

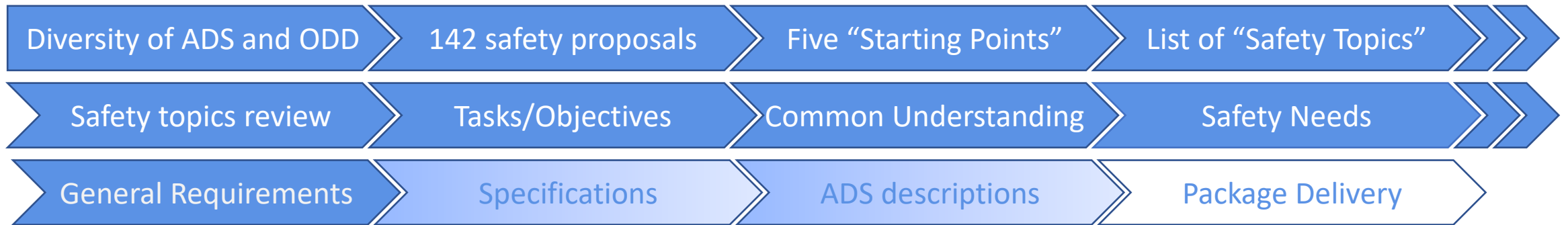
Informal Working Group on
Functional Requirements
for Automated Vehicles

Status Report

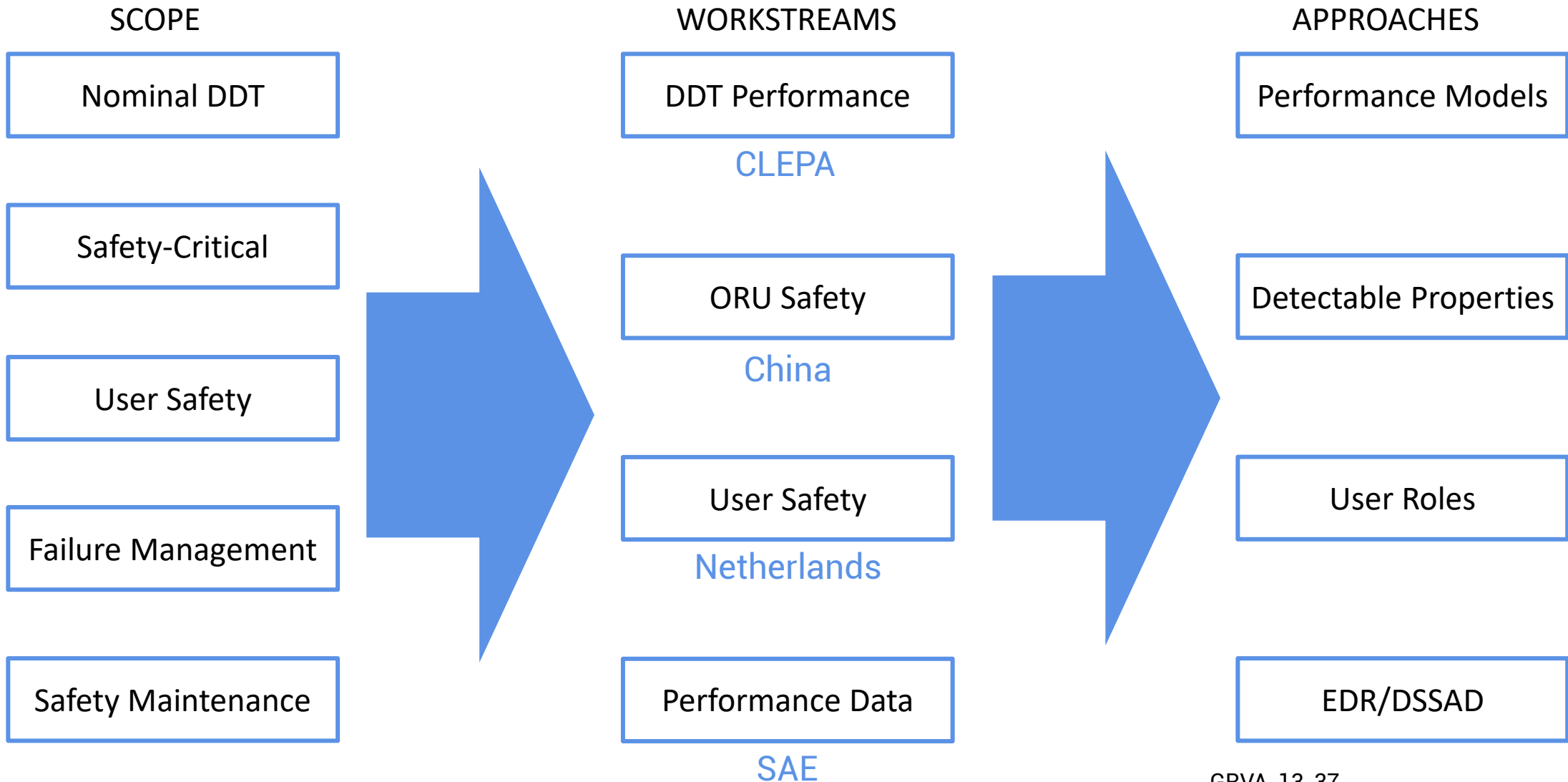
13th GRVA Session

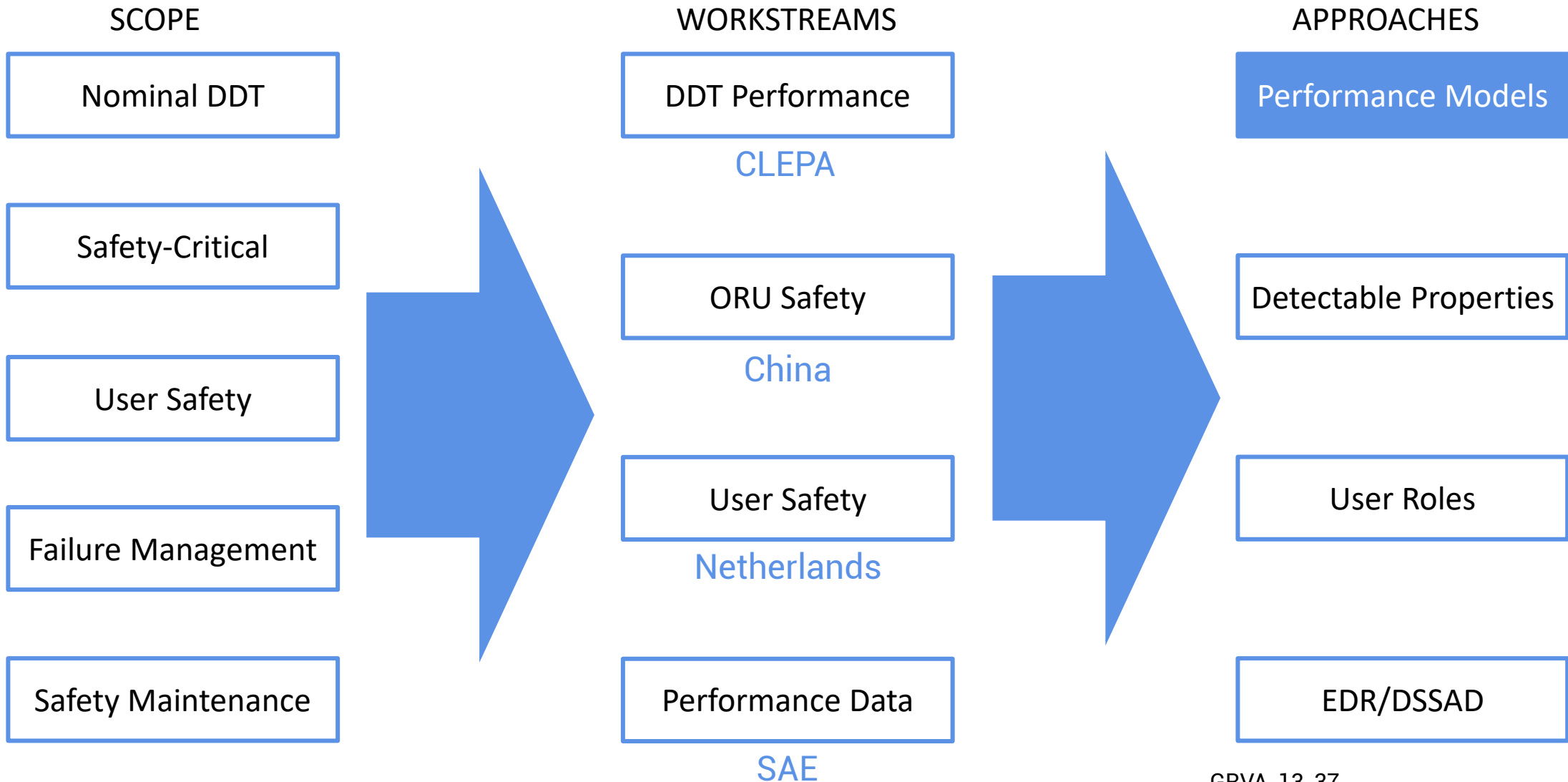
23-27 May 2022





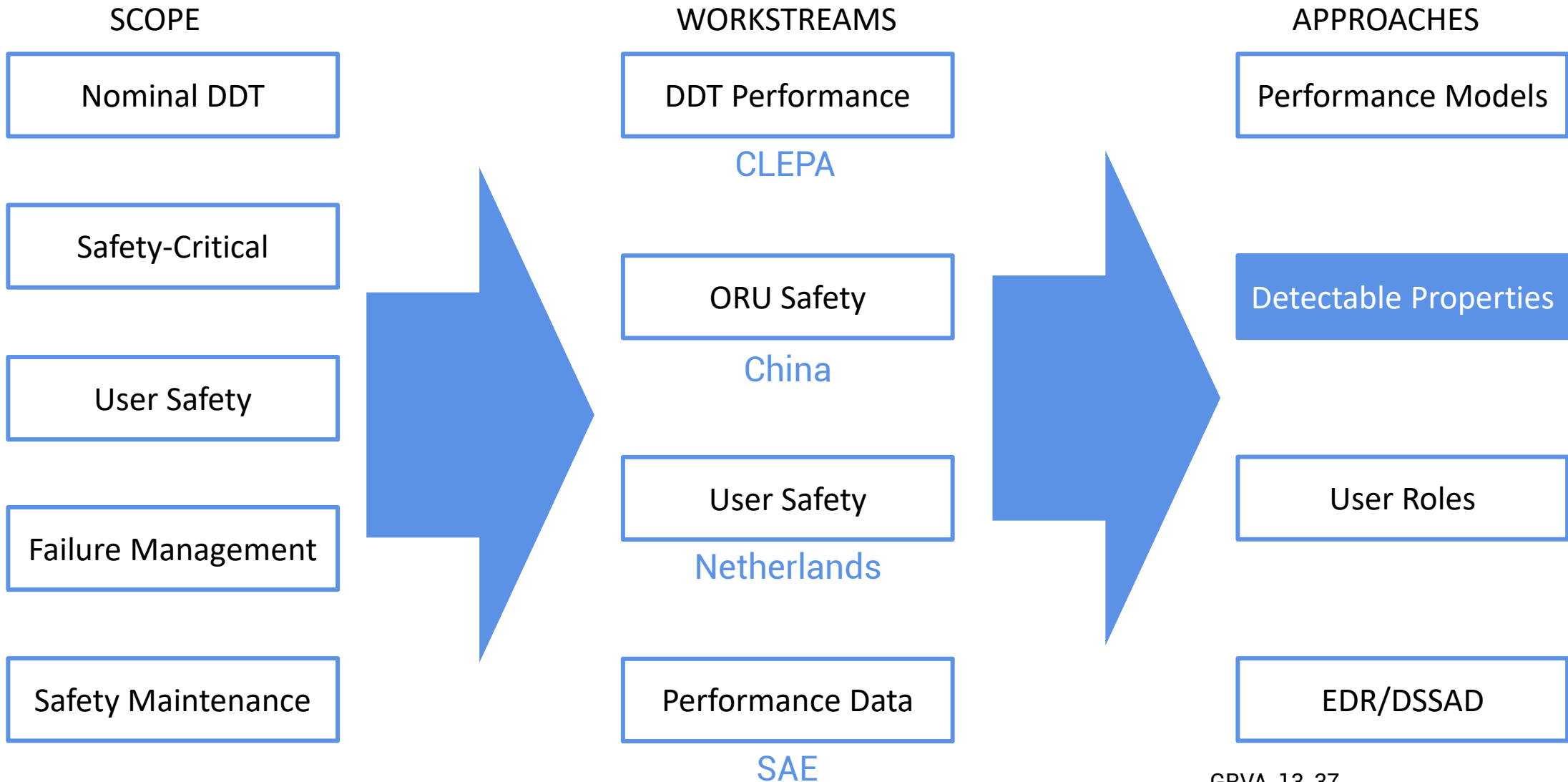
- DDT performance safety models
 - Global requirements/local variables
- Traffic law conversion procedure
 - ADS-applicable criteria for determining compliance with local laws
- OEDR framework to address ORU interactions
 - Recognition at level of detail needed to underpin response requirements (e.g., comply with traffic laws concerning response to priority vehicle)
- ADS user HMI and interactions specifications





- Challenge of local variables and assumptions.
 - Local operating conditions cannot be harmonized: Traffic laws, signs, signals, markings, languages, driver education and behaviors, etc.
 - Safe driving depends upon adaptation to local conditions and assumptions.
- Verifiable metrics can be derived from the application of an ODD-based approach.
 - Allow application of local variables and assumptions
 - Propose multiple modeling methodologies. (safety envelopes, scenario-based, driver modeling, technology state-of-the-art, etc.)
 - Compare ADS performance against benchmarks for expected behavior (e.g., ADS performance vs model performance)
 - Address collision-avoidance/crash-mitigation boundaries.

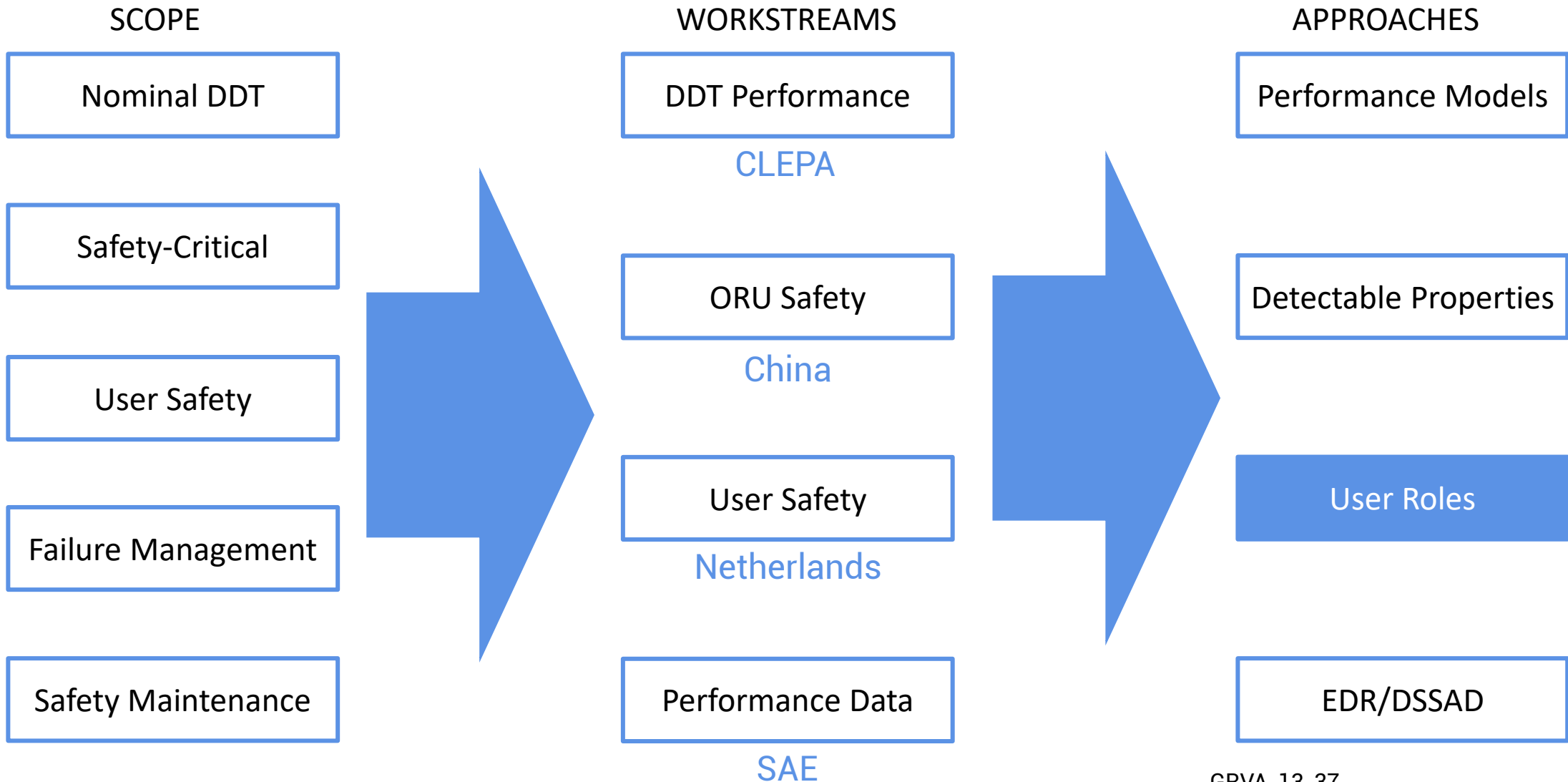
- Global requirements with verifiable criteria established via an ODD-based approach.
 - DDT performance requirements will not be prescriptive.
 - Approach allows for local constraints and parameters.
 - Performance acceptable if satisfies model expectation.
- FRAV analyzing various models.
 - Aim to propose various models that result in safe driving actions.
 - May result in multiple models that may be used to demonstrate performance.
 - Models can address nominal driving and collision avoidance/mitigation.
- Expectation to furnish global specifications with annexes providing methods for establishing verifiable criteria.



- Objects and other road users (ORU) have attributes detectable by an ADS.
 - These attributes enable differentiation.
- OEDR involves detection, recognition, and classification.
 - At the most basic level, an ADS must detect safety-relevant objects in and around the roadway.
 - Subsets of objects must be recognized to enable correct ADS evaluations and responses (e.g., car, truck, bus, motorcycle, cyclist, pedestrian, animal).
 - In some cases, subsets may need to be further classified (e.g., police car, fire truck, road worker).

- The properties-based approach aims to address ORU safety by ensuring that ADS will respond appropriately to roadway objects.
 - Detect the attributes that enable differentiation.
 - Recognize and classify objects in accordance with differences in the safety needs and ADS responses.
- This approach relates to issues surrounding ADS communications or signaling in ORU interactions.
 - Some, but not all, ORU may need information from the ADS.
 - For example, law enforcement may need to know if an ADS is operating a vehicle. However, this information could adversely impact ORU behaviors (e.g., increase in higher-risk behaviors based on predictability of ADS responses).

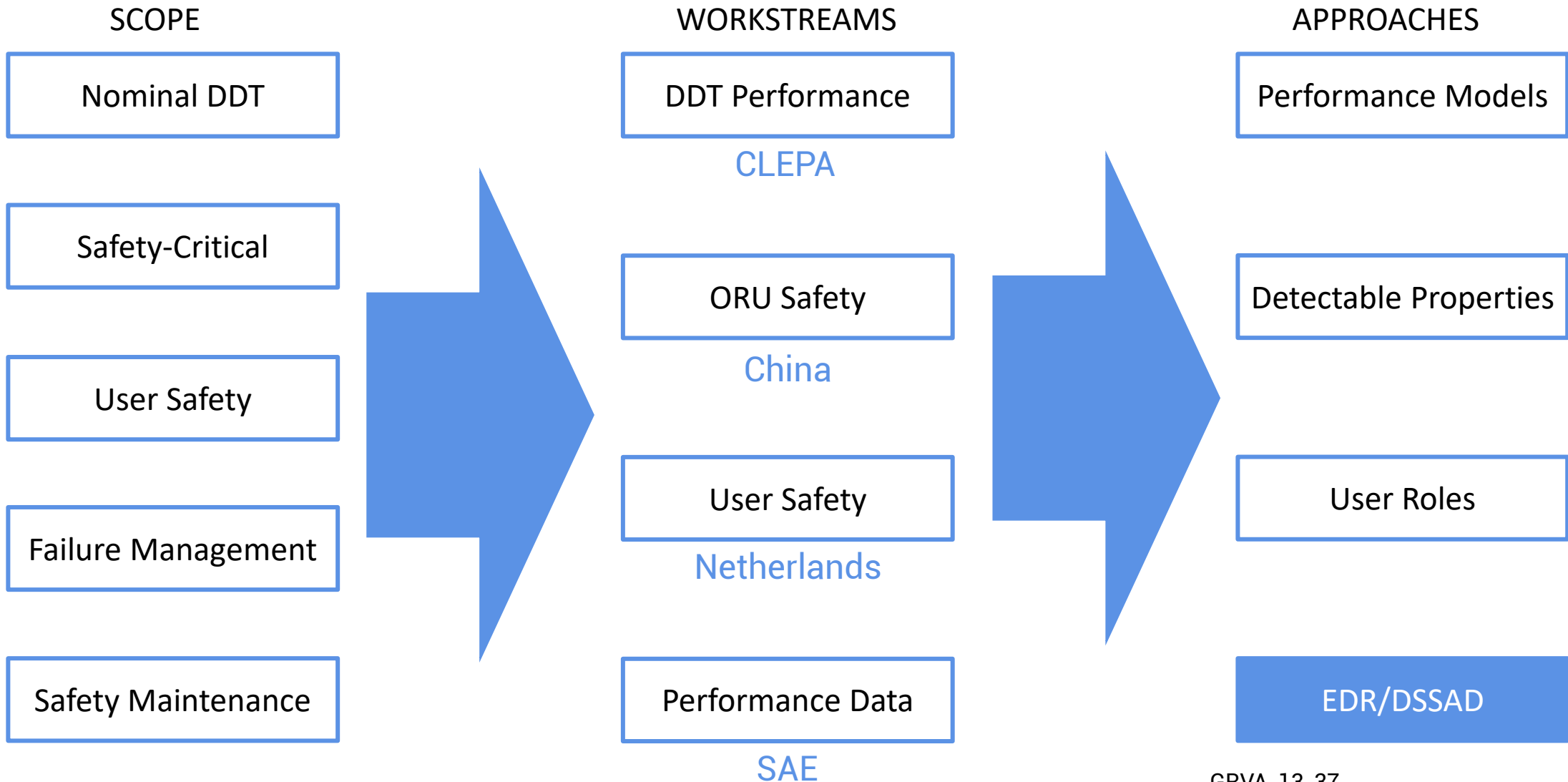
- ORU workstream building out OEDR-based framework.
 - Detectable properties to differentiate and classify ORU.
 - OEDR-based detection, recognition, and classification.
 - ADS safety recommendations for interactions with subsets of ORU.
- ORU workstream developing FRAV response to AC.2 mandate regarding external light-signaling.
 - Identify safety-relevant needs for external communication/signaling, if any.
 - Evaluate possible solutions to meeting needs.
 - Define nature of light-signaling solutions, if any.
 - Particular attention to communicating ADS operational status.
 - Deadline set for November 2022.



- ADS have different kinds of users.
 - Dependent upon ADS configuration and intended use.
 - Real-time role of the user which may change during a trip.
- Currently focused on in-vehicle user roles (vehicle occupants).
 - Driver controlling the vehicle.
 - Fallback user who may be permitted or requested to intervene in control.
 - Passenger with no possibility for direct physical role in vehicle control.
- Recognize possible external user relationships for future consideration of possible safety needs.
 - Forms of external activation (e.g., “dispatcher”).
 - Forms of external control (e.g., “remote operator”).
 - Forms of external commands (e.g., “summoning”).

- Aim to address user safety across roles, including but not limited to:
 - User information and education.
 - Driver activation of an ADS.
 - Fallback-user interventions to assume control.
 - Fallback-user responses to transition demands.
 - Transitions of control: notifications, fallback-user feedback evaluations, fallbacks to minimal risk condition.
 - Passenger interactions with ADS in driverless operation.
- Ensure commonality across ADS.
 - Avoid learning-curve risks.
 - Experience transferable across ADS vehicles.
 - Design neutrality: “commonality more than uniformity”

- Refining input on detailed provisions.
- Structuring recommendations for applicability across ADS use cases.
- Discussing alignment of roles with ADS configurations/use cases.
 - ADS that can be activated by a driver while the vehicle is in motion.
 - ADS that permit or request transitions to fallback user while vehicle moving.
 - ADS that only permit either ADS or driver control for duration of a trip.
 - ADS passenger vehicles with no driver controls (driverless vehicles).
 - ADS vehicles designed solely for goods (no possibility for any occupants).



- EDR/DSSAD addressing data collection/recording, including ADS.
 - EDR/DSSAD requested FRAV perspectives on data collection for ADS vehicles.
- FRAV provided recommendations to EDR/DSSAD
 - ADS data elements should be aligned to ADS configurations/use cases.
 - ADS differ in ways that impact relevant data (e.g., not all ADS would have driver controls, transport occupants, or permit transitions of control while vehicle is moving).
 - ADS data useful in crash investigations and general performance monitoring.
 - VMAD's In-Service Monitoring and Reporting pillar concerns in-use performance.
 - "Crash-event recorder" (EDR) different from uploaded general performance data.
 - User-interactions differ from "TTC minus five seconds" data.
 - User interactions outside "five-second window" may be relevant.
 - ADS can "flag" sequential interactions aligned with safety requirements (e.g., activation, user intervention, transition demand).

- EDR/DSSAD considered recommendations and requested example(s) to illustrate more concretely.
- FRAV provided “transition of control” example.
 - TOC only apply to ADS that permit fallback-user interventions.
 - TOC may be user-initiated or ADS-initiated.
 - TOC may be successful or unsuccessful. (Based on ADS evaluation of user inputs)
 - ADS can flag sequence of interactions to provide clear picture of occurrence.
 - Same elements can be used for crash analysis and in-service analysis.
- Communication across EDR/DSSAD, FRAV, and VMAD important.
 - Each group can work individually (i.e., not essential to wait on each other) but share drafts to ensure coherence (i.e., consistent terms and understanding)

- ODD-based approach to verifiable criteria.
- Non-prescriptive DDT performance requirements.
- Safety models as basis for determining fulfillment of requirements.
- ORU safety needs and risk/benefit of external signaling.
- OEDR-based approach to addressing ORU interactions.
- ADS configurations/use cases and user roles context for HMI and user-safety requirements.
- Data collection input to EDR/DSSAD completed (expect continued sharing and exchanges)