STEM Club Challenge 3

Design, build, animate, and derive a final cost of materials for a Rising, Tilting, Centrifugal Force Ride similar to “Der Wirbelwind” Swing Ride at Busch Gardens Williamsburg.

Centrifugal Force

When something is going straight, it always keeps going straight unless something else stops it or turns it. If it can't go straight, then it goes as straight as it can. So when you hit a tetherball, it tries to go straight away from you. But the rope pulls on it and keeps the tetherball from going straight. So the tetherball goes as straight as it can - around the pole in a circle. That's centrifugal force - the energy of something trying to go straight even though it can't.

The Earth is also affected by centrifugal force. It is moving, so it tries to keep moving in a straight line. But the gravity of theSun pulls the Earth toward it, just as the rope pulls the tetherball. Gravity can't pull the Earth into the Sun, because the Earth keeps trying to go straight. So the Earth takes a middle road, going in a circle around the Sun. *Exerpt taken from*

http://quatr.us/physics/machines/centrifugalforce.htm

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Ride Animations:

"The Swashbuckler" Six Flags Magic Mountain

The ride in its dormant state must be low enough for the riders to easily enter and seat themselves. The ride must then lift the riders from the ground to prevent injury when the rotations start.

"The Texas SkyScreamer" at Six Flags Over Texas allows up to twenty-four riders to sit in open-air swings while spinning in a 124-foot circle at speeds up to 35mph, 400 feet above the ground.

Read more: http://www.dailymail.co.uk/news/article-2331066/Six-Flags-Over-Texas-Amusement-Park-Worlds-highest-swing-ride-opens-taking-thrill-seekers-400-FEET-air.html#ixzz3yZQDu12x
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Once the ride achieves its full height and commences its rotations, the rotating carriage must tilt to add extra excitement for the riders.

When the ride has finished, total duration between 2 minutes 30 seconds and 3 minutes, the ride must level, gradually stop rotating and lower to the ground to allow the riders to exit.

Considerations:

Support of the entire ride is critical which includes the motor/servo mounts. The ride must maintain a balanced appearance even though weight will shift when the rotating carriage is tilted. The center support is critical to the success of this ride.

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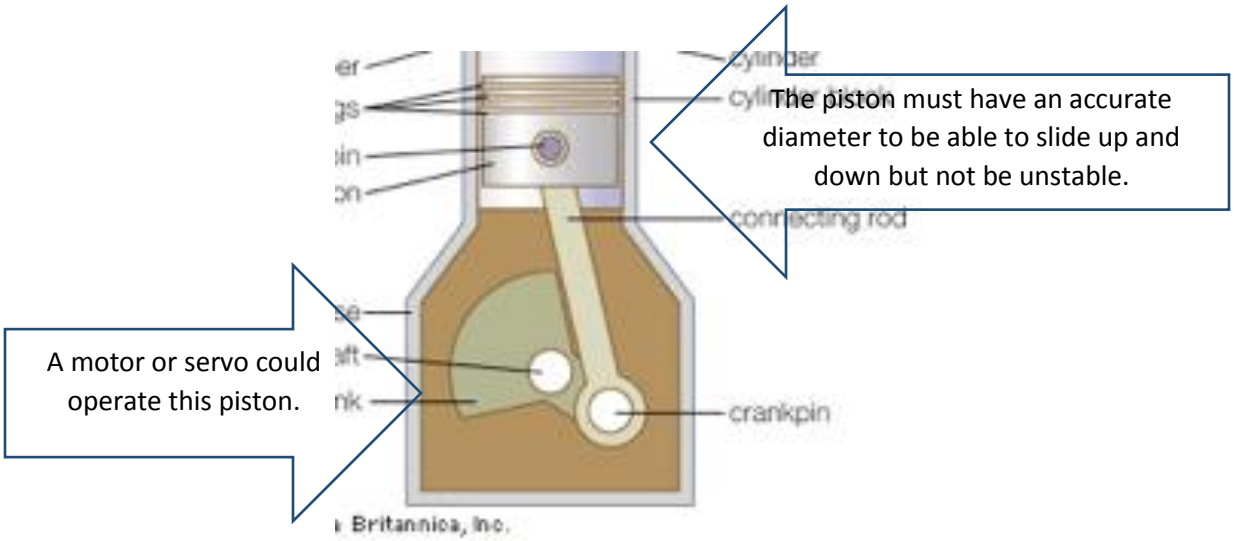
The lift process could be achieved using a piston approach like that of an automobile engine but, we are open to other approaches.



Capacity Requirements:

Ride must accommodate no less than 12 riders.

Light Requirements:

Due to the height of this ride when lifted, stationary blinking lights must be at the highest point due to air traffic concerns.

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Sound Requirements: Ride must have a musical component that will entice young adult riders with music programmed to correspond with the ride operation.

Size of Model:

The ride model, without the que area (the area where riders line up and wait to get on the ride), must not exceed a 20 inch by 20 inch footprint.

The center post must have a diameter that is 6 inches or less.

The height of the model has no restrictions but, when the ride commences, the riders must be lifted a minimum of 2 inches.

Planning:

Due to the complexity of this model, supplies for construction will not be provided until plans are prepared for the appearance, operation, and programming of this ride. Once basic plans are drawn, roles assigned (job foreman, construction specialists, programmer, and aesthetic designer), and plans are signed-off by Mrs. D, Mr. B, or Mr. W, you may start construction. To help with your planning we have

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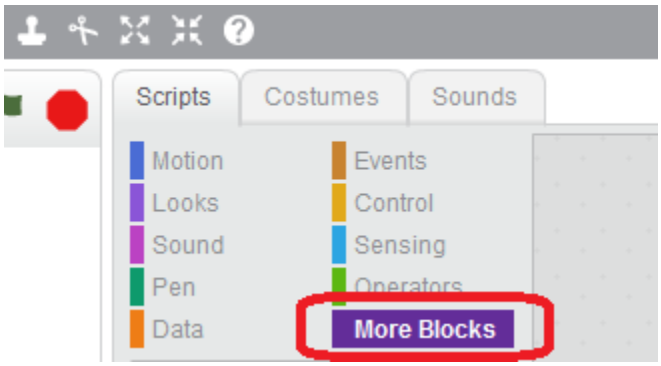
provided Design Planners for you draw on and a Role Roster to assign responsibilities with.

Programming:

Due to the complexity of this challenge and the need to have more than one function occurring at the same time it is recommended that you use the Scratch platform.

Launching Scratch with Hummingbird

1. Plug in a Hummingbird.
2. Start the BirdBrain Robot Server helper application.(This is located on your desktop.)
3. Start Scratch 2.0 by pressing the **Open Scratch** button on the BirdBrain Robot Server. In Windows/Mac, the Hummingbird Scratch blocks should be pre-loaded under the **More Blocks** category:



Hummingbird Block Descriptions

Motor Commands

- **HB servo:** Sets servos 1 through 4 to a value from 0 to 180 degrees.
- **HB motor:** Sets motor port 1 or 2 to a value from -100 to 100.
- **HB vibration.** Sets vibration motor 1 or 2 to an intensity value from 0 to 100.

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LED Commands

- **HB LED:** Sets the intensity of light on a single color LED on ports 1 through 4. Intensity ranges from 0 to 100.
- **HB triLED R G B:** Sets the full color LED at port 1 or 2. The R, G, and B arguments control the intensity of the red, green, and blue elements in the tri-color LED. Range is 0 to 100 for each color.

Sensors

All sensing commands allow the user to specify a number corresponding to the port the sensor is on. For example, a distance sensor on port three would be read by Hummingbird distance on port 3.

- **HB temperature:** Returns the value in Celcius of a temperature probe.
- **HB sound:** Returns the value of a sound sensor, range is 0 to ~100.
- **HB rotary:** Returns the value of the hummingbird's knob; range is 0 to 100.
- **HB light sensor:** Returns the value of a light sensor, range is 0 to 100.
- **HB distance sensor:** Returns the distance to an object from a distance sensor in centimeters. The range is 8 to 80 cm with the kit's range sensor (a value greater than 60 cm should be considered as not seeing an object).
- **HB voltage:** Returns the raw analog voltage reading at the sensor port, range is 0.00 to 5.00.

Speak Block

The "speak" block will cause the computer to say whatever text is placed in the box.

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Supply Tracking and Total Cost Calculations

ITEM	TALLY	TOTAL USED x	Real Cost per Item	Total Cost per Category
Hot Glue Sticks			$550.00	
Craft Sticks			$225.00	
Construction Paper (full sheets used)			$75.00	
Pipe Cleaners			$30.00	
PomPoms (each)			$65.00	
Googley Eyes (x2)			$82.00	
Pencil			$137.00	
Hemp String/wire (1 foot)			$43.50	
Plastic String (1 foot)			$38.00	
Duct Tape (1 foot)			$275.00	
Scotch Tape (1 foot)			$115.00	
Zip Tie			$143.25	
Styrofoam Ball			$87.30	
Toilet Paper Roll			$295.00	
Cardboard (by approx. square foot			$1,295.00	
Servo			$2,568.00	

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Swing Ride Design

Group Number: _____

Motor			$4,875.00	
LED light			$750.00	
TriColored LED light			$750.00	
Vibration Motor			$423.00	
Sensor (Due to the energy savings that sensors provide a credit shall be given for each sensor used.)			CREDIT $-5,000.00	
			Total for Ride	

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CATEGORY	4	3	2	1
Completion	The entire project is complete.	Most of the project is complete.	Half of the project is complete.	Less than half of the project is complete.
Measurements	In the dormant (ride not running) position, the ride model does not exceed the 20 inch by 20 inch footprint. (400 square inches)	In the dormant (ride not running) position, the ride mode slightly exceeds the 20nch by 20 inch footprint. (400 square inches)	In the dormant (ride not running) position, the ride model exceeds an 24 inch by 24 inch footprint. (More than 576 square inches)	In the dormant (ride not running) position, the ride model exceeds an 28 inch by 28 inch footprint (More than 784 square inches)
Lift Requirement	When ride operation commences the swings are lifted at least two inches above their starting position.	When ride operation commences the swings are lifted at least one inch above their starting position.	When ride operation commences the swings are lifted at least ½ inch above their starting position.	The ride is currently unable to lift.
Tilt Requirement	When ride is fully elevated, the ride carriage will tilt achieving at least a one inch difference between the high and low side.	When ride is fully elevated, the ride carriage will tilt achieving at least ¾ inch difference between the high and low side.	When ride is fully elevated, the ride carriage will tilt achieving at least a ½ inch difference between the high and low side.	The ride is currently unable to tilt when fully elevated.
Light Requirement	Blinking Light attached to highest point of ride. Operates even when ride is in dormant state.	Blinking Light attached to highest point of ride. Only operates when ride is in motion.	Light attached to highest point of ride. Light does not blink.	Lights were not utilized in this model.
Use of Hummingbird Robotics	Robotic accessories used in a proper fashion. More accessories were used than just a motor or a servo.	Robotic accessories used in a proper fashion. Accessories used were just a motor or a servo.	Robotic accessories used in a proper fashion. Programming was done but motors and servos not attached.	Did not have an opportunity to program the robotics.
Design	Ride is well organized and attractive to the eye. All wires, motors, servos, and circuit board are not visible.	Ride is organized and attractive to the eye. Most of the wires, motors, servos, and circuit board are not visible.	Ride is somewhat organized. Many of the wires, motors, servos, and circuit board used are visible.	Ride still in basic construction phase.
Planning Document	Every step was planned and document was completed.	Every step was planned, document was not completed	All steps were not planned and document was partially completed.	No planning was done and document was not utilized

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CATEGORY	4	3	2	1
Use of Music	Music starts when ride commences and ends appropriately. Appropriate type of music used.	Music starts when ride commences but does not end at the appropriate time.. Appropriate type of music used.	Music does not starts when ride commences and does not end at the appropriate time.. Appropriate type of music used.	No attempt to use music was made.
Supply Tracking	All materials including waste was tracked, tallied and totaled on tracking sheet.	Materials were tracked, tallied, and totaled on tracking sheet but waste was not accounted for.	Not all materials were tracked, tallied and totaled on the tracking sheet.	Tracking sheet not utilized.
Total Real-World Cost Calculations	Total real-world cost including waste has been calculated and totaled. Cost was lowest model.	Total real-world cost including waste has been calculated and totaled. Cost was neither the lowest nor highest model.	Total real-world cost including waste has been calculated and totaled. Cost was highest model.	Real-world cost not completely calculated. Information is incomplete.

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"**Swing Project" Team _____**

Phase: Circle one(Construction, Aesthetics, Mechanical, Programming)

Date: _____

Designer Responsible for this drawing/plan.

_____

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