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Midterm Writings

Week 2: Columbia: A Normal Accident?

I would like to start by pointing out that at the time this report was constructed, knowledge of what actually happened to the Columbia space shuttle in the final minutes before its destruction is circumstantial. Therefore, I will base my opinions and arguments on what data NASA has released to the public. With that in mind, I make the following argument:

Charles Perrow, as most of you are aware wrote “Normal Accidents: Living With High-Risk Technologies” almost 20 years ago. He developed a theory that failure in complex-tightly coupled systems was almost guaranteed, so much so that he called it “Normal.” Such systems include nuclear reactors and airplanes. In fact, several (including myself) have made the argument that the events of September 11 were a result a several failures in a complex system.

In an interview posted by the *Boston Globe*, Charles Perrow discussed the Columbia tragedy and commented on how his theory of Normal accidents did not play a role. In particular, Perrow said that if as he suspects, the shuttle’s insulating heat tiles failed on the left wing, “it’s odd and almost embarrassing, but this may be a case of a single point failure, not a complex interaction of multiple failures.” (1)

I argue that Perrow is not looking at the entire system here. Is it possible that a tile on the heat shield was damaged, and that gasses penetrated the head shield around the wing and destroyed it from the inside? Yes. (2) However...

First, assume that the tile alone was the cause. Perrow is simply not looking at the whole picture. The entirety of NASA, the shuttle mission, and all the contract businesses used in the construction of the shuttle make up the system, not just Columbia. The mere fact that a part of insulation, the size of a couch cushion, traveling at 700 feet / sec, is a complex component to the equation that evaluates to the Boolean answer: will Columbia make safe reentry? (3) makes one think about the complexity of the problem. Other theories that a space particle traveling at so called “hypervelocity” (21,000 feet per second) may have hit the wing, and according to a study published in March 2000, could “pose the highest risk for critical failure,” are now emerging. On Jan. 17 an Air Force radar image gathered at Eglin Air Force Base in Florida showed a small object moving away from the shuttle. Could this be space debris? Did it hit the shuttle? No one knows.

My point is that this is all complex. The fact that a million things could have happened to Columbia, and even more, the fact that scientists spent every minute while the shuttle was in the air analyzing every detail of the mission to make sure the crew was safe, and the fact that the shuttle burned up is enough evidence to show that the problem was complex, too complex for NASA to prevent the accident. Columbia was a Normal Accident.

Of course, there are many other possible failures that may have caused the Columbia disaster. It has been argued that if the tile failure were the source of the accident, then the problem would have been very apparent previous to breakup. I give two reasons to support this theory. First, while in orbit, the bottom of the shuttle faces the sun, protecting the shuttle from the extreme temperatures in space. While in orbit the sensors didn't exhibit abnormal temperature readings – a sign that the tiles were

functional. Second, the external temperature upon reentry is somewhere between 2000 and 3000 degrees. The temperature spikes inside the wheel wells were unusual, but they did not indicate that the area had suffered catastrophic failure. If it had, according to Mr. Dittmore, the temperature increases would have been much higher. (4)

So what does this mean? There is still a good possibility that a much more complicated failure occurred – one that I am sure Perrow would not have as much trouble disagreeing with. Either way, however, Mr. Perrow needs to realize that you cannot simply look at the space shuttle as the only system in which the failure occurred. He needs to look at a larger scale. The fact that failure occurred despite 100% to prevent the tragedy occurring is enough proof to show that the mission was complex, and it had a Normal, complex system failure.