

3. Weather

3.1 - Sources of Weather



Structure & Formatting Reminder

This presentation is provided as a reference to help you prepare for the your exam. It seeks to go beyond memorization and provide explanation and rationale.

While this reference considers many of the points covered in the exam, given the breadth it is in no way exhaustive. It is suggested to consult a variety of resources when preparing for the exam.

Text that is marked in **YELLOW** has a high probability of being referenced directly in one of the exam's nearly 400 possible questions.

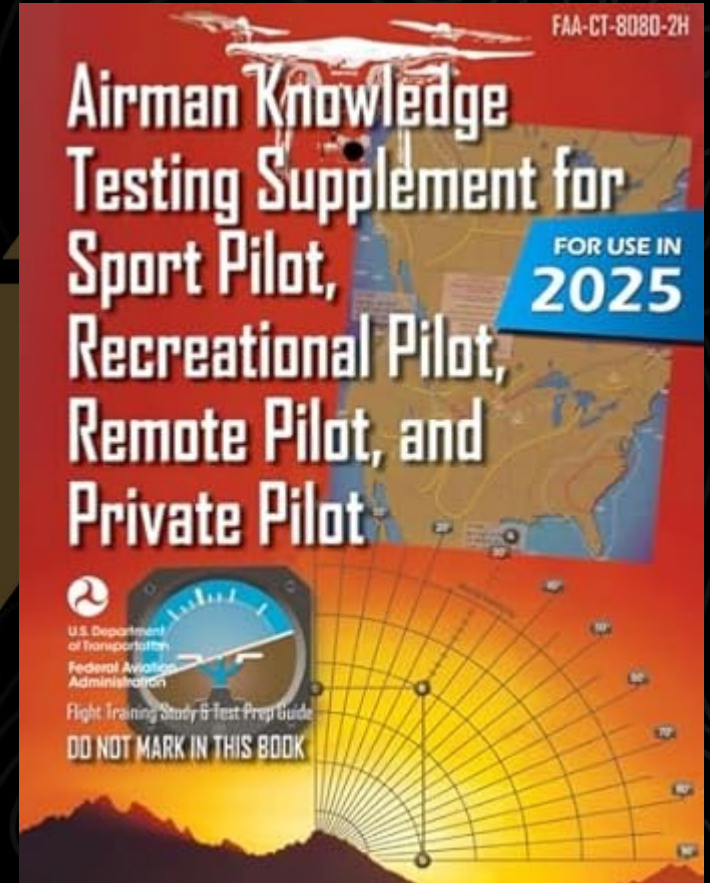
Take the quiz at the end to gauge your understanding.



Airman Knowledge Testing Supplement

Many of the points covered in the slideshow and quiz reference images and concepts found in the “Airman Knowledge Testing Supplement”.

You can download the document from the FAA [here](#). Alternatively, a hard copy can be purchased online for around \$10.





3.1 - Internet Weather Briefing



3.1 - Internet Weather Briefing

Before every flight pilots should gather as much information about weather conditions as possible.

Preflight weather briefing is required in order to be compliant with FAA regulations.

A common source of information is the FAA and NOAA (National Weather Service's) Aviation Weather Center website at (aviationweather.gov)



1-800-WXBrief or visit 1800wxbrief.com can provide additional route-specific information for crewed aviation.



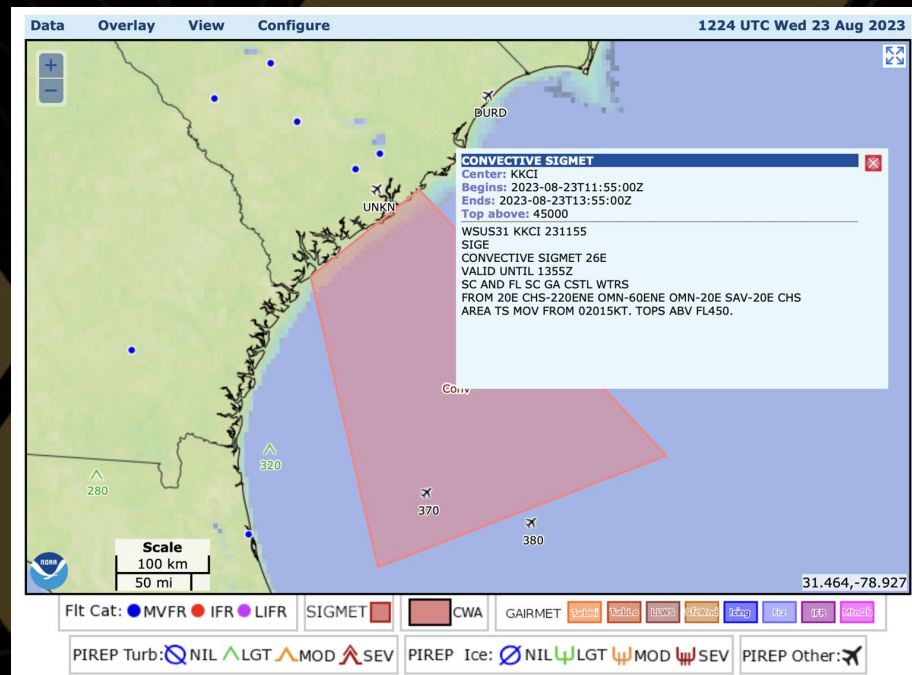
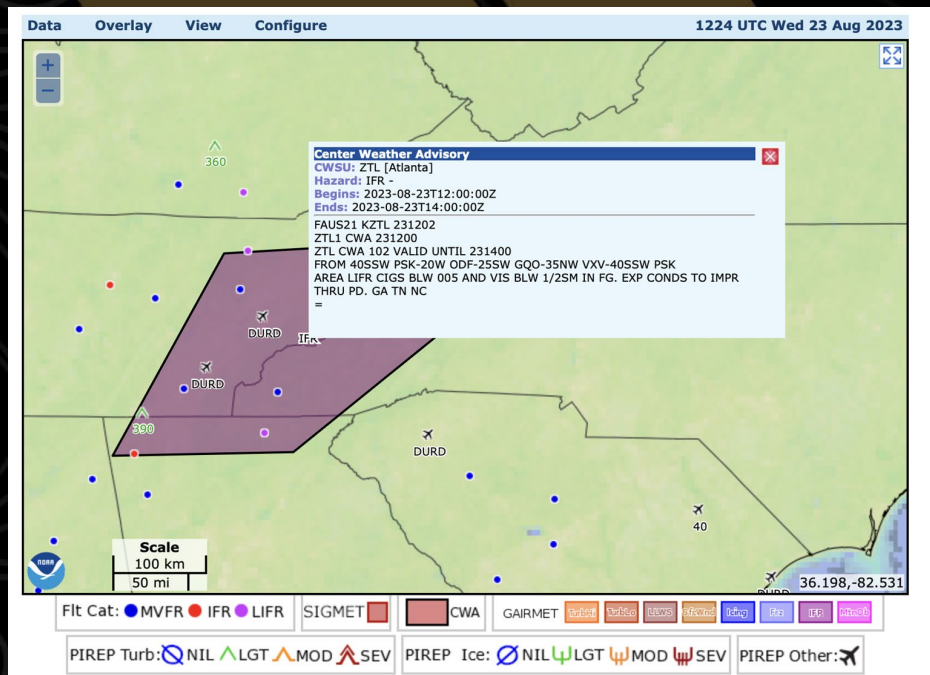
3.1 - Internet Weather Briefing

Briefing types include the following:

- Adverse Weather Conditions
 - Convective (Thunderstorm or Tornado activity)
 - SIGMET (Significant Meteorological Information)
- Synopsis
 - Weather charts
 - Barometric Pressure
- Current Conditions
 - METARs
 - Radar
 - Pilot Reports
 - Satellite
- En Route and Destination Forecasts
- Winds and Temps Aloft
- Aviation Notices
- ATC Delays



3.1 - Internet Weather Briefing



Why is important for drone pilots to monitor weather?



Why is important for drone pilots to monitor weather?

Weather affects drone control, visibility, and battery life. Knowing conditions helps avoid accidents and maintain compliance.





3.1 - Aviation Routine Weather Reports (METARs)



3.1 - Meteorological Aerodrome Reports (METARs)

- METARs are weather reports with information relevant to aviation.
- Weather is a measure of current surface weather in a standard international format.
- METARs are issued on a regularly scheduled basis unless significant weather changes have occurred.
- A special METAR (SPEIC) can be issued at any time between routine METAR reports.



3.1 - Meteorological Aerodrome Reports (METARs)

Example

KBNA 281451Z AUTO 12008KT 4SM -RA HZ BKN010 21/17 A3005



3.1 - Meteorological Aerodrome Reports (METARs)

Example

KBNA 281451Z AUTO 12008KT 4SM -RA HZ BKN010 21/17 A3005

KBNA - refers to the airport from where the report was issued.

- KBNA is Nashville International airport.
 - *K*-refers to the continental United States (
 - Alaska (PA) and Hawaii (PH))
 - *BNA* is the airport designation.



3.1 - Meteorological Aerodrome Reports (METARs)

Example

KBNA 281451Z AUTO 12008KT 4SM -RA HZ BKN010 21/17 A3005

Q: What is **KBNA**?



3.1 - Meteorological Aerodrome Reports (METARs)

Example

KBNA 281451Z AUTO 12008KT 4SM -RA HZ BKN010 21/17 A3005

Q: What is **KBNA**?

A: The airport from where the report was issued (KBNA Nashville).



3.1 - Meteorological Aerodrome Reports (METARs)

Example

KBNA 281451Z AUTO 12008KT 4SM -RA HZ BKN010 21/17 A3005

- 28** - references the date when it was issued.
- **28** - is the day of the month (*it is assumed that it is referencing the current month*).



3.1 - Meteorological Aerodrome Reports (METARs)

Example

KBNA 281451Z AUTO 12008KT 4SM -RA HZ BKN010 21/17 A3005

281451 - references the date when it was issued.

- **1451** - is the time (24 hour military time)
 - 14:51 = 2:51pm.



3.1 - Meteorological Aerodrome Reports (METARs)

Example

KBNA 281451Z AUTO 12008KT 4SM -RA HZ BKN010 21/17 A3005

281451Z - references the date when it was issued.

- **Z** - mean “Zulu” and is a reference to UTC time.
 - UTC (Coordinated Universal Time) is the same as GMT (Greenwich Mean Time) that reference the current time at the prime meridian (0° longitude).
 - Zulu = UTC = GMT
- All aviation around the world references this time zone.



3.1 - Meteorological Aerodrome Reports (METARs)

Example

KBNA 281451Z AUTO 12008KT 4SM -RA HZ BKN010 21/17 A3005

Q: What does 281451Z mean?



3.1 - Meteorological Aerodrome Reports (METARs)

Example

KBNA 281451Z AUTO 12008KT 4SM -RA HZ BKN010 21/17 A3005

Q: What does 281451Z mean?

A: The METAR report was issued on the 28th day of the month at 14:45 Zulu time.



3.1 - Meteorological Aerodrome Reports (METARs)

Example

KBNA 281451Z **AUTO** 12008KT 4SM -RA HZ BKN010 21/17 A3005

AUTO - simply means that the report was automatically generated by a computer.

- If a human has a role in creating the report Auto is removed from the METAR.



3.1 - Meteorological Aerodrome Reports (METARs)

Example

KBNA 281451Z AUTO 12008KT 4SM -RA HZ BKN010 21/17 A3005

12008KT - The first three digits refer to the **direction** of the wind in degrees.



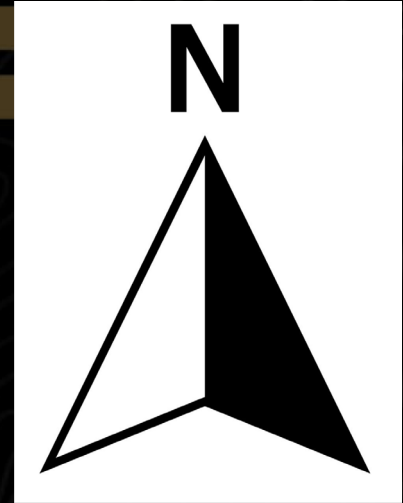
3.1 - Meteorological Aerodrome Reports (METARs)

True vs. Magnetic North

General Rule - “If you read it, it’s true. If you hear it, it’s magnetic.”

What uses True North? *Charts and text sources (METAR, TAF, winds aloft, surface analysis charts)*

What uses Magnetic North? *Radio broadcasts referencing wind direction or ATIS/AWOS/ASOS reports (except for FSS briefers that simply read text)*



Why is it important to understand which type of North is being referenced?



Why is it important to understand which type of North is being referenced?

There are different “Norths.” True North, Magnetic North, and Grid North and they don’t all point the same way. Confusing them can cause navigation errors, leading to incorrect flight paths or lost orientation.



3.1 - Meteorological Aerodrome Reports (METARs)

Example

KBNA 281451Z AUTO 12008KT 4SM -RA HZ BKN010 21/17 A3005

12008KT - The second two digits refer to the wind speed.

- This examples references a **wind speed** of 8.
 - 8 what though?



3.1 - Meteorological Aerodrome Reports (METARs)

Example

KBNA 281451Z AUTO 12008KT 4SM -RA HZ BKN010 21/17 A3005

12008KT - KT refers to the speed being measured in knots.

- Why Knots? - Knots factor in the curvature of the earth in calculating speed over long distances.
 - To find MPH = Knots X 1.151



3.1 - Meteorological Aerodrome Reports (METARs)

Example

KBNA 281451Z AUTO 12008KT 4SM -RA HZ BKN010 21/17 A3005

12008KT

- If you see 12008**G21**KT the **G21** means that the wind is variable and might **g**ust to 21 knots.
- If you see **VRB**21KT the **VRB** means that winds are **v**ariable.



3.1 - Meteorological Aerodrome Reports (METARs)

Example

KBNA 281451Z AUTO 12008KT 4SM -RA HZ BKN010 21/17 A3005

4SM - refers to the distance of **visibility** measured in **Statute Miles**.

- SM are land measured miles as opposed to NM (Nautical Miles)
- If you see “10SM” it means visibility is unlimited. You will never see more than 10SM listed.

REMEMBER: ** When flying a drone you need a **minimum of 3SM** of visibility**



3.1 - Meteorological Aerodrome Reports (METARs)

Example

KBNA 281451Z AUTO 12008KT 4SM -RA HZ BKN010 21/17 A3005

-RA HZ - refers to current **precipitation**.

- **RA** means light rain

- **HZ** means haze.



3.1 - Meteorological Aerodrome Reports (METARs)

Example

KBNA 281451Z AUTO 12008KT 4SM -RA HZ BKN010 21/17 A3005

METAR Precipitation codes are listed as either “-”, “ ”, or “+”

- - light intensity
- blank is moderate intensity
- + is heavy intensity



3.1 - Meteorological Aerodrome Reports (METARs)

Example

KBNA 281451Z AUTO 12008KT 4SM -RA HZ BKN010 21/17 A3005

There are a total of 35 METAR Precipitation codes.

Others include:

- FG - Fog
- BR – Mist (baby rain)
- DZ - Drizzle
- SN - Snow
- TS - Thunderstorm



3.1 - Meteorological Aerodrome Reports (METARs)

Example

KBNA 281451Z AUTO 12008KT 4SM -RA HZ BKN010 21/17 A3005

BKN - refers to the type of cloud cover.

- BKN means “broken clouds”

Other include:

- OVC - overcast clouds
- SCT - scattered clouds
- FEW - few clouds
- CLR - clear skies (below 12,000ft)



3.1 - Meteorological Aerodrome Reports (METARs)

Example

KBNA 281451Z AUTO 12008KT 4SM -RA HZ BKN010 21/17 A3005

Sky Cover is measured by dividing the sky from horizon to horizon into 8 parts and determining how many parts are obscured by clouds.

SKY COVER	OBSERVATION	CONTRACTION
Less than 1/8 obscured	Clear	SKC, CLR
1/8 - 2/8 obscured	Few	FEW
3/8 - 4/8 obscured	Scattered	SCT
5/8 - 7/8 obscured	Broken	BKN
8/8 obscured	Overcast	OVC



3.1 - Meteorological Aerodrome Reports (METARs)

Example

KBNA 281451Z AUTO 12008KT 4SM -RA HZ BKN010 21/17 A3005

BKN010 - refers to the type of cloud cover.

- 010 means clouds at 1,000 feet.

Other examples:

005 = 500 feet

015 = 1,500 feet

100 = 10,000 feet



3.1 - Meteorological Aerodrome Reports (METARs)

Example

KBNA 281451Z AUTO 12008KT 4SM -RA HZ BKN010 21/17 A3005

21/17 - refers to the current temperature (in celsius).



3.1 - Meteorological Aerodrome Reports (METARs)

Example

KBNA 281451Z AUTO 12008KT 4SM -RA HZ BKN010 21/17 A3005

21/17 - refers to the dew point (in celsius).

- Dew point is important because fog typically occurs when the difference between the temperature and dew point is 3 degrees or less.



3.1 - Meteorological Aerodrome Reports (METARs)

Example

KBNA 281451Z AUTO 12008KT 4SM -RA HZ BKN010 21/17 A3005

A3005 - refers to the current atmospheric pressure (30.05)

- Atmospheric pressure is measured as "inHg" - inches of mercury).
- A "standard day" measures at 29.92inHg.
 - Measurements lower than a standard day will likely result in a cloudy, rainy, and windy weather.
 - Measurements higher than a standard day will likely result in a clear, cool day.

NOTE: If the pressure is rising or falling quickly it means that a front of unsettled air is moving through the area.



Why are monitoring the dew point and barometric pressure important?



Why are monitoring the dew point and barometric pressure important?

Monitoring dew point and barometric pressure helps drone pilots anticipate weather changes that could impact flight safety. A rising dew point means increasing moisture and possible fog or storms. Falling barometric pressure often signals worsening weather. Tracking both helps pilots avoid dangerous conditions.





METAR REVIEW



3.1 - Meteorological Aerodrome Reports (METARs)

KBNA 281451Z AUTO 12008KT 4SM -RA HZ BKN010 21/17 A3005

Airport



3.1 - Meteorological Aerodrome Reports (METARs)

KBNA 281451Z AUTO 12008KT 4SM -RA HZ BKN010 21/17 A3005

Airport

Date/Time



3.1 - Meteorological Aerodrome Reports (METARs)

KBNA 281451Z AUTO 12008KT 4SM -RA HZ BKN010 21/17 A3005

Airport

Date/Time

*Automatically
Created*



3.1 - Meteorological Aerodrome Reports (METARs)

KBNA 281451Z AUTO 12008KT 4SM -RA HZ BKN010 21/17 A3005

Airport

Date/Time

*Automatically
Created*

*Wind
Direction
and Speed*



3.1 - Meteorological Aerodrome Reports (METARs)

KBNA 281451Z AUTO 12008KT 4SM -RA HZ BKN010 21/17 A3005

Airport

Date/Time

*Automatically
Created*

*Wind
Direction
and Speed*

*Visibility
Distance*



3.1 - Meteorological Aerodrome Reports (METARs)

KBNA 281451Z AUTO 12008KT 4SM -RA HZ BKN010 21/17 A3005

Airport

Date/Time

*Automatically
Created*

*Wind
Direction
and Speed*

*Visibility
Distance*

Precipitation



3.1 - Meteorological Aerodrome Reports (METARs)

KBNA 281451Z AUTO 12008KT 4SM -RA HZ BKN010 21/17 A3005

Airport

Date/Time

*Automatically
Created*

*Wind
Direction
and Speed*

*Visibility
Distance*

Precipitation

*Cloud
Cover/Height*



3.1 - Meteorological Aerodrome Reports (METARs)

KBNA 281451Z AUTO 12008KT 4SM -RA HZ BKN010 21/17 A3005

Airport

Date/Time

*Automatically
Created*

*Wind
Direction
and Speed*

*Visibility
Distance*

Precipitation

*Cloud
Cover/Height*

*Temperature &
Dew Point*



3.1 - Meteorological Aerodrome Reports (METARs)

KBNA 281451Z AUTO 12008KT 4SM -RA HZ BKN010 21/17 A3005

Airport

Date/Time

*Automatically
Created*

*Wind
Direction
and Speed*

*Visibility
Distance*

Precipitation

*Cloud
Cover/Height*

*Temperature &
Dew Point*

*Barometric
Pressure*



3.1 - Meteorological Aerodrome Reports (METARs)

Example

REMEMBER:

METARs are not forecasts. They are a snapshot of weather at a particular place at a particular time.





3.1 - Terminal Aerodrome Forecasts (TAFs)



3.1 - TAF Reports

A TAF is a string of text that provides **forecasted (not current) weather** information for a specified period of time.

- T - Terminal
- A - Aerodrome
- F - Forecasts



3.1 - TAF Reports

Remember:

- TAF = forecast
- METAR = current conditions



3.1 - TAF Reports

A TAF report covers a **5SM** mile radius **around an airport**.



3.1 - TAF Reports

TAF reports are **updated four times** a day and are valid for either a 24 or 30 hour period.

- 0000Z
- 0600Z
- 1200Z
- 1800Z



3.1 - TAF Reports

Example

KCLT 221124Z 2212/2318 23004KT P6SM FEW060 BNK130

FM221700 24006KT P6SM SCT050

PROB30 2221/2303 4SM TSRA BKN050CB

FM230300 21005KT P6SM SCT090 BNK200

FM231400 22008KT P6SM SCT040 BKN250



3.1 - TAF Reports

Example

KCLT 221124Z 2212/2318 23004KT P6SM FEW060 BNK130

General
Weather
Report

FM221700 24006KT P6SM SCT050

PROB30 2221/2303 4SM TSRA BKN050CB

FM230300 21005KT P6SM SCT090 BNK200

FM231400 22008KT P6SM SCT040 BKN250

The General Weather Report is very similar to a METAR and contains much of the same information.



3.1 - TAF Reports

Example

KCLT 221124Z 2212/2318 23004KT P6SM FEW060 BNK130

FM221700 24006KT P6SM SCT050

PROB30 2221/2303 4SM TSRA BKN050CB

FM230300 21005KT P6SM SCT090 BNK200

FM231400 22008KT P6SM SCT040 BKN250

Forecast
Change
Groups

Forecast Change Groups provide information about expected changes in weather conditions over time.



3.1 - TAF Reports

Example

KCLT 221124Z 2212/2318 23004KT P6SM FEW060 BNK130

FM221700 24006KT P6SM SCT050

PROB30 2221/2303 4SM TSRA BKN050CB

FM230300 21005KT P6SM SCT090 BNK200

FM231400 22008KT P6SM SCT040 BKN250



3.1 - TAF Reports

Example

KCLT 221124Z 2212/2318 23004KT P6SM FEW060 BNK130

- **KCLT** - Airport designation



3.1 - TAF Reports

Example

KCLT **221124Z** 2212/2318 23004KT P6SM FEW060 BNK130

- KCLT - Airport designation
- **221124Z** - Date and Time (22nd day / 1124 UTC)



3.1 - TAF Reports

Example

KCLT 221124Z **2212/2318** 23004KT P6SM FEW060 BNK130

- KCLT - Airport designation
- 221124Z - Date and Time (22nd day / 1124 UTC)
- **2212/2318** - Starting time (22nd day / 1200) and Ending Time (23rd day / 1800) of the TAF.



3.1 - TAF Reports

Example

KCLT 221124Z 2212/2318 **23004KT** P6SM FEW060 BNK130

- KCLT - Airport designation
- 221124Z - Date and Time (22nd day / 1124 UTC)
- 2212/2318 - Starting time (22nd day / 1200) and Ending Time (23rd day / 1800) of the TAF.
- **23004KT** - Wind direction (230°) and wind speed (04 KT)



3.1 - TAF Reports

Example

KCLT 221124Z 2212/2318 23004KT **P6SM** FEW060 BNK130

- KCLT - Airport designation
- 221124Z - Date and Time (22nd day / 1124 UTC)
- 2212/2318 - Starting time (22nd day / 1200) and Ending Time (23rd day / 1800) of the TAF.
- 23004KT - Wind direction (230°) and wind speed (04 KT)
- **P6SM** - Prevailing visibility in statute miles (6SM)



3.1 - TAF Reports

Example

KCLT 221124Z 2212/2318 23004KT P6SM **FEW060 BNK130**

- KCLT - Airport designation
- 221124Z - Date and Time (22nd day / 1124 UTC)
- 2212/2318 - Starting time (22nd day / 1200) and Ending Time (23rd day / 1800) of the TAF.
- 23004KT - Wind direction (230°) and wind speed (04 KT)
- P6SM - Prevailing visibility in statute miles (6SM)
- **FEW060 BNK130** - Few clouds at 6,000 feet / broken clouds at 13,000 feet.



3.1 - TAF Reports

Example

KCLT 221124Z 2212/2318 23004KT P6SM FEW060 BNK130

FM221700 24006KT P6SM SCT050

PROB30 2221/2303 4SM TSRA BKN050CB

FM230300 21005KT P6SM SCT090 BNK200

FM231400 22008KT P6SM SCT040 BKN250



3.1 - TAF Reports

Example

FM221700 24006KT P6SM SCT050

- **FM221700** - From 22nd day at 1700



3.1 - TAF Reports

Example

FM221700 **24006KT** P6SM SCT050

- FM221700 - From 22nd day at 1700
- **24006KT** - Winds from 240° at 6 knots



3.1 - TAF Reports

Example

FM221700 24006KT **P6SM** SCT050

- FM221700 - From 22nd day at 1700
- 24006KT - Winds from 240° at 6 knots
- **P6SM** - Visibility is 6 statute miles or greater



3.1 - TAF Reports

Example

FM221700 24006KT P6SM **SCT050**

- FM221700 - From 22nd day at 1700
- 24006KT - Winds from 240° at 6 knots
- P6SM - Visibility is 6 statute miles or greater
- **SCT050** - Scattered clouds at 5000 feet



3.1 - TAF Reports

Example

KCLT 221124Z 2212/2318 23004KT P6SM FEW060 BNK130

FM221700 24006KT P6SM SCT050

PROB30 2221/2303 4SM TSRA BKN050CB

FM230300 21005KT P6SM SCT090 BNK200

FM231400 22008KT P6SM SCT040 BKN250



3.1 - TAF Reports

Example

PROB30 2221/2303 4SM TSRA BNK050CB

- **PROB30** - A 30% probability



3.1 - TAF Reports

Example

PROB30 **2221/2303** 4SM TSRA BNK050CB

- PROB30 - A 30% probability
- **2121/2303** - From the 22nd at 2100 to the 23rd at 0300



3.1 - TAF Reports

Example

PROB30 2221/2303 **4SM** TSRA BNK050CB

- PROB30 - A 30% probability
- 2121/2303 - From the 22nd at 2100 to the 23rd at 0300
- **4SM** - visibility at 4 statute miles



3.1 - TAF Reports

Example

PROB30 2221/2303 4SM TSRA BNK050CB

- PROB30 - A 30% probability
- 2121/2303 - From the 22nd at 2100 to the 23rd at 0300
- 4SM - visibility at 4 statute miles
- TSRA BNK050CB - Thunderstorms & Rain with Broken Clouds at 5000 feet - Cumulonimbus clouds.



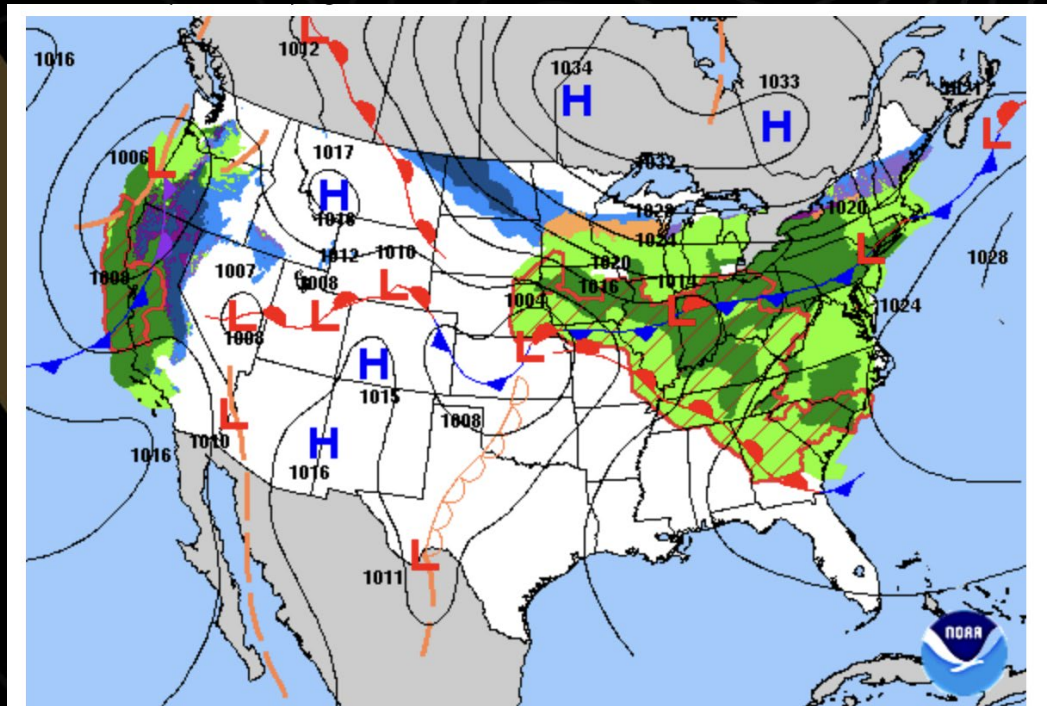


3.1 - Weather Charts



3.1 - Weather Charts

- A weather or **Surface Prog chart** is a **general forecast** for **surface** conditions.
- They can be found on the aviationweather.gov page.
- Prog charts are generated by the national Weather Prediction Center.



3.1 - Weather Charts

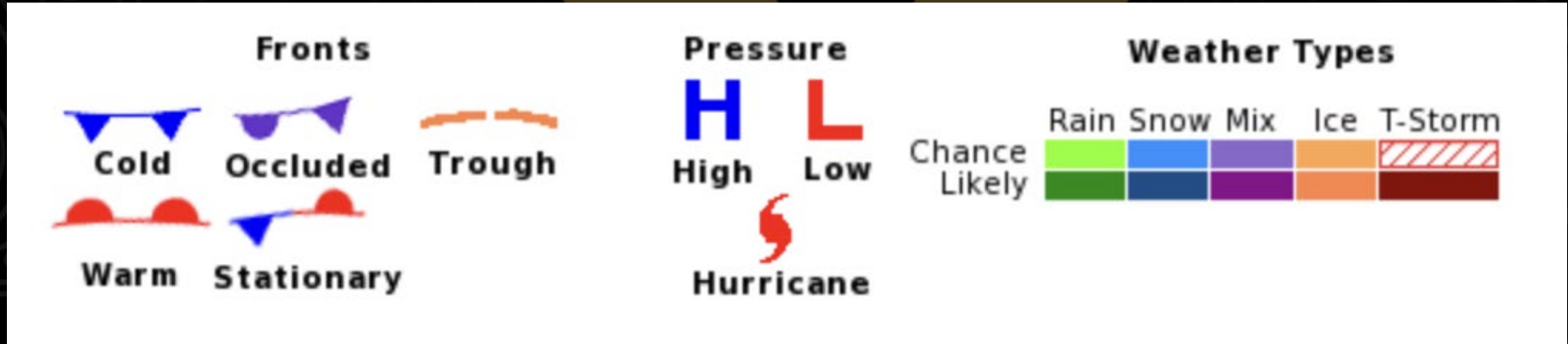
Prog forecasts come in multiple forms and are updated at different intervals.

Product	Frequency	Times
Current Analysis	3 hours	every 3 hours about 90 minutes after valid time
12 hour Forecast	4 times daily	~0200 (valid 12Z), 0400 (18Z), 1300 (00Z), and 1430 (06Z)
24 hour Forecast	4 times daily	~0430 (valid 00Z), 0700 (06Z), 1330 (12Z), and 1930 (18Z)
36 hour Forecast	Twice daily	~0730 (valid 12Z), 1930 (00Z)
48 hour Forecast	Twice daily	~0730 (valid 00Z), 1930 (12Z)
60 hour Forecast	Twice daily	~0730 (valid 00Z), 1930 (12Z)
3, 4, 5, 6 and 7 day Forecasts	Once daily	~1400 (valid 12Z). The 3 day forecast is actually a 3 1/2 day forecast



3.1 - Weather Charts

The symbols in the legend denote **fronts**, **precipitation** types, and **pressure systems**.



3.1 - Weather Charts

- Valid Through: 0600 Zulu
- On April 15th, 2012
- 24-hour Significant Weather Prog
- Based on a standard barometric pressure (in millibars) at 24,000'

VT 06Z

Sun Apr 15 2012

24 HR SIG WX PROG

LOW LVL SFC-400MB



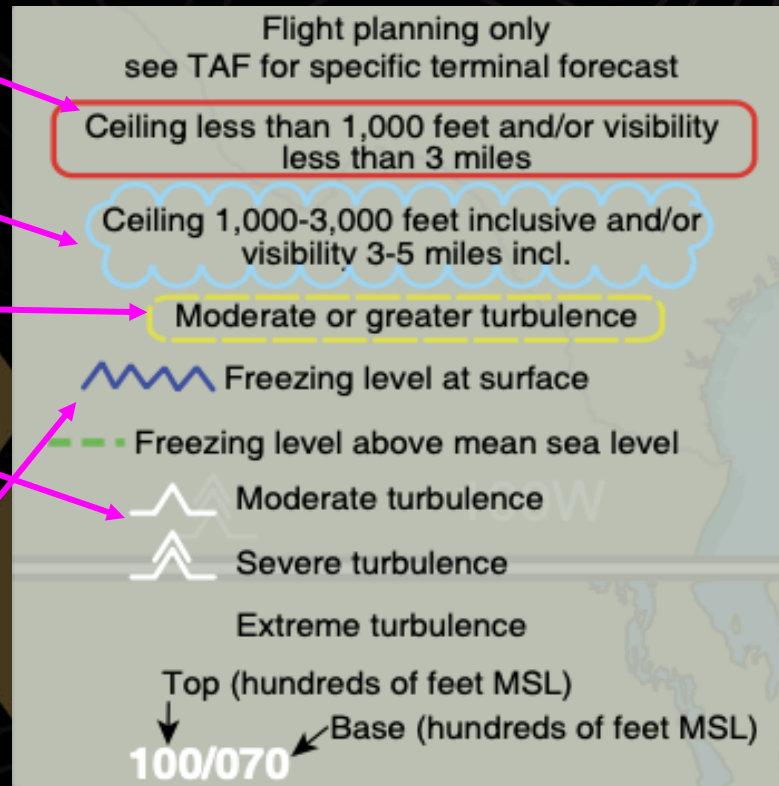
3.1 - Weather Charts

Below VFR Minimums - IFR Areas

Marginal VFR Area (depends on
airspace/field)

Concerns regarding turbulence

Freezing Level MSL (if Cyan it will be
at a specific altitude.





3.1 - ATIS, ASOS, & AWOS



3.1 - ATIS, ASOS, & AWOS?

What's common?

- They all tell you the weather at a particular airport.



3.1 - ATIS, ASOS, & AWOS?

How do they differ?

- If there is a human involved.
- If it's automated
- How often the reports are taken (hourly or by the minute)
- What they report
- Whether they can provide extra information (NOTAMS)
- Who is responsible for the system (FAA/National Weather Service)



3.1 - ATIS, ASOS, & AWOS?

ATIS is a **continuous broadcast of recorded non-control information** in a terminal area.

- **Human's** add to and monitor it
- It is intended to **relieve frequency congestion** by **automating** repetitive but essential information.

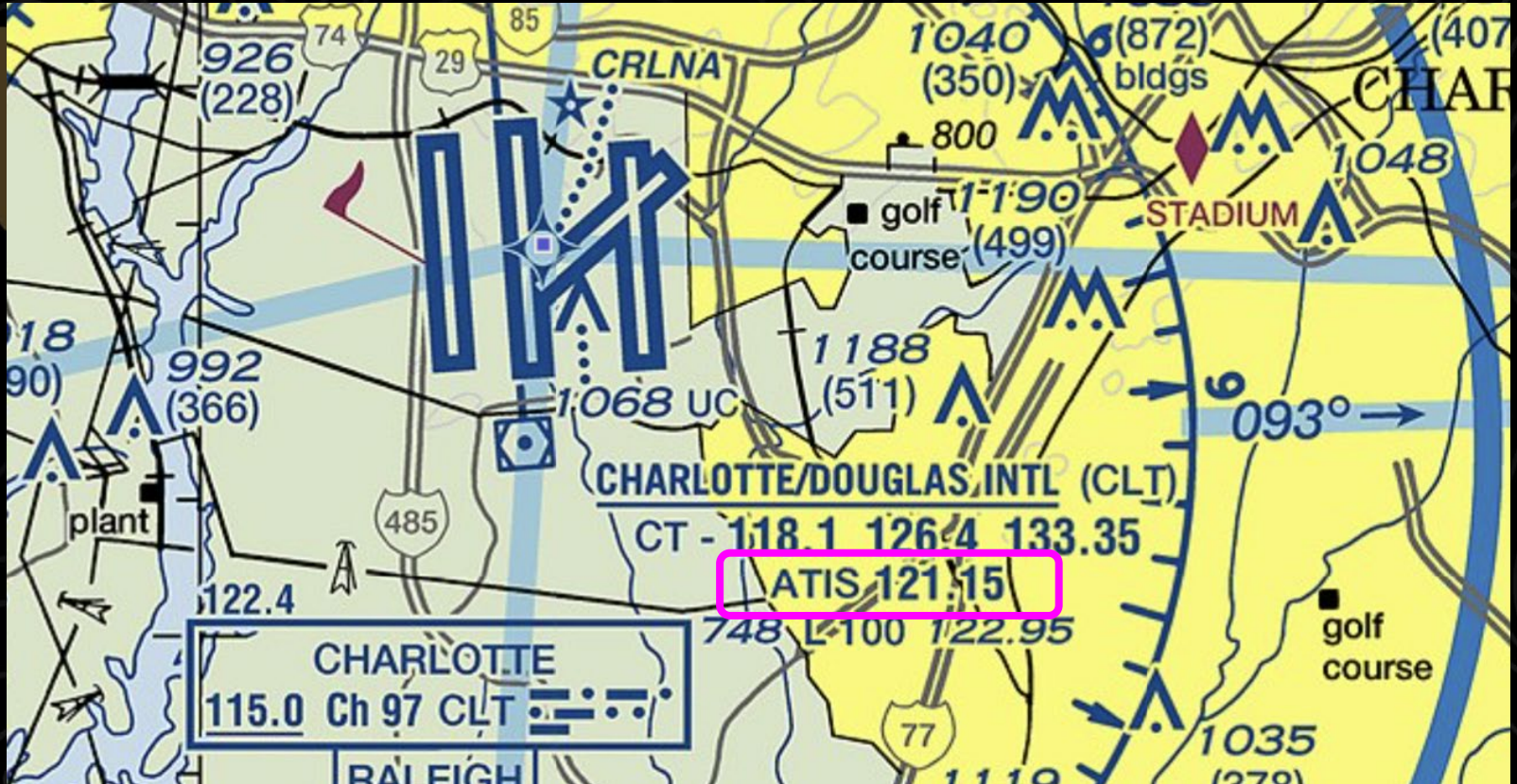
EXAMPLE:

“Los Angeles information Alfa. One three zero zero Coordinated Universal Time. Weather, measured ceiling two thousand overcast, visibility three, haze, smoke, temperature seven one, dew point five seven, wind two five zero at five, altimeter two niner niner six. I-L-S Runway Two Five Left approach in use, Runway Two Five Right closed, advise you have Alfa.”



3.1 - ATIS, ASOS, & AWOS?

ATIS



3.1 - ATIS, ASOS, & AWOS?

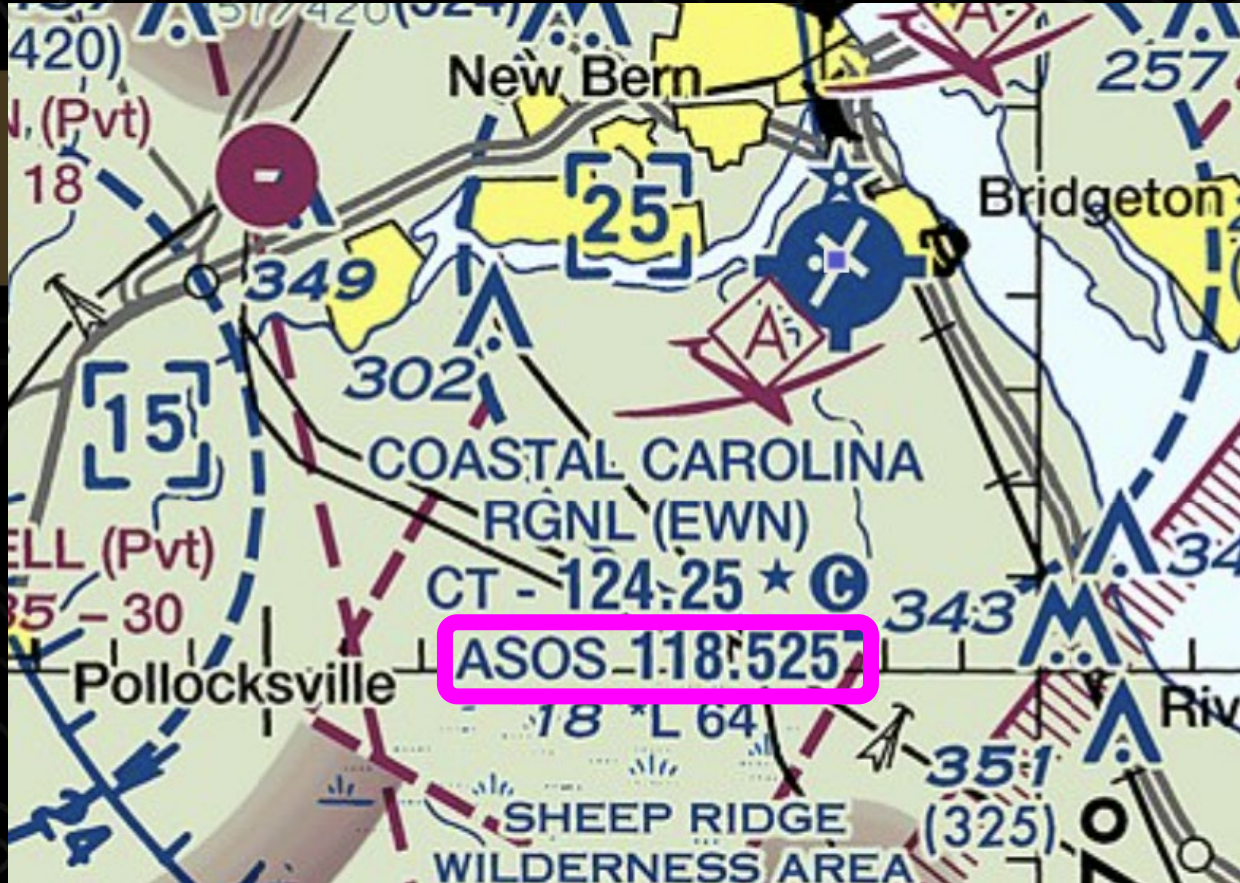
ASOS

- Usually monitored and controlled by the National Weather Service (NWS).
- ASOS helps gather weather information for both **aviation and non-aviation purposes**.
- Robust system that can tell things like barometric pressure, wind speed and direction, visibility, sky condition, ceiling height, and precipitation.



3.1 - ATIS, ASOS, & AWOS?

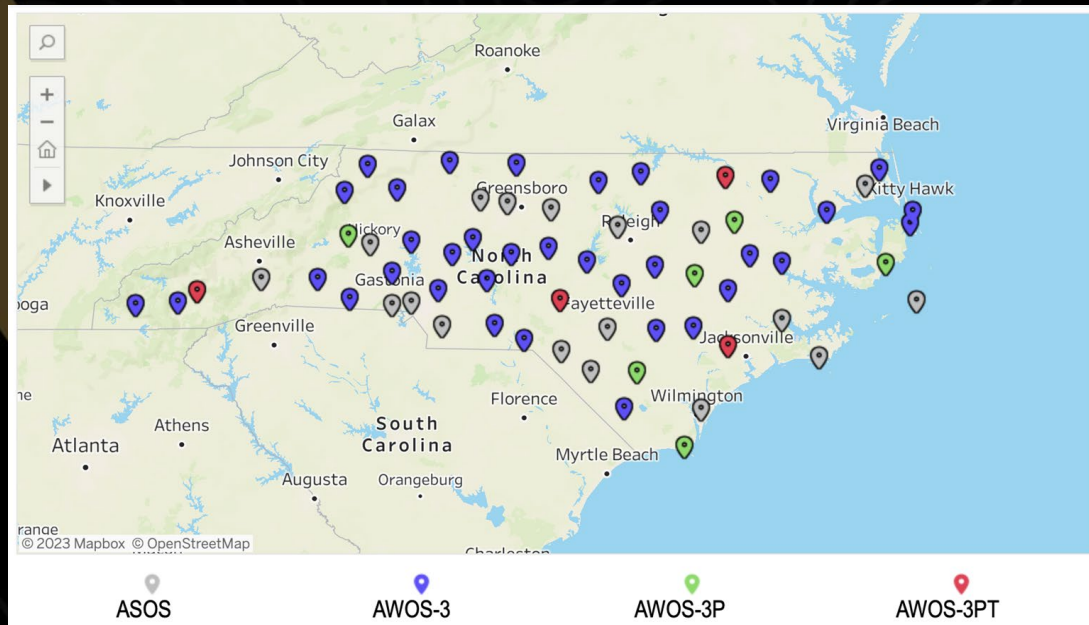
ASOS



3.1 - ATIS, ASOS, & AWOS?

AWOS

- Operated and controlled by the **FAA**
- **Automated report on the minute.**
- Different levels of AWOS determine what type of weather it can report



3.1e - ATIS, ASOS, & AWOS?

AWOS



Why is it important to know which type of aviation weather system you are referencing?



Why is it important to know which type of aviation weather system you are referencing?

Knowing the type of aviation weather system helps ensure accurate flight planning. Each system provides different information and mixing them up can lead to poor weather decisions.



How can a drone pilot use automated weather services to their advantage?



How can a drone pilot use automated weather services to their advantage?

Drone pilots can use automated weather services to plan safer, more efficient flights. These services give real-time data like wind, visibility, and temperature, helping pilots avoid hazardous conditions and choose the best time to fly.



Unit 3 Weather – 3.1 Review Quiz

- [3.1 - Sources of Weather – QUIZ](#)
- This quiz contains 37 questions.
 - You may take it as many times as you like.
 - The order of questions are randomized each time.
 - The large majority of the questions are worded exactly as they appear on the exam.

