### What?
- Anthropomorphic Test Device (ATD, or crash test dummy)
- Represents male of average height and weight
- Designed for frontal and frontal oblique crash tests
- Measures risk of injury to occupants in a crash
- Used in hundreds of NHTSA research tests

### Why?
THOR's human-like characteristics in a crash and state-of-the-art measurement capability make it the best choice to evaluate the advanced safety features in today's vehicles.

### Human-Like Characteristics
- Neck that bends, twists, and stretches for realistic head motion
- Torso with anatomically correct ribcage and shoulder
- Flexible spine to allow proper upper body motion
- Abdomen and pelvis that mimic human seat belt interaction
- Legs that respond to impact of dashboard and pedal

### Measurement Capability
Over 100 distinct measurements to help predict injury, including:
- Head acceleration and rotation
- Neck forces and moments
- Ribcage motion at four locations and three dimensions
- Abdomen motion at two locations and three dimensions
- Pelvis, thigh, shin, and ankle forces

### Repeatability & Reproducibility

<table>
<thead>
<tr>
<th>Qualification Tests</th>
<th>24 × 5 × 5 = 600 Qualification Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Modes</td>
<td>5 Test per ATD</td>
</tr>
<tr>
<td>ATD Tests</td>
<td>3 ATDs at VRTC, 1 ATD at 2 other labs</td>
</tr>
<tr>
<td>CRASH Tests</td>
<td>3 Test per Lab</td>
</tr>
<tr>
<td>Crash Tests</td>
<td>3 × 3 = 9 Oblique Crash Tests</td>
</tr>
</tbody>
</table>

\[ CV = \left( \frac{\sigma}{\mu} \right) \times 100\% \]

### Finite Element Model
- Allows virtual crash tests, parametric analyses
- Developed by NHTSA with support from academic and industry partners
- Current work (University of Virginia Center for Applied Biomechanics)
- Updated hardware to current drawing package
- Match response to current qualification specifications
- Improve computational efficiency and stability

### Biofidelity

<table>
<thead>
<tr>
<th>Body Region</th>
<th>THOR-50M</th>
<th>H3-50M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head</td>
<td>Excellent</td>
<td>Poor</td>
</tr>
<tr>
<td>Neck</td>
<td>Good</td>
<td>Poor</td>
</tr>
<tr>
<td>Thorax</td>
<td>Excellent</td>
<td>Good</td>
</tr>
<tr>
<td>Abdomen</td>
<td>Marginal</td>
<td>Marginal</td>
</tr>
</tbody>
</table>
| Knee/Thigh/ 
Hip          | Good     | Poor   |
| Lower Extremity | Good     | Excellent |
| Whole Body  | Good     | Good   |

### Application in NHTSA Research Projects

- Assessing Occupant Protection for Automated Vehicles
- Oblique Restraint Countermeasures

### Enhanced Features
- In-dummy Data Acquisition System (DAS)
- Improved 3D thorax and abdomen measurement

For more information see Docket ID NHTSA-2019-0106 NHTSA Crashworthiness Research - THOR-50M Documentation