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Item 18.2 of the provisional agenda

**Proposal to develop new gtrs and/or amendments to established gtrs, not included under agenda item 16 - Proposal to develop a new gtr on Pole Side Impact**

### **Proposal to develop a new global technical regulation on side impact dummies (WorldSID Proposal)**

#### **Submitted by the representative of the United States of America\***

The text reproduced below was prepared by the representative of the United States of America for the development of a new global technical regulation on side impact dummies. It is based on informal document No. WP.29-150-4-Rev.1, distributed at the 150<sup>th</sup> session of the World Forum (ECE/TRANS/WP.29/1083, paragraph 106.)

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\* In accordance with the programme of work of the Inland Transport Committee for 2006–2010 (ECE/TRANS/166/Add.1, programme activity 02.4), the World Forum will develop, harmonize and update Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

## I. Objective of the Proposal

1. Currently, there are several side impact dummies in world-wide use for regulatory and consumer information purposes. In North America, the ES-2re male dummy and the SID-II's small female dummy are being used to evaluate the crashworthiness of vehicles in side impact crashes. Countries that follow UNECE Regulation No. 95 Side Impact testing Regulation are using the ES-2 side impact dummy. The ES-2 dummies were intended as interim dummies until the WorldSID dummies were completed.<sup>1</sup> The development of the WorldSID 50<sup>th</sup> and 5<sup>th</sup> percentile dummies is now at a point in which international collaboration is necessary to ensure that the final product is a pair of harmonized dummies and associated injury measures that can be used in testing regimes throughout the world.

2. The United States of America (U.S.) proposes the creation of an informal group to fully develop the WorldSID 50<sup>th</sup> and 5<sup>th</sup> dummies under the Side Impact topic on the Program of Work. This informal group would complete the tasks necessary for these dummies to be incorporated into existing and new vehicle regulations. These tasks include finalizing the drawing packages, developing and validating certification procedures, evaluating biofidelity, evaluating durability, ensuring good repeatability and reproducibility, and developing injury measures and criteria for each dummy.

3. The U.S. proposes to be the technical sponsor and chair of this activity.

## II. History, Description, and Status of the WorldSID dummies

### A. WorldSID 50<sup>th</sup> Male

4. Development of the WorldSID 50<sup>th</sup> male dummy began in June 1997 with a resolution by the International Standards Organization (ISO) ISO/TC22/SC12/WG5 to establish a task group. This task group consisted of many government and industry organizations worldwide. Through this collaboration, the group conducted extensive testing and evaluation, and prepared the drawings and users manual. In 2008, the group finished the biofidelity assessment. They are currently working on risk curves for the injury measures and a practical seating procedure.

5. The WorldSID 50<sup>th</sup> Male dummy has a standing height of 1753 mm, seating height of 911 mm, and a mass of 77.3 kg. It has symmetrical response (left/right) and is able to be used in side impacts up to  $\pm 30^\circ$  from the pure lateral impact direction. The dummy biofidelity was evaluated using both the ISO TR9790 method and the U.S. National Highway Traffic Safety Administration (NHTSA) BioRank method<sup>2</sup>. In both cases, the WorldSID dummy was shown to have considerably better biofidelity than the ES-2re. NHTSA's preliminary evaluation of the dummy's durability, repeatability, and reproducibility indicate that the dummy appears to be suitable for regulatory testing.<sup>3</sup>

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<sup>1</sup> Wisman, Jac, "EEVC WG12 WorldSID Presentation," presented in Washington, D.C, 5 November 2009.

<sup>2</sup> Rhule, H.H.; Maltese, M.R.; Donnelly, B.R.; Eppinger, R.H.; Brunner, J.K.; Bolte IV, J.H., "Development of a New Biofidelity Ranking System for Anthropomorphic Test Devices," Paper No. 2002-22-0024, Stapp Car Crash Journal, Vol. 46, 2002.

<sup>3</sup> Rhule, D, "Status of WorldSID 50<sup>th</sup> Male and 5<sup>th</sup> Female ATDs", presented in Washington, D.C., 5 November 2009.

## B. WorldSID 5<sup>th</sup> Female

6. The development of the WorldSID 5<sup>th</sup> female dummy began in 2004 and was coordinated under the Advanced Protection Systems project (APROSYS). This group was a consortium of 51 partners, including automobile manufacturers, suppliers, research organizations, and universities, and led by Netherlands Organisation for Applied Scientific Research (TNO). This group developed a working prototype of the dummy and conducted biofidelity, reproducibility, repeatability tests, and preliminary injury criteria. The group effort was completed in March 2009. Additional durability and component and system testing will be necessary.

7. The WorldSID 5<sup>th</sup> female dummy was designed to the anthropometric specifications defined in a study conducted for NHTSA<sup>4</sup> and has a total weight of 48.3 kg. The biofidelity responses of the dummy female dummy were scaled from the WorldSID 50<sup>th</sup> male dummy. In biofidelity testing conducted by APROSYS, the WorldSID 5<sup>th</sup> female was found to have a similar biofidelity rating to that of the WorldSID male and superior biofidelity when compared to the SID-IIIs.<sup>5</sup> A series of tests conducted on three dummies showed the results to be repeatable and reproducible. Additional pole tests conducted suggest the dummy is suitably robust.

## III. Benefits

8. In addition to the benefits gained from having harmonized side impact dummies, both WorldSID 50<sup>th</sup> male and 5<sup>th</sup> female dummies have demonstrated improved overall biofidelity, when compared to the current test tools. The WorldSID 50<sup>th</sup>'s expanded capability includes an improved shoulder range of motion and displacement measurement, more human-like shoulder and thorax motion, improved external oblique biofidelic response, and abdominal displacement measurement capability. With over 130 possible data channels, these dummies also offer onboard data acquisition capability. Finally, it will be possible to do a more thorough analysis of benefits once there is consensus on the injury criteria and the associated risk curves for both dummies.

## IV. Next Steps and Timelines

9. The WorldSID 50<sup>th</sup> male dummy is closer to being finalized than the WorldSID 5<sup>th</sup> female. At meetings on 5 November 2009 and 4 February 2010 of parties interested in a collaborative effort to finalize the development of these dummies, the group developed a list of issues to be resolved and tasks to be completed (see Attachment 1) and a tentative timeline for completion (see Attachment 2). Based on these meetings, most of the work to finalize both dummies is expected to be completed in late 2012. The finalization of the 5<sup>th</sup> female dummy drawings is expected to take at least another year after that. It is recommended that the established informal group provide progress reports to the Working Party on Passive Safety (GRSP) and necessary updates to WP.29 to ensure the effort is progressing at the necessary pace.

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<sup>4</sup> Schneider, L.W.; Robbins, D.H.; Pflüg, M.A.; Snyder, R.G., "Anthropometry of motor Vehicle Occupants", Final Report DOT-HS-806-715 NHTSA, 1983.

<sup>5</sup> Eggers, Andre; Schnottale, Britta; Been, Bernard; Waagmeester, Kees; et al., "Biofidelity of the WorldSID Small Female Revision 1 Dummy," Paper Number 09-0420, Enhanced Safety of Vehicles Conference, Stuttgart, Germany, 2009.

## V. Summary

10. The development of both the WorldSID 50<sup>th</sup> male and the WorldSID 5<sup>th</sup> female has progressed to the point that a collaborative effort among all regions of the world will result in the finalization of two harmonized side impact dummies. Everyone can benefit from the combined effort to complete these more biofidelic dummies. Governments gain by leveraging resources to produce a superior test tool to be used in regulations to decrease side impact crash injuries and fatalities. Manufacturers benefit from reducing the cost of development, testing, and fabrication of new vehicles. Finally, consumers benefit by having a better choice of vehicles built to higher, globally recognized standards providing a better level of safety at a lower price. Therefore, it is recommended to establish the informal group to finalize the development of the WorldSID family of dummies.

## Attachment 1

### Task Definitions

#### 50<sup>th</sup> WorldSID

##### 1. Drawing Package

- (a) 2D and/or 3D
  - (i) 50<sup>th</sup> dummy drawings available from ISO website
  - (ii) Need to clean up (define specs, etc.)
  - (iii) Specify on-board Data Acquisition System (DAS) (independent of vendor)
    - a. modeling approach?
      - i. Finite Element (FE) or rigid body methods?
    - b. inertial property tolerances
    - c. comparison of on-board vs. umbilical equipped dummy response
- (b) Location...UNECE website (globally)
  - (i) Issue of quality control/maintenance

##### 2. General

- (a) Are all world regions interested in this dummy?
- (b) What are potential benefits over existing technology?

##### 3. Injury Risk Functions

- (a) Statistical method selection
  - (i) Cooperative effort under Petitjean ISO group, results will be provided to informal group
  - (ii) Need to define schedule and expertise

##### 4. Seating procedure

- (a) ISO WorldSID group is drafting procedures, final results expected in a year.

##### 5. Advanced instrumentation

- (a) Multi-axis deflection measurement (RibEye)

##### 6. Data

- (a) Provide availability of NHTSA test data and report of WorldSID.
- (b) ISO WorldSID group and FTSS to organize repository of test data and verify quality of data

##### 7. Testing

- (a) Full vehicle

## **5<sup>th</sup> Female WorldSID**

### **1. Drawing Package**

- (a) Process of how/when of availability needs to be determined
- (b) 2D and/or 3D?
- (c) On-board DAS (issues same as 50<sup>th</sup>)

### **2. Certification procedures**

- (a) Already in users manual

### **3. Biofidelity**

- (a) Test plan needs to be determined
  - (i) APROSYS did 9790 tests
    - a. Review tests completed and should others be done? High severity tests were not done, but need to be considered
  - (ii) NHTSA test plan similar to WorldSID 50th?  
Additional PMHS tests for matched comparisons

### **4. Durability**

### **5. Repeatability and Reproducibility**

- (a) Need more dummies and plan to test

### **6. Other Action Items**

- (a) EEVC report (APROSYS report) on WorldSID5th needs to be completed and circulated;
- (b) Transport Canada : Test plan presented at 5 November 2009 meeting;
- (c) JAMA testing: testing complete (biofidelity and car-to-car test), presented in 4 February 2010 (WS-2-4);
- (d) Manufacturers may interested in testing;
  - (i) Process to get dummies for testing;
- (e) Need to develop overall action plan for dummy (Informal group item);
- (f) ISO WG5 Preliminary Work Item agreed;
- (g) Consider a worldwide project manager (similar to WorldSID 50th);
- (h) Review Petitjean document for testing that should be done and data required for risk curves.

Attachment 2

Timeline

(Informal group document WS-2-5)

Draft Schedule of WorldSID Informal Working Group		Year '09		'10							'11				'12+ (Tentative)*			'13+ (Tentative)*					
		11 WP29 (146)	2 (147)	3 (148)	6 (149)	7 (149)	9 (149)	11 (149)	2 (150)	3 (151)	6 (151)	9 of 10 (152)	11 (152)	3 (153)	6 (154)	11 (155)	3 (156)	6 (157)	11 (158)				
GRSP		12 (44)		5 (45)				12 (46)	5 (47)			12 (48)	5 (49)		12 (50)	5 (49)		12 (50)					
General Schedule		Task Del.																					
Informal face-to-face meeting for research/validation and development		#1 (US)	#2 (JP)	#3 (UK)	#4 (FR)	#5 (CN)	#6 (AU)	#7 (IN)	#8 (BR)	#9 (RU)	#10 (SA)	#11 (EG)	#12 (IL)	#13 (IT)	#14 (ES)	#15 (SE)	#16 (NO)	#17 (DK)					
Research Items		Research Institutes							Research/Validation Completion and Submission of Draft Proposal (Estimate)														
V = Research ongoing/planned V(Comp.) = Research completed T = Tentative		Japan	EEVC	EC	NHTSA (US)	Korea	OICA/P DB	Dummy supplier (Denton/F TSS)	Trans Canada	ISO													
WorldSID Dummy Devel. Process	50th Percentil	Drawing package (2D and 3D)			V			V		V	----->												
		Certification procedures			V			V			Done Add'l data needed												
		Biofidelity			V					V	Done												
		Repeatability & Reproducibility			V	V	V			V	Done												
		Generate User's Manual			V				V			Done											
		On board data acquisition			V	V	V	V	V		V	----->											
		Seating Procedure			V	V	V			V	V	----->											
	5th Percentil Female	Data Archive							V		V	----->											
		Acquire dummies			T	V			V			----->											
		Drawing package (2D and 3D)				V			V		V	----->											
		Inspection			V							----->											
		Certification procedures			T	V						----->											
		Durability			T	V				V		----->											
		Biofidelity			T	V	V			V		----->											
		Repeatability & Reproducibility			T	V	V			V		----->											
		Generate User's Manual							V			----->											
		Seating Procedure								V	V	----->											
		On board data acquisition			V	V	V	V	V		V	----->											
Injury Risk Functions and IARVs				V	V		V		V	----->													
Project Management																							
Effects on reduction of injury and cost effectiveness evaluation																							
Advanced Instrumentation				V			V	V	V	----->													