



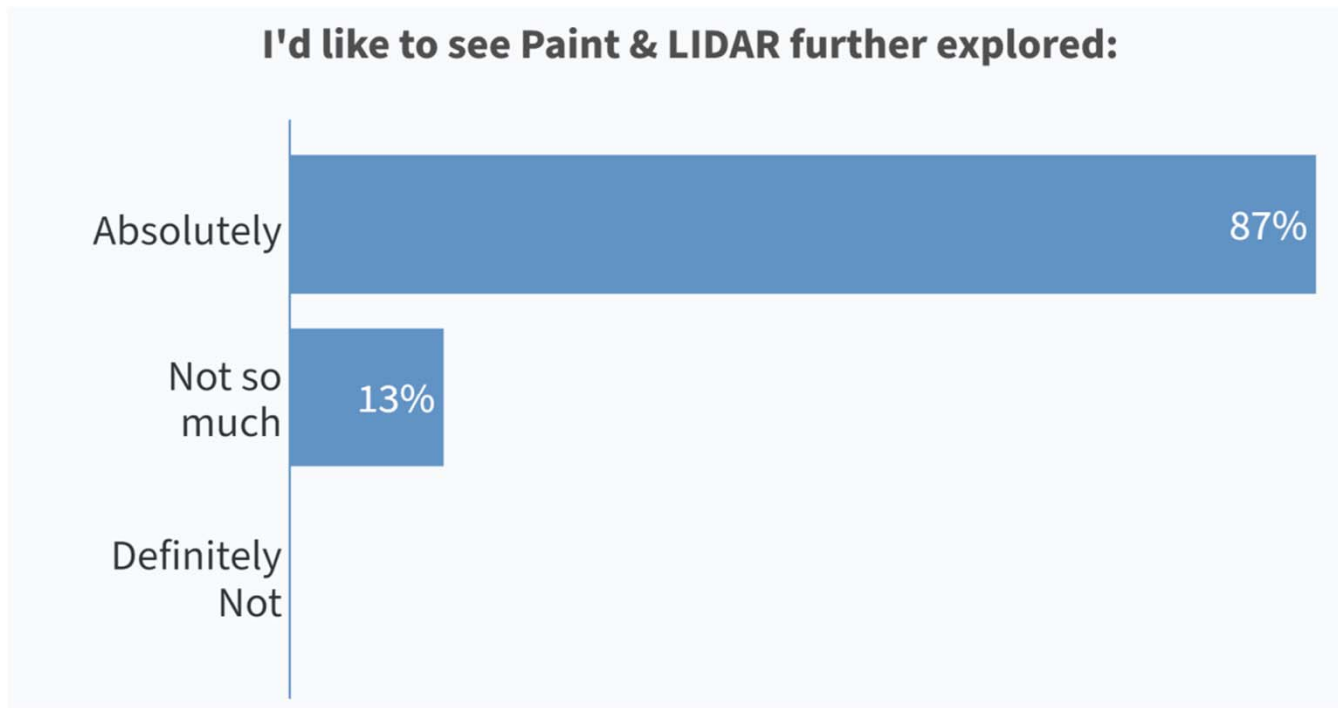
COLLISION INDUSTRY
CONFERENCE

Parts & Materials

PRESENTED BY:

AARON SCHULENBURG | SOCIETY OF COLLISION REPAIR SPECIALISTS

CIC Audience Guidance



General Motors



GM's new Ultra Cruise technology to make use of behind-the-windshield

- General Motors announced its new Ultra Cruise hands-free driving system will debut in 2023 on a future [Cadillac](#) model.
- The system will work on more than two million miles of every type of road in the U.S. and Canada, joining Super Cruise, which is currently available and only works on highways.
- Ultra Cruise uses a combination of cameras, radar, and lidar and has a 360-degree view of the car.

Volvo

Next generation pure electric Volvo comes with LiDAR technology and AI-driven super computer as standard to help save lives



Jun 24, 2021 | ID: 283443

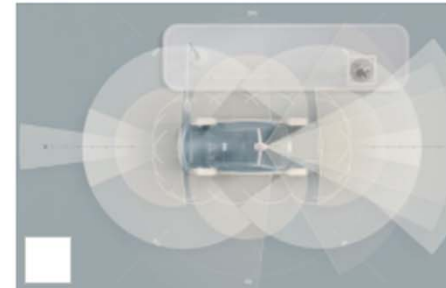
Aa- | Aa+



Volvo Cars' forthcoming fully electric flagship SUV will have industry-leading safety technology as standard, helping to save even more lives as the company sets a new benchmark for automotive safety.

The fully electric successor to Volvo Cars' XC90, to be revealed in 2022, will come with state-of-the-art sensors, including LiDAR technology developed by Luminar and an autonomous driving computer powered by the NVIDIA DRIVE Orin™ system-on-a-chip, as standard.

Related Images



Lucid Motors



DreamDrive

IN-CAR COMMUNICATION
AT GIGABIT SPEED

OVER-THE-AIR UPDATES

Up to **32** sensors

DIRECTOR MONITORING SYSTEM

DIRECTIONAL AUDIO ALERTS
WITH SURREAL SOUND

LUCID

High-Res LIDAR

LIDAR is ALMOST Here

- **What is it?**
- **How does it work?**
- **How can materials impact effectiveness of systems and sensors**

Industry Perspectives

Josh Center

I-CAR | Senior Associate SME, ADAS/EV

Jason (Buck) Zeise

Lametry's Collision Centers | Mechanical Operations Manager

LIDAR Specialists

Daniel Ferris, PhD.

BASF | Scientist III – OEM Coatings – Southfield – R&D

Cibby Pulikkaseril

Baraja | CTO and co-founder

Intro to LIDAR

Cibby Pulikkaseril

2 November 2021

SEMA

Agenda

What is LIDAR?

LIDAR vs. Other Technology

Types of LIDAR Systems

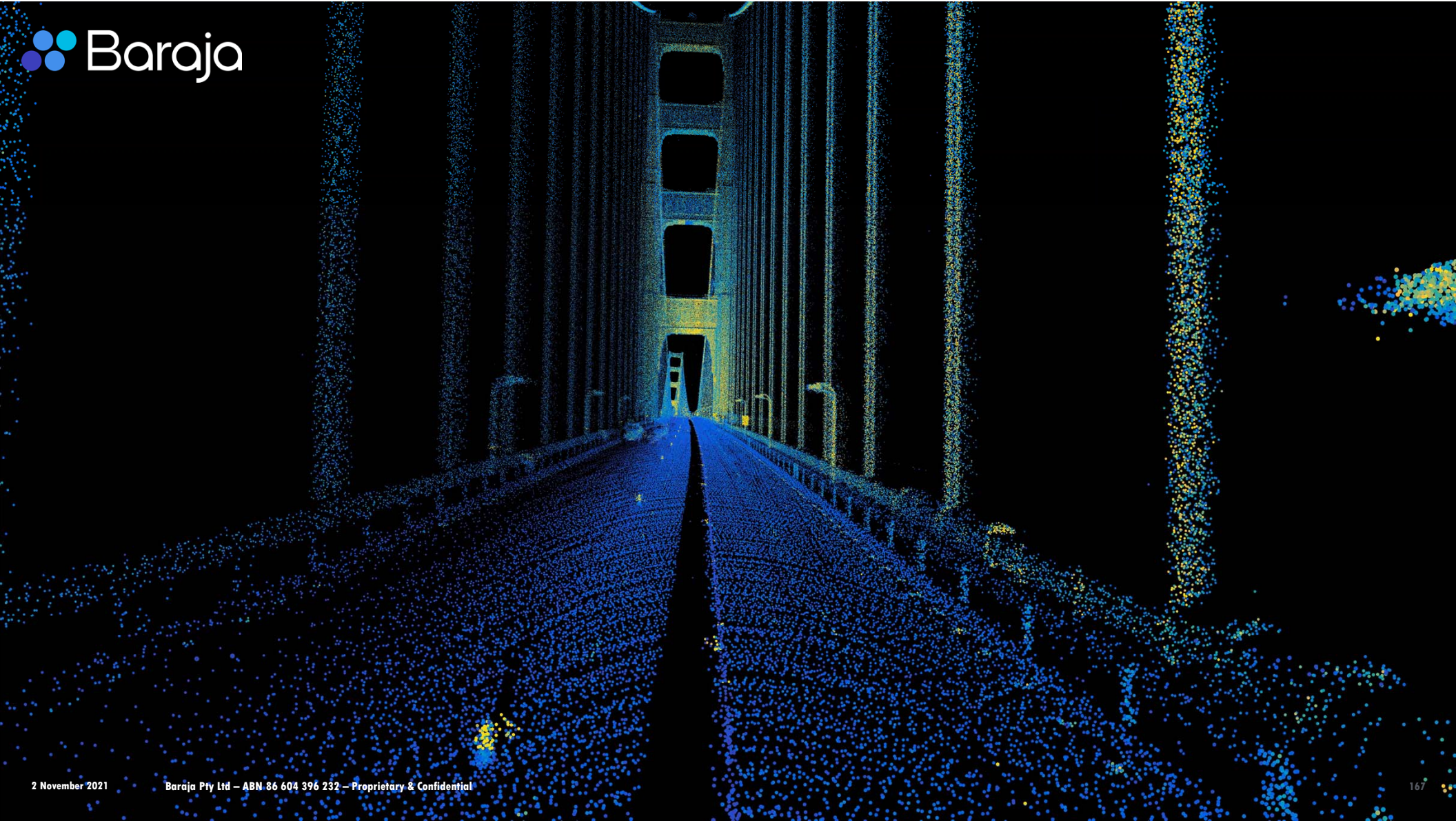
Baraja Spectrum-Scan™

Design Considerations

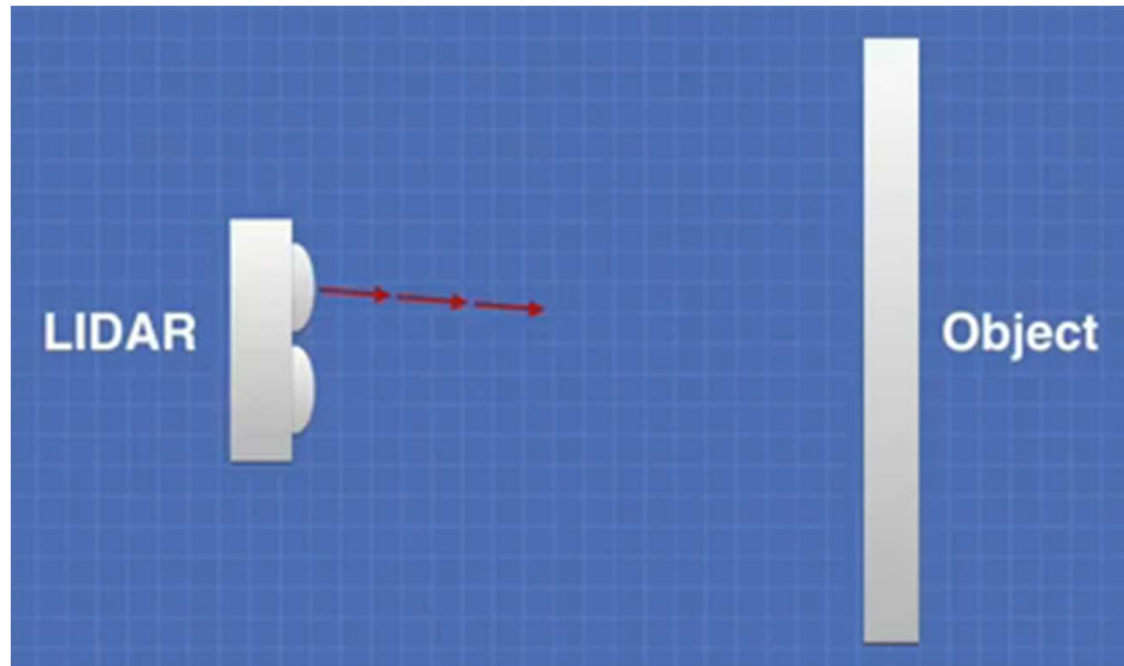
What is LIDAR?

LIDAR: Laser eyes for autonomous vehicles

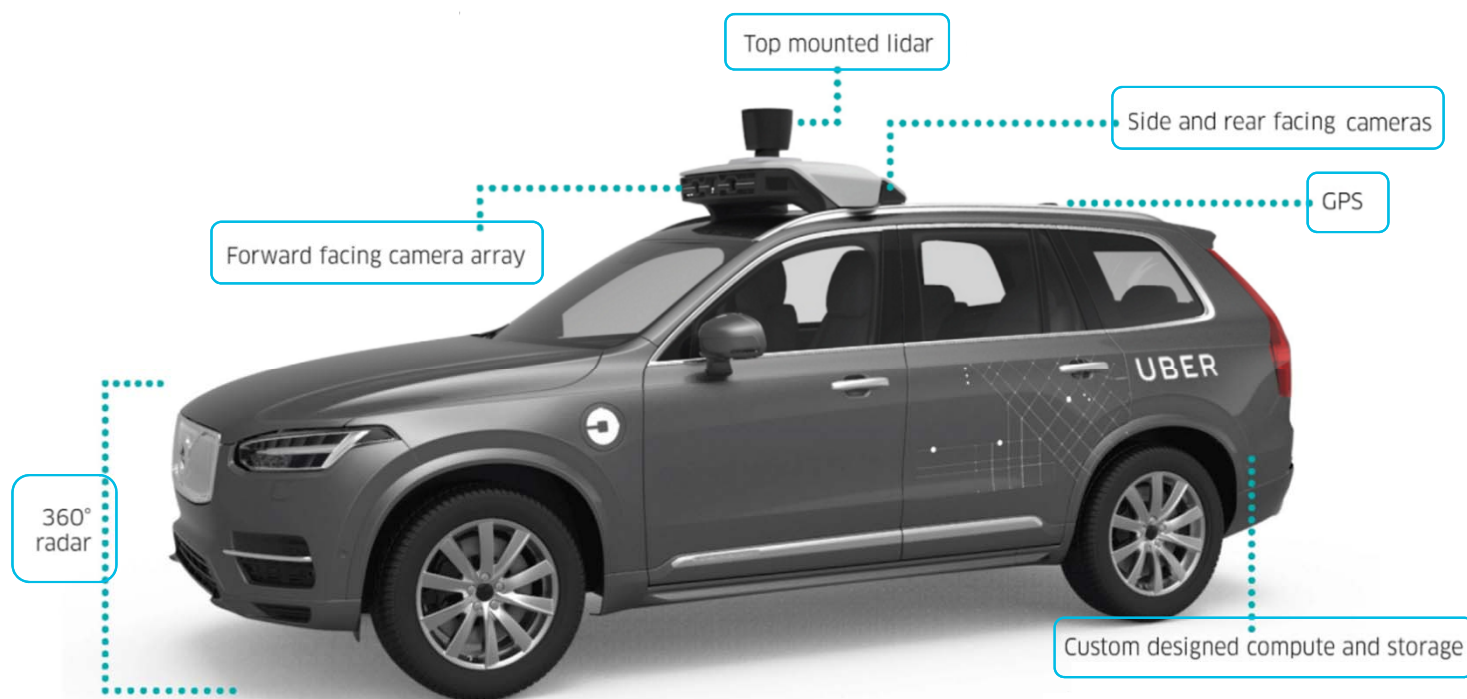




Light, Detection And Ranging: LIDAR



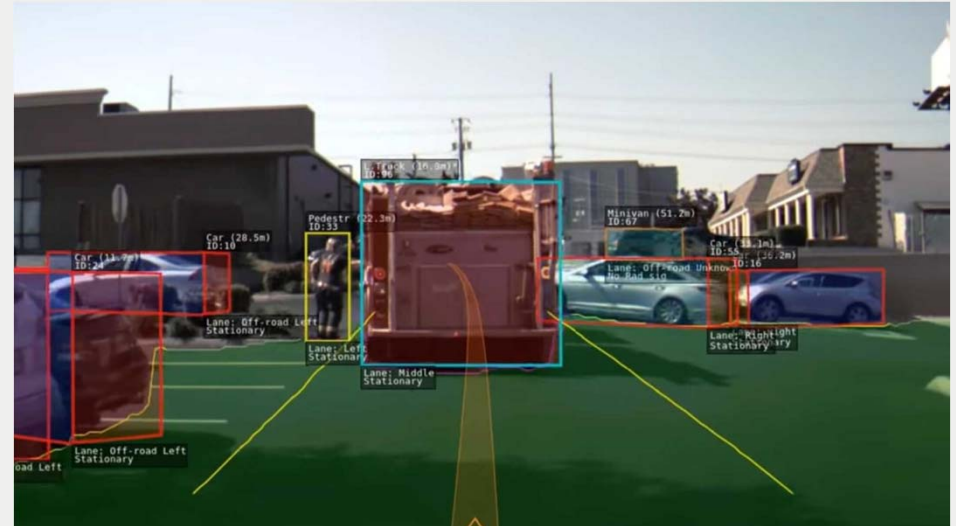
The entire sensor suite



LIDAR vs. Other Technology

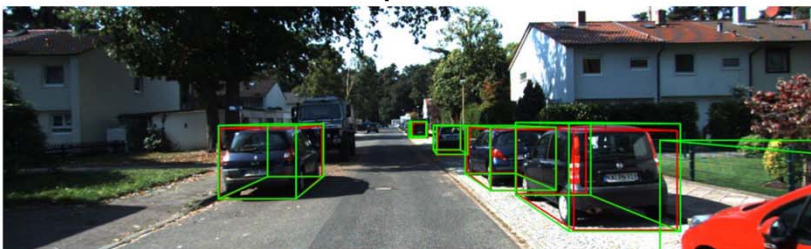
LIDAR vs Cameras

- Produces true colour, high resolution images
- Ability to see long ranges
- Enhanced by computer vision and object recognition
- Poor performance in rain and other extreme weather or lighting conditions
- No true distance measurement



"For example, the error of stereo-based 3D depth estimation grows **quadratically** with the depth of an object, whereas for Time-of-Flight (ToF) approaches, such as LiDAR, this relationship is **approximately linear**"

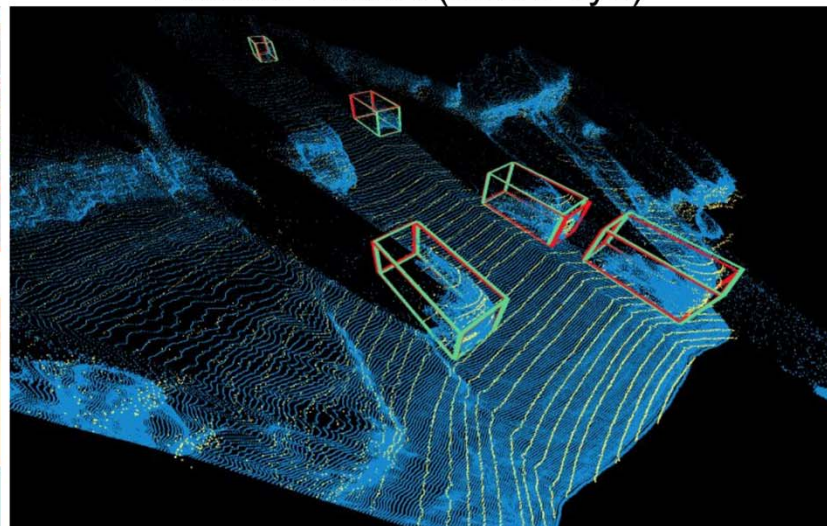
Input

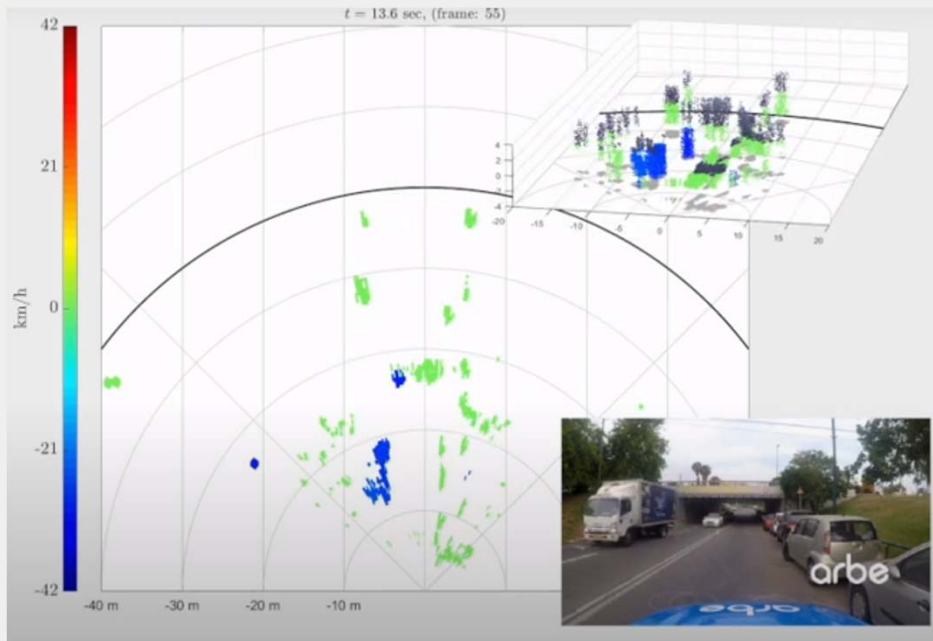


Depth Map



Pseudo-LiDAR (Bird's-eye)





LIDAR vs Radar

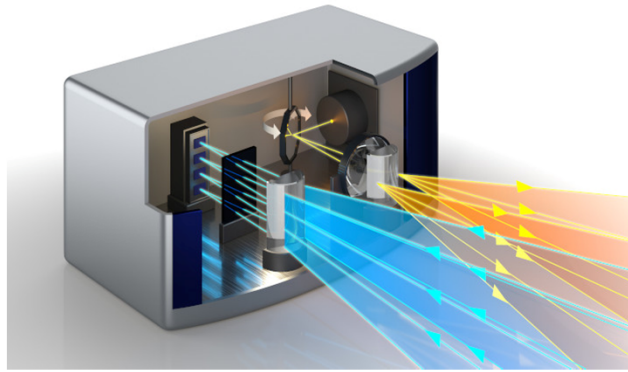
- **Good in all weather conditions**
- **Long range performance**
- **Poor accuracy & resolution**
- **Struggles with false signals**

Types of LIDAR Systems

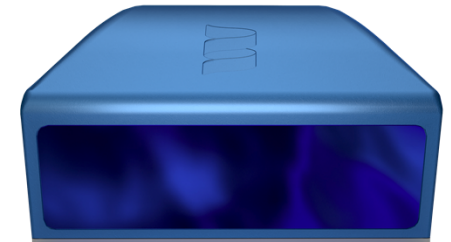
Mechanical



Mirrors



Solid-State



Baraja Spectrum-Scan™

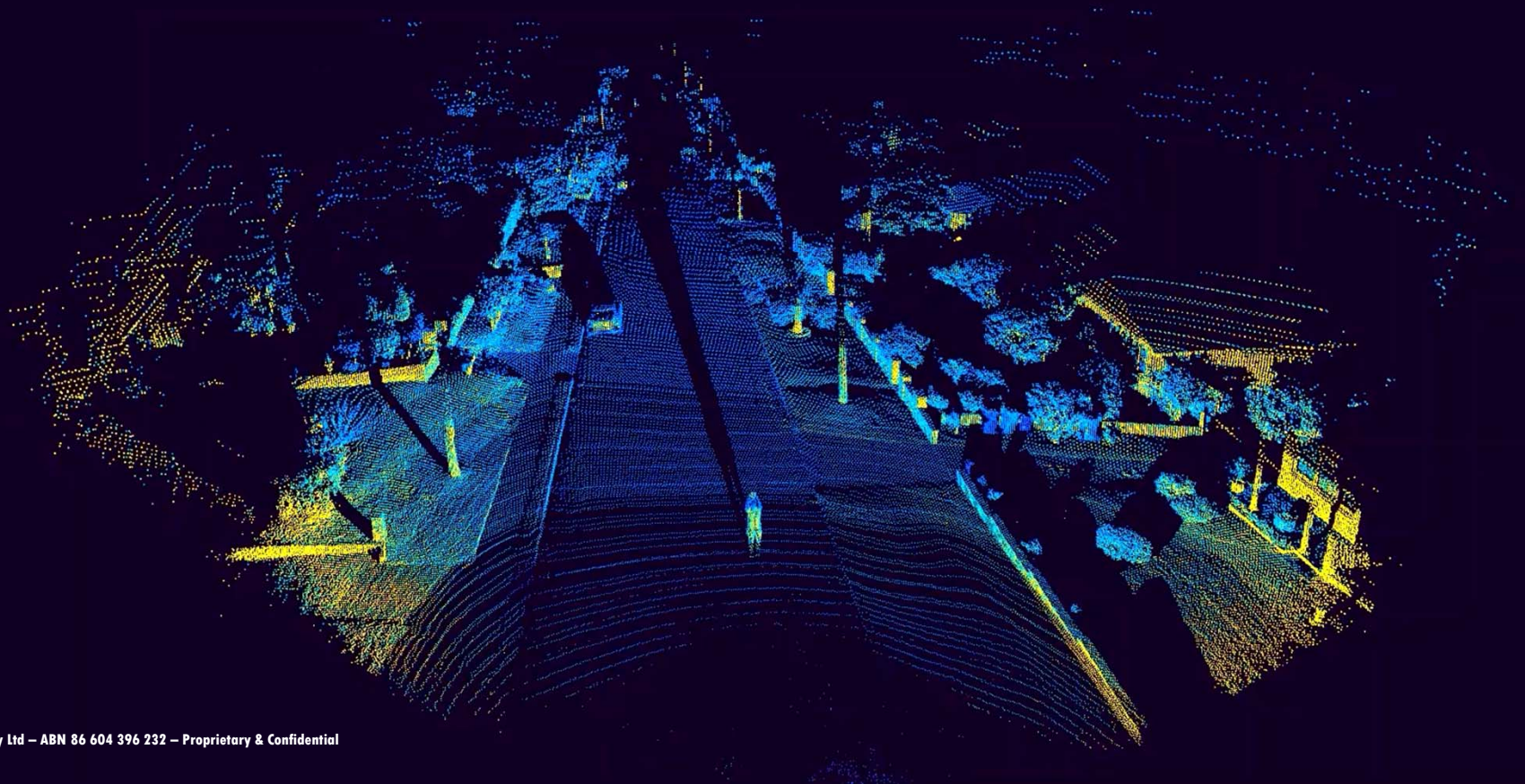


Spectrum-Scan™: The Basics

Pointcloud **CONTROL**



Arbitrary number of beams
Arbitrary beam separation
Nominate and Change Regions of Interest



Design considerations

LIDAR Mounting Positions

Windshield

- Requires tailored windshield glass

Roof lining

- Extra design & style considerations

Grill

- Susceptible to dirt & damage
- Poor vantage point



Wideye – Windshield glass for sensors

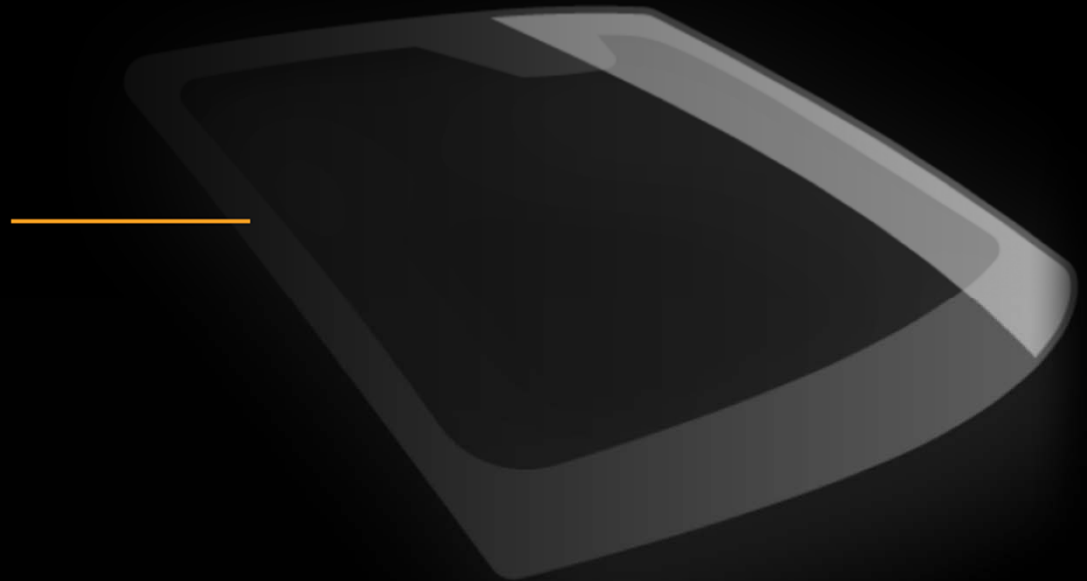
Exterior Glass Integration

Integration of LiDAR by means of standard exterior glass parts, such as windshield, backlight, side glazing.

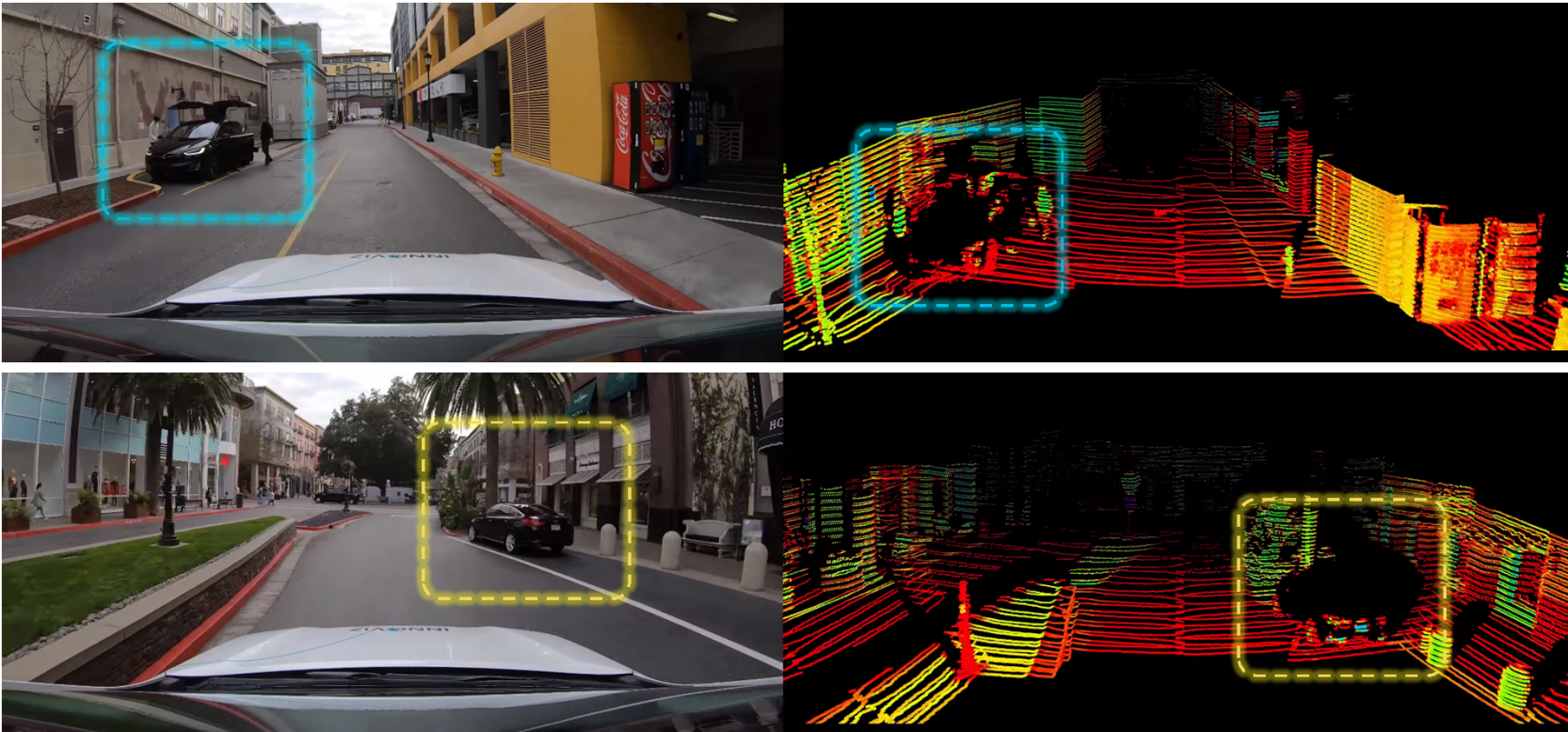
Unique solution, combining IR blocking technology for thermal comfort with IR transmission for LiDAR.

Maturity level:

- Co-development with several partners to mature technology
- Prototype production running
- First development projects starting. Similar components in mass production at AGC for camera and radar integration.



What about Paint?



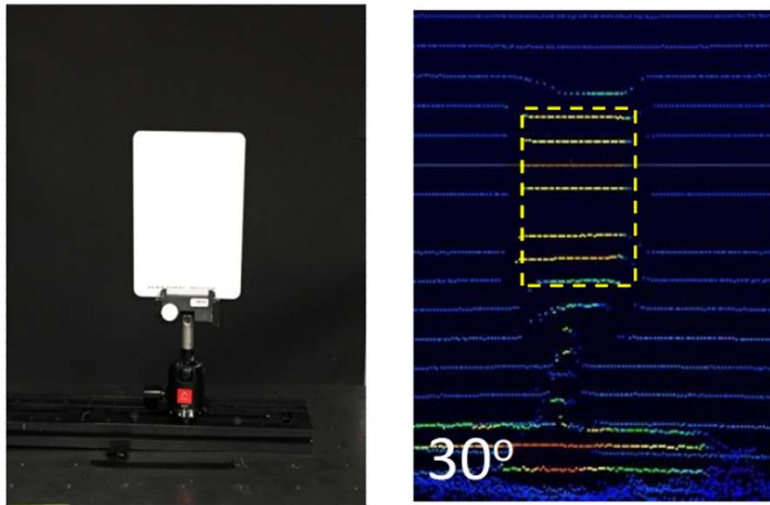
<https://www.youtube.com/watch?v=rMNpAuOro0>

2 November 2021

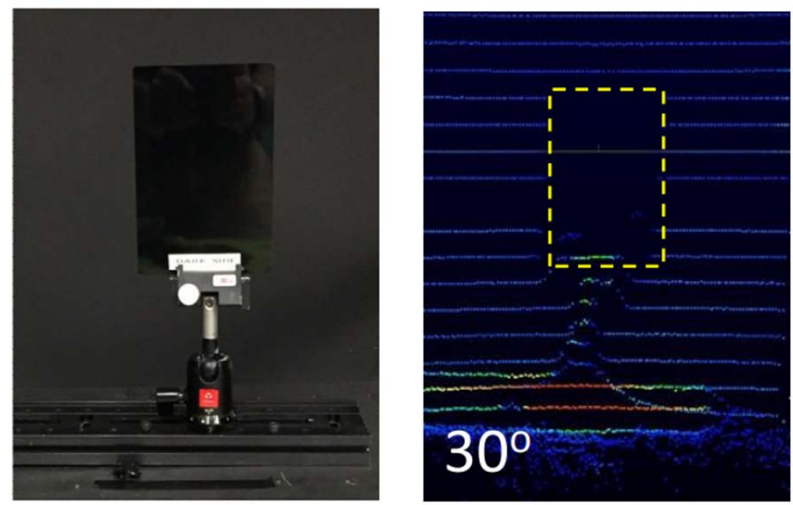
Baraja Pty Ltd – ABN 86 604 396 232 – Proprietary & Confidential

Bright vs. Dark Car Paints

Solid White Paint



Solid Black Paint



Thank you!

Cibby Pulikkaseril

Baraja

www.baraja.com

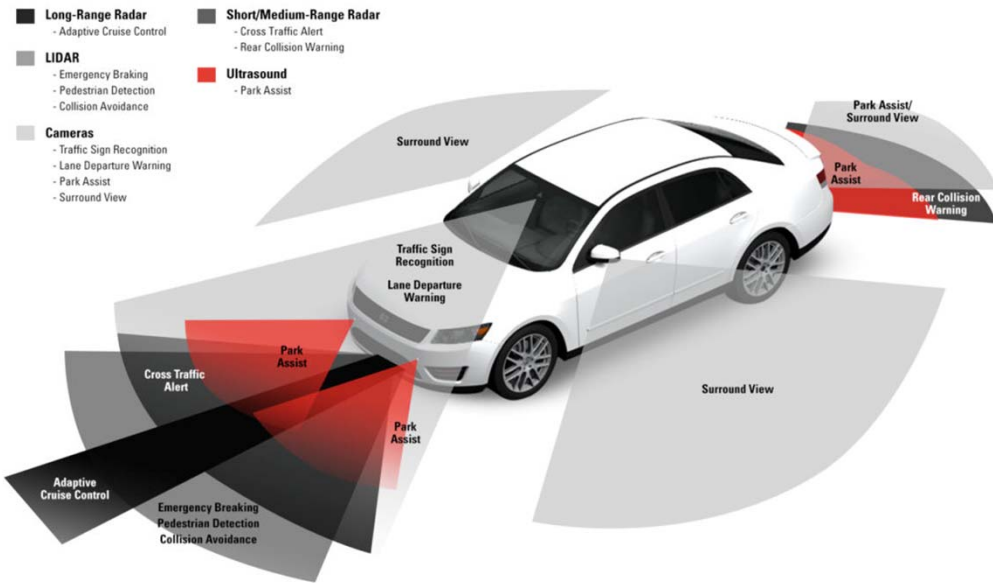
LiDAR Specialist

Daniel Ferris, PhD.

BASF | Scientist III – OEM Coatings – Southfield – R&D



Sensor Technologies in Autonomous Driving



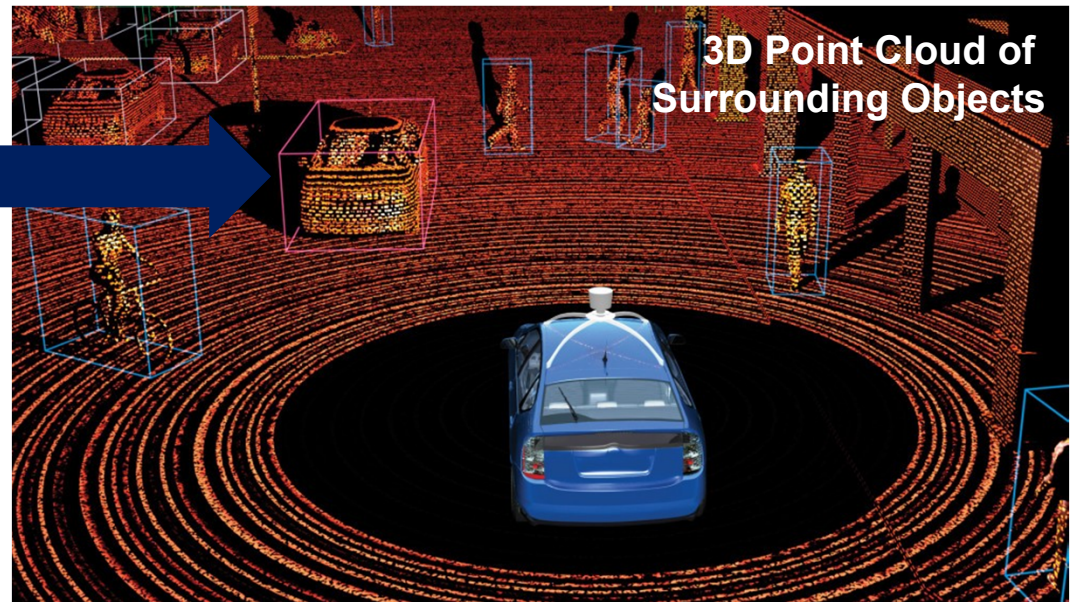
Task	Lidar	Camera	Radar	Lidar + Radar + Camera
Object detection	Good	Fair	Good	Good
Object classification	Fair	Good	Poor	Good
Object edge precision	Good	Good	Poor	Good
Distance estimation	Good	Fair	Good	Good
Lane tracking	Poor	Good	Poor	Good
Range of visibility	Fair	Fair	Good	Good
Functionality in bad weather	Fair	Poor	Good	Good
Functionality in poor lighting	Good	Fair	Good	Good

● Poor
 ● Fair
 ● Good

Image: <https://roboticsandautomationnews.com/2017/07/01/adas-features-of-advanced-driver-assistance-systems/13194/>

Role of Coatings in Object Detection

Is this vehicle visible for the Lidar sensor?



Coating Development Goals

- ▶ Appealing Design
- ▶ Durability
- ▶ **NEW**: Sensor Functionality

Role of Coatings in Object Detection

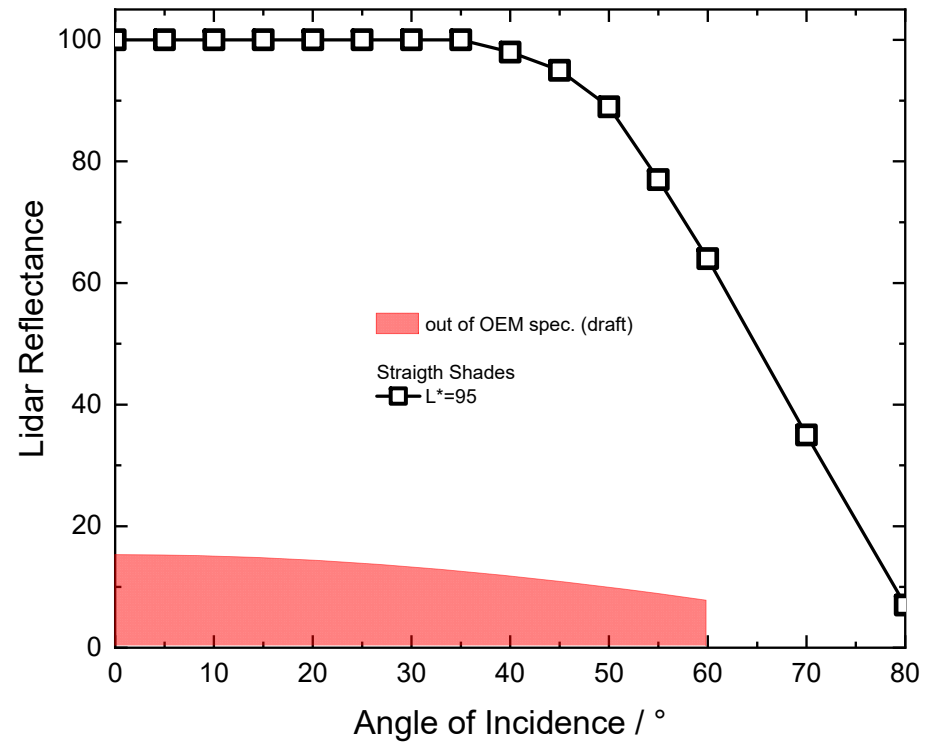
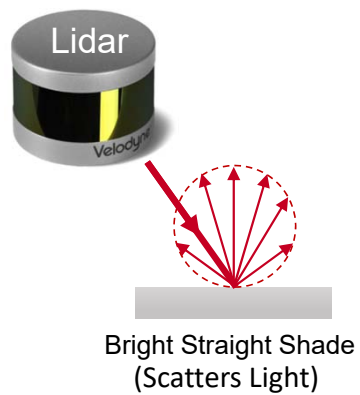


Image: <https://news.voyage.auto/an-introduction-to-lidar-the-key-self-driving-car-sensor-a7e405590cff>

Role of Coatings in Object Detection

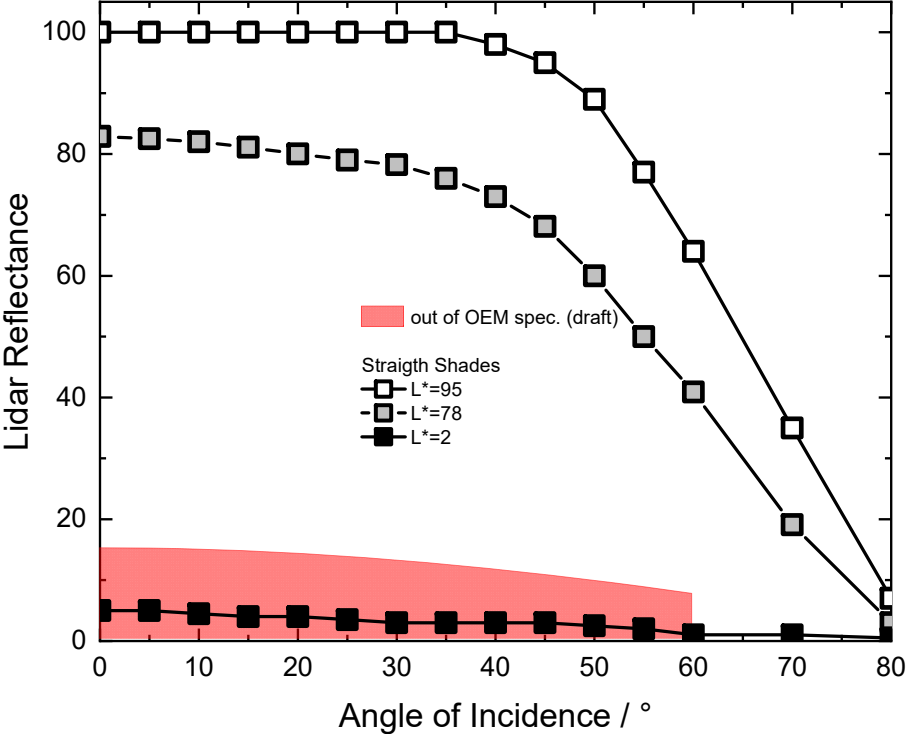
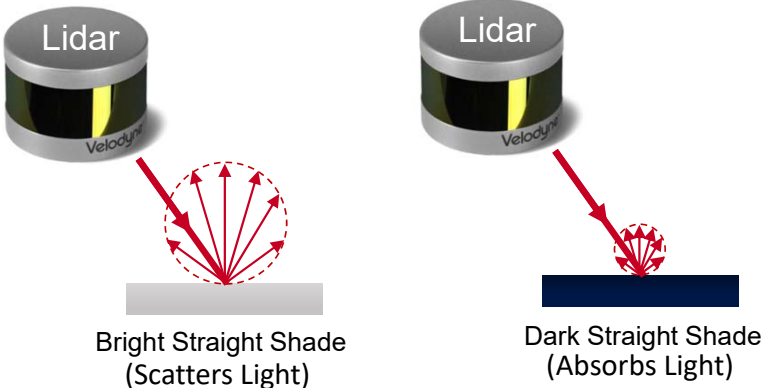


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Role of Coatings in Object Detection

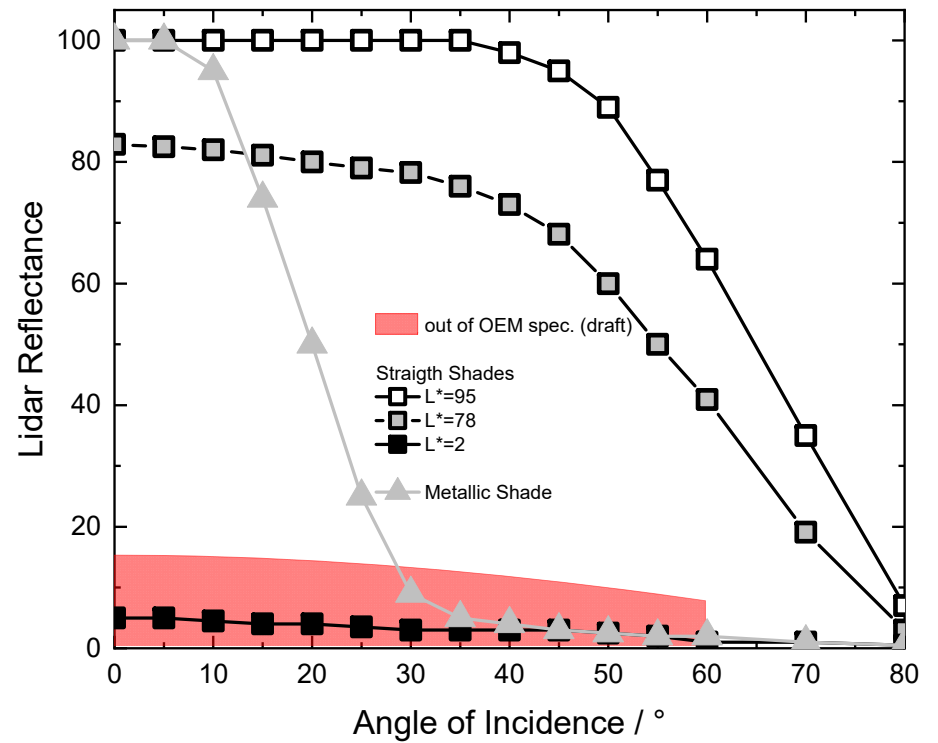
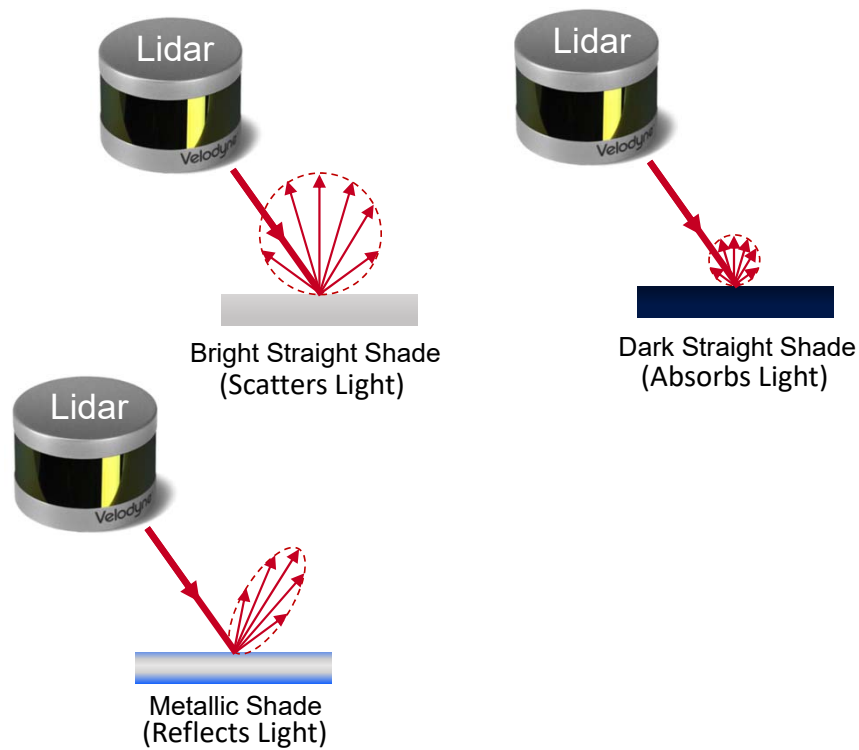


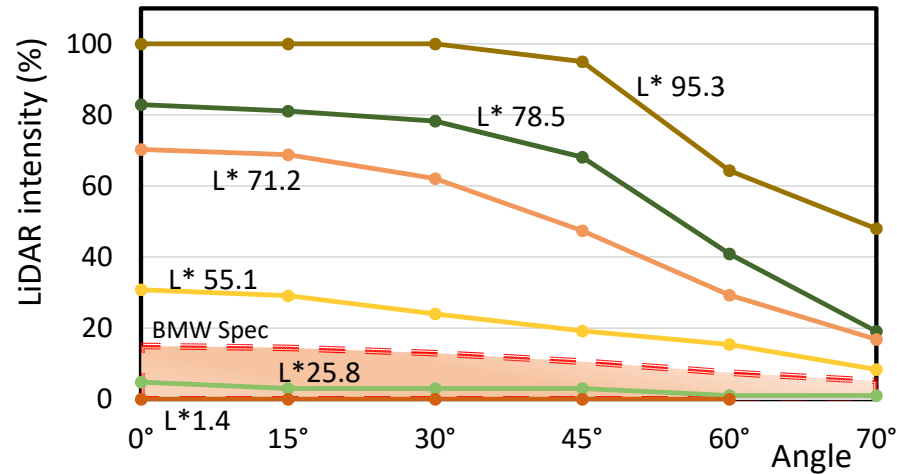
Image: <https://news.voyage.auto/an-introduction-to-lidar-the-key-self-driving-car-sensor-a7e405590cff>

Current Paint Technology Challenge – Dark Colors

Light adsorbing pigment – Carbon Black (inexpensive, effective, neutral)

Effect of Carbon Black on Signal Return to LiDAR

Code	L*
White	95.3
Tint 1	78.5
Tint 2	71.2
Tint 3	55.1
Tint 4	25.8
Pure Black	1.4

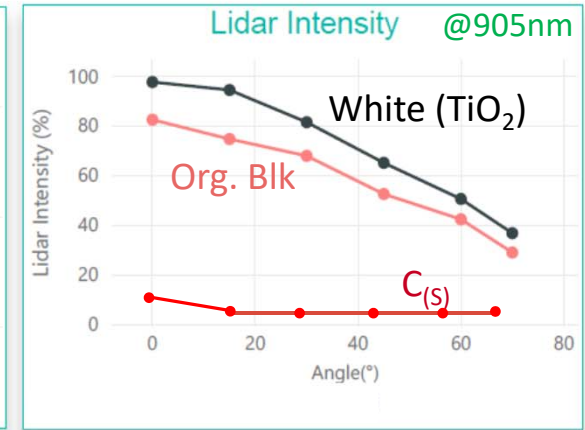
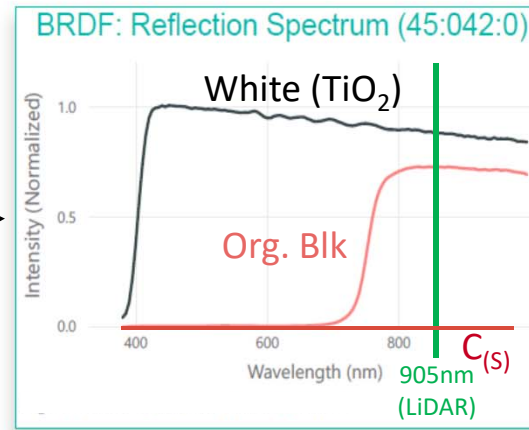
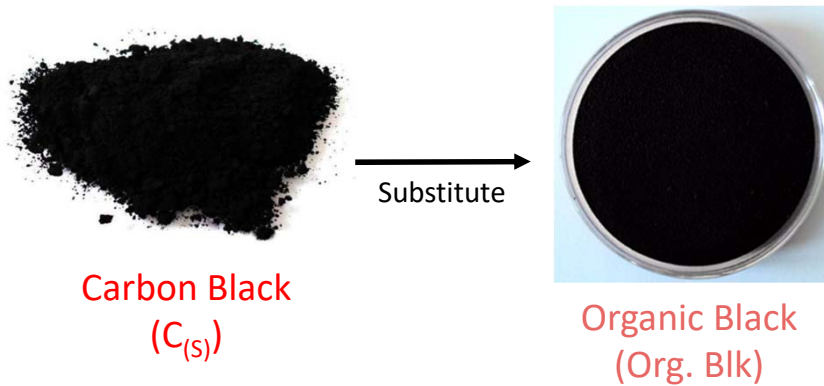


Layering System

- Clearcoat (ProGloss/2K4)
- Different Grey Shades
- Titanium M6534 Primer

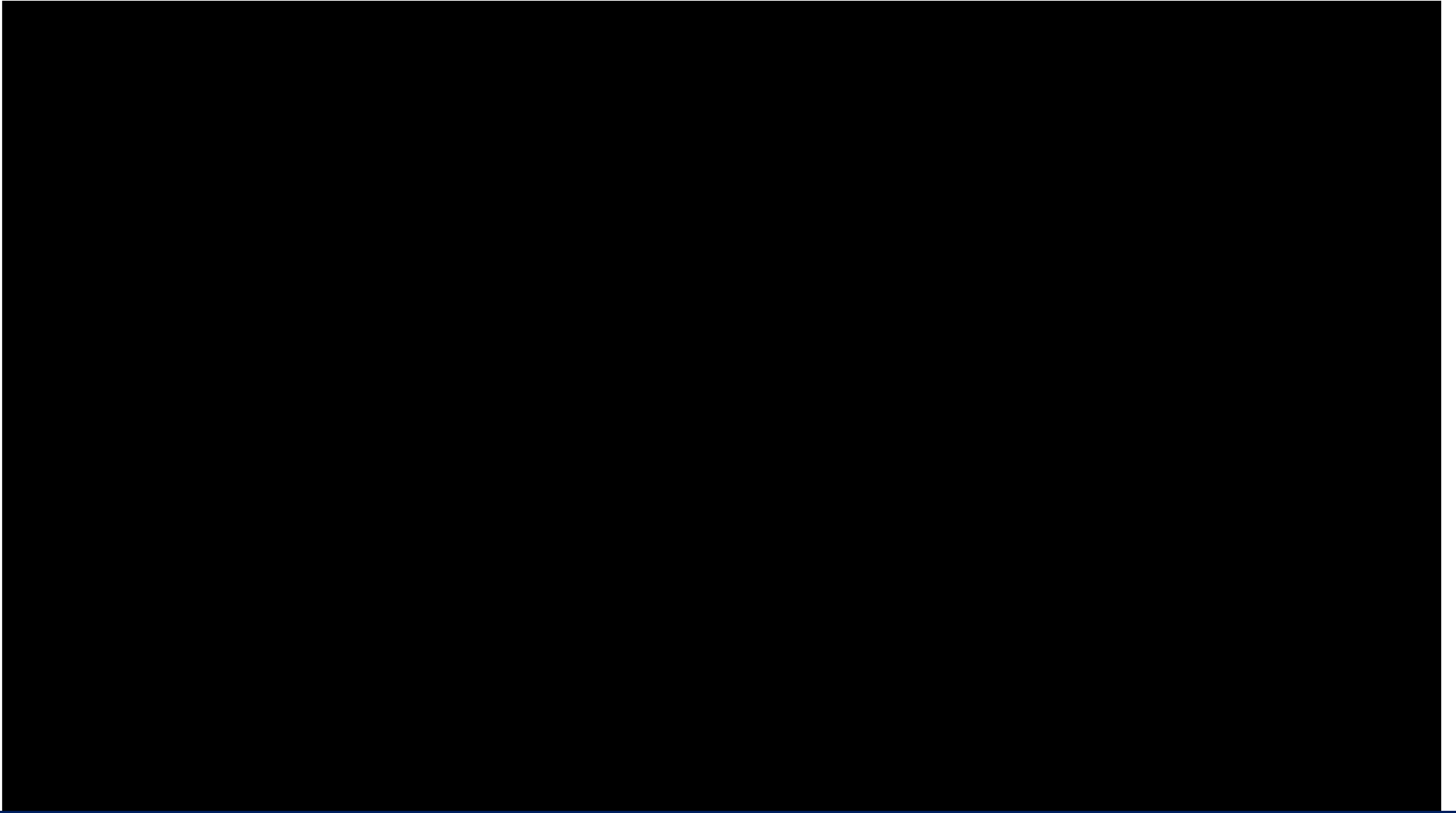
Addition of >1% Carbon Black can result in a significant decrease in signal return to the detector

Redesigning Paint Formulations to be Compatible



Issues for consideration for aftermarket applications

- Existing Cars left untreated may have detectability problems.
 - LiDARs sensitivity is improving.
 - Advantageous for aftermarket repairs.
- New Formulations will be inherently more expensive.
 - A price decrease would be expected as demand increases.
- Color matching to existing paints may require recalibration.
- Not the only solution to this problem.
 - More new technologies may emerge as demand increases.



Discussion

Cibby Pulikkaseril

Baraja | CTO and co-founder

Daniel Ferris, PhD.

BASF | Scientist III – OEM Coatings – Southfield – R&D

Josh Center

I-CAR | Senior Associate SME, ADAS/EV

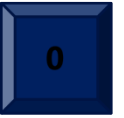
Jason (Buck) Zeise

Lametry's Collision Centers | Mechanical Operations Manager

Next Meeting – Upcoming Topic Ideas

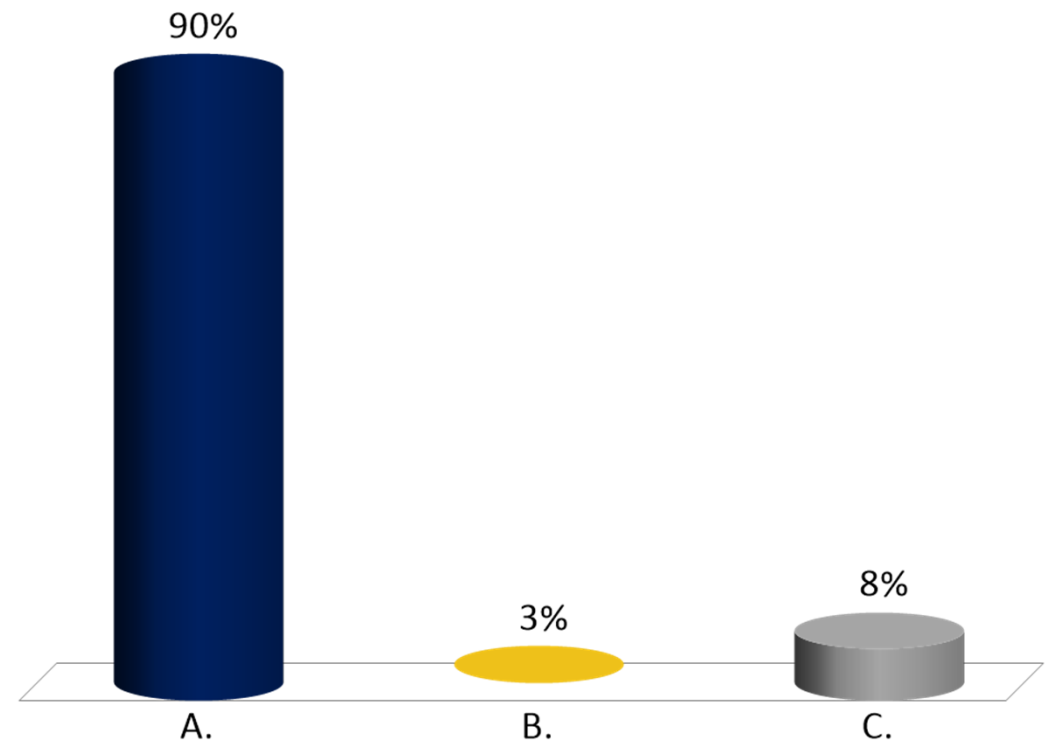


JANUARY

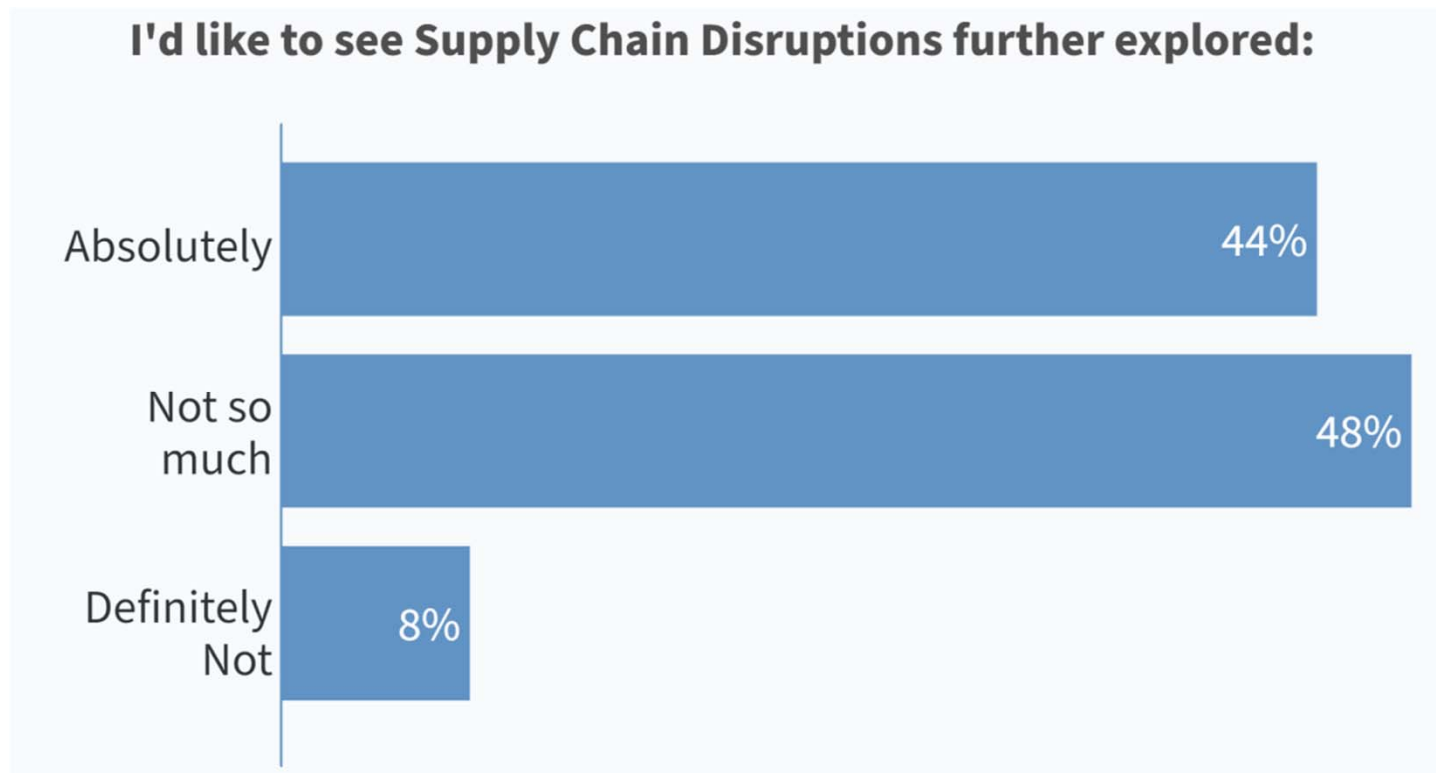


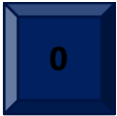
Are parts delays currently an issue?

- A. Agree
- B. Disagree
- C. Abstain



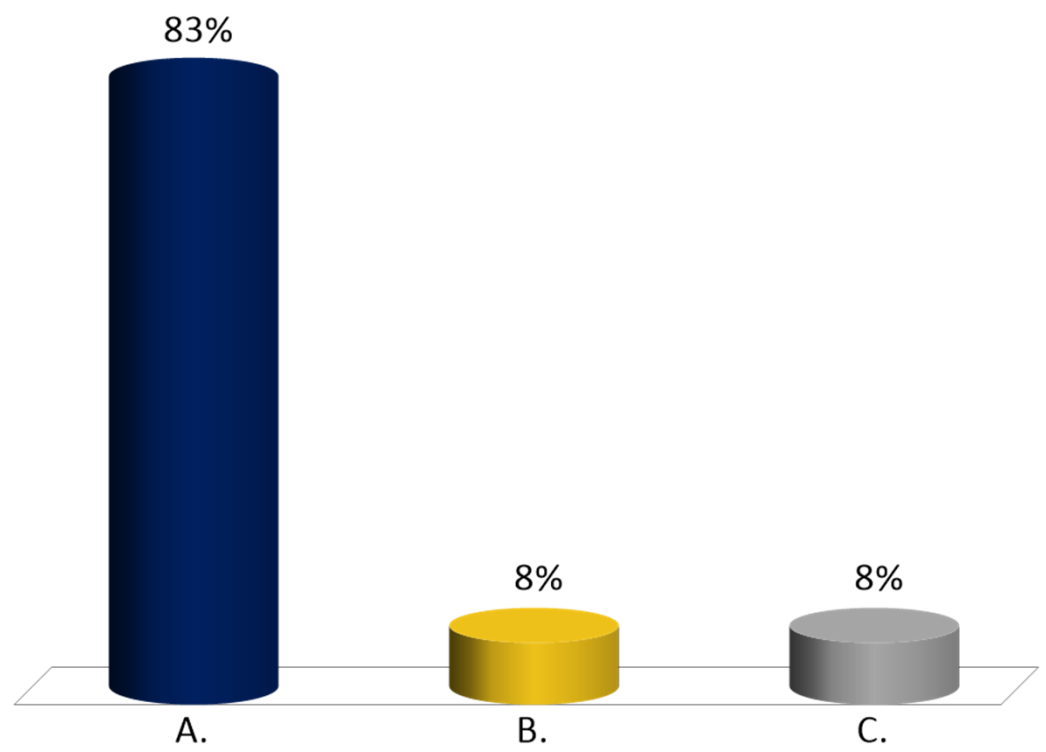
Audience Response Question:





Is this a topic you would like the committee to further explore now?

- A. Agree
- B. Disagree
- C. Abstain



Audience Questions?

Thank you!