

NEWTON'S 2ND LAW

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Blue Origin, Jeff Bezos' Rocket Company, Passes an In-Flight Escape Test

Blue Origin, the rocket company started by Jeffrey P. Bezos, the billionaire chief executive of Amazon, successfully separated a crew capsule from a rocket after it had lifted off on Wednesday, an important step toward Blue Origin's goal of carrying tourists into space. Before putting anyone on board its spacecraft, the company wants to make sure that its rockets' launch-abort system will carry passengers to safety if anything goes wrong during a flight. "It's like the airbag in your car," Ariane Cornell said as she helped host Blue Origin's webcast of the test. "It provides some peace of mind, but you're only going to use it if there's an emergency." She said it was the first in-flight test of an abort system since those conducted by NASA's Apollo program in the 1960s. The Apollo tests also did not carry any people. Wednesday's launch was the latest for Blue Origin's New Shepard spacecraft, which was designed to take space tourists on a suborbital jaunt across the boundary 62 miles above Earth that is regarded as the edge of outer space. The tourists would see the curvature of the planet and the blackness of space while experiencing a few minutes of floating at the top of the arc. Blue Origin tested the escape system in 2012, but that was while the capsule was resting on a launchpad. This time, the capsule separated in flight, during the most stressful portion of the upward trajectory — 45 seconds after ignition, at an altitude of 16,000 feet, when the rocket was passing the speed of sound and experiencing maximum air pressure. A solid-fuel rocket at the bottom of the crew capsule fired for 1.8 seconds, exerting 70,000 pounds of force to quickly separate the capsule and steer it out of the way of the booster. Its parachutes deployed, and the capsule landed softly.



SINGLE-STAGE SUBORBITAL ROCKET

New Shepard, named after Mercury astronaut and Apollo moonwalker Alan Shepard, is Jeff Bezos' scheme for high-altitude, near-space tourism. A propulsion module (rocket) lobs the crew to an altitude of 307,000 feet (93,573 meters) — well above the height required to earn NASA astronaut wings. The rocket returns to its launch site and lands, while the crew capsule descends on a parachute.

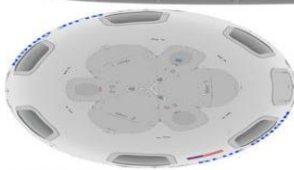
SIX-PERSON CREW CAPSULE

Interior volume: 530 cubic feet (15 cubic meters)

Six large windows for a great view



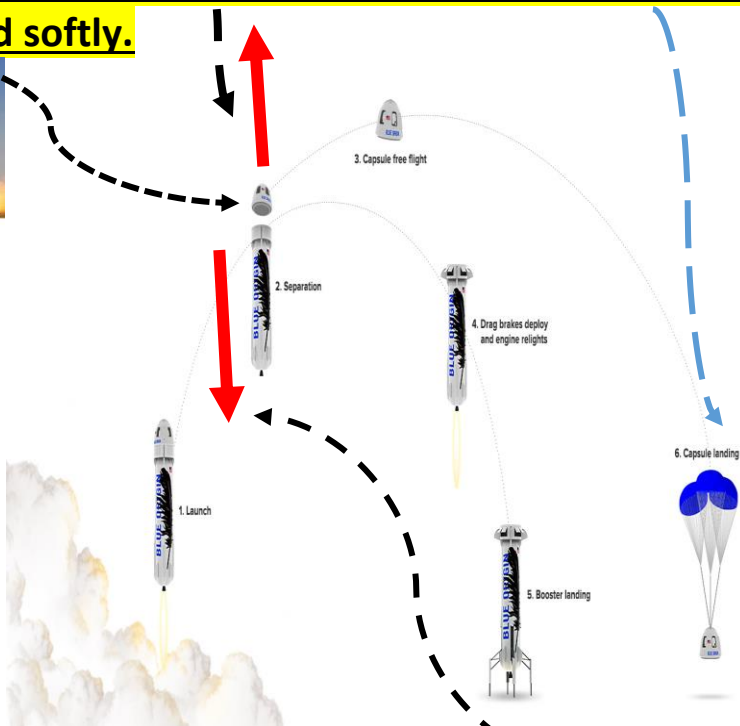
Above: The propulsion module in landed configuration, with a human figure and crew capsule to scale.



Similar to Russia's Soyuz landing, Blue Shepard is slowed by parachutes and cushioned by soft-landing jets.

SOURCE: BLUE ORIGIN

SPACE



INTRODUCTION: The crew capsule and rocket (in middle underneath) has a weight of 17,000 lb.

QUESTIONS: (a) Find mass (in slugs) of crew capsule? , (b) What is net force vertical on crew capsule?

(c) Show the working equation application of Newton's 2nd Law for the forces on this capsule while escaping?,(d) Find acceleration of crew capsule during escape?,(e)Relative to booster rocket, how far away is escaped crew capsule after 1.8 s. rocket firing?

HINTS: weight = m g , g = 32 ft./s.² , F_{NET} = m a , x = v₀t + ½ a t²

ANSWERS: (a) 531.25 slugs , (b) 53,000 lb., (c) 53,000 lb. = (531.25 slugs) a , (d) 99.8 ft./s.² , (e) x = 161.6 ft.