

TRANSFR Inc. Automotive

Automotive Safety Systems Overview: Airbag, Braking, Driver's Assistance and High Voltage Batteries – Storyboard & Specification

Automotive: Delivery 5

Sim 5: Automotive Safety Systems Overview: Airbag, Braking, Driver's Assistance and High Voltage Batteries

Designer: Elena Tilley

Teleporting?: Yes, but not self-directed

Uberskills / Subskills and Medal Scoring: TBD

References:

1. n/a
2. Airbag Basics
3. Removing an Airbag Fuse: <https://bit.ly/2Mdkdkv>
4. Handling an Airbag
5. ABS
6. ADAS
7. Hybrid High Voltage

Tutorial

#1 Intro

[Garage environment][Garage door is open, car rolls in front of us and comes to a stop. We can see the driver's side as it comes into the garage. There is no driver; windows can be tinted.][Trainee is standing outside the car, facing the driver's side of the car. The top of the driver's side door should be at eye level.]

Welcome to the garage! [BREATH / PAUSE] Most modern vehicles are equipped with multiple safety systems. Each system has many components and rely on one another, like the airbag, brakes, the battery and we are going to give you an introduction to the basics. We will explore the basics of an airbag, the braking system, and the advanced driver assist system. Then we will touch on how to identify a high voltage battery in a hybrid vehicle and the required PPE and safety tools. Let's get to it!

#2 Airbag Basics [How it works and location of airbags]

[Trainee is standing outside the driver's side door.]

Let's take a look at the airbag system. One common location of an airbag you may be aware of is in the steering wheel on the driver's side.

Use the grip button on your controller, to open the driver's side door.

[trainee reaches for the driver's side door]

[if trainee doesn't open the driver's side door after 7 seconds] Use the grip button on your controller, to open the door.

[trainee opens the driver's side door] [sfx confirmation] [haptic feedback]

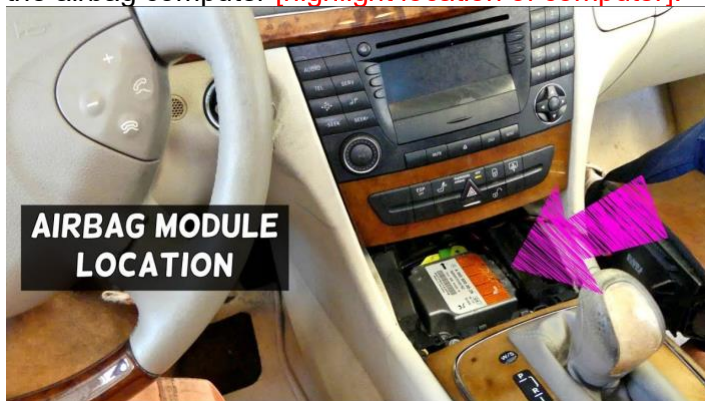
[if trainee doesn't open the door after 14 seconds] To get to the airbag, use the grip button on your controller, to open the driver's side door.

The location of an airbag, often called a “module” [highlight], is critical to preventing serious injuries during a moderate or severe collision. Let’s look at the skeleton of the airbag system. [exterior of car turn transparent; sensors (blue squares), airbag computer, steering wheel, and tires are visible]



There are sensors all around the vehicle. Use the grip button on your controller, to touch the rear bumper sensors [highlight rear bumper sensors] [trainee touch the rear bumper sensors] [sfx confirmation] [if trainee doesn’t touch the rear bumper sensors every 7 seconds] Use the grip button on your controller, to touch the rear bumper sensors.

In the event of a crash, the impact sensors [highlight impact sensors around car] send a signal [a small highlighted green circle darts from the rear bumper sensor to the airbag computer] to the airbag computer [highlight location of computer].



The computer [highlight] sends a signal to the electrical connectors triggering a chemical reaction of sodium azide inside the inflator [highlight inflator].

[a small highlighted green circle darting from the airbag computer along the electrical connectors to the inflator]

Use the grip button on your controller, to touch inflator to inflate the airbag.

[trainee touch the rear bumper sensors]

The inflator emits nitrogen into the airbag, causing it to rapidly inflate at the site of impact [animate nitrogen flowing into airbag as the airbag inflates].

The nitrogen quickly escapes through holes [highlight] on the backside of the airbags.

Use the **grip** button on your controller, to deflate the airbag.

[trainee deflates the airbag] [SFX confirmation]

[if trainee doesn’t deflate airbag every 7 seconds] Use the grip button on your controller, to deflate the airbag.

[steering wheel airbag disappears]

[driver's side airbags, steering wheel airbag, passenger side airbag, and curtain airbags deploy]



Some common locations in a car are the driver's side airbag [highlight], steering wheel airbag [highlight], the passenger side airbag [highlight], and curtain airbags [highlight]. There may be additional airbags depending on the manufacturer.

Fade to black.

#3 Changes Locating and Removing an Airbag Fuse

[trainee is standing in front of the car hood; the hood is open]



[the utility cart is on the trainee's left side]

Now that we have an idea of where the airbags are located, let's remove the airbag fuses. I've gone ahead and disconnected the negative terminal from the battery [highlight].

We're going to need a lot of tools and supplies as we perform this oil change. I'll give them to you as you need them, on this cart beside you. Let's start by putting on our PPE.



[safety goggles appear on cart]

These are your safety goggles. They protect your eyes from any debris.

If you normally wear glasses, you can ask your supervisor about how to get prescription safety goggles.

[pedestal_4_use_the_grip.wav](#) Use the grip button on your controller to pick up the safety goggles, then bring them towards your head to put them on.

[trainee grabs goggles]

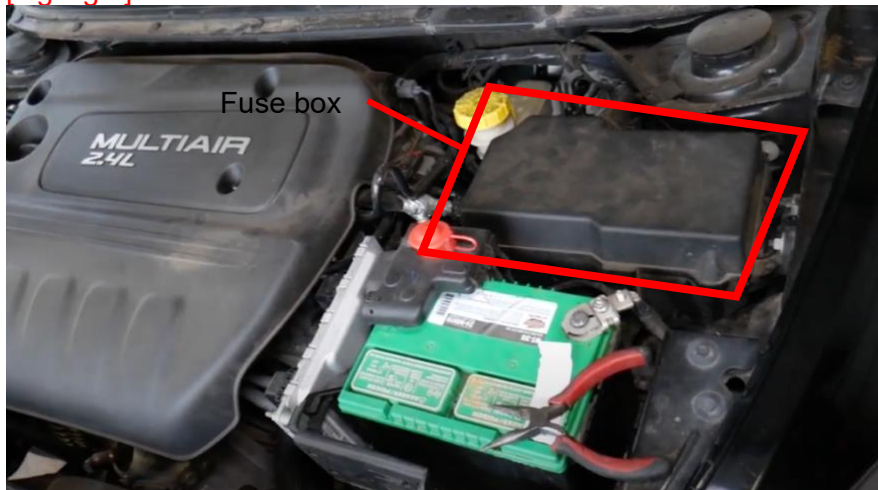
[if trainee doesn't grab goggles after 7 seconds] [pedestal_4_pick_them_up.wav](#) Use the grip button on your controller to pick them up.

[Trainee puts on goggles][SFX confirmation][haptic feedback]

[pedestal_4_there_you_go.wav](#) There you go. Now your eyes are protected.

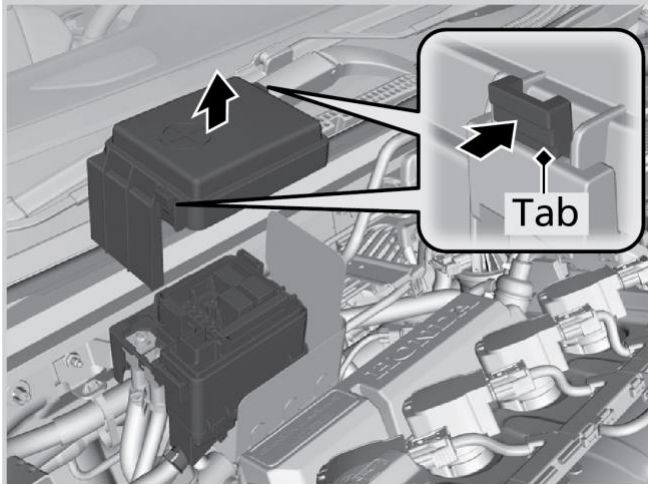
[If trainee doesn't put on goggles every 7 seconds] [pedestal_4_you_have_the.wav](#): You have the goggles. Now all you have to do is bring them towards your headset to put them on.

Let's remove the airbag fuse to cut the electrical current to the airbag. Let's take a look under the hood to find the fuse box. The manufacturer's manual indicates the fuse box is here [highlight].



We need to take off the fuse box cover to find out where the airbag fuses are.

Use the grip buttons on your controllers to push the tabs [highlight] on the side of the fuse box.



[trainee touches fuse box taps][haptic feedback]

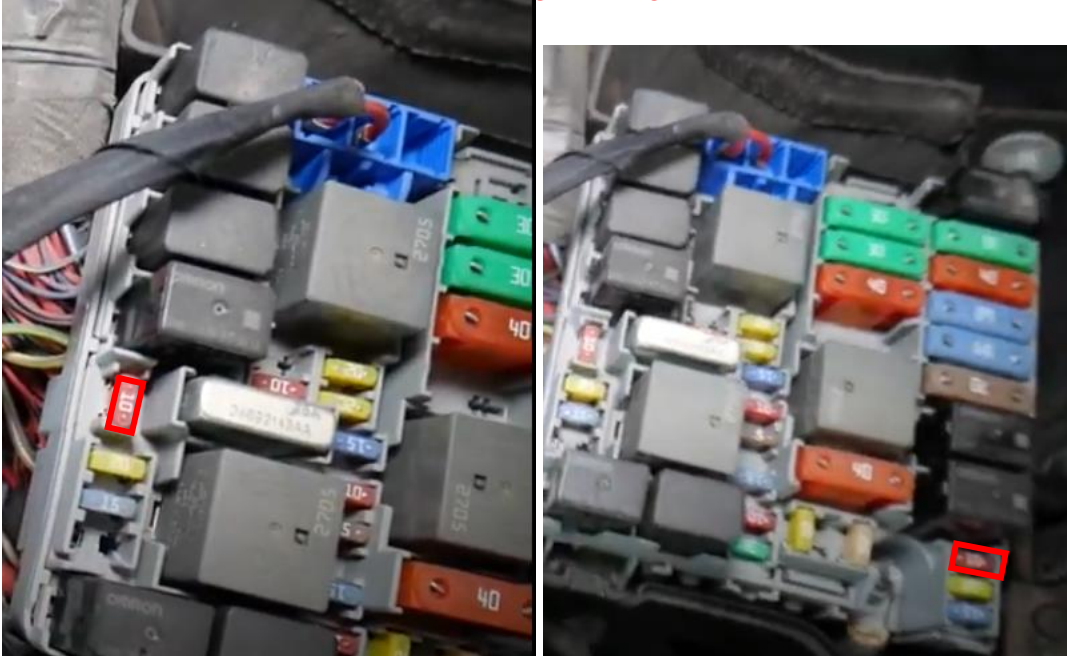
[fuse box cover flips so the inside of the cover is visible]

Underneath the fuse box is a diagram called the fuse chart [highlight the fuse chart].

Each of the fuses have a fuse number [highlight the fuse number] that corresponds to their location in the fuse box. I will highlight the one you need for you.



Let's take out the two airbag fuses [highlight airbag fuses in fuse box].



On your cart is a tool called a fuse puller [highlight] that will help you remove the fuses [highlight airbag fuses].



Use the grip button on your controller to pick up the fuse puller [highlight].

[trainee picks up fuse puller]

[if trainee doesn't pick up fuse puller after 7 seconds] Use the grip button on your controller to pick up the fuse puller.

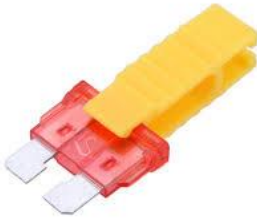
Let's take these airbag fuses out.

Use the trigger on your controller to use the fuse puller to remove the one airbag fuse [highlight airbag fuses].

[trainee removes one airbag fuse][sfx confirmation][haptic feedback]

That's it! Ok, remove the other one.

[if trainee doesn't remove one airbag fuse every 7 seconds] Use the trigger on your controller to use to remove the airbag fuse.



Nice work! You have removed the airbag fuses!

Fade to black.

#4 Handling of an Airbag

Alright! We are finished here! Let's move on to how to safely handle an airbag.

[Trainee is standing next to the open driver's side door. The driver's side door is to their left. On the right is a mechanics cart without any tools or PPE on top. Behind the trainee is an empty table. We can see an avatar in a mechanics uniform (navy button down, navy pants, black work shoes) is sitting in the driver's seat.]

We're going to need some PPE while we handle an airbag. I'll give them to you as you need them, on this cart beside you.



[safety goggles appear on cart]

These are your safety goggles. They protect your eyes from dust and debris. If you normally wear glasses, you can ask your supervisor about how to get prescription safety goggles.

[pedestal_4_use_the_grip.wav](#) Use the grip button on your controller to pick up the safety goggles, then bring them towards your head to put them on.

[trainee grabs goggles]

[if trainee doesn't grab goggles after 7 seconds] [pedestal_4_pick_them_up.wav](#) Use the grip button on your controller to pick them up.

[Trainee puts on goggles][SFX confirmation][haptic feedback]

[pedestal_4_there_you_go.wav](#) There you go. Now your eyes are protected.

[If trainee doesn't put on goggles after 7 seconds] [pedestal_4_you_have_the.wav](#): You have the goggles. Now all you have to do is bring them towards your headset to put them on.



[chemical gloves appear on cart] It's a good idea to wear chemical gloves when you're working with an airbag because they protect you from [REDACTED].

[battery_12_use_the_grip.wav](#) Use the grip button your controller to pick up and put on the gloves.

[trainee picks up glove]

[hack_53_great_now_put.wav](#) Great! Now put it on your other hand.

[Trainee puts on glove][SFX confirmation]

[hack_54_there_you_go.wav](#) There you go. Now do the same for the other hand.

[Trainee puts on glove][SFX confirmation]

[hack_55_well_done_now.wav](#) Well done. Now your hands are protected.

[if trainee doesn't pick up or put on glove or gloves after 7 seconds] Use the grip button your controller to pick up and put on the gloves.

Let's walk through a couple of ways to safely handle an airbag.

Your fellow mechanic is loosening the bolts in the steering wheel to remove the airbag. [avatar in driver seat unscrewing bolts]
[drill sfx].

But they need your help to place it on the bench next to you.

[avatar reaches out to hand the airbag to the trainee; the logo on the airbag cover is facing out]

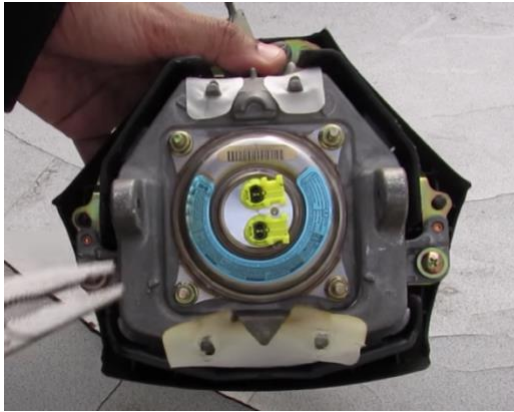
Use the grip button your controller to take the airbag.

[Trainee takes the airbag][airbag logo should be facing the trainee]

[if trainee doesn't take the airbag every 7 seconds] Use the grip button your controller to take the airbag.



Notice you can see the logo [highlight logo] on the airbag [airbag should flash red]. If it were to deploy it would inflate against you. Always handle the airbag with the airbag cover or logo facing out. We should be able to see the inflator.



We need to turn it around so in order to carry it safely.

Use the joystick on your controller to turn the airbag cover away from you.

[Trainee turns the airbag around] [airbag inflator is visible as the trainee holds the airbag] [sfx confirmation]

[airbag inflator facing the trainee. Airbag flashes green]

[if trainee doesn't turns the airbag around every 7 seconds] Use the joystick on your controller to turn the airbag cover away from you.

That's it! Now the airbag can be safely handled.

Ok, let's set the airbag down on the table behind you.

Turn around to the table behind you and use the grip button your controller to place the airbag facing up.

[Trainee turns around and sets airbag on table][sfx confirmation]

[Trainee places the airbag on the table]

[if trainee doesn't turns around and sets airbag on table every 7 seconds] Turn around and use the grip button your controller set the airbag on the table.

With the airbag facing this way, if it were to deploy, it would inflate toward the ceiling [arrow above airbag pointing up], rather than inflating into the table. This decreases the chance of the airbag coming into contact with items in your work area. Remember to NEVER modify an airbag in any way. ALWAYS follow manufacturer procedures on testing, removal, handling, storage, disposal, and deployment.

Fade to black.

#5 Anti-Lock Braking

Fade in

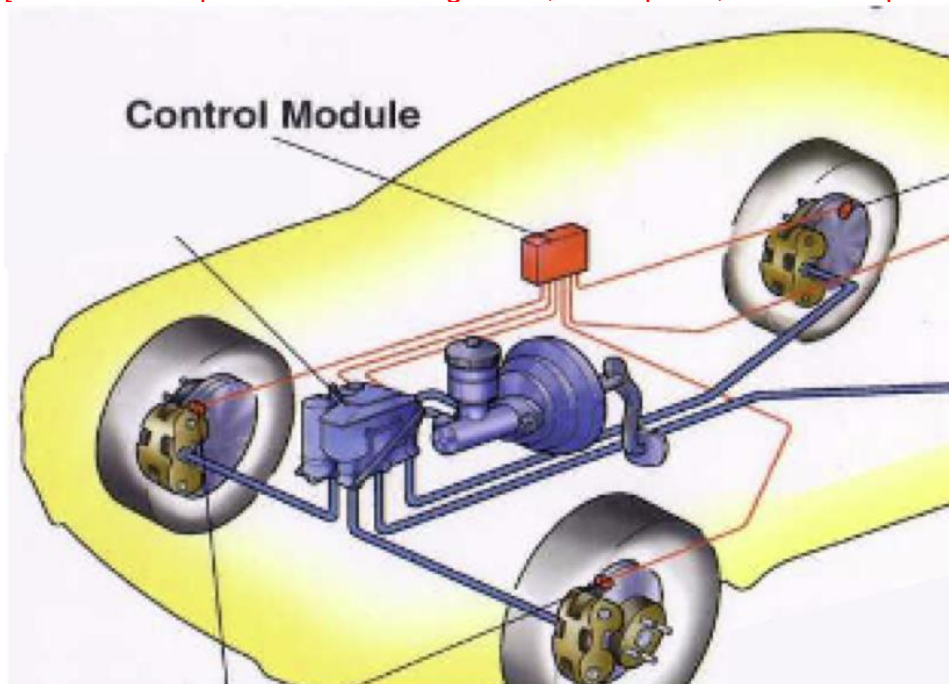
[Car in the garage on a lift. The vehicle is at eye level. Trainee is standing outside the car, facing the driver's side of the car.]

Let's explore how a car comes to a stop with the help of the Anti-Lock Braking System. While braking during a sudden stop, you may have experienced the pulsating feeling [pulse the controllers] in the brakes—that's the Anti-Lock Braking Systems, commonly called ABS. Let's pull back the curtain on ABS.

Use the grip on your controller to touch the driver's side tire so we can see all of the ABS parts.

[trainee touches the driver's side tire]

[car turns transparent. The steering wheel, brake pedal, accelerator pedal are in view]



ABS allows the driver to steer during emergency braking and allows the vehicle to stop at a shorter distance on low traction surface. Let's put the wheels in motion so we can see it happen.

[all four tires begin to rotate at the same speed]

Use the grip on your controller to touch the [brake pedal](#) to slow down the wheels.

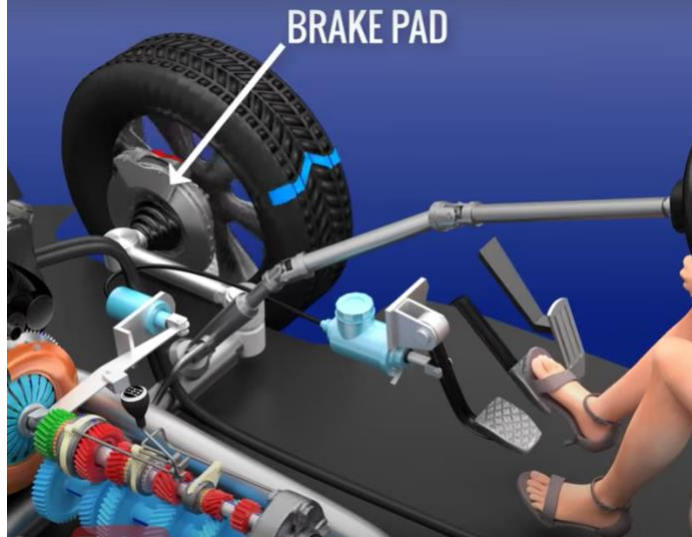
[trainee touches the brake pedal]

[SFX confirmation]

[if trainee doesn't touches the brake pedal every 7 seconds] Use the grip on your controller to touch the brake pedal.

[close up of the driver side tire to display the brake pad and disc brakes]

When the brake pedal [highlight brake pedal] is pressed, the brake pads [highlight brake pads] press against the disc brakes [highlight disc brakes].



This stops the rotation of the wheels. Speed sensors positioned inside the brake pad on each wheel measures the rotational speed.

Use the grip on your controller to touch the brake pad [highlight driver's side brake pad].

[trainee touches brake pad]

[if trainee doesn't touche the brake pad every 7 seconds] Use the grip on your controller to touch the brake pad

[sfx confirmation]

The rotational speed is information sent to the ABS Control Module [highlight ABS Control Module].

Use the grip on your controller to touch the ABS Control Module.

[Trainee touches the ABS Control Module.]

The ABS Control Module monitors for consistent rotational speed of the wheels, but if the sensors detect one wheel is rotating slower, the system takes action to prevent a lock up. Let's see what this looks like when one wheel is rotating slower than the others.

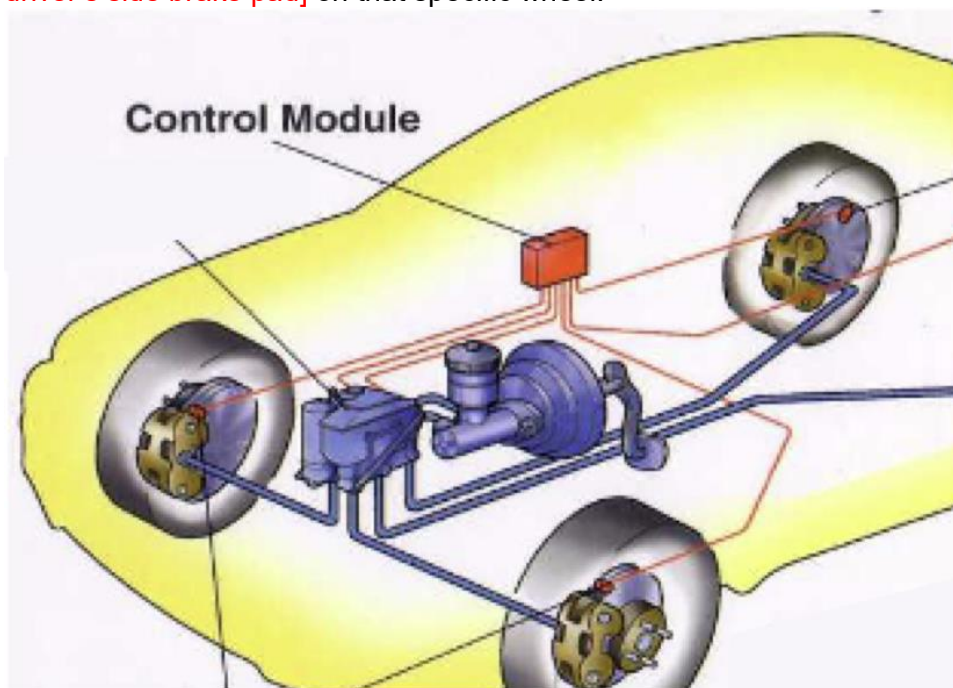
Use the grip on your controller to touch the driver's side tire wheel to slow it down

[Trainee touches the driver's side tire wheel to slow it down.]

[slow down the front driver side wheel while other wheels keep the same rotation]

[highlight front driver's side wheel]

The ABS Control Module [highlight] sends a signal to partially release the brake pad [highlight driver's side brake pad] on that specific wheel.



This allows the wheels to spin intermittently and regain traction during braking, causing the pulsating fee [animate tire pulsating while simultaneously pulsing the oculus controllers].

ABS allows a driver to maintain control of the vehicle during emergency braking by decreasing the time to stop and by steering around obstacles while braking.

Fade to black.

#6 Advanced Driver Assist Systems

Fade in.

[Trainee is standing on the passenger side of the vehicle, near the passenger door.]

Vehicles equipped with Advanced Driver Assistance System, also called ADA, makes driving safer by notifying the driver of potential collisions. The system uses a variety of motion sensing devices.

Use the grip on your controller to select either the front bumper[highlight], trunk[highlight], or rear camera[highlight].

[Trainee touches either the front bumper, trunk, or rear camera.]

[sfx confirmation]

[if trainee doesn't select either the front bumper, trunk, or rear camera every 7 seconds] Use the grip on your controller to select either the front bumper, passenger door, or passenger tire wheel.

[Front Bumper]



Front cameras [highlight], as well as rear cameras detect for collisions [highlight].



Using the front camera and sensors, ADAS can measure if the car in front is too close

[translucent car appears in front of car a few inches from the front bumper]

[front sensors flash red][translucent car disappears]

or there is an object is behind

[translucent car appears behind garage car a few inches from the back bumper]

[back sensors flash red]

[translucent car disappears].

The driver is alerted with a two second warning to to brake.

Use the grip on your controller to touch either the passenger door [highlight] or tire wheel [highlight].

[Trainee touches either the passenger door, or passenger tire wheel.]

[sfx confirmation]

[if trainee doesn't touch either the passenger door, or passenger tire wheel every 7 seconds]

Use the grip on your controller to touch either the passenger door or tire wheel.

[trunk]

Let's move to the back of the car for a better view.

[trainee teleported to the trunk]
[garage environment fades away and car is on open road. Lane markings appear on the asphalt.]



On the front doors, ADAS can identify when a vehicle is veering from the lane
[car begins to veer into lane to the right]
[white radar sensors ripple from both sides of the car (see image above)]
and provide a lane assistance warning. Some vehicles may automatically correct the vehicle and position it back into the lane.
[vehicle slowly navigates back into lane]
[open road fades away and garage environment slowly reappears]

Use the grip on your controller to touch the passenger tire.

[Trainee touches the front passenger tire.]

[if trainee doesn't front passenger tire every 7 seconds] Use the grip on your controller to touch the passenger tire.

In situations where there is a front or rear collision, the vehicle may be fitted to automatically brake, without the driver pressing the brake pedal.



If needed, the ABS will engage to prevent an accident.

Fade to black.

****Scene change****

#7 High Voltage Battery Safety [Identifying cable and PPE overview]

Fade in.

[On a table is a orange high voltage wiring. Trainee is standing facing the table and can see the table and its contents.]



Alright! We are done here. Let's dive into safety around high voltage batteries.

While working in a shop you may see some hybrid vehicles coming in that need service. These vehicles have extremely high voltage batteries and require special PPE. We will cover what a high voltage battery looks like as well as the required PPE and safety precautions around these batteries. Remember only a trained technician should service a high voltage battery.

Like any battery, a hybrid's battery can be found under the hood—but be sure to check the manufacturer's manual. I've gone ahead and taken out the wiring [highlight] that connects to the battery and placed it on the table so we can see it better. It's easy to spot because of its orange color.

Safety is paramount around these types of batteries, and because of that, it requires additional high voltage PPE.

On your table are three types of gloves: cotton [highlight], rubber [highlight], and leather [highlight].

We need to inspect the rubber gloves [highlight] for any holes.



[right glove is laying flat next to left glove on table]

Use the grip on your controller to pick up the **left** rubber glove.

[trainee picks up left glove] [sfx confirmation]

[if trainee doesn't ____ every 7 seconds] Use the grip on your controller to pick up the left rubber glove.

Use trigger to bring it close to your face to blow air into the glove.

[Trainee brings the left glove to their face.] [sfx confirmation]

[left glove inflates with air]



Nice! Looks like this one is good.

Use the grip to set it back on the table.

[trainee places glove back on table]

[if trainee doesn't ____ every 7 seconds] Use the grip to set it back on the table.

Let's test the other glove.

Use the grip on your controller to pick up the **right** rubber glove.

[trainee picks up right glove] [sfx confirmation]

[if trainee doesn't ____ every 7 seconds] Use the grip on your controller to pick up the right rubber glove.

Use the trigger to bring it close to your face to blow air into the glove.

[Trainee brings the right glove to their face.] [sfx confirmation]

[The right glove inflates, but suddenly deflates. Air is escaping.]

Looks like one of these gloves has a hole. I'll go ahead and replace these with a new pair.

[The rubber gloves disappear from trainee's hand and table. New rubber gloves appear and highlight on table.]

Now that we have tested the rubber gloves, let's put on the all of the high voltage gloves.

We need to put these on in a specific order.

Use the grip on your controller to put on the cotton gloves [highlight].



battery_12_use_the_grip.wav Use the grip button your controller to pick up and put on the gloves.

[trainee picks up glove]

hack_53_great_now_put.wav Great! Now put it on your other hand.

[Trainee puts on glove]

[SFX confirmation]

hack_54_there_you_go.wav There you go. Now do the same for the other hand.

[Trainee puts on glove]

[SFX confirmation]

Next, put on the rubber gloves[highlight] over the cotton gloves.



[battery_12_use_the_grip.wav](#) Use the grip button your controller to pick up and put on the gloves.

[trainee picks up glove]

[hack_53_great_now_put.wav](#) Great! Now put it on your other hand.

[Trainee puts on glove]

[SFX confirmation]

[hack_54_there_you_go.wav](#) There you go. Now do the same for the other hand.

[Trainee puts on glove]

[SFX confirmation]

Great! And finally, let's put on the leather gloves **[highlight]** over the rubber gloves.



[battery_12_use_the_grip.wav](#) Use the grip button your controller to pick up and put on the gloves.

[trainee picks up glove]

[hack_53_great_now_put.wav](#) Great! Now put it on your other hand.

[Trainee puts on glove]

[SFX confirmation]

[hack_54_there_you_go.wav](#) There you go. Now do the same for the other hand.

[Trainee puts on glove]

[SFX confirmation]

Alright! Now that we have our gloves on, it's time to put on the face shield **[highlight]**.

[Face shield appears on table]



Use the grip on your controller to put on the face shield.

[Trainee raises the face shield to their face.]

[sfx confirmation]

[Trainee raises face shield to their head. (The trainee should be looking out of the face shield.

On the perimeter of the trainee's sight line is the face shield.)]

[if trainee doesn't raises the face shield to their face every 7 seconds] Use the grip on your controller to put on the face shield.

There you go! Now that we've covered high voltage PPE is on, we can cover one last safety tool related to hybrid vehicles. I'll go ahead and remove your PPE so we can see the tool clearer.

[Face shield and gloves are removed from the trainee]

On your table is a rescue tool called a Shepard's hook [highlight].



Whenever a high voltage battery is being serviced, it is required that another technician be present and at the ready to help in case of an emergency.

In the event that the servicing technician experiences electric shock, the other technician will grab the Shepard's hood and use the hook end to pull the servicing technician away from the vehicle. Call 911 after the technician is pulled away. This rescue tool is required and can save the life a technician in need.

Hands-On Practice / Assessment

#XX Start over from the beginning

[dip to black, scene resets to underneath car] drills_13_lets_start_over_from_the.wav Let's start over from the beginning and try everything again. You'll be scored for this part, and I'll be here if you get stuck, but you'll lose points if I have to help

#XX Scene change

Looks like we're all done here. Let's lower the car and add the new oil!

[fade to black]

[come up from black, we're standing in front of car, it's been lowered to the ground, and the hood is up]
[the cart is beside the trainee]

[the following stuff is on top of the cart: bottle of oil, the rag]

#XX Multiple Choice Question One

Question copy goes here.

[Text appears in front of trainee plus VO: "When is the best time to change the oil?"]

[Choices on buttons:

When the engine has been running and is warm

When the engine has been sitting and is cold

[trainee selects response] [selected response highlights in yellow] [SUBMIT button appears] [trainee has opportunity to change response] hoists_17_touch_the_submit_button_if.wav Touch the submit button if that's your response. You can change your answer, if you want.

[trainee is idle for 10 seconds] multiple_touch_the_answer.wav Touch the answer you think is correct.

[SUBMIT button is touched]

[trainee selects a response, but doesn't touch SUBMIT button within the next 7 seconds] Touch the submit button if that's your response. You can change your answer, if you want.

#XX Medal awarded [or not]

[medal appears, according to scoring logic detailed [here](#)]

Congratulations! You just earned a gold/silver/bronze medal! Grab it to unlock it!

[Buttons in menu: MAIN MENU, ANIMATED TUTORIAL, HANDS-ON PRACTICE]

[if not mastered, trainee retakes hands-on practice][pedestal_46_looks_like_you.wav] Looks like you need more practice on this. You can either retake the animated tutorial, or try the hands-on practice again.