**Weather**

**Chapter 1**

 2.199 DESCRIBE the characteristics of the troposphere, in a classroom, in accordance with Naval Aviation Fundamentals,

* **The troposphere is the area from the surface to about 36,000 feet.**
* **Less dense with increasing altitude.**
* **Temperature decreases with increasing altitude.**
* **Large amounts of condensation nuclei**

2.200 DESCRIBE the characteristics of the tropopause, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Transition zone between troposphere and stratosphere**
* **Strongest winds (jet stream) occur just below tropopause.**

2.201 DESCRIBE the characteristics of the stratosphere, in a classroom, in accordance with Naval Aviation Fundamentals,

* **The stratosphere is characterized by increasing temperature with increasing altitude.**
* **Generally smooth with excellent visibility**

2.202 DESCRIBE the flight conditions associated with the troposphere, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Light winds near earth’s surface. Increase in intensity with altitude**
* **Normal variation in flight conditions.**

2.203 DESCRIBE the flight conditions associated with the tropopause, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Anvil tops of thunderstorms**
* **Haze layer**
* **Wind shear**

2.204 DESCRIBE the flight conditions associated with the stratosphere, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Generally smooth with excellent visibility**

2.205 DEFINE a lapse rate, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Lapse rate is the decrease in temperature with increasing altitude.**

2.206 STATE the average lapse rate in degrees Celsius, in a classroom, in accordance with Naval Aviation Fundamentals,

* **The standard lapse rate is 2° C per 1000 ft (3.5° F)**

2.207 DEFINE atmospheric pressure, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Atmospheric pressure is the pressure exerted on the surface of the earth by the weight of the column of air directly above that spot.**

2.208 STATE the standard units of pressure measurement, in a classroom, in accordance with Naval Aviation Fundamentals,

* **29.92 in-Hg and 1013.2 mb**

2.209 DEFINE the standard atmosphere, in a classroom, in accordance with Naval Aviation Fundamentals,

* **29.92 in-Hg and 1013.2 mb**
* **1 in-Hg/ 1000 ft and 34 mb/ 1000 ft**

2.210 DIFFERENTIATE between sea level pressure and station pressure, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Station pressure is the atmospheric pressure measured at an airfield or station**
* **Sea level pressure is the pressure that would be measured from the existing weather if the station were at MSL**

2.211 DEFINE the types of altitudes, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Indicated: What is read off of the altimeter in the cockpit**
* **Calibrated: Indicated corrected for instrument error**
* **True: actual height above sea level (MSL)**
	+ **Calibrated corrected for nonstandard temperature**
* **Absolute: AGL**
* **Pressure: Height above the standard datum plane.**
	+ **Standard datum plane is the actual elevation above or below the surface where the pressure is equal to 29.92 in-Hg**
* **Density: PA corrected for nonstandard temperature and humidity**
	+ **Density decreases, DA increases**
	+ **Indicator of aircraft performance, not elevation**

2.36 DEFINE indicated altitude, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Above**

2.212 DESCRIBE the effects of pressure changes on aircraft altimeters, in a classroom, in accordance with Naval Aviation Fundamentals,

* **From high to low, lookout below**
	+ **Into lower pressure: altimeter indicated higher than actual**
	+ **Into higher pressure: altimeter indicated lower than actual**

2.213 DESCRIBE the effects of temperature deviations from the standard lapse rate on aircraft altimeters, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Into lower temp: Altimeter indicates higher than actual. MSL altitude lower than indicated**
* **Into higher temp: Altimeter indicates lower than actual. MSL altitude higher than indicated.**

**Chapter 2**

2.214 EXPLAIN the term pressure gradient, in a classroom, in accordance with Naval Aviation Fundamentals,

* **The pressure gradient is the rate of pressure change perpendicular to the isobars.**
	+ **The isobar spacing dictates the size of the pressure gradient force.**
	+ **The create winds that flow from high to low pressure areas.**

2.215 EXPLAIN and identify gradient winds and Buys Ballot's Law with respect to the isobars around pressure systems in the Northern Hemisphere, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Gradient winds are caused by the combination of the Coriolis force and the pressure gradient force.**
	+ **The winds flow perpendicular to the pressure gradient force. (Or parallel to the isobars)**
	+ **Clockwise around Highs and CCW around Lows.**

2.216 EXPLAIN and identify the surface wind direction with respect to the gradient winds in a pressure system in the Northern Hemisphere, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Surface friction reduces the effect of the Coriolis force.**
* **Causes ‘angled’ winds.**
	+ **Crossing isobars**
	+ **CCW around and into lows**
	+ **CW and out of highs**

2.217 DESCRIBE the jet stream, in a classroom, in accordance with Naval Aviation Fundamentals,

* **The jet stream is a narrow band of strong winds of 100 to 150 knots. In excess of 250 kts**
* **Located near tropopause**

2.218 DESCRIBE sea breezes, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Sea breezes are created by the DAYtime heating of land.**
	+ **Air rises over land, cools off and descends over water**

2.219 DESCRIBE land breezes, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Land breezes are created by the land cooling off at NIGHTtime.**
	+ **Air flows over water and warms up, rises, then descends over land.**

2.220 DESCRIBE mountain winds, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Cools off at night and then descends down valley floor**
	1. SCRIBE valley winds, in a classroom, in accordance with Naval Aviation Fundamentals,
* **Valley is heated by sun**
	+ **Warm air is displaced and forced up the mountain.**

2.222 DEFINE saturation, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Saturation is the point at which air can hold no more water.**
	+ **Higher temp, more water vapor can be held**

2.223 DEFINE dew point temperature, in a classroom, in accordance with Naval Aviation Fundamentals,

* **The dew point is the temperature at which saturation occurs.**

2.224 DEFINE dew point depression, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Dew point depression is the difference in dew point and actual temperature.**
	+ **Also called the dew point spread.**

2.225 DEFINE relative humidity, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Relative humidity is the percent of saturation in the air.**
	+ **Dew point spread of 4° F or 90% RH = condensation into fog or clouds.**

2.226 DESCRIBE the relationship between air temperature and dew point temperature with respect to saturation, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Dew point swill ALWAYS be lower than the temperature.**
* **Dew point spread of 4° F or 90% RH = condensation into fog or clouds.**

2.227 DESCRIBE the three characteristics of precipitation, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Showers: Sudden beginning and ending**
	+ **Abruptly changing intensity**
	+ **Associated with cumuliform clouds**
* **Continuous: Steady. NOT showery**
	+ **Intensity changes gradually**
	+ **Associated with stratiform clouds**
* **Intermittent: Stops and starts at least one during the hour**
	+ **Shower or steady**
	+ **Associated with either cloud type**

2.228 DESCRIBE the types of precipitation, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Drizzle: Small droplets that appear to float in the air**
* **Freezing drizzle: freezes on impact**
* **Rain: water droplets that fall to the ground**
* **Freezing rain: Rain that freezes on impact**
* **Hail or graupel: Lumps of ice. Rain carried into freezing temps by updrafts**
	+ **Does not lead to aircraft icing but can cause structural damage**
* **Ice pellets or sleet: Form when rain falls through freezing temps**
	+ **Does not lead to aircraft icing unless mized with super-cooled water**
* **Snow: Ice crystals**
	+ **Can lead to structural icing**
* **Snow grains: Grains of ice**

2.229 DESCRIBE the four principal cloud groups, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Clouds are classified by appearance, form, and base altitude**
	+ **Low clouds: Surface to 6500 ft AGL**
	+ **Middle clouds: 6500 to 20000 ft AGL**
	+ **High clouds: Above 20000 ft AGL**
	+ **Special clouds: Extensive vertical development**

2.230 DESCRIBE the weather conditions associated with various clouds, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Low clouds are mainly composed of water droplets**
	+ **Icing accumulated faster on low clouds because they are denser**
	+ **Low clouds can lead to terrain collision**
	+ **Turbulence: None to moderate**
* **Middle clouds are mainly composed of ice crystals and water droplets (Alto)**
	+ **Fog is often present. Expect poor visibility**
	+ **Frequently dark and turbulent**
	+ **Icing is common**
* **High clouds are mainly composed of ice crystals (Cirro)**
	+ **No precipitation and not an icing hazard**
	+ **Moderate turbulence with severe or extreme turbulence in anvil t-storms.**
* **Special clouds have extensive vertical development with high risk of icing**
	+ **Severe to extreme turbulence, hail, icing, lightning, and others.**

2.231 DESCRIBE the types of atmospheric stability, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Stable: Tendency to return to equilibrium**
* **Neutrally stable: Equilibrium encountered at any displacement**
* **Unstable: Tendency to move away from equilibrium**

2.232 DESCRIBE the four methods of lifting, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Convergence: Forces air up in between air masses**
* **Frontal: Cold fronts lift air in front of it**
* **Orographic: Wind against a mountainside pushes air up**
* **Thermal: When cool air is over a warm surface, heightened by solar heating**

2.233 DESCRIBE the flight conditions associated with a stable atmosphere, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Stratiform clouds indicate stable flight conditions**
	+ **Warm front**
	+ **Warm airmass**
	+ **Smooth turbulence**
	+ **Poor visibility**
	+ **Rime icing**
	+ **Steady precipitation**
	+ **Steady winds**

2.234 DESCRIBE the flight conditions associated with an unstable atmosphere, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Cumuliform clouds indicate unstable flight conditions**
	+ **Cold front**
	+ **Cold airmass**
	+ **Rough turbulence**
	+ **Good visibility**
	+ **Clear icing**
	+ **Showery precipitation**
	+ **Gusty winds**

**Chapter 3**

2.235 DEFINE the term air mass, in a classroom, in accordance with Naval Aviation Fundamentals,

* **An air mass is a large body of air that has essentially uniform temperature and moisture conditions (in the horizontal plane)**

2.236 DEFINE the term front, in a classroom, in accordance with Naval Aviation Fundamentals,

* **A front is an area of discontinuity that forms between two contrasting air masses**

2.237 DESCRIBE the structure of a front, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Can be hundreds of miles long**
* **Air masses are 3-D. So are fronts.**
* **The point where the front comes in contact with the ground is called the surface front.**
	+ **This is what is plotted on charts**
* **Most active (dangerous) weather is focused on and along either side of the surface front**
* **End at about 15,000 or 20,000 ft**

2.238 DESCRIBE the discontinuities used to locate and classify fronts, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Fronts are named for the temperature change they bring**
* **Fronts move across the country with their attached low-pressure system**
	+ **All fronts are located in troughs of low pressure**
* **Cold fronts move faster than warm**
* **Usually see a 90° shift in wind direction as a front passes**
* **Amount and rate of temp change depends on the front’s intensity**
* **Pressure decreases as the front approaches, then rises right after passage**

2.239 DESCRIBE the factors that influence frontal weather, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Amount of moisture available (need moisture for active weather)**
* **Stability of lifted air (dictates cloud type)**
* **Slope of the front**
	+ **Gradual slope: slow moving with extensive cloudiness and steady precipitation**
	+ **Steep slope: quick moving with narrow bands of clouds and showery precipitation**
* **Speed of frontal movement**
* **Contrast of temperature and moisture**

2.240 DESCRIBE the conditions associated with a cold front, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Cold fronts are the leading edge of an advancing cold air mass**
	+ **Lift action can produce violent and unstable conditions**
	+ **Wind shifts from SW to NW**
	+ **Narrow belt of precipitation**
	+ **Possibility for severe icing**
	+ **Post frontal weather includes rapidly clearing skies, decreasing temp, and decreasing dew point**
	+ **Altocumulus clouds on horizon**

2.241 DESCRIBE the characteristics of a squall line, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Squall line is a line of violent t-storms**
* **Indicated by dashed, double-dotted line**
* **Develop 50-300 miles ahead of cold front**
	+ **Cold downdrafts ahead of cold front lift warm, unstable air**

2.242 DESCRIBE the characteristics of a warm front, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Warmer, less dense air rides up and over a cold air mass**
* **Broad areas of cloudiness (500 to 700 miles in front)**
* **Not as defined as cold front (they are slow moving and gradual)**
* **Wind shifts from SE to SW**
* **Cirrus, cirrostratus, altostratus clouds**
* **Precipitation gradually increases on approach**
* **Low ceilings and poor visibility covering thousands of square miles**
* **Can contain embedded thunderstorms (highly dangerous)**

2.243 DESCRIBE the conditions associated with a stationary front, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Little or no movement**
* **Winds can still be blowing**
* **Surface winds blow parallel on both sides of front**
* **180° wind shift**
* **Symptoms similar to warm front, but less intense**
	+ **Can persist for several days**

2.244 DESCRIBE the conditions associated with occluded fronts, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Occurs when a cold front overtakes a slower moving warm front**
	+ **Cold occluded front if cold front remains in contact with ground**
	+ **Warm occluded front is vice versa**
* **Tend to be aligned from NW to SE. Move toward the NE**
* **Also has a 180° wind shift (from SE to NW)**
* **Most severe weather located 100 NM south to 300 NM north of the frontal intersection**

2.245 DESCRIBE the conditions associated with an inactive front, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Clouds and precipitation do not accompany inactive fronts**
* **Often, not enough moisture for weather**
* **In many cases, inactive fronts just have a wind shift and a change in temperature and pressure**

**Chapter 4**

2.246 LIST the classifications of turbulence used in Pilot Reports (PIREPs), in a classroom, in accordance with Naval Aviation Fundamentals,

* **Thermal, mechanical, frontal, and large scale wind shear**

2.247 LIST the intensities of turbulence used in Pilot Reports (PIREPs), in a classroom, in accordance with Naval Aviation Fundamentals,

* **Light**
	+ **Momentarily cases slight, erratic changes in flight orientation**
* **Moderate**
	+ **Light turbulence but with greater intensity**
* **Severe**
	+ **Large, abrupt changes in altitude and/or attitude**
* **Extreme**
	+ **Aircraft is violently tossed about and near impossible to control**

2.248 DEFINE the terms used to report turbulence with respect to time, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Occasional**
	+ **Less than 1/3 of the time**
* **Intermittent**
	+ **1/3 to 2/3 of the time**
* **Continuous**
	+ **More than 2/3 of the time**

2.249 DESCRIBE how thermal turbulence develops, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Thermal turbulence is caused by localized vertical convective currents due to strong solar heating, etc.**
	+ **It results from cool air being heated from below**
	+ **Most extreme over barren surfaces as opposed to forests or grass**

2.250 DESCRIBE how mechanical turbulence develops, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Mechanical turbulence results from wind flowing over or around irregular terrain or other obstructions**
	+ **Buildings, hills, mountains, bluffs, etc**

2.251 DESCRIBE the cloud formations associated with mountain wave turbulence, in a classroom, in accordance with Naval Aviation Fundamentals,

* **5 or 10 miles downwind from the peak, rotor or lenticular clouds may appear**
	+ **This is a result of the air ascending again in the standing wave pattern**
* **A cap cloud can obscure both sides of the mountain peak as well**

2.252 DESCRIBE techniques for flight in the vicinity of mountain waves, in a classroom, in accordance with Naval Aviation Fundamentals,

* **The worst turbulence is found at low levels on the leeward side of the mountain**
	+ **In or near associated rotor or cap clouds**
* **Causes severe turbulence from the surface to the tropopause and miles downwind**
* **Fly around wave areas**
* **Avoid rotor, lenticular, and cap clouds**
* **Approach mountains at 45°**
* **Avoid leeward side of mountains**

2.253 DESCRIBE how frontal lifting creates turbulence, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Warm air is forced upward by front, leading to instability**
* **Abrupt shift in wind direction**
* **Fast moving cold fronts are most extreme**

2.254 DESCRIBE how temperature inversions are examples of wind shear turbulence, in a classroom, in accordance with Naval Aviation Fundamentals,

* **In an inversion, the border between warm air and cold calm air can develop wind shear if the winds just above the inversion grow relatively strong**

2.255 DESCRIBE how jet streams are examples of wind shear turbulence, in a classroom, in accordance with Naval Aviation Fundamentals,

* **The jet stream has a rapid change of wind speed within a short distance inside the jet core**
	+ **Both horizontal and vertical shear**

2.256 DESCRIBE the recommended procedures for flying through turbulence, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Don’t chase airspeed or altitude**
* **Keep proper attitude**
* **Establish and maintain thrust settings consistent with your aircraft for turbulent air penetration**

2.257 DESCRIBE structural icing, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Structural icing is icing that forms on the external structure of an aircraft**
	+ **Can cause degraded performance**
* **Clear, rime, mixed, and frost**

2.258 STATE the requirements for the formation of structural icing, in a classroom, in accordance with Naval Aviation Fundamentals,

* **The atmosphere must have super-cooled, visible water droplets**
* **The OAT and the aircraft’s surface temperature must be below freezing**

2.259 STATE the temperature range most conducive to structural icing, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Clear ice: Between 0° and -10° C**
* **Rime ice: Between -10° and -20° C**

2.260 DESCRIBE icing conditions associated with fronts, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Cold fronts and squall lines have a narrow band of cumuliform clouds that present bad weather and icing**
	+ **Predominantly clear icing**
	+ **10,000 feet thick**
* **Warm and stationary fronts have a much wider band of weather and icing**
	+ **Mostly stratiform clouds, accumulating at a low rate**
	+ **Mostly rime, with some mixed**
	+ **3,000 to 4,000 feet thick**
* **Most critical freezing precipitation is water falling from warm air TO a FL that is below freezing**
	+ **Result is clear ice. Solution is to climb to higher altitude above freezing**
* **Occluded fronts produce a widespread icing area**
	+ **Stratiform and cumuliform**
	+ **20,000 feet thick**
	+ **Clear, mixed, and rime with heavy rate of accumulation**

2.261 IDENTIFY the hazards of aircraft icing, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Decreases lift, thrust, and range**
* **Increases drag, weight, fuel consumption, and stall speed**
* **Can change AOA**
* **Can badly misbalance props and rotors**
* **Engines, fuel, and instruments can also be affected by icing**

2.262 DESCRIBE the types of engine icing, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Induction icing: when air intakes experience condensation and deposition**
	+ **Can happen in clear skies and above freezing temps**
	+ **The reduced pressure at the intake lowers the temp to freezing**
* **Compressor icing: ice can form on compressor inlet screens and guide vanes**
	+ **Will restrict the flow of inlet air, leading to flameout**

5.1 DESCRIBE ground icing hazards, in a classroom, in accordance with Naval Aviation Fundamentals,

* **De-icing fluids can be corrosive to internal equipment**
* **Taxiing through mud, water, or slush can create ice**
* **Braking action can be degraded as well**

2.263 IDENTIFY the procedures to minimize or avoid the effects of icing, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Climb to a colder temperature where the precipitation is frozen**
* **Descend to an altitude where the OAT is well above freezing**
* **Utilize anti-icing and deicing equipment**
	+ **Mechanical: Deicing boots that crack ice**
	+ **Fluid: Freezing point depressants are pumped through holes in the leading edge**
	+ **Heat: Heat application capability to wings, props, tail surface, or engine intakes**

2.264 LIST the intensities of icing used in Pilot Reports (PIREPs), in a classroom, in accordance with Naval Aviation Fundamentals,

* **Trace: Ice becomes perceptible**
	+ **Not hazardous unless presence is over an hour**
* **Light: Accumulation rate may create problem if condition last for over an hour**
	+ **Not problem if deicing equipment is used**
* **Moderate: Rate of accumulation that even short encounters can become hazardous**
	+ **Use of deicing equipment is necessary**
* **Severe: Even use of deicing equipment fails to reduce/control the hazard**
	+ **Divert immediately**

2.265 LIST the types of icing used in Pilot Reports (PIREPs), in a classroom, in accordance with Naval Aviation Fundamentals,

* **Rime: -10° to -20° C**
* **Clear: 0° to -10° C**
* **Mixed**

2.266 DEFINE the types of visibility, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Visibility: the ability to see and identify prominent unlighted objects by and prominent lighted object by night**
* **Flight visibility: Average forward horizontal distance (in statute miles) from the cockpit that a pilot can see prominent unlighted objects at day and lighted prominent object at night**
* **Prevailing visibility: The greatest horizontal visibility (in statute miles) equal or exceeding 180°**
	+ **Does not have to be consecutive**
* **Slant range visibility: The distance on final approach when the runway environment is in sight**
	+ **RVR provides best indication of slant range**
* **Runway Visual Range (RVR): The horizontal distance (in meters or feet) a pilot will see by looking down the runway from approach end**

2.267 DEFINE obscuring phenomena, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Obscuring phenomena are any collection of particles that reduce horizontal visibility to less than 6 miles**
	+ **Fog, haze, smoke, ash, spray, dust**

2.268 DESCRIBE the sky coverage terms that define a ceiling, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Ceiling is the lowest level of BROKEN or OVERCAST**
	+ **Broken: 5/8 to 7/8 sky coverage**
	+ **Overcast: 8/8 sky coverage**

2.269 DESCRIBE the parameters that define fog, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Fog is a visible aggregate of minute water droplets that is based at or within 50 feet of the surface, greater than 20 feet in depth and reduces the prevailing visibility to less than 5/8 of a statute mile**
* **Fog less than 200 feet in height is considered SHALLOW fog**

2.270 STATE the requirements for fog formation, in a classroom, in accordance with Naval Aviation Fundamentals,

* **For fog to form, the air must be:**
	+ **Temporarily supersaturated**
	+ **Condensation nuclei must be present**
	+ **Low dew point spread (high moisture content)**
	+ **Light surface winds must be present**

2.271 DESCRIBE the two main types of fog, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Radiation fog: occurs during nocturnal cooling, usually on CLEAR NIGHTS when the earth releases large amounts of radiation into the atmosphere**
	+ **Winds of less than 5 kts: shallow fog**
	+ **Winds of 5 to 10 kts: dense fog**
	+ **Winds greater than 10 kts: low stratus or stratocumulus clouds form**
* **Advection fog: Occurs when warm, moist air moves over a cold surface (water) and the air is cooled to below its dew point**
	+ **Wind is necessary**
	+ **Common in coastal areas**
	+ **More than 15 kts of wind: Fog becomes a layer of low stratus**
	+ **Can last for weeks**

2.272 DESCRIBE the aviation hazards of ash clouds, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Loss of engine thrust**
* **Flameouts**
* **Leading edges and windshields sandblasted**
* **Plugged instruments**
* **High oil temperatures**
* **Airspeed indications may fluctuate greatly**

**Chapter 5**

2.273 DESCRIBE the hazards associated with thunderstorms, in a classroom, in accordance with Naval Aviation Fundamentals,

* **HIMELT**
	+ **H: Hail**
	+ **I: Icing**
	+ **M: Microbursts**
	+ **E: Extreme Turbulence**
	+ **L: Lightning**
	+ **T: Tornados**
* **Four requirements:**
	+ **Moisture**
	+ **Lifting action**
	+ **Unstable air**
	+ **Building through freezing layer**

2.274 DESCRIBE the signs and hazards associated with microbursts, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Localized downward flow of 2,000 to 6,000 feet per minute**
* **Outflow produces wind shears of 20 to 200 knots**
* **¼ to 2.5 miles wide**
* **Lasts only 5 to 10 minutes**
* **Emanates from cumuliform and convective clouds, not a thunderstorm**
* **Visual cues:**
	+ **Virga (cools air off as it descends, ‘causing’ microburst)**
	+ **Blowing dust**
	+ **Rain shafts diverging from core of storm**
	+ **Roll clouds**
	+ **Extreme lightning**

2.275 EXPLAIN how radar can aid a pilot when flying in the vicinity of thunderstorms, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Location and intensities can be determined**
	+ **Locates most severe conditions**
* **Used as avoidance, not penetration tool**

2.276 DESCRIBE the recommended techniques for avoiding thunderstorm hazards, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Stay 20 miles out**
* **Circumnavigate storm**
* **Fly over the top**
	+ **Some CAT and hail can be encountered above the cloud**
* **Fly under base layer**
	+ **Fly 1/3 the distance from the surface to the base of the cloud (Not in mountainous terrain)**
* **Fly through**
	+ **Through lower 1/3 of the storm**
	+ **4,000 to 6,000 feet AGL**
* **Keep level attitude in all cases!!**

**Chapter 6**

4.18 DESCRIBE the use of METARs in flight planning in accordance with Naval Aviation Fundamentals,

* **METARs are used to communicate the latest observed weather to aircrew to make the most informed decisions**
	+ **Weather at primary or alternate destination**
	+ **IFR or VFR**
	+ **Trends in weather**
* **Hourly report**
	+ **Brevity and clarity**

4.19 INTERPRET weather conditions from a METAR, in a classroom, in accordance with Naval Aviation Fundamentals,

* **PRACTICE!!!**

4.20 DESCRIBE the use of TAFs in flight planning, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Airport forecast for specific period (usually 24 hours)**
* **VFR or IFR**

4.21 DESCRIBE differences in U.S. civil, military, and international TAFs, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Civilian:**
	+ **Date/Time prepared**
	+ **First two digits date**
	+ **Z time of issuance**
	+ **Forecast valid times**
	+ **First two digits date**
	+ **Valid time period of forecast**
	+ **Visibility in statute miles**
* **Military:**
	+ **Preparation date (time omitted)**
	+ **Valid time of forecast**
* **Military and Overseas:**
	+ **Visibility in meters**
		- **9999 means unrestricted**
* **Overseas**
	+ **May use CAVOK**
		- **No significant weather**
		- **Vis greater than 10 km**

4.22 INTERPRET forecast weather conditions from a TAF, in a classroom, in accordance with Naval Aviation Fundamentals,

* **PRACTICE!!**

**Chapter 7**

4.23 DESCRIBE the use of Surface Analysis Charts, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Surface Analysis charts depict pressure centers, fronts, and barometric pressure lines**
* **Observed weather**
	+ **Represents past history**
* **Uses UTC time**

4.24 INTERPRET Surface Analysis Charts, in a classroom, in accordance with Naval Aviation Fundamentals,

* **4-mb intervals**
* **Practice!!**

4.25 DESCRIBE the use of Low Level Significant Weather Prognostic Charts, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Include the latest surface analysis charts along with 12, 24, 36, and 48 hour forecasts**

4.26 DESCRIBE displayed data METARs, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Text or visual**
* **To determine IFR/VFR**
* **Temperature**
* **Dewpoint**
* **Pressure**
* **Winds**
* **Visibility**
* **Ceiling**
* **Clouds**

4.27 DESCRIBE weather data on NEXRAD, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Shows precipitation levels**
	+ **Energy return**
* **Hook echo for tornadoes**
* **Hail display**
* **Wind shear display**
* **Microburst display**
	+ **Based off of density gradient of descending air**
* **Satellite imagery**
	+ **Infrared**
	+ **Visible**

4.28 DESCRIBE weather data on satellite imagery, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Infrared**
	+ **Records heat radiation being emitted by clouds and earth**
* **Visible**
	+ **Displays clouds and the earth reflecting sunlight back to satellite**
		- **More reflected light = whiter appearance**

4.29 DESCRIBE the use of Winds-Aloft Prognostic Charts, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Represent the observed and average forecast flight level for winds aloft**
* **Variable altitude**
* **Wind direction and speed**
* **Temperatures**

4.30 DESCRIBE the use of Winds-Aloft Forecasts, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Similar to Winds-Aloft prognostic chart but organized in to columns and rows for multiple locations**
* **1733 = 170 °T at 33 knots**
* **All temps above FL 24,000’ are negative**
* **99 = variable wind direction**
* **9900 = light and variable winds**
* **Greater than 100 knots**
	+ **7409 = (74-50) 240° T at 109 knots**
* **Winds never forecasted below 1500 ft**
* **Temps never forecasted below 2500 ft**
* **Temps are never forecasted for the 3000 ft level**

4.31 DESCRIBE the use of Severe Weather Watch messages, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Issued as required**
* **Given in local time**
* **WW is required for:**
	+ **Tornadoes**
	+ **Severe thunderstorms**
		- **50 kts of wind or greater**
		- **3/4 inch diameter hail**

2.277 DESCRIBE the use of In-Flight Weather Advisories, in a classroom, in accordance with Naval Aviation Fundamentals,

* **SIGMETs**
	+ **Other than convective activity that is potentially hazardous to all aircraft**
* **Convective SIGMETs**
	+ **Issued only for thunderstorms and related convective phenomena over the CONUS**
* **AIRMETs**
	+ **Other than convective activity, but lower intensity than SIGMET**
	+ **Sierra: widespread IFR conditions**
		- **Less than 1000 foot ceilings, less than 3 SM visibility**
	+ **Tango: Moderate turbulence or sustain surface winds of 30 kts or more**
	+ **Zulu: Moderate icing or freezing level data**

2.278 STATE the letter identifiers of each of the In-Flight Weather Advisories, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Sierra: widespread IFR conditions**
	+ **Less than 1000 foot ceilings, less than 3 SM visibility**
* **Tango: Moderate turbulence or sustain surface winds of 30 kts or more**
* **Zulu: Moderate icing or freezing level data**

2.279 DESCRIBE the use of Pilot Weather Reports (PIREPs), in a classroom, in accordance with Naval Aviation Fundamentals,

* **Supplemental to ground information**
* **ATC required to ask for PIREP when:**
	+ **Ceilings below 5000 feet**
	+ **Vis at or below 5 miles**
	+ **Thunderstorm related phenomena**
	+ **Light icing or greater**
	+ **Moderate turbulence or greater**
	+ **Wind shear**
* **Pilots required to submit when:**
	+ **Requested**
	+ **Unusual or unforecast conditions occur**
	+ **Conditions of IFR differ from last observation**
	+ **Missed approach due to weather**
	+ **Wind shear is encountered on arrival or departure**

4.32 DESCRIBE the weather data entered on a DD Form 175-1, in a classroom, in accordance with Naval Aviation Fundamentals,

* **Used by local weather office to brief pilots**
* **Typical METAR data required**
* **Freezing level**
* **Flight plan**
* **Deviation from standard lapse rate**
* **RSC**