

The Ariane 5 Rocket Failure

On June 4th, 1996, the European Space Agency launched the very first Ariane 5 rocket. Its engines ignited, it accelerated away from the launch pad, and only 37 seconds later exploded, spreading debris over an area of twelve square kilometres, and costing the ESA \$360 million (Le Lann, 1997). The subsequent investigation found two main contributing factors, both errors in the on-board software, had caused the malfunction. The simplicity of the errors resulted in the Ariane 5 becoming one of the most infamous examples of systems failure.

The main fault was the result of a casting error, trying to store a variable of one size into a variable of an insufficient size. The rocket had an Inertial Reference System which controlled the direction the rocket was pointing relative to the horizontal plane. The BH value (the variable used to control this) was stored as a 64-bit floating variable. The issue arose when the software tried to move this value to a 16-bit integer. This resulted in a system error, the rocket performed a 180 degree turn and sped back towards the earth before exploding.

Dealing with variables of different sizes is one of the most basic programming skills, and a foundation of software engineering. The fact that an information system of this size and importance failed because of an error like this is both laughable and lamentable.

To compound the initial casting error, the subsequent investigation discovered that the piece of code containing the bug was not even an essential part of the Ariane 5 system, but a non-essential snippet that had been copied over from the Ariane 4 software (Lynch, 2017).

The nature of these errors indicate that the testing procedures implemented by the software development team were not of sufficient quality. Evidently, either the BH variable was not covered by the tests, or it was, but the tests did not investigate what would happen should the variable be overloaded.

References:

Le Lann, G. (1997) 'An analysis of the Ariane 5 flight 501 failure - a system engineering perspective.' Engineering of Computer-Based Systems, IEEE International Conference 339-346.

Lynch, J. (2017) Software Bugs in History. Available from: <https://www.bugsnag.com/blog/bug-day-ariane-5-disaster> [Accessed 19 August 2021].