Welcome to LEGOLAND Florida Resort!

**Education Programs:** AstroBot was developed by the LEGOLAND Education Department. For information on LEGOLAND Education programs, visit [http://florida.legoland.com/education](http://florida.legoland.com/education)

**Directions:** LEGOLAND® Florida Resort is located in Winter Haven, just 45 minutes south of the Orlando theme parks. From Orlando take 1-4 west to exit 55 (U.S. Hwy 27 South). Turn right off U.S. Highway 27 at State Road 540/Cypress Gardens Boulevard. Park is 4 miles on the left.

Just 45 minutes from downtown Tampa. From Tampa take 1-4 EAST to Exit 27 (Polk County Parkway). Exit Winter Haven (2nd Toll Booth) at S.R. 540 and follow eight miles to Hwy 17 North. Take Hwy 17 North two miles over the bridge to first light and turn right. Follow the signs to LEGOLAND Florida Resort.

**Arrival and Entry:**
Please arrive 30 minutes before your program. Teachers must be present during the 45-minute instructional program. Please report to the Imagination Zone Area 10 minutes prior to your program. Teachers must be present during the 45-minute program.

**Lunches:**
School groups may bring lunches in disposable containers or may bring coolers that may be stored at the Imagination Pavilion located near the Imagination Zone beside the Pirate Ski Stadium.

**Safety:**
LEGOLAND Parks are built to the highest standards of quality and safety. Height restrictions apply on selected attractions throughout the park.

**Hands on Investigations:**
The hands on activity which is located in the Imagination Zone of the park, is available on a first come, first serve basis. It is not guaranteed unless you reserve an instructional class. Self-guided programs are not guaranteed these activities. Please ask a model citizen in the Imagination Zone if this activity is available.
Background Information

How Does NASA Use Rockets?
Early NASA missions used rockets built by the military. Alan Shepard was the first American in space. He flew on the U.S. Army's Redstone rocket. John Glenn was the first American in orbit. He flew on an Atlas rocket. NASA's Gemini missions used the Titan II rocket. The first rockets NASA built to launch astronauts were the Saturn I, the Saturn IB and the Saturn V. These rockets were used for the Apollo missions. The Apollo missions sent men to the moon. A Saturn V also launched the Skylab space station. The space shuttle uses rocket engines. NASA uses rockets to launch satellites. It also uses rockets to send probes to other worlds. These rockets include the Atlas V, the Delta II, the Pegasus and Taurus. NASA uses smaller "sounding rockets" for scientific research. These rockets go up and come back down. They do not fly into orbit.

Photos - Left: Space Rocket Launch Center: Space Shuttle in Orbit Right: Satellite in Space

How Will NASA Use Rockets in the Future?
New rockets are being developed today. They will launch astronauts on future missions. The new rockets will not look like the space shuttle. These rockets will look more like earlier ones. They will be tall and round and thin. These rockets will take astronauts into space. They will take supplies to the International Space Station. NASA also is working on a powerful new rocket called a heavy lift vehicle. This rocket will be able to take big loads into space. Together, these new rockets will make it possible to explore other worlds. Someday they may send humans to Mars.

How long has NASA been using the Space Shuttle and what are they used for?
The U.S. Space Shuttle Columbia completed its first mission in April 1981 and made several successive flights. It was followed by the Challenger, which made its first mission in April 1983. There after there have been many successful flights in a number of different shuttles. The Shuttle Program is one of NASA's most exciting endeavors. Through the work done by astronauts during these shuttle missions scientists learn the effects of weightlessness on humans, they learn how to make better equipment, they develop invaluable medical, and technological advances, and they set the stage for future exploration.

Why Are Satellites Important?
The bird's-eye view that satellites have allows them to see large areas of Earth at one time. This ability means satellites can collect more data, more quickly, than instruments on the ground. Satellites also can see into space better than telescopes at Earth's surface. That's because satellites fly above the clouds, dust and molecules in the atmosphere that can block the view from ground level. Before satellites, TV signals didn't go very far. TV signals only travel in straight lines. So they would quickly trail off into space instead of following Earth's curve. Sometimes mountains or tall buildings would block them. Phone calls to faraway places were also a problem. Setting up telephone wires over long distances or underwater is difficult and costs a lot. With satellites, TV signals and phone calls are sent upward to a satellite. Then, almost instantly, the satellite can send them back down to different locations on Earth.
Before and After Visit: Applied Robotics at LEGOLAND Florida

**Structural engineering:**
Some of the LEGO models you see at LEGOLAND Florida have internal bracing to support the weight of the model, just like you would in full scale buildings. We also use steel internal frames to support the weight of some of our large models. See picture labeled “Dino Steel Frame” & “Fire hose Dino” to look at the plans for the Big red Dino located at the park opening right behind the turnstiles.

**Mechanical Engineering:**
We use various methods of mechanical engineering to make the models move. See the picture below to look at some of our Pneumatic actuators (arms that move by air) that move the dragon head in the Castle located in LEGO Kingdoms.

**Electrical Engineering:**
We use a lot of electrical components to operate or control our animation systems. We have units called show controllers that operate PLC’s (Programmable Logic Circuits), which sends electrical signals to the solenoid valves (see picture below) to control the air actuators that make the models move. In Miniland, we use Servo motors to operate the cars that drive around on a wireless track being controlled by a wire that is imbedded in the road. The car gets the signal through an RF (Radio Frequency) receiver. The RF signal is broadcasted from the imbedded wire in the ground and the car follows the strongest signal and stays on its path.
LEGOLAND Florida’s spectacular dark ride invites guests to fire laser blasters at targets and brave the rugged Egyptian landscape in all-terrain roadsters, while attempting to unearth the vast treasures of a forgotten empire.

**Robots in the Lost Kingdom Adventure ride:**
- Lost Kingdom Adventure has robotic animations, also known as animatronics.
- Some of the models in the ride are animated and are larger scale representations of the LEGO mini-figure.
- The models are pneumatically driven, meaning they use the power of air, along with some electronic control to actually move.

**Sensors in the Lost Kingdom Adventure ride:**
- There are two main types of sensors that are used in this ride. The first is the target that is shot at by the guest using the laser blaster. This sensor has a numeric value and contributes to the overall score for the guest. Some of these sensors also trigger select robotics to move.
- The other sensor is one that identifies the presence of the ride vehicle and triggers, or starts, a “show” element to the ride, where a robotic figure moves and/or speaks to the guests.

**How many robots can you find on the Lost Kingdom Adventure ride?**

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Hands on Activity

AstroBot at LEGOLAND Florida

Go on a mission to find golden treasures with the LEGO® MINDSTORMS™ EV3 Robots! Complete missions near a Space Research Station like recovering our satellite and launching the space rocket to the planet Mars.

Students work in pairs with a robot, attachments, and computer loaded with the AstroBot software.

Each pair plans a strategy to complete the robotic tasks needed to program robots in outer space.

Students use the icon-based program to set up their robot’s actions, then test it on the “space research station” table.

Students modify their program based on the results, until they successfully complete one or more missions. They have a chance to demonstrate their strategy to the group.

Check out the Robots Body:

- Find the EV3 program brick, a tiny microcomputer that acts like the robot’s “brain.”
- Find the Infrared window, which receives instructions for action.
- Find the Gyro sensor, programmed to conduct precise turning.
- Choose a motorized attachment which can help you with a specific challenge.

Create a program on the screen:

- Click and drag the commands to go forward, backward, left, right and finish off with a victory dance!
About AstroBot

Educational Objectives

• Explore computer programming with motors and sensors to complete tasks with a robot.
• Predict and investigate how different strategies affect a robot’s performance.
• Learn to use different types of motors with different attachments
• Relate the Hands-On investigations to the experience of LEGOLAND attractions.

Florida’s State Standards

Benchmarks Associated with AstroBot

GRADE FOUR

_Earth and Space Science / Big Idea 5: Earth in Space and Time_

SC.4.E.5.5 Investigate and report the effects of space research and exploration on the economy and culture of Florida.

_Nature of Science / Big Idea 1: The Practice of Science_

SC.4.N.1.1 Raise questions about the natural world, use appropriate reference materials that support understanding to obtain information (identifying the source), conduct both individual and team investigations through free exploration and systematic investigations, and generate appropriate explanations based on those explorations.

SC.4.N.1.2 Compare the observations made by different groups using multiple tools and seek reasons to explain the differences across groups.

SC.4.N.1.3 Explain that science does not always follow a rigidly defined method but that science does involve the use of observations and empirical evidence (“the scientific method”).

SC.4.N.1.5 Compare the methods and results of investigations done by other classmates.

SC.4.N.1.8 Recognize that science involves creativity in designing experiments.

_Nature of Science / Big Idea 3: The Role of Theories, Laws, Hypotheses, and Models_

SC.4.N.3.1 Explain that models can be three dimensional, two dimensional, an explanation in your mind, or a computer model.

_Measurement and Data / Cluster 1: Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit._

MAFS.4.MD.1.1 Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table.

_Measurement and Data / Cluster 3: Geometric measurement: understand concepts of angle and measure angles._

MAFS.4.MD.3.6 Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure.

MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.

MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.

MAFS.K12.MP.4.1 Model with mathematics
Florida State Standards continued...

Benchmarks Associated with AstroBot

GRADE FIVE

Earth and Space Science / Big Idea 5: Earth in Space and Time

SC.5.E.5.2 Recognize the major common characteristics of all planets and compare/contrast the properties of inner and outer planets.

SC.5.E.5.3 Distinguish among the following objects of the Solar System -- Sun, planets, moons, asteroids, comets -- and identify Earth’s position in it.

Nature of Science / Big Idea 1: The Practice of Science

SC.5.N.1.1 Define a problem, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types such as: systematic observations, experiments requiring the identification of variables, collecting and organizing data, interpreting data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.

SC.5.N.1.3 Recognize and explain the need for repeated experimental trials.

SC.5.N.1.5 Recognize and explain that authentic scientific investigation frequently does not parallel the steps of “the scientific method.”

Nature of Science / Big Idea 2: The Characteristics of Scientific Knowledge

SC.5.N.2.1 Recognize and explain that science is grounded in empirical observations that are testable; explanation must always be linked with evidence.

SC.5.N.2.2 Recognize and explain that when scientific investigations are carried out, the evidence produced by those investigations should be replicable by others.

Measurement and Data / Cluster 1: Convert like measurement units within a given measurement system.

MAFS.5.MD.1.1 Convert among different-sized standard measurement units (i.e., km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec) within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real-world problems.

MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.

MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.

MAFS.K12.MP.4.1 Model with mathematics

GRADE SIX

Nature of Science / Big Idea 1: The Practice of Science

SC.6.N.1.4 Discuss, compare, and negotiate methods used, results obtained, and explanations among groups of students conducting the same investigation.

SC.6.N.1.5 Recognize that science involves creativity, not just in designing experiments, but also in creating explanations that fit evidence.

Nature of Science / Big Idea 2: The Characteristics of Scientific Knowledge

SC.6.N.2.2 Explain that scientific knowledge is durable because it is open to change as new evidence or interpretations are encountered.

Geometry / Cluster 1: Solve real-world and mathematical problems involving area, surface area, and volume.

MAFS.6.G.1.1 Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.

MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.

MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.

MAFS.K12.MP.4.1 Model with mathematics