

# Report of New Issues TF –CFD\* wg Kick-Off meeting

\*CFD: Computational Fluid Dynamics method, method to simulate aero drag

**Apr., 2018**

**Mayumi “Sophie” Morimoto (JASIC)**


# Background of CFD wg under New Issues TF

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- During Dec. 2017 New Issues TF meeting, Exa (software vender) proposed revisions to text related to CFD in Annex 7 of GTR 15.

WLTP Simulation Requirements  
ECE/TRANS/WP.29/2017/140 (page 247)


- Current text:
  - a) The alternative determination method shall fulfill an accuracy for  $\Delta(CD \times Af)$  of  $\pm 0.015 \text{ m}^2$  and additionally, in the case that simulation is used, the Computational Fluid Dynamics method should be validated in detail, so that the actual air flow patterns around the body, including magnitudes of flow velocities, forces, or pressures, are shown to match the validation test results;
- Comments:
  - The requirements for the validation of the alternative method state that the "method should be **validated in detail**". It is also stated that "the actual air flow patterns around the body, including magnitudes of flow velocities, forces, or pressures, are shown to **match the validation test results**." These statements are vague. The validation requirements need to be quantified in order to enable clear validation procedure.
  - The validation with respect to test results needs to take into account the measurement accuracy. The drag coefficient can be measured  $\pm 1\%$  accurate, while the velocity and pressure not less than  $\pm 10\%$
  - The validation for any alternative determination method should have the same requirements when it comes to the prediction of the flow pattern. For example, based on the current regulation text a wind tunnel with static ground could be used for evaluation of the rotating wheel drag despite the fact the the flow pattern will be wrong.
- Proposal:
  - a) The alternative determination method shall fulfill accuracy level for  $\Delta(CD \times Af)$  of  $\pm 0.015 \text{ m}^2$  and should be validated so that the actual air flow patterns around the body match the validation test results. The predicted flow velocities and pressures need to be within 10% of the validation test results accuracy band;

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WLTP Simulation Requirements  
ECE/TRANS/WP.29/2017/140 (page 247)

- Current text:
  - b) The alternative method shall be used only for those aerodynamic-influencing parts (e.g. wheels, body shapes, cooling system) for which equivalency was demonstrated;
- Comments:
  - Since an alternative method can be used for the evaluation of variances, it should be explicitly stated that the equivalency needs to be demonstrated for variances in aerodynamic-influencing parts.
  - It is not clear how the equivalence should be demonstrated and to whom. It would be helpful to have an explicit statement about it.
- Proposal:
  - b) The alternative method shall be used only for those aerodynamic-influencing parts (e.g. wheels, body shapes, cooling system) for which variance equivalency was demonstrated. The equivalency needs to be demonstrated for each of the variances:
    - Between different wheels if alternative method is to be used for wheels
    - Between different body shapes if alternative method is to be used for body shapes
    - Between different cooling systems if alternative method is to be used for cooling systems

The variance equivalency can be verified by a responsible authority.

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- During Mar. 2018 New Issues TF meeting in Paris, Japan proposed to compose a CFD expert working group as a reply to Exa proposal. TF members agreed Japan to compose the member list and lead a kick-off meeting of CFD expert working group.

Comments by Japan

- We should consider these text revisions after we discuss to create a concrete regulatory text like Paragraph 3.2. of Annex 4 Wind tunnel criteria. Or, after we discuss whether we should create a regulatory text like Paragraph 3.2. or not, at first.
- To do this, we propose to set a separate working group in New Issues TF for discussion of CFD and invite specialists from software venders and vehicle manufacturers. And in that TF, we discuss Terms of Reference (ToR) at first, then solve those problems.
- If there are any requests on urgent discussions on this from software venders and vehicle manufacturers, they should make clear on the proposal of regulatory text development plan.

[Example of discussion timeline in UN]

- To finalize GTR in 2019 summer: Need to finish discussion within 2018. (Preferably by Sep. 2018.)
- To finalize GTR in 2020 summer: Need to finish discussion by Sep. 2020.

# Members of CFD wg under New Issues TF

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| Full Name            | Company                 | Full Name         | Company                  |
|----------------------|-------------------------|-------------------|--------------------------|
| Domenico Caridi      | ANSYS                   | Denis Ricot       | Renault                  |
| Hiroshi Yukawa       | ANSYS                   | Keiji ONISHI      | RIKEN                    |
| Takeshi Okada        | ANSYS                   | Peter Altmann     | Siemens PL               |
| Jan Czarnota         | Audi AG                 | Frederick Ross    | Siemens PL               |
| Christoph Lueglinger | BMW AG                  | Jeremy Dahan      | Siemens PL               |
| Thomas Schütz        | BMW AG                  | Jan Jagrik        | Skoda Auto               |
| Holger Gau           | BMW AG                  | Radek Svanhal     | Skoda Auto               |
| Kazuki Oota          | DAIHATSU MOTOR CO.,LTD. | Takumi Hasegawa   | SUBARU                   |
| Thomas Schumacher    | Engys                   | Masanori Uchida   | SUBARU                   |
| Ales Alajbegovic     | Exa, Dassault Systemez  | Atsushi Miura     | SUZUKI MOTOR CORPORATION |
| Richard Shock        | Exa                     | Tomoaki Takeda    | SUZUKI MOTOR CORPORATION |
| Hans-Dieter Glueck   | Ford Werke GmbH         | Takahiro Kumano   | SUZUKI MOTOR CORPORATION |
| Gensuke Hoshino      | Honda R&D               | Antoine Delacroix | Toyota Motor Europe      |
| Minoru Teramura      | Honda R&D               | Carsten Repmann   | Volkswagen               |
| Adrian Gaylard       | Jaguar Land Rover       | Axel Fischer      | Volkswagen               |
| Wilko Jansen         | Jaguar Land Rover       | Hardy Schmidt     | Volkswagen               |
| Tim Walker           | Jaguar Land Rover       | Erik Sällström    | Volvo Cars               |
| Makoto TSUBOKURA     | Kobe Univ./RIKEN        | Torgny Karlsson   | Volvo Cars               |
| Kousuke NAKASATO     | NISSAN                  | Zbynek Hrcir      | ICON                     |
| Hideyuki KAWAMATA    | NISSAN                  |                   |                          |

Software vender,  Vehicle manufacturer,  
New Issues TF members attending CFD wg is not counted

**7 software vendors and 14 vehicle manufacturers are joined.**

## 1. Certification criteria of CFD simulation model

- Air flow patterns, delta-cw accuracy, etc.

## 2. Certification demonstration/process of CFD simulation model

- Equivalency validation
- Validation of CFD simulation models by software vender/manufacturer
- Documentation format, etc.

## 3. Certification process of vehicle aero drag using CFD simulation model

- Evidence of CFD result (How to prove the usage of authorised simulation method)

## 4. Re-certification criteria of CFD simulation model

- Define what is „change in simulation model“

## 5. Certification scope using CFD simulation model

(NEWLY raised after kick-off meeting)

- R/L family are not relevant with aerodynamic drags.

## 6. Certification motivation using CFD simulation model

(NEWLY raised after kick-off meeting)

- CFD process must be feasible, reasonable, time/resource consumption

There are several points which need **involvement of CPs/TAs**

## ■ Next Actions

- Discussion points raised by member will be prioritized.
- The timeline will be set based on the volume of discussion points.  
(Agreed not to incorporate into Amendment#5 on Sep. 2018)

## ■ Request by some member

- Hold a face-to-face meeting for 2 days.  
(40 or more members expected to join at the maximum)

## ■ Request to CPs/TAs and IWG

Since there are several points which need CPs/TAs involvement in the discussion.

- Request attendees from CPs and TAs, like other TFs.
- If CPs and TAs are difficult to send attendees to CFD wg, need guidance from WLTP IWG, CPs, and TAs, how to proceed CFD wg.

**Thank you very much  
for your attention!**

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