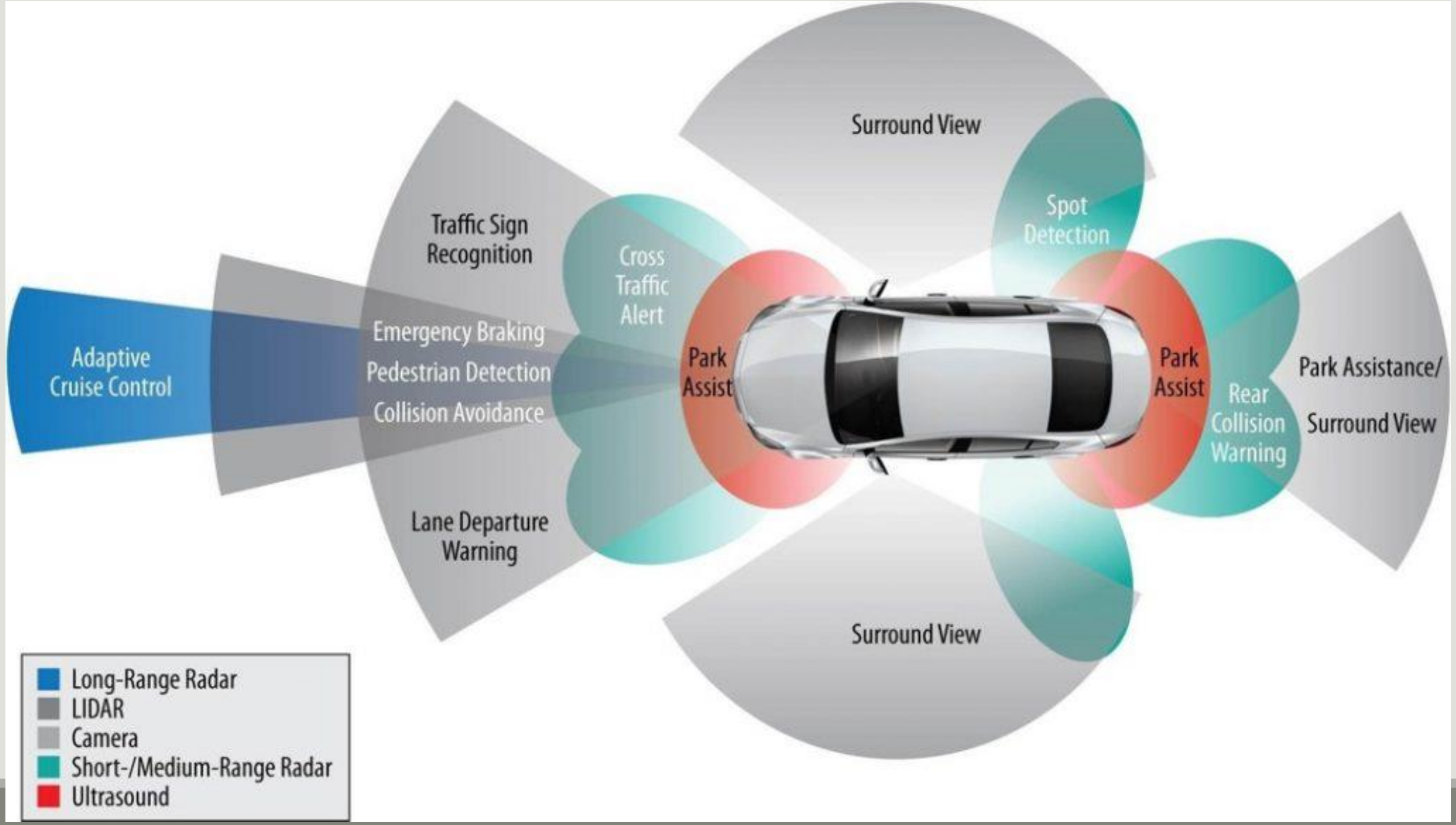
Advanced Drivers Assistance System and the transmission service industry

Kent Meckfessel

Southern Illinois University


Surround View
Spot Detection
Traffic Sign Recognition
Cross Traffic Alert
Adaptive Cruise Control
Emergency Braking
Pedestrian Detection
Collision Avoidance
Park Assist
Park Assist
Rear Collision Warning
Park Assistance/ Surround View
Lane Departure Warning
Surround View
Long-Range Radar
LIDAR
Camera
Short-/Medium-Range Radar
Ultrasound

Intimidations of new systems

Soon to be history or least the norm

- TPMS, ABS, Airbags

Automatic Emergency Braking

- Goal of 100% production cars by 2024

Cameras and sensing equipment found in everything

- Alignment equipment
- Sliding electric commercial doors
- Sinks, toilets
- Its all around now why not cars?
- Safety is increased!

AEB

NHTSA AEB commitment by 20 auto makers

December 17, 2019 | Washington, DC

WASHINGTON – The U.S. Department of Transportation's National Highway Traffic Safety Administration today released an update on the progress of 20 automakers in manufacturing new passenger vehicles with low-speed automatic emergency braking systems). The installation of AEB is part of a voluntary commitment by 20 automakers to equip virtually all new passenger vehicles with low-speed AEB that includes forward collision warning by September 1, 2022.

Four manufacturers, Tesla, Volvo, Audi and Mercedes, have already met their voluntary commitment under the agreement - 3 years ahead of schedule. During the reporting period, September 1, 2018, through August 31, 2019, 12 manufacturers equipped more than 75% of their new passenger vehicles with AEB.

Percent of Vehicles that Meet the Voluntary Commitment

	2017	2018	2019
JLR	0	0	0
Mitsubishi	3	6	5
FCA	6	10	10
GM	20	24	29
Porsche	0	8	38
Kia	11	13	59
Ford	1	6	65
Maserati	30	27	69
Hyundai	9	18	78
Mazda	24	61	80
BMW	28	49	84
Subaru	47	57	84
Honda	30	61	86
Nissan	14	78	86
VW	36	69	92
Toyota	56	90	92
Audi	73	87	**99**
Mercedes	96	96	**99**
Volvo	68	93	**100**
Tesla	**100**	**100**	**100**

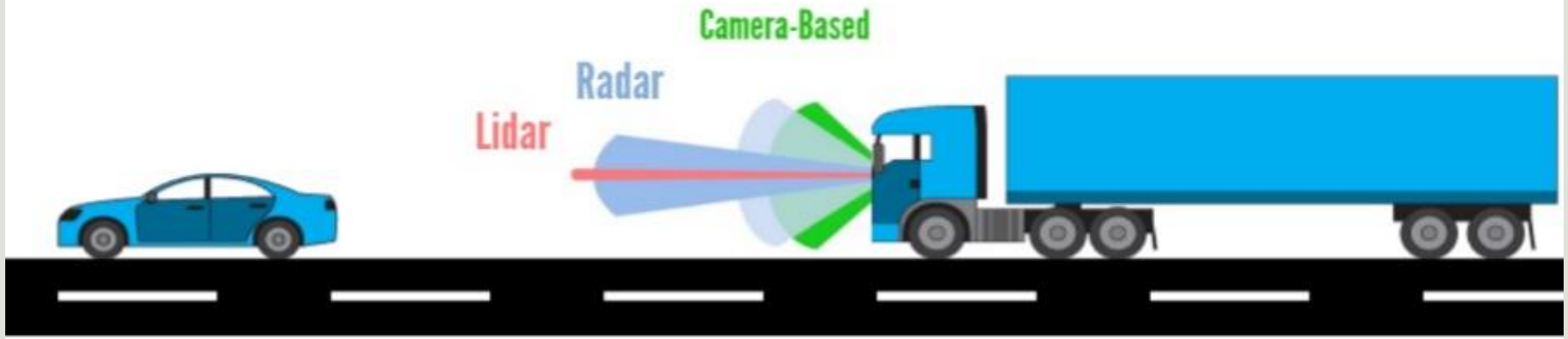
J.D. POWER on AEB

Effectiveness of Automatic Emergency Braking Systems

Studies conducted in Europe, the U.S., and other regions consistently show that AEB is one of the most effective collision-avoidance technologies you can have in your vehicle.

One of the most recent studies, conducted by the Highway Loss Data Institute (HLDI) and the Insurance Institute for Highway Safety (IIHS) in April 2019, found a 50-percent reduction in front-to-rear collisions for vehicles with forward-collision warning and AEB, and a 56-percent decrease in front-to-rear crashes with injuries. Reverse automatic braking systems demonstrate a 78-percent reduction in collisions compared to vehicles equipped only with a reversing camera and parking sensors

Automatic Emergency Braking



Truck Drivers Operating Tractor Trailers with Collision Avoidance Systems* (Automatic Emergency Braking, Electronic Stability Control, and Lane Departure Warning) Experienced:

71%
Rear-End Collisions

63%
Unsafe Following Distance

46%
Improper Lane Change

*Study Collected Data Over 30 Months on More than 12,500 Tractor Trailers

ADAS Defined

Automated systems to assist the driver

Minimizing human error

Reducing accidents

Increasing safety

Leading us into full autonomous vehicles

ADAS Acronyms / Features

AEB Automatic Emergency Braking

FCW Forward Collision Warning

LDW Lane Departure Warning

LKW Lane keep Warning / LKA Lane Keep Assistance

ACC Adaptive Cruise Control

BSI Blind Spot Monitor / Intervention

Collision Warning / Avoidance

Automatic Parking Assist

Adaptive Lights / Wipers

Surround View

Traffic Light Recognition

Rear Cross Traffic Warning and Braking

Rearview Backing and Trailer Backing Assistance…….MANY MORE

I-CAR website (i-car.com/oem-calibration-requirements-search.html)

2019 Ford F-150

Print

Click the links below for directions; definitions; articles; and additional RTS portal information such as OEM position statements and publications.

How To Use The OEM Calibration Requirements Search

ADAS, Calibration, And Scanning Article Hotspot

Vehicle System Definitions

Additional RTS OEM Information

Vehicle System Options

360° Camera View

360 Degree View Camera

Cameras/Sensors:

Camera in Deck Lid/Liftgate/Tailgate (With 360° View)

Camera in Front Bumper Cover/Grille (Middle)

Camera in Side Mirror (Left)

Camera in Side Mirror (Right)

	Yes	No	Not Identified
DTCs Set	X		
System MIL			X

Active Park Assist

Active Park Assist

Cameras/Sensors:

Sensor(s) in Fender (Sides)

	Yes	No	Not Identified
DTCs Set	X		
System MIL			X

Adaptive Cruise Control

Cruise Control with Adaptive Cruise Control

Cameras/Sensors:

Sensor(s) Behind Front Bumper Cover/Grille

	Yes	No	Not Identified
DTCs Set	X		
System MIL			X

Collision Warning

Collision Warning

Cameras/Sensors:

Camera Near Rearview Mirror

Sensor(s) Behind Front Bumper Cover/Grille

	Yes	No	Not Identified
DTCs Set	X		
System MIL			X

Collision Braking

Collision Avoidance System

Cameras/Sensors:

Camera Near Rearview Mirror

Sensor(s) Behind Front Bumper Cover/Grille

	Yes	No	Not Identified
DTCs Set	X		
System MIL			X

Blind Spot Detection

BLIS

Cameras/Sensors:

Sensor(s) in Tail Lamp (Sides)

	Yes	No	Not Identified
DTCs Set	X		
System MIL			X

Lane Departure Warning

Lane Keeping Alert

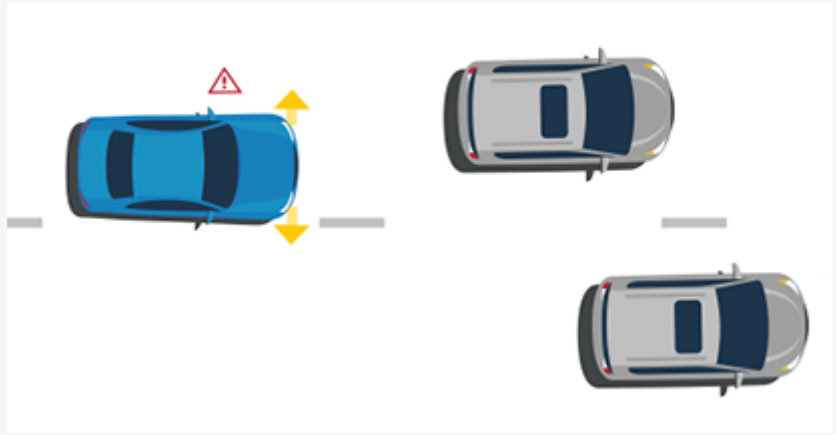
Lane Keep Assist

Lane Keep Aid

Rear View

Parking Aid Camera

Lane Departure Warning



A lane departure warning system monitors lane markings and alerts the driver when it detects that the vehicle is drifting out of its lane. It's important to note that a lane departure warning system only provides a warning to the driver and does not take action to avoid a crash.

Lane Keep Assist LKA

Lane keeping assistance helps prevent the vehicle from unintentionally drifting out of its lane. The system uses information provided by lane departure warning sensors to determine whether the vehicle is about to unintentionally move out of its lane of travel. If so, the system activates and corrects the steering, brakes or accelerates one or more of the wheels, or does a combination of both, resulting in the vehicle returning to its intended lane of travel.

Blind Spot Intervention

Blind spot intervention helps prevent a collision with a vehicle in the driver's blind spot. If the driver ignores the blind spot warning, and starts to change to a lane where there's a vehicle, the system activates and automatically applies light braking pressure, or provides steering input to guide the vehicle back into the original lane. The system monitors for vehicles in the driver's blind spot using rear-facing cameras or proximity sensors.

BLIND SPOT MONITORS

Adaptive Cruise Control

Adaptive Cruise Control has a speed set point and works very similar to traditional cruise control however can BRAKE and ACCELERATE to accommodate traffic for changes. It has a set distance to set back from the vehicle traveling in front of it which can be adjusted closer or farther depending on driver preference.

Autonomous cruise control

Adaptive cruise control is an available cruise control advanced driver-assistance system for road vehicles that automatically adjusts the vehicle speed to maintain a safe distance from vehicles ahead. As of 2019, it is also called by 20 unique names that describe that basic functionality. Wikipedia

SAFETY SYSTEM FIELD EFFECTIVENESS

HIGH-INTENSITY DISCHARGE (HID) HEADLIGHTS

▼21% NIGHTTIME ANIMAL/ PEDESTRIAN/ BICYCLIST CRASHES

INTELLIBEAM

▼35% NIGHTTIME ANIMAL/ PEDESTRIAN/ BICYCLIST CRASHES

FORWARD AUTOMATIC BRAKING W/ FORWARD COLLISION ALERT

▼46% REAR-END STRIKING CRASHES

FORWARD COLLISION ALERT

▼21% REAR-END STRIKING CRASHES

LANE KEEP ASSIST W/ LANE DEPARTURE WARNING

▼20% LANE DEPARTURE CRASHES

LANE CHANGE ALERT W/ SIDE BLIND ZONE ALERT

▼26% LANE CHANGE CRASHES

REAR VISION CAMERA

▼21% BACKING CRASHES

REAR PARK ASSIST

▼38% BACKING CRASHES

REAR CROSS TRAFFIC ALERT W/ REAR VISION CAMERA & REAR PARK ASSIST

▼52% BACKING CRASHES

REVERSE AUTOMATIC BRAKING W/ REAR CROSS TRAFFIC ALERT, REAR VISION CAMERA & REAR PARK ASSIST

▼81% BACKING CRASHES

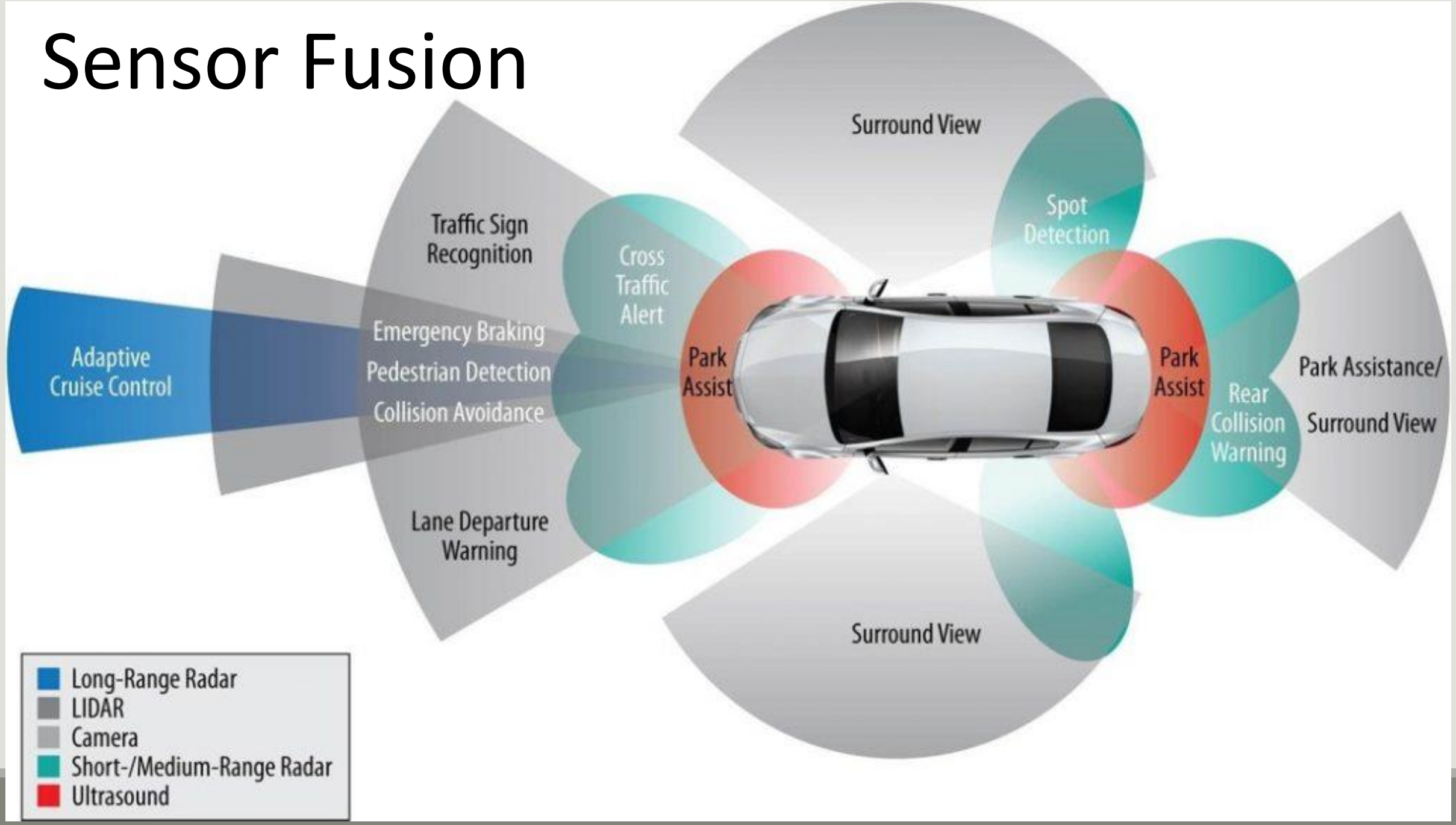
University of Michigan Transportation Research Institute (UMTRI) July 2019

SAE J3016™ LEVELS OF DRIVING AUTOMATION™

Learn more here: sae.org/standards/content/j3016_202104

	SAE LEVEL 0™	SAE LEVEL 1™	SAE LEVEL 2™	SAE LEVEL 3™	SAE LEVEL 4™	SAE LEVEL 5™
What does the human in the driver's seat have to do?	**You are driving** whenever these driver support features are engaged – even if your feet are off the pedals and you are not steering			**You are not driving** when these automated driving features are engaged – even if you are seated in "the driver's seat"		
	You must constantly supervise these support features; you must steer, brake or accelerate as needed to maintain safety			When the feature requests, you must drive	These automated driving features will not require you to take over driving	
	These are driver support features			**These are automated driving features**		
What do these features do?	These features are limited to providing warnings and momentary assistance	These features provide steering **OR** brake/ acceleration support to the driver	These features provide steering **AND** brake/ acceleration support to the driver	These features can drive the vehicle under limited conditions and will not operate unless all required conditions are met		This feature can drive the vehicle under all conditions
Example Features	• automatic emergency braking • blind spot warning • lane departure warning	• lane centering **OR** • adaptive cruise control	• lane centering **AND** • adaptive cruise control at the same time	• traffic jam chauffeur	• local driverless taxi • pedals/ steering wheel may or may not be installed	• same as level 4, but feature can drive everywhere in all conditions

Sensor Fusion



ADAS inputs

- Sensor fusion
  - Same sensors works multiple ADAS features (LKA,ACC & AEB)
- Sensors
  - Radar
    - Short range, Medium range, Long range
  - Camera
  - Lidar
  - Ultra-sonic (sonar)
  - GPS
  - Night vision
  - Can data INPUT
    - WSS, SAS, Accelerometers

ADAS inputs, that need calibration

- Sensor fusion
  - Same sensors works multiple ADAS features (LKA,ACC & AEB)
- Sensors
  - Radar
    - Short range, Medium range, Long range
  - Camera
  - Lidar
  - Ultra-sonic (sonar)
  - GPS
  - Night vision(not really calibrated--but tested)
  - Can data INPUT
    - WSS, SAS, Accelerometers, BPP….etc

Radar

Radio Detection and Ranging

Radio microwaves transmitted out and received back an echo

Distance and speed relative information gained

Not affected by rain/fog, light/dark

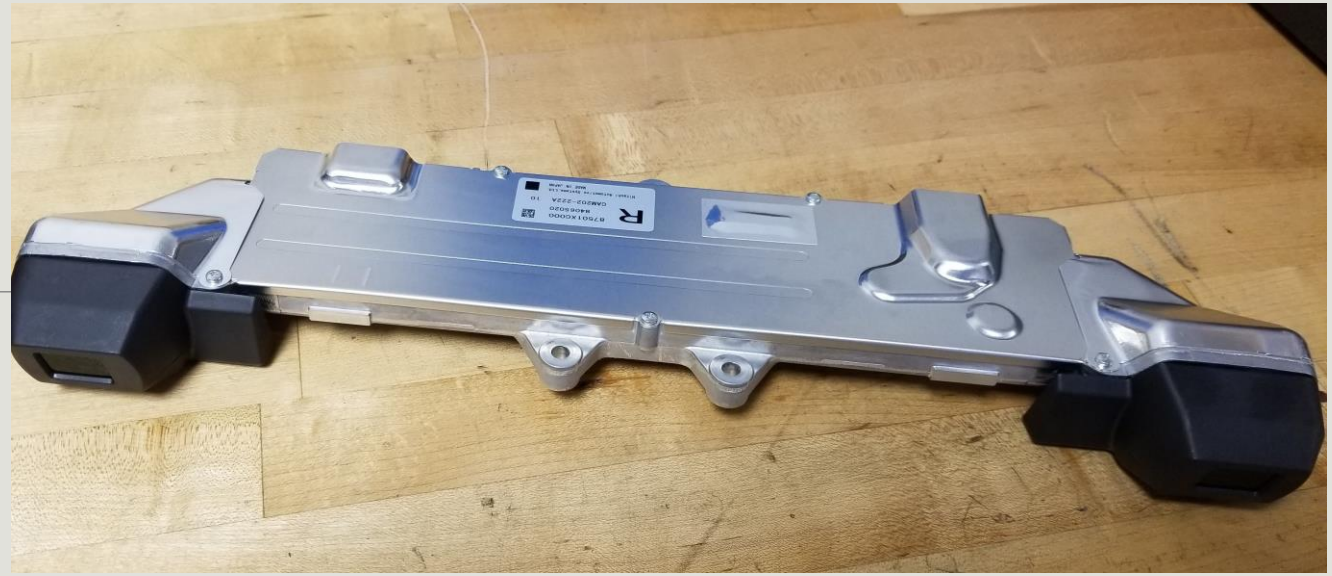
Works great to detect metal objects
- metal blocks further view

SRR up to 30 meters

MRR up to 100 meters
- Blind Spot Warning
- Rear Cross Traffic Alert

LRR up to 200 meters
- ACC and FCW

Cameras



Cameras offer high resolution
- Less than a megapixel
  - I phone 7 is 12 megapixels
  - Human eye is 576 megapixels

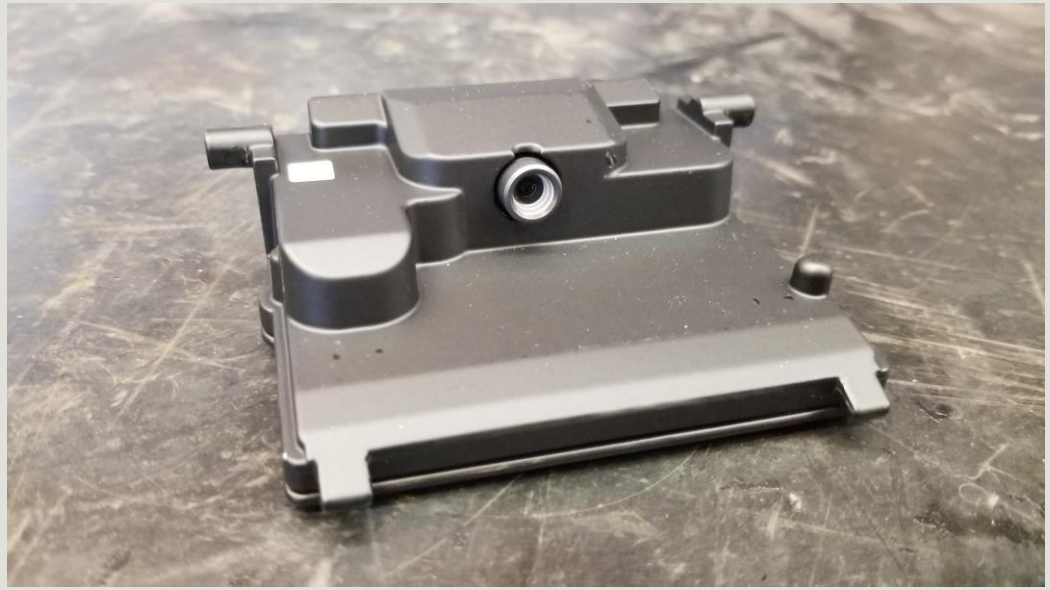
Requires powerful processor over Radar & Lidar

Stereo Cameras
- do not require a radar

Mono Cameras
- requires radar or lidar in addition

Offer color input
- Traffic Light Detection and brake light detection

Environmental concerns
- Rain, snow, ice, dirty lens, bugs juice, wax, dirt and debris, reflections, glare,



Surround view & rear view cameras

Offer 360 view of vehicle

Backup view

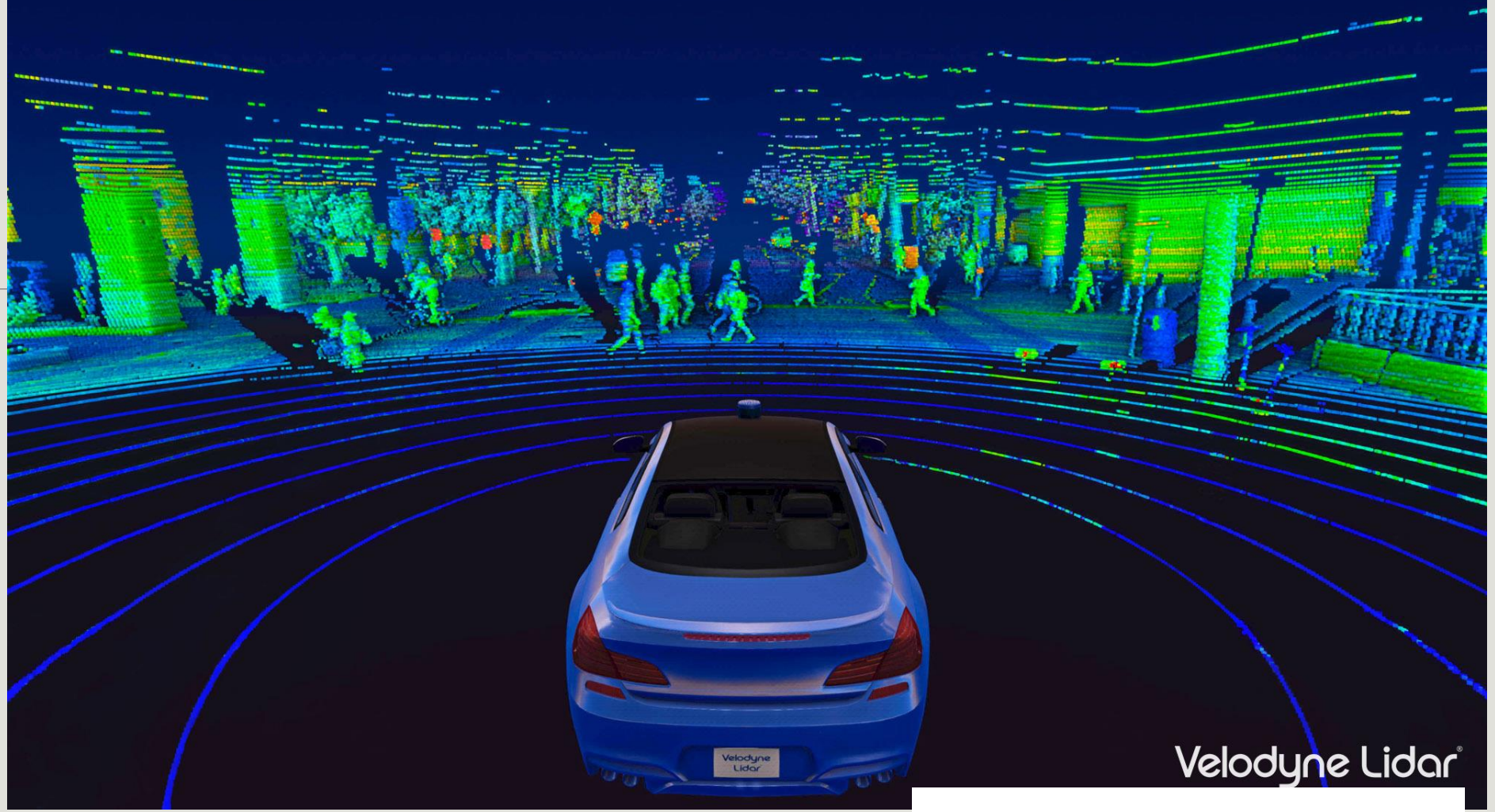
Blind spot assistance

Trailer backing assist

Lidar

- Light detection and ranging
- Laser pulses echoed back like a radar signal
- Relative speed and distance gained
- More accuracy and definition than Radar
- Can be 360 degrees
- Very expensive (currently)
- Used in autonomous fleets like google and Navya
- Higher level of autonomy may require Lidar systems to accomplish


robosense


Velodyne Lidar


QUANERGY

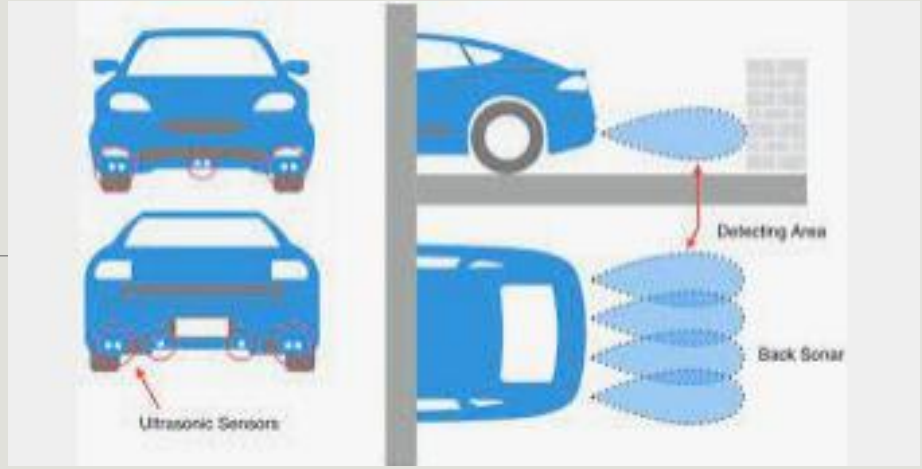

Velodyne

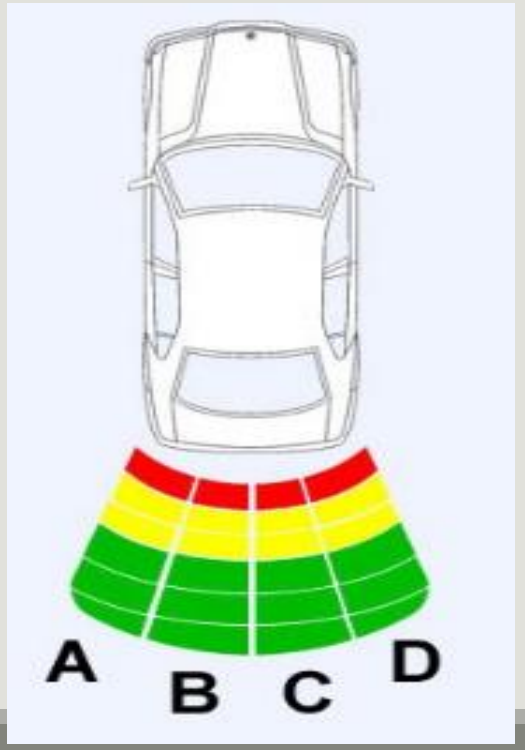
Ultrasonic Sonar sensors

Uses high frequency sound waves pulses that reflect back to measure relative short distance

Used for backup detection and park assist

Located commonly in bumpers, or lower fenders





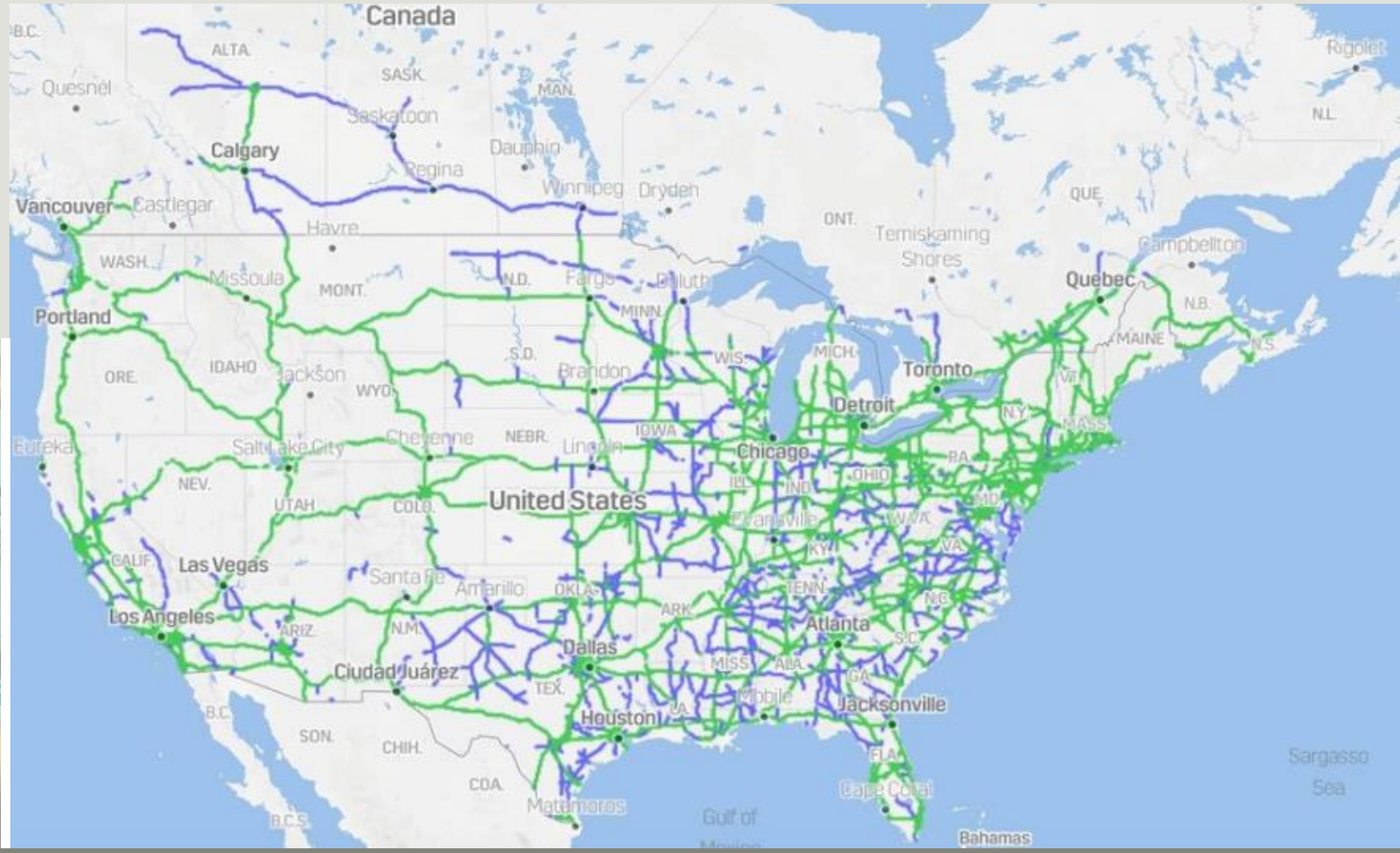
GPS

Used for seamless lane centering guidance

GM Supercruise vehicles current Cadillac models, 22 Chevy Bolt

Coming 2022+

- Silverado
- Sierra

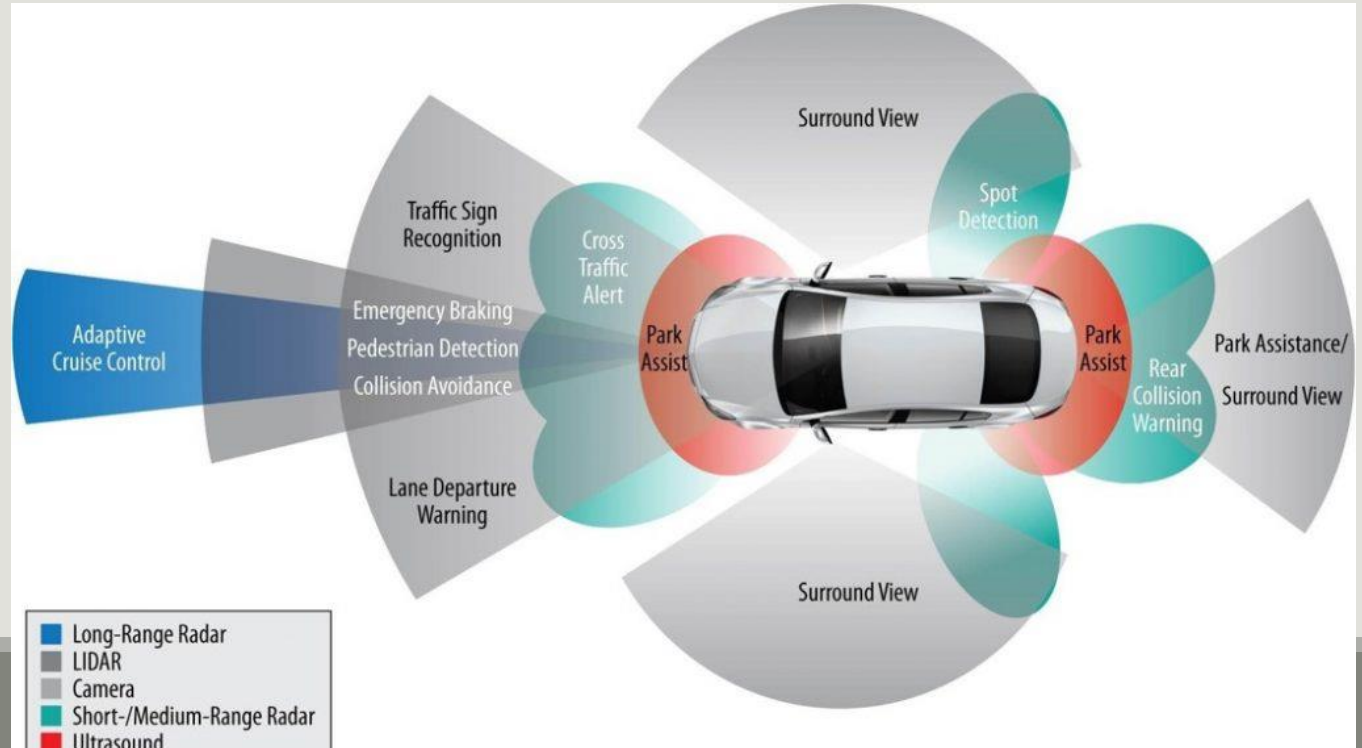


Sensor Fusion term

All the sensors used together like the human 5 senses

Some have advantages and disadvantages

Together cover a full range of coverage around the vehicle



When to calibrate

- Windshield replacement
  - Change the view of sensor
- Collision
  - Change of whole car geometry
- Wheel Alignment
  - Geometry of centerline and steering change
- Parts change or removal or relocation
  - Replace sensor (camera, radar, etc)
  - Remove sensor for another repair

When to calibrate

- Windshield replacement
  - Change the view of sensor
- Collision
  - Change of whole car geometry
- Wheel Alignment
  - Geometry of centerline and steering change
- Parts change or removal or relocation
  - Replace sensor (camera, radar, etc)
  - Remove sensor for another repair
- Diagnosis
  - Fault, system malfunction or operational issue

Transmission repair encounters on ADAS

Sub frame removal

- Changes alignment and thrust angle
- Needs steering angle reset also

Coolers replacements near grill

- May require radar and or front facing surround camera R&R, then calibration

Tires & wheel changeovers

- Changes ride height if not OE

Aftermarket parts replacement

- Side mirrors
- bumpers and brush guards with heavy steel

Extra weight changes

- Towing and hauling

Transmission repair encounters on ADAS

- Pushing in a vehicle
  - Careful what is under the panel
  - Unintentional misalignment of radars
- Dead battery or lost adaptive and calibrations
- Test drive before and after
  - All systems scan info
  - Pre-existing conditions
  - Pre and post scan

ANYTIME a sensor is even unplugged

Tools Required!

Reset Required!

This vehicle may be equipped with a Lane Keeping System (LKS) / Lane Keeping Aid/Alert/Assist (LKA) system which requires the system to be reset after a wheel alignment.

CodeLink® 2 (with WinAlign 15.0+) or OEM scan tool and a test drive is required to perform reset and ensure correct functionality of the system.

To determine if a vehicle is equipped with LKS/LKA: Look for the system's camera located near the top of the windshield.

Attention:

ICC/FCW/Distance sensor alignment is only required when the ICC/FCW/Distance sensor is removed, reinstalled or front end structural repairs are performed.
Only check the ICC system selection box if ICC and/or FCW calibration is to be performed.

To determine if the vehicle has FEB/FCW (Forward Emergency Braking/Forward Collision Warning):

- Look for the lamp shown above on the right during the bulb check (not present on all models).
- Look for the icon on the left shown above in the driver information display. This icon may not be displayed if the system is equipped but disabled. To enable the system, use the buttons on the steering wheel to navigate the vehicle settings as follows: Settings->Driver Assistance->Driving Aids.
  If FEB/FCW is present in the menu, the system is equipped.

To determine if t
Control):

- Look for a bu
  icon shown a
  and button lo

HONDA

Job Aid

June 2021 Version 9

Aiming Driving Support Systems

Supersedes version 8, dated March 2021, to revise the information highlighted in yellow

APPLIES TO

All models with the millimeter wave radar, FCW/LDW camera, multipurpose camera, LaneWatch™ camera, and blind spot information radar.

REVISION SUMMARY

Information supporting the 2022 Civic series has been added throughout this job aid, American Honda recommends you read this entire job aid.

INTRODUCTION

Many Honda vehicles have advanced safety driving support systems to help warn drivers and mitigate hazards. It is very important to be familiar with these systems and know how to properly aim the camera or radar units. This job aid covers the function of each driving support system, the tools needed to properly aim the camera or radar unit, general requirements for aiming, and troubleshooting tips.

System	Abbreviation	Description
Adaptive Cruise Control	ACC	This system helps maintain a constant vehicle speed and a set following interval behind a vehicle detected ahead. For models with the added low speed follow (LSF) feature, if the vehicle ahead slows to a stop, the vehicle with LSF will slow down and come to a stop.
Auto High-Beam	AHB	This system can automatically switch the headlights from low beam to high beam using the multipurpose camera, depending on road conditions, oncoming vehicles, and vehicles ahead.
Blind Spot Information	BSI	This system can detect vehicles in specified alert zones next to the vehicle, particularly in harder-to-see areas commonly known as blind spots.
Collision Mitigation Braking System™	CMBS™	This system alerts you when there is a possibility of a frontal collision with a vehicle or pedestrian detected ahead. It also reduces vehicle speed to help minimize collision severity if a collision appears unavoidable.
Cross Traffic Monitor	CTM	This system monitors the rear corner areas using the BSI radar units when reversing and alerts you if a vehicle approaching from a rear corner is detected.
Forward Collision Warning	FCW	This system alerts you when it determines there is a possibility of a frontal collision with a vehicle detected ahead.
Lane Departure Warning	LDW	This system alerts you when it determines the vehicle maybe unintentionally crossing over detected lane markings.

Type of calibrations

Static

- Done with a ADAS fixture & targets
- Requires a scan tool
- Intense, detailed directions
- Potential for errors
- Could take hours per sensor

Dynamic

- Initiated with scan tool
- Drive in proper condition while sensor self adapts
- Usually scan tool updates the status as percentage
- Sometimes done after a static calibration
- Dependent on conditions
  - weather
  - traffic
  - light

Static and Dynamic calibrations

- Some vehicles will require both
- No manufacturer sticks to either
- Depends more on the brand of sensor not vehicle make

The options for ADAS equipment

- OEM
- Autel
- Bosch/Hunter
- Hella Gutman
- Texa
- As-tech

The options for ADAS equipment

- OEM
- Autel
- Bosch/Hunter
- Hella Gutman
- Texa
- As-tech

EQUIPMENT COMPARISON

Autel

- Stand alone unit only
- Fully capable scan tool
- All online training
- Documentation
  - Does not include alignment, SAS, ride height and other geometry considerations
- Requires yearly updates
  - ADAS & scan tool

Bosch/Hunter

- Stand alone unit &
  - Integrates with aligner
- Fully capable scan tool
- Training available
  - Local service reps
  - Seated course available
- Complete documentation
- Requires updates yearly **
  - Hunter $1200
  - Bosch $1200
  - Not required
    - Jeopardizes hardware warranty

EQUIPMENT COMPARISON

Autel

- Fit for windshield & collision applications
- Stand alone & mobile applications

Bosch/Hunter

- Fits a full-service auto shop
- Already has align equipment
- Much more comprehension

*Both systems have cameras setup and do not require as much tape measure and plumb bob action

Documentation

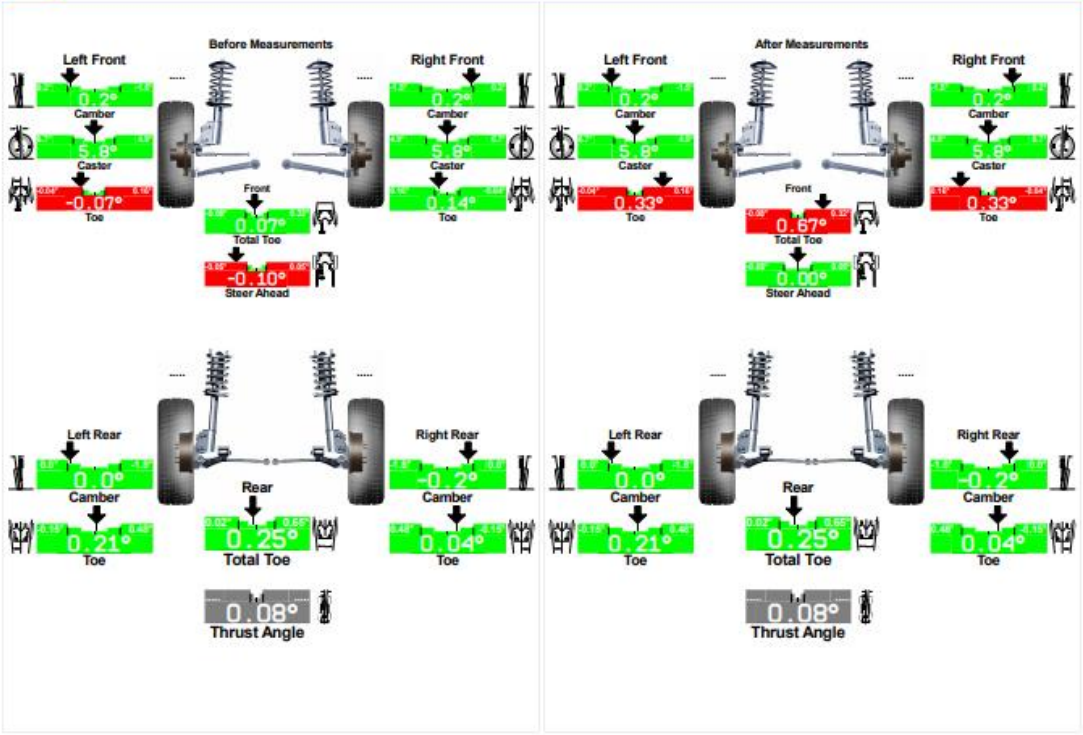
- PRE and POST scan of the systems
- Alignment performed prior ?
  - Tire psi & size, ride height, SAS relearned
- What was source for needed calibration ?
- VIN, License plate, pic of car any damage pre-existing
- Insurance companies require for claims
- Liability coverage

R000001
7/22/21 6:39 PM
JN8AT2MT9JW460787

JN8AT2MT9JW460787

Nissan : Rogue : 2018 : Front Wheel Drive (except USA Production) : with 18" Wheel
4-Wheel Total Alignment

Wheel Alignment



Safety System Alignment™ — Complete

Required OEM procedures performed according to vehicle service documentation.

Before			Current		
	(ESC) Electronic Stability Control	+2.3°	✓	(ESC) Electronic Stability Control	+0.0°
	(ICC) Intelligent Cruise Control		✓	(ICC) Intelligent Cruise Control	

GENERAL AIMING REQUIREMENTS

Although the procedures for radar unit and camera aiming are different, the general aiming requirements are the same. Here are the minimum requirements for both the vehicle and the aiming area.

Vehicle Requirements

- The suspension has not been modified.
- The tire sizes and pressures are correct according to the driver's doorjamb label.
- The fuel tank is full.
- All excess cargo is removed, except for the tool kit and spare tire (if equipped).
- All doors are closed.
- The transmission is in Park (Neutral for M/T models) with the parking brake set.
- The wheels are pointed straight ahead.
- No objects are on the instrument panel, hood, or windshield.
- There is no dirt or debris around the radar unit or camera.

Aiming Area Requirements

- Do the aiming in a well-lit area such as inside the shop. Avoid doing it outside; certain weather conditions may affect aiming results.
- Make sure there is enough space (see below). Avoid areas with poles and large tool boxes nearby. Also, avoid aiming in front of any metal garage doors, shutters, or steel grates in the ground.
- Do not use the listed dimensions for target placement.

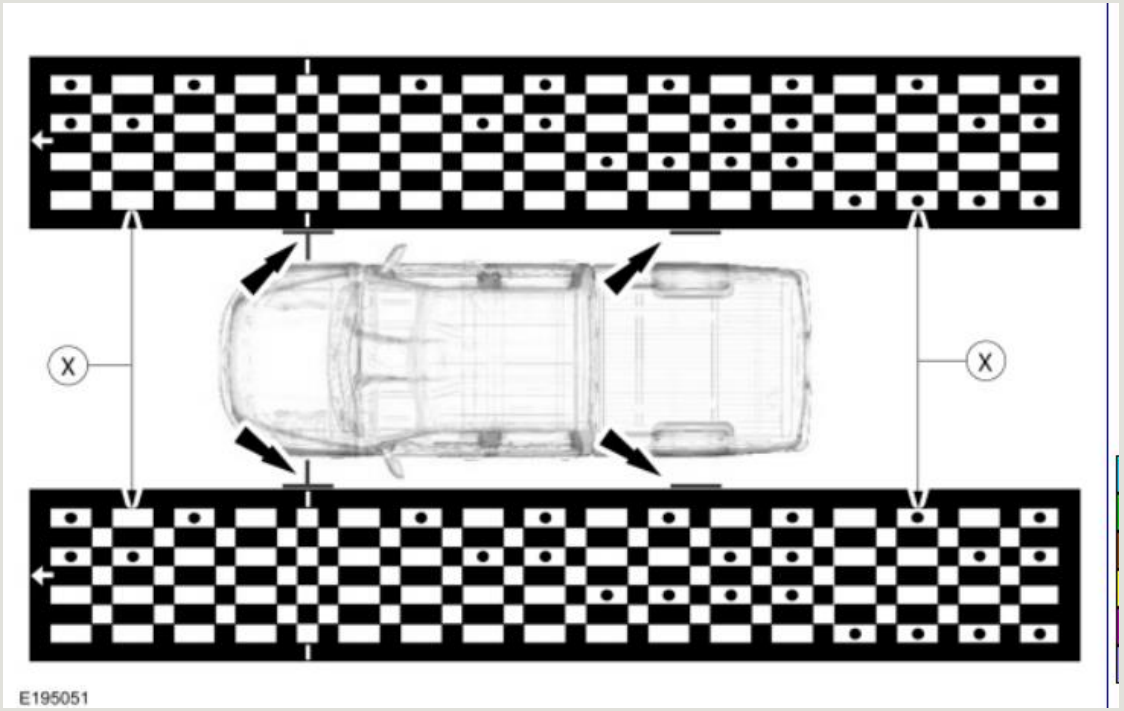
Calibration and service

Takes flat, large space to perform calibrations

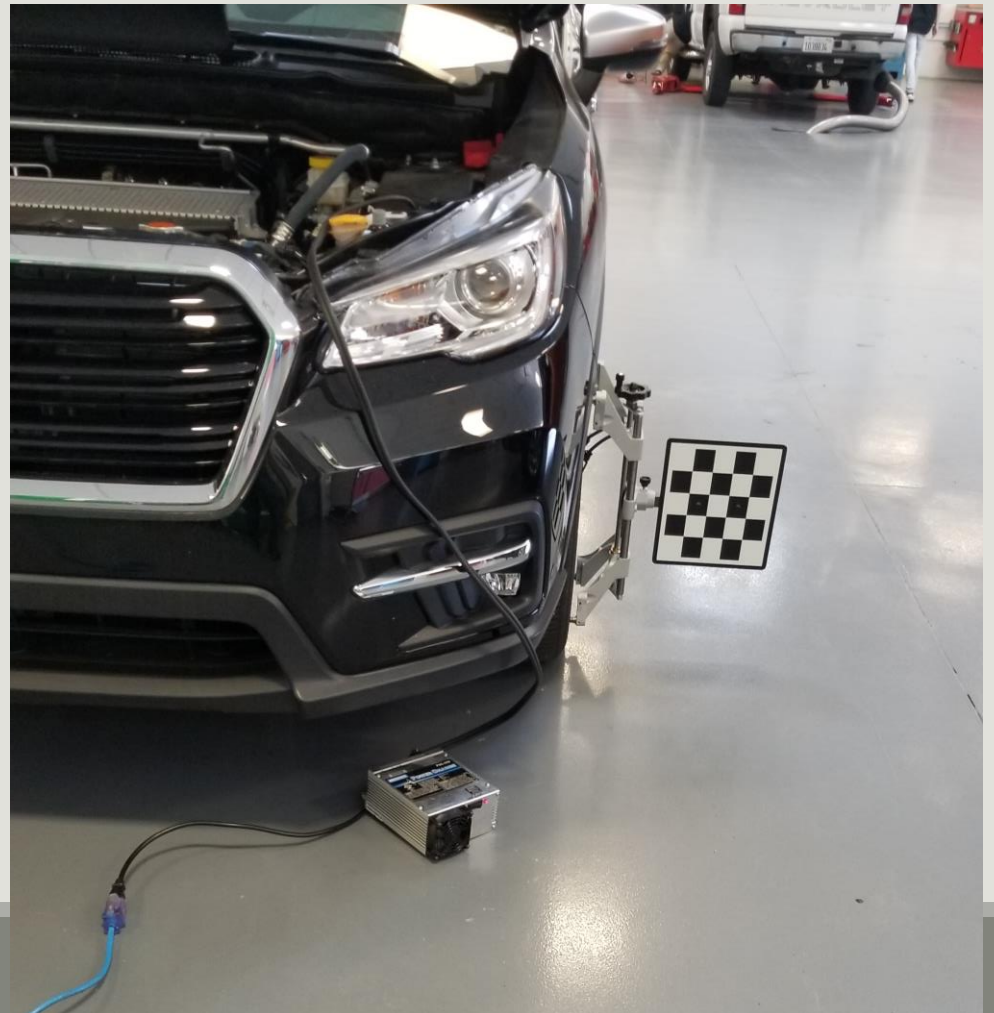
- Most shops don’t have appropriate space

Environmental conditions

- Light, glare, reflections, clean glass
- Weather
- Road conditions, traffic
- Bumper stickers
- GPS or phone mount on dash or windshield
- No large metal objects nearby



Battery voltage is critical during calibrations



Ignition swith position

What is on/off/accessory?

Every auto manufacturer different

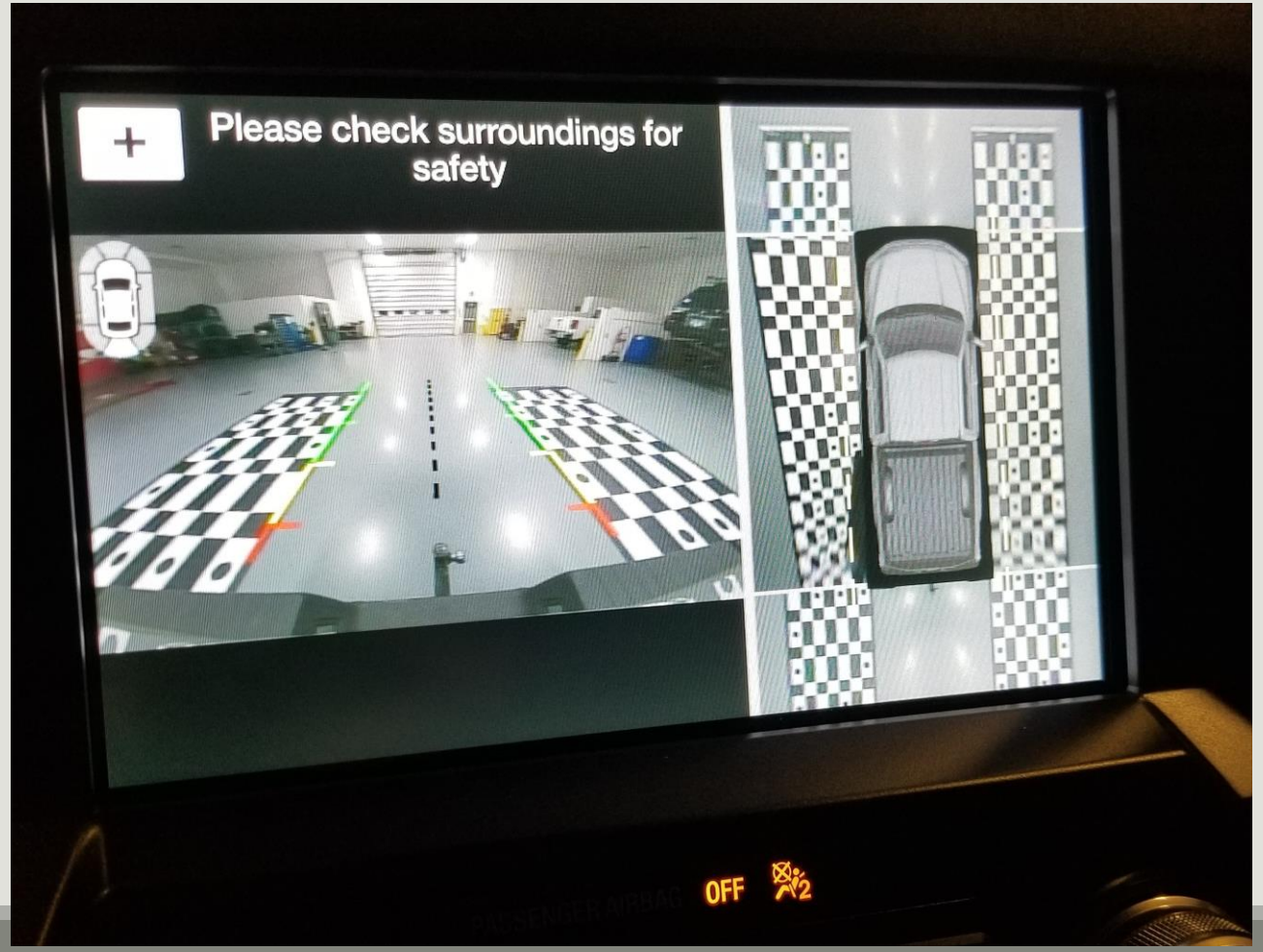
Some even key in diagnostic mode

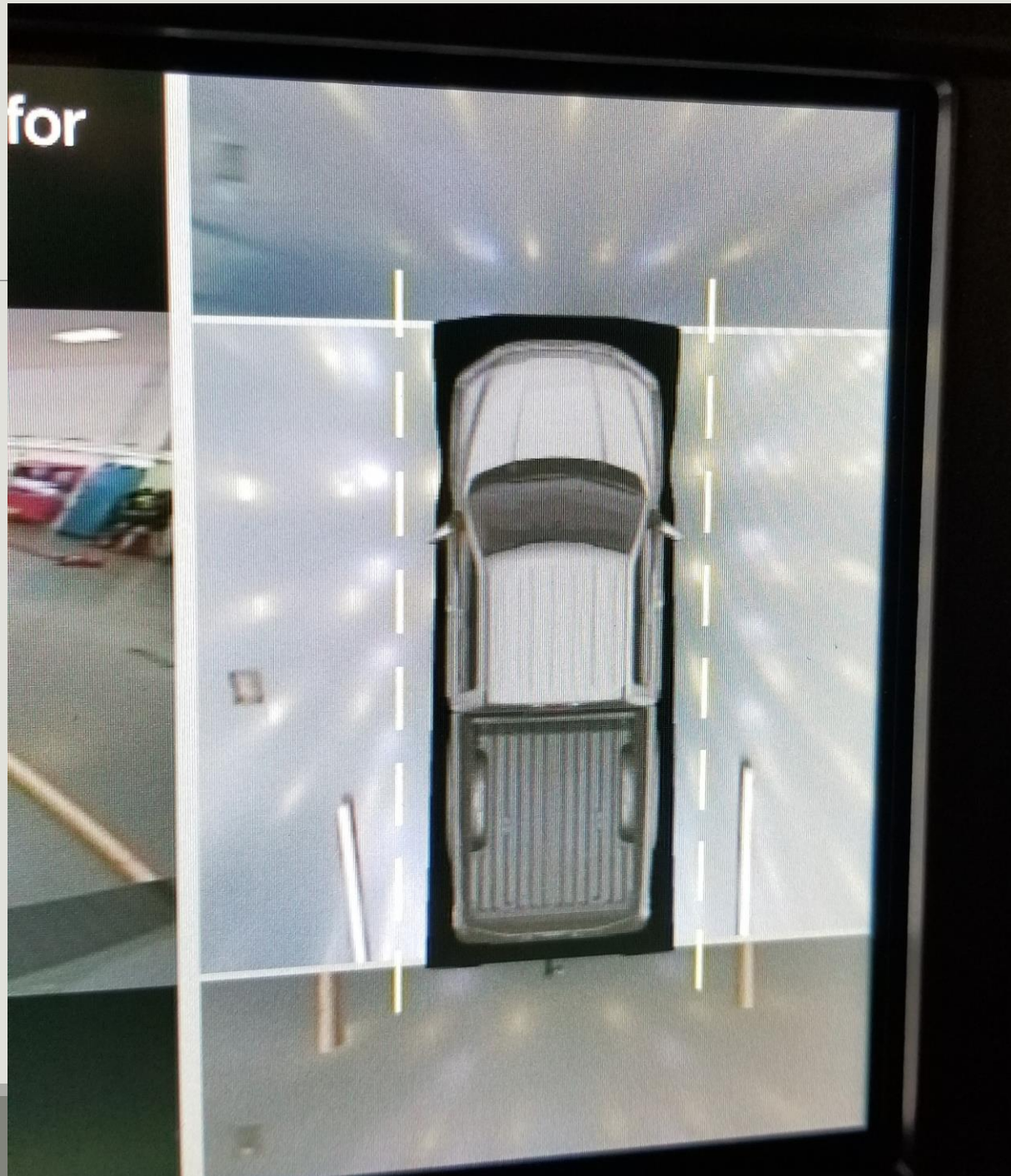
- Drain battery

Tesla alignments

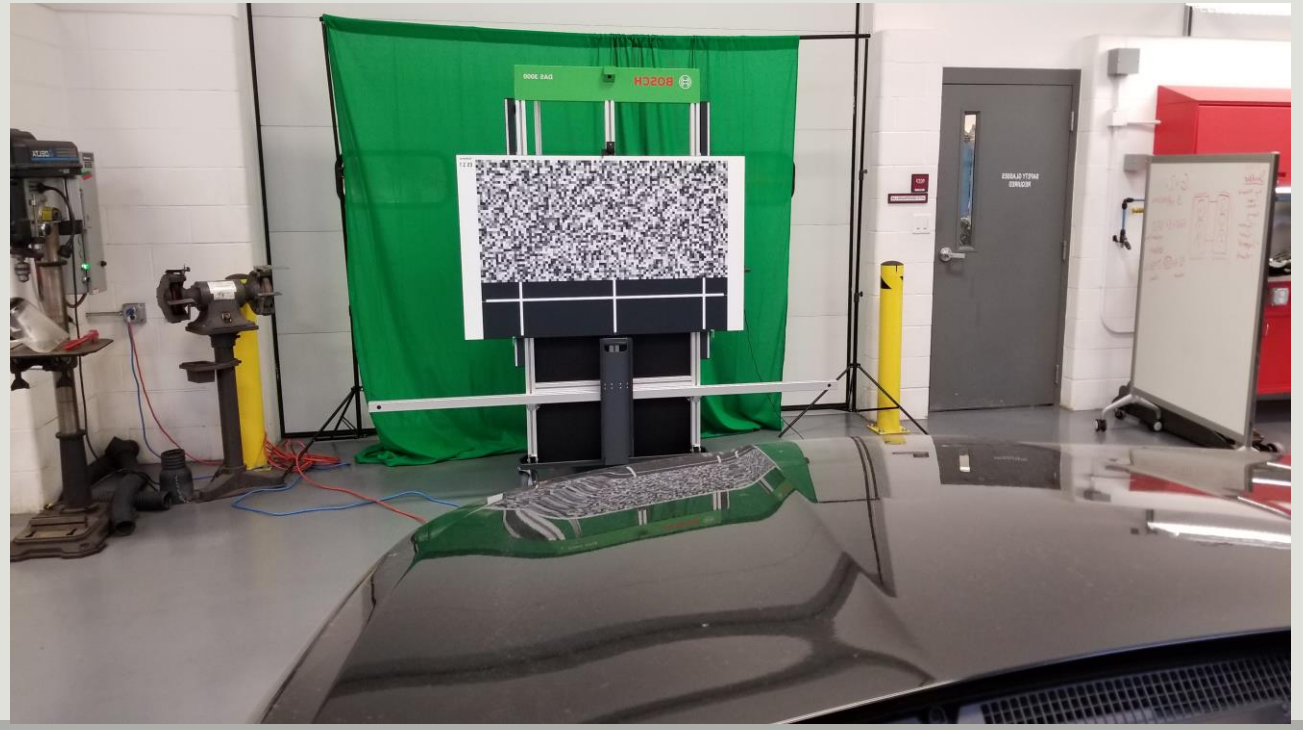
Use car wash mode to put in Neutral, for compensation

360 view test





Check surrounding/ background



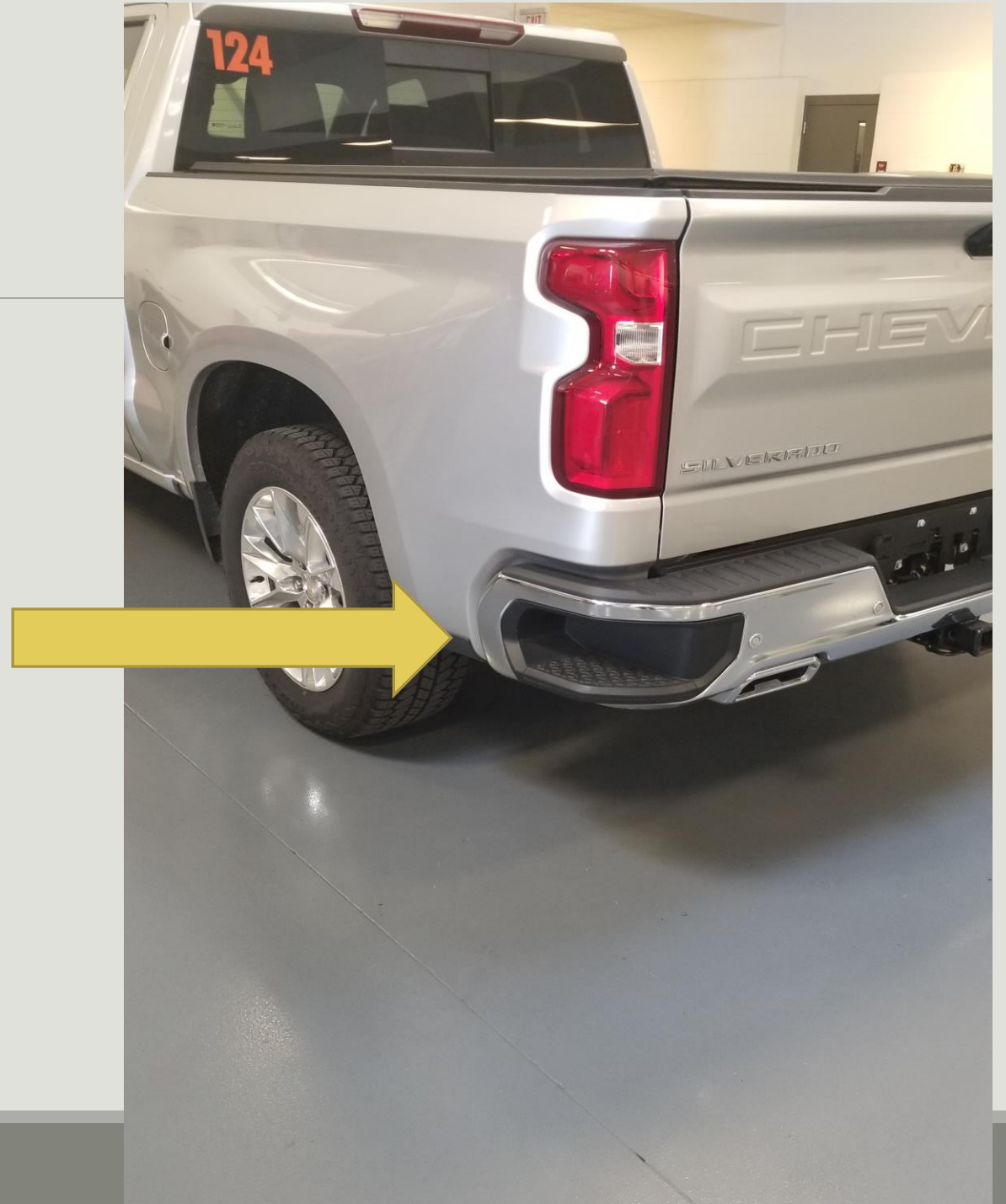
Surround camera test

Scope tool


PicoScope® Accessories
pico Technology
Parking Sensors Are Designed To Help Eliminate Damage,
Our New Signal Detector Measures If They're Operating Properly.
Used with a PicoScope® automotive oscilloscope, quickly test the signal strength of ultrasonic parking sensors or identify potential obstructions from aftermarket accessories like tow bars or lights.
aeswave .com
Click Here For More Information

Ford BLISS Brake light itegrated safety system

Gm radar is step side bumpers



Questions ??

Contact information:

Kent Meckfessel

Southern Illinois University Carbondale, School of Automotive

Automotive.siu.edu

Kmeckfessel@siu.edu