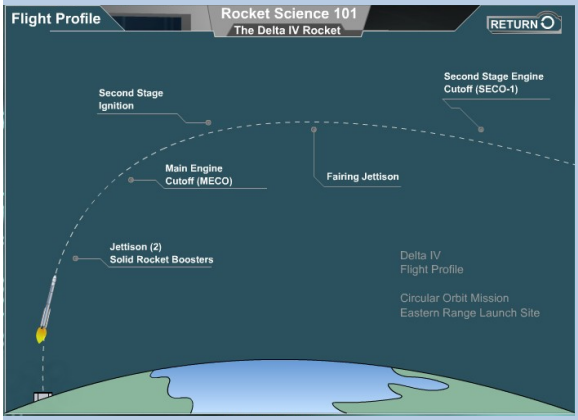
Rockets Factsheet

The flight of a rocket



(Image Credit: NASA)

This screenshot shows the flight profile of a Delta IV Rocket, using NASAs interactive rocket builder, Rocket Science 101. It illustrates the fact that rockets often have multiple stages in order to take a payload into orbit. The first stage of the Delta IV rocket is provided by solid rocket boosters and a liquid fuelled engine. Solid boosters give a large initial thrust and use oxygen in the air to burn. As the rocket reaches the upper atmosphere, liquid oxygen and hydrogen must be used as the propellant since there is very little oxygen left in the atmosphere at this altitude. The second stage also uses liquid hydrogen and oxygen as propellants.

Why multiple stages?

Each stage of the rocket is jettisoned as the fuel is exhausted. As each stage is jettisoned, the mass of the rocket decreases. Conservation of momentum tells us that the smaller the mass we are pushing along, the faster we can make it go:

Mu = mV, or (mass of propellant burnt) x (propellant speed) = (mass of rocket) x (rocket speed)

So by giving the rocket multiple stages, we are making it more fuel efficient. By the time the satellite leaves the second stage, the total mass may be only around 1% of that which it had on the ground.

(Image Credit: NASA)

ACTIVITY

Water rocket kits can be purchased very cheaply (try www.rokit.com). This investigation looks at finding the best water to air ratio to achieve the maximum height. Use a measuring jug to enable you to put markings on your bottle for ¼ , ½ , and ¾ full of water. Try a few launches for each volume to

see which reaches maximum height. Think about how the volume of water affects both the mass of the rocket and the amount of thrust. Try weighing the water and the rocket before filling it up – what percentage of the mass of the rocket is the fuel?