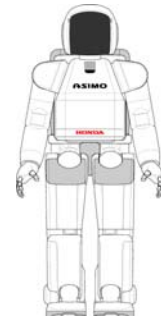


# ASIMO



## Frequently Asked Questions

Basic Facts	
What does the name <i>ASIMO</i> stand for?	<ul style="list-style-type: none"><li>• <i>ASIMO</i> stands for “<u>A</u>dvanced <u>S</u>tep in <u>I</u>nnovative <u>M</u>obility.”</li></ul>
Who created ASIMO?	<ul style="list-style-type: none"><li>• ASIMO was developed by Honda Motor Co., Ltd., a world leader in advanced robotics.</li></ul>
Why was ASIMO developed?	<ul style="list-style-type: none"><li>• ASIMO was created to be a helper to people. ASIMO’s height of four feet (120 centimeters) makes it the perfect size for helping around the house, or to assist a person confined to a bed or a wheelchair. ASIMO’s size also allows it to look directly at an adult sitting in a chair or sitting up in bed.</li></ul>
How long did it take to develop ASIMO?	<ul style="list-style-type: none"><li>• Honda’s development of a humanoid robot began in 1986.</li><li>• The world’s first self-regulating, bipedal (two-legged) humanoid robot, named P2, was completed by Honda in December 1996.</li><li>• P3, the first completely independent, bipedal humanoid walking robot, arrived in September 1997. P3 stood 5’2” tall and weighed 286 pounds (130 kilograms).</li><li>• ASIMO was completed October 31, 2000 and remains the most advanced humanoid robot ever created.</li></ul>
What are ASIMO’s main features?	<ol style="list-style-type: none"><li>1) Lightweight and compact size</li><li>2) Advanced, flexible walking technology</li><li>3) Expansive range of arm movement</li><li>4) Simplified operation</li><li>5) People-friendly design</li></ol>
What is the size and weight of ASIMO?	<ul style="list-style-type: none"><li>• ASIMO stands 4 feet tall (120 centimeters) and weighs 115 pounds (52 kilograms).</li></ul>

<p>What are the main differences between ASIMO and earlier models of Honda's humanoid robots?</p>	<ol style="list-style-type: none"> <li>1) <i>Lightweight and Compactness</i> <ul style="list-style-type: none"> <li>• Redesigned skeletal structure</li> <li>• Reduced frame wall thickness</li> <li>• Specially designed control unit</li> </ul> </li> <li>2) <i>Walking technology</i> <ul style="list-style-type: none"> <li>• The use of intelligent Real-Time Flexible walking technology permits continuous walking while changing directions, and high stability in response to sudden movement.</li> </ul> </li> <li>3) <i>Expanded range of arm movement</i> <ul style="list-style-type: none"> <li>• By raising ASIMO's shoulder joint 20 degrees, elbow height can be raised to 105 degrees for performing a wide range of jobs. With P3, elbow height was limited to 90 degrees.</li> </ul> </li> <li>4) <i>Simplified operation</i> <ul style="list-style-type: none"> <li>• In addition to a wireless laptop computer, a new wireless portable computer controller can be used for flexible walking operation and for gesticulations via button operation. Operation has been simplified and is now much more direct, and ASIMO can be easily and fully controlled by a single operator.</li> </ul> </li> </ol>
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**Walking Technology**

<p>How does ASIMO walk?</p>	<ul style="list-style-type: none"> <li>• ASIMO walks by "prediction movement control," that is, predicting the next move and shifting the center of gravity accordingly.</li> <li>• Unlike an earlier version called P3, which had to stop temporarily between changes of direction, ASIMO can change direction smoothly while walking. ASIMO is very stable even when moving suddenly. Stored walking patterns for start/acceleration, steady speed, deceleration, stopping and turning are combined to achieve smooth walking.</li> <li>• ASIMO turns smoothly without pausing. Walking patterns are generated in real time, and foot placement locations and turning are carried out while walking smoothly in any direction.</li> </ul>
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Can ASIMO walk on slopes or walk backwards?	<ul style="list-style-type: none"> <li>• Yes. ASIMO was designed to operate in a human environment. Currently, ASIMO can easily navigate a slope up to 30 degrees in maximum incline or decline.</li> </ul>
Can it walk up and down stairs?	<ul style="list-style-type: none"> <li>• Yes, ASIMO is the world's only humanoid robot that can ascend and descend stairs independently.</li> </ul>
Can ASIMO navigate stairs of different sizes?	<ul style="list-style-type: none"> <li>• With the rise and run of a staircase stored in its internal memory, ASIMO can easily navigate stairs of varying sizes and numbers of steps. Honda engineers are working on technologies to allow ASIMO to use its onboard cameras to independently measure the rise and run of a staircase for increased ease and flexibility of operation.</li> </ul>
Does ASIMO ever fall over when walking, and can it stand up by itself?	<ul style="list-style-type: none"> <li>• ASIMO can maintain balance while walking on uneven surfaces and slopes, and can also maintain balance when pushed or impacted to a certain degree. If pushed strongly enough, however, ASIMO could fall over. But because it is so light and compact, damage would be minimal.</li> <li>• ASIMO cannot get back on its feet by itself. Honda engineers are currently working on this capability.</li> </ul>
How fast can ASIMO walk?	<ul style="list-style-type: none"> <li>• ASIMO's walking speed is presently set at one mile per hour (1.6 km/h), although a special experimental version of ASIMO has achieved speeds as high as two miles per hour (3.2 km/h).</li> </ul>
Does ASIMO need to move its arms to maintain balance while walking?	<ul style="list-style-type: none"> <li>• It is not necessary for ASIMO to move its arms for balance if walking at a speed of one mile per hour or less. If ASIMO's walking speed were to increase, arm movements may become necessary to maintain smooth walking.</li> </ul>
<b>Structure</b>	
What powers ASIMO?	<ul style="list-style-type: none"> <li>• ASIMO is powered by a 40V nickel metal hydride battery.</li> <li>• ASIMO can operate for approximately 30 minutes on a single battery.</li> <li>• Four hours are required to completely recharge ASIMO's battery, though the battery can be easily changed so</li> </ul>

	<p>ASIMO can continue to operate on a fresh battery.</p> <ul style="list-style-type: none"> <li>At around 17 pounds (7.7 kg), ASIMO's battery is its single heaviest component. By placing the battery in ASIMO's midsection, the robot's center of gravity can be more easily maintained while walking and turning.</li> </ul>
How many cameras does ASIMO have?	<ul style="list-style-type: none"> <li>ASIMO is equipped with two cameras in its head. These camera "eyes" allow ASIMO and its operator to view the surrounding environment. These cameras also allow ASIMO to independently recognize unique faces that have been stored in its memory and to accurately judge distance from objects by using mathematical formulas and the stereoscopic nature of the cameras. ASIMO also has a camera mounted in its torso used to view markers on the floor and on stairs. These markers help ASIMO determine its relative position within its environment.</li> </ul>
How many motors are used in ASIMO?	<ul style="list-style-type: none"> <li>ASIMO is equipped with 26 separate servomotors. ASIMO uses two kinds of servomotors – DC motors and DC brushless motors.</li> </ul>
How many joints does ASIMO have?	<ul style="list-style-type: none"> <li>Because the word "joint" has a slightly different meaning for robots than for humans, the term "Degrees of Freedom" (DOF) is used instead.</li> </ul> <p><b>Head</b></p> <ul style="list-style-type: none"> <li>Rotation, Up/Down (nodding) = 2 DOF</li> </ul> <p><b>Arm</b></p> <ul style="list-style-type: none"> <li>Shoulder: Forward/Backward, Left/Right, Rotation = 3 DOF</li> <li>Elbow: Forward/Backward = 1 DOF</li> <li>Wrist: Rotation = 1 DOF</li> <li>Hand: Grasping = 1 DOF (not counting the joints for the 5 bending fingers)</li> </ul> <p><b>Leg</b></p> <ul style="list-style-type: none"> <li>Groin: Rotation, Forward/Backward, Left/Right = 3 DOF</li> <li>Knee: Forward/Backward = 1 DOF</li> </ul>

	<ul style="list-style-type: none"> <li>• Foot: Forward/Backward, Left/Right = 2 DOF</li> </ul> <p><b>Total</b></p> <ul style="list-style-type: none"> <li>• Head (2) + Arms &amp; Hands (6 x 2 = 12) + Legs (6 x 2 = 12) = 26 DOF</li> </ul>
<b>Technology</b>	
How is ASIMO controlled?	<ul style="list-style-type: none"> <li>• ASIMO is controlled by a laptop computer or by a portable computer controller unit through a wireless network system. This permits more direct and flexible operation. A single operator can easily and fully control ASIMO's movements.</li> </ul>
Can ASIMO also be controlled by voice commands?	<ul style="list-style-type: none"> <li>• ASIMO can comprehend and carry out tasks based on simple voice commands given in English that have been preprogrammed into its onboard memory. The number of commands that can be programmed is basically unlimited. Individual voices can also be registered to increase the performance of the voice recognition function.</li> </ul>
How intelligent is ASIMO?	<ul style="list-style-type: none"> <li>• ASIMO's intelligence lies in the technologies with which it is equipped, not in the ability to think or reason as a human.</li> </ul>
What are some recent technological developments with the robot?	<ul style="list-style-type: none"> <li>• The most recent technological attributes being added to ASIMO are voice recognition and visual recognition capabilities.</li> <li>• Voice recognition enables ASIMO to respond to simple voice commands.</li> <li>• Visual recognition enables ASIMO to recall the face of a select number of individuals.</li> <li>• ASIMO can independently map its environment using its camera "eyes" and register stationary obstacles. ASIMO can store this data in an onboard map of its environment, then recall this data while walking in order to avoid these obstacles.</li> <li>• ASIMO can also recognize moving pedestrians in its walking path and stop momentarily until these persons have</li> </ul>

	cleared the robot's path.
What new developments do you see for ASIMO in the future?	<ul style="list-style-type: none"> <li>• A team of Honda engineers is dedicated to the continued advancement of ASIMO and humanoid robotics.</li> <li>• At this time, we cannot comment on future projects or capabilities.</li> </ul>
<b>Applications</b>	
What is the current use for ASIMO in the United States?	<ul style="list-style-type: none"> <li>• The only application of ASIMO in the United States at this time is the "ASIMO Technology Circuit," a traveling presentation about humanoid robotics designed to educate university students and the general public.</li> </ul>
What is ASIMO going to be used for in the future?	<ul style="list-style-type: none"> <li>• ASIMO was created to be a helper to people in need.</li> <li>• While the robot is not yet ready for any specific applications of this kind, development is headed in this positive direction.</li> </ul>
When will ASIMO be available for sale to the U.S. consumer?	<ul style="list-style-type: none"> <li>• There are no plans at the current time to introduce ASIMO for sale or lease in the U.S.</li> </ul>
What purpose does ASIMO serve in Japan?	<ul style="list-style-type: none"> <li>• In Japan, ASIMO works as a guide in science museums and is being used by a few high-tech companies to welcome guests to their facilities.</li> </ul>
Will ASIMO ever be used in a military application? How about space or under water?	<ul style="list-style-type: none"> <li>• ASIMO will not be employed for any military purpose.</li> <li>• The current version of ASIMO was not designed to be used in a weightless environment such as outer space or in an under water environment.</li> </ul>
<b>Question of the Hour</b>	
Is ASIMO a "he," or "she," or an "it?"	<ul style="list-style-type: none"> <li>• ASIMO is a humanoid robot, but still a robot.</li> <li>• It is most appropriate for ASIMO to be referred to as an "it," or simply as "ASIMO."</li> </ul>