



Truth, Lies and O-Rings

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„It looks like we have lost our first Astronaut Crew in space”

Those shocking words rang back to me after more than 30 years when I first saw the cover of Allan McDonald's memoir “Truth, Lies and O-Rings”.

I received the devastating message from my friend and colleague Neal Ausman from JPL, Galileo Mission Operations Manager, on a sunny, cold January 28, 1986, in my office at the German Space Operations Center (GSOC) in Oberpfaffenhofen, Bavaria.

This event was not only a tragedy for NASA's human spaceflight program but had immediate consequences for Germany as partner in the Galileo project, to be launched on STS by mid of 1986, and the German D-2 mission which was slated for September 1988. So, I decided to listen to the full story.

The book's title sounds like a dramatic romance novel however, according to the foreword: “Allan McDonald's memoir contributes to pointing out the conflicts of testimony and other evidence that demonstrated that some form of cover-up had taken place [after the Challenger accident]. It addresses what happened to the people at the National Aeronautics and Space Administration (NASA) and Morton Thiokol Inc. (MTI), who were involved in the ill-fated decision to launch Challenger, and it contains McDonald's own deeply personal recollections [as Thiokol's Director of the Space Shuttle SRM Project] of his traumatic travails as he fought to draw attention to the real reasons behind the disaster and to the fact that some of the responsible individuals in NASA and his own company, were doing their very best to cover up those reasons. McDonald's remarkable story - one revealing the character of the very best type of 'whistle-blower' - uncovers the acts of retribution directed against him by his company and by NASA, as well as the protective measures that had to be taken by the Rogers Commission and by Congress to preserve his job at Morton Thiokol.”

Allan McDonald describes in an almost day-to-day detail the development of events leading to the Challenger accident from his perspective as responsible, deeply involved development engineer and manager as Thiokol's Solid Rocket Motor (SRM) Director.

The author walks you through his 1983 appointment as Thiokol's STS - SRM Director, his management and development engineer's experiences with NASA, and his first exposure the nozzle pocketing erosion problem (STS-8), and to field joints “soot” problems between primary and secondary O-rings detected in post inspections of the STS-2 (1981) and STS-41-D (1984) flights. The history of a thorough, in depth analyses, processing, testing and dispositioning of those complex

problems are described in exhaustive technical detail, illustrated by appropriate original, technical design drawings leading up to the climax, the fateful morning of the *Challenger* launch. The detailed technical descriptions and analyses which follow in the main body of the book and the resulting decisions require a lot of “inside” knowledge about human spaceflight procedures and processes, like quality assurance, failure analysis and criticality, and closeout decisions – and of course about solid motor rocket design too, which you must be willing to embark on to understand the purpose and thrust of Allan McDonald’s memoir.

Part 3 and the rest of the of the book deals with the inside workings and almost verbatim deliberations and recommendations of the Rodger Commission, the Congressional hearings outcome and the personal consequences for the key people, centered around the January 1986 *Challenger* L-1 Flight Readiness Review (FRR) telecon, and the reversal of Thiokol’s original recommendation **not** to launch “outside the lowest experienced temperature so far” (53° F).

Recovering from the shock of the *Challenger* loss McDonald leads us through the exemplary redesign and test phase conducted by the MTI team, NASA and external supervising teams to get the R-SRM (Redesigned SRM) boosters back to “ready to fly” status in his capacity of re-appointed Director of SRB redesign.

McDonalds personal anguish during the critical boost-phase of the first STS flight after the *Challenger* accident, the *Discovery* (STS 26-R) launch on September 29, 1988, and the elation after the shuttle has reached its orbit is very understandable, however it didn’t last long, as MTI was accused by Rockwell to be responsible to have caused the worst damage on one of the wings of the orbiter ever observed, by a piece of separated cork insulation from one of the R-SRM boosters.

And again, during the immediately following *Atlantis* (STS-27-R) Level I/II FRR Board review at KSC, Allan McDonald stood up and replied to the Rockwell engineer after implicating MTI for the wing damage: “*Personally I do not agree with what you said*” – feeling to be thrown back into a situation similar to that in the previous *Challenger* review and investigation boards.

In my opinion, McDonald’s attitude after his agonizing experiences with the *Challenger* accident investigation boards required tremendous courage, which very, very few engineers in his position would have mustered.

It later turned out that, would the Rockwell engineers have listened to his analyses and followed it up more seriously the *Columbia* (STS-107) accident on February 1st 2003 might have been avoided.

Allan McDonald quotes the Webster Dictionary for definition of an accident: “a happening that is not expected, foreseen or intended”.

With the decision to launch the *Challenger outside the specified temperature limit, in the presence of strong wind and ice-problems*, the *Challenger* disaster may not qualify as an accident by Webster’s standards by meeting only one of the three criteria: It may have been expected and foreseen by some, but not intended by anyone!

Summary

In addition to the hundreds of books, reviews, and testimonies written since the *Challenger* accident over the past 35 years, Allan McDonald’s memoir reads like the forensic investigation of a “cold case” relying on his private 1,400 pages of handwritten notes and unpublished private communications and unambiguously presents the facts for a public, virtual jury, to decide on the ‘truth and nothing but the truth’.

The book an example how success or failure is located close together – in the *Challenger* case only separated by a formal signature on a sheet of paper, triggered by the “intimidation” of a prime contractor jockeying for a substantial contract and a customer driven to demonstrate it can fulfill its

highly ambitious plans of launching 24 shuttle flights per year! (*Larry Mulloy- SRB Project Manager of NASA-MFSC: "My God, Thiokol, when do you want me to launch; next April?!"*)

McDonald explained the peculiar circumstances for *Challenger* to the Rodgers Commission members Dr. Feynman and General Kutyna with his "green ball/Jolly Green Giant" theory:

It was a decision under inescapable pressure.

The book is a gapless lessons-learned lecture and a general warning for all engineers and managers to always put ethical considerations up front in any critical management-, political-, or financial decisions.

Allan McDonald's verdict is:

"Clearly, the *Challenger* disaster could have been avoided if only the voice of reasonable caution had been heeded:"

While reading the first part of the book recounting the analysis of the previous 24 successful shuttle flights and acknowledging the high wire act all the shuttle astronauts were performing before the *Challenger* accident, it is amazing that the astronauts were not given more rights to have a say in critical launch readiness decisions. This shortcoming was picked up by the Rodgers Commission recommendation V:

"The flight crew commander, or a designated representative, should attend the FRR, participate in acceptance of the vehicle for flight, and certify that the crew is properly prepared for flight."

Allan McDonald must to be highly praised for his memoir.

As an engineer, I am sure I also would have written this book if I were in McDonald's position, however standing your ground against NASA, the Rodgers Commission, the Senate Subcommittee Hearing and your own Company requires tremendous courage.

Doing the same again after the first successful *Discovery* re-flight in 1988 with the respect to the newly discovered debris problem, McDonald's courage must have grown beyond him.

The book should become required reading for all project managers and engineers!