LS-DYNA Model Development of the Harmonized Hybrid III 05F Crash Test Dummy

Chirag Shah², Christian Kleeßen¹, Robert Kant¹, Paul Lemmen¹

¹Humanetics Europe GmbH, Heidelberg, Germany
²Humanetics Innovative Solutions, Inc. Plymouth, Michigan, USA

1 Introduction

- Euro NCAP 2015 Protocols

- From January 2015 on the HIII 5th is used in full width tests
- Dummy configuration
  - Humanetics harmonized design
  - SAE Harmonized jacket
  - Neck shield ABA-211-DN
  - ASIS Loadcell for dummy on rear seat (criteria / modifier for submarining)
- Euro NCAP dummy definition is now also being proposed for future updates to R94
  - Decision during May 2015 GRSP meetings

Fig.1: Introduction

2 H305 Jacket comparison

- Different structure, geometry and materials -> different response

Fig.2: H305 Jacket hardware design comparison
3 Harmonized rib model validation

Fig.3: Single rib drop test

4 Thorax Enhancements

4.1 New harmonized SAE jacket from CT scan data

New Harmonized SAE jacket update from CT scan data
- Thickness details for each layer
- Jacket fitting is simulated and verified against final state scan

Fig.4: Harmonized SAE jacket
4.2 New material testing and materials modeling

New material testing and materials modeling
- Material models optimized to function in the essential loading modes

![Material test matrix for thorax model](image)

Fig.5: Material test matrix for thorax model

4.3 Material enhancement and verification

- Bib material bending behavior enhancement for upper thorax kinematics

![Bib bending](image)

Fig.6: Bib material validation and thorax stress distribution
4.4 Thorax stamp testing

- Stamp tests with a controlled displacement over time on the thorax
- Stress and deformation mode similar to vehicle simulations

Fig.7: Stamp test impact locations

Fig.8: Stamp test pre-simulations to verify load levels
5 Harmonized thorax model validation
- Confirm thorax model against current hardware

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**Fig.9:** Sled tests rear occupant; analyze hardware variability

6 Borderline chest model
- 3m/s certification test allows 4.5mm spread
- Euro NCAP chest model prepared for borderline model development

**Fig.10:** Thorax low speed certification test and model prediction
7 Additional Euro NCAP enhancements

- Euro NCAP compliant Neck shield model implemented

- Lower leg flesh (Denton) CT scanning and model development (reference Harmonized H350)

*Fig.11: Euro NCAP specific adjustments*

8 Neck model development

8.1 Neck material validation

- neck material tests based on harmonized hardware

*Fig.12: Neck material test matrix*
8.2 Neck torsion validation

Fig.13: Test setup for neck torsion test

Fig.14: Pre-simulations to address load levels

9 Summary
- Euro NCAP requires use of the HII-5th percentile for its full width frontal barrier test procedures
  - Dummy should be according to the latest agreed harmonization
- An LS-DYNA model for this dummy is being developed
  - The model is being optimized to predict the nominal response
- Chest hardware variability can cause significant variation in the final Euro NCAP tests
  - The model allows to explore the influence of chest hardware variability