NHTSA RFC: NCAP

Docket # NHTSA-2021-0002-0001

QUESTIONS ADDRESSED BY VAYYAR

(8) Should NHTSA consider adding Euro NCAP's road edge detection test to its NCAP program to begin addressing crashes where lane markings may not be present? If not, why? If so, should the test be added for LDW, LKS, or both technologies?

- [Vayyar] It is highly advisable to monitor unmarked road edges and in some conditions, radars can be used to detect them.

(9) The LKS and "Road Edge" recovery tests defined in the Euro NCAP LSS protocol specify that a range of lateral velocities from 0.2 to 0.5 m/s (0.7 to 1.6 ft./s) be used to assess system performance, and that this range is representative of the lateral velocities associated with unintended lane departures (i.e., not an intended lane change). However, in the same protocol, Euro NCAP also specifies a range of lateral velocities from 0.3 to 0.6 m/s (1.0 to 2.0 ft./s) be used to represent unintended lane departures during "Emergency Lane Keeping—Oncoming vehicle" and "Emergency Lane Keeping—Overtaking vehicle" tests. To encourage the most robust LKS system performance, should NHTSA consider a combination of the two Euro NCAP unintended departure ranges, lateral velocities from 0.2 to 0.6 m/s (0.7 to 2.0 ft./s), for inclusion in the Agency's LKS evaluation? Why or why not?

- [Vayyar] When assessing all lane-safety features we recommend that NHTSA consider the surroundings of the vehicle, such as other cars/empty road, to maintain the right balance between passive alerts and active interventions.

(16) Should all BSW testing be conducted without the turn signal indicator activated? Why or why not? If the Agency was to modify the BSW test procedure to stipulate activation of the turn signal indicator, should the test vehicle be required to provide an audible or haptic warning that another vehicle is in its blind zone, or is a visual warning sufficient? If a visual warning is sufficient, should it continually flash, at a minimum, to provide a distinction from the blind spot status when the turn signal is not in use? Why or why not?

- [Vayyar] Yes, BSW testing should be conducted without the turn signal indicator activated, to reflect human driving behavior. The agency should align the test procedure to the following principle: If there is no turn signal activated and no sign of a steering wheel turning, the alert should be visual. If there is clear intent to change lanes, the alert should be haptic or audible.

(19) The Agency recognizes that the BSW test procedure currently contains two test scenarios that have multiple test conditions (e.g., test speeds and POV approach directions (left and right side of the SV)). Is it necessary for the Agency to perform all test scenarios and test conditions to address the real-world safety problem adequately, or could it test only certain scenarios or conditions to minimize test burden in NCAP? For instance, should the Agency consider incorporating only the most challenging test

conditions into NCAP, such as the ones with the greatest speed differential, or choose to perform the test conditions having the lowest and highest speeds? Should the Agency consider only performing the test conditions where the POV passes by the SV on the left side if the vehicle manufacturer provides test data to assure the left side pass-by tests are also representative of system performance during right side pass-by tests? Why or why not?

- [Vayyar] We advise also evaluating scenarios in which the target is stationary or moving at very low speed, to cover all real-world eventualities. We feel this should also include targets such as fences, parked cars, trees, etc. for false alert testing.

(20) Given the Agency's concern about the amount of system performance testing under consideration in this RFC, it seeks input on whether to include a BSI false positive test. Is a false positive assessment needed to insure system robustness and high customer satisfaction? Why or why not?

- [Vayyar] One of the critical parameters for a user to rely fully on the system is to ensure a low false-alert rate (false-positive). A high false-positive rate will significantly decrease the reliability and efficiency of the system. For BSI, false-positive testing is critical, including in scenarios where the vehicle passes by static objects (fences, parked cars, trees, etc.). Otherwise, vehicles may be equipped with solutions that mistakenly intervene, impacting driver experience and, to an extent, safety.

(25) Given that a large portion of pedestrian fatalities and injuries occur under dark lighting conditions, the Agency has proposed to perform testing for the included test conditions (i.e., S1 a-e and S4 a-c) under dark lighting conditions (i.e., nighttime) in addition to daylight test conditions for test speed range 10 kph (6.2 mph) to 60 kph (37.3 mph). NHTSA proposes that a vehicle's lower beams would provide the source of light during the nighttime assessments. However, if the SV is equipped with advanced lighting systems such as semiautomatic headlamp beam switching and/or adaptive driving beam head lighting system, they shall be enabled during the nighttime PAEB assessment. Is this testing approach appropriate? Why or why not? Should the Agency conduct PAEB evaluation tests with only the vehicle's lower beams and disable or not use any other advanced lighting systems?

- [Vayyar] The Agency should incorporate advanced lighting systems into nighttime scenarios to assess their functionality as well.

(26) Should the Agency consider performing PAEB testing under dark conditions with a vehicle's upper beams as a light source? If yes, should this lighting condition be assessed in addition to the proposed dark test condition, which would utilize only a vehicle's lower beams along with any advanced lighting system enabled, or in lieu of the proposed dark testing condition? Should the Agency also evaluate PAEB performance in dark lighting conditions with overhead lights? Why or why not? What test scenarios,

conditions, and speed(s) are appropriate for nighttime (i.e., dark lighting conditions) testing in NCAP, and why?

- [Vayyar] For nighttime testing, we also recommend a test with no headlights at all. This would enable the Agency to assess how well ADAS sensors for PAEB work in low light/total darkness conditions.

(33) In addition to tests performed under daylight conditions, the Agency is proposing to evaluate the performance of PAEB systems during nighttime conditions where a large percentage of real-world pedestrian fatalities occur. Are there other technologies and information available to the public that the Agency can evaluate under nighttime conditions?

- [Vayyar] Yes. 4D imaging radar is agnostic to light and weather conditions, providing robust monitoring of vehicle surroundings at all times. It identifies both static and moving targets within a range of up to 140m. With its high imaging resolution, this technology can easily detect pedestrians, scooters and cyclists. For more information about evaluating 4D imaging radar, please contact Vayyar VP and Head of Automotive, Ian Podkamien, at ian.podkamien@vayyar.com

(34) Are there other safety areas that NHTSA should consider as part of this or a future upgrade for pedestrian protection?

- [Vayyar] We would recommend considering parking space entry/exit scenarios within parking lots as an additional measure for pedestrian protection.

(36) Considering not only the increasing number of cyclists killed on U.S. roads but also the limitations of current AEB systems in detecting cyclists, the Agency seeks comment on the appropriate timeframe for adding a cyclist component to NCAP and requests from vehicle manufacturers information on any currently available models that have the capability to validate the cyclist target and test procedures used by Euro NCAP to support evaluation for a future NCAP program upgrade.

- [Vayyar] Yes, bicycles should be evaluated (in daylight and nighttime conditions) as a matter of urgency. Since 2018, Euro NCAP has assessed and awarded points for cyclist-oriented AEB, even increasing the points awarded for this scenario since following its introduction.

(43) As fused camera-radar forward-looking sensors are becoming more prevalent in the vehicle fleet, and the Agency has not observed any instances of false positive test failures during any of its CIB or DBS testing, is it appropriate to remove the false positive STP assessments from NCAP's AEB (i.e., CIB and DBS) evaluation matrix in this NCAP update? Why or why not?

- [Vayyar] We would not recommend removing the false-positive STP assessments because this will lead to the developments of suboptimal technologies and an increase in false positives.

(84) If NHTSA considers this technology for inclusion in NCAP, are door logic solutions sufficient? Should NHTSA only consider systems that detect the presence of a child?

- [Vayyar] Door logic is absolutely insufficient for numerous reasons:
    - It is inconclusive and difficult to verify
    - It doesn't have any knowledge about whether occupants are children or adults
    - During the drive, intermediate stops may occur, and the logic will be reset

- NHTSA should consider solutions that are based on the direct sensing of a child, specifically. Since door logic doesn't offer differentiation between a child and an adult, it would trigger an alarm even when an adult is left in the car, creating countless false alarms, which users will undoubtedly ignore after a time. A better user experience will lead to increased OEM uptake and consumer satisfaction.

- The Euro NCAP protocol (from 2023 onward) assesses Child Presence Detection (CPD) quite sufficiently and OEMs are already embedding sensors in vehicles globally. If NHTSA will adopt the same protocol for the US NCAP, OEMs will have a uniform, global standard they can comply with. This will decrease industry resistance to new regulation, reduce overall costs for safety and enable faster deployment within the US, as Euro NCAP-compliant solutions will already be in vehicles starting in 2023.

- CPD alerting systems should also be able to act fast: within 20 seconds to ensure the driver is close enough to get the audible alarm, followed by a secondary alarm that connect over cellular/vehicle app to the driver, and escalates to 911 within a few minutes if no door is opened.

(85) What research data exists to substantiate differences in effectiveness of these system types?

- [Vayyar] Euro NCAP has conducted substantial research on the differences between systems, leading them to take the decision to only award full points to solutions that enable direct sensing. Vayyar has full access to that research and is happy to provide it upon request.

(86) Are there specific protocols that should be considered when evaluating these in-vehicle rear seat child reminder systems?

- [Vayyar] Euro NCAP [2] and ASEAN NCAP have a well-defined CPD protocol.

- Vayyar recommends solutions that don't just rely on rear seats, as children have died even in vehicles with rear occupant detection systems [1]. Beyond this, we recommend solutions that monitor the entire cabin, since in some cases a child may be seated in the front. According to Kids and Cars [3], 26% of 'hot-car' deaths have also occurred as a result of children getting into parked cars they can't get out of. This is a scenario that rear seat reminder systems can't fully cover.

- EURO NCAP's 'Scenario 3' in the CPD protocol deals with the parked vehicle scenario: a child entering a locked vehicle and getting locked inside. These incidents aren't specific to a certain row in the vehicle, so our recommendation is that NHTSA define:
    - The full cabin (all rows)
    - Seats and footwells
    - Child/adult classification

- We would also recommend adding escalating intervention to the protocol, beyond detection and alerting. Cars should be scored on their active lifesaving capabilities within the scenarios, such as (a) unlocking doors (b) opening the windows (c) turn the AC on, etc.

(87) What information is known or anticipated with respect to consumer acceptance of integrated rear seat child reminder systems in vehicles? What consumer interest or feedback data exist on this topic?

- [Vayyar] Vayyar conducted a consumer survey with 2500 participants globally to assess the response to different aspects of in-cabin safety. The survey results can be downloaded here.

- We see that consumers want better in-cabin safety, specifically in the domain of Child Presence Detection. If sensing technology doesn't affect vehicle aesthetics, doesn't intrude on privacy, and avoids false alarms, consumers will be highly receptive to it. And the solution's presence will only be felt in the rare cases where it must operate.