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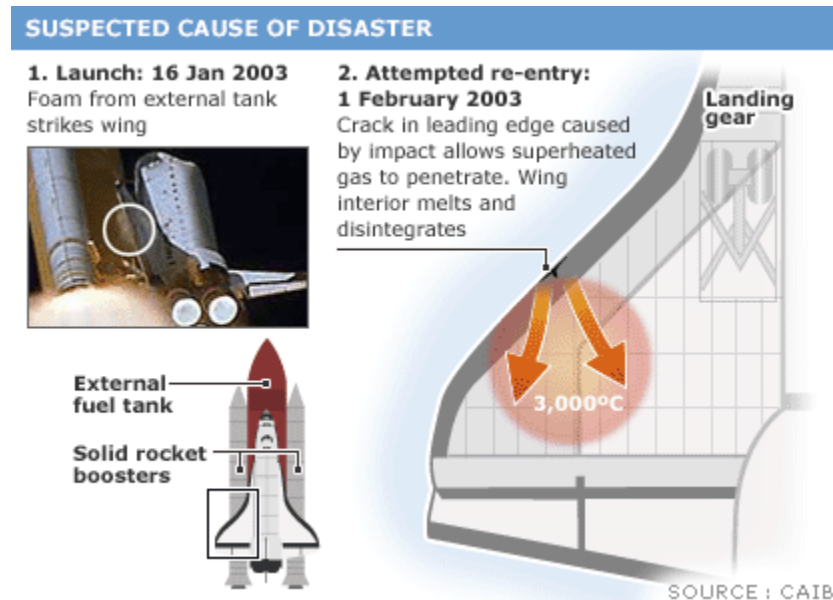
Ethics in Engineering

On the first day of February in 2003, The United States Space Shuttle Columbia, was lost as it disintegrated upon reentry into Earth's atmosphere. As a result, all seven crew members on board lost their lives. This was the second such event in the Space Shuttle program to result in the loss of all crew members.

The main cause of the disaster was a piece of foam that had broken off of the external tank of the launch vehicle and struck the left wing of the spacecraft orbiter. About 80 seconds after launch, photographic evidence showed debris separating from the external tank and striking the leading edge of the left wing of the spacecraft. Several reports of such incidents involving foam debris had been noted in previous flights of the

shuttle program (CAIB). A crack then developed in the front edge of the left wing of the spacecraft. During the re-entry process, extreme temperatures melted the inside of the wing and a panel was ripped free, causing the thermal management system of the aircraft to fail. Heating of the spacecraft due to the the Earth's atmosphere caused the spacecraft to separate from the crew module, and both entities to subsequently fracture and disintegrate. (BBC News)

When damage was originally suspected by the engineers at NASA, a damage analysis report was made to assess the possible threats to the integrity of the spacecraft. Engineers used data based on the impacts of very small pieces of ice on the panels of the wing to predict the possible damage to the wing tiles. One such scenario showed that it was possible for small pieces of ice to cause severe penetrative damage to the wing panels. The engineers involved significantly downplayed the proposed effects of impact, thinking that the foam material was less dense and therefore less likely to cause damage. These underestimations resulted in NASA management ultimately ruling that there was no significant flight risk posed by the suspected damage (CAIB).



On the ground there were repeated attempts by the engineers involved to gain access to Department of Defense imaging of the shuttle while in orbit, to assess the possible damage to the wing. Management of the mission in NASA repeatedly denied these requests. Though there is absolutely no proof that these images would have yielded any useful results in the diagnosis of the wing damage to the Columbia spacecraft, it should be noted that the attempt at such aid was denied by management even though the opportunity existed. This was due to the decision made by the NASA officials influenced by the underestimated engineering reports.



One of the obvious changes that could have been made in the situation would have been to allow the engineers to view the footage that was requested during the orbital period of spacecraft. Again, though there is no guarantee that it would have helped, it certainly did not help to stop these requests from being

approved. In fact, this exact change was made by NASA administration in part with congress to ensure that NASA engineers had access to surface and space imaging of the spacecraft using DOD assets.

On NASA's end, they decided that certain precautions needed to be taken to ensure the safety of the lives of future crew members aboard the Space Shuttles and into the future of the United States' interests in space. After the sixteen month mandatory referendum on the Space Shuttle was over and it was deemed fit again to service the American people, only one single flight was ever made again that was not directly to the International Space Station. This was due to the space station being used as a safe haven waypoint for astronauts in the event of another damaged reentry vehicle. In the one case that this was not the intended destination, the Space Shuttle was used to service the Hubble Space Telescope (CAIB).

This mission to the telescope did now have a few safety nets that the fallen members of Columbia did not. All flights after the disaster now were mandated to have a backup launch vehicle designated for the safe recovery of an expeditionary crew in the event that the reentry vehicle was deemed unable to safely return its occupants to Earth's surface once more. On top of this, once the spacecraft was in orbit, it was now subject to a thorough in-orbit flight inspection. This inspections main goal was then to assess whether or not the thermal protection outfitting the spacecraft was damaged beyond its needed functions. These inspections were very useful in part due to the NASA engineers' new ability to levy DOD imaging assets (CAIB).

Though all of these organizational and operational changes were made, the Space Shuttle program never really recovered from this incident. Almost all flights to the International Space Station during the memorandum, and all flights between the end of the Shuttle Program

and the beginning of private launches to the station, were then carried out via the Russian space industry. Other than the obvious economic impacts of delaying our space industry, this put the United States at a major disadvantage when it came to protecting its governmental and personal interests in space.

The route that should have been undertaken by the engineers and managers involved is that of the actual engineering method. Instead of extrapolating from the data that was available, an actual simulation of the foam piece in question and a direct mechanic analysis of the suspected wing damage should have gone through. After the disaster, said analysis was performed on the ultra strong grey carbon panels of the left wing assembly. This analysis undoubtedly proved that the piece of foam in question was more than capable of creating the irreparable damage to the shuttle during the final launch of the Columbia spacecraft (BBC Last Flight). Had proper data been collected and used by the engineers, there would have been no doubt in the moment that the damage had occurred and that a plan would have been needed to safely bring those brave men and women home to their families. Had these individuals acted proactively and justly, then these people may have never lost their lives on that fateful February day.

Work Cited

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