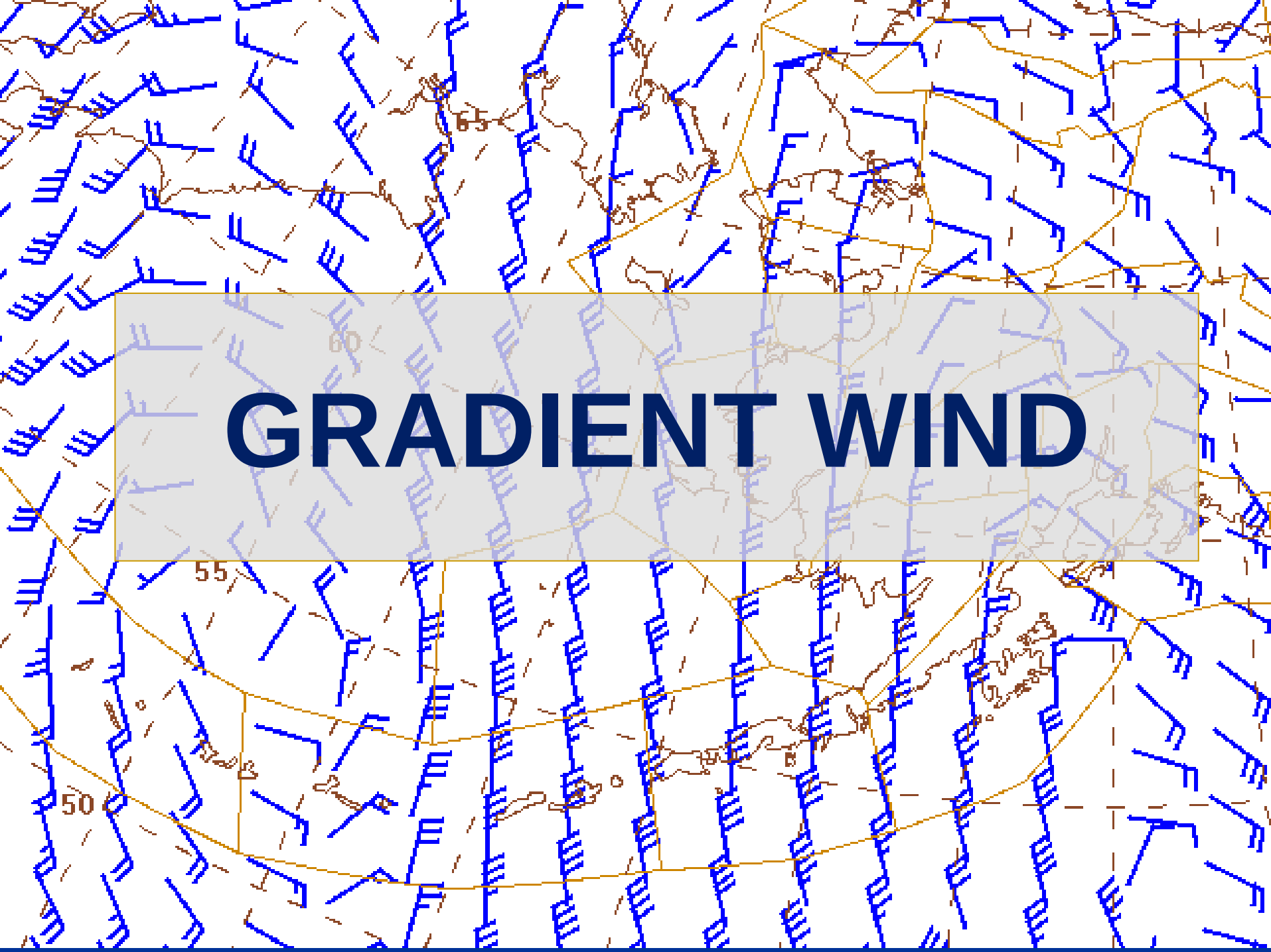

Hazards to Flight

The following presentation contains important information about Hazards to Flight.

If you have any questions about the information, please see your instructor.

After you have viewed the presentation, you will be asked to complete a test on the information you have learned.

Thank you for your time and attention.


GRADIENT WIND

Gradient Wind

When an aircraft moves from one air mass to another over a short space of time, there is a period of transition during which the aircraft's inertia has great influence on its short-term performance.

This is called Gradient Wind.

Wind Gradient: VFR Examples

We see examples of Gradient Wind in VFR flying all the time. Here are two:

You are on final approach to Runway 33 in Hyannis. At three hundred feet you have a 25-knot headwind. As you descend below the tree line, however, the headwind goes away and you begin to sink. You quickly counter the sink with a burst of power and land without incident. The decrease in headwind gave you a temporary loss of performance.

It is a gusty day, and you are departing into a 15-knot headwind. Once you climb above the trees, you encounter an even stronger headwind. As you transition through the gradient wind, you note that the VSI is showing a several hundred feet-per-minute increase. The increased headwind gave you a temporary boost in performance.

Gradient Wind: Instrument Approaches

A strong understanding of gradient wind is essential when flying instrument approaches.

The following two scenarios illustrate the airplane's performances on two different approaches.

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ILS 4R into Boston

You are shooting the ILS 4R into Boston. The winds aloft at 3,000 ft are out of the southwest at 25 knots. The surface winds, however, are light out of the east. As you descend through the change in gradient wind, you should expect that the aircraft will trend above glideslope and airspeed will increase. This occurs because the strong tailwind has suddenly gone away.

ILS 24 into Martha's Vineyard

You are shooting the ILS 24 into Martha's Vineyard. The surface winds are southwesterly at 20 knots. While established on the localizer outside the FAF, you note that your groundspeed is 40 knots less that your indicated airspeed. As you descend through the change in gradient wind, you should expect that the aircraft will trend below glideslope and airspeed will decrease. This occurs because the headwind is decreasing.

Solutions for Handling Gradient Wind

Method 1: Specific Airspeed

- Set a specific airspeed, and then do whatever it takes to maintain it.
- Continuously scan the airspeed while playing with the power to hold the target airspeed.
- As you descend through the decreasing headwind, increase the power early and often to hold the target speed. Keep the needles crossed.

Method 2: Cruise Power (Specific to a decreasing headwind)

- Leave the power near cruise during the In-Range flow, and then let the airspeed do what it will within limits (120 knots is a good bottom speed).
- Focus on the attitude indicator and HSI, occasionally scanning the altimeter and airspeed.
- Right about the time you arrive at decision altitude, the airspeed will have decreased to 120 knots.

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Solutions for Handling Gradient Wind

Either of the methods listed above is acceptable. The first is more precise and demanding. The second has the advantage of leaving you with more airspeed and more ability to maneuver out of trouble until you either miss the approach or transition to land.


THUNDERSTORMS

Thunderstorms

Thunderstorms are obvious hazards to airplanes and should be avoided at all cost.

Severe turbulence can be expected up to 20 miles from severe thunderstorms, and so pilots should give any thunderstorm cells a wide berth when flying near them.

Wind Shear

Wind Shear is one of the many unpleasant aspects of thunderstorms. Wind shear is an abrupt change in direction and/or velocity of wind. It can be horizontal or vertical.

In addition to thunderstorms, wind shear can be associated with frontal activity, temperature inversions or surface obstructions.

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Microbursts

If you inadvertently penetrate a microburst, you should do the following:

- Add full power
- Clean up the aircraft
- Maintain Vx

Flying Through Thunderstorms

If you cannot avoid penetrating a thunderstorm, you should do the following:

- Lower your seat
- Tighten your belt
- Slow to Va
- Continue straight ahead
- Concentrate on maintaining attitude

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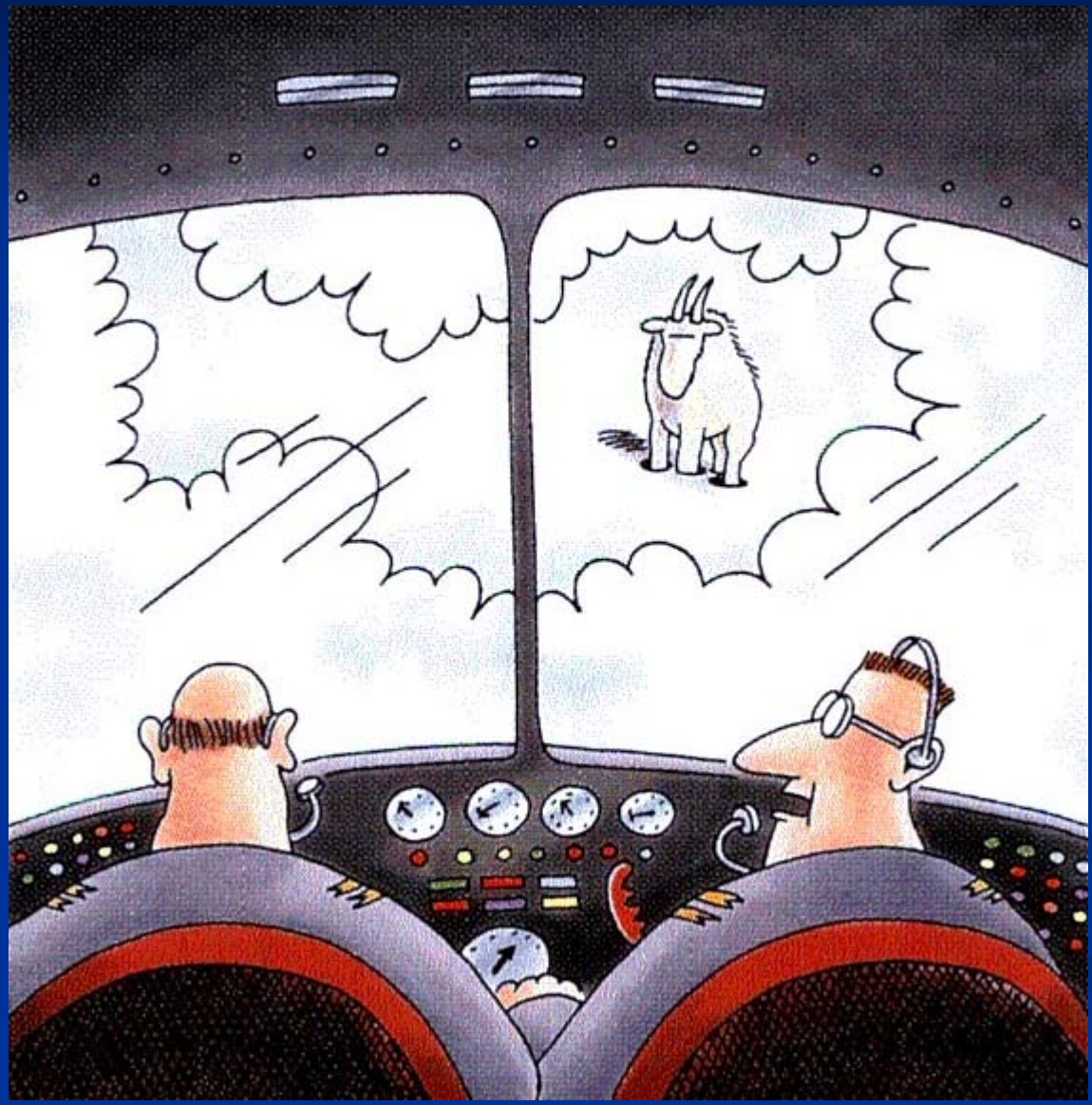
Controlled Flight Into Terrain (CFIT)



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Controlled Flight Into Terrain (CFIT)

CFIT occurs when an airworthy aircraft is flown, under the control of a qualified pilot, into terrain (water or obstacles) with inadequate awareness on the part of the pilot of the impending collision.

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CFIT: Common Elements

The following are all common elements in accidents involving Controlled Flight Into Terrain:

- Multiple step-down fixes
- Poor or no radar coverage
- Darkness
- Required descent gradients of less than 3 degrees.

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CFIT: Decision-Making Scenario

After getting cleared for a full approach to St. Croix, a pilot begins his descent and is advised that radar contact is lost. He becomes confused about his position. What should he do?

Answer: Add full power, start an immediate climb at Vx, then advise ATC of the missed approach.

Remember: If at any time during the approach you feel that you are out of position or configuration, GO AROUND. Never compromise the safety of the flight.

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Pilot Incapacitation

Pilot Incapacitation

Pilot incapacitation is an extremely serious situation, especially in a one-pilot operation. For this reason, it is vital to the safety of the flight that each pilot perform the "I'M SAFE" checklist prior to each flight.

Remember: If you feel that you are not in a condition to safely operate the aircraft,

DO NOT FLY!

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Pilot Incapacitation: Actions

If you should become incapacitated in flight, perform these tasks as quickly as possible:

- Engage the autopilot
- Put the radio on speaker
- Alert ATC and/or SOC
- Alert a passenger of the situation and give him/her as much of the following information as possible:
  - What is happening
  - How to talk on the radio
  - How to operate the controls (if you are alert enough to assist)
  - Anything else that might help the situation

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Instrument Malfunctions

Instrument Malfunctions: Actions

While our aircraft are maintained to the highest possible standard, it is possible for an instrument to malfunction.

The following scenarios demonstrate the correct pilot response for solving instrument problems that may arise.

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Instrument Malfunction: Blocked Static Port

If a pilot takes off with the static ports blocked, he/she could expect the following:

- The indicated airspeed is sluggish, then decreases to zero during climb.
- Altimeter freezes
- VSI freezes

If a pilot takes off with the static ports blocked, he/she could most easily solve the instrument indication problems by selecting alternate static air.

Instrument Malfunction: Broken Vacuum Line

A broken vacuum line results in the loss of the attitude indicator in the Cessna 402C.

Which instrument should the pilot rely on for bank information?

Answer: The turn coordinator

Instrument Malfunction: Autopilot

A pilot reaches down for a chart during climbout in bumpy IMC. When the pilot looks up again at the flight instrument, he notes an unusually high attitude. What should be his first action?

Answer: Verify the autopilot is disengaged

Flight Illusions

Flight Illusions

There are certain circumstances in flight when pilots see or feel things that are not really occurring. These illusions can be hazardous to flight.

Pilots must be aware of these illusions in order to recognize them when they do occur.

It is important that pilots not act on these illusions and that they trust that the readings on their instruments are accurate.

Coriolis Illusion

During a turn, a pilot drops a pen and lowers his head to pick it up. This creates the illusion of turning or accelerating in an entirely different axis. This sensory illusion is called a Coriolis Illusion.

“The Leans”

A pilot takes off into a dark, featureless sky and rolls into a very gradual bank to the left. When she corrects the attitude abruptly, it creates the illusion of a banked attitude to the right. This sensory illusion is called “The Leans.”

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Somatogravic Illusion

A pilot drops off a full load of passengers and then taxis out for a reposition flight. During takeoff, the aircraft accelerates and climbs abruptly into the fog. This creates the illusion of a higher than actual pitch attitude. This is called a Somatogravic illusion.

Inversion Illusion

A pilot levels off abruptly from a climb and feels as though he is tumbling backwards. This is called an Inversion Illusion.

Runway and Approach Lights

Bright runway and approach lighting systems, especially where few lights illuminate the surrounding terrain, may create the illusion of less distance to the runway. The pilot who does not recognize this illusion will fly a higher approach.

Rain and Haze

Rain on the windscreen can create the illusion of greater height, and atmospheric haze can create the illusion of being at a greater distance from the runway. The pilot who does not recognize these illusions will fly a lower approach.

Wake Turbulence

Wake Turbulence

Every aircraft in flight generates wake. This disturbance is caused by a pair of counter-rotating vortices trailing from the wing-tips.

The vortices from large aircraft pose problems to other aircraft that encounter them. In some instances, aircraft encountering the vortices of another may become uncontrollable.

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Wake Turbulence

Wake turbulence is an especially important topic for our operation because of the size of our aircraft and the particular airports we serve.

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Wake Turbulence: Facts

An aircraft develops the strongest wake turbulence when it is heavy, clean and slow.

Wake turbulence tends to sink at approximately 500 feet per minute and levels off 900-1000 feet below the aircraft.

Strong or gusty winds will tend to break up wingtip vortices.

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Wake Turbulence: Scenario

A pilot of a Cessna 402C is taking off from the full length of a runway immediately after a non-heavy jet. There is a 15 knot wind with a 10 knot crosswind component from the right. The jet rotates at approximately 4,000 feet down the runway and climbs away steeply before turning left. What should the pilot of the Cessna 402C do?

Answer: Lift off prior to the rotation point of the jet, side step to the right of the departure runway and climb out at Vy for the current weight.

Wake Turbulence: Scenario

A pilot of a Cessna 402C is descending for landing on runway 4L in Boston. The surface winds are out of the east at 10 knots. A mile ahead, a large non-heavy jet is landing on runway 4R. What should the Cessna pilot do?

Answer: Stay above the glideslope of the ILS 4R and land beyond the touchdown point of the jet on the parallel runway.

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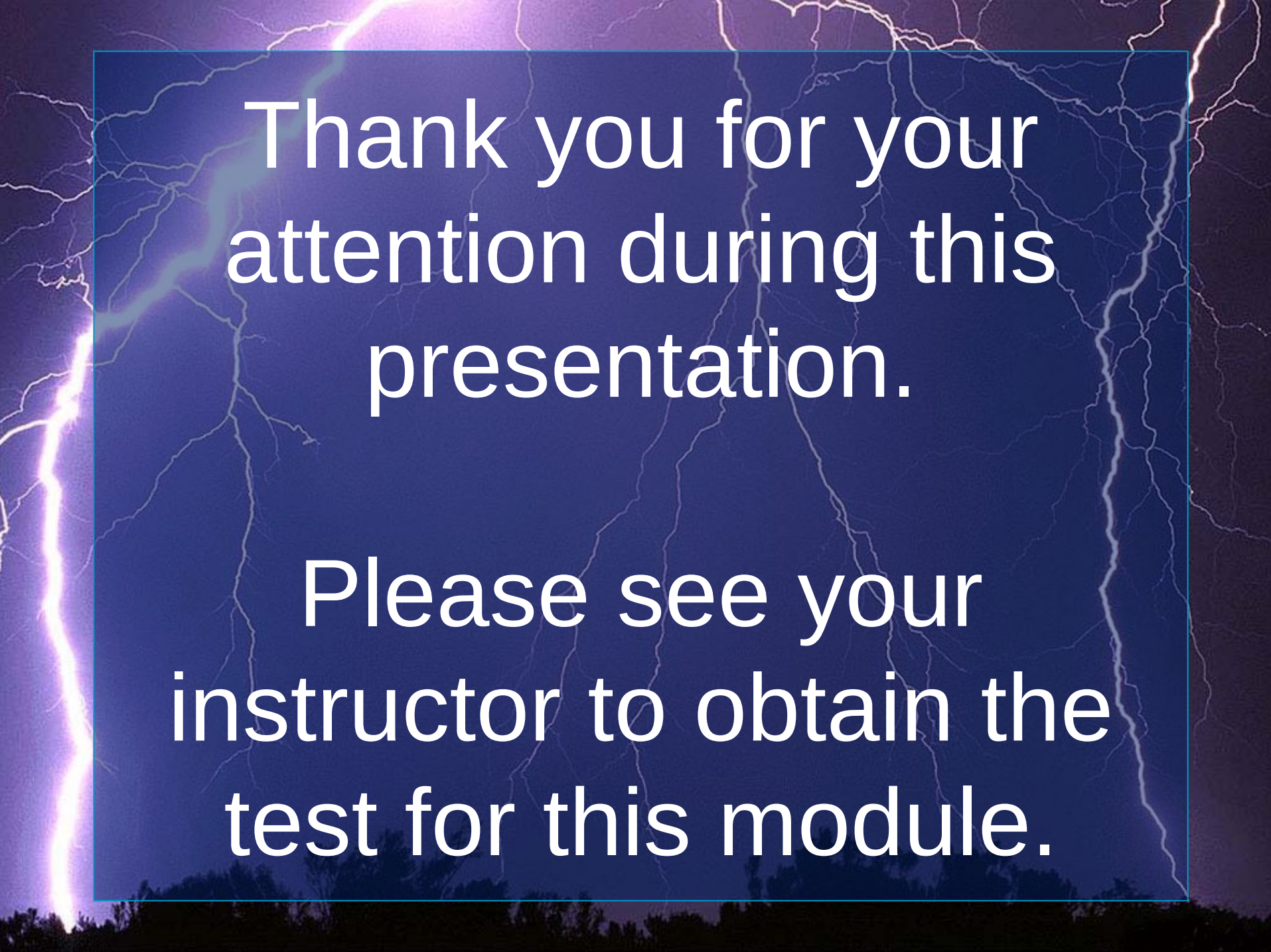
Thank you for your attention during this presentation.
Please see your instructor to obtain the test for this module.