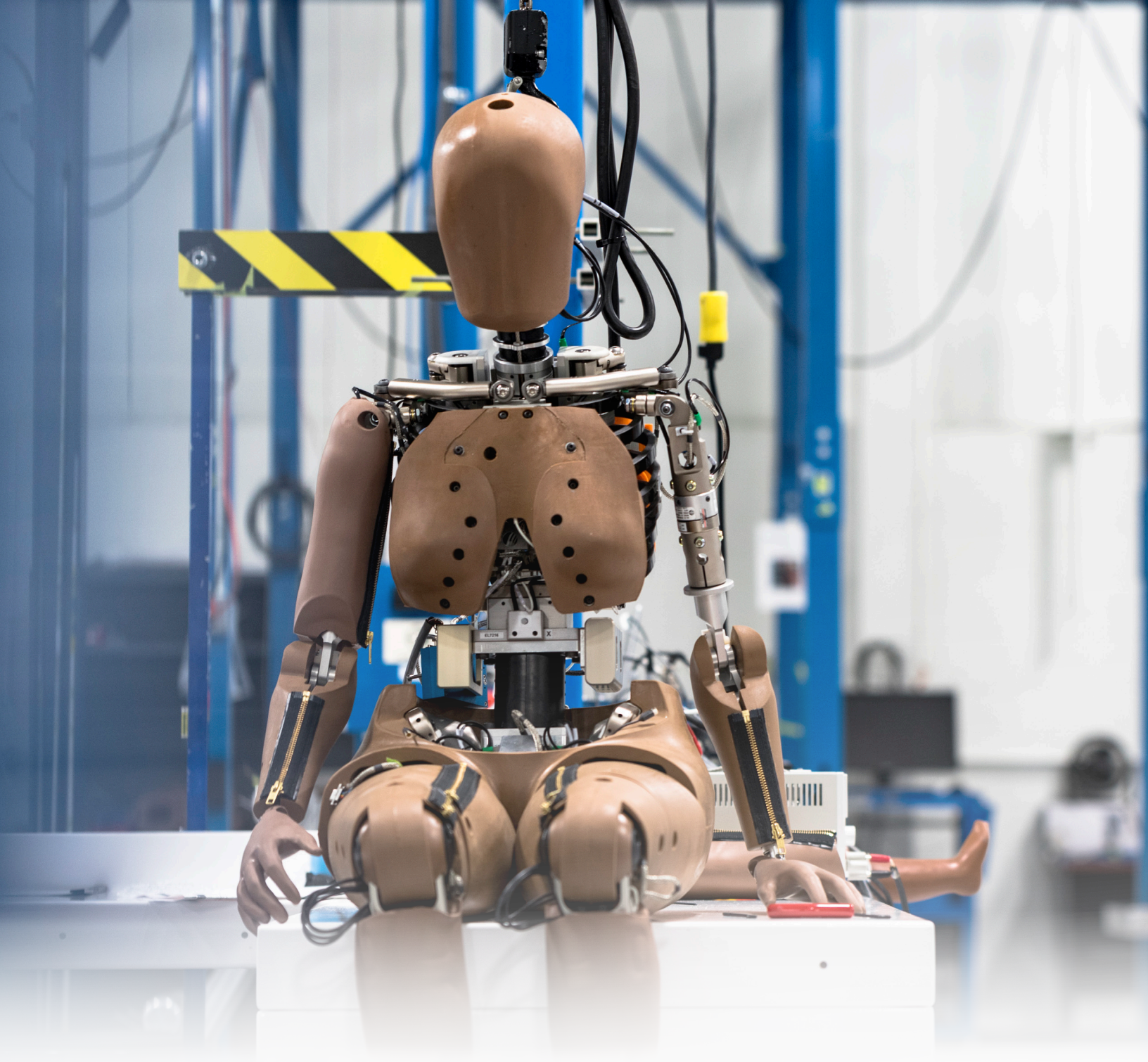


# THOR-5F

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.

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# THE NEXT GENERATION

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Crash test dummy technology has evolved to develop a next generation of Anthropomorphic Test Devices (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, more ways to measure chest compression to reduce the risk of rib fractures, and expanded lower

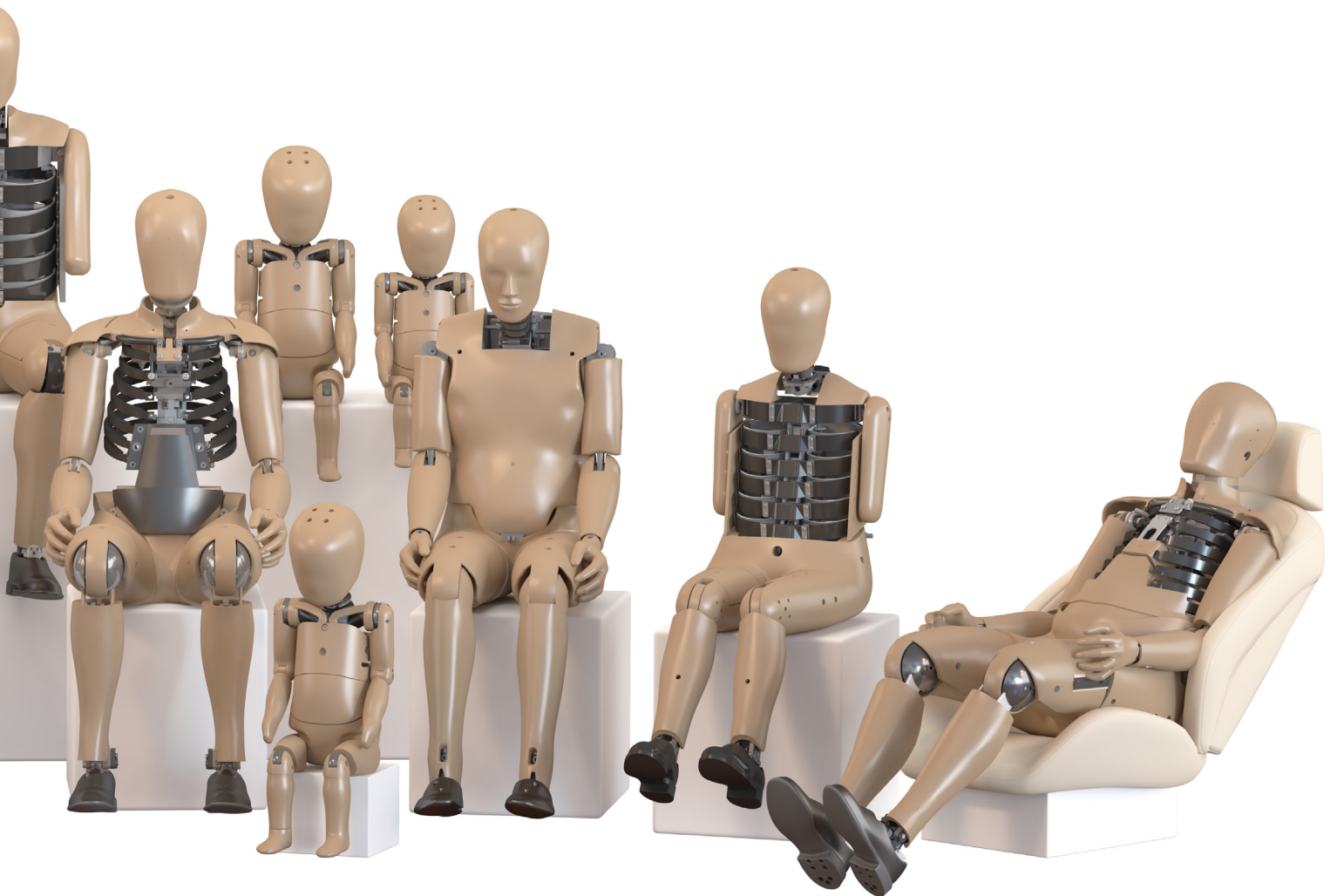
limb capabilities. Data provided by advanced dummies could help tune car design for safer and more effective seat belts, headrests, airbags, pedals and cabin structures.





## OUR LINEUP OF NEXT GENERATION ATDS:

THOR-50M	WorldSID-5F
THOR-5F	Elderly Female
THOR-AV-50M	Obese Male
THOR-AV-5F	BioRID
WorldSID-50M	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]

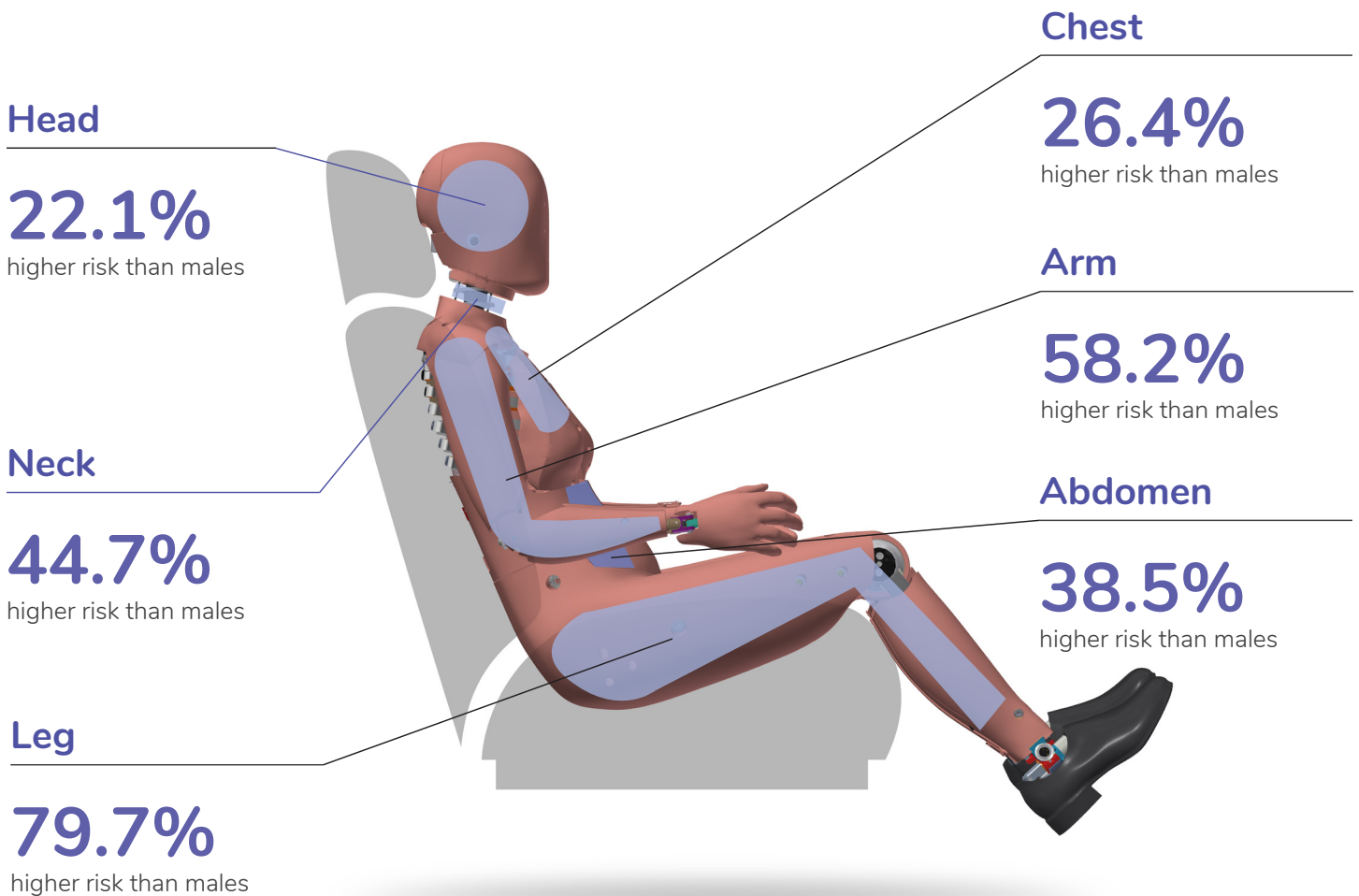
Tragically, gender bias in road safety is also costing women their lives. In 2018, 8,593 American women were killed in car crashes, a majority of them (61%) in the driver's seat. [14] A 2013 NHTSA report found that female drivers and right front passengers wearing their seat belts are 17% to 18.5% more 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](http://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

# FUTURE OF CRASH-TECHNOLOGY

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Our Test device for Human Occupant Restraint, or THOR, is the future ATD blueprint for crash-technology, available today. The THOR family incorporates major advancements in biofidelity and sensing, with significantly expanded instrumentation and improved user handling. Available in adult male and female models, THOR is our most sophisticated ATD for assessing whole-body trauma in a variety of occupant restraint

THOR-5F is an advanced frontal-impact 5th percentile adult female ATD. The THOR-5F design is currently being validated by regulators and NCAPs worldwide for certified use in frontal impact tests. Humanetics is actively involved in addressing the test procedures, replacement parts and other refinements needed to ensure regulatory adoption.

THOR-5F is advanced in her design and usability. She can carry 150+ channels of instrumentation. Chest measurements are done on 4 points in a 3D manner while her abdomen provides pressure measurements. Her spine is equipped with flexible joints in both the thoracic and lumbar regions and her shoulders are designed for better interaction with restraints.

THE  
**MOST ADVANCED**  
ATD EVER CONCEIVED  
FOR WIDESPREAD  
ADOPTION

Find out more  
[humaneticsgroup.com](http://humaneticsgroup.com)





# WHAT IS THE THOR-5F?

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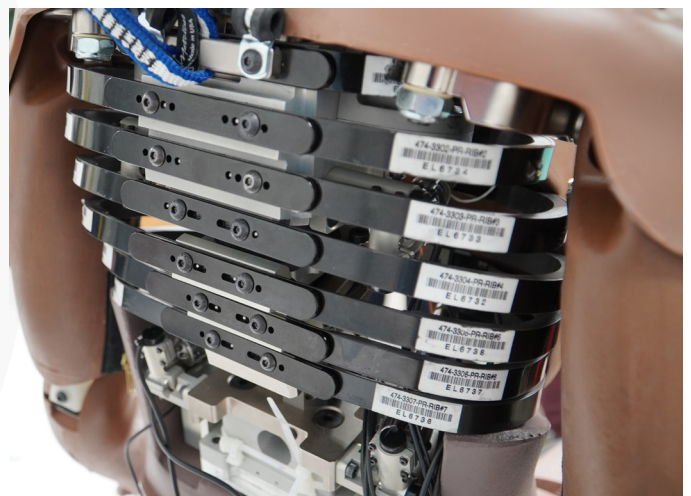
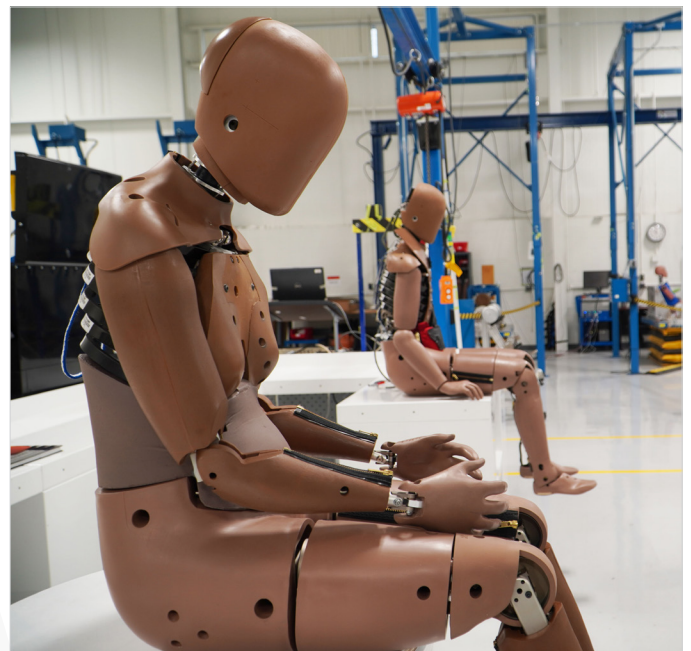
THOR (Test device for Human Occupant Restraint) is an advanced dummy representing significant improvements over the Hybrid III dummy which is still widely used in test labs today. Building on the same technology as the THOR-50M male, the THOR-5F represents a 5th percentile female automotive occupant. 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

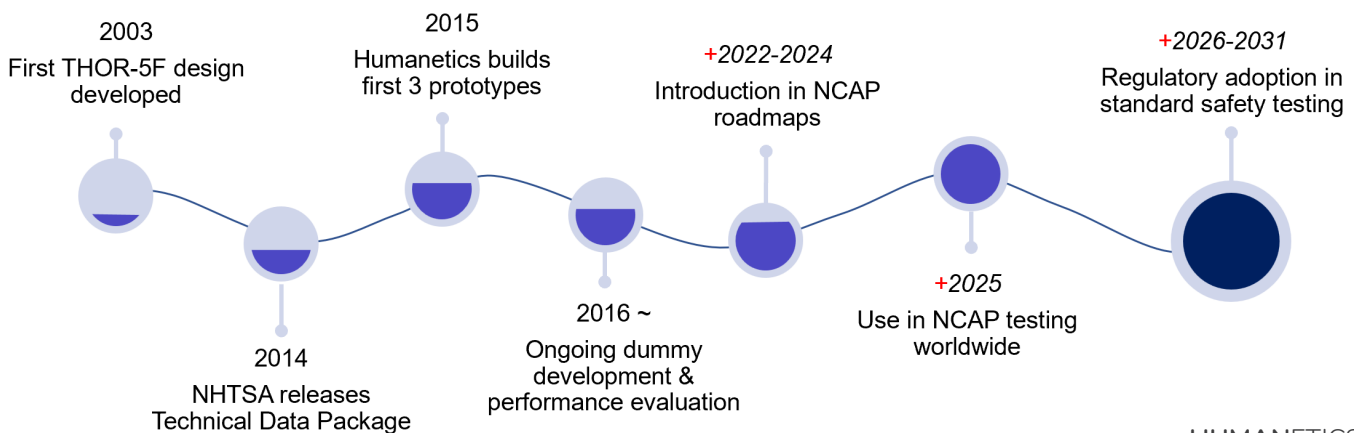
The Hybrid III dummy family has been the standard workhorse tool for decades in the U.S. crash testing evaluations as well as every other legislative and NCAP protocol around the world. The Hybrid III 50th was federalized into Part 572 in 1985 followed by the 5th female a decade later, and then of course 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.



# PRODUCT 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 104 lbs. (47.3 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

Total Weight	47.3 kg	104.3 lb
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Seated Height	788.1 mm	31 in
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# DESIGN

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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
- The pelvis is a statistical representation of a 5th percentile female pelvis, resulting in more accurate anthropometry
- 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.

## Thorax

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

## Lower Thoracic Spine

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

## 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

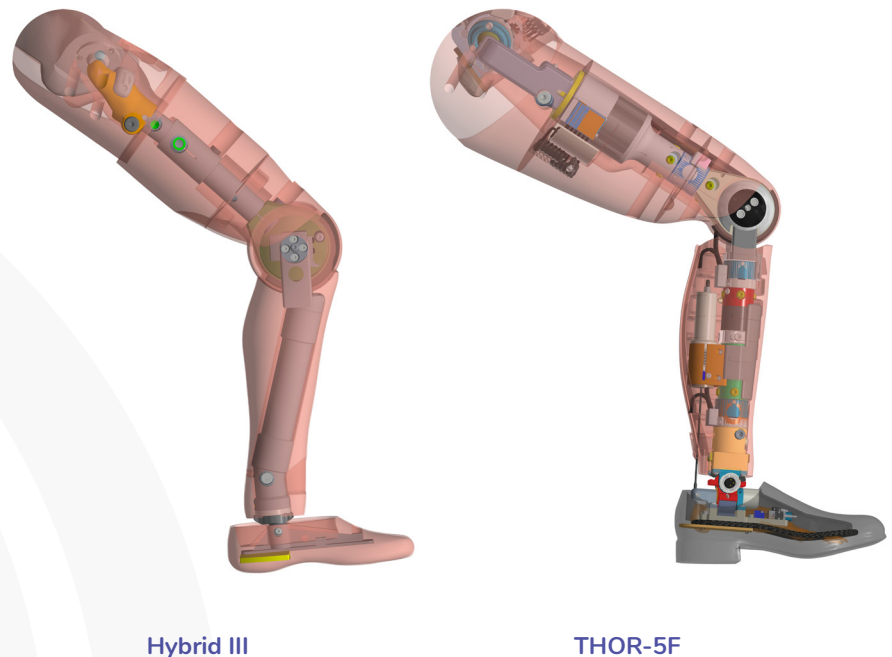
Lower extremities of female drivers are one of the most susceptible parts of the body to injury. Researchers point out that women are more than 2½ times as likely to suffer moderate leg injuries and about 70% more likely than men to suffer serious leg injuries. [1] University of Virginia data has also 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.



[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.

# ATD

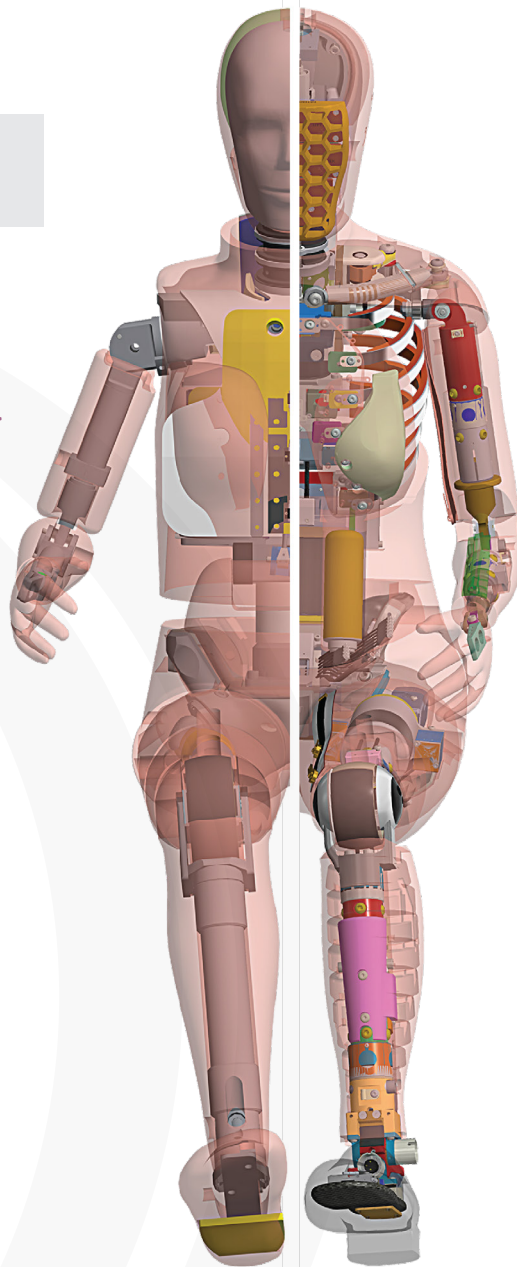
## BIOFIDELITY RANKING

ATDs are constructed to represent the human body's biomechanical properties accurately. According to NHTSA, the purpose of the Biofidelity Ranking System (BRS) is to objectively quantify response differences between human subjects and crash test dummies to evaluate how well a dummy replicates the behavior and response of a human.

**HYBRID-III 5<sup>TH</sup>**  
Hybrid-III Design

**2.66**  
**MARGINAL**

Overall BioRank Biofidelity Score



**THOR-5F**  
THOR Design

**1.20**  
**GOOD**

Overall BioRank Biofidelity Score

BRS Range	$BRS \leq 1.0$	$1.0 < BRS \leq 2.0$	$2.0 < BRS \leq 3.0$	$BRS \geq 4.0$
Biofidelity	Excellent	Good	Marginal	Poor

The lower the BioRank score, the more biofidelic the ATD response is. A BioRank score less than 2 is desirable.



# INSTRUMENTATION BY CHANNELS

## HYBRID-III 5<sup>TH</sup> Hybrid-III Design

## THOR-50F THOR Design

Head  
**3 CHANNELS**  
In head center of gravity, COG

Neck  
**12 CHANNELS**  
Upper and lower neck

Upper Torso  
**8 CHANNELS**  
Spine and thorax

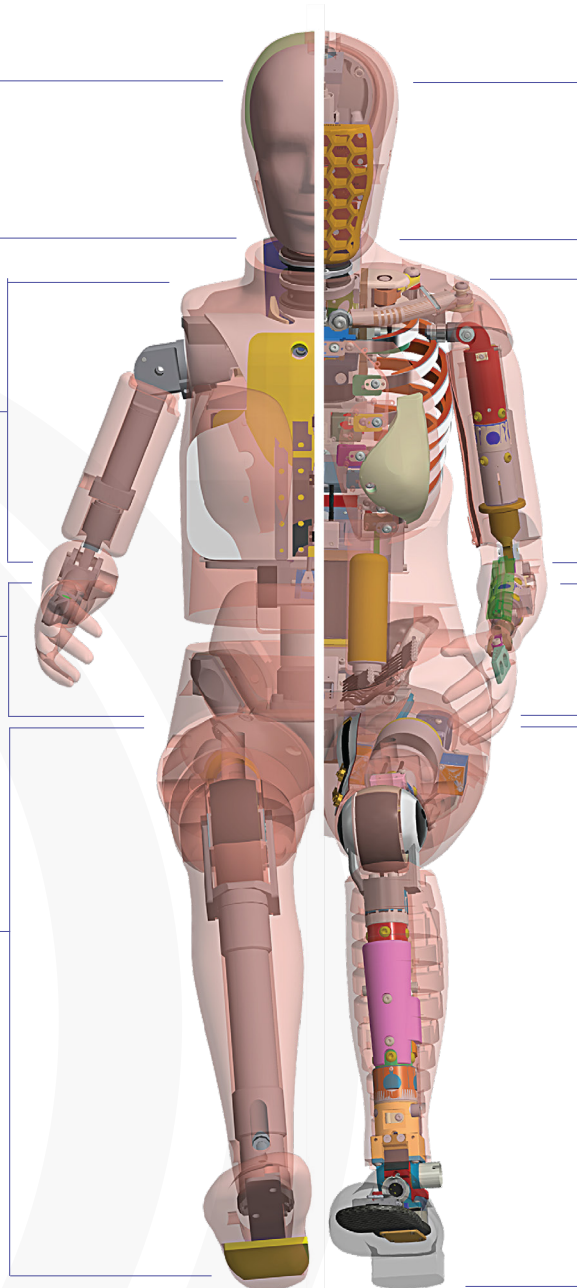
Lower Torso  
**9 CHANNELS**  
Lumbar, ASIS and pelvis

Lower Extremity  
**19 CHANNELS**  
Femur and tibia

**< 75**

**DATA CHANNELS**

Available for injury sensing



Head  
**14 CHANNELS**  
Includes tilt, facial, and angular rate sensor (ARS)

Neck  
**15 CHANNELS**  
Upper and lower neck

Upper Torso  
**36 CHANNELS**  
Chest, clavicle, spine and thorax

Lower Torso  
**27 CHANNELS**  
Abdomen, pelvis, ASIS, lumbar and acetabulum

Lower Extremity  
**58 CHANNELS**  
Femur, knee, tibia, achilles, ankle and feet

**150+**

**DATA CHANNELS**

Available for injury sensing

# COMPARISONS

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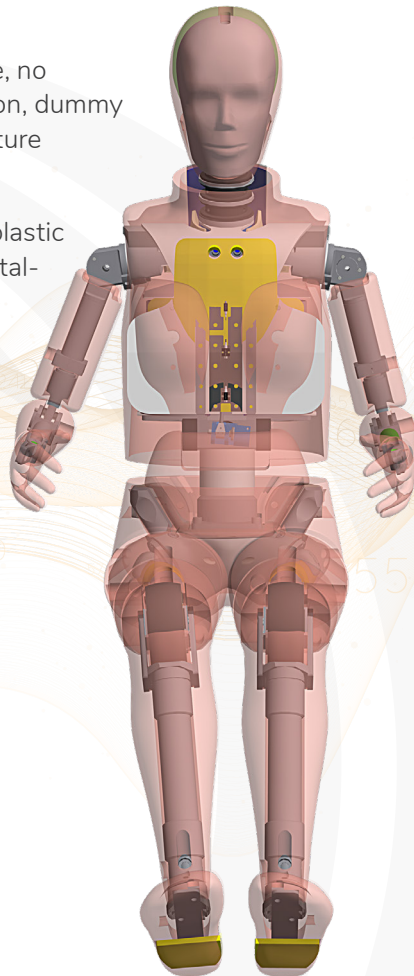
## FEMALE ATDS

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

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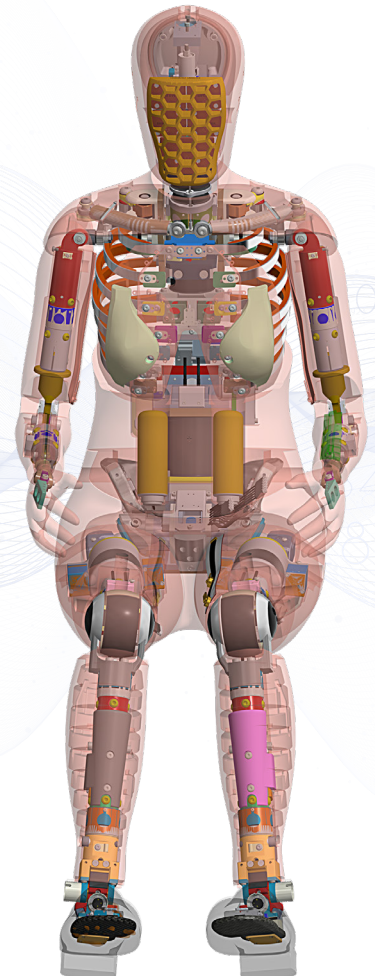
- Hybrid III 50th Male design (scaled down)
- Straight lumbar spine, no driver's slouch position, dummy represents erect posture behind the wheel
- Lumbar spine cable plastic bushings prevent metal-to-metal contact
- Ankle bumpers and improvements to minimize mechanical noise



### THOR-5F Female

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- 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



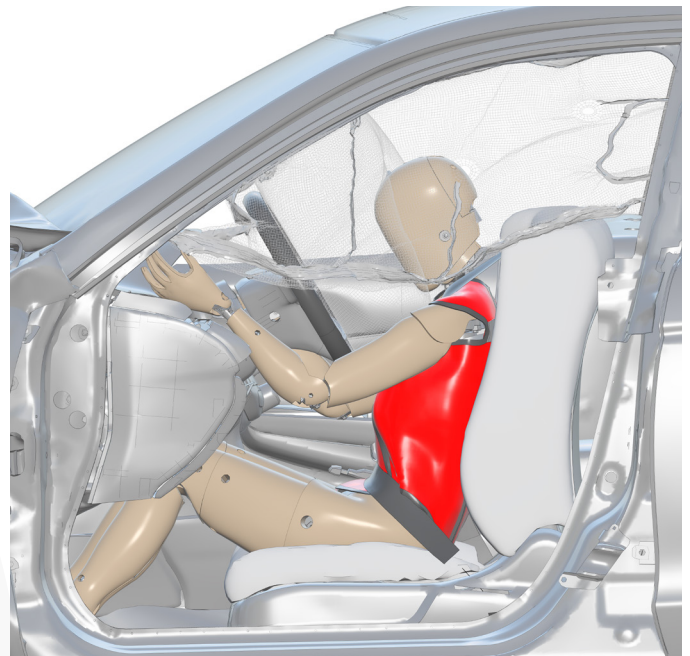
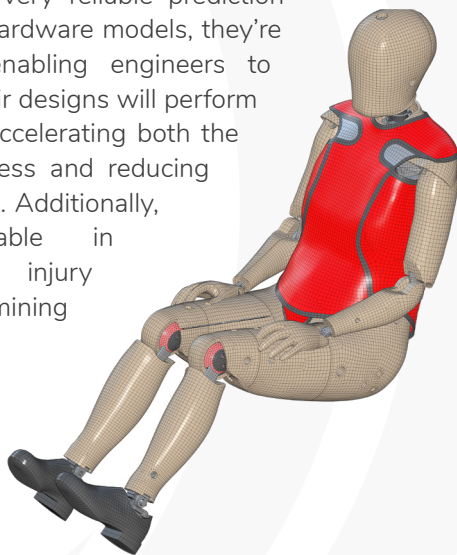
# VIRTUAL ATD MODELS

## 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.



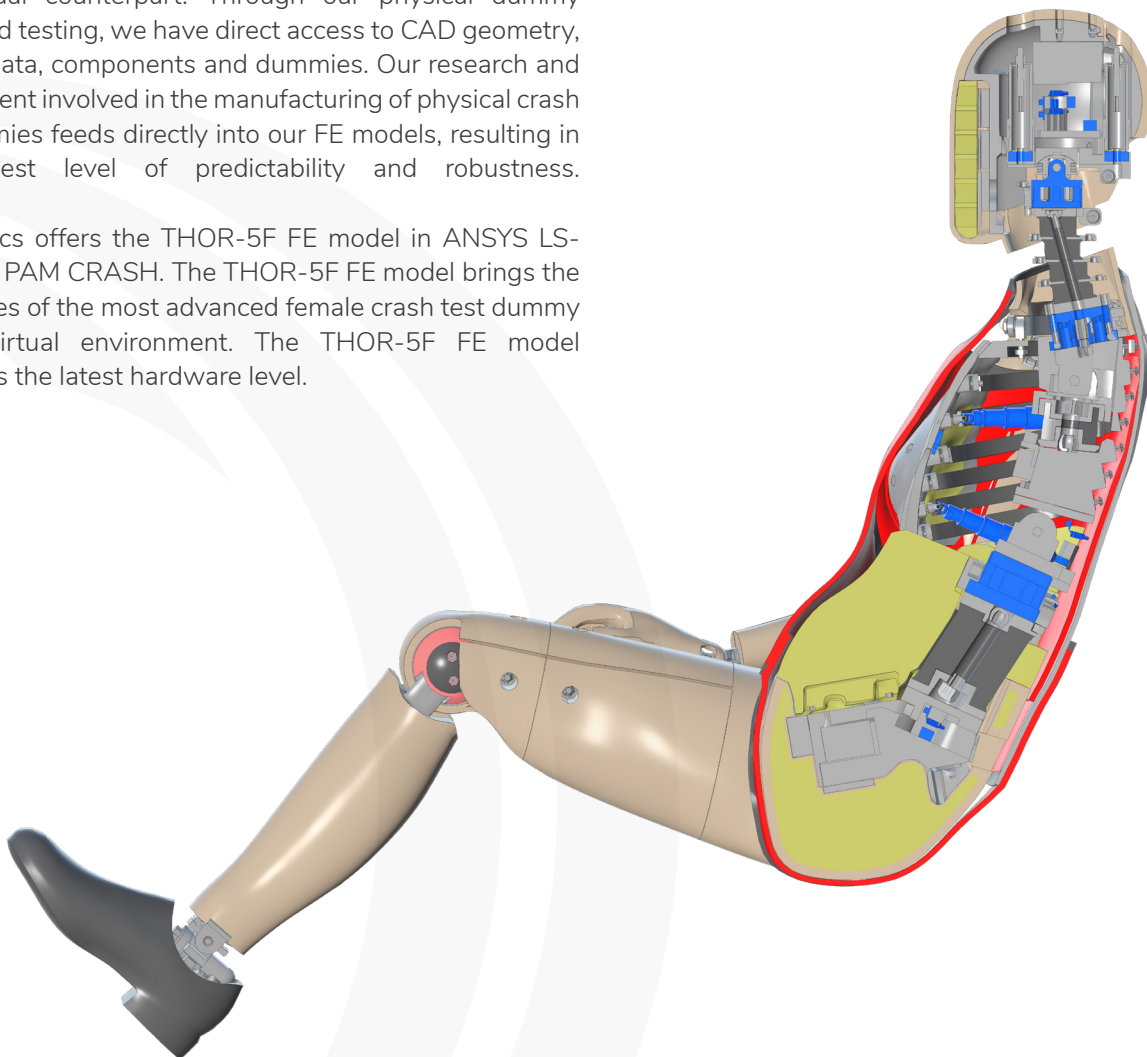
The primary focus of virtual models is to evaluate various scenarios in real-world crashes which otherwise would be very challenging with hardware testing alone. FE models that represent crash-test dummies are vastly more robust and trustworthy than they were only a few short years ago, while simulation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



# THE HUMANETICS ECOSYSTEM ADVANTAGE

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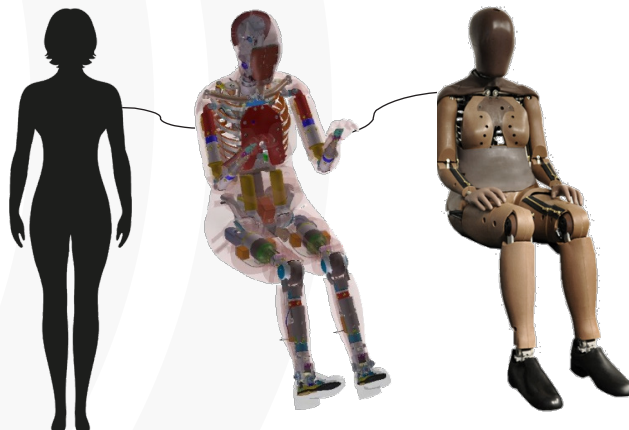
Humanetics has earned its reputation as a global leader in the development and manufacturing of crash test products by providing a complete ecosystem that covers every aspect of safety testing. From virtual simulations to physical crash test dummies, Humanetics offers a seamless workflow that ensures the most accurate and reliable results throughout the testing process.

Humanetics' toolkit begins with state-of-the-art digital simulations. Leveraging advanced computer-aided engineering (CAE) technologies, Humanetics allows manufacturers to conduct thorough virtual crash tests before any physical prototypes are created. This not only accelerates the product development cycle but also minimizes costs associated with physical testing.

The virtual phase seamlessly transitions into physical testing, where the accuracy of the simulations is rigorously validated. Humanetics' virtual testing solutions ensure that the digital model faithfully represents real-world scenarios, providing engineers with unparalleled insights into the performance of their designs.

Humanetics original legacy is in the development of physical crash test products. Our (Anthropomorphic Test Devices) ATDs are engineered with precision and attention to detail, ensuring that they accurately replicate the biomechanics of the human body. From head-to-toe, Humanetics' ATDs are designed to provide the most realistic and reliable data possible.

**Through our physical dummy designs and testing, we have direct access to complex geometry and material data to ensure the consistency of our digital twins so the physical and virtual worlds perform as identical as possible.**



# THE HUMANETICS WORKFLOW ADVANTAGE

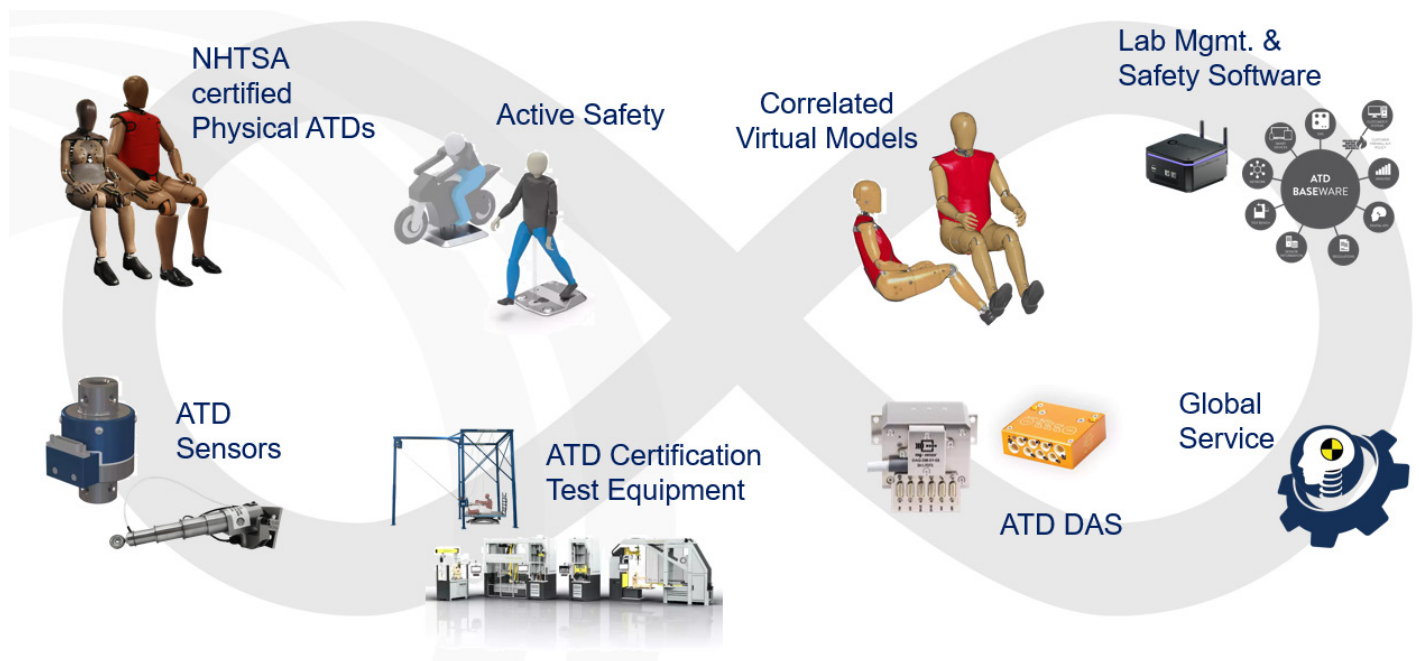
Humanetics' closed-loop workflow ensures a seamless transition from digital simulations to physical testing with integrity and feedback control. This integration minimizes the risk of discrepancies between the virtual and real-world results, providing engineers with the confidence that the safety features designed in the digital realm will translate accurately to physical products.

Humanetics provides a comprehensive range of testing products such as crash test dummies, digital twins, active safety platforms, calibration systems, lab management software, and precision sensor technologies. This integrated ecosystem ensures seamless collaboration and compatibility among our solutions.

With a complete workflow in place, Humanetics guarantees the integrity of the testing process. The closed-loop system eliminates potential gaps or

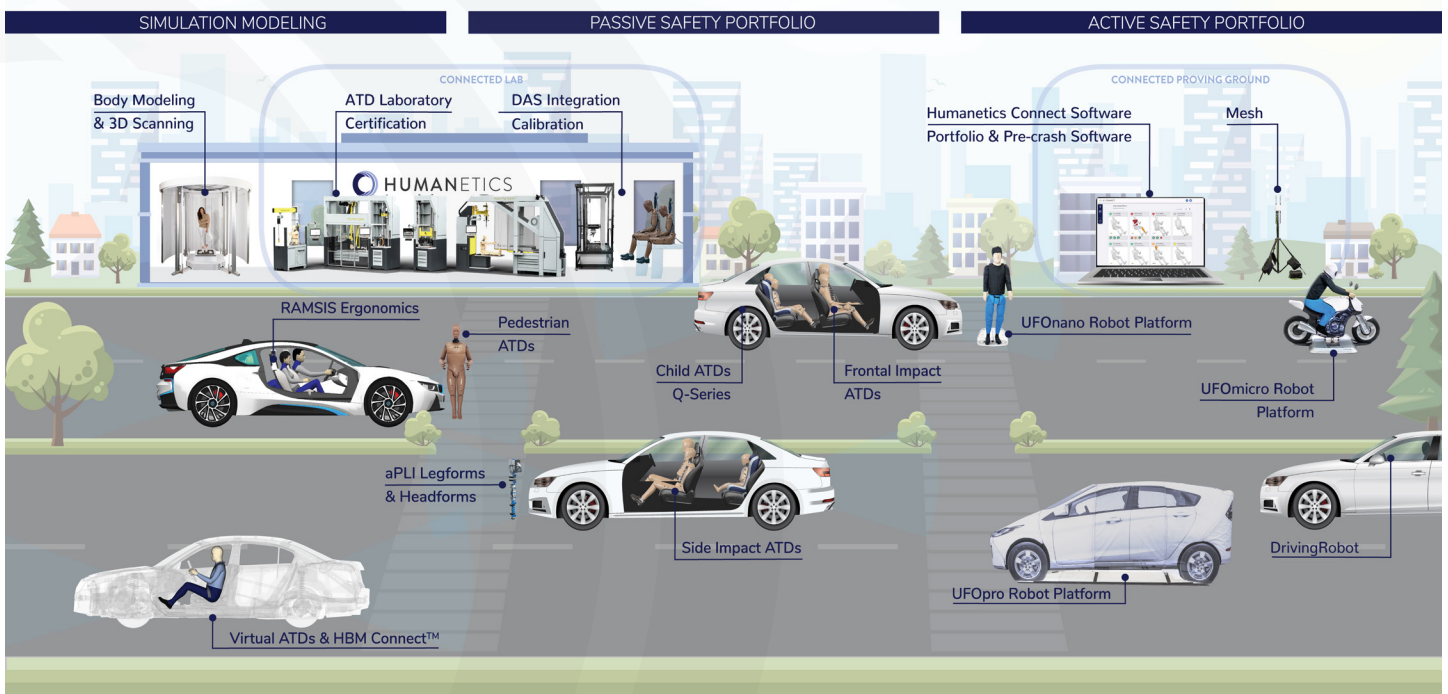
inconsistencies in the workflow, providing a holistic and reliable approach to crash testing. Manufacturers can trust that the results obtained from Humanetics' products accurately reflect the performance of their vehicles in real-world collision scenarios.

For example, Humanetics creates data models and simulation software that accelerate design and test, improve safety & comfort, and reduce development cost and time to market.



By seamlessly integrating digital software and management tools into the test lab, we can offer the capabilities to connect not only ATDs and sensor solutions but also test systems with each other, analysis software and cloud solutions. Our products provide the ability for connected and integrated lab management, ensuring measurement accuracy and repeatability.

- Low Variation
- Seamless Integration
- High Efficiency
- Data Integrity
- Speed to market
- Lower long-term costs
- Management of increased development complexity across disciplines



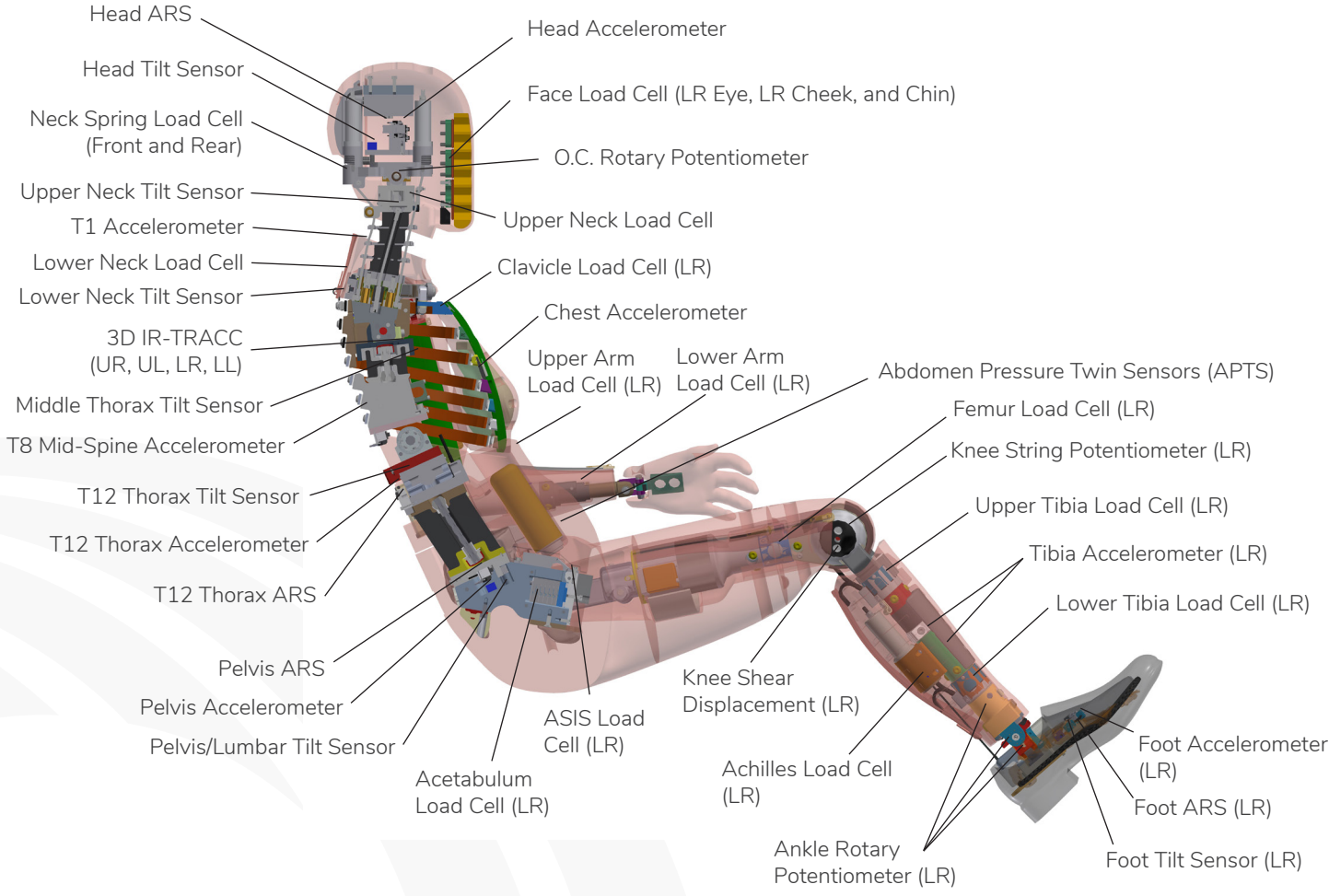
# HUMANETICS SENSORS

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We develop special sensors to measure the forces that break bones and cause injuries. These readings are controlled and repeatable, providing vehicle development engineers 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.



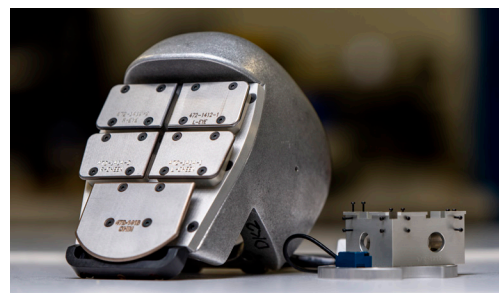


# SENSOR OPTIONS

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.

## LOAD CELL MATRIX

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



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

## ADDITIONAL INSTRUMENTATION AVAILABLE

### INSTRUMENTS

Head Accelerometers (CG)

Head Accelerometers (Top)

Head Accelerometers (Side)

Head Accelerometers (Rear)

Head CG Angular Rate Sensor

O.C. Rotary Potentiometer

T1 Accelerometer (Tri-pack)

Mid Sternum Accelerometer

Thorax Accelerometer (Tri-pack)

T12 Accelerometer (Tri-pack)

Thorax Angular Rate Sensor

3D IR-TRACC or S-TRACK Upper Thorax (Left)

3D IR-TRACC or S-TRACK Upper Thorax (Right)

3D IR-TRACC or S-TRACK Lower Thorax (Left)

3D IR-TRACC or S-TRACK Lower Thorax (Right)

Upper Abdomen Accelerometer

APTS SENSOR Abdomen (Left)

APTS SENSOR Abdomen (Right)

Pelvis CG Accelerometer (Tri-pack)

Pelvis Angular Rate Sensor

Knee Shear Displacement Potentiometer

Tibia Accelerometer

Ankle Rotation Potentiometer X Y Z

Foot Accelerometer

# THOR-5F PACKAGES

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# SIMPLIFIED INSTRUMENTATION

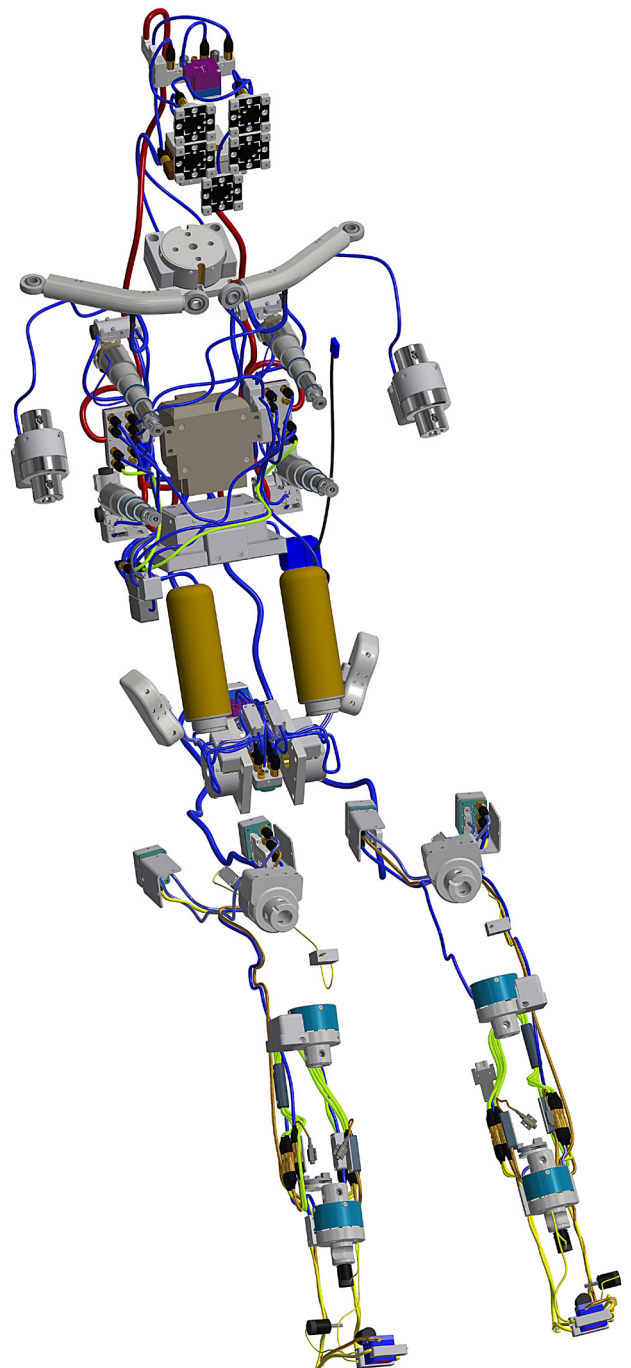
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Packaged for convenience, usability and simplification.

A tier of standardized option menus have been created for the THOR as part of the ATD complexity reduction initiative in an effort to simplify the purchasing process for integrated ATDs. We have instrumentation and channel configurations to match NHTSA and various NCAP specifications.

These package options offer sets of predetermined channel counts of load cells, accelerometers, and angular rate sensors conveniently bundled together for optimal usability. Moreover, the standard delivery time will be greatly reduced as a result of streamlining the ATD production and assembly processes.

Historically, most integrated ATDs are coupled with a choice of on-board data acquisition systems with customer specific instrumentation, and they have typically been engineer-to-order items that require unique build designs for each dummy. To minimize the sometimes unnecessary customization, customers now have the option to purchase the standardized packages with preset instrumentation. This allows a simplified ordering and build process that will not only meet the customer's data collection needs, but also come with a much quicker delivery time and savings in cost.



# ONBOARD DAS INTEGRATION



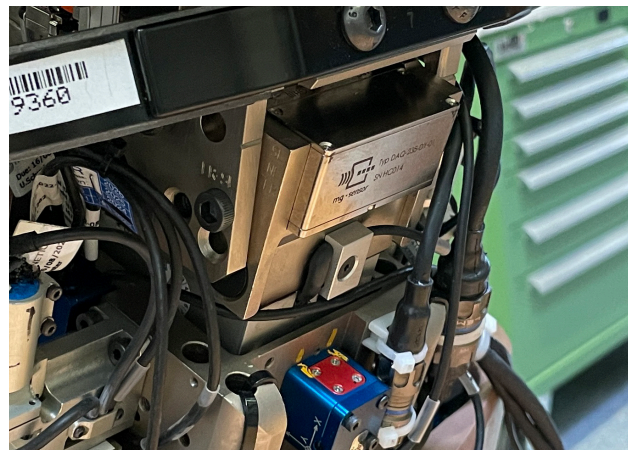
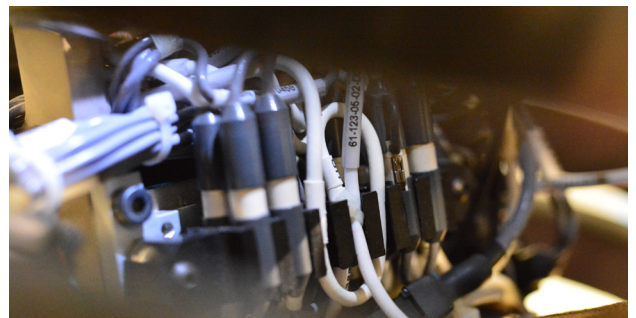
# ONBOARD DAS INTEGRATION OVERVIEW

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The Humanetics legacy of integrating ATDs with onboard 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 both automotive and military applications. Being a DAS neutral integrator allows Humanetics to utilize the customer's choice of systems from suppliers like DTS, Kistler, mg Sensor, Messring, and Kyowa. 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, and physical measurements.



# ON-BOARD DAS

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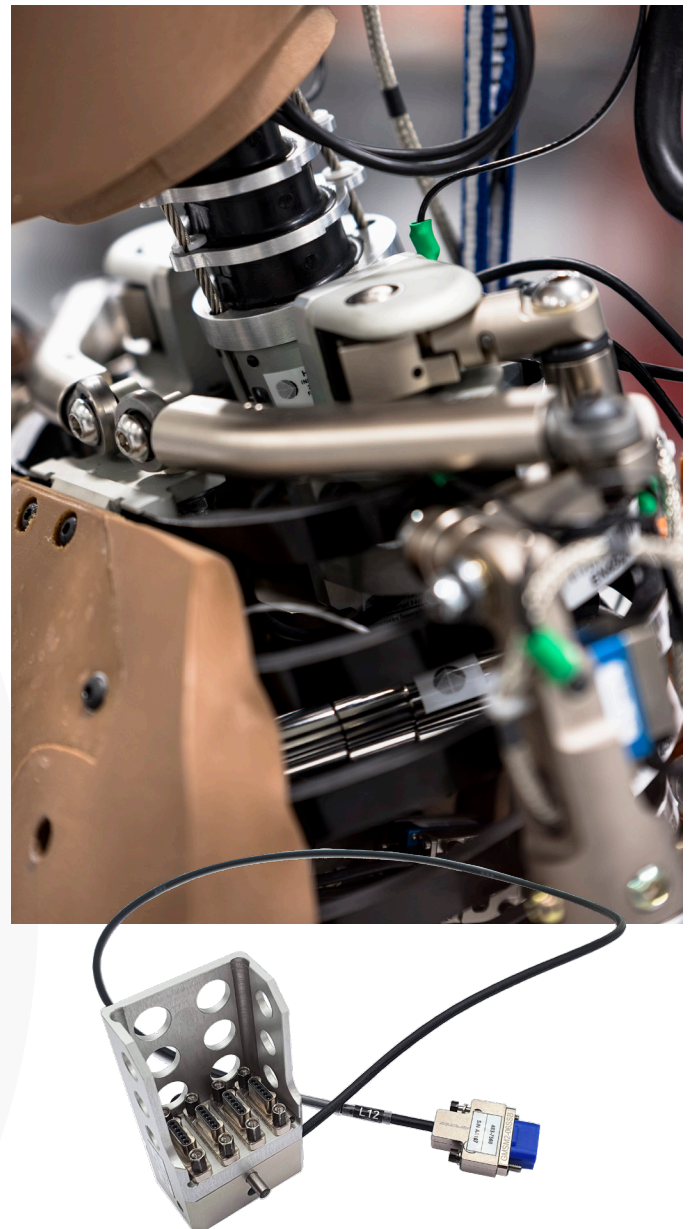
## ON-BOARD DATA ACQUISITION SOLUTIONS (DAS)

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'.

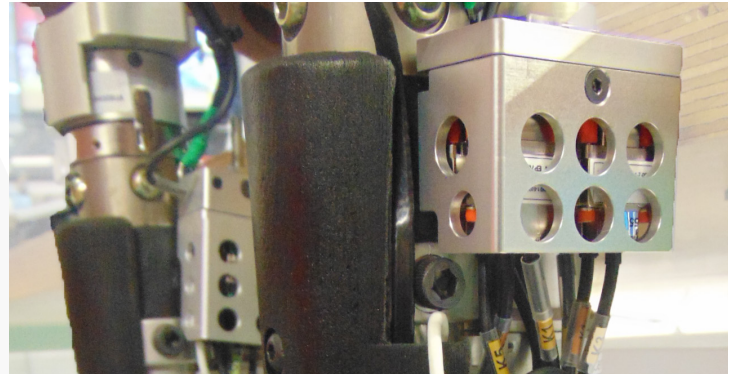
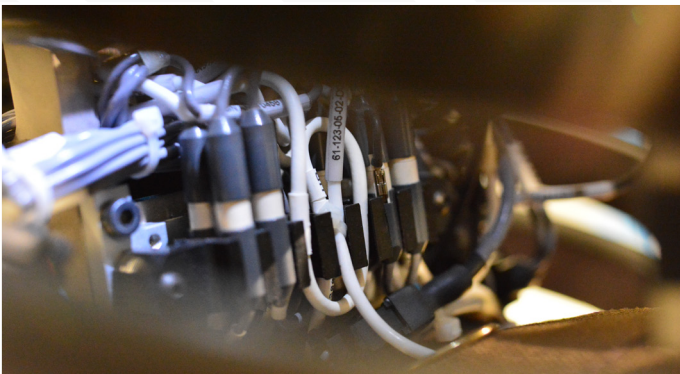




Our integration team surpasses 60+ members incorporating engineers, technicians and expert professionals. This large pool of talent allows Humanetics to implement integration solutions for many other types of instruments including angular rate sensors, accelerometers, potentiometers and pressure sensors 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.

# MG-SENSOR-DTI RECORDER OPTIONS

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Hubs connect sensors throughout the dummy by collecting sensor data of specific areas. The collected sensor signals are transferred into a single cable. Hubs help reduce the number of cables routed through the dummy, which ultimately reduces umbilical mass and weight.

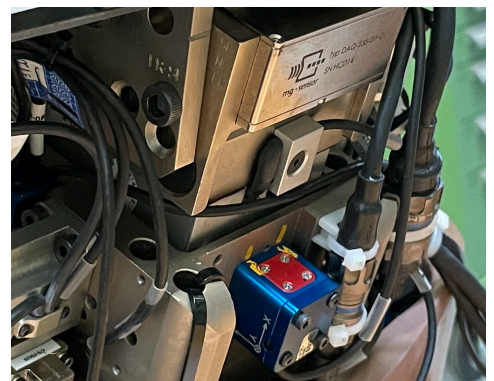
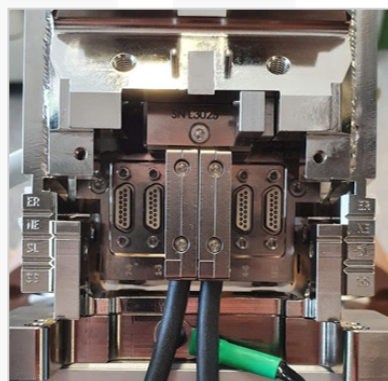
Data recorders are used to collect measurement data in a central erasable memory. For the DTI integrated THOR-5F version, Humanetics offers a data recorder by mg-sensor, called DAQ-238-DY. The recorder features 17 DTI ports and a system LED port, as well as a 64 GB Flash Memory for data storage.

To ensure an optimal distribution of the sensor data, hubs by Humanetics are always customized to the certain needs within the area they are used, for example, the amount of input connector slots or the number of data channels that need to be connected to the hub.

Due to the user-friendly design and installation, the recorder can easily be accessed from the front as well as the back of the spine. The recorder is working with all DTI compatible DIMODs and ADMs and has been tested with various software packages with DTI support, to ensure frictionless operation and making it a valuable component of the integrated dummy. Additionally, the integrated power supply supports user efficiency by avoiding unnecessary downtime.

This new recorder can cover a maximum amount of 238 channels and is featuring 10/100/1000 Mbit Ethernet for extremely fast data download, simplifying and speeding up the daily work with the dummy. With an embedded web interface, it can be operated within the web browser.

The DAQ-238-DY is fully compliant with SAE J211 and ISO6487 and accepted by Euro NCAP.

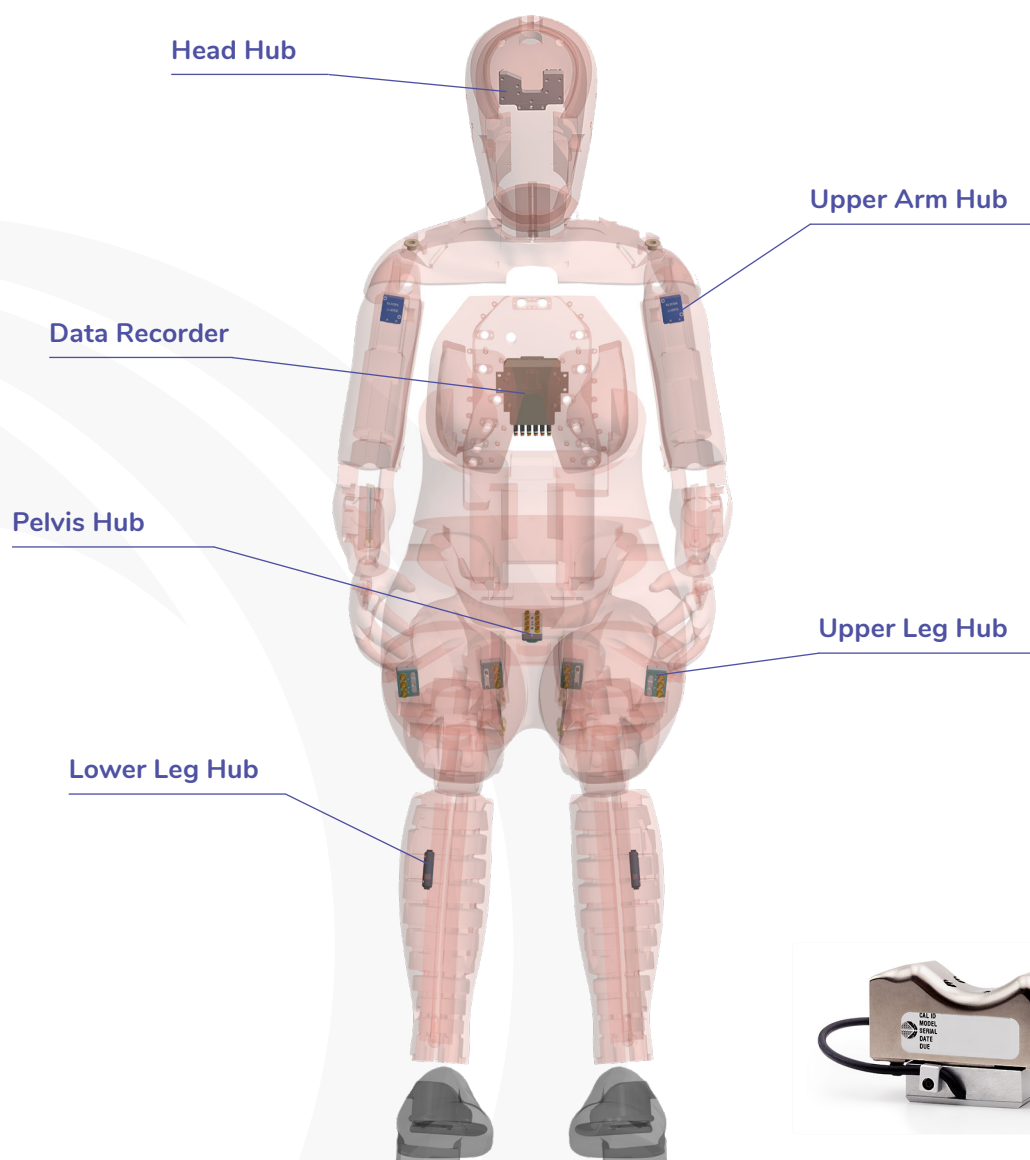


# LOCATIONS

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A THOR-5F can have modules and hubs built into different parts of the dummy to service those areas where data channels are concentrated.

An example of locations can be seen below.



# PRODUCT + CUSTOMER SUPPORT

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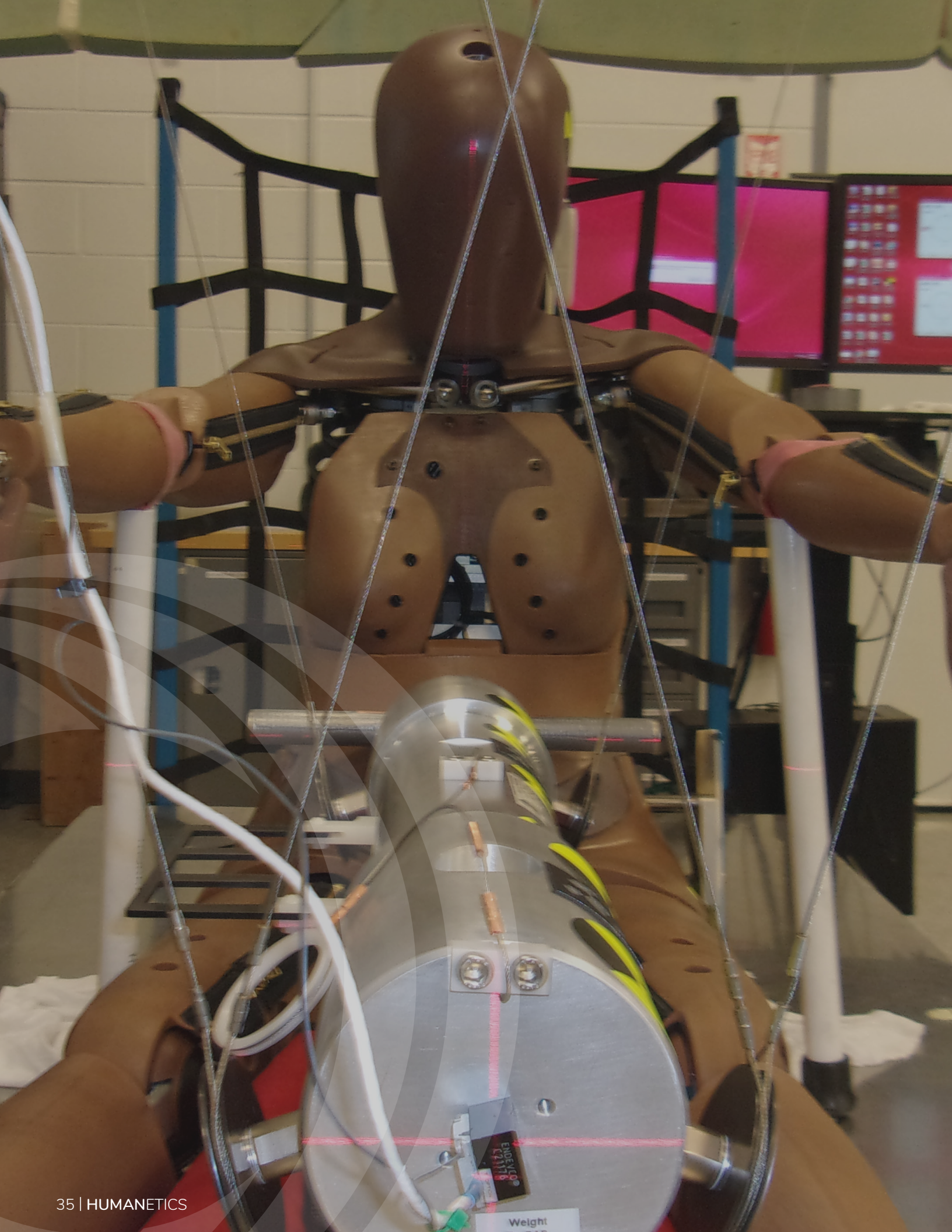
18.5

There is no company of engineers more experienced in designing, installing, and maintaining sophisticated passive and active safety testing equipment than Humanetics.

Our experts in each of our global facilities spend much of their time on-site with customers training them to use the latest technologies. 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.

Let us know how you would like us to support you - we are here to help you succeed.




# SPARE PART AVAILABILITY

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.

To help with your inventory planning, we've put together lists of the most common and consumable components to have readily available for regular and emergency use. Visit our website to download the latest recommended spare parts for the THOR-5F.

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

## RECOMMENDED SPARE PARTS & CONSUMABLES THOR-5F



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.

**Importance of ATD Spare Part Inventory**


Accidents happen. And within vehicle safety test facilities, they happen on purpose! So there's nothing more frustrating than lacking a critical replacement part for a test dummy that's scheduled for a required re-certification or needed immediately for a crucial test series.

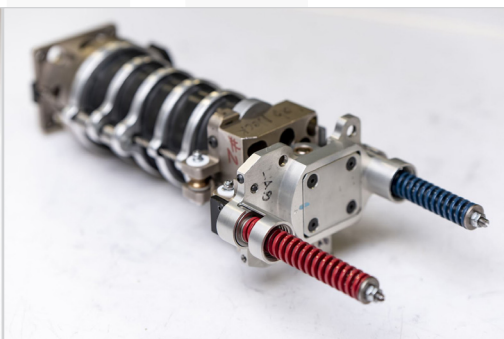
Some of the components that bare the brunt of physical impact and abuse are critical items to have on-hand for quick replacement when damaged or worn-out. Many test dummy spares have delivery lead times that could delay your testing if you don't have them available in your local inventory.

To help with your inventory planning, we've put together a list of the most common and consumable components to have readily available for regular and emergency use.

**Recommended THOR-5F Spare Parts**

ITEM #	PART NUMBER	DESCRIPTION	QTY	ITEM #	PART NUMBER	DESCRIPTION	QTY
1	474-1008	HEAD SKIN THOR-M	1	15	474-3313	RIB STIFFENER, RIBS 1,2,3	3
2	474-1401	FACE FOAM	4	16	474-3334	RIB STIFFENER, RIBS 4,5,6,7	4
3	474-1025	CAP SKIN THOR-5fb	1	17	474-3240	UPPER SPINE ASSEMBLY	1
4	472-2016	SCREW, OCCIPITAL CONDYLE	1	18	474-3959	SHOULDER PAD	1
5	474-2100	NECK COLUMN ASSEMBLY, THOR 5TH	1	19	6004605	BEARING, FLANGE 12mm OD X 10mm ID X 5mm LG	2
6	474-2115	FLEXION/EXTENSION STOP ASSY	1	20	5000903-FT	NUT HEX NYLON INSERT M6 X 1 X 18-8-SS	2
7	474-3301	RIB ASSEMBLY 1, UNTESTED	1	21	5000093-FT	M6 X 1 HEX LOCKNUT ZINC	2
8	474-3302	RIB ASSEMBLY 2, UNTESTED	1	22	5000064-FT	M5 X 0.8 X 12 LG BHCS	16
9	474-3303	RIB ASSEMBLY 3, UNTESTED	1	23	5000486-FT	M8 X 1.25 HEX LOCKNUT ZINC	2
10	474-3304	RIB ASSEMBLY 4, UNTESTED	1	24	5000149-FT	M10 X 1.5 HEX LOCKNUT ZINC	2
11	474-3305-1	RIB ASSEMBLY 5, UNTESTED	1	25	474-3533	FRICTION WASHER	2
12	474-3306	RIB ASSEMBLY 6, UNTESTED	1	26	5000318-FT	M8 X 1.25 HEX LOCK NUT SS	2
13	474-3307	RIB ASSEMBLY 7, UNTESTED	1	27	5001154-FT	M8 X 20 LG SHSS	2
14	474-3700	CHEST BUSH-STERNUM MOLDED	1				

humaneticsatd.com 



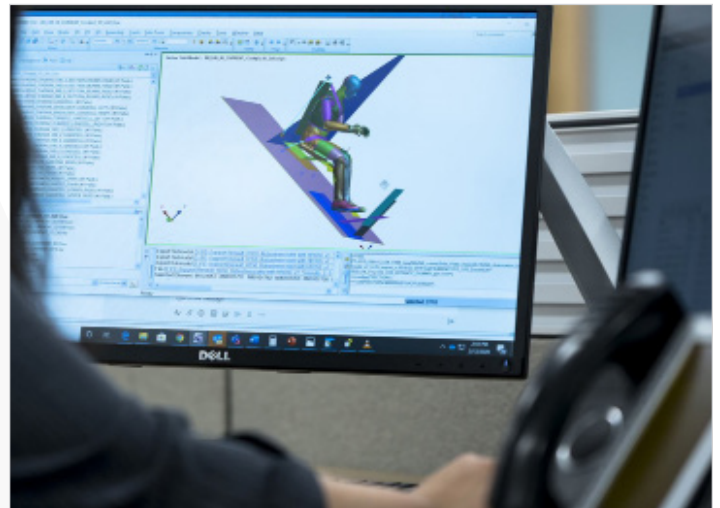
# CERTIFICATION AND CALIBRATION

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Humanetics provides a full range of services to install, maintain, calibrate, and certify our ATD's. 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.

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 laboratories makes sure regional support is always available for your ATD.

Humanetics offices 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

## GLOBAL NETWORK

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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 are 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 and ensure that people are safe every time they get into a car.



# SALES, MAINTENANCE, AND TRAINING

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Humanetics provides a full range of services to install, maintain, calibrate, and certify our ATD's. 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 some of our clients a turnkey solution 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 and 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 in your teams on a short term or long-term basis.

## KEEP YOUR TESTING PROGRAM ON TRACK



Scan QR code to view the full Humanetics Safety Portfolio.

## CONTACT US

Having 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 team in case you have questions or are interested in more detailed information at any time.

Detailed contact information for each region as well as the latest product information including user manuals and technical service bulletins is located on our homepage.

# WEBINARS AND TECHNICAL SUPPORT

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

Our on-line 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.

## JOIN OUR LIVE WEBINARS TO STAY UP-TO-DATE



Scan QR code to view our list of upcoming live and on-demand webinars.

## TECHNICAL SUPPORT

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

Don't forget, registered website users can access 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 HUMANS IN MOTION



**CONTACT US**

Scan QR code to contact your  
local Humanetics Representative

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