Tape #50
Ref #10

UNITED STATES ARMY PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS 76067

File Nr. 2-300-2

PERFORMANCE OBJECTIVES

INTRODUCTION TO WEATHER

1. Knowledges: Without the use of any reference the student will be able to:

   a. State the properties of the atmosphere.

   b. List the four elements of weather.

   c. List the two major divisions of the atmosphere.

   d. List the three factors that affect air density.

   e. List the methods of heat transfer and their effects on the atmosphere, air temperature, and flight conditions.

   f. List the prevailing winds in the three cells of the northern hemisphere.

   g. State the result of the greenhouse effect.

   h. State the exact temperature lapse rate.

2. Skill: None

Tape #50
Ref #11

DEPARTMENT OF WEATHER
UNITED STATES ARMY PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

File Nr. 2-300-2

STUDENT OUTLINE

INTRODUCTION TO WEATHER

22 Jan '68

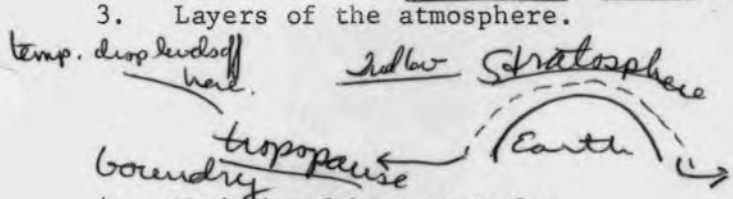
1. Scope of the weather course.

Will cover 35 hours. First ½ is mainly theory.
TM1-300 is the main source of reference.

2. Composition of the atmosphere.

Dry Air - 78% Nitrogen, 21% - O_2, 1% mixture
also have H_2O Vapor, and condensation nuclei (junk)
is natural air. H_2O is 0-4% of Vol.

3. Layers of the atmosphere.



at tropopause temps drop levels off. About -55° C
0-60,000' at equator, 25,000 at poles

4. Methods of heat transfer.

terrestial radiation heats up surface.

1.) radiation - a molecular transfer - electro-mag. Depends on sun.
2.) conduction - Sun - insolation ☀
3.) convection - heating by direct contact.
4.) advection - movement of heat in a vertical rise. allows cooler air to flow in below.

this is a horizontal movement of heat.

5. Greenhouse effect.

Sun hot waves move down thru to surface, but are changed, and can't escape back out!
Moisture helps maintain this heat.

6. **Primary** circulation.

Air rises from equator due to heat, & flows toward poles. Land heats faster, but water will hold heat thru nite.

7. Conclusion.

May have an inversion - layers of varying temp. in air. 2°/1000' may not hold in this. Equatorial zone has a more direct ∠ to the sun.

Tape #50
Ref #12

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File Nr. 2-300-2

PERFORMANCE CHECK

INTRODUCTION TO WEATHER

1. List the properties of the atmosphere.
It is highly compressible, can move, has weight, occupy space.

2. List the four elements of weather.
a. moisture
b. pressure
c. temperature
d. wind

3. List the two major divisions of the atmosphere.
a. troposphere
b. stratosphere

4. List the three factors that affect air density.
a. Temperature
b. pressure
c. moisture

5. List the methods by which heat is transferred.
radiation, conduction, convection, advection.

6. What is the factor causing simple circulations?
Uneven heating of the earths surface.

7. What is the standard temperature lapse rate in the atmosphere?
2°C / 1000' MSL

8. State the result of the greenhouse effect.
Tends to hold heat in + about earths surface.

weather is the present condition of the atmosphere

Tape #50
Ref #14

DEPARTMENT OF WEATHER
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FORT WOLTERS, TEXAS

File Nr. 2-301-2

PERFORMANCE OBJECTIVES

MOISTURE IN THE ATMOSPHERE AND CLOUDS

1. Knowledge: Without the use of notes or reference material, the student will be able to:

   a. State two types of clouds and characteristics of each.

   b. State the four classes of clouds.

   c. Identify the 10 symbols that represent each cloud.

   d. State the general flight conditions associated with Stratiform and Cumuliform clouds.

2. Skills: None

Tape #50
Ref #13

DEPARTMENT OF WEATHER
UNITED STATES ARMY PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

File Nr. 2-301-2

STUDENT OUTLINE

MOISTURE IN THE ATMOSPHERE AND CLOUDS

1. States of moisture in the atmosphere.

Moisture may be in liquid, solid, or gas.
rain, snow, or steam. (ice crystals, frost, hail, sleet etc.

2. Expressing water vapor content.

Saturation - condition that exists when air, at certain temp + pressure can't hold any more H_2O vapor. (max)
Dew point - a temp. at which saturation will occur.
Realative humidity - ratio of H_2O vapor in air/amount at saturation

3. Changes of state of moisture. Dew pt. can't be warmer than air.

Evaporation from liquid to gas. Freeze liquid to solid
Melting - solid to liquid. Condensation gas to liquid.
Sublimation from solid to gas vice versa.

4. Temperature scales.

Calorie - amount of heat to raise one gm of H_2O 1°C.
°F - 32° → 212°
°C - 0° → 100°
$F° = 9/5\ C + 32$
$C = 5/9\ (F - 32)$

5. Types of clouds.

Strato - form - flat - (Stratiform)
Cumulo - form - vertical - (cumuliform)
for these clouds temp + dew pt. must come together
higher the humidity, the lower the cloud

6. Classes of clouds.

High - cirrus - (CI) ice crystal, above 20,000'
cirrostratus - (CS) " " "
Cirrocumulus - (CC) " " "
medium - alto - stratus - 6,500 - 20,000 (AS)
alto - cumulus " " (AC)

7. Conclusion.

low - Stratus - ST — 6,500 to 50
Stratocumulus SC
Nimbo Stratus NS
special - cumulus (CU)
cumulonimbus (CB)
} Thunderstorm type clouds.

Tape #50
Ref #15

DEPARTMENT OF WEATHER
UNITED STATES ARMY PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

File Nr. 2-301-2

PERFORMANCE CHECK

MOISTURE IN THE ATMOSPHERE AND CLOUDS

1. Where is the centigrade scale used?
   C° is used in measuring atmospheric temp, i.e. 2°C/1000' from surface to tropopause. Lab work.

2. Define:

   a. Saturation
      Temp at which air can't hold anymore H_2O due to pressure
   b. Sublimation
      from solid to gas, vice versa. (snow)
   c. Relative humidity
      ratio of H_2O vapor in air/amount at saturation. (a %)
   d. Dew point
      Temp. at which saturation will occur.
   e. Condensation
      from gas to a liquid
   f. Evaporation
      from a liquid to a gas.

3. Convert the following temperatures as indicated:

   a. 40°C to 104 °F
   b. 85°F to 29.4 °C
   c. 16°C to 290 °F
   d. 20°F to 6.5 °C

4. List four classes of clouds.
   a. high
   b. medium
   c. low.
   d. special

5. List the ten symbols that represent each cloud.

hi: CI, CS, CC
med: AS, AC
low: ST, SC, NS
special: CU, CB

stratoform – rain, etc, [illegible], low visibility, rime, icing.

Cumulo – turbulence, visibility not so bad – heavy showers, gusts.

ice - 0 - 10°C

Tape #50
Ref #16

DEPARTMENT OF WEATHER
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FORT WOLTERS, TEXAS

File Nr. 2-302-2

PERFORMANCE OBJECTIVES

PRESSURE IN THE ATMOSPHERE

1. Knowledge: Without the use of note and reference material, the student will be able to:

   a. Define Barometric Pressure

   b. List the standard sea level pressure in inches of Mercury and Millibars.

   c. State the pressure change per 1000 feet of altitude in the standard atmosphere.

   d. State the effect that a strong horizontal pressure gradient and a weak horizontal pressure gradient have on wind speed.

   e. State the effect that coriolis force has on wind.

   f. State the effect that the frictional force has on wind.

   g. State the meaning of convergence in relation to a low-pressure system.

   h. State the meaning of divergence in relation to a high pressure system.

   i. Explain altimeter error in relation to drift, pressure and temperature.

2. Skills: None

Tape #50
Ref #17

DEPARTMENT OF WEATHER
UNITED STATES ARMY PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

File Nr. 2-302-2

STUDENT OUTLINE

PRESSURE IN THE ATMOSPHERE

1. Atmospheric Pressure.

Pressure is force exerted by weight of air above a given point. Use barometer - mercury, or aneroid

2. Definition of an isobar.

A line on a weather map connecting points of equal pressure. Use a 4 mb seperation of isobars.

3. Definition of pressure gradient.

Pressure gradient - rate of change in pressure in a direction ⊥ to the isobar. Distance from center to center, and put it under pressure drop! 34 mb / 250 miles.

strong gradient - heavy wind.

4. Prevailing wind belts with the 3 cell circulation.

N. trade winds — 0°-30° N,
Prevailing Westerly — 30°-60°
Polar Easterlies — 60°-90°

equator doldrum -
Horse Latitudes - 5° either way of 30°
Polar Front
Hi alt is West to East

5. Forces which affect the wind.

Pressure gradients will effect and. (between hi & low pressure)
Coriolis Force — Clockwise force on (H) above friction level (2000') there are only forces which effect wind.
Friction — Below 2,000 feet you also have friction from ground surface.

6. Low pressure systems (cyclones).

A low is always storm, air flows to center and rises up. Low ceilings, etc.

7. High pressure system (anti-cyclones).

Air comes down and out.
Lite winds, good weather
air tends to be colder -
from hi to low, look out below.

Tape #50
Ref #18

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FORT WOLTERS, TEXAS

File Nr. 2-302-2

PERFORMANCE CHECK

PRESSURE IN THE ATMOSPHERE

1. Define:

   a. Atmospheric Pressure - a force exerted by weight of air above a given point.

   b. Isobars - lines of equal pressure which are connected - on a weather map.

   c. Pressure Gradient - rate of change in pressure in a direction ⊥ to an isobar

   d. Coriolis Force - a deflective force, bend right in (H)

   e. Divergence - air flows outward from a (H)

   f. Convergence - air comes together and rises (L)

2. List the standard sea level pressure in inches of mercury and millibars.

14.7# Sq in. 29.92 Hg 1"Hg = 1000' = 34mb.
at 15° C & MSL 1013.2 MB's

3. Pressure changes in the lower 10,000 feet at the rate of 1"Hg 34MB per 1000 feet.

4. List the effect that coriolis force has on wind.
The coriolis force is a deflective force outward to the right

5. What effect does frictional force have on wind.
This will tend to make an erratic flow & slowing tendency on surface, pushes it out at 30° across isobars. Reduces coriolis.

6. List the meaning of convergence in relation to a low pressure system.
Here air moves into center and will rise.

7. Subsidence - air is sinking in center of a (H)

Tape #50
Ref #19

7. State the meaning of divergence in relation to a high pressure system.

This would be the outward navigated flow in a (H)

8. List the effects of drift, pressure, and temperature on the altimeter readings.

In a low will drift to ~~left~~ left. pressure, look out below, low

Tape #50
Ref #20

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File Nr. 2-303-2

ATMOSPHERIC STABILITY

PERFORMANCE OBJECTIVES

1. Knowledges: With the aid of a complete SKEW T, LOG P chart located in TM-1-300, the student will be able to:

   a. Determine temperatures at various altitudes.

   b. Determine where cloud bases and cloud tops lay and what type of cloud.

   c. Determine where freezing levels lie in the atmosphere and type of ice that would be encountered there, if any icing conditions exist.

   d. List the effects of stable and unstable air on flight conditions.

   e. List four weather conditions that can be determined from the soundings on a SKEW T, LOG P diagram.

   f. Using temperature and dew points at differenct levels on a complete SKEW T, LOG P chart, the student will be required to determine the following:

      (1) Cloud bases and tops.

      (2) Types of clouds.

      (3) Freezing level.

      (4) Stability of the atmosphere.

2. Skills: None

1. thermal
2. advection
3 Cold front, etc.
9. Low cell rise.

Tape #51
Ref #7

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File Nr. 2-303-2

When temp + dew point within 2°C, clouds will form. Thus they can plot clouds

STUDENT OUTLINE

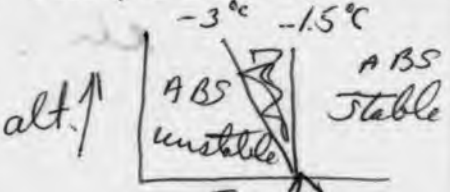
ATMOSPHERIC STABILITY

1. Introduction.

may also find the freezing level. cooling rate is 1½° C wet.

2. Construction of SKEW T, LOG P. Parallel line are horizontal ovr surface, ie, levels. Brown //s are isobars. Isotherms run up + down from left to right. Meet F° at bottom. Brown lines curving from + to left are dry adiabatic. Curved green lines are wet adiabatic. Heavy brown line is temp lapse rate.

3. Relative humidity and layers of the atmosphere.



4. Adiabatic process.

Wet is after saturation, looses 1.5°C
Dry is before " , looses 3°C
Humidity + Dew pt are factors here.

5. Interpretation of atmospheric conditions.

6. Analysis of weather.

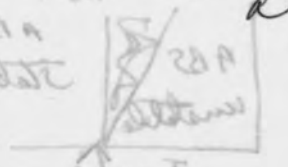
- - - - line is dew point
——— temp.

7. Flight conditions.

when air becomes saturated, temp + dew point remain the same. Air passing down other side is called Chinook.

where clouds form is condensation level.

LFC level of free convection - when rising air becomes equal to or warmer than stable air.



Tape #51
Ref #8

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FORT WOLTERS, TEXAS

File Nr. 2-303-2

PERFORMANCE CHECK

ATMOSPHERIC STABILITY

The following questions are based on the SKEW T, LOG P diagram in the TM 1-300.

1. What determines cloud bases and tops on the SKEW T, LOG P diagram?

When Temp + dew pt. are within 2°C of each other.

2. At what altitude are the bases of the low cloud? The top?

3243' - 8091'

3. At what altitude does an inversion exists?

6394 - 9882

4. What is the dry adiabatic rate per 100 feet? ✓

5. What is the wet adiabatic rate per 1000 feet?

6. What is the standard temperature lapse rate?

2°/1000'

Stable air
inversion -
Bad ceiling, vis.
gen precip.
Rime ice
Unstable -
turbulent, showers
good vis & out of rain.
clear ice
6°/1000'
1°

air may be lifted four 13-ways:
main are thermal.

Tape #51
Ref #9

7. List four weather conditions that can be determined from the soundings on a SKEW T, LOG P diagram?

8. List the effects of stable and unstable air on flight conditions.

Tape #51
Ref #10

DEPARTMENT OF WEATHER
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FORT WOLTERS, TEXAS

File Nr. 2-304-2

PERFORMANCE OBJECTIVES

AIR MASSES

1. Knowledges: Without the use of any reference, the student will be able to correctly:

   a. Identify the source region of the maritime polar and maritime tropical air masses that invade the United States.

   b. Identify the source region of the continental polar air masses that invade the United States.

   c. Identify the source region of the continental tropical air mass.

   d. Identify the letters used for the classification of air masses.

   e. Identify the method of classifying stable and unstable air masses.

   f. Write the characteristic weather associated with different air masses.

   g. Write the factors that cause an air mass to modify after it moves out of its source region.

   h. Identify the trajectory of air masses that invade the United States.

2. Skills: None

Tape #51
Ref #11

DEPARTMENT OF WEATHER
UNITED STATES ARMY PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

File Nr. 2-304-2

26 Jan '68

STUDENT OUTLINE

AIR MASSES

1. Introduction.

2. Definition of air mass.
A large body of air - whose physical characteristics are relatively uniform along a horizontal plane a (HA) area. 1 million sq mile, etc. Temp, dew pt., etc are similar.

3. Formation.
Come from source regions. Areas with same surface- land or water. When they leave - may change a bit.

4. Classification.
Moisture - m or c - maritime or continental.
Temp - A P I E - artic, Polar, Tropical, & equatorial air.
Stability w k - w warmer than surface - is stable
k - unstable, warms on k - air colder than surface - unstable, turbulence, showers, etc. lower level cumuliform clouds, clear ice - 0-10° visibility good - gusty wind,

5. Characteristics.

6. Movement and modifying changes.
CPK usually move from N to SE or MPK S to NE. (over)
MPK comes in over Washington + Oregon
Terrain will change some of the characteristics

7. Conclusion.

cPk - canada + alaska

mPk -> Ns. Pacific & Ns. Atlantic (rare)
mPw ->

MTk
MTw } Gulf - So. Atlantic

cT - ns. mexico (rare)
mT - So. Pacific - (very rare)

W - stable air stratoform - lt, precip over large area + poor visibility. Rhime ice.

Tape #51
Ref #12

DEPARTMENT OF WEATHER
UNITED STATES ARMY PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

File Nr. 2-304-2

PERFORMANCE CHECK

AIR MASSES

1. What is an air mass?

   a large body of air with same characteristics on a horizontal plane.

2. List the letters used for the classification of air masses.

   C or P or M

3. List the source region of the maritime polar and the maritime tropical air masses. N. Atlantic, Gulf, etc.

4. List the source region of the continental polar air masses.

   N. Canada + Alaska

5. Write the characteristic weather associated with different air masses.

6. What factors cause an air mass to modify after it moves out of its source region. Age, surface ~~in~~ friction etc effect.

7. List the method of classifying stable and unstable air masses.

Tape #51
Ref #13

DEPARTMENT OF WEATHER
UNITED STATES ARMY PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

File Nr. 2-305-3

FRONTAL WEATHER

PERFORMANCE OBJECTIVES

1. Knowledges: Without the use of notes or reference material, the student will be required to:

   a. List the characteristics of a cold front, warm front, occluded front, and squall line to include:

      (1) Average speed and direction of movement.

      (2) Principal type clouds.

      (3) Hazards.

      (4) Changes in weather conditions.

      (5) Symbol on a weather map.

      (6) Flight procedures.

2. Skills: None

Tape #51
Ref #14

DEPARTMENT OF WEATHER
UNITED STATES ARMY PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

File Nr. 2-305-3

STUDENT OUTLINE

FRONTAL WEATHER

1. Characteristics of a cold front and recommended flight procedures.

A front is a boundry between air masses of different characteristics.
a Cold front is a leading edge of advancing cold air mass.
a blue line ▼▼▼▼ about 22 kts. NE to SW. Winds are
from NW behind a Cold front. 60 to 80 mile slope in front.

2. The squall line and its associated weather.

Temp. decrease. a dash purple line = squall line - 50-75 miles in front of
Wind change Cold. — .. — .. — Very severe weather, extremely rough.
to N.W. A bulge in the front → over warm air - causes winds +
Correct to the right. the CU + CB - Fly into it at a 90° ∠. try for 4,000' clearance.

3. Characteristics of a warm front and recommended flight procedures.

The trailing edge of a retreating cold air mass. a red line with
- NE to SW cycle - moves about 10 kts. Winds slope
behind are SW warm cold air 1-200 miles in - a
red shallow slope - → mostly stratoform clouds. CI + CS + AS you
400 in width

4. Characteristics of an occluded front and recommended flight procedures.

Low ceilings + poor visibility. When a front overtakes another. Cold front catches a warm and
In winter you get F. rain. raises it up, vice versa. Worse part is apex of joint front.
Warm - front - cold air is ahead of the warm. In a cold front
the warm is ahead. a combination of weather.

5. The stationary front and its characteristics.

When a front tends to slow down below 5 kts. Stratoform -
Rime ice - red + blue line.

If you get freezing rain, climb up out of it

6. Conclusion.

Circumnavigate a thunderstorm. Penetrate at 90°
To correct to right. Moves about 22 kts.

Cold front will give CU + CB at front, severe turbulence,
showery precip, and strong gusty winds on surface.
Icing, etc. 0°C to -10°C Clear ice. This is about 50 miles
-10°C to -20°C Rime ice. wide.

Earths surface is heated by shortwave insolation. a.)

saturation may be brought about by evaporation. (d.)

5C → below 65 M (b.)

Pressure change (d) - 1" Hg 1000'

Moist adiabatic rate is 1.5°C per 1000'

(d)

Tape #51
Ref #15

DEPARTMENT OF WEATHER
UNITED STATES ARMY PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

File Nr. 2-305-3

PERFORMANCE CHECK

FRONTAL WEATHER

1. List the characteristics of a cold front and recommended flight procedures in cold front weather. * Fast, 22 kts – Narrow – Cumuliform – ~~turbulent~~ air N W winds. Showers clear ice – 50 miles wide. Enter at 90°

2. Write the symbol of a cold front as appear on a weather map. * Skies – wide, 10 kts. – stratoform. low ceilings, in winter severe ice + freezing rain.

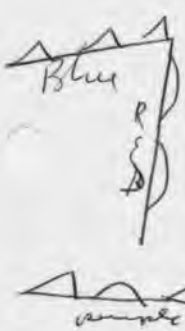
3. What are the characteristics of the squall line? What are its recommended flight procedures? Fast moving – 50 mils ahead. 40 kts –

4. Write the characteristics of a warm front and the recommended flight procedures. winds are S W, Stratoform clouds, etc.

5. List the characteristics of an occluded front and the recommended flight procedures.

6. Write the characteristics of a stationary front. Moves less than 5 kts. like precip – stratoform Cond.

7. Write the weather map symbols for the different types of frontal weather.



Cold – when coldest air is under cold front.

when cold air under warm front it is a warm occlusion.

above 2,000' wind will // the isobars
below 2,000' friction enters in +
will break it d// at 30° <

pressure gradient & contours.

to be white + surrounded by pussy
a tempay.

Tape #51
Ref #16

DEPARTMENT OF WEATHER
UNITED STATES ARMY PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

File Nr. 2-306-4

PERFORMANCE OBJECTIVES

WEATHER HAZARDS TO FLIGHT

1. Knowledges: Without the use of any references, the student will be required to:

   a. List three factors necessary for the formation of fog.

   b. List the definition and the factors necessary for their formation for:

      (1) Frontal Fog

      (2) Steam Fog

      (3) Ice Fog

      (4) Radiation Fog

      (5) Upslope Fog

      (6) Advection Fog

   c. List the factors necessary for fog dissipation.

   d. List three types of aircraft icing.

   e. State the hazards associated with icing conditions.

   f. List the conditions necessary for the formation of ice on an aircraft.

   g. List the recommended flight procedures in different types of icing conditions.

   h. State the three factors necessary for the development of a thunderstorm.

   i. List the two types of thunderstorms and lifting action associated with each type.

   j. List the three stages associated with thunderstorm development.

   k. List the weather hazards associated the mature cell of a thunderstorm.

   l. State the recommended flight procedures before and after entering a thunderstorm.

Tape #52
Ref #1

DEPARTMENT OF WEATHER
UNITED STATES ARMY PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

File Nr. 2-306-4

"STUDENT OUTLINE"

WEATHER HAZARDS TO FLIGHT

1. Types of aircraft icing.
Rime - in ~~stratiform~~ - (0°-20°C) water droplets cumuliform (-10°C to -20°C)
Clear - cumuliform - 0°C to +10°C + freezing rain. big water droplets.
Frost - not very serious.

2. Conditions conducive to ice formation.
Moisture has to be present, 0° to -20°C in structured in Clouds -

3. Results of icing.
Vibrations, loss of left, etc.

3 1/3
30 | 100
90
10

4. Flight procedures in icing areas.
if warm air below, descend. If below -20° above, let ~~that~~ stay out of

5. Definition of fog. Water or ice crystals which are suspended in air with no movement downward. actually a low layer of stratiform clouds.
air with hi realative humidity. ~~light winds, will~~ tend to mix it. Condensation nuclei.

6. Types of fog.
1. By dropping temp, or 2. adding moisture to air, raise Dewpoint
1. ground fog - expansive cooling - 1. Pre-frontal - ahead of a cold front
2. Advection - warm air over 2. Post-frontal - ~~ss~~ in winter
3. Upslope - adiabatic cooling 3. Sea-fog - cold air over warm H_2O

Nocturnal cooling radiational cooling

7. Factors necessary for fog formation.

Heat or hi winds would tend to dissipate fog.

Tape #52
Ref #2

8. Conditions necessary for thunderstorm development.

(10-12,000')- thick layer of moist air - unstable atmosphere - lifting - (either surface heating, frontal movement, etc.)

9. Types of thunderstorms.

* { Air Mass: thermal or convective - orographic (over Mtns, etc.)
  { Frontal: cold front
    squall line
    warm

10. Characteristics and stages of a thunderstorm.

* { a.) cumulus stage - all movement is vertical - ~~up + down drafts~~.
  { mature - up + down drafts - heavy precip.
  { Dissipating - downdrafts only.

11. Recommended flight procedures before and after penetration of a thunderstorm.

Enter at 90°, never turn back.
Never land in front of storm

12. Conclusion.

Precip is extremely heavy - lg. H_2O droplets - 50-80 kt drafts. Very critical. Thunder + lightning is from movement of air + resultant friction that developes hail - Real strong surface winds. 20 mins. to an hour

When real hot + humid

Tape #52
Ref #3

DEPARTMENT OF WEATHER
UNITED STATES ARMY PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

File Nr. 2-306-4

PERFORMANCE CHECK

WEATHER HAZARDS TO FLIGHT

1. What are the three factors necessary for the formation of fog?

1. hi rel. humidity
light wind
nuculei for condensation

2. Write the definition for the following:

a. Frontal Fog ahead of a front

b. Steam Fog cold dry air over warm water

c. Ice Fog - air ss cold it forms fog.

d. Radiation Fog - ground fog - rapid cooling.

e. Upslope Fog - a gentle rise in land.

f. Advection Fog warm moist air over old surface.

3. What factors are necessary for fog dissipation?

Send strong winds will help

4. Write three types of aircraft icing.

Rime, Clear, Frost

5. List the hazards associated with icing conditions.

Tape #52
Ref #4

6. What are the conditions necessary for the formation of ice on an aircraft? Must have visible moisture, + below 0°C

7. List the flight procedures recommended in icy weather.
Stay out of above 0°C temps.

8. What factors are necessary for thunderstorm weather development?
Thick, unstable, lifting air mass.

9. Write two types of thunderstorms and the lifting action associated with each type. Air Mass - orographic.
Frontal -

10. List the weather hazards associated with the mature cell of a thunderstorm. Heavy rain, hail, turbulence, clear ice, tornadoes.

11. What flight procedures are recommended for thunderstorm weather activity? Fly around, above a below, last go thru.

Tape #52
Ref #5

DEPARTMENT OF WEATHER
UNITED STATES ARMY PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

File Nr. 2-309-4

PERFORMANCE OBJECTIVES

TELETYPE SEQUENCE REPORTS

1. Knowledges: Given a teletype sequence report, the student will be required to write:

   a. The correct date time (Zulu or local) of the teletype report.

   b. Each sky condition symbol in the report.

   c. The height of the ceilings reported by various stations.

   d. The cause and amount of any reported partial obscuration as it is given in the remarks section.

   e. The exact time any precipitation.

   f. The vertical visibility and horizontal visibility from a report when a total obscuration is reported.

   g. The visibility as it is reported by any of the stations.

   h. The pressure in millibars and inches of mercury that is reported by any station in the group.

   i. The temperature and dewpoint reported by any designated station in the group.

   j. The wind speed, wind direction, gust or squall reported by any designated station in the group.

   k. An explanation for a reported variable ceiling and variable visibility for any station in the group.

   The runway visibility and runway visual range reported by any station in the group.

   m. Or interpret all letters used for reporting weather and obstructions to vision.

2. Skills: None.

Tape #52
Ref #6

DEPARTMENT OF WEATHER
UNITED STATES ARMY PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

File Nr. 2-309-4

STUDENT OUTLINE

2 Feb. '68

TELEYTPE SEQUENCY REPORTS

1. Introduction.

2. Purpose:
a real accurate, up to date weather info. Used for producing a weather map - every hr. A regular weather NET. Record hourly reports.

3. Circuit Headings. Weather Bureau, + Air Weather Service run by Air Force for Army. air 028 SA28 14 1400Z
mil - SAUS 8 KWRF
(day, time)

4. Types of Reports. Hourly report - special reports are significant changes: (ceilings, clouds, visibility, violent weather.)

5. Body of Reports.

a. Station Identifiers:

b. Sky Condition.
O - Clear
O - scattered .1 to .5
O - broken .6 to .9
O - overcast .9 .10

X - obscure - fog snow, dust. surface vapor
-X .8 or less partial obscuration

c. Ceiling.
Lowest condition O O or X not preceded by a minus — Broken, overcast, and obscuration are a ceiling - .5 or [illegible] up.

d. Visibility. M-easured, Estimated, aircraft, Radar, Balloon, W-indefinite. greatest horizontal distance from which an object may be seen + identified. Statute miles. less than 3 mile can be broken to 1/16 of a mile. 3-15 every stat. mile.

e. Weather.
symbols are in performance check.

f. Obscurations to Vision.
symbols are covered with check.

remarks - runway visibility R Ø6VV 3/4
R 20UR 22

Tape #52
Ref #7

g. Pressure. you either add ten or a 9 in front.

h. Temperature. 69°/59° given with temp in ° first.

i. Dewpoint.

j. Wind. 02/25 020°@25 1735 Q 69 squalls.

k. Altimeter Setting.
6, 7, 8, 9 add a 2 2.999
1 2 3 4 add a 3 3.441

Page 11-14 l. Remarks. amount of partial obscuring phenomena, precip + times
F4- .4th of mile in Fog. RB32 RE45

Fig 11-11 6. Conclusion.

ceiling visibility weather if over 5 add 9 if under add 10
MWL 12 ⊕ M65 ⊕ 2 1/2 - R K H 999/69°/59°

17 356 45 9.99

L+ 6ICCG

Lighting in cloud, cloud to ground.

Tape #52
Ref #8

DEPARTMENT OF WEATHER
UNITED STATES ARMY PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

File Nr. 2-309-4

PRACTICAL EXERCISE

TELETYPE WEATHER REPORTS

Fill in the blanks to complete the following sentences:

1. A ceiling is defined as the lowest condition reported that is either broken, overcast, obscured, or U (when above 20,000 ft) and not reported as thin or partial.

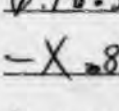
2. The ceiling height is always preceded by one of the following letters: (Indicate next to each letter how the ceiling is classified.)

M estimated E estimated A aircraft B balloon
W indefinite R radar D above 20,000 persisting C immediately U 20,000 above hi cirrus

3. Ceiling designators "U" and "D" are only used with clouds having bases above 20,000' feet. persistent cirrus.

4. How much ski coverage (or obscuration) is indicated by each of the following bymbols?

0 to .5 .6 to .9 .9 to .10 X total obscure
X 8 or less 0 - clear



5. At a certain weather station, the observer notes that to the northeast he can see 1/2 mile, to the southeast 3/4 mile, to the southwest 2 miles, and to the northwest 3/4 mile. The observer would report the prevailing visibility at this station as 3/4 miles.

6. Visibility is reported in statute miles (Statute, nautical).

7. Identify the following weather symbols:

T thunderstorm R rain RW Rain showers L drizzle
ZR freezing rain S snow ZL freezing drizzle A hail
E sleet RW+ heavy Rain showers BS Blowing snow BN Blowing sand
F fog H Haze K smoke D dust
GF ground fog BD Blowing dust SW- snow showers TRW thunderstorm/rain showers
IC - ice page 11-11 in manual

-- = very little
- = little
+ heavy

IF - ice Fog (-20° to -30°)

Tape #52
Ref #9

8. Obstructions to vision, other than precipitation, are not followed by intensity symbols. To determine the intensity of the obstructions, refer to the ~~remarks~~ visibility.

9. Station pressure corrected to msl is measured and reported in millibars to the nearest .10.

10. The temperature and dewpoint temperatures are reported in degrees farhenite. A closing temperature dewpoint spread may result in the formation of stratiform, ~~cumulus~~ FOG clouds, and low visibilities, if the spread narrows to within zero to 4°F degrees.

11. The ~~peak~~ average (lowest, average, peak) wind speed is reported to the nearest ~~10~~ knot and is true (true, magnetic) in direction. A G preceding a wind speed indicates a gusty condition and is the peak (lowest, average, peak) speed recorded within 15 minutes prior to transmission of the report.

12. The atmospheric pressure is reported in inches of mercury to the nearest one hundredth inch and is corrected to pressure altitude (altitude).

13. some of the items you may find in the remarks section are Phenomena, Pilot reports, Precip, Obscuration, weather changes and Times of precip.

14. When a partial obscuration is reported, the remarks section may contain a symbol such as F6. This would mean Fog ~~standard~~ .6 mile.

15. Prepare a teletype report from the following information.

Staion MWL
Ceiling measured 1200' overcast.
Pressure corrected to MSL 1017.0 mb.
Field elevation 300'
Surface visibility 2 miles.
Light freezing rain and light fog is observed.
Temperature 0°C.
Dew point -5°C.
Altimeter setting 30.03 inches Hg.
Wind southwest 10 knots.
Light freezing rain began falling 13 minutes past the previous hour.

~~MWL M12 ⊕ 2 -ZR -F 170/ 0°C/ -5°C/ 003~~

MWL M12⊕ 2 ZR-F- 170/ 30°F/ -5°C/ 2253 5645 003

Tape #52
Ref #10

DEPARTMENT OF WEATHER
UNITED STATES ARMY PRIMARY HELCIOTER SCHOOL
FORT WOLTERS, TEXAS

File Nr. 2-310-2

PERFORMANCE OBJECTIVES

SURFACE WEATHER MAP

1. Knowledges: Given a surface weather map, the student will be able to:

   a. State the importance of the surface weather map to an Aviator.

   b. Identify the fourteen items around the station model.

   c. Identify and/or write all the symbols that can be found on the surface weather map.

   d. Interpret the information found on a surface weather map related to flight planning.

2. Skills: None.

Tape #52
Ref #11

DEPARTMENT OF WEATHER
UNITED STATES ARMY PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

File Nr. 2-310-2

6 Feb '68

STUDENT OUTLINE

SURFACE WEATHER MAP

1. Introduction.
   Weather maps are sent out via computer in U.S.W.Bu. in Wash.

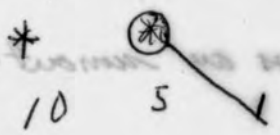
2. Collection of data.
   This comes in from all over the world in hourly reports, etc on condetions.

3. Station circle.
   a. Sky cover.
      circle will have a mark in regard to cloud cover.
   b. Wind.
      1½ = 69/59 wind is given by tail direction
   c. Temperature.
      Temp is always in the N.W. Dew Point is in S.W.
   d. Present weather.
      this goes between Dew Pt + Temps
   e. Visibility.
      this will be on left between temps.
   f. Dewpoint.
   g. Low clouds.
   h. Cloud heights and ceiling.
   i. Pressure tendency.

-X/M5/⊕4/-5/210/14/10/1405 005

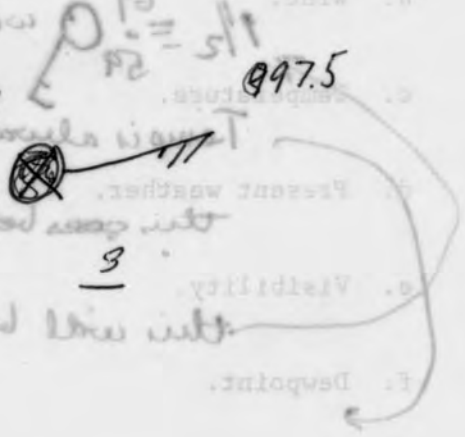
Ten

14 210



MEM - X M 3 ⊕/½/T+RW/975/ 47/11 07 25635

986 T above → S.W.



Tape #52
Ref #12

1.8 meter + wing

+1.8/

j. Pressure.
This is in Mb and goes in NE corner
pressure tendency -

k. Middle clouds.
These are just above circle

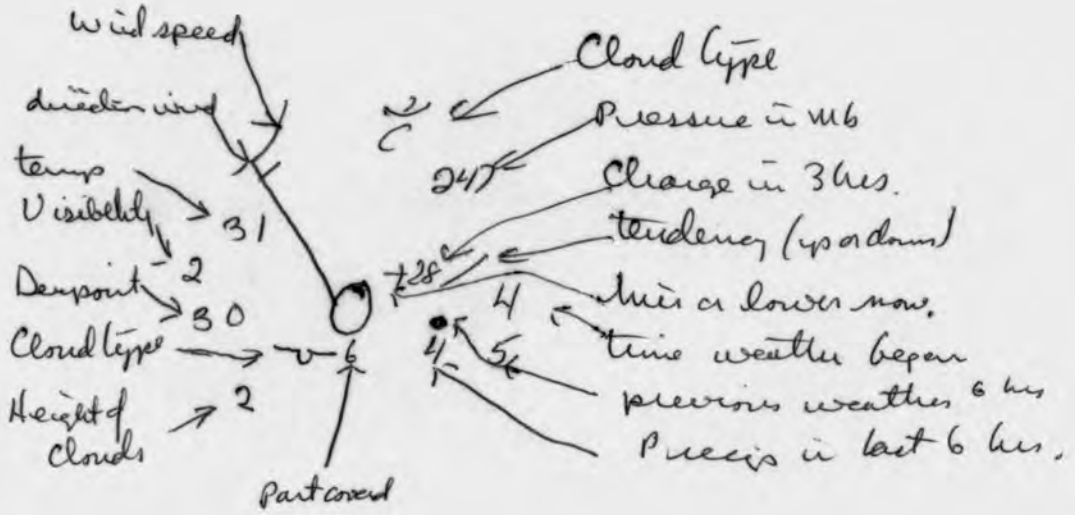
l. High clouds. above middle clouds.
low clouds are at the bottom

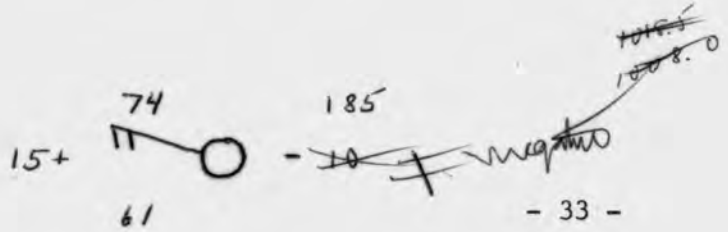
m. Direction of movement.

Cloud layers
12/80/0

5. Weather map analysis.

6. conclusion.





Tape #52
Ref #13

DEPARTMENT OF WEATHER
UNITED STATES ARMY PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

File Nr. 2-310-2

PERFORMANCE CHECK

SURFACE WEATHER MAP

1. What color is used on the weather map to show an occluded front?

Red + Blue

2. What color is used to show a cold front?

Blue

3. What color is used to show a warm front?

Red

4. What color is used to denote precipitation areas?

Green - (but is hatched green)

5. What does an area colored yellow denote?

Fog

Station circle gives cloud types -
Pressure changes also.

Tape #52
Ref #14

DEPARTMENT OF WEATHER
UNITED STATES ARMY PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

File Nr. 2-311-1

PERFORMANCE OBJECTIVES

WINDS ALOFT

1. Knowledges:

   a. Given a winds aloft forecast, a winds aloft report, and a winds aloft chart, the student will be required to:

      (1) Examine the winds aloft forecast and write:

         (a) Date and time of transmission.

         (b) Wind direction and speed for given altitudes.

         (c) Temperature, if applicable, recognizing freezing level.

         (d) Time for which forecast is valid.

      (2) Examine the winds aloft report and write:

         (a) Date and time of transmission.

         (b) Interpretation of simple groups to include time of observation, type of observation (PIBAL or RAWIN), and wind speed and direction.

      (3) Examine the winds aloft chart and write:

         (a) The wind direction and speed for a given station.

      (4) Write the times at which observations are made.

2. Skills - None

Tape #52
Ref #15

DEPARTMENT OF WEATHER
UNITED STATES ARMY PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

File Nr. 2-311-1

STUDENT OUTLINE

WINDS ALOFT

1. Methods of observing upper winds. reflector, ota bearing to his.

* Pibal - a balloon - gives reading - easy this is cheapest - clouds ruin.
* Rawinsonde - gives back all info - reg weather balloon type every 12 hrs.

2. Methods of transmission. highest, but accurate to 100,000'

a teletype is used to relay, then facsimile + report are issued

3. Types of winds aloft reports.

In the report even levels are given. odd negative
21920 1925 41925 typed gadget.
surface level is given as 12|9/5/2 speed
Time 'wind direction

4. Levels for which winds aloft are reported.

above 100 kts, subtract 50 from direction, then add 100 to the speed. If above 200 kts a 00200 will follow on chart,

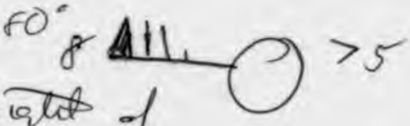
5. Winds aloft sequence. (Surface)

6. Winds aloft (upper groups).

7. Winds aloft charts. a facsimile

These go up to tropopause, at certain interval.

They use the stick + pennant 280° 8



"tide marks will always go to the right of the stick."

Tape #52
Ref #16

8. Winds aloft forecast.

2	5	8	10
1915+3	2222-01	2430-6	2633-10

this gives you the wind above MSL & also it gives you the free air temp for the altitude. These come out every 12 hrs. or so.

9. Conclusion.

Tape #52
Ref #17

DEPARTMENT OF WEATHER
UNITED STATES ARMY PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

File Nr. 2-311-1

PERFORMANCE CHECK

WINDS ALOFT

1. Winds aloft observations are normally made at 0600Z, 1200 Z, 1800 Z, and 2400 Z.

2. A winds aloft report with a surface group of 18941 would be decoded as 1800 Z observation time, observations made by _____ (rawin, pibal), wind direction South, and wind speed 10 to 20 knots.

3. A wind velocity of 240°/115 knots at 7,000 feet would be encoded in a winds aloft report as 7415.

4. A winds aloft observation made at 1800Z would be transmitted at 1801 Z.

Note: Decode the following winds aloft report.

UCUS 8 KWRF Ø2Ø222Z

24

MFX	ØØ93Ø	18Ø5	218Ø8	1812	41815
	1918	61925	1928	82Ø32	2Ø35
	Ø2138	22242	42248	62358	
	82465	Ø2575	3268Ø	52692	
	Ø2798	5781Ø	Ø7925	58135	
	Ø835Ø				

5. How does the weatherman alter the formula to show winds in excess of 100 knots, but less than 200 knots?

you subtract 50 from direction add 100 to speed.

6. How are the winds in excess of 200 knots shown?

If winds are above 200 you use 00200 following data + add to it. Temp is added

7. What is sometimes added to the winds aloft forecast that is very significant to flight planning?

this will help!

Tape #52
Ref #18

DEPARTMENT OF WEATHER
UNITED STATES ARMY PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

File Nr. 2-312-1

8 Feb 66

PERFORMANCE OBJECTIVES

FORECAST - RADAR SUMMARY AND WEATHER DEPICTION CHARTS

1. Knowledges:

   a. When provided with a radar summary chart, the student will:

      (1) Read the information available on the chart, i.e., date time group, altitude plotted for base and top of radar echo, movement of thunderstorms, intensity of percipitation, valid time severe weather warning, identify scattered, broken or overcast echos.

      (2) Read the symbols on the radar summary charts.

      (3) Write the source of information for the radar summary charts.

   b. When provided a weather depiction chart, the student will:

      (1) Read the information on the chart to include; date time group, the base of clouds as plotted, visibility, weather and obstructions to vision.

      (2) Identify the sky-condition symbols.

      (3) Identify the color that is used to show areas where the reported ceiling and/or visibility is below 1000 feet and 3 miles. The color for ceiling between 1000 feet and 5000 feet and a visibility of 3 miles or more.

      (4) Interpret a weather depiction chart.

   c. When given a terminal or an area forecast, the student will read and understand information provided on the forecast, to include: valid time, forecast weather and hazards to flight.

2. Skills: None

Tape #52
Ref #19

DEPARTMENT OF WEATHER
UNITED STATES ARMY PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

File Nr. 2-312-1

STUDENT OUTLINE

FORECAST - RADAR SUMMARY AND WEATHER

1. Introduction.

Use of radar for weather checks

2. Purpose of radar summary charts.

W.W. weather warning area — echo line

Sent as a Rarep - all fed into K.C. and reproduces as facsimile

20 250/120 Echo coverage. every 3 hrs.

3. Purpose of weather depiction charts.

They will give you VFR, + IFR locations - Blue - 1000 to 5000' viz greater than 3
Red - ceiling below 1,000 less than 3 mile.

4. Area Forecasts.

rather easy take

5. Terminal forecast.

If looking for a front change check wind for 180° direction change

6. Vertical cross-section forecast.

7. Horizontal depiction chart.

Tape #52
Ref #20

8. Weather advisories.

9. Conclusion.

Rarep

Regular weather broadcasts are at 0015 & the H.; + 0045. First is close in, 2nd is for long range.

Tape #52
Ref #21

DEPARTMENT OF WEATHER
UNITED STATES ARMY PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

File Nr. 2-312-1

PERFORMANCE CHECK

FORECAST - RADAR SUMMARY AND WEATHER DEPICTION CHARTS

1. Write the symbols used on a Radar Summary Chart for the following:

a. Echo Line. 

b. Echo coverage. 

c. Cellular echoes.

d. Stratified echoes.

e. Coverage

(1) .9

(2) .5 to .9

(3) .1 to .5

(4) less than .1 clear

f. Strongest cell.

g. Intensity of echo. w = how big water droplet - relates turb

h. Severe weather.

i. Intensity.

j. Height in hundreds of feet.

k. Cell movement and speed.

l. Area or line movement.

m. No echo.

n. No report.

o. Out for maintenance.

p. Not operating.

q. Area of severe weather, type, and valid time.

2. What colors are being used for the following on a weather depiction chart?

a. Cold front.

b. Warm front.

c. Occluded front.

d. Stationary front.

3. What symbols are being used on a weather depiction chart for:

a. Rain

b. Fog

c. Snow

d. Hail

e. Thunderstorm

f. Blowing sand or dust

g. Blowing snow

h. Ice

i. Freezing rain

j. Squall

k. Moderate rime ice

l. Severe rime ice

m. Lite clear icing

n. Moderate clear icing

o. Severe clear icing

p. Lite turbulance

q. Moderate turbulance

r. Severe turbulance

Tape #53
Ref #2

DEPARTMENT OF WEATHER
UNITED STATES ARMY PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

File Nr. 2-313-4

PERFORMANCE OBJECTIVES

COMPOSITE WEATHER FLIGHT PLANNING AND AVIATION FORECAST

1. Knowledges: When given a practical exercise that covers performance objectives for each class taught to date, the student will answer the questions and solve the problems within the tolerance set by these objectives.

2. Skills: None