Transmitted by the HDH Secretary

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STATUS OF THE GRPE INFORMAL WORKING GROUP ON HEAVY DUTY HYBRIDS (HDH)

The Informal Working Group on Heavy Duty Hybrids (HDH) held two meetings since the 65th GRPE session. The 13th meeting took place on 21 and 22 March 2013 in Borlänge. The 14th meeting took place on 04 June 2013 in Geneva.

Korea informed about investigations to replace the existing fuel economy regulation, which is based on a 60 km/h constant speed driving on a chassis dyno, with the WHVC cycle. Analysis of driving conditions showed a good correlation between typical Korean driving patterns and the WHVC. As a first step, Korea plans to introduce the WHVC chassis test into the national fuel economy regulation. As a second step, Korea intends to adopt the HILS method as an option upon completion of the gtr.

The institutes presented the new model structure that would allow greater flexibility for the modelling. Task was to set up a data bus system in the model that allows various combinations of engines, gear boxes and energy storage systems. The original open source model was restructured in order to meet these demands. Two types of interfaces will be included, the physical interface that is related to how different components are connected physically, and the signal interface that is related to the control/sensor signals needed for the ECUs. In the gtr, the physical interface will be specified, while for the signal interface only a minimum set of signals can be specified. If other signals or more complex models are needed for the simulation, they may be included without affecting the model structure.

The new model structure for serial and parallel hybrids was made available for testing at the end of April. It includes a comprehensive component model library, a new signal naming convention based on AUTOSAR and the restructuring of the vehicle models. Relevant powerpack components were included in the library toolbox, while previously developed models were transferred into the model library. The models will be further developed until the end of June 2013 based on feedback from OICA members and other stakeholders. For OICA, it is essential that the generic HILS models may be replaced with OEM specific models for better accuracy and better compatibility with OEM specific control units.

In order to cope with the cold start test required in the gtr, TU Graz had developed thermal models that may be used in the HILS modelling. JARI proposed a simpler approach, which is based on adding a predicted temperature profile for the ICE and the aftertreatment system to the interface model. This would not require any changes to the model, but cannot be used for temperature changes of the battery or the motor/generator.

Japan presented new approaches for calculating slopes (road gradients) for WHVC in order to better match WHVC cycle work with WHTC cycle work. The approach of applying a 30 second moving average to the speed/torque trace, resulted in slopes with realistic levels between - 1.9 % and + 6.5 %. The approach of a constant positive slope is neither realistic nor favorable for hybrid vehicles, and was therefore abandoned. An alternative method for

calculation of slopes was presented by the institutes. The method divides the WHVC into mini-cycles and calculates for each mini-cycle the WHTC/WHVC work difference and transforms it into average mini-cycle slopes. With all methods, slopes vary depending on the vehicle. It was therefore discussed whether the slope should be fixed in the gtr or calculated for the individual vehicle. No conclusion could be reached, but it was agreed that slopes need to be added to the WHVC. It was decided to check the 30 sec moving average and the mini-cycles approaches during validation test program 2.

TU Graz presented a transmission model developed in the context of the EU heavy duty CO_2 program VECTO. It was agreed that the generic gearbox model be included in the gtr, but might be replaced with an OEM specific model. It was further agreed that the use of OEM specific models should be allowed, provided validation and verification of such models is specified in the gtr. Standardized component tests will remain in the gtr, but further discussion is necessary, if OEM specific component tests are needed. Model verification by means of on-road tests will be investigated during validation test program 2, powertrain verification will be added. OEM specific interface models would need to be approved by the TAA during the certification process. As regards multiple ECUs, it was agreed that a master ECU would need to be defined in the gtr, with supportive ECUs to be integrated via interface or software emulation. OICA suggested to include plug-in hybrids in the gtr and will develop a proposal in due time for discussion at the 15th HDH meeting.

EPA requested to include powertrain testing and verification in the gtr, and to validate the HILS method with emission results. They asked for further discussion on how to maintain and update the models and the required level of validation in the gtr. EPA also confirmed to take part in validation test program 2.

Validation test program 2 at JRC started with the Volvo parallel hybrid bus in May. Test program and timetable were set up between the participating OEMs and JRC. JRC will be responsible for the coordination of the program. Chassis dyno testing will be done with emissions measurement, on-road testing in accordance with the PEMS rules, but w/o emissions measurement. Engine testing on the HILS cycle will be done at OEMs premises. EPA requested to receive an ECU for HILS testing, and this will be arranged directly between the OEMs and EPA. OICA will cover the budget for contributions of the institutes (approx. 200 k€) incl. further investigations on drive cycle modifications (road gradients).

CO_2 emission is part of the HDH mandate. Currently, CPs have their own regional HD CO_2 regulations in place or are developing CO_2 regulations for HD vehicles. There is no WP.29 mandate for a CO_2 regulation for conventional heavy duty vehicles. At a meeting between EU-COM (DG-CLIMA) and HDH Chair and Secretary, it was agreed that it was not appropriate to develop a CO_2 regulation by UNECE just for HD hybrid vehicles. HDH IWG should develop the procedure for CO_2 determination, thereby fulfilling their mandate on CO_2 emissions. The HILS CO_2 result may then be used as input for the regional CO_2 regulations, if needed. Chair and Secretary suggested other CPs to apply a similar approach, and this was agreed by the HDH IWG.

The HDH drafting group has been established and had two meetings, so far. The Technical Secretary has not yet been nominated. It was agreed and confirmed to integrate the hybrid test procedure into gtr n° 4. Starting point is the Japanese regulation. Modifications to the Japanese regulation (e.g. new model structure) and any additional items (e.g. thermal models) would be included based on the input from the HDH work program. The details of the HILS method and the powertrain test procedure will be incorporated into a new Annex 8 to gtr n°4.

HDH IWG intends to submit the final report of the work program and the informal document of the gtr at the 68th GRPE in January 2014. The official document will be submitted at the 69th GRPE in June 2014 for adoption. WP.29 adoption is foreseen in November 2014. The road map is shown on page 9 of informal document n° GRPE-66-23. This timing is in jeopardy, if the nomination of Technical Secretary is further delayed due to non-availability of the budget. EU-COM is urged to submit the budget a.s.a.p.

Next steps:

- Continuation of validation test program 2 at JRC until September 2013
- Investigations of the institutes on HILS verification and calculation of road gradients
- Input on chassis dyno and powerpack testing required by October 2013
- Drafting of gtr n° 4, Annex 8

The next meetings are scheduled as follows:

- 15th HDH meeting: 24 and 25 October 2013, San Francisco
- 16th HDH meeting: 08 January 2014, Geneva (date to be confirmed)
- 17th HDH meeting: March 2014, Europe (date and place to be confirmed)
- 18th HDH meeting: June 2014, Geneva (date to be confirmed)

GRPE is asked to reserve a half day for the 16th HDH meeting during the 68th GRPE session.

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