

# **MOBIS ADB Technologies** and **Its Application Towards Safety**

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Soo Im

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DVN US Workshop

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# TRENDS

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Lighting Technology with Sensors  
MOBIS ADB Technology  
Regulations

TRENDS

# Lighting Technology

**Full LED in U.S.**  
Cadillac Escalade



**LED Swivel ADB**  
BMW 7



**First Laser**  
BMW i8



**First DMD**  
Maybach S



2007

2011

2014

2018

2020?



**First LED Low Beam**  
Lexus LS600h



**LED AFS**  
Mercedes CLS



**LED Matrix ADB**  
Audi A8



**LED Multibeam ADB**  
Mercedes CLS

*First LED ADB in U.S.*

TRENDS

# Lighting Technology with Sensors

Steering wheel

Navigation

Radar / Lidar

Full LED in U.S.  
Cadillac Escalade



LED Swivel ADB  
BMW 7



First Laser  
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LED Multibeam ADB  
Mercedes CLS

First LED ADB in U.S.

Forward Camera



TRENDS

# Lighting Technology with Sensors



**16-Pixel ADB**

Opel Insignia, 2017



**32-Pixel ADB**

Audi A8, 2017



**84-Pixel ADB**

Mercedes E, 2017



**24-Pixel ADB**

JLR Velar, 2017



**48+27-Pixel ADB**

VW Touareg, 2018



**1.3 Mega Pixel DMD**

Maybach S, 2018



**Lidar integrated headlight**

Koito, 2017



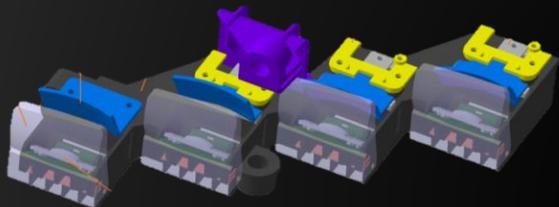
**Lidar & camera integrated headlight**

AL, 2018

# MOBIS ADB Technology

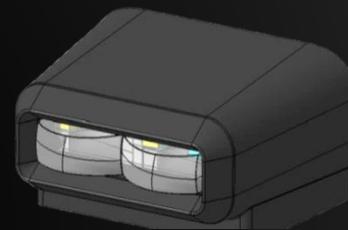
## ■ Multi-Reflector ADB

- **20** Segments
- Opening size  $w \times h$ : **45x35mm** (per reflector)



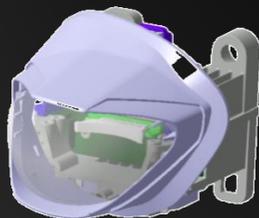
## ■ Slim Single Projection ADB

- **18** Segments
- Opening size  $w \times h$ : **100x20mm**



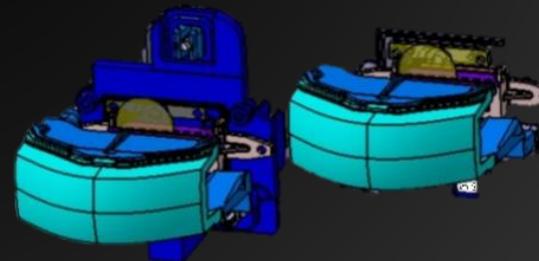
## ■ Bi-Matrix ADB Low & Matrix high beam

- **12** Segments
- Opening size  $w \times h$ : **80x55mm**



## ■ Slim Dual Projection ADB

- **12** Segments
- Opening size  $w \times h$ : **70x25mm** (per module)



# Regulation

- **ADB Vehicles are Everywhere** : Europe, Asia, Canada, But **NOT** in U.S.
  - Regulation needs to be **harmonized** regardless of region
  - **NHTSA** needs to consider ADB (R123 or SAE J3069)

## 16. Abstract

This report summarizes NHTSA's evaluation of existing European adaptive driving beam headlighting systems. "Adaptive Driving Beam" (ADB) is a type of adaptive front-lighting system that automatically enables upper beam headlamps and adapts their beam patterns to create a shaded area around oncoming and preceding vehicles to improve long-range visibility for the driver without causing discomfort, distraction, or glare to other road users. In recent years, Europe and Japan have begun to allow adaptive beam headlighting systems as optional equipment. Using Economic Commission for Europe (ECE) test procedure maneuver scenarios for ADB and glare limit values derived from current static beam pattern information in FMVSS No. 108, the amount of glare cast on other vehicles by ADB systems was assessed. Overall in these tests, ADB was shown to have the ability to dynamically adapt the headlamp beams to shade oncoming and preceding vehicles. However, in many cases, ADB illuminance levels exceeded that of

lower beam mode in the location of other vehicles. In particular, tested ADB systems exceeded derived lower beam glare limit values in curve scenarios involving both the ADB-equipped vehicle and other vehicle moving, and in intersection scenarios. Some ADB systems were also unable to control glare to lower beam levels in scenarios involving a motorcycle.

This effort was successful in objectively assessing the performance of European ADB headlighting systems. A comprehensive objective test procedure was achieved. The test procedure was developed based on driving scenarios from the ECE R48 test procedure and incorporated use of the glare limit values derived from existing static beam pattern requirements of FMVSS No. 108. Existing FMVSS No. 108 requirements and the work summarized here together can provide a basis for performance criteria and an objective test procedure for ADB headlighting systems. Existing FMVSS No. 108 requirements and the work summarized here together can provide a basis for objective performance criteria and an objective test procedure for assessing ADB headlighting system performance.

## 17. Key Words

## 18. Distribution Statement

WHY SENSOR-2-FUSION ADB

# Why *Sensor-Fusion* ADB?

## ■ Limitations of Current ADB

- Mainly depends on **the front camera**
- **Viewing angle** of the camera is *not enough* to detect passing vehicles
- Errors in recognizing vehicles too **slow**

## ■ Why **Sensor-Fusion** is necessary

- Accuracy increases using other sensors : such as radar, steering wheel, navigation, etc.
- Other vehicles' movement **can be predicted**
- Glare can be prevented

**MOBIS Advanced ADB Solution**

# MOBIS ADVANCED ADB

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Passing by Vehicles

Following Vehicles on S-Curve Roads

Roads with Center Line Barriers

# MOBIS *Advanced ADB System*

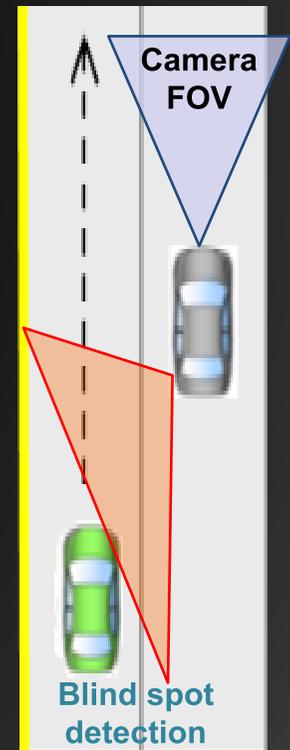
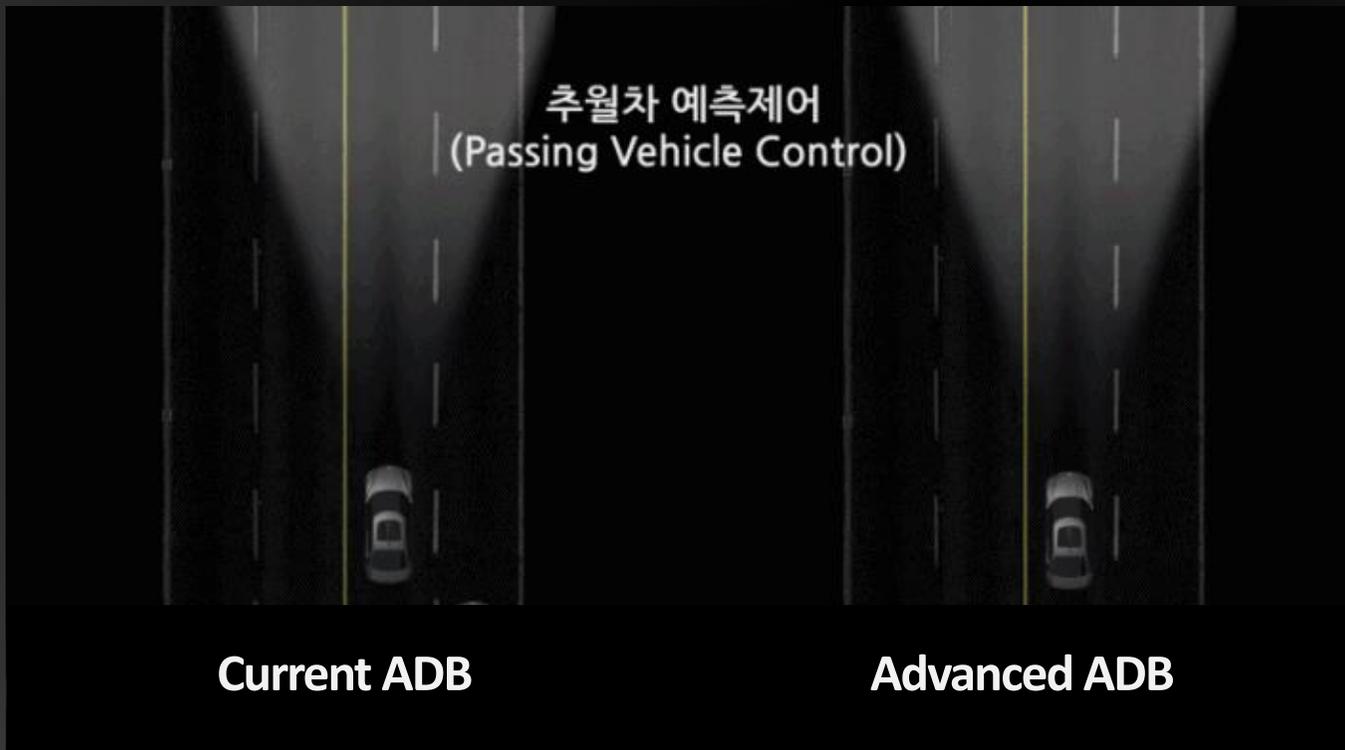
- Predicts the movement of other vehicles and prevents glare
  1. when other vehicles pass by → *Radar*
  2. when preceding vehicles making a turn on S-curve roads → *Steering wheel*
  3. when on roads with center line barrier → *Navigation*



# 1. Passing by Vehicles



- Uses *a radar* located on the rear corner to detect vehicles from the rear
- Receives their data to enhance the ADB accuracy as well as its reaction speed



# 1. Passing by Vehicles



ADB

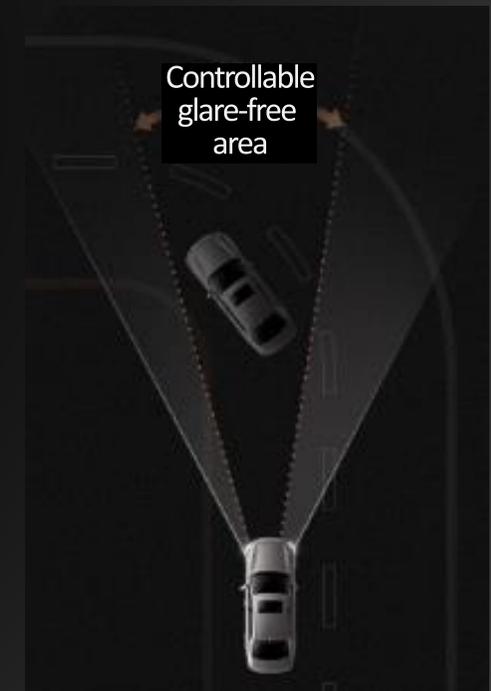
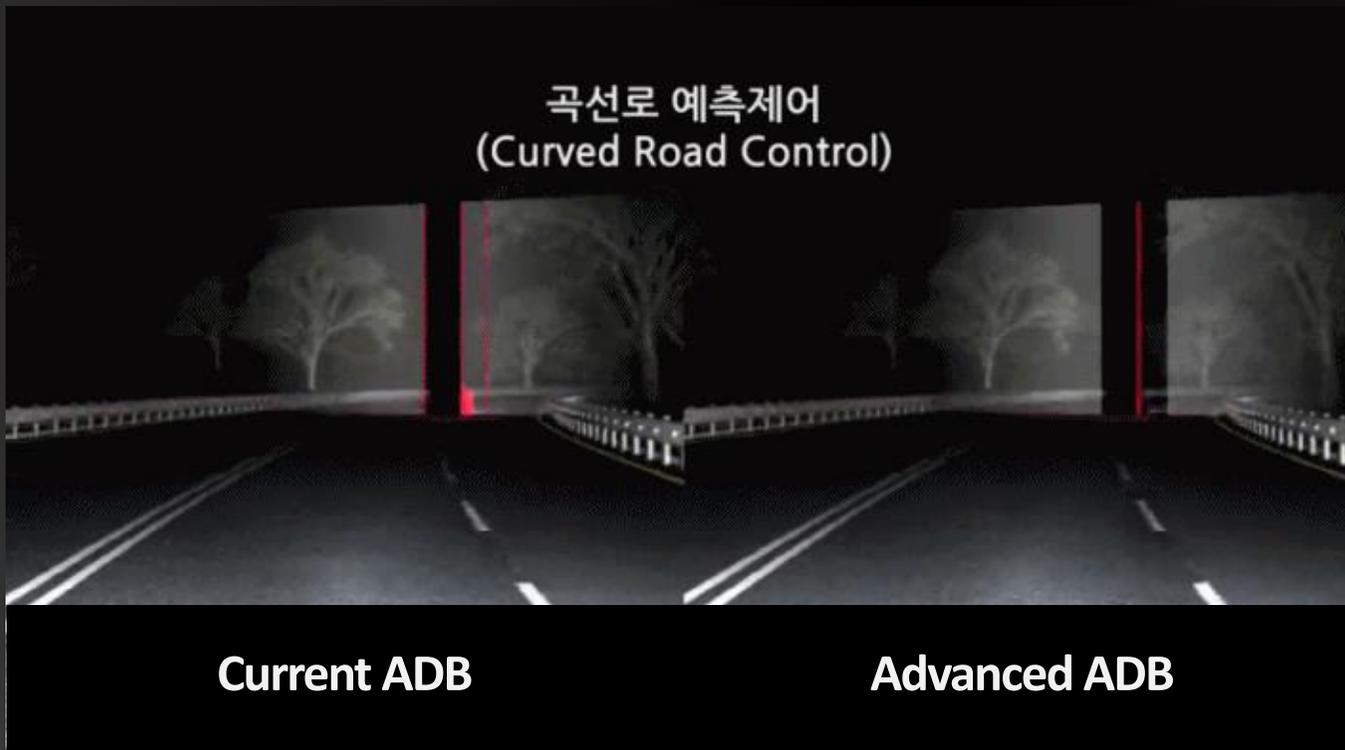


ADB with ADAS

## 2. Following Vehicles on S-Curve Roads



- Utilize data of **steering wheel and lane curvature** to predict movement of the preceding vehicle
- When a sudden change in angle is perceived, the size of glare-free area is widened



MOBIS Advanced ADB System

## 2. Following Vehicles on S-Curve Roads



ADB



ADB with ADAS

### 3. Roads with Center Line Barriers

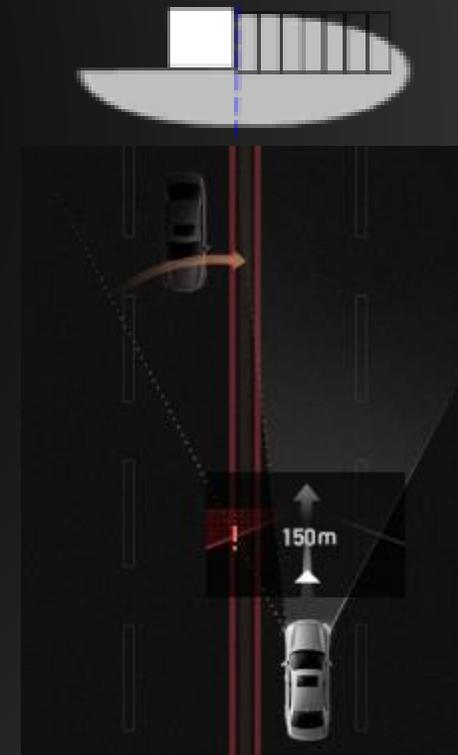
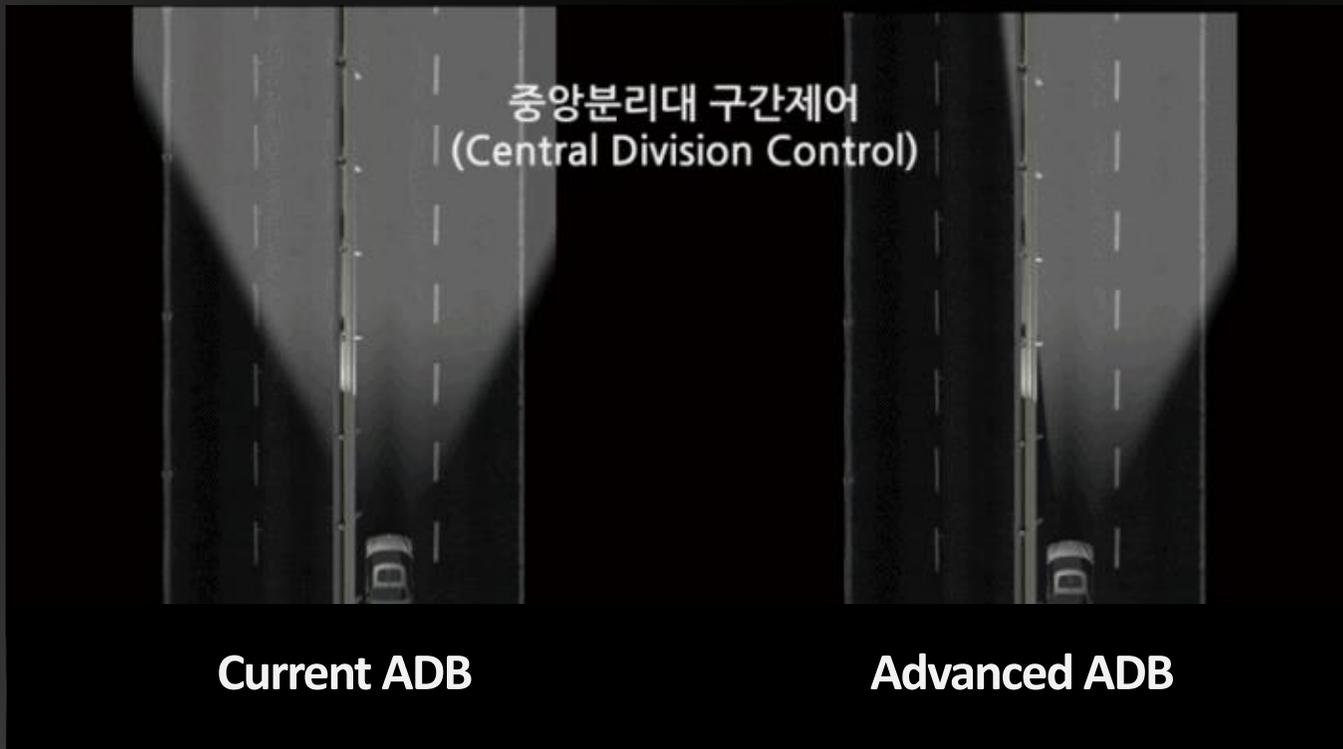
Front Camera

Rear Radar

Steering Wheel

Navigation

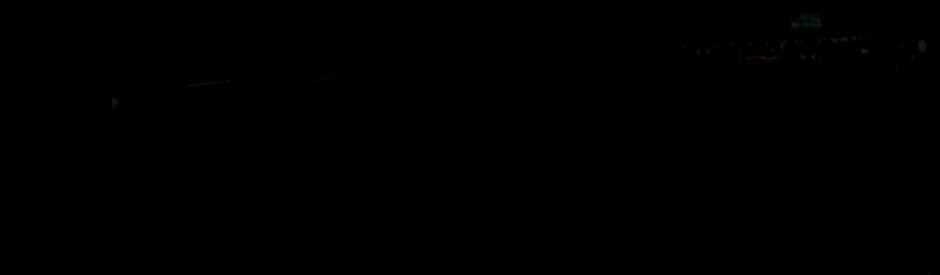
- Barrier blocks the camera view, causing glare to vehicles with high driver's position
- Using data from **camera and navigation**, system finds my location and shuts off the left section of high beam



### 3. Roads with Center Line Barriers



ADB



ADB with ADAS

# CONCLUSION

# Conclusion

- **Sensor is *the key* to prevent glare and improve overall safety**
  - Lighting needs to 'communicate' more with the ADAS system
- **MOBIS Advanced ADB can prevent glare in many circumstances**
  - Performance is improved without any increase in cost
- **A unified regulation that satisfies everyone *is needed***
  - It is now time for American drivers to experience ADB headlights



THANK YOU