

With rockets, so many things can and do go wrong

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In this April 8, 2012 file photo, a North Korean soldier stands in front of the country's Unha-3 rocket at a launching site in Tongchang-ri, North Korea. It really is rocket science and it really is hard. North Korea proved that again. The giant explosion that gets a rocket off the ground isn't that complicated. Controlling that reaction and going where you want, when you want - that's where engineers earn their money and ulcers. And it's where past rockets and spaceships have ended in spectacular and sometimes deadly failures. (AP Photo/David Guttenfelder, File)

(AP) -- It really is rocket science and it really is hard. North Korea proved that again.

The giant explosion that gets a [rocket](#) off the ground isn't that complicated. The superhot, superfast exhaust from that giant fire is funneled in a way that shoots the rocket upward. North Korea's Unha-3

rocket combines two liquid propellants - [hydrazine](#) and nitric acid - that ignite when mixed, space experts say.

That's the easy part.

Controlling that reaction and going where you want, when you want - that's where engineers earn their money and ulcers. And it's where past rockets and spaceships have ended in spectacular and sometimes deadly failures.

"Anybody can make something go boom. Controlling it is hard," said former NASA associate administrator Scott Pace, director of [space policy](#) at George Washington University.

All that power has to be confined by metal and controlled by electronics. It takes the power of about a ton of TNT just to get 60 pounds into orbit at almost 18,000 mph. One tiny mistake, one mismatch in devices, one miscommunication, one bubble, and boom.

In 1986, the fiery power of the space shuttle Challenger burned through an O-ring seal and seven astronauts died.

Other control problems have doomed spaceships. Aerodynamics - keeping the pointy end straight up - is key. If a rocket veers too much it just breaks apart, said Jonathan McDowell of Harvard University.

New countries launching rockets generally fail half the time, he said. John Glenn recalled how NASA's first astronauts watched in horror as an Atlas rocket blew up in front of them. More recently, private U.S. company SpaceX failed on its first three Falcon 1 launch attempts before finally succeeding twice. Even the normally reliable Russians couldn't get a rocket to Mars last fall because of a post-launch failure that ended up with the spaceship on board falling back to Earth.

What doomed the North Korea rocket minutes after launch Friday isn't yet known.

Failure often comes from not putting things together right. Tens of thousands of parts have to match perfectly and talk to each other.

NASA's 2001 Mars Odyssey probe took 10,000 separate actions to go right to get there, said Scott Hubbard of Stanford University. Two years earlier, NASA mistakenly used both metric and English measuring units, dooming a \$125 million Martian probe.

Former NASA deputy administrator Hans Mark said most failures are from human error. He pointed to a dropped oxygen tank that caused the near-fatal Apollo 13 explosion.

Poor communication between engineers and managers about known problems was a factor in both the 1986 and 2003 space shuttle disasters and that's a bigger issue for totalitarian societies like North Korea, Pace said.

"In many ways, the worst enemy of NASA is `Star Trek'," Pace said. "Captain Picard says `engage' and the ship moves. And people think `How hard can this be?'"

North Korea knows.

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