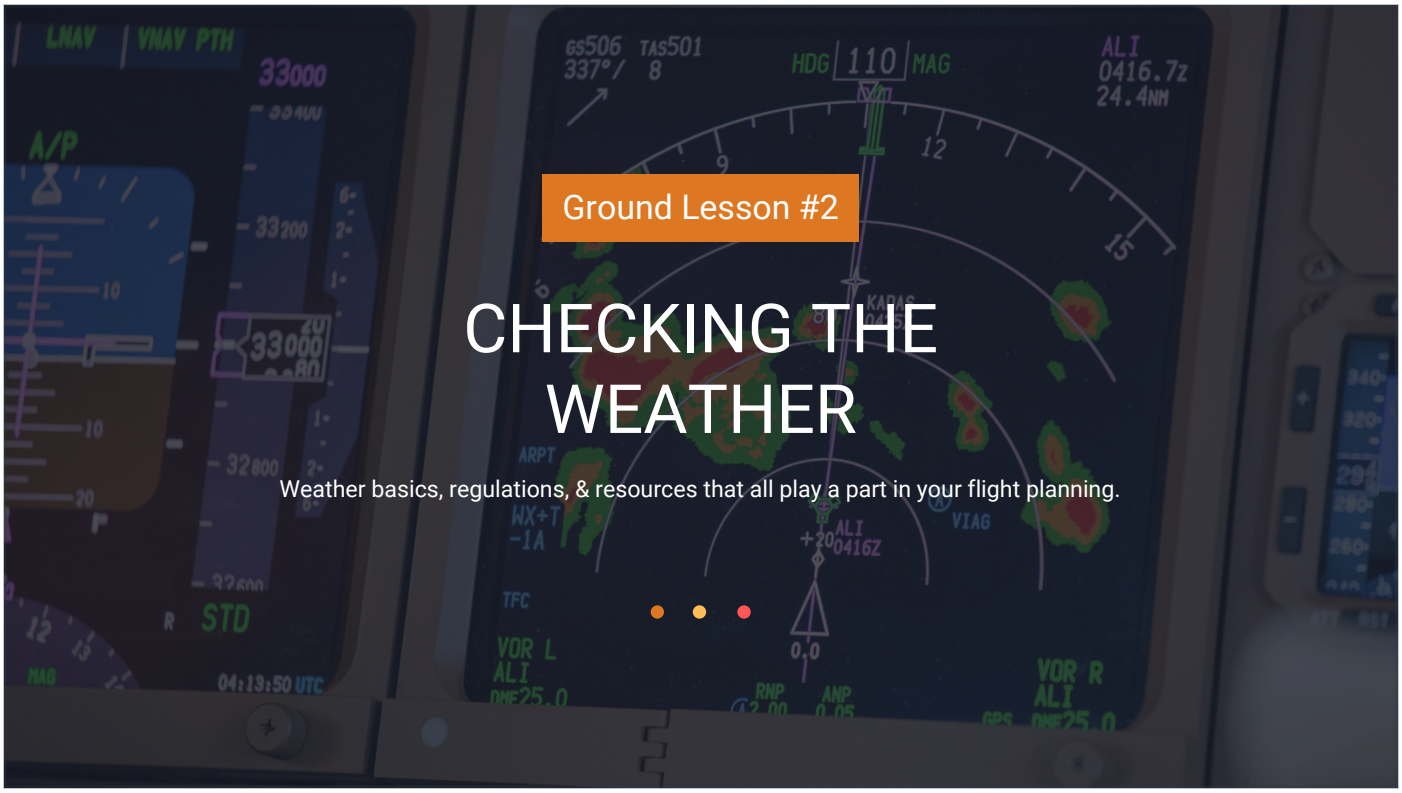


Ground Lesson #2

CHECKING THE WEATHER

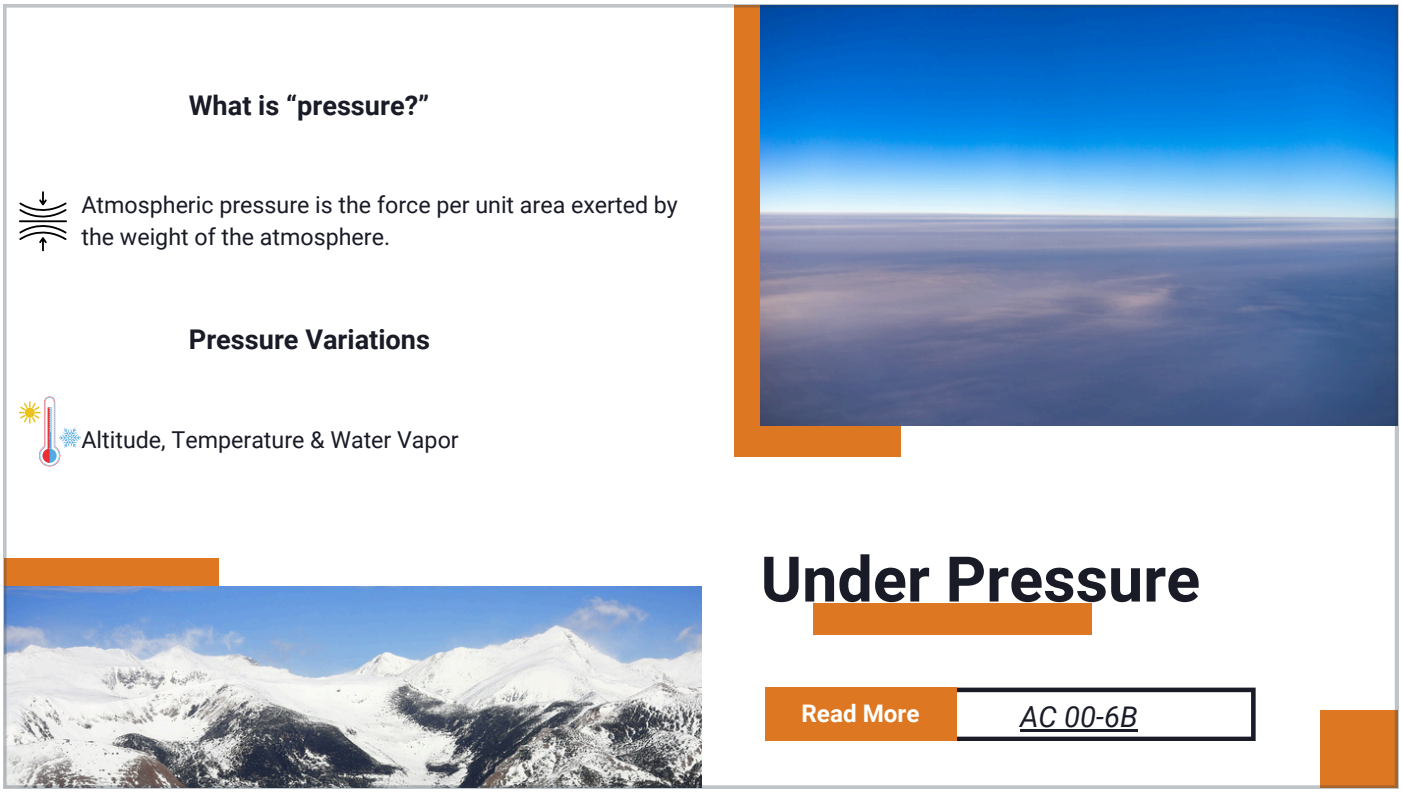
Weather basics, regulations, & resources that all play a part in your flight planning.

Weather is not a capricious act of nature, but rather the atmosphere's response to unequal rates of radiational heating and cooling across the surface of the Earth and within its atmosphere.

The Earth-atmosphere energy balance is the balance between incoming energy from the sun (solar radiation) and outgoing energy from the Earth (terrestrial radiation)

Atmospheric circulations and weather are the atmosphere's never-ending attempt to redistribute this heat and achieve equilibrium.

Atmospheric pressure varies with altitude and the temperature of the air, as well as with other minor influences, such as water vapor.



The air around you has weight, and it presses against everything it touches. That pressure is called atmospheric pressure, or air pressure. It is the force exerted on a surface by the air above it as gravity pulls it to Earth.

As we move upward through the atmosphere, the weight of the air above us decreases.

Like most substances, air expands
as it becomes warmer and contracts as it cools.

We measure in inches of mercury or millibars.

We get the barometric pressure when we listen to the AWOS and it says 29.99 or 30.12, or etc. When you set the altimeter, it should read within 75 feet of field elevation. If it doesn't, then the instrument is off.

Pressure Altitude

The altitude that is indicated on your altimeter when you set it to 29.92

Pressure Altitude=(29.92 - Altimeter Setting) x 1000 + Field Elevation

Density Altitude

Pressure altitude corrected for non-standard temperature. The altitude your plane "thinks" it's flying at.

Density Altitude= PA + [120 x (OAT°C - ISA °C)]

Read More *More information*

The altitude that is indicated on your altimeter when you set it to 29.92

The altimeter indicates how high the airplane is above sea level by calculating the difference between the pressure in the aneroid wafers and the atmospheric pressure fed into the static port.

Calculating the aircraft's cruising altitude.
Pressure altitude is also used when setting flight levels for air traffic control purposes.

Density altitude is important because all aircraft' performance decays with increasing density altitude. For example, an airplane could be taking off from a sea-level airport on the coast of Florida, and yet if it is hot and humid, the density altitude could be as high as 5,000 feet, in which case the airplane, even at sea level, requires a longer takeoff run and has a reduced rate of climb.

HOT, HIGH, & HUMID
standard temp at SL 15ºC, -2 for every 1000' ft.

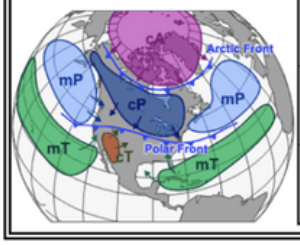
Strategy University

Fronts & Air Masses

An air mass is a large body of air with generally uniform temperature and humidity

A front is a boundary or transition zone between two air masses. Fronts are classified by which type of air mass (cold or warm) is replacing the other

Figure 10-1. Air Mass Classification



SOURCE REGION	Continental (c)	Maritime (m)
Arctic (A)	Continental Arctic (cA) *(Cold, dry)*	*Not Applicable*
Polar (P)	Continental Polar (cP) *(Cold, dry)*	Maritime Polar (mP) *(Cool, moist)*
Tropical (T)	Continental Tropical (cT) *(Hot, dry)*	Maritime Tropical (mT) *(Warm, moist)*

As these air masses move around the Earth, they can begin to acquire different attributes. For example, in winter an arctic air mass (very cold and dry air) can move over the ocean, picking up some warmth and moisture from the warmer ocean and becoming a maritime polar (mP) air mass—one that is still fairly cold but contains moisture.

Air masses can control the weather for a relatively long time period ranging from days to months. Most weather occurs along the periphery of these air masses at boundaries called fronts.

Strategy University

Fronts & Air Masses

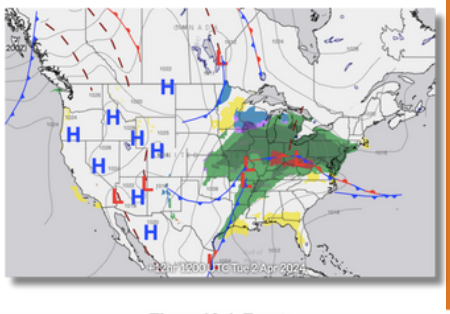


Figure 10-4. Fronts

FRONT	CHART SYMBOL	DEFINITION
Cold Front		A front that moves in such a way that colder air replaces warmer air.
Warm Front		A front that moves in such a way that warmer air replaces colder air.
Stationary Front		A front which is stationary or nearly so.
Occluded Front		A composite of two fronts as a cold front overtakes a warm front or stationary front.

Note: Frontal symbols point in the direction of frontal movement.

Fronts are usually detectable at the surface in a number of ways: significant temperature gradients, or differences, exist along fronts; crosswinds when you're crossing a front; and pressure typically decreases as a front approaches and increases after it passes.

Cold front: poor weather, storms, good vis
Warm: fair wx, good vis
Stationary: combo of cold & warm, usually several days of light rain & overcast
occluded: heavy storms, showery, unstable. two types: cold & warm occlusions

DEMO ON FOREFLIGHT

THUNDERSTORMS

INSTABILITY

LIFTING

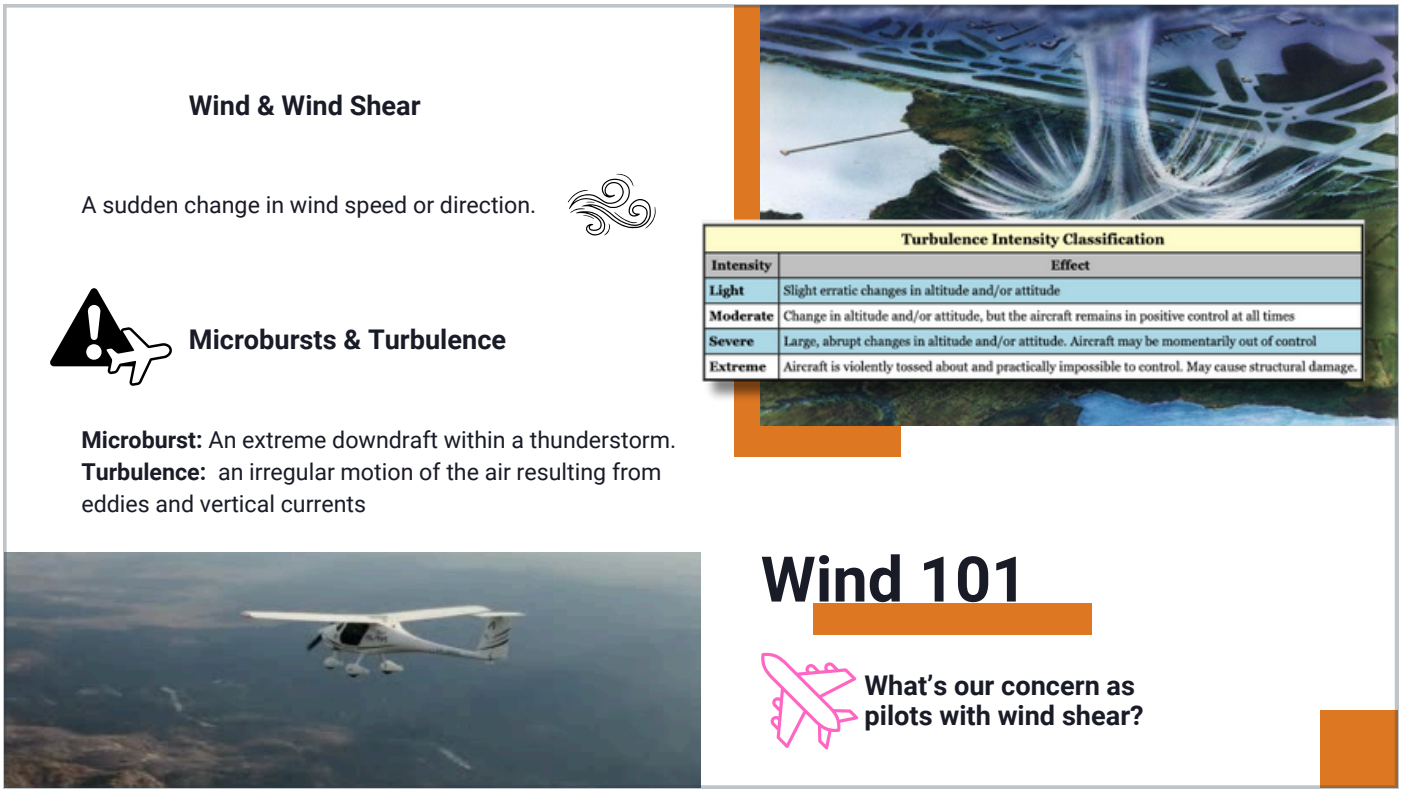
MOISTURE

there are 3 ingredients.
you need instability so that the air parcel has the ability to lift.

then you need a source of lift. this a difference of air density, which can be the result of differential heating, frontal passage, terrain, dry lines.

moisture, you have to have water in the air. usually the ocean. you'll find that weather and fronts in the northern hemisphere usually move from west to east.

20 mile distance



wind shear can be vertical or horizontal.

types of wind shear: gain and loss shear (of a headwind)
typically a concern on takeoff and landing especially. low level wind shear is a hazard

wind shear can change a routine approach into an emergency recovery in a matter of seconds.

1. Frontal activity.
2. Thunderstorms.
3. Temperature inversions.
4. Surface obstructions.

A microburst is an incredible downdraft that spills forth from the belly of thunderstorms.

turbulence: 4 intensities
light, moderate, severe & extreme
type: mechanical, wind shear, convective, frontal

Atmospheric Stability

Why do pilots care if the air is stable or unstable?

Indications of stability:

- Clouds
- Precipitation
- Lapse Rate

What causes changes in stability?

- Temperature changes with height

The types of clouds & precip levels we encounter as pilots are results of atmospheric stability.

These sharply contrasting conditions result from the atmosphere either resisting or accelerating the vertical motion of air parcels.

A parcel is an imaginary bubble of air of no definite size that retains its shape and general characteristics as it rises or sinks in the atmosphere.

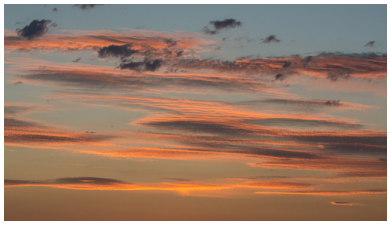
Atmospheric stability is the property of the surrounding air that either encourages or discourages vertical motion of air parcels and determines which type of clouds and precipitation a pilot will encounter.

Changes in atmospheric stability are related to temperature (density) changes with height.

If temperature lapse rates increase, then stability decreases. Conversely, if temperature lapse rates decrease, then stability increases. Most of these changes occur as a result of the movement of air (wind), but day/night temperature variations can playa significant role.

Clouds

Cumulus clouds
- Vertical development
- Turbulent
- Icing



Stratus clouds
- Flat, stable
- Smooth air
- Icing possible

Cirrus clouds
- Wispies
- Smooth air
- No icing

The types of clouds & precip levels we encounter as pilots are results of atmospheric stability.

These sharply contrasting conditions result from the atmosphere either resisting or accelerating the vertical motion of air parcels.

A parcel is an imaginary bubble of air of no definite size that retains its shape and general characteristics as it rises or sinks in the atmosphere.

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Weather Regulations

91.155 Basic VFR Weather Minimums

The following operations may be conducted in Class G airspace **below 1,200 feet above the surface:**

I**f the visibility is less than 3 statute miles but not less than 1 statute mile during night hours** and you are operating in an airport traffic pattern within 1/2 mile of the runway, you may operate an airplane, powered parachute, or weight-shift-control aircraft clear of clouds.

Read More AIM Chapter 7

Altitude	Type of Airspace	Flight Visibility	Cloud Clearance
10,000 MSL	E	5 statute miles	111 ✈1,000 below, ✈1,000 above, ✈1 sm horizontal
Below 10,000 MSL	C	3 statute miles	152 ✈ 500 below ✈1,000 above ✈2,000 horizontal
	D		
	E		
	B	3 statute miles	Clear of clouds
1,200 AGL or higher	G (night)	3 statute miles	152 ✈ 500 below ✈1,000 above ✈2,000 horizontal
	G (day)	1 statute mile	152 ✈ 500 below ✈1,000 above ✈2,000 horizontal
Below 1,200 AGL	G (night)	3 statute miles	152 ✈ 500 below ✈1,000 above ✈2,000 horizontal
	G (day)	1 statute mile	Clear of clouds

These are the basic VFR weather minimums that you are legally obligated to follow.

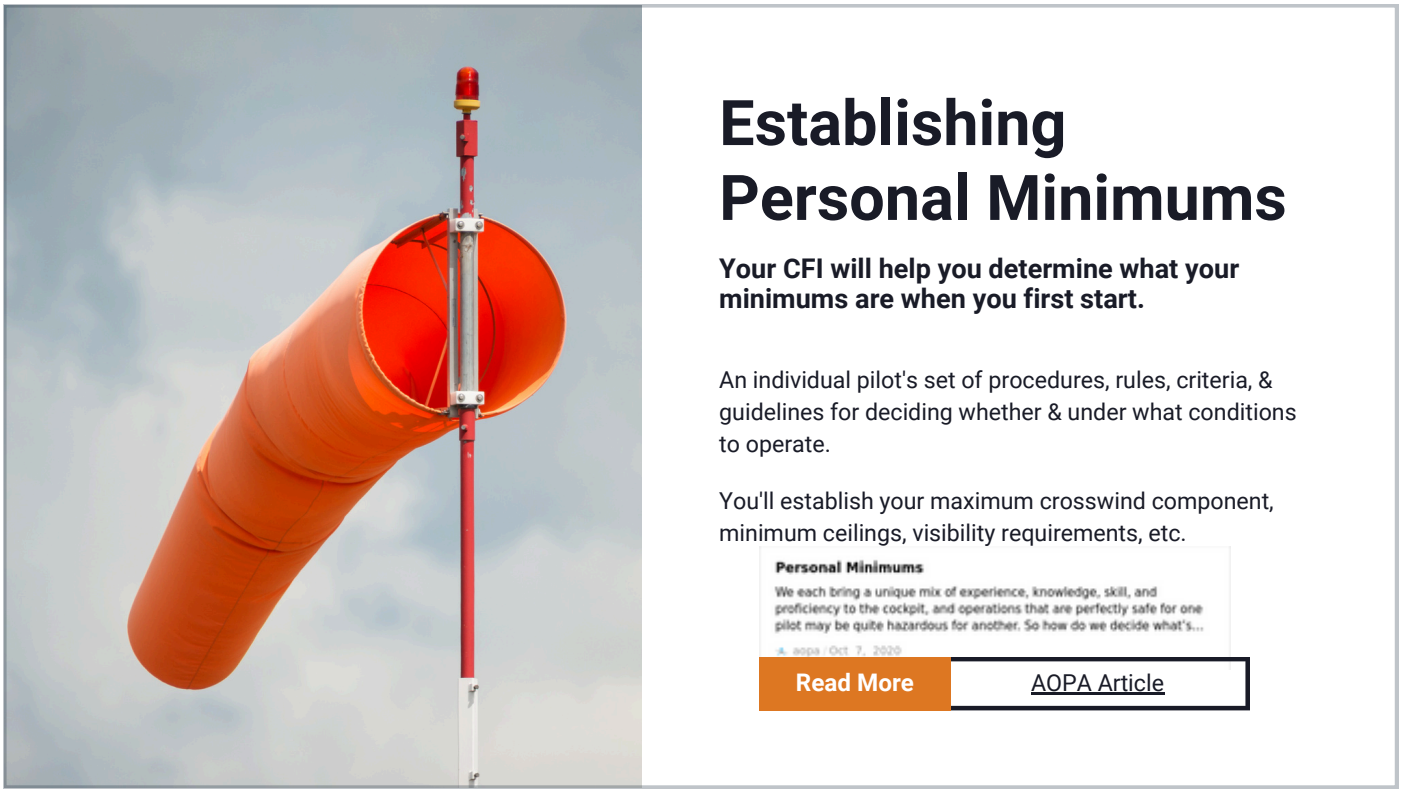
3 miles is NOT MUCH AT ALL

If you're using foreflight, you can get a more accurate idea of where the clouds are horizontally by referencing landmarks or airports that are around you.

Class G: if you're in the airport traffic pattern with less than 3sm but not less than 1sm at night, you are legal

LEGAL DOES NOT MEAN SAFE

Higher mins at higher altitudes bc higher airspeeds! Gives you more separation & reaction time.



WRITE THEM DOWN! Hold yourself to them as a contract. If you get into professional flying, you'll have tighter minimums by company policy. Start that discipline NOW. If you want to expand your mins, GO WITH A CFI.

for example:
VFR XC non mountainous - 5,000’ ceiling
Mountainous - 8,000’ ceiling

No flying over mountains at night
No flying over mountains with winds over 15kts

IFR
300’ above precision mins
400’ above non precision
NO LIFR

METARs vs. TAFs

METAR

METeorological Aerodrome Reports, report observed weather conditions by airfield. They are issued every hour, & considered "NOWCASTS". They are different than AWOS, ASOS or ATIS.

TAF

Terminal Aerodrome Forecast, statements of the expected meteorological conditions within a 5 SM radius from the center of an airport over **24 hours** & are issued 4x a day. These are considered FORECASTS. Issued by humans!

Not every airport has a weather reporting facility. You should check airports that are nearby within 20nm for their weather & use that as a weather resource.

METAR & TAF: you read it & decode it. ForeFLight decodes for you, but you should still be able to read it on your own, esp for a checkride.

Download a METAR/TAF legend & keep it with your binder or notebook for quick reference bc there's so many.

Briefers love TAFs.

ATIS contains current, routine information to arriving and departing aircraft as well as weather reports derived from human data collection that is updated hourly or upon pertinent data changes. "Inform upon arrival that you have Information (ALPHA)"

AWOS and ASOS are automated and provide continuous real-time weather observations.

METAR = every hour except for SPECIs
an unscheduled report taken when there is a significant change in the weather during the period between the hourly reports. SPECIs contain all data elements found in a METAR, plus additional plain language information which elaborates on data in the body of the report. Fortunately, METARs and SPECIs are coded using the same format.

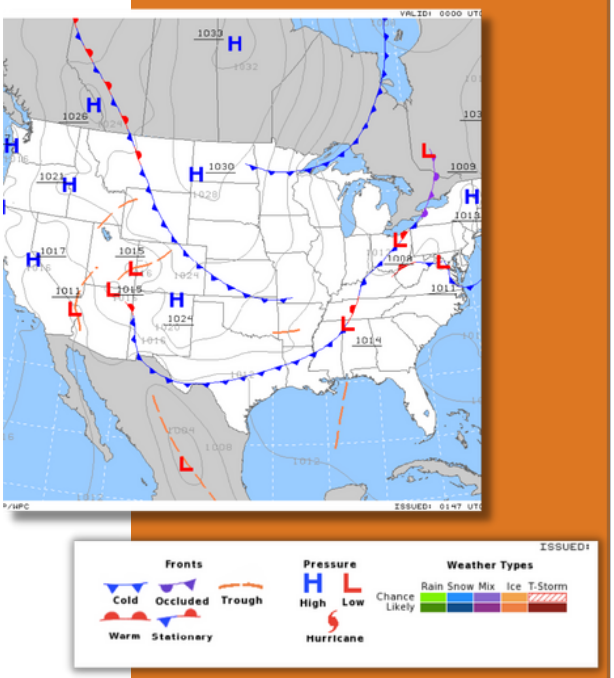
ex: wind changes by 45 degrees or more within 15 minutes & the wind speed is 10 kts or more.

The Big Picture

PROG Charts

Prognostic Charts portray forecasts of positions and characteristics of pressure patterns, fronts, and precipitation at specific times.

They're generated by atmospheric models as output from numerical weather prediction and contain a variety of information such as temperature, wind, precipitation and weather fronts.



A prognostic chart is a map displaying the likely weather forecast for a future time. Such charts generated by atmospheric models. They basically use math to predict weather conditions. This became more effective when computers were produced.

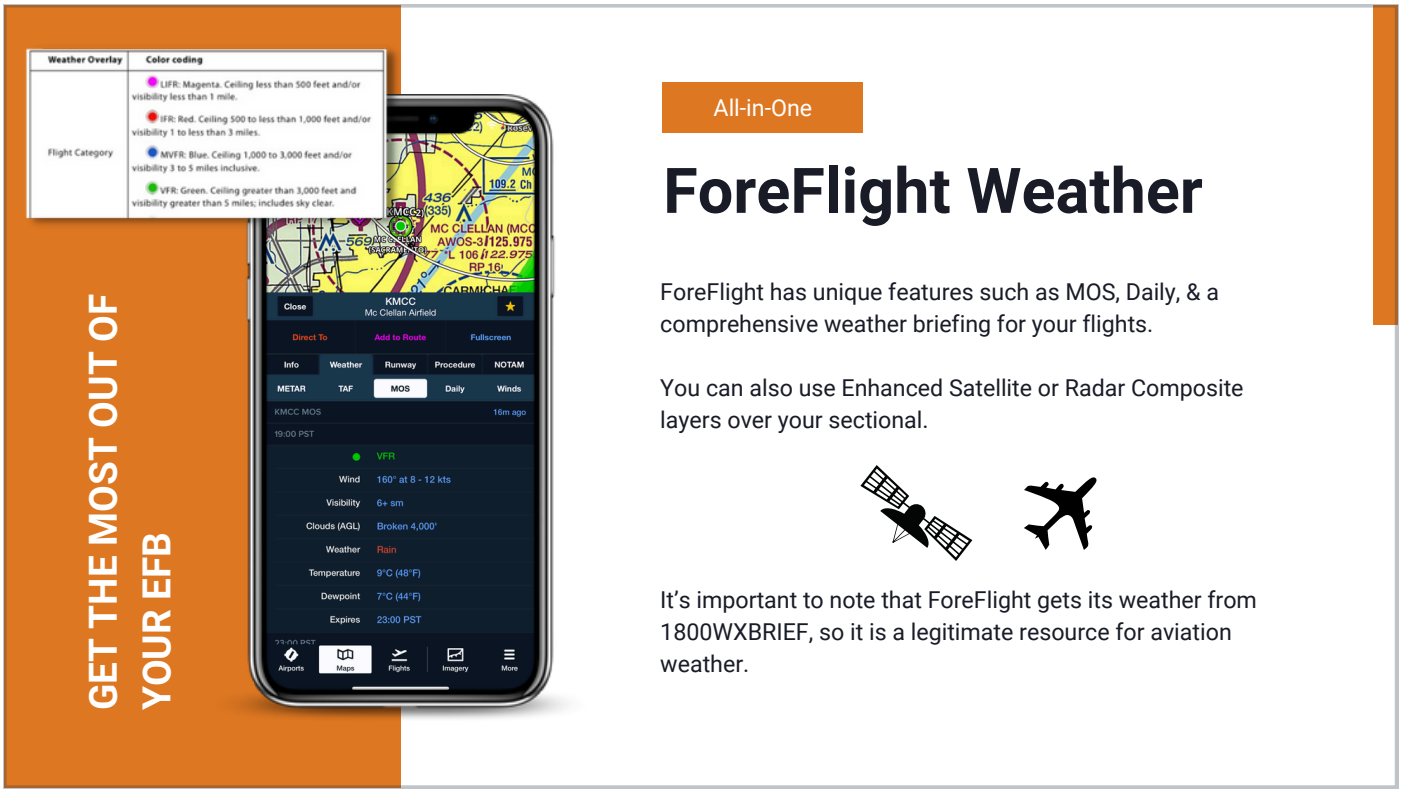
Prog charts are great if you want an all inclusive overview of the weather & the trends.

issued four times daily and are valid at fixed times: 0000, 0600, 1200, and 1800 UTC.

In 2018 the Graphical Forecasts for Aviation (GFA) replaced the legacy text Area Forecast (FA) in the contiguous United States. The GFA can provide more localized areal coverage and a tem- poral resolution of one hour—surface to FL480.

FA is a forecast of Visual Meteorological Conditions (VMC), clouds, and general weather conditions over an area the size of several states

GFA includes SIGMETs & AIRMETS
The experimental Graphical Forecasts for Aviation is intended to provide the necessary aviation weather information to give users a complete picture of the weather that may impact flight in the continental United States." The Graphical Forecasts for Aviation (GFA) is a digital product for commercial and general aviation pilots, operators, brief- ers, and dispatchers.



ForeFlight is a great resource for flight planning and checking weather. They provide different weather tools depending on the flight you're planning.

You can go about it different ways by checking weather airport to airport along your flight route. This takes a bit longer but it's really good to practice reading METARs and TAFs, etc.

Like the GFA, there's layers you can utilize if you're more of a visual person as well.

For those who want to follow along the forecasts, you can look at the IMAGERY section to get access to information.

My favorite thing is uploading a flight & going to the briefing.

'Ol Reliable

Weather Briefer

When in doubt, TALK TO A HUMAN.

Outlook Briefing: 6-48 hours prior
Standard Briefing: Within 6 hours
Abbreviated Briefing: As soon as practical before flight

Read More AC 91-92

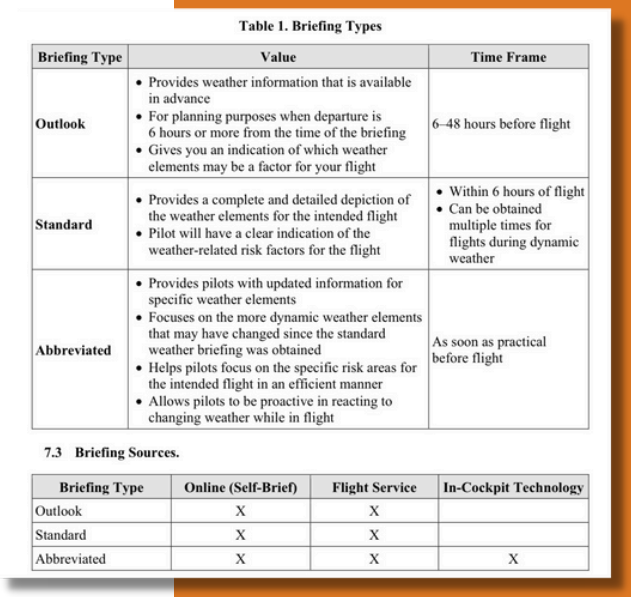


Table 1. Briefing Types

Briefing Type	Value	Time Frame
Outlook	• Provides weather information that is available in advance • For planning purposes when departure is 6 hours or more from the time of the briefing • Gives you an indication of which weather elements may be a factor for your flight	6–48 hours before flight
Standard	• Provides a complete and detailed depiction of the weather elements for the intended flight • Pilot will have a clear indication of the weather-related risk factors for the flight	• Within 6 hours of flight • Can be obtained multiple times for flights during dynamic weather
Abbreviated	• Provides pilots with updated information for specific weather elements • Focuses on the more dynamic weather elements that may have changed since the standard weather briefing was obtained • Helps pilots focus on the specific risk areas for the intended flight in an efficient manner • Allows pilots to be proactive in reacting to changing weather while in flight	As soon as practical before flight

7.3 Briefing Sources.

Briefing Type	Online (Self-Brief)	Flight Service	In-Cockpit Technology
Outlook	X	X	
Standard	X	X	
Abbreviated	X	X	X

Call 1800wxbrief

Make an account using your phone # so you can avoid the annoying & long voice menu in the beginning.

They're nice people! When you call just talk like a normal person & introduce yourself. If you're a student, let them know. Provide them with the required info & they'll get into it automatically. You can also ask them specific questions if you already got a wx briefing online & didn't understand something. Keep in mind, they're most likely not from California so they may not be familiar with the airports in your flight route.

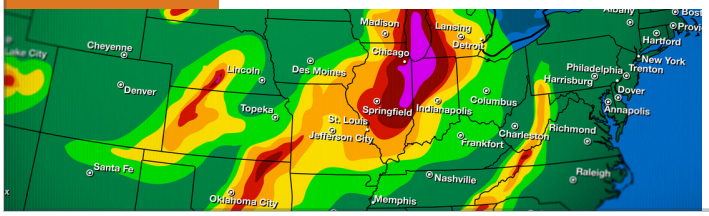
Standard Briefing Checklist

- Type of flight planned
- Aircraft identification
- Aircraft Type
- Departure Point
- Route of Flight
- Destination
- Altitudes
- ETD & ETE

Standard Briefing Overview

- Adverse Conditions
- VFR Not Recommended
- Synopsis
- Current Conditions
- En Route Forecast
- Destination Forecast
- Winds Aloft
- NOTAMS

Read More AIM 7-1-4



This is what you provide or what will be asked of you.
Make sure you have it all ready to go prior to your call.

I recommend having a sheet of paper with each of the overview categories so you can organize what they're saying.

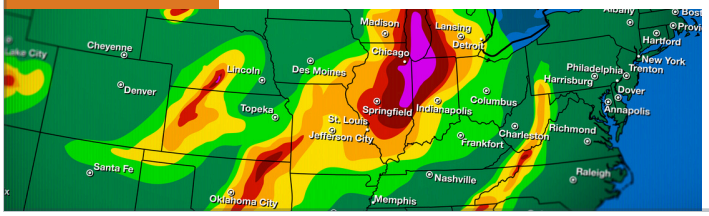
Don't overcomplicate it!
Your weather app or weather reporter are great resources that you are probably already familiar with.

Weather reporters will use terms such as fronts, air mass, trough, etc. Listening to them explain it will help you interpret the information better on your own.

Weather apps have a lot more info now than they used to that is relevant to flying.

REVIEW

- What causes weather?
- What causes pressure variations?
- Why do we care about pressure variations?
- What are the ingredients for a thunderstorm?
- What is wind shear and why do we care?
- What are some indications of atmospheric instability that we can observe?
- Why do we establish personal minimums?



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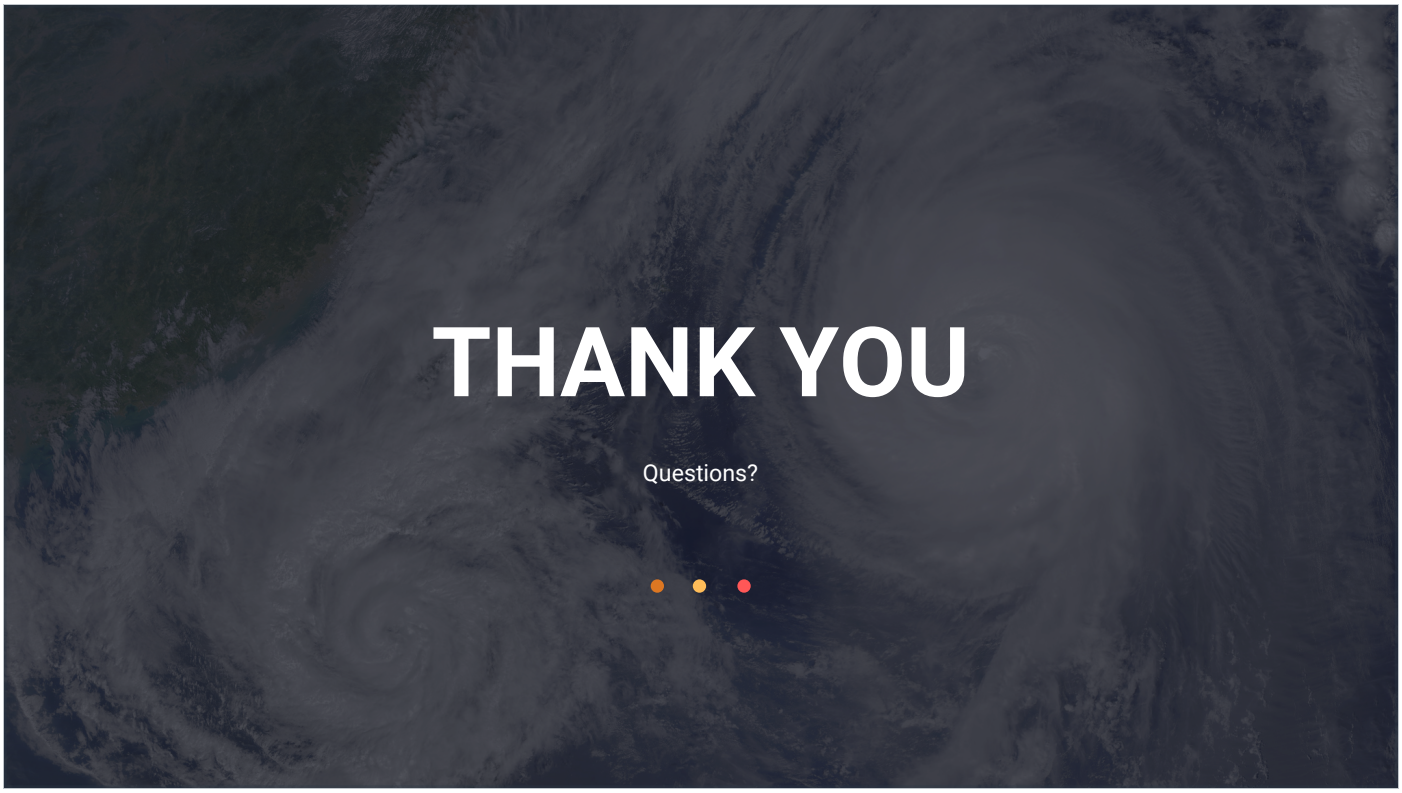
THANK YOU
Questions?