Following the conclusion of the ATD Harmonization Task Group’s final recommendations in November of 2011, a timetable for the manufacture of the first harmonized dummies and the scheduling of product phase-in periods has been initiated. Internally, Humanetics has begun the task of building new dummy bills of materials and updating documentation and manufacturing processes including vinyl molding and metal finishing.

In June of 2012, the Hybrid III 50th ATD will be the first complete harmonized dummy offered for sale by Humanetics. The harmonized Hybrid III 10-YO will follow after a stringent internal review of the recently released final drawing package from the National Highway and Traffic Administration (NHTSA), who issued the Final Rule in February.

The Hybrid III 5th small female will be third in line as a harmonized ATD. The Task Group recommended that the 2009 harmonized chest jacket design be included with this dummy. NHTSA is finishing some final torso flexion validation testing using this version of the chest jacket and plans to begin using it regularly as soon as it is commercially available.

Rounding out the schedule, the harmonized versions of the Hybrid III 95th large male, EuroSID-2, and the child ATDs will be available by the end of 2012. As each harmonized dummy is released, the legacy FTSS and Denton brands will no longer be available for sale. The complete harmonization matrix detailing the brand recommendations is shown in the table below.

For more information, including white papers, technical bulletins, and news, please review the harmonization section of the website at: http://www.humaneticsatd.com/harmonization-commonization/harmonization.

### ANNOUNCEMENT

On February 21, 2012, the National Highway Traffic Safety Administration (NHTSA) issued a Final Rule on the Hybrid III 10-year-old crash test dummy. The new rule amends the current child seat standard to include child seats and boosters for children weighing between 65 and 80 pounds. The 10-year-old will help evaluate higher weight restraint systems for the first time in compliance tests.

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### Harmonization Matrix

<table>
<thead>
<tr>
<th>ATD</th>
<th>Head</th>
<th>Neck</th>
<th>Arms &amp; Hands</th>
<th>Upper Torso</th>
<th>Lower Torso</th>
<th>Legs &amp; Feet</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hybrid III 95th Male</td>
<td>DN</td>
<td>DN</td>
<td>DN</td>
<td>DN</td>
<td>DN</td>
<td>FTSS</td>
<td></td>
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<tr>
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<td>DN</td>
<td>DN</td>
<td>DN</td>
<td>DN</td>
<td>FTSS</td>
<td>DN</td>
<td></td>
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<tr>
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<td>DN</td>
<td>DN</td>
<td>FTSS</td>
<td>FTSS</td>
<td>FTSS</td>
<td>FTSS</td>
<td></td>
</tr>
<tr>
<td>Hybrid III 10YO*</td>
<td>DN</td>
<td>DN</td>
<td>DN</td>
<td>FTSS</td>
<td>DN</td>
<td>DN</td>
<td></td>
</tr>
<tr>
<td>Hybrid III 6YO*</td>
<td>DN</td>
<td>FTSS</td>
<td>DN</td>
<td>DN</td>
<td>DN</td>
<td>DN</td>
<td></td>
</tr>
<tr>
<td>Hybrid III 3YO*</td>
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<td>FTSS</td>
<td>DN</td>
<td>DN</td>
<td>DN</td>
<td>FTSS</td>
<td></td>
</tr>
<tr>
<td>EuroSID-2, ES2-RE*</td>
<td>FTSS</td>
<td>DN</td>
<td>FTSS</td>
<td>FTSS</td>
<td>FTSS</td>
<td>FTSS</td>
<td></td>
</tr>
<tr>
<td>CRAB: 32</td>
<td>Combo</td>
<td>DN</td>
<td>Combo</td>
<td>DN</td>
<td>-</td>
<td>Combo</td>
<td></td>
</tr>
<tr>
<td>FMH</td>
<td>DN</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

*Harmonized vinyl & CAPPS brand shoes  - DN = Denton ATD  - FTSS = First Technology Safety Systems

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Humanetics Innovative Solutions is currently updating the material formulations for certain components used in the crash test dummy product lines. The affected materials mostly belong to a family of plastics and vinyls commonly specified in the construction of ATD parts.

There are two basic factors mandating material updates to various polyurethane and vinyl parts produced by Humanetics:

1. In today’s environmentally conscious age, governments are increasingly banning older chemicals and materials deemed unsafe to manufacture, use, and dispose of safely. These bans are forcing suppliers to discontinue certain products used by Humanetics to produce some of its existing polyurethane (harder plastics) and PVC vinyl components.

2. During 2011’s worldwide harmonization effort, the Global Task Group decided to harmonize the builds of today’s most commonly used dummies. This harmonization effort mandates using a common vinyl flesh for all dummies.

**Background**

The hardening agent used to mold various bones, skulls, and rib cages is no longer commercially available due to European REACH (Registration, Evaluation, Authorization and Restriction of Chemical Substances) compliance requirements. The European community’s regulation body REACH deals with chemicals and their safe use. Certain vinyl formulations also use a plasticizer which has been recently restricted in parts of the United States. Plasticizers make plastics less rigid, giving them flexibility and durability; a necessity in vinyl dummy flesh.

Humanetics must therefore make changes to these plastic materials and vinyls used in the manufacture of bones and flesh for the Q-dummies, P1.5, EuroSID-2, WorldSID, Hybrid III family, SIDIIs and the Ejection Mitigation Headform.

Table 1 lists the current components affected within the individual dummies.

**General Summary**

Humanetics has qualified new polymers as replacement materials for affected components that will provide similar durability, consistency, and dynamic response characteristics as the original products. The new plastics have been subjected to controlled testing protocols to ensure that they meet all known standards and specifications. Since the old polymer agents are no longer available, Humanetics has consumed most of its inventory, many of the new materials will be used immediately in producing new dummies.

- Alternate polyurethane Q-dummy bone materials were tested quasi-statically and dynamically including full-scale sled testing to ensure they behaved in a manner equal to, or better than the originally product. The replacement material had to meet minimum durability, repeatability, and certification requirements. It was also critical that the new material parts were interchangeable with current dummies in the field. The Q6 dummy was used as the test bed for most of the evaluation process because it had many components affected by the obsolete urethane. However, other Q-dummy components were evaluated and tested as well. The report on the bone replacement testing titled “Q-dummy – Material Equivalency” can be found on www.humaneticsatd.com.

- The Q-dummy skulls, WorldSID skulls and iliac wings have also been affected by the obsolete urethane. Humanetics has evaluated a new rigid, wear resistant polyurethanes specifically for these skulls and iliac wings. A series of bench top material tests as well as pendulum tests on the WorldSID pelvis have been completed. All of the test responses with the newly proposed material have been acceptable.

- The elastomer and foam used to fill some of the Q-dummy and WorldSID flesh parts have also become obsolete. Humanetics has a large stock of this product remaining and will continue making parts for the immediate future. A secondary project has been started to establish a replacement product.

- The current Ureol polyurethane components are black in color on the children, and yellow in color on the adult side impact ATDs. In general, new components manufactured with the new polyurethanes and vinyls will have a light brown color to distinguish them from parts manufactured using the previous generation of materials.

- In 2011, the worldwide Harmonization Task Group voted unanimously to harmonize the vinyl material utilized throughout the current family of ATDs. They found that the general vinyl flesh formulations of each brand are very similar; both the Denton and FTSS materials used the same resins, plasticizers, and stabilizers.

- Because of a restricted plasticizer component used in the vinyl formulation of the FTSS brand SIDIIs and 18kg Ejection Mitigation Headform head flesh, Humanetics is now producing these head skins using the brown harmonized vinyl agreed upon by the ATD Harmonization Task Group.

- Both Denton and FTSS had historically used a common rib damping material provided by a single supplier. This supplier discontinued their product last year and a new supplier has begun manufacturing the damping material using the original formulation owned by the U.S. Navy.

**TABLE 1**

<table>
<thead>
<tr>
<th>Materials</th>
<th>Q-Series</th>
<th>P1.5</th>
<th>EuroSID-2 &amp; ES-2re</th>
<th>WorldSID 5th</th>
<th>WorldSID 50th</th>
<th>SIDIIs</th>
<th>18kg EMH</th>
<th>Hybrid III Family</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head Skin</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skull</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bones</td>
<td>X</td>
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<td>Clavicles</td>
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<tr>
<td>Ribs</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Iliac Wings</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pelvis</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harmonized Vinyl/Flesh</td>
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<td>X</td>
<td>X</td>
<td>X</td>
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</tr>
</tbody>
</table>
New Hybrid III 50th Ankle

An update to the Hybrid III 50th male ankle is being added to the Insurance Institute for Highway Safety’s (IIHS) offset testing protocol. The updated ankle design will eliminate electrical signal noise resulting from metal-to-metal contact between the ankle joint ball shaft and the bumper retainer.

In 2008, the Society of Automotive Engineers (SAE) Hybrid III dummy task force started investigating the design of the 50th ankle based on signal noise findings by IIHS in 2007. To solve the problem, the task force worked with Humanetics to create an updated ankle design which eliminates the metal-to-metal contact while still maintaining the ankle’s 45 degree range of motion as originally specified in the 1996 NHTSA final rule.

The new ankle adds rubber wrap all around the ball retainer and clamping nuts to the ankle shaft and lower tibia attachments. SAE’s full report on the updated ankle design is documented in J2949.  

Mark Brown

Flex-PLI UPDATE

Mark Burleigh  
Robert Kant

The corridors will be reviewed within the Task Force of the new Informal Group set up for this purpose by GSRP. Humanetics has prepared 6 bone sets for stiffness assessment that will be confirmed by JARI. Static corridors will be reassessed using a more stable platform. Original biofidelity will be maintained so injury thresholds should not change.

After completion of the bone and sub-assembly testing this month, onboard DAS will be installed onto the legs and used to gather dynamic data in an international round robin. Testing is scheduled to be completed near the end of summer 2012; the data will then be analyzed and the corridors reviewed. A small shift to some existing corridors is anticipated. However, it is not intended to widen any corridors nor to change the GTR9 proposed injury thresholds: 340Nm bone moment, 22mm MCL ligament and 13mm ACL and PCL ligament monitoring.

FE Flex-PLI Consortium

The Consortium Group responsible for the numerical model development of the FLEX-PLI in LS-DYNA, PAM-CRASH, RADIOSS and ABAQUS code has recently approved the released of version 2.0.

These models meet the targets that were set at the start of the project. The models have been validated against a well-controlled experimental data set consisting of material, component and full-leg tests, which were defined by the Consortium Group and generated specifically for model development purposes. The 10 full-leg load cases cover a wide range of load levels, and the models shows excellent overall correlation. Almost all of the injury channels (MCL and tibia moment) show less than 15% peak error for these full-leg load cases.

The Group wishes to proceed as soon as the hardware and corresponding certification conditions are frozen and approved by the committees involved. This should guarantee that the model represents the finalized hardware. A second future goal is to validate the models against new test data that is generated with several hardware legs at different test labs, in order to better understand potential variability.

Background

Since the early stage of developing the Flex-PLI and establishing the pendulum corridor requirements with the Japanese automotive community, there was a request to change the bone material from polyester to vinyl ester for improved durability. This and later bone batches appeared to have a negative effect on the leg capabilities to meet the GTR Inverse corridors. Humanetics and JARI are recommending through the new GSRP Informal group (IG GTR9-PH2) to review the corridors with round robin testing with a higher sample size so that corridors can be met in the future. Within that group, a Task Force has been formed, TF-RUCC (Task Force-Review and Update Certification Corridors), to look specifically at the technical issues regarding certification.

Current State

- Components: femur, tibia and knee pass current static GTR 9 requirements
- Leg meets current GTR 9 dynamic pendulum test corridors
- Leg gets as close to current GTR 9 corridors on the Inverse test as possible, typically two tibia moment channels are outside the corridors’ lower limit
Hybrid III 5th Female v7.0 Model Released

Humanetics is pleased to announce the availability of v7.0 of the Hybrid III 5th model in the codes LS-DYNA and PAM-CRASH. This model is completely new and achieves superior correlation in critical areas such as neck and chest. CORA was used to objectively rate and compare the performance of the model.

The mesh was refined in order to capture more detail. Joint stops that were modeled as a stiff moment-angle function in the past have been replaced by physically modeled parts; each with their respective material properties assigned to them.

New component and material tests were also executed to extract better test data that was used for validation purposes. Humanetics also analyzed historical certification test data, in order to select validation curves that represent the average, and average +/- 1 standard deviation. Correlation increased for neck and chest signals at all validation levels.

For the in-house sled test (pictured), an all time high CORA rating of 0.91 (on a scale of 0-1) for the total load case was achieved. Most important is which signals were mainly contributing to this increase; the chest deflection increased to 0.98 (up from 0.87) while the neck Fz increased to 0.94 (up from 0.74). These numbers are for LS-DYNA; PAM-CRASH achieved similar individual signal scores, and also achieved a total load case score of 0.91. The chest deflection comparison is depicted with illustrations above.

Roel Van De Velde

FE NEWS

Q6 & Q10 Child
Robert Kant

In April 2012, a new version of the Q6 FE model will be released in LS-DYNA and PAMCRASH code, and the ABAQUS and RADIOSS code will soon follow. Updated in this release are the thorax, neck and lumbar spine models which have now gone through an extensive component validation program. The specification of this validation program was approved by the OEM consortium group that is involved with the development of the Q6 models. Mesh development of the Q10 Child had started in 2011 and is planned to be completed in the coming months. Since the first OEM has confirmed the need to use a preliminary Q10 Child FE model, Humanetics is executing an ambitious plan to release an LS-DYNA model by late summer/early autumn. The approach followed to build the Q10 model is similar to the proven successful approach as followed for the Q6.

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Roel Van De Velde

Automotive Testing Expo 2012 INDIA

The global trade show for automotive test and development technologies opened its doors in Chennai India on March 6, 2012 and welcomed 5,000 plus visitors from the Indian automotive industry. Humanetics was one of many exhibitors at the show to share the latest technologies and products. Local Humanetics representatives were able to meet with the customers to personally demonstrate some of the latest developments, and how they could be used and contribute to enhance automotive safety. Many positive responses were received.