



Informal document **GRVA-07-23**  
7th GRVA, 21-25 Sept. 2020  
Agenda item 6 (d)

# UN-R79 Lane Keep Assist Hands-off

Proposal



# Lane-keep Assist Hands-off: Background and motivation



- **The informal group ACSF (16<sup>th</sup> session)**
  - decided to develop provisions for Automated Lane Keeping Systems, **ALKS** based on the assumption that such systems are already **Level 3-4** according to the SAE classification.
  - invited industry to start directly with GRVA the discussion on what needs to be **changed /added to ECE-R79** to allow for **Hands-Off/ Eyes On** Lane Keeping Systems under a **SAE Level 1-2** assumption.
- Level 2 hands-off systems lane keeping systems from various manufacturers have been successfully introduced in US, China and Japan and industry is seeking to amend UN-R79 to be able to certify these features as well in UN-R79 territories
- Motivation to increase the comfort of the driver, with positive effect on safety
- Allows both drivers and manufacturers a stepwise introduction to higher levels of assistance, while being affordable for a wider audience



Source: <https://www.cadillac.com/world-of-cadillac/innovation/super-cruise>

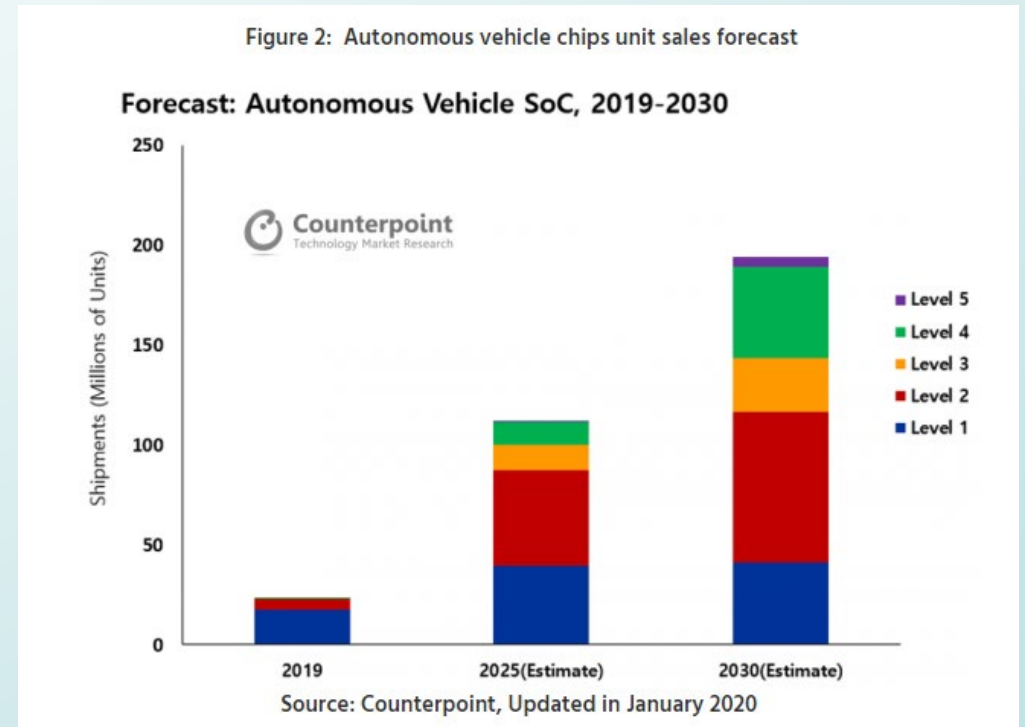
Industry aims to understand the principles under which such technology seems acceptable as a driver assistance system



## Driver assistance systems will remain important to contribute to safety

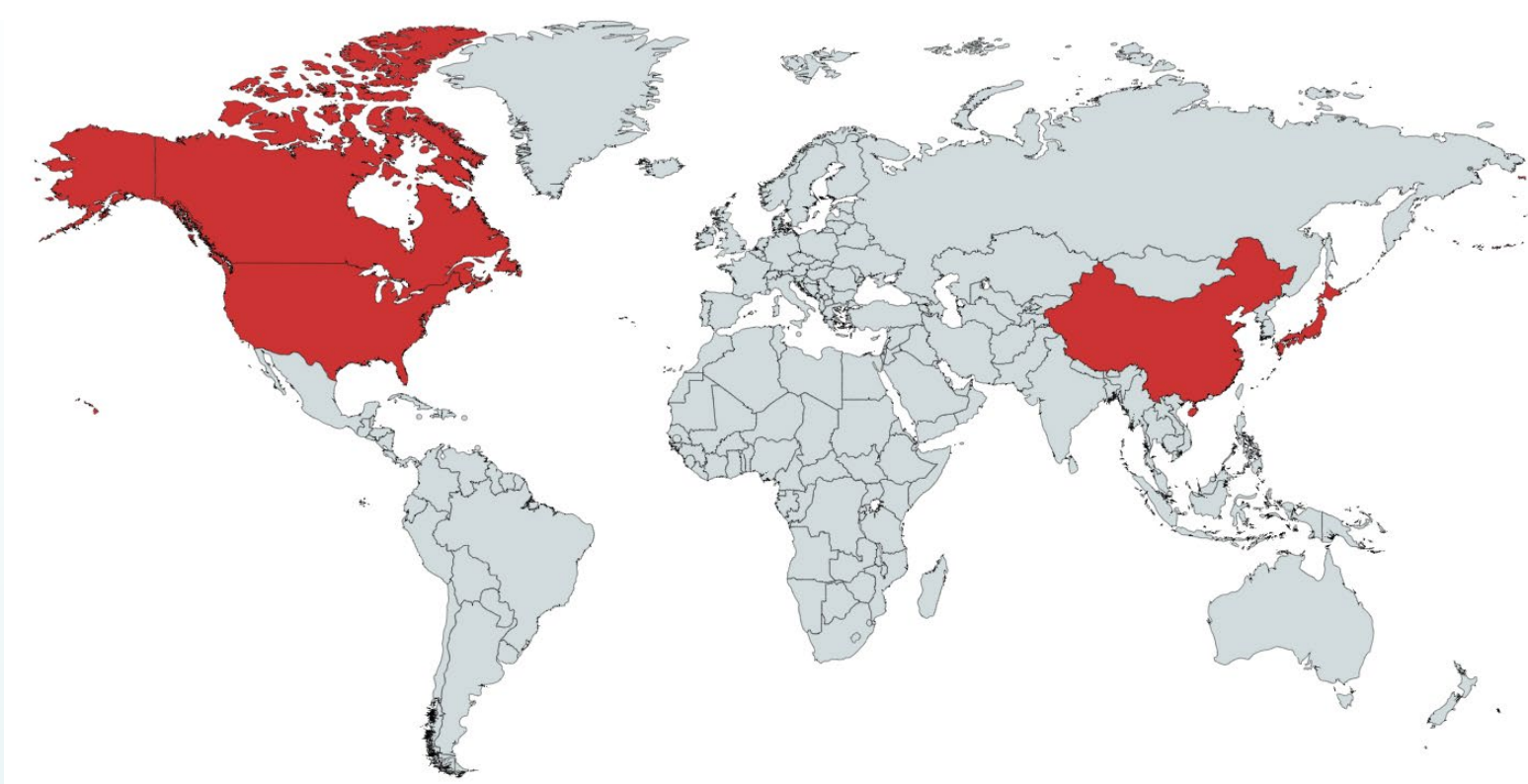
- ❑ Driver assistance systems will keep a major role to contribute to safety in the next 10 years due to the wide expansion into market and further technology progress
- ❑ Level 3-4 systems will have restricted ODD and driver assistance will contribute to safety outside of ODD
- ❑ Drivers should be able to get the level of assistance or automation they feel comfortable with, including level 1-2

Figure 2: Autonomous vehicle chips unit sales forecast





# Hands-off lane keeping systems introduction in the market



## Introduction:

US: 2018  
Canada: 2018  
China: 2018  
Japan: 2019

Hands-off lanekeeping system are provided by several manufacturers in several large markets since 2018



# Proposal and Comparison with current ACSF B1



	<b>ACSF B1 “hands-on” Entry into force: 2017</b>	<b>ACSF B1 “hands-off” Industry proposal</b>
Category		Driver assistance systems Lane keeping assist Motion Control by system OEDR: Driver
ODD restriction		Only highway
Driver confirmation	Hands-on confirmation + Warning escalation	Eyes/head-on confirmation* + Warning escalation <i>*Driver Monitoring system</i>
Max lateral acceleration	3 m/s <sup>2</sup>	3 m/s <sup>2</sup>
Additional requirements		<ul style="list-style-type: none"><li>• AEBS</li><li>• Auto slowdown in lane if no driver reaction</li><li>• Hands-on request &amp; acoustic warning in case of system failure</li></ul>

Lane-Keep Assist Hands-Off systems are driver assistance systems which allow hands-off when drivers eyes/head direction to road is confirmed, only on highways and with vehicle equipped with additional features.



# Driver Monitoring System as key safety technology enabling hands-off

- ❑ Industry is aware of possible issues of driver over-reliance
- ❑ A Driver Monitoring System, ensuring the driver is directing eyes/head to the road, addresses these concerns

## System operation



eyes/head on detection

- ❑ required for system continuation
- ❑ driver can put hands-off the wheel



- ❑ Eyes/head-on warning after few [x] seconds continuous eyes/head off detection
- ❑ Eyes/head-on warning after cumulative eyes-off threshold



if no positive confirmation of eyes/head-on : warning escalation



if no reaction: auto slowdown in lane

In case of system failure: hands-on request + acoustic warning



## Comments regarding safety of hands-off lanekeeping



- The objective of the proposal is to introduce an alternative means to the hands-on detection for preventing driver's over-reliance during the assisted lane keeping operation. The fact that the driver can remove his/her hands from the steering wheel is compensated by ensuring that the driver is directing his eyes/head to the road. Both principles equivalently support the driver in his/her driving task of continuously monitoring the behavior of the system and the driving environment and to intervene appropriately when required.
- Additionally, industry has been developing specific HMI concepts to avoid over-reliance, inform driver about his/her role and is open to exchange further ideas. NHTSA already investigated in detail suitable HMI for hands-off lanekeeping systems
- Due to the driver monitoring system and appropriate HMI, industry does not see risk for mode confusion, as the driver is reminded about his task to watch the road (differently from level 3 systems)
- Various systems have been introduced in US, Canada, China and Japan since 2018. They have received positive feedback from customers, and have built a good reputation for safety. Customers perceive it as a useful intermediate solution for future higher degrees of automation. Industry is open to discuss the proposed safety concept and welcomes any proposals and further ideas



## Proposal how to amend UN-ECE R79

	UN-R79/02 ACSF B1 Entry into force: 2017	<b>Lane-Keep Assist-Hands Off Proposal</b>
Type of roads	Not limited	<b>Limited to highways, detected by system</b>
Driver confirmation	Trough hands-on monitoring and warning escalation	<b>Trough driver monitoring system (head/eyes to road etc) and warning escalation</b>
Activation	By driver, when considered useful	<b>By driver, when considered useful</b>
Other requirements (incl. longitudinal control)	/	<input type="checkbox"/> <b><i>If no reaction from driver to warnings: Automatic slowdown in lane</i></b> <input type="checkbox"/> <b><i>AEBS</i></b>
Lateral limitation	MAX 3 m/s <sup>2</sup>	<b>MAX 3 m/s<sup>2</sup></b>



In case all these conditions are fulfilled, ACSF B1 hands-off warnings can be suppressed.  
Target is to introduce this possibility in UN-R79 ACSF B1  
Manufacturers to provide detailed safety aspect description trough Annex VI





**Back-up**



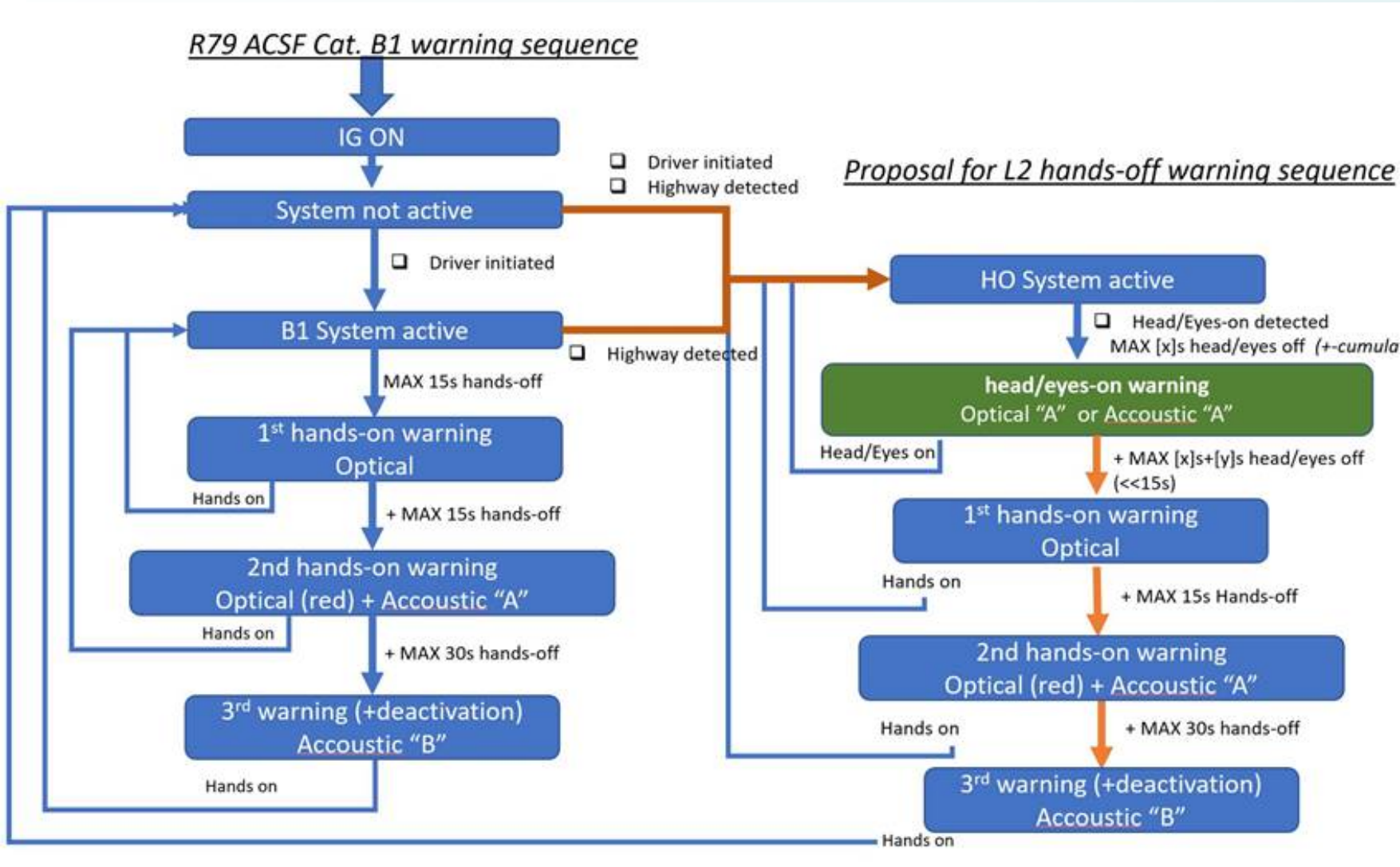
# Proposal and Comparison with current ACSF B1 and ALKS



	<b>ACSF B1 “hands-on” Entry into force: 2017</b>	<b>ACSF B1 “hands-off” Industry proposal</b>	<b>UN-R 157 ALKS Entry into force: 2020</b>
Category	Driver assistance systems Lane keeping assist Motion Control by system OEDR by Driver		Automated driving system Motion control & OEDR by system
ODD restriction		Only highway	Only highway & declared ODD
Driver confirmation	Hands-on confirmation + Warning escalation	Eyes-on confirmation* + Warning escalation * <i>Driver monitoring system</i>	Availability for take-over Override intention
Control requirements	Lateral		Lateral + Longitudinal
Additional requirements Vs. B1		AEBS  Auto slowdown in lane if no driver reaction  Direct hands-on request & acoustic warning in case of system failure	(see R157)



# Warning sequence vs current B1





## Studies related to hands-off driving



- 2019 MIT study on Functional Vigilance in Real-World Human-Machine collaboration (<https://hcai.mit.edu/tesla-autopilot-human-side.pdf>)
- 2016 Study by RWTH Aachen, sponsored by VDA (FAT) and BASt, on Drivers' management of sudden take-over situations after partly automated, hands-off driving
- <https://www.vda.de/de/services/Publikationen/fat-schriftenreihe-289.html>
- 2015-2018 NHTSA studies on Human Factors Evaluation & Guidance of Level 2 and Level 3 Automated Driving Concepts
  - [https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/812182\\_humanfactorseval-l2l3-automdrivingconcepts.pdf](https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/812182_humanfactorseval-l2l3-automdrivingconcepts.pdf)
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