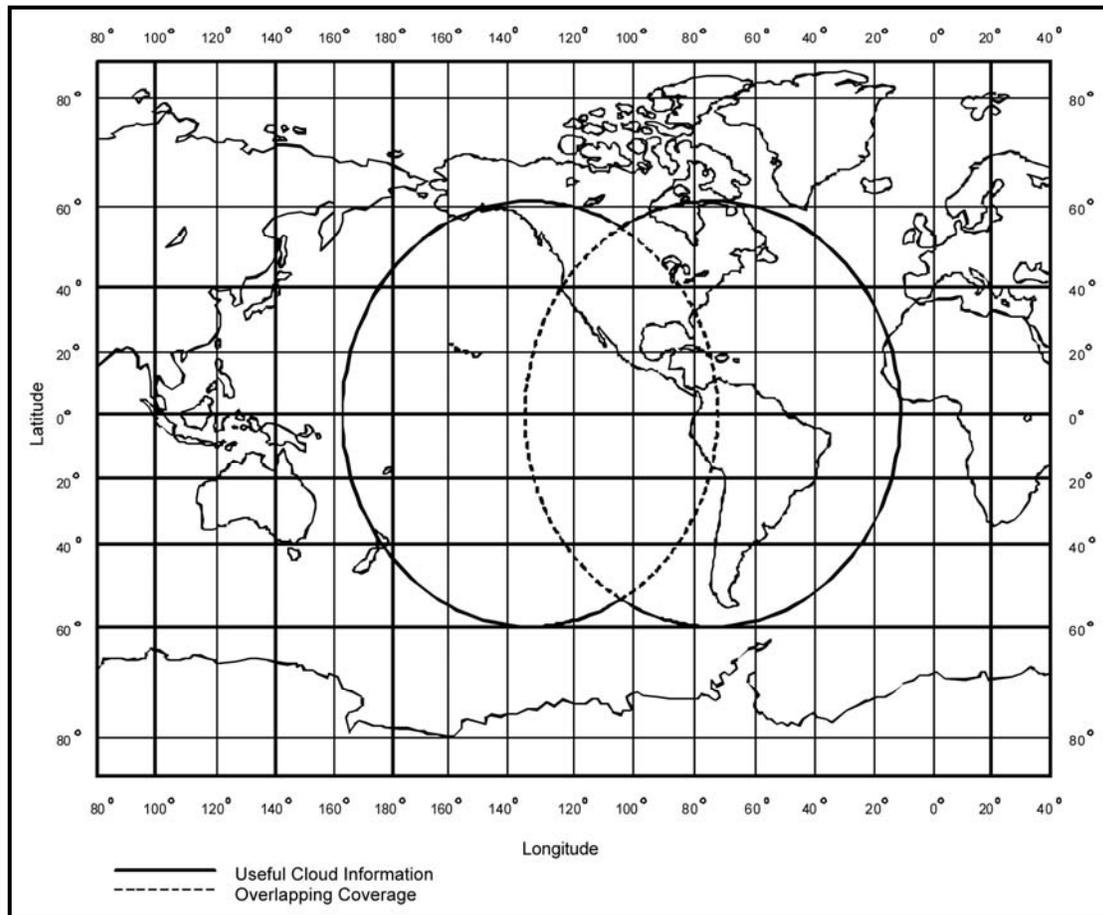
**Figure 2-35 GOES Satellite**

- (c). 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.

- (d). Scanners provide information on reflected visible light and thermal infrared portions of the spectrum

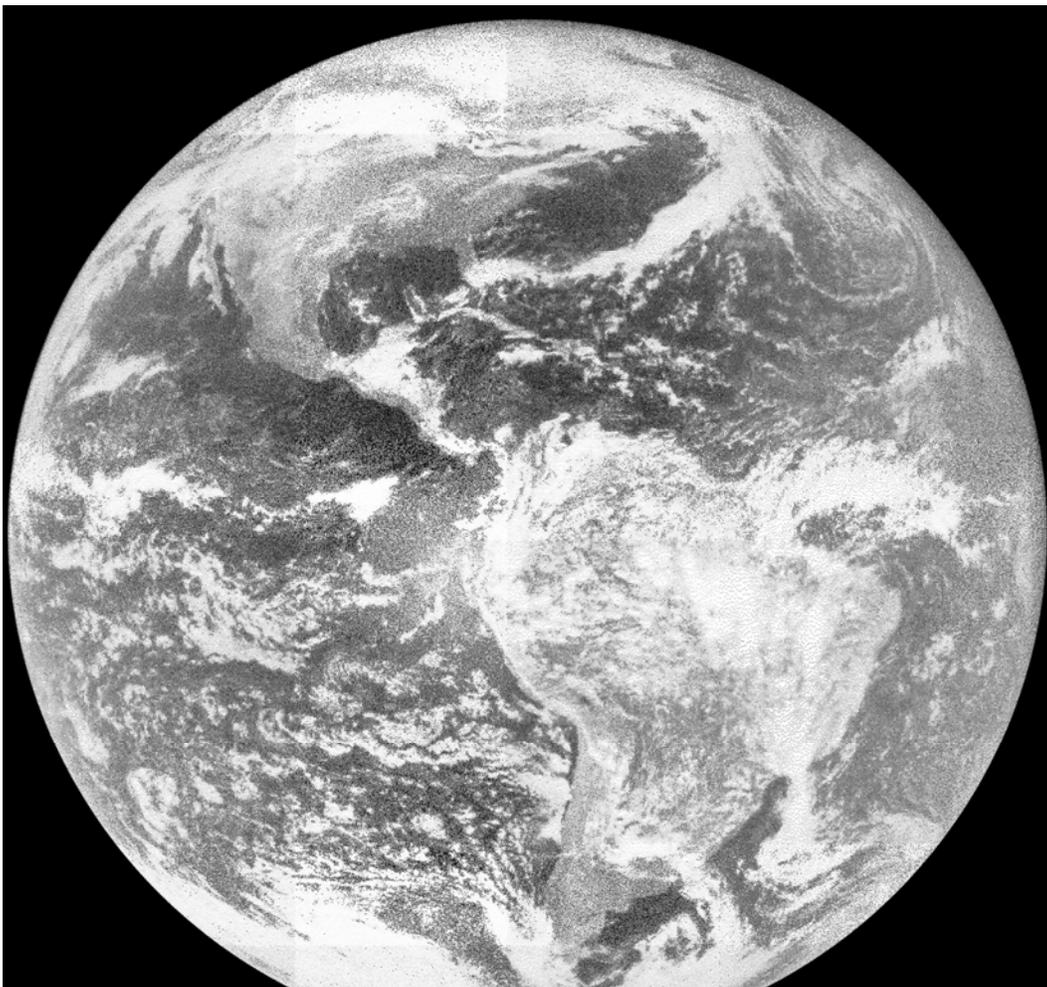


**Figure 2-36 GOES Coverage**

2. Visual pictures

- Resemble standard black and white photographs
  - i. Reconstructed on Earth by line processing similar to television, from digital data collected by the satellite sensors
  - ii. Picture is the result of reflected sunlight
    - (a). Clouds are an excellent reflector of sunlight
    - (b). Neither the Earth's atmosphere nor empty space reflects sunlight; therefore, the background will always be black
    - (c). Reflectivity table: (thick clouds appear white, thin clouds appear darker)
      - (1). Cumulonimbus - 92%

- (2). Thick Cirrostratus - 74%
- (3). Thick Stratocumulus - 68%
- (4). Thin Stratus - 42%
- (5). Sand, No Foliage - 27%
- (6). Sand and Brushwood - 17%
- (7). Water Surfaces - 9%

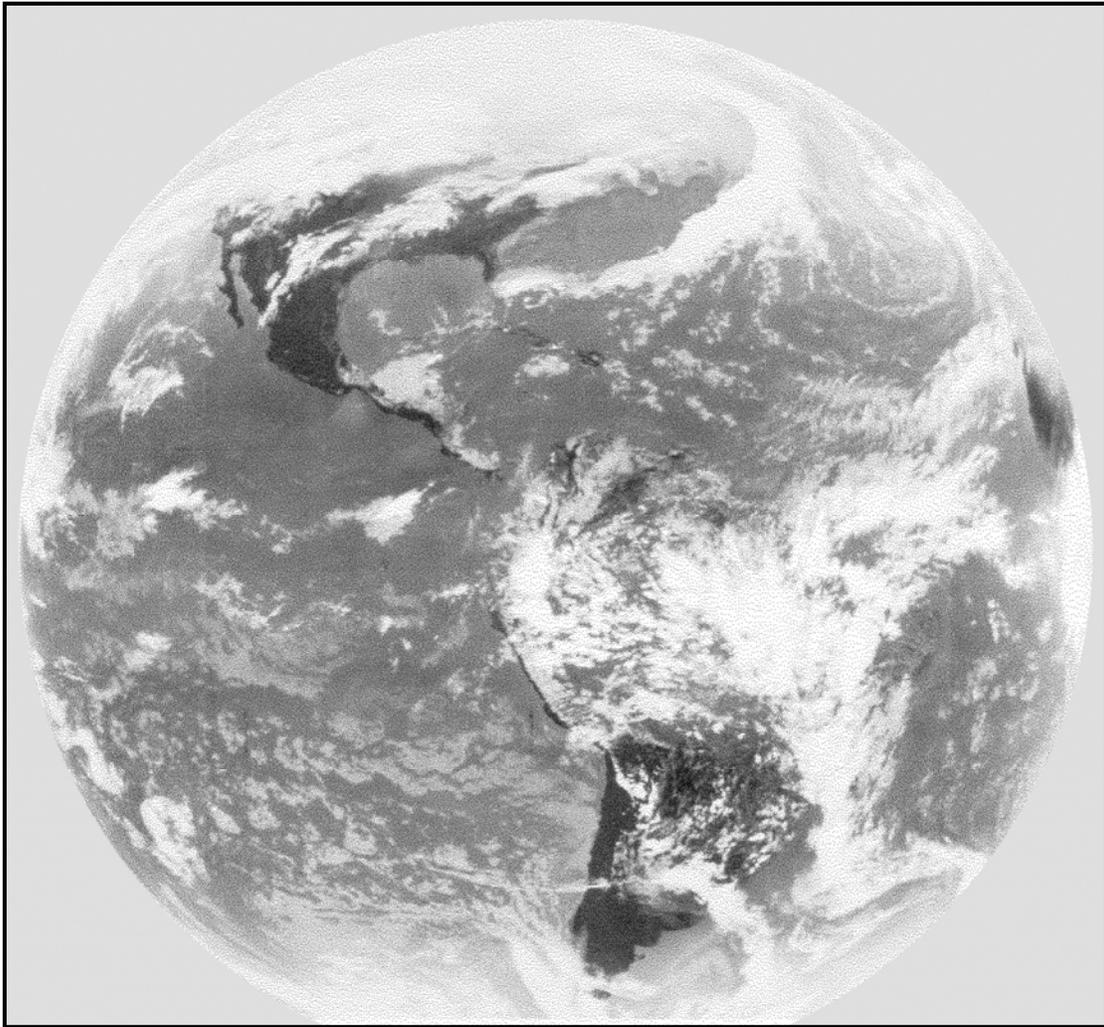


**Figure 2-37 Visual Picture**

**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.

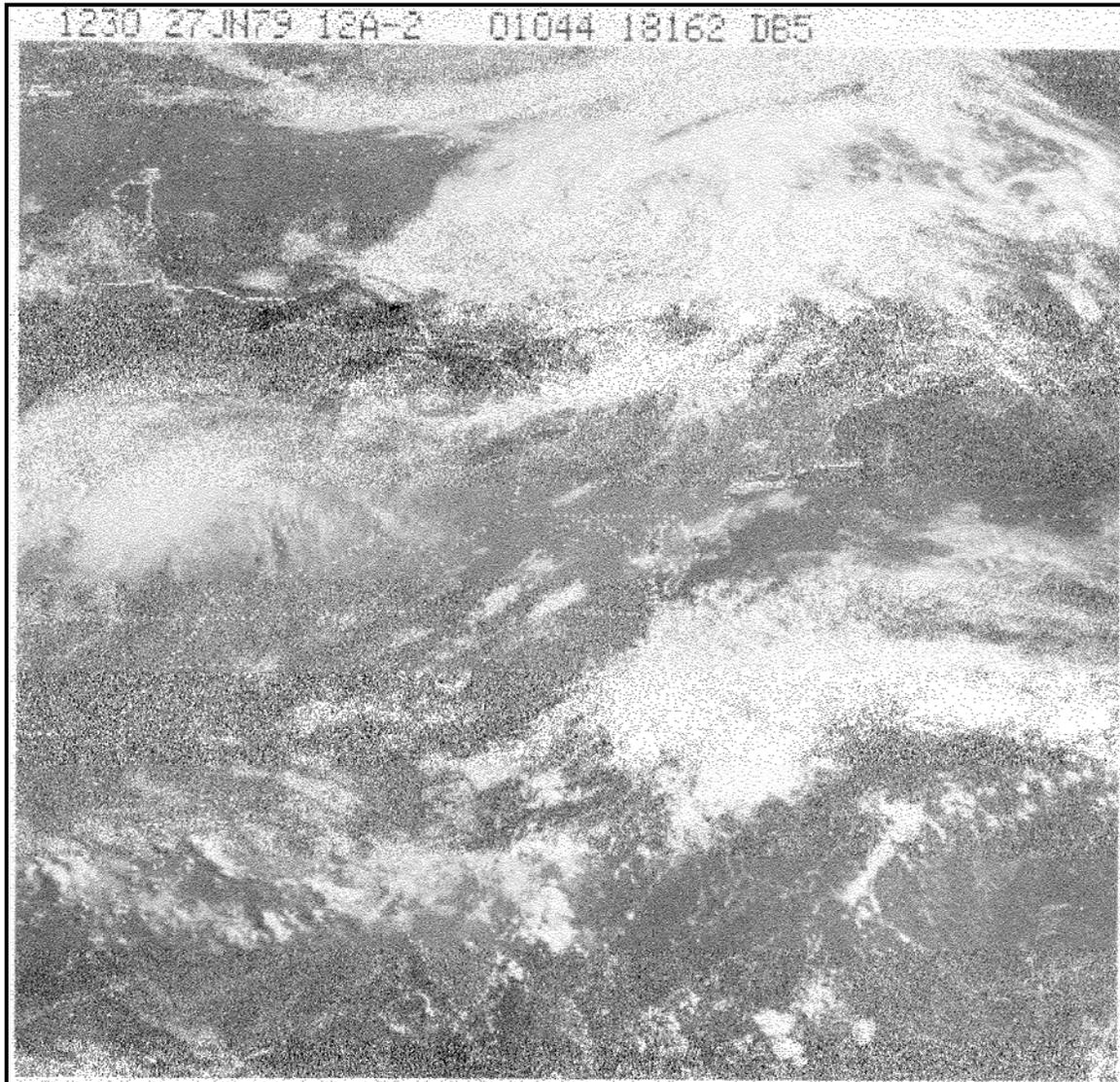
3. Infrared pictures
  - a. Everything with a temperature above absolute zero radiates energy
  - b. Wave length of energy varies with temperature
  - c. GOES measures energy level at specific wave lengths
  - d. Earth receivers convert energy measurements to temperatures
    - i. IR imagery portrays different temperatures as black (very warm), white (very cold), or some shade of grey
    - ii. 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
  - e. Enhanced IR Pictures
    - i. Meteorologist has the option of assigning shades of grey to specific temperatures which allows specific items, i.e., thunderstorms, to be highlighted
    - ii. Operationally enhanced IR used quite often



**Figure 2-38 Infrared Picture**

4. Date/Time data
  - a. As with all weather products, checking the currency of the product can be important
  - b. Some weather briefing facilities can provide real-time CRT imagery, direct from the appropriate satellite
  - c. Printed product will display DTG legend
    - i. First four numbers UCT (Z) time - indicates time of picture transmission start
    - ii. Second group calendar day, month, year

- iii. Last group indicates sector



**Figure 2-39 Picture with Date/Time Data**

- 5. Use of the pictures
  - a. Low-pressure areas and fronts
    - i. Primary characteristic is "question mark" or "comma" shaped cloud pattern
    - ii. Center of low pressure located near center of vortex
    - iii. Tail of the "comma" denotes the location of the cold front

- iv. Warm fronts often hard to define without the use of surface data
- v. Enhanced IR very helpful in determining locations of thunderstorms in the cloud pattern
- b. Mountain Wave Turbulence
  - i. Caused by winds in excess of 25 kts blowing perpendicular to rough or mountainous terrain causing moderate to severe turbulence
  - ii. Satellite imagery of wavy cloud pattern

**NOTE**

The tighter the waves, the more severe the turbulence.

- c. Jet Streams
  - i. Indicated by narrow bands of cirrus clouds
  - ii. Almost always marked by very sharp northern and southern boundaries
- d. Fog and Low Clouds
  - i. Show up on visual pictures only (reflective sunlight)
  - ii. Not enough contrast to show on IR



**Figure 2-40 Satellite Picture of Jet Stream**

6. Other uses of the GOES
  - a. IR radiation in any of several bands

- b. Atmospheric temperature sounding capability
- c. Solar X-ray emissions and the near earth space environment
- d. Provides selected data for research-oriented environmental scientists

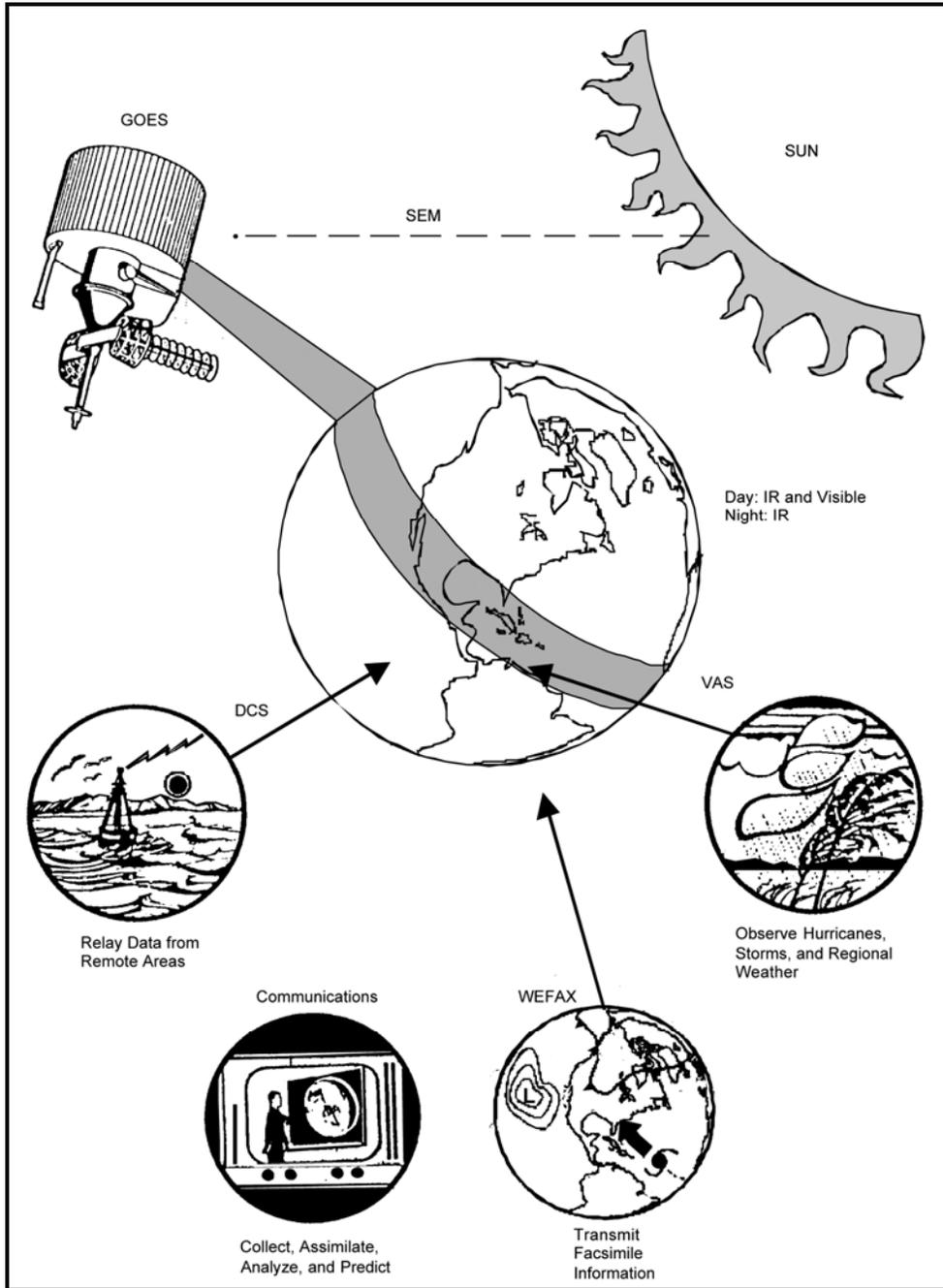


Figure 2-41 The GOES Mission

**206. SUMMARY**

This lesson has focused on the following topics:

1. Weather minimums
2. Weather charts
3. Printed reports and forecasts
4. Flight weather briefing
5. Enroute procedures
6. Flight weather packets
7. OPARS
8. Satellite imagery

**207. CONCLUSION**

Reviewing the different weather charts, reports, and advisories will increase your ability to predict weather phenomena that can affect your planned flight.

**CHAPTER THREE  
METEOROLOGY REVIEW**

**300. INTRODUCTION – N/A**

**COURSE/STAGE:**

- Meteorology

**LESSON TITLE:**

- Meteorology Review

**LESSON IDENTIFIER:**

- Metro-03

**LEARNING ENVIRONMENT:**

- Classroom

**ALLOTTED LESSON TIME:**

- .5 hr

**TRAINING AIDS:**

1. Meteorology CD-ROM
2. Figures

**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.

**301. LESSON OBJECTIVES****Metro-01 Weather Theory and Hazards**

1. Recall weather associated with frontal systems
2. Recall reasons for and effects of direction and velocity of surface winds
3. Recall definition of frontal systems
4. Recall meanings of severe weather hazards
5. Recall hazards associated with thunderstorms
6. Remember meaning of microbursts
7. Recall causes and dangers of ice formation
8. Recall causes and dangers of fog formation
9. Remember meaning of clear air turbulence (CAT)
10. Recall features and hazardous conditions associated with jet streams
11. Recall causes and hazards of wake turbulence phenomenon

**Metro-02 Weather Minimums, Restrictions, and Data Interpretation**

1. Determine weather minimums
2. Recall weather minimums required IAW OPNAVINST 3710.7
3. Recall information contained/displayed on weather charts
4. Interpret surface charts (analysis/prognostic)
5. Interpret weather depiction charts
6. Interpret radar summary charts

**3-2 METEOROLOGY REVIEW**

7. Interpret prognostic charts
8. Recall information contained in forecasts
9. Recall information contained in METARs
10. Recall information contained in area forecasts
11. Recall information contained in terminal aerodrome forecasts
12. Recall information provided in winds aloft forecasts
13. Recall information contained in severe weather forecasts
14. Recall aviation in-flight weather advisories
15. Recall OPNAVINST severe weather restrictions
16. Recall CNATRA severe weather restrictions
17. Recall information provided in SIGMETs
18. Recall information provided in AIRMETs
19. Recall requirements IAW OPNAVINST 3710.7 for obtaining DD-175-1
20. Recall the five sections of the DD-175-1
21. Recall enroute facilities/procedures for weather information and reporting
22. Recall information provided in PIREPs
23. Recall PIREP information to provide controlling agency

### **302. 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.

### **303. 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:

1. Overview of the test
2. Fronts and resulting winds
3. Meteorological hazards
4. Weather minimums
5. Weather charts
6. Printed reports and forecasts
7. Flight weather briefing DD-175-1
8. Enroute procedures

### **304. PRESENTATION**

#### **Overview of Meteorology Test**

1. Grading criterion: 80%
2. Length of test: 40 questions
3. Questions
  - a. General questions concerning weather theory and application toward flight planning and IFR flight
  - b. 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
4. Formats appearing on test
  - a. Multiple choice (single answer)
  - b. True/false
5. Content
  - a. Frontal systems
  - b. Meteorological hazards

### **3-4 METEOROLOGY REVIEW**

- i. Thunderstorms
- ii. Structural ice
- iii. Fog
- iv. Jet streams
- v. Clear air turbulence (CAT)
- vi. Wake turbulence avoidance
- c. Weather minimums
  - IFR alternate airport weather minimums as required in OPNAVINST 3710.7
- d. Weather charts
- e. Printed reports and forecasts
- f. Severe weather restrictions
- g. Flight weather briefing
  - i. Components and requirements for filing DD-175-1
  - ii. Interpretation of DD-175-1 for flight planning purposes
- h. Content and use of PIREPs

### **Fronts and Resulting Winds**

1. Frontal system: discontinuity formed between two contrasting airmasses of different characteristics

### **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:

- a. Cold front weather is usually associated with unstable air, cumulus clouds, and thunderstorms.
  - b. Warm front weather is usually more stable, bringing low clouds and continuous or steady precipitation.
2. Cold front
- a. Characteristics
    - i. Predominantly cumulus clouds
    - ii. Thunderstorms and occasional squall lines (seasonal)
    - iii. Turbulence and unstable air
    - iv. Strong, gusty winds
    - v. Showery precipitation
    - vi. Clearing skies and good visibility after frontal passage
  - b. Wind changes
    - i. Before passage, wind flows parallel to (along) the front
    - ii. After passage, wind flows perpendicular to front
      - (a). Follows prevailing wind in same direction as front movement (perpendicular to front)
      - (b). Generally stronger due to steeper pressure gradient of colder airmass

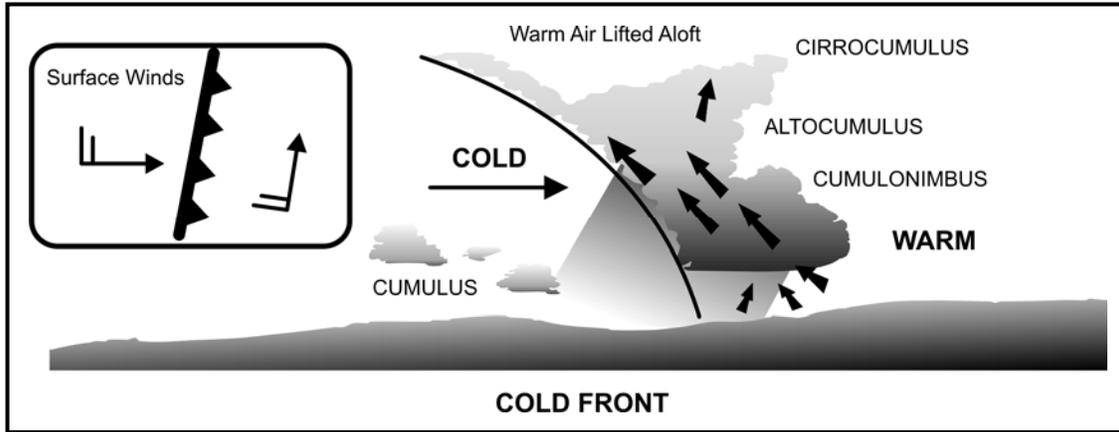


Figure 3-1 Cold Front

3. Warm front

a. Characteristics

- i. Predominantly cirriform and stratiform type clouds
- ii. Predominantly stable air and little turbulence
- iii. Continuous precipitation ahead of front in wide area
- iv. Poor visibility from haze or fog
- v. Icing conditions

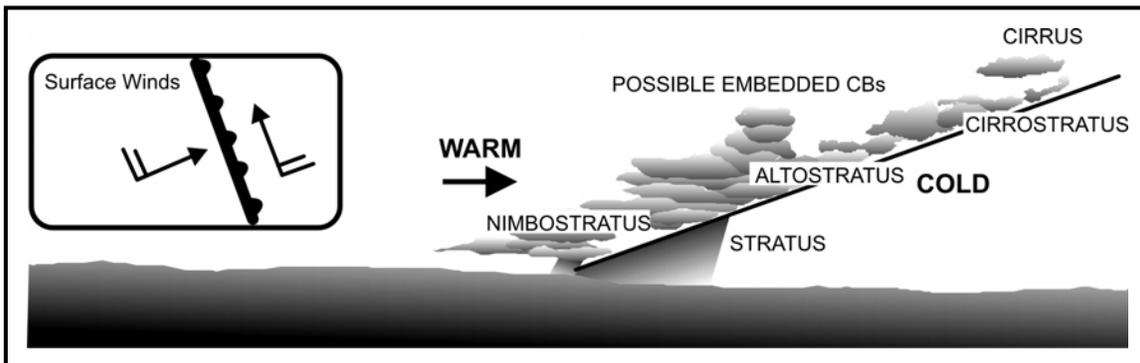


Figure 3-2 Warm Front

- b. Wind changes
  - i. Before passage, wind flows parallel to front from higher to lower pressure
  - ii. After passage, wind flows perpendicular to front
4. Stationary front
  - a. Characteristics: same as warm front, only less intense—can persist in an area for many days
  - b. Winds flow parallel to frontal line, but in opposite direction—no prevailing wind to push front in any direction
5. Occluded fronts: form when faster-moving cold front overtakes slower warm front
  - a. Cold front occlusion
    - Characteristics
      - (a). Rain or freezing rain
      - (b). Poor visibility from fog and low ceilings
      - (c). Embedded thunderstorms

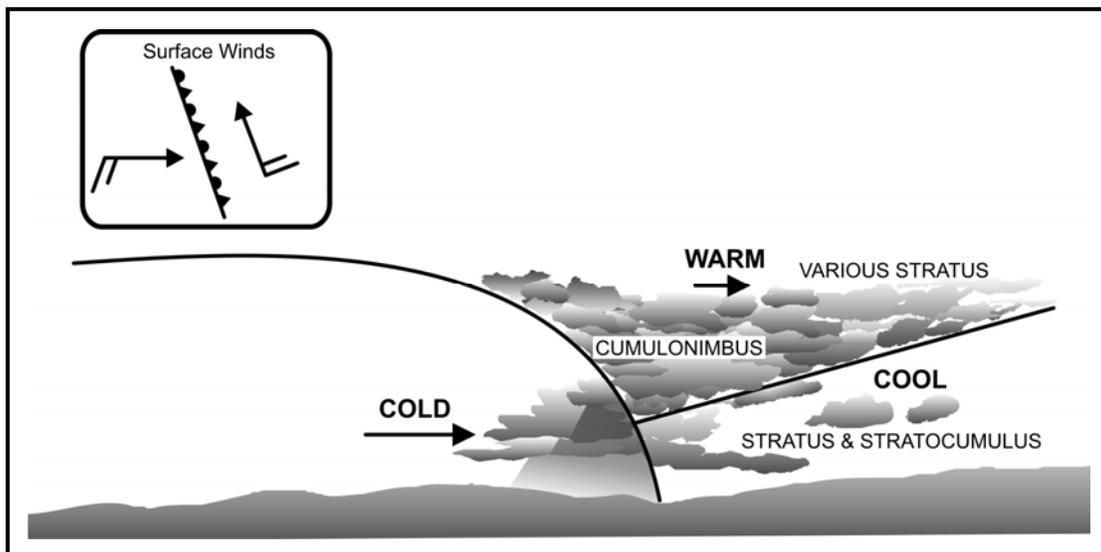


Figure 3-3 Cold Front Occlusion

- b. Warm front occlusion characteristics
  - i. Rain or freezing rain
  - ii. Poor visibility from fog and low ceilings
  - iii. Embedded thunderstorms

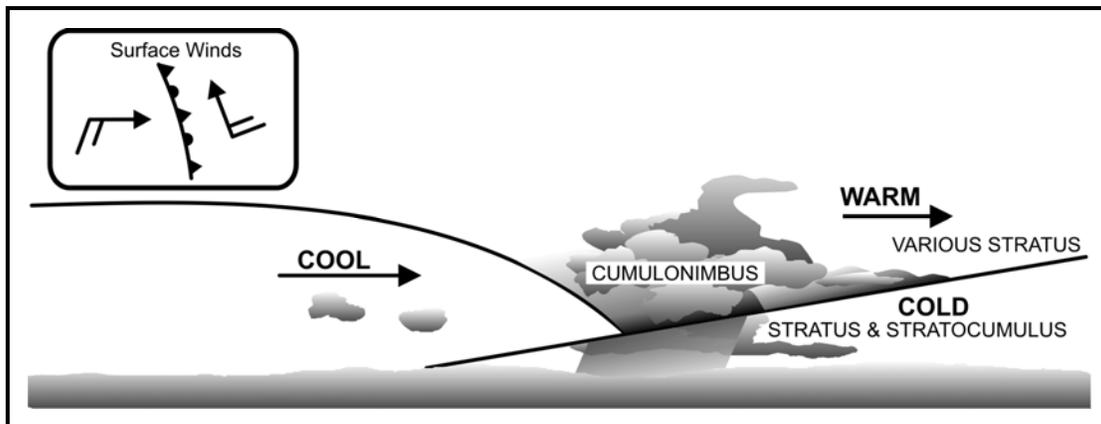


Figure 3-4 Warm Front Occlusion

**What are the characteristics of a cold front occlusion?**

ANSWER:

- a. Freezing rain
- b. Poor visibility
- c. 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

### Meteorological Hazards

**List six flight hazards common to thunderstorms.**

ANSWER:

- a. Severe turbulence

- b. Hail
  - c. Tornadoes
  - d. Lightning
  - e. Microbursts
  - f. Icing
1. Thunderstorms
- a. Turbulence
  - b. Hail
  - c. Tornadoes
  - d. Lightning
  - e. Surviving a thunderstorm penetration
  - f. 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.

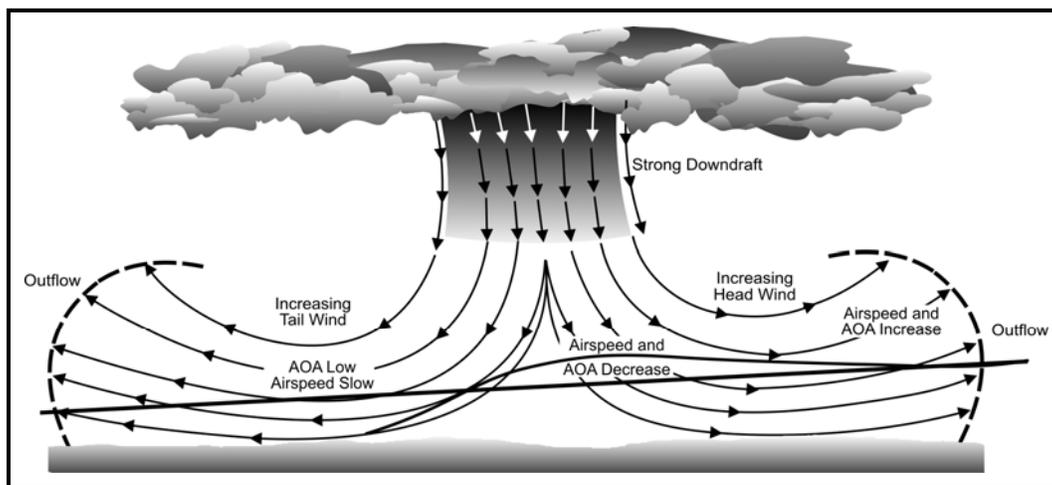


Figure 3-5 Microbursts

- i. Description and composition
  - (a). Intense and localized downburst of air that descends from a thunderstorm and, upon reaching the ground, spreads horizontally
  - (b). Usually found beneath thunderstorms with visible rain or virga
  - (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
  - (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
- ii. Indications
  - (a). Blowing dust, dust devils, and gust fronts (downbursts will occasionally generate distinctive circular dust patterns)
  - (b). Thunderstorms in vicinity with visible areas of 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 1,500-2,000 ft AGL and surface winds
  - (g). LLWAS (Low-Level Windshear Alert System) alert
  - (h). PI REP of windshear or airspeed gain or loss

#### NOTE

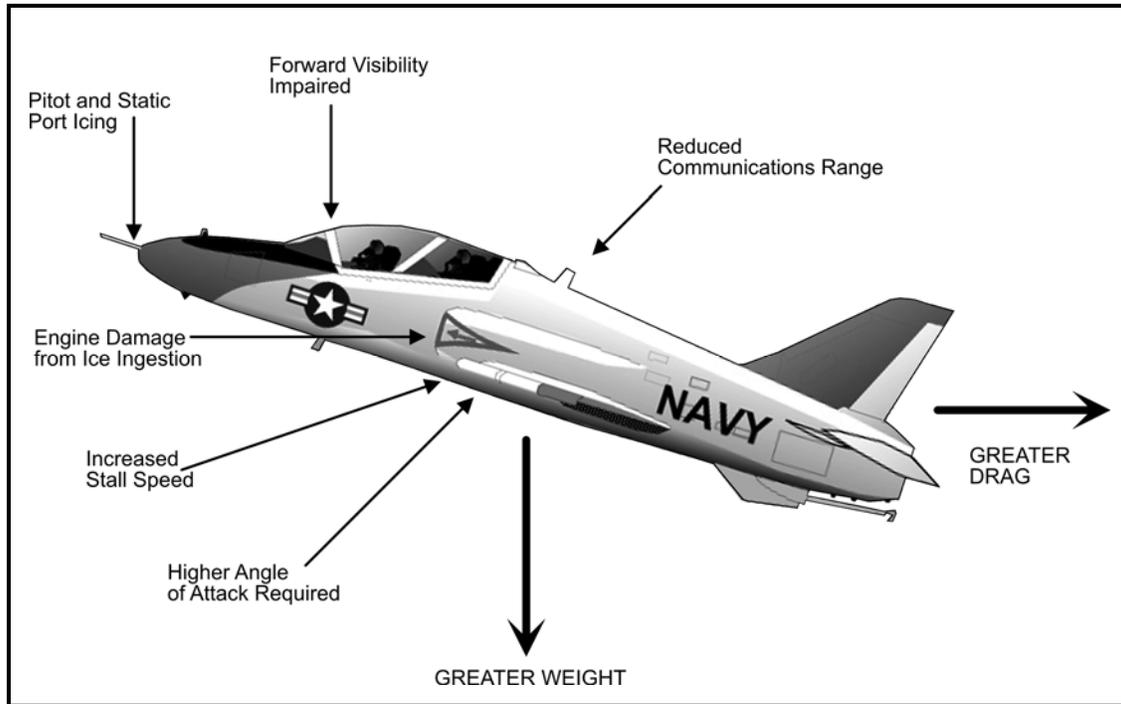
Although PIREPs are important to alert other pilots of microbursts, microburst intensity can change rapidly, so even recent PIREPs may not reflect the true strength of a microburst--listen to the aircraft ahead or ask for PIREP information from ATC. Report any airspeed fluctuations of 5 kts or more as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

- iii. Avoidance
  - (a). Takeoff: delay departure
  - (b). Landing: delay approach or use alternate runway/approach/airfield
- iv. 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.

- 2. Structural ice
  - a. Increases drag and weight
  - b. Decreases lift and increases stall speed: level flight requires higher angle of attack (AOA)
  - c. 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



**Figure 3-6 Structural Icing**

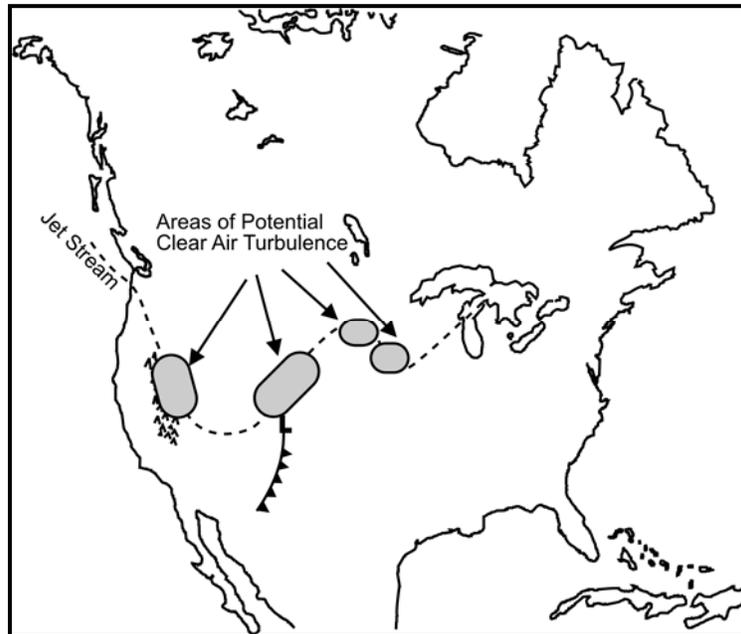
- d. Other considerations
- i. Pitot and static sources can clog, affecting reliability of Mach/airspeed indicator, altimeter, and vertical speed indicator (VSI)
  - ii. Vision impaired due to windshield icing
  - iii. Engine sensors can clog, resulting in improper throttle and fuel control
3. Fog can form when temperature and dew point within 3 degrees C/5 degrees F of each other

**Name two phenomena that can produce clear air turbulence.**

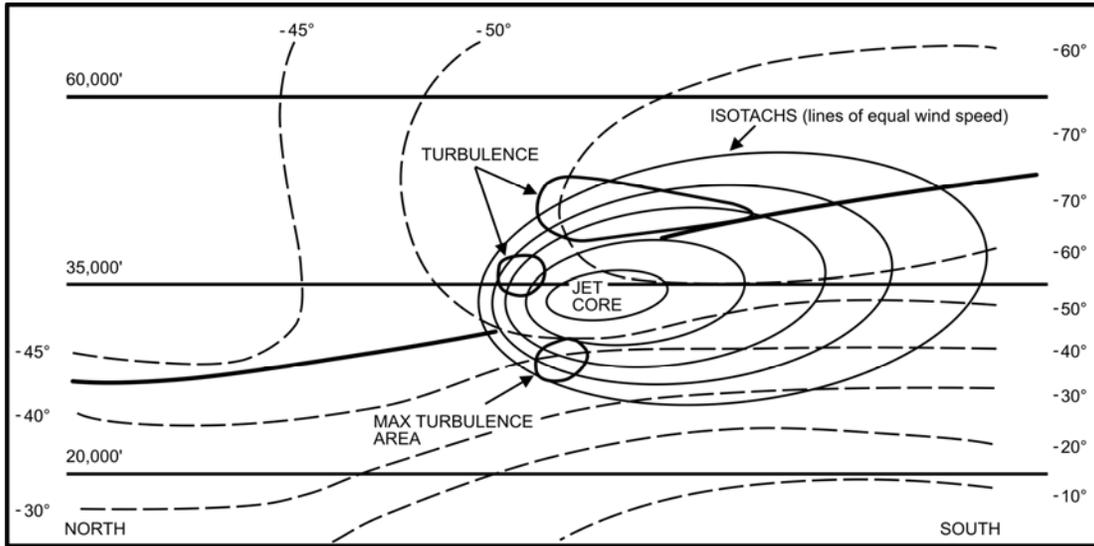
**ANSWER:**

- a. Jet streams
  - b. Mountain wave
4. Clear air turbulence (CAT)
- a. Jet Stream CAT

- i. Caused by shear zones associated with the movement of wind within the jet stream
- ii. Most common when wind speed increases or decreases rapidly between altitudes
- iii. Common near areas of highest wind velocity within the jet stream, on the polar side and below the core



**Figure 3-7 Jet Stream Clear Air Turbulence (CAT)**

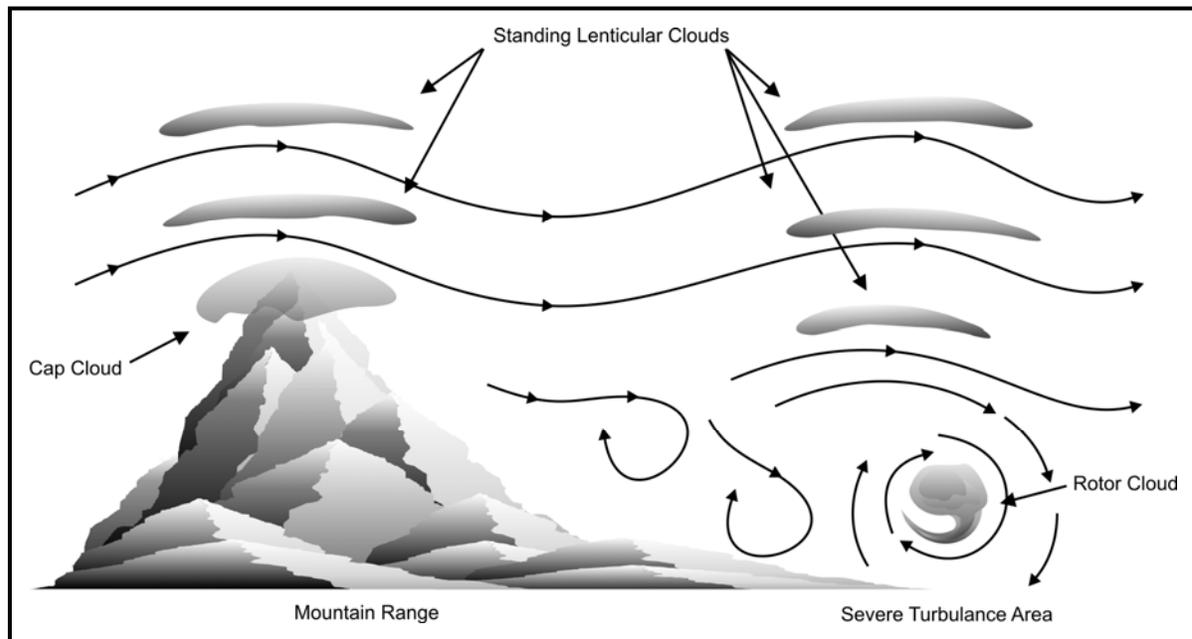


**Figure 3-8 Jet Stream Clear Air Turbulence (CAT)**

**Where is the most severe turbulence in a mountain wave phenomenon?**

ANSWER:

- Near rotor cloud formations
- b. Mountain wave CAT
  - i. High velocity airflow over mountain range is disrupted and causes turbulence over and downwind of range
  - ii. Produces large “waves” of air with strong updrafts and downdrafts
  - iii. Rotor turbulence very severe below wave, tops of mountains, and especially near rotor clouds-similar to turbulence found near thunderstorms

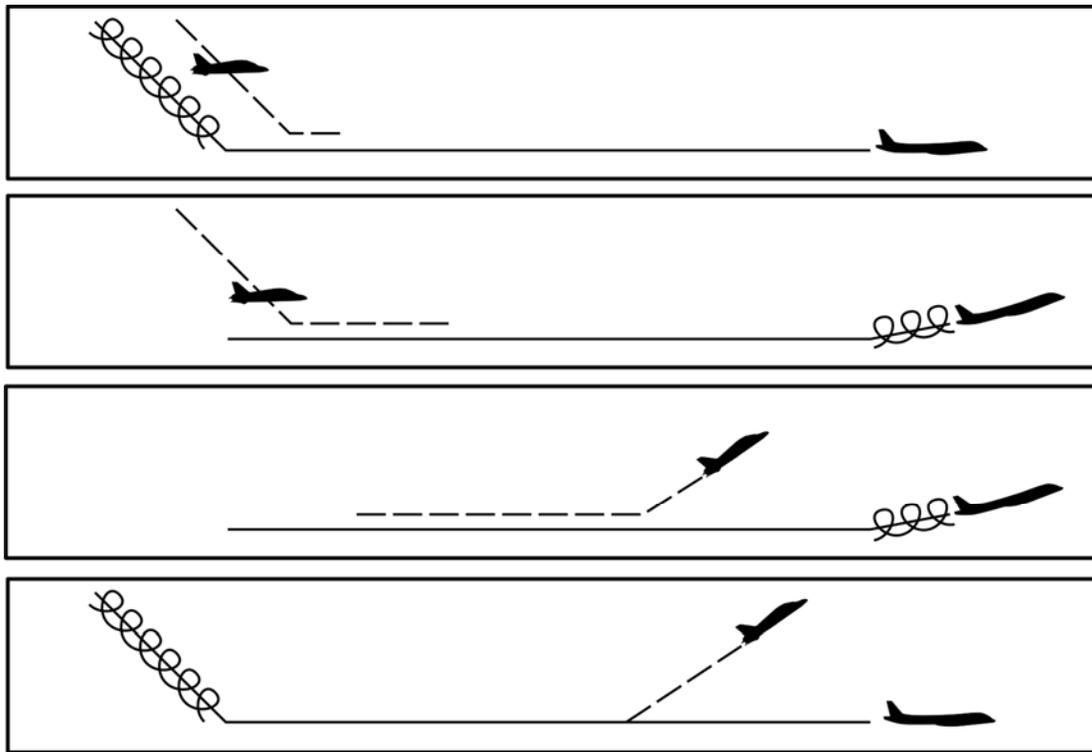


**Figure 3-9 Mountain Wave Phenomenon**

5. Wake turbulence
  - a. Characteristics
    - i. Heavy and slow aircraft generate greatest vortex strength
    - ii. 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.



**Figure 3-10 Wake Turbulence Avoidance**

- b. Operational considerations
  - i. Plan flight path above previous aircraft's flight path
  - ii. Take off before previous aircraft's lift-off point
  - iii. Land beyond touchdown point of previous aircraft

#### **Weather Minimums (OPNAVINST 3710.7)**

#### **NOTE**

Weather at ETA +/- 1 hr 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 non-precision, alternate must be published minimums plus 300-1

- b. 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.

- 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.

**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

DESTINATION WEATHER ETA plus and minus one (1) hour	ALTERNATE WEATHER ETA plus and minus one (1) hour		
0-0 up to but not including published minimums	3,000-3 or better		
Published minimums up to but not including 3,000-3 (single-piloted absolute minimums 200-1/2)	NON- PRECISION	PRECISION	
		ILS	PAR
	* Published minimums plus 300-1	Published minimums plus 200-1/2	*Published minimums plus 200-1/2
3,000-3 or better	No alternate required		
*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.			

**Figure 3-11 Weather Minimums Required IAW OPNAVINST 3710.7**

**Weather Charts**

1. 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.

- a. Surface analysis chart symbology
  - i. Standard symbols depict fronts
  - ii. “H” or “L” and isobars denote pressure systems
  - iii. 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.

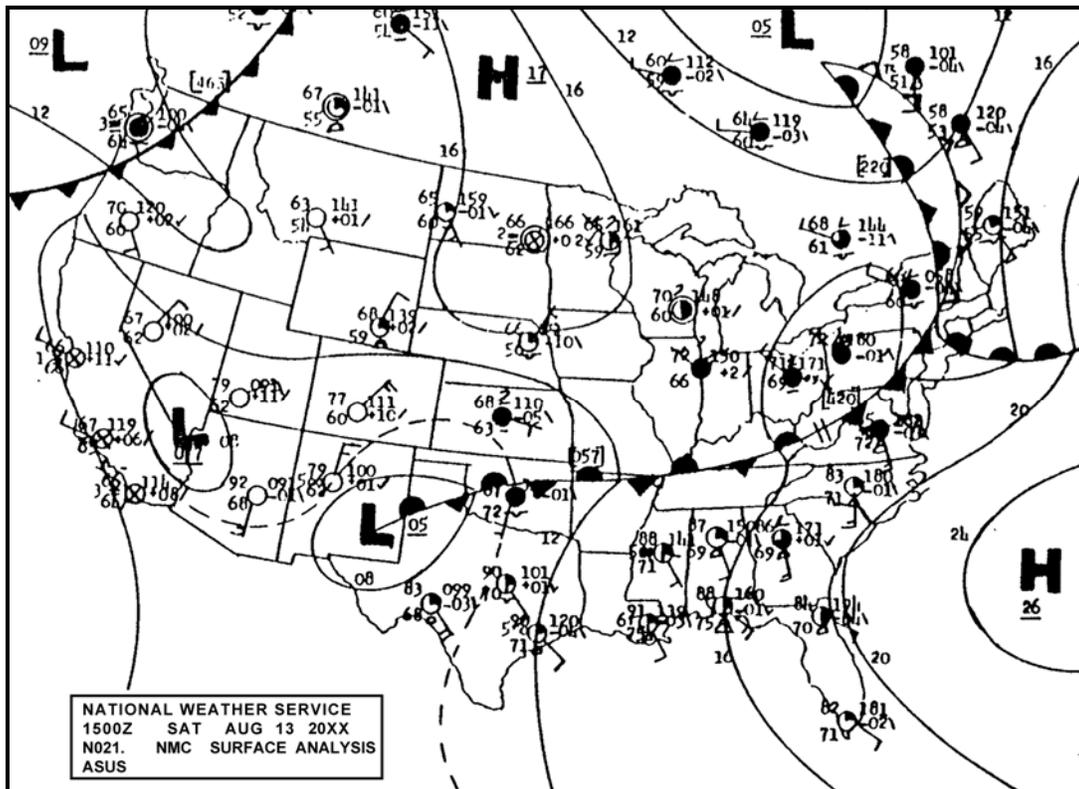


Figure 3-12 Surface Analysis Chart

- b. Weather depiction chart symbology
  - i. Standard symbols depict fronts (as on surface analysis chart)
  - ii. Contoured, unshaded areas indicate marginal VFR (MVFR) weather with ceilings of 1,000-3,000 ft AGL and/or visibilities of 3-5 sm
  - iii. Contoured, shaded areas indicate IFR weather with ceilings less than 1,000 ft AGL and/or visibility of less than 3 sm
  - iv. 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.

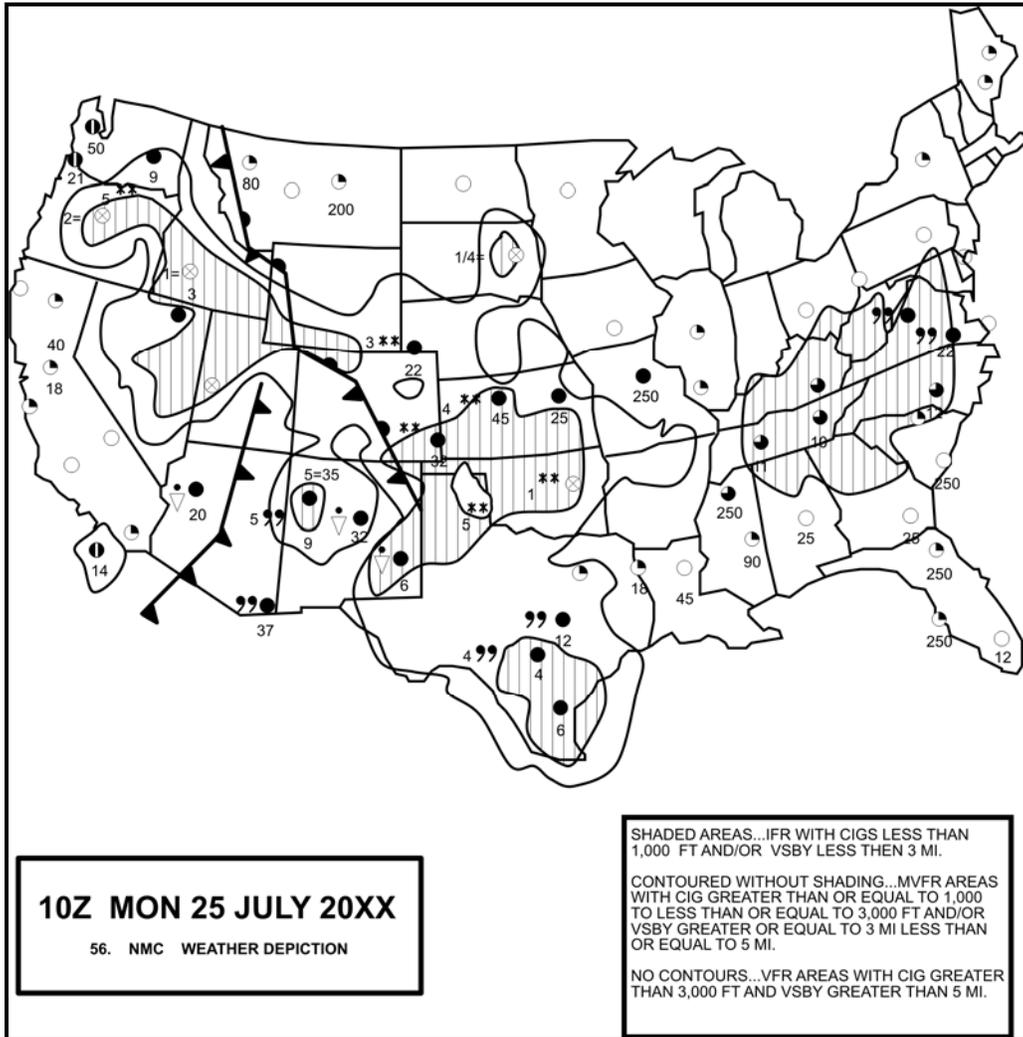


Figure 3-13 Weather Depiction Chart

According to the weather depiction chart, what are the predominant conditions in south Texas?

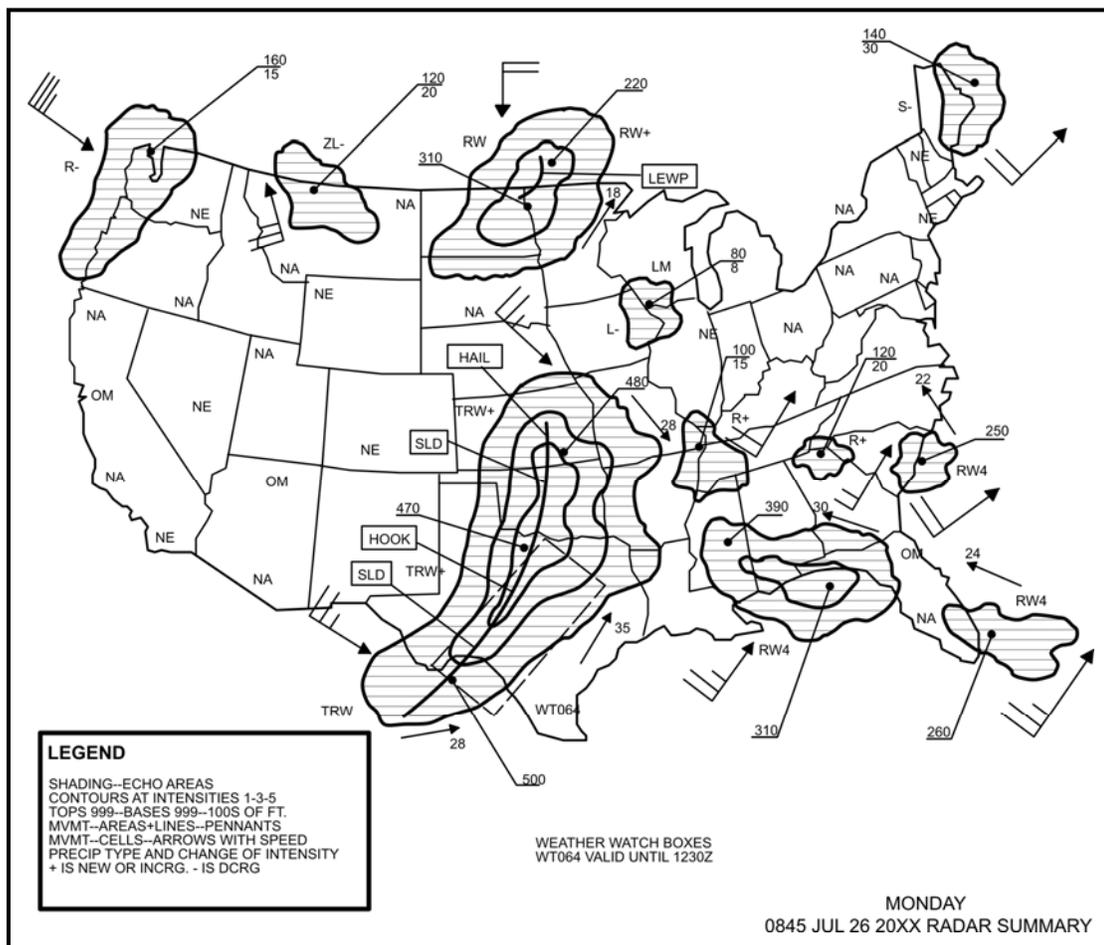
ANSWER: IFR conditions with 400-600 ft overcast ceilings and drizzle to light rain.

- c. Radar summary chart symbology
  - i. Three levels of contoured lines display areas and intensity of precipitation; remaining three levels are interpolated
  - ii. Display cloud tops in hundreds of feet, identified with the top of the radar return

- iii. Direction arrows show movement of precipitation areas
- iv. Letter symbols depict type of precipitation - rain, hail, snow, ice pellets, etc.
- v. Dashed boxes indicate severe thunderstorm and tornado watch areas

**LESSON NOTES**

Point to the weather watch area in central Texas on the chart.



**Figure 3-14 Radar Summary Chart**

**Refer to the Radar Summary Chart (Figure 3-14). 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.

- 2. Prognostic charts
  - a. Low-level significant weather prognostic chart symbology—surface to 24,000 ft MSL
    - i. Smooth lines enclose forecast areas of IFR conditions; scalloped lines enclose marginal VFR (MVFR) conditions
    - ii. Broken line depicts areas of moderate or greater turbulence—numbers with bars denote altitude
    - iii. Dashed lines display the freezing level at altitudes of 4,000, 8,000, 12,000, and 16,000 ft

**NOTE**

Dotted line indicates freezing level at surface.

- iv. Chart contains legend for clarity

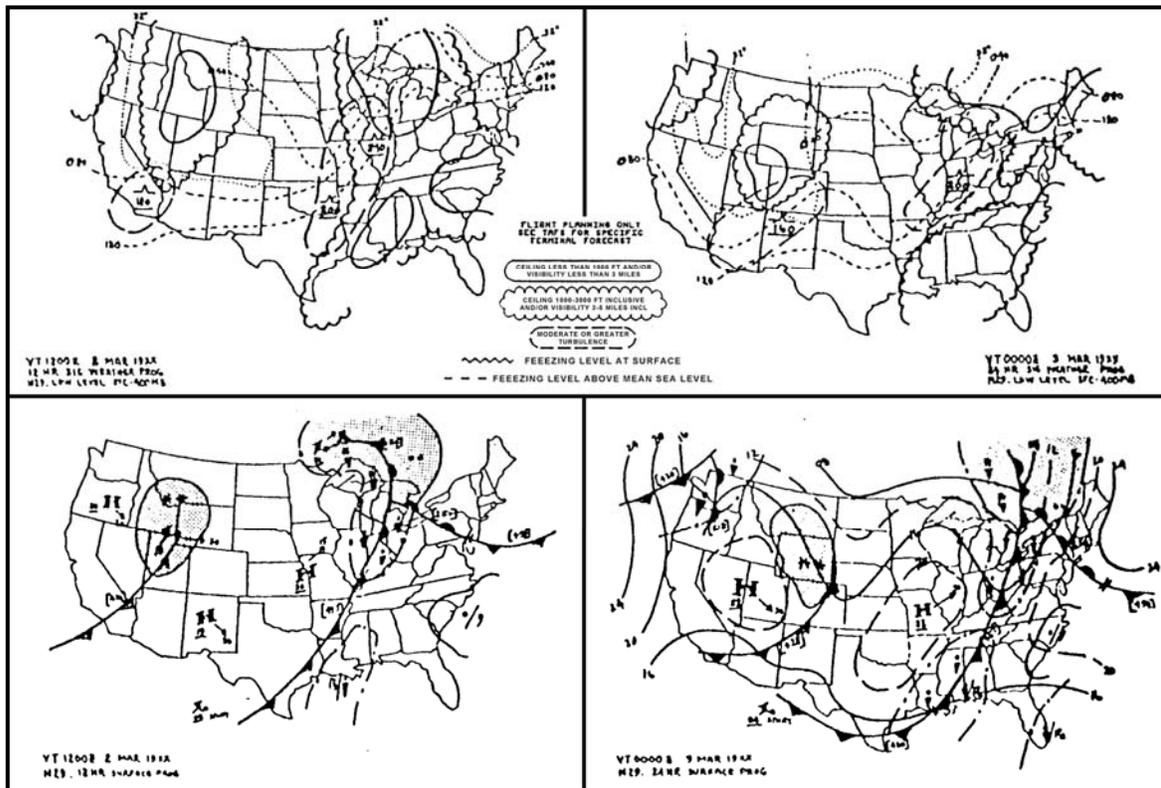


Figure 3-15 Low-Level Prognostic Chart

- b. High-level significant weather prognostic chart

**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 3-15.

**Refer to the Low-Level Prognostic Chart (Figure 3-15). 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.

- c. Winds aloft prognostic chart symbology
  - i. Wind shafts indicate wind direction
  - ii. Wind flags, barbs, and half-barbs mounted on arrow display wind speed
  - iii. Temperature depicted in degrees C near base of wind flag

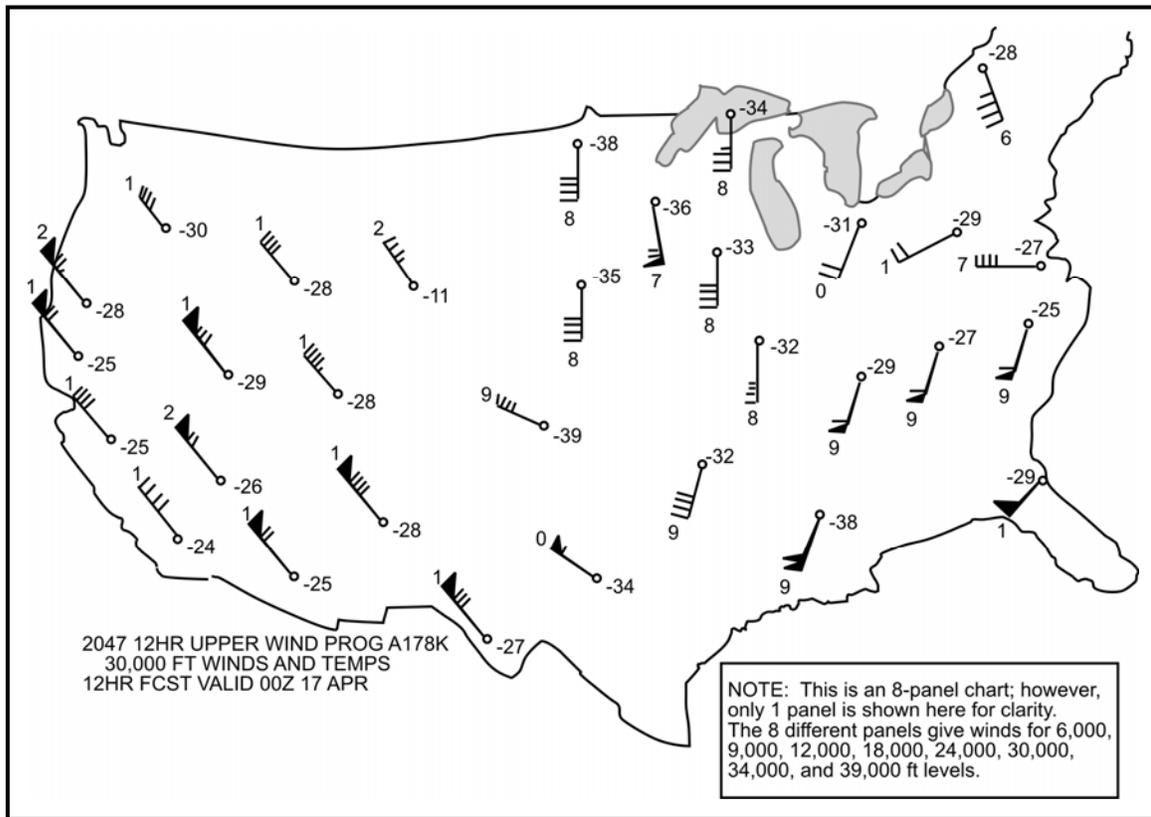


Figure 3-16 Winds Aloft Prognostic Chart

Printed Reports and Forecasts

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.

1. METAR
2. Area Forecast (FA)
  - a. 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

- b. Plain language and FAA-approved codes identify hazards/flight precautions, icing and freezing level, pressure systems and fronts, turbulence, significant clouds, and weather

```
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 3-17 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 3-18 Area Forecast (FA)**

3. Terminal Aerodrome Forecasts
  - a. Provides 24-hour forecast for a specific station
  - b. 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
  - c. Breakdown in FLIP planning (GP)

```

KNQI TAF 1915/2015 16018G28KT 8000 FEW015 SCT025CB BKN040 BKN250
52005 QNH2990INS VCTSSHRA
TEMPO 1919/2000 VRB20G35KT 3200 TSSHRA BKN 015CB OVC025
BECMG 2001/2002 17013G22KT 9999 SCT020 SCT250 QNH2995INS
BECMG 2009/2010 14005KT 4800BR SCT010 SCT250 QNH3000INS
TEMPO 2010/2013 0800FG VV002
BECMG 2014/2015 16010KT 9000 HZ SCT020 SCT100 BKN250 QNH2292INS
  
```

**Figure 3-19 Terminal Aerodrome Forecast (TAF)**

4. Winds Aloft Forecast (FD)
  - a. 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
  - b. 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

FD WBC 250550 BASED ON 2500Z 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 3-20 Winds Aloft Forecast (FD)**

5. Severe weather reports, advisories, and forecasts
  - a. Severe Weather Watch bulletin (WW)
    - i. 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)
    - ii. Hazards include thunderstorms with winds of 50 kts or more, 3/4 inches hail, or tornadoes
    - iii. Flight restrictions
      - (a). Navy pilots will not file into or fly through WW areas
      - (b). Exceptions to OPNAVINST 3710.7 severe weather restrictions
        - (1). Operational necessity
        - (2). Research/weather reconnaissance
        - (3). Emergencies
        - (4). 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

- (5). Aircraft capable of flying above existing or developing severe storms
- b. CNATRA Weather Warning (CAWW)
  - i. 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
  - ii. Flight restrictions
    - (a). Training activities suspended in CAWW area
    - (b). 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
    - i) when flight remains in VFR conditions, or
    - ii) if in IFR conditions, operable weather radar is installed in the aircraft
  - (5). The aircraft is capable of flying above the hazard
- c. Convective SIGMETs (WST)
    - i. In-flight advisory alerts pilots to convective activity and related hazards posing danger to all types of aircraft
    - ii. Hazards include lines and large areas of thunderstorms, tornadoes, and embedded thunderstorms

WSUS33 KPCI 081655  
SIGW  
CONVECTIVE SIGMET 8W  
VALID UNTIL 1855Z  
AZ CA  
FROM 30S EED-10NNE PHX  
DVLPG LINE TS 30 NM WIDE MOV FROM 18015KT. TOPS TO FL340.

OUTLOOK VALID 081855-082255  
FROM PGS-40NNW ABQ-40W ELP-TUS-BZA-40ESE HEC-PGS  
WST ISSUANCES EXPD. REFER TO MOST RECENT ACUS01 KWNS FROM STORM  
PREDICTION CENTER FOR SYNOPSIS AND METEOROLOGICAL DETAILS.

WSUS31 KPCI 081655  
SIGE  
CONVECTIVE SIGMET 14E  
VALID UNTIL 1855Z  
NC AND CSTL WTRS  
FROM 50ESE ECG-130SE ECG-140SSE ECG-60ENE ILM-50ESE ECG  
AREA SEV TS MOV LTL. TOPS ABV FL450  
TORNADOES....HAIL TO 1 IN....WIND GUSTS TO 50KT POSS

OUTLOOK VALID 081855-082255  
AREA 1....FROM 90E ECG-170ESE ECG-170SE ECG-30SW CEW-40NE MSL-90E ECG  
WST ISSUANCES EXPD. REFER TO MOST RECENT ACUS01 KWNS FROM STORM  
PREDICTION CENTER FOR SYNOPSIS AND METEOROLOGICAL DETAILS.

**Figure 3-21 Convective SIGMET (WST)**

- d. SIGMETs (WS)
  - i. In-flight advisory alerts pilots to weather hazards that pose danger to all types of aircraft
  - ii. Hazards include severe icing and turbulence and large areas of IFR conditions

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 3-22 SIGMET (WS)**

- e. AIRMETs (WA): in-flight and teletype advisory alerting pilots to hazards that are not as severe as SIGMETs and/or convective SIGMETs

```

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 WNDZ 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 2000Z.
*
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 3-23 AIRMET (WA)

- f. Military Weather Advisory (MWA)
  - i. Used as a preflight aid to help plan your route of flight to avoid possible severe weather
  - ii. Hazards include tornadoes, waterspouts, funnel clouds, thunderstorms, strong surface winds, heavy rain, heavy snow, and freezing precipitation

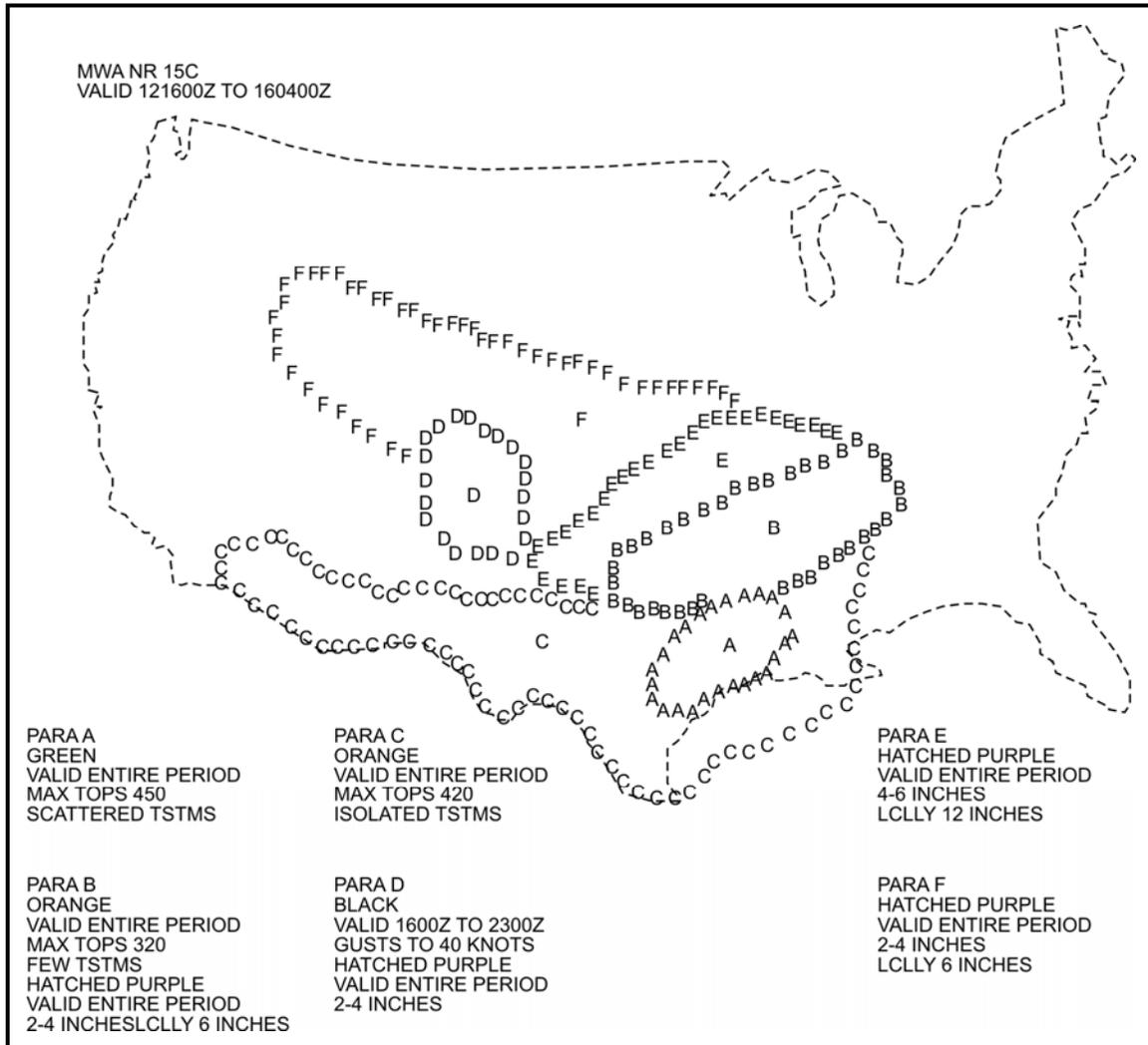


Figure 3-24 Military Weather Advisory (MWA)

Flight Weather Briefing (DD-175-1)

- IAW OPNAVINST 3710.7 (series)

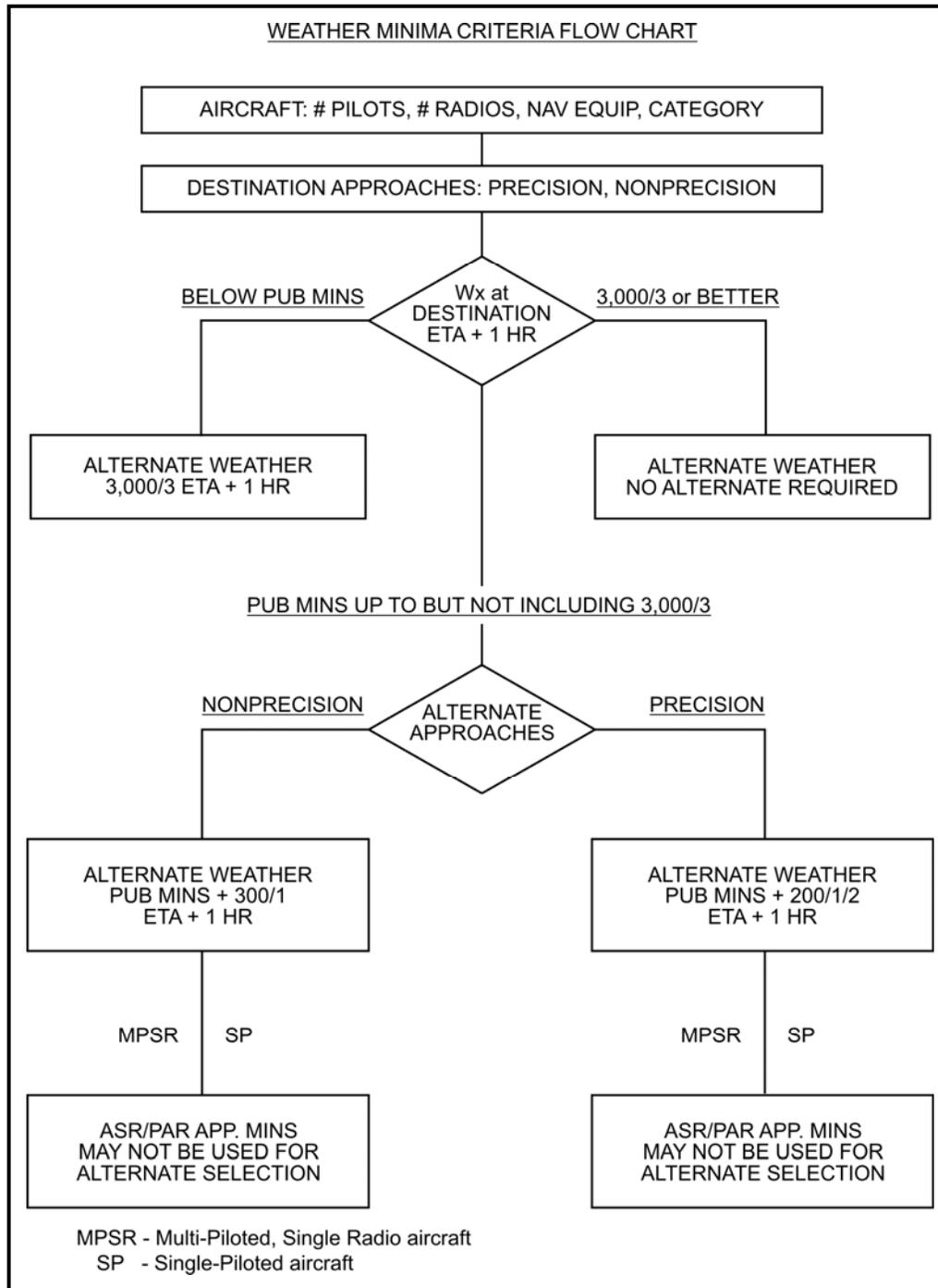


Figure 3-25 Weather Minima Criteria Flow Chart

- a. Required for all IFR flights
  - b. Exceptions for CNATRA scheduled local flights
2. Five sections of the DD-175-1
- a. Mission/takeoff data: first three boxes identify date, aircraft type and bureau number; remaining boxes specify forecast conditions for takeoff and climbout
  - b. Enroute data
    - i. 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
    - ii. Minimum ceilings, maximum cloud tops, and minimum freezing levels
    - iii. Pertinent information on thunderstorms, turbulence, icing, and precipitation
  - c. 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
  - d. Comments/remarks—can include
    - i. Latest braking action code
    - ii. PIREPs
    - iii. Latest METAR of first destination
    - vi. Any significant data not covered elsewhere, i.e., SIGMETs/AIRMETs/warnings, low-level windshear, and runway conditions
  - e. Briefing record
    - i. Actual time of brief
    - ii. Flimsy Briefing No. (2-digit month code followed by sequential number of this briefing)
    - iii. Signature of forecaster
    - iv. Void time: 30 minutes after ETD time
    - v. Extensions: new time based on a new ETD
    - vi. Forecaster's initials and name of the person being briefed

FLIGHT WEATHER BRIEFING												
PART I - TAKEOFF DATA												
1. DATE	2. ACFT TYPE/NO.	3. DEP PT/ETD	4. RWY TEMP	5. DEWPOINT	6. TEMP DEV	7. PRES ALT	8. DENSITY ALT					
9. SFC WIND		10. CLIMB WINDS		11. LOCAL WEATHER WATCH/WARNING/ADVISORY			12. RSC/RCR					
13. REMARKS/TAKEOFF ALTN FCST												
PART II - ENROUTE & MISSION DATA												
14. FLT LEVEL/WINDS/TEMP			SEE ATTACHED			16. SPACE WEATHER			16. SOLAR/LUNAR		LOCATION	
						NO IMPACT			MARGINAL		SEVERE	
						FREQ			BMNT		Z	
						GPS			SR		Z MR	
						RAD			SS		Z MS	
									EENT		Z ILLUM	
17. CLOUDS AT FLT LEVEL						18. OBSCURATIONS AT FLT LEVEL RESTRICTING VISIBILITY						
YES <input type="checkbox"/> NO <input type="checkbox"/> IN AND OUT <input type="checkbox"/>						YES <input type="checkbox"/> NO <input type="checkbox"/> TYPE						
19. MINIMUM CEILING - LOCATION				20. MAXIMUM CLOUD TOPS - LOCATION				21. MINIMUM FREEZING LVL - LOCATION				
FT AGL				FT MSL				FT MSL				
22. THUNDERSTORMS			23. TURBULENCE			24. ICING			25. PRECIPITATION			
CHART			CHART			CHART			CHART			
NONE AREA LINE			NONE IN CLEAR IN CLOUD			NONE RIME MIXED CLEAR			NONE DRIZZLE RAIN SNOW PELLET			
ISOLATED 1 - 2%			LIGHT			TRACE			LIGHT			
FEW 3 - 15%			MODERATE			LIGHT			MODERATE			
SCATTERED 16 - 45%			SEVERE			MODERATE			HEAVY			
NUMEROUS - MORE THAN 45%			EXTREME			SEVERE			SHOWERS			
HAIL, SEVERE TURBULENCE & ICING, HEAVY PRECIPITATION, LIGHTNING & WIND SHEAR EXPECTED IN AND NEAR THUNDERSTORMS.			LEVELS			LEVELS			FREEZING			
LOCATION			LOCATION			LOCATION			LOCATION			
PART III - AERODROME FORECASTS												
26.	27. VALID TIME	28. SFC WIND	29. VSBY/WEA	30. CLOUD LAYERS			31. ALTIMETER	RWY TEMP	PRES ALT			
DEST/ALTN	Z TO Z	M T					INS	°F/C	FT			
DEST/ALTN	Z TO Z	M T					INS	°F/C	FT			
DEST/ALTN	Z TO Z	M T					INS	°F/C	FT			
DEST/ALTN	Z TO Z	M T					INS	°F/C	FT			
DEST/ALTN	Z TO Z	M T					INS	°F/C	FT			
DEST/ALTN	Z TO Z	M T					INS	°F/C	FT			
DEST/ALTN	Z TO Z	M T					INS	°F/C	FT			
DEST/ALTN	Z TO Z	M T					INS	°F/C	INS			
PART IV - COMMENTS/REMARKS												
32. BRIEFED RSC/RCR		YES	NOT AVAILABLE	33. PMSV		34. ATTACHMENTS		YES	NO			
35. REMARKS												
PART V - BRIEFING RECORD												
36. WX BRIEFED TIME			37. FLIMSY BRIEFING NO.			38. FORECASTER'S INITIALS			39. NAME OF PERSON RECEIVING BRIEFING			
Z			Z			Z			Z			
40. VOID TIME			41. EXTENDED TO/INITIALS			42. WX REBRIEF TIME/INITIALS			43. WX DEBRIEF TIME/INITIALS			
Z			Z			Z			Z			

DD FORM 175-1, OCT 2002

PREVIOUS EDITION MAY BE USED.

Adobe Professional 7.0

Figure 3-26 DD-175-1

**Enroute Procedures**

**Once you are airborne, where can you get current weather information?**

ANSWER:

- a. Pilot-to-Metro facilities
  - b. Flight Watch facilities (EFAS)
  - c. Flight Service Stations
  - d. ARTCC (center)
  - e. Transcribed Weather Broadcasts
1. Sources of in-flight weather information

**NOTE**

The sources below are listed in the order in which they should be used.

- a. Pilot-to-Metro Service (PMSV)
  - i. Operated out of NASs, MCASs, and USAF bases—call name example: “Kingsville Metro” or “Metro”
  - ii. Pilots can directly access weather forecasters; however, check FLIP Flight Information Handbook for specific availability times and/or locations
- b. Enroute Flight Advisory Service (EFAS)
  - i. Operated by FAA on VHF frequencies—call name example: “San Antonio Flight Watch” or “Flight Watch”
  - ii. Provides updated enroute weather information
- c. Flight Service Station (FSS)
  - i. Operated by FAA—call name example: “Houston Radio”
  - ii. Provides enroute weather information as part of its service

**NOTE**

Operators are qualified weather "briefers," not forecasters.

- d. Air Route Traffic Control Center (ARTCC)
  - i. Can provide weather information and updating as requested, but weather dissemination not primary service
  - ii. Can provide real-time weather avoidance assistance through use of current ATC radar and weather radar
  - iii. Do have forecasters available
- e. Hazardous In-flight Weather Advisory Service (HIWAS)
  - i. Broadcasts continuously over selected VOR stations
  - ii. Contains summary of any AIRMETs, SIGMETs, convective SIGMETs, CWAs and PIREPs
- f. Automated Weather Observation System (AWOS)
  - 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
- g. Automatic Terminal Information Service (ATIS)
  - i. 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"
  - ii. When the pilot acknowledges that he has received the ATIS broadcast, controllers may omit those items contained on the broadcast if they are current
  - iii. 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
- 2. Pilot weather reports (PIREPs)
  - a. Issued by pilot to ATC or weather disseminating agencies (PMSV, EFAS, FSS, etc.)
  - b. Reports filed when
    - i. Requested

- ii. Unusual and unforecast weather is encountered
  - iii. Weather conditions on an IFR approach differ from latest observation
  - iv. Missed approach is executed due to weather
  - v. Hazardous or potentially hazardous weather is encountered (windshear, microburst, icing, severe turbulence, etc.)
- c. Relay time-critical information directly to ATC
  - d. 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)
  - e. Format: available in FLIP Flight Information Handbook

**Post-instructional activities: students with specific questions will be directed to the following resources as appropriate**

1. Meteorology Lesson Guides
2. NAVAIR 00-80U-24, Meteorology for Naval Aviators
3. CNATRA P-303, Meteorological Theory Workbook I
4. CNATRA P-304, Meteorology Flight Planning Workbook II
5. DOD FLIP, Flight Information Handbook, Section C

### **305. SUMMARY**

This lesson has focused on the following topics:

1. Overview of the test
2. Fronts and resulting winds
3. Meteorological hazards
4. Weather minimums
5. Weather charts
6. Printed forecasts

7. Flight weather briefing DD-175-1
8. Enroute procedures

**306. CONCLUSION**

Having reviewed the material from the previous lessons, you are now prepared to take the exam for this block of instruction.

**APPENDIX A  
GLOSSARY**

**A100. INTRODUCTION – N/A**

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