

Tower Plane

General

This is a proof of concept exercise. 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.

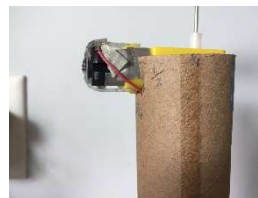
NOTE: The wire connections to the motor are delicate. Short wires called pigtails have been attached to the motor and have also been taped to the motor to reduce strain on the connection. When making connections to the motor, attach longer wires to the pigtails with wire nuts. Do not pick up the motor by the wires. When placing or adjusting the wires connected to the motor, hold the wires firmly between where you are adjusting them and the connection. You can press on the tape on the motor that is reinforcing the connection.

Review the Parts List and Receipt before starting the exercise.

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

1. Build the tower assembly

- 1.1. Cut notches in one end of the paper towel roll so that the motor drops in and is held in place. The motor is about 0.75" wide the protrusion on the other side is about 0.175".
- 1.2. Cut a slit about 0.5" long at the other end of the roll at 90° to the motor
- 1.3. Make sure the motor sits level, you have to shimmy one side up for the motor to be level using tape.
- 1.4. Remove motor and insert axle in the motor and tire
- 1.5. Extend the pigtails on the motor by using wire nuts to attach additional wire. If the extension wires are not color coded the same as the pigtails, mark the red wire by attaching a small piece of tape to the extension. Test the connection by touching the ends of the wire extensions to the battery. If the motor works the connections are good.
- 1.6. Insert axle and wheel into the top of the motor.
- 1.7. Run the wires through the tube
- 1.8. Set the motor in place and make sure it is firm.
- 1.9. Bring the wires out through the slit in the bottom



2. Mount the tower and wire the circuit

- 2.1. Use duct tape to fasten the tower assembly in the upright position to the large cardboard base
- 2.2. Wire the motor, batteries and switch in a series circuit. See schematic diagram. Use wire nuts to connect the wires.
- 2.3. Insert the battery and test the circuit. 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.

3. Final Assembly

- 3.1. Layout the wires in an orderly manner on the cardboard base and fasten them with tape.
- 3.2. Create a loop in one end of the copper wire and fasten it to the top of the wheel assembly with tape.
- 3.3. 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.
- 3.4. Straighten out the copper wire and make sure it extends out in a horizontal or above position.
- 3.5. Turn on the motor and watch the plane circle the tower.

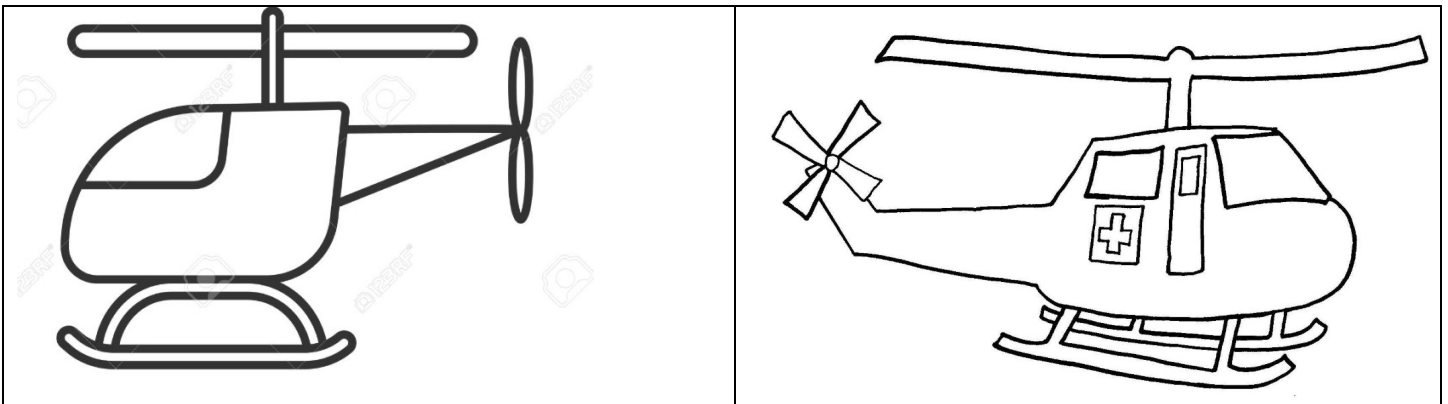
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4. Things to experiment with and make the part better

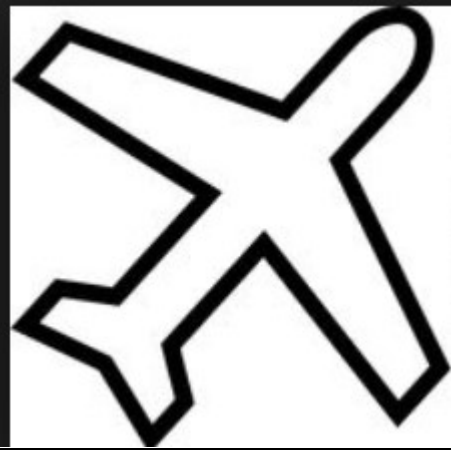
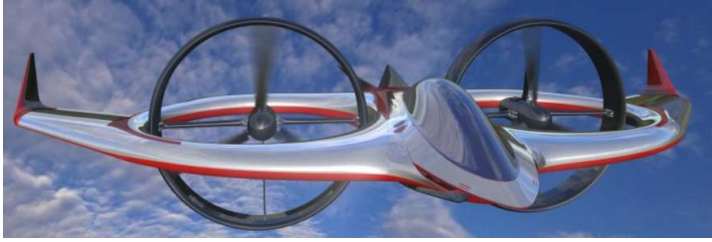
- 4.1. Build a more realistic looking plane. Perhaps a 3d printed futuristic quadcopter.
- 4.2. Use a different type of wire to connect the plane to the motor. Make it less visible by painting it black or a color that blends with the back ground of your city.
- 4.3. Attach the wire to the motor directly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

Parts List and Receipt for Parts

	Unit Cost	Qty	Cost
AutoEC DC Gear Motor	\$3.25	1	\$3.25
Grey Wire Connectors	\$0.04	5	\$0.20
AAA Batteries	\$0.40	1	\$0.40
AMPATH Battery Holders	\$0.54	1	\$0.54
Switch	\$0.47	1	\$0.47
Wheel and Axel	\$1.00	1	\$1.00
Hook up wire and suspension wire	\$0.00	2	\$0.00
Cardboard base	\$0.00	1	\$0.00
Cardboard tube	\$0.00	1	\$0.00
Total			\$5.86



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