

# Bereshit Crash - Technical Overview

Prior to the launch there was an issue reported already - a malfunction in the star trackers, a pair of cameras that were responsible to tell certain planets to determine the angle of the spacecraft (and determine the direction of the flight), which is a major issue because a wrong angle will lead to a different path which is a critical failure.

Another error occurred when the Spacecraft's computer suddenly restarted and rejected a scheduled maneuver.

Many restarts occurred during the mission, probably because of the cheap electronics that were never tested in space before.

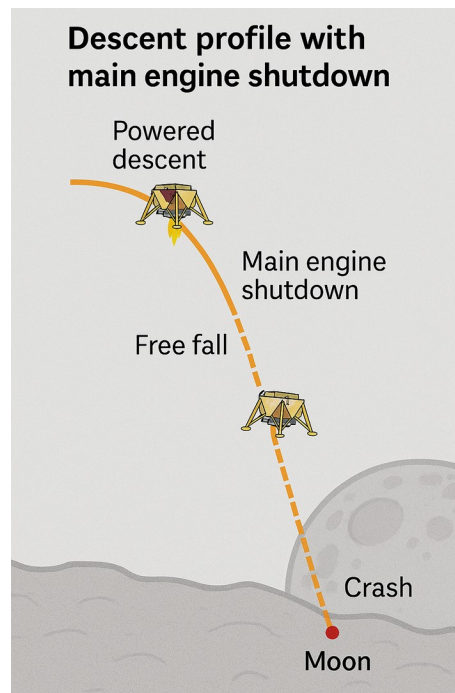
In addition, there was only one computer on Bereshit due to budget reasons therefore the program extensions that were meant to overcome the issue were not saved to the computer memory, only on the RAM. Because of that, the extensions were deleted on each restart and had to be uploaded again.

During the moon landing, the first issue arose when the IMU (Inertial Measurement Unit, responsible for the velocity and surface angle calculations) was shut off. The team attempted to restart the faulty IMU, which, combined with the spacecraft's logic, led to a brief miscommunication lasting one second. This disrupted the data transfer between the operational IMU and the faulty one.

Due to this miscommunication and the resulting lack of data, a navigation error occurred, triggering an automatic system restart. The restart took two seconds, but the computer rebooted without loading the necessary program extensions, which were designed to be reloaded every minute. This led to a series of five consecutive restarts before the extensions were finally restored.

These repeated restarts caused the main engine, which was supposed to operate continuously to slow the descent, to shut down. While the computer was programmed to restart the engine immediately, another issue arose - the engine required power from two sources to restart, but due to the system reboot, only one was functional, preventing the main engine from turning back on.

Due to the downtime of the engine, as short as it was, and due to the lack of atmosphere on the Moon – the spaceship was in free-fall mode. This can be observed in the video when the shuttle accelerates towards the surface while the angle relative to the surface remains constant – 3 deg (since one IMU device is still working correctly). This can be observed in the following diagram:



Even though the crew managed to reactivate the auxiliary engines before the impact, their force was not strong enough to decelerate the ship and land correctly.

As a result, Bereshit remained on a crash trajectory accelerating up to a speed of 3,000 km/h and was destroyed upon impact with the Moon.