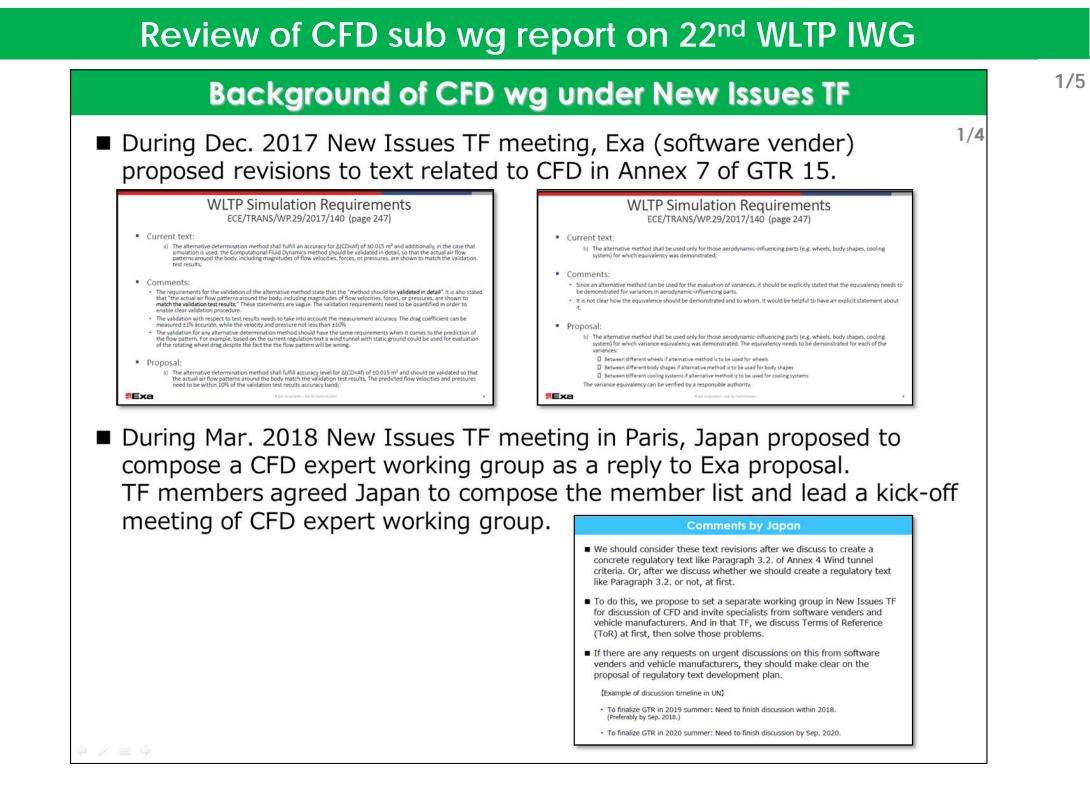


Status Report of New Issues TF – CFD* sub wg

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

7th Jan., 2019 Mayumi "Sophie" Morimoto (JASIC)



Review of CFD sub wg report on 22nd WLTP IWG

Discussion Points raised by members		
1.	 Certification criteria of CFD simulation model Air flow patterns, delta-cw accuracy, etc. 	3/
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

Review of CFD sub wg report on 24th WLTP IWG

Background of CFD discussion/Status

Review of 22nd WLTP IWG in April 2018

- Sub working group members requested to CPs/TAs and IWG to join the meeting.
- Because of lack of resources, WLTP IWG decided to postpone the discussion of CFD sub working group until GTR15 Amd5 discussion finish.

During the CFD discussion on May

- Even with WLTP IWG decision, some manufacturers strongly requested discussion even without TA/CPs, to make some proposals on Spring 2019. They also did not accept discussion between manufacturers within each regions.
- Therefore, web meeting of CFD sub wg in UN level was held on 5th Sep.

Status & Schedule

- 2 meetings were held after April WLTP IWG.
- Next meeting will be held at late November or early December

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Status of CFD discussion

Status & Schedule

- 1 meeting was held after 24th Sep. WLTP IWG.
- Next meeting is planned on February.

Current discussion in CFD sub wg

Introduction

Section 3.2.3.2.2.3.2 (a)

- Current GTR states:
 - ▷ "The alternative method shall fulfil an accuracy for ∆(C_D×A_f) of ±0.015 m² and, additionally, in the case that simulation is used, the Computational Fluid Dynamics method should be validated in detail such 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"

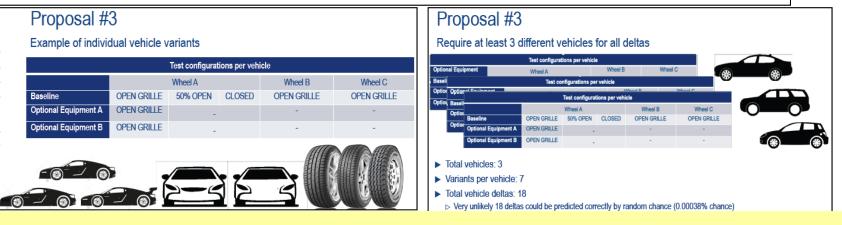
It was agreed that validating air flow patterns would be difficult for many reasons

- No objective/quantitative metric available
- Flow visualization is not usually available unless dedicated physical tests are performed
- Accuracy/Repeatability of wind tunnel flow measurements is not good
- Proposals were suggested of how to proceed

Questions to WLTP IWG

Proposal #3

- Define demonstration of equivalence to be 'sufficiently large'
 - Require a well defined set of cases such that it is very unlikely CFD results could be correct for incorrect reasons (e.g. cancellation of errors)
 - Multiple vehicles must be demonstrated
 - Multiple variants must be shown for each vehicle
- Reasoning
 - Provides well defined process for OEM to follow to certify CFD method
 - Eliminates uncertainty of flow visualization
 - > Relies on data OEM already has from physical WLTP process
 - > Volume of variants demonstrated gives confidence that CFD method is accurate
- Drawbacks
 - Does not compare to measured flow field results
 - > OEMs with limited vehicles may not have enough variants to meet requirements
 - Depending on how demonstration of equivalence requirements are defined



Is it acceptable to define the common procedure to certify CFD software?

Does any CPs/TAAs/TSs require workshop on CFD?

Thank you very much for your attention!