

CASE STUDY



SHAININ AND THE APOLLO 13 MISSION

Shainin's innovative reliability approach demonstrates zero failures in eleven manned missions, six moon landings...and a module meant for two.

BACKSTORY

In the 1960s, NASA was focused on meeting President Kennedy's challenge to put men on the moon. NASA wanted its astronauts to be as safe during their trips to the moon as they would be in a cross-country car trip from New York to L.A. and back. The American Automobile Association (AAA) calculated the risk of a fatality during this trip as 0.05 %. Several aerospace companies were competing for the contract to build the Lunar Excursion Module (LEM), the vehicle the astronauts would use to travel from the Apollo Command Capsule to the surface of the moon and back. Grumman brought in Dorian Shainin to help them with their bid to meet NASA's reliability requirements.

THE PROBLEM

The conventional approach to reliability could not provide a high enough confidence in the test results without successfully testing 4600 units. The more workable plans proposed by other contractors did not provide the needed level of confidence.

THE SOLUTION

Shainin recognized that neither success testing, nor measuring time to failure would result in a workable test plan with high confidence in the results. Instead, Shainin used a unique approach he developed called Multiple Environment Overstress Probe Testing, which allowed NASA to verify the margin of safety above and beyond the planned use of the LEM. With Shainin's unique approach to reliability, Grumman won the contract to meet NASA's reliability target of 0.9995 with 90% confidence.

THE ACHIEVEMENT

On April 13, 1970, two days after the Apollo 13 mission left Earth for the third planned lunar-landing mission, an oxygen bottle exploded in the command module, causing its life support system to fail. Although the LEM was expected to carry at most two astronauts to the moon's surface, the failure of the command capsule life support system forced all three astronauts to use the LEM as a lifeboat. With the mission now focused on bringing everyone home safely, the astronauts sling-shot around the moon and used its gravity to propel them back to Earth. Due in part to Shainin's reliability test plan, that ensured the LEM could withstand stresses well beyond what was expected in the mission, the LEM brought the Apollo 13 astronauts home safely.

