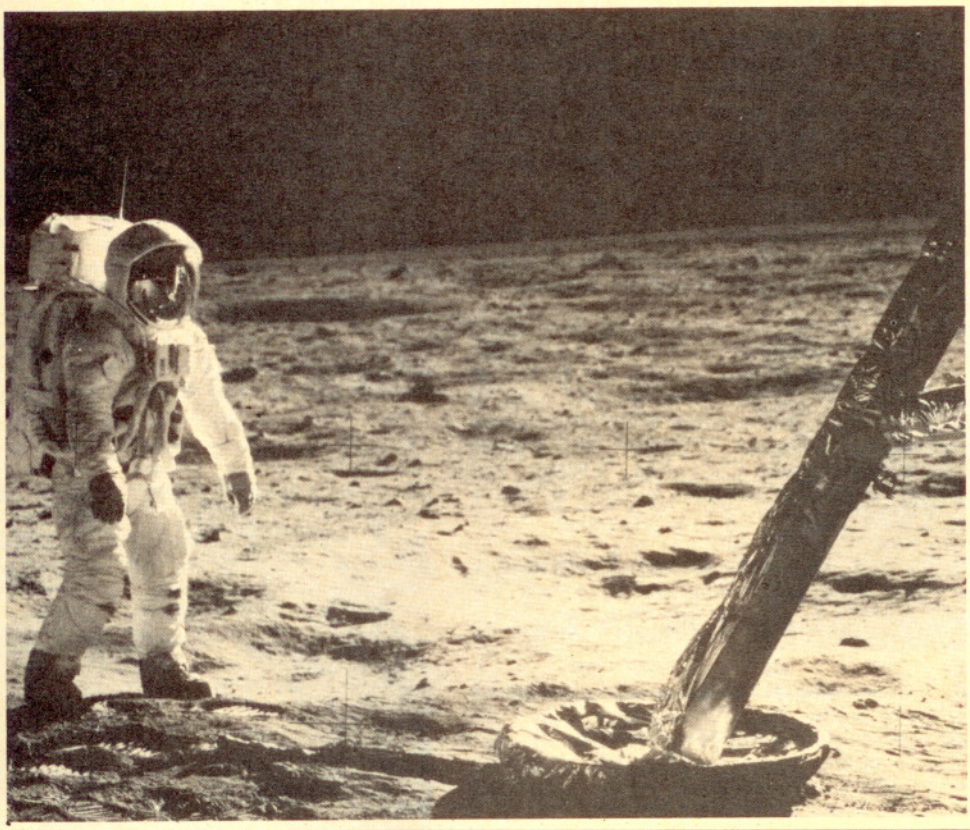
He flies a three-place craft with a service ceiling that's out of this world. It has three modules and 70 engines, and is flown almost always on instruments. It has flown only once—for about 195 hours—and has never been flown again. The craft: Apollo 11. The man: Edwin E. (Buzz) Aldrin, Lunar Module Pilot aboard man's first flight to the moon.

BUZZ ALDRIN: An Exclusive Interview



by BARRY SCHIFF
AOPA 110803

Some astronauts fly airplanes before a mission to "prepare for a space flight." How does this prepare an astronaut for space?

It has to do with motion sickness. During the Mercury and Gemini flights, no one got sick. But when we began flying the larger Apollo spacecraft, several astronauts admitted to some queasiness. Motion sickness seems to increase in proportion to the size of the spacecraft, but I'm not sure why. It is not commonly known, but Frank Borman, for example, vomited while en route to the moon. At any rate, some astronauts feel that performing aerobatics before a mission helps to build a resistance to motion sickness.

Did you fly an airplane prior to the flight of Apollo 11?

No, but I was flown in a KC-135. The pilots of the Boeing aircraft executed about 50 consecutive, parabolic, pitch-down arcs to create zero-G conditions for 30 seconds at a time. As I floated in the cabin, I tried every which way to make myself sick but was unable to do so. I believe that my experience as a scuba diver had conditioned me to the disorientation of being upside down and moving sideways.

What is the most dangerous phase of a space flight?

The first 12 seconds are the most hazardous, because of the potential for collision with the tower. This could result in quite a fireworks display, placing the astronauts in immediate jeopardy.

After clearing the tower, are there other specific danger periods?

Yes, when the dynamic, or ram-air, pressure is at a maximum. This occurs about one minute into the flight, at about 40,000 feet; our speed is almost supersonic. The ram-air pressure at this point is so great that if the guidance system should cause the rocket to quiver, uncontrollable gyrations could occur so rapidly that an astronaut looking at his eight-ball [artificial horizon] couldn't react fast enough to take control.

What would you do if the tail struck the tower during blastoff, or if the rocket went out of control at 40,000 feet?

We'd abort. From about 15 seconds before launch until safely in orbit, the commander keeps one hand on the abort handle. When this handle is twisted, the powerful abort engine on the nose of the spacecraft fires, hurling us and the command module away from the rocket with a force of 4 to 5 Gs. The normal reentry sequence then takes place automatically.

Is this why you blast off near the ocean?

Obviously. It's difficult to build a spacecraft to withstand the shock of landing on a highway or building. This explains the call we get shortly after launch, "Your feet are wet." This doesn't mean much to someone listening on TV, but it tells us that an abort

NOTE: Buzz Aldrin's recent book, *Return to Earth* (Random House, 338 pages, $7.95), provides a candid, behind-the-scenes view of the space program. It also tells the honest, humorous, and often controversial story of a man who returned from a flight to the moon only to face a greater challenge—finding himself.

from that point on would result in a water landing. During the first seconds of flight, an abort could result in a beach landing, a risk we have to accept.

What happens if you abort after crossing the Atlantic?

We might be far enough along to use the service propulsion engine to burn us into orbit. Otherwise, we land in Africa, and that's bad news. We simply hope for the best and review what we learned during jungle survival training.

How do you know when conditions dictate an abort?

There's only one red light on the instrument panel, and that's the abort light. When it illuminates, we react—right now—but only if there's another indication that something is wrong. That second cue could come in the form of an abort message from the capsule communicator [Capcom]. As you may know, the only man allowed to talk to us during a mission is another astronaut, a man with whom we've worked and trained. Anyone else wanting to talk to us has to talk to Capcom, who relays the message to us.

I notice you wince when I use the term "blastoff"...

If you'll excuse the pun, "blastoff" and "A-OK," are "buzz" words used only by news commentators and science fiction writers. To the best of my knowledge, no astronaut ever said "blastoff" instead of "liftoff," because in no way does it describe what happens during launch.

How would you describe a liftoff, Buzz?

When the Saturn's five engines ignite, you really don't hear or feel them, even though they develop 7½ million pounds of thrust. It's that quiet. And the acceleration is so slight you can't feel it either. Were it not for the words "We have a liftoff," which come over the radio, we wouldn't know we were off the ground.

Once liftoff begins, there is only a vague sensation of no longer being bolted to the ground—that you are sitting on the end of something trying to find its way to a point in space. During the first 12 to 15 seconds, we felt only a barely perceptible sideways motion, similar to the shifting back and forth of a railroad car. After about 15 seconds, there is an extremely gradual, 2½-minute buildup to about 4½ Gs. This is the largest G-load of the flight to the moon, and anyone who's done aerobatics knows that 4½Gs isn't very much.

When the first-stage rockets cut out, you tend to lunge forward as the acceleration force is removed. Subsequent rocket stages push you into orbit, and then toward the moon, with little more or less than 1 G, the same amount of force exerted by earth's gravity. It's a very comfortable ride.

During the flight of Apollo 11, were you concerned about malfunctions or the possibility of being stranded on the moon?

I'm surprised at your asking that question, Barry. After all, you're an airline captain who's undoubtedly been asked, "Aren't you ever afraid?" Pilots and astronauts accept risks, but we aren't preoccupied by them. If you were afraid, every time you took off, that an engine would fail, you'd be a nervous wreck and would settle for needlepoint instead of flying. Besides, a rocket engine is so much simpler and more reliable than a recip or even a jet. As long as you throw "wood" on the fire, it keeps running. And there is a procedure for virtually every emergency. We were very confident.

Airplane pilots are concerned about midair collisions. Were you worried about colliding with "space garbage" or meteors?

Not really. But during my first space flight in Gemini 12, I was in orbit for four days. When looking earthward at night, I was disturbed by the sight of shooting stars burning in the atmosphere below, because I knew that those meteors had descended through our altitude only seconds earlier. It was a little spooky.

Could the Apollo spacecraft withstand a meteor strike?

Yes, but only if the rock poked no larger than a quarter-inch hole in the spacecraft. We would have enough time to get into our pressure suits before too much oxygen had escaped from the cabin.

'Flying an airplane isn't as enjoyable as it used to be. Today you're told where you can and cannot fly, and under what conditions. . . . The fun is being bled from flying by ignorant bureaucrats who scamper to write regulations, seemingly to justify their existence. Continuing in this vein, general aviation will reach the mechanization level of space travel; pilots will become button-pushers and computer programmers.'

What were the "flicker flashes" that "struck" the spacecraft?

Those were visible bombardments of high-energy cosmic rays that may have penetrated the command module and damaged a few of our millions of brain cells.

Can a comparison be made between flying an airplane and piloting a spacecraft?

Not really. Some of our instructors aren't pilots, and they can "fly" a simulator to a rendezvous or lunar landing better than the astronauts. A big difference between flying an airplane and a spacecraft is that an astronaut isn't concerned about relative wind. In space we can move sideways, backwards—in any direction—without regard to relative wind and angle of attack. Another major difference is that an airplane driver operates in a hostile environment—the atmosphere—and must contend with a variety of changing conditions. In space, everything is constant. Also, a pilot can't pick up the phone and say, "Houston, I've got a problem." A pilot has to solve his own problems.

Aldrin during training for his first space flight, aboard Gemini 12, in November 1966. Gemini 12 was the last mission of Project Gemini, which preceded the Apollo series. NASA photos except as noted.

Astronauts have all the help they need, and frequently the best emergency procedure requires doing nothing. Just sit and let Houston do the thinking.

How is spacecraft attitude controlled?

With a hand controller that functions like a joystick. Pulling the controller aft, for example, causes a few small rockets to ignite, causing the spacecraft to pitch up. A spacecraft doesn't have rudder pedals, and that took getting used to.

How do you control yaw?

Simple. Just twist the hand controller in the desired direction and the spacecraft yaws. NASA has installed similar three-axis controllers in a few experimental aircraft. Eventually, this technology will find its way into general aviation. Digital autopilots were pioneered by Apollo, and these are already in civilian use.

Is it possible to perform aerobatics in a spacecraft?

Sure, but you'd be doing them on instruments. Since the ground (earth) is hundreds or thousands of miles away, you'd have no idea which way is up or down. And pulling back on the stick, for example, would not produce a G-load; you'd pitch up and rotate about the lateral axis without feeling a thing.

Pilots will be interested in a major problem we had with the artificial horizon on the lunar-landing vehicle. NASA engineers wanted to install it so that the horizon would be in reference to the thrust line of the engine, just like on an airplane. But the lunar-module (LEM) engine fires vertically during a moon landing, and our windows face the natural lunar horizon, 90 degrees out of phase with the engine's thrust line. From a pilot's standpoint, you'd have to be staring down at the surface before the artificial horizon would indicate a level attitude. This created quite a hassle between the astronauts and the engineers, because we wanted the artificial horizon to coincide with the moon's horizon. The astronauts won the argument.

How is rocket engine power controlled?

With the exception of the descent engine on the LEM, all Apollo engines are strictly on or off; you get full power or none. We did have a form of mixture control for the Saturn's first-stage rockets. A propellant-utilization gauge indicated the oxygen-to-fuel ratio. The idea was to adjust this mixture so that the oxygen and fuel would run out simultaneously. The descent engine on the LEM was throttleable between 10% and 100%. Approximately 25% power was equivalent to lunar gravity. Pulling less than 25% power resulted in a descent, and more than 25% produced a climb.

How much actual hand-flying is done on a flight to the moon?

Very little. The computer flies a spacecraft much more efficiently than an astronaut. An astronaut maneuvering a spacecraft uses up to three times as much fuel as the computer would use performing the same maneuver. We'd like to do all the flying, but it would be too wasteful.

Astronauts are usually button-pushers. For example, let's say we need to make a midcourse correction after hours of monotonous thumb twiddling. You grab the manual and it says that the needed acceleration of 3.6 mph requires an engine burst lasting 2.2 seconds. It takes an hour to prepare for that minor correction. Finally, at exactly the right instant, we push the power button on the computer. The engine fires; we just sit there and watch. After 2.2 seconds, the engine shuts down automatically, and the computer tells us we've accelerated 3.6 mph. Houston has been monitoring the maneuver and confirms that the required acceleration has been accomplished. Then—more hours of doing nothing.

Is it enjoyable to fly a spacecraft?

It's too mechanical to be enjoyable; everything is so disciplined and controlled. Astronauts just go along for the ride. It's kind of sad, because space travel is the extreme toward which aviation is heading. Flying an airplane isn't as enjoyable as it used to be. Today you're told where you can and cannot fly, and under what conditions. You're told what speed to fly and what equipment you must have on board. The fun is being bled from flying by ignorant bureaucrats who scamper to write regulations, seemingly to justify their existence. Continuing in this vein, general aviation will reach the mechanization level of space travel; pilots will become button-pushers and computer programmers.

Do you enjoy sightseeing on space flights?

The sights are fantastic. When people ask for a description of what I saw, I get a little tongue-tied. So I simply show them photographs. It's too bad that a talented writer hasn't been trained as an astronaut; only he could do literary justice to what is seen from the window of a spacecraft.

What is your primary method of communication with earth?

Conventional VHF.

What if you lost voice communications?

Without voice we'd have to improvise. We could transmit written messages via television. Or we could diddle around with the computers and communicate using numerical codes. We could even transmit Morse code. We didn't know Morse code, but it was printed on our checklists.

Did you land on the moon visually or on instruments?

Aldrin, a jet-fighter pilot during the Korean War, has a keen interest in general aviation. Now retired from the Air Force, he has done most of his nonmilitary flying in Cessna 172s and 310s and Bell 47-series helicopters. Here he perches on the wing of a friend's Bonanza. Photo by Barry Schiff.

Visually and by manual control, but we relied on a radio altimeter for the touchdown. The altimeter activates at 35,000 feet agl and transmits a radar beam at an angle to the surface. The returning "echo" enables the computer to provide a constant readout of altitude and groundspeed.

During our lunar approach, computer warning lights began flashing at about 3,000 agl. The coded readout told us the computer was overloaded. Armstrong and I got a bit uptight, and the guys at Houston went ape. There we were, about to land the first manned spacecraft on the moon, and our vital computer was overloaded.

We pushed a button to cancel the alarm, hoping to get some valid data. Seconds later, the program alarm light repeated the warning. Meanwhile, an engineer, Steve Bales, hollered to the capsule communicator, "I understand. Tell them it's okay; they're go for landing!"

Armstrong and I accepted those confidence-building words and continued the descent to about 300 feet, during which time we got an additional half-dozen computer warnings. Bales understood the problem but didn't bother us with an explanation; he knew our hands were full.

We learned later what had caused the problem. The LEM had two radar systems, one to rendezvous with the orbiting Apollo command module and the

other for lunar approach and landing. Both radar systems are fed to a single computer. Prior to beginning our lunar descent, we elected to leave on the rendezvous radar in case we had to abort and return to the command module. After timing the passage of craters below to confirm that our speed was proper, we turned on the landing radar and started down. That's when the computer flipped its cookies. It wasn't designed to handle data from both radar systems simultaneously, but nobody had bothered to determine this. The engineers who designed the system never anticipated that we'd descend with the rendezvous radar turned on.

Well, this fellow Steve Bales, sitting behind his console in Houston, figured out the problem in seconds and gave us the confidence to continue. Otherwise, we probably would have aborted and headed for home with our tails between our legs. For his contribution, Bales received the Presidential Medal of Freedom.

When you were about to touch down on the moon, were you concerned about landing on a soft spot that would cause Eagle to tip over and prevent a subsequent liftoff from the moon?

That possibility had occurred to us, but only academically. The unmanned lunar probes transmitted data that convinced everyone there would be no such problem. We were cautioned, however, about large boulders in the touchdown area. As a matter of fact, we had to extend our landing approach to avoid a few boulders and damn near ran out of fuel in the process.

Was lunar liftoff different from the liftoff from earth?

I'll say it was. We were a bit apprehensive about this maneuver. Eagle was programmed to rise 300 feet and then rapidly pitch over 45 degrees. From a pilot's standpoint, this seemed a bit hairy. But because of the tremendous acceleration and the way the moon dropped away so rapidly, the pitchover didn't bother us.

Since you are so intimate with space travel, have you formed any opinions about UFOs?

Yes. First of all, I discount recent flying-saucer sightings that originated in the swamps of the Southeast. I can't believe that aliens from space would behave so irrationally. If I were piloting a flying saucer and came to planet earth, I'd find the leaders and arrange for a chit-chat. I wouldn't make a series of low passes and unnerve the populace.

So you don't believe in visitors from outer space?

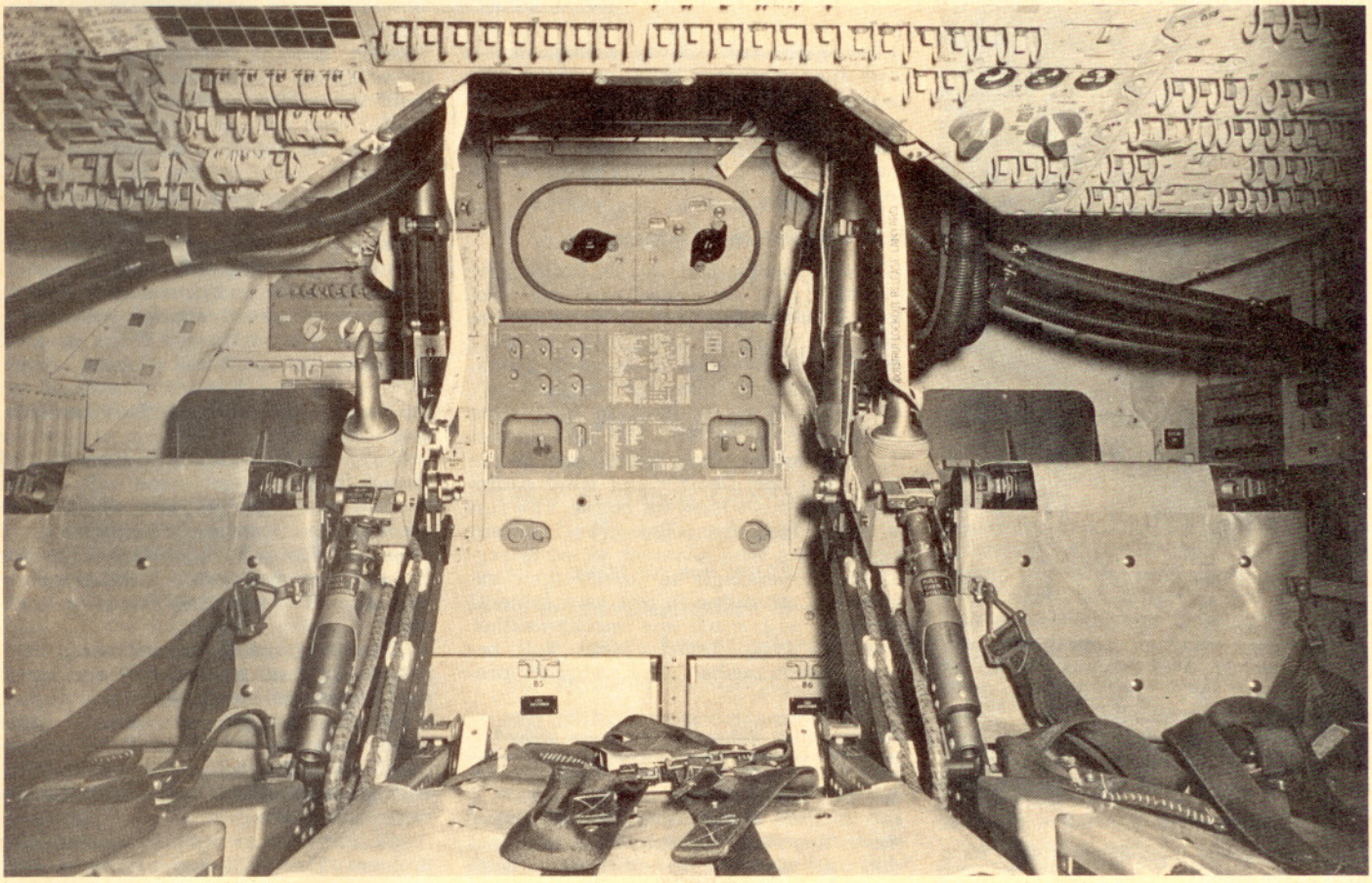
I didn't say that. I simply feel it's unlikely that anyone has seen them in recent years. Look at it this way. Humans are relatively close to being able to do on other planets what space creatures are allegedly doing here. This assumes that humans are at about the same evolutionary level as the space visitors. From a probability standpoint, this is highly unlikely. It is more logical to assume we were visited 20,000 years ago or won't be visited for at least 5,000 years. This line of reasoning concurs with the theories of Erich Von Däniken, author of *Chariots of the Gods.*

Do you think the government is withholding information about secret vehicles that are mistaken for flying saucers?

Absolutely not. I know too much about the military to believe such a secret could be kept for long. Consider how the press uncovered the Watergate affair. Do you believe that press could be kept ignorant of such astounding developments?

Do you feel that astronauts are heroes?

No. There's a dividing line somewhere between Charles Lindbergh and the astronaut. Early aviators were heroes because they pursued a dream when everyone else questioned their sanity. They dug up their own financing and did their own research. To perform astonishing feats today requires a mass of capital and people. Astronauts are simply the visible tip of an iceberg, who do what they are trained to do. Are we



Aldrin says astronauts in flight are primarily button-pushers, as this view of Apollo 11's command-module cockpit suggests.

heroes? No way. Actually, fighter pilots are more heroic. They fly when thousands of enemies below want to shoot them down; when an astronaut flies, he has thousands of people helping to keep him up.

I asked several well-informed people to name the three astronauts on the first manned flight to the moon. Very few could do it. Why does the public have such a short memory?

I can't answer that one, Barry. Perhaps Americans are too fickle. One day they're hep on space exploration and the next day they're preoccupied with pot or long hair. Americans just seem ready to jump from one interest to another. Europeans, on the other hand—especially Germans and Italians—seem to know more about our space program than most Americans.

Could the average general aviation pilot be trained as an astronaut?

Yes, without a doubt. Anybody could carry out a nominal mission. What makes astronaut training difficult is the rigorous classwork and seemingly endless drilling.

Do pilots possess special qualifications that make it easier for them to become astronauts?

That's a controversial question. The heart of the astronaut corps will swear you've got to be a test pilot to fly a spacecraft, but I don't agree. I believe any of NASA's nonpilot simulator instructors could do as good a job as any of the pilot-astronauts.

What training is best for the aspiring astronaut?

A strong academic background is most important. An astronaut has to absorb a mountain of information. He has to learn where the wires are connected, how to operate systems, and memorize an almost endless maze of emergency procedures. I believe also that future astronauts will be more scientifically qualified. It is easier to train a scientist to become an astronaut than to educate a pilot to be a scientist.

I understand you have a Doctor of Science degree from MIT. Was this a factor in your being selected as an astronaut?

Definitely. In preparation for the lunar landing, they tried to make a geologist out of me, but I just wasn't wild about geology. Fortunately, on the first flight to the moon, we only had enough time to grab a few rocks—any rocks—and run. Subsequent astronauts had to use their geology studies to be more selective about the samples they brought back.

Why are most astronauts between the ages of 35 and 44?

The same reasons why most airline captains are 35 and older—seasoning and seniority. Maturity has a bit to do with it, and so does politicking. But I think pilots in their mid-20s could do as well; they're just a bit sharper too. The Russian cosmonauts Gagarin and Titov were in their mid-20s when they went into space. I don't know that there is a "best" age. The Russians, however, made a mistake sending up Valentina Tereshkova—the first and last woman cosmonaut. She panicked early in the mission, and most of her flight had to be controlled from the ground. Evidently she went bananas.

'Early aviators were heroes because they pursued a dream when everyone else questioned their sanity. They dug up their own financing and did their own research. To perform astonishing feats today requires a mass of capital and people. Astronauts are simply the visible tip of an iceberg, who do what they are trained to do. Are we heroes? No way.'

You're probably tired of this question, Buzz, but can you describe for PILOT readers what it was like to be on the moon?

There were few surprises on the lunar surface; our training had been that thorough. We did, however, have a problem walking, because of the lightness on our feet. On earth, my weight—including equipment—would have been 360 pounds, but on the moon I weighed only 60 pounds. As a result, my toe muscles—which help tell a man which way is up—were not as useful. And I had to walk very carefully to maintain equilibrium and prevent my back pack from pulling me over backwards.

What was your reaction when you looked up from the moon and saw the earth?

There was nothing unusual or startling about seeing the earth, because we had watched it grow smaller from the windows of the space capsule during our flight to the moon. Once, however, I remember looking earthward and thinking, "My gosh, I'm here and the earth is there." I marveled at how things were so completely reversed. By the way, from the moon a "full earth" looks about four times as large as a full moon looks from earth.

When you stood on the moon, was the horizon curved or straight?

Curved. There was no mistaking that we were standing on a sphere. The lunar horizon dropped so rapidly that we could see only about a mile in each direction.

Did you have any personal thoughts as you sauntered about the moon?

Yes. I kept thinking, "Armstrong and I are farther from home—more isolated—than any humans have ever been." And yet, because of television, our every move was being studied by millions. Curiously, Armstrong and I couldn't enjoy the moon walk as much as those who watched it on television in living-room comfort. We were deprived of that pleasure.

When you returned to earth, were you affected spiritually?

To be candid and perhaps unpopular, no. To me, the flight of Apollo 11 was a mechanical mission. But the astronaut corps consists of a wide variety of individuals. It's reasonable that out of 70 astronauts, one is going to return and perhaps say, "My God, I saw Jesus Christ on the moon." So it wasn't surprising to me when Jim Irwin returned and claimed having experienced spiritual revelations. Others return from space with a very "ho-hum" attitude.

Will PILOT readers have an opportunity to experience space travel?

The only hope for a general aviation pilot is the space shuttle, which may operate by the late 1980s. This would allow him to orbit earth. But boarding passes will be tough to get. A news reporter with impressive credentials might get a ride by 1990. He'll be given priority because of the service he can perform. A PILOT reader without a beneficial purpose may have to wait until 2000 or later before he'll be able to go as a casual passenger. But I'm just guessing. People are optimistic about what can be accomplished in 2 or 3 years, but we are pessimistic about what can be done in 15 years. With the exception of a few science fiction writers, who would've guessed 15 years ago that we'd be where we are now? Technologically, we've been traveling on an exponential curve, and I don't think we're slowing down.

What were your feelings about being chosen copilot for Apollo 11 instead of captain?

Neil Armstrong was captain on that "jetliner" to the moon, and I was damned envious. But I'd been a military officer for 17 years and was disciplined to accept my role, irrespective of personal feelings. Frankly, I was grateful for the opportunity to be a crew member on man's first flight to the moon. □