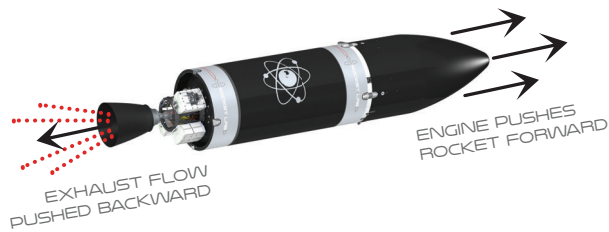


# HOW ARE ROCKETS LAUNCHED?

Have you ever quickly let the air out of a balloon and watched as it flew off around the room? Or how the flapping of its wings allows a bird to fly? Or how a fish using its fins to push water backwards helps it to swim through the water?

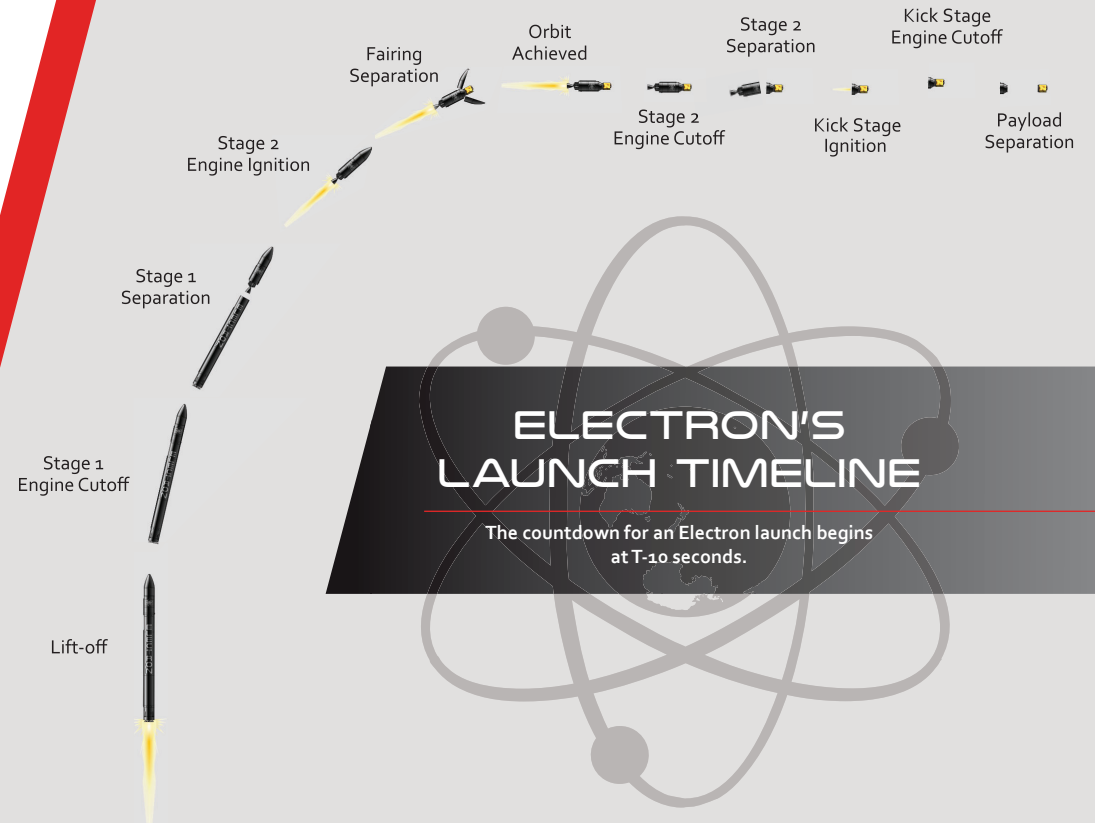
These actions follow the idea that for every action there is an equal and opposite reaction - otherwise called Newton's Third Law of Motion.

## NEWTON'S THIRD LAW / ROCKET ENGINE THRUST



Rocket Lab's Electron rockets work in much the same way. Because of how heavy rockets can be, they need a lot of fuel and very powerful engines to lift their weight off the launch pad. However, when a rocket lights its engines, the force of the rocket engines' exhaust (known as thrust) can push the rocket forward to overcome Earth's gravity. Once the Electron rocket escapes Earth's atmosphere, the force of its thrust helps Electron reach speeds of up to 28,000km an hour!

THE FORCE OF ITS THRUST HELPS ELECTRON REACH SPEEDS OF UP TO 28,000KM AN HOUR!



- 1 At T-2 seconds, the nine Rutherford engines at the bottom of Electron's Stage 1, or booster, ignite and power the rocket towards space. Within 3 minutes, Electron reaches speeds of around 7,000 km per hour!
- 2 Electron's Stage 1 acts like a fuel tank. Once Electron escapes Earth's atmosphere and the engines have burned through all the fuel, Electron doesn't need to carry an empty tank to orbit. At about 70km above Earth, the Rutherford engines on the rocket turn off to allow the rocket to slow down for a couple of seconds before Stage 1 and Stage 2 separate.
- 3 Next, the single Rutherford engine on Stage 2 fires up to continue carrying the satellite to orbit.
- 4 Along the way, the pointy end of the rocket called the fairing will separate and fall away from Stage 2. It has done its job of protecting the satellite during lift-off, and in space it no longer needs that protection.
- 5 Once Stage 2 is close to where the satellite wants to go, it shuts down its engines and separates from Electron's third stage, which is called the Kick Stage. When the Stage 2 engine shuts down, Stage 2 falls back towards Earth. Because it's travelling so fast (up to 27,000km an hour!), it burns up without a trace when it re-enters Earth's atmosphere.
- 6 When the Kick Stage is all that's left of Electron to complete the mission, it starts up its own little engine called Curie to take the satellite exactly where it needs to go in its orbit around the Earth.
- 7 Once the satellite is released, the Kick Stage is designed to restart its engine and propel itself back towards Earth to burn up in the atmosphere - leaving nothing behind in space but the satellite and helping to keep the areas above Earth clear of space junk!
- 8 And there you have it! Mission success for another Electron launch.