BISC VTOC- ADAS

June 25, 2020

An Overview

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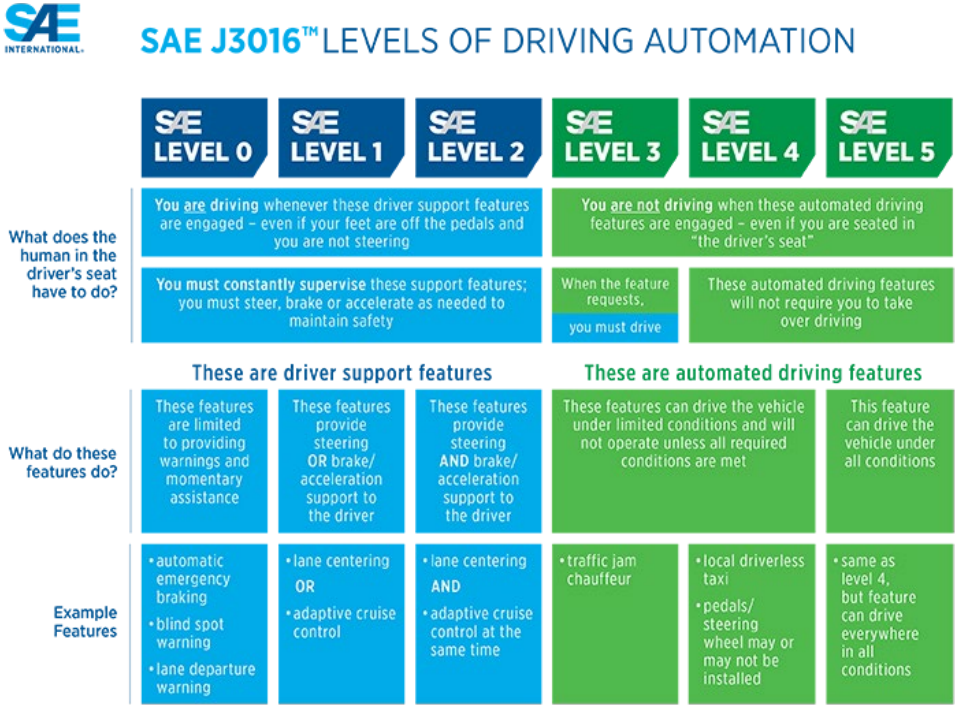
- There are many organizations involved and terms being used in the automotive and commercial vehicle space around ADAS (Advanced Driver Assistance Systems) & ADS (Autonomous Driving).
- Some key organizations are:
  - SAE – Society of Automotive Engineers
  - DOT – Department of Transportation
  - NHTSA – National Highway Traffic Safety Administration
  - FMVSS – Federal Motor Vehicle Safety Standards
  - FMCSA – Federal Motor Carrier Safety Administration
  - ISO – International Standards Organization
  - IEEE – Institute of Electrical & Electronics Engineers

SAE Automation Levels



- SAE defines driving automation into 6 levels
- Levels 0, 1, & 2 are support features (you are driving)
- Levels 3, 4, & 5 are automated driving features (you are NOT driving)
- Level 5 is FULL AUTONOMY at all times (NO DRIVER)

Reference: SAE J3016 Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles

SAE Automation Levels

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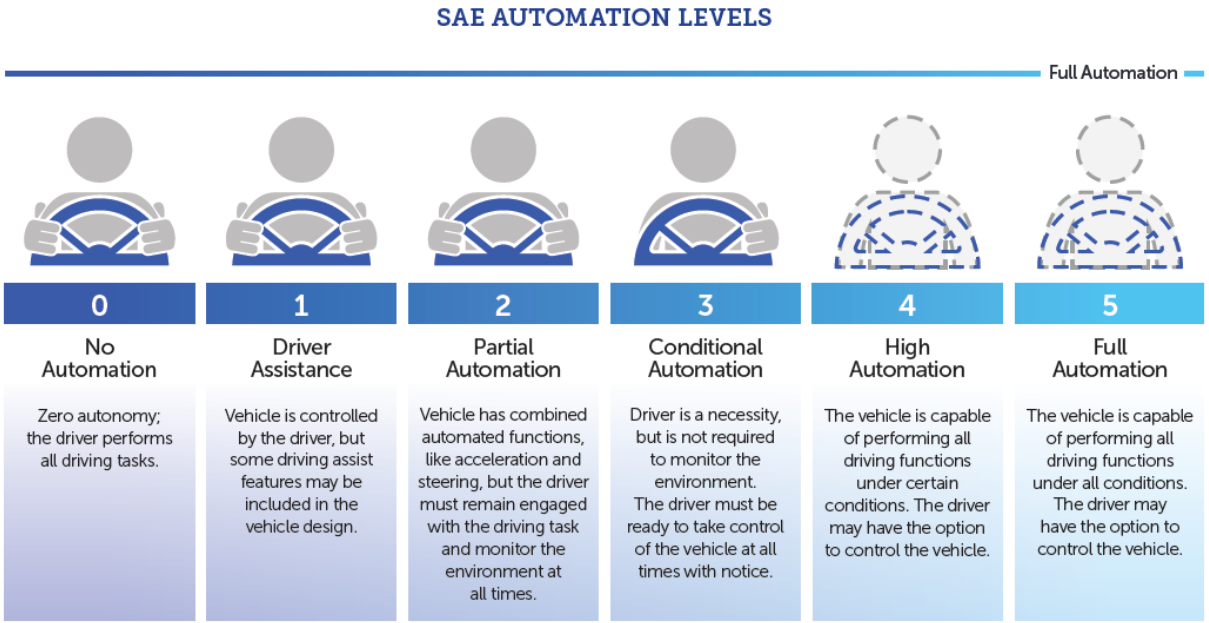

REFERENCE: https://www.nhtsa.gov/technology-innovation/automated-vehicles-safety

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Safety & ADAS: The Big Picture

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Source: BOSCH

An Effective ADAS Strategy is Complex Interaction Between Vehicle Systems

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ADAS – Systems Available

- Cruise Control
- ABS (Anti Lock Braking)
- Electronic Stability Control (ESC)
  - Standard on OTRBs (Motor Coaches) as of June 2018
- Tire Pressure Monitoring (TPMS)
- Digital Wheel End Sensing (DWES)
- Side View Camera System
- 360 Degree Camera System
- Bendix Wingman Fusion – MCI J-Model
  - Superseded Wingman Advanced

ADAS – Bendix Wingman Fusion

- The MCI J Model updated its Bendix collision mitigation system option as of MY2019
  - The Wingman Fusion collision mitigation system includes a windshield mounted, forward facing camera in addition to the front bumper mounted radar unit already included with the Wingman Advanced option.
  - The added camera utilizes object recognition software to further identify vehicles, lane markings, road signs and other objects.

Bendix Wingman Fusion System

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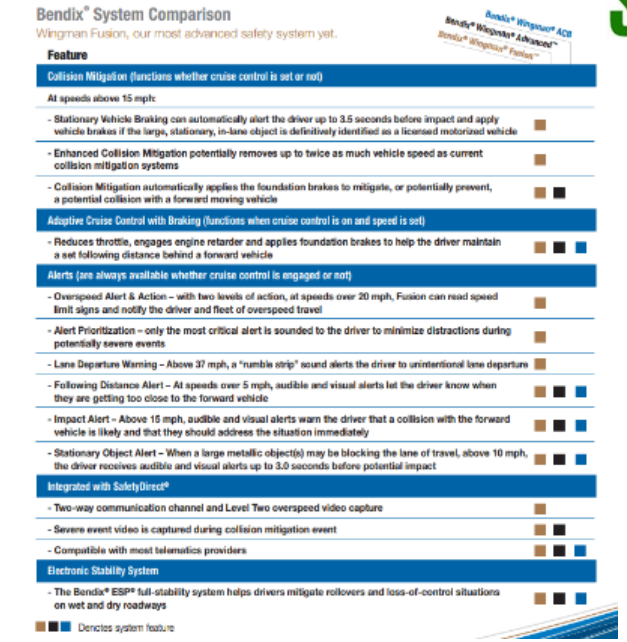
What it is / what it does

- Latest generation Adaptive Cruise / Collision Mitigation system from Bendix.
- Integrates a forward facing camera with vehicle recognition software.

Why do the project / benefits

- Provides enhanced system functionality over the existing Bendix Wingman Advanced system option:
  - Following Distance Alerts (FDA)
  - Stationary Object Alert
  - Adaptive Cruise Control with Braking (ACB)
  - Collision Mitigation (CMT)
  - Stationary Vehicle Braking (SVB), **NEW**
  - Lane Departure Warning (LDW), **NEW**
  - Traffic Sign Recognition (TSR), **NEW**

Available Model Year 2019 (Q3/18)

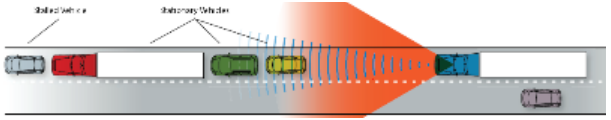


Bendix® System Comparison

Wingman Fusion, our most advanced safety system yet.

Feature	Bendix® Wingman® ACB	Bendix® Wingman® Advanced™	Bendix® Wingman® Fusion™
Collision Mitigation (functions whether cruise control is set or not)			
At speeds above 15 mph:			
- Stationary Vehicle Braking can automatically alert the driver up to 3.5 seconds before impact and apply vehicle brakes if the large, stationary, in-lane object is definitively identified as a licensed motorized vehicle	■	■	■
- Enhanced Collision Mitigation potentially removes up to twice as much vehicle speed as current collision mitigation systems	■	■	■
- Collision Mitigation automatically applies the foundation brakes to mitigate, or potentially prevent, a potential collision with a forward moving vehicle	■	■	■
Adaptive Cruise Control with Braking (functions when cruise control is on and speed is set)			
- Reduces throttle, engages engine retarder and applies foundation brakes to help the driver maintain a set following distance behind a forward vehicle	■	■	■
Alerts (are always available whether cruise control is engaged or not)			
- Overspeed Alert & Action – with two levels of action, at speeds over 20 mph, Fusion can read speed limit signs and notify the driver and fleet of overspeed travel	■	■	■
- Alert Prioritization – only the most critical alert is sounded to the driver to minimize distractions during potentially severe events	■	■	■
- Lane Departure Warning – Above 37 mph, a "rumble strip" sound alerts the driver to unintentional lane departure	■	■	■
- Following Distance Alert – At speeds over 5 mph, audible and visual alerts let the driver know when they are getting too close to the forward vehicle	■	■	■
- Impact Alert – Above 15 mph, audible and visual alerts warn the driver that a collision with the forward vehicle is likely and that they should address the situation immediately	■	■	■
- Stationary Object Alert – When a large metallic object(s) may be blocking the lane of travel, above 10 mph, the driver receives audible and visual alerts up to 3.0 seconds before potential impact	■	■	■
Integrated with SafetyDirect®			
- Two-way communication channel and Level Two overspeed video capture	■	■	■
- Severe event video is captured during collision mitigation event	■	■	■
- Compatible with most telematics providers	■	■	■
Electronic Stability System			
- The Bendix® ESP® full-stability system helps drivers mitigate rollovers and loss-of-control situations on wet and dry roadways	■	■	■

■ Denotes system feature



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Bendix Wingman Fusion – System Functionality

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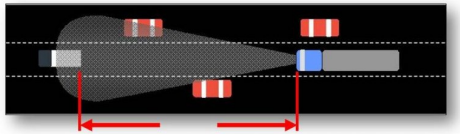
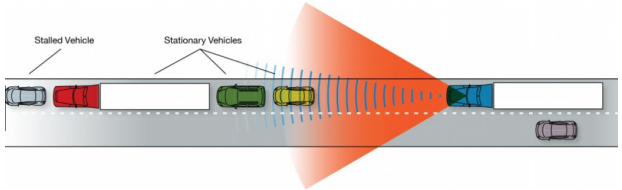
The previous "Wingman Advance" option provides system functionality as follows:

- Following Distance Alerts (FDA)
- Stationary Object Alert (SOA)
- Adaptive Cruise Control with Braking (ACB)
- Collision Mitigation (CMT)



The current "Wingman Fusion" option adds further system functionality as follows:

- Stationary Vehicle Braking (SVB)
- Lane Departure Warning (LDW)
- Traffic Sign Recognition (TSR)



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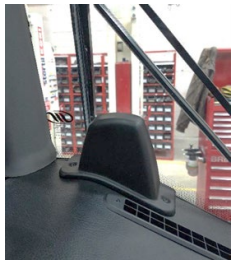
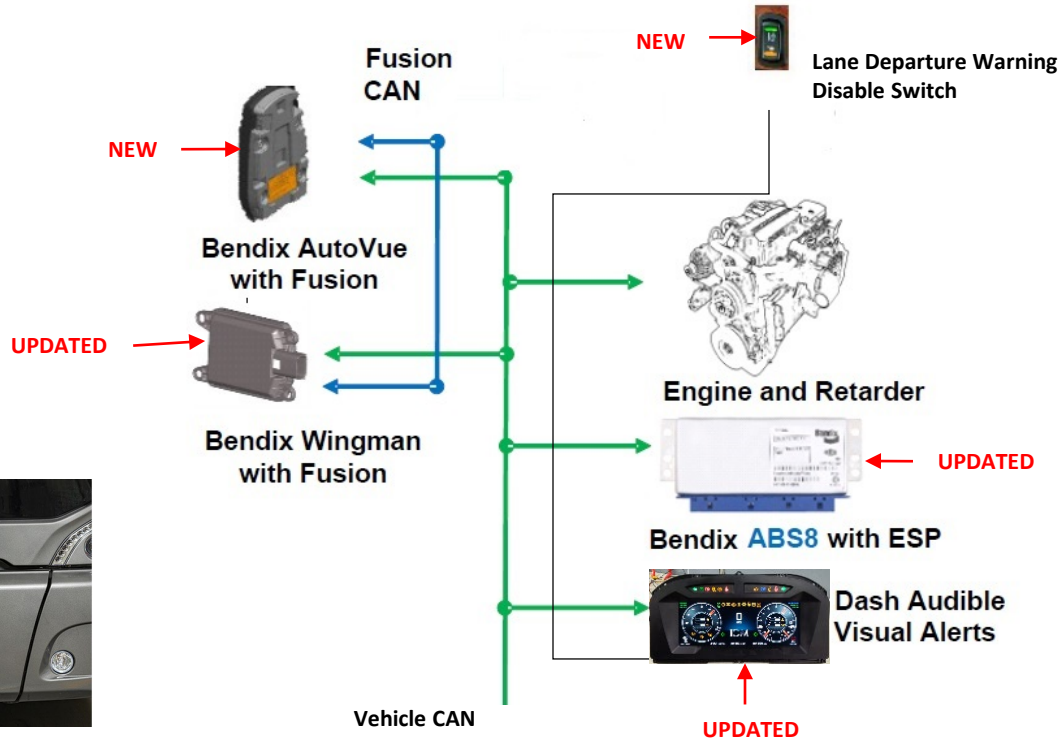
Bendix Wingman Fusion - New Features

- **Stationary Vehicle Braking (SVB)**
  - Wingman Advanced uses forward facing radar to identify large metal objects. The system interprets these objects as vehicles only if these objects are moving in the same direction as the coach. Wingman Advanced will not intervene and apply braking on a stationary object.
  - With Wingman Fusion, the camera recognition software is able to discern between different types of objects. If Fusion's radar is tracking a large metallic object, and that object "looks" like a vehicle to the camera recognition software, then Fusion will apply braking – even if the object in not in motion. This is "Stationary Vehicle Braking".
- **Lane Departure Warning (LDW)**
  - Fusion's camera recognition software is able to discern vehicle lane markers. If a vehicle drifts over a lane marker, then a lane departure warning will be displayed in the instrument panel.
  - A system disable switch is located on the driver's LH console.
- **Traffic Sign Recognition (TSR)**
  - Fusion's camera recognition software is able to identify common road signs, such as speed limit signs.
  - If Fusion "sees" a speed limit sign and the coach is exceeding that speed limit, then an over speed warning will be displayed in the instrument panel. However, the system will not take action to slow the coach down.

Bendix Wingman Fusion - System Overview





Bendix Wingman Fusion - Summary

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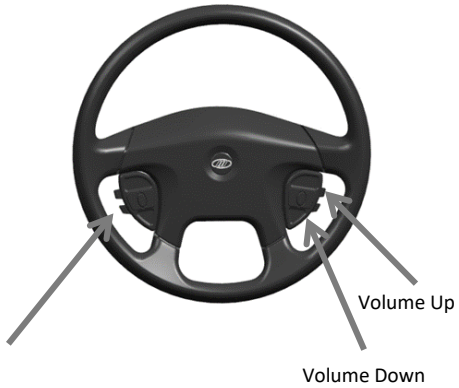
Key Changes & Benefits of Wingman Fusion vs Wingman Advanced:

- Lane Departure Warning functionality, including a switch to disable the system temporarily when required (for example when driving through road construction).
- Traffic Sign Recognition functionality.
- Stationary Object Braking functionality.
  - If a stationary object is interpreted to be a vehicle, then the coach will intervene to activate the brakes if the driver does not take action.
- Instrument panel updates: system volume control, more intuitive following distance settings, lane departure visual warnings, over-speed warnings, better overall integration with driving screens.



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Reference Materials

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- Visit www.mcicoach.com
- Visit the MCI Coach LMS https://training.mcicoach.net/
- Visit NHTSA https://www.nhtsa.gov/technology-innovation/automated-vehicles-safety
- Visit Bendix https://www.bendix.com/en/products/wingman_fusion/standard_page_4.jsp

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