SAE INTERNATIONAL

SAE EDGE™
RESEARCH REPORT

Unsettled Issues on HD Mapping Technology for Autonomous Driving and ADAS

Thomas Bock

SAE EDGE™
RESEARCH REPORT

Unsettled Issues on HD Mapping Technology for Autonomous Driving and ADAS

Thomas Bock
Porsche Digital Inc.

EDGE CONTRIBUTOR TEAM

Wei Luo, PhD, *DeepMap*
Ro Gupta, *CARMERA*
Henning Lategahn, PhD, *Ascentec GmbH*
Gunnar Gräfe, Dr. -Ing., *3D Mapping Solutions GmbH*
Chris Wilson, *Connected Vehicle and ADAS Consultant*
John D. Russell, *ORX-Labs*
Fabian Klebert, *Navitagion Data Standard*
Sven Beiker, PhD, *Silicon Valley Mobility*
Martin Schleicher, *Elektrobit*

SAE INTERNATIONAL®
Warrendale, Pennsylvania, USA

About the Publisher

SAE International® is a global association of more than 128,000 engineers and related technical experts in the aerospace, automotive and commercial-vehicle industries. Our core competencies are life-long learning and voluntary consensus standards development. Visit sae.org

SAE EDGE™ Research Report Disclaimer

SAE EDGE™ Research Reports focus on topics that are dynamic, in which knowledge is incomplete, and which have yet to be standardized. They represent the collective wisdom of a group of experts and serve as a practical guide to the reader in understanding unsettled subject matter. They are not meant to provide a recommended practice or protocol. The experts have assembled as a community of practitioners to contribute and collectivize their thoughts and points of view; these are not the positions of the institutions or businesses with which they are affiliated, nor is one contributor's perspective advanced over others. SAE EDGE™ Research Reports are the property of SAE International and SAE alone is responsible for their content.

About This Publication

SAE EDGE™ Research Reports provide state-of-the-art and state-of-industry examinations of the most significant topics in mobility engineering. Contributors to SAE EDGE™ Research Reports are experts from academia, government, industry, and research who have come together to explore and define the most critical advancements, challenges, and future direction in areas such as vehicle automation, unmanned aircraft, cybersecurity, advanced propulsion, advanced manufacturing, Internet of Things, connectivity, and quantum technology.

SAE Team

Frank Menchaca, Chief Growth Officer
Michael Thompson, Director of Standards, Information and Research Publications
Monica Nogueira, Director of Content Acquisition and Development
Beth Ellen Zibeler, Product Manager
William Kucinski, Managing Technical Editor

EPR2021013
ISSN 2640-3536
e-ISSN 2640-3544
ISBN 978-1-4868-0015-3

To purchase bulk quantities, please contact: SAE Customer Service

E-mail: CustomerService@sae.org
Phone: 877-606-7323 (*inside USA and Canada*)
+1-724-776-4970 (*outside USA*)
Fax: +1-724-776-0790

https://www.sae.org/publications/edge-research-reports

About the Editor

Thomas Bock is the Engineering Manager at Porsche Digital in Palo Alto, California where he guides engineering teams that are building Porsche's next-generation digital products.

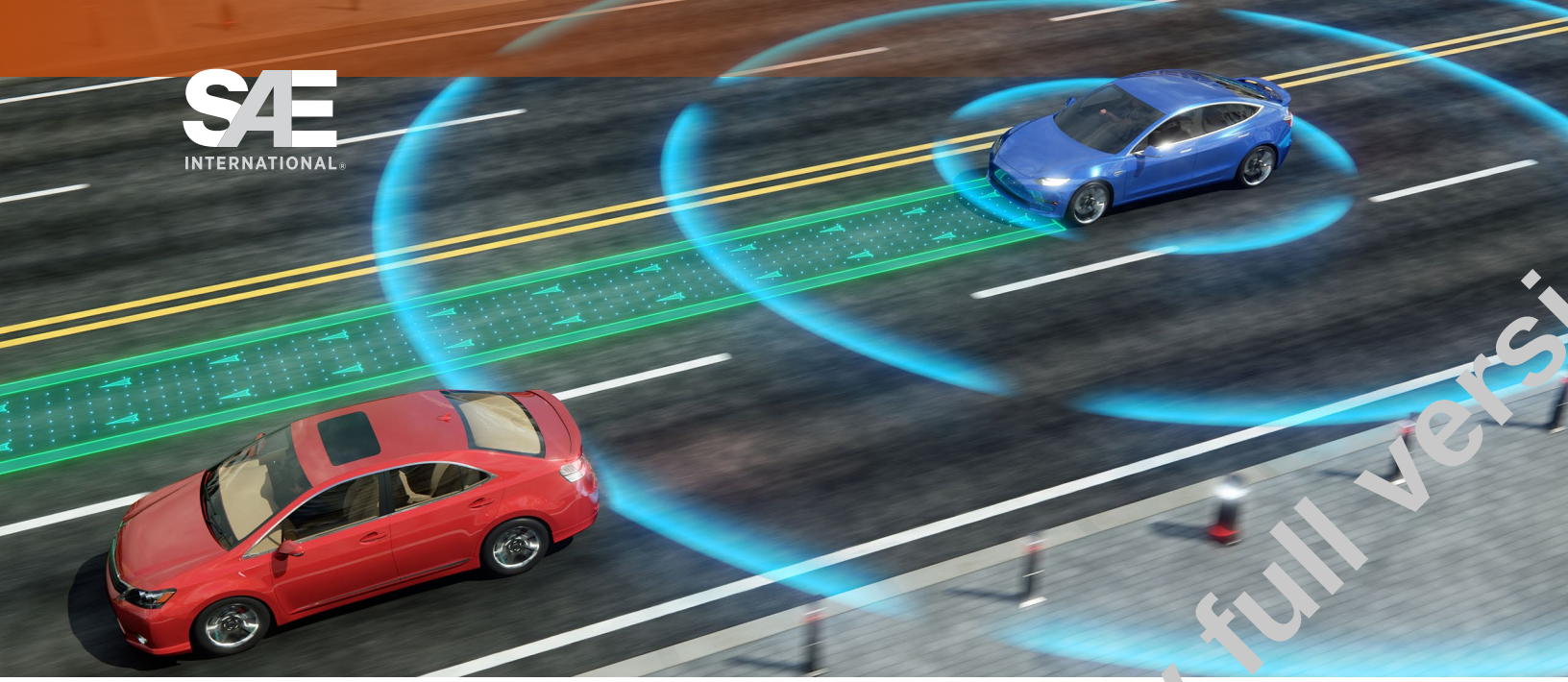
Previously, Thomas was the Director of Vehicle Integration & Testing at Samsung Smart Machines, a part of Samsung Electronics, that developed a full stack, system-on-chip-based advanced driver-assistance systems platform solution for Tier 1 automotive suppliers and original equipment manufacturers. He led teams responsible for integrating the platform into development and test vehicles, data collection software and operation, and platform validation and verification through software-, hardware-, and vehicle-in-the-loop testing. He contributed to the bilingual SAE-DIN Spec 91381 "Terms and Definitions Related to Testing of Automated Vehicle Technologies" as well as multiple SAE EDGE Research Reports on automated driving simulation and testing.

Thomas has more than 20 years of experience within the automotive industry. Prior to joining Samsung and Porsche, he worked at Mercedes-Benz Research & Development North America (1998-2018) on the original Mercedes prototype for internet in the vehicle, wireless communication for safety and infotainment (early dedicated short-range communications), connected navigation, initial Apple iPod integration, and multiple telematics concepts for concept vehicles.

Thomas was part of the team that developed and launched the Mercedes-Benz maps in 2011. In the years following the launch, he worked on expanding services and market distribution. From 2014 and on, he worked on the specification and predevelopment of high-definition (HD) maps and localization for the SAE Level 3 Highway Chauffeur Mercedes product that was successfully handed over for development to the engineering group in Germany. After that, he worked on Daimler and Bosch's joint urban automated driving project where he led the team on HD maps and services for SAE Level 4 automated driving.

Thomas is originally from Germany and earned his Dipl.-Ing. (Master of Science equivalent) in Computer Science & Electrical Engineering from the University of Siegen.

contents



Unsettled Issues on HD Mapping Technology for Autonomous Driving and ADAS

Abstract

Current advanced driver-assistance systems (ADAS) and automated driving systems (ADS) rely on high-definition (HD) maps to enable a range of features and functions. These maps can be viewed as an *additional* sensor from an ADAS or ADS perspective as they impact overall system confidence, reduce system computational resource needs, help improve comfort and convenience, and ultimately contribute to system safety.

However, HD mapping technology presents multiple challenges to the automotive industry. This report identifies the current unsettled issues that need to be addressed to reach the full potential of HD maps for ADAS and ADS technology and suggests some possible solutions. The key unsettled issue involves the creation of ADAS and ADS HD map content that is timely, accurate, safe, and high fidelity:

- Initial map creation—economics and feasibility of scaling HD map creation worldwide
- Map change detection and updates—how changes in map content are detected and how a map is updated
- Map safety levels—how map content is validated in order to contribute to system safety

Other important topics, like security and privacy are noted, but not further addressed in this report. In this report, we do not discuss map-less ADAS or ADS technology—we assume a map is required.

NOTE: SAE EDGE Research Reports are intended to identify and illuminate key issues in emerging, but still unsettled, technologies of interest to the mobility industry. The goal of SAE EDGE Research Reports is to stimulate discussion and work in the hope of promoting and speeding resolution of identified issues. SAE EDGE Research Reports are not intended to resolve the challenges they identify or close any topic to further scrutiny.

THOMAS BOCK
Porsche Digital Inc.

EDGE Contributor Team

Wei Luo, PhD, *DeepMap*
Ro Gupta, *CARMERA*
Henning Lategahn, PhD, *atlatec GmbH*
Gunnar Gräfe, Dr. -Ing., *3D Mapping Solutions GmbH*
Chris Wilson, *Connected Vehicle and ADAS Consultant*
John D. Russell, *ORX-Labs*
Fabian Klebert, *NDS*
Sven Beiker, PhD, *Silicon Valley Mobility*
Martin Schleicher, *Elektrobit*

ISSN 2640-3536