

Faster, Better, Cheaper – Choose Two: A Response to the Columbia Accident Investigation Board Report

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My title of “Faster, Better, Cheaper – Choose Two”, is meant to symbolize what I feel has been NASA’s biggest failure – its inability to understand that it can not be everything to everybody. This generation of NASA engineers and administrators struggle to perform acts of technical wizardry with an insufficient and fluctuating budget while adhering to an airline’s schedule, and no one has stood up and said that they can not do it. I’m a person that has always felt a swelling of pride at seeing the Shuttle launch and land. Even though I was only eleven, I still remember exactly where I was when my gym teacher announced on the playground that the *Challenger* had been destroyed – even though I did not understand until many hours later. The tragedy of Columbia (and Challenger if we had listened) point to inherent problems in both NASA and the entire Space Shuttle program.

Ten years ago, if someone said that the a proud and mighty Space Shuttle would be brought down by a piece of foam, I would have laughed in their face. Yet, that is exactly what happened, and given the Shuttle’s tremendous complexity it is not surprising that such a small event can have catastrophic consequences. Unfortunately, the phrase “the devil is in the details” has proven to be a chillingly accurate heuristic of manned spaceflight. A small short in *Apollo I’s* high O₂ cockpit caused the deaths of three astronauts during simple launch pad test; a small defect in one of *Apollo XIII’s* O₂ containers nearly led to disaster; and the combination of a cold day and O-ring resulted in the destruction of *Columbia’s* sister, *Challenger*. Space travel requires mechanical complexity of an unimaginable degree; and when applied to current space architectures, such tremendous complexity creates extremely delicate systems. Despite the Board’s efforts to isolate the exact cause of *Columbia’s* destruction, the Shuttle’s characteristics force me to conclude that even if that stray piece of foam had not hit *Columbia’s* left leading edge, we would have eventually lost another vehicle and crew because of some other unforeseen scenario – it was only a matter of time.

Some may limit the technical causes of *Columbia* destruction to the craft’s left wing and the external tank’s foam covering, but this engineer sees a technical problem far more pervasive. An environment of conflicting interests, unclear goals, and financial desperation permeated every facet of the original Shuttle development program resulting in a system that does not perform any mission particularly well. If the system was intended to put satellites into orbit why does it need to be manned? If the Shuttle was intended as a scientific spacecraft, why does it have the tremendous cargo bay? If the Shuttle was intended to carry people into low-earth orbit, why were they going there? Perhaps most important, why was a runway landing seen as preferable to a simple splash down in the ocean? In the midst of such conflicting characteristics, the Shuttle becomes an engineering marvel with out a clear mission.

To my reasoning, all of the Space Shuttle's were/are experimental systems that should be treated as such. No matter how hard NASA administrators and engineers tried to modify and market the Shuttle as a reliable space transit and support system, its base architecture prohibits such a function. The Space Shuttle system is simply immature. Unfortunately, the Space Shuttle has all the trappings of a mature and reliable technology. Everything about the Shuttle implies that it functions like a very capable and powerful airplane. The Shuttle is a class of four extremely similar space craft that land on a regular runway, are quickly refurbished, and sent back into space burdened with a cargo and a crew of scientists and engineers. These characteristics hide the fact that the Shuttle is an experimental system.

Despite the Shuttle's technical complexity and system fragility, I have become firmly convinced that the main cause of the Shuttle's problems lie with in NASA's complex and desperate bureaucracy. NASA's Human Space Flight Program that has been on life support since the end of the Apollo-Soyuz missions¹. The only thing sadder than NASA's weakened state is that NASA is an organization that refuses to admit that it has been weakened. The Shuttle was life-preserver thrown to manned space flight, and somewhere down the line, NASA convinced itself that the life preserver was a cruise ship. Perhaps it is because the Shuttle actually do successfully carry people into orbit and can be reused that NASA forgot that the program was merely a stop-gap measure until the nation decided to once again become serious about space travel?

Unfortunately, the Shuttle became NASA's symbol – a symbol that NASA could not allow to be tarnished by shrinking budgets, outdated hardware, or poor maintenance because if there were a problem with the Shuttle then it would indicate there was a problem with NASA itself. NASA administrators and engineers could not admit the system's weaknesses and fragility with out risking the little funding they were being given. I believe that such institutional blockages could eventually be overcome with new personnel that had not spent their careers fighting for legitimacy. Unfortunately, NASA could not afford to keep staffs at minimum levels much less attract and hire the new blood that they needed².

My earlier life preserver analogy has another lesson to teach about the Space Shuttle program. No matter how good the life preserver is, eventually a wave will come along that will leave you submerged. The *Columbia* and *Challenger* disasters should not have surprised anyone – the vehicles have been trying to tell us their limitations for decades, but we refuse to listen. Unfortunately, NASA needed to perform and keep performing no matter what. The irony is that other far less expensive programs like the Martian Rovers *Spirit* and *Opportunity* have been tremendous successes³, but NASA, at least right now, requires more than the adventures of two robotic geologists to give it renewed legitimacy and purpose. In my opinion, NASA must accept the fact that it can not do everything, and instead concentrate on what they consider most important whether that be the Space

¹ This date, July 24, 1975, coincidentally is the date of my birth.

² The Board states that NASA operated under a hiring freeze for much of the 1990's.

³ Both rovers have already remained functional for almost two years beyond their expected life cycles.

Shuttle, the International Space Station, returning to the Moon, or going to Mars. NASA has the ability to do tremendous things, but it can only do one at a time.