

Top Level

**F1** Transform electrical energy to mechanical energy

**C1a** DC motor

Sub-Functions (C1a)

**sF1** Transfer energy from motor to wheels

**sC1a** Direct drive

**sC1b** Gear box

**sC1c** Belt drive

**sC1d** Chain drive

**sC1e** Friction drive

**sC1f** Fan or propellor

**C1b** Explosives

**sF1** Move explosives behind center of mass

**sC1a** Chute of gunpowder with a servo

**sC1b** Gravity fed tube

**sC1c** Small fan

**sF2** Set Off Explosives

**sC2a** Lighter

**sC2b** Primer with pins

**sC2c** Arcing electricity

**C1c** Jet Engine

**sF1** Hold Fuel

**sC1a** Internal gas tank

**sC1b** External gas tank

**sF2** Move fuel to engine

**sC2a** Gravity

**sC2b** Injection

**sC2c** Difference in air pressure

**sF3** Expel fuel

**sC3a** Fan or propellor

**sC3b** Air compressor

**sF4** Light fuel

**sC4a** Pilot light

**sC4b** Arcing electricity

**F2** Detect turns

**C2a** Potentiometer

**sF1** Detect resistance changes

**sC1a** Arduino

**C2b** Accelerometer/gyrometer

**sF1** Detect changes in acceleration/gyration

**sC1a** Arduino

**C2c** Light sensor

**sF1** Detect differences in light reflected from track

**sC1a** Arduino

**C2d** Preset time intervals

**sF1** Wait for preset time interval

**sC1a** Arduino

**C2e** None

**sF1** Go slow enough to not need turn detection

**F3** Turn relative to ground

**C3a** Conical wheels

**sF1** Adjust speed for each wheel to account for difference in distance travelled

**sC1a** Geometry will account

**C3b** Flat wheels

**sF1** Allow for slip

**sC1a** Use material with low coefficient of friction

**C3c** Slip differential

**F4** Move up steep inclines

**C4a** High momentum

**sF1** Quickly accelerate

**sC1a** Lightweight chassis

**sC1b** Gear ratio

**C4b** High torque

**sF1** Increased amounts of friction

**sC1a** Rubberized wheels

**sC1b** Adhesive

**sF2** Sustain torque

**sC2a** Gear ratio

**sC2b** Multiple motors

**C4c** Sticky arms

**sF1** Move along its length

**sC1a** Ratchet

**sC1b** Pulley and motor powered

**sF2** Launch arms forward

**sC2a** Crossbow

**sC2b** Pneumatics

**sC2c** Explosives

**sC2d** Slingshot

**sC2e** Catapult

**F5** Control speed

**C5a** Drum brake

**sF1** Apply pressure to wheels

**sC1a** Servo

**sC1b** Hydraulics

**sC1c** Pneumatics

**C5b** Spike

**sF1** Force spike into ground

**sC1a** Servo motor

**sC1b** Heavy spike with release latch

**sC1c** Shoot spike into ground

**sC1d** Hydraulics

**sC1e** Pneumatics

**C5c** Disk brakes

**sF1** Apply pressure to wheels

**sC1a** Servo

**sC1b** Hydraulics

**sC1c** Pneumatics

**sC1d** Electromagnets

**C5d** Drag based brakes

**sF1** Increase drag coefficient

**sC1a** Flip panels outward

**sC1b** Parachute

**C5e** Electric brake system

**sF1** Transform kinetic energy of motor to electrical/heat energy

**sC1a** Connect motor to storage battery/capacitor (regen braking)

**sC1b** Connect motor to resistor (dynamic braking)

**sC1c** Connect motor to power source in reverse (plug braking)

**F6** Stay aligned with rails

**C6a** Conical wheels

**C6b** Wheels with o-rings and flanges

**C6c** Tank treads

**F7** Contain components

**C7a** Sit in box

**C7b** Drill to plate

**C7c** Adhere to plate

**C7d** Potting

**C7e** Welding

**F8** Connect to cargo carts

**C8a** Screws

**C8b** Rope/wire

**C8c** Links

**C8d** Pins

**C8e** Glue