

## ATD Harmonization Meeting - ATD Brand Consolidation Task Group HYIII 50<sup>th</sup> Male and HYIII 5<sup>th</sup> Small Female

MEETING MINUTES

May 12<sup>th</sup>, 2011

8:30am- 3:30pm EST

Humanetics Headquarters in Plymouth, Michigan

Attachments: Complete Voting Record  
Harmonization Preparation for May 12<sup>th</sup>, 2011

Attendees: *All Attendees in Person:*

Jack Jensen (General Motors)

Steve Rouhana (Ford)

Hollie Pietsch (Ford)

Brian Grenke (Chrysler)

Joe McFadden (VRTC)

Michael Jarouche (Humanetics)

Paul Depinet (Humanetics)

Michael Beebe (Humanetics)

Marvin Hatchett (IIHS)

Mitsutoshi Masuda (Toyota) (JAMA)

Leo Ferdinand (Porsche) (ACEA)

Tony Walbridge (Mitsubishi)

Yuji Okuda (Humanetics)

Naoki Kiuchi (Humanetics)

Joe Bastian (Humanetics)

Mark Brown (Humanetics)

*\*Voting members or their designees must attend the meetings in order to cast a vote on that day's topics.*

*\*One single member of JAMA and ACEA represents all four voting members of each group.*

### Introductions

Introductions of members in person were conducted.

### This Meeting's Agenda

Review any remaining issues for 10YO, 95<sup>th</sup>, vinyl material

Continue/Finish 5<sup>th</sup> Small Female review

Continue/Finish 50<sup>th</sup> Male review

Tasks for next meeting

### Foamed Vinyl Part Sealing

From the previous meetings, Mike Beebe asked the group to discuss and consider harmonizing how foamed vinyl parts are sealed. The foam pour holes in vinyl parts typically leave noticeable holes that have historically been patched for both brands. Generally the European manufactured parts (ex. EuroSID) have left the pour holes open.

Leo Ferdinand, representing the European Automobile Manufacturers' Association, ACEA, responded that they were mainly concerned with the sealing of the abdomen component on the dummies. Leo stated that they would prefer that abdomens remain sealed across all models. Mike Beebe agreed to accommodate the request, so abdomens will remain sealed with a patch.

### **10YO Follow-up**

A few weeks prior, Humanetics had a meeting with VRTC to address the shoulder contact issues and the neck cable snap occurrences they had brought up at the previous harmonization meetings. Humanetics will continue to work with VRTC to clear up the issues before the NPRM proceeds.

### **HIII 5<sup>th</sup> Small Female Head**

Mike Beebe began the small female review with a chart comparing dimensions of the head skins produced from the FTSS mold, the current Denton mold, and a brand new Denton mold that has not yet been put into production service. Width and length measurements were the same across the three versions, but thickness and weight showed minor variations. *Please reference the Harmonization attachment.*

Two small female head skins, one FTSS and one Denton brand, produced using the new proposed harmonized vinyl material were passed around for members to examine. Both passed certification testing.

The new Denton head skin mold (vs. the current Denton mold) produces a skin thickness in the forehead region within the specification. The current Denton head skin was casted in 1999 from the VRTC 'Golden Shell' dummy which is no longer available. According to the drawing measurements, the new Denton brand head skin mold is the closest to the specs. No 3D shape specifications are available.

Jack Jensen questioned why we would choose the new Denton version head skin if no parts were sold in the past. Masuda commented that they wanted to choose the best for quality going forward. Mike Beebe reminded the group that the only true specification available was the drawing, which the new mold conforms to the closest. This new head skin mold is unchanged in all other Denton brand size and shape characteristics and only revises the forehead thickness.

Marvin Hatchett asked about the engagement of the neck shield and if there were any issues using the current Denton head skin. Hollie Pietsch replied that Ford uses the Denton skin and shield combination and has seen no problems.

No preference on the rubber neck was voiced by members. Both rubber neck brands meet and pass the design specifications adequately.

A vote was taken. The new Denton mold and head assembly was recommended. *Please review the Voting Record attachment.*

### HIII 5<sup>th</sup> Small Female Upper Torso

Mike Beebe reviewed the attribute slides for the small female torso. The main difference in brands is found in the chest jacket and rib set combinations. Each brand's current chest jacket has enough difference in geometry and construction to require the ribs to be tuned to the specific jacket being used. The harmonized chest jacket produced by the NHTSA project in 2009 has yet to be adopted into regulation. Joe McFadden shared with the group some failing torso flexion test data using the harmonized jacket which has delayed the verification and acceptance process within NHTSA.

The original harmonized jacket was produced in a joint effort between FTSS and Denton to create a jacket with one common geometry and breast location for both brands. The material and stiffness specs were not part of this original harmonization. The harmonized jacket shape was created purely from the federalized drawings and is the closest to those specifications.

Paul Depinet shared his own series of torso flexion test data utilizing two original harmonized jackets on a Denton dummy. The Denton jacket passed on the high end of the corridor, but could be manipulated to fail low or fail high with abdomen changes. The FTSS harmonized jacket failed high in most cases on the Denton dummy. The FTSS brand harmonized jacket has two stiffness versions to accommodate rib sets originally tuned to either current FTSS or Denton jackets.

Today, when using the standard FTSS or Denton brand jackets, the rib damping material must be produced with different thicknesses to match the brand of jacket being used. Each brand's separate damping material thickness tuning corridor is wide enough to cause jacket interchangeability issues with users.

Joe McFadden also raised a question concerning the rib stiffeners. VRTC has observed stiffener bending in the past and the metal thickness for each brand may have been on opposite ends of the tolerances. Mike Beebe replied that neither brand should bend and what they may have seen was an isolated heat treat issue, and not a design problem or characteristic.

Factors used to evaluate the small female chest jacket designs:

#### Current FTSS or Denton

- Does not meet all drawing specs
- Easier to pass torso flexion
- Current part inventories in the field
- May not pass all current rib sets for thorax impact

#### Harmonized Design

- Meets most drawing specs
- Harder to pass torso flexion
- May not pass all current rib sets for thorax impact
- Shoulder engagement is better, more consistent
- New molds
- Has mandrel to check jacket size and shrinkage
- Shoulder belt engagement is better
- New foam pad drawing with corrections
- Molded on breasts

To alleviate the failing torso flexion problem with the harmonized jacket design, Mike Beebe proposed two solutions:

- Make the jacket shorter/ a technical correction to the drawing would be feasible
- Make the jacket bottom thinner

Mitsutoshi Masuda presented a comparison study of the current FTSS and Denton brand harmonized jackets. The physical measurements presented showed differences in breast shape and the breast divided area. Mr. Masuda's thorax impact tests showed that the FTSS and Denton Harmonized and the current Denton jacket produced the same deflection results. The current FTSS jacket produced slightly different deflection results.

Joe McFadden acknowledged that NHTSA is expecting the change in the jacket, so any technical corrections should be made now. Joe also wrote a paper for the ESV conference on the jacket harmonization and the progress made to date. Paul Depinet pointed out that the jacket stiffness is now called out in an SAE J document as a durometer measurement, which falls closer to the Denton stiffness. The rib damping material thickness issue will have to be worked through as new jackets are acquired by users and the harmonized components are phased in.

A vote was taken with members unanimously accepting the new Harmonized jacket design. *Please review the Voting Record attachment.*

### **HIII 5<sup>th</sup> Small Female Lower Torso**

Mike Beebe started the discussion of the lower torso with a review of the pelvis. The pelvis bones from Denton and FTSS are noticeably different in the tuberosity shape (bottom set of 'wings') and their respective locations in front or behind of the H-point location. The FTSS bone dates back to 1988 and is a scaled version of the 50<sup>th</sup> male pelvis with the wings cut down. In 1995 the Denton version was created from the NHTSA drawings and a dummy provided by NHTSA for examination. Neither brand of pelvis bone completely matches the drawing, but the drawing itself is inadequate to determine the exact shapes.

The difference in the bottom shape of the pelvis bone brought questions concerning its affect on dummy submarining and if the two different pelvis assemblies could rotate differently during testing. No feedback or data was presented to show such an affect.

Both lower torsos meet weight and cg requirements, but there have been different load cell openings in the past and the individual weights of the molded pelvis differ for each brand. Both brand pelvises' now have the molded triangular shape in front the iliac load cells. The FTSS brand upper femurs are thought to be heavier, resulting in a lighter molded pelvis weight which creates interchangeability issues using Denton brand parts. The FTSS molded pelvis alone is slightly under the weight spec, relying on the heavier femurs to make up the difference in the full assembly weight. Joe Bastian checked the FTSS brand femur weights and found the current production matches older femur weights. A further look into the weight combinations of the FTSS pelvis and femurs was suggested.

- Task item: Examine pelvis/femur combinations and weight compliance when interchanging components.

A vote was taken. The FTSS brand Lower Torso assembly was recommended. *Please review the Voting Record attachment.*

**HIII 5<sup>th</sup> Small Female Arms and Hands**

The arm assemblies were reviewed, highlighting the differences between the FTSS and Denton brands. The Denton brand hand is solid vinyl while the FTSS brand is foam filled. This difference has produced some debate on the durability of fingers with foam filling. Hollie Pietsch’s observation was that the foam filled fingers are less pliable and seem to be stiffer. This difference with the hand construction may cause positioning variances with the arms, and depending on the hand used, could cause changes in the testing results. No conclusive data was submitted showing there is a difference in chest g’s caused by varying placement of each hand during testing. The drawing shows a solid vinyl hand.

The foam fill around the wrist of the 5<sup>th</sup> lower arm has similar brand differences as those seen in the HIII 50<sup>th</sup>. The FTSS foam stops at a set point down the lower arm while the Denton brand has foam throughout the entire vinyl molding. Neither version exactly matches the drawing at the molded wrist area, but all arm pieces are interchangeable between brands.

A vote was taken. FTSS brand arms using the Denton brand hand were recommended. *Please review the Voting Record attachment.*

**HIII 5<sup>th</sup> Small Female Leg Assemblies**

The lower leg assemblies were discussed. Both mold sets are in good shape. Leo Ferdinand stated that they prefer the lower leg cavity of the Denton version flesh for ease of use. All other parts were shown to be equal. The group agreed that the optional ball sliders (the standard female has friction sliders) should follow the design preference of the 50<sup>th</sup>, which had been identified previously as Denton.

A key deciding factor that was also considered in the decision making: the same small female leg assemblies used on the 5<sup>th</sup> are also used on the SIDIIs, which has already been harmonized to the FTSS brand version.

A vote was taken. FTSS brand legs using the Denton brand lower leg cavity and optional ball sliders were recommended. *Please review the Voting Record attachment.*

**The Harmonization Task Group recommended HIII 5<sup>th</sup> Small Female:**

<i>DN = Denton Brand FTSS = FT Brand</i>	Head	Neck	Upper Torso	Lower Torso	Legs & Feet	Arms & Hand	Comments
<b>HIII 5<sup>th</sup> Small Female*</b>	DN	DN	FTSS	FTSS	FTSS	FTSS	<i>Harmonized Jacket, DN Ball Sliders, &amp; Lower Leg Cavity, DN Hands</i>
<i>*Harmonized Vinyl for all HYIII Family and CAPPs brand shoes.</i>							

### **Shoe Brand for HIII Adult Family**

Mike presented slides showing three brands of Shoes; the Denton Bates, the FTSS CAPPs, and the GM proposed model. The drawing specifies MIL-S13192 change "P." Joe Bastian stated that the weight and sole thickness requirements of the MIL-Spec have been the hardest to meet consistently over the years and required FTSS to work with CAPPs to provide a specific model that meets these specs and passes the Euro impact tests.

Jack acknowledged that there could be a dozen different types of shoes being used throughout the industry today and that it would be beneficial if everyone bought the same shoe to eliminate this particular variable.

The Denton and FTSS brands have rubber soles, removable insoles, and are close to each other in overall size and shape. The GM model uses a leather sole, which was traditionally the preferred material but proved problematic over the years as shoe manufacturers changed over to rubber materials. The friction differences between rubber and leather soles are not known, but Jack pointed out that rubber can change over time and the friction characteristics can change based on cleanliness.

Marvin Hatchet stated that he noticed a slight difference in overall length of the Denton and FTSS brand shoes. Both shoes conform to the 11EEE sizing, but the toe box length of the Denton brand is slightly longer. Marvin said this can affect the dummy positioning of the leg and may affect some test results.

A vote was taken. The FTSS CAPPs version was recommended.

### **General HIII 50th Review**

Mike Beebe presented a harmonization review of the HYIII 50<sup>th</sup> male previously presented in the March and April meetings. A larger FTSS population of dummies was shown in comparison with the Denton brand.

### **HIII 50<sup>th</sup> Male Head Assembly**

From the previous meetings, the most evident difference observed between the two brands of head assemblies is the head skin. The Denton brand head skin has a hollow nose and an angled chin. The FTSS brand head skin has a solid nose, straight chin, thicker vinyl, and is approximately a ¼ lb heavier than the Denton version.

The FMVSS part 572 head skin drawing calls out a vinyl thickness of .441 +/- .030 lbs. The Denton brand measures .471 and the FTSS version measures .513. The drawing also references the original GM pattern (mold) as the basis for the head skin shape and size specification. The GM mold has a hollow nose.

Denton brand head skins will fit on FTSS brand skulls, but will produce a lighter assembly that will need re-ballasting. Some members have stated that they keep the brand parts together and don't mix. Part of the weight difference is from the thicker wall of the FTSS head skin. One reason for a thicker skin is to allow head drop certification without the use of friction modifiers such as grease. Mike Beebe stated that the use of friction modifiers to help pass the certification was part of the original design intent of

the head and is called out in the Hubbard design paper. They found that in order to certify using the design thickness of .441, the use of grease was necessary. The friction modifier specification was on the original head assembly drawing but was removed by NHTSA when the dummy went into regulation. The FTSS brand head skin vinyl formulation has also been optimized to allow certification without grease.

Leo Ferdinand and Mr. Masuda confirmed their group's votes for the Denton brand head assembly. The previous meeting's vote was finalized. The Denton brand head was recommended. *Please review the Voting Record attachment.*

### **HIII 50<sup>th</sup> Male Neck Assembly**

From the previous meetings, the group discussed the two brand's different rubber molding processes. The FTSS brand uses an injection process and the Denton brand utilizes a compression press. Paul stated that Humanetics has not run enough necks in parallel, but adjustments could be made to either process to produce comparable parts. Both necks use 70-80 durometer butyl rubber and both are shipped with the nodding blocks used to certify the neck.

Leo Ferdinand and Mr. Masuda submitted their group's votes. ACEA has no neck preference and JAMA wishes to keep the neck brand the same as the head brand.

### **HIII 50<sup>th</sup> Male Upper Torso**

The HIII 50<sup>th</sup> review was continued beginning with the Thorax. The main topic was the chest jacket's slight differences in height, arm hole shape, and the foam fill areas. Mike Beebe presented a review of the pattern, drawings and a side by side photo comparison.

The bottom of the vinyl jacket is solid on the FTSS version and filled with foam on the Denton brand. The arm holes are longer on the FTSS version and the Denton jacket is slightly taller overall. The shoulder width is the same, but the original pattern is not symmetrical, which is reflected in both jackets. The jacket drawing references the pattern from Humanoid Systems, which resides with GM and was provided for the meeting. The final comparison results determined that the FTSS brand jacket is closer to the pattern and the drawing.

The current rib damping material thickness used to tune each brand's thorax impact performance is similar using either brand jacket. The interchangeability testing has been very good during internal Humanetics comparisons. Mike Beebe pointed out that the rib thickness specification on the drawing is a snapshot in time of the material delivered during the creation of the spec. Each new batch of damping material is tested before production and can vary in its performance characteristics. This variance changes over time and from batch to batch. Since FTSS and Denton use the same material from the same manufacturer, both brands tune the thickness in similar ways.

Although the metal skeletal components are the same across brands, Humanetics recommends utilizing the FTSS brand investment shoulder castings because of their consistency and quality.

A vote was taken. The FTSS brand upper torso was recommended. *Please review the Voting Record attachment.*

### **HIII 50<sup>th</sup> Male Lower Torso**

The HIII 50<sup>th</sup> lower torso was reviewed. Mike Beebe began by presenting an abdomen comparison for height, width, and length. There is not much physical difference between the two brands. The mold preference is the newer Denton mold.

A comparison of the two pelvis bones and the pattern was presented. Both FTSS and Denton used the same pattern when originally creating their versions, so the casting shape is consistent between the two. The distance between the ASIS points show the biggest measurement difference, but they are within casting tolerances.

The upper femur cavities of the molded pelvis has slight size differences between brands and Leo stated that the hip range of motion certification tests show differences between the right and left sides of both versions. Mike Beebe explained that the pelvis bone was casted from a human bone and is not symmetrical. This has produced a ten degree angle difference between the right and left ball socket locations and can produce the differences seen in the HROM test. No appreciable differences in the femurs have been noticed. The group did not voice any issues with the outside molded shape of the pelvis fleshes. The Denton pelvis mold is newer and easier to handle per the Humanetics engineering and molding departments.

The SAE committee will continue with the development of static and dynamic lumbar tests. The Denton version lumbar has revised sprue locations for quality purposes and is still the recommended version from the previous meetings.

A vote was taken. The Denton brand Lower Torso was recommended. *Please review the Voting Record attachment.*

### **HIII 50<sup>th</sup> Male Arm and Hands**

During the previous meetings, some noticeable differences in arm components were presented. These include foam fill areas around the wrist (similar to the small female lower arm and wrist area) and joint interfacing at the elbow. It was decided to maintain one brand throughout the arm components, regardless which version was recommended.

A vote was taken. The Denton brand arm and hand was recommended. *Please review the Voting Record attachment.*

### **HIII 50<sup>th</sup> Male Leg Assemblies**

The HIII 50<sup>th</sup> legs were reviewed. During the last meeting, the lower leg flesh drawing and mold recommendations were presented and lower leg flesh shrinkage and bone fit were discussed. It was noted that the new vinyl proposal would help eliminate shrinkage and the commonized nickel coatings would also help with installation and removal. No preference on friction sliders was given by the group. A variety of leg flesh and foot options would still be available regardless of the final harmonized components.

The most noticeable difference occurs in the knee flesh and the rubber knee insert. The standard FTSS version of the 50<sup>th</sup> knee has a shorter, squared off rubber knee insert with a corresponding sized insert cavity within the flesh. Denton has produced this same version for the Japanese market, but the standard Denton brand 50<sup>th</sup> dummy includes the longer, tapered rubber insert found in the drawing package.

A vote was taken. The Denton brand leg assembly was recommended. *Please review the Voting Record attachment.*

**The Harmonization Task Group recommended HIII 50<sup>th</sup> Male:**

<i>DN = Denton Brand FTSS = FT Brand</i>	Head	Neck	Upper Torso	Lower Torso	Legs & Feet	Arms & Hand	Comments
<b>HIII 50<sup>th</sup> Male*</b>	DN	DN	FTSS	DN	DN	DN	
<i>*Harmonized Vinyl for all HYIII Family and CAPPs brand shoes.</i>							

**EuroSID-2 and ES2RE**

Because of time restraints, today's meeting did not permit a formal review of the EuroSID-2 ATDs. Some ES2 issues that will be discussed further during the next meeting are:

- Head assembly interchangeability
- Shoulder foam comparison
- Foam recovery time
- Thorax Damper differences
- Arm bone comparison
- Abdomen brand recommendation from Humanetics

**The group has suggested the following matrix of harmonized ATD definitions to date:**

<i>DN = Denton Brand FTSS = FT Brand</i>	Head	Neck	Upper Torso	Lower Torso	Legs & Feet	Arms & Hand	Comments
<b>HIII 10YO*</b>	DN	DN	FTSS	DN	DN	DN	
<b>HIII 95<sup>th</sup> Large Male*</b>	DN	DN	DN	DN	FTSS	DN	<i>FT Clavicles, DN Ball Sliders &amp; Feet</i>
<b>HIII 50<sup>th</sup> Male*</b>	DN	DN	FTSS	DN	DN	DN	
<b>HIII 5<sup>th</sup> Small Female*</b>	DN	DN	FTSS	FTSS	FTSS	FTSS	<i>Harmonized Jacket, DN Ball Sliders, &amp; Lower Leg Cavity, DN Hands</i>
<i>*Harmonized Vinyl for all HYIII Family and CAPPs brand shoes.</i>							

### **What does the Phase-in mean to everyone?**

During the next couple of meetings the task group will begin to discuss how to plan for phase-in periods for the proposed Harmonized ATDs. This will include timelines for the manufacture and sale of harmonized ATDs and spare parts.

During the previous Harmonization meetings, it was concluded that many of the two brands of parts are already interchangeable and will have no affect on use. The major discussion points have been in the heads, pelvis, and the chest jacket components. Other subtle differences than already discussed may occur on some of these parts. How to communicate customer direction on backward compatibility and component choice will be discussed.

### **June 21<sup>st</sup> Meeting Agenda**

ES2 and ESRE Review  
Phase-in Discussions  
Tasks for next meeting

*\*Please comment on the previous meeting minutes during the beginning of each meeting.*

### *The current harmonization schedule*

**January 13<sup>th</sup>** – HYIII 95<sup>th</sup> Large Male  
**February 10<sup>th</sup>** – HYII 10YO Child  
**March 14<sup>th</sup>** – HYIII 50<sup>th</sup> Male  
**April 21<sup>st</sup> /April 28<sup>th</sup>** – HYIII 50<sup>th</sup> Male  
**May 12<sup>th</sup>** – 5<sup>th</sup> Small Female/50<sup>th</sup> Male  
**June 21<sup>st</sup>** – EuroSID-2  
**July 14<sup>th</sup>** – HYIII 6YO Child  
**Aug 11<sup>th</sup>** - HYIII 3YO Child  
**Sept 8<sup>th</sup>** – CRABI  
**Oct 13<sup>th</sup>** - SID  
**Nov 10<sup>th</sup>** - FMH / Misc.

*Meetings are usually held the 2<sup>nd</sup> Thursday of each month barring any conflicts. Locations to be determined.*

-END-