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SPECIAL EDITION

TO THE MOON AND BACK

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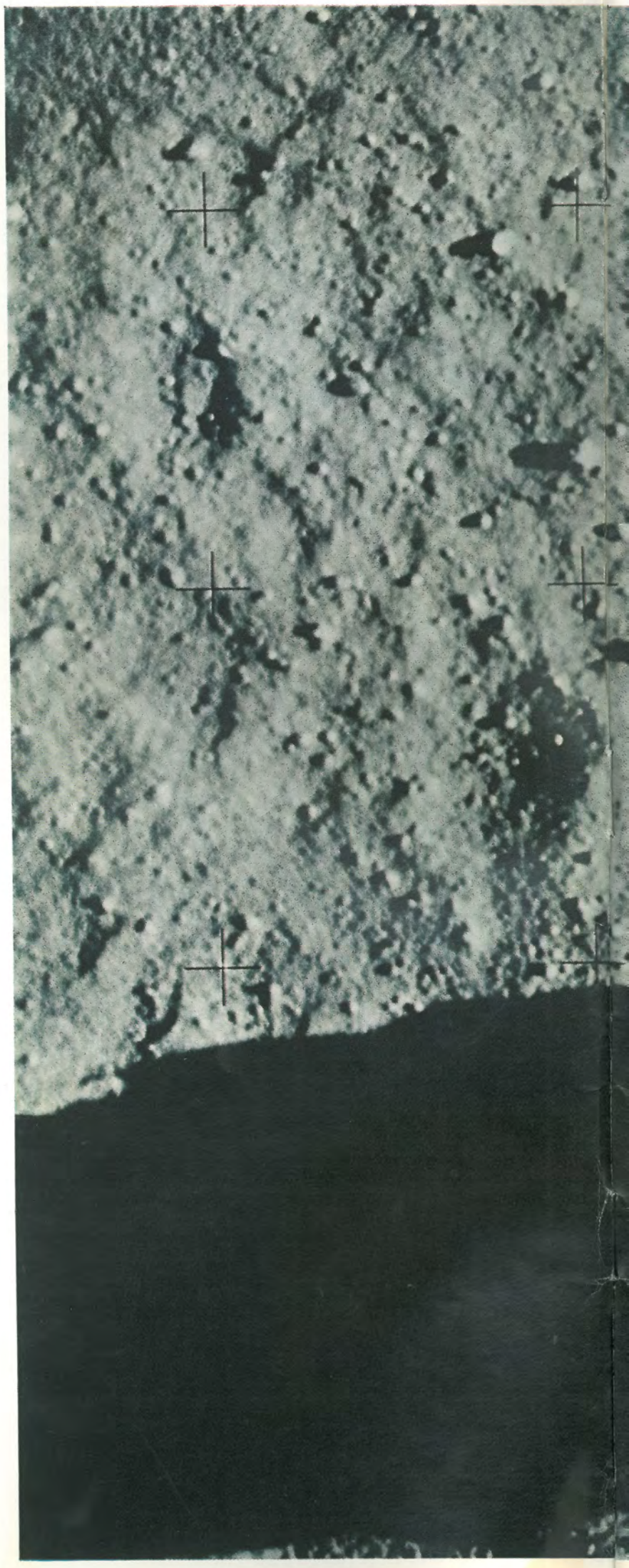
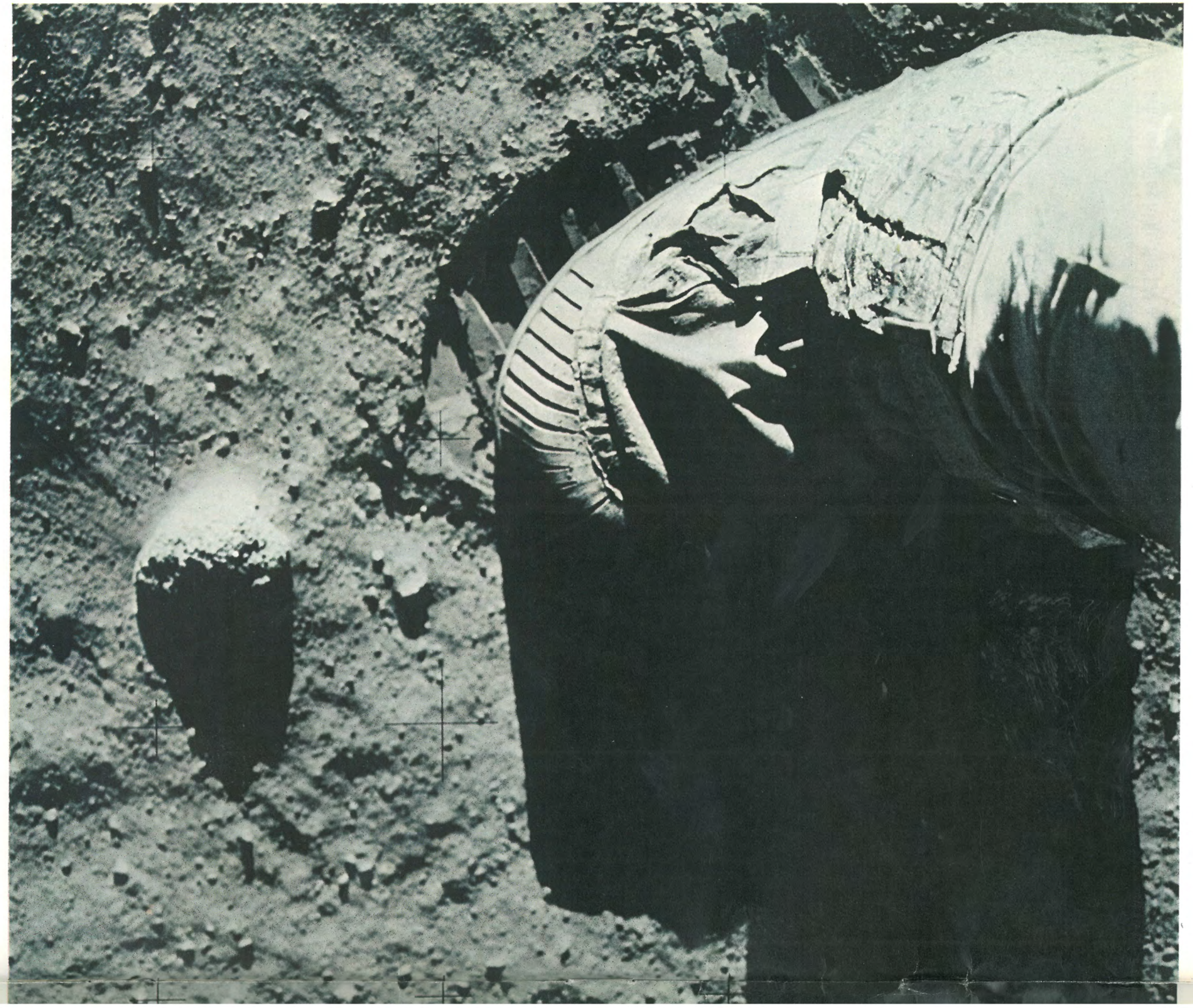
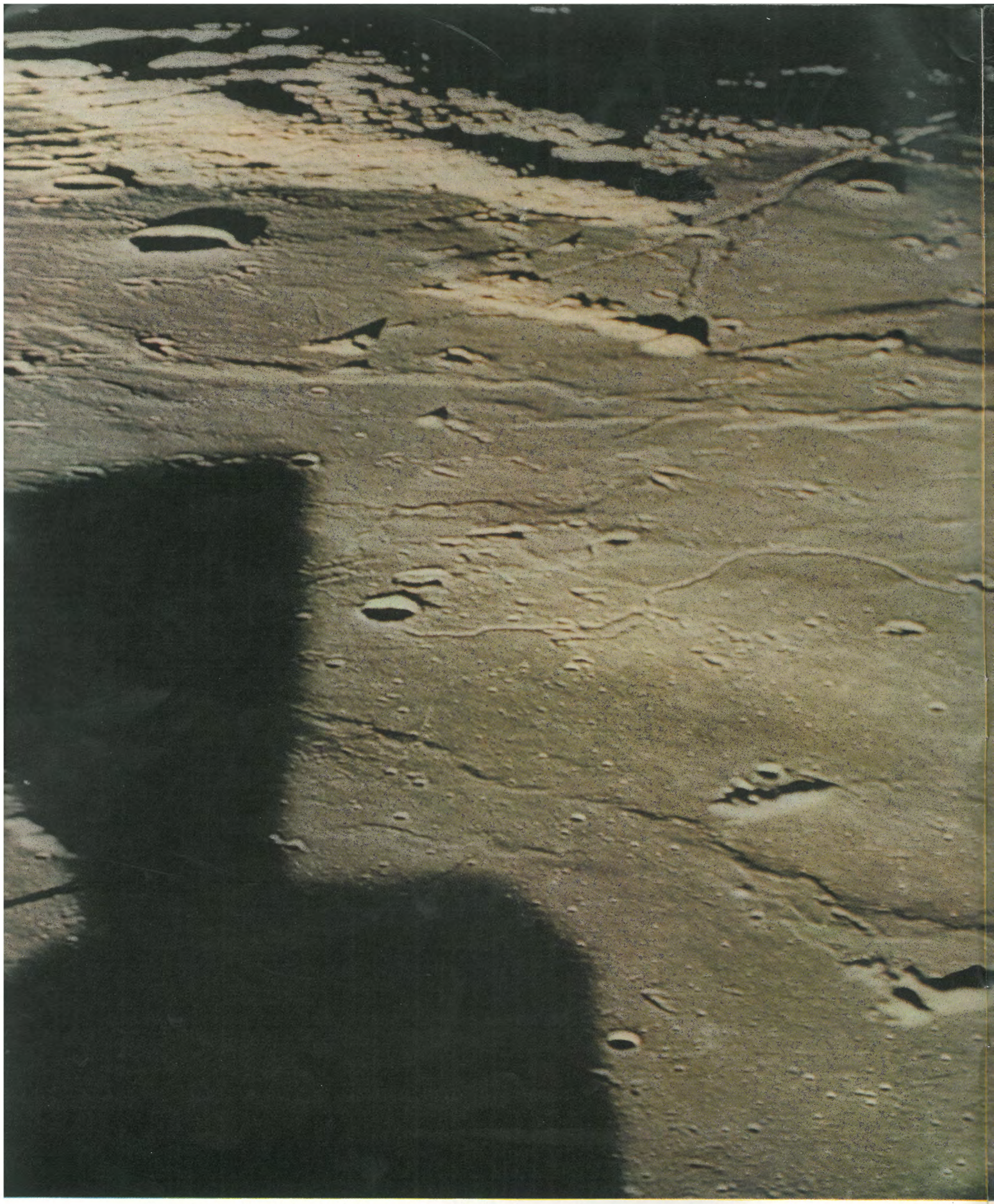
'A GIANT LEAP FOR MANKIND'

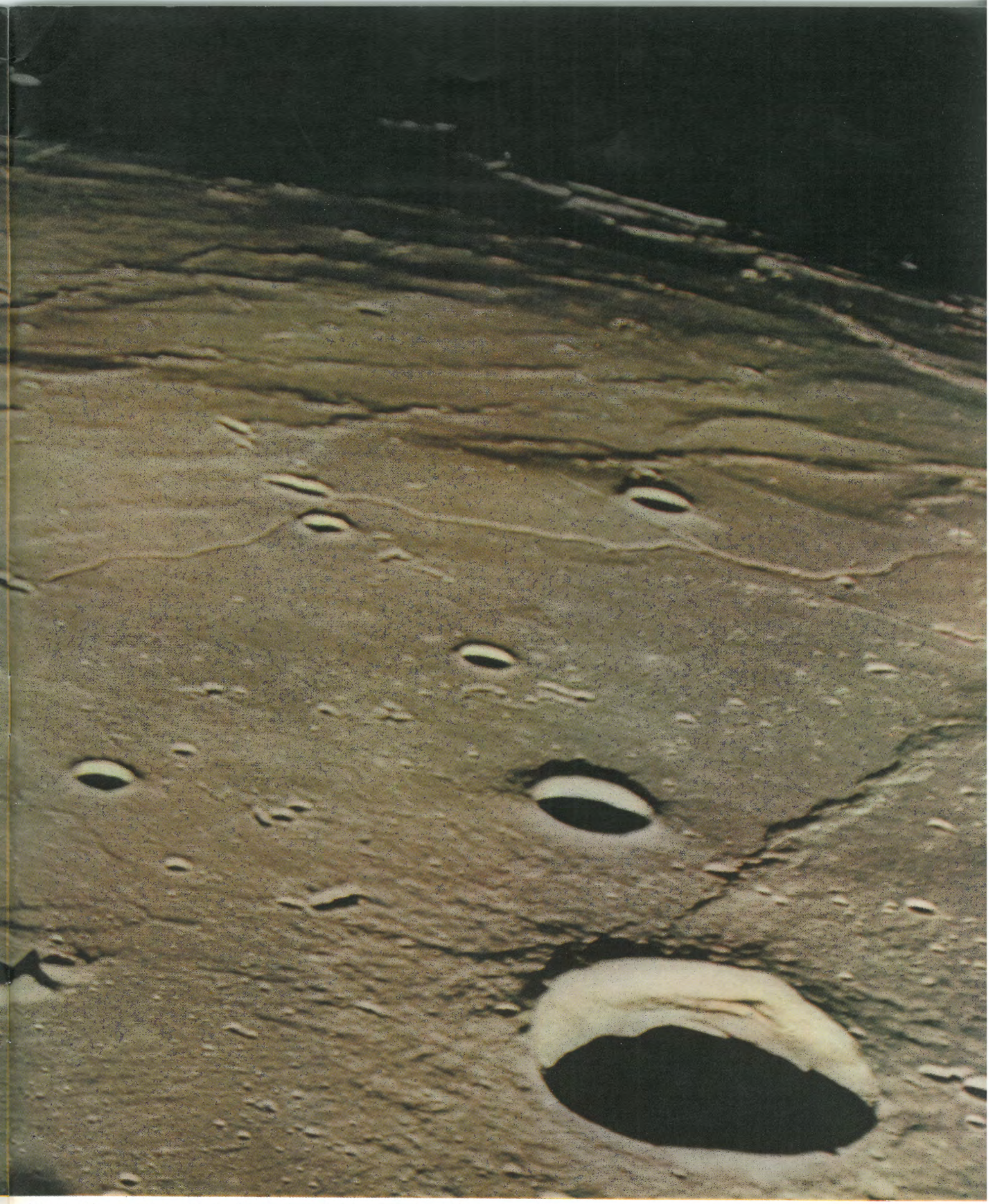


Neil Armstrong's booted foot, pressed firmly in the lunar soil, symbolized the stunning success of man's highest adventure—the achievement, with the first moon step on the evening of July 20, 1969, of the ambitious goal set by President John F. Kennedy eight years earlier. This special edition of LIFE is a record of that historic accomplishment, brought about by the high courage of the Apollo 11 astronauts and the superb technical precision of the tens of thousands who supported them. Along with color photographs of mankind's two-and-a-quarter-hour walk on the moon are detailed biographical portraits of Armstrong, Edwin Aldrin and Michael Collins, and a report on the scientific experiments now being conducted on the lunar samples they brought home. Here also is a comprehensive illustrated history of manned space exploration from Yuri Gagarin's first single orbit around the earth in 1961 to the present, and a picture account —including revealing glimpses of the astronauts' families during the eight days from lift-off to splashdown —of the world's expectancy, excitement and joy during the tense and triumphant moments of Apollo 11's flight from Pad 39A to the Sea of Tranquillity.

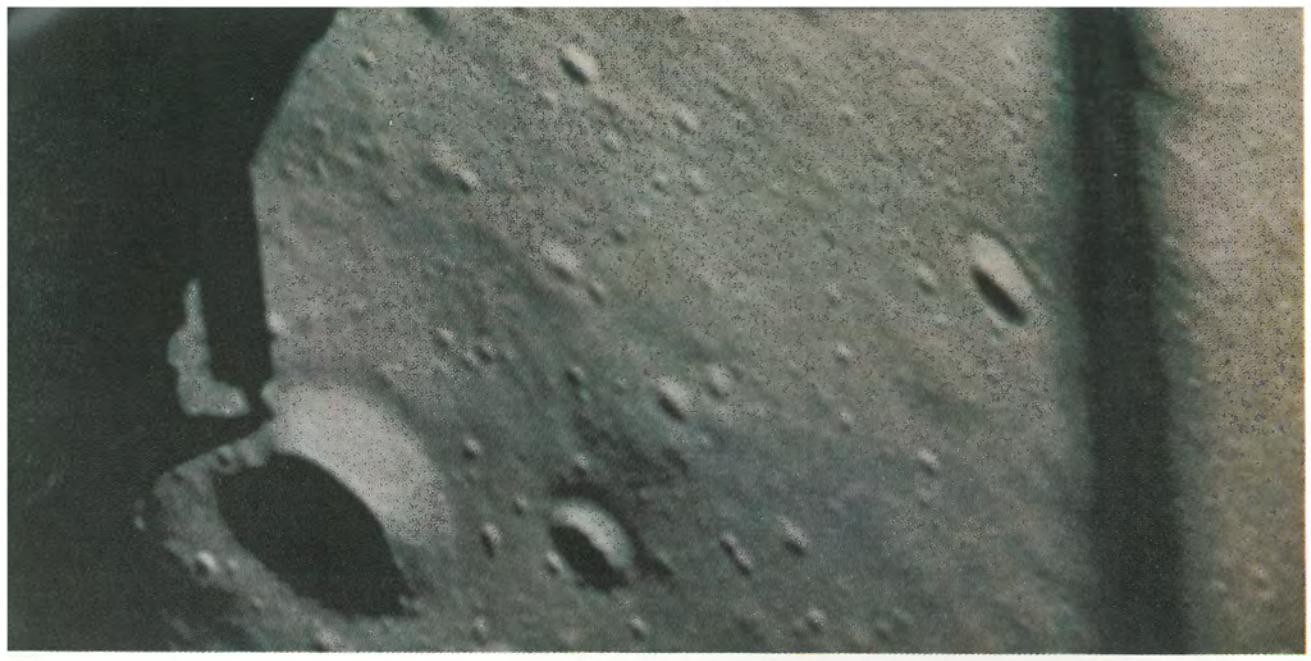


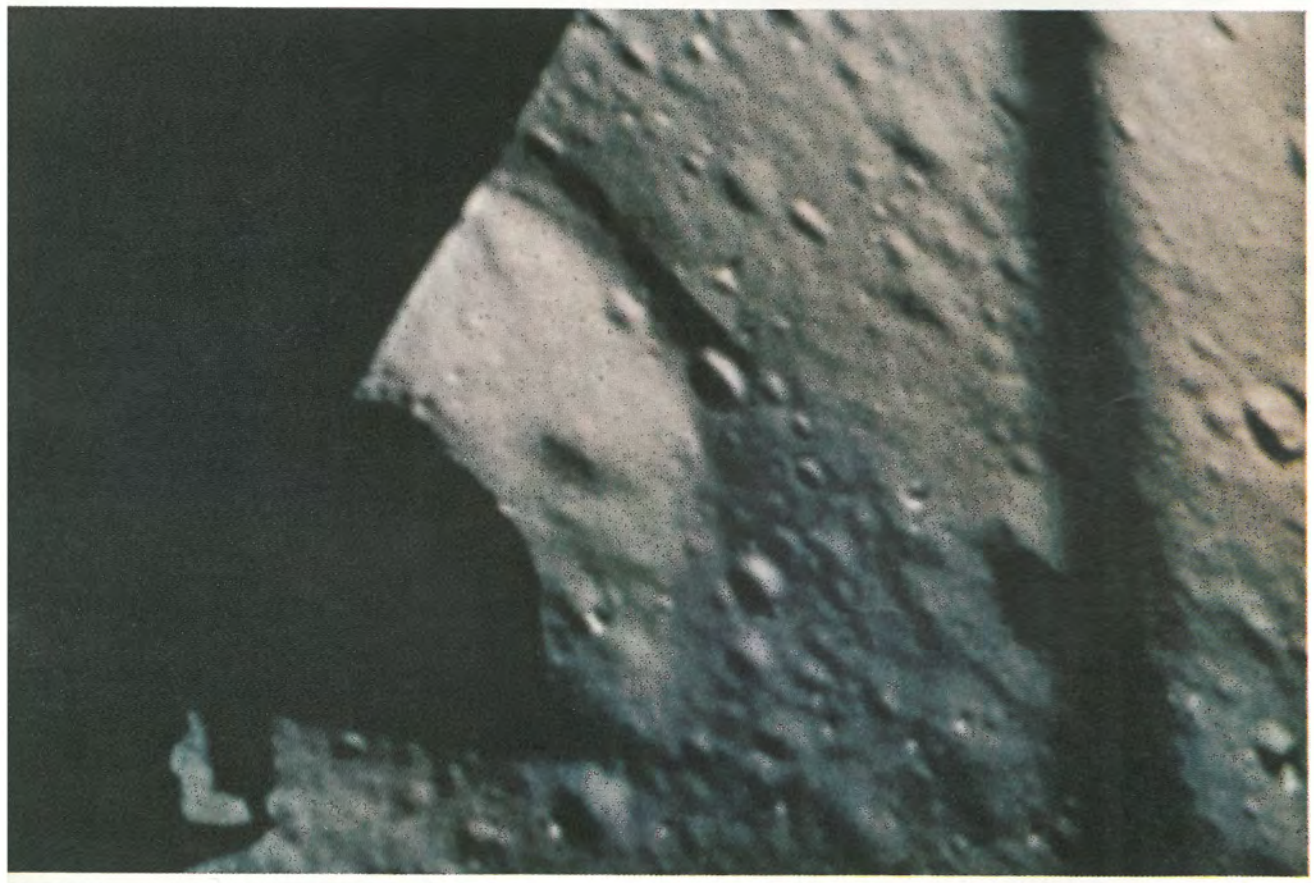


In orbit 63 miles high, the LM approaches the landing zone (top center) on its final pass before swooping down



to the lunar surface. Dark silhouette at left is one of Eagle's control thrusters





Eagle's powered let-down to the moon on Sunday afternoon was a surpassingly suspenseful maneuver. The dialogue between Eagle, whose on-board computer kept ringing false alarms, and Houston—with occasional interpolations by Apollo Control—was heard by tens of millions. A part of the sequence follows.

CONTROL: Altitude about 46,000 feet, continuing to descend. . . . 2 minutes 20 seconds [into the burn of the descent engine]. Everything looking good.

EAGLE: Our position checks downrange here seem to be a little long.

HOUSTON: Eagle, you are go—you are go to continue power descent.

EAGLE: We've got good [radar] lock on. Altitude lights out. . . . And the earth right out our front window.

EAGLE: 1202, 1202!

CONTROL: Good radar data. Altitude now 33,500 feet.

EAGLE: Give us the reading on the 1202 program alarm.

HOUSTON: Roger. We got—we're go on that alarm.

CONTROL: Still go. Altitude 27,000 feet.

EAGLE: [We] throttle down better than in the simulator.

CONTROL: Altitude now 21,000 feet. Still looking very good. Velocity down now to 1,200 feet per second.

HOUSTON: You're looking great to us, Eagle.

EAGLE: Good, roger.

HOUSTON: Eagle, you're looking great, coming up 9 minutes.

CONTROL: We're now in the approach phase, looking good. Altitude 5,200 feet.

EAGLE: Manual auto attitude control is good.

CONTROL: Altitude 4,200.

HOUSTON: You're go for landing. Over.

EAGLE: Roger, understand. Go for landing. 3,000 feet.

EAGLE: 12 alarm. 1201.

HOUSTON: Roger, 1201 alarm.

EAGLE: We're go. Hang tight. We're go. 2,000 feet. 47 degrees.

HOUSTON: Eagle looking great. You're go.

CONTROL: Altitude 1,600 . . . 1,400 feet.

EAGLE: 35 degrees. 35 degrees. 750, coming down at 23. 700 feet, 21 down. 33 degrees. 600 feet, down at 19 . . . 540 feet . . . 400 . . . 350 down at 4. . . . We're pegged on horizontal velocity. 300 feet, down 3½ . . . a minute. Got the shadow out there . . . altitude-velocity lights. 3½ down, 220 feet. 13 forward. 11 forward, coming down nicely . . . 75 feet, things looking good.

HOUSTON: 60 seconds.

EAGLE: Lights on. Down 2½. Forward. Forward. Good. 40 feet, down 2½. Picking up some dust. 30 feet, 2½ down. Faint shadow. 4 forward. Drifting to the right a little.

HOUSTON: 30 seconds.

EAGLE: Drifting right. Contact light. Okay, engine stop.

HOUSTON: We copy you down, Eagle.

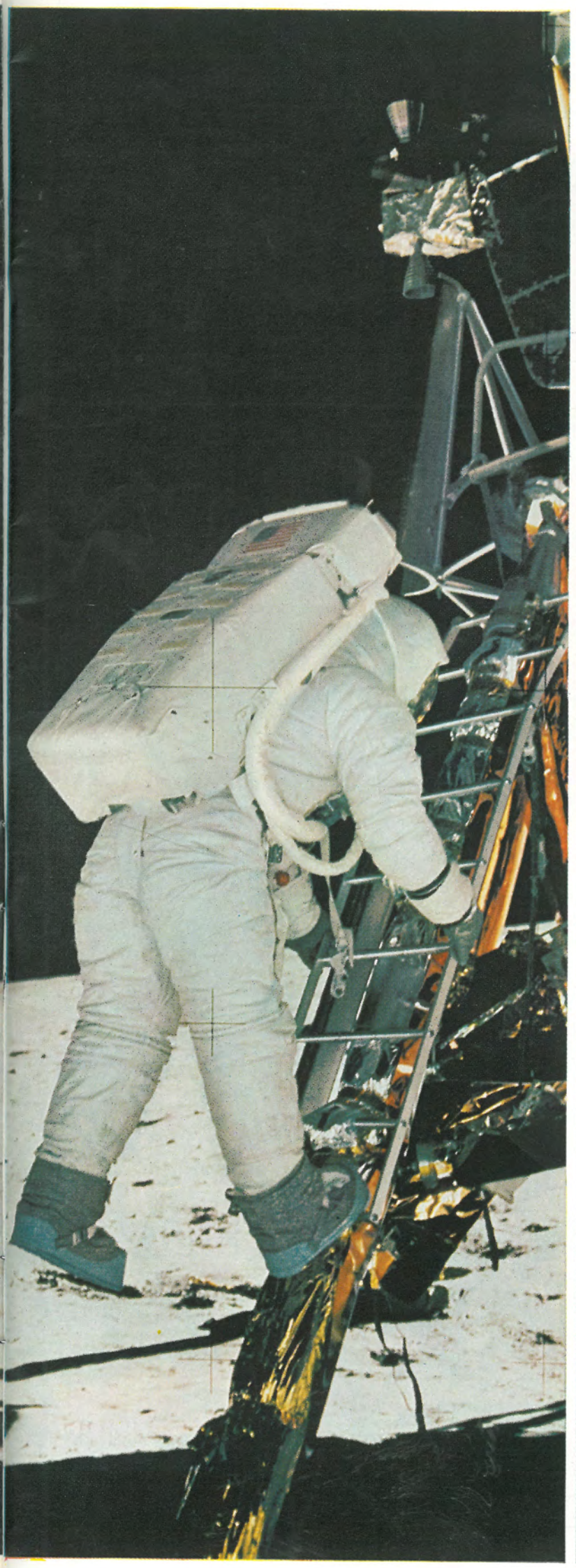
EAGLE: Houston, Tranquillity Base here. The Eagle has landed.

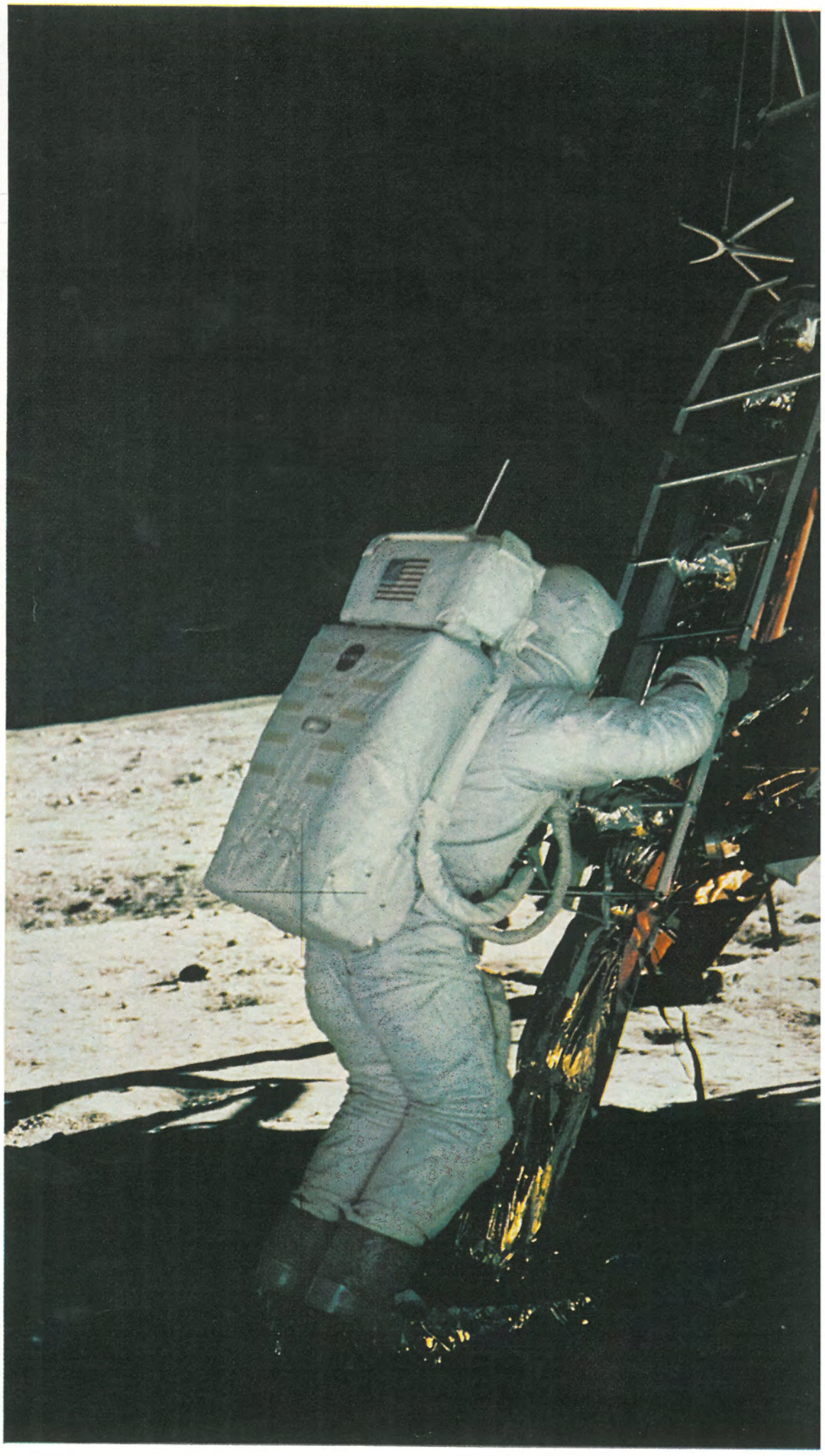
HOUSTON: Roger, Tranquillity, we copy you on the ground. You got a bunch of guys about to turn blue. We're breathing again. Thanks a lot.

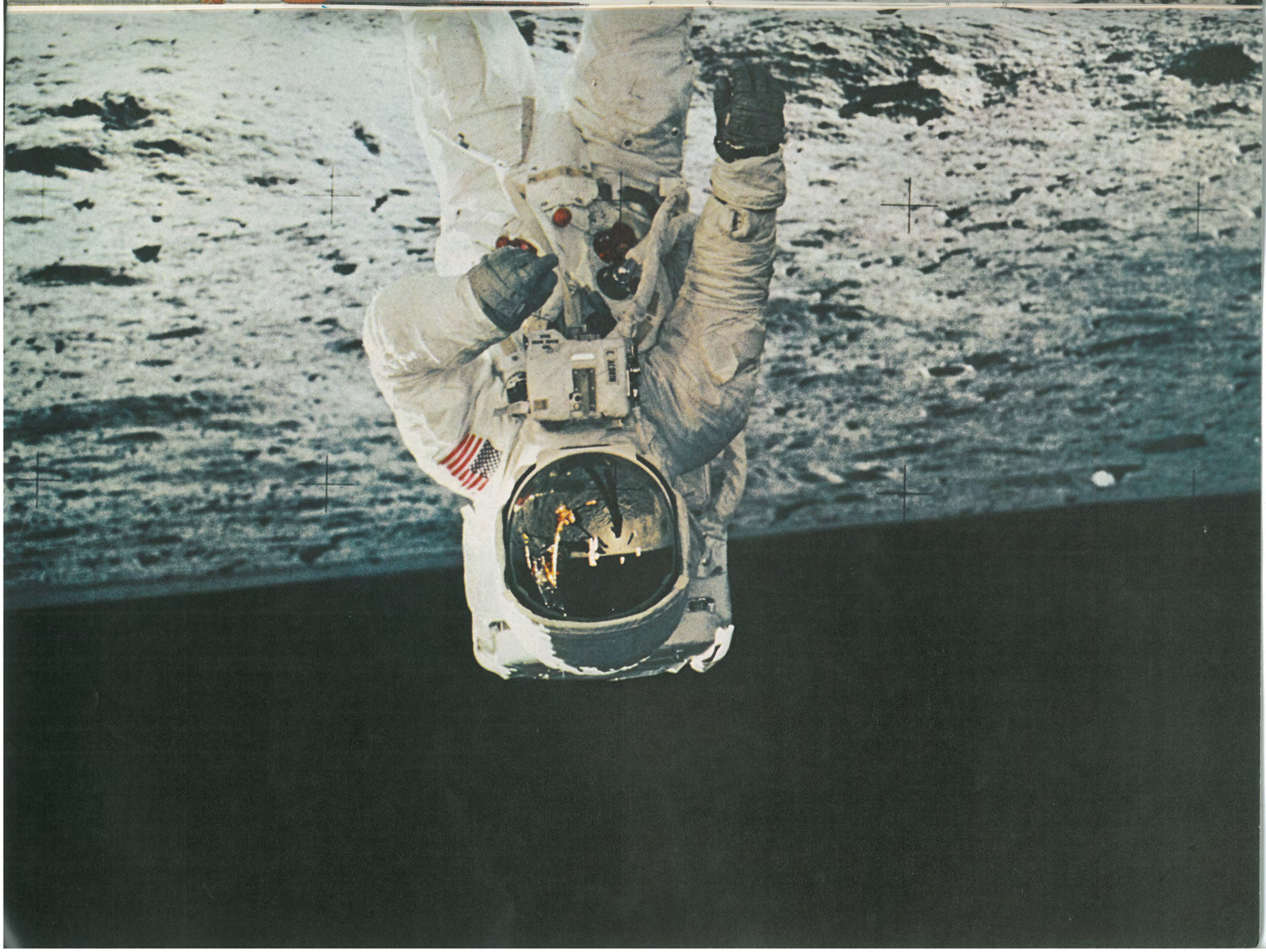
A tense dialogue and then

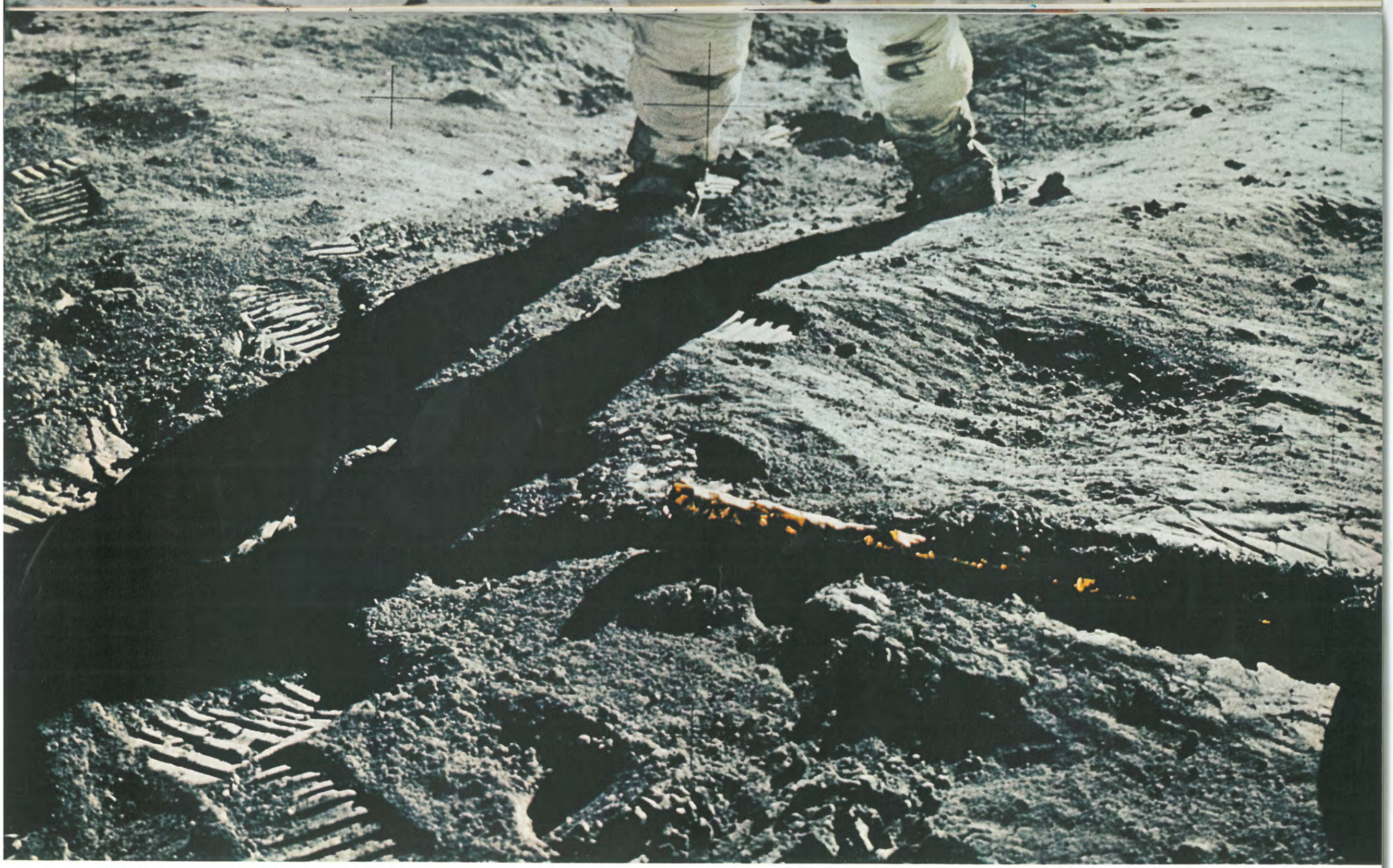
'The Eagle has landed'

Buzz Aldrin eased down Eagle's ladder, paused on the last rung and jumped the final three feet



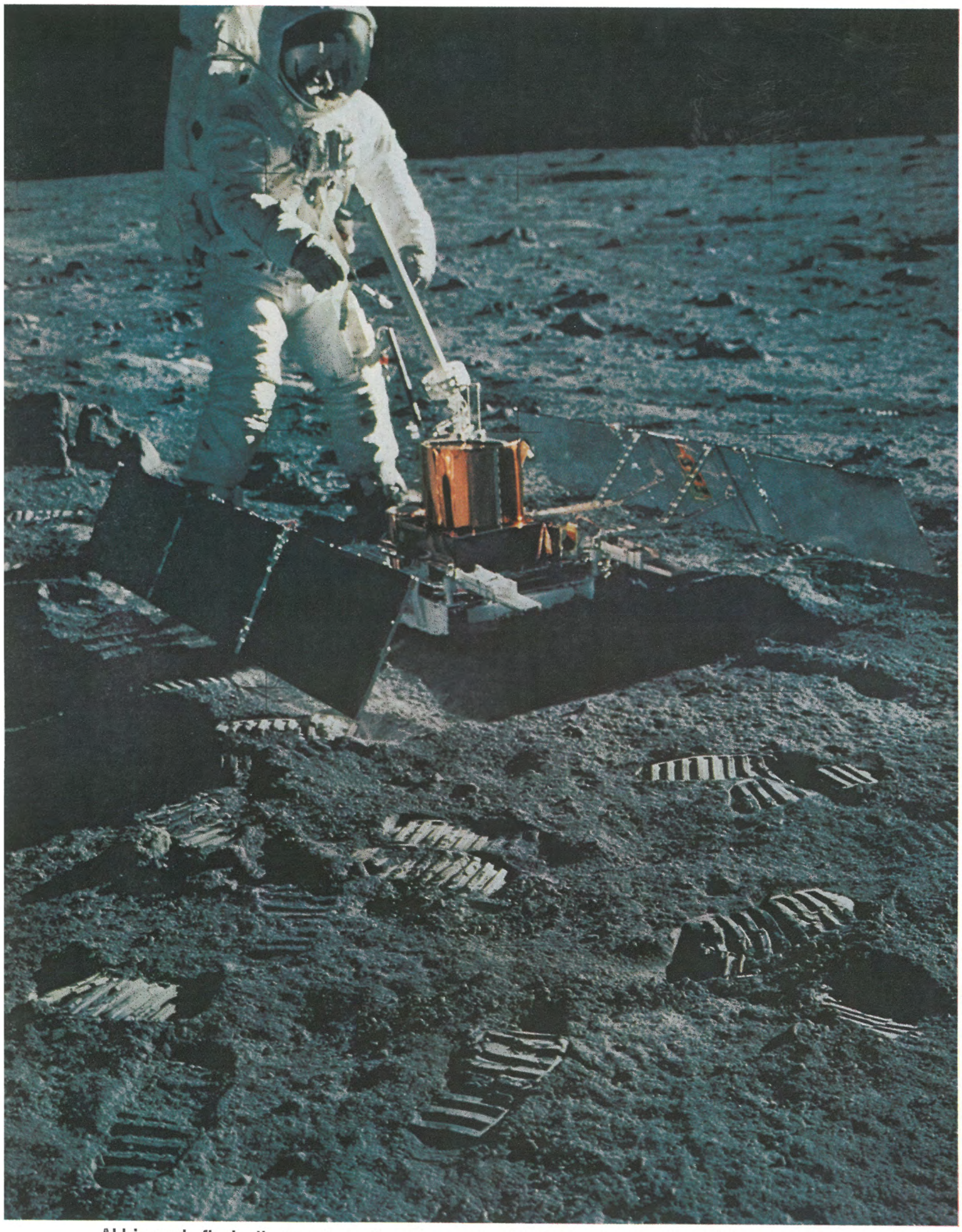




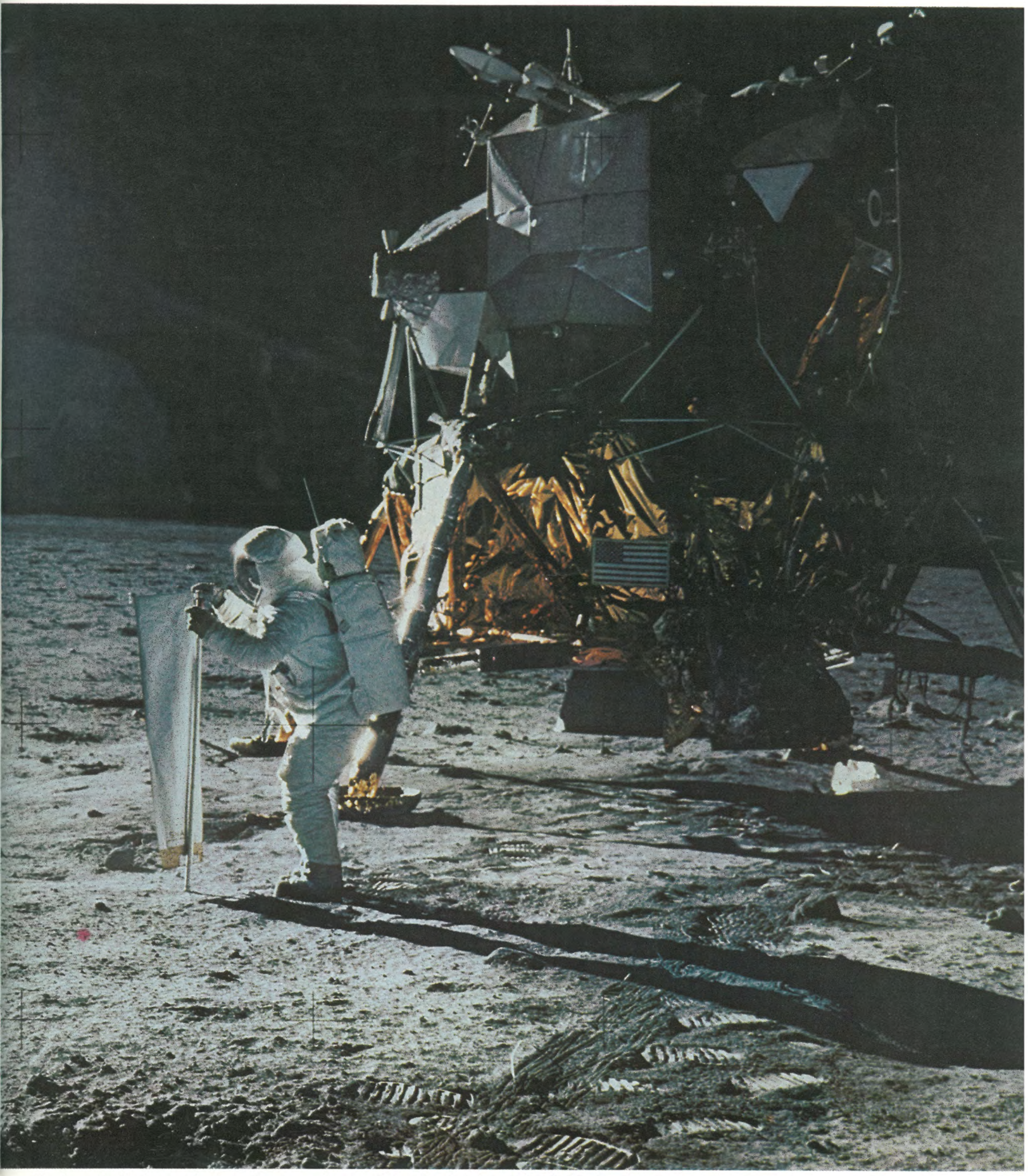


Aldrin's gold-plated visor mirrored Eagle and Armstrong, who took most of these pictures. Foil-wrapped rod is landing probe, bent out during touchdown

Aldrin walked from the LM to set up two experimental packages—the laser beam reflector and the seismometer

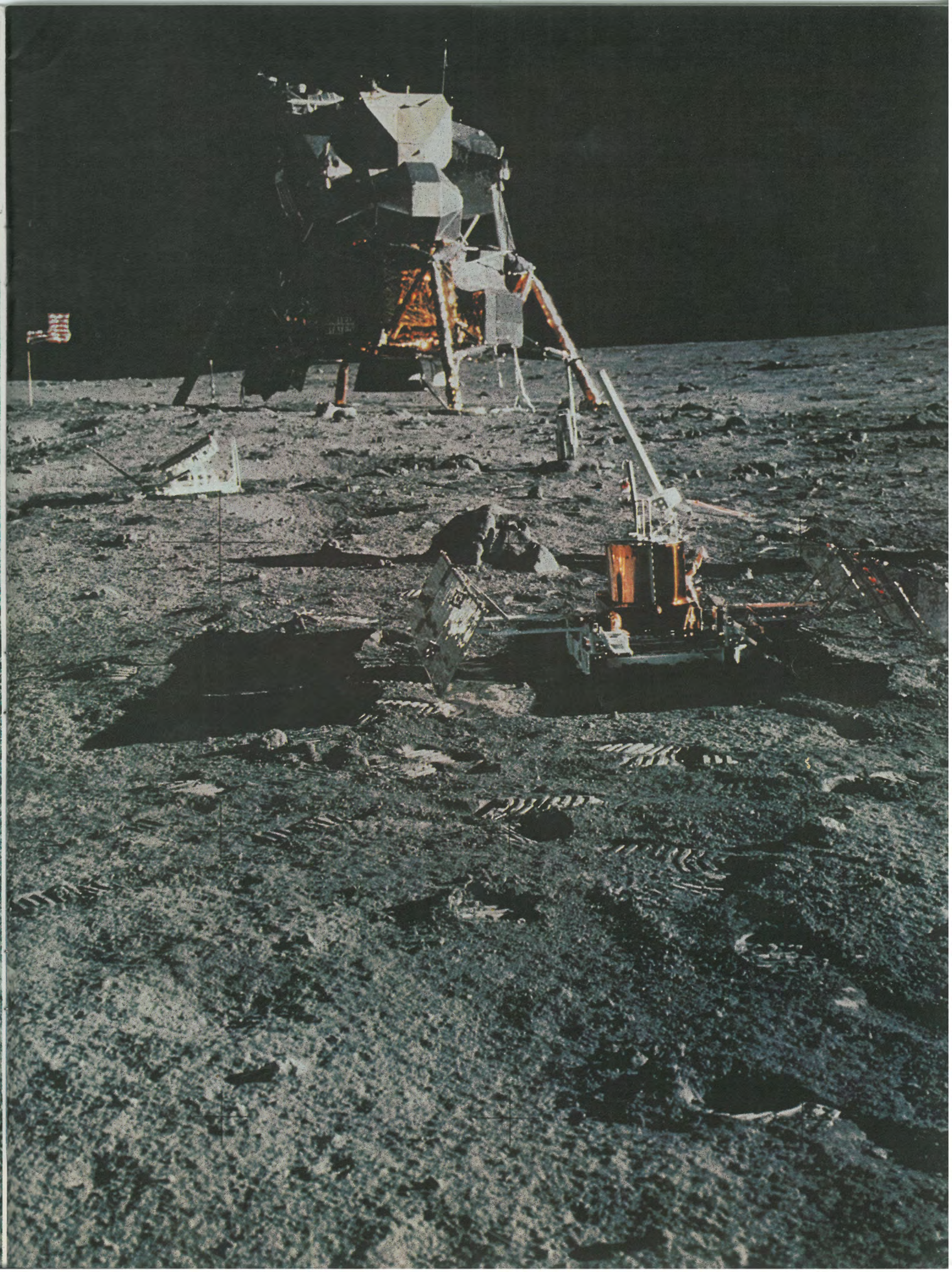


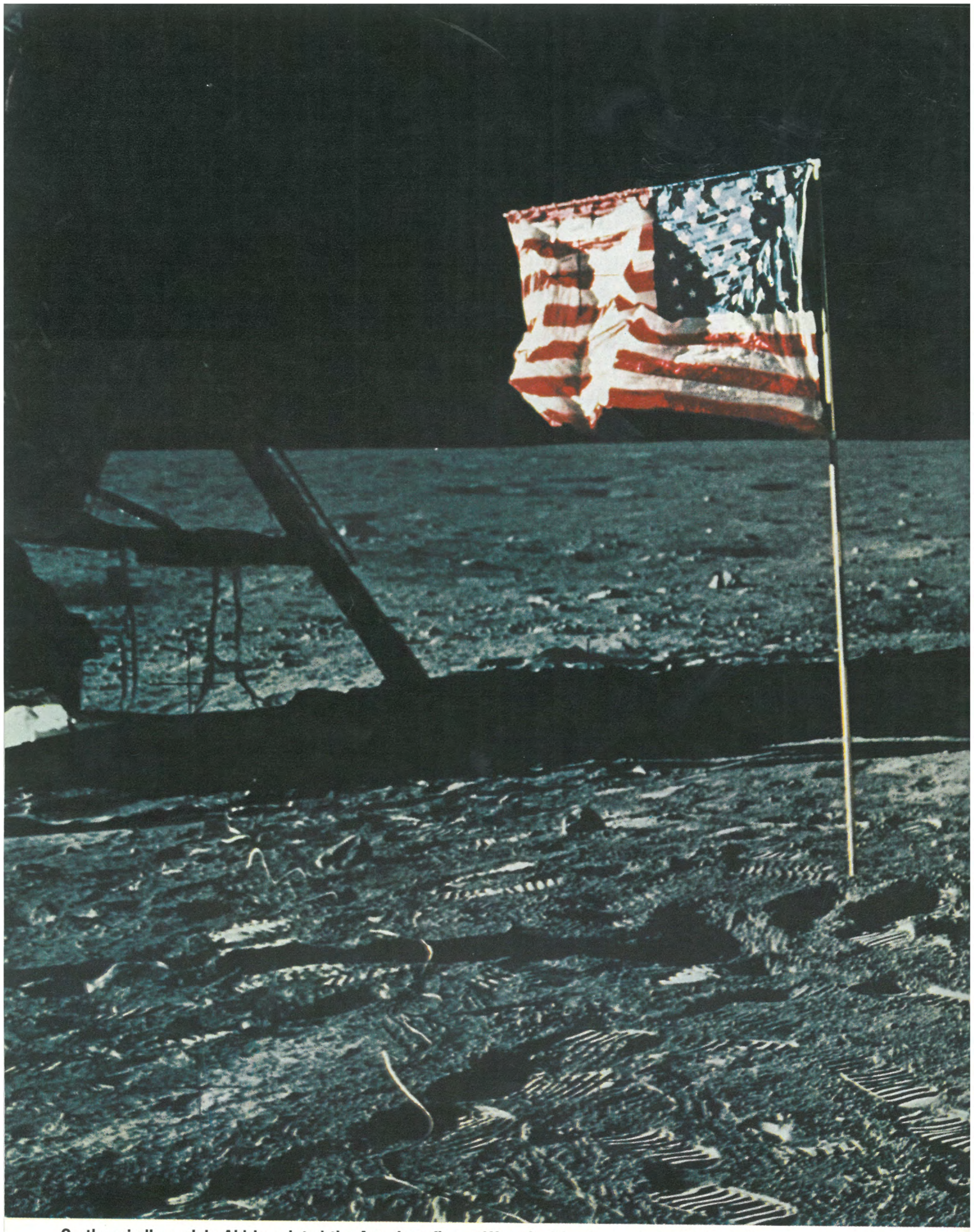
Aldrin made final adjustments on the seismometer, left behind to record possible moon quakes. Earlier he unfurled the



'"solar wind" sheet, designed to trap tiny particles hurled from the distant sun

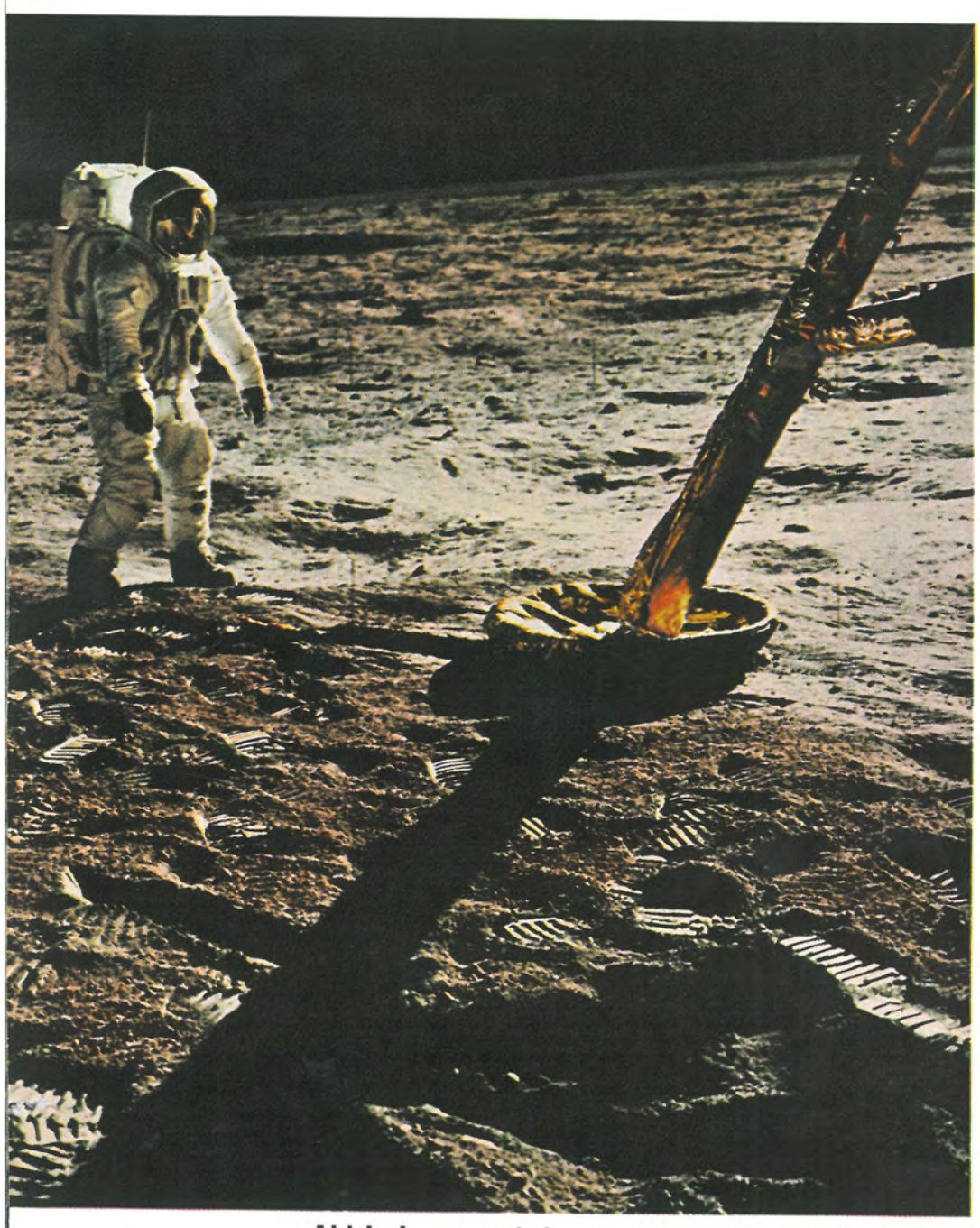
Nine hours after his arrival, man had littered the moonscape with his paraphernalia—TV camera, flag, laser reflector, "solar wind" sheet (hidden behind LM), special stereo camera and the sun-powered seismometer





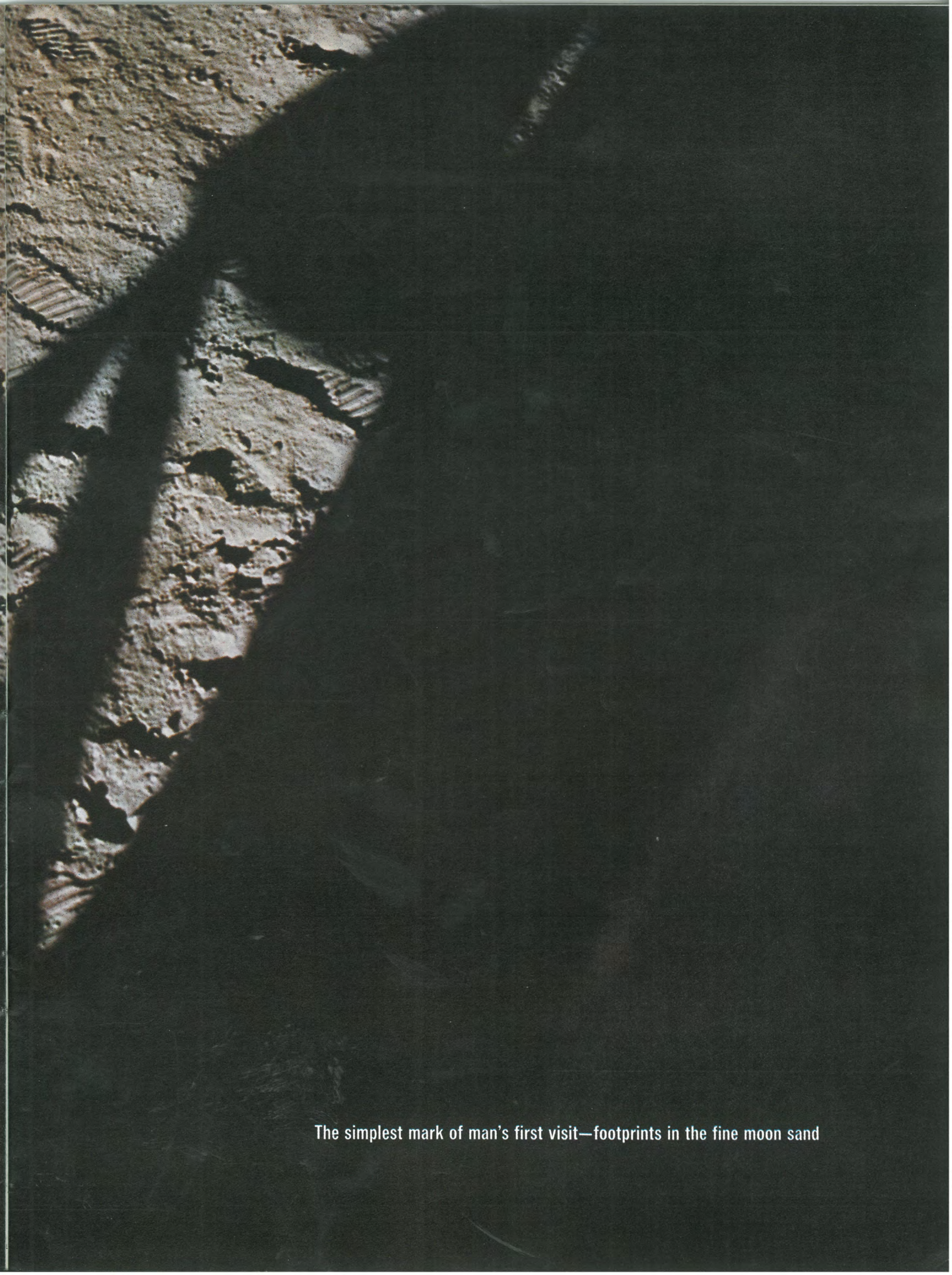
On the windless plain Aldrin saluted the American flag, stiffened with wire so it would "wave"

Eagle landed 125 feet west of a rock-strewn crater, several feet deep and about 80 feet across



Aldrin inspected the condition of the LM's footpad

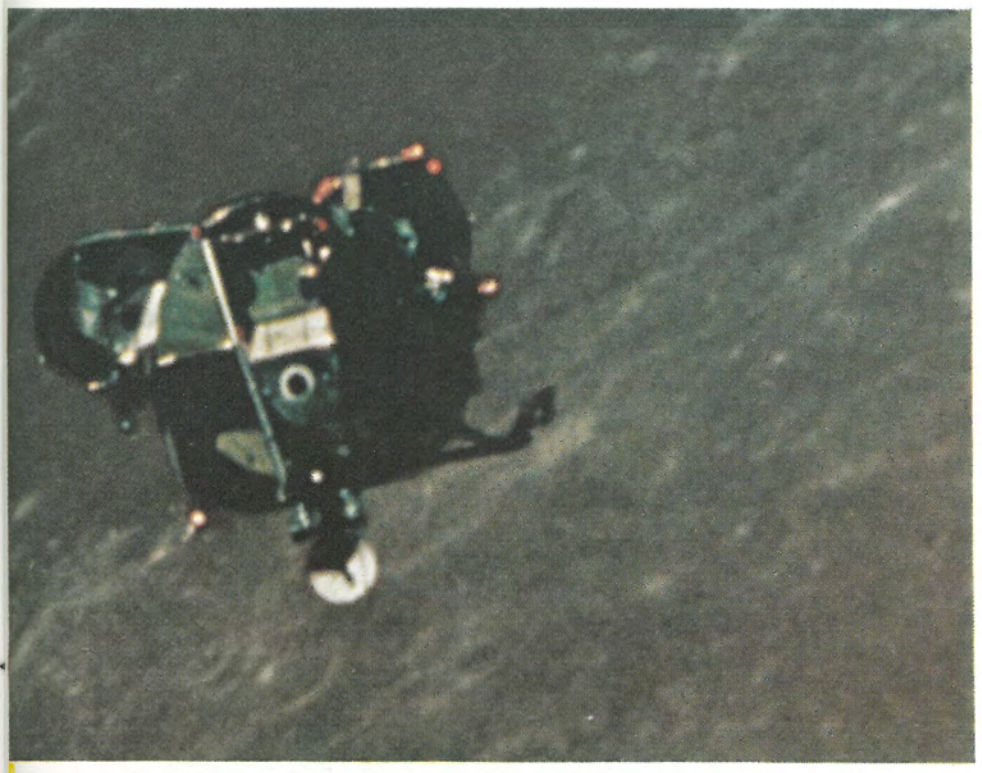
The view from Eagle's window after the walk

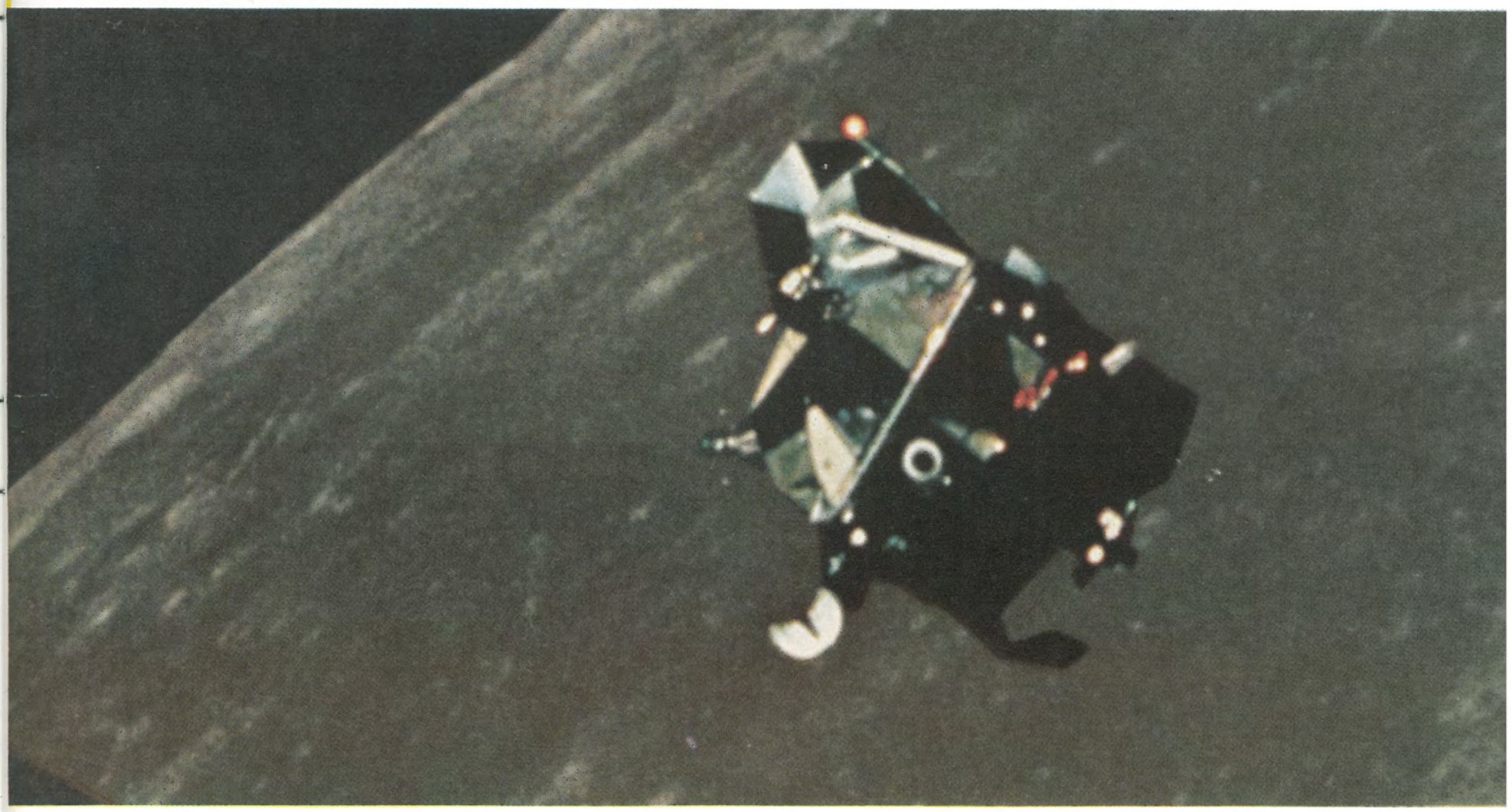


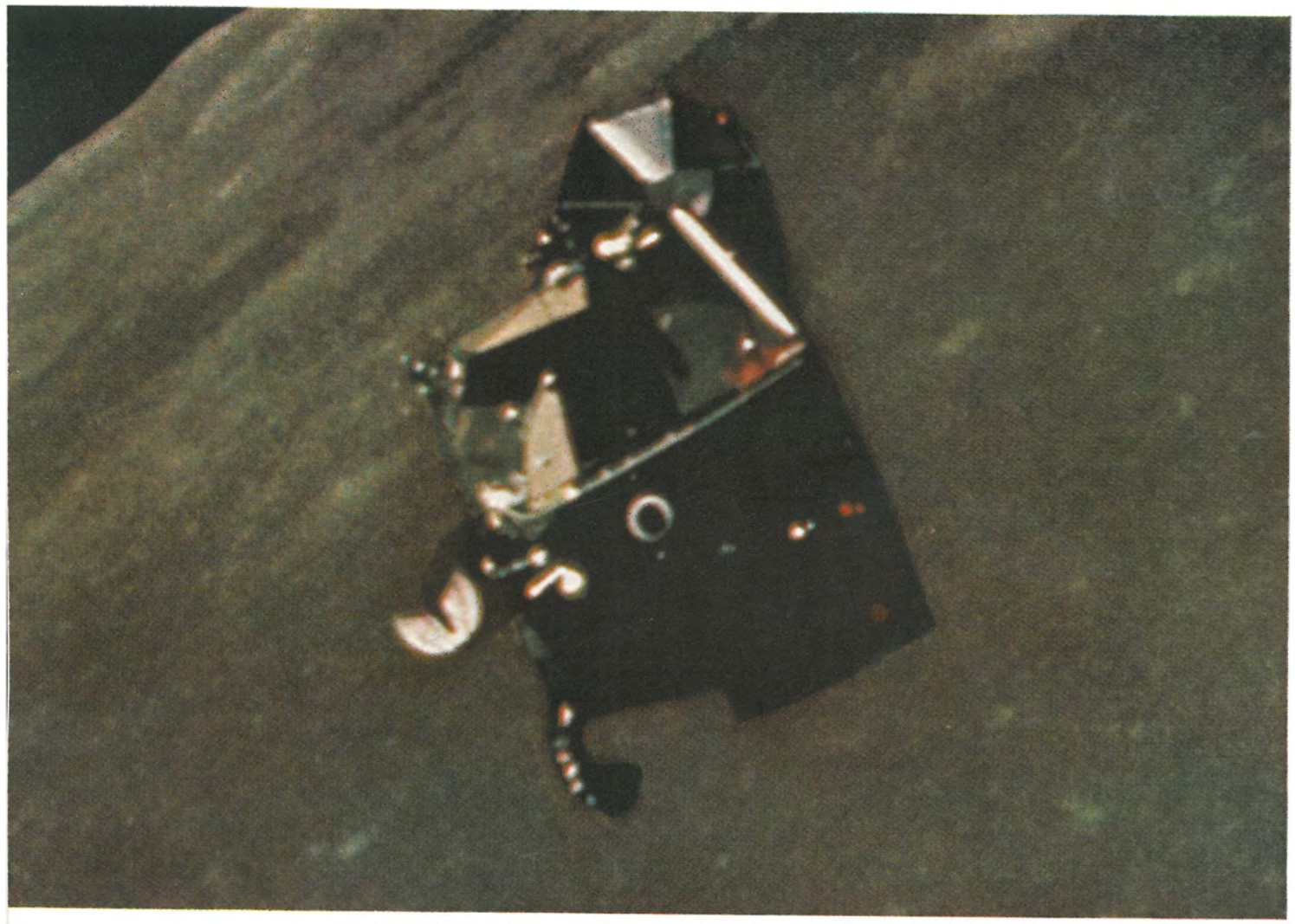
The simplest mark of man's first visit—footprints in the fine moon sand

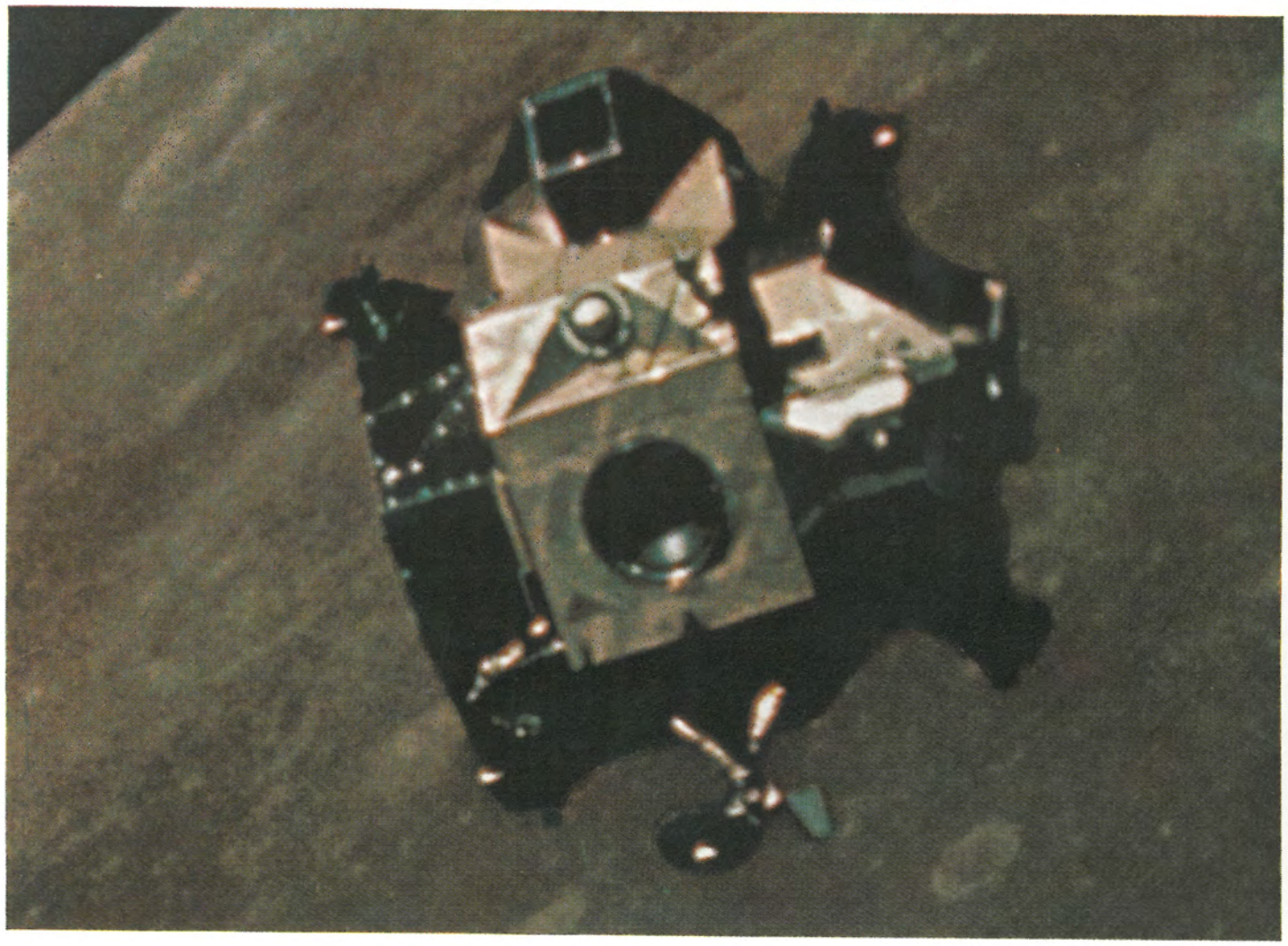
As seen at some distance from Columbia, Eagle rolled left and closed for rendezvous 69 miles above moon

‘Eagle is back in orbit’

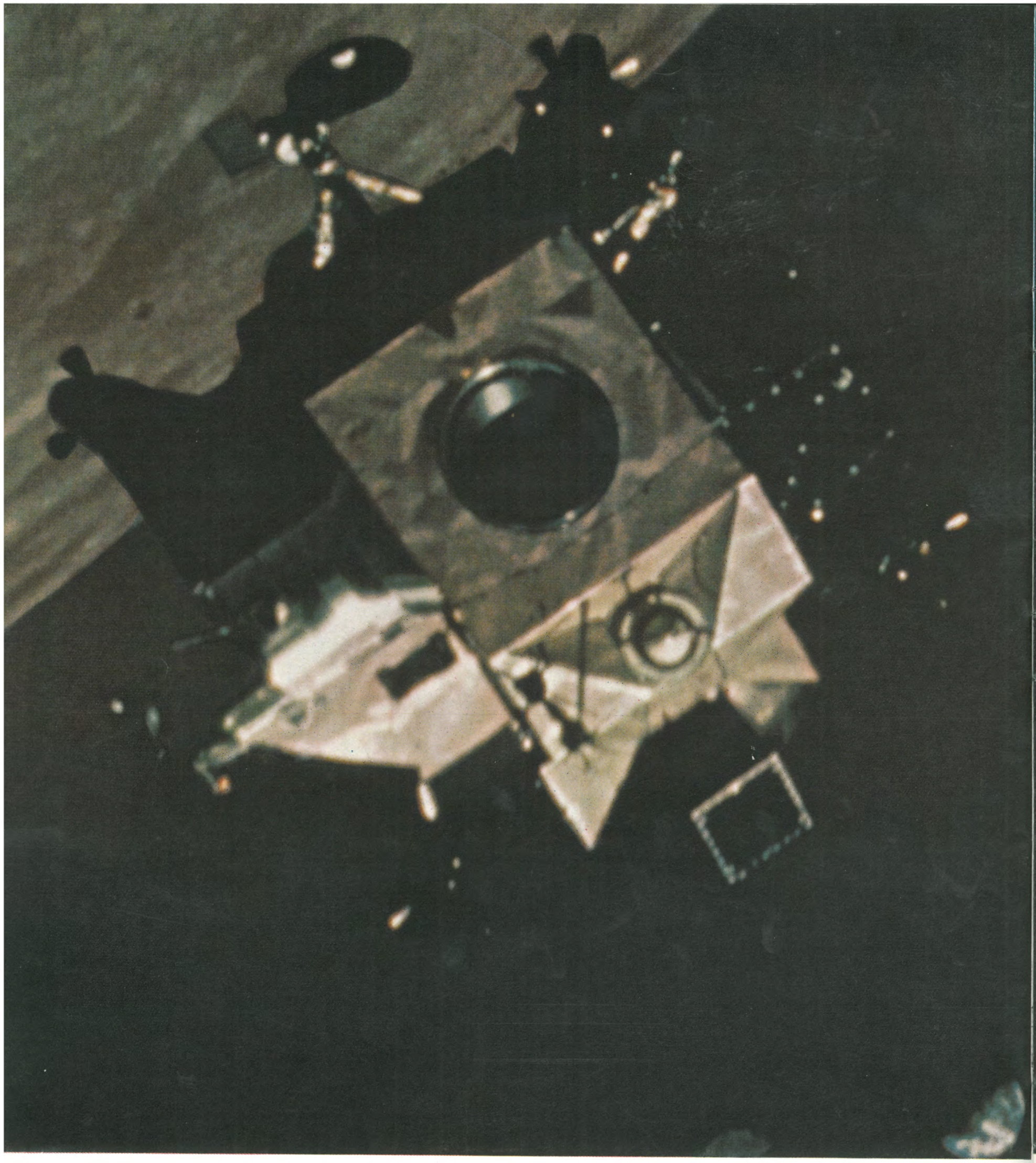


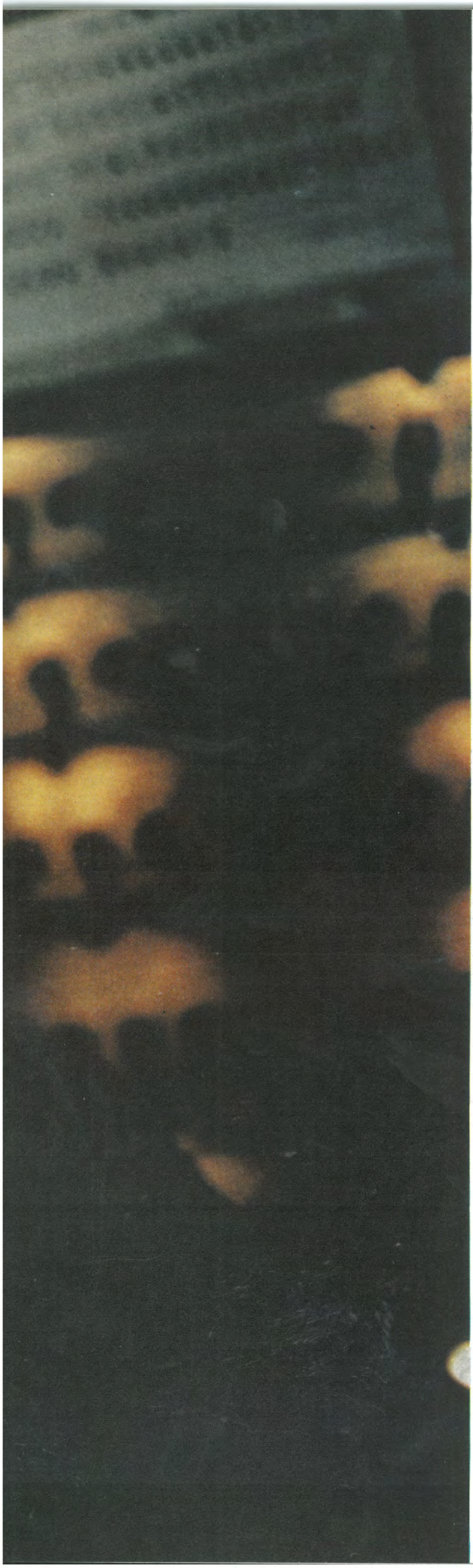




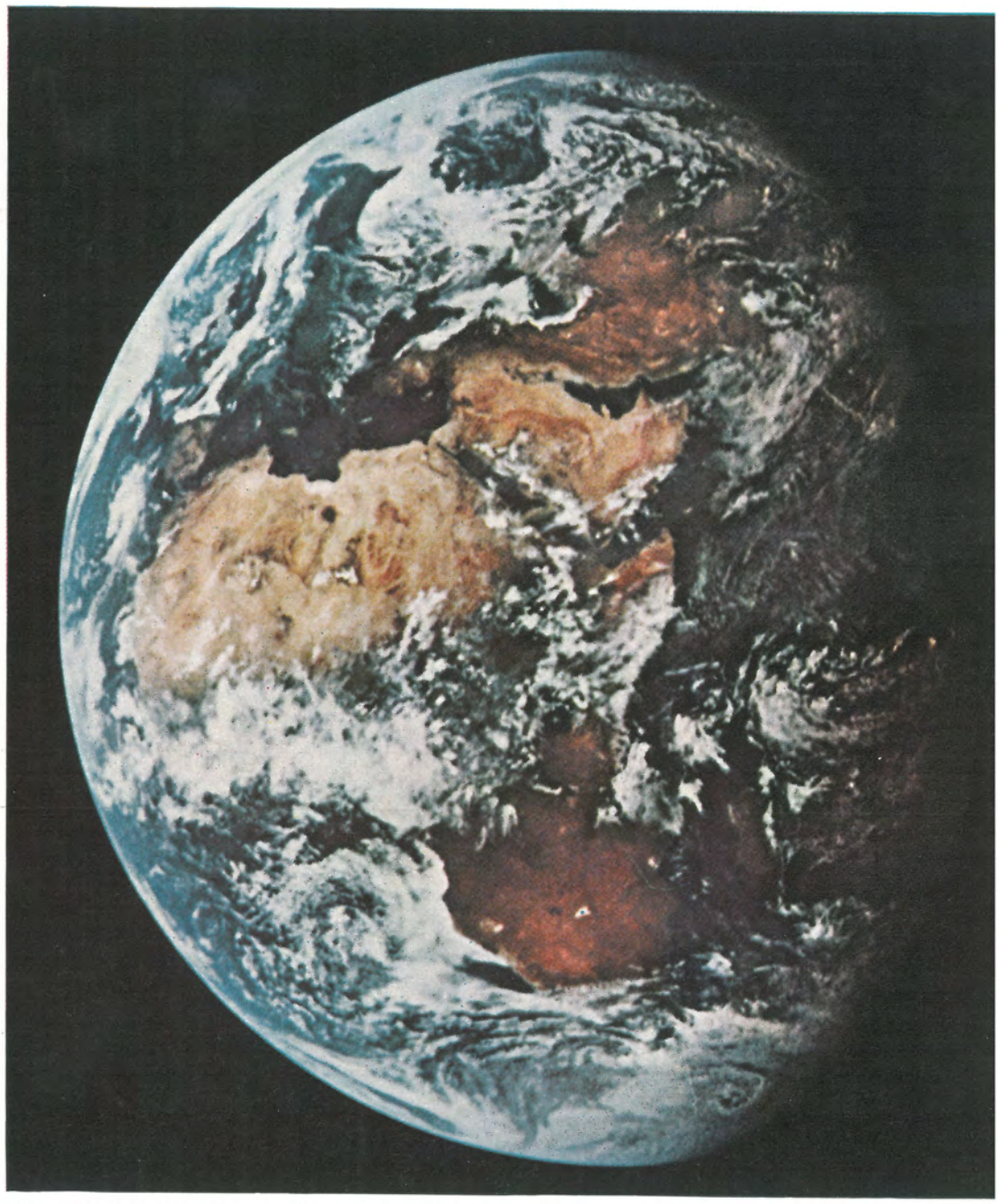


Eagle turned its docking port toward Columbia moments before hookup. Earth is in upper left corner of large picture





'We got you coming home'



Tired but triumphant, Armstrong got ready for the trip back

The plaque left behind with the LM's descent stage

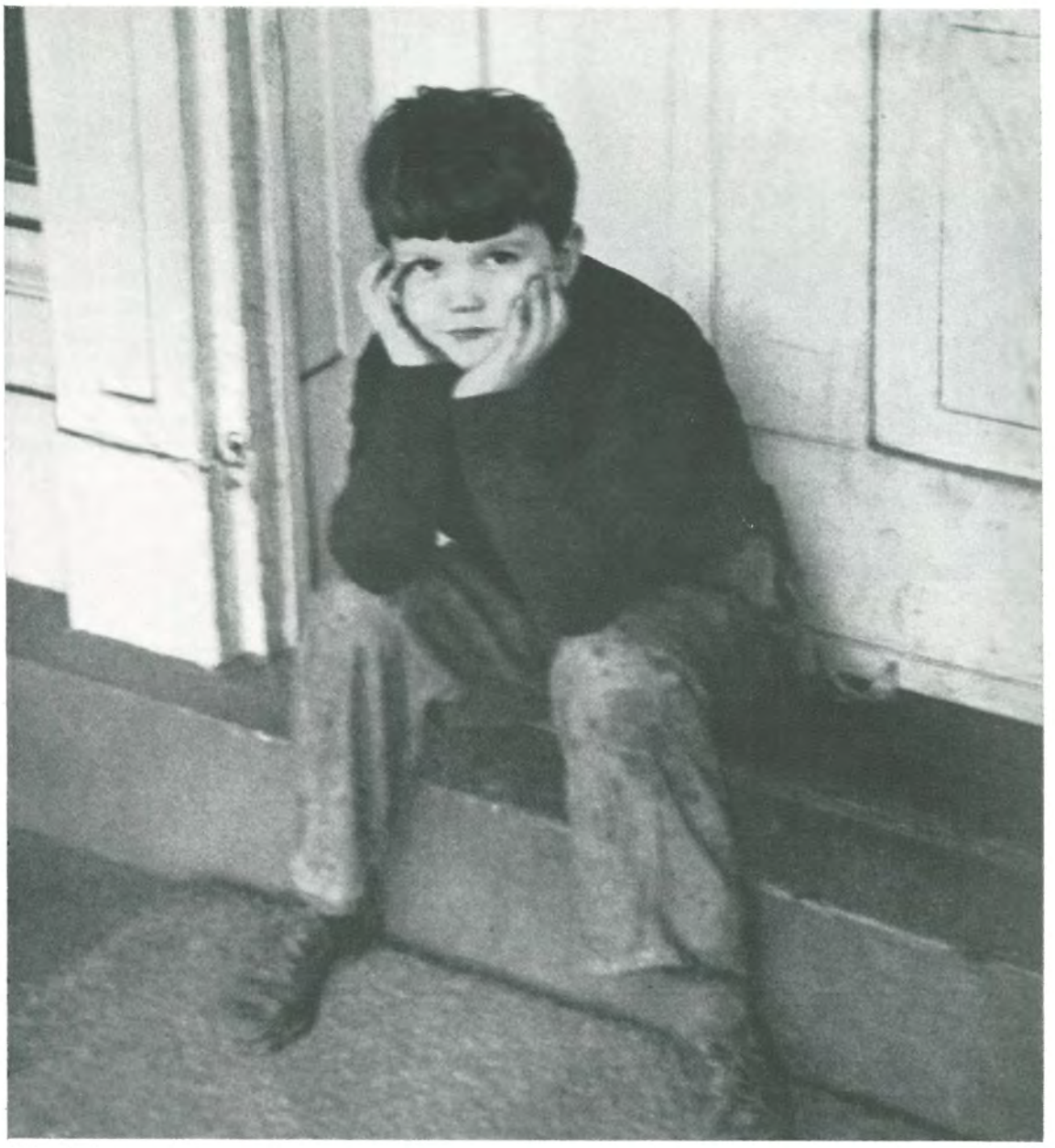
Aldrin, Collins, Armstrong—heroes of history's greatest exploration

The Men of Apollo 11

Three kids bound for the moon

Neil Armstrong, age 8

Buzz Aldrin, age 5



Mike Collins, age 7

A visit to the moon. Three decades ago, when these snapshots were made—how few had thought they might go there? Certainly not these three lads, just starting grade school, sitting quietly on the front step or posing awkwardly astride ponies. Their worlds were heady enough with the business of telling time, learning to catch, beginning to read, exploring strange neighborhoods. They were just kids with skinned knees and nicknames, who had to learn —like everyone else—that north is at the top of the map and that seven times nine is 63. When teachers in those days talked of the moon, its very distance from earth staggered young comprehensions. Oh, Neil Armstrong had dreams about floating in mid-air, but the dreams never had him floating very far from home. Buzz Aldrin didn't much care that his dad knew Orville Wright or rocket pioneer Robert Goddard; Buzz preferred football. And Mike Collins liked to play among the tunnels of a 400-year-old fortress, where space was something measured in inches. A visit to the moon? Then such a trip could take place only with the best fantasies of these bright and lively boys. Now they have gone to the moon, and come back again, and life for these three—and for the rest of us—will never be the same.

Stern-faced at the age of 6, Neil Armstrong was flanked by brother Dean and sister June in 1936 photo (left). By 13 he was building sophisticated model airplanes, and by 16 he was flying real ones. At Purdue University he donned his merit badges and —belatedly—became an Eagle Scout.

He could

NEIL ARMSTRONG

When he was a small boy, he had a recurrent dream: he could, by holding his breath, hover over the ground. Nothing much ever happened—he neither flew nor fell, just hovered, and the whole thing must have been frustrating to a child as captivated by the idea of flight as Neil Armstrong was even then. Today, he remembers the dream with a characteristic flickering smile. "I tried to do it later, when I was awake. It didn't work."

From age 9 Neil Armstrong was an aircraft nut, loving all types of aircraft with a single-mindedness bordering on obsession. When he joined the elite group of astronauts in the autumn of 1962 he did so almost reluctantly. For seven years as a civilian pilot at Edwards Air Force Base, Calif., he had been test-flying the most exotic aircraft the U.S. had to offer, and working as engineer and researcher far out on the fringes of flight.

"In those days it wasn't a question of 'Do you want to be an astronaut or do you want to sweep streets?' " he says. "A whole array of approaches to space was in the works. We were doing some exciting, way-out things in which we were more than just pilots. We were engineers and developers using airplanes merely as tools, the way an astronomer uses a telescope as a tool. We considered the space flight task group," he concludes with more diffidence than arrogance, "as babes in the wood."

Not until after John Glenn had orbited the earth and "space programs had become well-defined, the lunar mission a definite reality," did he come to NASA as an astronaut. He entered the program as a senior NASA research pilot, a civilian, at the highest salary ever offered an astronaut. He is still, at something over $27,000, the highest-paid astronaut and as such is occasionally resented by some of his colleagues who are still on military

Home on leave from Navy flight training (left), Armstrong was soon ready for combat over Korea. In 1956 he married Jan Shearon, then moved to California to test the experimental, rocket-powered X-15 (far right).

fly before he could drive

by Dora Jane Hamblin

discipline and military pay. He is probably the most intense of the astronauts, and the most enigmatic.

"If you tell Neil that black is white, he may agree with you just to avoid argument," says an acquaintance. "No, most likely he won't say anything at all," says someone else. "He'll smile at you and you'll think he is agreeing. Later on you'll remember that he didn't say a word."

"Silence," agrees his wife Jan, who can be pretty enigmatic herself, "is a Neil Armstrong answer. The word 'no' is an argument."

In any case, aircraft—not people—are the passion of Armstrong's life. When he speaks of them, or of aerodynamic principles, he is eloquent. When the subject changes to a less familiar area, he tends toward silence which is not so much icy as controlled. Neil Armstrong finds people far less efficient than aircraft and their performance generally short of their capacity.

"The single thing which makes any man happiest is the realization that he has worked up to the limits of his ability, his capacity," he says. "It's all the better, of course, if this work has contributed to knowledge, or toward moving the human race a little farther forward."

He grew up in middle-America during the Depression, steered by a set of stern and stubborn values: work hard, smile, save your money, count your blessings (things could be worse) and pray a lot (things could be better). Also: learning is the salvation of the human race, and sloth by far its greatest peril.

One of the words Neil uses often in conversation is "luxury," but he doesn't mean either physical possessions or life style. To him "luxury" is time, or choice. "In your business you're probably capable of thinking of a couple of projects at once," he will say. "That is a luxury I'd like to be able to afford." Or, "We'll be too busy to have the luxury of monitoring all the study sessions."

He's done a lot of brooding about the aims of his space missions. "There are two viewpoints: whether we should concentrate on what's best for the results of a particular expedition, or whether it's best to prepare so that later expeditions may be even more fruitful," he says. "It's a matter of balancing two objectives and coming up with a procedure that fulfills both within the operational restrictions." Before a mission, he usually works so hard that he comes home white with fatigue, eats a hurried supper crouched over the latest batch of NASA reports, and rushes back to work in the morning with only coffee for breakfast.

Neil was the oldest of three children of Stephen and Viola Armstrong. His tall, good-looking, image-conscious father worked as an auditor for the state of Ohio and moved his family around about once a year from one county seat to another as he audited the books. His mother was musical, somewhat literary, self-effacing and every inch "a *good* woman." The children were expected to help at home, earn money at odd jobs and be careful to yearn only for the things they could afford.

By the time Neil was 14 he had passed through an extensive model-airplane-building stage and the family had come to rest in Wapakoneta, Ohio, pop. 7,000. (Wapakoneta's present pride in Neil is almost unbounded. There have been two Neil Armstrong Days already and a third one is planned for this fall. A street and an airport are named after him. His photograph is displayed everywhere.)

In 1944, Neil took a 40-cents-an-hour job sweeping out and hoisting cartons at Rhine and Brading's

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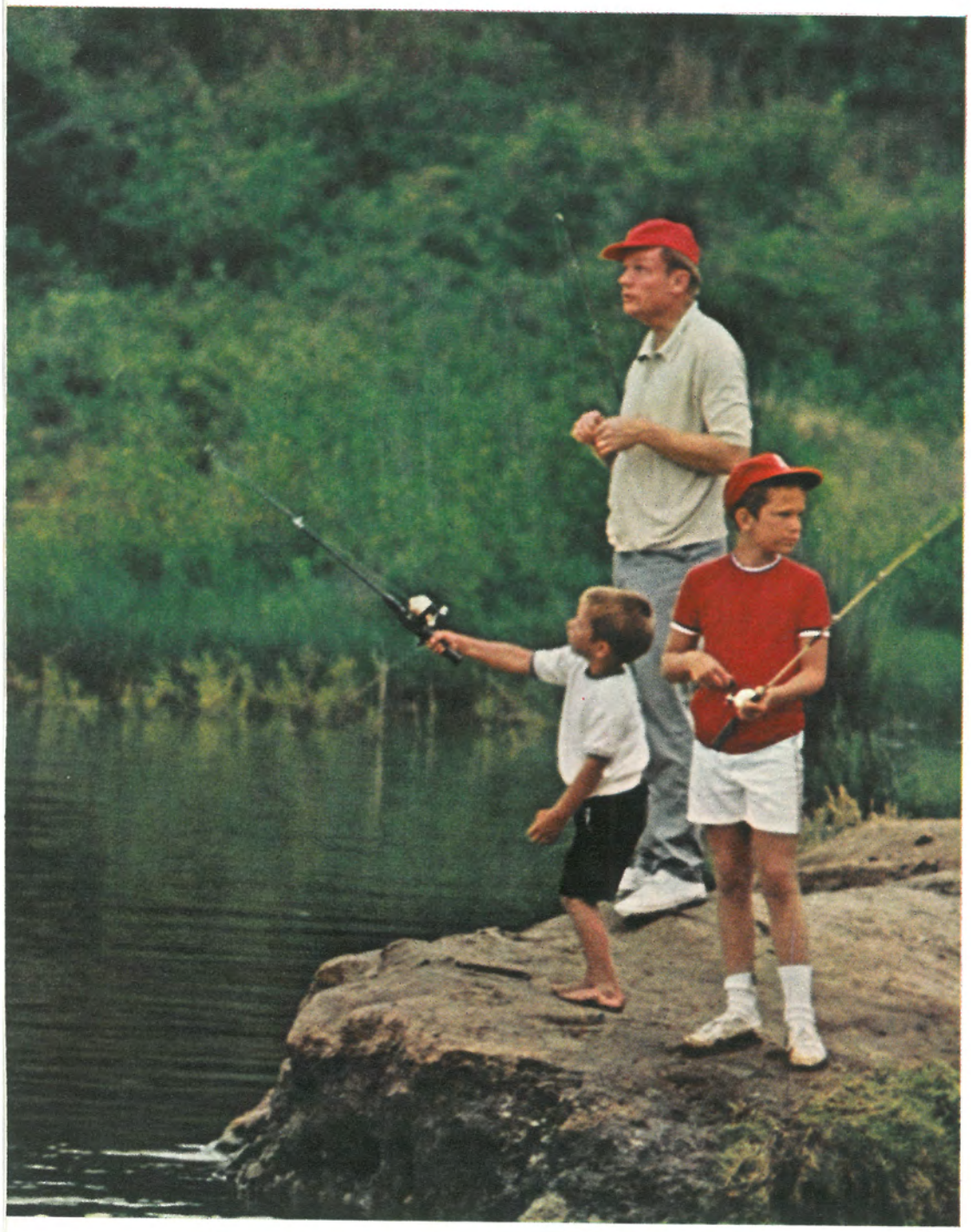
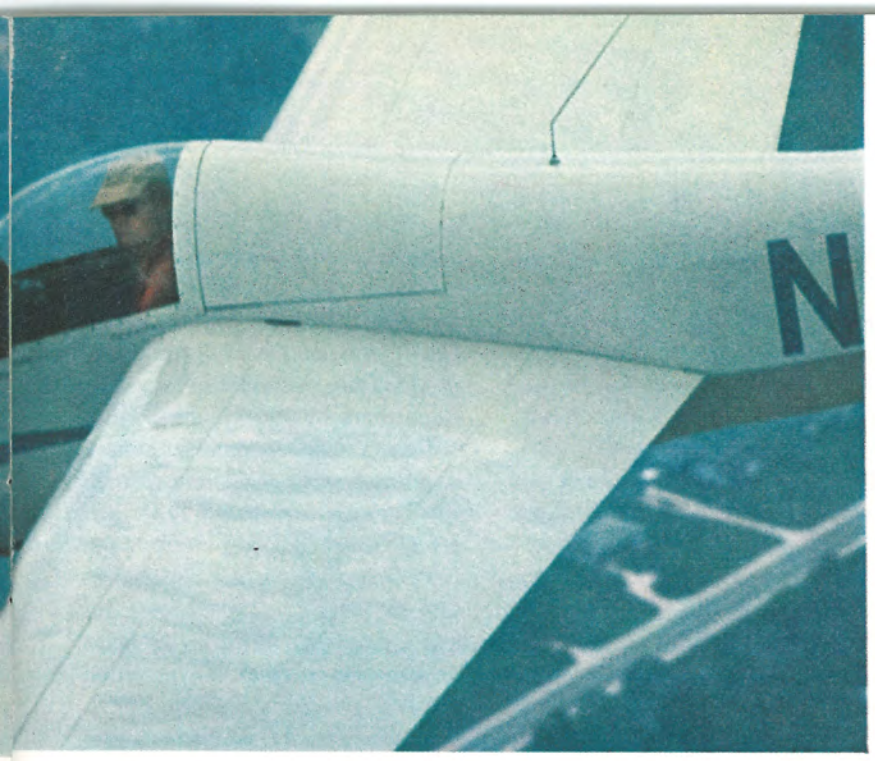
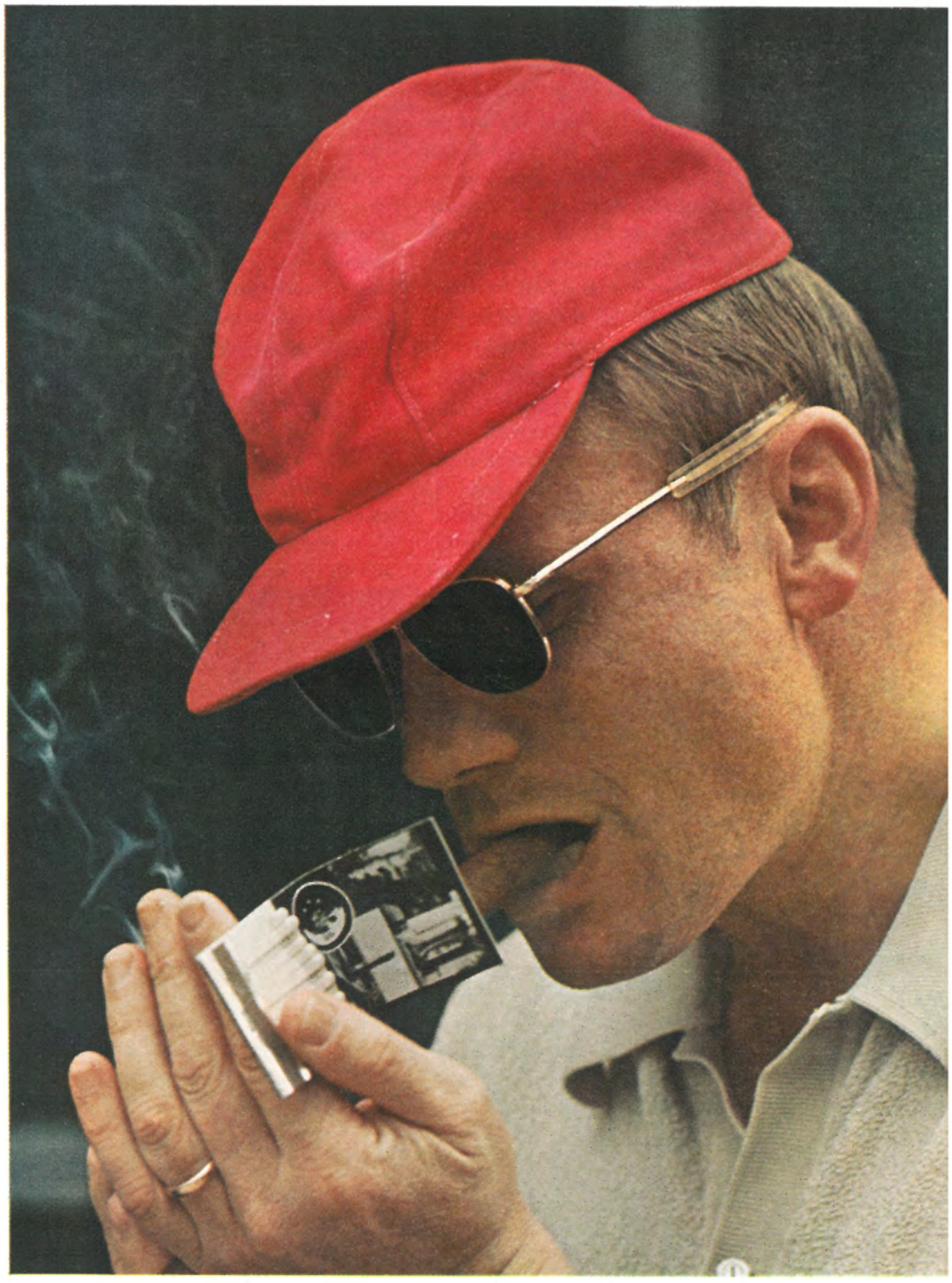






In spite of a relentless schedule, Armstrong sometimes found moments for normal family life —fishing in a nearby Texas bayou with his two sons (top left) or pitching a determined fastball to 12-year-old Ricky (bottom left). Some family projects looked suspiciously astronautical—giving wife Jan and the kids some pointers on scuba diving in the backyard pool (Neil had to learn as part of weightless training), or soaring silently in a glider through the updrafts south of Houston (top). Others, like the home-cooked pizza feast (above), were strictly for fun. At lower right, 6-year-old Mark got some coaching in a chess duel with Ricky. At top right, Armstrong fired up a stogie. "I smoke one cigar a month," he says, "but sometimes I forget to."

pharmacy before and after school. Every now and again he would ask his boss Dick Brading for a couple of hours off. This didn't happen often, because what he yearned for cost $9 an hour, and it took a while to accumulate that sum. Brading always gave him the time, and Neil rode off on his bicycle three miles out on what is still called "the old brewery road" to the Wapak Flying Service. There he would hand over his fistful of money to Charles Finkenbine, and then all but sprint to one of the light planes Finkenbine used for flying instruction.

On his 16th birthday, Aug. 5, 1946, Neil Alden Armstrong got his pilot's license. He looked about 12 years old and didn't yet have an automobile driver's license.

Depression times were long over by 1947, but the Armstrongs still feared that it would take the intervention of divine providence to send the kids to college. It is therefore no wonder that on the day when Neil ran home to tell his mother he had won a Navy scholarship that good churchgoing lady dropped a quart jar of preserved raspberries on her right foot and broke her big toe.

Neil went to Purdue University to study aeronautical engineering for two years, then went to Pensacola for Navy flight training. By the time he won his wings the Korean War was on, and he was sent to fly Panther jets from the deck of the carrier *Essex*. He was 21 years old. In 78 combat missions he became known as a very hot pilot and won three Air Medals. He once coaxed a badly crippled jet back to the deck of the *Essex* and in an even closer call was shot down—behind enemy lines—and rescued within a day. Since then, he has survived several near misses in experimental aircraft, including the X-15; a middle-of-the-night fire in his Texas home; a hair-raising flight on Gemini 8—the only manned space flight to date which had to be brought home early because of an emergency; and the crash a year ago of a Lunar Landing Research Vehicle in which he was training at Ellington AFB, Texas.

Obviously, after that string of cliff-hangers, anyone who was willing to send this man to the moon must have considered that a) he is one of the best pilots in the world or that b) everything that is going to happen to him has already happened. Armstrong himself denies any particular courage or any fear. "I have been in relatively high-risk businesses all of my adult life," he says. "I have confidence in the equipment, the planning, the training. I suspect that on a risk-gain ratio, space missions would compare very, very favorably with those to which I've been accustomed in the past 20 years."

Neil and Jan Armstrong met while both were students at Purdue, after Neil came home from Korea. Janet Shearon knew quite a lot about airplanes because her father, a physician in Wilmette, Ill., had owned one for flying back and forth to the family summer home in Wisconsin. But the initial bond between Neil and Jan wasn't planes. They got acquainted by running into each other around the campus in the chilly dawn. Neil had a job delivering the campus newspaper and Jan, a home economics student with a passion for swimming, had a lot of 7 a.m. lab courses. Each admired the other's industry. After three years of admiration, Neil finally asked her for a date.

"He is not," says Jan, "one to rush into anything." Neither is he one to abandon a project after he has started it. Having been a Boy Scout most of his life, he finally finished the requirements to make Eagle during his freshman year at Purdue. He finally got around to marrying Janet Shearon in January 1956.

One of their first homes was a primitive summer cabin 5,000 feet up in the mountains and "50 miles without a stoplight" from Edwards Air Force Base, where Neil had signed on as a research pilot. It was so lacking in modern conveniences that Jan bathed their first son, Ricky, in a plastic bathtub in the backyard after the sun had heated the water. But the privacy and the view were magnificent, and Neil could flash through the sky right over their house, waggling at his wife the wings of some of the most exciting airplanes of the era. At Edwards, he also learned to fly gliders. The special exhilaration of silent, powerless flight has remained one of his greatest pleasures. Neil never cared much for team sports. Among the astronauts, for whom physical fitness is almost a fetish, he is an anomaly. He neither jogs, does push-ups nor plays handball. "I believe," he says mildly, "that every human being has a finite number of heartbeats available to him, and I don't intend to waste any of mine running around doing exercises."

Neil's dry humor, of which he has a considerable fund, often tends to slip by unnoticed. Consequently, almost nobody heard him quietly remark, during a heated cocktail-party discussion of education in Texas, that "My son is only in kindergarten, and already he's had two years of Texas history."

As family man, Armstrong is low-key. He both grants and takes a high degree of you-live-your-life-and-I'll-live-mine. When he dashes off to Cape Kennedy for training he often neglects to tell Janet where he'll

Away from work, Armstrong enjoyed a few frivolous moments, watching a nuzzling match between Jan and their younger son Mark, or dashing off a few jazzy bars on the living room piano. But most hours at home were spent in the sanctuary of the downstairs den, absorbed in moon study.

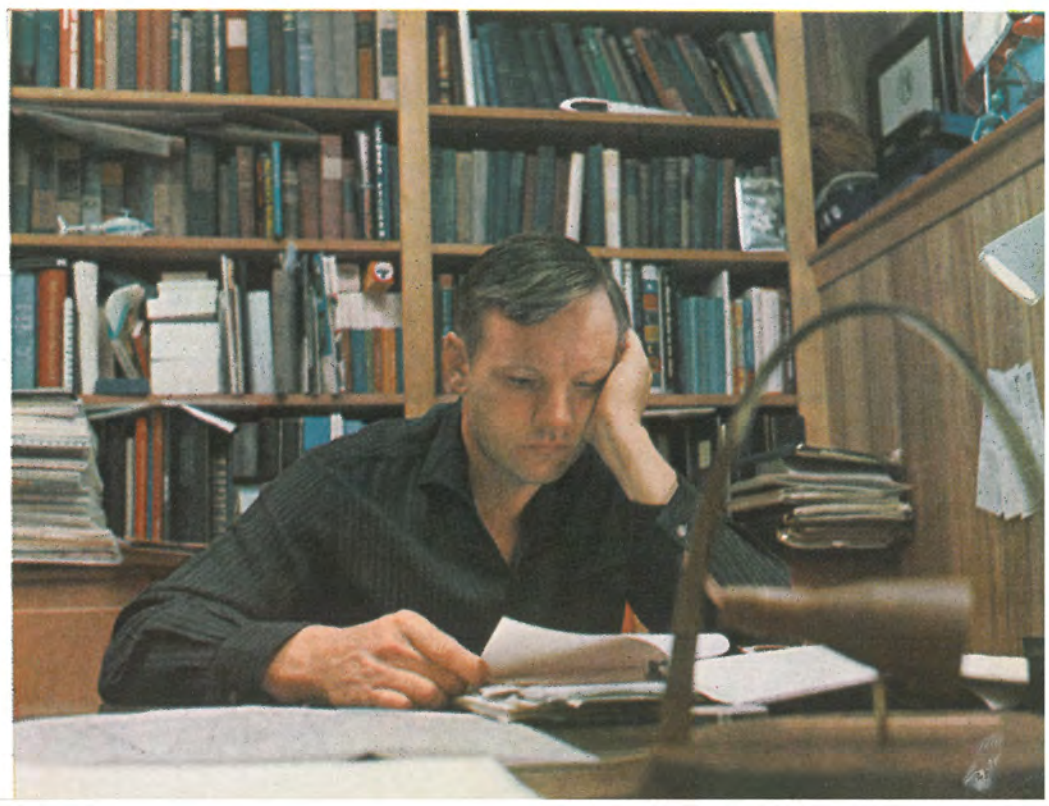
be staying. He will telephone her when and if he can. When he comes home at mealtime and finds Janet is off teaching swimming classes, he reads the note she has left on the refrigerator door and then equably fishes dinner out of the oven where she has left it and feeds himself and the two boys. When they entertain they do it at home, with Neil helping in the kitchen. From one of his childhood jobs in a bakery—a job he got because he was small enough to be put bodily into the mixing vats to clean them at night—he acquired an expert touch as a dough mixer. He now can make a mean pizza. He is capable of cold, tight-lipped rage, triggered most often by what he considers either dishonesty or subterfuge. These defects he apparently finds scarce in his own family, however, since his parents and his wife all consider him "a very easy man to live with."

He enjoys reading, although "I've had to stop lately, because I am incapable of putting a book down once I've started it, and that's a luxury I can't afford for the time being." He loves music. He "scrimped and saved" to buy himself a baritone horn back in Wapakoneta, and he once permitted himself a deviation from his self-set working schedule by playing for one giddy high school year in a four-boy combo called the Mississippi Moonshiners. He also learned to play the piano creditably, and he and Jan occasionally sit side by side on the family piano bench attempting impromptu duets which seldom survive the first 20 bars. It is both a joy and a relief to visitors to see the noncommittal Armstrongs engaged in the totally human act of breaking each other up laughing in mid-duet.

At times like these the optimist may begin to think that he has found a pattern to the Neil Armstrong enigma. He is a folk hero who obviously has nine lives, all but one of which he has offered, repeatedly and publicly, to his country. But the last one is purely his own, the one he was privately enjoying while offering up the rest. That is the life in which he doodles aircraft of the future, the life he lived in a lonely California cabin, the life in which he plays the piano and flies gliders, flying for once in a silence and solitude in which he is both pawn and master of the elements.

The analysis is put to the subject: "You know what you really are? You're a screaming nonconformist, and a loner!"

"Oh, I don't know," says Neil, letting that boyish smile creep clear up into his eyes. "It's just that it's nice to get away from the office once in a while, you know . . .?" ◀



A sturdy 2-year-old in a stylish swimsuit, Buzz Aldrin grappled with a backyard garden hose. At 8, he lazed on a beached boat at the family's Manasquan, N.J. summer home. His favorite high school snapshot shows him as the football center.

'The best

BUZZ ALDRIN

He is a perfectionist and NASA workmen who have to do his bidding at the Manned Spacecraft Center find him a demanding taskmaster. A good many people inside the astronaut community think, with somewhat less justice, that Aldrin is a square as well. "If Buzz had his way," said one wife, "the code names for the spacecraft on Apollo 11 would be Alfa and Bravo."

He has practically no hair and, on the testimony of his wife, is a strange mix—"humility and magnificent confidence bordering on conceit." He is without much tolerance for inconsequential talk, but is happy to wrap his fist around a glass of bourbon and branch and talk until the small hours about the subject that interests him, which is his trade. It is then that he chews at the left side of his lower lip as he rambles on about rendezvous and docking in space, his eyes gleaming with the intensity of small volcanoes as he addresses himself to the problems of "ecliptic orbit" —as if everyone understood as much about that as he does.

One eminent geologist flatly calls Aldrin "the best scientific mind we have sent into space." Says Ted Guillory, a flight plan writer at the Houston Manned Spacecraft Center, "Boy, he's really something. He carried a slide rule for his Gemini flight on the rendezvous and I sometimes think he could correct a computer. I can remember hearing him say things like, 'If the computer says I'm 20 feet out of plane I'll believe 10 of that, but not all 20.' He's one of the few people who can figure out all these rendezvous things in his head."

"If Buzz were a trash man and collected trash," Joan Aldrin says,

At camp in Maine (left), Buzz was visited by his father, an Air Corps colonel. Later he was in uniform himself, a pilot—and occasionally a tourist—in Korea (right). In 1954 he married Joan, and got caught in a genuine wedding shower (below).

scientific mind in space'

by Gene Farmer

"he would be the *best* trash collector in the United States." Buzz was the first man to join the astronauts with a doctorate (M.I.T., 1963), having written a thesis which, NASA's Chris Kraft has acknowledged, contributed a great deal to the success of the space dockings achieved in the Gemini program. When he tested his theories successfully in the last Gemini flight in November 1966 (simultaneously becoming the first astronaut to beat the fatigue problem in a space walk —by learning to pace himself properly), he had the satisfaction of knowing that he personally had contributed significantly to the space program.

"Challenge" is a word Buzz Aldrin uses frequently. "What is challenge?" he asked once. "What determines excellence? In grade school it's the marks that you get, what you do on the athletic field. At West Point the name of the game is, 'Do what people tell you to do, keep your nose clean and work out your academic progress.' I fitted into that pretty well. I'm a sort of mechanical man—or I was."

This is a judgment with which most of his fellow astronauts would agree. He is an easy man to appreciate, but not an easy man to know. To one of his colleagues he "has enormous ability, enormous talent —but he is very much a loner."

Buzz was born in Montclair, N.J. Jan. 20, 1930, about five months after his father, who left the Army Air Corps in 1928 to work for Standard Oil of New Jersey, had bought a comfortably large house there. The elder Aldrin was a distinguished aviator in the 1920s and 1930s (he still holds a pilot's license at the age of 73) and at one time was a close associate of Orville Wright. He was also a student and friend of the American rocket pioneer Robert Goddard; he introduced Charles A. Lindbergh to Goddard in 1929 and is one of the few men who still refer to General Lindbergh by his old nickname "Slim."

Buzz's father was away a lot, flying all over the U.S. and Europe to promote commercial aviation (only the oil companies had money for that in those days), but the income was good and steady; none of the Aldrins remembers the Depression as a time of privation. There was enough money for a nurse and a cook, who indulged Buzz in certain *outré* tastes he had developed in food—sandwiches of peanut butter, sliced banana and a topping of powdered chocolate; whole cans of tuna eaten straight out of the can; packages of Jell-O consumed dry. "I don't know how he got his mouth apart," says his sister, Mrs. Fay Ann Potter of Cincinnati.

His other sister, Madeline, now Mrs. Charles P. W. Crowell Jr. of Tulsa, Okla., remembers that all through grade school Buzz was more inclined to buckle down to neighborhood football games than to his homework—his report cards were mostly C's and D's.

All that changed just before he was due to enter high school. Not surprisingly, considering his father's example, Buzz decided that he wanted to be an aviator, which meant trying for an appointment to West Point or Annapolis. At a conference with his parents and the school counselors it was made frighteningly clear to him that unless his grades improved he would never see the inside of either academy except as a custodian or a

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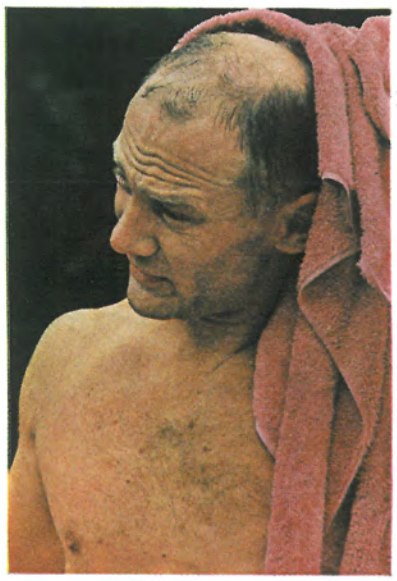
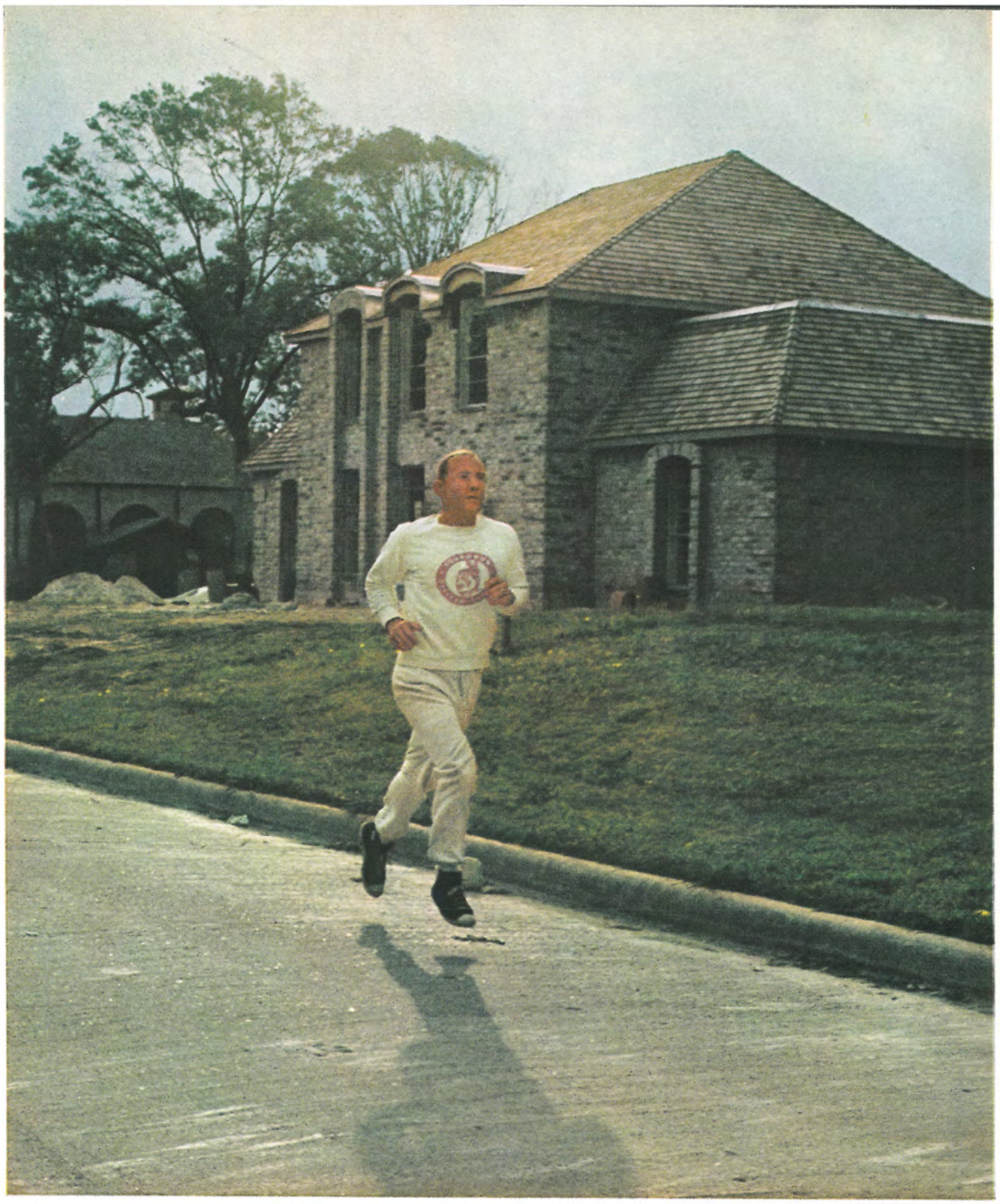
Aldrin is, like most astronauts, an exercise buff who spends nearly an hour a day keeping fit. Awake at dawn, he jogged a mile or two through his Houston neighborhood (right), then jumped into the family pool for a brisk 10-minute swim. Later, he coached son Andy, 11, in high jumping (bottom) and basketball (bottom right). An accomplished pole vaulter at West Point, Aldrin took pleasure in his old skill (far right) by using an aluminum pole to swing his 165 pounds over a suspended fishing rod.





tourist. Buzz got the message, and after that it was all A's and B's —mostly A's. He made it look almost too easy. Fay Ann was a year ahead of him in high school but, she says, "If I had a math problem or a science problem I'd go in and work it out with him even though he hadn't taken the subject yet. He seemed to be able to explain it to me. I marvel today at how well he can explain the intricacies of what he is doing and make you understand and not feel stupid."

He still found football a challenge, and played center on the Montclair High School team that won the New Jersey state championship in 1946, compensating for his small size with what French generals call *cran* and football coaches call "desire." He had learned how to make friends, but even then was beginning to draw apart; he chose to walk to and from school (a mile and a half each way) with Fay Ann. This, Fay Ann thinks, was "so that he didn't have to get involved with finding other people to walk with. We didn't talk an awful lot."

At the end of his plebe year at West Point, Buzz was No. 1 in his class. In 1951 he was graduated as No. 3. He was also a 13-foot-9-inch pole vaulter—with a bamboo pole, before fiber-glass poles started whiplashing 13-foot vaulters to suborbital heights.

For a West Point graduate in 1951, a diploma was a ticket to Korea—in Buzz's case, by way of Bryan, Texas, where he spent a year getting his Air Force wings. Just before going to Korea, at a dinner party in New Jersey, he met Joan Archer, a striking blonde who owned a master's degree in theater arts and was otherwise unattached. But, says Joan, "Nothing happened, no spark." At the time, Buzz was writing to another girl. When he came back from Korea a year later (66 fighter missions, two MiGs destroyed and one damaged, the D.F.C. and other decorations) he again got in touch with Joan. She was soon wearing Buzz's West Point pin and getting thoroughly bored, since she was now off limits to other dates and Buzz was out in Nevada as an Air Force instructor courting her by mail.

"Buzz wouldn't make the move," says Joan. She persuaded her father to take his vacation in Las Vegas for two weeks, and the night before they were to leave Buzz proposed. "I had just about given up," says Joan. "I sensed that," says Buzz. When they finally got married it was only the fifth time they had been out together.

Buzz shortly found himself in Germany, flying F-100s, surrounded by pilots who were either as hot as he or claimed to be, and increasingly convinced that what he really needed was more formal education. What he was really doing was looking for a new "challenge." By the time he and Joan were flattened simultaneously by hepatitis for six months in 1959 ("from drinking dirty wine in Italy," according to Joan), Buzz had set his sights on the U.S. space program. He got the Air Force to send him to M.I.T. to get a doctorate, bypassing the master's degree. While there he applied for the 1962 class of astronauts and was turned down. Test pilot experience was then required and Buzz did not have it. "I tried for a waiver," he says. "I knew darned well I wouldn't get it, but I wanted the application in the record." He was disappointed nonetheless and even considered leaving M.I.T. to get test pilot experience. Finally he decided, "Here I am. I might as well get the best out of it." So he stayed in Cambridge. "I had some original ideas," he says without either false pride or false modesty, "about piloting problems and rendezvous. That thinking fitted beautifully with what they needed for Gemini."

Buzz has had only one other space flight—Gemini 12. Characteristically he was about the only person dissatisfied with the results —he would have liked to have pressed extravehicular activity (the "space walk") to new limits, but in the last Gemini mission nobody wanted an extra risk. Then, in January 1967, came the pad fire in which three men died, one of them Buzz's close friend Ed White, and the Apollo program was set back almost two years. For 21 months nobody flew. Joan Aldrin began to sense that something big was up in January this year when Buzz began acting more withdrawn than usual. When she finally realized that he had been selected for the moon landing crew, she hardly knew whether to cheer or cry. Waiting for the formal announcement was a time "of walking on eggs, normalcy tinged with hysteria. I wished Buzz were a carpenter, a truck driver, a scientist, anything but what he is. Now I understand how Susan Borman felt—wanting to run and hide. I want him to do what he wants but I don't want him to . . ."

No astronaut's wife ever seems able to complete that sentence satisfactorily. For Joan Aldrin, the Apollo 11 flight was a time of housecleaning—get the rugs cleaned,

Before his flight, Aldrin went over lunar maps with wife Joan (above), reviewing possible landing sites. At right, he guided daughter Jan through some sixth-grade math.

wash the windows, paint the walls. It was her way to keep sane. During the months preceding the flight Buzz had not been home much —any more than his father had been home much when Buzz was the age of his 11-year-old son Andy. During the Apollo 9 mission in March, Buzz called home every night from Cape Kennedy to check on how Andy's school science project was going, perhaps remembering something missing in his own boyhood. Last month, Joan Aldrin took the three children (Andrew; Janice, 12; and Michael, 13) to stay at the elder Aldrin's beach house in New Jersey for a quiet vacation while Buzz was at the Cape for his final weeks of training. It was her way of staying out of the way. She was wondering if Buzz would be the same man when he got back from the moon. She had wondered the same thing when Buzz flew Gemini 12. She had felt then that "our marriage wouldn't be the same, that it would be so much more magical and meaningful and magnificent because he'd done this wonderful thing." Then, perhaps six months later, she realized that their marriage was exactly what it had been. "At first I was disappointed," she says, "and then it was comforting to think that it hadn't changed him. He's not the same person I married, but I don't believe that I am the same person either."

What kind of person is Buzz Aldrin? What kind of person is any man who risks a death no man has ever died? Why does he do it? For money? (There isn't that much money.) For glory? For old-fashioned patriotism? There is some of that in all these men. But as Aldrin says, there is something else, a common denominator, perhaps, for all 50 astronauts:

"When you try to answer the question of motivation, you have to ask: 'What type of people are we talking about?' In our business we're talking about airplane pilots, fighter pilots. If you are a fighter pilot, you want to get hold of the hottest thing you can. And having flown that, you ask yourself: 'What else can I fly?'

"You come down to the ultimate, the space program. It's *there*. Some people don't think they have a chance and don't bother to try. Others say, 'I'll accept that challenge.' Some make it and some don't. But there's a treadmill going and if you make it, you're on it. You have some control over it by your own performance. Fate determines a lot of where you fit into the puzzle. But why do you do anything? Because you were selected to do it." ◄

On a family outing, the Aldrins (above, from left: Mike, 13; Andy, 11; Buzz; Jan, 12; and wife Joan) journeyed through Houston's Astroworld in an electric tram, then stopped for ice cream (top). At right, Andy looked on admiringly as Dad discussed the mission-to-come.

At 18 months, Mike Collins was so chubby his mother nearly put him on a diet. Later (and thinner) he posed in Puerto Rico with his father, an Army major general. At West Point, Mike played end on an intramural football squad (front row, right).

An engineer

MIKE COLLINS

He is a pleasant man who smiles readily and is highly popular with his fellows. He is pragmatic and fatalistic in a way that goes more to attitude and the control of worry than to philosophy, but Mike Collins also is intelligent and a good deal more subtle and many-layered than he cares to admit. He has immense faith in himself and his capacity to perform under pressure. What worries him more than the dangers of traveling in space are the tiny, insidious cells of cancer, for instance, because cancer is irrational and against it he feels helpless, while the menace of space is ordered, logical, and allows him to rely on himself, which is the stance in which he is most comfortable.

At 38, Collins is slender, limber, deceptively slight, the handball champion of the astronauts. Early last year his game went off. "My legs felt peculiar, as if they didn't belong 100% to me. I'd heard prizefighters talk about their legs going and I thought, well, instant old age." But the condition progressed. Parts of his legs were soon without feeling. His reflexes were failing. Sometimes he fell down.

The doctors found a bone spur and a loose disk in his neck that were pressing on his spinal cord. There are two operations for this, both serious. One relieves the problem. The other, more dangerous and complex, cures if it succeeds. Collins chose the latter and the operation was successful. He recovered fully and returned to flying status. He discusses the episode today with utter matter-of-factness and no hint of emotion. And yet this was a devastating turn of events. It cost him a position on Apollo 8, the first flight around the moon. His whole future as a space pilot and an Air Force officer had been in the balance. Surely there was distress and trauma?

"Well, it seems to me that trauma comes from having to make decisions that are very nearly 50-50. You know, 50.1 against 49.9. Those are the things that really bug people. But here there was no doubt. I had this thing creeping up the left side of my body, and the salient fact was that it had to be stopped and the operation was the way to stop it. All the other things—what failure could mean to my career and so on—were only background noise. I had no choice—I had the condition, surgery was the only answer and—*voilà*—it would be done, and one hoped it would work and if it didn't, it didn't, but I still had no alternatives."

But isn't there a sense of horror in this rude invasion of the body that always has served so well?

"No, not really. If trauma comes

The Collinses were married at Chamblay Air Force Base in France, where she worked and where he flew fighter planes. At left, Mike stood on the wing of his F-100 between gunnery practice runs in Tripoli, Libya.

who does not love machines

by David Nevin

from decisions that are nearly 50-50, I think horror comes from things that are not clearly understood. You can get a cancer and they remove part of your liver and then later on you find it in the lymph stream and then it shows up in some other horrible place—that sort of thing is very insidious, mysterious, a cult of evil, you know? In my case, pressure on the spinal cord—that was a relatively clean thing. The mechanism was well understood. Things that you understand are not really frightening."

Is he an optimist then? That, after all, would be comforting in the dark of space.

"Not a perennial optimist, anyway. I think I'm more the fatalist—what's written is written, and I don't know what it is. I'm not always convinced that everything is going to work out well. On the other hand, there's nothing wrong in acting as if things *will* work out. I mean, if I tell my wife I believe in the Easter bunny—well, why not? Either he exists or he doesn't, and I choose to believe. I think that is much more pleasant. But if you really cornered me, I'd have to admit reluctantly that there is no Easter bunny."

Collins is of a military family and is himself an Air Force lieutenant colonel, though he has little of the military manner. He was born in Rome, where his father, Major General James L. Collins, was then military attaché to the U.S. Embassy. His uncle, General J. Lawton ("Lightning Joe") Collins, was a famous World War II division commander and eventually Army chief of staff, and his older brother now is a brigadier. Collins grew up on military posts and as a result there is no place he thinks of as home. The place he remembers most happily is Puerto Rico, where his father was commanding in the days before World War II and they lived in a building some 400 years old which the Spanish had built with stone walls thick enough to withstand cannon fire. It was an immense structure with gunports and tunnels that made extraordinary play places for a 10-year-old. There was a strip of beach and when a shark appeared the guard would run down and hose it with a tommy gun. A high stone wall surrounded the military area and a poor, waterfront section of town had been built against it. "A house of, well, ill repute, you know, was right there." Collins remembers it well. "They did a thriving business, so I used to sit up on the wall and watch everyone come and go and talk to the girls, and I can remember they used to—oh, I was a rat fink—they used to toss me money to get me to come down and visit them but I never would. I was scared to death to."

He went to West Point, attracted, he is fond of saying, by the fact that the education was both excellent and free, and when he graduated in 1952, elected to serve in the Air Force. The Air Force trained him in fighters, and from the beginning he loved the great machines that boomed off the earth and became alive and supple and responsive to his touch. His wife remembers meeting him for the first time on a base in France with a group of young fighter pilots, all of whom were excited and confident. Her name was Patricia Finnegan and she came from Boston and was employed by the Air Force. She would sit with these brash young men, often enjoying a mood of private irony. She would see an expression cross Collins' face that

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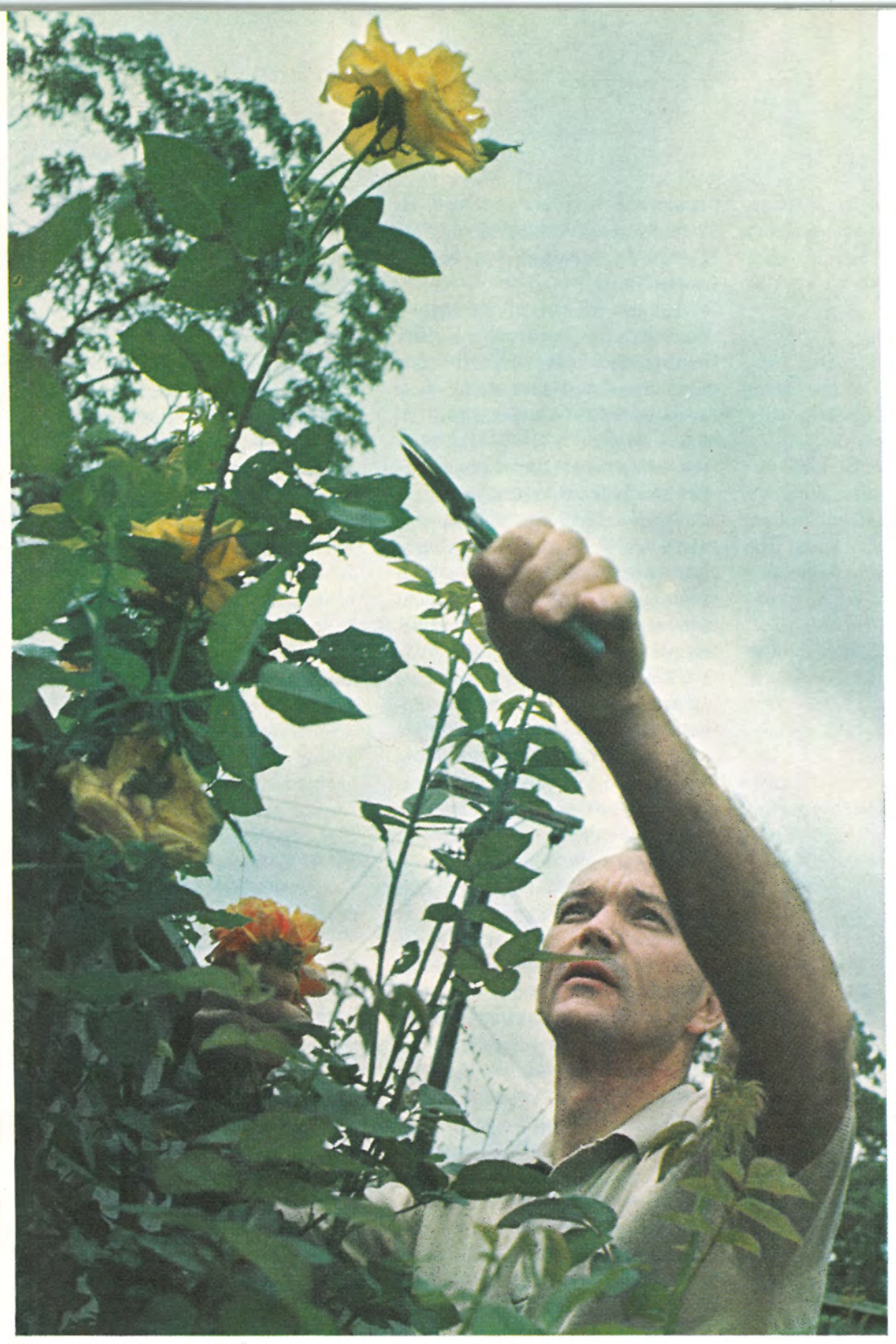
Before the moon flight Mike Collins spent his spare time at home with his family (pictures on right page), painting a still life in oil, pruning his prized roses, reading the Sunday funnies over breakfast or supervising backyard gymnastics (at bottom right) with Ann, 7; Mike, 6; wife Pat; and Kate, 10. Their German shepherd Dubhe was often nearby, joining occasional bicycle tours or Collins' fishing trips with son Mike.



matched her mood and she decided then that he was special.

In 1956, four years after graduation, Collins could have resigned from the Air Force and for a time thought seriously about doing so. His intense commitment, his wife remembers, was not to the military but to the matter of flight itself, and Collins was thinking about test piloting, which is a logical extension of flying but not of military flying. Eventually he made the Air Force test pilot school at Edwards AFB in the Mojave Desert and flew far-out aircraft. Then, naturally, he turned to space.

"I like fighter pilots. They're independent, they say what they mean, they prove who they are by what they do. They have nice parties and they let their ids hang out. They're good people. But fighter pilots can afford to be irresponsible and impetuous and test pilots can't. Test pilots have to be older, smarter, steadier or they'll make a wrong judgment on an airplane and someone will kill himself later. The old thing about, you know, white scarf trailing, put her in a power dive and see if the wings come off—it's not true. The test pilot has to be more of an engineer, studying charts and graphs for the airplane's limits.

"And space flight is an extension of that. Our training is more thorough, more elaborate. People think we're baked in heat chambers and whirled in centrifuges until our eyeballs fall out, and there is a little of that, but essentially we are learning an incredibly complex array of machines—all the nuts and bolts and wires—and learning what to do if some of it doesn't work as advertised."

So he came finally to the exploration of space. Yet Collins really is not quite completely the various things he seems to be. He loves flying, but he could quit tomorrow. He is a trained engineer, but he does not love machines as such. He knows a great deal about wines and he reads good books and raises roses in the backyard. He is one of those men who take particular pleasure in the way a flower grows or a cat walks or his little boy looks when he wants something. When he comes home, he is so *here*, his wife says, so completely relaxed and easy, fun to be around—light, happy, bright in the late afternoon when she is tired and the day has been long and it is time for a change of authority with the children.

Collins finds it hard to articulate his reasons for going into space. "I think man has always gone where he could, he has always been an explorer. There's a fascination in exploring and thrusting out to new places, but I can't say there is anything special about me—that I'm a natural explorer or I've always been bent in this direction—because it isn't true. I can be a good explorer, but so could other people. I really think the key is that man has always gone where he could and he must continue. He would lose something terribly important by having that option and not taking it."

Collins' nature, of course, requires that he approach his work confidently, cheerfully, as if there were indeed an Easter bunny—and with immense concentration. At home he may read the comics to the children and talk to his wife and pay the bills all at approximately the same time, but in the affairs of space his training is intense, and his concentration focuses that training to a bright point of instant and reliable reaction that is designed to keep him alive.

"You know, some say the getting up and down in space will be minor and what's done while up there will be important. Then the piloting—the fighter-pilot/test-pilot/space-pilot pattern—will recede and the scientists will become important. But if you took along, say, a geologist on these first flights—well, during these years of preparation, he would have focused on his rocks and his plans for exploration rather than on the flight and he would not have seen the flaws and defects in the total plan to get him up there and back again. And in fact he would kill himself by emphasizing his primary job instead of the difficulties of the transport system."

And this question of what really is important in a pioneer flight explains the lingering regret that sounds in Collins' voice when he describes what he was not able to do when he stepped out of the spacecraft and floated free a hundred-odd miles above the earth, connected by a slender 50-foot tube to the systems that kept him alive. He remembers very little of what anything looked like or of his emotional reaction to the enormity of what he was doing. But he remembers what happened, and as you listen you begin to see the relationship between concentration in space and surviving.

The flight was Gemini 10, with John Young, in July 1966, and one of its tasks was to maneuver close to an unmanned Agena rocket that had been in orbit for several months. Collins would then cross over to recover a small box—a micrometeorite measuring device. Young approached from below and brought the Gemini to within 12 feet of the Agena. They inflated their spacesuits and opened the hatch. Collins stood up, gave a little push with his fingertips and floated toward the Agena.

He moved slowly enough, but the situation was nevertheless desperately, if somewhat deceptively, unstable. First, the two spacecraft and the man were traveling at some 17,000 mph, and despite weightlessness and the absence of air, the speed induces a good deal of random motion. Next, the weightless condition means that each motion sets up an unwanted countermotion and yet the three bodies are free to move quite independently of each other. So, arms out-

Air Force duty in France gave Collins a taste for good food and wine. In a bistro near Houston, he and wife Pat sampled a red Burgundy.

stretched, Collins floated toward the Agena.

"The work, you see, makes your surroundings secondary . . . the awe and wonder is pushed into the background and your immediate occupation is a series of mundane chores that have to be done. I did them, but it was at the expense of being able to look around and say, God, look at this—you know?

"Too bad in a way. There you are suspended in the most incredible position and everyone asks you, 'Really, what was it like?' and it's a little frustrating not to be able to tell them. But my whole attention was riveted on the next job in line. I wasn't blocking it out, either, you know, ignoring it, not looking down—nothing would have been more pleasant than just to float around and look."

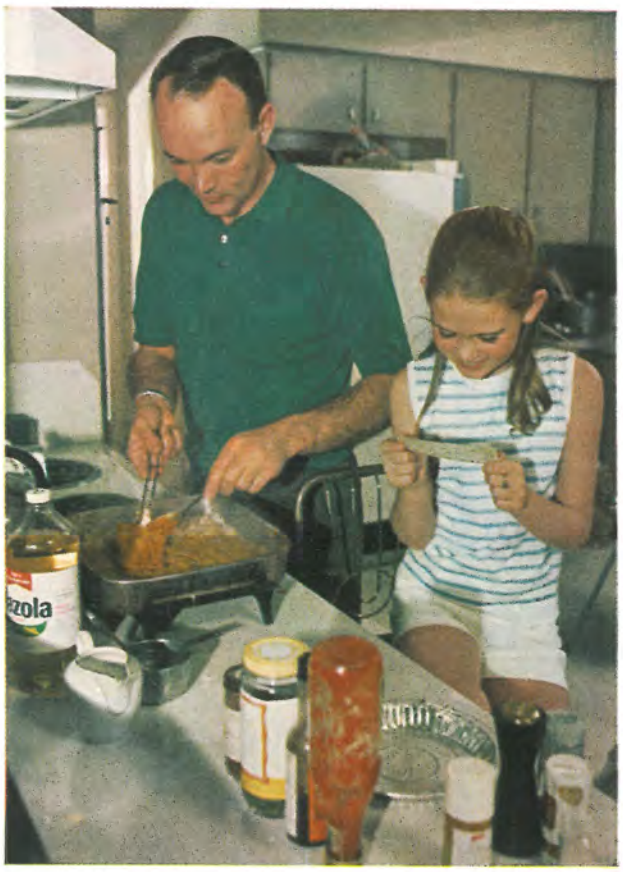
Young held the Gemini steady and Collins floated up to the Agena. He caught its front, which was a docking collar, open like the mouth of a jar except that it was broad and blunt and made a poor handhold. The spacesuit was stiff with pressure and made movement awkward and hard work, but Collins went hand over hand around the collar to the Agena's top.

When he got to the top, however, he could not stop. Momentum tore loose his poor handhold and he turned two complete flips in space. Remembering the scene as he sat on a couch in his living room in Houston, Collins rolled on one side, throwing his legs up to show how it had been, and you had the image of the rigid figure, fatly inflated, hardly manlike at all, tumbling awkwardly off into space with his little silver line looping behind him, and suddenly the awful strangeness and the danger of it all struck you like cold wind. For in the mind's eye you saw that now the Gemini spacecraft was far below and that between it and the rigid tumbling suited figure, the big Agena was moving independently.

Collins had a propellant gun that he could point where he wanted to go and it would drag him along. But it was untried in space and he was avoiding using it. Now he reached for the gun—and it was gone. It must have torn loose from his pack, he reasoned, and he fumbled about for the cord that fed the gun, found that and dragged the gun back.

"Now I was close to the end of my tether and I had sort of a sideways velocity so the gun took me back toward the Gemini in a big arcing loop. I went all the way back to the Gemini and from there to the Agena again and this time I reached inside the Agena and grabbed a handful of wires and held on with one hand while I detached the micrometeorite package with the other and brought it back to the Gemini."

You have to keep your cool, he said. You just have to concentrate every second and keep your cool and that is how you get home. ◀



While daughter Kate checked off the ingredients (above), Collins prepared his own version of spicy lamb curry. After dinner he and Pat sprawled by the fire, she reading history, he a personally inscribed copy of Lindbergh's "The Spirit of St. Louis."

A Calendar of Space Flight: Man's Countdown for the Moon

The first trips look modest now —lone men strapped in tiny capsules, 15-minute suborbital flights or cautious whirls around the earth, all bound by gravity to come home again. They are modest only by comparison, of course. At the time those early trips were enormously exciting and seemed incredibly adventurous. Starting with Vostok 1 in 1961, each gave impetus to the next, each compounding the sophistication of space technology, each expanding the boldness of the goal. Rockets grew from the slender Mercury Redstone to the overwhelming Saturn V that launched Apollo 11. Flights around the earth grew to voyages around the moon, and walks in space led to steps upon the lunar surface. The effort has been enormous, demanding the best from hundreds of thousands of men and women. The cost has been great: the United States has spent $51 billion exploring space, the Soviet Union a comparable amount. And there has been sacrifice; four men have died testing the limits of equipment and techniques. Since 1961 the two countries have launched 33 manned space flights. In them were the 40 cosmonauts and astronauts pictured on these pages, every one of whom has helped mankind reach out and touch the moon.

Technicians made adjustments in Vostok 1


Gagarin rode to launch pad in special van


A hero's welcome from Premier Khrushchev

The first man to fly in space was Soviet pilot Yuri Gagarin. A 125-foot rocket hurled him once around the earth, more than 200 miles high at 17,000 miles an hour. After 89 minutes in orbit, Gagarin fired braking rockets, plunging the Vostok ("East") capsule back into the atmosphere. Parachutes cushioned its fall to the earth, and Gagarin stepped out "without a bruise." The Soviets led the space race, and Premier Khrushchev boasted, "Let the capitalist countries try to catch up."

April 12, 1961
VOSTOK 1


Alan Shepard in first Mercury capsule


On the deck of the U.S.S. "Lake Champlain"

The first American space flight was suborbital; that is, pilot Alan Shepard was thrown up into space and back again in a ballistic trajectory. The Mercury Redstone rocket pushed the 4,265-pound spacecraft to a speed of 5,100 miles an hour and an altitude of 115 miles. Shepard's capsule, which he had named "Freedom 7" (the number 7 was used on these first capsules by Mercury astronauts), landed in the Atlantic 300 miles from the Cape Canaveral (now Kennedy) launch site. The trip took 15 minutes.

May 5, 1961
MERCURY 3

Grissom was rescued as capsule sank


Medics checked him out on carrier

Gus Grissom's suborbital flight was almost identical to Alan Shepard's, except that Grissom's space capsule was never recovered. Just after splashdown, an escape hatch was unexpectedly blown open and the capsule, "Liberty Bell 7," began to fill with water. Grissom jumped free and was plucked from the sea by a helicopter. Moments later the capsule and all its instruments sank.

July 21, 1961
MERCURY 4

Titov was jubilant after 17-orbit flight

Television monitored him in space

He lifted off from cosmodrome in central Russia

The second manned Soviet craft stayed aloft for 17 orbits, giving pilot Gherman Titov 25 hours in space. He slept eight hours, ate three meals and twice used manual controls to change the angle of his space capsule. He was stunned by the colors of the earth and more than once rejoiced: "I am Eagle, I am Eagle!" His orbits crisscrossed most of the earth—including the United States, which led some in Congress to worry anew about the military uses of space.

August 6, 1961
VOSTOK 2

Glenn's launch at Cape Canaveral

Strapped in, Glenn waited for blast-off

New York welcomed Glenn, wife and L.B.J.

By the time "Friendship 7" and John Glenn splashed down safely, both had become household words. For two months, 10 separate delays had jeopardized America's first orbital flight. But at last the mission succeeded. Boosted into space atop a new, more powerful rocket, the Atlas, Glenn circled the earth three times. His hero's reception was enormous, with parades in New York and in Washington, where he also made a special address to Congress.

February 20, 1962
MERCURY 6

Crewman helped Carpenter with flight suit

Carpenter in mission simulator

Caribbean splashdown was far from target

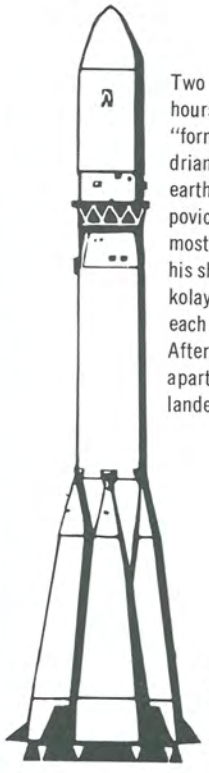
President Kennedy phoned congratulations

Scott Carpenter's voyage was similar to Glenn's—three turns around the earth in about five hours. Like Glenn, Carpenter saw ice crystal "fireflies." But unlike Glenn's, Carpenter's was a continuously troubled flight. His suit overheated, instruments gave faulty readings, and the craft ran low on fuel. The reentry rockets didn't fire on time, and when they did fire, smoke filled the cabin. Out of contact with the recovery forces, Carpenter splashed down 250 miles from the target area, and spent nearly three hours on a life raft waiting for a helicopter.

May 24, 1962
MERCURY 7

Andrian Nikolayev piloted Soviet Vostok 3

Pavel Popovich, the pilot of Vostok 4



Two Soviet pilots, launched 24 hours apart, were the first to fly "formation" in space. After Andrian Nikolayev orbited the earth alone 16 times, Pavel Popovich was launched into an almost identical orbit and brought his ship within four miles of Nikolayev's. The two could see each other, and talked by radio. After a few orbits they drifted apart, and three days later both landed safely in central Russia.

August 11 & 12, 1962
VOSTOK 3
VOSTOK 4


Automatic camera recorded Schirra's flight


Capsule was lifted to deck of "Kearsarge"


Navy man Schirra was welcomed aboard

Walter Schirra and "Sigma 7" circled the earth nearly six times in nine hours, then splashed down safely in the Pacific. His orbits were oblong, taking him as high as 176 miles and as low as 100. He landed four miles from the aircraft carrier "Kearsarge," and the capsule—with Schirra inside—was plucked out of the water by a huge Navy crane. The flight, a test of his and the capsule's endurance, was practically trouble-free.

October 3, 1962
MERCURY 8


Last Mercury flight leaves launch pad


Cooper grinned after 22-orbit flight


Headed for hot food aboard the "Kearsarge"

The last flight in the Mercury series was manned by Gordon Cooper, who piloted his "Faith 7" capsule around the earth 22 times in 34 hours. Cooper was remarkably relaxed—he dozed while waiting for blast-off—and his mission was largely successful. He took color photographs and movies of the earth and sent the first TV pictures from an American spacecraft. When automatic reentry devices failed, Cooper took the controls and piloted the capsule back to earth.

May 15,1963
MERCURY 9


Bykovsky before his five-day flight


Cosmonauts Bykovsky and Tereshkova embraced

Soviet cosmonaut Valery Bykovsky spent nearly five days in space studying the effects of long-term weightlessness. During that time he circled the earth 81 times, gradually slowing in the outer edges of the atmosphere until further orbits became impractical. Like several other Soviet pilots, Bykovsky reentered the atmosphere inside his spacecraft, then ejected at an altitude of several miles and parachuted to earth.

June 14, 1963
VOSTOK 5

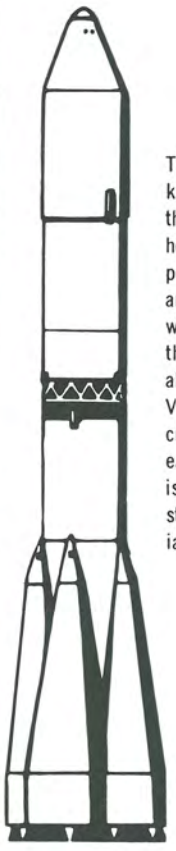

Valentina Tereshkova before flight


The only woman to fly in space

The first—and only—woman to fly in space was 26-year-old Valentina Tereshkova, a textile technologist whose interest in parachuting led her to apply for space training. Launched 48 hours after Vostok 5, she stayed in orbit for three days, and communicated by radio with the other spacecraft. She, too, landed safely by parachute, and in early November married Vostok 3 commander Andrian Nikolayev. The following summer she gave birth to a daughter.

June 16, 1963
VOSTOK 6

Feoktistov, Komarov and Yegorov



The first flight of the Soviet Voskhod ("Sunrise") series took three men into space for 24 hours. The crew space was pressurized and air-conditioned, and the three men wore lightweight wool coveralls instead of the bulky, inflated suits used by all previous space travelers. Vladimir Komarov piloted the craft during its 16 orbits of the earth, while space doctor Boris Yegorov and scientist Konstantin Feoktistov—both civilians—conducted experiments.

October 12, 1964
VOSKHOD 1

Leonov, Belyayev in Voskhod 2 cabin

Bulky suit, gloves made work awkward

Leonov floated freely in first space "walk"

As his ship raced around the earth at 17,500 mph, Aleksei Leonov stepped out of a double air lock to become the first man to "walk" in space. Inside the pressurized cabin, pilot Pavel Belyayev watched Leonov's 10-minute walk and reentry by television. At the end of their 17-orbit flight, the two overshot the touchdown site and landed in five feet of snow in the Ural Mountains, where it took rescuers two days to reach them.

March 18, 1965
VOSKHOD 2

Titan II rocket powered first Gemini

Young and Grissom waited out countdown

The first in a long series of two-man Gemini flights, powered by the new Titan II rocket, was a three-orbit ride by veteran astronaut Gus Grissom—the first man to travel in space twice—and John Young. Three times during the five-hour flight, Grissom changed the capsule's orbit—the first occasion a manned spacecraft had altered course. Grissom, alluding to his sunken Mercury capsule, nicknamed the 7,000-pound ship "The Unsinkable Molly Brown," and she floated just fine.

March 23, 1965
GEMINI 3

Ed White spacewalked during third orbit

Snaking lifeline fed air, communications

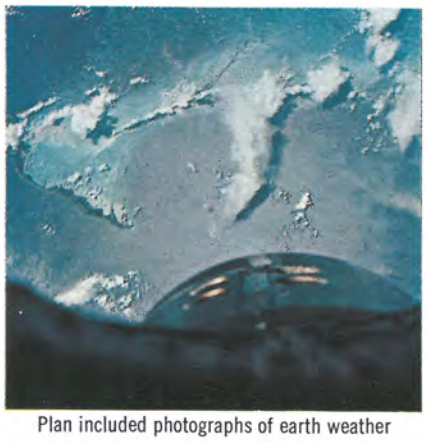
He floated 120 miles above California

White and McDivitt aboard carrier "Wasp"

During the spacecraft's third orbit of earth, astronaut Ed White opened the hatch and stepped out—thus becoming the first American man to "walk" in space. Unlike the Russian flight three months earlier, the Gemini capsule remained opened during the walk, requiring pilot James McDivitt to wear a pressurized suit as well. White floated for 20 minutes, connected to the spacecraft by a 25-foot tether supplying oxygen and communications. He maneuvered around the outside of the capsule using a small jet gun for propulsion.

June 3, 1965
GEMINI 4

Conrad (left), Cooper rehearsed mission


Plan included photographs of earth weather


Conrad kidded Cooper after splashdown

The third manned flight in the Gemini series was an endurance trial that subjected Charles Conrad and Gordon Cooper to eight days in space, during which they circled the earth 120 times and traveled a distance of three million miles. The astronauts practiced rendezvous navigation techniques with an imaginary target; problems with the thruster rockets forced cancellation of several other exercises. Both men lost weight in space—an average of a pound a day—and grew heavy beards.

August 21, 1965

GEMINI 5


Gemini 7 photographed from Gemini 6


Formation flying at 17,500 miles an hour


Borman and Lovell after two weeks in space


Stafford, Schirra quizzed by reporters

Gemini 7 took off first, sending Frank Borman and James Lovell on a two-week endurance mission that took them around the earth 206 times. Toward the middle of that journey, Gemini 6 —whose launch had been delayed—lifted into space for a 185-mile-high rendezvous with the other spacecraft. Walter Schirra and Tom Stafford navigated to within six feet of Gemini 7 and the two spacecraft flew in tight formation for six hours.

December 4 & 15, 1965

GEMINI 6 & 7


Gemini 8 prepared to dock with Agena


Scott (left), Armstrong before countdown


Runaway thruster forced early splashdown

Following the navigational instructions of copilot David Scott, Neil Armstrong was able to find and follow a 26-foot Agena "target" rocket that had been put into space over an hour earlier. Then Armstrong coupled the Gemini capsule to the Agena, but minutes later one of the Gemini's tiny maneuvering thrusters began firing uncontrollably, sending the two linked spacecraft into alarming gyrations. Armstrong pulled away from the Agena and shut off the errant thruster, and the rest of the mission was canceled.

March 16, 1966

GEMINI 8


Stafford and Cernan at Kennedy launch site


Attempted Agena docking was unsuccessful


Stafford (left), Cernan talked with L.B.J.

Tom Stafford and Eugene Cernan were to try another "docking" in space, but found that a protective covering on the 11-foot unmanned "target" craft kept them from actually linking up. Later in the three-day mission, Cernan stepped outside for a record two-hour space "walk." The flight plan called for Cernan to use a backpack for oxygen and communications part of the time. But Cernan became tired and the pack's radio failed, so that plan was dropped.

June 3, 1966

GEMINI 9

Docked Agena's antenna seen from Gemini

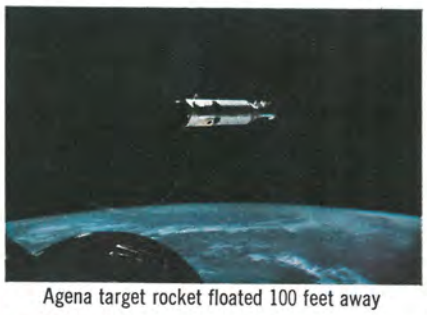
Gemini partners Young and Collins

On this flight the Gemini capsule quickly found the rendezvous target—an unmanned Agena—and docked perfectly. Thus attached, the Gemini used the Agena's still-active engines to push itself into a record orbit, 475 miles high at its peak. Later the Gemini flew to a rendezvous with another Agena. While John Young piloted, Mike Collins twice walked in space, recovering a detachable measuring device from the second Agena, but losing a $470 Hasselblad camera in the process.

July 18, 1966

GEMINI 10

Conrad, Gordon began trip to space capsule



Agena target rocket floated 100 feet away

Gordon's spacewalk proved exhausting

During their first orbit, Pete Conrad and Richard Gordon were able to dock with an Agena rocket. Gordon later walked outside of the Gemini and attached a 100-foot rope between the capsule and the Agena. Further spacewalking was cut short because of Gordon's exhaustion. Later the Gemini undocked, backed away until the rope was taut, then began orbiting around the Agena until both craft were spinning around each other, like the ends of a baton, creating a temporary gravity in weightless space.

September 12, 1966

GEMINI 11

Buzz Aldrin took pictures from capsule door

Jim Lovell piloted last Gemini flight

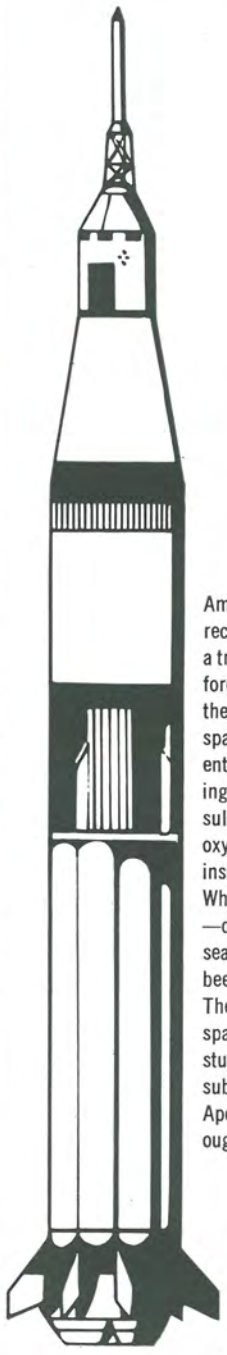
The last flight in the Gemini series included several successful dockings with an Agena rocket and a series of open-door maneuvers by copilot Buzz Aldrin. While James Lovell kept the capsule steady, Aldrin twice leaned halfway out of the spacecraft, taking pictures and doing exercises. Aldrin also left the capsule completely for more than two hours, working at the end of a 25-foot tether, and beating the fatigue suffered by others by taking regular rests.

November 11, 1966

GEMINI 12

Chaffee, White, Grissom training in Apollo

Wreckage of fire that killed them



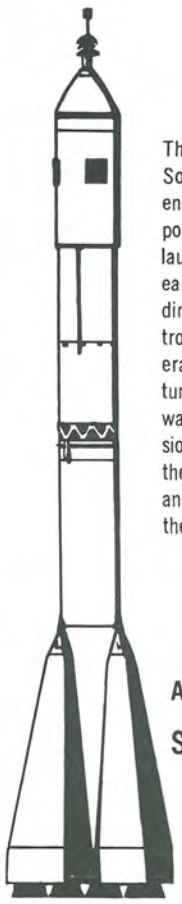
America's space program received a major setback in a tragic fire three weeks before the scheduled launch of the first three-man Apollo spacecraft. The fire apparently started in some wiring, and in the sealed capsule environment of pure oxygen the three astronauts inside—Gus Grissom, Ed White and Roger Chaffee—died quickly, near the seats in which they had been simulating a flight. The tragedy brought U.S. space exploration to a stunned halt. It forced a substantial redesign of the Apollo, as well as a thorough restudy of procedures.

January 27, 1967

APOLLO FIRE

Vladimir Komarov, suited up for launch

In Moscow, a hero's funeral in Red Square



The first flight of the Soviet Soyuz ("Union") series also ended in death. The 15,000-pound capsule was successfully launched into a near-circular earth orbit, but soon pilot Vladimir Komarov had trouble controlling its motions. After several orbits the spaceship began tumbling badly and Komarov was ordered to end the mission. Four miles above the earth the parachute lines snarled, and the capsule plunged to the ground, killing Komarov.

April 23, 1967

SOYUZ 1

Donn Eisele grinned for his photograph

Walter Cunningham was systems expert

Mission commander and pilot Wally Schirra

The first American manned flight after the fire was made by Walter Schirra, Donn Eisele and Walter Cunningham. In a completely redesigned space capsule atop a Saturn IB rocket, they circled the earth 163 times in 11 days, despite severe head colds all three developed shortly after the launch. The crew made several complicated rendezvous maneuvers, and staged seven TV broadcasts. Only the splashdown was marred; Navy Captain Schirra became seasick.

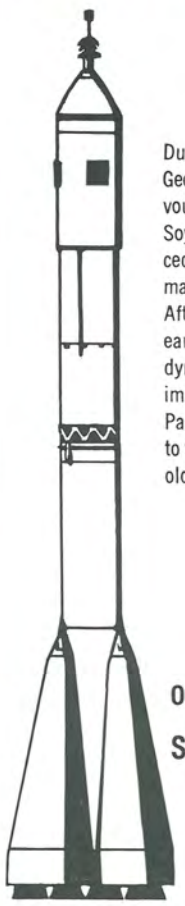
October 11, 1968

APOLLO 7

Soyuz 3 rocket en route to launch site

Recovery of massive landing parachutes

Pilot Georgi Beregovoi became a major general



During his four days in orbit Georgi Beregovoi twice rendezvoused with an unmanned Soyuz capsule which had preceded him into space. But he made no attempt to dock with it. After 64 orbits he returned to earth, using his capsule's aerodynamic design to soften the impact with the atmosphere. Parachutes then eased the ship to the ground. At 47, he was the oldest man to fly in space.

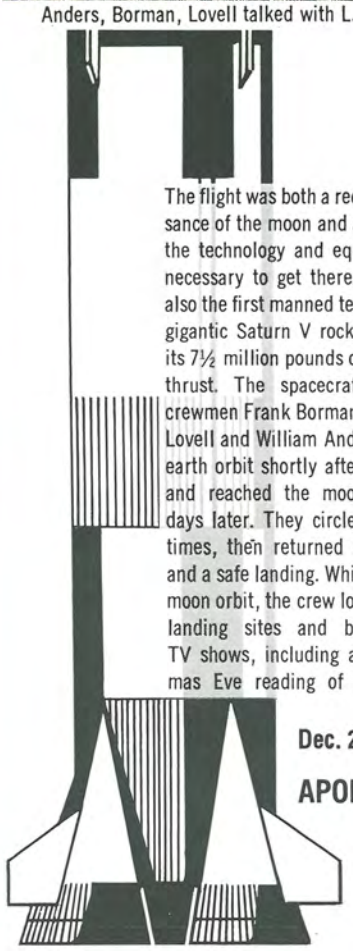
October 26, 1968

SOYUZ 3

"Earth-rise," photographed from the moon

Capsule was recovered by U.S.S. "Yorktown"

Anders, Borman, Lovell talked with L.B.J.

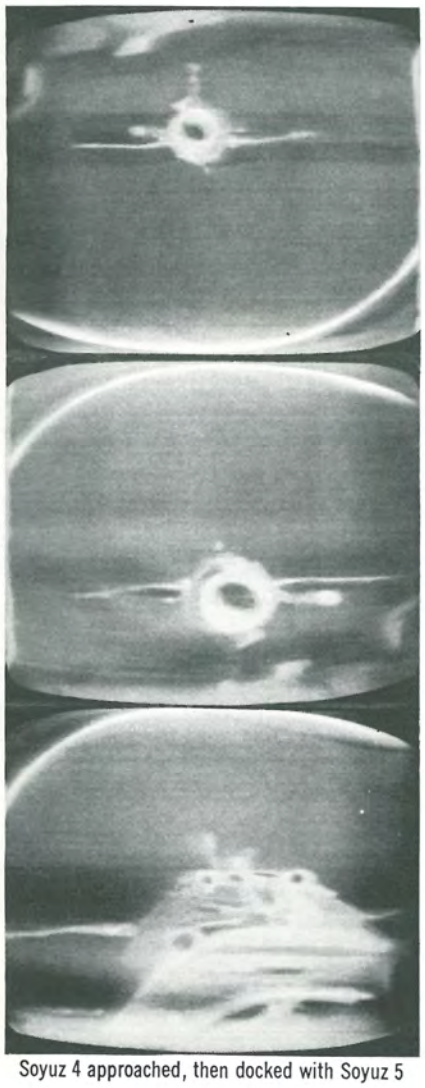


The flight was both a reconnaissance of the moon and a test of the technology and equipment necessary to get there. It was also the first manned test of the gigantic Saturn V rocket, with its 7½ million pounds of lift-off thrust. The spacecraft, with crewmen Frank Borman, James Lovell and William Anders, left earth orbit shortly after lift-off and reached the moon three days later. They circled it ten times, then returned to earth and a safe landing. While in the moon orbit, the crew looked for landing sites and broadcast TV shows, including a Christmas Eve reading of Genesis.

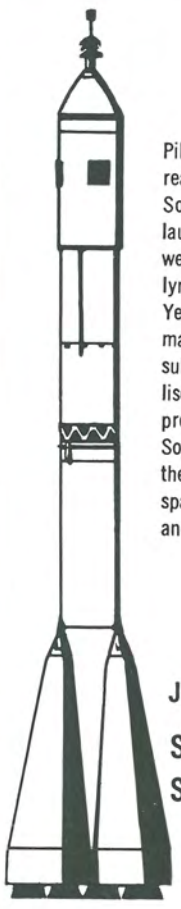
Dec. 21,1968

APOLLO 8

Khrunov, Yeliseyev, Shatalov and Volynov



Soyuz 4 approached, then docked with Soyuz 5



Pilot Vladimir Shatalov was already orbiting the earth alone in Soyuz 4 when Soyuz 5 was launched. In the second craft were three crewmen—Boris Volynov, Aleksei Yeliseyev and Yevgeni Khrunov. After lengthy maneuvers, the two Soyuz capsules docked in space, and Yeliseyev and Khrunov, wearing pressurized suits, walked from Soyuz 5 to Soyuz 4. The ships then separated—the first two spacecraft to have met in orbit and exchanged passengers.

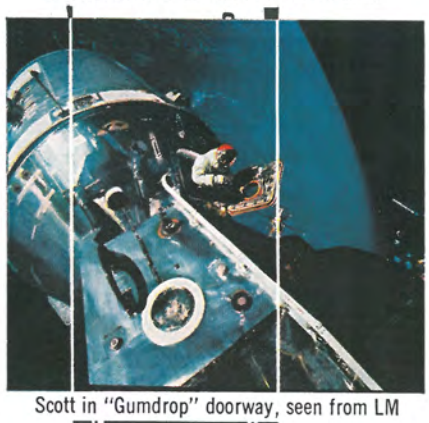
January 14 & 15,1969

SOYUZ 4

SOYUZ 5

Schweickart, McDivitt, Scott, before launch

LM floated free 145 miles above Atlantic

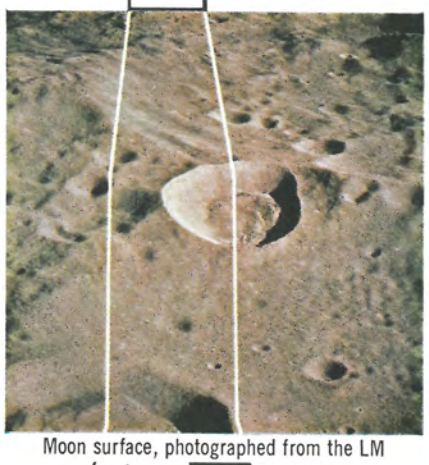


Scott in "Gumdrop" doorway, seen from LM

The first space test of the lunar module (LM) took place in the relatively familiar orbit of earth. While David Scott piloted the Apollo command module ("Gumdrop"), James McDivitt and Rusty Schweickart entered the LM ("Spider"), pulled it free of the mother ship and flew it on its own for 6½ hours. After the test, in which "Spider" went up to 100 miles away from the command module, the LM was jettisoned—it could not have survived a fiery reentry.

Mar. 3, 1969

APOLLO 9



Moon surface, photographed from the LM

Cernan, Young, Stafford, of Apollo 10

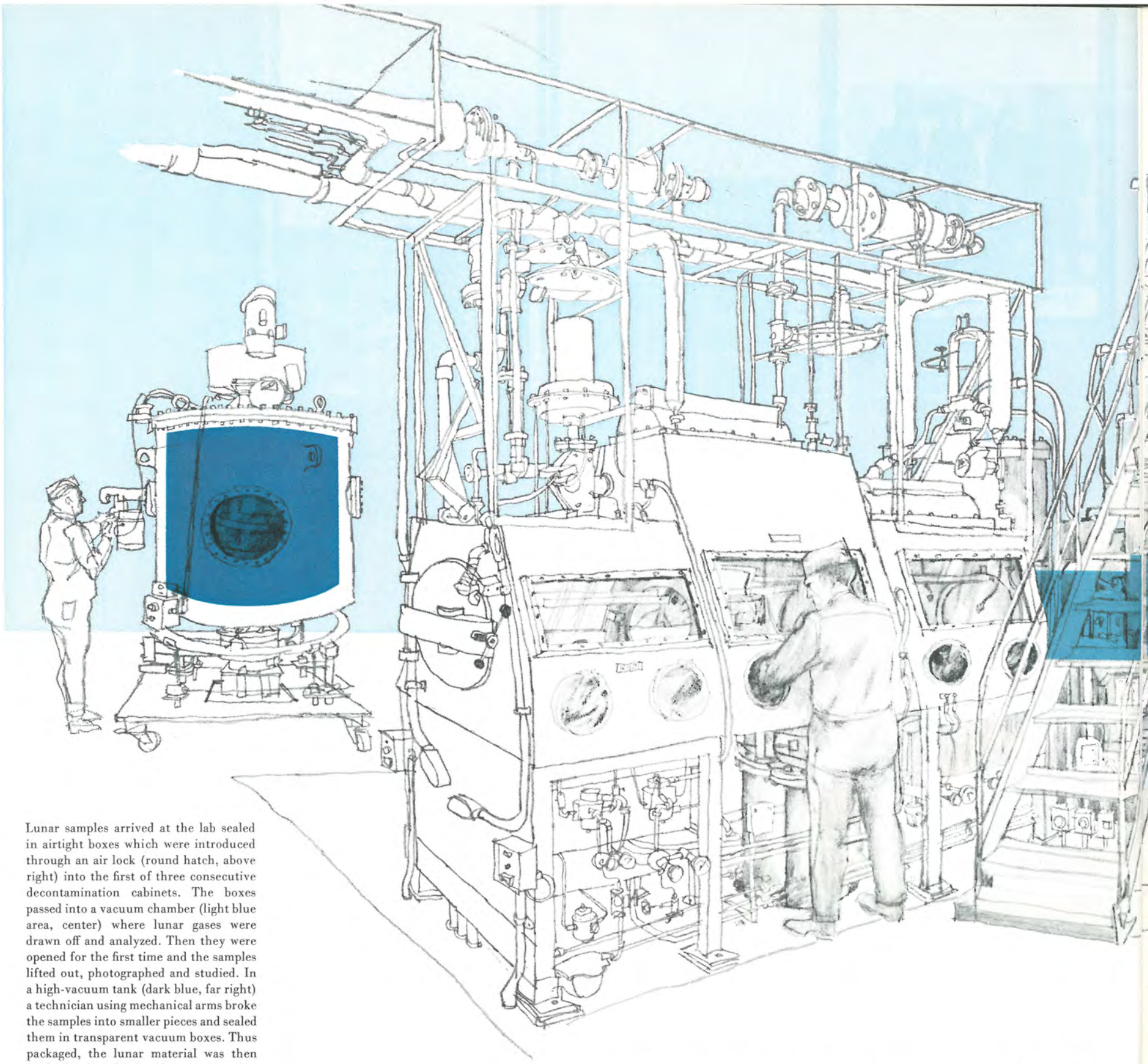
This was the final dress rehearsal before a manned moon landing. The 44-ton Apollo assembly flew 240,000 miles in three days to a lunar orbit, and while John Young watched from the command ship ("Charlie Brown"), Thomas Stafford and Eugene Cernan unhooked the lunar module ("Snoopy") and made two low-level passes at the moon's surface, at one time swooping down to 47,000 feet. The crew also broadcast 19 color TV transmissions, and with obvious glee became the first men to shave in space.

May 18,1969

APOLLO 10

July 16, 1969

APOLLO 11

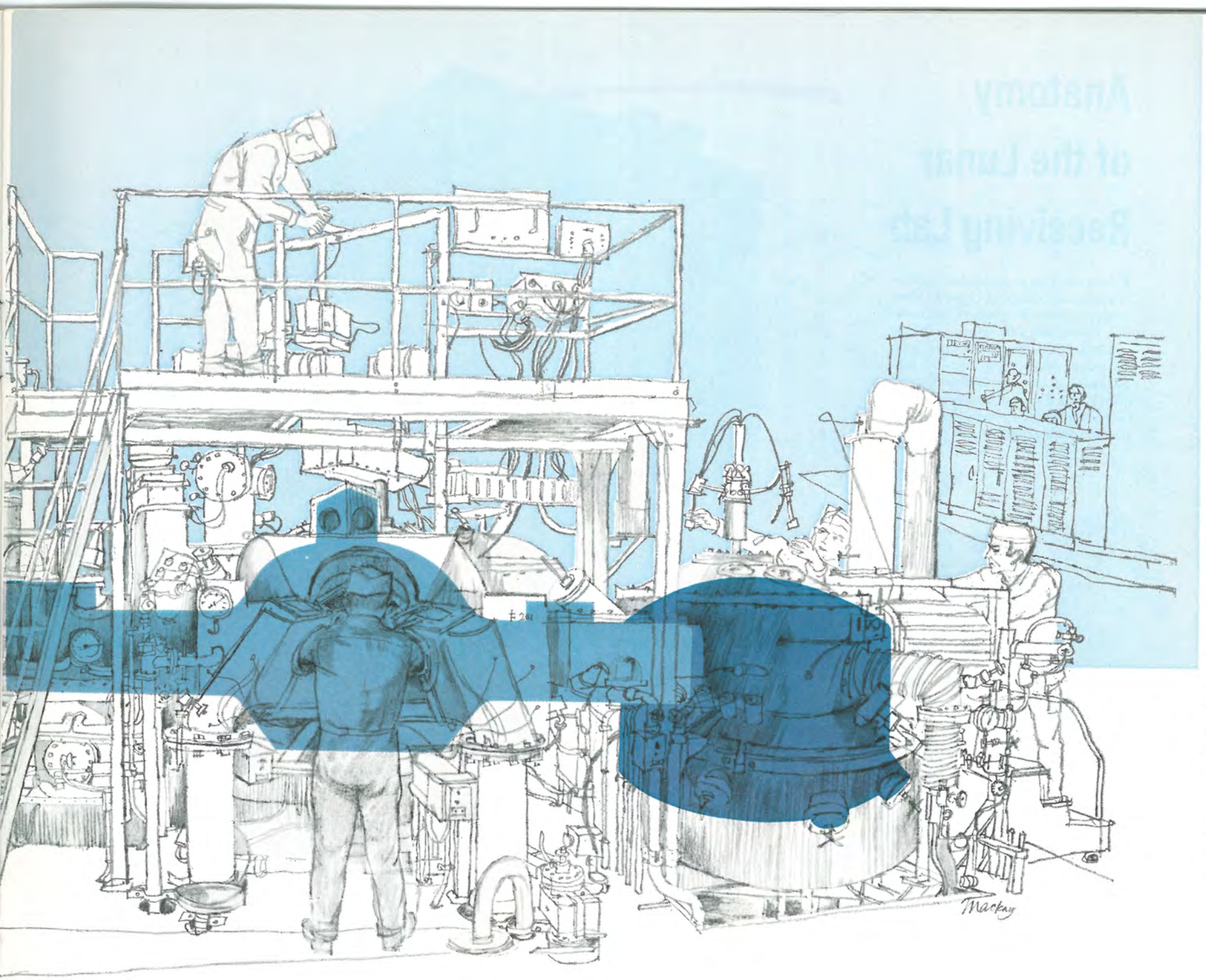


Lunar samples arrived at the lab sealed in airtight boxes which were introduced through an air lock (round hatch, above right) into the first of three consecutive decontamination cabinets. The boxes passed into a vacuum chamber (light blue area, center) where lunar gases were drawn off and analyzed. Then they were opened for the first time and the samples lifted out, photographed and studied. In a high-vacuum tank (dark blue, far right) a technician using mechanical arms broke the samples into smaller pieces and sealed them in transparent vacuum boxes. Thus packaged, the lunar material was then ready for transfer to other testing areas —or for storage in high-vacuum containers like the one at far left (dark blue).

Unlocking the ancient

While the Apollo 11 astronauts and their precious moon sample remain under rigorous quarantine in the $8.5 million Lunar Receiving Laboratory at the Manned Spacecraft Center near Houston, both the men and the rocks are undergoing exhaustive examination —to make sure they harbor no harmful "moon bugs" and to harvest their information about the moon.

The men will probably clear quarantine after 15 days. The moon sample will spend at least 50 days



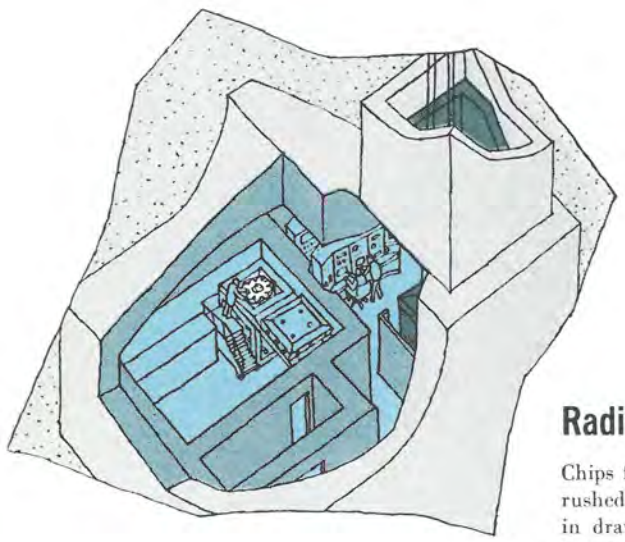
Drawings by DONALD MACKAY

mysteries of the moon

there, while scientists expose it to the alien environment of earth's atmosphere under carefully controlled conditions and perform a number of preliminary, time-critical experiments. Once the sample is released, probably some time in September, it will be distributed to 142 carefully chosen scientists in nine countries (Britain, Germany, Japan, Australia, Canada, Finland, Switzerland, Belgium, U.S.) who have been preparing for this big moment doing dry runs with simulated lunar samples (*pp. 66–69*). These scientists will subject the moon material to every significant test they can devise. They plan to grind the material, slice it, peer at it with microscopes, bombard it with radar beams, and inspect it with exotic equipment like electron microprobes and mass spectrometers, analyzing it almost atom by atom in an attempt to wrest from it not only the secrets of the moon, but precious knowledge about the earth, the sun and even the universe itself.

Anatomy of the Lunar Receiving Lab

Routes into biologically isolated sectors of the Lunar Receiving Lab are shown here by red lines. At upper left, lunar samples arrived and were taken to vacuum system and then down by elevator to radiation lab (blue). Other entrances indicated are for astronauts, for the command module, for food and laundry. Lines at far right show where personnel come and go through ultraviolet air locks (purple).



Radiation Laboratory

Chips from the first lunar samples were rushed to a radiation laboratory (blue in drawing) built 50 feet beneath the building, to measure their radioactivity.

Lunar Sample Laboratory

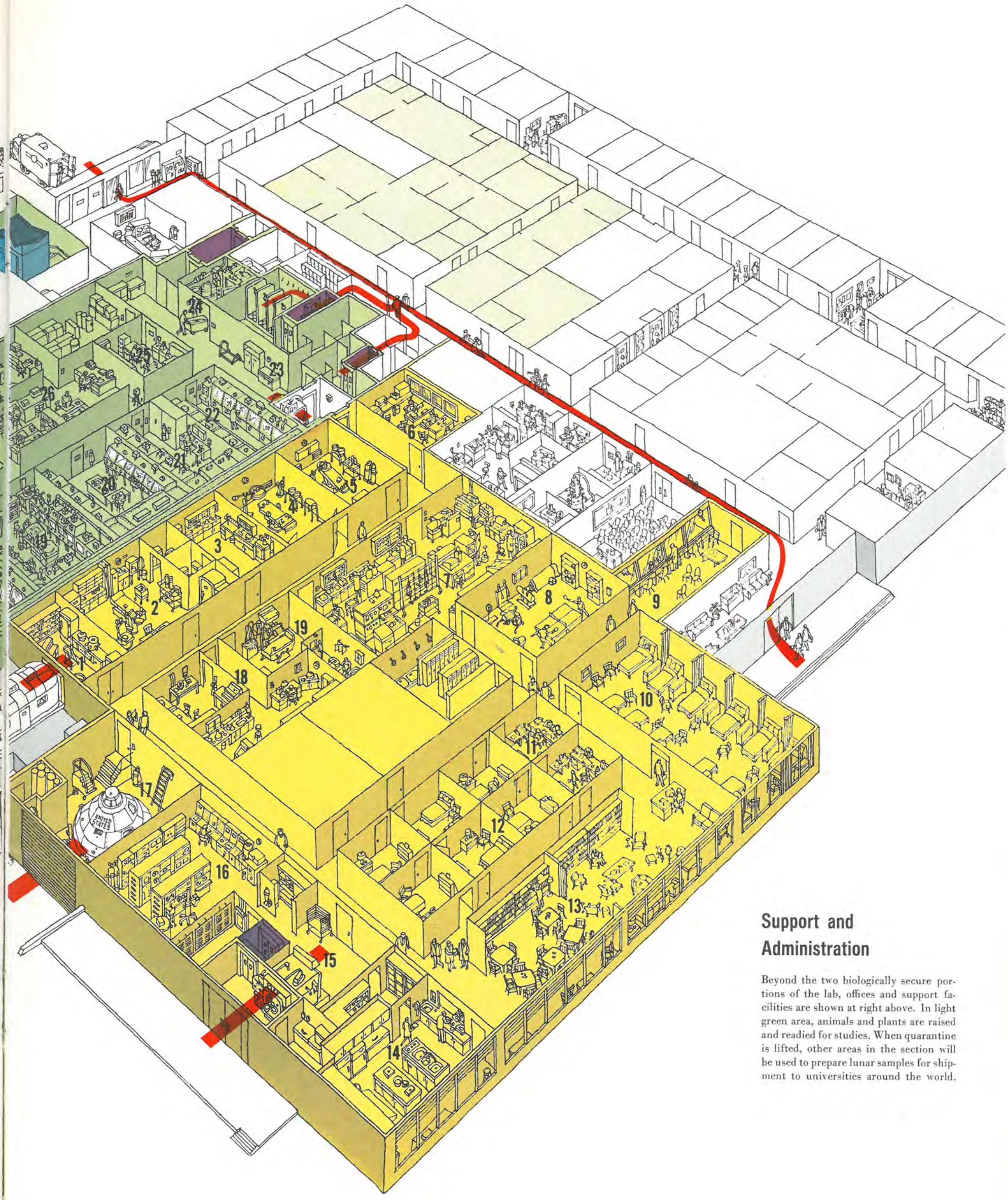
More than 100 scientists and technicians started performing tests with lunar materials in the lab area, shaded green.

1 Vacuum system where lunar material was received and processed
2 Carousels for storage and transfer of lunar material
3 Controls for vacuum system
4 Equipment for preflight tool sterilization
5 Gas analysis laboratory
6 Special air-conditioning system to sterilize air entering and leaving building
7 Elevator
8 Viewing room for participating scientists
9 Pump room and electrical support equipment for vacuum system
10 Transfer tubes for moving samples directly from vacuum system to labs
11 Physical-chemical test lab—mineralogy, petrology, geochemistry
12 Bio-prep lab to prepare and package lunar material for distribution
13 Bio-analysis lab for blood tests and other tests on mice
14 Holding lab for germ-free mice
15 Holding lab for conventional mice
16 Lunar microbiology lab to isolate, identify and possibly grow lunar microorganisms
17 Spectrographic lab and darkroom (connects to 11)
18 Bird, fish and invertebrate lab where shrimp, quail, cockroaches, oysters and other creatures are exposed to lunar material
19 Microbiology lab for test cultures of lunar and astronaut material
20 Egg and tissue culture lab (support and additional facilities for 21)
21 Crew virology lab for postflight virological analysis of astronauts
22 Plant lab where germ-free algae, spores, seeds and seedlings are exposed to lunar material
23 Entrance to lunar sample operations area; showers and facilities for all personnel passing in and out to change clothing
24 Autoclave for sterilizing all material entering or leaving area
25 Bio-safety lab to monitor all systems
26 Support offices
27 Entrance to radiation counting lab

Astronaut Reception Area

Quarantine area where astronauts live is shaded yellow. In an emergency, lab workers could also be quartered there.

1 Crew reception area (connected to transfer van)
2 Medical and dental examination room
3 Medical examination room
4 Operating room
5 Tilt-table room for physiological testing
6 Tape-out room where data can be passed into nonquarantine area electronically
7 Biomedical lab—clinical chemistries and immunology of astronauts and support personnel
8 Exercise room
9 Astronaut debriefing room, separated by glass from family visiting room
10 Dormitory for support personnel
11 Offices for astronauts and doctors
12 Paired sleeping quarters for three astronauts and their three attendant doctors
13 Lounge and dining room
14 Kitchen
15 Receiving room where food and laundry are sterilized passing in and out
16 Computer room for data storage from biomedical lab (7)
17 Spacecraft storage, equipped with closed-circuit TV for inspection
18 Microbiology lab for clinical tests of quarantined personnel
19 X-ray room with fluoroscope and darkroom



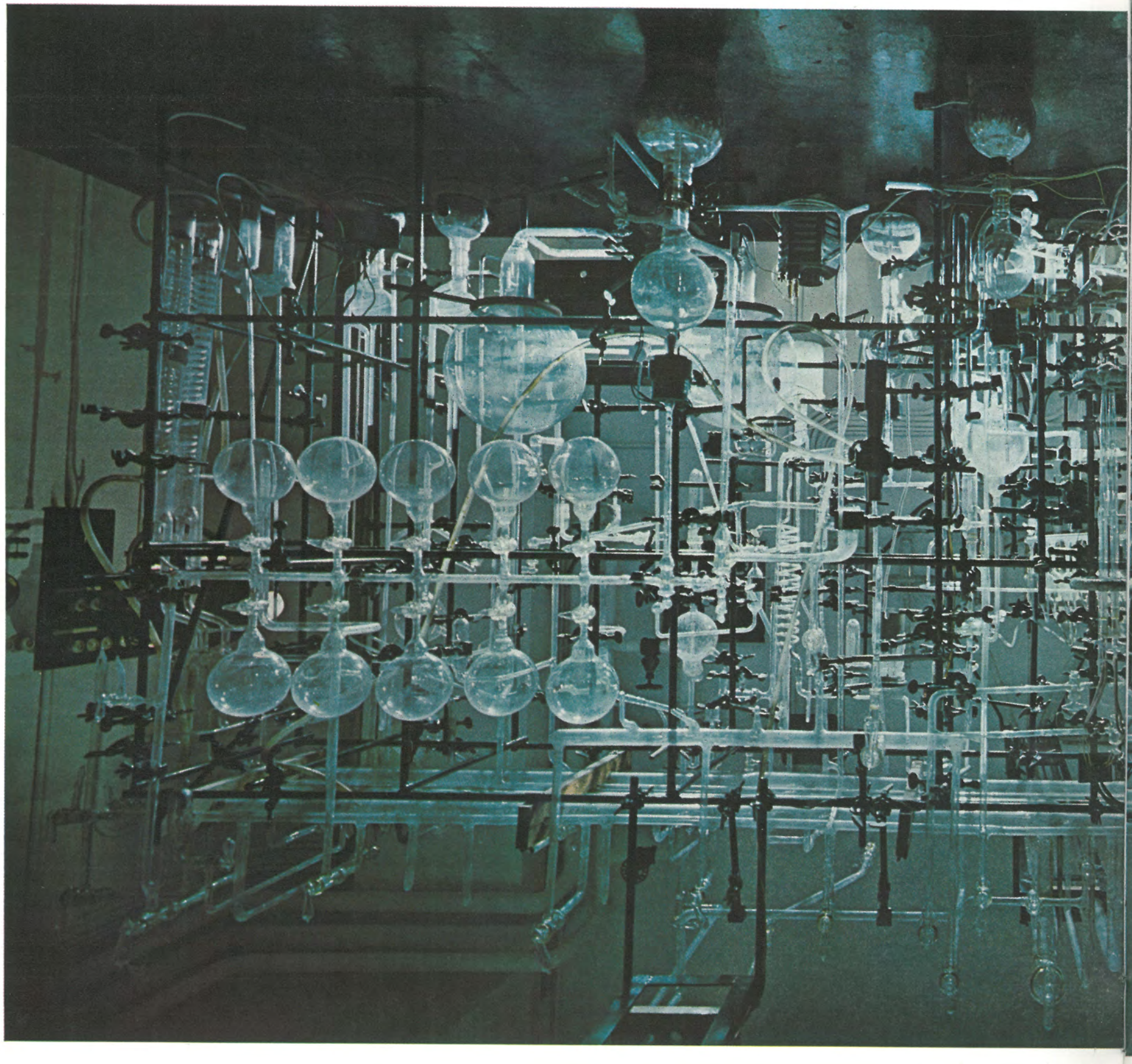
Support and Administration

Beyond the two biologically secure portions of the lab, offices and support facilities are shown at right above. In light green area, animals and plants are raised and readied for studies. When quarantine is lifted, other areas in the section will be used to prepare lunar samples for shipment to universities around the world.

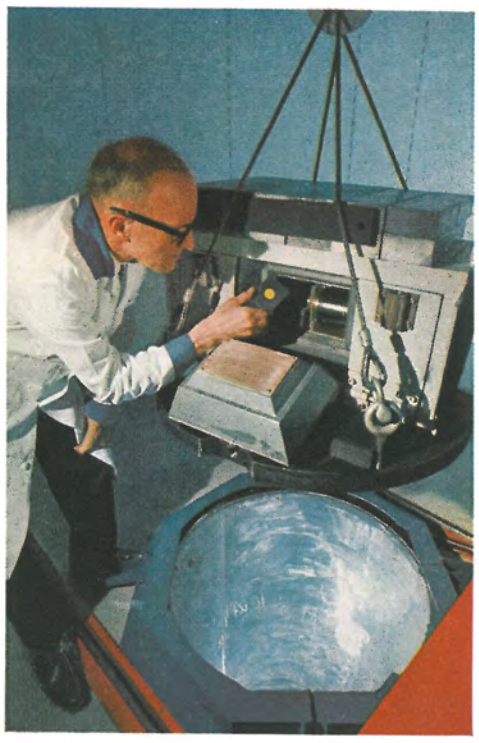
What the Moon Samples Might Tell Us

The odds are a billion to one, scientists think, against finding living organisms in the lunar samples. Nonetheless Dr. Vance Oyama (*above*), at NASA's Ames Research Center near San Francisco, will attempt to grow microorganisms such as bacteria and molds, incubating lunar material for up to a year under hundreds of different environmental conditions. Here, working with gloved hands from behind a plastic barrier, he shows how he will use a specially designed gold-plated apparatus to distribute the moon material onto flat, round Petri dishes for incubation. Organic chemists will also examine the sample for traces of the complex biochemicals which living organisms produce. If they find any, these might tell whether life ever existed on the moon and shed light on how the chemical precursors of life evolved on earth.

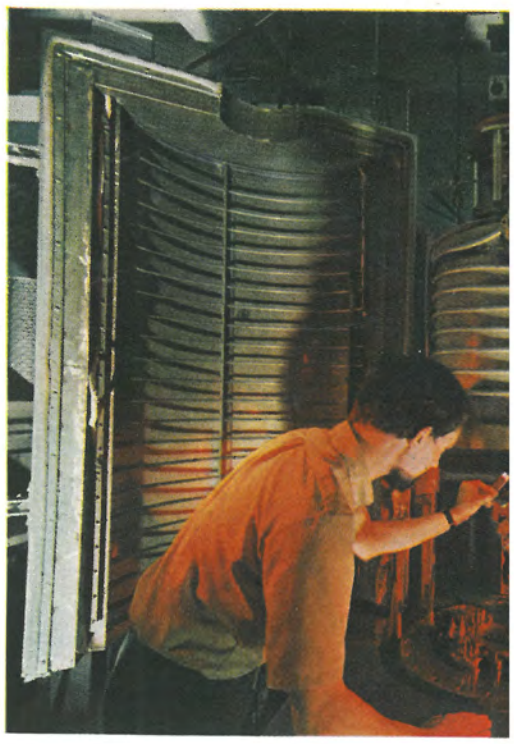
At the Max Planck Institute for Chemistry in Mainz, Germany, scientists will use this marvelously intricate assemblage of tubes, flasks and coils (*right*) to separate and analyze rare gases (helium, argon, neon) from the moon sample. Here, Professor Friedrich Begemann seals off a flask containing a gas sample while Dr. Else Vilcsek looks on. Since many of the rare gases are products of radioactive decay, they help scientists determine the age of the moon material. Presumably the earth and moon are the same overall age, but many scientists believe the rocks on the lunar surface may be as much as a billion years older than those on the earth, since the moon has not suffered the drastic weathering the earth has undergone. The moon may thus be a fossil planet, still preserving ancient records of the early years of the solar system.

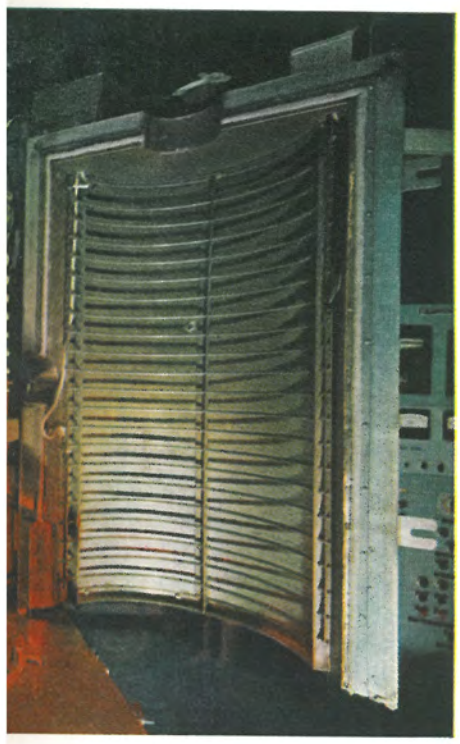


The University of Chicago's Dr. Anthony Turkevich (*right*) will put his sample into a radiation counter and lower it into this 50-foot-deep hole to study radioisotopes of the heavy elements uranium and thorium. These radioisotopes are possible sources of heat on the moon. Below, at the University of California at San Diego, Professor James Arnold (in print shirt) will insert a lunar sample into the heavily shielded radiation detector at left rear. He will work with Nobel Prize-winner Dr. Harold C. Urey (looking over his shoulder) and Dr. Kurt Marti (kneeling at right). Arnold and Urey are interested, among other things, in what they call "gardening," the amount of mixing or turnover of lunar surface material as the result of meteorite hits. By measuring both radioactive and stable isotopes produced by cosmic rays, they can tell how long the lunar material has been on the moon's surface.



At Cornell University Dr. Malcolm J. Campbell (*right*) will put his lunar specimen into this machine which simulates the solar wind, the supersonic stream of charged particles continuously emanating from the sun. Once the moon specimen is in place, the overhanging bell jar will be lowered and evacuated, the heating panels on either side swung shut, and the sample bombarded with a stream of protons. One hour inside this vacuum apparatus, Dr. Campbell calculates, is equivalent to 20,000 years' exposure to the solar wind on the lunar surface. The Cornell scientists want to find out what effect solar wind bombardment has had, over the eons, on the color and appearance of the lunar surface material. (The solar wind never strikes earth, because it is deflected by our extensive magnetic field.)





Professor Gustaf O. Arrhenius (*right*) of the University of California at San Diego will study the moon sample with this machine called an X-ray spectrometer. By beaming X-rays onto each separate fragment of the lunar sample, each on its own separate disk, and analyzing the X-rays that bounce back, it will give him a quick chemical composition for each fragment. After thus screening the material, Arrhenius will proceed with more detailed experiments. Since the moon is much lighter than the earth (its average density is 40% less), its chemical composition cannot be the same. The scientists will, of course, be able to determine the composition of the lunar sample very precisely, but until they get samples from other places on the moon, they will wonder whether the Apollo 11 sample is typical of the entire lunar surface.

Professor Joseph V. Smith (*silhouetted below*), a mineralogist and crystallographer at the University of Chicago, will inspect the crystals in a thin slice of moon material with a polarizing microscope. Here he looks at a section of earth rock (shown projected behind him), a basalt from an 1868 eruption of Kilauea crater in Hawaii, chosen because its chemical composition was believed to be similar to that of the material on the moon. From such examinations of the shapes and textures of crystals, plus the composition of the material, the scientists may be able to reconstruct the processes which formed the lunar sea—Mare Tranquillitatis or the Sea of Tranquillity—where the Apollo 11 astronauts collected the moon sample. The scientists can probably figure out, for instance, whether the mare material was ever molten and, if so, whether it was melted by a meteorite hit or by volcanic action.

So long to the good old moon

by Paul O'Neil

It is only fitting that we applaud the astronauts (well-intentioned chaps to a man), but we owe them very little for the sort of moon they are now revealing to us. The damned thing is nothing but a ball of rocks and dirt. No Lunarians. No magic rays calculated to dull knives on earth and make women pregnant. The moon our grandfathers saw at its unimaginable distance in the sky had far more impact—often as a direct result of the fallacy, naiveté and astonishment with which it was regarded—than the new one is ever likely to exert. It inspired fertility rites among Asians and human sacrifice among Celts. It provided goddesses for Babylonians and Egyptians. It told Winnebagos when to plant corn. It stopped the sap in Cuban trees and started it in Broadway song writers. Whadda we got now? Craters, old boy. Craters.

Still, we remain far more subservient to the moon lore of half-forgotten centuries than most of us realize. The astronauts themselves, ironically enough, are among its servants; earth's pale and mysterious satellite inspired scientific curiosity as well as superstition among the ancients, and prompted early thought in both mathematics and astronomy. All sorts of our religious attitudes stem from primitive moon worship, from which evolved a triple deity, the idea of hell and the concept of resurrection. Our marriage ceremony has similar roots. Even our belief in the Easter bunny and the efficacy of a rabbit's foot are by-products of the hare-in-the-moon, which was identified by other civilizations. Sunday —or rather the observance of a sabbath—was dictated by lunar rhythm and so, of course, were measurements of months and years.

While we have all grown up to take the moon for granted and to disregard all but a minute residue of lunar superstition (the most prevalent: that the full moon prompts drunkenness, wife-beating and man's innate impulse to throw bricks through plate-glass windows), it is easy enough to understand its enormous influence on the lives and emotions of primitive man. It illuminated his hostile world during the lonely and frightening hours of darkness. It was capricious. Because its orbit was elliptical and eccentric (something which drove early astronomers crazy), it not only looked bigger at certain times than at others, and rose above the horizon at different speeds, but appeared as much as 80 minutes or as little as 22 minutes later than the previous night. And in rare instances, high clouds of volcanic dust turned it green, or even blue.

It was, in short, a very awesome and exciting sort of thing to have hanging up there above you in the dark and seems to have been apotheosized almost as soon as man

looked at it. The original moon deities were male, but—doubtless because the moon's cycle corresponded with woman's menstrual period and because many peoples believed its rays, rather than Daddy's attentions, got girls with child—they were gods who took an extraordinary interest in females. Mama didn't marry Daddy in many primitive societies; when she took up housekeeping with a man there was a wedding ceremony only because it was obviously necessary that she engage in a nuptial rite with the moon—the prospective father, after all, of her children. Sometimes the headman or chief acted as the moon's representative and slept with the bride on conclusion of the ceremony. The custom of "*droit du seigneur*" hung on in Europe as late as the 19th Century. This privilege entitled a big landowner to sleep with daughters of his tenants on their wedding nights.

There were all sorts of lunar gods, but Sinn, the Babylonian one, was a particularly prime example. He became a kind of lunar trinity, for one thing, and during the three bright stages of the moon was known, progressively, as Anu, Ea and Enlil. During the dark of the moon he went to the underworld, a constituency with some of the characteristics of hell. Like all moon gods, Sinn was eventually replaced by a goddess, though not, apparently, without trying to keep the job himself. He became quite feminine—at one point being addressed as "Mother Womb, Oh Merciful Father"—but was beaten out by his daughter, Ishtar. The Babylonians believed Ishtar was menstruating when the moon was full and that it was unlucky to work or cook food on this "evil day." Since the moon was neither expanding nor diminishing at this point they also felt it was a day of "heart rest." Eventually the Babylonians got around to observing a *shabbattu* or sabbath at each quarter of the moon, or four times in a lunar month. Jews adopted the custom, and passed it along, in turn, to Christianity, thus surrendering us all to brunch, comics and the televised adventures of the Los Angeles Rams.

Moon goddesses brought man yet another religious concept which has persisted through the centuries. Almost all of them had a son who died with the old moon and was resurrected with the new one; the moon is still called "Mother of God" in obscure corners of Portugal, and the Virgin Mary—who was long equated with this phenomenon in the minds of European peasants—was known for centuries as "the Moon of the Church." Moon goddesses themselves, however, behaved with an imperious and uninhibited female savagery worthy of a Cecil B. De Mille epic. Cybele, the lunar goddess, worshiped in Phrygia—a corner of Turkey renowned for its orgiastic rites and plaintive music—was madly in love with her son, Attis. When Attis decided to marry a king's daughter, Mama "struck him mad"—upon which he gave up his marriage plans, castrated himself and devoted his time to telling Cybele that she was just the nicest mater a boy ever had. This worked a certain hardship, however, on Phrygian priests; they had to castrate themselves, too, while dancing around Cybele's statue, and wear women's clothing for the rest of their lives.

The moon, of course, influenced a great many nonsexual aspects of life back in the good old days, and was, as a result, a very reassuring and comforting—as well as, um, kicky—part of the human condition. Almost all early civilizations based calendars on the lunar rhythm—though few assigned such poetic names (Moon of the Corn Tasseling, Moon of the Coon Running) to lunar months as did the American Indians. The waxing and waning of the moon was held to have a fertilizing or inhibiting influence on almost everything from crops to human destiny. It was widely believed that sap rose in trees as the moon got bigger and retreated as it waned; good lumber, thus, could be cut only when the moon was diminishing, and Cuban law forbade the felling of trees for railroad ties during the moon's period of increase as late as 1928. The Emperor Tiberius—who had very thin hair—consulted his barber only after the new moon. The ancient Gauls were afraid to begin a journey or a battle until the new moon appeared, and so were the Spartans—so much so that they simply could not bring themselves to join the Athenians against the Persians at the Battle of Marathon.

The advent of scientific astronomy—which started in its simplest forms thousands of years before Christ, and is almost certainly the oldest science—did not put an end to man's belief in this sort of pervasive lunar influence. Early astronomers often labored under erroneous, though fascinating, ideas about the heavenly bodies they observed. Plato thought the moon was composed of a fiery substance and Xenophanes believed it was a thick cloud. Still, it was so big and peculiar that it prompted innumerable avenues of speculation and a complex use of mathematics.

Occasionally, along the slow parade of centuries, men hit on astonishingly perceptive ideas about it. Pythagoras (582–500 B.C.) believed the moon (and the earth, as well) was a sphere. Followers of Hipparchus of Nicaea (190–120 B.C.) were able to predict eclipses almost to the hour. But most astronomers believed the earth was the center of the universe, that the sun as well as the moon revolved around it and, often, that the sky

CONTINUED

Pythagoras (right) was the first to believe that the moon was a sphere. Galileo's drawing (center) was one of the earliest made from telescopic observation. He ascertained that the moon was not a smooth disk but a sphere with a rough mountainous surface. A few decades later, Johannes Hevelius did an illustration that shows the 59% of the moon visible from the earth.

In almost every culture, lunacy has been attributed to an arbitrary force of evil, such as the moon. Here, five countrywomen, crazed by moonlight, dance in demented frenzy in the village square.

was a huge, hollow translucent sphere which enclosed the atmosphere and to which the stars were fastened like lights on a nightclub ceiling. The innovative thinker could risk his neck: Anaxagoras of Clazomenae (a mentor of Socrates) was condemned to death in Athens for saying the moon was made of the same stuff as the earth.

Moon watching was still a risky business, as indeed was the rest of astronomy, at the conjunction of the 16th and 17th Centuries when a trio of its most famous practitioners—Denmark's Tycho Brahe, Germany's Johannes Kepler and Italy's Galileo Galilei—burst upon the world and laid the groundwork for modern concepts of the universe. An astronomer needed an enormous ego and an equally enormous sense of bravado—or the ability to keep his mouth shut—if he wanted to engage in his science for long.

Brahe was obstinate, irritable and as proud as a peacock of a gold-and-silver nose he designed for himself after one Manderupius Pasbergius whacked off the original in a duel over a problem in mathematics. He was a great pal of Denmark's King Frederik II, talked that monarch out of enormous sums of money, built an island castle as an observatory, staffed it with servants, imported "English barking dogs" to keep the curious at bay and enjoyed 21 years of vastly comfortable astronomical calculation and self-applause. When the king died and the royal court cut off his funds, Brahe simply moved to Prague and talked Emperor Rudolph out of more money and yet another castle.

The Italian genius Galileo was the first to make really efficient telescopes (some of his best magnified up to 32 times) and discovered the kind of moon—with mountains, craters and canyons—which the astronauts know today. This horrified the experts, among them Aristotelians who were certain it was a smooth, polished sphere. Galileo was a charming fellow, but one with a sardonic sense of humor, and he did not endear himself to these skeptics by daring them to look for themselves—and laughing uproariously when they claimed his mountains were not only impious but did not, since they had been seen by artificial means, exist. Outspokenness eventually did him in; he was tried by the Inquisition for insisting the earth revolved around the sun and spent his declining years as a prisoner in his own house.

Johannes Kepler believed the moon influenced tides as "a lodestone attracts iron" but he professed to believe that the earth was an enormous living animal and that this "terrene monster" produced a rise and fall of the oceans by breathing them in and out of its gills—on a rhythmic schedule because the moon influenced its periods of wakefulness and sleep. He also believed the moon was subject to intense cold and parching heat, had enormous mountains and might be populated by prehistoric lizards, but masked these ideas as fiction.

Kepler, whatever his motivation, was not alone in expressing himself in this early form of science fiction. The moon inspired other writers to imaginary lunar voyages all through the 17th and 18th Centuries. These tales incorporated a mix of scientific knowledge, wishful thinking and unabashed speculation. They ranged from parody to straight adventure, set a precedent for the stories of Jules Verne and H. G. Wells, and were a great deal more interesting—if one may be pardoned for saying so—than anything the astronauts are likely to experience. Domingo Gonsales, hero of Francis Godwin's *Man in the Moon* (1638), was towed up to the moon by 25 huge swans and found himself among men who were 28 feet tall; France's Cyrano de Bergerac took an imaginary lunar trip by means of a firecracker chariot and was instantly jailed there for saying there were people on earth.

Nothing in man's long history of lunar speculation, however, so twitted and titillated Americans and Europeans as did "The Celebrated Moon Story," a scientific hoax which the New York *Sun* published over a period of 11 days in August and September, 1835. It reported "Great Astronomical Discoveries Lately Made by Sir John Herschel, LL.D., F.R.S. & etc. at the Cape of Good Hope"—namely, Herschel's invention and use of a telescope so fantastically powerful as to bring lunar objects no bigger than 18 inches into clear view on earth—and was, the *Sun* solemnly assured its readers, simply being reprinted in New York after original publication in something called the supplement to the Edinburgh *Journal of Science*. Crowds mobbed the paper day after day and not a soul among them seemed to suspect that 1) there was no Edinburgh *Journal of Science*, or that 2) even though there was a scientist named John Herschel, the lunar wonders attributed to him were being invented by *Sun* editor Richard Adams Locke.

Their credulousness is easily understood. The Moon Story—which has remained among the most obscure of American literary curiosities—had the ring of veracity. Its author, Locke, was a graduate of Cambridge University and a man who was well grounded in the scientific theory of the day. He knew a great deal about optics, and his tongue-in-cheek recital of ideas upon which Astronomer Herschel—who actually was making observations at the Cape of Good Hope—had supposedly built his enormous telescope sounded splendidly complex and convincing. Locke de-

scribed a "prodigious lens, 24 feet in diameter, weighing 14,826 pounds, and boasting a magnifying power of 42,000" which became part of Herschel's great telescope; he asked his readers to visualize the long teams of oxen and "companies of Dutch Boors" needed to haul it across the plains east of Capetown, and the vast pillars upon which it was suspended 150 feet above ground.

This was all New Yorkers needed to be convinced that every word of the Moon Story was the sensational truth; the *Sun*'s steam press clattered away night and day pumping out newspapers for the enormous street crowds, and tension built up in the city with each delicious instalment.

Looking at the moon through Sir John's imaginary telescope sounded, as Locke described it, very much like watching a big color TV screen. Herschel's grand apparatus could zoom in for close-ups—while gangs of "domesticated Hottentots" worked a series of windlasses which regulated the lenses—or pull back for a more general survey of forests, glades and mountains. New Yorkers learned, to their fascination, that "lunar quadrupeds" all had a remarkable fleshy appendage over the eyes, a hairy veil shaped like the frontal outline of a headpiece known to ladies as a Mary Queen of Scots cap—which lifted and lowered by means of the ears. The "acute mind" of Dr. Herschel instantly deduced "that this was a providential contrivance to protect the eyes from great extremes of light and darkness." The animals and birds—tiny bison, lead-colored goats, tailless beavers which walked on hind legs, horned bears, long-tailed blue pheasants and exotic waterfowl—were both curious and yet satisfyingly similar to their counterparts on earth.

The Moon Story was full of suspense. The great telescope not only kept zeroing in on vast treasures—a crimson mountain with long crevices full of virgin gold and "equi-triangular temples of polished sapphire"—but threatened to break down and ruin everything. At one point the big lens was turned incorrectly, caught the rays of the sun, and burned a 15-foot hole through the observatory. But repairs were made and the *Sun*'s readers were finally privileged to see lunar humanoids through Sir John's astonished eyes. These creatures were "four feet in height, covered, except on the face, with short, copper-colored hair, and had wings composed of a thin membrane lying snugly along their backs." The astronomer felt they were "an improvement upon the orang-outang, being more open and intelligent in expression."

The occasional cries of indignation prompted by all this monkey business were almost completely drowned by applause—not the least of it from other newspapers. The New York *Times* called the revelations "wonderful, probable and plausible." Thousands went on insisting the story was true even when it was clearly exposed—after the passage of a few weeks—as an ingenious hoax. Mails from Europe, meanwhile, disclosed that it was being republished in England, France, Germany, Portugal and Spain—and was being received by foreign millions as the revealed word of a beneficent technology. When the French Academy of Sciences assailed it as a profanation of Sir John's reputation, Parisians somehow got the idea that members were debating its merits. Herschel thought it was all very funny. The Moon Story lived on for decades among the faithful—who treated skeptics with "pity and contempt" and died believing it "the sacred and delightful truth."

Ah, well—we know better now. But are we absolutely sure—science or no science—that the moon does not really influence living things on earth? How about the five-testicled sea urchins of Suez which are triggered to the act of spawning at every full moon? How about the grunions which only come to the beaches of California in summer on the three nights following fruition of the lunar cycle? Why does the Palolo worm of Samoa discharge its eggs early in the morning one week after the full moon in November—and never, never, never at any other time? One must assume, at the very least, that it is not yet aware of the extent of the Apollo program and the imminent demise of the earth's last lunar illusion.

Still, it is possible to predict that the moon has some oldtime excitement yet in store for the inhabitants of our earth and that it is going to scare hell out of our progeny if any of them lasts long enough. Few of us realize it once whirled around our planet every five hours and at a distance of only 15,000 miles—and that it has been retreating from us, at the rate of five feet a century, ever since. Neither have many of us troubled to notice that the earth has been rotating 2/1,000ths of a second more slowly every hundred years. But these effects, given a few million more millennia, are going to develop into something absolutely sen-sa-tion-al. The earth day and the lunar month will eventually become the same—47 of our days. The moon will start creeping back to us . . . closer . . . closer . . . closer. It won't hit us—or at least today's mathematicians don't think so. But it will break into a zillion pieces and rearrange itself into a ring of orbiting fragments across which future astronauts will doubtless scamper like Eliza scampered across the ice. So give 'er a little time, kids, and hang . . . on . . . to . . . your . . . HATS! ◂

Man has always speculated on the kinds of creatures likely to inhabit the moon, and in a 17th Century satire Cyrano de Bergerac imagined an Earthling meeting a lunar giant (far left). In 1835, New York Sun *articles by Richard Adams Locke regaled credulous readers with descriptions of fantastic lunar humanoids with "short, copper-colored hair" and "wings composed of a thin membrane" (left).*

The dawn of the day man left his planetary cradle

by Loudon Wainwright

Maybe the attrition of 10 years has something to do with it. Perhaps the fierce compression of so many events into such a period reduces the capacity for anticipation of still another, greater climax. Whatever the reason, I found myself waiting at Cape Kennedy for the moon launch with a growing sense of non-excitement. No amount of telling myself, "They're going to the moon, they'll be walking around on the surface, it could be awfully dangerous," did anything much to sharpen my appetite for the happening, and I found myself wandering around in the deadening Florida humidity in a pair of broken sunglasses, feeling less like a man who was going to observe the ear-splitting, eye-smashing beginning of the greatest trip in history than one who would prefer to be in another place, riding the waves, say, in colder waters.

It hasn't always been that way. Meeting and interviewing the seven Mercury astronauts in 1959, two years before any manned flight, I recall strong feelings of excitement and awe at the fact that these men proposed to allow themselves to be flung the incredible (at that time) distance of 100 miles above the earth. When Alan Shepard flew more than eight years ago (20 days *before* President Kennedy set the moon goal), I recall an emotion approaching prayerful panic at his lift-off. And I remember how, a few days later, the first American astronaut's voice trembled at places as he told me about that amazing 15-minute trip.

On the day of John Glenn's parade in New York, where the huge crowds enthusiastically crushed the fenders of cars in the cavalcade, I talked to Glenn while he was getting a haircut in his Waldorf-Astoria suite. The luxury of his private tonsorial attention struck me as entirely fitting for him, and I felt quite flattered when he offered to treat me to a trim.

When Scott Carpenter got lost in the Atlantic for almost 45 minutes after the reentry from his flight, I saw Rene Carpenter smiling in calm and complete disbelief as we watched Walter Cronkite, in tones that grew more sepulchral by the moment, preparing his millions of viewers for the very worst.

Surely the dreadful and stupid fire that killed Grissom, White and Chaffee had a lot to do with the end of my astronaut-thrill period. Grissom and I had talked one day very early in the Mercury program for about 45 minutes and I *thought* I was taping our conversation. Before that bright and laconic man left, I tried to play back the tape and found we'd recorded nothing. When Gus heard that, he stared hard at me for a moment, then sat down and said: "Let's do it again."

The almost monotonous success of the flights before the Grissom tragedy has evolved to near perfection with the Apollo flights since. Of course, that's a fact worth anybody's deep gratitude, but precision has a way of dehumanizing adventure, even if the destination is a piece of the moon. Thanks to this technology, we *know* the views are fantastic. Anything is possible and most of it is predictable to the millisecond. Two days before this flight, Neil Armstrong was asked a question about the reasons for the wild gyrations

experienced by the LM crew during the Apollo 10 mission. His answer: "I think we understand the nature of the difficulty that came up with the Apollo 10, even though we cannot precisely ascribe the difficulty to a certain failure. Our procedure is one where we have procedurally implemented methods of circumventing the problem and, should it occur, we have procedures that will be able to cancel the kind of problem we might get in." Now that comment surely shows that Armstrong is the right man for the job, but it also served for me as a dampener of the magic I wanted to feel about his trip.

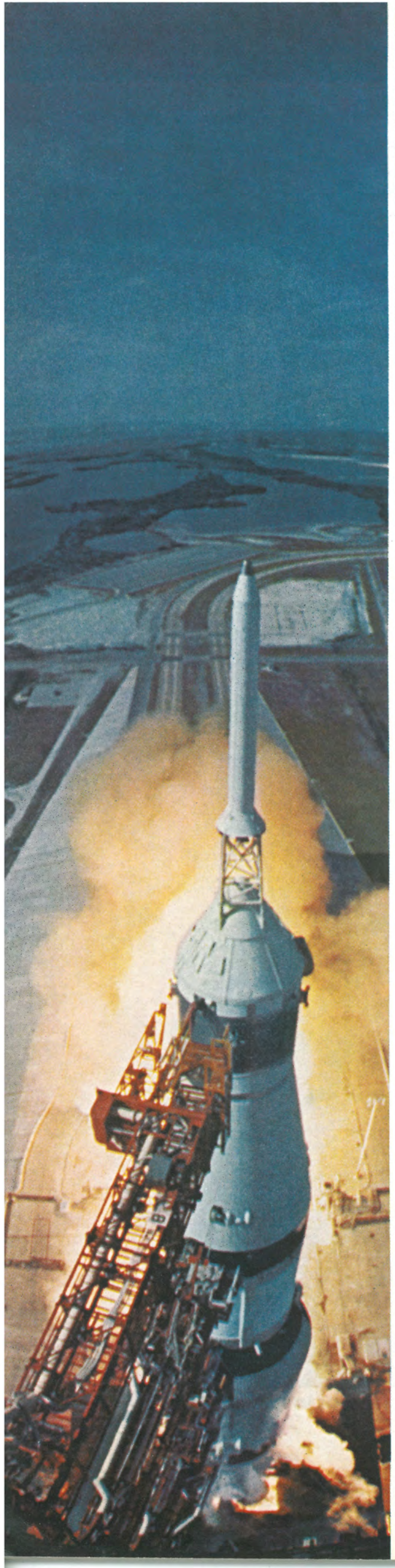
Possibly I was trying to rekindle a little of the old magic by going fishing a couple of days before the launch with Deke Slayton, but we talked mostly about how careful one has to be not to be impaled on the wicked fin of a hooked catfish. A drink with Alan Shepard showed his contained delight in the good possibility that, after eight spaceless years, he would fly to the moon. Still, it all had the feeling of a talk that had taken place in the past.

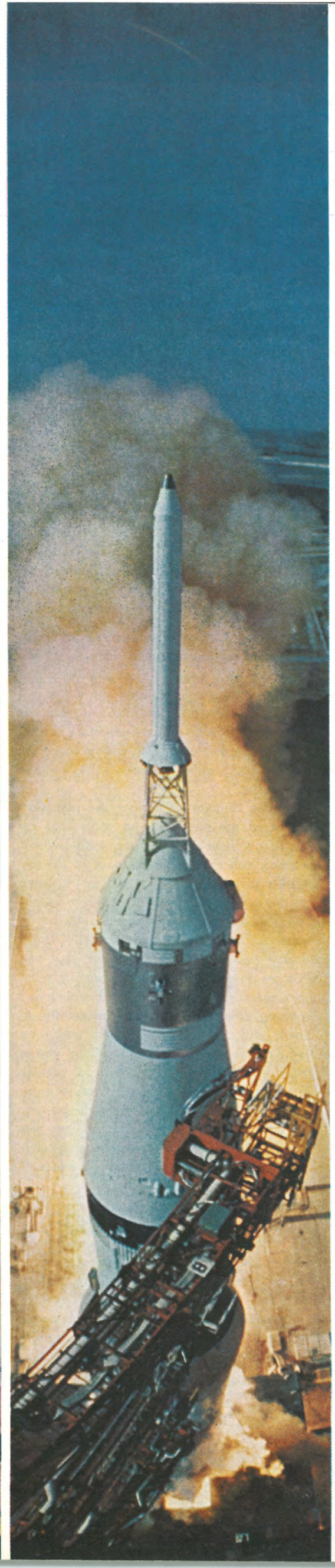
But it changed, by God, it changed. The change began while I was listening to a speech by Wernher von Braun on the night before lift-off. At one point he said: "What we will have attained when Neil Armstrong steps down upon the moon is a completely new step in the evolution of man. For the first time, life will leave its planetary cradle, and the ultimate destiny of man will no longer be confined to these familiar continents that we have known so long."

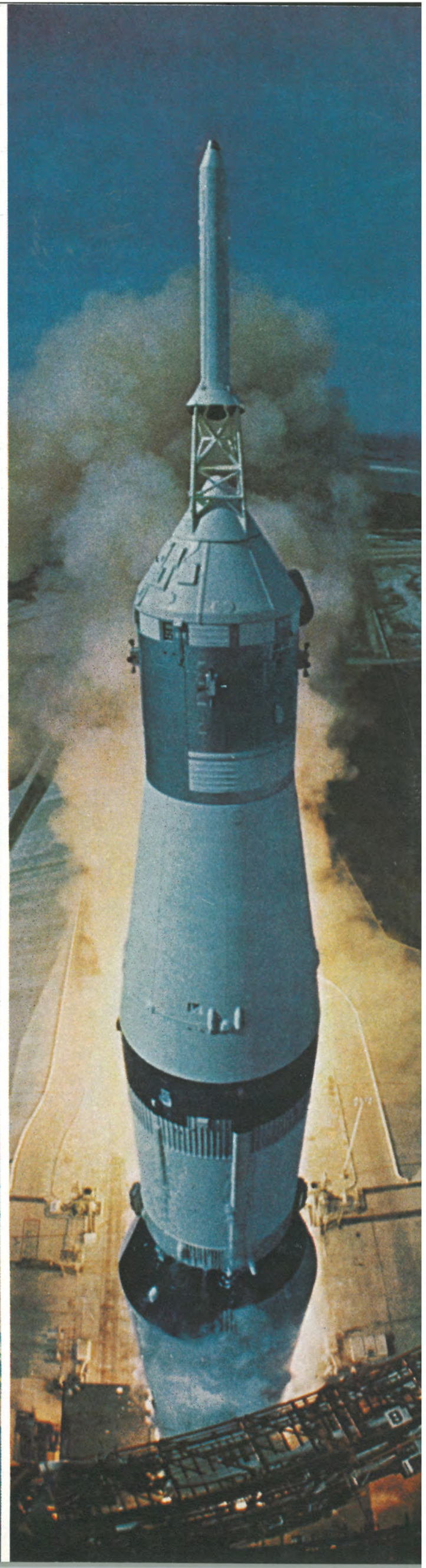
The simple thought of leaving the planetary cradle stirred me suddenly—in ways that no amount of engineering brilliance, astronautical competence, and the cool confidence of the entire Apollo project ever could, and as we drove back to the motel for a quick sleep before watching the last hours of the countdown, I was moved still more. All along the shoulders of U.S. Highway 1 and packed solid to the river that ran near it were thousands of trailers, camping vans, tents, makeshift shelters of all kinds. People lolled in the grass, infants were sleeping in cradles on the hoods and tops of cars, fathers and sons were setting up telescopes, bands of the young in trunks and bikinis ran everywhere. Clearly visible through the night about 10 miles away was the Apollo 11, bathed in searchlights, a tiny stalk of light in the darkness, and this vast picnic crowd had gathered to see the booster belch out its tremendous power and hurl likenesses of themselves at the moon.

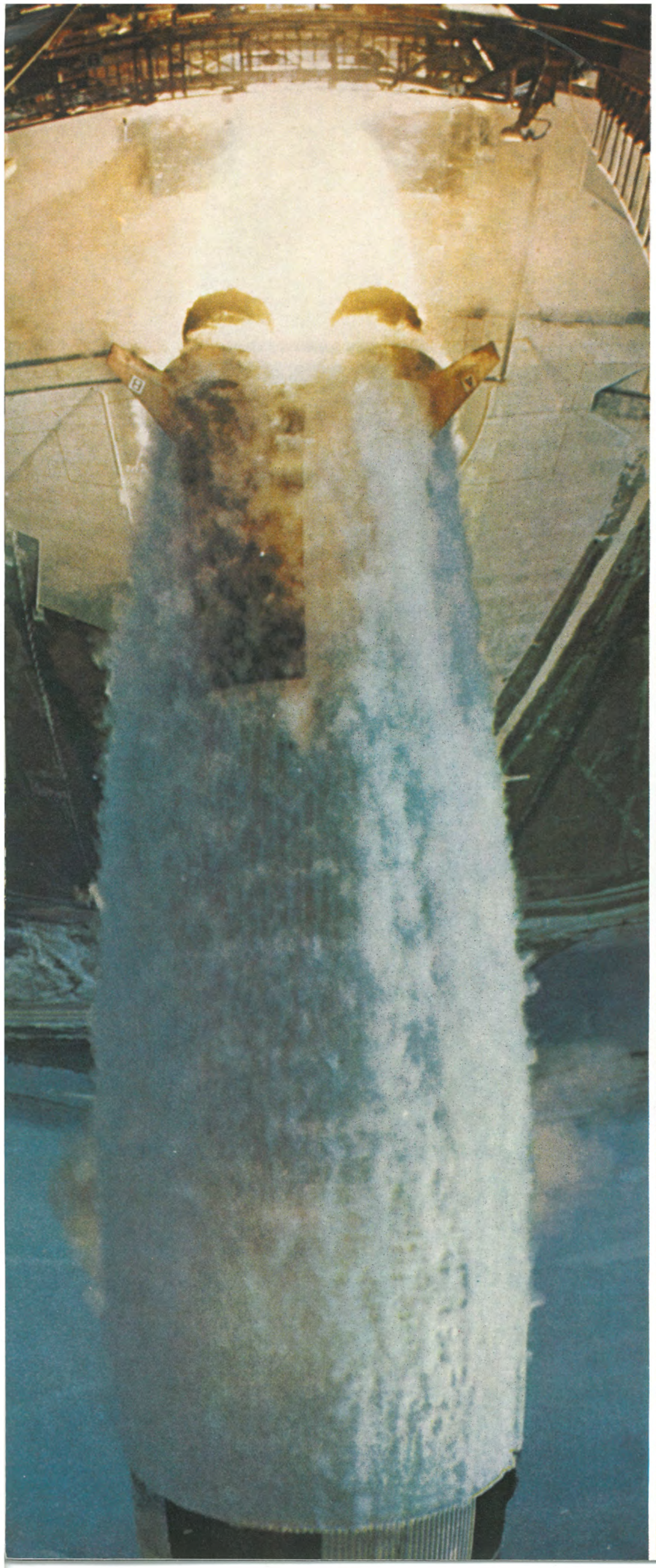
By morning there were many more—roadsides, beaches, jetties, every place of viewing space was jammed with the watchers, and it was extraordinary indeed to drive past miles of faces staring toward 30 seconds of history. By the time the last minute of the count began, the event felt exactly right. When the first flicker of orange appeared and the clouds of smoke and steam began to billow, I heard myself urging on that slow, slow rise with all the rest, and when the fire burned almost too bright to bear and the battering sound turned all the faces foolish, it was even better than it used to be.

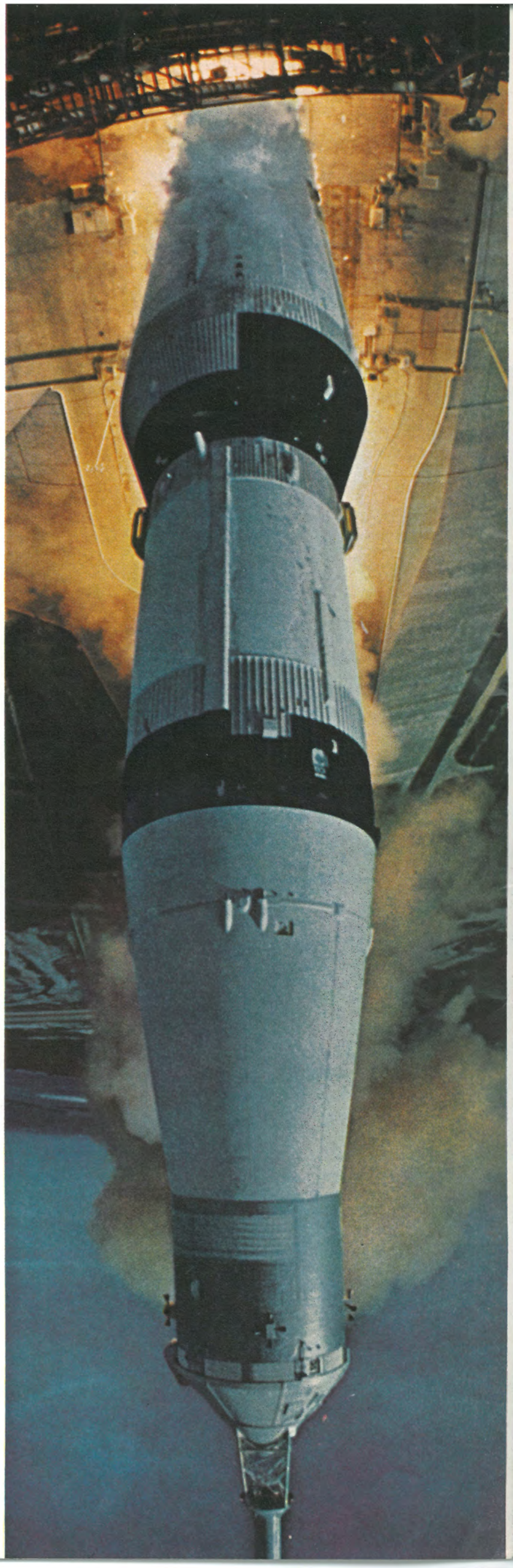
Armstrong led the way from gantry to Apollo spacecraft





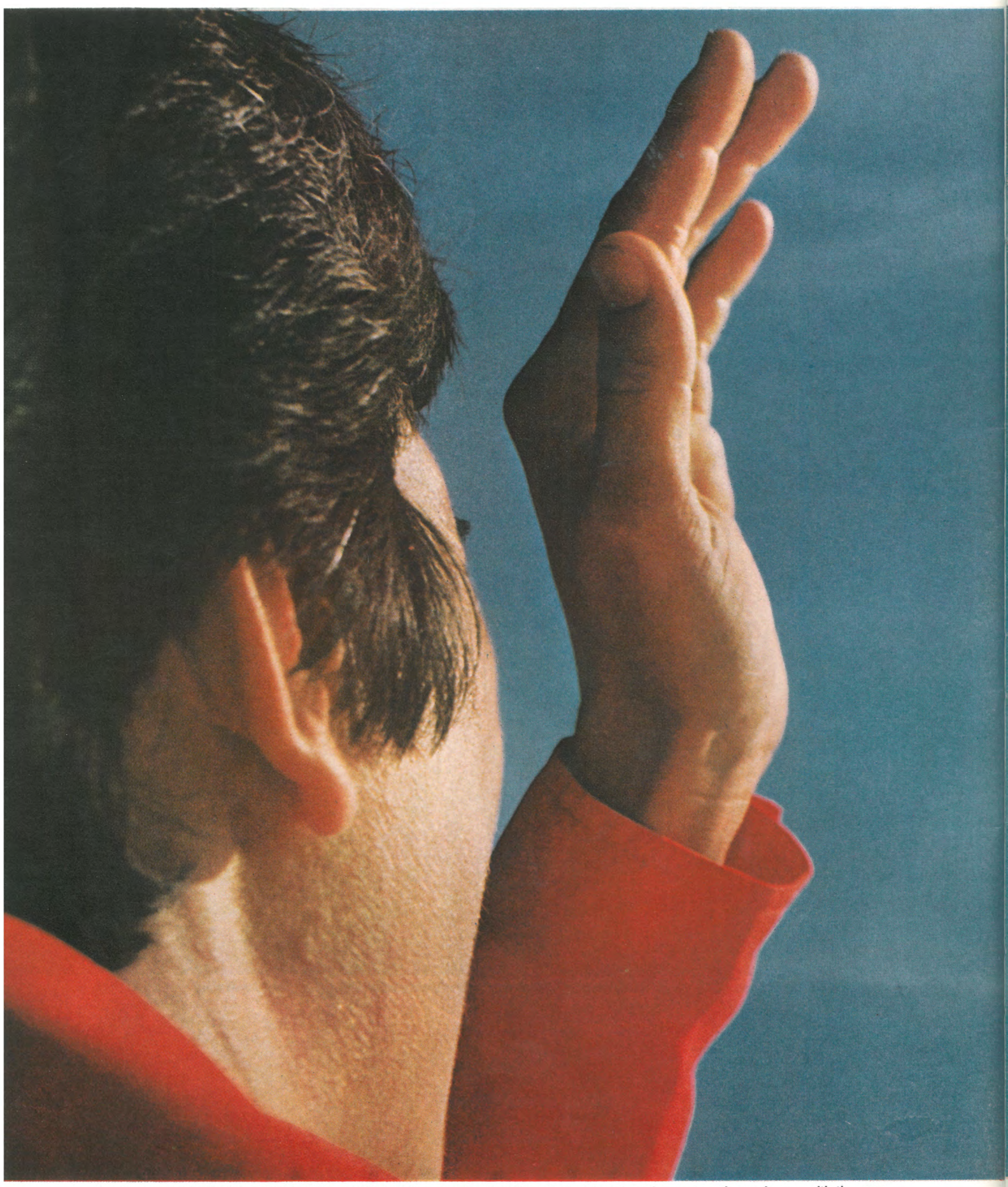






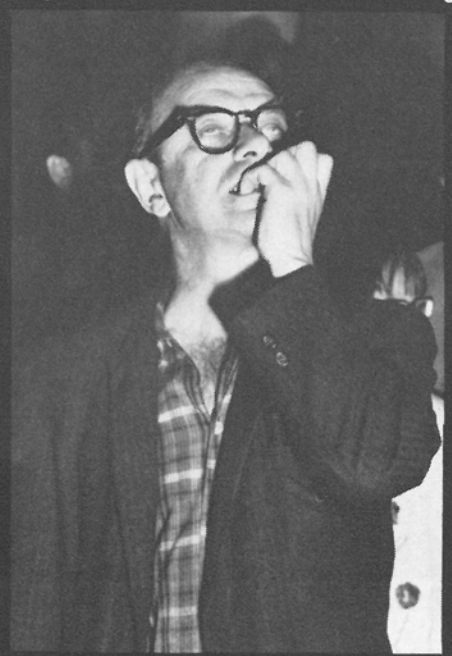
Journalists—nearly 3,500 of them from the U.S. and 55 other countries—watched in hushed and expectant awe as the Apollo rocket began its

slow climb skyward. Fifteen seconds after the launch the low steady whirr and click of cameras was overwhelmed by the rocket's thunderous noise

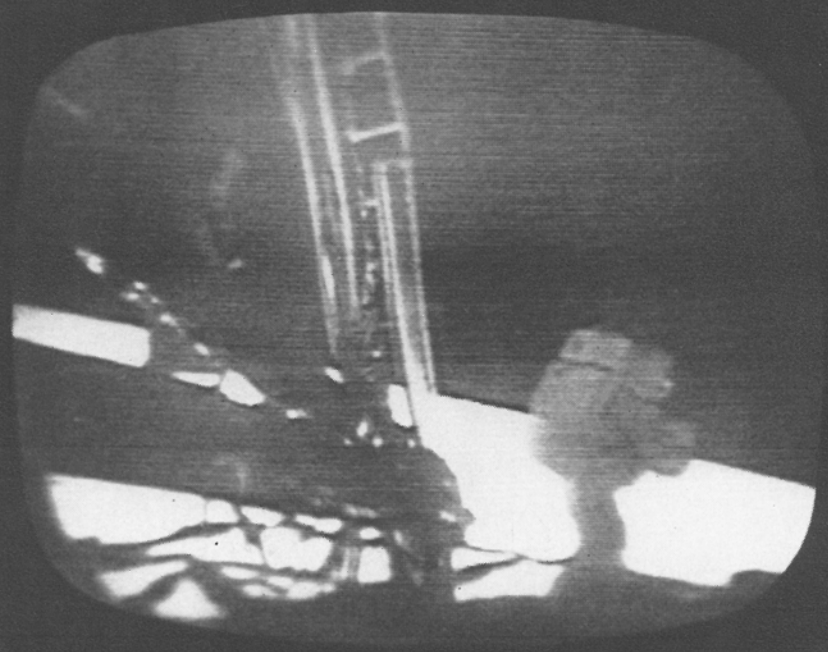


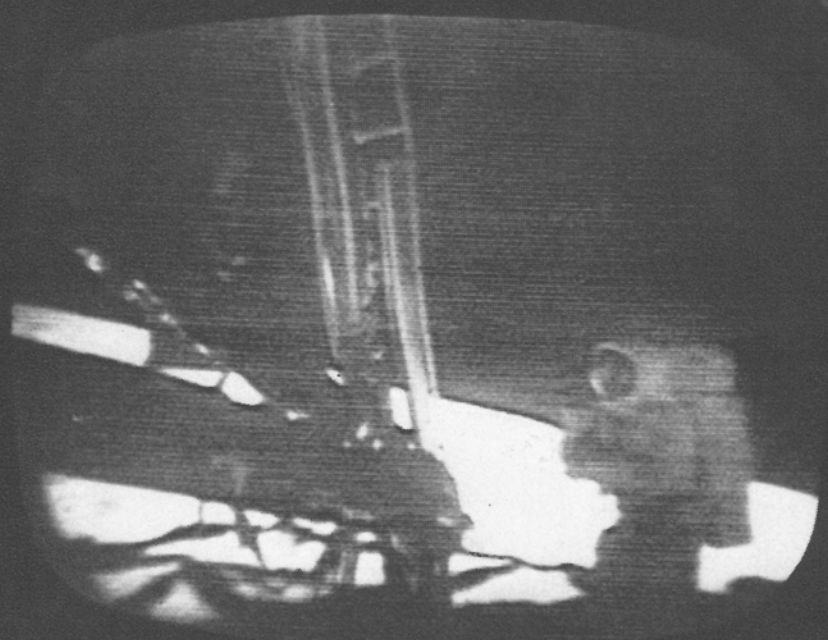
Jan Armstrong raised a hand to ward off the bright morning sun and watched her husband's spacecraft roar toward a rendezvous with the moon

At Disneyland (left) hundreds gave up "moon rides" to watch the real thing, while in Manhattan people cheered and worried in front of huge TV screens



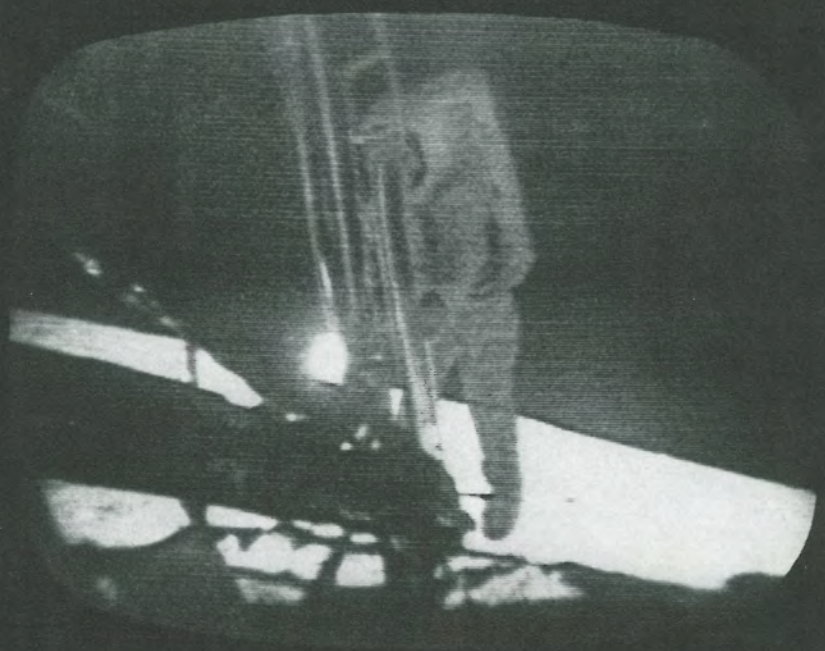
The first step—and 600 million people watched it

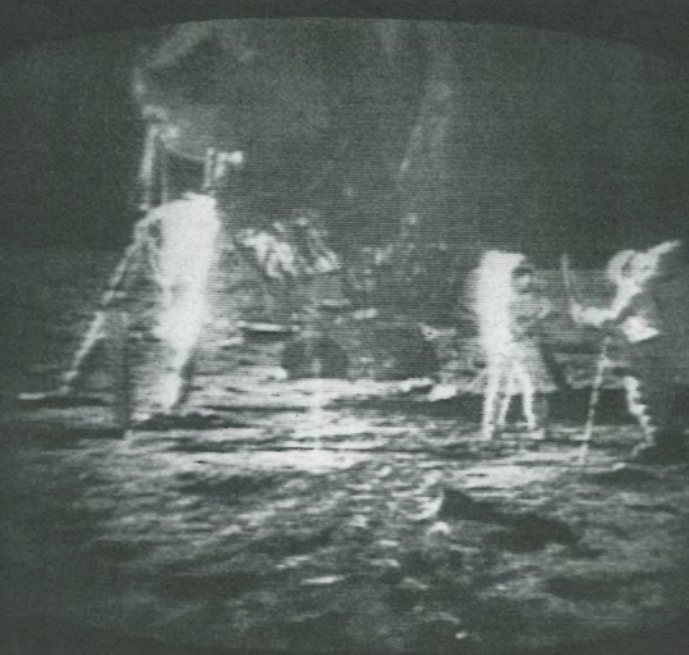




Live TV images from the moon—they flickered onto tiny bedroom sets and giant outdoor screens the world over, blurry and a little bewildering at first, then resolving into the eerie silhouette of Neil Armstrong, clinging to a ladder and gingerly testing his foot against the face of the moon (*far left*). These first stark scenes, broadcast by a camera mounted beside the exit ladder, were viewed on earth by more than 600 million people.

Las Vegas casino crowds paused over baccarat (below), and passengers jammed a waiting room at Kennedy Airport (right) watching Armstrong's walk

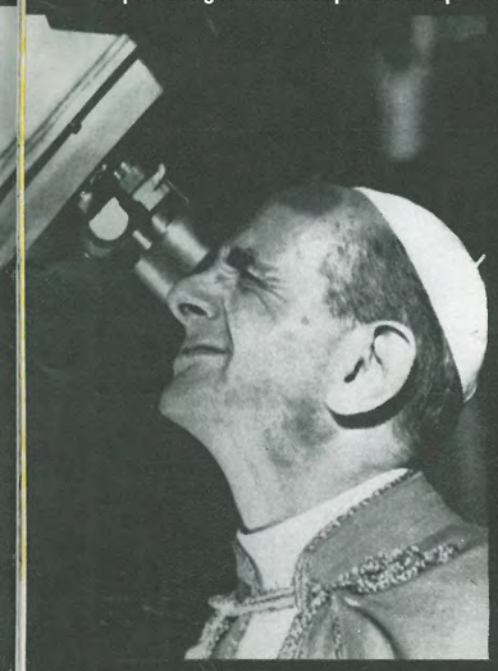


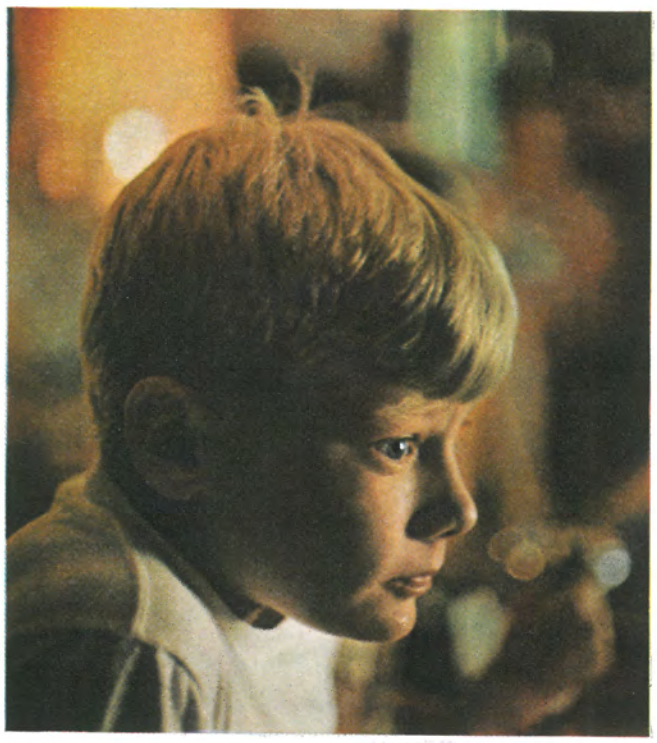


People from 47 countries watched the astronauts. The broadcast originated in a $400,000, seven-pound camera specially designed for the hostile vacuum of the lunar surface. Images of Buzz Aldrin's leap (above) or the flag-planting ceremony passed through the fixed-focus lens of the camera, were transformed into electrical impulses, amplified a hundred times and beamed directly to earth. At Parkes, Australia, a 210-foot-diameter radio telescope gathered the signal which was then converted to a conventional TV image and sent, via microwave and satellite, off to Houston, which instantly rebroadcast it to the world.

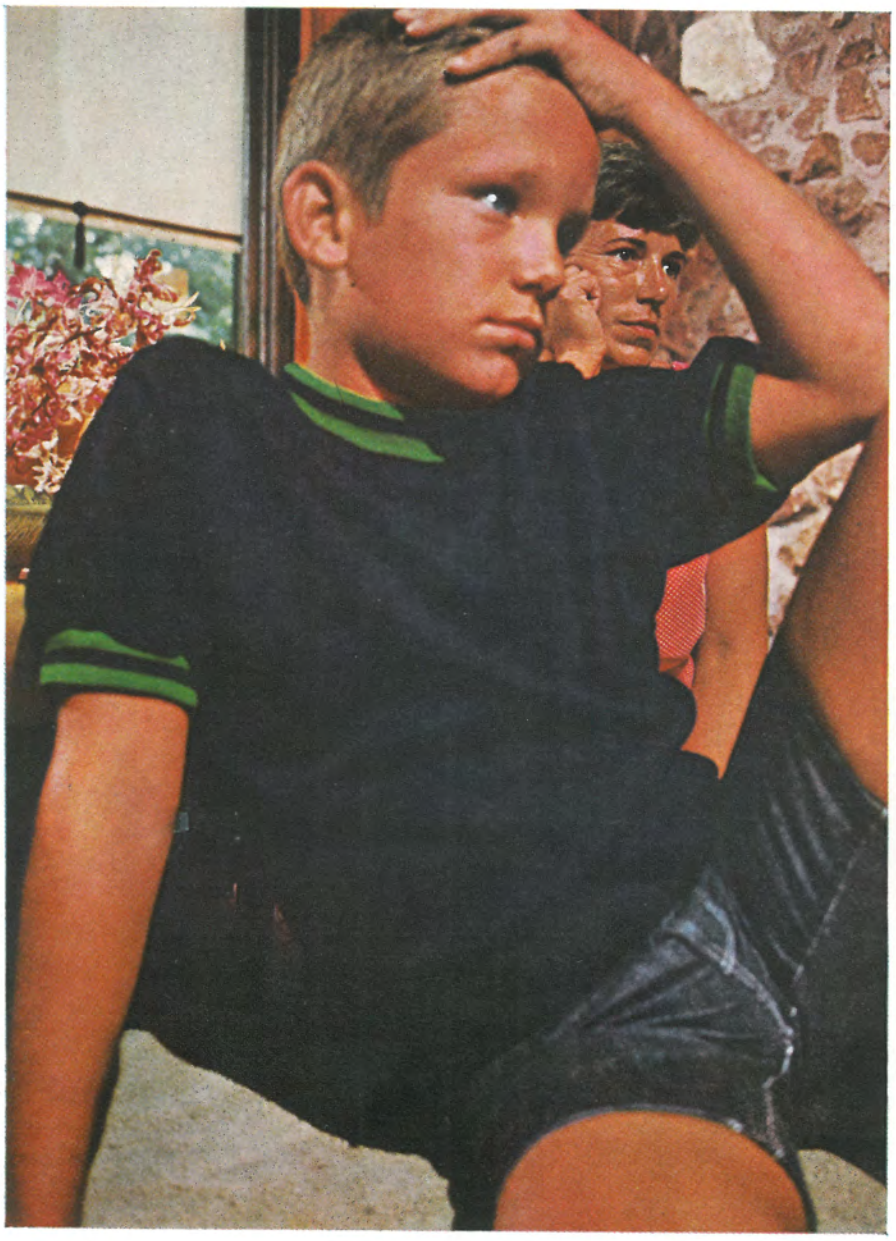
The moon walk was broadcast live in London (left) and other world capitals, although Moscow viewers (right) had to wait several hours for an edited version

Pope Paul got a telescopic close-up of the moon, while South Koreans clamored around a 20-foot-square TV screen. In Saigon, GIs read of lunar adventure





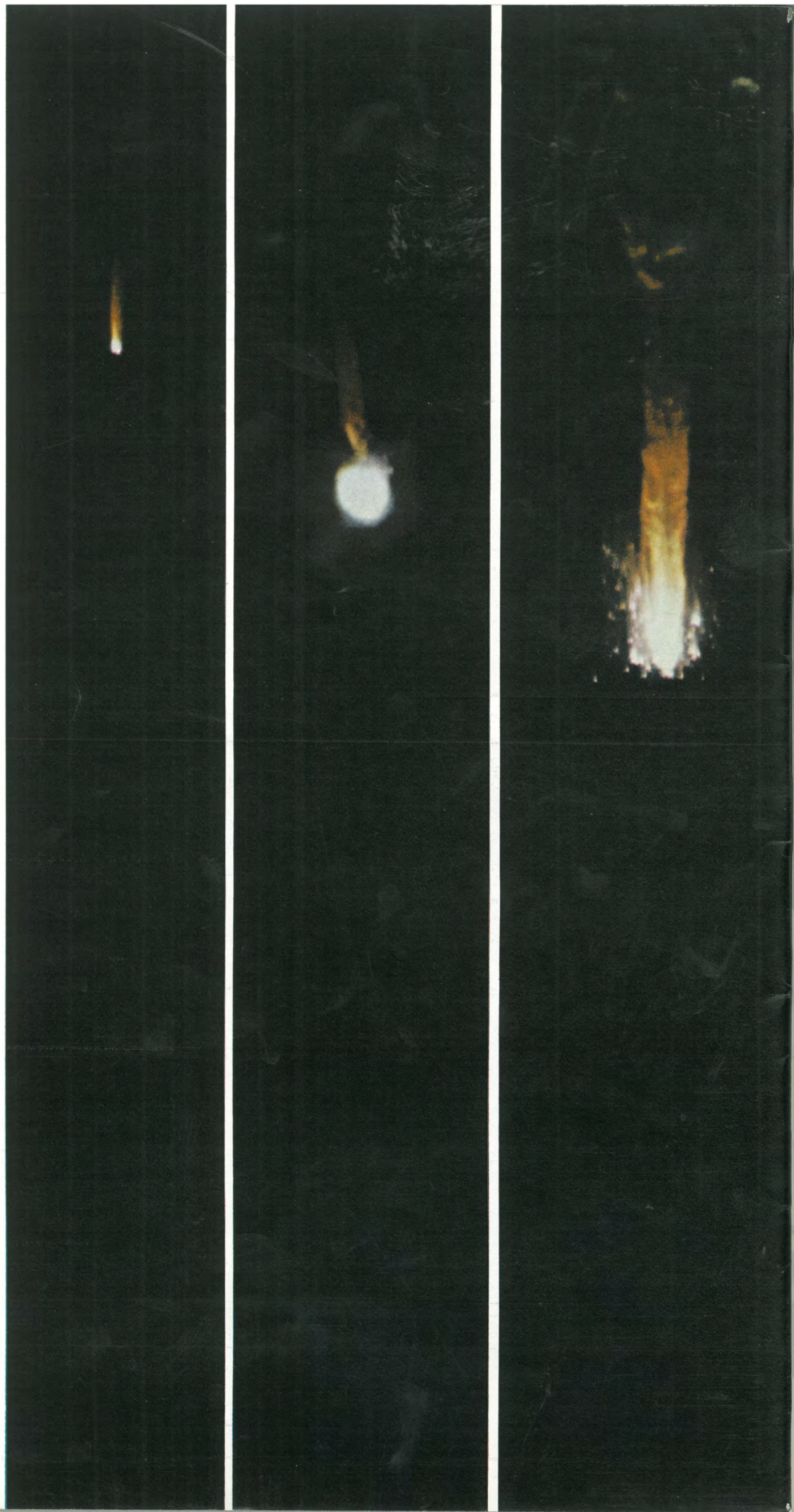
Andy Aldrin watched with grim concentration as his father set foot on the moon, while at the Collins home Pat and friends followed the walk on two television sets



Ann Collins waved at her father during his broadcast

Ricky Armstrong stared at TV as LM came in for landing

Joan Aldrin collapsed on the floor in happy relief when Eagle lifted safely off the moon

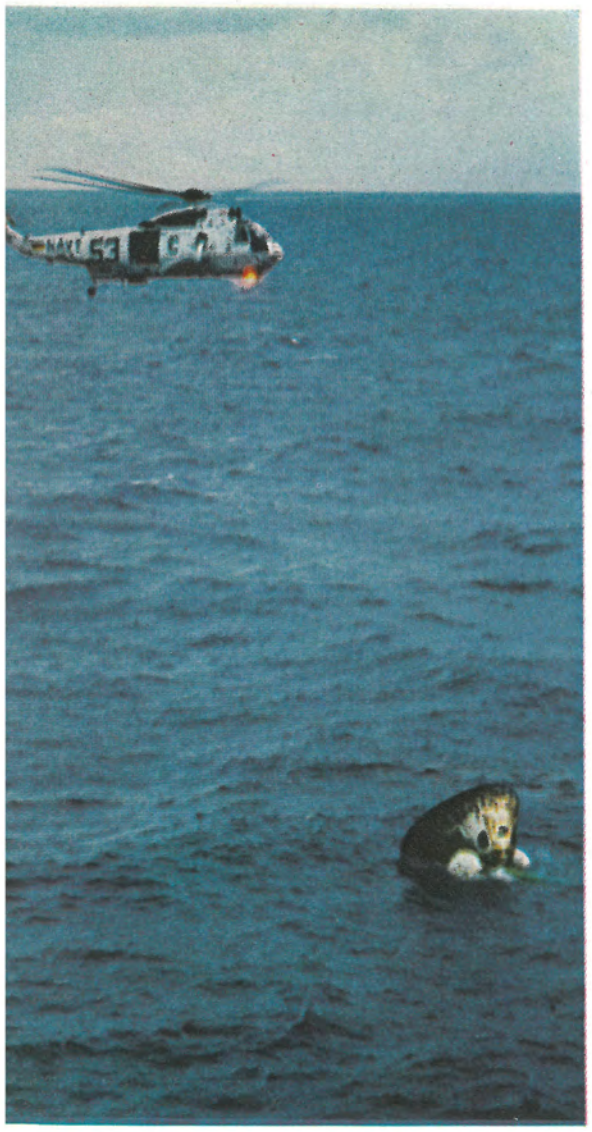


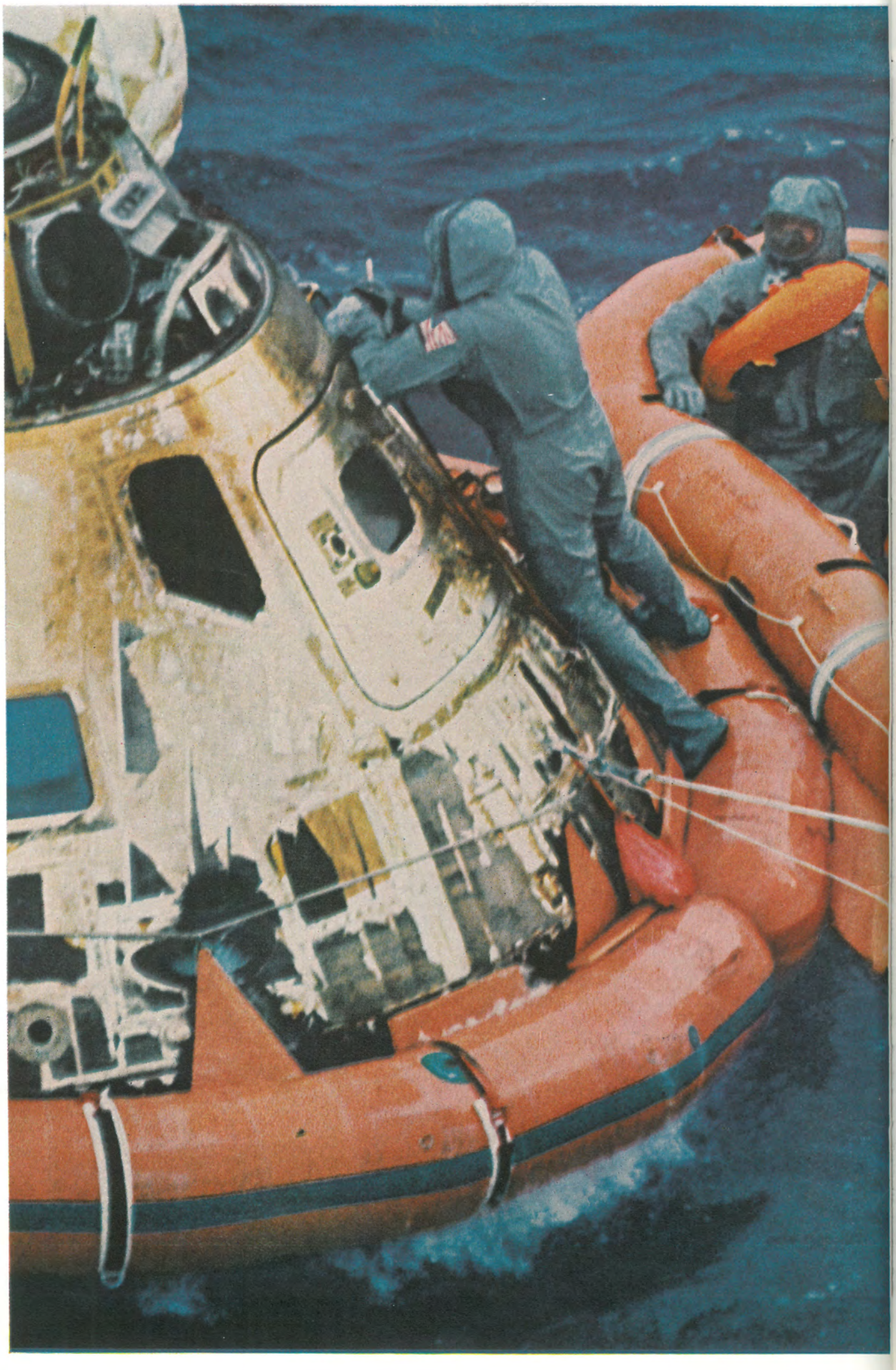
A Fiery Sideshow As Apollo Comes Home

As the astronauts returned to earth, Apollo's service module —which as part of *Columbia* had provided the astronauts with propulsion, oxygen and water—went out in a blaze of glory. Jettisoned from the capsule containing the astronauts at an altitude of 5,300 miles, it plummeted through the atmosphere, heating to more than 5,000° F before its final disintegration at the end of an enormous arc that spanned the dawn Pacific sky.

These photographs, made by a radar-controlled airborne camera with a 200-inch lens, show the service module's minute-and-a-half incineration. At near left, more than 60 miles up—and 342 miles from the Air Force 707 carrying the camera—it plunged, accelerating to nearly 25,000 mph, before melting (*right*) 35 miles above the earth.

Capsule was first righted by flotation bags (left). Then, as astronauts in special





isolation suits watched, frogman scrubbed it down with disinfectant. At right, Apollo crew waved as they entered quarantine trailer aboard Hornet

In Houston the splashdown joy was personal and intense. NASA workers leaped from their consoles waving flags, and at home Jan Armstrong (below, left)

beamed and sighed in relief. Joan Aldrin applauded as Buzz struggled into the raft, and Pat Collins served a case of champagne to a houseful of happy friends

Armstrong, Collins and Aldrin grinned jubilantly from inside their quarantine trailer on the carrier Hornet

before their flight home to Houston

The Moon Ground

by James Dickey

You look as though
You know me, though the world we came from is striking
You in the forehead like Apollo. Buddy,
We have brought the gods. We know what it is to shine
Far off, with earth. We alone
Of all men, could take off
Our shoes and fly. One-sixth of our weight, we have gathered,
Both of us, under another one
Of us overhead. He is reading the dials he is understanding
Time, to save our lives. You and I are in earth
light and deep moon
shadow on magic ground
Of the dead new world, and we do not but we could
Leap over each other like children in the universal playground
Of stones
but we must not play
At being here: we must look
We must look for it: the stones are going to tell us
Not the why but the how of all things. Brother, your gold face flashes
On me. It is the earth. I hear your deep voice rumbling from the body
Of its huge clothes Why did we come here
It does not say, but the ground looms, and the secret
Of time is lying
Within amazing reach. It is everywhere
We walk, our glass heads shimmering with absolute heat
And cold. We leap slowly
Along it. We will take back the very stones
Of Time, and build it where we live. Or in the cloud
striped blue of home, will the secret crumble
In our hands with air? Will the moon-plague kill our children
In their beds? The Human Planet trembles in its black
Sky with what we do I can see it hanging in the god-gold only
Brother of your face. We are this world: we are
The only men. What hope is there at home
In the azure of breath, or here with the stone
Dead secret? My massive clothes bubble around me
Crackling with static and Gray's
Elegy helplessly coming
From my heart, and I say I think something
From high school I remember Now
Fades the glimmering landscape on the sight, and all the air
A solemn stillness holds. Earth glimmers
And in its air-color a solemn stillness holds
It. O brother! Earth-faced god! APOLLO! My eyes blind
With unreachable tears my breath goes all over
Me and cannot escape. We are here to do one
Thing only, and that is rock by rock to carry the moon to take it
Back. Our clothes embrace we cannot touch we cannot
Kneel. We stare into the moon
dust, the earth-blazing ground. We laugh, with the beautiful craze
Of static. We bend, we pick up stones.

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