Tower Plane

General

You will build a not very pretty version of a moving part to use in your city model. This is called a Proof of Concept or POC. It gives you experience in working with the materials and connecting the electrical circuits. The version you build for your city model will look much better, but work basically the same.

All of the parts and supplies you need are in your team's brown bag or on the table. **Leave scissors, needle nose pliers, tape and other supplies on the table when you leave the room**. You may want to partially disassemble your moving part so it fits in your pack, or you can just carry it around.

NOTE: The wire connections to the motor are delicate. Short wires called pigtails have been attached to the motor and have also been zip tied to the motor to reduce strain on the connection. When making connections to the motor, attach longer wires to the pigtails with the provided wire nuts. Do not pick up the motor by the wires. When placing or adjusting the wires connected to the motor, hold the wires firmly between when making the connection.

Review the Parts List and Receipt before starting the exercise. (See end of instructions)

***Take the parts out of the bag and arrange them neatly on the table. ***

1. **Wire and Assemble the motor**
   1.1. Extend the pigtails on the motor by using wire nuts to attach the additional long section of wire. Test the connection by touching the ends of the wire extensions to a battery. If motor works the connections are good!
   1.2. Insert axel into the plastic wheel and then insert the other end of the axel into the part of the motor that rotates.

2. **Build the tower assembly**
   2.1. Place "T" Shaped Piece of cardboard on one end of Cardboard Tube. The V-Shaped notch should be located near as close to the center of the tube as possible.
   2.2. Fold cardboard overhangs of the "T" over the edge of the tube and tape the flaps securely to the tube.
   2.3. Place motor onto top of tower. The long wires should be extended through to the other end of the tube. The axel and tire should be centered above the tower. The opposite drive side of the motor will sit in the "V" notch of the cardboard "T".
   2.4. Set the motor in place, taping to the "T". Make sure it is firm and level.

3. **Mount the tower and wire the circuit**
   3.1. Use duct tape to fasten the tower assembly in the upright position to the large cardboard base. **Make sure the long wires pop out through the slit in the bottom of the tube.**
   3.2. Wire the motor to the batteries holder in a series circuit. See schematic diagram. Use wire nuts to connect the wires.
   3.3. Insert the batteries and test the circuit but closing the switch on the battery pack. If the motor does not turn, check all of the wire nut connections. If you cannot find the problem, ask one of the engineers for assistance.

4. **Final Assembly**
   4.1. Layout the wires in an orderly manner on the cardboard base and fasten them with tape.
   4.2. Create a loop in one end of the metal wire and fasten it to the top of the wheel assembly with tape and twisting as necessary.
   4.3. Cut out the outline of a flying vehicle from the outlines supplied or make up your own shape. Fasten to the end of the wire with a small piece of tape.

4.4. Straighten out the metal wire and make sure it extends out in a horizontal or above position.
4.5. Turn on the motor and watch the plane circle the tower.

5. Things to experiment with and make the part better

5.1. Build a more realistic looking plane. Perhaps a 3d printed futuristic quadcopter.
5.2. Use a different type of wire to connect the plane to the motor. Make it less visible by painting it black or a color that blends with the back ground of your city.
5.3. Attach the wire to the motor directly (perhaps with a hot glue gun) to the motor so you don't need the wheel and axel.
5.4. Use a building in your city instead of the tube to support the structure.
5.5. Decorate the assembly

Parts List and Receipt for Parts

	Unit Cost	Qty	Cost
AutoEC DC Gear Motor	$3.25	1	$3.25
Wire Connectors	$0.04	5	$0.20
AA Batteries	$0.40	1	$0.40
AMPATH Battery Holders	$0.54	1	$0.54
Wheel and Axel	$1.00	1	$1.00
Binding wire	$0.00	2	$0.00
Cardboard base and top	$0.00	1	$0.00
Cardboard tube (can be a paper towel roll)	$0.00	1	$0.00
Total			$5.86

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