



Informal Working Group on
**Functional Requirements for
Automated Vehicles**

Report to the 7th GRVA Session

- FRAV is focused on Automated Driving Systems (ADS)
 - System capable of driving a vehicle without human support
 - Not driver assistance (ADAS) or “automated/autonomous vehicles”
 - ADS means the hardware and software that are collectively capable of operating a vehicle on a sustained basis (i.e., SAE Level 3+ systems).
- An ADS may operate in more than one ODD
 - Not “the ODD of the vehicle”—not necessarily a single ODD
 - “Operational Design Domain” (ODD) refers to the conditions under which an ADS is designed to operate; however, there may be more than one discrete set of conditions.
 - FRAV understands ODD as categorically referring the **external driving environment** of the vehicle.
 - Nothing prevents application of ADS technologies to specific and separate driving environments or use specifications.
 - Nothing prevents a single ADS from controlling more than one distinct and separate application.

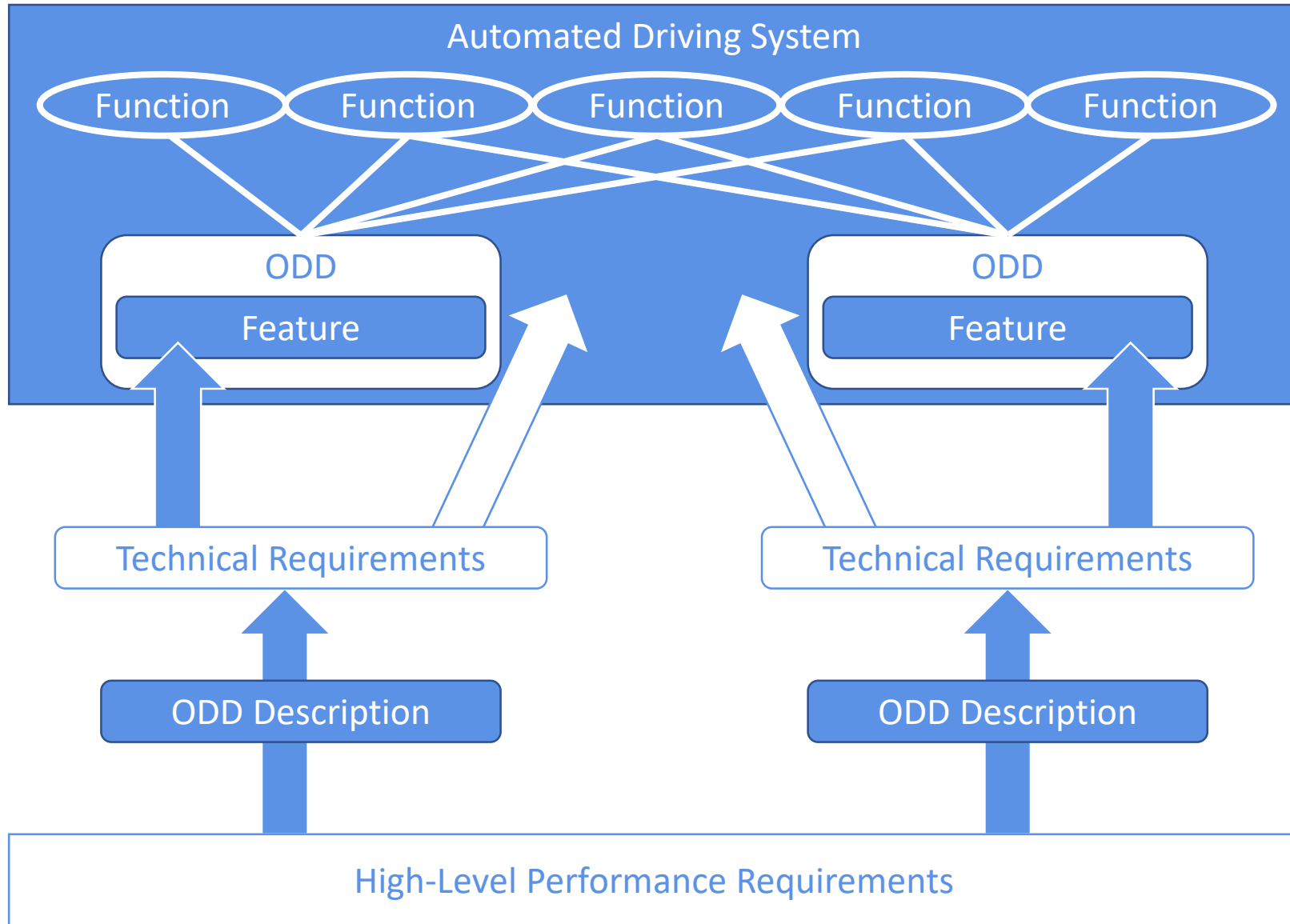
- ADS requirements should address these ODD-specific uses
 - ADS should be evaluated based upon the capabilities made available to the operator.
 - Each ODD presents a unique set of conditions and safety considerations.
- An ADS feature is an ODD-specific application of ADS technologies
 - “Feature” is a widely used term in the marketing of ADS technologies (e.g., ALKS, traffic jam pilot, highway pilot, valet parking, summon feature).
 - These features have different intended uses and limitations on their use.
 - An ADS feature means an application of ADS hardware and software designed specifically for use within an ODD.
 - ODD refers specifically to the conditions under which an ADS **feature** is designed to operate (not “the ODD of the ADS” or “the ODD of the vehicle”).
 - Addresses innovation, including updates in use (e.g., activating new capabilities with a unique ODD, modifying ODD of existing features, merging of features under a single ODD)

- An ADS may control more than one feature.
 - Each feature should be assessed based on its intended use(s) and limitations on use.
- FRAV will define performance requirements applicable across ADS configurations
 - Top-down approach to seek optimal level of detail
 - Avoid multiplication of texts based on definitions of applications (e.g., ALKS)
 - Regulations should not set artificial boundaries on the ODD of individual features
 - Manufacturers should define the ODD of the features
 - Avoid proliferation of ODD-specific technical specifications and test procedures (“1000-page regulations”)
 - Requirements responsive over the long term to technological advances (technology-neutral to avoid interference with innovation)

- Requirements need to be applicable based upon specifications of individual ADS features
 - ADS features expected to have diverse ODD conditions per each manufacturer's decisions on intended uses and limitations.
- Manufacturers need to provide descriptions of ADS and its feature(s)
 - Uniform guidance on the descriptions to be provided
 - Definition of ODD elements (e.g., described in measurable/verifiable terms)
 - Additional elements may be deemed necessary (e.g., driver status or other “internal” operational conditions)
 - The elements would include mandatory items as well as additional items the manufacturer may wish to include
 - Ensure accurate understanding of ADS intended uses and limitations:
 - “Rain” may be an ODD boundary condition for an ADS (i.e., not designed to operate in “rain”). Therefore, the general requirement is to detect this condition and safely deactivate the ADS.
 - An ADS may be designed to operate in “rain”. Therefore, the general requirement is to adapt the driving behavior to account for lower visibility, lower road-surface adhesion, etc.

- Drivers continuously perform certain functions
 - Control the vehicle motion and behavior
 - Monitor the driving environment
 - Evaluate the vehicle situation relative to other road users
 - Determine appropriate responses to static and dynamic conditions
- Requirements should ensure that ADS have means to perform DDT
 - Above functions described under SAE J3016 as the Dynamic Driving Task (DDT)
 - Loss of such capabilities would render the ADS inapt to drive the vehicle
 - ADS will need safeguards to safely manage such failures (i.e., functional safety)
 - VMAD has responsibility for the validation of functional and operational safety
 - FRAV has responsibility for performance requirements related to the DDT

- Definitions of performance requirements
 - Applicable across the anticipated applications of ADS technologies (i.e., high-level requirements)
 - Addressing ADS and feature behaviors (e.g., nominal and emergency driving behavior, interactions with operators and other road users, post-crash behavior)
 - Addressing ADS functional prerequisites (e.g., object detection and classification, environmental and operator monitoring)
- Mandatory requirements for manufacturer descriptions of the ADS and its feature(s)
 - Ensure understanding of ADS design, intended uses, and limitations on use
 - Definition of measurable/verifiable ODD elements to be addressed
 - Definition of other elements as may be needed
- Performance requirements designed for objective interpretation as ADS-specific technical requirements based on the ADS descriptions.



The ADS is the system.

An ADS has one or more features.

Each feature has a unique ODD.

ADS functions perform the DDT.

The functions enable the features.

Features may use all or some ADS functions and features may share the same functions.

Descriptions enable objective determination of ADS-specific requirements.

ODD descriptions enable a clear understanding of the ADS design and intended uses and limitations of its features.

Performance requirements cover all ADS configurations.

- “System safety” is an overall concept, not a set of requirements
 - Related to design, performance, and safety assurance methods (i.e., assurance of system safety is an overall objective of FRAV and VMAD).
 - FRAV intends to describe “system safety” as a basis from which to derive specifications for “safe performance”.
- “Safe performance” will address ADS driving behavior, interactions with the ADS operator, interactions with other road users, post-crash behavior, DDT performance, and other aspects to be determined.
- ADS descriptions will define elements that could impact ADS performance
 - Aligned with performance requirements to enable methodical and objective interpretation at a technical level suitable for assessment of the ADS and its feature(s).

- FRAV is positioned to consider individual performance requirements
 - Definition of “system safety” as an overarching concept
 - Top-down approach informed by 142 proposals for requirements gathered from FRAV stakeholders
- FRAV is seeking consensus on the method(s) for considering proposals for requirements
 - Method to determine optimal level of specificity
 - Method to ensure coverage of ODD and other performance-related elements
- By the November WP.29 session, FRAV hopes to:
 - Provide a list of performance elements for which FRAV will define “safe” (to ensure coverage of Contracting Party performance concerns)
 - Provide a list of elements to be defined by FRAV and covered by manufacturer descriptions of an ADS and its feature(s)
- FRAV intends to seek close alignment with the work of VMAD.
 - The FRAV-VMAD leaderships are coordinating and foresee updates to Table 1 in the annex of the AV Framework Document to ensure alignment of work schedules and deliverables to WP.29.



Thank you for your attention

Any questions or comments?