

## **Proposal for structuring the working items for FRAV**

Note: The purpose of this document is to propose a structure for the working items related to the development of functional requirements for the automated and autonomous vehicles. It covers the functions listed in the IWG on FRAV Terms of Reference. If agreed by FRAV, this structure could be converted to the IWG on FRAV workplan. This document is based on the documents FRAV-00-02 and FRAV-00-05 submitted by the expert from the Russian Federation to the IWG on FRAV preparatory meeting.

### **Extract from the IWG on FRAV Terms of Reference (TOR) (GRVA-04-13 reproducing Annex V to the session report of the WP.29 178<sup>th</sup> session)**

“3. As noted in document ECE/TRANS/WP29/2019/34 as amended, the IWG shall:

- Develop functional (performance) requirements for automated/autonomous vehicles, in particular, the combination of the different functions for driving:

- (a) longitudinal control (acceleration, braking and road speed),
- (b) lateral control (lane discipline),
- (c) environment monitoring (headway, side, rear),
- (d) minimum risk maneuver,
- (e) transition demand,
- (f) HMI (internal and external) and
- (g) driver monitoring.”

### **Working item 1: Classification and definitions for automated driving technologies**

It can be foreseen that the functional requirements for the automated and autonomous vehicles could be divided to general requirements and those specific to a particular technology and not relevant to other technologies.

**Example 1.** An automated passenger shuttle should provide specific features ensuring safety of passengers and interact with passengers. It also should provide ride comfort for passengers.

**Example 2.** A platooning technology should ensure smooth transition of vehicle control from a human driver to an automated driving system and vice versa. Providing priority of human control actions is important for this technology.

**Example 3.** A robotaxi should be assessed with regard to a wide variety of use cases.

### **Working item 2: Performing a Dynamic Driving Task (DDT)**

**Working item 2.1:** According to SAE J3016 (term 3.13), Dynamic Driving Task (DDT) is all real-time operational and tactical functions required to operate a vehicle in on-road traffic. **IWG on FRAV may decide on** the list of functions and the requirements for the execution of the functions, if this approach does not look too generic.

**Working item 2.2:** Performing a Dynamic Driving Task (DDT) means providing longitudinal control (TOR item (a)) either by accelerating, or decelerating, or maintaining constant speed via engine control or braking system, and lateral control (TOR item (b)) via steering system. **IWG on FRAV may decide on** development of specific functional requirements to vehicle engine control, braking and steering, bearing in mind that existing UN Regulations Nos. 13, 13H and partly 79 are not relevant to the automated driving conditions.

**Working item 2.3:** A Dynamic Driving Task (DDT) is performed within an Operational Design Domain (ODD), which is, according to SAE J3016 (term 3.22) an automated driving system or a feature thereof operating conditions under which it is functioned (depending on the level of automation called in SAE J3016 (term 3.28) “usage specification” relevant to a particular ODD. **IWG on FRAV may decide on** the mandatory list of conditions, restrictions and boundaries, which formulate ODD.

**Working item 2.4:** In the case of a DDT performance-relevant failure or exit ODD a DDT Fallback shall be executed. According to SAE J3016 (term 3.14) DDT Fallback is the response of the user to perform DDT or achieve a minimum-risk condition in response to DDT performance-relevant failure or exit ODD or the response of the Automated Driving System (ADS) to achieve a minimal risk condition. Taking into account the performance of an ADS under this working item, **IWG on FRAV may decide on** the list of DDT fallback cases and the ADS performance at DDT fallback cases.

**Working item 2.5:** According to SAE J3016 (term 3.17), Minimal Risk Condition is a condition to which a user or a driving automation system may bring a vehicle after performing the DDT fallback. **IWG on FRAV may decide on** the list of the minimal risk conditions and on how to bring a vehicle to such conditions by executing minimum risk maneuver(s) (TOR item (d)) or emergency maneuver(s). A minimum risk maneuver is executed when a driver did not respond to the ADS request to intervene. An emergency maneuver is executed in the case of a sudden and unexpected event in which a vehicle is in immediate danger of colliding with another object, in order to prevent a collision or to reduce the severity of its consequences. **IWG on FRAV may decide on** the specifications for the minimum risk maneuver(s) and emergency maneuver(s).

**Working item 2.6:** Performing a Dynamic Driving Task (DDT) is impossible without monitoring the driving environment. According to SAE J3016 (term 3.19.2), monitoring the driving environment is the activities and/or automated routines that accomplish real-time roadway environmental object end event detection, recognition, classification and response preparation. Monitoring the driving environment is linked to the other term from SAE J3016 (term 3.20): Object and Event Detection and Response (OEDR), which means the subtasks of DDT that include monitoring of the driving environment and executing the appropriate response as needed to complete DDT and DDT Fallback. TOR item (c) is environment monitoring (headway, side, rear). **IWG on FRAV may decide on** the list of objects for OEDR, the relevant list of activities and routines, as well as performance requirements.

### **Synergy of IWG on FRAV and IWG on VMAD (Informal Working Group on Validation Methods for Automated Driving)**

Similarly to IWG on FRAV, the activity of the IWG on VMAD relates to performing a Dynamic Driving Task (DDT). But IWG on VMAD works on the ADS safety in general, developing for that a multi-pillar approach. To verify the ADS performance, IWG on VMAD develops a set of traffic/testing scenarios, the assessment criteria for those, to ensure that the characteristics of vehicle dynamics are within the boundaries acceptable for humans. IWG on VMAD activity also covers to requirements to Complex Electronic systems (CEL).

### **Working item 3: Interaction of an automated driving system with human user(s) and the environment**

**Working item 3.1:** Activities of Human Users and internal HMI. TOR item (f) refers to HMI (internal and external). According to SAE J3016 (term 3.29), a [Human] user means a human role in driving automation. SAE J3016 divides the roles of users to: Conventional Driver (term 3.29.1.1), Remote Driver (term 3.29.1.2), Passenger (term 3.29.2), DDT Fallback-Ready User (term 3.29.3) and Driverless Operation Dispatcher (term 3.29.4). **IWG on FRAV may decide on** what kinds of users are involved in vehicle operation, his/her functions and expected performance.

**Working item 3.2:** External HMI, which means the interaction of an ADS with other traffic participants, so that they could recognize and understand the intentions of an ADS. TOR item (f) refers to HMI (internal and external). **IWG on FRAV may decide on** what kind of signals should be provided by an ADS to other traffic participants.

**Working item 3.3:** Providing priority of a human driver control actions. **IWG on FRAV may decide on** how the priority of a human driver control actions should be provided.

**Working item 3.4:** Transition Demand, which refers to TOR item (e). This corresponds to the SAE J3016 term 3.24 “Request to intervene”, which means notification by an ADS to a fallback-ready user indicating that he/she should promptly perform the DDT fallback, which may entail manual operation of the vehicle or achieving a minimal risk condition if the vehicle is not drivable. According to SAE J3016 (term 3.14) DDT Fallback is the response of the user to perform DDT or achieve a minimum-risk condition in response to DDT performance-relevant failure or exit ODD or the response of the Automated Driving System (ADS) to achieve a minimal risk condition. Taking into account the performance of a human user under this working item, **IWG on FRAV may decide on** the list of DDT fallback cases and the ADS performance at DDT fallback cases (see also the working item 2.4).

**Working item 3.5:** Driver monitoring, which refers to TOR item (g). This corresponds to the SAE J3016 terms 3.19.1 “Monitor the User”, which means the activities and/or automated routines designed to assess whether and how the user is performing his/her specified role, and 3.23 “Receptivity [of the user]”, which means a person’s ability to reliably and appropriately focus his/her attention in response to a stimulus. **IWG on FRAV may decide on** the role of the users (e.g. conventional driver or passenger, whether they can be allocated a role of a DDT fallback-ready user – see working item 3.1) and how the monitoring should be performed.

#### **Working item 4: Monitoring performance of a vehicle and an automated driving system**

**Working item 4.1:** Monitoring vehicle performance. According to SAE J3016 (term 3.19.3), monitoring vehicle performance is the activities and/or automated routines that accomplish real time evaluation of the vehicle performance and response preparation. This term corresponds to the term 3.18 “[DDT Performance Relevant] System Failure”, which means a malfunction in driving automation system that prevents it from reliably performing DDT on a sustained basis. **IWG on FRAV may decide on** the list of considerable system failures, description of failures and relevant actions by a vehicle and the list of what is monitored.

**Working item 4.2:** Monitoring driving automation system performance According to SAE J3016 (term 3.19.4), monitoring driving automation system performance means the activities and/or automated routines for evaluating whether the driving automation system is performing DDT appropriately. **IWG on FRAV may decide on** the list of activities and routines and how such monitoring should be performed.

**Working item 4.3:** Roadworthiness of an ADS in operation. **IWG on FRAV may decide on** the activities to be undertaken to verify the correctness of an ADS performance while the automated driving vehicle is in operating conditions.

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