Name: _____ Date: _____

How Mark Rober Builds Things That Fail First

Reading level 10 (6th grade) · 1137 words

Who is Mark Rober, and did he really work for NASA? Yes. Rober is an engineer who worked for nine years, starting in 2004, at the Jet Propulsion Laboratory, a NASA lab. Seven of them went to the Curiosity rover. Today he makes YouTube videos in which he builds a machine, tests it and shows what happened when it failed. This book follows that habit: make it, test it, watch it fail and change it.

In August 2012 Rober posted a video about what it felt like to watch Curiosity land on Mars. He was one of more than 3,000 people who helped build and land it. The rover is about the size of a small SUV. Airbags could not safely land a rover this large. So the landing used a sky crane. A rocket stage lowered the rover on three cords and cut them once the wheels were down.

Rober made his first YouTube video in October 2011, while he still worked at NASA. It showed a Halloween costume made from two iPads, so that it looked as if you could see through his body. Engineering was a habit long before that. As a kid he made goggles to stop his eyes from stinging while he cut onions. A PBS profile says he tinkered with gadgets and built creative contraptions.

In 2017 the Guinness World Records book listed a six-foot foam-dart gun that Rober built. The hard part, Guinness said, was using a paintball pressure tank to shoot a dart made from a pool noodle and a toilet plunger. He spent several weeks on it. The darts flew about 40 miles an hour. Records move, though. Guinness now lists a larger Nerf blaster, 12 feet 6 inches long, built by another maker in 2021.

In July 2017 a news report said Rober had set a Guinness record for the largest Super Soaker. It was seven feet long. It shot water at 243 miles per hour. Rober said the gun had no pump. Instead, pressurized nitrogen pushed water out of a tank in the handle. The pressure was 2,400 psi, a 2018 report said. Rober used it to break wine glasses and cut a watermelon in half. Kinetic energy is the energy of motion, and it grows with the square of speed. Water moving twice as fast hits with four times the energy.

In 2021 Rober's team built a robot named Dom to set up dominoes. Funnels and Connect Four-style slots let it place 300 at a time. A route set ahead of time in its software lets it move across the floor much like a Roomba does. Guinness lists the team's record as 6,141 dominoes set up and toppled by a robot in one hour, on 19 July 2021, in California. By our arithmetic, that is about 102 dominoes every minute. Press reports of a 24-hour run gave totals near 100,000. They do not agree.

In December 2018 Rober posted a video of a decoy package he had spent six months engineering. Reports said he tried different set-ups along the way. The final box used a 3D printer, a custom circuit board, GPS and four phones with cameras. The circuit board was its brain. It also sprayed glitter when it was opened, and that is where the name glitter bomb came from. The video drew 25 million views in one day.

Inside the box, a circuit board had a sensor for motion. It also checked whether the box had left a zone around Rober's house. Then four Android phones woke up and filmed with wide-angle lenses. The phones had data plans and sent their video to the cloud. By our reading, that means the video could be saved even if the box was never seen again. Rober posted an improved version in December 2019 and a third one a year later.

In 2020 Rober built an eight-part obstacle course in his yard to keep squirrels from stealing food from his bird feeders. He filmed the squirrels in secret as they tried each part. Reports said the first part was a ladder bridge, and the squirrels soon found a way to skip it. After just a few days, they had beaten the whole course. Rober said he had underestimated how smart and quick they were.

A year later he tried again with a bigger course. It took about two months to build and had nine parts. It was made to test the squirrels' mental limits and their physical limits. There was a pop-up security doll, a spinning pole and a small helicopter on a zip line. There was a brick wall that moves in and out, a fake laser grid and a vault called Fort Knuts. Each room had a one-way exit door. In the end the squirrels reached the vault.

Rober built a dartboard that moved so that you got a bullseye every time. By one report, cameras tracked the dart and motors moved the board. A video of it appeared in March 2017. His builds usually take two or three months, but this one took about three years. At a TEDx talk in April 2018, he said that at one rehearsal it was barely working. He said he asked, "OK, that sucked, but what did we learn from that?"

That talk gave the idea a name: the Super Mario Effect, which means focusing on the princess and not the pits. Rober also ran an experiment. About 50,000 of his YouTube followers, three million at the time, tried a coding puzzle. Each was randomly given one of two versions. In one, a failed run cost five of 200 starting points. According to a transcript of the talk, about 52 percent of that group solved the puzzle. In the group with no penalty, 68 percent did. People chose to play, so the result describes that group only.

Rober's work has drawn notice outside YouTube. In 2021 the Institution of Engineering and Technology gave him a prize as STEM Personality of the Year. In 2023 he gave the commencement speech at the Massachusetts Institute of Technology. The school's page says he urged graduates to practice optimism combined with dedication. By our reading, those two words fit this book: a trap that went through three versions, two courses that fell to squirrels and a dartboard that took three years.

Look at the builds together. A record gun was passed by a bigger one. A domino robot made a slow job into a long run. A trap went through three versions. Two squirrel courses fell to the squirrels, and the second took two months to build. A dartboard worked, but it took three years instead of three months. Each time, Rober built something, tested it and watched what happened. Even after two months of building, a squirrel reached Fort Knuts.

Questions

1. How long did Rober work at NASA's Jet Propulsion Laboratory?

A. Four years
B. Nine years
C. Seven years

2. Why did the Curiosity landing use a sky crane?

A. Parachutes do not work on Mars
B. The rover had no wheels
C. Airbags could not safely land a rover that large

3. Why does a jet of water at 243 miles per hour hit so hard?

A. Water is heavier than glass
B. Energy of motion grows with the square of speed
C. The gun was seven feet long

4. In the sentence "Then four Android phones woke up and filmed with wide-angle lenses," what does wide-angle most likely mean?

A. Taking pictures of a big area
B. Taking pictures in the dark
C. Taking very sharp pictures

5. What did Rober say about the squirrels after the first course?

A. They were slow
B. He had underestimated them
C. They stayed away

6. What do the squirrel courses and the dartboard have in common?

A. Both were built in one weekend
B. Both won a Guinness record
C. Tests that went badly led to more building

Words to know

rover: Mars vehicle
decoy: bait
sensor: detector

kinetic: of motion
underestimated: guessed too low

Answer key: How Mark Rober Builds Things That Fail First

1. B. Nine years
2. C. Airbags could not safely land a rover that large
3. B. Energy of motion grows with the square of speed
4. A. Taking pictures of a big area
5. B. He had underestimated them
6. C. Tests that went badly led to more building