

Paper 1

ENMG 656: Engineering Law and Ethics

Case Study:

The Challenger Disaster

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Introduction:

On January 28, 1986, the NASA Space Shuttle Challenger blew apart and everything exploded in just 73 seconds [2] making this incident one of the most significant events of the American Space Program. This tragic episode took lives of seven people, the seven-member crew was to deploy a large communications satellite, deploy and retrieve an astronomy payload to study Halley's Comet, and the first teacher in space would conduct lessons for schoolchildren from orbit [1]. The launch was live telecasted all over the world on televisions and the Challengers disaster left the people in grieving state. The Challenger tragedy impacted NASA and led to reawakened concentration on secure exploration to prevent similar incidents from occurring in future along with modification to the NASA's systems and protocols which was crucial. The main reason that contributed to this devastating event were the technical failure in the O-ring seal, temperature, management decisions in concern with the safety, risks included and regulatory oversight.

Technical Issues:

The Space Shuttle Challenger has following technical issues which dealt with excessive erosion in primary O-ring and had lost its seal also it was observed in the solid rocket boosters (SRBs). The Morton Thiokol engineering team did not recommend launching the Challenger and warning not to fly it below 53°F. NASA started questioning Morton Thiokol engineering team and asked to provide base for such recommendations and they told they don't think temperature has anything to do with it.[2] The right motor suffered erosion of the primary O-ring in the nozzle joint with gaseous oxygen (GOX) bypassing the primary seal of the left nozzle.[3] At '59 sec' jet stream kept pushing vehicle on side and nozzle didn't expanded which burned the tank. [2] These flames eventually burned through the shuttle's external tank, rupturing the liquid-hydrogen tank milliseconds before the right booster crashed into the liquid-oxygen tank. The two liquids mixed and exploded, destroying the orbiter with it.[4] There were possible concerns about the ability of the fluorocarbon O-rings in the field joints to maintain a proper seal while the launch during low temperatures. Notwithstanding these concerns and along with this all-risks NASA management chose to proceed with the launch. The Rogers Commission, the Committee concluded that the Challenger accident was caused by a failure in the aft field joint on the right-hand Solid Rocket Motor. This tragic accident was not caused by the Orbiter, the Space Shuttle Main Engines, the External Tank, the onboard payloads, the ground support equipment, or the other elements of the Solid Rocket Boosters. But it was due to a faulty design, and that neither NASA nor Thiokol fully understood the operation of the joint prior to the accident. [3]

Stakeholders:

Stakeholders, defined as those who have a stake or claim in some aspect of a firm's products, operations, markets, industry, and outcomes, have long been recognized as an important component in business and society relationships. Customers, employees, and suppliers are some of the examples of the stakeholders. (Frooman, J. (1999)).

Due to the incident are who sustain damage to their lives or possessions are unequivocally the most profoundly impacted stakeholders. Even distant observers of emergency situations may at times undergo notable distress. A case in point is the psychological trauma experienced by minors were impacted by the scene of the space shuttle Challenger explosion on television. (Goleman, 1986).

The main stakeholders in the Challenger Space Shuttle disaster involved the US Federal Government, NASA, Thiokol, Kennedy Space Flight Center, the general public, the media, crew members and their families etc . (Mark Elom Tuani 2015)

Ethical Issues:

Major ethical issues arise here in the organizations decision making process. The Challenger disaster was not an isolated incident but rather the result of systemic failures in NASA's decision-making processes, organizational culture, and communication practices. (Kaplan, R. M. (2002)). As clearly stated by the Engineering team and despite of the warnings given on not to launch the shuttle due to the of the O-rings in cold temperatures, the concerns were not properly handled by the management. The Challenger incident occurred due to the neglection, and the decisions made by Thiokol and NASA's Solid Rocket Booster Project office. According to the Rogers Commission, NASA's decision-making process was found to be flawed. Even though there was a wealth of information available and at least one comprehensive briefing at Headquarters regarding the issues with the O-rings, the technical managers from NASA and Thiokol did not fully comprehend or acknowledge the gravity of the problem. There was no sense of urgency on their part to correct the design flaws in the SRB. No one suggested grounding the fleet, nor did NASA embark on a concerted effort to remedy the deficiencies in O-ring performance. NASA instead opted to continue launching flights despite a flawed design, adhering to a deliberate 27-month corrective plan. [3]

Engineers' responses to the ethical problems:

In the initial phase issues like the O-rings sealing in low temperature, and the construction of the rocket boosters were raised by the Morton Thiokol engineers. The Engineering team were put into the position where they were asked to prove that it would fail at that temperature and as they could not prove at that point the launch was proceeded. [2]. NASA managers, who not only had all the information prior to the launch but also were warned against it yet decide to proceed. (Vaughan, D. (1996)). NASA did not accept that the disaster happened due to the cold temperature. [2] After the accident, O- ring was declared as the main reason of the explosion of the Challenger Spaceship following which the engineers were investigated and to prevent the further occurrence analysis were carried out.

Corporate responses to the ethical problems:

There were many hurdles faced by NASA for the earlier space shuttle Columbia where the launch was delayed by 7 times. This lead and impacted the scheduled launch of the Challenger. (Rossow, M., 2012). The relentless demand on NASA to meet scheduled flight quotas unquestionably influenced attitudes toward safety in a negative manner. The pressure to achieve planned flight rates was compressing mission preparation as earlier missions were delayed due to unforeseen problems. Had the accident not occurred there would soon have been a collision between planned launch dates and mission preparation needs which could not have been met by overtime, cannibalization, or other undesirable practices. Operating pressures were causing an increase in unsafe practices.[3]

Professional codes or standards:

Engineers are bound to follow all the ethics and laws and are expected to ensure the environmental prosperity also to ensure the safety procedures and guidelines for the people. Concerns were raised by the people on whether the engineers followed the appropriate guidelines and with the responsibility of the successful launch of the Challenger space shuttle. To avoid negative consequences an engineer should adhere to all organizational ethical standards may be through displaying morals or identifying the solutions to a problem or identifying the problem itself. If an engineer lacks the ability to identify above can lead to criticism questioning their potential.

In the case of Challenger disaster, the engineers had given warnings to the NASA about the expected problems and tried to refrain the launch from occurring which displays the professional codes and standards being followed.

Role of government oversight or regulation:

The government has played certain roles in the investigation of the disaster. A investigation committee Rogers Commission was set up to investigate the issue. Although NASA's approach of blending self-regulation with external review appears to have been the most effective option, it's believed that the level of autonomy and interdependence at NASA may have weakened regulatory effectiveness. This scenario made it less probable that safety issues would be recognized and resolved (Vaughan, D., 1990). The commission's findings regarding the Challenger disaster determined that NASA was at fault in the decision-making process, improper standards followed and unclear communication. It also failed to consider the concerns raised by the engineering team. Ignoring the safety concerns played a major part leading the disaster.

Prevention and recommendations:

The NASA Space shuttle Challenger accident led to loss of seven lives which could have been avoided if correct decision were made by the organizations following the ethical code and standards and adhering the values. The safety of the crew should have been the top priority without keeping anyone in the dark. NASA's denial of the cold temperature not being the reason of the accident and avoiding the points raised by the Morton Thiokol engineering team displays unethical behaviour. The Decision-making process between the organizations had a huge impact in the explosion of the Challenger. Enhance safety protocols and pretesting are some ways which could be used to analyze the issues. A diverse and integrated approach for the testing and extra attention towards the condition of the hardware like O-ring, taking decision which are not under any pressure, clear communication are some of the factors which would have made a huge impact in avoiding the NASA Space Shuttle Challenger disaster.

References:

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