Business plan for a DIN SAE SPEC project according to the PAS procedure on

“Test methods for LiDAR Performance in Adverse Conditions”

Status:

For developing the DIN SPEC after adoption on 12.05.2025

Recipients of this business plan are requested to name all patent rights known to them to be relevant to the project and to make available all supporting documents.

Berlin, 20.05.2025 (Version 2)

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1 Status/version of the business plan

- **For public commenting (Version 1)**

  This business plan is intended to inform the public of a new DIN SAE SPEC project. Any interested party can take part in this project and/or comment on this business plan. Please send any requests to participate or comments by e-mail to maria.mensch@din.de.

  Once this business plan is published, the Chairman of DIN's Executive Board decides whether or not the project is to be carried out.

  If the project is accepted, all those who have applied for participation or have commented on the business plan by the deadline will be invited to the kick-off meeting of the project consortium.

- **For developing the DIN SPEC after adoption on <date of kick off> (Version 2)**

  Changes to the previous version xx:

  – Section 2: Table of participating organizations added

  – Section 7: Information on consortium leader added

2 Initiator and other consortium members

- **Initiator:**

Person/Organization	Short description
Amogh Sakpal &Prof. Dr.-Ing. Adrian Zlocki ,fka GmbH	Heading the LiDAR Testing activities at fka GmbH. Led the activities which led to the creation of the DIN SAE 91471 specification in 2023. Led a consortium on LiDAR Performance in adverse conditions from 2023 until 2025.

- **Other potential participants:**

  This DIN SAE SPEC will be developed in a consortium (temporary body) that is open to any interested party. The participation of other experts would be helpful and is desired. It is recommended that

  – R&D personnel

  – Sensor hardware and software developer

  – Test track operators

  – Testing organizations

  – Manufacturers of automated vehicles and ADAS/AD functions

  – etc.

  take part in the development of this DIN SAE SPEC.

- **Organizations**[Fehler! Textmarke nicht definiert.] **that have registered for participation**

Jan Thielmann	Honda R&D Europe GmbH
Ovidiu Luca-Savin	Valeo Detection Systems GmbH
Nico Heußner,	TORC Robotics, Inc.
Matthew Weed	Luminar Technologies, Inc.,
Henrik Eliasson,	Volvo Car Corporation
Viktor Rausch	MicroVision, Inc.
Gerhard Schunk	Scantinel Photonics GmbH
Felix Kocksch	DEKRA SE
Dan Skiba	CHASM Advanced Materials, Inc.
Alexis Vander Biest	SONY Depthsensing Solutions
Daniel Dreschers	Kautex Textron GmbH & Co. KG
Ulf Grothusen	Daikin Chemical Europe GmbH
Eric Amiot	Driving Vision News
Dr. Maria Mensch	DIN e.V.

- **Organizations**[Fehler! Textmarke nicht definiert.]**, that have adopted this business plan (consortium members):**

Person	Organization
Dr. Amogh Sakpal	fka GmbH
Ulrich Kradephol	fka GmbH
Prof. Dr.-Ing. Adrian Zlocki	fka GmbH
Jan Thielmann	Honda R&D Europe GmbH
Ovidiu Luca-Savin	Valeo Detection Systems GmbH
Henrik Eliasson,	Volvo Car Corporation
Vivek Pimpalshende	Scantinel Photonics GmbH
Felix Kocksch	DEKRA Automotive
Daniel Dreschers	Kautex Textron GmbH & Co. KG
Dr. Maria Mensch	DIN e.V.

3 Objectives of the project

3.1 General

This DIN SAE SPEC shall build on the DIN SAE SPEC 91471 and mainly focus on adverse conditions such as weather, contamination and interference. Adverse weather tests, contamination tests, interference tests and sensor cleaning tests are considered in this specification. Static tests are mostly based on the DIN SAE 91471 specification. Along with static tests, this new specification shall also include driving tests for evaluation on object level. The driving tests are similar to the EuroNCAP AEB tests and leverage adverse conditions proposed for an evaluation on the object level, including the software for point cloud processing.

Another aspect addressed by this specification is generation of training data for AI models. Modern research topics include leveraging onboard ADAS/AD sensors for estimation of weather conditions in order to choose the best fusion parameters for the estimated weather conditions. The estimation of weather conditions for different sensor modalities is performed using artificial intelligence. In order to train the AI models, a lot of data is required from the different sensor modalities with the corresponding measurements for weather conditions. For sensors such as LiDARs, using standardised tests with standard targets under artificial controlled adverse conditions such as rain or fog can help generate data to support the training process for such AI-based features. Standardised tests for adverse conditions not only help to train the AI algorithms but also can be used for validation of the weather estimation features.

3.2 Planned scope

This DIN SAE SPEC shall define requirements for performance evaluation of the LiDAR sensors in adverse conditions independent of LiDAR technology. This new SPEC shall include static tests which allow performance evaluation on point cloud level as well as dynamic tests which allow performance evaluation on object level. Object level evaluation combines performance of LiDAR sensor and perception software for point cloud processing. Adverse conditions include non-ideal weather, contamination on LiDAR or in the environment surrounding the LiDAR, interference with other LiDARs. Along with adverse conditions, a set of tests for evaluation of LiDAR cleaning systems using the point cloud output of LiDARs are also proposed. Similar to the DIN SAE SPEC 91471 test scenarios, tools and methods considered for physical testing on the proving ground will be defined. This document does not seek to establish functional safety requirements. This document is intended for R&D personnel, sensor hardware and software developers, test track operators, testing organizations and manufacturers of automated vehicles and ADAS/AD functions.

3.3 Related activities

The subject of the planned DIN SAE SPEC is not at present the subject of a standard. However, there are committees, standards and/or other technical rules that deal with related subjects and thus need to be taken into account - and involved or incorporated, where necessary - in this project:

- SAE LiDAR Task Force
- ISO/AWI 13228
- NA 052-00-32-16 AK
- DIN SAE 91471
- EuroNCAP

4 Work programme

The aim of the project is to develop a DIN SAE SPEC according to the PAS procedure (see www.din.de/go/din-spec-en). The DIN SAE SPEC shall be consistent with the body of German standards and shall not be in conflict with any DIN Standard.

The kick-off meeting is planned to take place on 12. May 2025 per Web conference. The project duration will be about 5 months.

At this kick-off meeting, the consortium for developing the DIN SAE SPEC will be constituted, further organizational issues will be decided on and clarified, and, where possible, work on the subject matter will be begun.

A draft for public commenting will not be published.

A total of 2 project meetings (kick-off meeting and work meetings) and 1 web conferences will be held, during which the content of the DIN SAE SPEC will be presented, discussed and approved. The content of the DIN SAE SPEC can be drawn up by individual consortium members or in working groups.

Dates of further meetings and/or web conferences are to be agreed on within the consortium in consultation with DIN.

The DIN SAE SPEC will be drawn up in English (language of meetings, minutes, etc.). The DIN SAE SPEC will be written in English.

NOTE The calculation covers only one language version. Please keep in mind the fact that other language versions involve additional expenses; for this reason, they shall be agreed on separately. If another language version is desired, DIN Media/DIN can provide a translation. Requests for translations are to be submitted after the DIN SPEC manuscript has been approved for publication.

5 Resource planning

Each consortium member shall bear the expenses he/she incurs as a result of participation in the project.

If the DIN Executive Board approves the project, the initiator of the project will then conclude a contract with DIN.

Consortium membership and participation in the project meetings is free of charge, as the costs incurred by DIN throughout the performance of this project will be financed by funding from the research project "Modul F5 – KI-Geschäftsstelle 2021-2025" funded by the Federal Ministry for Economic Affairs and Climate Action of Germany (BMWK) as per the funding announcement “Förderung von Technologie- und Innovationstransfer aus Kapitel 0901 Titel 685 01 des Bundeshaushaltes 2021 bis 2025 (funding reference no.: 46DINF5).

6 Rules of cooperation in the DIN SPEC consortium

This project is governed by the PAS procedural rules. All interested parties and consortium members are to inform themselves of these procedures by going to www.din.de/go/din-spec-en.

The consortium will be constituted during the course of the kick-off meeting. The kick-off meeting will not take place until the business plan has been published and approved by DIN's Management Board. The consortium shall comprise at least three members

from different organizations[1]. It is not necessary that these members come from different areas and represent different stakeholders. By approving this business plan, the interested parties declare their willingness to participate in the consortium and will be formally named as consortium members, with the associated rights and duties. Participants at the kick-off meeting who do not approve the business plan are not given the status of a consortium member and are thus excluded from further decisions made during the kick-off meeting and from any other decisions regarding the project.

If an organization (e.g. an association) sends someone who is not an employee to the consortium, this person shall be authorized by the organization, who shall provide proof of this to DIN.

Each consortium member is entitled to vote and has one vote. If an organization sends several experts to the consortium, that organization has only one vote, regardless of how many consortium participants it sends. Transferring voting rights to other consortium members is not permitted. During voting procedures, decisions are passed by simple majority; abstentions never count.

As a rule, the consortium is closed once it is constituted. The current consortium members shall decide whether any additional members will be accepted or not.

During the kick-off meeting, the consortium members shall elect a consortium leader, who is responsible for content management and any decision-making and voting procedures. The leader is supported by the responsible DIN Project Manager, whereby DIN will always remain neutral regarding the content of the DIN SPEC. Furthermore, the DIN Project Manager shall ensure that DIN's rules of procedure, rules of presentation, and the principles governing the publication of DIN SPEC have been observed. Should a consortium leader no longer be able to carry out his/her duties, the DIN Project Manager shall initiate the election of a new leader.

The DIN Project Manager is responsible for organizing and leading the kick-off meeting, in consultation with the initiator. Further project meetings and/or web conferences shall be organized by the DIN Project Manager in consultation with the consortium leader.

If consortium members cannot be present when the DIN SPEC or its draft is approved, an alternative means of including them in the voting procedure shall be used (e.g. in writing, electronically).

All consortium members who voted for the publication of the DIN SPEC or its draft will be named as authors in the Foreword, including the organizations which they represent. All consortium members who voted against the publication of the DIN SPEC or its draft, or who have abstained, will not be named in the Foreword.

Any expansion of the consortium at a later date is decided on by the members making up the consortium at that time. It is particularly important to consider these aspects:

a) expansion would be conducive to shortening the duration of the project or to avoiding or averting an impending delay in the planned duration of the project;

b) the expansion would not result in the project taking longer to complete;

c) the new consortium member would not address any new or complementary issues beyond the scope defined and approved in the business plan;

[1] Organizations are legal entities and natural persons, insofar as they participate in business transactions on a commercial or freelance basis. If several legal entities are part of a group or a corporate structure within the meaning of Section 15 of the German Stock Corporation Act (§ 15 Aktiengesetz) or Section 271 (2) of the German Commercial Code (§ 271 Absatz 2 Handelsgesetzbuch), they are deemed to be one organization.

d) the new consortium member would bring complementary expertise into the consortium in order to incorporate the latest scientific findings and state-of-the-art knowledge;

e) the new consortium member would actively participate in the drafting of the manuscript by submitting concrete, not abstract, proposals and contributions;

f) the new consortium member would ensure wider application of the DIN SPEC.

To allow the legal reproduction and distribution of results for the purposes of project work, the consortium members grant DIN rights of use on the basis of the copyright that will accrue to them for the results of their work on the DIN SPEC. The transfer of these utilization rights does not prevent the consortium members from using and further developing the knowledge, experience and findings they bring to the project.

Consortium members are requested to inform DIN of all patent rights known to them to be relevant to this DIN SPEC project.

Subsequent changes to the scope (Section 3.2) or to the resource planning (Section 5) require, in addition to a two-thirds majority of all votes cast, the approval of DIN.

7 Contacts

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Annex: Project schedule (preliminary)

DIN SPEC Project	2025																									
	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		Jan	
Initiation																										
1. Request and review																										
2. Business plan drawn up																										
3. Publication of business plan																										
Development phase																										
4. Kick-off meeting/consortium constituted																										
5. DIN SPEC drawn up																										
6. DIN SPEC approved by consortium																										
Publication																										
7. Review and release by DIN																										
8. Publication of DIN SPEC																										
Milestones									**K**				**W**				**M / A**									

K Kick-off
M Project meeting
W Web conference
A Adoption of DIN SPEC