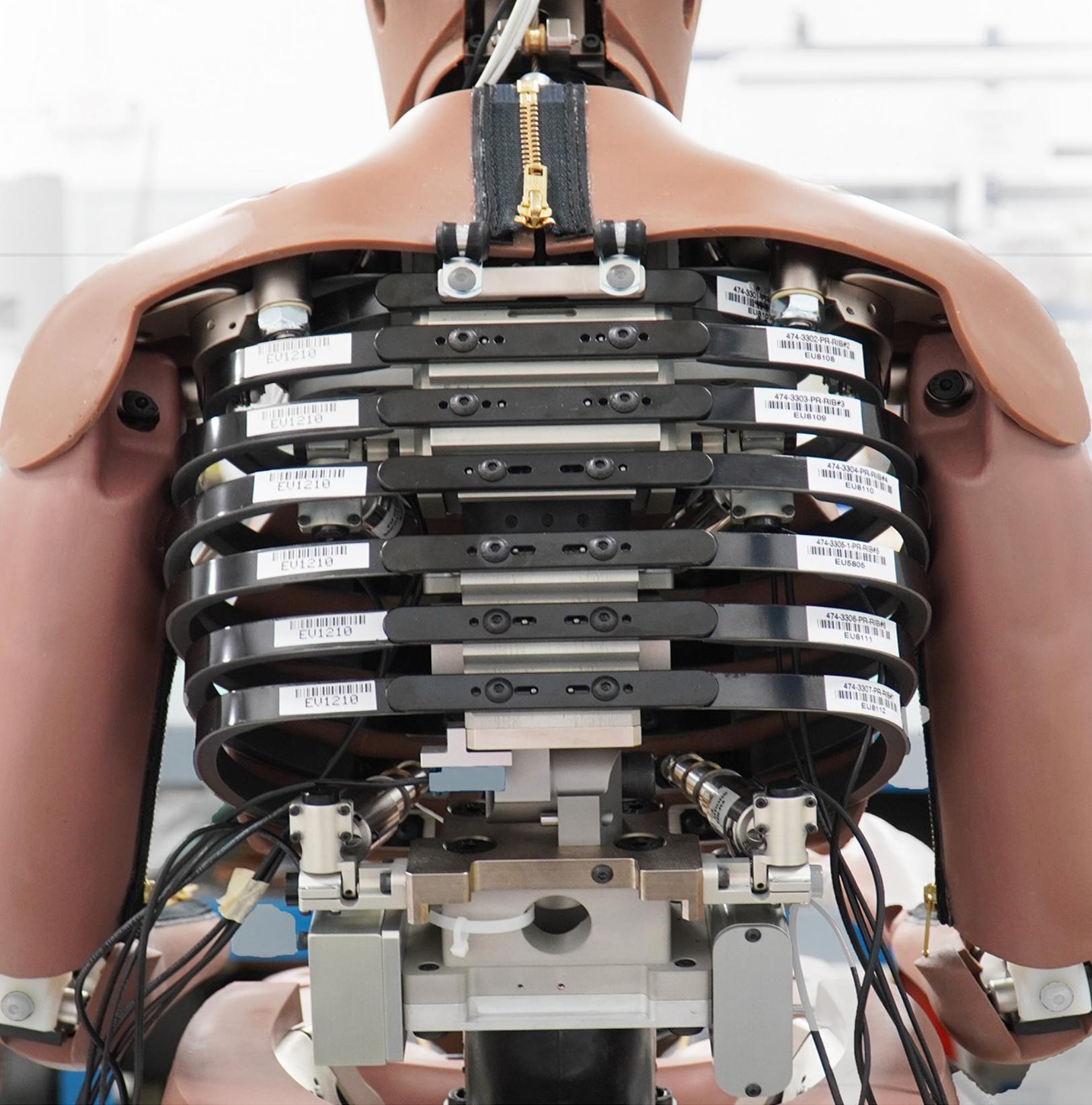




THOR-5F

THE NEW GENERATION OF FEMALE TEST DEVICE



The THOR-5F is the first frontal Anthropomorphic Test Device (ATD) that is instrumented with sensors to measure impacts where women are most vulnerable to injury. The additional sensors enable a much more accurate understanding of injury risk and prevention.

The THOR-5F gives regulators and safety engineers an opportunity to look at the unique needs of women's safety beyond a reduced size male dummy.

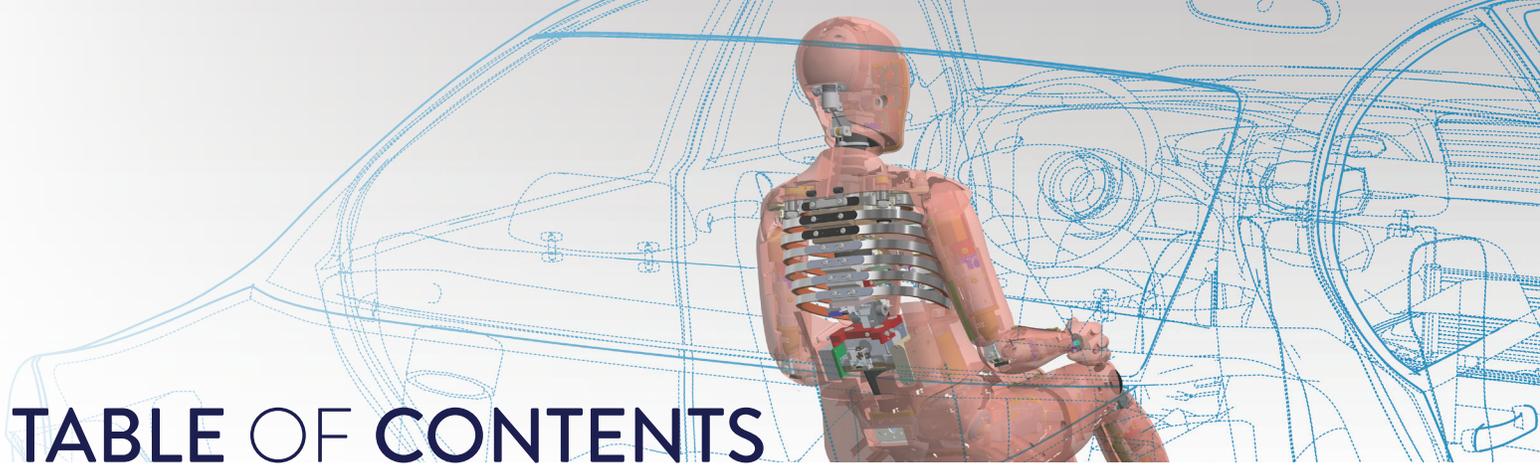


TABLE OF CONTENTS

| | |
|---|----|
| The Next Generation | 3 |
| The Risk to Women | 5 |
| What is the THOR-5F? | 7 |
| The Future of THOR-5F | 8 |
| Specifications | 9 |
| Design | 10 |
| Enhancements | 11 |
| Versions | 13 |
| Data Collection | 14 |
| Load Cell Matrix | 15 |
| Channel Configurations | 16 |
| CAE & Finite Element Models | 17 |
| Onboard DAS | 19 |
| DAS Integration - Slice6 & Nano | 21 |
| DAS Integration - DTI & Kyowa | 23 |
| Certification & Calibration | 25 |
| Global Network | 26 |
| Renting/Leasing Options | 27 |
| Sales, Maintenance & Training | 38 |
| Spare Part Availability | 29 |
| Webinars & Technical Support | 30 |

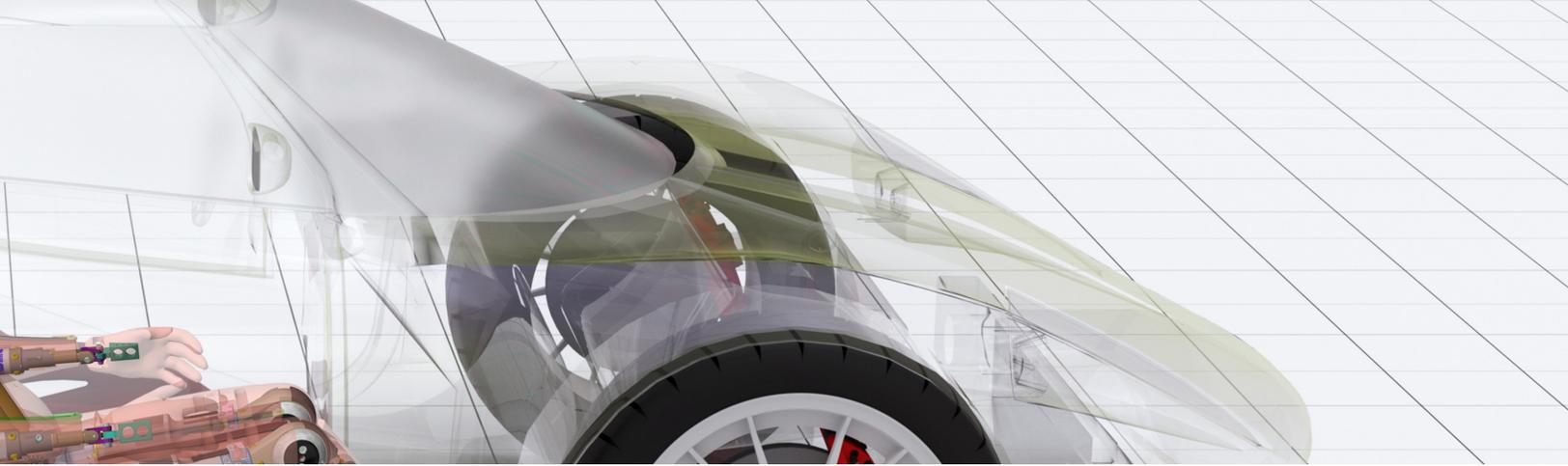
THE NEXT GENERATION

TRANSITIONING TO THE NEXT GENERATION OF ATDS

Crash test dummy technology has evolved to develop a next generation of ATDs that can better replicate a person's physiology.

These dummies have more sensors in the abdomen and pelvis to measure seat belt loads during impact, more facial sensors and more ways to measure chest compression to reduce the risk of rib fractures. Data provided by advanced dummies could help fine tune car design for safer and more effective seat belts, headrests, air bags, pedals and cabin structures.





Our lineup of Next Generation ATDs.

- THOR-50M
- THOR-5F
- THOR-AV-50M
- THOR-AV-5F
- WorldSID-50M
- WorldSID-5F
- Elderly Female
- Obese Male
- BioRID
- Q-Dummy Children



THE RISK TO WOMEN

Today's average American female is 5.4 inches (~14cm) shorter and 27 pounds (~12kg) lighter than the average male.[5] Among other effects, this means women sit closer to the steering wheel in order to reach the pedals. With shorter legs, women reaching for pedals are also 80% more likely than men to suffer severe leg injuries.[6] In technical terms, women are often "out of position" drivers, essentially piloting vehicles designed for men.[7]

Height and weight measurements do not nearly describe the extent of differences between male and female bodies. Take, for instance, differences in neck musculature. Male necks are more muscular and have greater spinal column strength; female necks use less muscle mass to support heads that are nearly as large and heavy. This means women are significantly more prone to whiplash in an accident. A 2013 NHTSA study found that, relative to males of the same age, females in deadly crashes were 9.4% more likely to die as a result of neck injury.[8]

The gender bias in road safety is costing women their health. Just over one million injuries were sustained by women in 2018 (76% in the driver's seat).[12]

Tragically, gender bias in road safety is also costing women their lives. In 2018, 8,593 American women were killed in car crashes, a majority of them (61%) in the driver's seat. [14] A 2013 NHTSA report found that female drivers and right front passengers wearing their seat belts are 17% to 18.5% more likely than their male counterparts to be killed in a crash, largely due to unbalanced safety standards such as the current crash test dummy measures.[15] These uneven

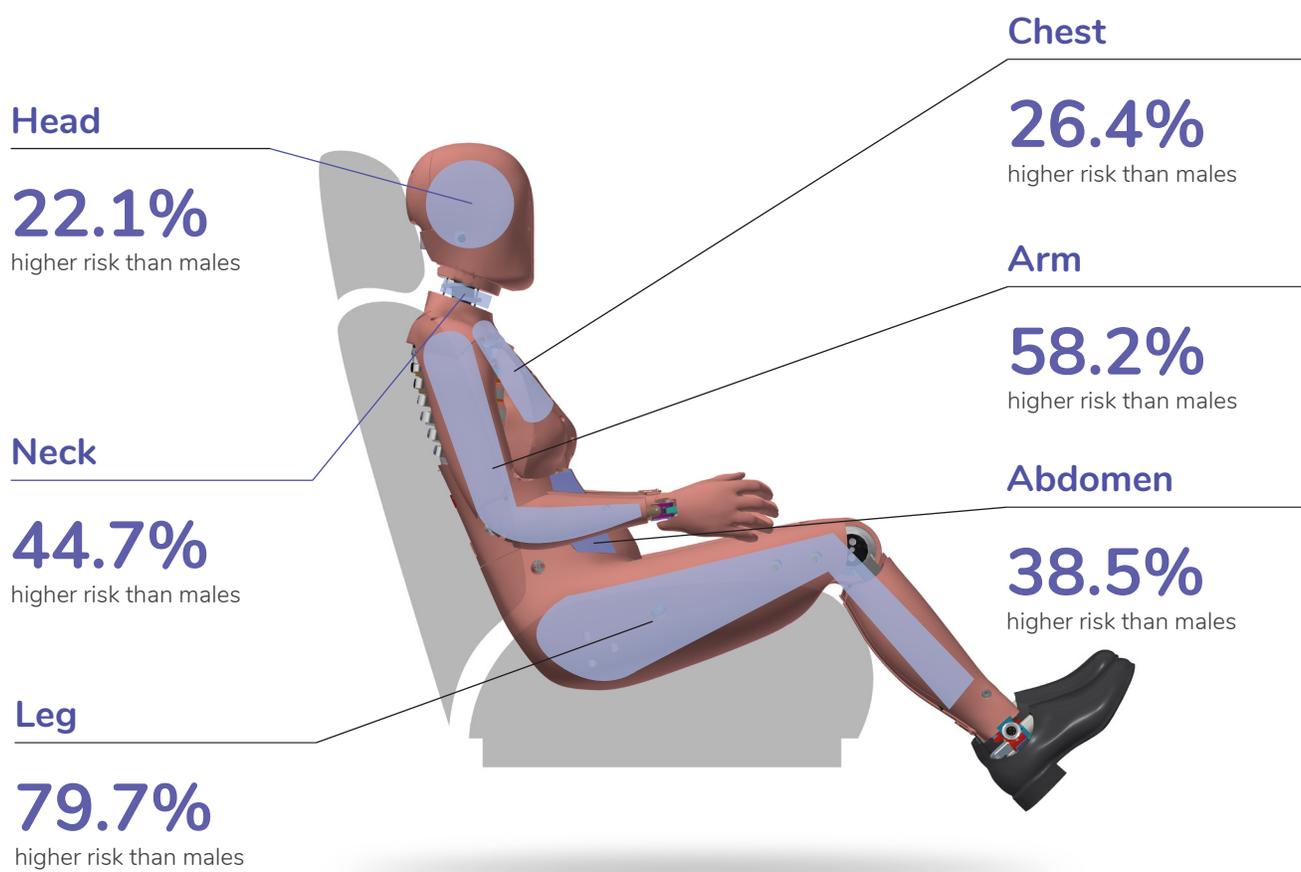
odds mean that the death of up to 1,342 mothers, daughters, spouses, and loved ones could be prevented in one year alone. Using National Safety Council (NSC) estimates, these preventable tragedies translate to an economic cost of over \$2 billion in 2018.[16] The non-economic costs are immeasurable.



[5] Fryar, Cheryl D., Deanna Kruszon-Moran, Qiuping Gu, and Cynthia L. Ogden. "Mean body weight, height, waist circumference, and body mass index among adults: United States, 1999–2000 through 2015–2016." National Health Statistics Reports; no 122. Hyattsville, MD: National Center for Health Statistics, 2018. <https://www.cdc.gov/nchs/data/nhsr/nhsr122-508.pdf>. [6] "Cost of auto crashes & statistics." Rocky Mountain Insurance Information Association (RMIIA), 2015. www.rmiiia.org/auto/traffic_safety/Cost_of_crashes.asp. [7] "Inclusive crash test dummies: Rethinking standards and reference models." Gendered Innovations in Science, Health & Medicine, and Environment, Stanford University. <http://genderedinnovations.stanford.edu/case-studies/crash.html#tabs-2>. [8] Kahane, Charles J. "Injury vulnerability and effectiveness of occupant protection technologies for older occupants and women." Report No. DOT HS 811 766. Washington, DC: National Highway Traffic Safety Administration, 2013. <https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/811766>. [12] National Highway Transportation Safety Administration. "Crash Report Sampling System (CRSS)." Accessed March 2020. <https://www.nhtsa.gov/crash-data-systems/crash-report-sampling-system>. [13] Forman, Jason, Gerald S. Poplin, C. Greg Shaw, Timothy L. McMurry, Kristin Schmidt, Joseph Ash, and Cecilia Sunnevang. "Automobile injury trends in the contemporary fleet: Belted occupants in frontal collisions." Traffic Injury Prevention, 20:6, 607-612. 2019. <https://www.tandfonline.com/doi/pdf/10.1080/15389588.2019.1630825?needAccess=true> [14] Id. NHTSA CRSS. [15] Kahane, C. J. "Injury vulnerability and effectiveness of occupant protection technologies for older occupants and women." (Report No. DOT HS 811 766). Washington, DC: National Highway Traffic Safety Administration, May 2013. [16] National Highway Transportation Safety Administration. "Fatality Analysis Reporting System (FARS)." Accessed March 2020. <https://www-fars.nhtsa.dot.gov/Main/index.aspx>.



Estimated increase of risk for moderate injuries in a car crash compared to a male driver or right front passenger of the same age:



Source: NHTSA Injury Vulnerability and Effectiveness of Occupant Protection Technologies for Older Occupants and Women

WHAT IS THE THOR-5F?

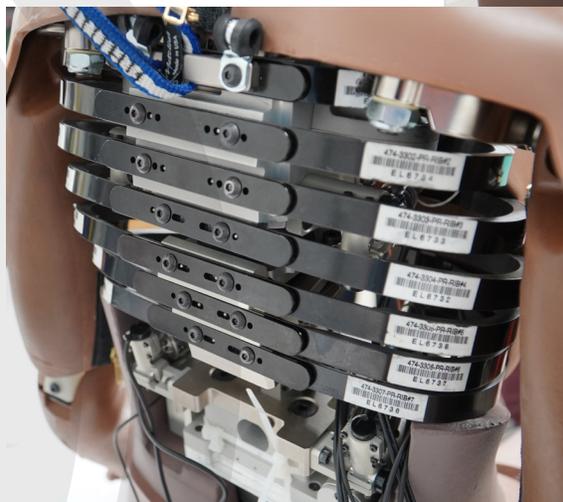
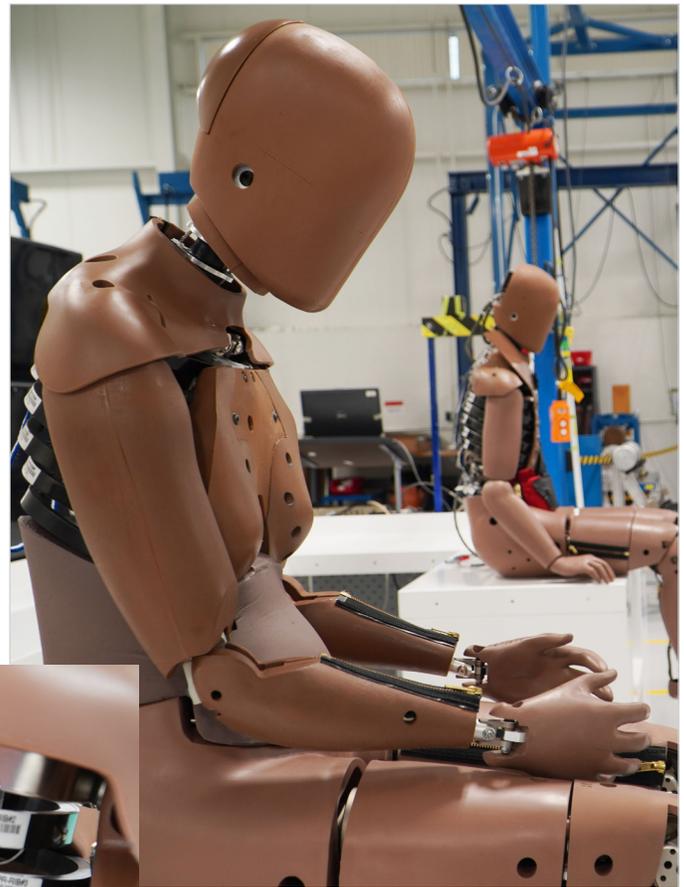
THOR (Test device for Human Occupant Restraint) is an advanced dummy representing significant improvements over the Hybrid III dummy which is still widely used in test labs today. Building on the same technology as the THOR-50M male, the THOR-5F represents a 5th percentile female automotive occupant. The THOR-5F has more human-like biofidelity and a greater range of sensors for advanced injury detection.

Whereas the THOR-50M covers the male occupant, with its size, weight and physiology representing a 50th percentile man, the THOR-5F is addressing safety concerns for smaller sized females in crashes.

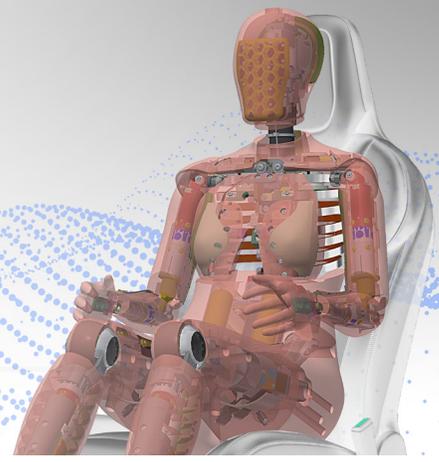
The THOR-5F is the most sophisticated female ATD with a stature of 59 inches (1.51 m) and a weight of 108 lbs. (47.5 kg). She covers the spectrum of smaller and lighter vehicle occupants and corresponds with the fifth percentile of the female population. This means that only 5 percent of the female population are smaller and lighter than this dummy.

Leading OEMs are analyzing real world evidence and designing vehicles that consider safety and design needs equivalently for both males and females.

Implementing the THOR-5F enhances female safety design by increasing biofidelity and dynamic response in assessments. It also addresses potential updates in regulatory requirements for female testing.



THE FUTURE OF THOR-5F



REGULATORY AND NCAP

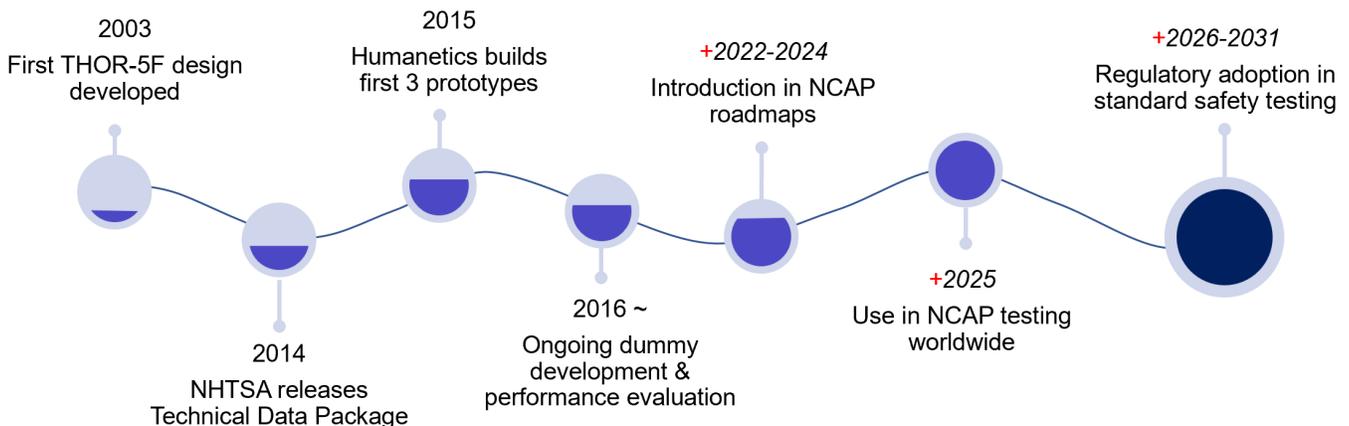
The Hybrid III dummy family has been the standard workhorse tool for decades in the U.S. crash testing evaluations as well as every other legislative and NCAP protocol around the world. The Hybrid III 50th was federalized into Part 572 in 1985 followed by the 5th female a decade later, and then of course the Hybrid III children. These newer Hybrid IIIs updated the Hybrid II family, which had been in use since before the advent of the first airbag system in automobiles.

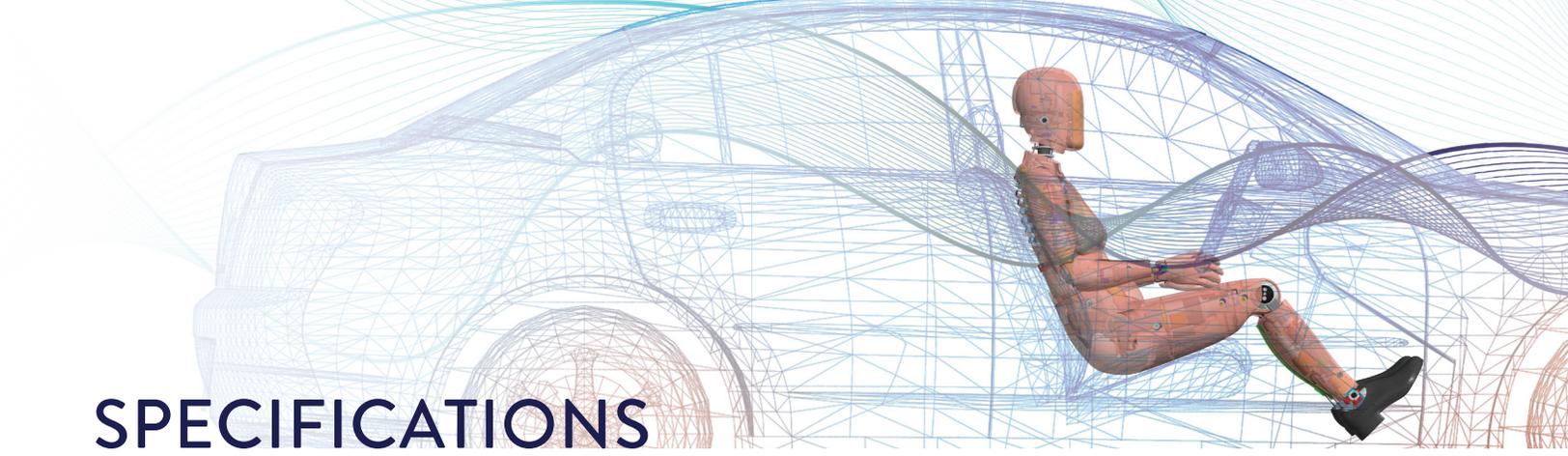
We know in the ATD development business, it can take a decade or more to produce a new dummy that is fit to be the next-level testing tool. They require years of prototyping and analysis to work out the kinks and make it more biofidelic to even be considered as a replacement for a tried-and-true test dummy, like the Hybrid III that's been in service for 30 years.

In the U.S., NHTSA must define the ATDs and tools used for their testing by incorporating them into CFR 49, Part 572, the place where our test dummies live. Part 572 applies strict parameters on how they are built and how they must perform in certification tests before being installed into cars for impact testing. Once a test dummy has permanent residence in Part 572, they can then be used in the appropriate U.S. federal test protocols like FMVSS 208 (Frontal Impacts) and FMVSS 214 (Side Impacts).

In Euro NCAP, the THOR-50M was adopted for use in the frontal Mobile Progressive Deformable Barrier (MPDB) test in 2020 and is expected to take similar measures with the THOR-5F in the near future. The U.S. NHTSA has communicated their intent to make both the THOR-50M and 5F a part of their NCAP updates and to define the dummies in Part 572 to begin the transition in federal test protocols. With these new, well-defined ATDs, the industry will have superior tools to develop safer vehicles.

The THOR dummies are important tools for improving occupant safety, both in the U.S. and globally. The THOR series represents the future of crash-technology - the most sophisticated ATDs for assessing whole-body trauma in a variety of occupant restraint environments.





SPECIFICATIONS

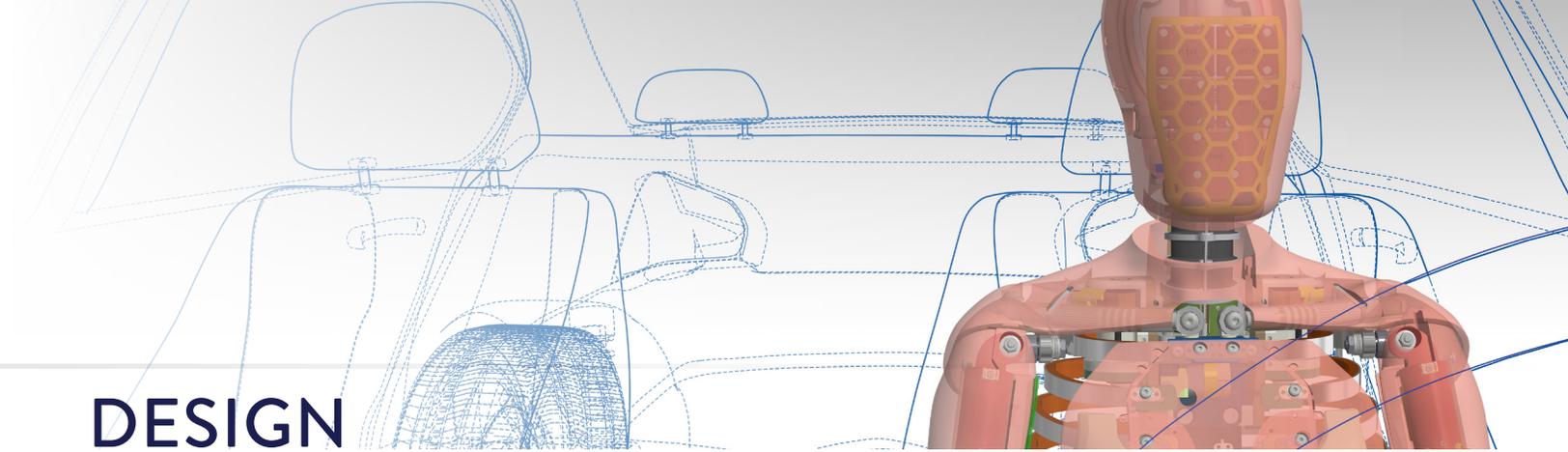
The overall design specifications of the THOR-5F were guided by the University of Michigan Transportation Research Institute's (UMTRI) Anthropometry of Motor Vehicle Occupants (AMVO) fifth percentile female data, weighing in at 108 lbs. (47.5 kg) and with a stature of 59 inches (1.51 m). The THOR-50M dummy was used as a basis for the mechanical and technological blueprint with the skeleton and flesh geometry redesigned to match the UMTRI AMVO 5F landmarks and surface geometry.

The first THOR-5F prototype was built in the early 2000's. Humanetics started its own THOR-5F development in the fall of 2014, and presented in 2015. NHTSA awarded Humanetics a contract to develop a THOR-5F in September 2015. Final design decisions were made collectively through discussions between NHTSA and Humanetics.

PRODUCT SPECIFICATIONS

| | | |
|--------------------|---------------------------|-----------------------|
| Overall Dimensions | 1042.4 x 428.4 x 951.1 mm | 41.0 x 16.9 x 37.4 in |
| Total Weight | 47.5 kg | 104.3 lb |
| Seated Height | 788.1 mm | 31 in |





DESIGN

Implementing the THOR-5F enhances female safety design by increasing biofidelity and dynamic response in assessments. It also addresses potential updates in regulatory requirements for female testing.

- Reduced complexity of the shoulder assembly while retaining its functionality
- Redesigned arms to better coincide with the UMTRI AMVO 5F data
- The breast and sternum integrated together to deliver more accurate and consistent chest positioning within the dummy assembly
- Range of Motion (ROM) limiters are incorporated for the lower spine adjustable joint to prevent the upper torso from tipping over during dummy handling
- In place of IR-TRACCs, Abdomen Pressure Twin Sensors (APTS) are utilized in the upper and lower abdomen as an alternative way to predict abdomen injury and submarining
- Significant changes were made to the lower leg and ankle to comply with the UMTRI AMVO 5F data - a newly shaped foot is utilized to better represent the metatarsal bones
- Restructured leg design allows for standalone testing capabilities of the Achilles assembly
- Torque cylinder rubber elements (“ROSTA”) eliminated to reduce the overall ankle package size
- Redesigned ankle bumpers to allow even compression and eliminate the high local strain
- The THOR-5F has on-board DAS-ready (Data Acquisition System) versions with a 150-channel capability

ENHANCEMENTS

The THOR-5F was designed to realistically represent the female anatomy. The composition of this ATD has some significant differences and improvements in biofidelity compared to the Hybrid-III 5F.

Abdomen

Abdominal Pressure Twin Sensors (APTS), have been incorporated within a molded polymer abdomen flesh representation.

Head, Neck and Shoulder

Adjusted for manufacturing and usability reasons, as well as redesigned shoulder structure to meet anthropometry specifications while retaining the appropriate joint configuration and range of motion.

Lower Thoracic Spine

A range-of-motion (ROM) limiter for the pitch adjustment joint prevents the dummy from falling over in operation.

Thorax

Breast and sternum are integrated together for a better representation of the female anatomy.

Arms

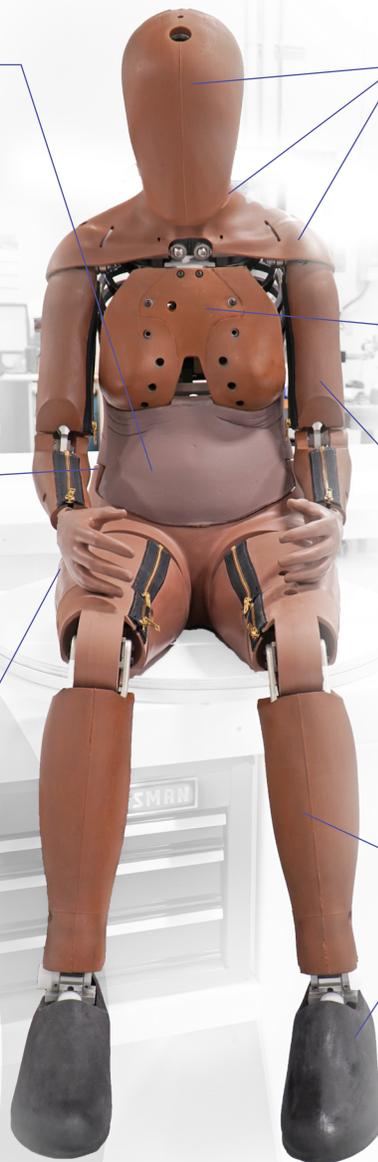
Redesigned, and instrumentation has been added on the elbow joint and flesh to comply with UMTRI AMVO 5F.

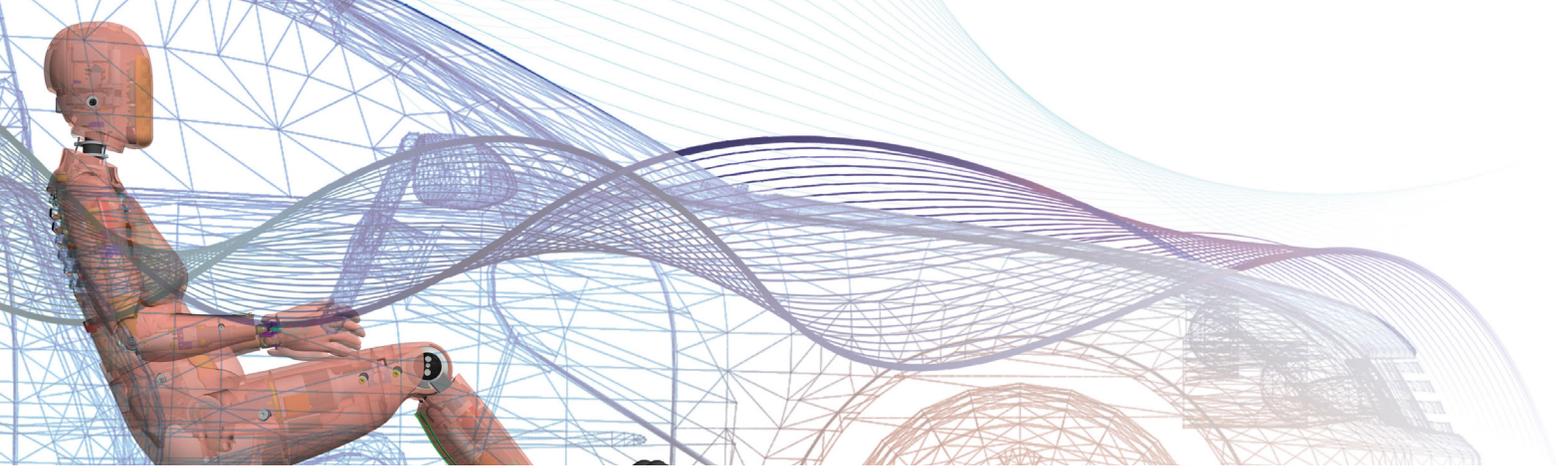
Pelvic bone

Designed in accordance with the statistical representation of a 5th percentile female pelvis, resulting in more accurate anthropometry compared to the Hybrid III 5th pelvis.

Legs and Feet

Anthropometry and handling have been improved. Also, integrating a molded shoe into the foot design, the mechanical response variance of purchased shoes has been minimized.





SIGNIFICANT LEG UPDATES VS. HYBRID III

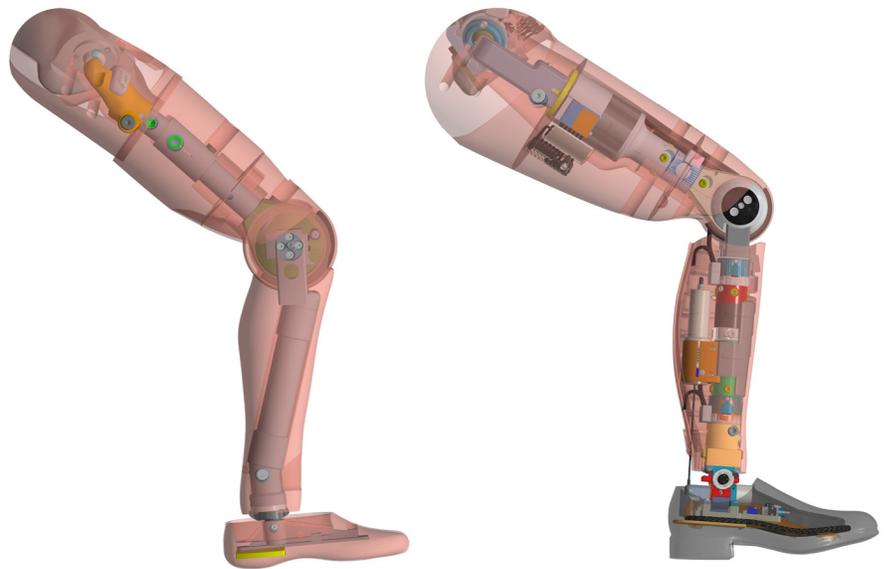
Lower extremities of female drivers are one of the most susceptible parts of the body to injury. Researchers point out that women are more than 2½ times as likely to suffer moderate leg injuries and about 70% more likely than men to suffer serious leg injuries.[1] University of Virginia data has also highlighted the difference in front-end car accident risk of injury between men and women is greatest for injury to the lower extremities (knee-thigh-hip region and the ankle).[2]

The THOR-5F is particularly suited to evaluate the probability of lower extremity injury with a design revised to improve its anthropometry and instrumentation capability.

The THOR-5F leg is packaged to fit the UMTRI AMVO 5th percentile anthropometry. The skeletal features and flesh geometry are designed to match the UMTRI AMVO 5F landmarks and surface geometry.

The foot bone is shaped to better represent the human metatarsal. The leg instrumentation consists of femur load cell, upper tibia load cell, lower tibia load cell, Achilles' load cell, knee string potentiometer, three ankle rotary potentiometer, tibia accelerometer, foot accelerometers, ARS, and tilt sensor.

The THOR-5F femur has been designed with an axially compliant bushing which has been tuned to create a biofidelic response along the axis of the femur during a knee impact. The compliant section is constrained on a square shaft that slides linearly within a bushing.



Hybrid III

THOR-5F

[1] IIHS, Vehicle choice, crash differences help explain greater injury risks for women [2] UVA CAB 2019 study on female occupants referenced in an October 23, 2019 Consumer Reports article.

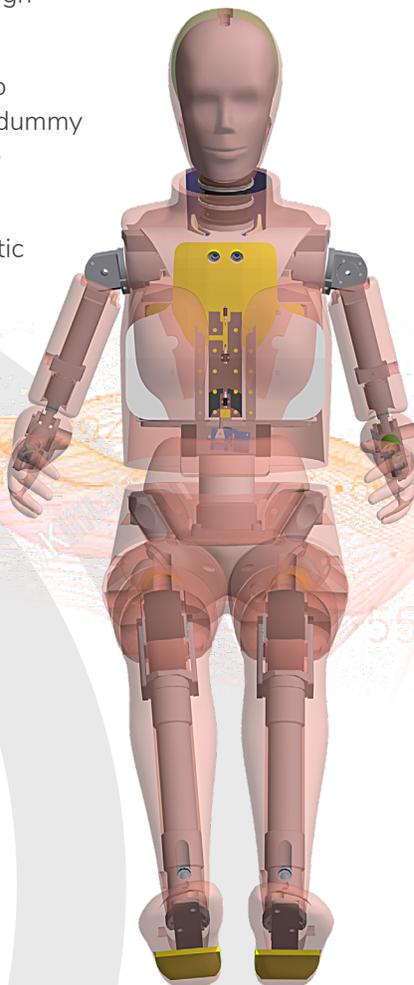
VERSIONS

FEMALE ATDS

The THOR 5th, unlike her predecessor the Hybrid III 5th, is not a strict adaptation of the male device. She has been designed specifically to address women's unique physiology. Her 150 data channels are designed to help address those parts of the body where women have increased vulnerability to injury.

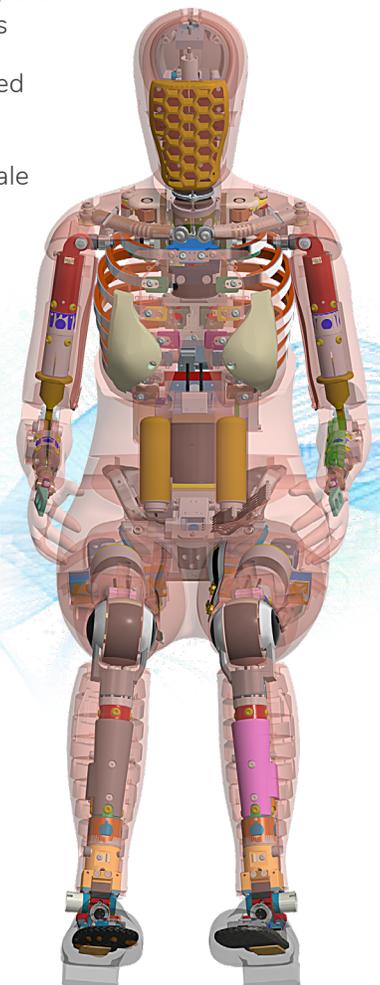
Hybrid III 5th Female

- Hybrid III 50th Male design (scaled down)
- Straight lumbar spine, no driver's slouch position, dummy represents erect posture behind the wheel
- Lumbar spine cable plastic bushings prevent metal-to-metal contact
- Ankle bumpers and improvements to minimize mechanical noise



THOR-5F Female

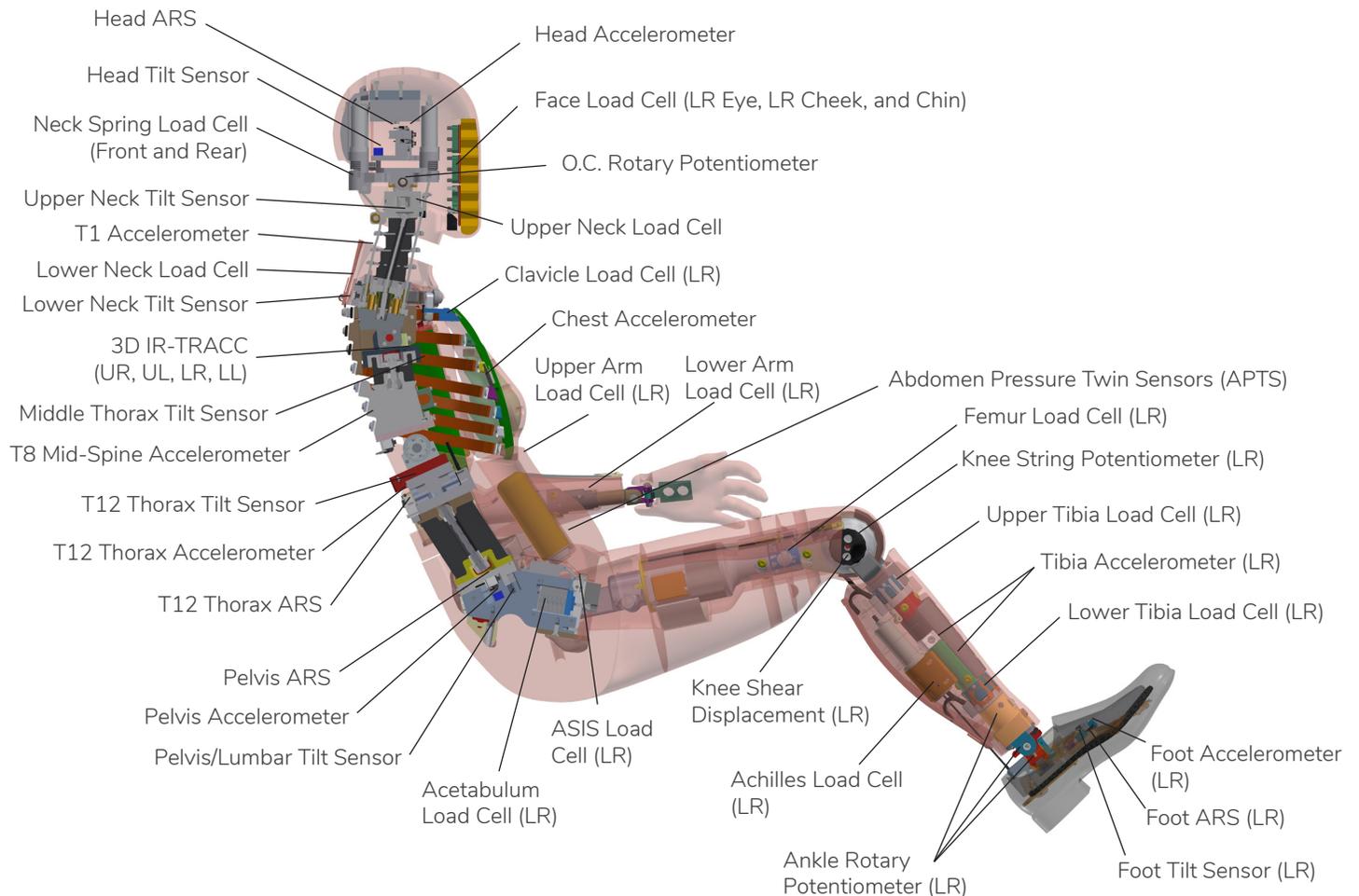
- Neck: Manufacturing and usability adjustments
- Thorax: Breasts added
- Pelvic bone: Made to comply with 3D female pelvic bone
- Abdomen: APTS sensors replace IR-TRACCs; molded abdomen replaces canvas
- Arms: Instrumented elbow joint and flesh comply with UMTRI AMVO 5F
- Grounding: Ground cables connect dummy segments



DATA COLLECTION

SENSORS

We develop special sensors to measure the forces that break bones and cause injuries. These readings are controlled and repeatable, providing vehicle designers with reliable data to enhance and refine product safety. Thanks to our advanced engineering and meticulous manufacturing, Humanetics dummies are highly sophisticated platforms that deliver trusted sensory intelligence.



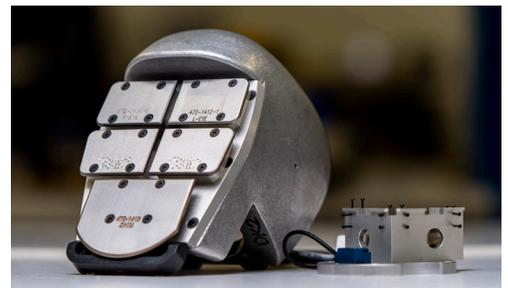
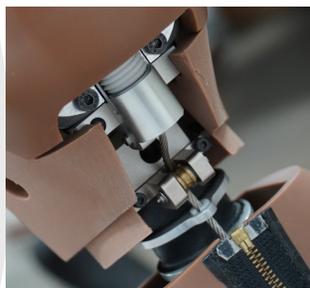
DATA COLLECTION

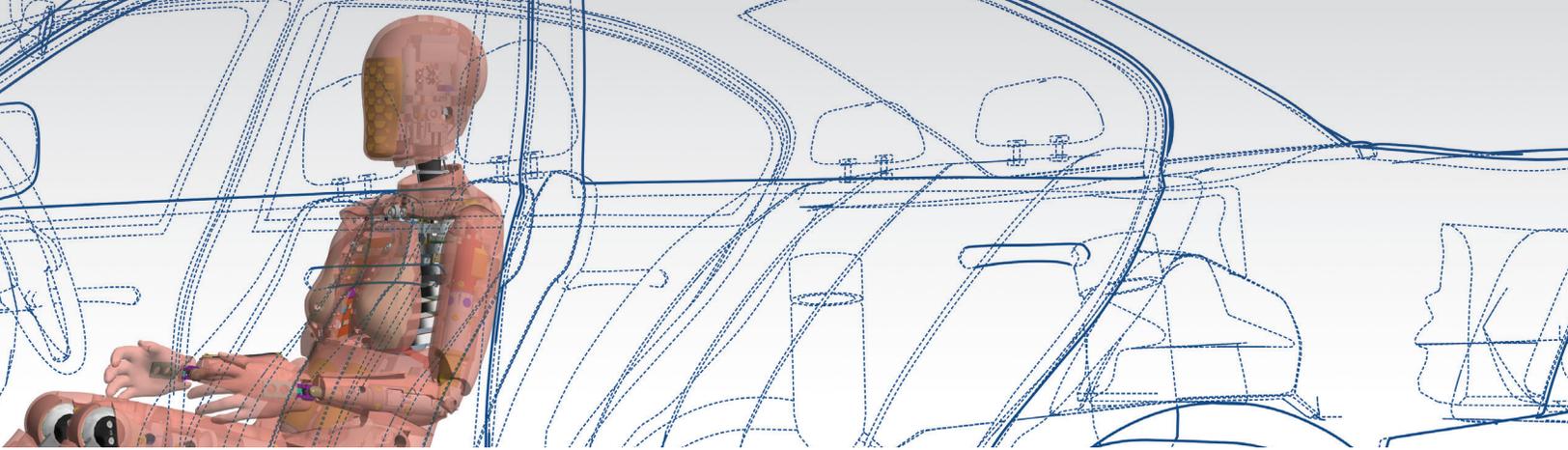
LOAD CELL MATRIX

Humanetics is the industry leader in the design and manufacturing of ATD load cells. We developed the first load cells for the Hybrid-III 50th in 1974 and now offer over 1,000 load cells for all ATDs on the market.

The THOR 5F, can accommodate a full range of regional load cells.

| MODEL NUMBER | DESCRIPTION | AXIS | CHANNELS |
|--------------|-------------------------------|-------------------|----------|
| 10382J | FACIAL-J-211 | FX | 1 |
| IH-11450J | LOWER NECK J-211 | FX FY FZ MX MY MZ | 6 |
| IH-11610J | UPPER NECK J-211 | FX FY FZ MX MY MZ | 6 |
| IH-11460J | THORACIC SPINE J-211 | FX FY FZ MX MY MZ | 6 |
| IH-11660J | CLAVICLE J-211 (Left Side) | (2X) FX & (2X) FZ | 4 |
| IH-11670J | CLAVICLE J-211 (Right Side) | (2X) FX & (2X) FZ | 4 |
| IH-12500J | UPPER ARM J-211 | FX FY FZ MX MY MZ | 6 |
| IH-11560J | LOWER ARM J-211 (Right Side) | FX FY FZ MX MY MZ | 6 |
| IH-11550J | LOWER ARM J-211 (Left Side) | FX FY FZ MX MY MZ | 6 |
| IH-11490J | ASIS J-211 (Left Side) | FX MY | 2 |
| IH-11500J | ASIS J-211 (Right Side) | FX MY | 2 |
| IH-11470J | ACETABULUM J-211 (Left Side) | FX FY FZ | 3 |
| IH-11480J | ACETABULUM J-211 (Right Side) | FX FY FZ | 3 |
| IH-11510J | FEMUR J-211 | FX FY FZ MX MY MZ | 6 |
| IH-11800J | UPPER TIBIA J-211 | FX FY FZ MX MY | 5 |
| IH-11820J | UPPER TIBIA J-211 | FX FY FZ MX MY | 5 |
| 10389J | ACHILLES J-211 | FZ | 1 |





CHANNEL CONFIGURATIONS

The THOR-5F has a standard 150 channel package to optimize the data collection requirements of next generation analysis.

| MODEL NUMBER | INSTRUMENT DESCRIPTION | CHANNELS |
|----------------------|--|----------|
| X17-123-05-150-5V | ACCEL,UNIAXIAL,7264C-2K, T&Z - HEAD X, TIBIA L&R | 5 |
| X17-123-05-70-5V | ACCEL,UNIAXIAL,7264C-2K, T&Z - HEAD Y & Z | 2 |
| X17-123-05-250-5V | ACCEL,UNIAXIAL,7264C-2K, T&Z - T12 | 3 |
| X17-123-05-300-5V | ACCEL,UNIAXIAL,7264C-2K, T&Z - T1, FEET | 9 |
| X17-123-05-350-5V | ACCEL,UNIAXIAL,7264C-2K, T&Z - MID STERNUM | 1 |
| IT-8630 | 6DX A2, 500G (5kHz), 18K DEG/S (2kHz) | 18 |
| IH-11621-R4-240-X17 | IR-TRACC, 3D, UL | 3 |
| IH-11622-R4-240-X17 | IR-TRACC, 3D, UR | 3 |
| IH-11609-R4-170-X17 | IR-TRACC, 3D, LL | 3 |
| IH-11608-R4-170-X17 | IR-TRACC, 3D, LR | 3 |
| 61-803-05-150 | APTS SENSOR - 40MM DIA. X 125.25 LG | 2 |
| X17-514-05-5V-310 | KNEE STRING POT, UNIVERSAL | 2 |
| 9945-5VFL-170-X17-05 | POT ASSY, CALIBRATED, NECK | 1 |
| 9945-5VFL-180-X17-05 | POT ASSY, CALIBRATED - ANKLE Z, L&R | 2 |
| 9945-5VFL-220-X17-05 | POT ASSY, CALIBRATED - ANKLE Y, L&R | 2 |
| 9945-5VFL-270-X17-05 | POT ASSY, CALIBRATED - ANKLE X, L&R | 2 |
| IH-11490JD6I4-130 | LC, 2X A.S.I.S, LEFT | 2 |
| IH-11500JD6I4-130 | LC, 2X A.S.I.S, RIGHT | 2 |
| IH-11460JD6I4-130 | LC, 6X THORACIC SPINE | 6 |
| IH-11660JD6I4-250 | LC, 4X CLAVICLE LEFT | 4 |
| IH-11670JD6I4-250 | LC, 4X CLAVICLE RIGHT | 4 |
| 10382JD6I4FL-200 | LC 1X FACE THOR | 5 |
| 10386JD6I4-150 | LC, 1X SKULL SPRING, REAR | 1 |
| 10386JD6I4-250 | LC, 1X SKULL SPRING, FRONT | 1 |
| IH-11610JD6I4-240 | LC, 6X NECK, UPPER | 6 |
| IH-11450JD6I4-360 | LC, 6X NECK, LOWER | 6 |
| IH-12500JD6I4-50 | LC, 6X UPPER ARM | 12 |
| IH-11470JD6I4-100 | LC, 3X ACETABULUM, LEFT | 3 |
| IH-11480JD6I4-150 | LC, 3X ACETABULUM, RIGHT | 3 |
| IH-11510JD6I4-230 | LC, 6X FEMUR | 12 |
| 10389JD6I4FL-225 | LC, 1X ACHILLES, THOR ATD, METRIC | 2 |
| IH-12460JD6I4-320 | LC, 5X UPPER TIBIA, RIGHT | 5 |
| IH-12450JD6I4-320 | LC, 5X UPPER TIBIA, LEFT | 5 |
| IH-11820JD6I4-520 | LC, 5X LOWER TIBIA | 10 |

TOTAL **150**

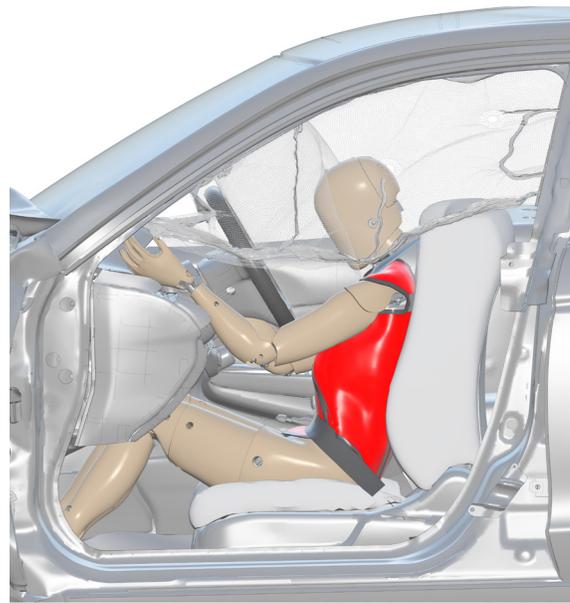
CAE & FEM MODELS

THE CRASH TEST DUMMY'S DIGITAL TWIN

Finite Element Analysis (FEA) has transformed the automotive safety industry. Virtual crash dummies can be transferred into a virtual vehicle environment, thereby opening up the possibility to carry out unlimited simulations of real-world crash scenarios. This allows automotive manufacturers to optimize their vehicle structure and restraint system to deliver safer vehicles for occupants.

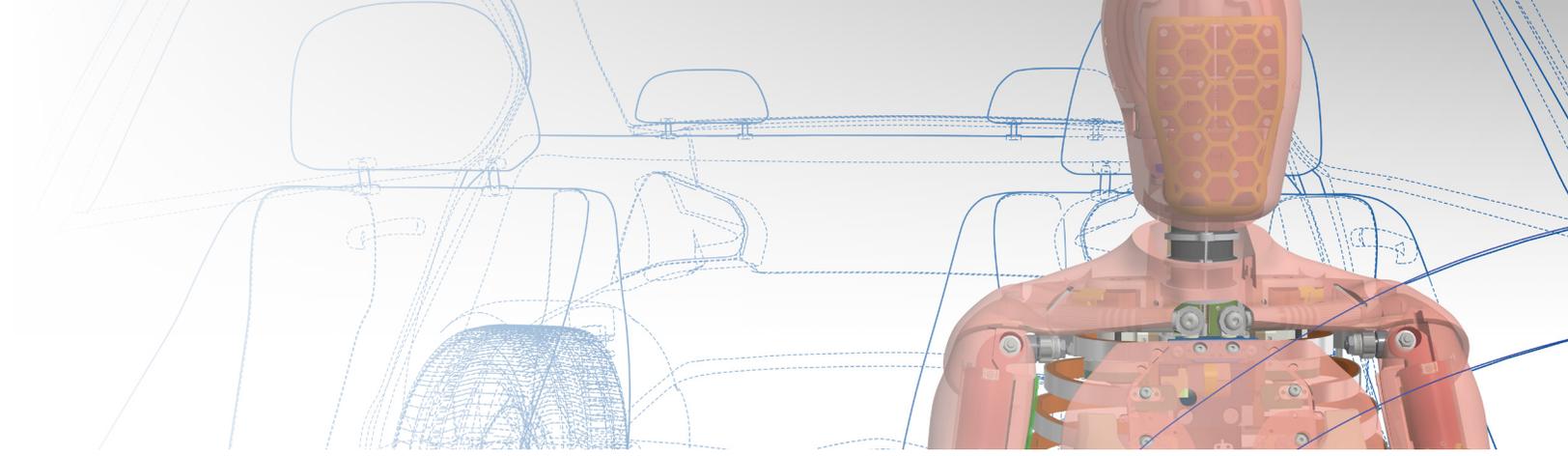
The crash test dummy has a long history of helping scientists and engineers understand the myriad ways collisions impact vehicle occupants. Today, as engineering and design functions are increasingly relying on digitization to move fast, boost efficiency, and lower costs, the complexities of replicating real-world crashes in the lab or on the track need an integrated approach that takes into consideration all the variables at play in a collision.

Today's Finite Element (FE) models – which are exact digital replicas of Anthropomorphic Test Devices (ATD) – precisely correlate to each material used in the ATDs. Since they offer a very reliable prediction comparison to the hardware models, they're highly useful in enabling engineers to understand how their designs will perform in regulated tests, accelerating both the vehicle design process and reducing cost of development. Additionally, they are valuable in standardizing injury outcome and determining injury criteria.



The primary focus of virtual models is to evaluate various scenarios in real-world crashes which otherwise would be very challenging with hardware testing alone. FE models that represent crash-test dummies are vastly more robust and trustworthy than they were only a few short years ago, while simulation and adaptive systems offer speed and cost-efficiencies well beyond that of physical-only development.



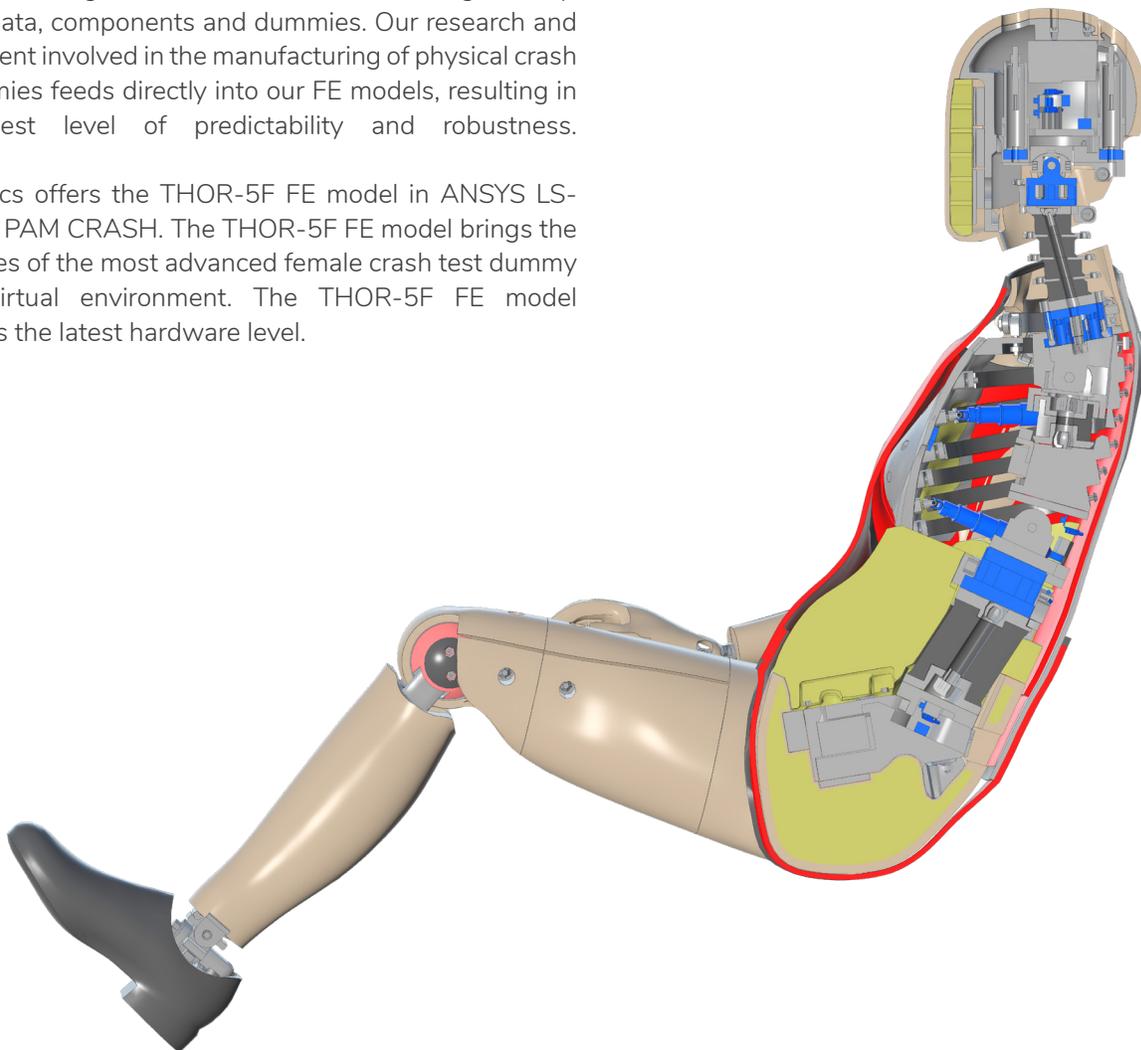


Using computer-aided design (CAD) and FEA, our developers have created a portfolio of products and platforms to enable engineers to run unlimited iterations of real-world crash tests in virtual simulations

Humanetics is the only company in the world that provides a diverse portfolio of both physical crash dummies as well as their virtual counterpart. Through our physical dummy design and testing, we have direct access to CAD geometry, material data, components and dummies. Our research and development involved in the manufacturing of physical crash test dummies feeds directly into our FE models, resulting in the highest level of predictability and robustness.

Humanetics offers the THOR-5F FE model in ANSYS LS-Dyna and PAM CRASH. The THOR-5F FE model brings the advantages of the most advanced female crash test dummy to the virtual environment. The THOR-5F FE model represents the latest hardware level.

Humanetics also offers surfaced 3D CAD models for use in vehicle packaging studies using major common CAD systems. The models are available in IGES Format for import to CATIA, Pro/Engineer, IDEAS, Unigraphics, PDGS and other IGES compatible systems. The models are derived from the Humanetics family of FE models and 3D dummy design geometry.



ON-BOARD DAS

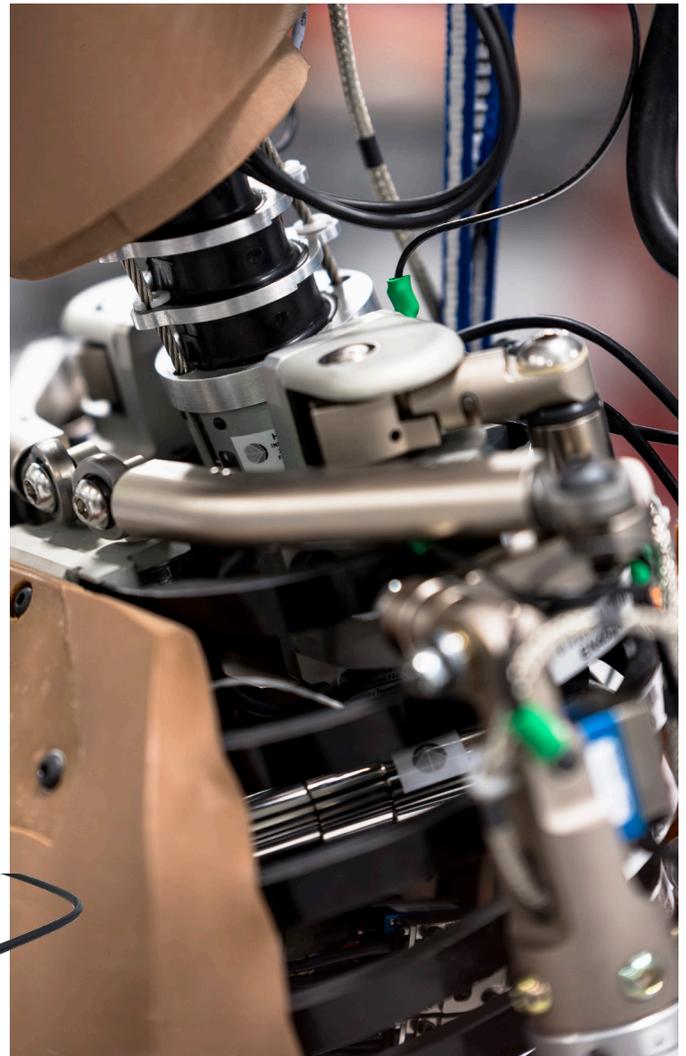
ON-BOARD DATA ACQUISITION SOLUTIONS (DAS)

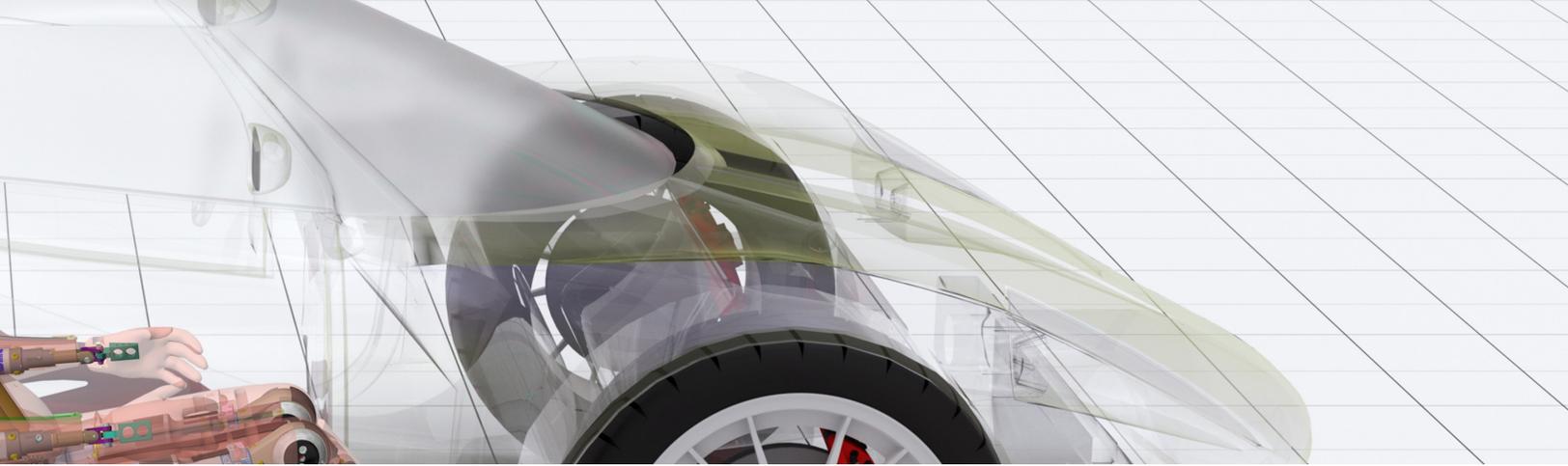
As the world leader in ATD integrations, Humanetics provides the most optimized designs in on-board DAS solutions.

The Humanetics legacy of integrating ATDs with on-board Data Acquisition Systems (DAS) spans over twenty years starting in the mid 1990s with the Intelligent Dummy Data Acquisition System (IDDAS). This first system found itself assimilated into the spine of the Hybrid III 50th ATD with a limited number of channels.

Today, as the world leader in integrations, Humanetics' role in the development of the integrated dummy is well known in the industry and continues to push the boundaries of this technology. A Humanetics iDummy can now exceed 200 channels of available data collection.

The secret to Humanetics' iDummy success has been the ability to integrate all types of dummies using any type of DAS for automotive, military, aircraft, and railroad applications. Being a DAS neutral integrator allows Humanetics to utilize the customer's choice of systems from suppliers like DTS, mg-sensor, Messring, Kyowa, and others. And since the manufacture of dummies and load cells are part of the Humanetics core business, the level of expertise of these integrations provides customers with the assurance that any integrated dummy will seamlessly function and be equal to the non-integrated counterpart in mass, CG, physical measurements, and the range of motion of flexible dummy components'.

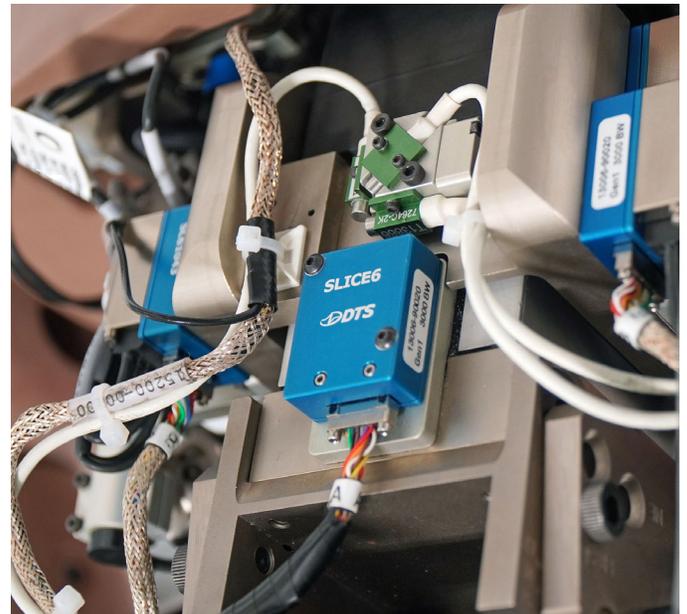
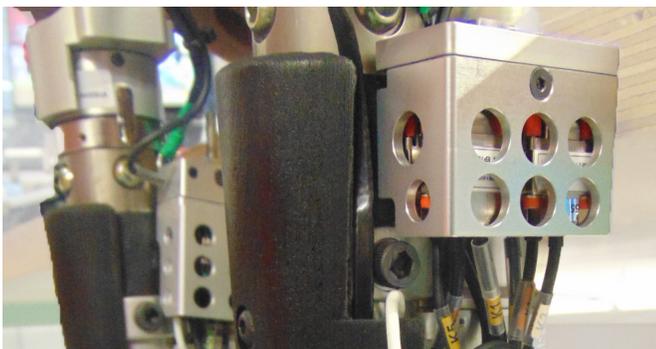




Our integration team surpasses 60+ members incorporating engineers, technicians and expert professionals. This large pool of talent allows Humanetics to implement integration solutions for many other types of instruments including angular rate sensors, accelerometers, potentiometers and pressure sensors into our designs. And once the integration is complete, our worldwide testing facilities are staffed with experienced experts that understand the certifications and calibrations of the ATD.

Humanetics DAS integrated ATDs are guaranteed to meet the same specifications and meet all the CG and mass specs with the same kinematics and dynamics as the non-DAS counterpart.

- Our DAS integrated ATDs have been used by every Government agency in their automotive safety programs.
- We are DAS neutral, which means YOU have the choice of which DAS to use for your integration.
- We work with customers and Task Groups to optimize designs and test all changes during the process.
- We are a global Integration, Service, and Certification provider with an unmatched worldwide network!



With more than 350 integrated dummies and over 30,000 channels worldwide, no one knows the on-board DAS crash test dummy like Humanetics.

DAS INTEGRATION

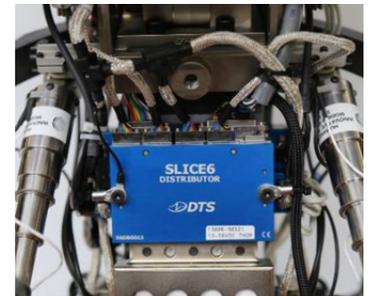
DIVERSIFIED TECHNICAL SYSTEMS OPTIONS

THOR-5F ATDs are produced with integrated DAS available from multiple solutions based on the customer's choice. The DTS SLICE6 is a miniature, rugged Data Acquisition System designed for test applications that require high-speed sampling with precision timing. An IEEE 1588 compliant Ethernet switch allows PTPv2 daisy-chaining of hundreds of channels. SLICE6 was originally designed to be integrated into crash and blast test ATDs.

The DTS SLICE NANO is an ultra-small form factor, stackable up to 24 channels per base and can be daisy-chained up to hundreds of channels per test.

On-board DAS solutions like DTS offer many advantages over traditional umbilical dummies that have the acquisition systems located outside of the ATD.

- Long sensor cable mass and noise that can alter test dynamics can be eliminated
- Improved dummy handling and positioning
- Data reliability can increase with reduced test set-up time.
- NCAP programs worldwide accept and support on-board DAS solutions



SLICE6 & NANO OPTION

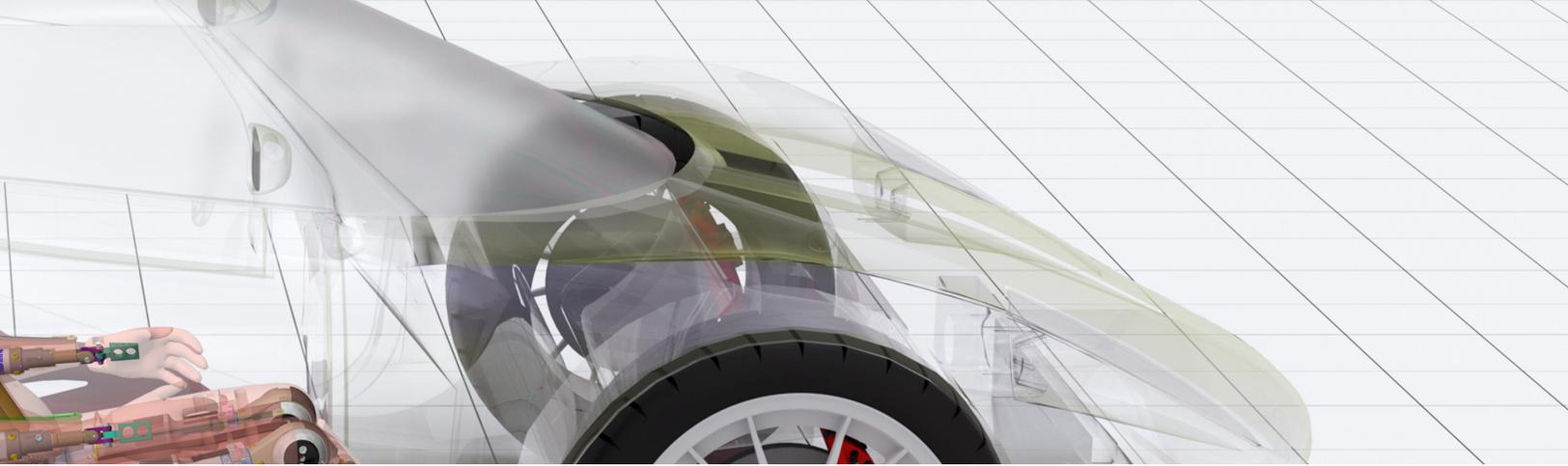
SLICE6 is the newest generation of in-dummy DAS for THOR. The ultra-small DAS reduces in-dummy cabling and connectors by up to 75%.

The SLICE6 and Nano integrations are tested and certified and available in 99, 118, 139, 150 channel configurations. The design and certification is available according to Euro NCAP and NHTSA standards and maintains the standard THOR-5F mechanical properties and Range of Motions.

Possible integration locations in the THOR-5F are:

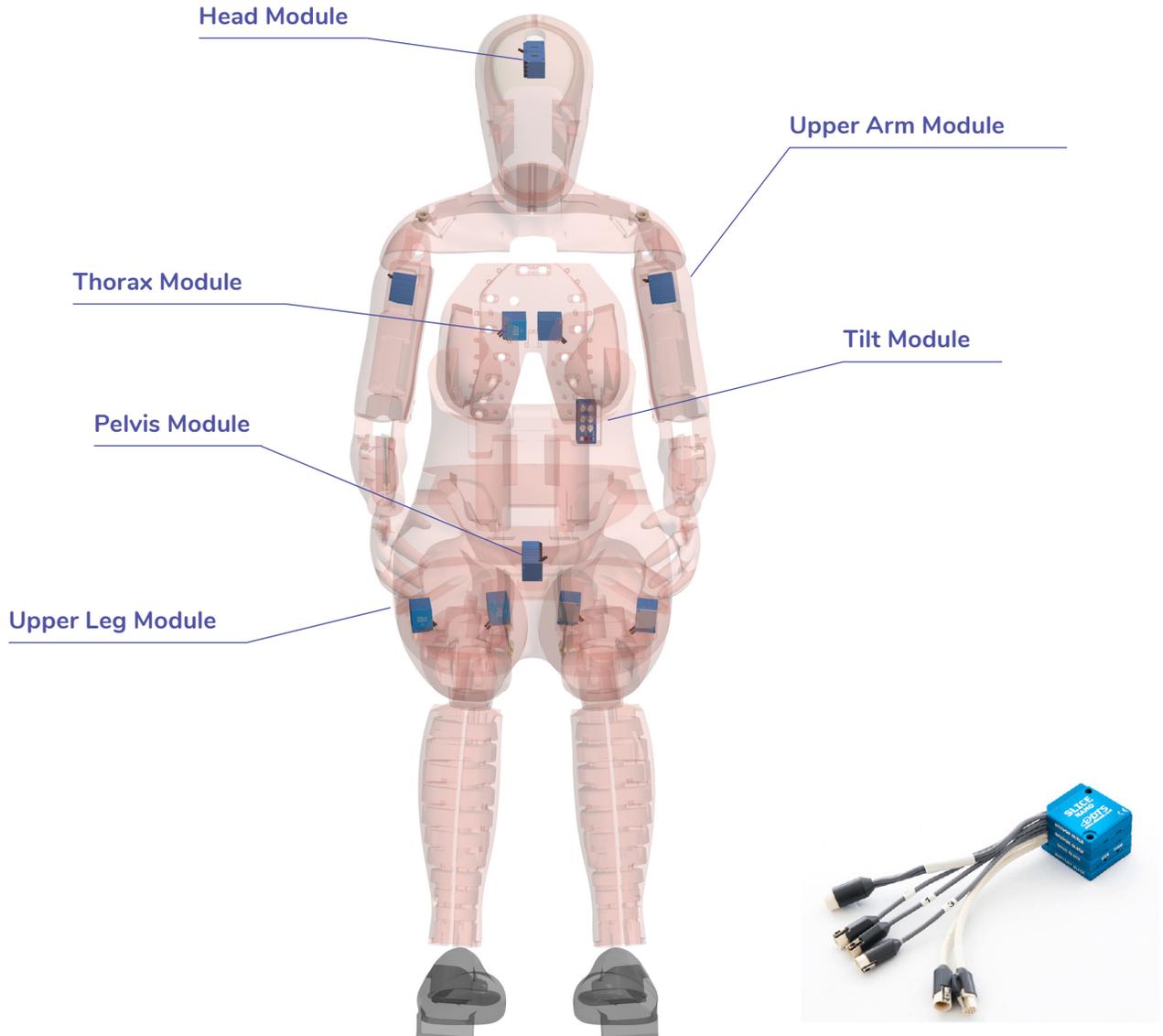
- Head
- Thorax
- Pelvis
- Upper Leg
- Lower Leg

DTS as a DAS solution is accepted by organizations like Euro NCAP and compliant to all common standards like SAE J211 and ISO 6487. These standards specify basic features like filter, frequency response, sampling rates, A/D resolution, CFCs, CAC, accuracy, to ensure repeatable, reliable results.



DTS LOCATIONS

Humanetics uses hubs in DTS integrated dummies for optimal distribution of data signals. A DTS THOR-5F can have multiple hubs built into different parts of the dummy. An overview is shown below.



DAS INTEGRATION

DIGITAL TRANSDUCER INTERFACE OPTION

Another of the integration systems Humanetics offers is Digital Transducer Interface (DTI). The DTI DAS converts an analog sensor output into a digital one, with the advantage of an easy and straightforward wiring as well as easy access to installation positions and calibration results of the sensors.

With a long history of dummy integration, Humanetics has gained extensive experience in mastering challenges with DAS. A DTI integrated dummy by Humanetics has a lot of great advantages such as:

- Compact and small system to fit into all advanced dummies to make the best use of limited space in the dummy.
- After integration the dummy meets all the specifications for CG, mass, and MOI as a whole and for each subcomponent (for example head, torso, legs etc.).
- The cabling concept allows the easy separation of subcomponents (e. g. head from the torso, lower legs from upper legs).
- Cabling harness, hubs and connectors are robust and allow handling in a rough environment.
- Grounding concept eliminates interferences that could have an influence on the signals and the data integrity.
- DAQ-238 from mg-sensor is the only tailor-made DTI recorder available for the THOR-5F

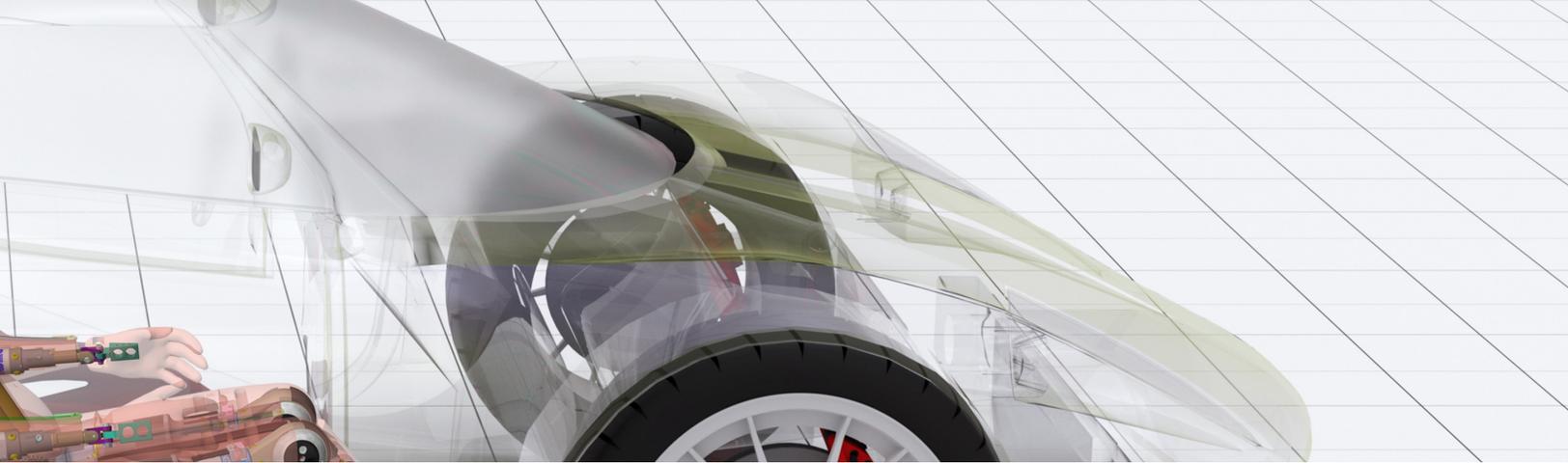


mg-sensor and the DTI solutions are accepted by Euro NCAP and compliant to all common standards like SAE J211 and ISO 6487. These standards specify basic features like filter, frequency response, sampling rates, A/D resolution, CFCs, CAC, accuracy, to ensure repeatable, reliable results.

KYOWA OPTION

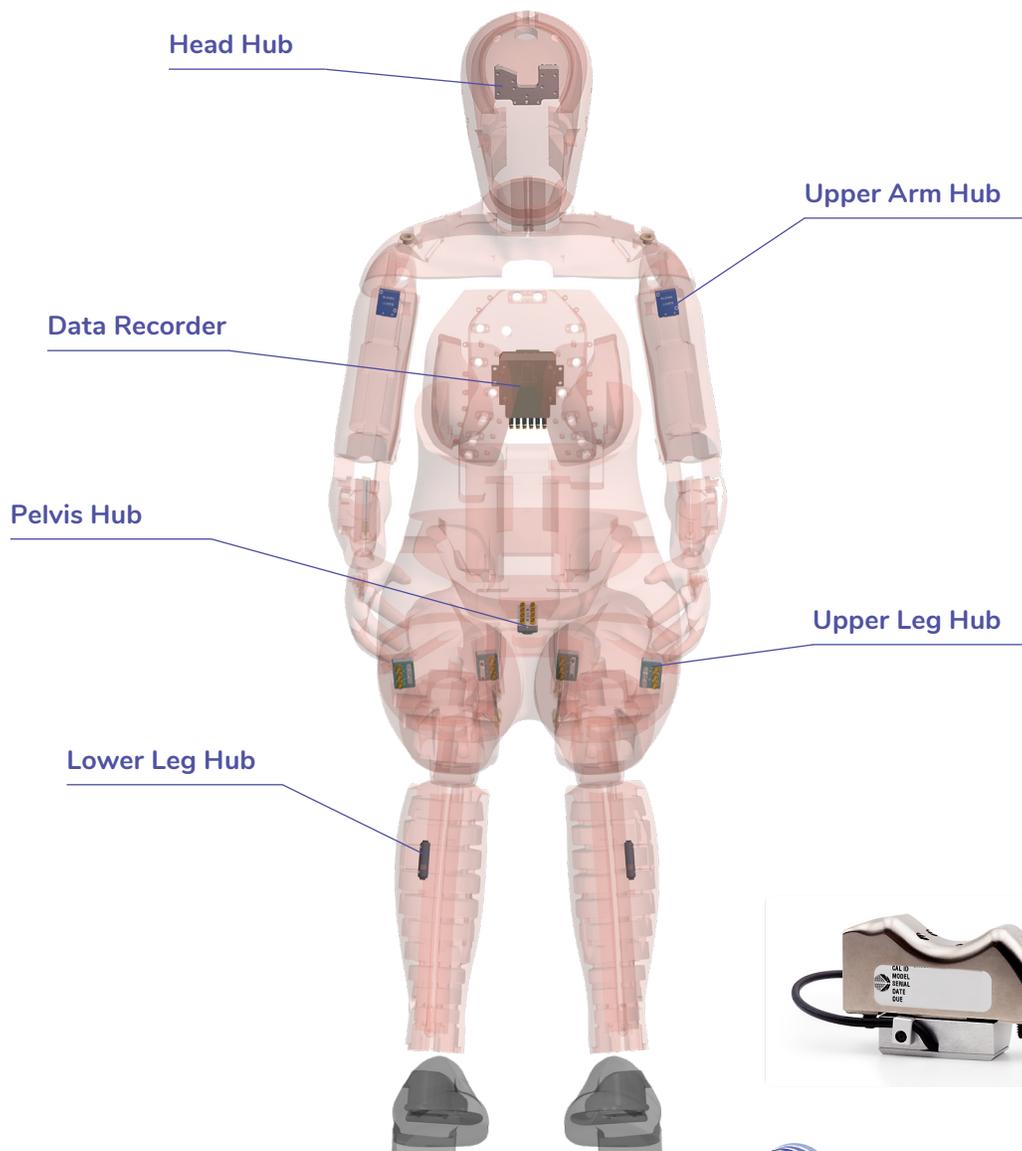
Kyowa Instruments integrated Data Acquisition Systems are another good option in the crash test environment. Humanetics has standard Kyowa integration builds for WorldSID-50M, THOR-50M and soon THOR-5F as well. Kyowa's small sized data loggers have been integrated in numerous crash test dummies, including the Advanced series like THOR and World SID as well as ATD segment testers like headforms and leg impactors.

Kyowa as a DAS solution is accepted by many NCAP organizations and compliant to all common standards like SAE J211 and ISO 6487. These standards specify basic features like filter, frequency response, sampling rates, A/D resolution, CFCs, CAC, accuracy, to ensure repeatable, reliable results.



DTI LOCATIONS

Humanetics uses hubs in DTI integrated dummies for optimal distribution of data signals. A DTI THOR-5F can have multiple hubs built into different parts of the dummy, as shown below.



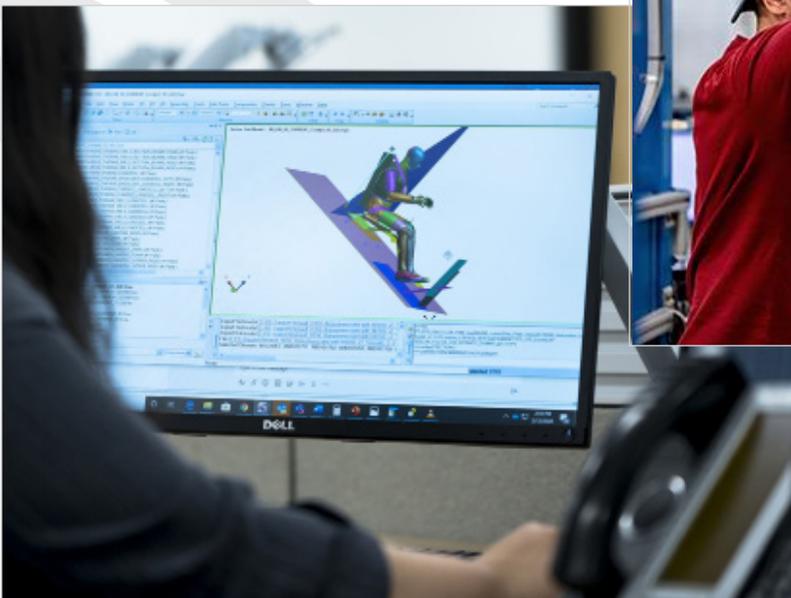


CERTIFICATION & CALIBRATION

Humanetics offers an extensive global service model. We train automaker and test facility engineers in a range of capabilities: calibration of sensors, set-up of complete test facilities, and management of CAE and FE modeling. We also provide fully outsourced on-site dummy management through our own test engineers.

Humanetics offers calibration and certification services for the entire range of THOR-5F dummy components and sensors. ATD certification includes initial overall inspection of the dummy and dynamic testing certified to the latest approved industry standards. Our worldwide presence with laboratories makes sure regional support is always available for your ATD.

Humanetics labs also stock the most commonly replaced certified parts for all dummy types. This allows Humanetics to offer the fastest possible turn-around times to meet your testing schedules.

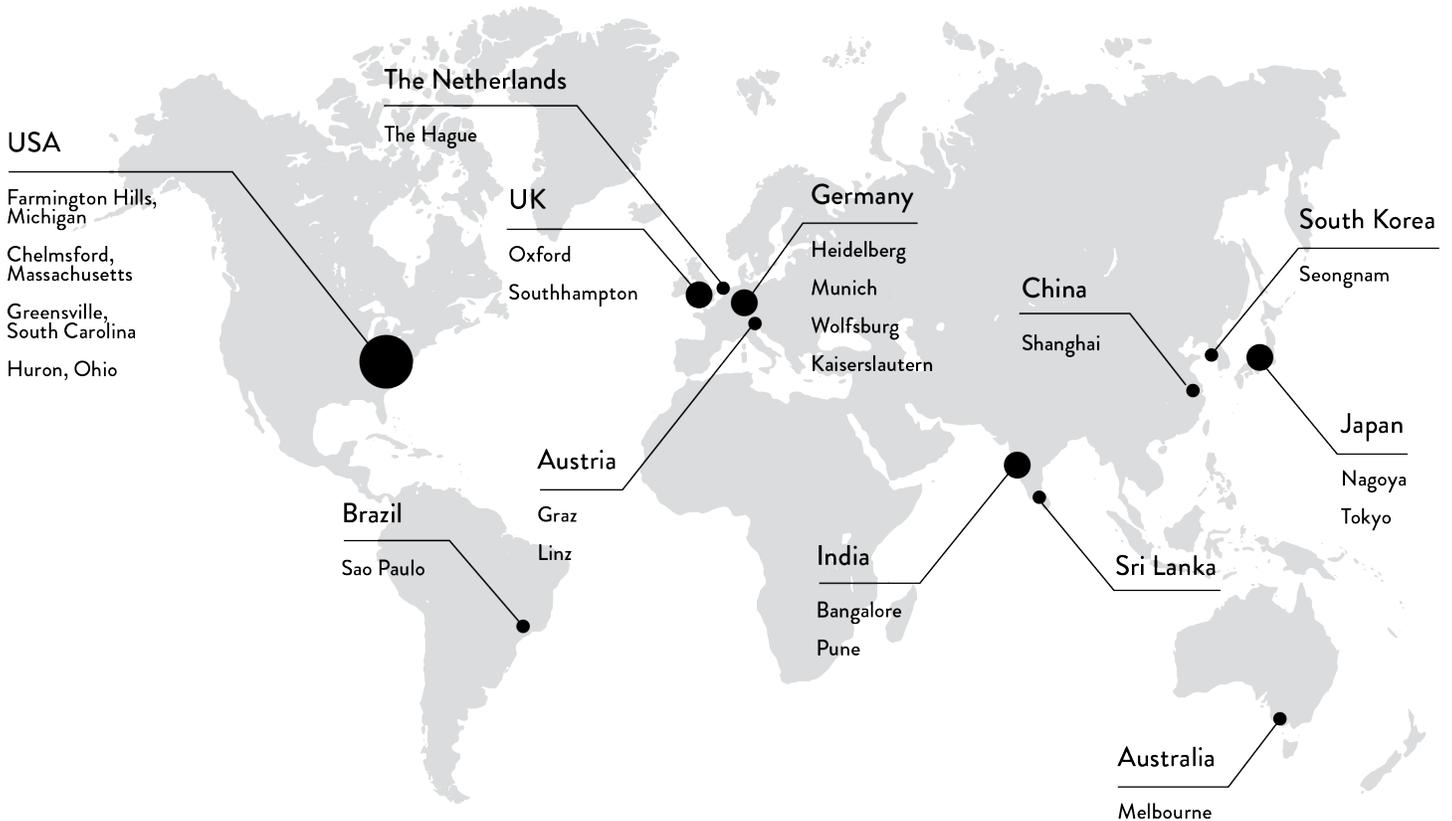


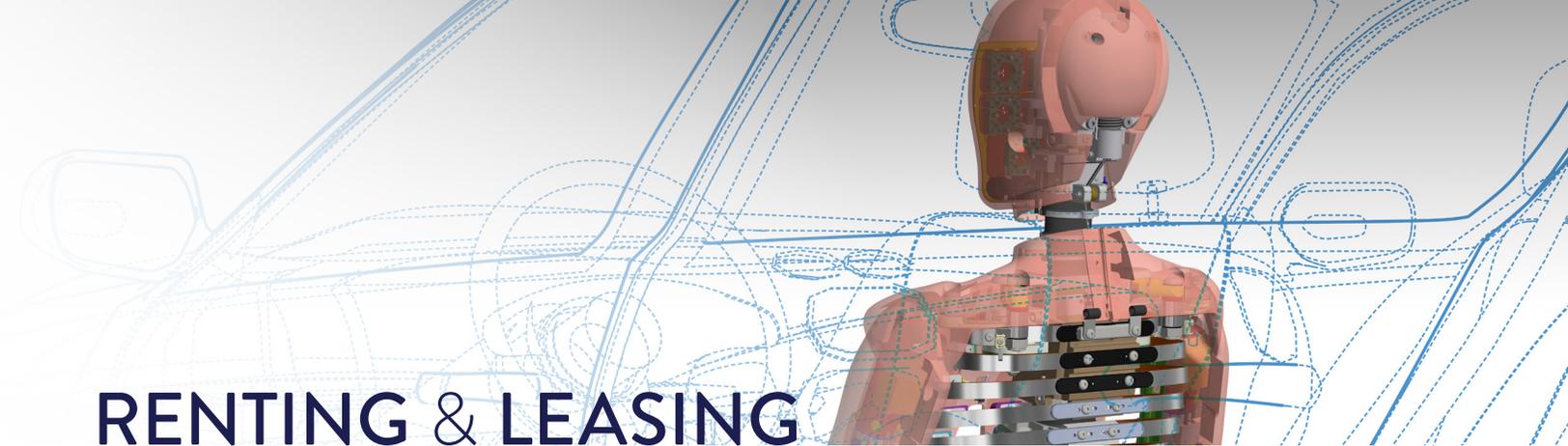
HUMANETICS WORLDWIDE

GLOBAL NETWORK

Humanetics has a strategic presence in major automotive and industrial markets to fully support the advanced THOR ATDs with 24 locations worldwide including 12 sales & customer, design & service centers.

Our management team is some of the world's leading experts on vehicle safety and biomechanical engineering. They have a passion to lead their teams to develop the best devices, service the needs of our incredible customers worldwide to ensure that people are safe every time they get into a car.





RENTING & LEASING

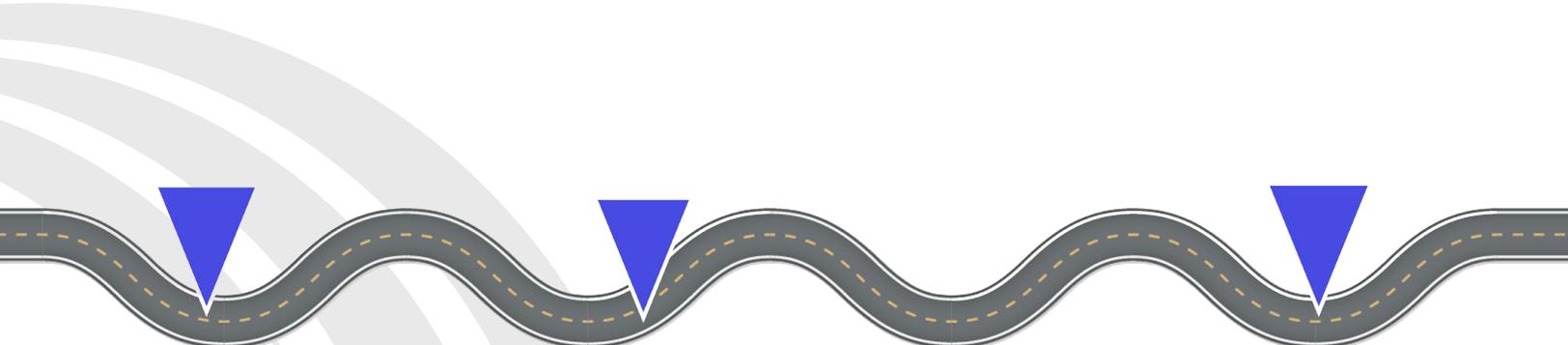
Understanding that the testing needs and schedules of our customers might change at any moment, Humanetics has multiple renting & leasing models to support your testing needs at any time.

Covering **short-term** demand - Testing demands that occur at short notice can be hectic and stressful. By using a rental dummy, Humanetics can supply a THOR-5F to cover short-term demand for testing. Availability and integration of ATDs might vary from region to region.

Covering **mid-term** demand - With a slightly longer planning horizon, leasing an ATD can be a good option to receive greater flexibility in planning for future testing needs. Leasing has a lot of the advantages of renting and owning.

Covering **long-term** demand - In addition to leasing, buying a dummy can be a good option to securely plan for future test demand. With the buying option the THOR-5F can be configured to exactly match your needs. Humanetics has a number of engineers to help you in the process of configuring the ATD to meet your requirements regarding integration, channel numbers etc.

Please reach out to your local sales representative to receive further details.



Short-Term
Demand

Mid-Term
Demand

Long-Term
Demand



SALES, MAINTENANCE & TRAINING

Humanetics provides a full range of services to install, maintain, calibrate, and certify our ATDs. Our aim is to keep your test operations running to the highest certified standards by providing you with our expertise, products, and partnership when you need it.

- A complete plug and play management service to give those clients needing a turnkey solution when building and resourcing new facilities around the world, and others, a scalable set of resources during peak testing.
- Leased ATDs and engineers to install them for specific tests or longer periods of time. We can provide regular maintenance and training for in-house teams, or schedule times to deliver one-off programs tailored to your needs.
- A full training program to develop the next generation of engineers in your labs, or a fully outsourced solution with our engineers embedded within your teams on a short term or long-term basis.

Please reach out to us for further details of how we can help keep your testing program on track.

Scan the QR code below or go to: bit.ly/humaneticsproducts



CONTACT US

With offices across Europe, the U.S. and Asia, we have a number of experts in each region who can help you with inquiries. Feel free to reach out to our teams at any time with questions or for more detailed information.

Detailed contact information for each region as well as the latest product information including user manuals and technical service bulletins can be found on our website.

SPARE PART AVAILABILITY

SPARE PARTS AND RECOMMENDED REPLACEMENTS & CONSUMABLES

Having a variety of THOR-5F spare parts on hand for quick replacement during an ATD certification or a crash test series is an affordable and efficient way to help manage unexpected needs and regular maintenance requirements.

- Neck Rubbers
- Rib Set
- Shoulder Pad
- 3D IR-TRACC Assemblies
- Abdomen
- Lumbar Rubbers
- Knee Slider Assemblies
- Misc Hardware and Washers

The Platinum Spare Parts Program offers immediate component availability on select high demand parts. The focus of the Program is to service our global customers who have emergency or urgent needs with an immediate turnaround for minimal quantities of spare parts.

The Program offers immediate shipments from Humanetics North American manufacturing facilities for hundreds of spare parts which can be ordered worldwide. The list of available components has been generated from a historical analysis of sales from both regulated and future regulation test dummies. With market shifts and newly released dummies, the Program's component mix is subject to change and evolves each year.



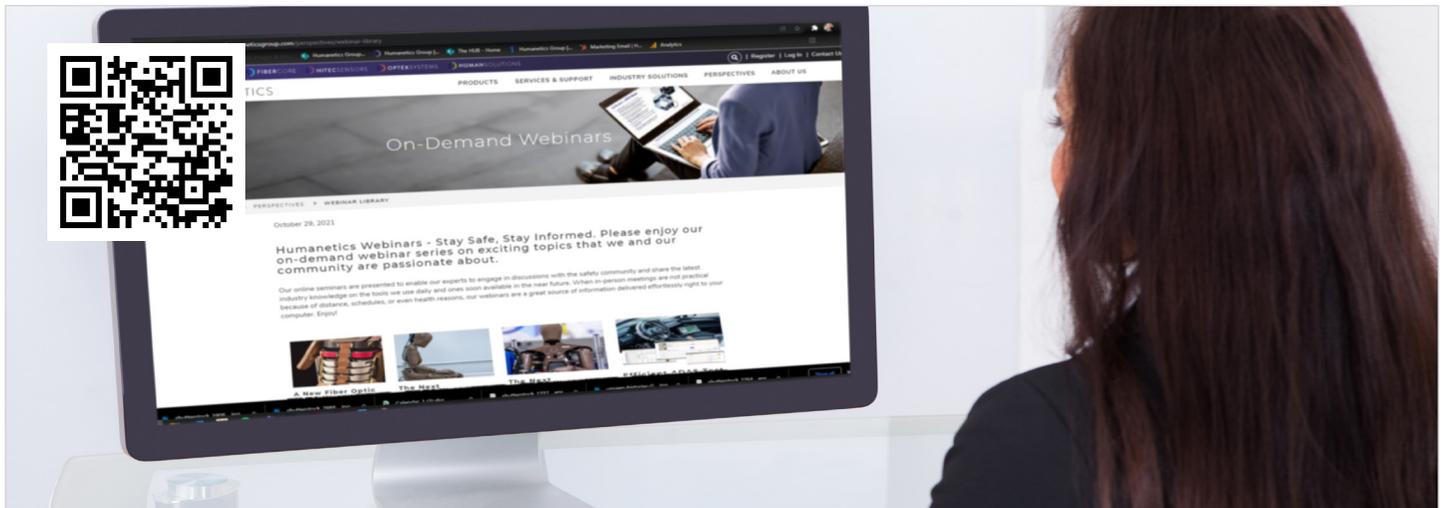
WEBINARS & TECHNICAL SUPPORT

HUMANETICS WEBINARS

Stay Safe, Stay Informed. Please enjoy our on-demand webinar series on exciting topics that we and our community are passionate about.

Our online seminars are presented to enable our experts to engage in discussions with the safety community and share the latest industry knowledge on the tools we use daily and ones soon available in the near future. When in-person meetings are not practical because of distance, schedules, or even health reasons, our webinars are a great source of information delivered effortlessly right to your computer.

Scan the QR code below or visit bit.ly/humaneticswebinars.



HUMANETICS TECHNICAL SUPPORT

Technical support by email is always available for our complete line of crash test dummies and test equipment, certification testing, product specifications and more at atdtechsupport@humaneticsatd.com

And don't forget, registered website users can access all the latest user manuals, product catalogs, and technical service bulletins 24/7 on individual product pages. Just select the RESOURCES tab on the page.



HUMANETICS

PROTECTING HUMAN POTENTIAL

Contact us by scanning the QR code below or go to:
bit.ly/humaneticscontact

