Title: Therac-25 and the Boeing 737 Max

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CS 3001: Computing & Society

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January 8, 2024

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Introduction

The major technical cause of both Boeing 737 Max crashes in late 2018 and early 2019 is the maneuvering characteristics augmentation system malfunction also known as the MCAS. The purpose of the MCAS is designed to help the plane's handling characteristic by lifting the tail up while moving the nose down. The MCAS also relies on the input data from the angle-of-attack sensor. According to the Ethiopian agency, "the design of Boeing's new flight control software that repeatedly pushed the jet's nose down." This unintentional nose-down movement is caused by the false input from the angle-of-attack sensor. The lack of maintenance is also a crucial factor that led to those two incidents.

Body Paragraph #1

The failure to eliminate root causes is related to the Boeing incident. Therac-25 reuses Therac-20's design and removes the hardware interlock that exists in therac-20 which is a safety mechanism designed to prevent the machine from overdoes the patient. Therac-25 relies heavily on software to keep the operation safe and the engineers did not fully understand what is the root cause of the incident in the therac-20. This caused the Therac-25 to have a single point of failure in its software. Boeing 737's angle-of-attack also has a single point of failure. Similarly, after the first Boeing 737 incident, the investigator and Boeing company were not sure what caused the problem and they began to implicate that the pilot and the crew did not operate properly. This also lead the the second crash of the 737 in early 2019. The difference between the two is that Boeing did not make an effort to eliminate the problem in the 737 Max and tried to blame others, whereas in the case of Therac-25 actions were taken but in the wrong direction. Another similarity that both cases have is that the pilot and those medical professionals do not know how to properly operate the product, some of them did not get trained on how to operate the device before their practice, and many are just way too confident on the product. Moreover, no documents and instructions were provide to the pilot for reference on how the MCAS works

as well as how to take action when an incident happens. In the case of Boeing 737 Max, the software design has flaw is the primary factor that led to two crash within this short period of time, whereas the Therac-25 were result of software bugs.

Body Paragraph #2

The inadequate software engineering practices that happened in the Therac-25 were also similar to the Boeing 737 incident. In both cases, the software in the device or the aircraft was not being tested enough, especially when the first 737 Max crashed they just did not have enough tests on the MCAS even when there was some evidence showing the plane was nose-down in the first incident. Similarly, the Therac-25 tests the software and hardware independently which overlooks the importance of integration tests on both software and hardware together are essential. The difference between the two cases is that there are safety features that the operator can shut down the device when treatment goes the wrong way, it is just not user-friendly. However, in the case of the 737 Max, there is no software that allow the pilot to shut down or override the MCAS, this safety feature was added after the second incident, which could be done in the first place to prevent the second incident.

Body Paragraph #3

The inadequate investigation or follow-up on accident reports with the Therac-25 occurred when incidents went unreported, and the doctor and hospital hide the incident. This resulted in fewer accident reports than actual accidents happened, which prevented the investigator and company from fixing potential bugs that might have reduced the number of incidents in the first place. Similarly, after the first Boeing incident happened the Boeing company tried to blame the airline company that wrongly operating the airplane lack of maintenance and unskilled crew and pilots. The CEO of Boeing states the 737 Max is safe. Boeing tries to prevent the loss of the ongoing 737 order by taking this action, instead of focusing on how to improve their airplane. The Boeing engineer and test pilots found out that the MCAS had a problem just right before the second 737 incident and rushed to upgrade the MCAS but did not file the report to the FAA. The difference is the

investigation of the problem of 737 is hard due to a lack of information and no previous experience, whereas information was hidden by the Therac-25 operator.

Conclusion

In conclusion, in many products whether software or hardware, there are always some flaws existing in the product. Therefore, no matter how well the device works in the past, we should always trust but verify. Companies and businessman aren't likely to admit that their product can be harmful even if they acknowledge it. Those incidents reveal that many industries especially technology are not well regulated. It also implies that as technology professionals, we should always serve the community with honesty and provide valuable products.

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