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STS.092 – Current Events from an STS Perspective
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Café Scientifique Discussion – Space Shuttle Columbia

On Monday, February 24th 2003, I attended a meeting called a Café Scientifique in Harvard Square. The meetings, which are organized by a weekly technology and science magazine called NewScientist, are forums that encourage a free environment for the informal exchange of ideas between both invited speakers and interested audience members. In general, the goal of the Café Scientifique series is to disseminate knowledge and opinions of current events to the public. At the meeting yesterday there were three distinguished guests who shared brief comments on current developments concerning the investigation of the space shuttle Columbia accident. I found that participants at the Café share a general STS perspective in how they ask big-picture societal questions about how the Columbia disaster will affect current NASA policies and technological paradigms.

The first speaker was John Hansman, an MIT Professor in the Department of Aeronautics and Astronautics and specialist in aviation safety. Professor Hansman spoke in a technically detailed manner about the damage to the thermal protection system on the belly of the left wing, which may have been caused by falling insulation debris at launch time. He elaborated on this statement later in the discussion remarking that initial estimates of the incurred damage was one or two tiles, which on almost any part of the spacecraft would not have caused a huge problem. However, since the damage was on the belly of the left wing, an especially vulnerable place during reentry, and since the left wing of the craft was experiencing higher drag than the other wing, the loss of even one or two tiles could have been enough for the heat to permeate through the thermal protection system and destroy the less resilient aluminum inner layer.

This was an appropriate introduction to the discussion as it was assumed that there was no technical knowledge base from which we were all speaking. Professor Hansman was questioned by listeners as to why NASA would permit risks in space shuttle missions like the dangerous launch and reentry phases of a journey. His reply was one that people have been hearing over and over from NASA – the business of space travel has inherent risk. One cannot mitigate every risk due to physical constraints. Even with near-infinite resources NASA could not make the Shuttle as safe as an airplane because the mass of the vehicle is the limiting factor in being able to achieve orbit. However, Professor Hansman was quick to point out that even given all the risks inherent in space travel, the Columbia had made 28 flights prior to the accident and that this incident was an anomaly. Thus he has confidence in the future of the space shuttle program in that he feels that even given the risks of space travel, the potential benefits attained from space exploration and research are great enough to merit the ongoing pursuit of space travel.

The second speaker was Jeff Hoffman, an MIT Professor in the Department of Aeronautics and Astronautics and a former NASA astronaut who has made space flights on the Shuttle Discovery in 1985, the Shuttle Columbia in 1990, the Shuttle Atlantis in 1992, the Shuttle Endeavor in 1993 (for the restoration of the Hubble Space Telescope), and finally on the Shuttle Columbia a second time in 1996. Professor Hoffman began immediately by building on the point that Professor Hansman was illustrating. He reminded the crowd that airplanes still crash and ships still sink so there is always the risk of failure. Furthermore, prompted by an audience question, he responded to questions of integrity due to Columbia's age. He explained that age was not a factor with the shuttle as all spacecraft undergo thorough upgrades and overhauls after every mission. By analogy he explained that if one were to take care of his or her car as well as they take care of the NASA spacecraft, the car would run for hundreds of years.

After that, Professor Hoffman explained why the reentry of a spacecraft is the second most dangerous part of a space flight as one must enter the Earth's atmosphere at an entry angle that applies an appropriate temperature to the thermal protection system over a tolerable period of time. If the angle were too shallow the heat on the outside of the shuttle would be allowed too much time to penetrate through the tiles into the shuttle and could potentially damage either the physical structure of the vehicle or damage it's electronic equipment. If the angle were too steep, the reentry heat would be too great for the thermal protection system and the craft would simply disintegrate. Thus specific and safe operating procedures on space missions are paramount for protection and success. On a separate topic, Professor Hoffman remarked that astronauts have a responsibility to perform the best quality science with the time that they have in orbit. Thus space laboratories need to be designed with flexibility and must have a crew as robots and automated machines are typically poor at operating with flexible applications. This comment shows Professor Hoffman's confidence in the future of manned spacecraft.

Unfortunately I was not able to obtain the name of the third speaker but I believe it was announced that he either worked closely with, or was himself, a former NASA administrator in the 1980s. I searched on NASA.gov for a list of former administrators with no success. Regardless, his talk put all the previous comments into perspective as he offered a different view of the current events. He apparently was a part of NASA when the first flight mission was being planned and prepared. He admitted that the first flight odds were approximately 50/50 because a lot of factors were only estimated and had not yet been tested. The most risky part of the mission, he said, was the potential loss of a liquid fuel tank because those tanks consistently operate on the extreme fringe of their performance profiles. The sequence of events that caused the Columbia disaster was on NASA's long list of worries but was not on top because reentry risks come second to launch risks. The reason for this is that in order to launch such a massive

vehicle into Earth's orbit you have to hold the spacecraft in place while a number of engines are lit one after the other then blow explosive bolts underneath the shuttle before the shuttle shakes itself to pieces. The way he described the process made it seem very complicated and very vulnerable to even the slightest error. This is why NASA does not tolerate even the smallest amount of error or weakness in its assemblies.

Then the former administrator gave general recommendations as to the future of the U.S. space program. He said that the international space station should be sent back up for research purposes after it comes down in April when its fuel cells will go cold. He said that while a shuttle transporting people to and from the ISS will be necessary, unmanned craft should be used for transporting cargo to and from the ISS to minimize the risk of human losses in unforeseen accidents. However, he warned that NASA must keep an active internal vertical flow of communication so that a proper system of checks and balances is maintained between engineers and management. The general mood of his talk was both optimistic and realistic due to the wisdom he has acquired during his career at NASA.

This discussion session, while a bit unorganized and overcrowded, was valuable in that I was able to hear many different perspectives *and* hear responses to questions that only experts in matters of space travel would be able to address. The atmosphere of the Café was much like the STS perspective. I encourage all STS students to participate in one of these meetings to see how much desire there is in the American public to be involved in STS-like discussions about current events.