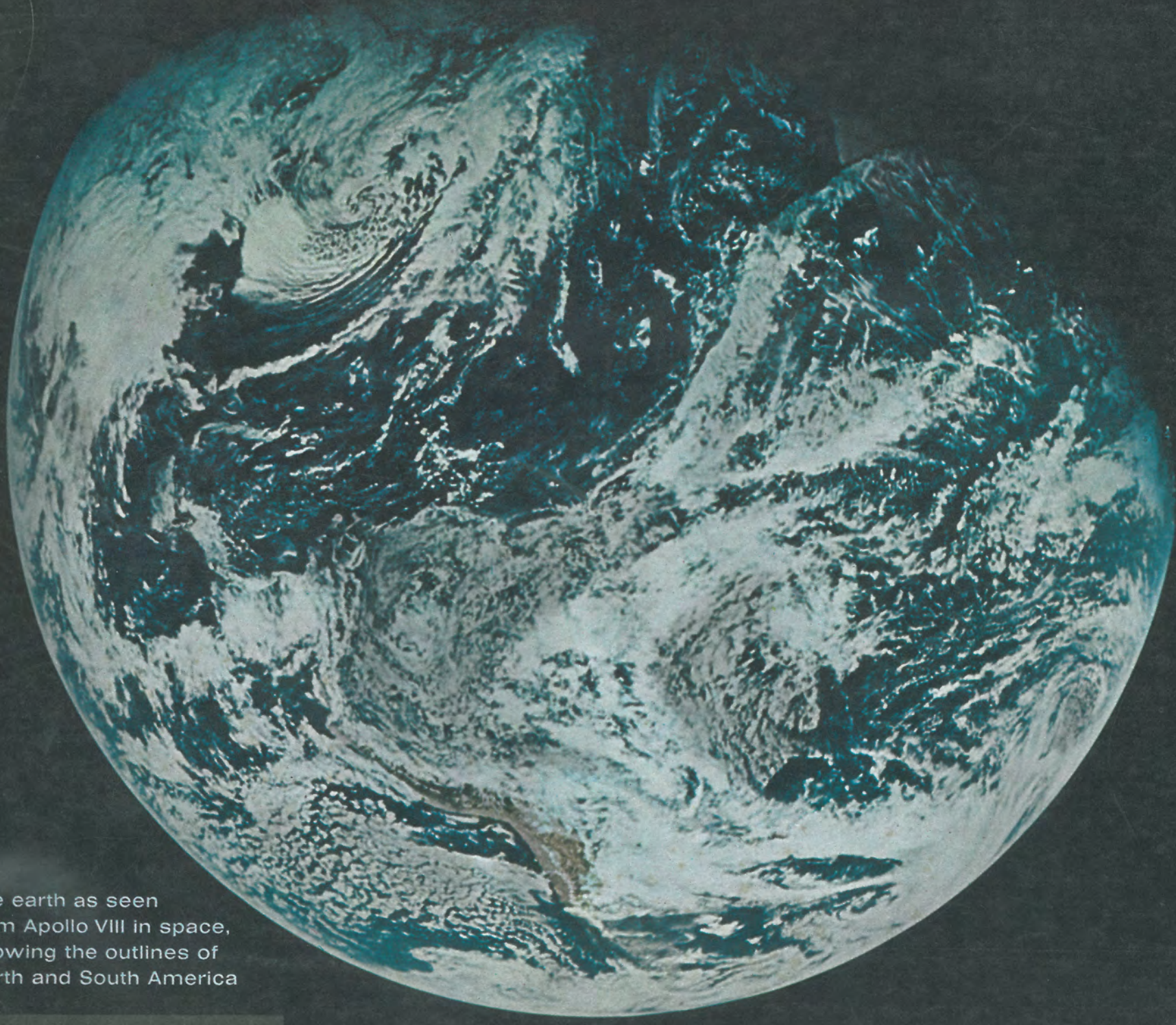
LIFE

SPECIAL SECTION

THE VIEW FROM THE MOON

IN COLOR: PICTURES FROM APOLLO VIII



The earth as seen from Apollo VIII in space, showing the outlines of North and South America

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EDITORS' NOTE

Bureau Chief for Space Travel

A year ago last March, Dora Jane Hamblin, a staff writer, once our bureau chief in Rome, forsook her more ordinary duties to become our bureau chief for Space Travel. No one was more involved than she with the men of Apollo 8 (*pp. 10-24*) and the families who anxiously awaited their reurn. This week we asked Dodie, a girl of Iowa origins whose adventures have taken her almost everywhere and often enriched the pages of LIFE, to remember how she got off the pad. "Well," she said, "I went down to Houston and checked in at the space center. I didn't know quite where to begin and I was wondering how I was going to get along with the spacemen and their wives. I was feeling kind of fat so I went to a health club. I was joggling on a vibrator when the girl next to me said something about Japan. 'I was there in 1945,' I said. So was she. Then Germany. Same thing. Turned out she was Marge Slayton, wife of Deke. I went back later and was baking in a sauna when I met Sue Borman."


DODIE HAMBLIN

"That's right," says Sue Borman, wife of the commander of Apollo 8, "and we've since become very good friends. Dodie has made a real effort to get to know all of us—she's really had to put on her track shoes for this job because there are three different groups of us living in three different places. She's got to know us well, which means she can drop in anytime she wants."

Since that March Dodie has taken an apartment near Taylor Lake. Because the three families, the Bormans, Lovells and Anderses, whose men flew in Apollo 8 live on different shores, she sometimes commutes in a red canoe named (after an old camp director) the *M. Genevieve Clayton*.

"The canoe was no trouble at all," she says. "I learned the tricks of paddling one in a swimming pool at camp. What was hard was that I had to learn an entirely new language. If you're going to talk to these men and their families you have to understand what they're doing and what they mean when they say the thruster does this or the inertial platform does that. These men are unbelievably patient. They talk business constantly and are willing to explain everything step by step, over and over again. When I was in Rome the space program didn't mean much to me. Now I'm a convert. I'm going to stay in Houston most of the time until we land on the moon.

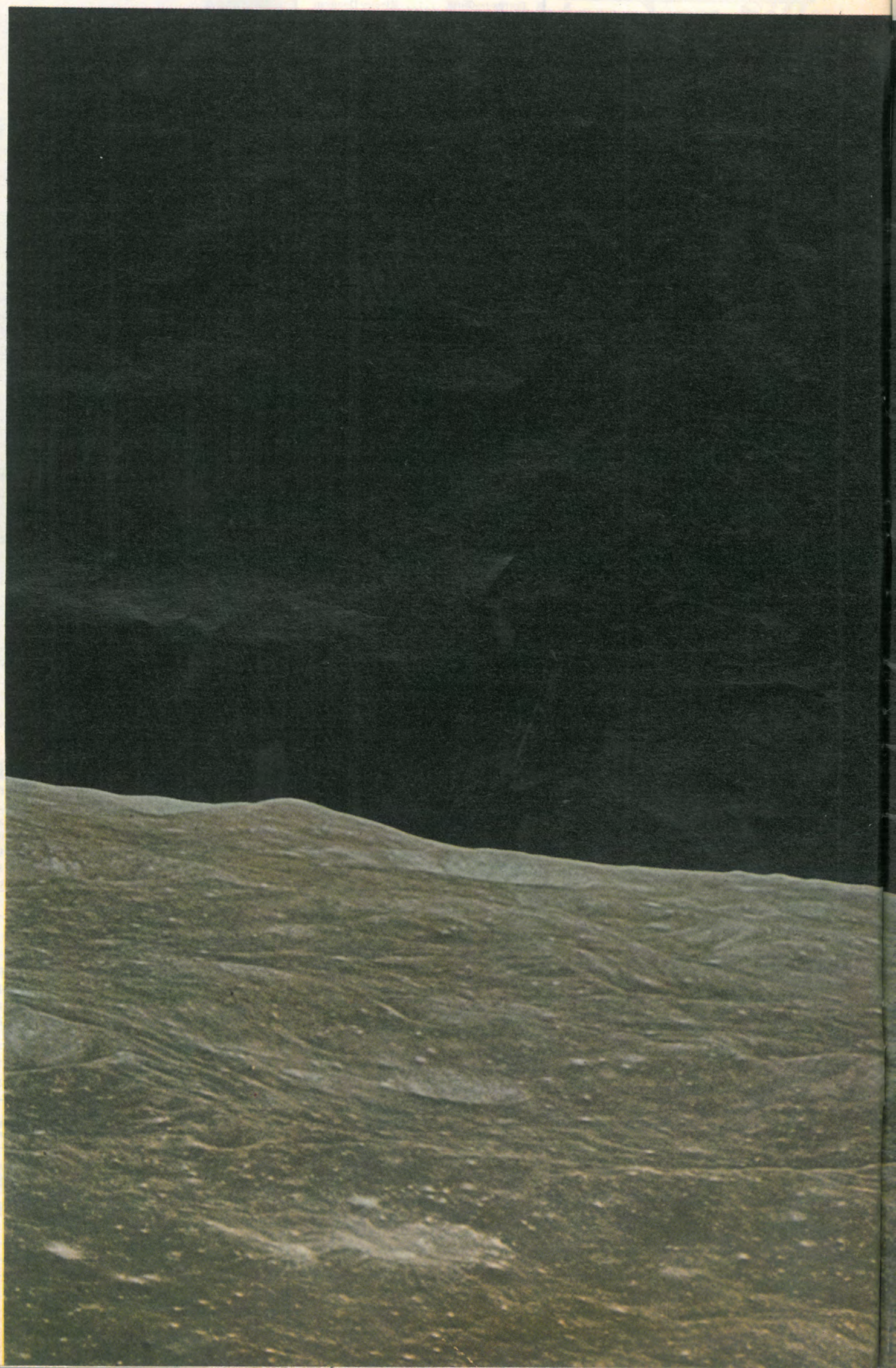
"These are warm and remarkable people. Before a recent launch one of the astronauts said to his kids, 'Goodby now, I'm going to work. I'll be back in a couple of weeks.' Each of the wives has a special NASA squawk box tuned to the capsule in orbit; each learns to know when her husband will be asleep or on duty in space, and adjusts her Texas life to match his waking voice." Dodie's deep interest is not lost on the wives. "Some of us aren't at our best before a launch," said Sue Borman recently, "so it's important to know us as we really are—when we're not under pressure. Right now I look forward to Dodie's visits during the seven days when Frank is up. I know she's going to be a real help to me then." She was.

George P. Hunt

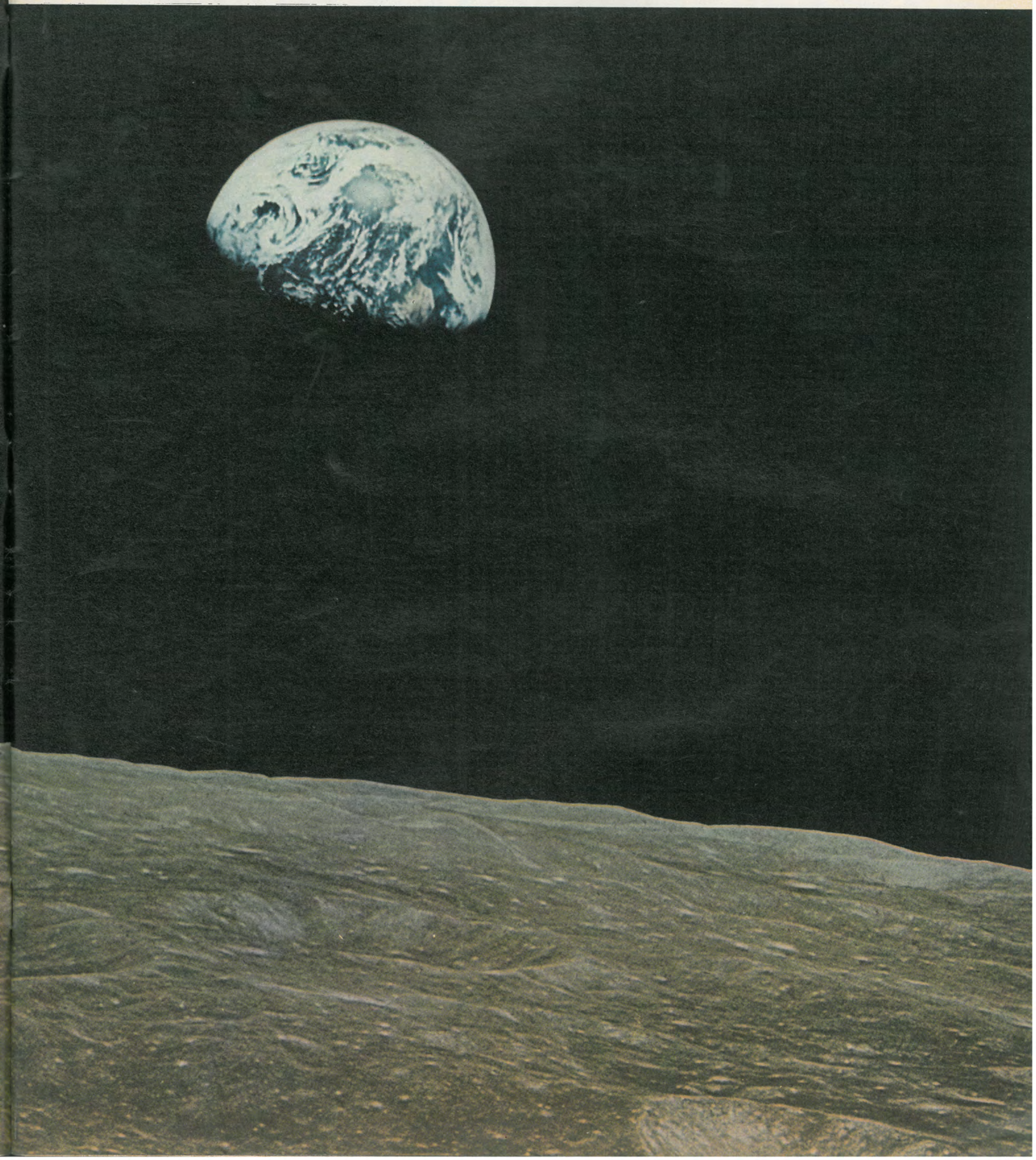
GEORGE P. HUNT,
Managing Editor

SPECIAL SECTION

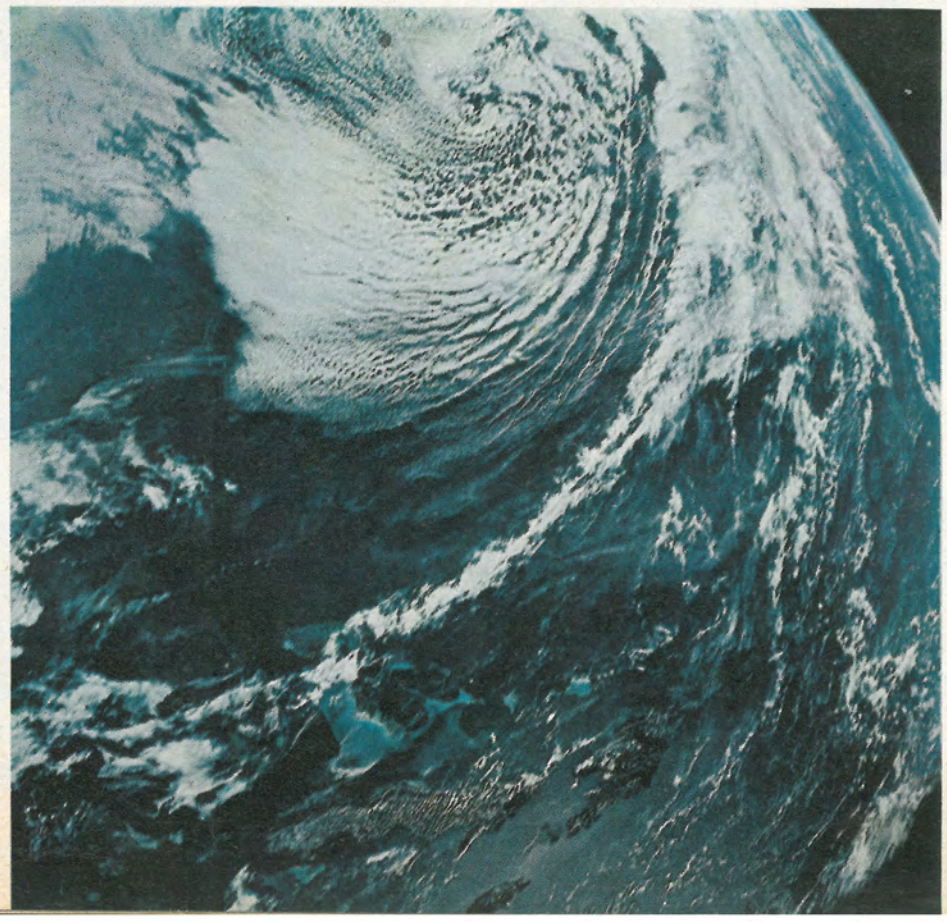
Man at the Moon

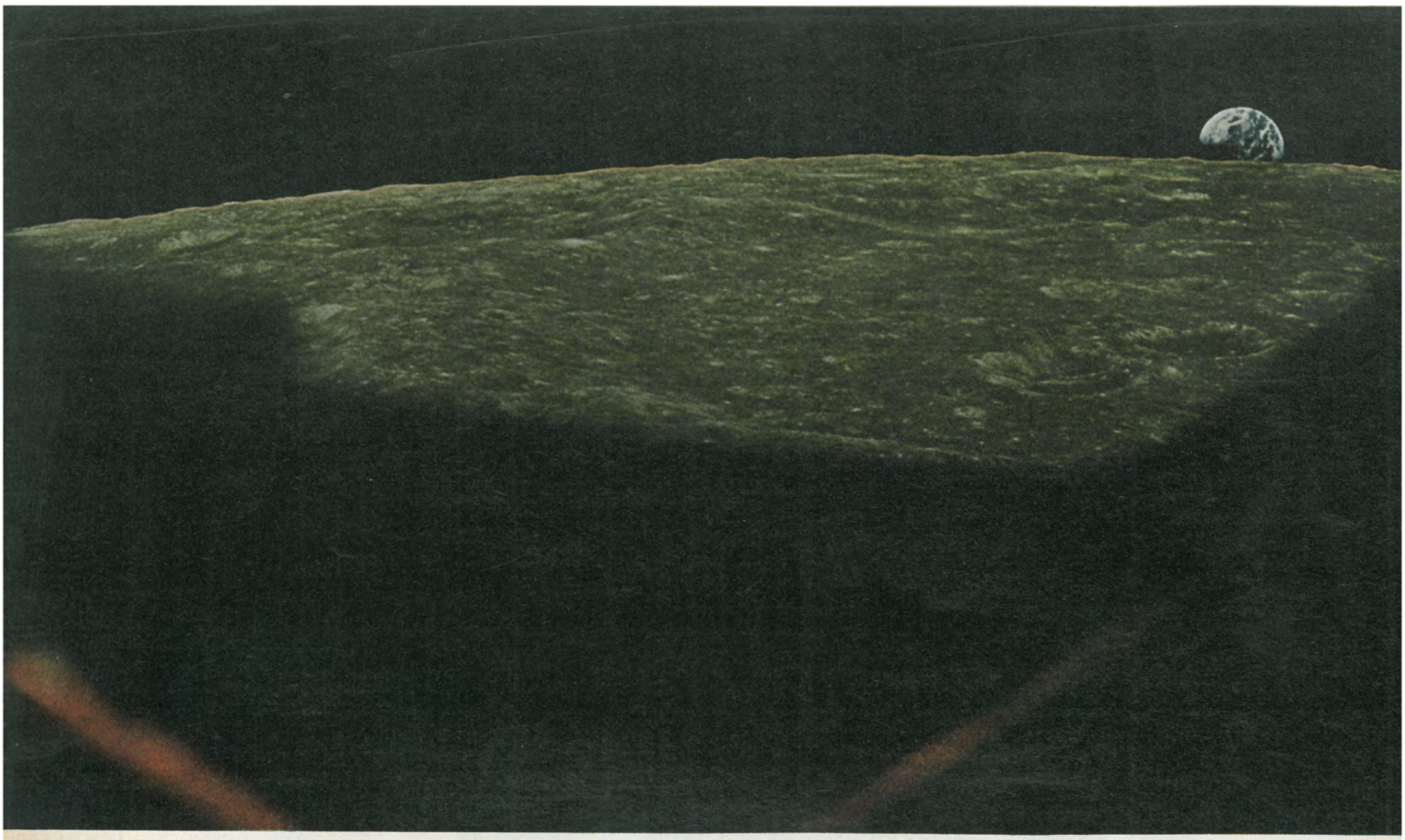


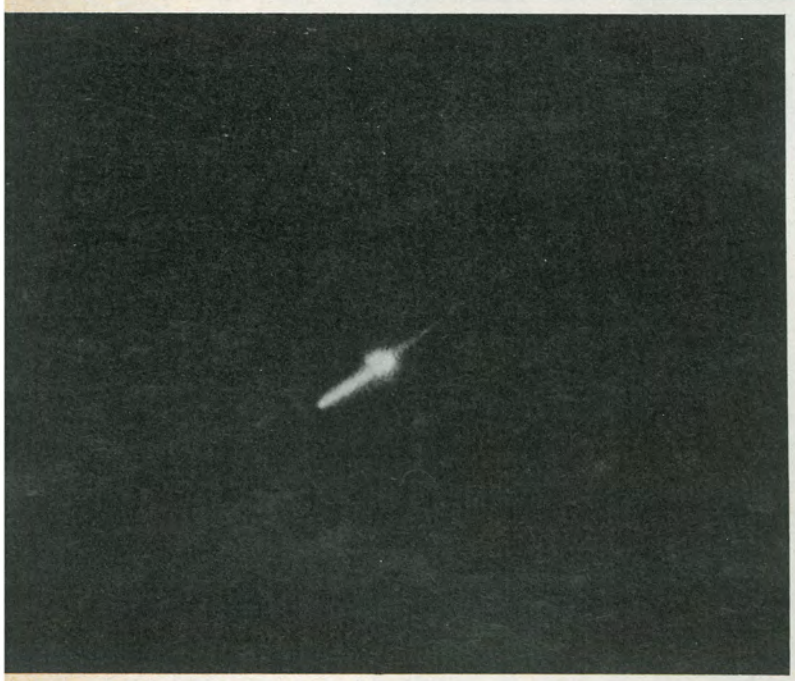
It was mankind's farthest stride in the history of exploration. Almost a quarter-million miles from the planet earth, Astronauts Frank Borman, James Lovell and William Anders took this photograph of the cratered surface of the moon and the glowing half-orb of earth hanging in the void of space 240,000 miles away, as they came over the horizon in their first orbit of the moon. The sunset terminator, separating day and the shadow of night, bisects Africa. The visible area of the moon's surface is about 100 miles across and 480 miles to the horizon.



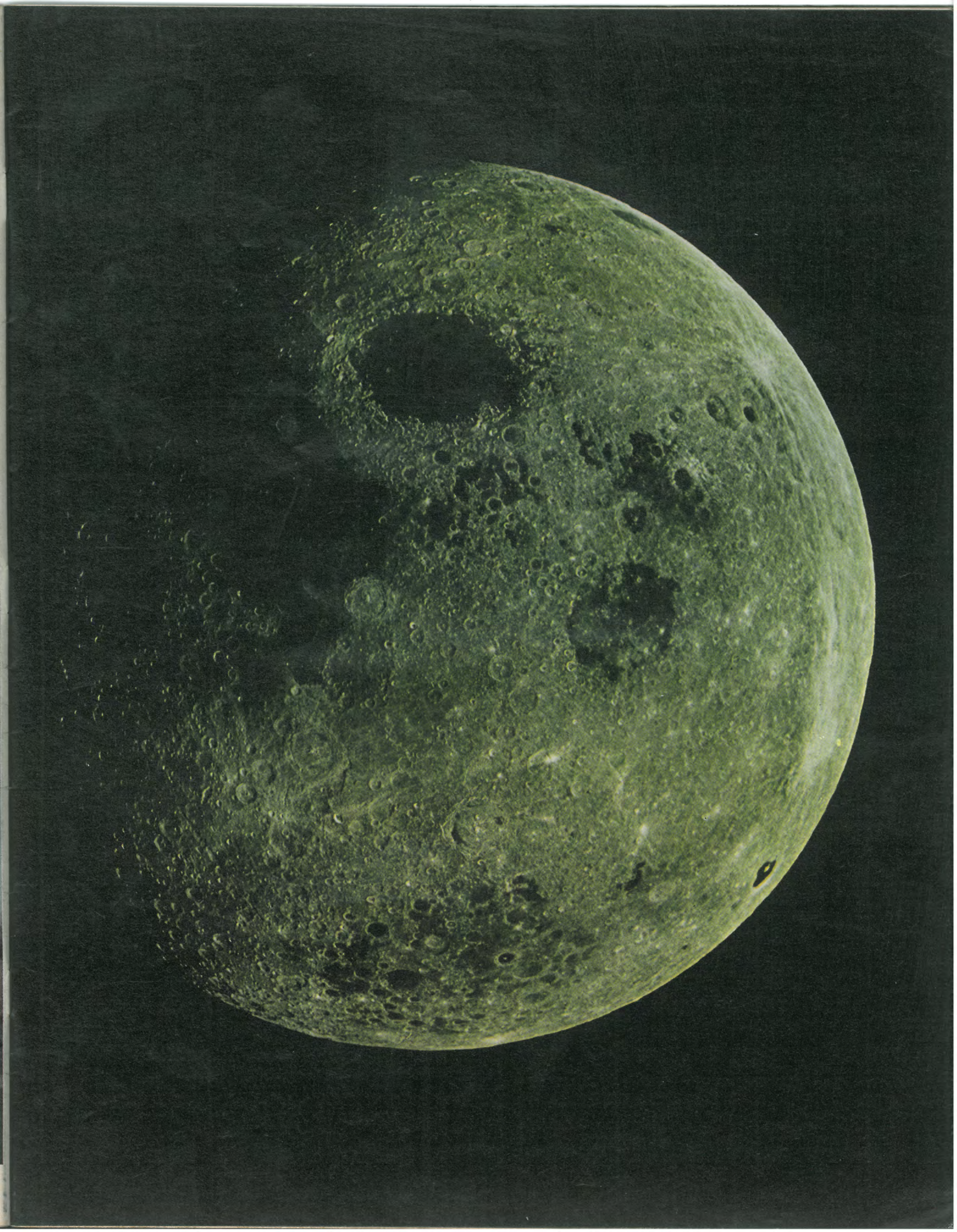
Jettisoned by the Apollo 8 astronauts as they soared out of the earth's gravitational field and toward the moon, the third stage of the Saturn V rocket (left and far left) floats free in space. Surrounding it are small particles of dust which reflect the light of the sun, creating the "firefly" effect seen by John Glenn seven years ago during the first earth orbital flight by an American. The photograph below was taken shortly after Apollo 8 left the earth orbit. The brown mass to the left is the southeastern coast of the United States, from Florida to Chesapeake Bay. Cuba is visible below and to the right of Florida. The light blue-green splotches are the shallow banks around the Bahama Islands.



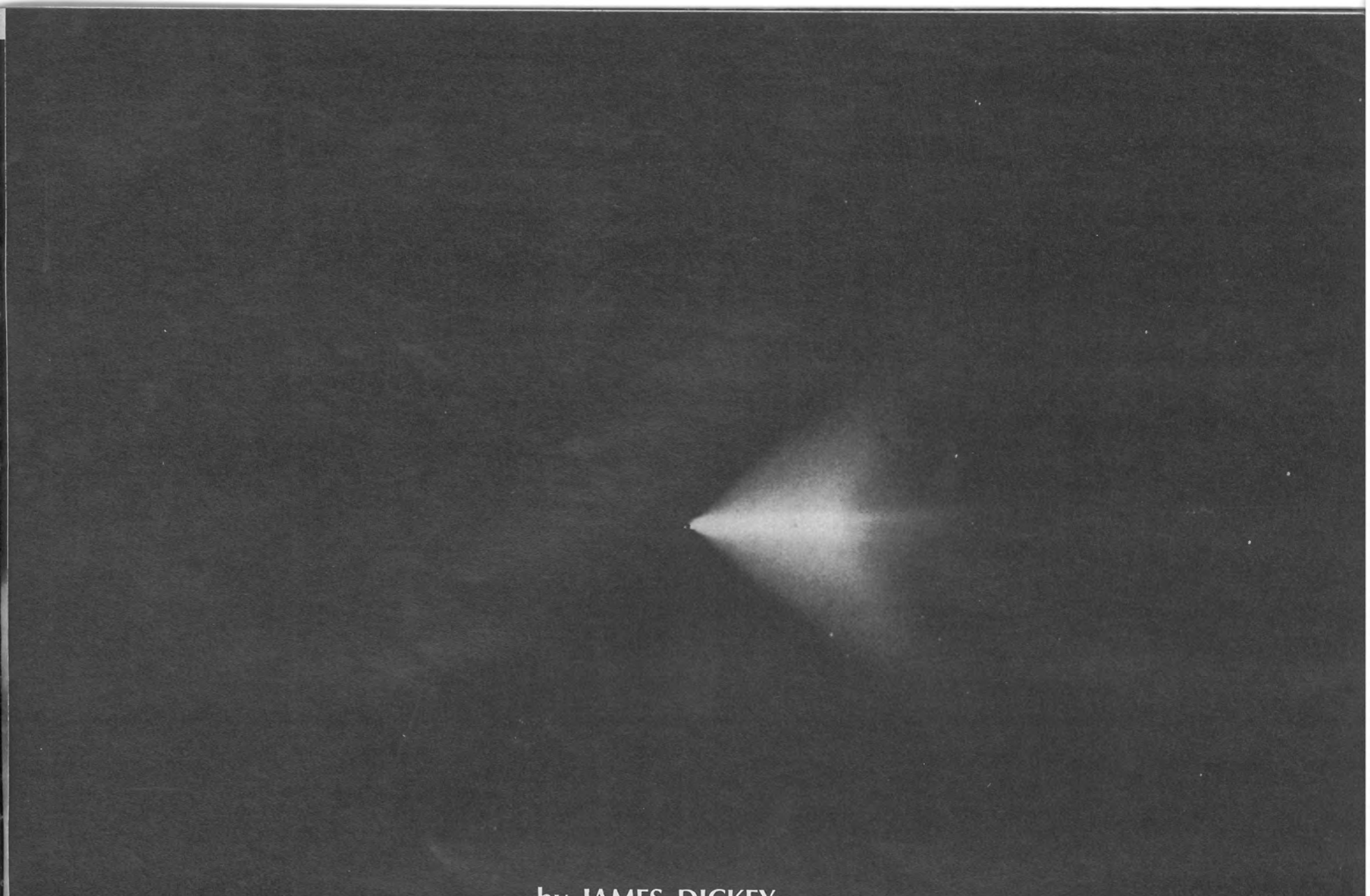




Across the choppy, near-oceanic surface of the moon, the earth rises and perches for a moment on the lunar horizon (top) as the astronauts clear the far side. On the way back to earth they took a parting shot (far right) of the object they had seen better than any men before them. As it reentered the atmosphere (above), followed by a tail of glowing ionized gas that at one point stretched 100 miles or more, their craft was photographed by a crewman on a tracking vessel 28 miles from the site of their phenomenally accurate splashdown. Aboard the carrier, Borman (left), Anders and Lovell thanked the crew and apologized for disrupting their holiday.



"What I keep imagining," James Lovell said from Apollo 8, "is if I am some lonely traveler from another planet what I would think about the earth at this altitude, whether I think it would be inhabited or not." Here he was looking at clouds over the Atlantic Ocean and the brown bulge of West Africa. At upper right, the spacecraft was photographed through a telescope in Hawaii as it fired its third-stage rocket to leave Earth's atmosphere. The tremendous journey celebrated (right) by American Poet James Dickey.



by JAMES DICKEY

So long

So long as the void
Is hysterical, bolted out, you float on nothing

But procedure alone,

Eating, sleeping like a man
Deprived of the weight of his own
And all humanity in the name

Of a new life
and through this, making new
Time slowly, the moon comes.

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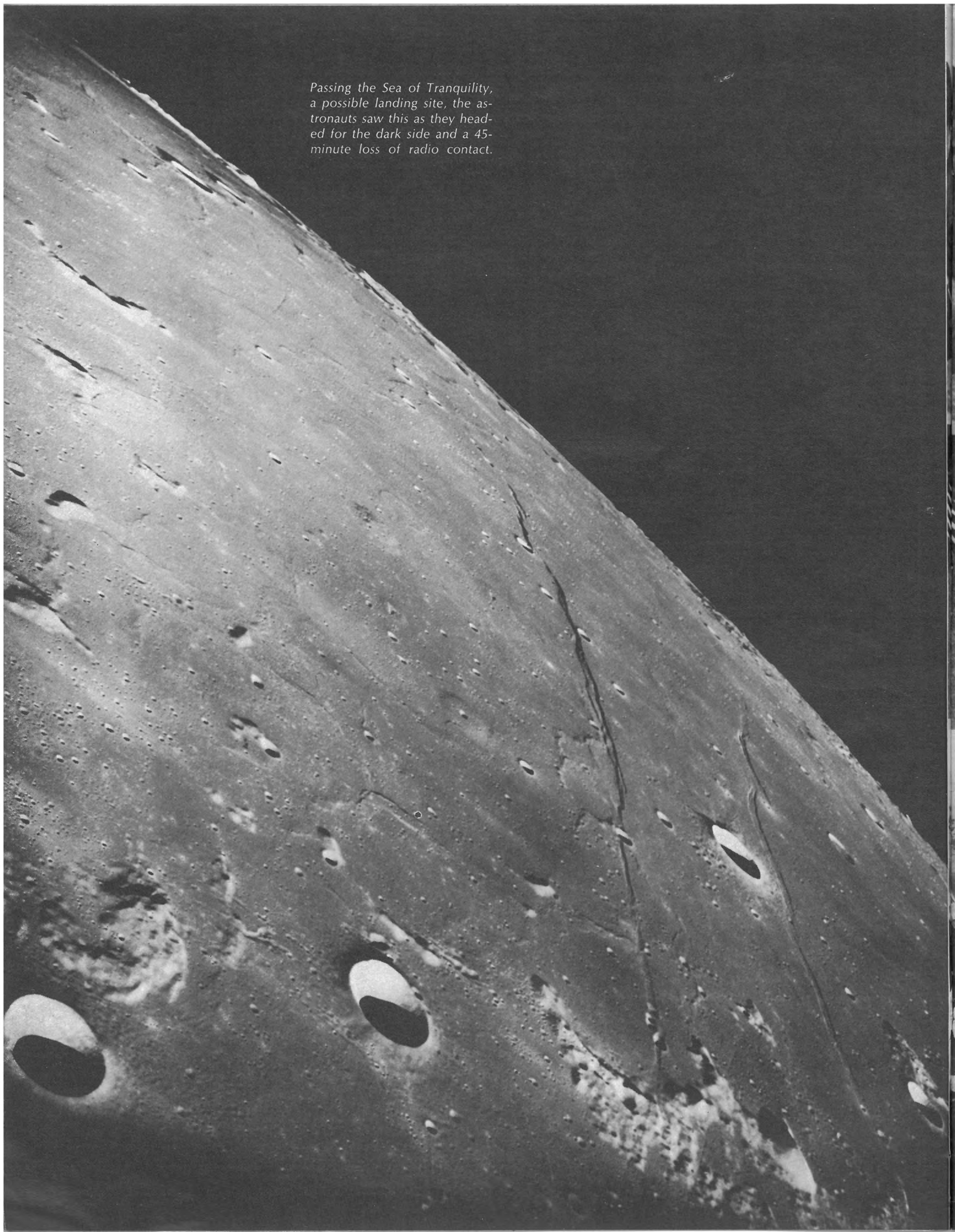


Passing the Sea of Tranquility, a possible landing site, the astronauts saw this as they headed for the dark side and a 45-minute loss of radio contact.

Its mountains bulge
They crack they hold together
Closer spreading smashed crust
Of uncanny rock ash-glowing alchemicalizing the sun
With peace: with the peace of a country
Bombed-out by the universe.
You lean back from the great light-
shattered face the pale blaze
Of God-stone coming

Close too close, and the dead seas turn
The craters hover turn
Their dark side to kill
The radio, and the one voice
Of earth.
You and your computors have brought out
The silence of mountains the animal
Eye has not seen since the earth split,
Since God first found geometry
Would move move
In mysterious ways. You hang

Mysteriously, pulling the moon-dark pulling,
And solitude breaks down
Like an electrical system: it is something

Else: nothing is something
Something I am trying

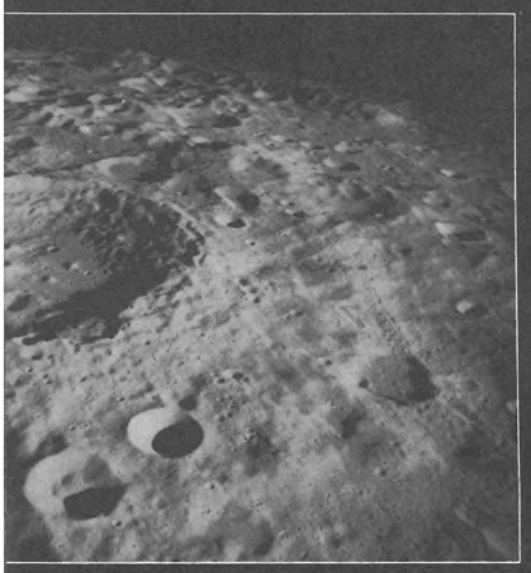
CONTINUED

To say O God
Almighty! To come back! To complete the curve to come back
Singing with procedure back through the last dark
Of the moon, past the dim ritual
Random stones of oblivion, and through the blinding edge
Of moonlight into the sun

And behold

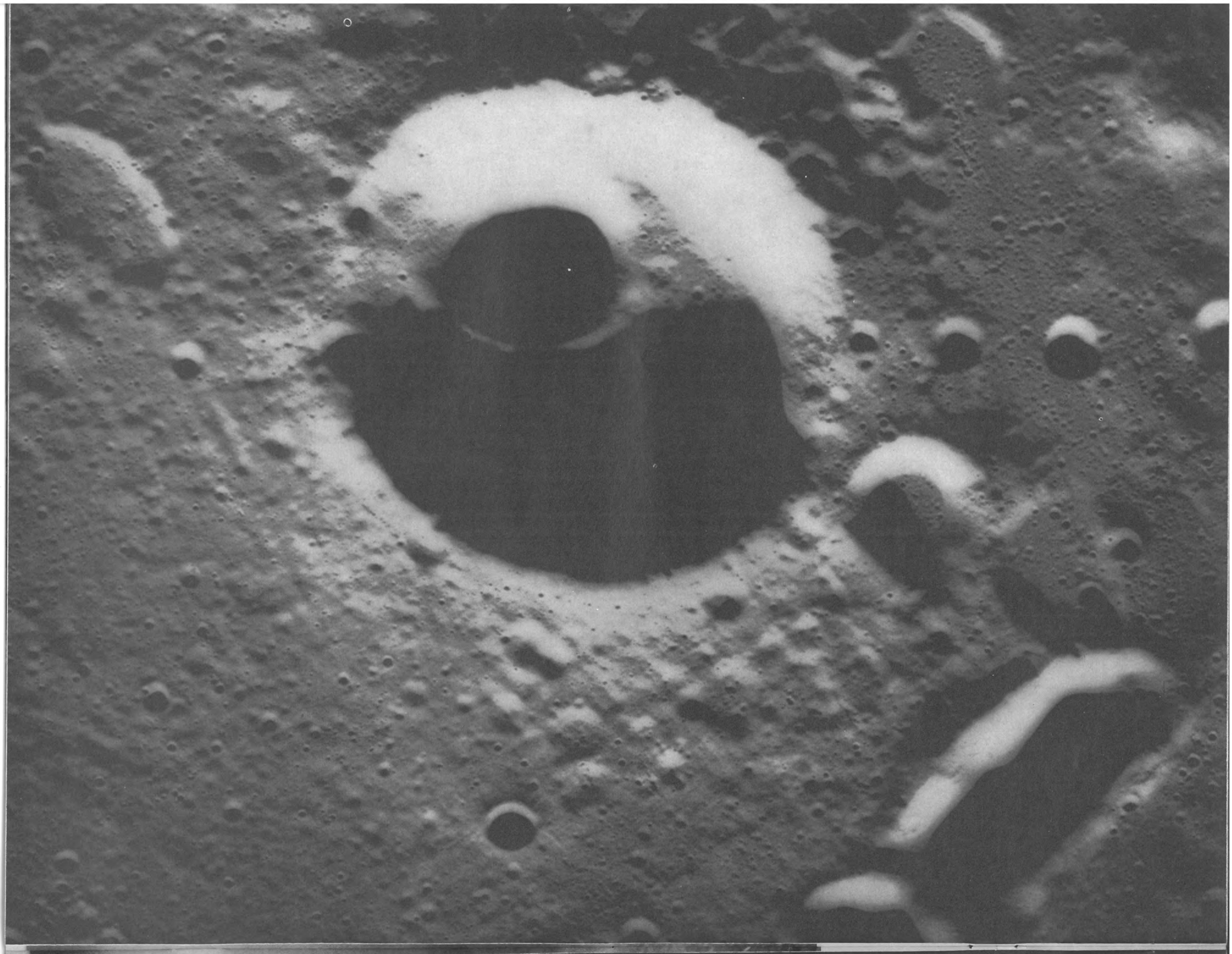
The blue planet steeped in its dream

Of reality, its calculated vision shaking with
The only love.



Craters, scarps and rills pockmark the near and far sides of the moon. The craters above are on the far side. Those below, the largest 40 miles in diameter, are on the near side.

In a rare close look at the far side of the moon, a photograph from Apollo 8 shows an area about 50 miles wide, inside a crater 250 miles in diameter. The center of the crater is about 157 degrees West Longitude and 4 degrees South Latitude.



While the astronauts' wives tensely watched their husbands' progress, their sons and daughters were less impressed by the marvels of science to which they had so long become accustomed. Above, Sue Borman (right) and Valerie Anders reacted emotionally as they got the news that the spacecraft had left lunar orbit and was on the way back to Earth. And Marilyn Lovell happily raised a champagne toast (left) at the word of a safe splashdown. But the Borman boys (right) calmly used the time of father's absence to go on a hunting trip.

The families' mixed emotions back on Earth

BEYOND THE MOON

discoveries—and more mysteries

by ALBERT ROSENFELD

As the astronauts were physically breaking the bonds of earth, the astronomers were, conceptually at least, pushing back the limits of the universe. Thus man, making his first giant leap into space, was reminded how trifling are the distances of mere moon journeys when measured on a cosmic scale.

Not that 1968 produced any final solutions to the great cosmological riddles. Instead, the news from beyond pointed up for man how truly enigmatic the universe remains in the face of his exciting efforts to fathom it.

In the detection instruments of orbiting satellites and in the computerized eyes of optical and radio telescopes, many unexpected astronomical objects turned up—among them the biggest stars yet discovered, a neighboring pair whose individual masses would make up 50 or 60 of our suns, and galaxies that radiate 100 times more energy than any previously known. Scientists remained baffled by the more bizarre and discomforting presences that have turned up in the past few years: gamma-ray sources, X-ray stars and galaxies, ammonia molecules among the interstellar gases, ultraviolet and infrared emissions, neutron stars, quasars—and, newest and most tantalizing of all, pulsars.

Even with some of the old phenomena, they kept running into new contradictions. For instance, attempting to compute the age of a distant star cluster known as NCG 188, they produced an answer that would have made NCG 188 older than the universe itself.

Theorists struggling to construct a cosmology based on the equations of relativity know that the answers can lead either to a finite or to an infinite universe. Some favor the finite universe, but the assumption brought them to this paradoxical picture: a universe that continues to expand as it now appears to be doing until it reaches a certain maximum radius of billions of light-years, after which it starts contracting again, continuing to shrink until its radius equals *zero*—with no assurance that it will ever be able to expand again!

One of the key concepts of relativity holds that the velocity of light is the speed limit of the universe. But this once-secure tenet is now being challenged. A few physicists have put forth the radical notion that, though it is impossible to accelerate a particle *past* the speed of light, there is nothing theoretically wrong with a particle moving faster than light *as long as it was already going that fast to begin with*. In that case it could never, ever move any *slower* than light. Such putative particles—Dr. Gerald Feinberg of Columbia named them "tachyons"—would, if they exist, be strange indeed. They would possess "imaginary mass" and "negative energy," and time for them would move backward. A search for tachyons is now under way.

Meanwhile, the quasars, those mystifying whatevers that are neither stars nor galaxies, continued to transmit, from billions of light-years away, outpourings of radio energy so prodigious that physicists have been hard put to account for them. Some scientists insisted that quasars *had* to be nearer to earth than originally calculated. Yet their distances had been computed by the standard astronomical measuring stick, the celebrated "red shift"—that is, the shift of light toward the red end of the spectrum as the source moves away from us. Could there be something about quasars that made the red shift of *their* light mean something different?

Studied closely, the light from a single quasar, PHL 938, seemed to be exhibiting four or five different and conflicting red shifts! This clearly meant that the red shift did *not* always mean the same thing throughout the universe. And if this could be true for quasars, it could be true for other celestial bodies. As a result, the red shift may have to be reappraised—and, with it, some cherished and long-standing notions about our expanding universe.

The quasar puzzle, though still unsolved, led inadvertently to the discovery that caused the year's big excitement. In February, astronomers in Cambridge, England announced a new class of pulsating radio stars (pulsars). Their transmissions came with such fantastically precise regularity that scientists, at a loss to think how the signals could be produced by any natural object, were tempted to believe that these were at last the intelligent messages from Someone Out There. The notion was soon dropped, though some scientists are still wondering.

By the end of 1968 some two dozen pulsars had been located by observatories around the world. In an effort to explain their emissions, early studies indicated that pulsars would have to be dense, compact objects—smaller in size than the earth, yet containing as much mass as the sun. Only two kinds of stars answered the description. One of them is known to exist—the "white dwarf," an old star which, as its thermonuclear fuel burns down, is gradually compressed by gravity into a dense mass of dull-glowing "degenerate matter."

The other possibility, the so-called neutron star, is purely theoretical, dreamed up by astrophysicists in the 1930s but never detected in the real sky. How does a neutron star come about? When a sun-sized star grows old, it turns into a white dwarf. But if a star is much more massive than the sun, it reaches a critical state of instability and then flares into a "supernova," spewing vast quantities of material out over vast distances. Meanwhile, at its inner core, "gravitational collapse" occurs, the explosive inward pressures creating a hard-packed mass of neutrons which, giving off little light, remain invisible (if they exist) to any present-day optical telescopes.

A neutron star is, in its way, as astounding as a quasar or a tachyon. Its Alice-in-Wonderland material would be so superdense that some have called it a fifth state of matter—the fourth being the hot electrified gas known as "plasma." The matter that we perceive as solid on earth is mostly empty space. The particles are kept apart (and at the same time held together in delicate equilibrium) by a variety of nuclear, atomic and molecular forces. During the gravitational collapse of a supernova's core, all these forces are overwhelmed and the particles are jammed together, electrons and protons joining to form neutrons in a reversal of the normal process. The resulting mass, though much smaller than the earth (a neutron star may be but a few miles across), generates gravitational and magnetic fields so powerful (billions of times stronger than the earth's) as to require a new set of physical laws to deal with them. A matchboxful of matter from a neutron would weigh *billions* of earth *tons*.

Several theories have been put forth which show how either a white dwarf or a neutron star might conceivably be a pulsar. But the most interesting, in the light of the latest evidence, was a theory proposed by Dr. Thomas Gold of Cornell. A pulsar, he suggested, might indeed be a neutron star (which, among its other absurd characteristics, can spin at a rate of several hundred rpm) surrounded by an atmosphere of plasma. Though the star might be so tiny as to be lost in the vastness of the plasma clouds, its superpotent magnetic field could force the plasma to spin along with it. In this state of superspin the atoms and electrons on the outer edge of the atmosphere would be moving at almost the speed of light, emitting a lighthouselike beacon. According to Dr. Gold's theory, the plasma would exercise enough drag on the neutron star to slow its spin—and therefore the rate of its pulsations.

As the year drew to a close, at least two pulsars were located in the midst of old supernovas—one of them the famous Crab Nebula—and a few of the pulsars were observed to be gradually slowing down as predicted. All this gave further credence to Dr. Gold's theory, and could turn out to be the first direct evidence that neutron stars do exist. But the evidence is still too tenuous for the conclusions to be anything but tentative. And the pulsar dilemma must be considered as unsettled as most of the other major mysteries of the universe.

Man might well quail with humility and a sense of profound insignificance as he looks out at the unimaginable immensities of the cosmos. But he can take heart from the fact that he is both astronaut and astronomer—and that the entire universe as he knows it is after all a magnificent artifact of the creative human imagination.

The following consists of selected pages scanned from the British edition of Life magazine, published in the UK on January 20 1969. It was published in the USA 10 days earlier in a slightly different format.

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