Issue 2, May 2000

WorldSID Newsletter

A publication by Biokinetics on behalf of the ISO WorldSID Task Group

In this Issue:

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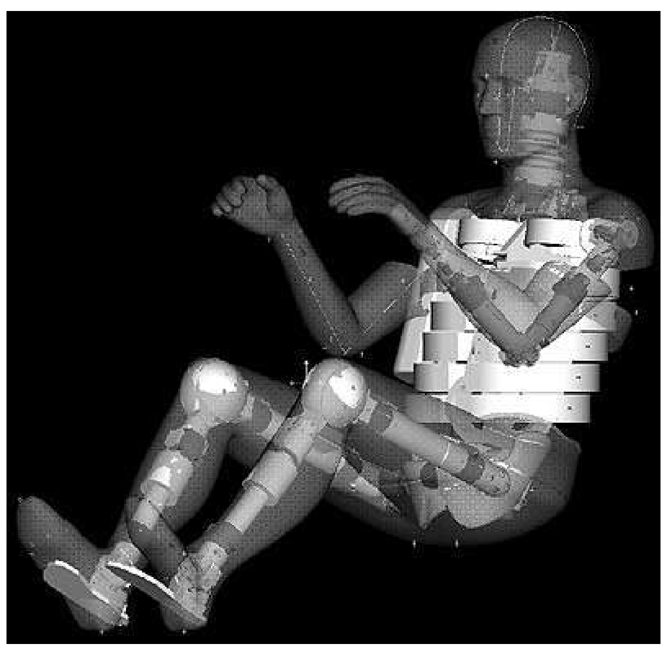
Dear Reader,

May 2000 already! Time sure flies when you're having fun... Where in the first issue of this WorldSID Newsletter we have presented the background and organization of the WorldSID program, this second issue concentrates on the actual technical design work. This work is done by the WorldSID Design Team, consisting of:

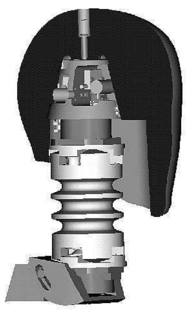
- First Technology Safety Systems
- SID-2000 consortium (TNO-Automotive, TRL and INRETS)
- R.A. Denton
- Applied Safety Technology Systems
- Diversified Technical Systems
- Endevco
- Biokinetics and Associates

Inside this WorldSID Newsletter, you will find details of the component development as of April 2000. A lot of time was spent on getting the specifications detailed - a big team effort - on which the component designs are based. We expect to present more on the specifications and functionality of the WorldSID in a future issue of the newsletter. Below, an impression is given of the total assembly of the new side impact dummy. Don't be misled, this is still a draft design as it is created in 3D CAD. Again, we greatly encourage that you pass this newsletter on to interested people in your organization or even other organizations that may benefit from the information enclosed. Please help us to keep our mailing list current by providing us with your mailing address and email address or any additions or changes you would like to see included. I wish you informative reading.

Marc Beusenberg
WorldSID project manager
On behalf of the ISO
WorldSID Task Group



Head



The head is being developed by the SID-2000 consortium (TNO-Automotive, TRL, and INRETS) to provide better performance when interacting with airbags and padded or rigid structures. The head is expected to have excellent biofidelity performance in both lateral and frontal impacts. Reference for the anthropometry is taken from the UMTRI data set. The head will be made of a polyurethane skull moulded directly into a PVC skin. Split lines and other facial features (eyes, nose, lips) are absent. The internal cavity for instrumentation will contain a core block that will house all instrumentation for accurate alignment and ease of handling. This core block includes the upper neck load cell that acts as the head / neck interface.

Neck

Development of the WordSID neck is subcontracted to the SID-2000 consortium (TNO-Automotive, TRL, and INRETS). The neck represents the human neck as it attaches to the head at the occipital condyles-atlas joint and to the torso at the C7-T1 junction. It will also have similar shape, mass, and mass distribution to that of the human as available from the reference UMTRI data set. The design is based on the EUROSID-1 neck. Expected improvements with respect to the EUROSID-1 neck are improved bolt tightening, improved pre-impact position stability, and elimination of buffer dislocation. A lower neck bracket will allow neck angle adjustment. The neck will incorporate a neck shroud to provide proper anthropometry and prevent unrealistic loading from airbag interaction. A universal spine load cell and a T1 tri-axial accelerometer will be incorporated at the base of the neck. The load cell will be oriented such that one of its sensitive axes coincides with or is parallel to the neck centerline.

Shoulders/Thorax/Abdomen

Development of the shoulder / thorax / abdomen is subcontracted to First Technology Safety Systems and the SID-2000 consortium (TNO-Automotive, TRL, and INRETS). The anthropometry is based on the UMTRI data set and is complimented with recent data from the ASPECT program. The shoulder, thorax and abdomen areas are required to be symmetrical about the mid-sagittal plane. The rib modules are constructed of a super elastic alloy that will accommodate 75 mm of deflection. The ribs are in a horizontal position in the seated posture, except for the shoulder rib and thorax rib #1. The ribs also contain deflection sensors capable of handling high speed airbag interaction. The spine box is a rigid structure of high density metal that is the mounting base for rib units, instrumentation and DAS modules.

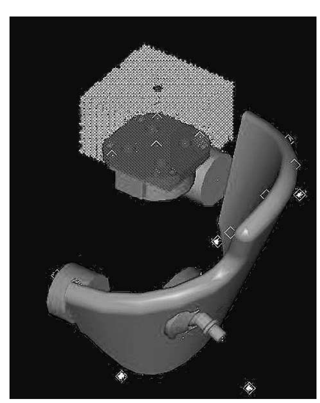
Full Arm

Development of the WorldSID full arms is subcontracted to R.A. Denton. The design of the full arm is based on the "SAE airbag interaction arm" and anthropometry is based on the UMTRI anthropometry data set. It will be constructed of a metallic instrumented bone structure with a soft flesh and skin covering. The flesh will be removable to access instrumentation. Load cells will be integral parts of the bone structure at the upper arm, lower arm and elbow, and structural replacements for these will be provided. Other instrumentation includes tri-axial linear accelerometers at the elbow and wrist, and an elbow rotation sensor. There will be a gripping hand, and the arm will have a 3-degree of freedom shoulder joint, 1-degree of freedom elbow joint, and 1-degree of freedom wrist joint.

Half Arm

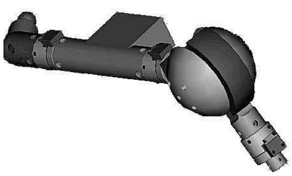
Development of the half arm is subcontracted to First Technology Safety Systems. The half arm represents only the upper arm of the midsize male, from the gleno-humeral joint to the elbow. The half arm is intended for testing where a full articulated arm is not required and could cause test repeatability problems. This arm has a deformable flesh over a skeletal structure. The deformable flesh is fabricated from a thin vinyl skin over urethane foam. The flesh contour is derived from the UMTRI shell surface model, and approximated to a rectangular section to improve the arms stability during test loading. The half arm will primarily be used for full-scale vehicle-to-pole and vehicle-to-vehicle crash tests. It will interact with vehicle door interior trim, B/C pillars, and side impact airbags in various configurations.

Pelvis



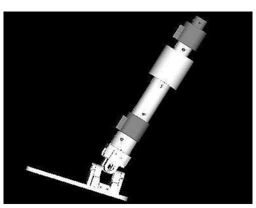
Development is subcontracted to the SID-2000 consortium (TNO-Automotive, TRL, and INRETS). INRETS is responsible for the pelvis concept. The pelvis is a semi-rigid structure that closely resembles the human anthropometry (based on the UMTRI data set and Reynolds study) and has integrated instrumentation. The instrumentation consists of load cells that are structural components of the pelvis skeleton, which are positioned to assess all load paths. The flesh structure has a new configuration with abdomen/pelvis insert, pelvis flesh and upper femur flesh. The pelvis will show continuous impact performance for a wide range of impacts. The pelvis will interact with airbags, belts, padded and rigid structures.

Upper Leg



The development of the upper leg is subcontracted to R. A. Denton. The upper leg incorporates a rigid instrumented bone structure with a soft flesh and skin covering. It extends from the pelvis interface to the knee-lower leg interface. The knees are designed as part of the upper leg and are load sensing. Load cells are integral parts of the bone structure and structural replacements will be provided. The bone structure is used as a mounting for DAS modules. A one-piece flesh extends from the pelvis to cover the knee. This flesh will have cable routings built in and split to allow easy removal from the bone structure. In compressed (seated) condition, the flesh shape simulates the shape defined by the UMTRI shell. The flesh will provide a near continuous outer surface with the pelvis flesh. The upper leg can be subjected to a variety of loading conditions and contact interactions. Contacts could come from doors, seats, intruding structures, leg-leg, another occupant, other interior structures, or restraints such as airbags.

Lower Leg



Development of the lower leg is subcontracted to Applied Safety Technologies Corporation (ASTC). The lower leg skeleton consists of a rigid bone structure, except the compliant tibia section and will be designed to represent the mid-sized male as represented by the UMTRI data set. The skeletal structure is represented by an instrumented metallic structure, which includes a lower leg bone, ankle joint and foot with shoe. It contains integrated load cells, ankle rotation sensors and integrated cable routing. The ankle has 3-degrees of freedom with "soft" joint stops. There is also an integrated foot-shoe moulding. Skin and flesh are represented by vinyl covered polyurethane foam and self-skinning foam, covering the bone structure. The lower leg will be loaded in a variety of ways. it can be loaded from the thigh, from contact with the floor pan of the tested vehicle, from the floor pedals, from the door panels, from the dash panel and even from the other leg.

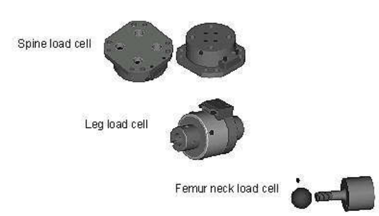
In Dummy DAS

Development of the in-dummy data acquisition system (**TDAS ATD**) is subcontracted to Diversified Technical Systems. This system is intended to be wholly contained within the WorldSID. The main purpose for an in-dummy data acquisition system (DAS) is to eliminate the umbilical wires normally required to transmit the sensor signals from inside the dummy to a data acquisition system located on, or off the vehicle. With close to 200 possible data channels the traditional umbilical system will not be practical due to cable mass and handling issues. An in-dummy DAS will also greatly reduce the time required for WorldSID installation and checkout. The TDAS ATD system combines sensor signal conditioning, analog to digital circuits, microprocessor, memory and communication circuits into the same package. This system moves a significant portion of the signal conditioning to the sensor along with self-calibration and sensor ID capabilities. This systems breaks the traditional data acquisition system into two main parts; sensor modules and DAS modules.

Accelerometers and Tilt Sensors

The development of linear acceleration, angular acceleration, and tilt sensors is subcontracted to Endevco. The WorldSID will be equipped with newly designed linear tri-axial accelerometers that will be positioned at 15 different locations throughout the dummy, when considering the struck side only. The tri-axial accelerometer footprint is basically the same as the today's uni-axial accelerometer footprint. The WorldSID will also be equipped with 6 tilt sensors, two in the head, torso and pelvis, measuring the orientation of these parts prior to impact. The uni-axial angular accelerometer that will be used in this dummy is based on Endevco's angular accelerometer type 7302B.

Load Cells



Development of the load cells is subcontracted to R. A. Denton. Design of the load cells is primarily driven by the number and type of channels, capacity for each of the channels, and the body part design, into which they are incorporated. The design intent is to minimize the number of types of loads cells in the WorldSID by using universal-types where possible.

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