Safe Is Not an Option by Rand Simberg

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There are many of us around who have witnessed the entire space age, which began on October 4, 1957, with the launch of *Sputnik* by the Soviet Union. We have witnessed the progression from small payloads all the way to human space flight, with the Soviets also being responsible for the first human in space—Yuri Gagarin launched aboard the *Vostok Capsule* in 1961. The ultimate space performance to date is considered by nearly everyone to be the series of moon landings accomplished by the United States, and so far only by the United States beginning in 1969, although China and others have sincere intentions of duplicating that feat. With the recent Pluto *New Horizons* fly-by, the appetite for space flight is being whetted again. My colleague Buzz Aldrin is intent on a journey to Mars, a journey by humans, that is. But the Mars mission has a special set of perils to be considered.

So, why were the “Russians” initially more successful, and in fact why do they still have the most readily available ride to the Space Station? The book by Rand Simberg gives an insight into that question and, in fact, lays out an argument for moving the space program forward by adhering to a very simple truth: travel to space is the ultimate peacetime danger, and humans were not designed for such. Attempts to make the trip as safe as a cross-country trip by car will prove incredibly costly and realistically will most certainly fail anyway. Even a handful of those car trips end up tragically and space flight is fraught with a far more perilous environment than the auto trip. But I must add here that at the turn of the century (1903) scientists regarded gasoline-powered automobiles to be far too dangerous to ever be practical. Gasoline is a far cry from rocket fuel in terms of hazardous materials, and hence we must accept a certain level of risk for the foreseeable future.

Simberg has done much of the work necessary to give a reliable estimate of the actual hazards and possible mitigation. He follows a logical line of thinking, discussing how the initial hazards were mitigated through deliberation and determination. So, from gasoline engines all the way through *Apollo* and *Shuttle*, he builds a consistent story about reducing the risks from unacceptable to a level of acceptance that brave souls are

willing to tolerate. He also points out that the risks cannot be taken to zero but merely to a level of acceptability: that is, the costs related to taking the risks further toward zero than is currently practical make nearly any transportation mode financially implausible and, in the end, still risky to some extent. Simberg’s premise is as the book’s title indicates: safety (complete) is not an option.

Many of the basic issues that affect both cost and reliability are discussed in the book. Something that is mentioned but not discussed at length is the unrealistic design criteria that are set at the beginning of most space projects. The space shuttle’s main engines are a great example. The design criteria called for almost an order of magnitude increase in the horsepower-to-weight ratio over any rocket engine built in the past. That coupled with the plan to have 55 starts on each of the mounted engines on the orbiter was perhaps not impossible but very close. Of course no large rocket engine built ever managed to be that reliable. In fact, NASA avoided most issues with the engines by a rigid set of inspections and engine replacement. Most people involved in the main engine program worried each and every launch that a major problem would occur. There were several near misses for the main engines, as there also were with the solid rocket boosters.

Another interesting fact about the engines was that at times the payload and particular mission required the engines to be operated at 109% of the “rated” power level. “Firewalling” the engine was not common during the shuttle era. In fact, when the engines had not performed up to initial design, 100% power had been redefined to accommodate the lesser performance. Taking the engines to 109% power simply meant that they were asked to operate near the initial design level. The point to all this is that quite often things in the exciting but hazardous world of space travel are either not quite what they seem or what the public is told. Simberg tries to take a realistic assessment approach that deals with some of these issues. His discussion of the new commercialized flight program deals with some of the reality that often gets hidden. Safety is always a concern, but generally it is not the leading consideration if the return on investment is expected to be large enough. Simberg discusses this aspect of the space program in *Safe Is Not an Option*.

As someone intimately involved with one of the worst space disasters in history, I can attest to his premises from firsthand

experience. The tragedy of the *Challenger* accident did not need to occur if only the standard procedures had been followed. The protocols were all in place to prevent that flight being launched, but they were ignored. The unknown factor in all safety considerations is that of the humans involved, that is, human error. In the case of *Challenger*, the level of acceptable risk was set not by the crew, scientists and engineers, but by the administrators involved. There was no amount of safety-oriented investment that would have saved that flight—all that was necessary was common sense. It is the application of common sense (I prefer the words “uncommon sense”) that permeates *Safe Is Not an Option*, a book worth reading for anyone involved in transportation, and particularly space transportation.

AUTHOR'S BIOGRAPHY

Dr. T. Dwayne McCay joined Florida Tech as provost and chief academic officer, where he is second in command and has responsibility for all academic, research, and student matters, including athletics. Dr. McCay came from University of Tennessee, where he was the vice president for research and information technology and served as the chief research officer and chief information officer for all units of the university.

Earlier, as a vice president of the University of Tennessee, he served as the chief executive officer of the Space Institute; professor, engineering science and mechanics; adjunct pro-

fessor, mechanical and aerospace engineering; UT Alumni Distinguished Service Professor; program chairman, engineering science and mechanics; chairman of the Center for Laser Applications; and principal investigator, NASA Space-lab Experiment and several projects on laser processing of materials.

Previously, he was at NASA George C. Marshal Space Flight Center in Alabama. There in the Structures and Propulsion Laboratory, he was chief of the Propulsion Division; branch chief of Turbomachinery and Combustion Devices Branch and of the Propulsion Analysis Branch; and senior aerospace engineer of the Auxiliary Propulsion Branch.

Also, Dr. McCay was a senior research physical scientist at the Air Force Rocket Propulsion Laboratory, Edwards Air Force Base, California, and a Research Engineer at ARO, Incorporated, Arnold Air Force Station, Tennessee. Dr. McCay holds a PhD in engineering and mathematics from Auburn University.

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