



Developing a HDV CO₂ measurement methodology and certification scheme for Europe

Stakeholder meeting
Brussels 03. July 2012

Overview

- Motivation
 - status quo, why measurement
- History
 - steps to develop the measurement
- Scope
 - of the measurement
- Instrument
 - for future policy steps
- Timeline
- Summary



Regulatory situation in Europe

Existing regulations setting performance standards for:

- Cars (Reg. 443/2009), and
- Vans (Reg. 510/2011)

Currently no legislation setting performance standards for HDV CO₂ emissions or parts of it

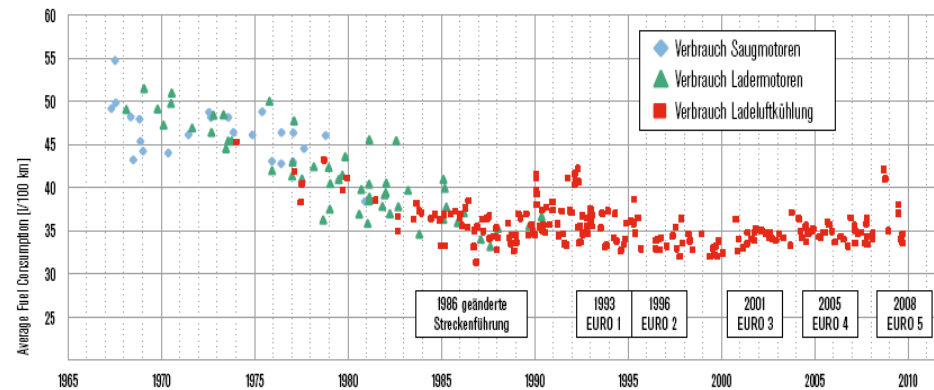
Current test cycle procedures are on engine basis (e.g. for regulation air pollutant emissions), not the whole vehicle

Why the COM wants to measure

No official/unified measurement or certification scheme for HDV in Europe (unlike for cars and vans)

Some single data exists, but more indicative

Average Fuel Consumption (Gross Vehicle Weight 38/40 t)



SOURCE LASTAUTO OMNIBUS TESTREPORTS 1967-2009

Status 10/2009



History

So far examined and result (contract: "LOT2")

- **Approaches explored :**

- measurement on chassis dynamometer
- measurement with PEMS
- model simulation

- **Selected option:**

model simulation for the whole vehicle (truck and trailer)
and component testing

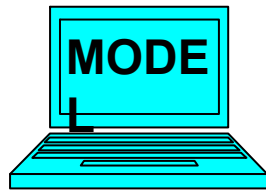
- **Methodology considers:**

engine, driving resistances of whole vehicle (rolling,
aerodynamic), gearbox, most relevant auxiliaries

Model



European Commission



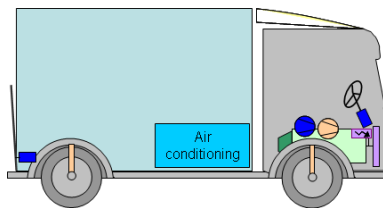
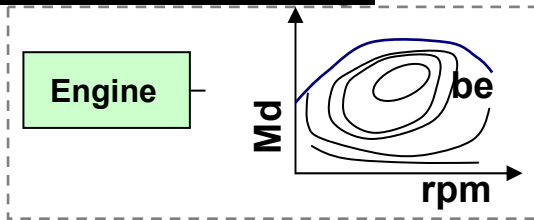
$$P_e = P_{\text{roll.}} + P_{\text{air}} + P_{\text{acc}} + P_{\text{grad}} + P_{\text{tr.}} + P_{\text{aux}} + P_{\text{cons.}}$$

$$n = (v \times 60 \times I_{\text{axis}} \times I_{\text{gear}}) / (d \times \pi)$$

Driver model

Fuel cons., CO₂

Component testing:



Gear box, axis:
transmission, $\eta = F(\dots)$

Auxiliaries
duty cycle, $\eta = F(\dots)$

Fuel consumption map:

a) steady state + WHTC correction factors
measured on engine test bed (for engine families)

Driving resistances, options:

- a) constant speed with torque measurement
- b) coast down tests

Influence from different tire models: resistance values adapted to EC No 1222/2009 (absolute value, optional with correction factor from drum to road)

Transmission ratios, transmission losses

OEM specific maps and default values

Power demand from engine from

- a) generic P_e for different technologies
- b) detailed simulation



European Commission

HDV Vehicle Classification

Axles	Identification of vehicle class				Segmentation (vehicle configuration and cycle allocation)					Norm-body allocation		
	Axle configuration	Chassis configuration	Maximum GVW [t]	vehicle class	Long haul	Regional delivery	Urban delivery	Municipal utility	Construction	Standard body	Standard trailer	Standard semitrailer
2	4x2	Rigid	>3.5 - 7.5	0		R	R			B0		
2	4x2	Rigid or Tractor	7.5 - 10	1		R	R			B1		
		Rigid or Tractor	>10 - 12	2	R	R	R			B2		
		Rigid or Tractor	>12 - 16	3		R	R			B3		
		Rigid	>16	4	R+T	R		R		B4	T1	
		Tractor	>16	5	T+S	T+S						S1
	4x4	Rigid	7.5 - 16	6				R	R	B1		
		Rigid	>16	7					R	B5		
		Tractor	>16	8					T+S			W1?
3	6x2/2-4	Rigid	all weights	9	R+T	R		R		B6	T2	
		Tractor	all weights	10	T+S	T+S						S2
	6x4	Rigid	all weights	11					R	B7		
		Tractor	all weights	12					R			S3
	6x6	Rigid	all weights	13					R	W7		
		Tractor	all weights	14					R	W7		
4	8x2	Rigid	all weights	15		R				B8		
	8x4	Rigid	all weights	16					R	B9		
	8x6 & 8x8	Rigid	all weights	17					R	W9		

R...Rigid,
T...Trailer,
T+S..Tractor+semi-trailer, W...only weight

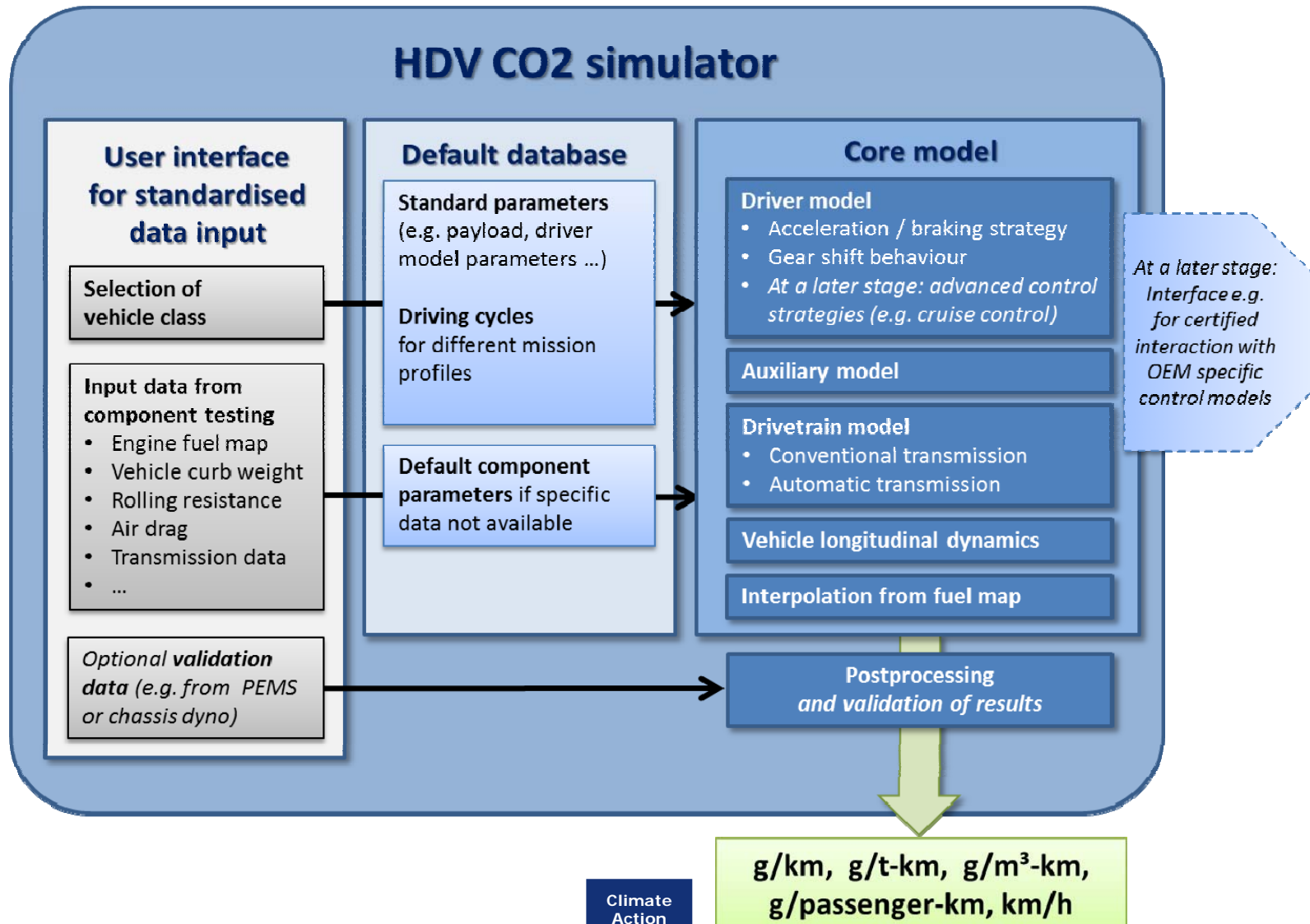
Vehicle design characteristics → Classification & mission profile → Segmentation
→ typical CO2-test cycles, vehicle loading and „norm bodies“ allocated to each vehicle

Vehicle Segmentation and test cycles

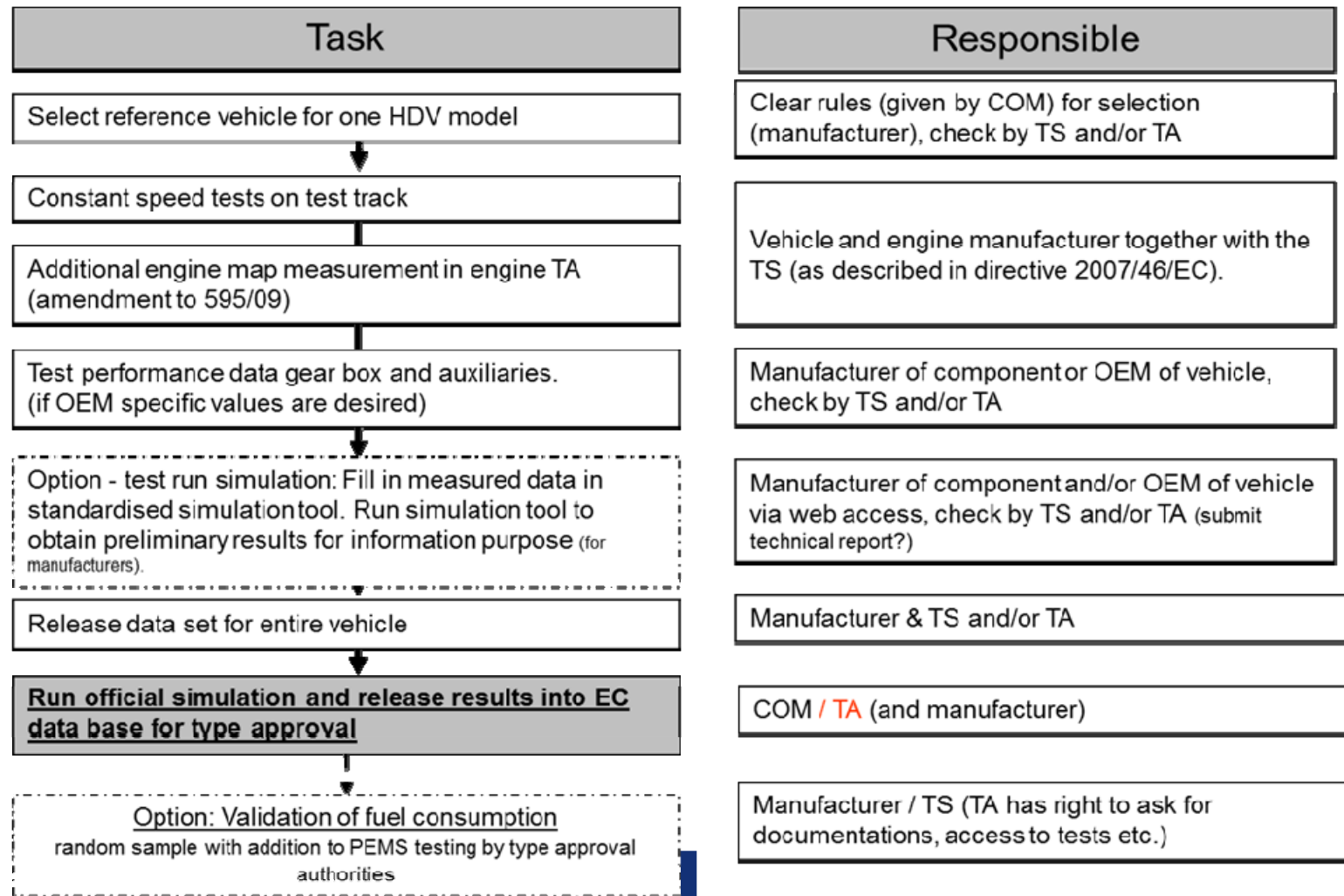
- **Total HDV classes:**
 - 18 truck classes
 - 6 bus and coach classes
- **In total 10 HDV CO₂ /fuel consumption test cycles:**
- **Bodies and trailers (influence aerodynamic drag):**
 - Standard bodies and trailers defined, with $\Delta(Cd \cdot A)$ measured for alternatives
- **Simplifications need to be discussed**

Mission	Cycle Acronym
Heavy Trucks	
Long Haul	LH
Regional Delivery	RD
Urban Delivery	UD
Municipal Utility	MU
Construction	CS
Heavy Passenger Vehicles	
Heavy Urban	HU
Urban	UR
Suburban	SU
Interurban	IU
Coach	CO
All HDV	
Common Short Test Cycle	CST ⁸

Programme structure



Draft for a certification procedure





Instrument for possible future policy steps

- CO₂ Measurement + reporting tool
- HDV Labelling
- Economic instruments
- Design/ performance requirements for components
- Measures targeted at HDV purchase and use
- Establishment of emission reduction objectives



Timeline HDV CO₂ measurement development

- next contract "LOT3" under development: start autumn 2012 to complete the measurement
- preparatory work from JRC in the meantime to establish more know how on special testing and simulation procedures at JRC
- HDV CO₂ measurement and certification finalisation by Commission : mid 2014



Summary I

- Further development of measurement:
methodology based on a simulation tool and
component testing
- Model detailed to get good real-world CO₂-Emissions but
simple to handle and implement
- Metrics: g / km, g / t*km, g / m³*km, g /
passenger*km
- Final implementation in a certification procedure

Summary II

- Methodology for:
 - Monitoring CO₂ from new registered HDVs
 - Future possibilities: "Labelling", multipurpose use to calculate fuel consumption, standards (trucks and trailers)
- 2014 proposal for a measurement and certification methodology
- Complete HDV CO₂ simulation procedure can be an innovative approach which shall set incentives to use efficient technologies, be flexible for the future, perhaps has the chance for an international approach and keep test burden manageable



Thank you,

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