



## Profile

# Remembering Challenger and Looking Forward

Nearly 30 years after the space shuttle Challenger disaster, Allan McDonald is on a mission to prevent it from ever being forgotten. McDonald, director of the shuttle solid rocket motor project at the time of the incident, is one of the few engineers who vehemently opposed NASA's decision to launch the shuttle on Jan. 28, 1986.

When asked if he would have changed any of his actions leading up to the launch decision, McDonald doesn't hesitate: "No, I really wouldn't. I would have done exactly what I did." A breath later, he adds, "But I would have done more."

**Early career.** McDonald was raised in Billings, MT, and attended Montana State Univ. in Bozeman, where he earned a BS in chemical engineering.

He started working at Thiokol Chemical Corp. in Brigham City, UT, after graduating in 1959. "The very first day I walked in, they had this extremely high profile program — developing an intercontinental ballistic missile (ICBM) using solid rockets for propulsion," he says. The missiles were to be launched from an underground silo, which posed a unique problem: "How were we going to insulate a rocket being launched at 6,000°F underground?" McDonald was charged with the design of the external insulation for the first underground silo ICBM — the Minuteman-I. Today, the insulation that McDonald helped design is still used on the missiles in Minuteman silos.

**A new role.** Throughout the 1960s and '70s, he worked in various facets of engineering for Thiokol, which in 1982 became Morton Thiokol, Inc.

The company's aerospace operations blossomed. In the early 1980s, Morton Thiokol was the sole-source producer of the solid rocket motors (SRMs) for NASA's space shuttle program, as well as the contractor chosen by the Air Force to develop a rocket booster for shuttle launches from the Vandenberg Air Force Base in California.

At that time, McDonald was manager of project engineering for Morton Thiokol's Wasatch Div. in northern Utah — essentially the head of engineering for all programs except the space shuttle SRM program.

In the spring of 1984, a massive explosion and fire in the solid propellant facility where the space shuttle SRMs were manufactured brought upheaval to Morton Thiokol. McDonald was reassigned to be the director of the space shuttle SRM project. "My full time job was now working on the space shuttle," says McDonald.

**The launch debate.** McDonald was serving as Thiokol's senior management representative at the Kennedy Space Center (KSC) the night before the Challenger launch. That evening, the forecast called for the temperature at the launch site to plunge to 18°F. During a three-hour teleconference

between KSC, Morton Thiokol in Utah, and the Marshall Space Flight Center (MSFC) in Alabama, engineers and management responsible for the shuttle's solid rocket booster (SRB) system — which encompassed the SRMs and various structural and instrumentation systems — debated about whether to launch Challenger. Representatives of NASA's top management, including the launch director, were not part of this teleconference.

Initially, Thiokol recommended not launching because the SRMs had never been tested at such low temperatures. But NASA directors from MSFC pushed for the launch, making the Thiokol engineers prove that the motors would fail.

After much pressure from NASA, the teleconference was interrupted when McDonald's boss, Joe Kilminster, vice president for space booster programs, requested a five-minute off-line caucus to reassess Thiokol's decision with senior leadership in Utah. After half an hour, he came back online and reversed Thiokol's earlier decision — the launch go-ahead was granted.

McDonald was extremely upset, with good reason. His concern centered around the performance of the rubber O-rings that prevented hot gases from leaking through the joints between the segments of the shuttle's SRBs. If both the primary and secondary O-rings were to fail, a fiery jet could erupt from a field-joint at ignition, hit the adjacent fuel tank, and cause a massive explosion. A previous launch in early 1985 had indicated blow-by of hot gases past primary O-rings in two joints at 53°F, a cool temperature for Florida.

Sensing the rift caused by the decision, NASA requested the launch recommendation in writing. This had never been asked of Morton Thiokol for previous shuttle launches. McDonald stuck to his guns, and refused to sign the launch recommendation. "This was the smartest decision I ever made," states McDonald. "I felt it was too risky. We were being asked to fly those motors outside of what they were qualified to do." Upon NASA's insistence that a signed recommendation be provided before the launch, Kilminster instead signed and faxed the memo from Utah.

In the time it took for the fax to arrive, McDonald reiterated his stance to the NASA directors in attendance. "There were three reasons why I wanted to cancel the launch," he says. The first, and most important, reason was the O-rings' sensitivity to low temperature. The second reason was the rough seas — the ships responsible for retrieving the SRBs out of the ocean after launch were struggling to stay afloat in 30-ft seas and high winds. "The third reason was ice formation on the launch structure," he says. "I told NASA 'If anything happens to this launch, I wouldn't want to be the person that has to stand in front of a Board of Inquiry to

explain why we launched this outside of the qualifications of the solid rocket motor.”

But the urge to go ahead with the launch overrode caution and sound judgment. The NASA representatives tried to reassure McDonald, saying that they would pass on his concerns to the launch director in an advisory capacity. “But they never passed on the concerns about the O-rings,” he says.

“Part of the lesson I learned was never presume anything.” NASA officials who had the ultimate decision to launch “didn’t receive any information from their own members,” he says, “and I presumed that they did.” McDonald would have taken more decisive action if he had known his concerns were not relayed. “I would have asked the launch director if he knew about the seals,” he says.

**The Challenger aftermath.** In our conversation, McDonald doesn’t dwell on the accident itself. “There is a quote,” he says, “that goes: ‘Regret for things we did is tempered by time. Regret for things we did not do is insoluble.’” It is clear that even though he did everything he could do to advise against the launch, he still feels in some small way at fault for the needless deaths of seven American astronauts.

The first closed session of the Presidential Commission on the Space Shuttle Challenger Accident was held on Feb. 10, 1986. By that time, it was quite evident that the shuttle had been lost due to an O-ring failure on the right SRB. McDonald was surprised, then, that the NASA official testifying made no mention of this, and in fact, lied to panel members about how much NASA knew about the cold-temperature risks before deciding to launch. It was even suggested that the SRB design would be safe to use for future shuttle missions.

At that point, McDonald knew what had to be done. “I walked down on the floor. I revealed what really happened that led up to the final decision.” The panel members, led by Chairman William Rogers, were shocked. From that point forward, McDonald would be at the center of much litigation for years to come.

The following weeks were a blur of late, stressful nights and early mornings, as McDonald strove to expose a NASA cover-up and set history straight. His handwritten notes, kept in great detail throughout this period, became the source for his 2009 book, *Truth, Lies, and O-Rings*, which exposed the events leading up to, and following, the Challenger accident.

**Demotion and reinstatement.** In the aftermath of his testimony, McDonald was demoted to a non-job at Morton Thiokol and removed from the task force investigating what went wrong on the SRBs. The only thing that kept him from quitting and moving on from Thiokol was his mentor, Joseph Pelham. “Together, we formed a committee of two — to figure out how to fix the joints with the O-Rings,” he says.

After hearing of his demotion, Chairman Rogers sup-

ported and vindicated McDonald. An act of Congress reinstated McDonald to his former position, and he was assigned to lead the redesign of the SRBs at Thiokol. “It was bitter-sweet,” says McDonald. “I thought I got the job because I was the most capable. But it was because they were forced to give it to me.”

Despite his misgivings, the work of McDonald and his team led to a new, and greatly improved, SRB design that was employed successfully on 110 shuttle missions. “The astronauts deemed the redesigned rocket boosters the most reliable part of the shuttle,” he says. “They used the same redesign until the shuttle’s retirement in 2011.”

McDonald retired in 2001 as vice president and technical director for advanced technology programs, after 42 years with Thiokol. Retired life for McDonald is “the greatest job I’ve ever had,” he says. He is far busier than he ever anticipated being — traveling cross-country for lectures and keynote speeches to educate others about ethical responsibility. In 2014, he was asked to become an adjunct professor for the test pilot school at Edwards Air Force Base — where he lectures on ethics and lessons learned from the Challenger.

**Thoughts on the future of space exploration.** For the first time in a generation, NASA is developing a new spacecraft, Orion, which will be designed for deep-space exploration. “I’m encouraged by that,” says McDonald. “But they won’t be successful in that project unless they get more funding. It’s our only avenue to get into real space exploration again.” McDonald wholeheartedly believes in the importance of the American space program. “There’s a lot of science and knowledge to be gained by going to Mars. Unless we change our priorities, the Chinese or Russians will overtake us in this field.”

He laments the fact that our current astronauts are ferried to and from the International Space Station aboard the Russian Soyuz crafts. “Even though the Russians can do it cheaper, I think the American people would rather pay twice as much to keep that capability here. It’s better than writing checks to the Russians.”

**Looking back.** McDonald’s life has been profoundly impacted by the Challenger accident. However, his decision to stand up for his beliefs, even under intense pressure and scrutiny from NASA, his employer, and the Presidential commission, helped ensure that the solid rocket boosters would never again endanger lives.

When asked how he feels about being labeled a whistleblower, McDonald is conflicted. “I always hated that name,” he quickly states. “I didn’t like it. There are too many who do it for financial reward or notoriety.” But he seems resigned to the term. “I wanted to encourage people to make things right and step up for good. We can’t repeat the same mistakes.” There are a few seconds of silence as McDonald mulls over his response. Finally, he says, “It’s a mixed bag.”

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