



LEAVING EARTH

Apollo 8's voyage to the Moon, highlighted by a live Christmas Eve broadcast from humankind's first-ever lunar orbit, had a lasting impact on America and the world.

BY TED SPITZMILLER

PHOTOS: NASA



The summer of 1968

was one filled with foreboding as far as the United States was concerned. Politically, the Vietnam War was going poorly. President Lyndon B. Johnson acknowledged that aspect in March, when he announced he would not seek re-election. Martin Luther King Jr., a principle civil rights advocate was assassinated in April, and race riots followed in many cities across the country. In a foreshadowing of events in the distant future, Senator Robert Kennedy was shot to death by a Muslim extremist in June following his primary campaign win in California.

The American space program had but 17 months remaining to place a man on the Moon to fulfill the late President John F. Kennedy's pledge of May 1961 to accomplish the task "before this decade is out." The Apollo program was designed to achieve that goal. During the first week of August 1968, the manager of the Apollo Spacecraft Program Office George Low, was about to make an incredible proposal to Chris Kraft, director of Flight Operations.

Eighteen months earlier the three-member crew of Apollo 1 had been killed during a ground test. Following the disastrous fire, critical systems had undergone extensive redesign. The rescheduled first manned flight was now designated Apollo 7 (the intervening numbers were unmanned tests) and was set to launch in October of 1968 using the much smaller 1.6 million-pound-thrust Sat-

urn 1B booster. It was still three months off when Low put forth his audacious suggestion.

The lunar launch vehicle for the Apollo program, the giant 7.5 million-pound-thrust Saturn V, had almost shaken itself to pieces on its second test (AS-502) the preceding April with the unmanned Apollo 6. Low's outrageous proposal was to use the next launch of the Saturn V (AS-503) to send the second manned Apollo Command and Service Module (CSM) around the Moon before the end of the year.

How could Low consider sending three men to orbit the Moon aboard a booster that had only flown twice, and a spacecraft that had yet to fly with a crew? Would there be no unmanned flight to pave the way and prove the hardware, software, and procedures? The Gemini program had orbited men to a height of but 800 miles above the Earth. In these flights the spacecraft was typically less than an hour from safety should anything go wrong. Yet the proposed circumlunar flight would send three astronauts a quarter of a million miles into space, where the safety of the Earth lay as much as three days distant.

Low's bold plan was based, in part, on the "all-up" testing philosophy established by another member of the NASA management hierarchy several years earlier. As the director of manned spaceflight, George Mueller (pronounced Miller) decreed in 1963, that to beat the Russians to the

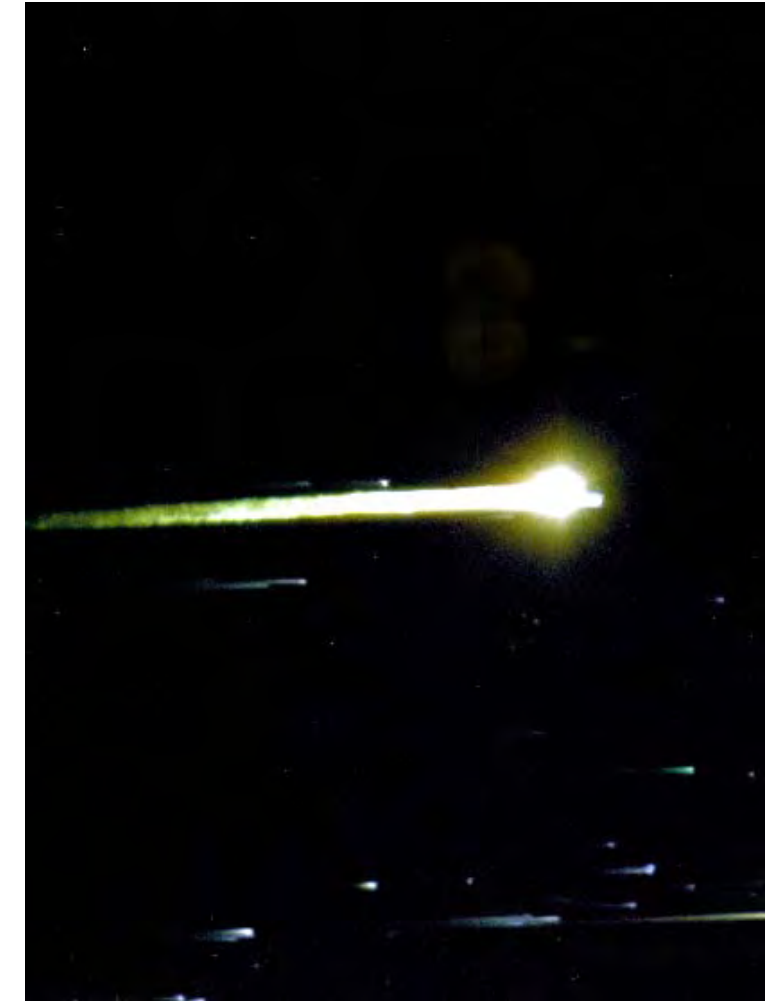
Moon some dramatic change had to be made with respect to how flight testing was performed. He advocated that each launch had to "prove" several major components of the hardware rather than the traditional and conservative method of incremental testing. Thus, the first test of the Saturn V rocket (AS-501) in November 1967 had all three stages "live" and drove its unmanned Apollo 4 into the Earth's atmosphere at lunar return reentry speed to test its heat shield. The flawed (but still somewhat successful) test of the second Saturn V (AS-502) in April of 1968 involved qualifying the spacecraft's propulsion system in a series of complex maneuvers.

But Low was not only facing the Kennedy deadline of the end of the decade, he was confronting the challenge of the Russian space program that had been accomplishing space spectaculars since the first Sputnik more than 10 years earlier. The Apollo 1 crew of Virgil "Gus" Grissom, Roger Chaffee and Ed White had perished due to a combination of poor design and workmanship compounded by inadequate management oversight in the rush to achieve the lunar goal. The intense national program had been created to beat the Russians to what many considered the finish line of the frantic space race—a race that used technology to demonstrate the superiority of the opposing political ideologies of the two great superpowers.

The Soviets had also encountered tragedy in their manned spaceflight program just months after the Apollo 1 fire. Cosmonaut Vladimir Komarov died in the first test flight of the Soyuz spaceship following its reentry. However, within the past 10 months the USSR had launched four large unmanned Zond spacecraft that appeared to be the equivalent of Apollo. Although not publicly acknowledged at that time, Zond was a Soyuz adapted for circumlunar flight!

Low's rationale for using the third Saturn V to send the second manned Apollo CSM to the Moon was actually very simple. At the Marshall Space Flight Center in Huntsville, Alabama, where the Saturn V was conceived, Wernher von Braun's team was making changes to the huge rocket to avoid the "pogo effect" that had almost destroyed the Apollo 6 test flight. They were also working intently on several other problems that had become apparent during that flight. In keeping with the all-up testing philosophy, there had to be more significance to the next launch (that cost about \$200 million) than simply verifying that these changes addressed the problems. Moreover, Mueller was insisting that AS-503 (Apollo 8) be a manned flight.

The progression of Apollo flights was defined as a series of mission objectives labeled A through G. Each of these had to be completed before the



The crew of Apollo 8, above, at breakfast before launch on December 21, 1968. Opposite page, clockwise from upper left: Liftoff of Apollo 8; the command module re-enters the Earth's atmosphere, creating a fiery streak; and a portrait of the prime crew: Frank Borman, William Anders, and James Lovell. Preceding pages: The crew prepares for launch; and Apollo 8 bathed in spotlights before launch.

lunar landing could be accomplished—Mission G. (The table on page TK shows the objectives and the progress as of August 1968. Note that to accomplish Mission A required the first two Saturn V flights.)

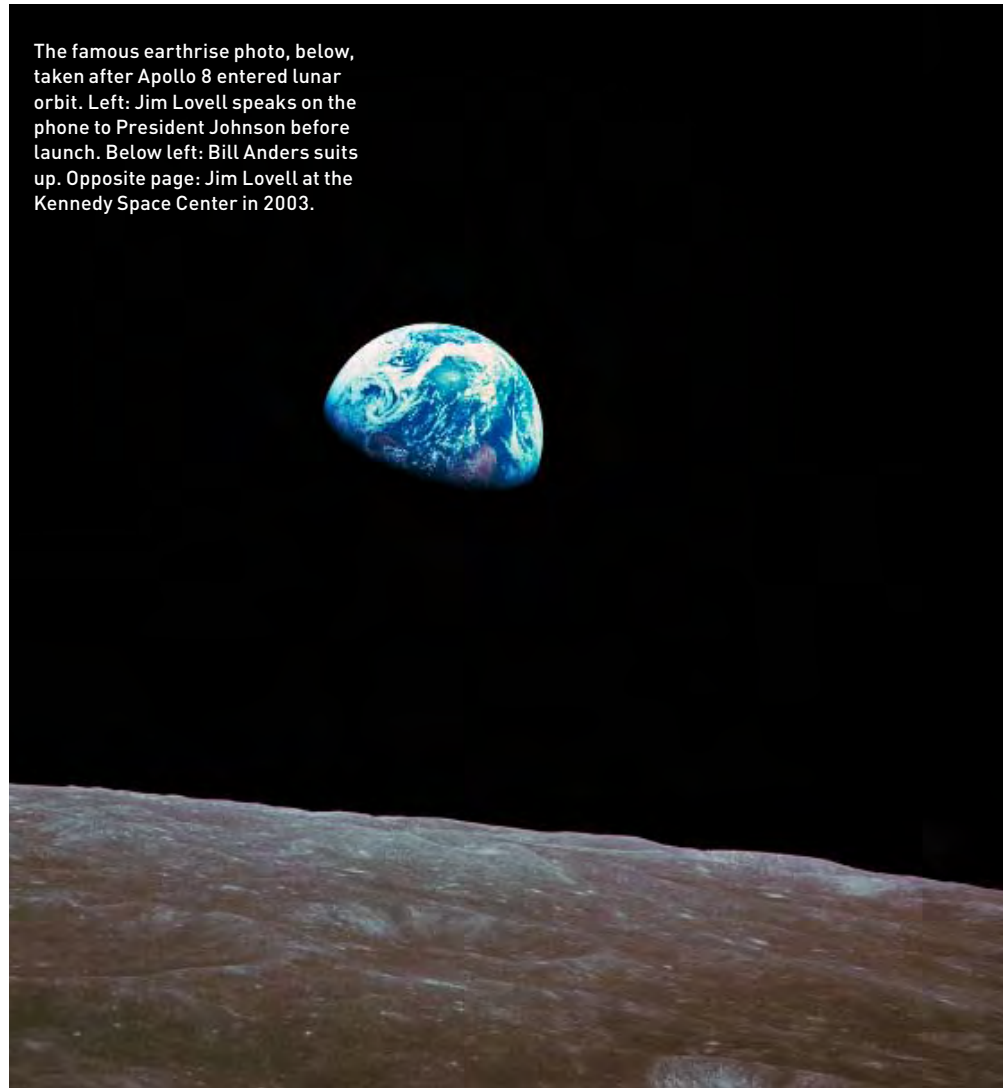
Despite the problems with completing Mission A with the second Saturn V flight, von Braun was confident that the changes being implemented would resolve the pogo problem (adding helium shock-absorbing cavities in the LOX line pre-valve assembly) and fix a leaking fuel line igniter.

Even assuming Mission C was successful with Apollo 7 (a manned Saturn 1B flight) in October, the Lunar Module (LM) was experiencing many development delays and was not expected to be available for manned flight-testing (Mission D) for at least another five months. So the question was—what could the next Saturn V flight accomplish? Mueller understood that the third flight of the Saturn V had to be manned to keep on schedule—but with the LM behind in its delivery, what kind of mission could move the program forward? As it now stood, it would be very difficult to achieve a manned lunar landing before the end of 1969 if they could not fly another Saturn V (AS-503) in the programmed three-lunar-month





The famous earthrise photo, below, taken after Apollo 8 entered lunar orbit. Left: Jim Lovell speaks on the phone to President Johnson before launch. Below left: Bill Anders suits up. Opposite page: Jim Lovell at the Kennedy Space Center in 2003.



launch cycle. To Low the answer was obvious—AS-503 would send the second manned CSM (Apollo 8) around the Moon.

While Kraft did not oppose Low's dramatic proposal, he indicated that key elements of the Apollo program had to be evaluated to determine if such a flight was within the current capability. The entire focus of the program had been the manned lunar landing and an explicit circumlunar flight had not been a part of the mission objectives. Of course, Low did not just want to loop around the Moon. In keeping with the all-up testing philosophy, he wanted to have the three intrepid astronauts orbit the Moon to accomplish some of the tasks required for later flights. Low was essentially modifying Mission D, which was to send the CSM and LM into a high Earth orbit (HEO). Of course, it would not have the LM and instead of Earth orbit it would go all the way to the Moon. It would accomplish most of the Mission D objectives, and perhaps beat the Russians to the circumlunar goal. America had been beaten to many space firsts since Sputnik 1 initiated the Space Age, sometimes by only a few weeks.

Low's audacious change in the Apollo schedule might just allow the American space effort to accomplish this very significant goal before the Russians.

Within days of the proposal, the various NASA centers began to report that the tracking, communications, launch vehicle, and CSM were capable of supporting the circumlunar mission. The specialized computer systems and software required could also be made available by a December launch window.

James Webb, the NASA administrator, had been out of the country, and was more than annoyed when Low called to advise him of the projected change in plans. He was upset that Low had not only proposed the high-risk mission, but also had performed so much preliminary planning before getting his approval. Webb had been a key ingredient in the administration of NASA and the political maneuvering required to get, and keep, the Apollo program funding—especially in light of the escalating costs of the Vietnam War. However, as he listened to Low's reasoning, he quickly saw

the rationale.

Webb was receiving sensitive covert intelligence briefings on Soviet progress and knew of their giant N1 rocket being readied for testing in support of their manned lunar program. He also recognized that the Proton booster and its Zond payloads were probably unmanned tests in preparation for a manned circumlunar flight. Although he was quite sure that America was finally outpacing the Soviet program, he did not want America to be on the losing end of yet another "first" in the space race.

But, if the stakes were high, the risk was too. Webb knew that by approving an attempt to send three men to the Moon on merely the third test of the Saturn V and only the second flight of the Apollo spacecraft, he was leaving himself, NASA, and the United States open for major political fallout if the attempt failed—especially if the astronauts were lost. He advised President Johnson of the possibility and the risks. The president had no reservations. He would go with Webb's judgment. But, Webb wasn't about to make the pro-

posal public—not yet.

Astronaut chief Deke Slayton called in James McDivitt, the scheduled commander of Mission D (Apollo 8), to give him the opportunity to accept the change in the objectives or adjust his flight to become Apollo 9—he opted for the latter. Having invested so much of their training in the CSM/LM flight plan McDivitt did not want to make the change. Thus, the Apollo 9 crew of Frank Borman, James Lovell, and William Anders readily agreed to move their Mission E to Apollo 8.

Who were these men who were willing to accept the challenge? Commander Frank Borman was a

40-year-old West Point graduate who switched to the Air Force to become a fighter pilot. He was part of the second group of astronauts selected in 1962 and had flown the long-duration, two-week Gemini 7 mission in December of 1966. James Lovell, born within two weeks of Borman, was a Naval Academy graduate, class of 1952. He too flew fighters and was part of the second astronaut selection. He made his first flight with Borman aboard Gemini 7 and his second as commander of the Gemini 12. The youngest member of the crew, 35-year-old William Anders, was also a Naval Academy graduate, class of 1955. Like Borman, Anders switched to the Air Force to become a fighter pilot and was a member of

the third astronaut selection group in 1963. This would be Anders's first spaceflight.

As the tentative planning for Apollo 8 continued, another Zond launch on September 15 sent live tortoises and other biological specimens around the Moon and back to Earth. The Soviets had apparently achieved complete success with their launch vehicle and spacecraft. The world now expected them to launch men to the Moon with the next lunar opportunity.

However, the Soviets had not revealed that the Zond's reentry trajectory placed extremely high G-loads on the spacecraft. To reduce the stress

JIM LOVELL'S VIEW

It was the "Old Man's Rocket".

LAUNCH: Besides the traditional critical events (Launch, TLI, LOI, TEI, and reentry) were there any others that created moments of "heightened awareness."

LOVELL: Docking the CM to the LM. Observing the far side of the Moon for the first time.

LAUNCH: What are the deepest impressions that return to you when you recall the event after 40 years?

LOVELL: Seeing the Earth as it really is. My thumb could completely cover the Earth. It immediately conveyed the thought of how insignificant we are in the universe. A small body orbiting a normal star, tucked away in the outer edges of the Milky Way—only one of the millions of galaxies in the universe.

LAUNCH: The unfolding of that scene with the reading from Genesis was quite emotional. Did you have any idea how significant the impact would be for those of us on Earth?

LOVELL: The effect on reading from Genesis was not apparent until we arrived back on Earth.

A veteran astronaut, Jim Lovell orbited the Moon on both Apollo 8 and the ill-fated Apollo 13. LAUNCH contributing editor Ted Spitzmiller contacted Lovell about the impact of Apollo 8 as the 40th anniversary of the mission approaches this December.

LAUNCH: Was it Frank Borman who conveyed to the crew that they were switching assignments and Apollo 8 would go to the Moon? Had you heard any "rumors" prior to that time?

LOVELL: We were in LA at North America when Frank was called back to Houston. When he returned he told Bill and I that the mission was changed.

LAUNCH: Many were surprised by the announcement that Apollo 8 was to fly to the Moon. As conservative as NASA had been, even considering the policy of "all-up" testing did you initially feel it was too big a step?

LOVELL: I was delighted! I had no worries about the risk involved. Perhaps I didn't understand the situation.

LAUNCH: With your understanding of the role of the LM as a lifeboat for the journey outbound before Apollo 13, do you recall any reservations about not having it available for Apollo 8?

LOVELL: Since Apollo 8 happened before 13 the thoughts about the LM as a lifeboat never entered our minds. It was only after 13 that the additional risk of not having the LM was apparent.

LAUNCH: To prepare you for "the ride" atop the Titan II during Gemini VII you had the experiences of those who had flown before. However, Borman, Anders, and yourself, were the first to experience the sound and fury of the Saturn V. Did it present a few surprises?

LOVELL: We were pleasantly surprised by the ride on the Saturn V compared to the Titan. Maximum G's was only 4 compared to 8 at the burnout of the second stage of Titan. The loading on the upper stages of Saturn V were less than one G.





on the occupants of a returning lunar flight, the spacecraft had to follow a path that allowed it to dissipate some of its energy in an initial dip into the upper layers of the atmosphere and to skip back out into space before the final plunge. The Soviets had not successfully demonstrated this but maintained the tightest secrecy over their lack of capability. NASA felt confident, as a result of Mission A, that their radar and computer codes could produce the desired return track without having to resort to a complete unmanned circumlunar mission. Thus, the first time an Apollo circumlunar flight was flown, it would be manned.

The redesigned Apollo CSM finally went aloft on October 11, 1968, after a delay of almost two years following the Apollo 1 fire. With Wally Schirra, Walter Cunningham, and Donn Eisele, Apollo 7 spent 11 days in Earth orbit testing all the spacecraft systems. The flight was an unqualified success.

Following an evaluation of the flight, an Apollo project review board met in an unusual Sunday meeting on November 10th, to assess all the elements that had to come together for the final approval to send Apollo 8 to the Moon. It is not known whether the launching that same day of Zond 6 had any real effect on the decision, but the unmanned spacecraft looped around the Moon and returned using the "skip reentry" that produced less G force. The board approved the launch of Apollo 8 for December 21st. The



The Apollo 8 astronauts emerge from a recovery helicopter after arriving aboard the USS Yorktown following splashdown on December 27, 1968. Opposite page: The Apollo 8 command module is recovered aboard the Yorktown.

TABLE 1 — APOLLO MISSION OBJECTIVES AS OF AUGUST 1968

MISSION DESIGNATION	OBJECTIVE	STATUS
Mission A	Test all three stages of Saturn V and CSM structural integrity at lunar return reentry velocity—unmanned	AS-501 Apollo 4, November 1967 AS-502 Apollo 6, April 1968
Mission B	Test LM ascent and descend engines in low Earth orbit (LEO)—unmanned	SA-204 Apollo 5, January 22, 1968 (Saturn IB)
Mission C	Test first manned CSM	SA-205 Apollo 7, Scheduled for October 1968 (Saturn IB)
Mission D	Manned CSM and LM System check in low Earth orbit	AS-503 Apollo 8, Scheduled for February 1969 (Third Saturn V)
Mission E	Repeat of Mission D in high Earth orbit (HEO)	AS-504 Apollo 9, Scheduled for May 1969
Mission F	Manned CSM and LM system check in HEO or lunar orbit	AS-505 Apollo 10, Scheduled for July 1969
Mission G	Manned lunar landing	AS-506 Apollo 11, Scheduled for October 1969

announcement was made to the press.

While the revelation met with excitement and anticipation by most, it was also the subject of some critical analysis. Among the detractors was Sir Bernard Lovell, director of Britain’s Jodrell Bank Observatory, who noted that, within a few years, missions to the Moon could be done by robotic spacecraft, avoiding the risk to a human crew. He also commented that the mission represented “a dangerous element of deadline beating,” an obvious reference to the Kennedy commitment and the race with the Soviets. Some critics cited the lack of an extensive “track record” for either the Saturn V or the Apollo spacecraft, and a few predicted outright failure.

Though it was not divulged for many years, the Zond 6 spacecraft lost pressurization during its return and the biological specimens died. In addition, the parachute released early and the spacecraft was destroyed. Although the Soviets had the capability and their launch window would have been the second week of December, they decided they needed at least one more test before they would commit a cosmonaut to a circumlunar flight. That hesitation cost them the race to the Moon.

History records that Apollo 8 successfully flew the first three men to the Moon. On Christmas Eve, the crew sent their last TV transmission from lunar orbit. Borman began by saying, “The Moon is different to each one of us ... I know my own impression is that it’s a vast, lonely, forbidding-type existence.” Lovell then commented, “The vast loneliness up here ... is awe-inspiring ... The Earth is a grand oasis in the big vast-

ness of space.” Anders added that the “terminator” (the area where the sun is rising or setting on the Moon) “brings out the stark nature of the terrain and the long shadows.”

The astronauts sent back only black and white TV images of a bright sphere that was Earth. However, from their perspective, the blue and white Earth, the grand oasis, was a constant reminder of the fragile nature of the planet and its inhabitants—especially entrancing as it rose from behind the lunar horizon with each lunar orbit of the CSM. Anders’s photo of Earth rising from behind the Moon would be widely published and his most memorable comment may have been, “We came all this way to explore the Moon, and the most important thing is that we discovered the Earth.”

Anders then began the closeout of the TV session, “... the crew of Apollo 8 has a message that we would like to send to you. ‘In the beginning, God created the heavens and the Earth ...’” Starting at Genesis 1:1 the three astronauts took turns reading from the Bible the first 10 verses as the rugged and desolate terrain of the lunar landscape moved slowly across the TV screen. It was an emotional occasion for the millions who witnessed it. But the crew had no idea the impact that their broadcast had on the world.

“The effect on reading from Genesis was not apparent until we arrived back on Earth,” Jim Lovell told LAUNCH.

In the days following the successful return of Apollo 8, the effort to downplay the Soviet’s own aspirations were voiced by Leonid Sedov, who

was the primary spokesman for their space program: “There does not exist at present a similar project in our program. In the near future we will not send a man around the Moon.” In losing the circumlunar race, the Soviets decided to cancel their manned Zond efforts and concentrate on the N1 and their lunar lander, as well as a robotic sample-and-return mission.

Cosmonaut Chief General Nikolai Kamanin wrote in his diary, “The flight of Apollo 8 is an event of worldwide and historic proportions. This is a time for festivities for everyone in the world. But for us, the holiday is darkened with the realization of lost opportunities and with sadness that today the men flying to the Moon are not named Valeriy Bykovskiy, Pavel Popovich, nor Aleksey Leonov...”

The high-risk decision to send Apollo 8 to the Moon dramatically revealed the shift in space exploration leadership that had actually occurred in 1966 because of the Gemini program. The foresighted George Low, and the man on whom the responsibility for failure would have lain, James Webb, had defied the odds. They had put their confidence in the skills and determination of the Apollo engineers and astronauts that had allowed America to triumph.

James Webb, the 62-year-old administrator left NASA in October 1968. He had expended his political capital during his long 7-year tenure and guided NASA through America’s rise to prominence in space technology. With the prospect of a Republican president (1968 being an election year), he also recognized that he would undoubtedly be replaced within months of the new

administration. He passed away in 1992.

George Low, the 42-year-old who had proposed the circumlunar flight became deputy administrator in December 1969, working with the early development of the space shuttle, the Skylab program, and the Apollo-Soyuz Test Project. His reputation was somewhat tarnished by accusations that he had a part in causing Wernher von Braun to leave NASA. He died in 1984.

The 50-year-old George Mueller, resigned from NASA in 1969 to return to private industry. His legacy in structuring the Apollo management and the all-up testing philosophy have earned him a place in history.

The courage of Borman, Lovell, and Anders, in rising to the challenge and accepting the risks stand as a measure of mankind’s enduring desire to explore the unknown.

The depth of the risk for the astronauts was not truly realized until the Apollo 13 mission. One role of the Lunar Module was as a back-up for life support and propulsion systems should there be a failure of a CSM system on the way to the Moon. Without the LM the Apollo 8 astronauts faced much higher risks as would eventually be displayed with Apollo 13.

Apollo 8 was the last space flight for Borman, who left NASA in 1970. He would go on to head Eastern Airlines. Lovell made one more flight as commander of the ill-fated Apollo 13, for which he is perhaps best known, before retiring from the Navy with the rank of Captain. Apollo 8 would be Anders’s only spaceflight and he continued his career in a series of significant positions in government and private industry.

The year 1968 was a difficult one for America with the Vietnam War, the racial strife, and the assassinations. Many felt that the successful circumlunar mission gave hope that, if humanity could overcome such highly technical problems presented by a flight to the Moon, the troubles here on Earth could be managed as well. However, engineering solutions are more easily mastered than human behavior. ✦